1-1-1967

Linear and nonlinear analyses of skewed plates.

Simon S. F. Ng
University of Windsor

LINEAR AND NONLINEAR ANALYSES OF SKEWED PLATES

A THESIS

Submitted to the Faculty of Graduate Studies through the

Department of Civil Engineering in Partial Fullfilment

of the Requirements for the Degree of

Doctor of Philosophy at The

University of Windsor.

by

Simon S.F. NG

B.A.Sc., The University of British Columbia, 1962

M.A.Sc., The University of Windsor, 1964

Windsor, Ontario, Canada.
1967

ProQuest Information and Learning Company
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

AEX 6239

APPROVED BY:

J. F. Kennedy

W. McInnis

Cameron MacInnis

A. C. Smith

169928

ABSTRACT

The perturbation method is used to analyze the problem of small and large deflections of clamped skewed plates under uniform pressure. The results are improved by successive approximations to the three displacement components in the middle plane of the plate. Numerical and graphical results are presented. Comparisons are made with existing results for skewed plates with small deflections as well as with results for rectangular plates with small and large deflection behaviour; good agreement is shown. The effects of skew and aspect ratio on plates with large deflections are investigated. It is shown that the centre deflection decreases with increase in skew and aspect ratio, and that the maximum resultant stress occurs along the longer edges of the plates and is displaced towards the obtuse corners.

Four aluminium skewed panels of different skew angles and aspect ratios were tested to verify the theoretical predictions. Experimental results for deflections as well as maximum edge and centre stresses are compared with those obtained analytically. Close agreement is found. It was also revealed from these experiments that, at large lateral loads producing plastic permanent deformations in the plate models, the obtuse corners are not only regions of stress concentration but also of instability, exhibited by sudden reversal of stresses.

ACKNOWLEDGMENTS

The writer wishes to express his gratitude to Dr. J.B. Kennedy for his guidance and suggestions in the preparation of this work and for his generous aid and constructive criticism throughout its development.

The writer is also indebted to Mr. William James and Mr. David Wongsing who have helped in the checking of the theoretical analysis. Thanks are also due to Mr. George Michalczuk who has helped generously in the setting up of the experiments.

The financial assistance given by the Defence Research Board is greatly appreciated.

TABLE OF CONTENTS

LIST OF TABLES PAGE

LIST OF TABLES (Cont.)

LIST OF FIGURES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Skewed plates and slabs are often required as component parts of large scale structures such as triangular dams and building floor systems. In the field of reinforced concrete, such plates are also of considerable interest and practical importance, especially in the case of skewed slabs for highway bridges that cross rivers, railways or other highways at an oblique angle. In general, the deflections of skewed plates or slabs used in the aforementioned structures are usually rather small in comparison with the thickness of the plate so that for a proper design of such plates, only a linear (small deflection) analysis is required. In contrast, the requirements of skewed plates or panels for the aircraft industry are quite different. In the case of the design of swept wings and skin panels of aircrafts, for example, the weight is of primary importance; for this reason, when skewed plates are used as their component parts, they must be thin and, as a result, their deflections are usually quite large in comparison with plate thickness. Hence, in order to obtain design charts and formulas for stressing skewed plates used for swept wings, skin panels and other related components of the aircraft, the nonlinear (large deflection) analysis must be used.

Many diverse and indirect methods are now available for

the linear analysis of clamped square and rectangular plates subjected to uniform normal loadings. Some of these methods are cited by Timoshenko and Woinowsky-Krieger (1). For the solution of a clamped uniformly loaded rectangular plate, Timoshenko and Woinowsky-Krieger employ a double series which operates with two independent systems of infinite linear simultaneous equations. Approximate solutions for the nonlinear (large deflection) analysis of uniformly loaded rectangular plates under similar boundary conditions have also been examined by Way (2) using the Rayleigh-Ritz technique and by Levy (3) who substituted a double Fourier series solution into the differential equations and evaluated the coefficients. Invariably, all the methods employed are extremely laborious and require considerable computations.

In contrast to the square and rectangular plates, skewed plates have not received as much attention. This may perhaps be due to its relatively difficult mathematical model and its absence of orthogonal relationships. For the clamped skewed plate under consideration, Morley (4) has presented results for a very limited number of skew angles and aspect ratios. Recently, due to the work of Kennedy (5) (6), deflections as well as principal stresses for such plates have been determined for various skews and aspect ratios both analytically and experimentally. However, with regard to large deflection behaviour of uniformly loaded skewed plates, no general solutions are as yet available.

The work embodied in this thesis comprises:

(i) a theoretical linear (small deflection) analysis on the bending of clamped skewed plates subjected to a uniformly distributed load and a comparison of the results so obtained with those obtained earlier by the author and other investigators (4) (5) (6) and (7)

(ii) an extension of the theoretical analysis to include the investigation into the large deflection behaviour of uniformly loaded skewed plates under the same boundary conditions.

(iii) an experimental investigation into the effect of varying the skew angle, aspect ratio and plate thickness on the small as well as the large deflection behaviour of uniformly loaded clamped skewed plates and thereby verify the theoretical predictions. The experiments performed consisted of the following aluminum plate models:

a) Test Panel 1 --- a skewed plate with aspect ratio 1/2, skew angle 50° and plate thickness 1/8 in.

b) Test Panel 2 --- a skewed plate with aspect ratio 1/2, skew angle 50° and plate thickness 1/16 in.

c) Test Panel 3 --- a skewed plate with aspect ratio 2/3, skew angle 30° and plate thickness 1/16 in.

and d) Test Panel 4 --- a skewed plate with aspect ratio 2/3, skew angle 30° and plate thickness 1/8 in.

With reference to the theoretical work, the perturbation method (8) (9), based on the smallness of the central deflection was used to determine the lateral deflection, the in-plane displacements and hence the moments and stresses of clamped skewed plates. Throughout the theoretical analysis, the dimensionless ratio of the central deflection to the thickness of the plate is used as the perturbation parameter. Essentially, the perturbation technique is based on the principle that, if a well constructed asymptotic power series should satisfy the differential equation, then each parameter should also satisfy the governing differential equation independently. Following the perturbation procedure, asymptotic power series containing a number of undetermined coefficients are assumed relating first the dimensionless load to the central deflection perturbation parameter W_o. Power series containing unknown functions of the oblique co-ordinate axes are also assumed relating each of the displacement components u, v, and w in the middle plane of the plate with the same perturbation parameter W_o. In assuming these functions for displacements, care was taken to ensure that these assumed functions satisfy not only the boundary conditions of the plate but also the condition of polar symmetry ---- a necessary condition for a uniformly loaded skewed plate. The assumed displacement functions are next substituted in turn into the governing partial differential equations derived in each step in the successive approximation sequence. By equating equal powers of the oblique co-ordinates ξ and η, and by solving the set of simultaneous linear

equations thus obtained, all the unknown coefficients in the displacement functions are evaluated. Finally, these displacement functions with their determined parameters are differentiated to yield the required bending and membrane stresses anywhere within the plate boundary.

Also included in the theoretical analysis is a brief discussion of the initiation of yield along the edge of the plate if the plate material reaches its yield in a region where the Von Karman equations are valid ($w/h \leq 2$). In this connection, the Huber-von Mises yield theory is used.

The experimental investigation consisted of the testing of four plate models of different skew angles, aspect ratios and plate thicknesses. All test plates were made of 6061-T6 aluminum alloy. Metal foil strain rosette gauges were installed at selected points on the plate models and principal stresses were calculated from the strain measurements recorded for the different intensities of loadings. Dial indicators were also installed at the bottom of the plate to measure the lateral deflections. In order to verify the results of the nonlinear (large deflection) analysis, all four test panels were loaded so that the centre deflection of the plate approaches twice the plate thickness.

In order to study the behaviour and stress distribution of skewed plates loaded beyond the validity of the Von Karman equations, two of the above-mentioned test panels were subjected to large loads resulting in plastic permanent deformation of the plate models.

To facilitate the computation of deflections, principal bending and membrane stresses at specified points on the skewed plate, all computational work for both the theoretical and experimental investigations was programmed in Fortran for the IBM 1620 II. The programmes are included in Appendix A.

CHAPTER II

Review of Literature

(a) Linear Analysis of Skewed Plates

The linear small deflection behaviour of skewed plates and slabs has been investigated mainly by the method of finite difference. The first publication on skewed plates was probably due to Brigatti (10) who obtained limited results, by means of finite difference equations, for uniformly loaded rhombic plates simply supported and clamped.

In 1939, Anzelius (11) investigated into the small deflection behaviour of uniformly loaded skewed plates, simply supported on two opposite sides and free on the other two. His solution is in the form of a series involving hyperbolic and trigonometric functions which yield an infinite system of linear equations. Results were given qualitatively only for twisting moments for a 45° skewed slab.

Studies of skewed plates by means of finite difference techniques were also made by Jensen (12) in 1941. Uniformly loaded skewed plates simply supported on four sides and similarly loaded skewed plates simply supported on two opposite edges and free on the other two sides were anslysed by use of difference equations developed in a form readily applicable to networks made up of lines parallel to the sides. Throughout his work, the aspect ratio of the plate was taken as 1/2 and Poisson's ratio was taken to be 0.2.

Since the work of Jensen in 1941, a great deal of work has been done on skewed plates and skewed structures. In 1953, Dorman (13) used the energy approach to investigate into the bending behaviour of a clamped skewed plate but the function he assumed for the lateral deflection has the restrictive character of satisfying not only the polar symmetry but also quadrant symmetry ----- a condition which is non-existent in a skewed plate. The outstanding researchers in skewed plates and related structures in the past decade include Morley (4), Mirsky (14) and Jones (15).

More recently, Kennedy and the author (5) (6)have solved the small deflection problem of uniformly loaded skewed plates by means of variational techniques and the results were verified by experiments.

In 1964, Kennedy and Huggins (16) presented an analytical solution for skewed stiffened plates under a uniformly distributed load. Stresses near the corners of skewed stiffened plates were also examined by Kennedy and Martens (17) who have observed experimentally that critical stresses often occur in obtuse corners of such skewed plates.

(b) Nonlinear Analysis of Skewed Plates

No general solution for the nonlinear (large deflection) analysis of skewed plates is as yet available in the literature. However, nonlinear analyses of rectangular, circular and elliptical plates are quite well known. Results for the nonlinear analyses

of such plates are largely due to the work of Way (2), Levy (3), Chien (18), Wang (19) and Weil and Newmark (20). Large deflections of simply supported rectangular plates on elastic foundations were examined by Sinha (21) in 1963 and more recently, approximate solutions for the small and large deflection behaviour of rectangular plates resting on elastic supports have also been obtained by Kennedy and the author (22).

CHAPTER III

THEORETICAL ANALYSIS

(a) Assumptions

Based on the small deflection theory of elastic thin plates, the problem of the clamped skewed plate subjected to uniform normal loading has recently been solved (4) (5) (6) by various theoretical methods. However, in all these theoretical analyses considered, the deflections are considered to be of such magnitude that the effect of the stretching of the middle plane of the plate on its curvature can be neglected. When the lateral deflection of the plate is moderately large, that is, in the neighbourhood of one half the plate thickness or more, the linear theory of thin plates is no longer applicable and the effect of the forces acting in the middle surface must be taken into account.

Throughout this theoretical work of linear and nonlinear analyses of skewed plates, the following assumptions are made:

i) points which lie on a normal to the midplane of the undeflected plate lie on a normal to the mid-plane of the deflected plate.

ii) the stresses normal to the mid-plane of the plate, arising from the applied loading, are negligible in comparison with the stresses in the plane of the plate.

iii) the slope of the deflected plate in any direction is small so that its square may be neglected in comparison with unity.

Also, for the linear (small deflection) analysis, the forces in the middle plane of the plate is neglected and this entails one additional assumption, viz.,

iv) the mid-plane of the plate is a neutral plane, i.e., any mid-plane stresses arising from the deflection of the plate into a non-developable surface is ignored.

(b) Formulation of the Governing Partial Differential Equations

The nonlinear large deflection behaviour of thin elastic plates is governed by three coupled nonlinear partial differential equations. When the boundary conditions of the plate are known, it is often convenient to express these equations in terms of the displacement components u, v, and w (parallel to the rectangular co-ordinate axes x, y, and z respectively) of a point in the middle plane of the plate.

i) Equilibrium of the Plate Element in the x and y directions

Consider the equilibrium of a small element cut out from the middle plane of the plate with sides dx and dy as shown in Fig. 1. Let N_x , N_y and N_{xy} be the in-plane forces per unit length of the plate.

Neglecting body forces, the equilibrium of the plate element in the x and y directions yields respectively,

$$N_{x,x} + N_{xy,y} = 0 \quad \text{.....(3-1)}$$

$$N_{xy,x} + N_{y,y} = 0 \quad \text{.....(3-2)}$$

where the comma notation signifies differentiation.

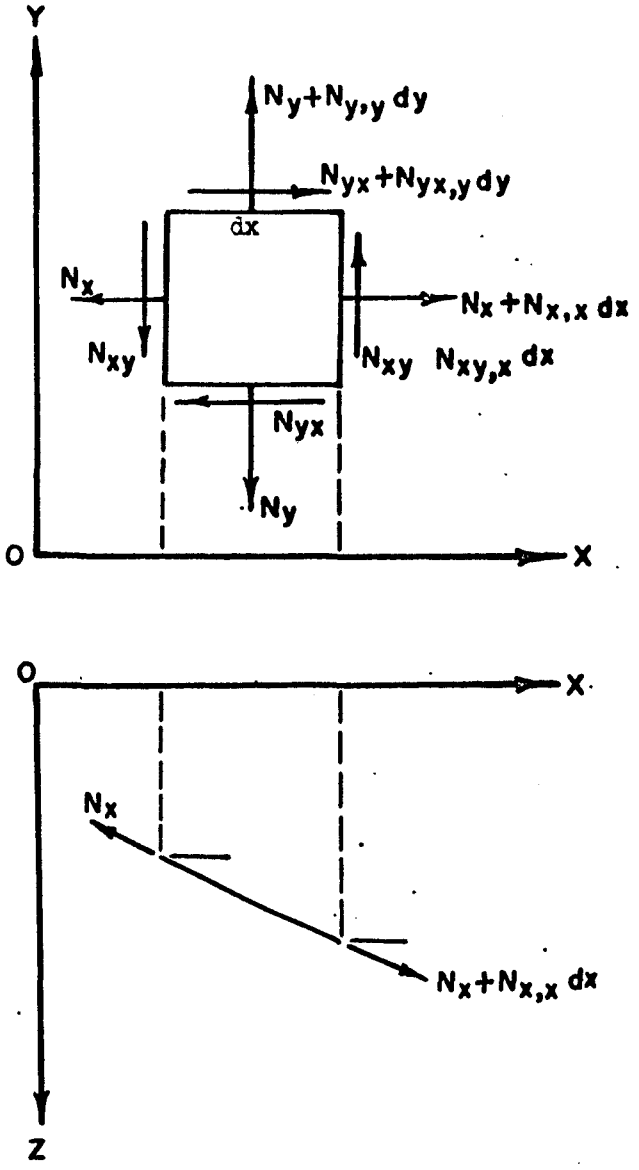


Fig. 1. In-plane Forces on Plate Element

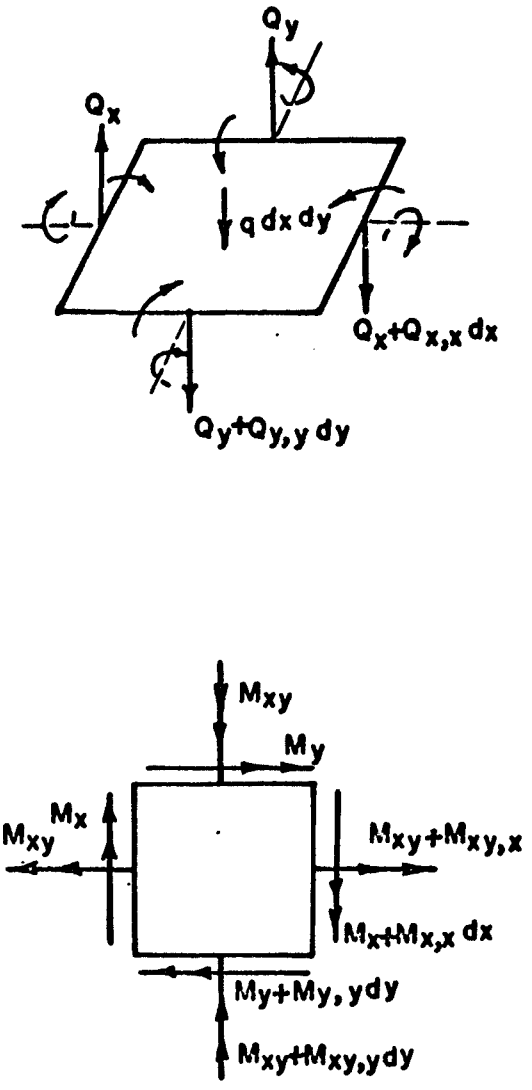


Fig. 2. Moments and Shear Forces on Plate Element

ii) Equilibrium of the plate element in the z direction

Forces in the z direction due to the in-plane forces:

From Figure 1, it is easily seen that the net contribution of the downward force by N_x in the plate element is

$$-N_x w_{,x} dy + (N_x w_{,x} dy)_{,x} dx$$

or $(N_x w_{,xx} + N_{x,x} w_{,x})\, dx\, dy$ .....(3-3)

Similarly, the net downward contribution of N_y on the plate element is

$$(N_y w_{,yy} + N_{y,y} w_{,y})\, dx\, dy$$ .....(3-4)

The net downward contribution of N_{xy} on the plate element is

$$-N_{xy} w_{,y}\, dy + N_{xy} w_{,y}\, dy + (N_{xy} w_{,y}\, dy)_{,x}\, dx$$

or $(N_{xy} w_{,xy} + N_{xy,x} w_{,y})\, dx\, dy$ .....(3-5)

Similarly, the net downward contribution of N_{yx} is

$$(N_{xy} w_{,xy} + N_{xy,y} w_{,x})\, dx\, dy$$ .....(3-6)

Hence, the net downward contribution of all the in-plane forces can be obtained by adding Eqs. (3-3) through (3-6), viz.,

$$(N_x w_{,xx} + 2 N_{xy} w_{,xy} + N_y w,yy)\, dx\, dy$$.....(3-7)

Forces in the z direction due to lateral loads:

Let Q_x, Q_y be the shear forces per unit length (Fig. 2). Also shown on the same figure are the direction of the bending and twisting moments acting per unit length.

Equilibrium in the downward direction (along the z axis) gives:

$$Q_{x,x} + Q_{y,y} + q = 0 \quad \text{.....(3-8)}$$

Also, by taking moments about an axis parallel to the x axis and ignoring terms of lower order of magnitude gives:

$$Q_y \, dx \, dy - M_{y,y} \, dy \, dx + M_{xy,x} \, dx \, dy = 0$$

or $$M_{y,y} - M_{xy,x} - Q_y = 0 \quad \text{.....(3-9)}$$

Similarly, by taking moments about an axis parallel to the y axis, we have,

$$M_{x,x} - M_{xy,y} - Q_x = 0 \quad \text{.....(3-10)}$$

Putting the well -known expressions for moments and curvature relationships (1), viz.,

$$M_x = -D \left(w_{,xx} + \nu w_{,yy} \right)$$

$$M_y = -D \left(w_{,yy} + \nu w_{,xx} \right)$$

$$M_{xy} = D (1-\nu) w_{,xy}$$

into expression (3-9) and (3-10), we get

$$Q_x = -D \left(w_{,xxx} + w_{,xyy} \right) \quad \text{.....(3-11)}$$

$$Q_y = -D \left(w_{,yyy} + w_{,yxx} \right) \quad \text{.....(3-12)}$$

Substituting Eqs. (3-11) and (3-12) into Eq. (3-8) gives,

$$w_{,xxxx} + 2 w_{,xxyy} + w_{,yyyy} = q/D \quad \text{.....(3-13)}$$

If we now add to this equilibrium equation in the vertical direction due to the lateral loads the effect due to the in-plane forces Eq. (3-7), we finally arrive at the equilibrium equation

in the vertical direction due to the combined action of the lateral and membrane forces,

$$D\left(w_{,xxxx} + 2\, w_{,xxyy} + w_{,yyyy} \right) = q + N_x\, w_{,xx} + 2\, N_{xy}\, w_{,xy} + N_y\, w_{,yy} \qquad \text{.....(3-14)}$$

In terms of stresses, Eqs. (3-1), (3-2) and (3-14) can be written as

$$\sigma_{x,x} + \tau_{xy,y} = 0 \qquad \text{.....(3-15)}$$

$$\sigma_{y,y} + \tau_{xy,x} = 0 \qquad \text{.....(3-16)}$$

and

$$D \nabla^2 \nabla^2 w = q + h\left(\sigma_x w_{,xx} + \sigma_y w_{,yy} + 2\tau_{xy} w_{,xy} \right) \qquad \text{....(3-17)}$$

But, from the elementary theory of elasticity (23), the equations of plane strain are:

$$\sigma_x = E/(1-\nu^2)\left(\epsilon_x + \nu \epsilon_y\right)$$

$$\sigma_y = E/(1-\nu^2)\left(\epsilon_y + \nu \epsilon_x\right) \qquad \text{.....(3-18)}$$

$$\tau_{xy} = E/2(1+\nu)\,\gamma_{xy}$$

and, the equations of compatibility are:

$$\epsilon_x = u_{,x} + 1/2\,(w_{,x})^2$$

$$\epsilon_y = v_{,y} + 1/2\,(w_{,y})^2 \qquad \text{.....(3-19)}$$

$$\gamma_{xy} = u_{,y} + v_{,x} + w_{,x}\, w_{,y}$$

Substituting equations (3-18) and (3-19) into Eqs. (3-15), (3-16) and (3-17), the three general differential equations in

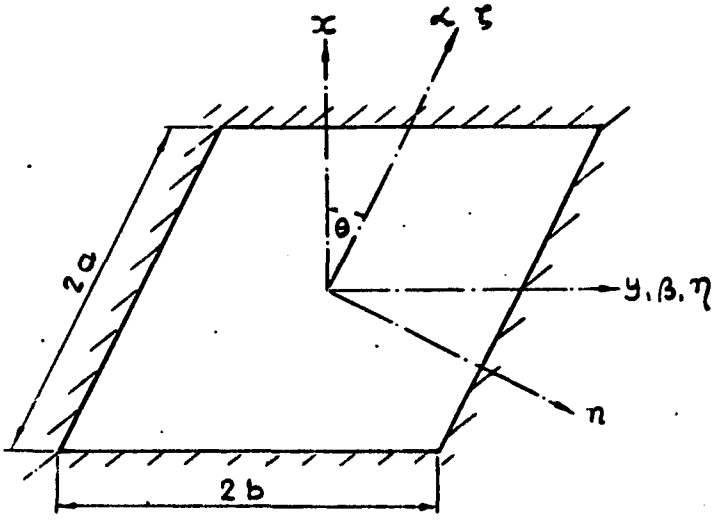


Fig. 3. The Rectangular and Skewed Co-ordinate Systems.

rectangular cartesian co-ordinates governing the large deflection of thin elastic plates are obtained:

$$u_{,xx} + w_{,x}w_{,xx} + \nu(v_{,xy} + w_{,y}w_{,xy}) + \frac{1}{2}(1-\nu)(u_{,yy} + v_{,xy} + w_{,x}w_{,yy} + w_{,y}w_{,xy}) = 0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}20)$$

$$v_{,yy} + w_{,y}w_{,yy} + \nu(u_{,xy} + w_{,x}w_{,xy}) + \frac{1}{2}(1-\nu)(v_{,xx} + u_{,xy} + w_{,y}w_{,xx} + w_{,x}w_{,xy}) = 0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}21)$$

$$D\nabla^2\nabla^2 w = q + h\left(\frac{E}{(1-\nu^2)}\left\{u_{,x} + \frac{1}{2}(w_{,x})^2 + \nu\left[v_{,y} + \frac{1}{2}(w_{,y})^2\right]\right\}w_{,xx} + \frac{E}{(1-\nu^2)}\left\{v_{,y} + \frac{1}{2}(w_{,y})^2 + \nu\left[u_{,x} + \frac{1}{2}(w_{,x})^2\right]\right\}w_{,yy} + \frac{E}{(1+\nu)}\cdot(u_{,y} + v_{,x} + w_{,x}w_{,y})\,w_{,xy}\right) \qquad \ldots\ldots (3\text{-}22)$$

where ∇ is the Laplacian operator, ν being Poisson's ratio, D, the flexural rigidity, E, the modulus of elasticity of the plate material, q, the intensity of uniformly distributed load, and h is the thickness of the plate. The comma notation signifies differentiation.

(c) The Oblique Co-ordinate System

In investigating the small and large deflection problem of skewed plates, it is often advantageous to adopt a co-ordinate system parallel to the edges of the plate, namely the oblique co-ordinate system α and β as shown in Fig. 3.

By the transformation

$$\left.\begin{aligned} x &= \alpha \cos\theta \\ y &= \beta + \alpha \sin\theta \end{aligned}\right\} . \qquad \text{.....(3-23)}$$

in which θ is the skew angle, the following relationships between the rectangular and oblique co-ordinate systems hold:

$$u_{,x} = u_{,\alpha} \sec\theta - u_{,\beta} \tan\theta$$

$$u_{,xx} = u_{,\alpha\alpha} \sec^2\theta - 2\, u_{,\alpha\beta} \sec\theta \tan\theta + u_{,\beta\beta} \tan^2\theta$$

$$u_{,xy} = u_{,\alpha\beta} \sec\theta - u_{,\beta\beta} \tan\theta$$

$$u_{,y} = u_{,\beta}$$

$$u_{,yy} = u_{,\beta\beta}$$

$$v_{,x} = v_{,\alpha} \sec\theta - v_{,\beta} \tan\theta$$

$$v_{,xy} = v_{,\alpha\beta} \sec\theta - v_{,\beta\beta} \tan\theta$$

$$v_{,xx} = v_{,\alpha\alpha} \sec^2\theta - 2\, v_{,\alpha\beta} \sec\theta \tan\theta + v_{,\beta\beta} \tan^2\theta$$

$$v_{,y} = v_{,\beta}$$

$$v_{,yy} = v_{,\beta\beta}$$

$$w_{,x} = w_{,\alpha} \sec\theta - w_{,\beta} \tan\theta$$

$$w_{,xy} = w_{,\alpha\beta} \sec\theta - w_{,\beta\beta} \tan\theta$$

$$w_{,xx} = w_{,\alpha\alpha} \sec^2\theta - 2\, w_{,\alpha\beta} \sec\theta \tan\theta + w_{,\beta\beta} \tan^2\theta$$

$$w_{,xxxx} = w_{,\alpha\alpha\alpha\alpha} \sec^4\theta - 4\, w_{,\alpha\alpha\alpha\beta} \sec^3\theta \tan\theta + 6\, w_{,\alpha\alpha\beta\beta} \sec^2\theta \tan^2\theta - 4\, w_{,\alpha\beta\beta\beta} \sec\theta \tan^3\theta + w_{,\alpha\beta\beta\beta} \sec\theta \tan^3\theta + w_{,\beta\beta\beta\beta} \tan^4\theta$$

$$w_{,xxyy} = w_{,\alpha\alpha\beta\beta} \sec^2\theta - 2\, w_{,\alpha\beta\beta\beta} \sec\theta \tan\theta + w_{,\beta\beta\beta\beta} \tan^2\theta$$

$$w_{,yyyy} = w_{,\beta\beta\beta\beta}$$

Using these transformation relationships and, by defining further the dimensionless quantities

$$R = \frac{b}{a} \quad ; \quad \zeta = \frac{\alpha}{a} \quad ; \quad \eta = \frac{\beta}{b} \quad ; \quad U = \frac{ua}{h^2} \quad ;$$

$$V = \frac{va}{h^2} \quad ; \quad W = \frac{w}{h} \quad ; \quad Q = \frac{qb^4}{Dh}$$

Eqs. (3-20), (3-21) and (3-22) can be re-written into the oblique dimensionless form as:

$$2R^3c\,U_{,\zeta\zeta} - 4R^2 sc\,U_{,\zeta\eta} + R(2s^2c+(1-\nu)c^3)U_{,\eta\eta} + R(1+\nu)\,c\,(RV_{,\zeta\eta} - sV_{,\eta\eta})$$
$$+2R^2 W_{,\zeta\zeta}(RW_{,\zeta} - sW_{,\eta}) + RW_{,\zeta\eta}\{-4Rs\,W_{,\zeta} + W_{,\eta}[4s^2 + (1+\nu)\,c^2]\}$$
$$+ W_{,\eta\eta}[RW_{,\zeta}(1 + s^2 - \nu c^2) - 2\,s\,W_{,\eta}] = 0 \quad \ldots\ldots\ (3\text{-}24)$$

$$R(1 + c^2 - \nu s^2)\,V_{,\eta\eta} - 2R^2(1-\nu)s\,V_{,\zeta\eta} + R^3(1-\nu)V_{,\zeta\zeta} + (1+\nu)(R^2c\,U_{,\zeta\eta} - Rsc\,U_{,\eta\eta})$$
$$+ W_{,\eta\eta}[2W_{,\eta} - R(1+\nu)s\,W_{,\zeta}] + RW_{,\zeta\eta}[(-3+\nu)s\,W_{,\eta} + R(1+\nu)W_{,\zeta}] + R^2 W_{,\zeta\zeta}[(1-\nu)W_{,\eta}]$$
$$= 0 \quad \ldots\ldots\ (3\text{-}25)$$

$$R^4 W_{,\zeta\zeta\zeta\zeta} - 4s(R^3 W_{\zeta\zeta\zeta\eta} + R\,W_{,\zeta\eta\eta\eta}) + 2R^2(1+2s^2)\,W_{,\zeta\zeta\eta\eta} + W_{,\eta\eta\eta\eta} =$$
$$Qc^4 + 12\{(R^2c\,U_{,\zeta} - Rsc\,U_{,\eta}) + \frac{1}{2}(R\,W_{,\zeta} - s\,W_{,\eta})^2 + \nu[Rc^2\,V_{,\eta} + \frac{1}{2}(cW_{,\eta})^2]\}$$
$$(R^2 W_{,\zeta\zeta} - 2Rs\,W_{,\zeta\eta} + s^2 W_{,\eta\eta}) + 12c^2\{Rc^2\,V_{,\eta} + \frac{1}{2}c^2(W_{,\eta})^2 + \nu[(R^2cU_{,\zeta} - RscU_{,\eta})$$
$$+ \frac{1}{2}(RW_{,\zeta} - sW_{,\eta})^2]\}W_{,\eta\eta} + 12(1-\nu)[(R^2cV_{,\zeta} - RscV_{,\eta}) + (RcW_{,\zeta} - sc\,W_{,\eta})\,W_{,\eta}$$
$$+ R\,c^2\,U_{,\eta}]\,(Rc\,W_{,\zeta\eta} - sc\,W_{,\eta\eta}) \quad \ldots\ldots\ (3\text{-}26)$$

where, for brevity, s = sin θ and c = cos θ, θ being the skew angle, 2a and 2b are the oblique dimensions of the plate.

Hence, the problem of large deflections of skewed plates is reduced to finding a solution to Eqs. (3-24), (3-25) and (3-26).

(d) Method of Solution

The small parameter perturbation method is now used to obtain approximate solutions to Eqs. (3-24), (3-25) and (3-26) for clamped skewed plates subjected to lateral uniform pressure. This method requires the expansion of the displacement components and the dimensionless load quantity in a power series of ascending powers of the dimensionless centre deflection parameter W_o. Thus we let,

$$Q = \gamma_1 W_o + \gamma_3 W_o^3 + \gamma_5 W_o^5 + \ldots \ldots \ldots \ldots \ldots \ldots \quad (3\text{-}27)$$

$$W = w_1(\zeta, \eta) W_o + w_3(\zeta, \eta) W_o^3 + w_5(\zeta, \eta) W_o^5 + \ldots \ldots \quad (3\text{-}28)$$

$$U = s_2(\zeta, \eta) W_o^2 + s_4(\zeta, \eta) W_o^4 + \ldots \ldots \ldots \ldots \ldots \quad (3\text{-}29)$$

$$V = t_2(\zeta, \eta) W_o^2 + t_4(\zeta, \eta) W_o^4 + \ldots \ldots \ldots \ldots \ldots \quad (3\text{-}30)$$

where $\gamma_1, \gamma_3, \gamma_5 \ldots\ldots$ are the undetermined parameters relating the dimensionless centre deflection W_o to the dimensionless load Q, $s_2, s_4, \ldots, t_2, t_4, \ldots$, and $w_1, w_3, w_5, \ldots$, are functions of the dimensionless oblique co-ordinates ζ and η, relating the in-plane and lateral displacements to the same perturbation parameter W_o.

From the series for W, Eq. (3-27), it is evident that, in order that the centre deflection be W_o as defined, it is necessary to require

$$w_1\,(0,0) = 1 \quad \text{and} \quad w_3\,(0,0) = w_5\,(0,0) = 0 \qquad \ldots(3\text{-}31)$$

The prescribed boundary conditions for the clamped edges are:

$$w_{,n} = v\cos\theta = w = 0 \quad \text{at } \eta = \pm\ 1$$
$$\text{and} \quad w_{,x} = u = w = 0 \quad \text{at } \zeta = \pm\ 1 \qquad \ldots\ldots\ldots(3\text{-}32)$$

Solution to the Linear Small Deflection Problem

(First Order Approximation)

Substituting Eqs. (3-27) and (3-28) into Eq. (3-26) and equating coefficients of the terms containing W_o, yield the following differential equation governing the linear (small deflection) behaviour of skewed plates:

$$R^4 w_{1,\zeta\zeta\zeta\zeta} - 4R^3 s\, w_{1,\zeta\zeta\zeta\eta} - 4Rs\, w_{1,\zeta\eta\eta\eta} + 2R^2(1+2s^2)\, w_{1,\zeta\zeta\eta\eta}$$
$$+ w_{1,\eta\eta\eta\eta} = \gamma_1 c^4 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}33)$$

The associated boundary conditions for this first order approximation are:

$$\left.\begin{aligned} &w_{1,n} = w_1 = 0 \quad \text{at } \eta = \pm\ 1 \\ &\text{and} \\ &w_{1,x} = w_1 = 0 \quad \text{at } \zeta = \pm\ 1 \end{aligned}\right\} \qquad \ldots\ldots\ldots(3\text{-}34)$$

It can be readily verified that conditions (3-34) are identically satisfied when

$$w_1 = (1-\eta^2)^2 (1-\zeta^2)^2 (1-\zeta\eta)(1+C_1\eta^2+C_2\zeta^2+C_3\eta^4+C_4\zeta^4+C_5\zeta^2\eta^2) \quad .. \quad (3\text{-}35)$$

where $C_1 \ldots C_5$ are undetermined coefficients. It is perhaps worth noting that the deflection function assumed, Eq. (3-35) not only meets the conditions set out in (3-31) but also satisfies the inherent condition of polar symmetry, i.e.,

$$w_1(\zeta, \eta) = w_1(-\zeta, -\eta), \text{ and } w_1(-\zeta, \eta) = w_1(\zeta, -\eta)$$

------- a necessary condition for a uniformly loaded skewed plate.

Substituting expression (3-35) into Eq. (3-33) and equating corresponding powers of η and ζ we obtain six linear algebraic equations for the six undetermined coefficients, $\gamma_1, \ldots C_1, \ldots, C_5$. The solution of this matrix equation defines uniquely the value of the small lateral displacement (deflection) of the plate anywhere within the plate boundary.

Solution to the Nonlinear Large Deflection Problem (Higher Order Approximations)

Making use of Eqs. (3-28) through (3-30) in Eqs. (3-24) and (3-25) and collecting coefficients of W_o^2 terms, result in two differential equations governing the in-plane displacement components of the plate:

$$2R^3c\,s_{2,\zeta\zeta} - 4R^2sc\,s_{2,\zeta\eta} + R(2s^2c+(1-\nu)c^3)s_{2,\eta\eta} + (1+\nu)R^2c^2t_{2,\zeta\eta}$$

$$-R(1+\nu)sc^2t_{2,\eta\eta} + 2R^3w_{1,\zeta\zeta}w_{1,\zeta} - 2R^2s\,w_{1,\zeta\zeta}w_{1,\eta} - 4R^2s\,w_{1,\zeta\eta}w_{1,\zeta}$$

$$+R[4s^2+(1+\nu)c^2]w_{1,\zeta\eta}w_{1,\eta} + R(1+s^2-\nu c^2)w_{1,\eta\eta}w_{1,\zeta} - 2s\,w_{1,\eta\eta}w_{1,\eta} = 0 \quad \ldots (3\text{-}36)$$

$$R(1+c^2-\nu s^2)t_{2,\eta\eta} - 2R^2(1-\nu)s\,t_{2,\zeta\eta} + R^3(1-\nu)t_{2,\zeta\zeta} + R(1+\nu)\,c\,s_{2,\zeta\eta}$$

$$-R(1+\nu)sc\,s_{2,\eta\eta} + 2w_{1,\eta\eta}w_{1,\eta} - R(1+\nu)s\,w_{1,\eta\eta}w_{1,\zeta} + R(\nu-3)s\,w_{1,\zeta\eta}w_{1,\eta}$$

$$+R^2(1+\nu)\,w_{1,\zeta\eta}w_{1,\zeta} + R^2(1-\nu)\,w_{1,\zeta\zeta}w_{1,\eta} = 0 \quad \ldots\ldots (3\text{-}37)$$

The boundary conditions for the in-plane displacements require

$$s_2 = t_2 \cos\theta = 0$$

at $\eta = \pm 1$ and $\zeta = \pm 1$ ..... (3-38)

which are satisfied if we take,

$$s_2 = (1-\zeta^2)(1-\eta^2)(D_2\zeta + D_3\eta + D_4\zeta^3 + D_5\eta^3 + D_6\zeta\eta^2 + D_7\zeta^2\eta$$

$$+ D_8\zeta^3\eta^2 + D_9\zeta^2\eta^3) \quad \ldots\ldots (3\text{-}39)$$

$$t_2 = (1-\zeta^2)(1-\eta^2)(E_2\eta + E_3\zeta + E_4\eta^3 + E_5\zeta^3 + E_6\zeta^2\eta + E_7\zeta\eta^2$$

$$+ E_8\zeta^2\eta^3 + E_9\zeta^3\eta^2) \quad \ldots\ldots (3\text{-}40)$$

Employing expression (3-35), (3-39) and (3-40) as dictated by Eqs. (3-36) and (3-37) and equating powers of x and y, yield sufficient linear equations to determine the twelve undetermined coefficients $D_2,\ldots, D_9$, $E_2,\ldots,E_9$, and hence the in-plane displacement components.

Collecting the coefficients of W_o^3 terms in equation (3-26), the differential equation governing the first nonlinear term of the lateral displacement expression is obtained, namely,

$$
\begin{aligned}
&R^4 w_{3,\zeta\zeta\zeta\zeta} - 4Rs(R^2 w_{3,\zeta\zeta\zeta\eta} + w_{3,\zeta\eta\eta\eta}) + 2R^2(1+2s^2) w_{3,\zeta\zeta\eta\eta} + w_{3,\eta\eta\eta\eta} \\
&= \gamma_3 c^4 + 12\Big\{[R^4 c\, s_{2,\zeta} w_{1,\zeta\zeta} - 2R^3 sc\, s_{2,\zeta} w_{1,\zeta\eta} + R^2 s^2 c s_{2,\zeta} w_{1,\eta\eta} - R^3 sc s_{2,\eta} w_{1,\zeta\zeta} \\
&+ 2R^2 s^2 c\, s_{2,\eta} w_{1,\zeta\eta} - Rs^3 c\, s_{2,\eta} w_{1,\eta\eta}] + \frac{1}{2}[R^4 w_{1,\zeta\zeta}(w_{1,\zeta})^2 \\
&- 2R^3 s\, w_{1,\zeta\eta}(w_{1,\zeta})^2 + R^2 s^2 w_{1,\eta\eta}(w_{1,\zeta})^2 - 2R^3 s\, w_{1,\zeta\zeta} w_{1,\zeta} w_{1,\eta} \\
&+ 4R^2 s^2 w_{1,\zeta\eta} w_{1,\zeta} w_{1,\eta} - 2Rs^3 w_{1,\eta\eta} w_{1,\zeta} w_{1,\eta} + R^2 s^2 w_{1,\zeta\zeta}(w_{1,\eta})^2 \\
&- 2Rs^3 w_{1,\zeta\eta}(w_{1,\eta})^2 + s^4 w_{1,\eta\eta}(w_{1,\eta})^2] + \nu[R^3 c^2 w_{1,\zeta\zeta} t_{2,\eta} \\
&- 2R^2 sc^2 w_{1,\zeta\eta} t_{2,\eta} + Rs^2 c^2 w_{1,\eta\eta} t_{2,\eta} + \frac{1}{2} R^2 c^2 w_{1,\zeta\zeta}(w_{1,\eta})^2 \\
&- Rsc^2 w_{1,\zeta\eta}(w_{1,\eta})^2 + \frac{1}{2} s^2 c^2 w_{1,\eta\eta}(w_{1,\eta})^2]\Big\} + 12\Big\{[Rc^4 w_{1,\eta\eta} t_{2,\eta} \\
&+ \frac{1}{2} c^4 w_{1,\eta\eta}(w_{1,\eta})^2 + \nu(R^2 c^3 w_{1,\eta\eta} s_{2,\zeta} - Rsc^3 w_{1,\eta\eta} s_{2,\eta} \\
&+ \frac{1}{2} c^2[R^2 (w_{1,\zeta})^2 (w_{1,\eta\eta}) - 2Rs\, w_{1,\eta\eta} w_{1,\zeta} w_{1,\eta} + s^2 w_{1,\eta\eta}(w_{1,\eta})^2]\Big)\Big\} \\
&+ 12(1-\nu)[R^2 c^3 w_{1,\zeta\eta} s_{2,\eta} - Rsc^3 w_{1,\eta\eta} s_{2,\eta} + R^3 c^2 w_{1,\zeta\eta} t_{2,\zeta} \\
&- R^2 sc^2 w_{1,\eta\eta} t_{2,\zeta} - R^2 sc^2 w_{1,\zeta\eta} t_{2,\eta} + Rs^2 c^2 w_{1,\eta\eta} t_{2,\eta} + R^2 c^2 w_{1,\eta} w_{1,\zeta} w_{1,\zeta\eta} \\
&- Rsc^2 w_{1,\eta\eta} w_{1,\eta} w_{1,\zeta} - Rsc^2 w_{1,\zeta\eta}(w_{1,\eta})^2 + s^2 c^2 w_{1,\eta\eta}(w_{1,\eta})^2] \qquad (3\text{-}41)
\end{aligned}
$$

The boundary conditions to be met here are:

$$w_{3,n} = w_3 = 0 \qquad \text{at } \eta = \pm 1$$
$$\text{and} \quad w_{3,x} = w_3 = 0 \qquad \text{at } \xi = \pm 1 \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}42)$$

which are identically satisfied by the following expression:

$$w_3 = (1-\eta^2)^2 (1-\xi^2)^2 (1-\xi\eta)(F_1 \eta^2 + F_2 \xi^2 + F_3 \eta^4 + F_4 \xi^4 + F_5 \xi^2 \eta^2) \quad (3\text{-}43)$$

Substituting Eq. (3-43) into expression (3-41) and again equating powers of η and ξ, the undetermined coefficients γ_3, F_1, ... F_5 are evaluated by solving the resulting set of simultaneous equations.

Repeating the same procedure, i.e., now collecting coefficients of W_o^4, equations governing the next approximation for the in-plane displacements can be written as:

$$2R^3 c\, s_{4,\xi\xi} - 4R^2 sc\, s_{4,\xi\eta} + R(2s^2 c + (1-\nu)c^3)\, s_{4,\eta\eta}$$
$$+ (1+\nu) R^2 c^2 t_{4,\xi\eta} - (1+\nu) Rc^2 s\, t_{4,\eta\eta} + 2R^3 (w_{1,\xi} w_{3,\xi\xi} + w_{3,\xi} w_{1,\xi\xi})$$
$$- 2R^2 s (w_{1,\eta} w_{3,\xi\xi} + w_{3,\eta} w_{1,\xi\xi}) - 4R^2 s (w_{3,\xi} w_{1,\xi\eta} + w_{1,\xi} w_{3,\xi\eta})$$
$$+ R(4s^2 + (1+\nu)c^2)(w_{1,\eta} w_{3,\xi\eta} + w_{3,\eta} w_{1,\xi\eta}) + R(1+s^2-\nu c^2)$$
$$(w_{1,\xi} w_{3,\eta\eta} + w_{3,\xi} w_{1,\eta\eta}) - 2s (w_{1,\eta} w_{3,\eta\eta} + w_{3,\eta} w_{1,\eta\eta}) = 0$$
$$\ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}44)$$

$$R(1+c^2-s^2)t_{4,\eta\eta}-2(1-\nu)R^2 st_{4,\xi\eta}+(1-\nu)R^3 t_{4,\xi\xi}+(1+\nu)R^2 c\, s_{4,\xi\eta}$$
$$-(1+\nu)\,R\,c\,s\,s_{4,\eta\eta}+2(w_{1,\eta}w_{3,\eta\eta}+w_{3,\eta}w_{1,\eta\eta})-R(1+\nu)s(w_{1,\xi}w_{3,\eta\eta}+w_{3,\xi}w_{1,\eta\eta})$$
$$+R(-3+\nu)s(w_{1,\eta}w_{3,\xi\eta}+w_{3,\eta}w_{1,\xi\eta})+R^2(1+\nu)(w_{3,\xi}w_{1,\xi\eta}+w_{1,\xi}w_{3,\xi\eta})$$
$$+R^2(1-\nu)(w_{1,\eta}w_{3,\xi\xi}+w_{3,\eta}w_{1,\xi\xi})=0 \quad \ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}45)$$

The associated boundary conditions for this approximation are:

$$s_4 = t_4 \cos\theta = 0$$

at $\eta = \pm 1$ and $\xi = \pm 1$ ..... (3-46)

Eq.(3-46) are satisfied by assuming the following forms for the in-plane displacements:

$$s_4 = (1-\xi^2)(1-\eta^2)(1-\xi\eta)(G_2\xi+G_3\eta+G_4\xi^3+G_5\eta^3+G_6\xi\eta^2+G_7\xi^2\eta+G_8\xi^3\eta^2+G_9\xi^2\eta^3)$$
..... (3-47)

$$t_4=(1-\xi^2)(1-\eta^2)(1-\xi\eta)(H_2\xi+H_3\eta+H_4\xi^3+H_5\eta^3+H_6\xi\eta^2+H_7\xi^2\eta+H_8\xi^3\eta^2+H_9\xi^2\eta^3)$$ ..... (3-48)

The undetermind coefficients $G_2,\ldots,G_6,\ldots,H_6$ are again evaluated by substituting Eqs (3-47) and (3-48) into Eqs. (3-44) and (3-45).

As a last appoximation in this analysis, we put Eqs.(3-27) through (3-30) into Eq. (3-26) and collect coefficients W_0^5. This yields the differential equation:

$$R^4 w_{5,\xi\xi\xi\xi}-4Rs(R^2 w_{5,\xi\xi\xi\eta}+w_{5,\xi\eta\eta\eta})+2R^2(1+2s^2)w_{5,\xi\xi\eta\eta}+w_{5,\eta\eta\eta\eta}=\gamma_5 c^4+12$$
$$\{[R^4 c(w_{1,\xi\xi}s_{4,\xi}+w_{3,\xi\xi}s_{2,\xi})-2R^3 sc(w_{1,\xi\eta}s_{4,\xi}+w_{3,\xi\eta}s_{2,\xi})+R^2 cs^2(w_{1,\eta\eta}$$
$$s_{4,\xi}+w_{3,\eta\eta}s_{2,\xi})-R^3 cs(w_{3,\xi\xi}s_{2,\eta}+w_{1,\xi\xi}s_{4,\eta})+2R^2 cs^2(w_{1,\xi\eta}s_{4,\eta}+w_{3,\xi\eta}$$
$$s_{2,\eta})-Rcs^3(w_{1,\eta\eta}s_{4,\eta}+w_{3,\eta\eta}s_{2,\eta})]+1/2[R^4(2w_{1,\xi\xi}w_{1,\xi}w_{3,\xi}+w_{3,\xi\xi}$$

$$(w_{1,\xi})^2)-2R^3s(2w_{1,\xi\eta}\,w_{1,\xi}\,w_{3,\xi}+w_{3,\xi\eta}\,(w_{1,\xi})^2)+R^2s^2(2w_{1,\eta\eta}\,w_{1,\xi}\,w_{3,\xi}+w_{3,\eta\eta}$$
$$(w_{1,\xi})^2)-2R^3s(w_{1,\xi\xi}\,w_{1,\xi}\,w_{3,\eta}+w_{1,\xi\xi}\,w_{3,\xi}\,w_{1,\eta}+w_{3,\xi\xi}\,w_{1,\xi}\,w_{1,\eta}\,)$$
$$+4R^2s^2(w_{1,\xi\eta}w_{1,\xi}\,w_{3,\eta}+w_{1,\xi\eta}\,w_{3,\xi}\,w_{1,\eta}+w_{3,\xi\eta}\,w_{1,\xi}\,w_{1,\eta}\,)-2Rs^3(w_{1,\eta\eta}$$
$$w_{1,\xi}\,w_{3,\eta}+w_{1,\eta\eta}\,w_{3,\xi}\,w_{1,\eta}+w_{3,\eta\eta}\,w_{1,\xi}\,w_{1,\eta}\,)+R^2s^2(2w_{1,\xi\xi}\,w_{1,\eta}\,w_{3,\eta}$$
$$+w_{3,\xi\xi}\,w_{1,\eta}\,w_{1,\eta}\,)-2Rs^3(2w_{1,\xi\eta}\,w_{1,\eta}\,w_{3,\eta}+w_{3,\xi\eta}\,(w_{1,\eta})^2)+s^4(2w_{1,\eta\eta}$$
$$w_{1,\eta}\,w_{3,\eta}+w_{3,\eta\eta}\,(w_{1,\eta})^2]+\nu[R^3c^2(w_{1,\xi\xi}\,t_{4,\eta}+w_{3,\xi\xi}\,t_{2,\eta})-2R^2sc^2$$
$$(w_{1,\xi\eta}\,t_{4,\eta}+w_{3,\xi\eta}\,t_{2,\eta}\,)+Rs^2c^2(w_{1,\eta\eta}\,t_{4,\eta}+w_{3,\eta\eta}\,t_{2,\eta}\,)$$
$$+1/2c^2(\,R^2\,(2w_{1,\xi\xi}\,w_{1,\eta}\,w_{3,\eta}+w_{3,\xi\xi}\,(w_{1,\eta})^2\,)$$
$$-2Rs(2w_{1,\xi\eta}\,w_{1,\eta}\,w_{3,\eta}+w_{3,\xi\eta}\,(w_{1,\eta})^2)+s^2(2w_{1,\eta\eta}\,w_{1,\eta}\,w_{3,\eta}+w_{3,\eta\eta}$$
$$(w_{1,\eta})^2))]+12\{Rc^4(w_{1,\eta\eta}\,t_{4,\eta}+w_{3,\eta\eta}\,t_{2,\eta})+1/2c^4(2w_{1,\eta\eta}\,w_{1,\eta}\,w_{3,\eta}$$
$$+w_{3,\eta\eta}(w_{1,\eta})^2)+\nu[R^2c^3(w_{1,\eta\eta}\,s_{4,\xi}+w_{3,\eta\eta}s_{2,\xi})-Rsc^3(w_{1,\eta\eta}\,s_{4,\eta}$$
$$+w_{3,\eta\eta}\,s_{2,\eta})+1/2[R^2c^2(2w_{1,\eta\eta}\,w_{1,\xi}\,w_{3,\xi}+w_{3,\eta\eta}\,(w_{1,\xi})^2)-2Rsc^2(w_{1,\eta\eta}$$
$$w_{1,\xi}\,w_{3,\eta}+w_{1,\eta\eta}\,w_{3,\xi}\,w_{1,\eta}+w_{3,\eta\eta}\,w_{1,\xi}\,w_{1,\eta}\,)+c^2s^2(2w_{1,\eta\eta}\,w_{1,\eta}\,w_{3,\eta}$$
$$+w_{3,\eta\eta}\,w_{1,\eta}\,w_{1,\eta}\,)]]\}+12(1-\nu)\{R^2c^3\,(w_{1,\xi\eta}\,s_{4,\eta}+w_{3,\xi\eta}\,s_{2,\eta})-Rsc^3$$
$$(w_{1,\eta\eta}\,s_{4,\eta}+w_{3,\eta\eta}\,s_{2,\eta}\,)+R^3c^2(w_{1,\xi\eta}\,t_{4,\xi}+w_{3,\xi\eta}\,t_{2,\xi}\,)-R^2sc^2(w_{1,\eta\eta}$$
$$t_{4,\xi}+w_{3,\eta\eta}\,t_{2,\xi}\,)-R^2sc^2\,(w_{1,\xi\eta}\,t_{4,\eta}+w_{3,\xi\eta}\,t_{2,\eta}\,)$$
$$+Rs^2c^2\,(\,w_{1,\eta\eta}\,t_{4,\eta}+w_{3,\eta\eta}\,t_{2,\eta}\,)+R^2c^2\,(w_{1,\xi\eta}\,w_{1,\eta}$$
$$w_{3,\xi}+w_{1,\xi\eta}w_{3,\eta}\,w_{1,\xi}+w_{3,\xi\eta}\,w_{1,\eta}\,w_{1,\xi}\,)-Rsc^2(w_{1,\eta\eta}\,w_{1,\eta}\,w_{3,\xi}+w_{1,\eta\eta}$$
$$w_{3,\eta}\,w_{1,\xi}+w_{3,\eta\eta}\,w_{1,\eta}\,w_{1,\xi}\,)-Rsc^2(2w_{1,\xi\eta}\,w_{3,\eta}\,w_{1,\eta}+w_{3,\xi\eta}\,(w_{1,\eta})^2)$$
$$+s^2c^2(w_{1,\eta\eta}\,w_{1,\eta}\,w_{3,\eta}+w_{1,\eta\eta}\,w_{3,\eta}\,w_{1,\eta}+w_{3\,\eta\eta}\,(w_{1,\eta})^2)\ldots\ldots\ldots(3\text{-}49)$$

The boundary conditions for this last approximation are:

$$w_{5,n}=w_5=0 \qquad \text{at } \eta=\pm 1 \qquad \ldots\ldots\ldots\ldots\ldots (3\text{-}50)$$

and

$$w_{5,x}=w_5=0 \qquad \text{at } \xi=\pm 1$$

which are met if we choose:

$$w_5 = (1-\xi^2)^2 \cdot (1-\eta^2)^2 \, (1-\xi\eta) \, (T_1\eta^2 + T_2\xi^2 + T_3\eta^4 + T_4\xi^4 + T_5\xi^2\eta^2) \quad \text{.....(3-51)}$$

Using this expression in Eq. (3-49) and equating powers of ξ and η, provide six linear simultaneous equations from which the undetermined coefficients, γ_5, $T_1, \ldots, T_5$ are found.

The above perturbation procedure has provided a means of determining uniquely the coefficients in all the dimensionless load and displacement functions represented by Eqs. (3-27) through Eq. (3-30). From these displacement functions, the principal bending and membrane stresses at any point within the plate boundary can be obtained.

(e) Displacement and Stress Relationships

It is well known that, in the theory of thin flat plates, the bending and membrane stresses can be expressed in terms of the displacements[1]. In terms of rectangular coordinates x and y, these displacements and stress relationships are given by:

$$\sigma''_x = \frac{-6D}{h^2}\,(w_{,xx} + \nu\, w_{,yy})$$

$$\sigma''_y = \frac{-6D}{h^2}\,(w_{,yy} + \nu\, w_{,xx}) \quad \text{..... (3-52)}$$

$$\tau''_{xy} = \frac{6D}{h^2}\,(1-\nu)\, w_{,xy}$$

$$\sigma'_x = \frac{E}{(1-\nu^2)} \left\{ u_{,x} + \frac{1}{2}(w_{,x})^2 + \nu \left[v_{,y} + \frac{1}{2}(w_{,y})^2 \right] \right\}$$

$$\sigma'_y = \frac{E}{(1-\nu^2)} \left\{ v_{,y} + \frac{1}{2}(w_{,y})^2 + \nu \left[u_{,x} + \frac{1}{2}(w_{,x})^2 \right] \right\} \quad \ldots\ldots (3\text{-}53)$$

$$\tau'_{xy} = G\,(u_{,y} + v_{,x} + w_{,x} w_{,y})$$

where σ''_x, σ''_y and τ''_{xy} are the extreme-fibre bending and shearing stresses, σ'_x, σ'_y and τ'_{xy} are the membrance stresses in the middle surface of the plate, and G is the shear modulus.

By means of the transformation Eqs. (4) and, by adding further the following dimensionless ratios for stress, viz.,

the nondimensional bending stresses:

$$S''_x = \frac{\sigma''_x b^2(1-\nu^2)}{Eh^2} \; ; \quad S''_y = \frac{\sigma''_y b^2}{Eh^2}(1-\nu^2) \; ; \quad S''_{xy} = \frac{\tau''_{xy} b^2}{Gh^2}$$

and, the nondimensional membrane stresses:

$$S'_x = \frac{\sigma'_x b^2}{Eh^2}(1-\nu^2) \; ; \quad S'_y = \frac{\sigma'_y b^2}{Eh^2}(1-\nu^2) \; ; \quad S'_{xy} = \frac{\tau'_{xy} b^2}{Gh^2} \quad \ldots (3\text{-}54)$$

Eqs. (25) can be readily expressed in terms of the dimensionless oblique co-ordinates as follows:

$$S''_x = -\frac{1}{2}\left[R^2\sec^2\theta W_{,\zeta\zeta} - 2R\sec\theta\tan\theta\, W_{,\zeta\eta} + (\tan^2\theta + \nu)\, W_{,\eta\eta}\right]$$

$$S''_y = -\frac{1}{2}\left[(1+\nu\tan^2\theta) W_{,\eta\eta} + \nu(R^2\sec^2\theta\, W_{,\zeta\zeta} - 2R\sec\theta\tan\theta\, W_{,\zeta\eta})\right] \quad \ldots\ldots (3\text{-}55)$$

$$S''_{xy} = R\sec\theta\, W_{,\zeta\eta} - \tan\theta\, W_{,\eta\eta}$$

$$S'_x = R^2 \sec\theta\, U_{,\zeta} - R\tan\theta\, U_{,\eta} + \nu R\, V_{,\eta} + \frac{1}{2}\left[R^2\sec^2\theta\,(W_{,\zeta})^2 + (\nu + \tan^2\theta)(W_{,\eta})^2 - 2R\sec\theta\tan\theta\, W_{,\zeta} W_{,\eta}\right]$$

$$S'_y = R\, V_{,\eta} + \frac{1}{2}(1+\nu\tan^2\theta)(W_{,\eta})^2 + \nu\left\{R^2\sec\theta\, U_{,\zeta} - R\tan\theta\, U_{,\eta} + \frac{1}{2}\left[(R\,W_{,\zeta})^2\sec^2\theta - 2R\, W_{,\zeta} W_{,\eta}\sec\theta\tan\theta\right]\right\} \qquad (3\text{-}56)$$

$$S''_{xy} = R\, U_{,\eta} + R^2\sec\theta\, V_{,\zeta} - R\tan\theta\, V_{,\eta} + W_{,\eta}(R\sec\theta\, W_{,\zeta} - \tan\theta\, W_{,\eta})$$

From these dimensionless bending and membrane stresses, the dimensionless principal stresses can be calculated in the usual manner:

$$S''_{\substack{\max\\ \min}} = 1/2\,(S_x'' + S_y'') \pm 1/2\sqrt{(S_x''-S_y'')^2 + 4(S''_{xy})^2}$$

$$S'_{\substack{\max\\ \min}} = 1/2\,(S_x' + S_y') \pm 1/2\sqrt{(S_x'-S_y')^2 + 4(S_{xy}')^2} \qquad (3\text{-}57)$$

The solution to the problem was programmed in Fortran for an IBM 1620 . To guard against round-off errors, all computations were carried to 16 significant figures.

(f) Observation and Discussion of Theoretical Results

Deflections (Lateral Displacements):

Results for the small deflection problem, obtained from the first order approximation, are shown in Table 1 for various skew angles and aspect ratios. It can be observed that the results are in close agreement with those obtained by Morley (4) and Kennedy (5). The results were also compared with experimental values obtained recently by the authors (6); the agreement was found to be good with the theoretical results being on the conservative side.

Results for the large deflection problem are shown graphically in Figures 4, 5, and 6, for aspect ratio R = 1/2, 2/3, and 1 respectively. To exhibit the difference between the linear and non-linear behaviour, results based on the small deflection theory are shown plotted in the above-mentioned figures.

For a given aspect ratio R, each of the Figures 4, 5, or 6 shows that the maximum deflection at the centre of the plate decreases with an increase in the skew angle. A similar observation can be made regarding deflections governed by the small deflection theory. (See also Table 1). This is due mainly to the increased rigidity of the obtuse corners with increase in skew, thus reducing the central deflection.

Furthermore, comparison of results for different aspect ratios R, indicates that the effect of skew on the central deflection decreases with decreasing R; this is expected since the influence of the plate corners on the central deflection diminish with decreasing R.

TABLE I. COEFFICIENTS w FOR MAXIMUM SMALL DEFLECTION AT CENTER FOR VARIOUS SKEW ANGLES AND RATIOS OF SIDES

$R = b/a$ $\qquad W_{max.} = w \frac{b^4 q}{D} (10)^{-2}$

Skew Angle θ	R = 1		R = 0.8		R = 0.667		R = 0.5	
	Present Method	Reference [5]	Present Method	Reference [5]	Present Method	Reference [5]	Present Method	Reference [5]
15°	1.797	1.793 1.792*	2.583	2.576 2.581*	3.123	3.093 3.098*	3.616	3.536 3.552*
30°	1.219	1.181	1.760	1.699 1.792*	2.096	2.050 2.081*	2.400	2.352 2.320*
45°	0.549	0.508	.791	.735	0.951	0.896 0.997*	1.088	1.056 1.040*
60°	0.128	.120	.186	.175	.230	0.216	.275	.259
75°	.00864	.00826	.0127	.0121	.0160	.0150	.0195	.0182

* Values obtained by Morley (4)

Results from the present method of solution are compared to those obtained by Way (2) for rectangular plates with small and large deflections, Figures 4, 5, and 6. Excellent agreement is shown for the small deflection results for all the aspect ratios considered, and for the large deflection results for aspect ratio R = 1/2; whereas for R = 2/3 and R = 1, the agreement is not as close, the difference not exceeding 5% for R = 1 and a dimensionless uniformly distributed load of 200. This discrepancy can be explained by the fact that the expressions assumed here for the displacement components, u, v, and w provide polar symmetry only in contrast to the rectangular plate where quadrant symmetry is required. The effect of this difference in symmetry on the behaviour of the plate under load seems to increase with increase in the aspect ratio R.

Figures 4, 5, and 6 also indicate that results obtained from small deflection and large deflection theories are sensibly the same when the central deflection is small compared to the thickness of the plate. However, the ratio, w_{max} /h at which the results from the two theories begin to deviate significantly is influenced by the aspect ratio, R = b/a. For example, Figure 4 (R = 1/2) shows that a distinct deviation between the small and large deflection results occurs when w_{max} /h exceeds a value of approximately 0.4; whereas Figure 5 (R = 2/3) and Figure 6 (R = 1) show such deviations occurring at ratios w_{max} /h approximately equal to 0.35 and 0.22 respectively. Thus we may conclude that the ratio w_{max}/h , at which

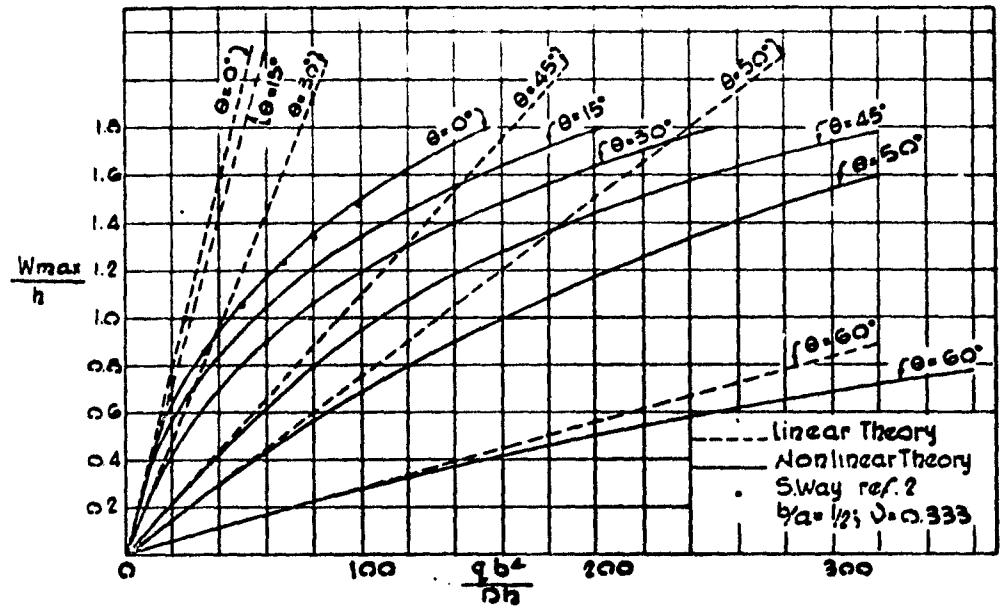


Fig. 4. Variation of Centre Deflections with Skew for Aspect Ratio = 1/2

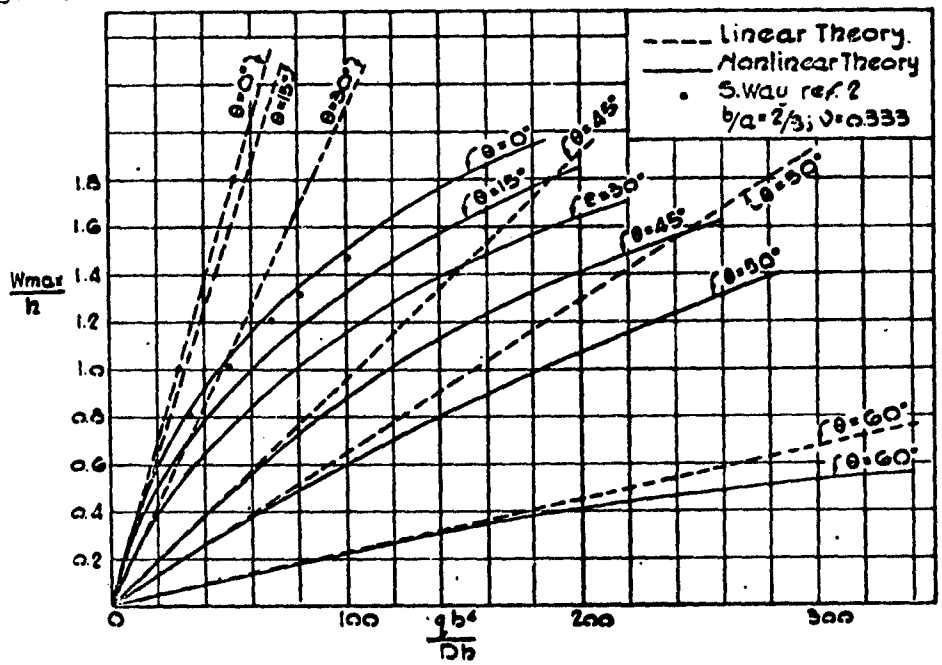


Fig. 5. Variations of Centre Deflections with Skew for Aspect Ratio =2/3.

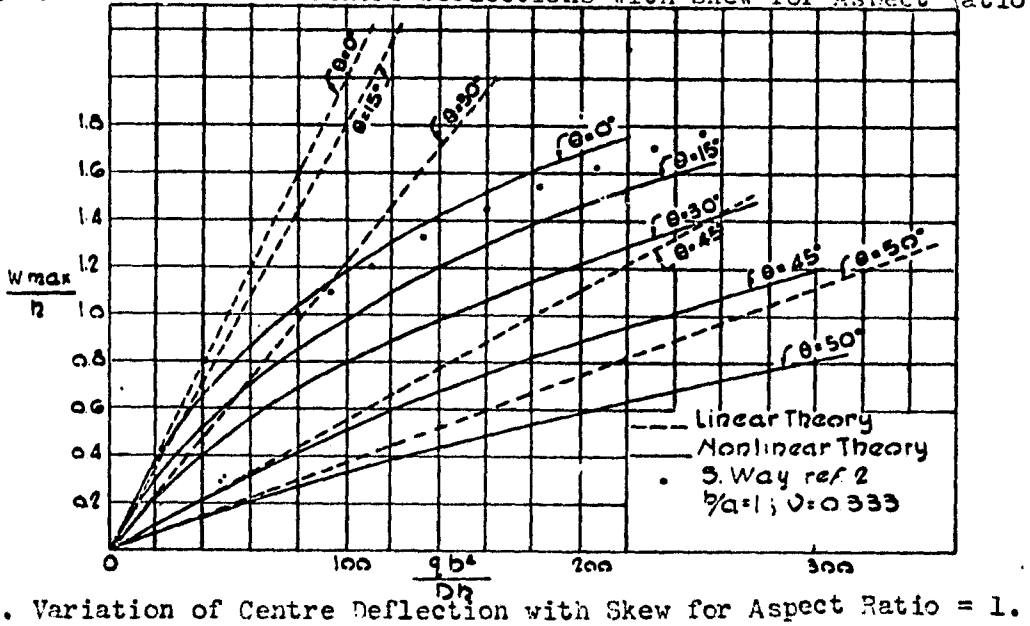


Fig. 6. Variation of Centre Deflection with Skew for Aspect Ratio = 1.

marked deviations of results from the two theories occur, decreases with increasing aspect ratio, R. It may be added also that the above w_{max} /h ratios do not appear to be sensitive to changes in the skew angle. In general, as the load on the plate is increased, the effect of the membrane forces on the deflection of the plate also increases, thus substantially reducing the lateral deflection as observed from Figures 4, 5, and 6.

The influence of the nonlinear terms on the deflection appears to diminish with increase in skew. Thus, for any given aspect ratio, the large deflection curves tend to become increasingly linear for large angles of skew.

Bending and Membrane Stresses:

Variations of the maximum principal bending and membrane stresses, at the edge and centre of the plate, with maximum centre deflection are shown in Figures 7 through 12 for several aspect ratios and skew angles. For the limiting case of zero skew ($\theta = 0^{\circ}$) and all the aspect ratios considered, the edge bending stresses are in close agreement with those obtained by Way (2). However, the corresponding membrane edge stresses reported by Way are approximately 30% higher. This discrepancy is probably due partly to the approximations in Way's energy solution, noted also by Timoshenko (1), and partly to the difference in symmetry existing between the skew and rectangular plate problems.

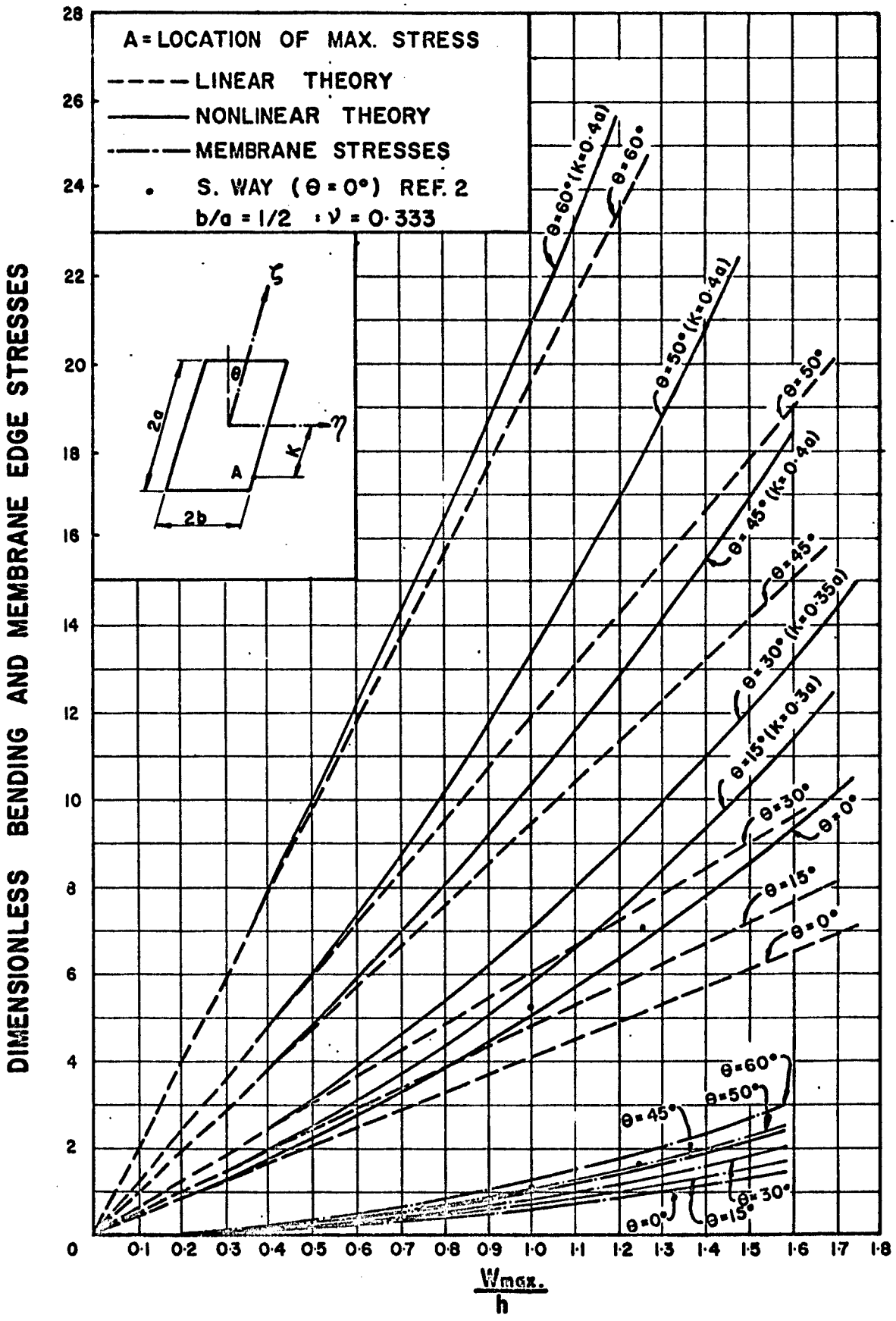


Fig. 7. Variations of Bending and Membrane Edge Stresses with Centre Deflections for Aspect Ratio b/a = 1/2

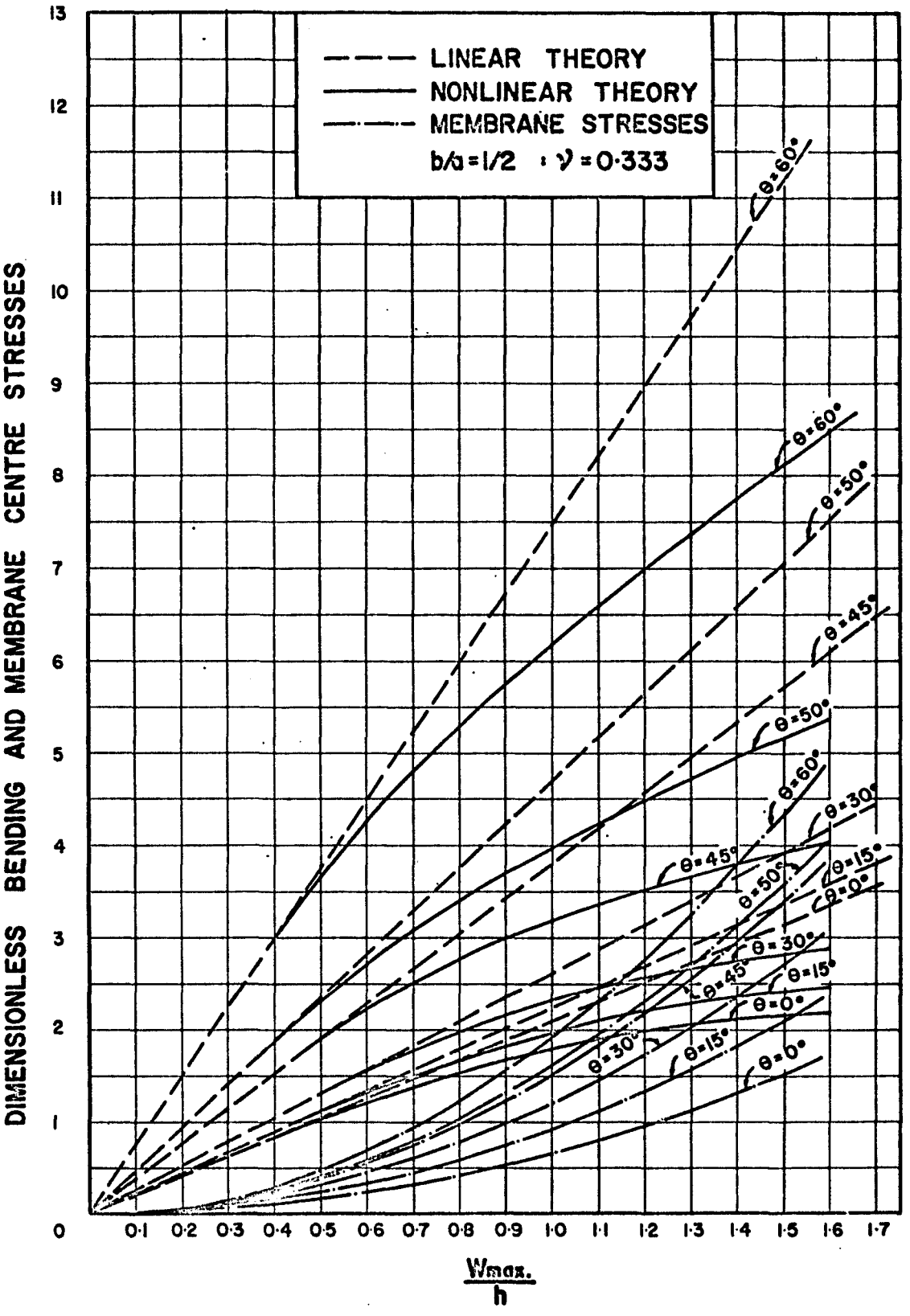


Fig. 8. Variations of Bending and Membrane Stresses at Centre of Plate with Centre Deflections for Aspect Ratio b/a = 1/2

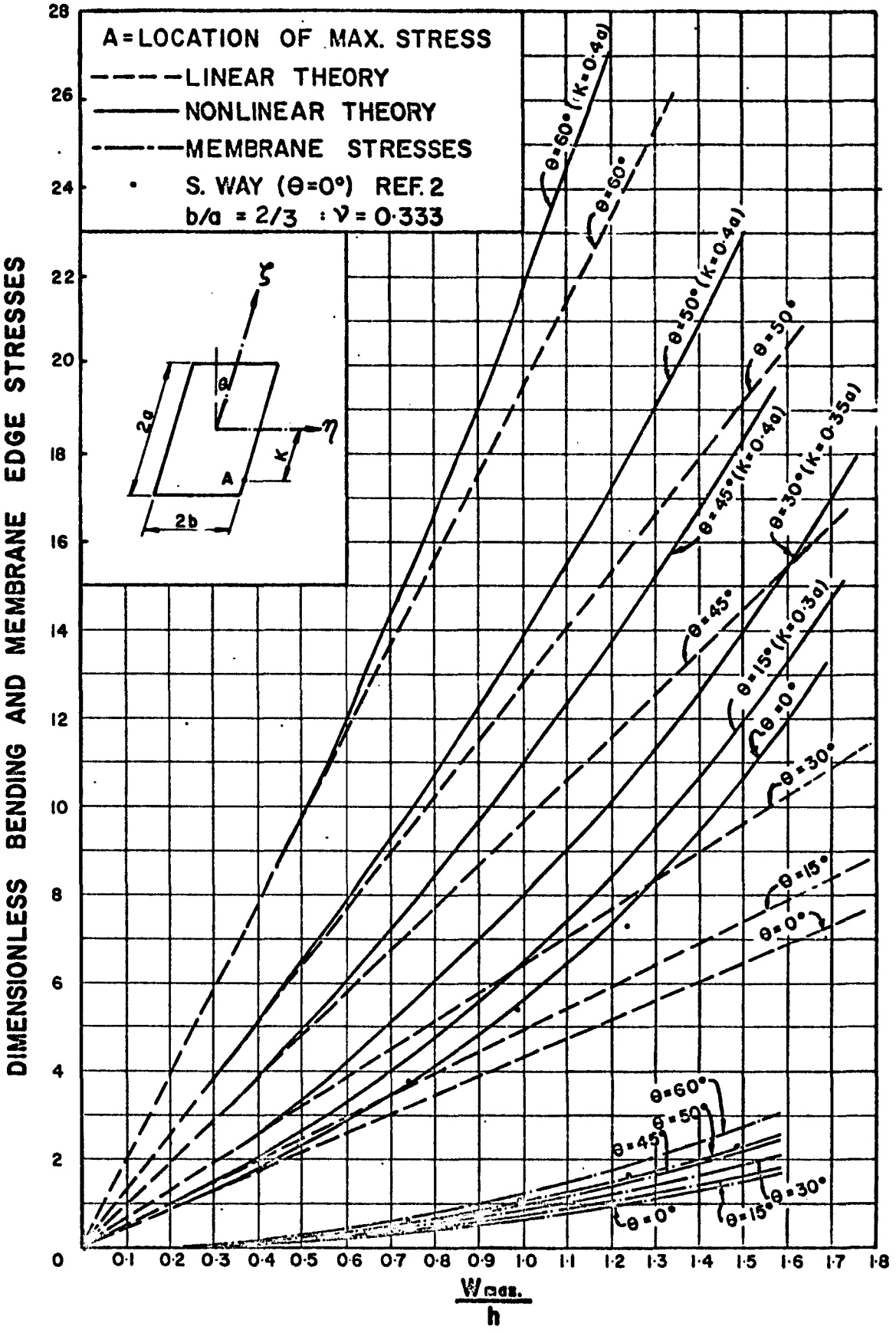


Fig. 9. Variations of Bending and Membrane Edge Stresses with Centre Deflections for Aspect Ratio b/a = 2/3

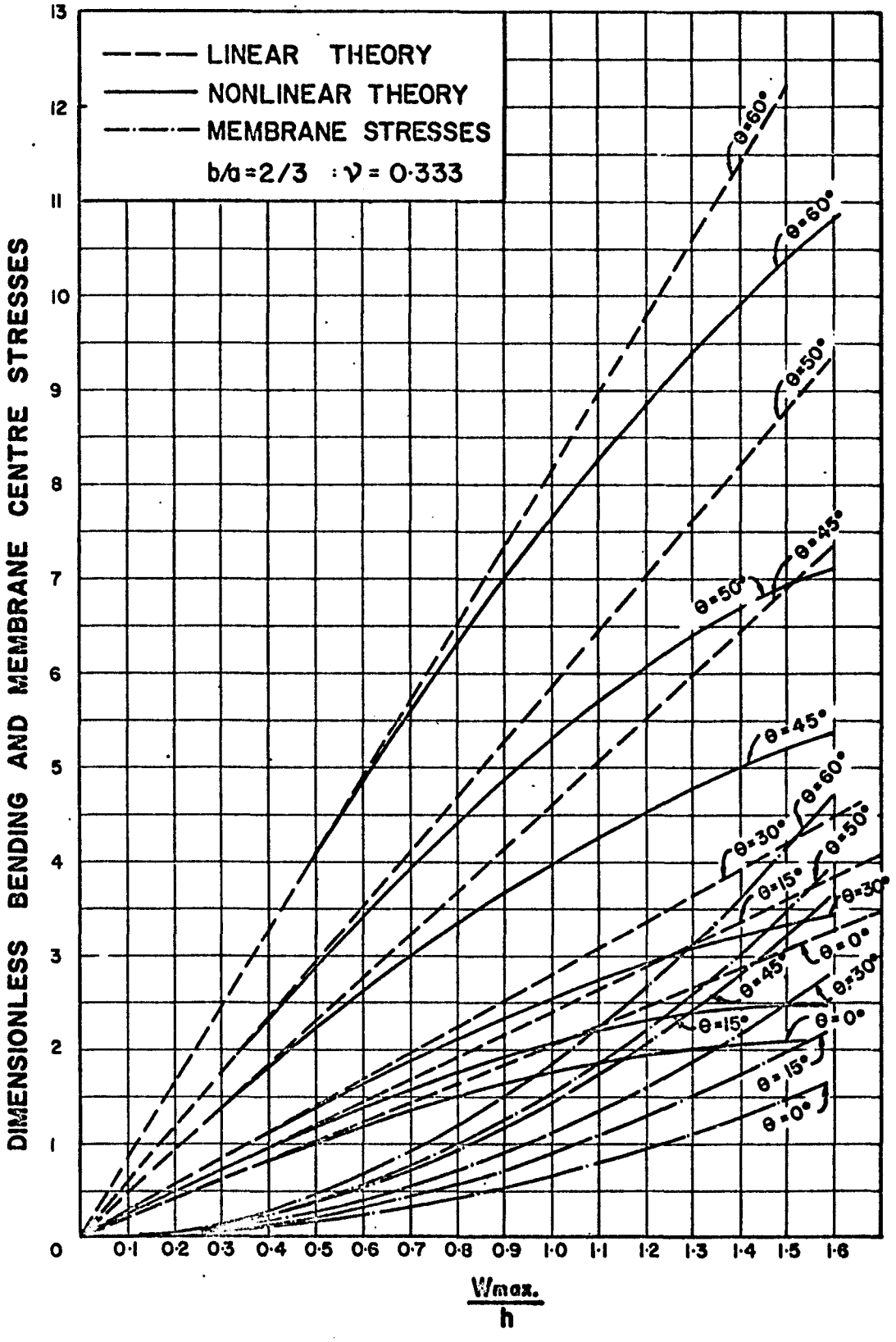


Fig. 10. Variation of Bending and Membrane Stresses at Centre of Plate with Centre Deflections for Aspect Ratio b/a = 2/3

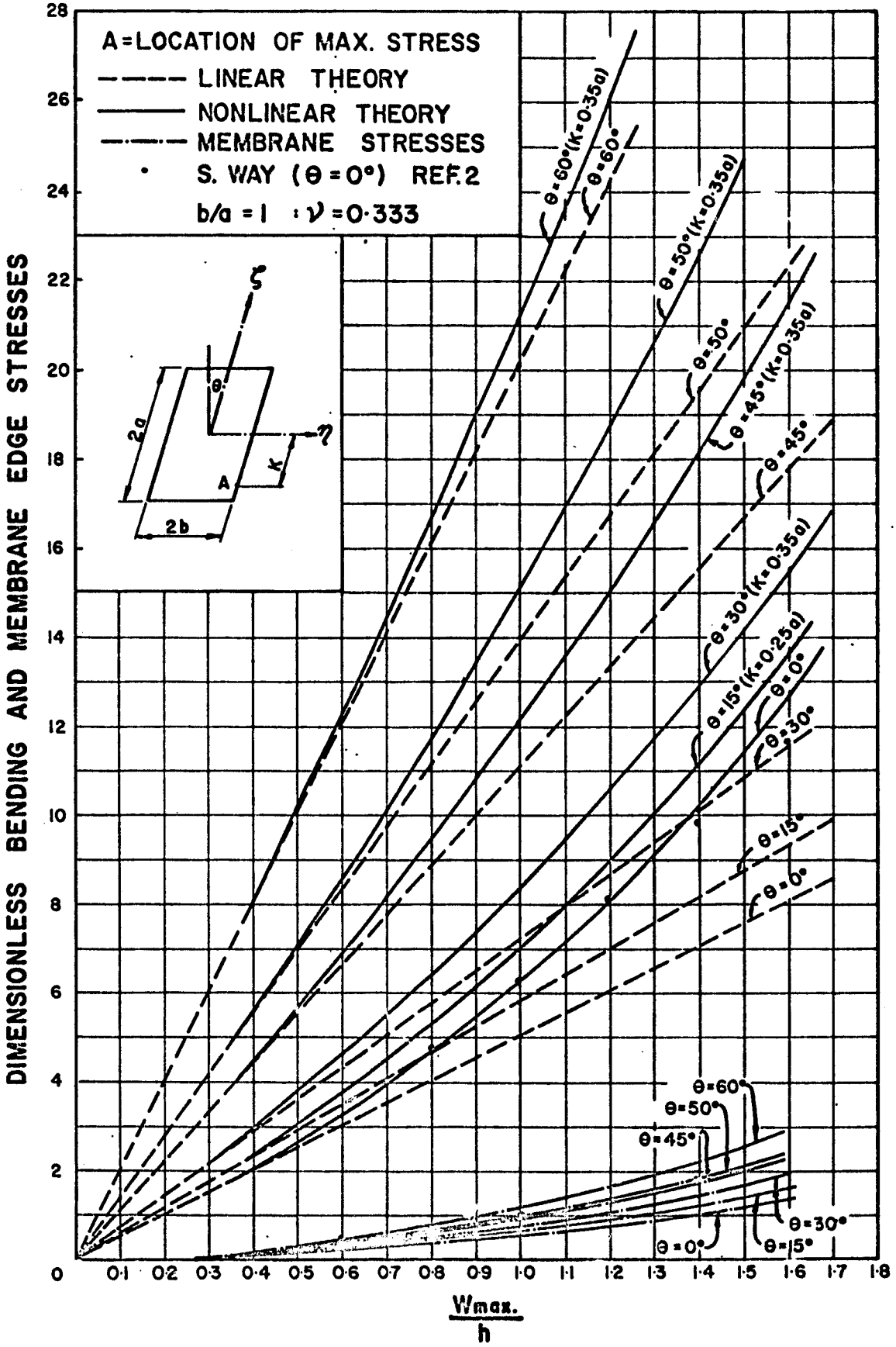


Fig. 11. Variation of Bending and Membrane Edge Stresses with Centre Deflection for Aspect Ratio b/a = 1

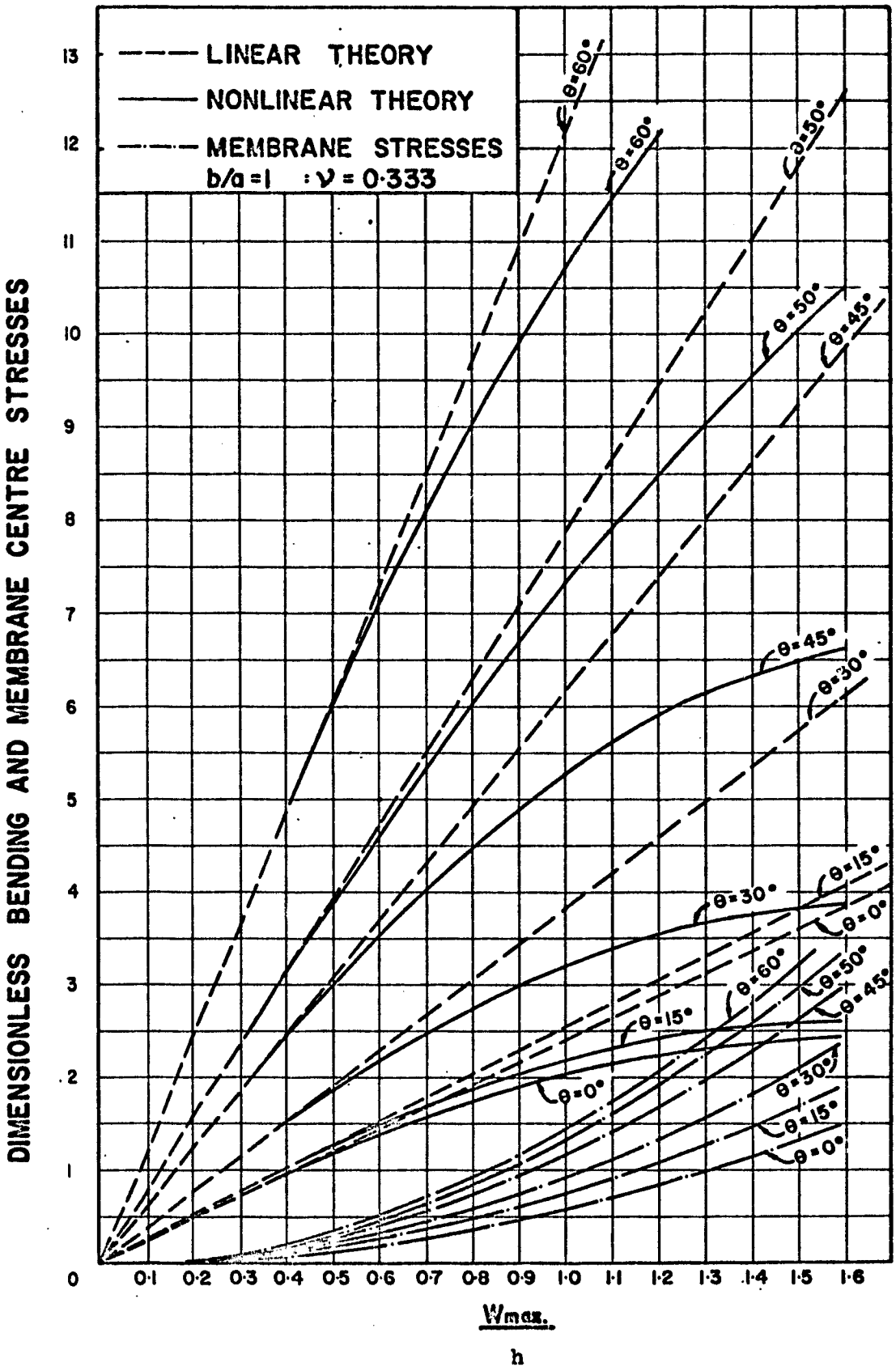


Fig. 12. Variation of Bending and Membrane Stresses at Centre of Plate with Centre Deflection for Aspect Ratio b/a = 1

Inspection of Figures 7 through 12 indicates that the maximum resultant or total stress occurs along the longer edge of the plate. The location of this resultant stress is invariably displaced towards the obtuse corners, and increasingly so with higher skew. It can also be observed from the above figures that, for a particular lateral displacement at centre, both the maximum edge and centre stresses increase with increasing skew; this is to be expected since more load is required to produce the same lateral centre displacement in a plate with a large skew than one with a small skew.

For different values of skew and aspect ratio considered, the curves representing the bending and membrane stresses are sensibly linear up to a point where the ratio w_{max}/h is between 0.35 and 0.40. This observation confirms the generally accepted criterion as to the limit of applicability of the small deflection theory.

Although the maximum membrane stresses along the edge and at the centre do increase with skew, they are relatively insensitive to changes in the aspect ratio, R. For any particular plate geometry the membrane stresses at the centre are invariably larger than those along the edge. However, for the entire combinations of independent variables considered, the magnitude of the membrane stresses is quite small when compared with the maximum resultant stresses along the longer edge of the plate.

(g) Convergence of the Results:

Although the convergence of the perturbation method has not been fully and rigorously clarified (25) (26), the method has been used successfully in solving many practical problems. Invariably, when the method was employed in solving plate problems, approximations beyond the third were not considered, mainly because of the formidable computational labour entailed. However, due to the restrictive symmetry of the problem treated herein, approximations up to and including the 5th were considered to obtain the results reported. It should be mentioned that in some cases with skew angles as high as 60°, the 5th order approximations were discarded, since with their inclusion the results began to diverge. The convergence and divergence of series solutions used in perturbation methods are fully discussed by Van Dyke (26). To illustrate the convergence, typical values for γ, in Equation (3-27), are given below:

For

$R = 1/2$, $\theta = 15^{\circ}$: $\gamma_1 = 27.654$, $\gamma_3 = 25.274$, $\gamma_5 = 0.792$

$R = 1$, $\theta = 45^{\circ}$: $\gamma_1 = 181.149$, $\gamma_3 = 38.745$, $\gamma_5 = 15.253$

(h) Plastic Analysis

As a result of foregoing theoretical analysis, it has been found that the maximum principal stress of a clamped skewed plate occurs along the longer edge of the plate and is displaced towards the obtuse corners (Figures 7, 9, and 11.) This maximum principal stress acts perpendicular to the edge of the plate and increases with increasing lateral centre deflection. When the yielding stress of the plate material is reached, the bending strength at the edge would break gradually.

The condition of yielding along the edge can be computed most simply by following the assumptions of the von-mises-Hencky theory of plastic failure. If σ_1, σ_2, and σ_3 are the principal stresses in the three perpendicular directions, the yielding condition is (23):

$$(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2 = \ldots\ldots\ldots\ldots\ldots (3\text{-}58)$$

Where E_o is the yielding stress in simple tension.

At the edge of the plate, we may identify σ_1, the maximum principal stress perpendicular to the edge of the plate as σ_x, and σ_2, the principal stress paralled to the edge of the plate as σ_y; and, due to the assumption of plane stress (assumption 2), σ_3 in the von Mises equation is neglected and Equation (3-58) is

reduced to :

$$\sigma_x^2 - \sigma_x \sigma_y + \sigma_y^2 = E_o^2 \quad \text{.....(3-59)}$$

Using equations (3-18) and (3-19) and recalling that the boundary conditions at the longer edge of the plate are:

$$w_{,x} = w_{,n} = w_{,y} = v_{,y} = 0 \text{ at } = \pm 1 \quad \text{.....(3-60)}$$

we have,

$$\sigma_x = \frac{E}{(1 - \nu^2)} u_{,x}$$

$$\sigma_y = \frac{E}{(1 - \nu^2)} \nu u_{,x}$$

or $$\sigma_y = \nu \sigma_x \quad \text{.....(3-61)}$$

Putting Equation (3-61) into Equation (3-59) and, after simplification, the yield condition at the edge of the plate on the convex side is obtained:

$$\frac{E_o b^2 (1 - \nu^2)}{E h^2} = \sqrt{(1 - \nu + \nu^2)} \; (S''_{max} + S'_{max}) \quad \text{...(3-62)}$$

This equation for the yield condition is plotted for aspect ratios R = 1/2, R = 2/3, and R = 1 respectively for various skew angles in Figures 13, 14, and 15.

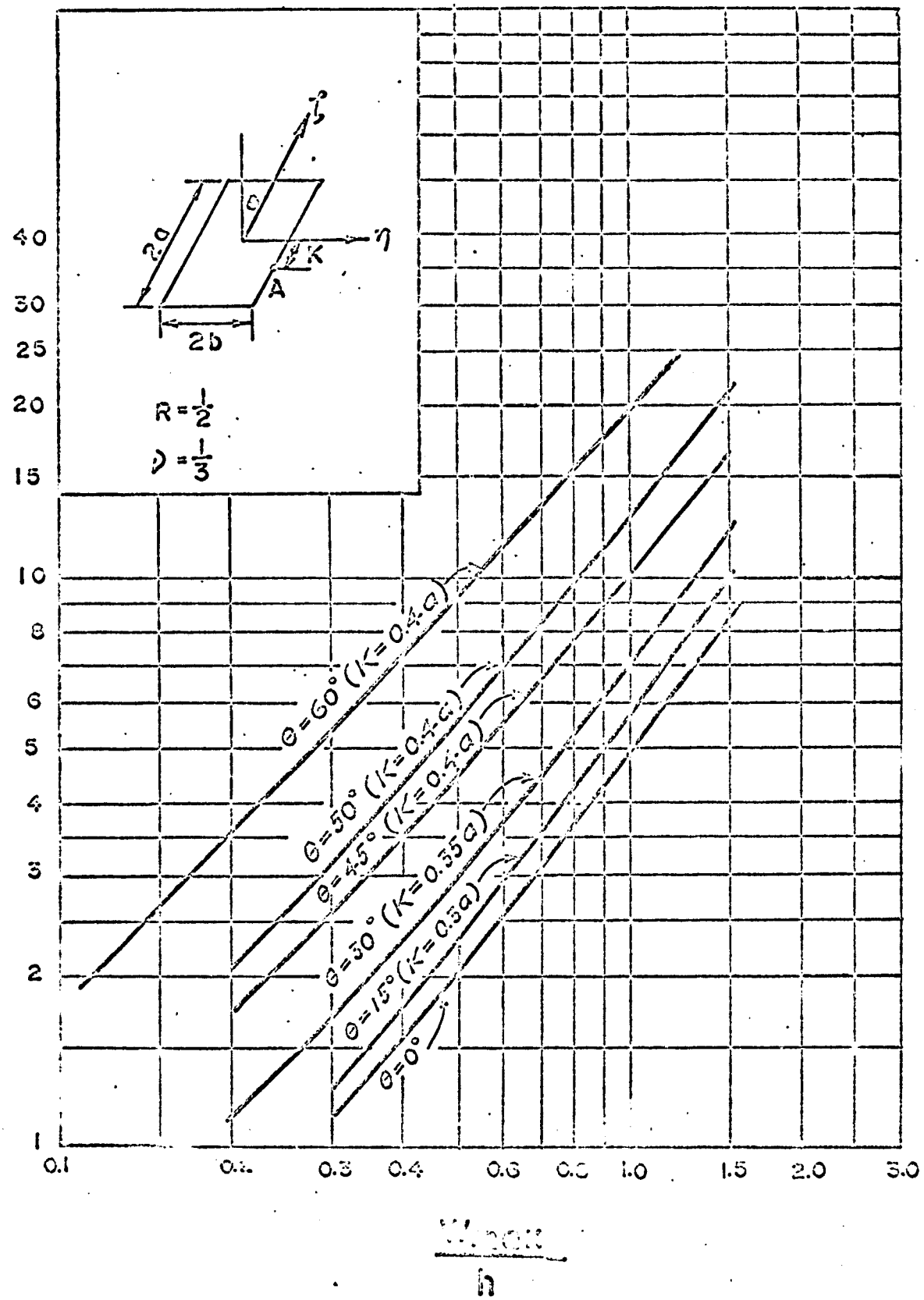


Fig. 13. Initiation of Yield at A for Various Skew Angles for Aspect Ratio b/a = 1/2

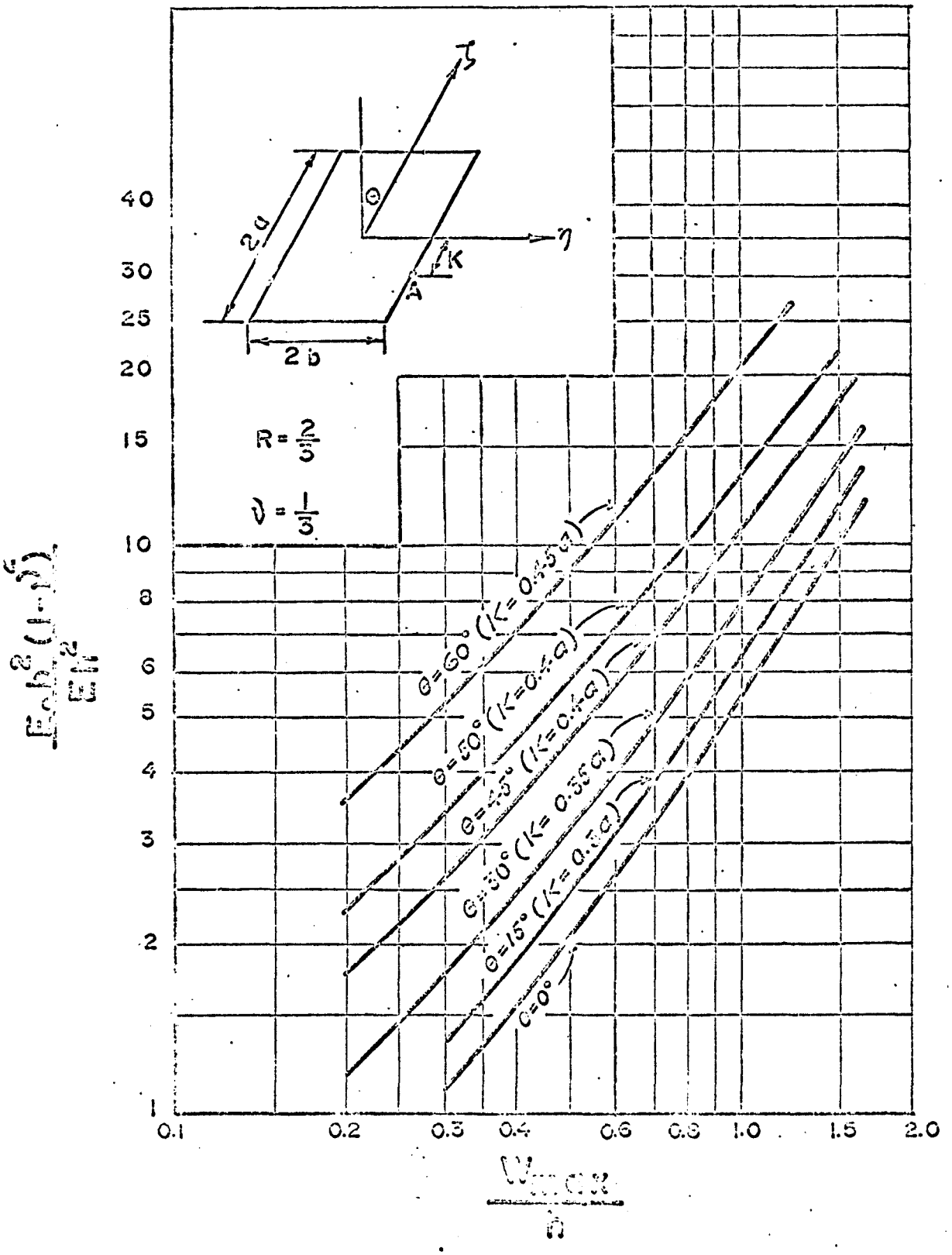


Fig. 14. Initiation of Yield at A for Various Skew Angles for Aspect Ratio b/a = 2/3

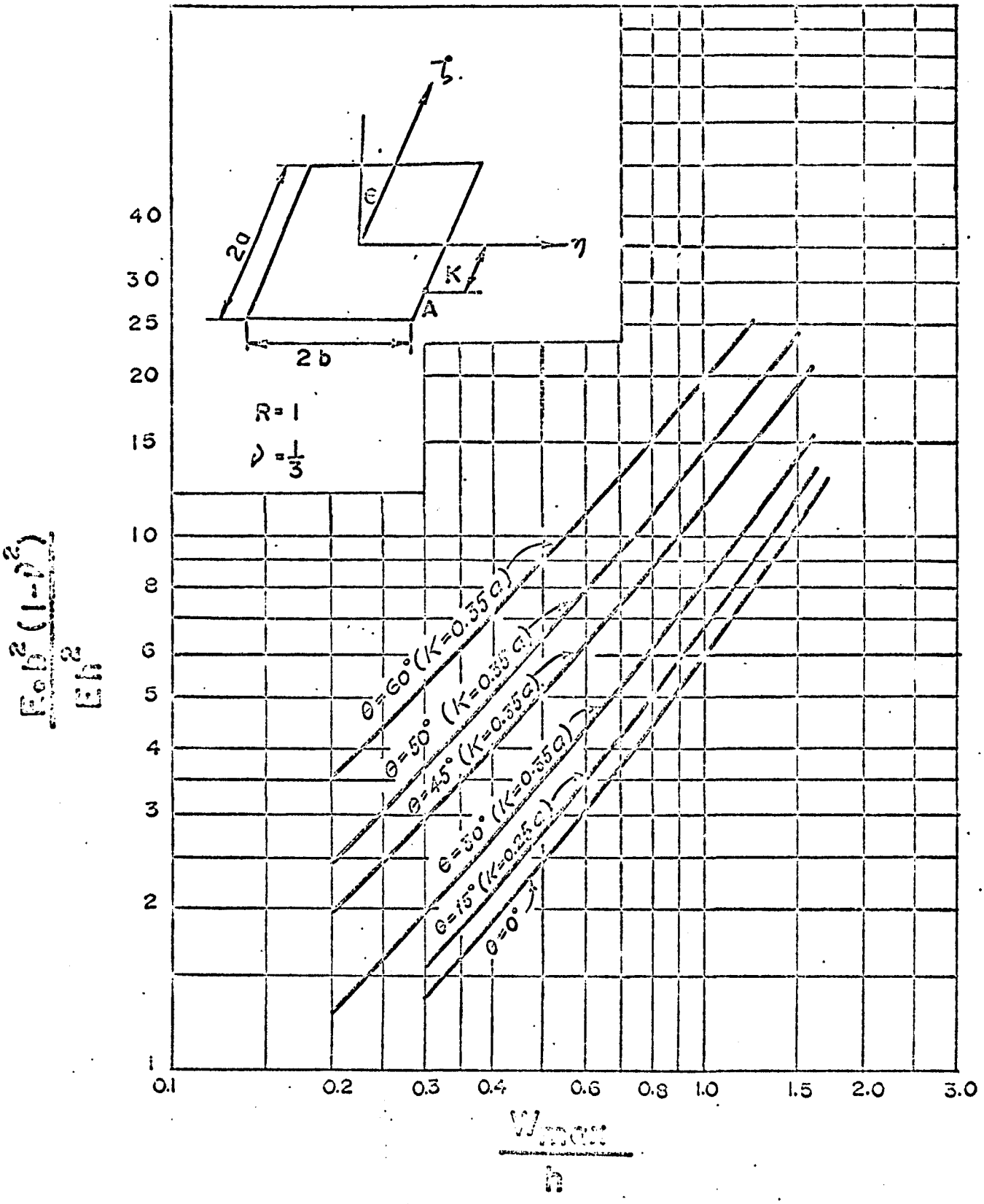


Fig. 15. Initiation of Yield at A for Various Skew Angles for Aspect Ratio b/a = 1

From these figures, it can be seen that, apart from the elastic and plastic properties of the plate material, the initiation of the yield condition in a clamped skewed plate depends largely on the angle of skew and is rather insensitive to changes in the aspect ratio R of the plate. For skewed plates with a given plate material, aspect ratio and oblique dimensions, the yielding occurs at a much lower dimensionless centre deflection ratio w_{max} / h for large skew angles than it is with small skews. This is to be expected since, for a given aspect ratio R, the maximum stress of the plate increases with the angle of skew for a particular dimensionless centre deflection w/h (Figures 7, 9, and 11). Due to the assumptions on which the large deflection equations (3-20),(3-21),(3-22) are based, the results from this analysis are applicable only to those skewed panels where the plate material has a very low yield strength so that yielding occurs in a region where the von Karman equations are still valid ($w_{max} / h \leq 2$).

CHAPTER IV

EXPERIMENTAL ANALYSIS

(a) Materials and Apparatus

Four aluminum alloy (24) 6061-T6 skewed panels were tested. The aspect ratio, skew angle, thickness and dimensions of these test panels are given in Table 2. A total of 18 metal-foil strain rosette gauges were installed on each panel, equally divided between the top and bottom surfaces of each test plate. All these rosette gauges are of the 3-gauge 45° rectangular type, having a gauge factor of 2.05 and a resistance of 120 ohms. Since the stress gradient near the edges of the plate is expected to be high, all the rosette gauges installed near the edge of the plate have a gauge length of 1/16 in. For gauges installed near the centre portion of the plate, gauges of gauge length 1/8 in were used. Terminal strips (type T-50) were used to connect the lead wires to the gauge tabs. All the lead wires are sixteen feet long, made of No. 26 stranded copper wire and with vinyl insulation. To provide mechanical protection and water-proofing, all gauges after installation were covered with gauge coat No. 1 (synthetic resin compound), gauge coat No. 2 (nitrite rubber) and gauge coat No. 5 (a two-component rubber epoxy resin)

A skewed frame left over from a previous experiment (7) on skewed plates was re-used as the supporting structure. The

Table 2. Geometries of test plates

	Panel 1	Panel 2	Panel 3	Panel 4
2b, in.	26	26	20	20
2a, in.	52	52	30	30
θ, degree	50	50	30	30
h, in.	0.125	0.0625	0.0625	0.125

Table 3. Location of rosette gauges in inches

Point	Panels 1 and 2		Panels 3 and 4	
	α	β	α	β
A	-11.0	12.6	-5.25	9.6
B	0.0	12.6	0.0	9.6
C	0.0	0.0	0.0	0.0
D	-25.0	12.6	-14.0	9.6
E	-13.0	0.0	-7.5	0.0
F	-25.0	11.5	-14.0	8.5
G	-25.0	-12.6	-14.0	-9.6
H	-24.0	12.6	-13.0	9.6
I	11.0	-12.6	5.25	-9.6

frame was made from four standard steel channels twelve inches deep and weighing 20.7 pounds per foot. To increase the rigidity of the skew frame, 1/4 in. thick vertical stiffeners were welded to the channels and were spaced approximately six inches apart. The plate and channel assembly was then seated on steel angles which were in turn bolted to heavy structural posts.

To assimulate the built-in condition, the aluminum test plate was sandwiched between the flange of the channels and a 1 in. thick cold-rolled steel cover plate, 3 inches wide. The test panels were all cut in such a way so as to provide a clamping edge of three inches while the flange width of the channel was also three inches. Heavy structural erection clamps were used to clamp down the edges of the plate. These clamps are spaced approximately three inches apart centre to centre.

For tests within the elastic limit, the 1/16 in. thick plate models 2 and 3 required relatively low pressures and hence, for these two models, the uniformly distributed load was provided hydrostatically. In this connection, for each plate model, a one-foot tall wooden tank having the same dimensions and skew as the plate model was made and a waterproof sheet of polyethylene material lined the inside of the wooden tank and test plate.

Plate models 1 and 4 are relatively thick and hence to exhibit large deflection behaviour, a high intensity of lateral uniform pressure was required. For each of these plate models,

a 1/4 in. thick plate was used together with leather gaskets to form an airtight connection. Air presser was used to provide the uniformly distributed load, this presser being regulated and recorded by means of two pressure gauges, one placed at the entrance to the test plate, the other in the vicinity of the centre of the plate. Similar experimental set-ups using air as a loading medium were also used for yield tests on plate models 3 and 4.

During the test , the strains were measured by means of three switch and balancing units(model C-10T and C-10 LTC, Budd Instrument Division), a digital strain indicator and an automatic print out unit (photograph A) which can print out strains in micro-inches per inch at all gauge locations for the different intensities of loadings. Dial indicators which permitted the measurement of lateral deflections in one-thousandth of an inch were installed at the bottom of the plate to measure the deflection of the centre and quarter points of each test plate. To clarify the description of the aforementioned apparatus and the general set-up of the experiments, photographs were taken and are included on pages 57 and 59 .

(b) Procedures and Results

For each of the four plate models, the plate was first cut to the required dimensions and skew, leaving three inches all around for clamping purposes. The plate was then cleaned with acetone and the locations for both the top and bottom surface gauges laid with reference to the oblique co-ordinates α and β (Fig. 3). In order to ascertain the magnitude of the membrane stresses, care was taken to ensure that all the top gauges are in proper alignment with the corresponding gauges at the bottom of the test plate. The co-ordinates of the gauge locations are given in Table 3. The installation of these rosette gauges followed a set procedure. The spot where the rosette was to be placed was first wiped clean with acetone and then sanded with a metal conditioner using silicon carbide paper. The exact location of the gauge was then marked and then cleaned in turn first with a metal conditioner and then with a neutralizer. With the rosette and the terminal strip properly lined Eastman 910 cement was applied to cement the assembly onto the plate. The gauge and terminal were then left to dry for approximately one minute during which time pressure was applied to the gauge by means of the thumb. The installation of both ends of the lead wires was next stripped and the bare copper strands twisted. Each lead wire consisted of three copper strands, one strand was soldered to one tab of the terminal strip while the other two strands were twisted together and soldered to the other tab of the terminal. The tabs of the terminal strip

were then connected in turn with the tabs of the gauges by means of thin copper jumper wires. After the lead wires were soldered into position, the gauge is then covered with gauge coats for waterproof and mechanical protection. Photographs B and D show a clear picture of some of the gauges completely installed on the plate models.

The skewed supporting structure was next prepared by first cutting the standard steel channels to the required dimensions and skew as the test plate and then welded and seated onto four heavy structural posts (photograph C). Each test plate with all the rosette gauges installed on both the top and bottom surfaces was then placed on top of the skewed supporting frame with the edges of the plate sandwiched between the flanges of the steel channels and a one inch thick cold rolled steel cover plate. A 1/4 in. thick plate cut into the same skew and dimensions as the plate model was in turn laid on top of the cold-rolled steel cover plate and the entire edge assembly was then clamped by closely spaced special structural clamps; allowance was made here to have clamps placed closer together near the corners of the plate. All four edges of the plate model were made airtight by inserting thin leather gaskets both immediately above and below the edges of the test plate. Compressed air, regulated and measured by means of two Bourdon type gauges was used to provide the uniform lateral pressure (photograph C).For plate models 1 and 4 with plate thickness equal to 1/16 in., a relatively low pressure was required to produce the desired centre deflection and hence for these two

models, hydrostatic pressure was used to provide the uniformly distributed load

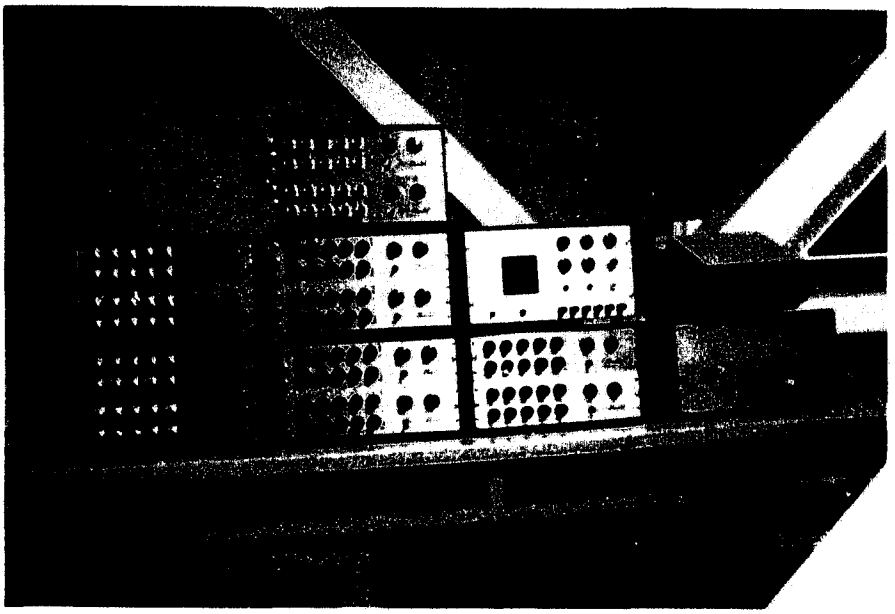
Next, gauge lead wires from the rosette gauges were soldered to ten 5-channel receptacles especially provided for the three switch and balance units. Unit strains for different intensities of loadings were automatically recorded by a precise digital strain indicator and printer.

To allow a direct measurement of the lateral deflections, four dial indicators graduated in one thousandth of an inch were installed for each plate model in locations previously marked on the bottom of the plate. The locations of these dial indicators in terms of the oblique co-ordinate axes α and β are tabulated in Table 4.

Three independent tests were performed on each of the four plate models loaded within the elastic limit with test data obtained for both loading and unloading. All experimental results for deflection and principal stresses reported herein represent an average value of these tests. To avoid the tedious task of copying the experimental results , strain readings from the digital indicators were photographically reduced and are included in Appendix B. Test data for experimental lateral deflections of each plate model recorded by means of the dial indicators are also reported in the same Appendix.

Table 4. Location of Dial Indicators (in.)

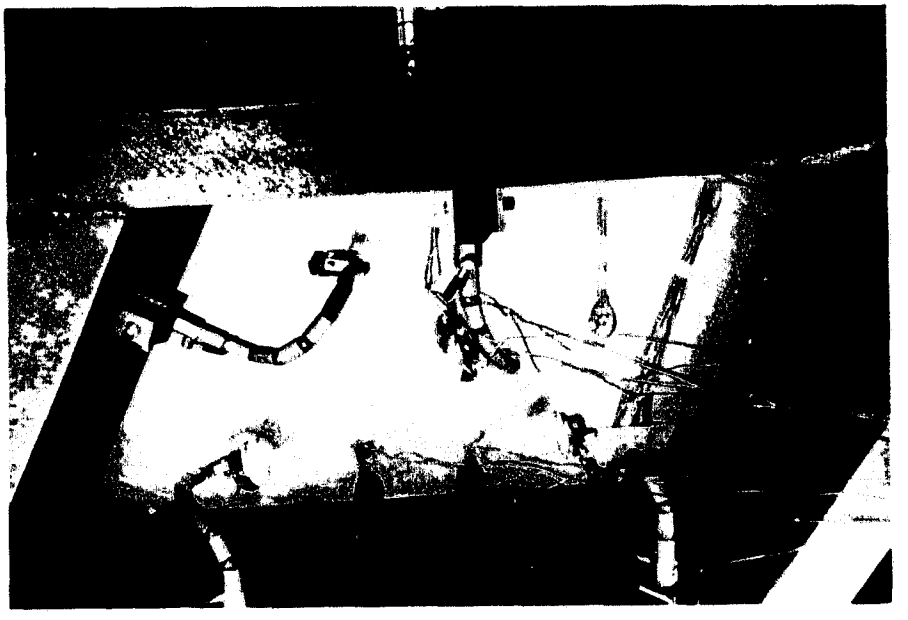
Dial Gauge	Panels 1 and 2		Panels 3 and 4	
	α	β	α	β
1	0.0	0.0	0.0	0.0
2	13.0	-6.5	5.0	-7.5
3	-13.0	6.5	-5.0	7.5
4	13.0	6.5	5.0	7.5



Photograph A. Digital Strain Indicator and Automatic Print-out Device

Photograph B. Test Plate Permanently Deformed after Yield Test.

Photograph C. Photograph showing air-tight Chamber and Supporting Structure.



Photograph D. Bottom View of Test Plate showing Dial Indicators in position

From the values of unit strains e_a, e_b, and e_c obtained from each rosette gauge, the principal stresses can be obtained in the usual manner:

$$\sigma_{max} = \frac{E}{2}\left(\frac{e_a + e_c}{(1-\nu)} + \frac{1}{1+\nu}\sqrt{2(e_a - e_b)^2 + 2(e_b - e_c)^2}\right) \quad \ldots\ldots (4\text{-}1)$$

$$\sigma_{min} = \frac{E}{2}\left(\frac{e_a + e_c}{(1-\nu)} - \frac{1}{1+\nu}\sqrt{2(e_a - e_b)^2 + 2(e_b - e_c)^2}\right) \quad \ldots\ldots (4\text{-}2)$$

To facilitate the computation of principal stresses from the unit strains, a small programme in Fortran was written and is included in Appexdix A.

(c) Comparison and Discussion of Experimental and Theoretical Results

Deflections (Lateral displacements)

Experimental and theoretical results for the centre deflections of the four test panels are plotted in Figure 16. From this figure, it is noted that, for low intensities of the uniformly distributed lateral pressure, the agreement between the theoretical and experimental values is excellent. However, as the lateral pressure increases and the centre deflection exceeds the thickness of the test plate, the measured experimental centre deflection starts to deviate from the theoretical values. This deviation may be due to a slight slippage of the test plate taking place at the edges of the test model, with the result that the experimental deflections range from 4-8 % higher than those predicted analytically. Since the ideal theoretical clamping conditions assumed in the analytical solution can never be realized in practice, this discrepancy between the experimental and theoretical values in the lateral displacement of clamped plates will always exist and must be taken into account in the design of such plates.

The variation of the plate thickness does not seem to affect appreciably the deflection pattern of the plate models as deflection measurements from test plates 1 and 2 (or test plates 3 and 4) do not differ significantly.

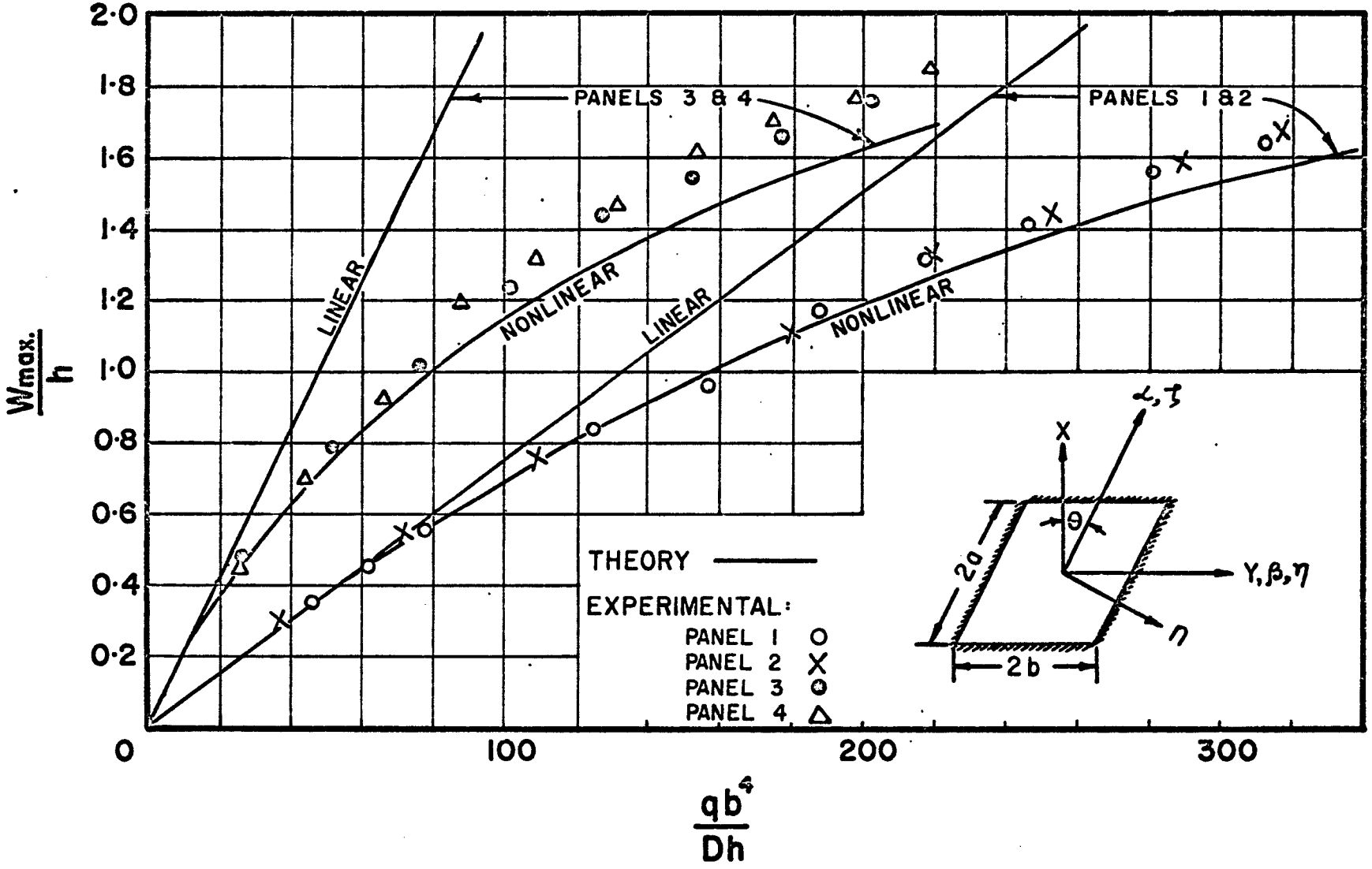


Fig. 16. Comparison of Experimental Centre Deflections with Theory.

Total Principal Stresses

Figures 17 and 18 show comparisons between the theoretical and experimental maximum total principal edge and centre stresses for panels 1 and 2 and 3 and 4, respectively. The agreement is quite good, with the theoretical predictions invariably on the conservative side. Here the degree of skew does affect the closeness of the results since with a high skew of 50° (Figure 17) the results from the 1/16 inch plate is shown to be closer to theory than those from a panel with the same thickness but with a moderate skew of 30° (Figure 18). Analytical results based on the linear theory are shown for comparison.

Typical experimental and the corresponding theoretical variations of the bending and membrane edge and centre stresses with the centre deflection are given in Figure 19. It can be observed that the results compare quite well generally, with the exception of the theoretical and experimental membrane stresses for test plate 3. This discrepancy may be due to a slight relaxation of the test panel along the clamped edges, resulting in an appreciable relief in the membrane stresses. Such discrepancies are of no great significance since, within the range of the centre deflections considered in the analytical solution ($w/h \leq 2$), the membrane stress accounted for a relatively small percentage of the total stress; hence, despite the apparent discrepancy between the theoretical and experimental membrane stresses, the agreement between the total stresses remains close (Figures 17 and 18).

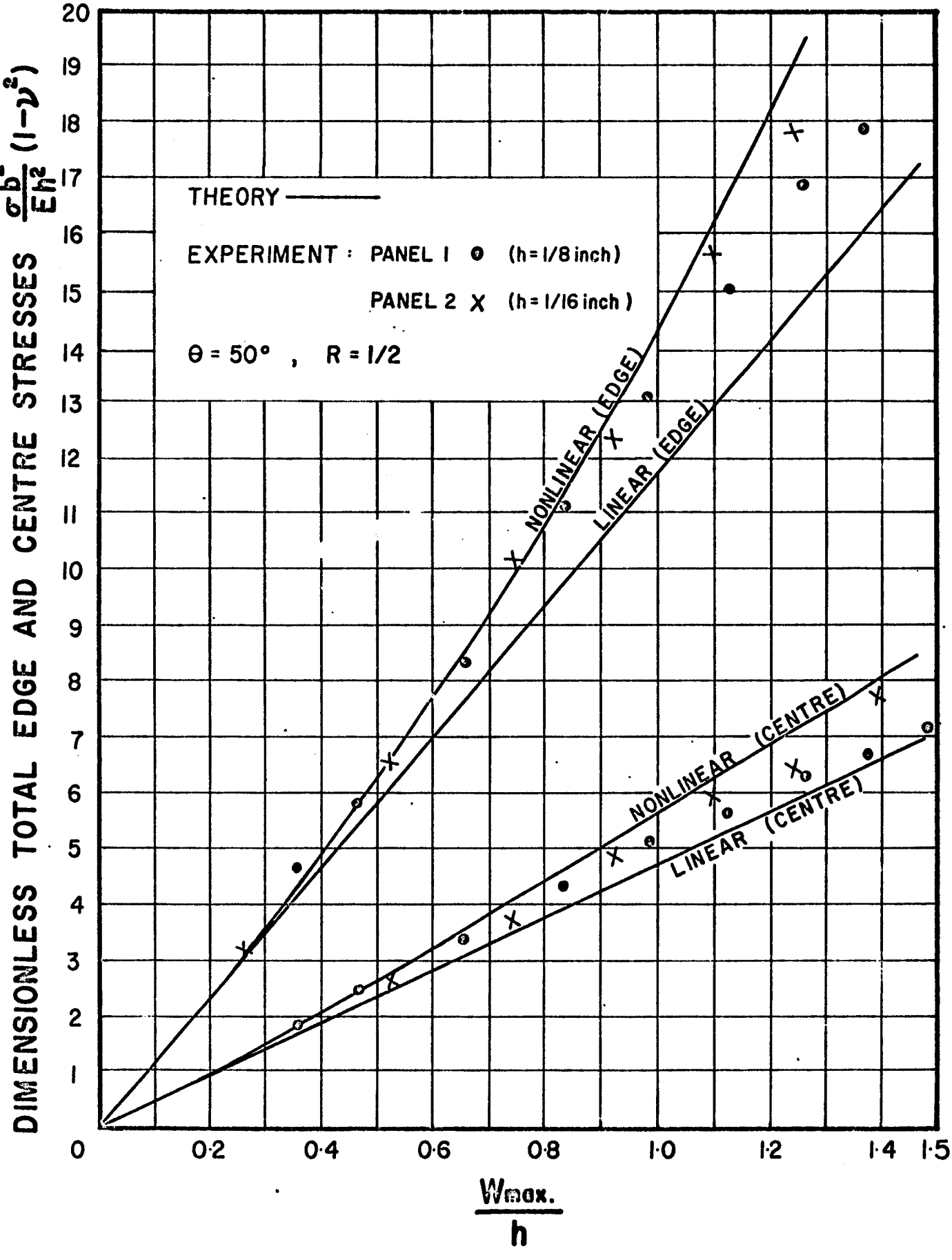


Fig. 17. Comparison of Experimental Edge and Centre Stresses with Theory for Two Plates 1 and 2

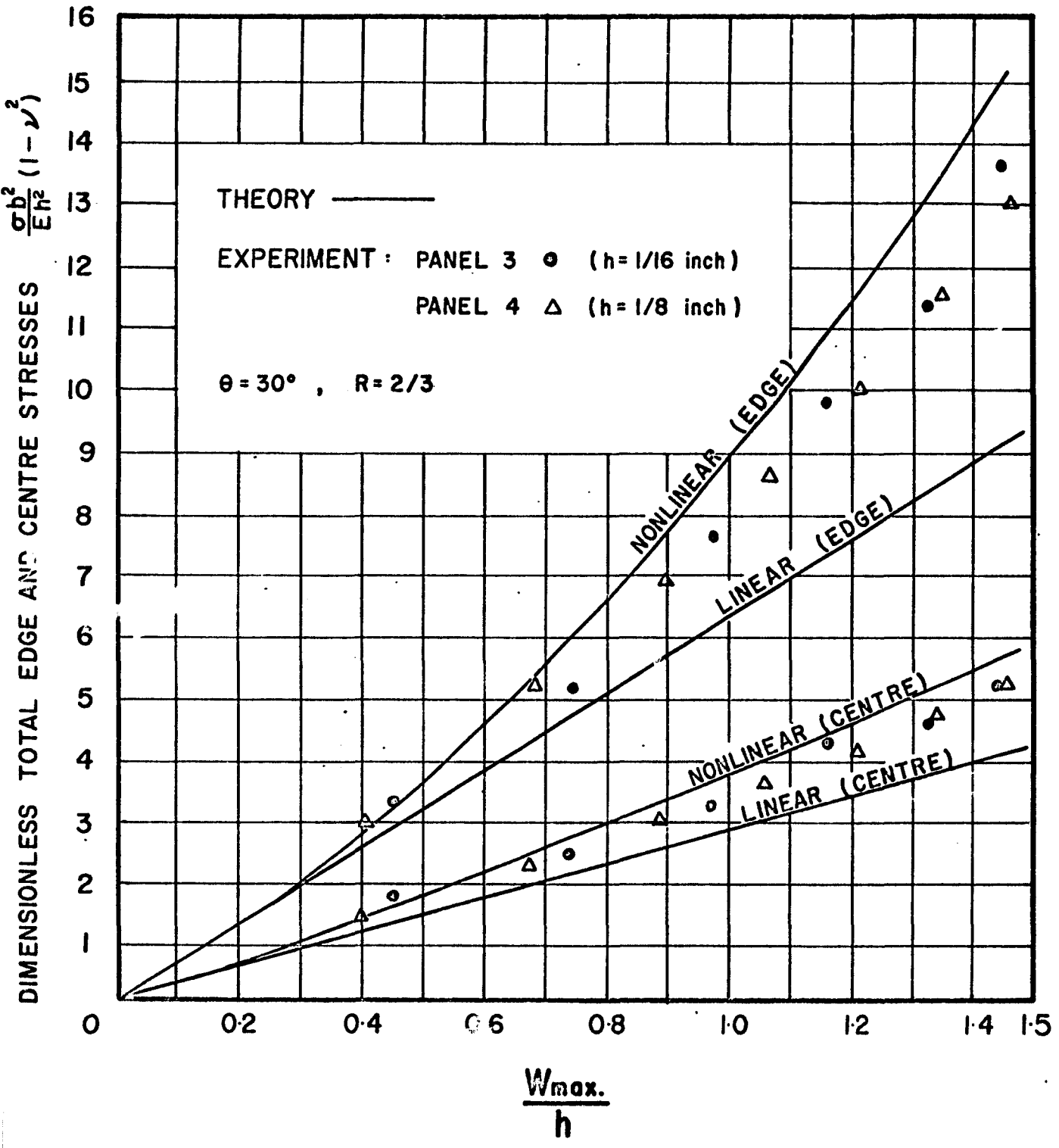


Fig. 18. Comparison of Experimental Edge and Centre Stresses with Theory for Test Plates 3 and 4.

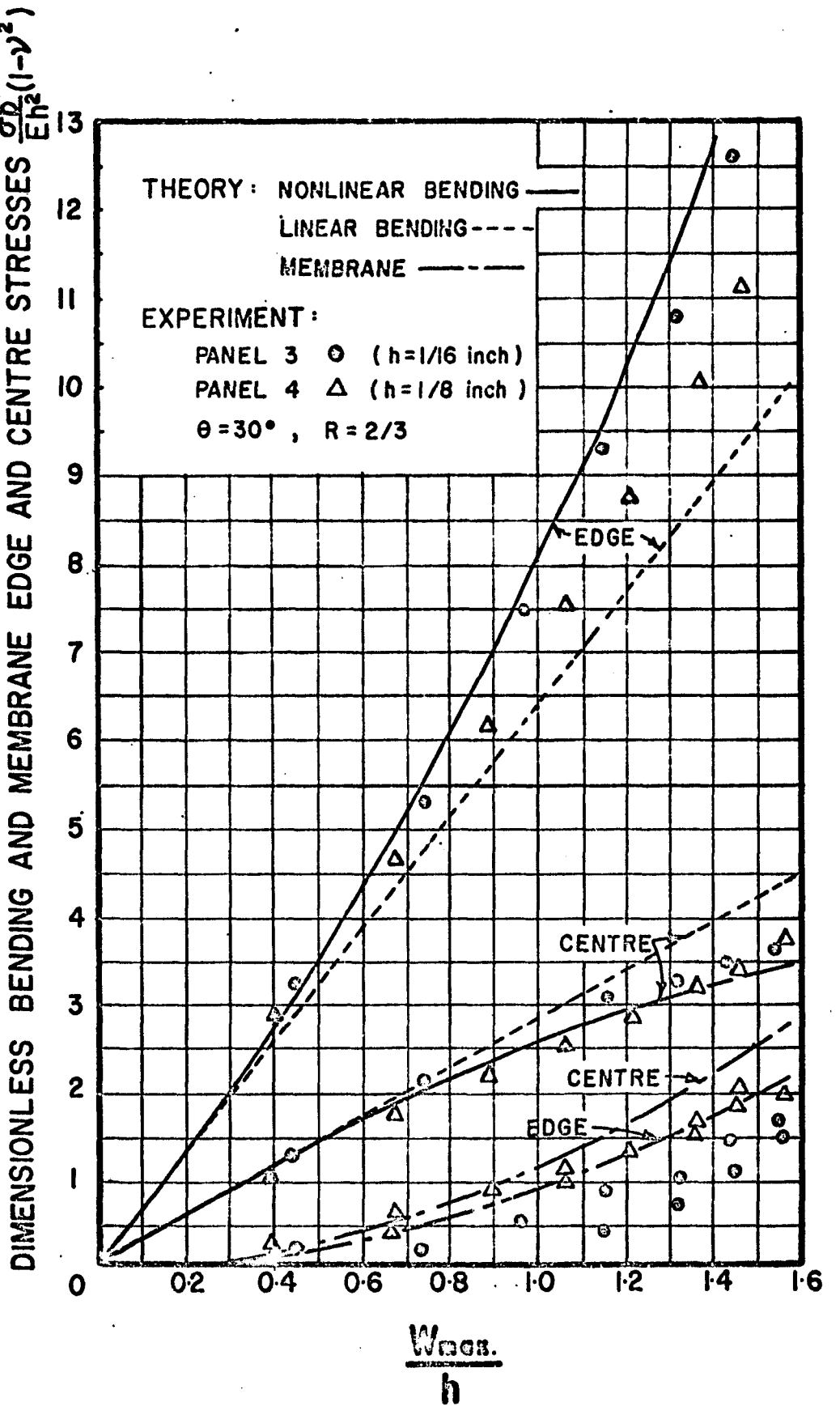


Fig. 19. Experimental and Theoretical Results for Bending and Membrane Stresses.

To exhibit the relative magnitude of the maximum total principal stresses at critical locations on the test panels, such stresses are shown plotted versus the applied pressure in Figures 20-23. Examination of these figures shows that for low intensities of pressure, the principal stress increases linearly with the applied pressure, producing a centre deflection not exceeding half the plate thickness and with insignificant membrane forces. However, with higher intensities of load (producing large deflections), the membrane forces become more pronounced, effecting a decrease in the slope of the stress-pressure curves shown. The total principal stresses at different locations will now be discussed:

As predicted by the analytical solution the experimental maximum total stress occurs along the longer edge of the plate and is displaced towards the obtuse corners, point A. [Compare with theoretical investigations of clamped rectangular plates (2) (3) where such stress occurs at the middle of the longer edge]. The total stress at the middle of the longer edge, point B, is about 85% of that at point A for test panels 1 and 2 with a skew of 50°. This percentage increases to approximately 90% for test panels 3 and 4 where the skew is 30°. Variations in the thickness of the plates do not seem to affect this percentage.

The variations of the experimental total stress at the panel centre (point C) with load are shown in Figures 20-23. It can be observed that for the entire range of loading considered, the total stresses at the centre of the test panels are approximately 35 to

45% of the corresponding maximum total edge stresses. This observation seems to indicate that the ratio of total stress at centre to maximum total edge stress is sensibly unaffected by changes in skew, aspect ratio, or plate thickness.

Results from the experimental study have revealed, as expected, severe concentration of stress in the vicinity of the obtuse corners. [Theoretically, stresses at the corners are zero, due to the nature of the mathematical model of the problem.] Figures 20-23 show that for low intensities of loading the total stress at the obtuse corners is of the same order of magnitude as the stress at centre of panel. With increased loading, the magnitude of the total stress at the obtuse corners can exceed that at the centre by approximately 10% for plates 1 and 4 (with 1/8 inch thickness) and by as much as 20% for plates 2 and 3 (with 1/16 inch thickness). Therefore, it may be surmised that the stress concentration at the obtuse corners, relative to the stress at the centre of the plate, is more affected by the plate thickness than by changes in skew or aspect ratio.

In contrast to the high level of stress in the vicinity of the obtuse corners, only nominal stresses were recorded in the vicinity of the acute corners. The experimental results obtained indicate that the total stress at such corners remains insignificant until parts of the edges yield due to excessive lateral loading. This will be expounded on in the next section.

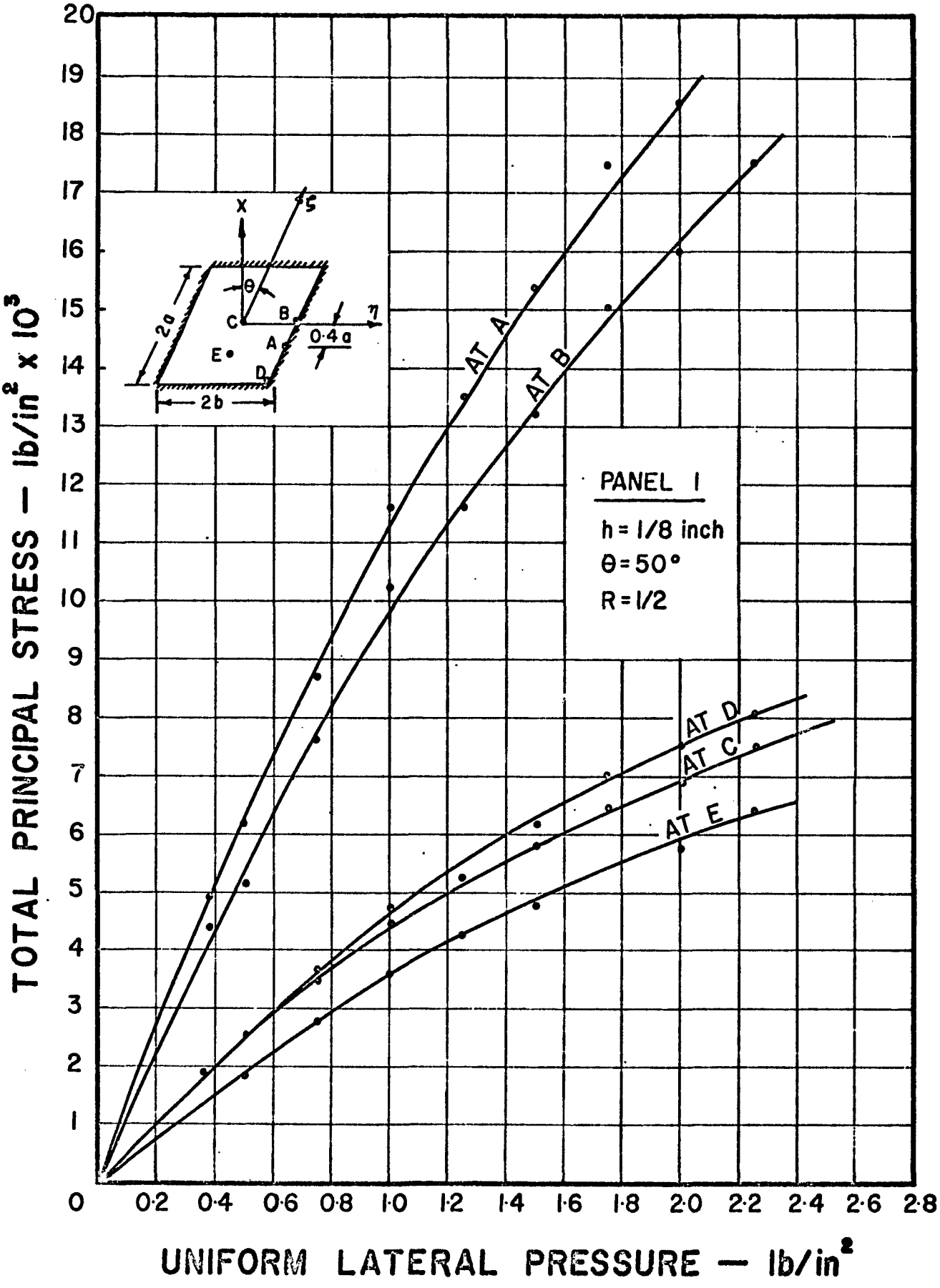


Fig. 20. Experimental Stresses at various Locations on Test Plate 1

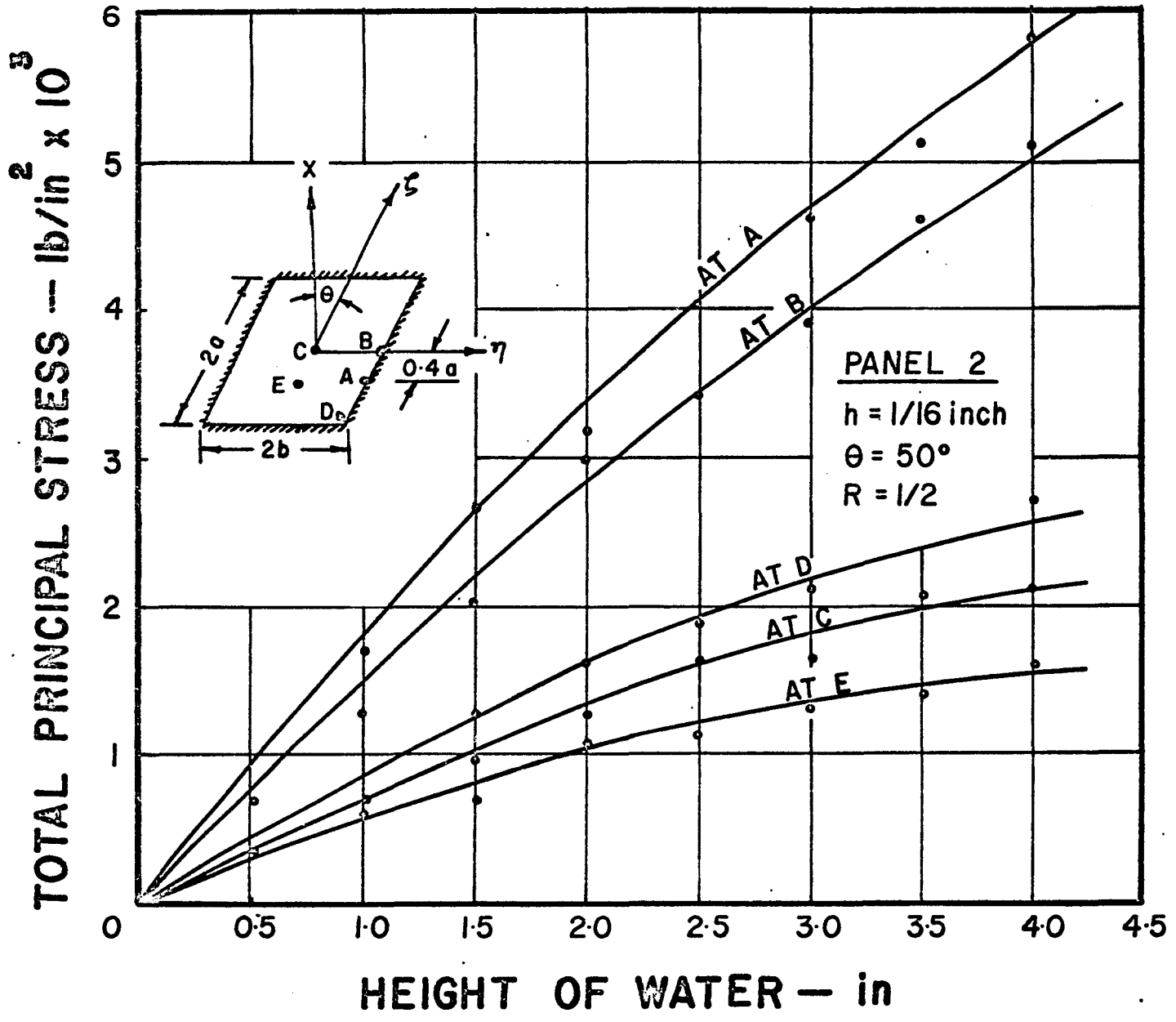


Fig. 21. Experimental Stresses at Various Locations on Test Plate 2

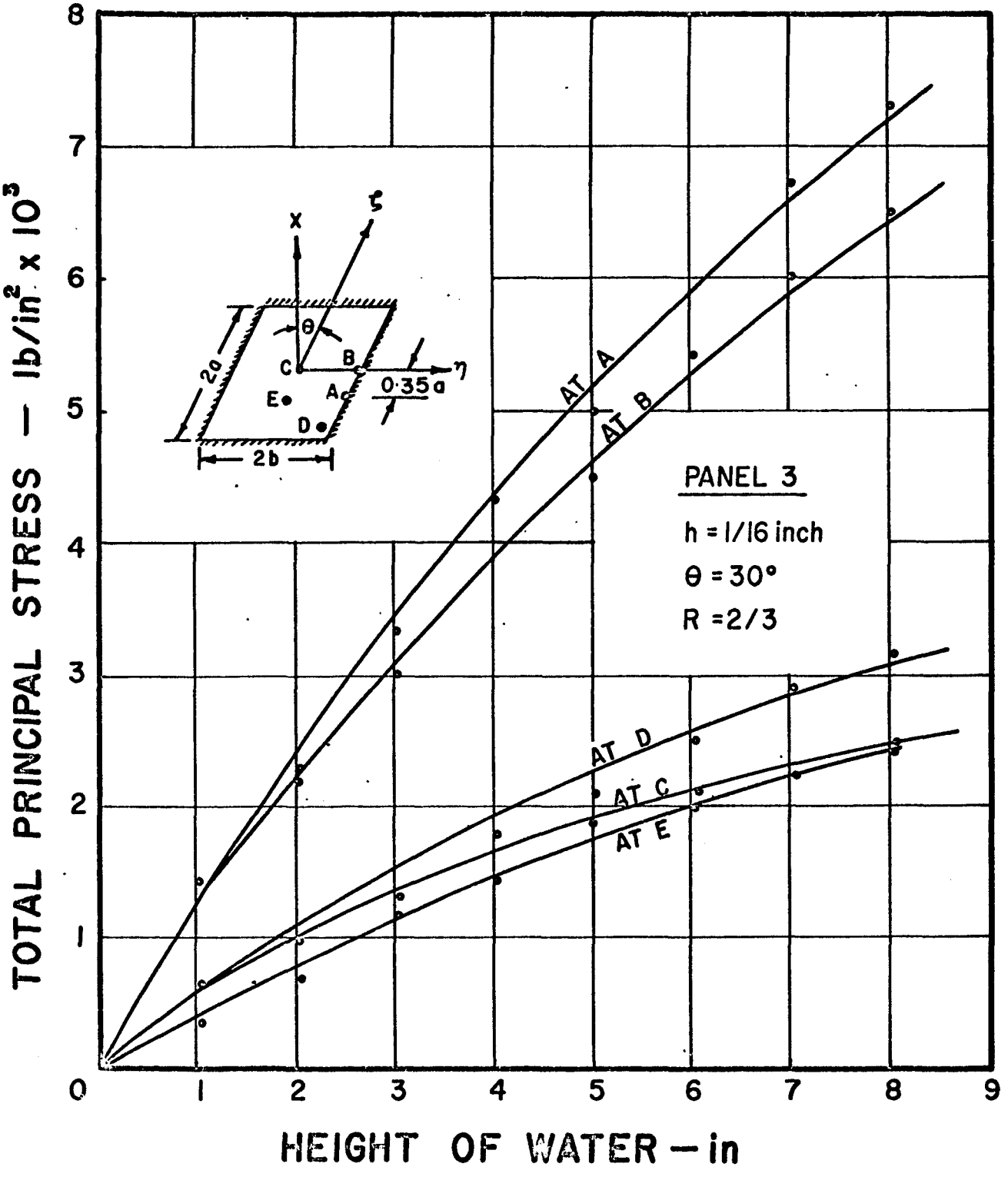


Fig. 22. Experimental Stresses at Various Locations on Test Plate 3.

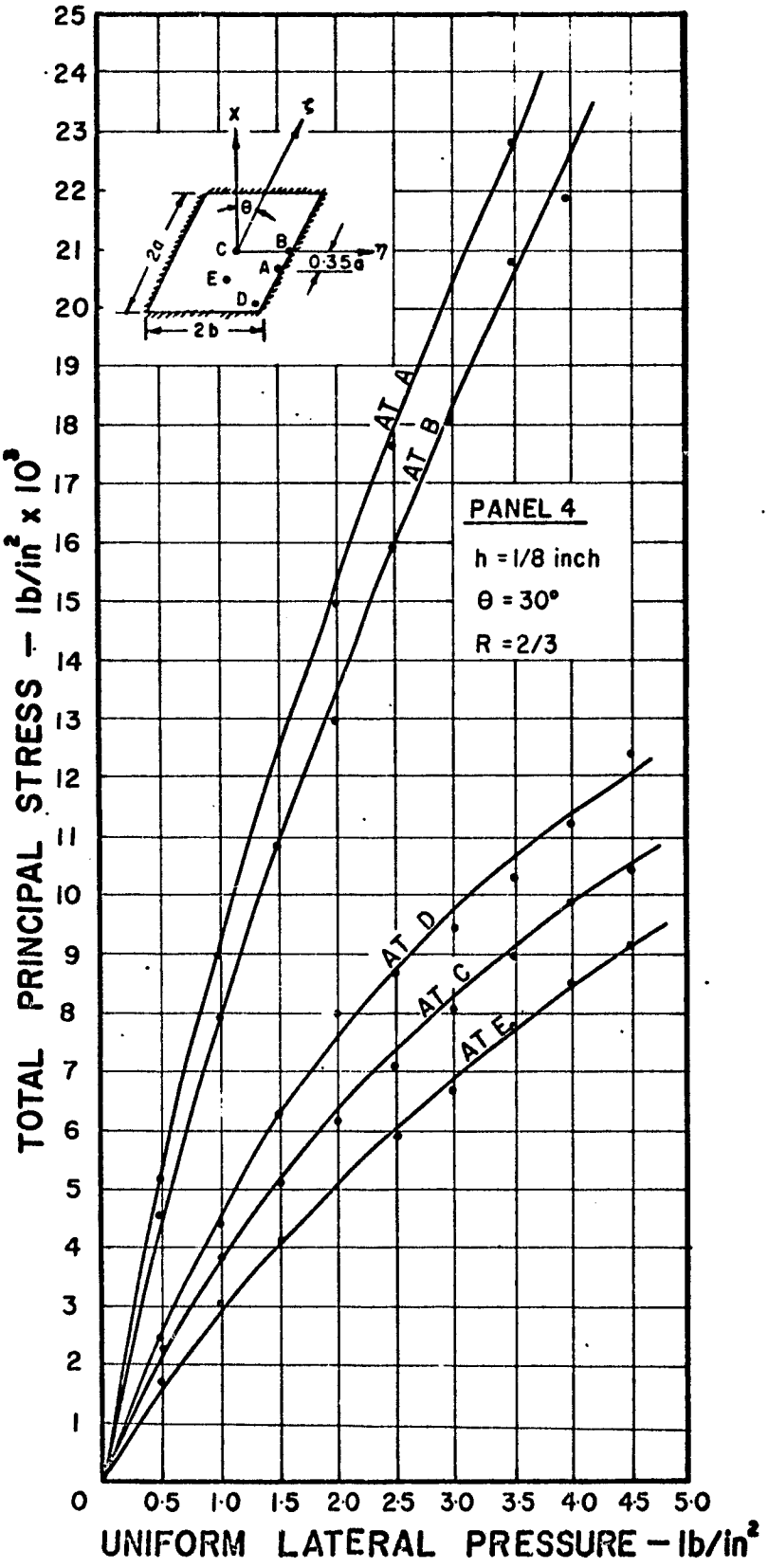


Fig. 23. Experimental Stresses at Various Locations on Test Plate 4.

Yield Tests:

In order to study the behaviour of clamped skewed plates beyond the validity of the Von Karman equations (9), where the centre deflection should not exceed 2 to 2.5 times the panel thickness, plates 3 and 4 were loaded until plastic regions were formed. The results of such tests are shown in Figures 24-26.

The variation of the total principal strain at the plate centre with applied pressure is shown in Figure 24. It is interesting to observe that when these plates were loaded excessively the strain in the middle plan of the plate increased to such a level that it nullified the compressive strain at the top of the panel at centre. This is not surprising since it was shown in Figure 15 that the magnitude of the membrane stress at centre increases rapidly with increase in centre deflection.

Figure 25 exhibits the behaviour and the distribution of principal strain in the vicinity of the obtuse corner when the panels are loaded beyond the elastic region. A sudden reversal in strain at these corners is noted when a certain critical load on the plate is reached. Such instability is preceded by progressive yielding of the panel edges towards the obtuse corners. (The variation of the maximum principal strain along the longer edge with lateral load is given in Figure 26) Ideally, one would have expected the curves from the top and bottom gauges to cross the horizontal axis at the same load. However, this was not the case and the discrepancy seems to be more pronounced for

plate 4 (1/8 inch thick) than plate 3 (1/16 inch thick). This can be attributed mainly to experimental errors such as those incurred in gauge alignment, support conditions, etc. It may be mentioned that results from a bottom gauge located less than I inch away, at point F, do indicate the expected reversal in strain.

Variation of the total principal strain at the maximum point along the longer edges of plates 3 and 4 with load are shown in Figure 12. It can be observed that after the yield stress of the material is reached the total strain decreases with further increase in strain in the vicinity of the acute corners after the edges have yeilded; reversal of strain is also possible at such corners as evidenced from the results obtained, although the observed instability here is not as proncunced as was found for the obtuse corners.

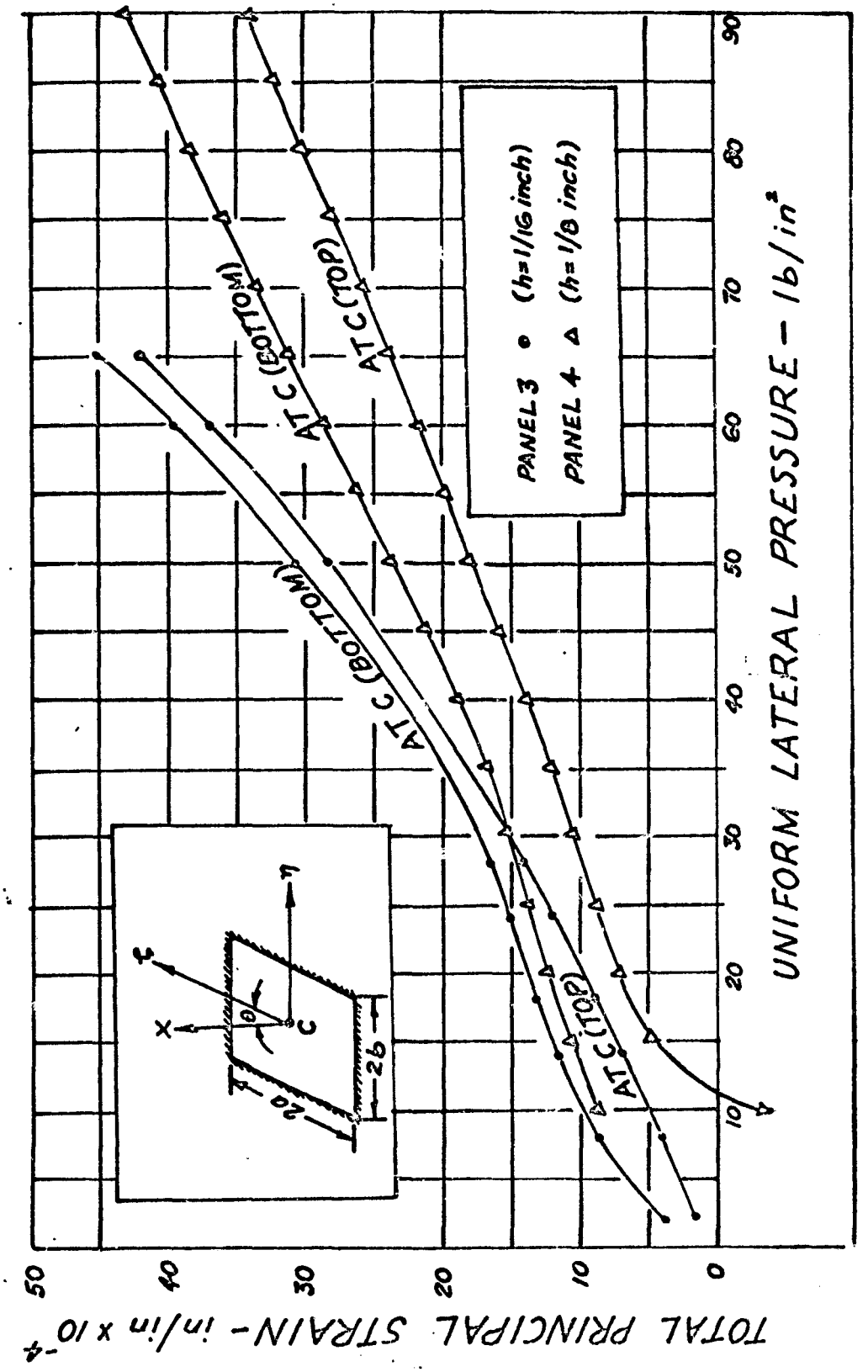


Fig. 24. Centre Stresses at Large Lateral Pressures

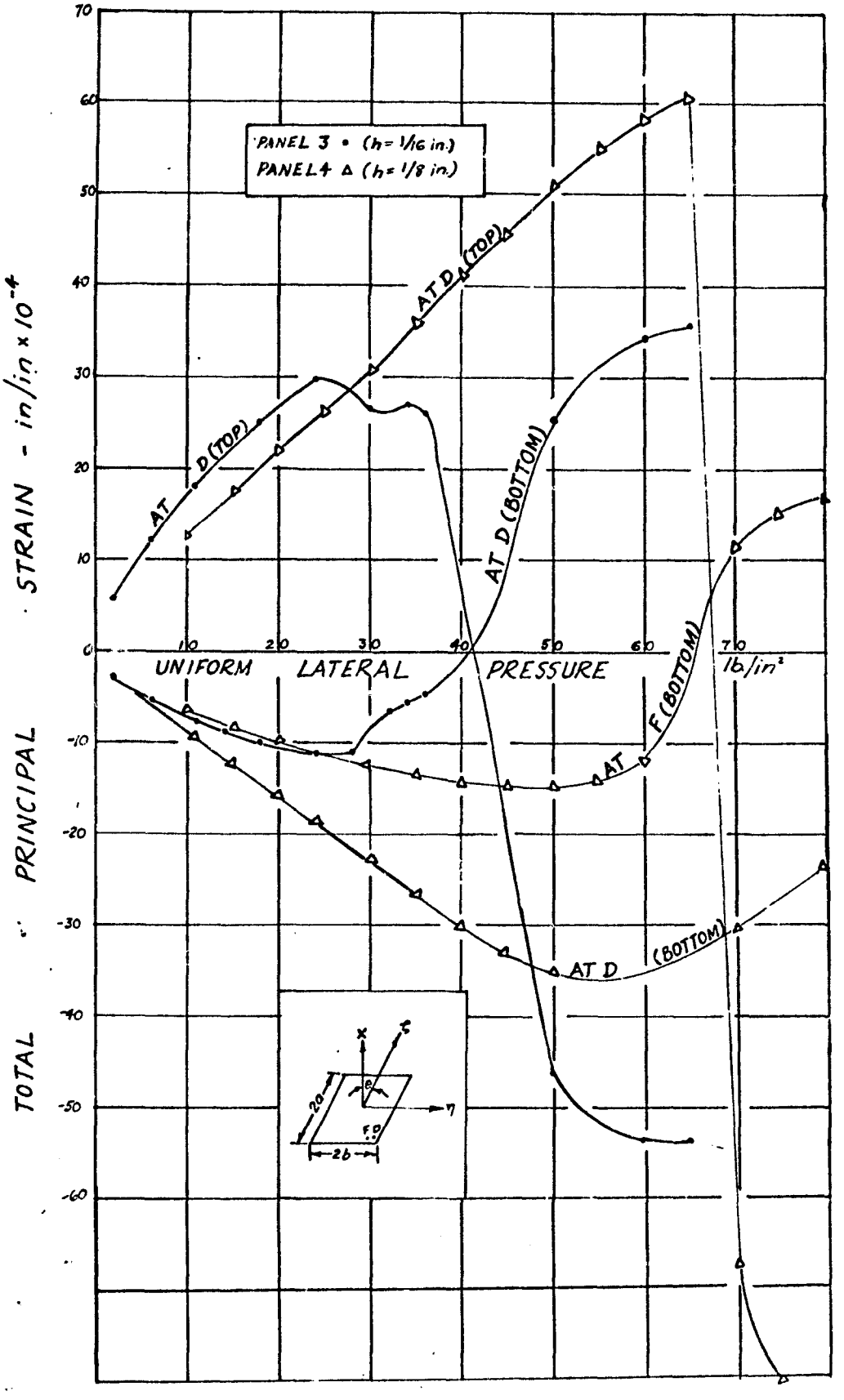


Fig. 25. Obtuse Corner Stresses at Large Lateral Pressures

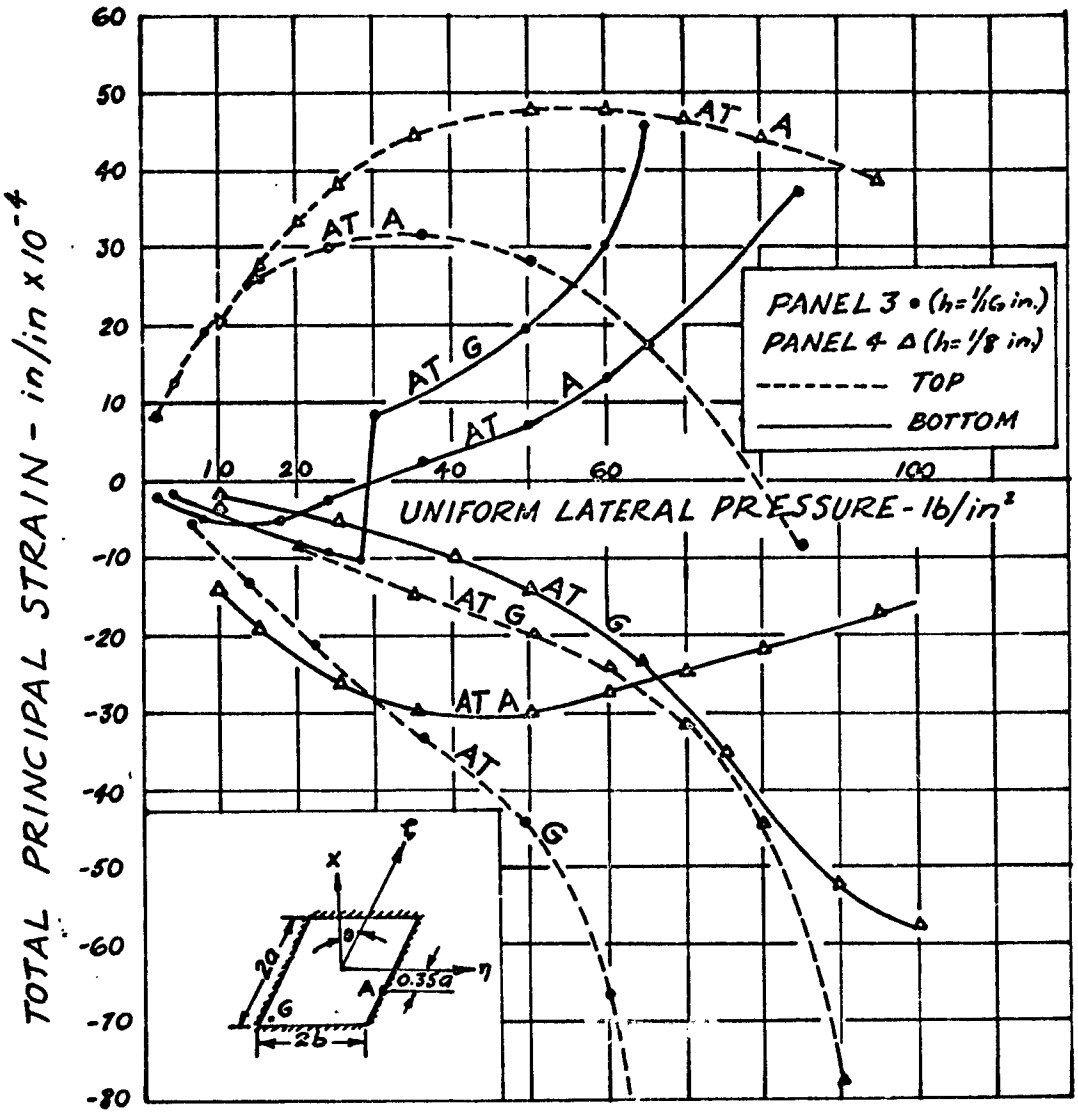


Fig. 26. Acute Corner and Maximum Edge Stresses at Large Lateral Pressures

CHAPTER V

CONCLUSIONS

As a result of this theoretical and experimental investigation on the small and large deflection behaviour of clamped skewed plates, the following conclusions may be drawn:

1. For the limiting case where the skew angle is reduced to zero, the perturbation method yields results which are in good agreement with those obtained for rectangular plates, analysed by more laborious methods.
2. The small deflection results for clamped skewed plates are in close agreement with those obtained by experiments and by other analytical methods.
3. For a given aspect ratio and a given uniformly distributed load, the maximum deflection at the centre of skewed plates decreases with increase in skew.
4. The effect of skew on the centre deflection decreases with decreasing aspect ratio R, where $R < 1$.
5. The ratios w_{max}/h, at which results from the linear and nonlinear theories begin to deviate significantly from each other are influenced by the aspect ratio, R; the ratio w_{max}/h decreasing with increasing R. Thus the deflection value, at which the influence of the in-plane forces begins to be effective, can be assessed.

6. Analytical nonlinear (large deflection) results have been substantiated by model tests. Notwithstanding the experimental errors inherent in such tests, the agreement between theory and experiment is found to be quite close.

7. Nonlinear deflection of clamped skewed plates tend to become increasingly linear with increase in skew.

8. The maximum resultant stress occurs along the longer edge of the plate and is displaced towards the obtuse corners. Such stress increases with skew for any specified aspect ratio and centre deflection.

9. Invariably membrane stresses are relatively insignificant in magnitude when compared to the maximum resultant edge stresses.

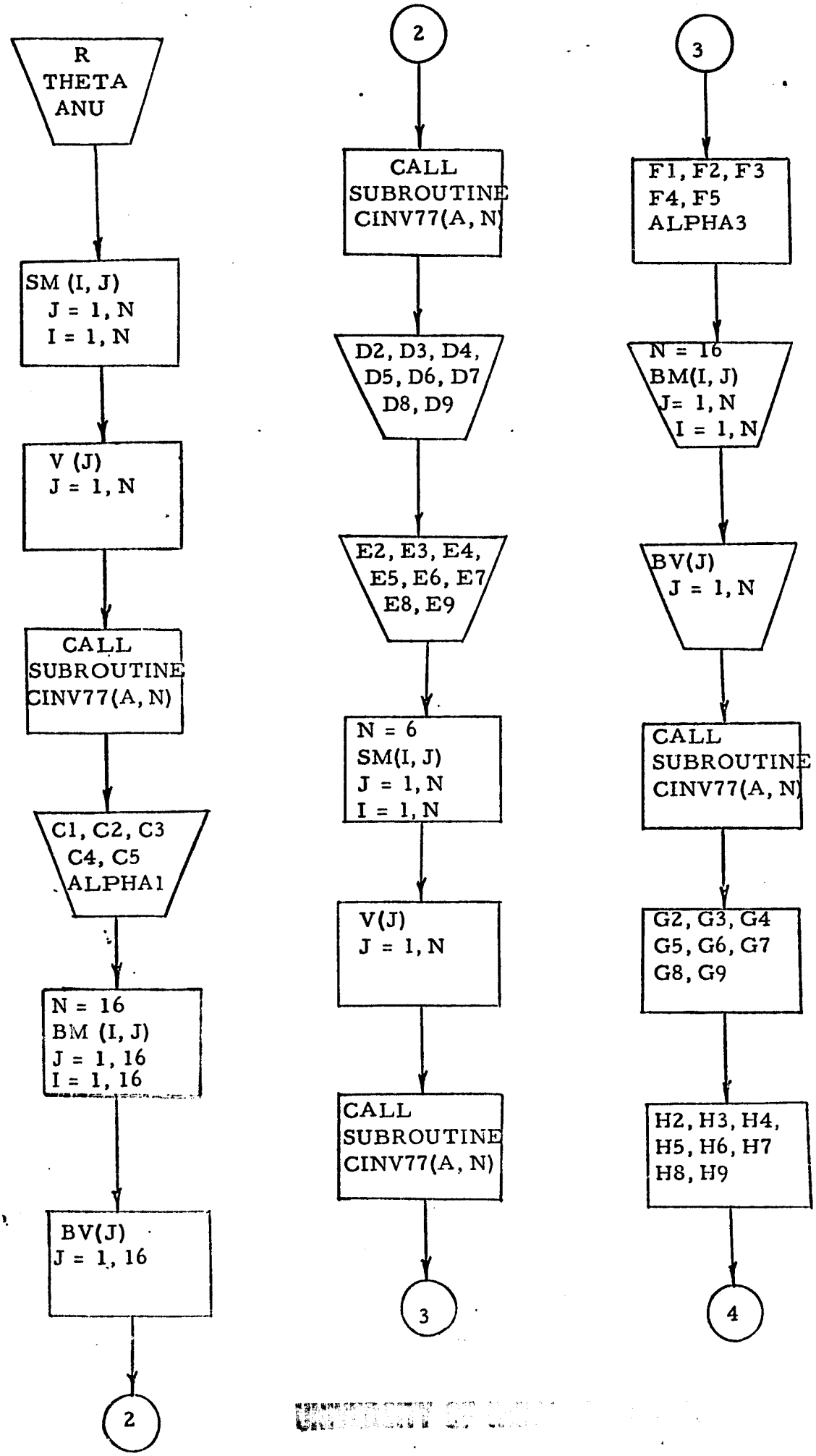
10. Experimental results obtained for very large loads, producing plastic regions, and outside the range of applicability of the analytical solution of the Von Karman equations have indicated that:

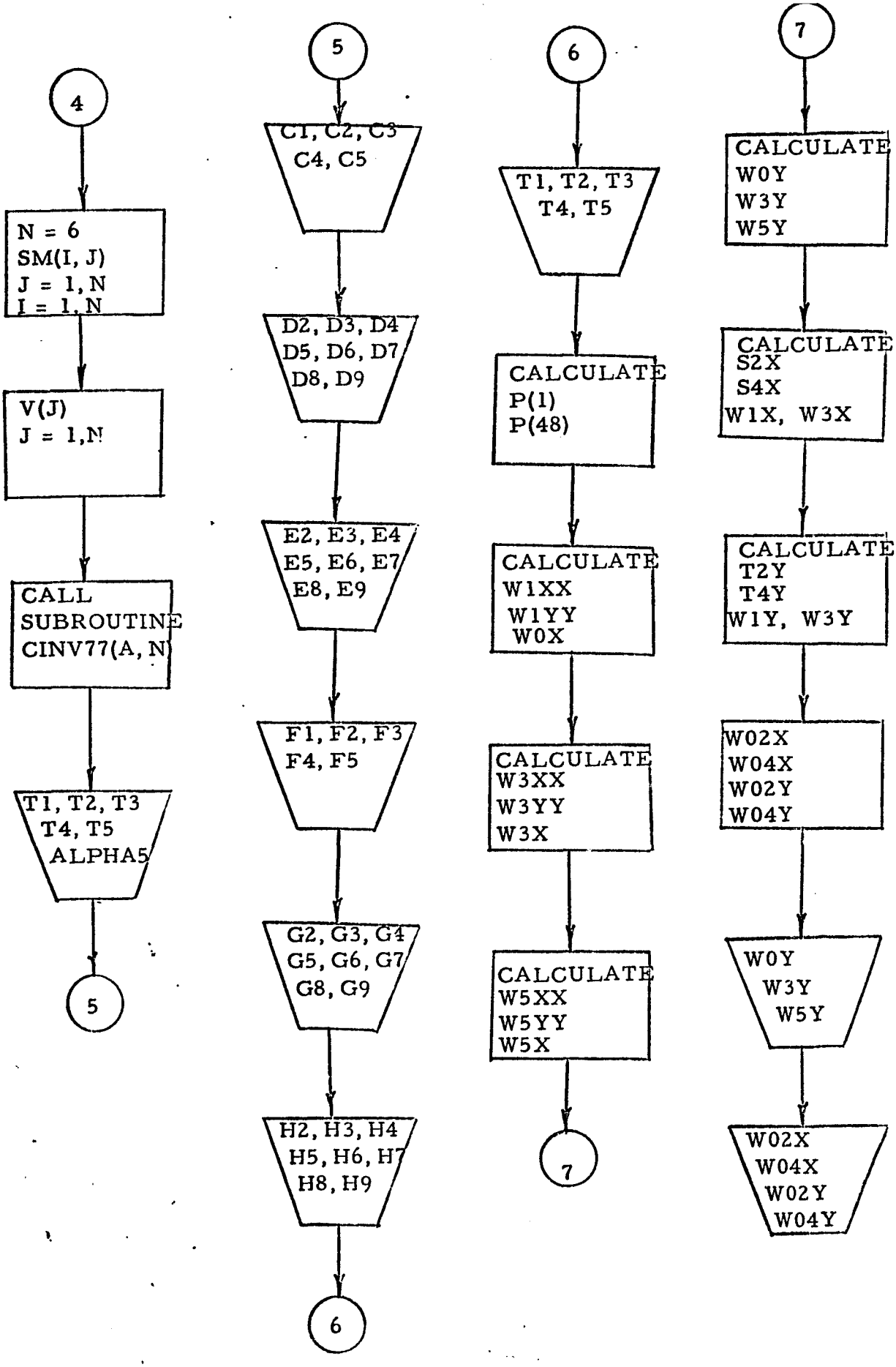
(a) The obtuse corners of clamped skewed plates are not only regions of severe stress concentrations, but also of instability, giving rise to sudden reversal of stresses.

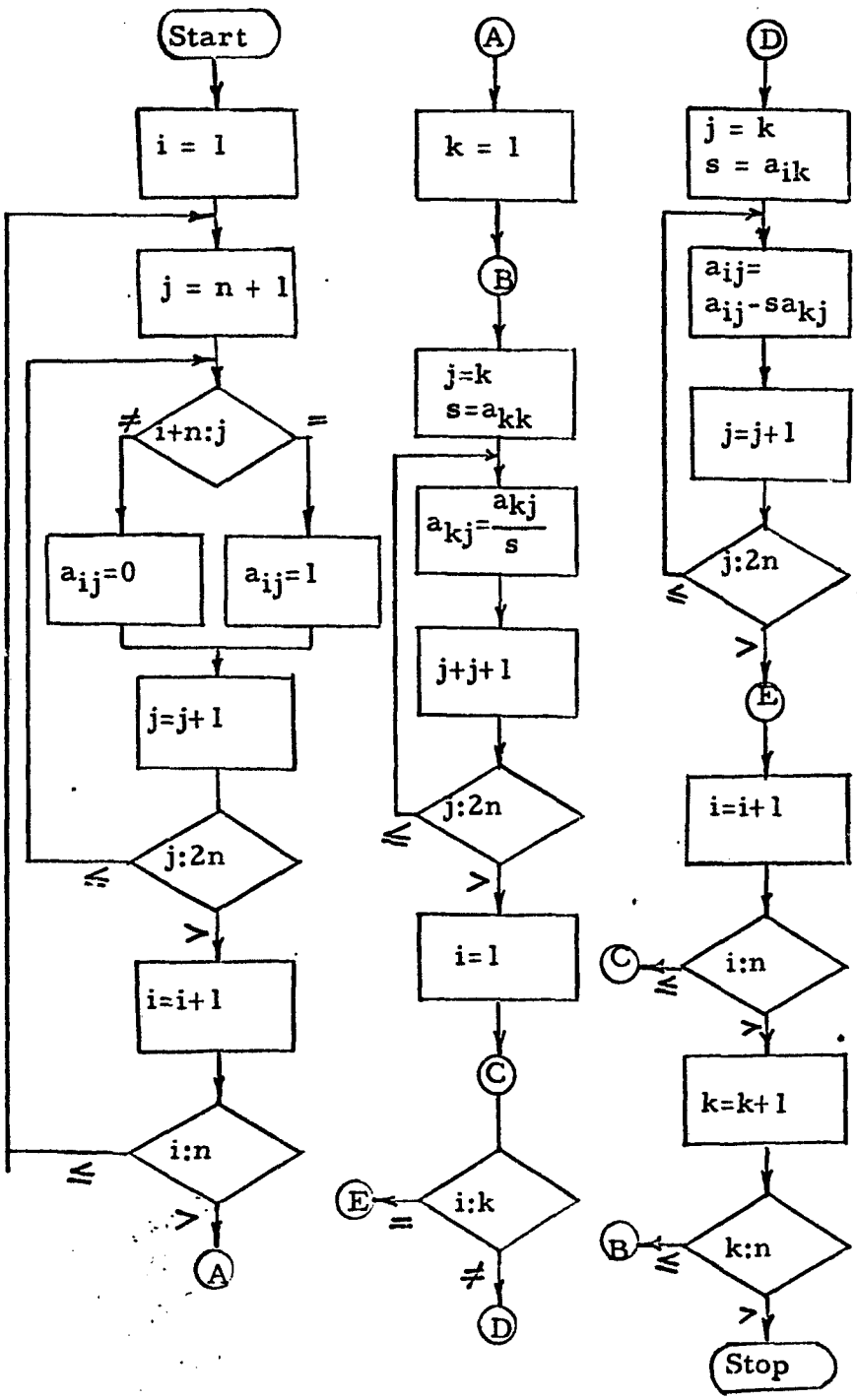
(b) The stress in the vicinity of the acute corners are relatively insignificant; however, when the edges have yielded, the stresses in such corners increase sharply with possible stress reversal at very large loads.

APPENDIX A

FORTRAN PROGRAMS FOR THEORETICAL AND EXPERIMENTAL ANALYSIS


R
THETA
ANU
SM (I, J)
J = 1, N
I = 1, N
V (J)
J = 1, N
CALL
SUBROUTINE
CINV77(A, N)
C1, C2, C3
C4, C5
ALPHA1
N = 16
BM (I, J)
J = 1, 16
I = 1, 16
BV(J)
J = 1, 16
2
2
CALL
SUBROUTINE
CINV77(A, N)
D2, D3, D4,
D5, D6, D7
D8, D9
E2, E3, E4,
E5, E6, E7
E8, E9
N = 6
SM(I, J)
J = 1, N
I = 1, N
V(J)
J = 1, N
CALL
SUBROUTINE
CINV77(A, N)
3
3
F1, F2, F3
F4, F5
ALPHA3
N = 16
BM(I, J)
J= 1, N
I = 1, N
BV(J)
J = 1, N
CALL
SUBROUTINE
CINV77(A, N)
G2, G3, G4
G5, G6, G7
G8, G9
H2, H3, H4,
H5, H6, H7
H8, H9
4


4
N = 6
SM(I, J)
J = 1, N
I = 1, N
V(J)
J = 1,N
CALL
SUBROUTINE
CINV77(A, N)
T1, T2, T3
T4, T5
ALPHA5
5
5
C1, C2, C3
C4, C5
D2, D3, D4
D5, D6, D7
D8, D9
E2, E3, E4
E5, E6, E7
E8, E9
F1, F2, F3
F4, F5
G2, G3, G4
G5, G6, G7
G8, G9
H2, H3, H4
H5, H6, H7
H8, H9
6
6
T1, T2, T3
T4, T5
CALCULATE
P(1)
P(48)
CALCULATE
W1XX
W1YY
W0X
CALCULATE
W3XX
W3YY
W3X
CALCULATE
W5XX
W5YY
W5X
7
7
CALCULATE
W0Y
W3Y
W5Y
CALCULATE
S2X
S4X
W1X, W3X
CALCULATE
T2Y
T4Y
W1Y, W3Y
W02X
W04X
W02Y
W04Y
W0Y
W3Y
W5Y
W02X
W04X
W02Y
W04Y


Start
i = 1
j = n + 1
i+n:j
≠
=
$a_{ij}=0$
$a_{ij}=1$
j=j+1
j:2n
≤
>
i=i+1
i:n
≤
>
A
A
k = 1
B
j=k
$s=a_{kk}$
$a_{kj}=\frac{a_{kj}}{s}$
j+j+1
j:2n
≤
>
i=1
C
E
i:k
=
≠
D
D
j = k
$s = a_{ik}$
$a_{ij}=a_{ij}-sa_{kj}$
j=j+1
j:2n
≤
>
E
i=i+1
C
i:n
≤
>
k=k+1
B
k:n
≤
>
Stop

```
[illegible]
      [illegible] (16,16),V(6),A(16,16),AMS(16),AI(16,16), V(16),
     1C(16,16),X(6)
      [illegible],T1,T2,T01,S,A2,C1,C2,C3,C4,C5,A2,A3,A4,A5,A6, 7,  ,  ,
     1 ,8,9, ,E6,E7,E8,E9,ANU,A1,DF,U,C,CV
      [illegible]
    2 F[illegible]T(1H1)
      [illegible] ,T2,TA,ANU
   19 F[illegible]T(1F1 .5)
      [illegible]C= 1 ,8,T2,TA,ANU
   14 F[illegible](8H  =F10.5,7H THETA=F10.5,5H ANU=F10.5)
      T1=T[illegible].17453292/10.
      S=SIN(T1)
      C=COS(T1)
      A2=A**2
      A1=A*A2
      A3=-4.*(A2*S)
      A5=-4.*(A3*S)
      A4=(2.*(1.+A2*S*S)*2.
      A6=S**6
      B(1,1)=-1.*A3-6.*A4-48.
      B(1,2)=(-4. *A1-6.*A2-8.*A4)
      B(1,3)=24.
      B(1,4)=24.*A1
      B(1,5)=4.*A4
    1 F[illegible]=-8
      F(1,1)=(1.*A1)+(30.*A2)+120.*A3+(96.*A4)+360.
      F(1,2)=(4.*A1+36.*A2+24.*A4)
```

```
      S(4,3)=(-...*A5-48.*A4-720.)
      S(4,4)=(-... *A1)
      S(4,5)=(-... *A1-10.*A2-40.*A4)
      S(5,0)=...
      S(5,1)=(...*A5+24.*A4+120.)
      S(5,2)=(...*A1+120.*A2+36.*A3+48.*A4+24.)
      S(5,3)=-...
      S(5,4)=(-...*A1-60.*A2-48.*A4)
      S(5,5)=(-...*A3-48.*A4-48.)
      S(5,6)=...
      S(6,1)=(-...*A1-120.*A2-210.*A3-120.*A4)
      S(6,2)=(-...*A1-30.*A2)
      S(6,3)=(24.*A1+60.*A2+420.*A3+1620.+240.*A4)
      S(6,4)=(24.*A1)
      S(6,5)=(...*A1+60.*A2+60.*A4)
      S(6,6)=...
      S(5,1)=(-30...*A3-48.)
      S(5,2)=(-210.*A2-120.*A3-120.*A4-48.)
      S(5,3)=24.
      S(5,4)=(1620.*A1+420.*A2+60.*A3+240.*A4+24.)
      S(5,5)=(6...*A3+60.*A4+96.)
      S(5,6)=0.0
      S(6,1)=(-1...*A2-720.*A3-288.*A4-720.)
      S(6,2)=(-720.*A1-720.*A2-180.*A3-288.*A4)
      S(6,3)=(360.*A3+144.*A4+1440.)
      S(6,4)=(1440.*A1+360.*A2+144.*A4)
      S(6,5)=(2880.*A1+360.*A2+360.*A3+576.*A4+360.)
      S(6,6)=...
      V(1)=-(...*A1+12.*A2+12.*A3+16.*A4+24.)
      V(2)=-(-...*A1-72.*A2-60.*A3-48.*A4)
      V(3)=-(-...*A1-72.*A3-48.*A4-48.)
      V(4)=-(...*A1+60.*A2)
      V(5)=-(...*A3+24.)
      V(6)=-...2+360.*A3+144.*A4)
      ...C(6,6)
      ...((I,J),J=1,6),I=1,6)
      ...(J),J=1,6)
   3...(/(6A,4E16.8))
      ...77(6,6)
      ...((I,J),J=1,6),I=1,6)
      ...
      ...(I)=0.0
      ...
   1...(I)=S(I)+A(I,J)*V(J)
   ...(/(6A,4E16.8))
      C1=...(1)
      C2=...(2)
      C3=...(3)
      C4=...(4)
      C5=...(5)
      ...(6)
      ...,C1,C2,C3,C4,C5,ALPH1
   17 ...(/...C1=E16.8,4H C2=E16.8,4H C3=E16.8/4H C4=E16.8,
     1...C5=E16.8,7H ALPH1=E16.8)
```

```
      CALL LINK(NOSAVE2)
      END
$ENTRY
      30.          0.
$ENTRY
$LOCSAVE
      A=10
      DO 31 I=1,15
      DO 31 J=1,15
   31 A(I,J)=0.
      A(1,1)=-10.*A2*A*C-2.*A44
      A(1,2)=4.*A
      A(1,3)=2.*A2*A*C
      A(1,4)=A*A44
      A(1,5)=-2.*A
      A(1,6)=A*A11
      A(1,10)=-4.*A10
      A(1,13)=-2.*A11
      A(1,14)=2.*A10
      A(2,1)=2.*A
      A(2,2)=-4.*A2*A*C-6.*A44
      A(2,4)=4.*A44
      A(2,5)=-2.*A
      A(2,6)=4.*A2*A*C
      A(2,9)=-2.*A10
      A(2,10)=2.*A11
      A(2,12)=-6.*A11
      A(2,13)=2.*A10
      A(3,3)=2.*A44
      A(3,4)=40.*A2*A*C-2.*A44
      A(3,5)=-2.*A44
      A(3,6)=4.*A
      A(3,7)=2.*A44
      A(3,9)=-2.*A11
      A(3,11)=2.*A11
      A(3,13)=2.*A11
      A(3,14)=-4.*A10
      A(3,15)=-2.*A11
      A(4,4)=8.*A2*A*C
      A(4,5)=-4.*A2*A*C-20.*A44
      A(4,6)=8.*A
      A(4,7)=-4.*A2*A*C
      A(4,8)=4.*A2*A*C
      A(4,11)=2.*A11
      A(4,13)=-4.*A10
      A(5,5)=12.*A2*A*C
      A(5,6)=-8.*A
      A(5,7)=-12.*A2*A*C
      A(5,8)=-1.*A
      A(5,10)=-1.*A2*A*C-12.*A44
      A(5,11)=8.*A
      A(6,6)=2.*A2*A*C
      A(6,7)=-8.*A
      A(6,8)=4.*A10
```

```
      .(6,12)=-3.*A11
      .(6,13)=3.*A10
      .(6,14)=-6.*A11
      .(6,15)=6.*A10
      .(6,16)=3.*A11
      .(6,17)=-6.*A10
      .(6,18)=6.*A11
      .(6,19)=6.*A10
      .(6,20)=-6.*A11
      .(7,3)=6.*A2*R*C
      .(7,5)=12.*A44
      .(7,6)=-12.*A45
      .(7,7)=-6.*A2*R*C-12.*A44
      .(7,8)=12.*A45
      .(7,13)=-12.*A11
      .(7,14)=12.*A10
      .(7,16)=12.*A11
      .(7,17)=-12.*A10
      .(8,4)=24.*A44
      .(8,5)=-12.*A45
      .(8,6)=24.*A2*R*C
      .(8,7)=12.*A45
      .(8,8)=-24.*A2*R*C-20.*A44
      .(8,12)=24.*A11
      .(8,13)=12.*A10
      .(8,15)=-12.*A10
      .(8,16)=24.*A11
      .(9,4)=2.*A3*R*C*S
      .(9,5)=-2.*A3*A2*C
      .(9,6)=-2.*A3*R*C*S
      .(9,7)=2.*A3*A2*C
      .(9,8)=-3.*A14-6.*A7*R2*R
      .(9,12)=7.*A7*A2*S
      .(9,13)=-7.*A7*A2*R
      .(9,19)=1.*A14
      .(9,20)=-1.*A7*A2*S
      .(10,4)=-1.*A3*A2*C
      .(10,5)=7.*A3*R*C*S
      .(10,6)=-7.*A3*A2*C
      .(10,7)=-7.*A3*R*C*S
      .(10,8)=-1.*A2*C
      .(10,12)=7.*A7*A2*S
      .(10,13)=-3.*A14-2.*A7*R2*R
      CALL LUD(A(1,2),N3)
```

```
*** 11

      END
****
*EDISKKJSAKD
      I=13
      A(10,12)=6.*A14
      A(10,13)=-4.*A7*R2*S
      A(10,14)=1.*A7*R2*R
      A(11,1)=-2.*A6*R*C*S
      A(11,6)=2.*A6*R*C*S
      A(11,8)=2.*A6*R*C*S
      A(11,9)=-6.*A6*R2*C
      A(11,7)=-2.*A6*R*C*S
      A(11,5)=2.*A14
      A(11,11)=-2.*A14-20.*A7*R2*R
      A(11,13)=-2.*A14
      A(11,14)=1.*A7*R2*S
      A(11,12)=2.*A14
      A(12,9)=20.*A6*R*C*S
      A(12,8)=-4.*A6*R2*C
      A(12,1)=1.*A7*R2*R
      A(12,10)=-4.*A7*R2*R-20.*A14
      A(12,11)=4.*A7*R2*S
      A(12,6)=-2.*A7*R2*R
      A(12,4)=4.*A7*R2*R
      A(13,8)=6.*A6*R2*C
      A(13,9)=-4.*A6*R2*C
      A(13,7)=-12.*A6*R*C*S
      A(13,6)=-4.*A6*R2*C
      A(13,5)=4.*A6*R2*C
      A(13,12)=6.*A7*R2*R
      A(13,13)=-12.*A7*R2*S
      A(13,14)=-2.*A7*R2*R
      A(14,12)=12.*A7*R2*S
      A(14,11)=-2.*A7*R2*R-12.*A14
      A(14,10)=12.*A7*R2*S
      A(14,14)=6.*A7*R2*R
      A(14,13)=-12.*A7*R2*S
      A(15,1)=4.*A6*R2*C
      A(15,2)=-6.*A6*R*C*S
      A(15,3)=-6.*A6*R2*C
      A(15,4)=6.*A6*R*C*S
      A(15,5)=6.*A6*R2*C
      A(15,7)=6.*A6*R2*C
      A(15,8)=-4.*A6*R*C*S
      A(15,9)=-12.*A7*R2*S
      A(16,14)=4.*A14
      A(16,13)=12.*A7*R2*S
      A(16,12)=-4.*A14
      A(16,1)=4.*A7*R2*S
      A(16,10)=-4.*A14-12.*A7*R2*R
      A(16,11)=-4.*A7*R2*S
      A(16,6)=4.*A14
      A(16,7)=-12.*A6*R*C*S
```

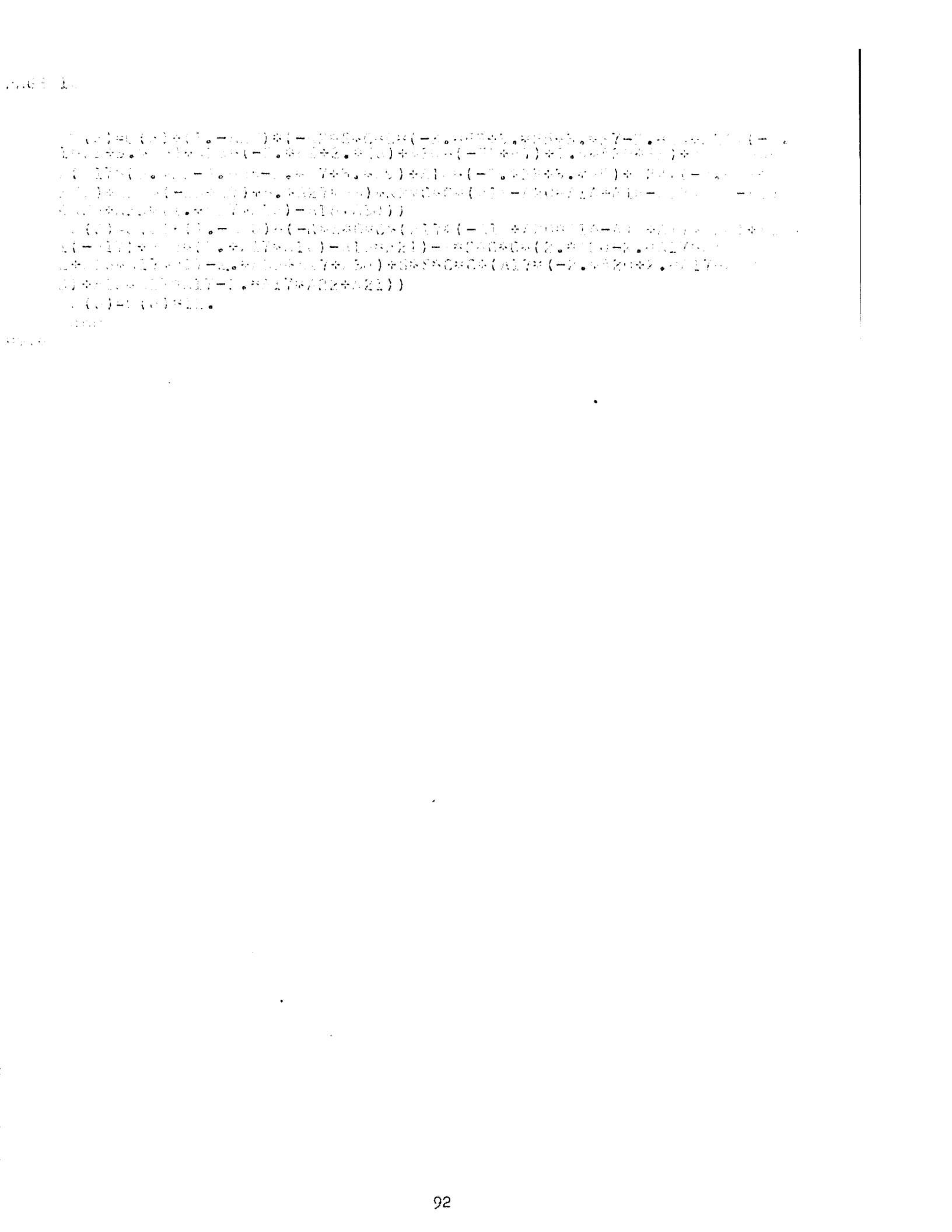
```
      SUBROUTINE JACOBN(X,Y,DFDX,DFDY,DGDX,DGDY)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION A(24)
      A(1)=1.
      A(2)=X
      A(3)=Y
      A(4)=X**2
      A(5)=X*Y
      A(6)=Y**2
      A(7)=X**3
      A(8)=X**2*Y
      A(9)=X*Y**2
      A(10)=Y**3
      A(11)=X**4
      A(12)=X**3*Y
      A(13)=X**2*Y**2
      A(14)=X*Y**3
      A(15)=Y**4
      A(16)=X**5
      A(17)=X**4*Y
      A(18)=X**3*Y**2
      A(19)=X**2*Y**3
      A(20)=X*Y**4
      A(21)=Y**5
      A(22)=X**6
      A(23)=X**5*Y
      A(24)=X**4*Y**2
      CALL L...(A,S,A,A)
      RE...
      SUBROUTINE ...(X,Y,F,G,DFDX,DFDY,DGDX,DGDY)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION A(24)
      A(1)=1.
      A(2)=X
      A(3)=Y
      A(4)=X**2
      A(5)=X*Y
      A(6)=Y**2
      A(7)=X**3
      A(8)=X**2*Y
      A(9)=X*Y**2
      A(10)=Y**3
      A(11)=X**4
      A(12)=X**3*Y
      A(13)=X**2*Y**2
      A(14)=X*Y**3
      A(15)=Y**4
      A(16)=X**5
      A(17)=X**4*Y
      A(18)=X**3*Y**2
      A(19)=X**2*Y**3
      A(20)=X*Y**4
      A(21)=Y**5
      A(22)=X**6
      A(23)=X**5*Y
      A(24)=X**4*Y**2
      CALL L...(A,S,A,A)
      F=...
      G=...
      DFDX=A(2)+2.*A(4)*S+A(5)*R+3.*A(7)*S**2+2.*A(8)*S*R+A(9)*R**2+4.*A(11)*S**3+3.*A(12)*S**2*R+2.*A(13)*S*R**2+A(14)*R**3+5.*A(16)*S**4+4.*A(17)*S**3*R+3.*A(18)*S**2*R**2+2.*A(19)*S*R**3+A(20)*R**4+6.*A(22)*S**5+5.*A(23)*S**4*R+4.*A(24)*S**3*R**2
      DFDY=A(3)+A(5)*S+2.*A(6)*R+A(8)*S**2+2.*A(9)*S*R+3.*A(10)*R**2+A(12)*S**3+2.*A(13)*S**2*R+3.*A(14)*S*R**2+4.*A(15)*R**3+A(17)*S**4+3.*A(18)*S**3*R+2.*A(19)*S**2*R**2+A(20)*S*R**3+5.*A(21)*R**4+A(23)*S**5+4.*A(24)*S**4*R+3.*A(25)*S**3*R**2+2.*A(26)*S**2*R**3+A(27)*S*R**4+6.*A(28)*R**5
      DGDX=A(2)+2.*A(4)*S+A(5)*R+3.*A(7)*S**2+2.*A(8)*S*R+A(9)*R**2+4.*A(11)*S**3+3.*A(12)*S**2*R+2.*A(13)*S*R**2+A(14)*R**3+5.*A(16)*S**4+4.*A(17)*S**3*R+3.*A(18)*S**2*R**2+2.*A(19)*S*R**3+A(20)*R**4+6.*A(22)*S**5+5.*A(23)*S**4*R+4.*A(24)*S**3*R**2
      DGDY=A(3)+A(5)*S+2.*A(6)*R+A(8)*S**2+2.*A(9)*S*R+3.*A(10)*R**2+A(12)*S**3+2.*A(13)*S**2*R+3.*A(14)*S*R**2+4.*A(15)*R**3+A(17)*S**4+3.*A(18)*S**3*R+2.*A(19)*S**2*R**2+A(20)*S*R**3+5.*A(21)*R**4+A(23)*S**5+4.*A(24)*S**4*R+3.*A(25)*S**3*R**2+2.*A(26)*S**2*R**3+A(27)*S*R**4+6.*A(28)*R**5
      RETURN
      END
      SUBROUTINE ...(X,Y,F,G,DFDX,DFDY,DGDX,DGDY)
      IMPLICIT REAL*8(A-H,O-Z)
      DIMENSION A(24)
      A(1)=1.
      A(2)=X
      A(3)=Y
      A(4)=X**2
      A(5)=X*Y
      A(6)=Y**2
      A(7)=X**3
      A(8)=X**2*Y
      A(9)=X*Y**2
      A(10)=Y**3
      A(11)=X**4
      A(12)=X**3*Y
      A(13)=X**2*Y**2
      A(14)=X*Y**3
      A(15)=Y**4
      A(16)=X**5
      A(17)=X**4*Y
      A(18)=X**3*Y**2
      A(19)=X**2*Y**3
      A(20)=X*Y**4
      A(21)=Y**5
      A(22)=X**6
      A(23)=X**5*Y
      A(24)=X**4*Y**2
      CALL L...(A,S,A,A)
      F=...
      G=...
      DFDX=A(2)+2.*A(4)*S+A(5)*R+3.*A(7)*S**2+2.*A(8)*S*R+A(9)*R**2+4.*A(11)*S**3+3.*A(12)*S**2*R+2.*A(13)*S*R**2+A(14)*R**3+5.*A(16)*S**4+4.*A(17)*S**3*R+3.*A(18)*S**2*R**2+2.*A(19)*S*R**3+A(20)*R**4+6.*A(22)*S**5+5.*A(23)*S**4*R+4.*A(24)*S**3*R**2
      DFDY=A(3)+A(5)*S+2.*A(6)*R+A(8)*S**2+2.*A(9)*S*R+3.*A(10)*R**2+A(12)*S**3+2.*A(13)*S**2*R+3.*A(14)*S*R**2+4.*A(15)*R**3+A(17)*S**4+3.*A(18)*S**3*R+2.*A(19)*S**2*R**2+A(20)*S*R**3+5.*A(21)*R**4+A(23)*S**5+4.*A(24)*S**4*R+3.*A(25)*S**3*R**2+2.*A(26)*S**2*R**3+A(27)*S*R**4+6.*A(28)*R**5
      DGDX=A(2)+2.*A(4)*S+A(5)*R+3.*A(7)*S**2+2.*A(8)*S*R+A(9)*R**2+4.*A(11)*S**3+3.*A(12)*S**2*R+2.*A(13)*S*R**2+A(14)*R**3+5.*A(16)*S**4+4.*A(17)*S**3*R+3.*A(18)*S**2*R**2+2.*A(19)*S*R**3+A(20)*R**4+6.*A(22)*S**5+5.*A(23)*S**4*R+4.*A(24)*S**3*R**2
      DGDY=A(3)+A(5)*S+2.*A(6)*R+A(8)*S**2+2.*A(9)*S*R+3.*A(10)*R**2+A(12)*S**3+2.*A(13)*S**2*R+3.*A(14)*S*R**2+4.*A(15)*R**3+A(17)*S**4+3.*A(18)*S**3*R+2.*A(19)*S**2*R**2+A(20)*S*R**3+5.*A(21)*R**4+A(23)*S**5+4.*A(24)*S**4*R+3.*A(25)*S**3*R**2+2.*A(26)*S**2*R**3+A(27)*S*R**4+6.*A(28)*R**5
      RETURN
      END
```

```
      1*-.*A(I*I))
     C  LL  [[...(A.S  ...)
...'C...3C'S1...'...'...3.3S7C'4*S0.4*2S11*S3611S0'10200
...D...2
...D...2
...L...SA*C*S...3)
        ...1=...2*...
        ...=-5.*(...**S)
        ...=-5.*(.*S)
        ...=...*(...*'.*C.*S)**2.
        ...5=C**4
        ...=1.*...)
        ...7=...-
        ...=*.*...**...)
        ...=(...*...*...*C)**...
         ...=(...*...*C)
        ...11=...*...*C...*S
        ...12=...(...*...*A3*C*C)
        ...13=...((...*...*...3)-(...U*C*C))
        ...14=...((...*...*C)-(A...U*S*S))
        ...15=...(-5.*...)*S
        ...16=...*...*...*...
        ...17=-...*...*C1
        ...18=(...-...*...C1-4.*C2+2.*C5)
        ...19=...-...*C2
        ...20=...-1.*C...
        ...21=1...-24.*C1+12.*C3
        ...22=...-...*C...
        ...23=...-...*C2+12.*C4
        ...24=...-...*C2**4.*C4
        ...25=...-...
        ...26=...-...*C...
        ...27=-...*...*C1+2.*C2-4.*C3-4.*C5
        ...28=...-...
        ...29=-...*...1...*C1+12.*C2-6.*C5
        ...30=...-...*C...
        ...31=...-...*C...**4.*C3
        ...32=-...*...*...*C1-5.*C3
        ...33=...-...*...-...*C2+4.*C5
        ...34=...*C1)-...*C3
        ...35=...*...1)-...*C4
        ...36=...*...)-...*C4
        ...37=-...*...*C2-C4
        ...38=-...*...*C2-5.*C4
        ...39=-...*...*...*C1+...*C2-4.*C4-4.*C5
        ...40=-...*...*...C2-...*C4
        ...41=...-...*...-20.*C2+1...*C4+1...*C5
        ...42=...-...*...)-...*C2**4.*C3+4.*C4+16.*C5
        ...43=...-...*...-5.*C2+1...*C3+1...*C5
        ...44=...(...*...**...*A7*C**3)
        ...45=
         ...(...-(...*...-...17)-...*A6*S*A17*A16+A15*1.**2*A6*(-A16)*...2*A7*(
       ...-...))
        ...(...)--(2.*...1 7 *A17-A*A6**S*(-A17)*A15*(-A17)**2*A3*1.**...**7*...1
```

```
```

```
 [illegible]*[illegible].[illegible](-[illegible].[illegible])[illegible]C*S**S*(D2*A1[illegible]+A17*(-3.*[illegible]2+3.*[illegible]))-[illegible]
 [illegible](-[illegible]*[illegible]7))+2.*[illegible]*C*S*S*([illegible]*A2[illegible]+[illegible]5-[illegible]7)-[illegible]
 [illegible]*(-[illegible]))
  U([illegible])=U([illegible])+[illegible]*([illegible]*A16*[illegible]A16)-2.*[illegible]*S*(-[illegible])*[illegible]
 1(A17*[illegible])-[illegible]*S*(-A16*[illegible])+4.*[illegible]*S*S*(A16)-2.*[illegible]
 2(-A17*[illegible])+[illegible]*S*S*(A16)-2.*[illegible]*S*[illegible](-1.)+S**4*(A17))
  U([illegible])=U([illegible])+[illegible]*([illegible]*C*C*(E3*A2[illegible]+A16*(-[illegible]*E7))-2.*[illegible]*C*[illegible](
 1*[illegible]-[illegible]7)+[illegible]*C*S*[illegible]*([illegible]*A1[illegible]+A17*(-[illegible]*E7))+0.5*C*[illegible]*2*(A1[illegible])-[illegible]
 2(-1.)+[illegible]*C*S*S*(A17))
  U([illegible])=U([illegible])+[illegible]*C**4*(E3*A1[illegible]+A17*(-E3+E7))+0.5*C**4*(A17)+[illegible]
 1*([illegible]+A17*(-3.*D2+3.*D4))-[illegible]*S*C**3*([illegible]*A2[illegible]+A17*(-D3+D7))+[illegible]
 2*C*C*([illegible]*(A17*A16*A16)-2.*R*S*(-A17*[illegible])+S*S*(A17)))
  U(2)=U(2)+(1.-[illegible])*(R2*C**3*([illegible]*A2[illegible]+[illegible]-D7)-[illegible]*S*C**[illegible]*([illegible]*A[illegible]-A17*
 1(-[illegible]7))+[illegible]*C*C*(E2*A26+3.*E2-3.*E4)-R2*S*C*C*(D2*A1[illegible]
 2A17*(-3.*[illegible]+3.*D4))-R2*S*C*C*(D3*A26+D3-D7)+R*S*S*C*C*([illegible]
 3A17*(-[illegible]7))+R2*C*C*(A16)-R*S*C*C*(-A17*A16)-R*S*C*C*(-1.)
 4+S*S*C*C*(A17))
  U(2)=U(2)*12.
  CALL LI[illegible](KJS[illegible])
*LDIS[illegible]
  U(3)=[illegible]*C*(D2*A16+A16*(-D2+D6))-2.*[illegible]*S*C*([illegible]-[illegible])
 1+[illegible]*C*S*S*(D2*A21+A17*(-D2+D6))-R2*R*C*S*(D3*A16+A16*(-3.*[illegible]+3.*[illegible]
 2))+2.*[illegible]*C*S*S*(D3*A30+3.*D3-3.*D5)-[illegible]*C*S**3*(D3*A21+A17*(-3.*[illegible]
 3+3.*[illegible]))
  U(3)=U(3)+0.5*(R2*R2*(A16)-2.*R2*[illegible]*S*(-1.)+R2*S*S*(A17)-2.*[illegible]
 1(-A16*A17)+[illegible]*R2*S*S*(A17)-2.*R*S**3*(-A17*A17)+R2*S*S*(A16*A17
 2*A17)-2.*R*[illegible]**3*(-A17*A17)+S**4*(A17*A17*A17))
  U([illegible])=U([illegible])+[illegible]*(R2*R*C*C*(E3*A16+A16*(-3.*E3+3.*E5))-2.*R2*C*C*[illegible]
 1([illegible]*A[illegible]+3.*E3-3.*E5)+R*C*C*S*S*(E3*A21+A17*(-3.*E3+3.*[illegible]))+[illegible].5*C
 2*C*[illegible]*([illegible]7*A17)-R*S*C*C*(-A17*A17)+0.5*C*C*S*S*(A17*A17*A17))
  U(3)=U(3)+[illegible]*C**4*(E3*A21+A17*(-3.*E3+3.*E5))+0.5*C**4*([illegible]17*A17
 1)+[illegible]*([illegible]*S**3*(D2*A21+A17*(-D2+D6))-[illegible]*S*C**3*(D3*A21+A17*(-3.*[illegible]
 2+3.*D5)+0.5*C*C*(R2*(A17)-2.*R*S*(-A17*A17)+S*S*(A17*A17*A17)))
  U(3)=U(3)+(1.-A[illegible])*(R2*C**3*(D3*A30+3.*D3-3.*D5)-R*S*C**[illegible]*([illegible]3*[illegible]
 1+A17*(-[illegible].*[illegible]+3.*D5))+R2*R*C*C*(E2*A30+E2-E6)-R2*S*C*C*(A21*[illegible]7
 2*(-[illegible]))-[illegible]*S*C*C*(E3*A30+3.*E3-3.*E5)+R*S*S*C*C*([illegible]*A21+A17*(
 3-[illegible]))+R2*C*C*(A17)-R*S*C*C*(-A17*A17)-R*S*C*C*(-[illegible]*A17)
 4+S*S*C*C*([illegible]17*A17*A17))
  U(3)=U(3)*12.
  CALL L[illegible]([illegible]JS[illegible])
*LDISKKJ[illegible]
  U(4)=[illegible]*C*(D2*A35+A16*(-3.*D4)+A23*(-3.*D2+3.*D4))-2.*[illegible]*S*C
 1*(D2*[illegible]+3.*D4+A26*(-3.*D2+3.*D4))+R2*C*S*S*(D2*A39-3.*D4*A17+[illegible]*
 2(-3.*[illegible]))-R2*R*C*S*(D3*A35-D7*A16+A23*(-D3+D7))+2.*R[illegible]*C*S*S*
 3(D3*[illegible]7*[illegible]26*(-D3+D7))-R*C*S**3*(D3*A39-D7*A17+A16*(-D3+[illegible])))
  U(4)=U(4)+[illegible]*(R2*R2*(A16*2.*A16*A24+A23*A16*A16)-2.*R2*R*S*(-[illegible]*
 1A16*[illegible]*A16)+R2*S*S*(2.*A16*A24*A17+A16*A16*A16)-2.*[illegible]*S
 2*([illegible]*(-[illegible]24+[illegible]*A16)-A16*A23)+4.*R2*S*S*(A24-A25*A16-A1[illegible])-2.*
 3*S*[illegible]*A17*(-A24+A25*A16)-A16*A1[illegible])+R2*S*S*(-2.*A25*A16+A23)-2.*[illegible]
 4S*[illegible]*([illegible]+A26)+S**4*(-2.*A25*A17+A16))
  U(4,-[illegible])*(R2*R*C*C*(-E7*A16+E3*A35+A23*(-E3+E7))-2.*[illegible]*C*C*S*
 1(E3*[illegible]7+A26*(-E3+E7))+R*C*C*S*S*(-E7*A17+E3*A39+A16*(-E3+E7))
 2*[illegible]*A2[illegible]*(-2.*A25*A16+A23)-R*S*C*C*(2.*A25+A26)+0.5*C*C*S*S*
 3(-2.*[illegible]*A17+A16))
```

```
      CALL LIBS(XD,A10)
*LDISKRDS,11
      U(1)=U(1)+(1.-AMU)*(R2*C**3*(D2*A30+D7*A24*(-D5+D7))-R3*(D2*A
     1(D2*A3*(-D7+D7*A17*(-D3*D7))+R2*C*C*(D2*(2.*A24*A25*A16)-A16*A1
     2*A1)))
      U(2)=U(2)+(1.-AMU)*(R2*C**3*(D2*A30+D7*A24*(-D5+D7))-R3*(D2*A
     1(D2*A3*(-D7+D7*A17*(-D3*D7))+R2*C*C*(D2*(2.*A24*A25*A16)-A16*A1
     2*A1)))
      U(3)=U(3)*(1.-AMU)*(R2*C**3*(D2*A30+D7*A24*(-D5+D7))-R3*(D2*A
     1(D2*A3*(-D7+D7*A17*(-D3*D7))+R2*C*C*(D2*(2.*A24*A25*A16)-A16*A1
     2*A1)))-R2*S*C*C*(-3.*E4*E2*A30*A1*(-3.*E2+2.*E4))-R2*S*S*(D7*A
     2(D7*A30*D7)*(-D3+E7))+R*S*S*C*C*(-E7*A17*A30*E3+A1*(-D5+D7))
     4*R3*C*C*(A30-A20*A16-A16*A20))
      U(4)=U(4)+(1.-AMU)*(-R*S*C*C*(A17*(-A24+A25*A16)-A16*A17)-R3*C*C*
     1(2.*A25*A17)+S*S*C*C*(-2.*A25*A17+A17))
      U(4)=U(4)*12.
      CALL LIBS(XD,A11)
*LDISKRDS,11
      U(5)=(-3.*R2*C*(D2*A27-D6*A16+A16*(-D2+D5))-2.*R2*R*S*C*(-2.*A32*
     1+A1*(-2.*A))+R2*C*S*S*(D2*A34-D6*A17*A21*(-D2+D6))-R2*R*C*S*(-27
     2*D3-5.*D2*A16+A16*(-3.*D3+3.*D5))+2.*R2*C*S*S*(D3*A32+5.*D3+3.*
     3(-3.*D3+3.*D5))-R*C*S**3*(D3*A34-5.*D5*A17+A21*(-3.*D3+3.*D5)))
      U(6)=U(6)*(-1.)*(-R2*R2*(-2.*A26*A14+A16)-2.*R2*R*S*(2.*A23+A5)+R2*
     1S*S*(-2.*A17*A21)-2.*R2*R*S*(A16*(A17*A28-A31)-A17*A16)+4.*R2*
     2S*S*(-A17*A26+A31-A17*A30)-2.*R*S**3*(A17*(A17*A28-A31)-A17*A21)
     3*(2.*A17*A31+A16*A17*A17)-2.*R*S**3*(-2.*A17*A31+A30
     4*A17*A17)*S**4*(2.*A17*A31*A17+A21*A17*A17))
      U(7)=U(7)*(-1.)*(R2*R*C*C*(-5.*E5*A16+A27*E5+A16*(-3.*E5+5.*E5))-2.*
     1R2*C*S*S*(5.*E5*A32+A30*(-3.*E5+3.*E5))+R*C*C*S*S*(-5.*R*A17
     2*A21*(-3.*E5+5.*E5))+0.5*C*C*R2*(2.*A17*A31*A16+A16*A17
     3*A17)-R*S*S*C*(-2.*A17*A31+A30*A17*A17)+0.5*C*C*S*S*(2.*A17*A31
     4*A17*A17+A17*A17))
      CALL LIBS(XD,A12)
*LDISKRDS,12
      U(1)=U(1)*(1.-AMU)*(-5.*E5*A17*A34*E3+A31*(-3.*E3+3.*E5))+0.5*R*R*S*S*
     1(2.*A17*A31*A17*A21*A17*A17)+AMU*(R2*C**3*(D2*A34-D6*A17+A21*(-D2
     2+D6))-R*S*S*C*(D3*A34-5.*D5*A17+A21*(-3.*D3+3.*D5))+0.5*C*C*(-2*
     3*A17*A17*A17*A17)-2.*R*S*C*C*(-A17*A21*A17*(A17*A28-A31))+S*S*C*(-2.*A17
     4*A17*A17*A17*A17)))
      U(2)=U(2)*(1.-AMU)*(R2*C**3*(D3*A32+5.*D5+A30*(-3.*D3+3.*D5))
     1-R*S*S*C*(5.*A34-5.*D5*A17+A21*(-3.*D3+3.*D5))*R2*R*C*C*(-5.*
     2*A17*A21*(-3.*E5+5.*E5))-R2*S*C*C*(-E6*A17+A34*E2+A21*(-3.*E2+E6))-R*R*C*C*
     3*(5.*A17*A17*A21*(-3.*E5+5.*E5))+R*S*S*C*C*(-5.*E5*A17*E3+A34
     4+A21*(-3.*E3+5.*E5))+R2*C*C*(-A17*A21+A17*A30))
      U(3)=U(3)*(1.-AMU)*(-R*S*C*C*(A17*(A17*A28-A31)-A17*A21)-R*S*C*C*
     1(-2.*A17*A31+A30*A17*A17)+S*S*C*C*(2.*A17*A31*A17+A21*A17*A17))
      U(5)=U(5)*12.
      CALL LIBS(XD,A13)
*LDISKRDS,13
      U(8)=(-R2*R*C*(D2*6.*A30*(-3.*D2+3.*D4)*A16*(-2.*D3+2.*D7)+A1*
     1(-2*A30*D2*(3.*D2-3.*D4-3.*D6+3.*D8)*A16)-2.*R2*R*S*C*(1.*A32
     2*2+A1*(-3.*D2*D4)*A30+(-2.*D5+2.*D7)*A35*(-D2+D8)*A26-5.*D3*5.*
     3*5.*A16-5.*D5*D7)*A16)*R2*C*S*S*(6.*A27*D2*(-3.*D2+3.*D4)*A21*(-2.*D3+2.*D
     4)*A22*(-D2*D8)*A16*(3.*D2-3.*D4-3.*D6+3.*D8)*A17))
      U(9)=U(9)+(-R2*R*C*S*(A16*(3.*D3-3.*D5-3.*D7+3.*D9)+A23*(-3.*D3+
```



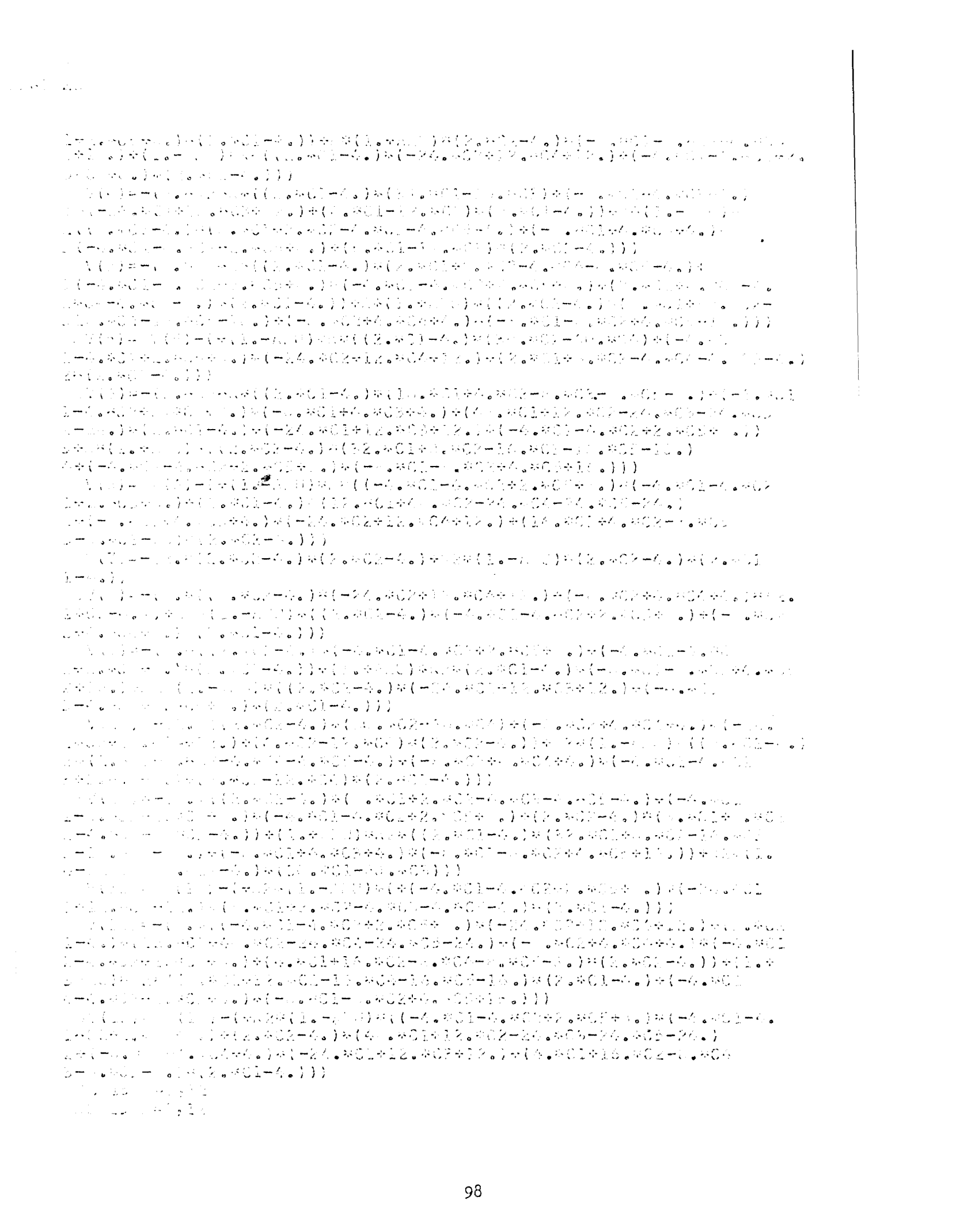
```
```

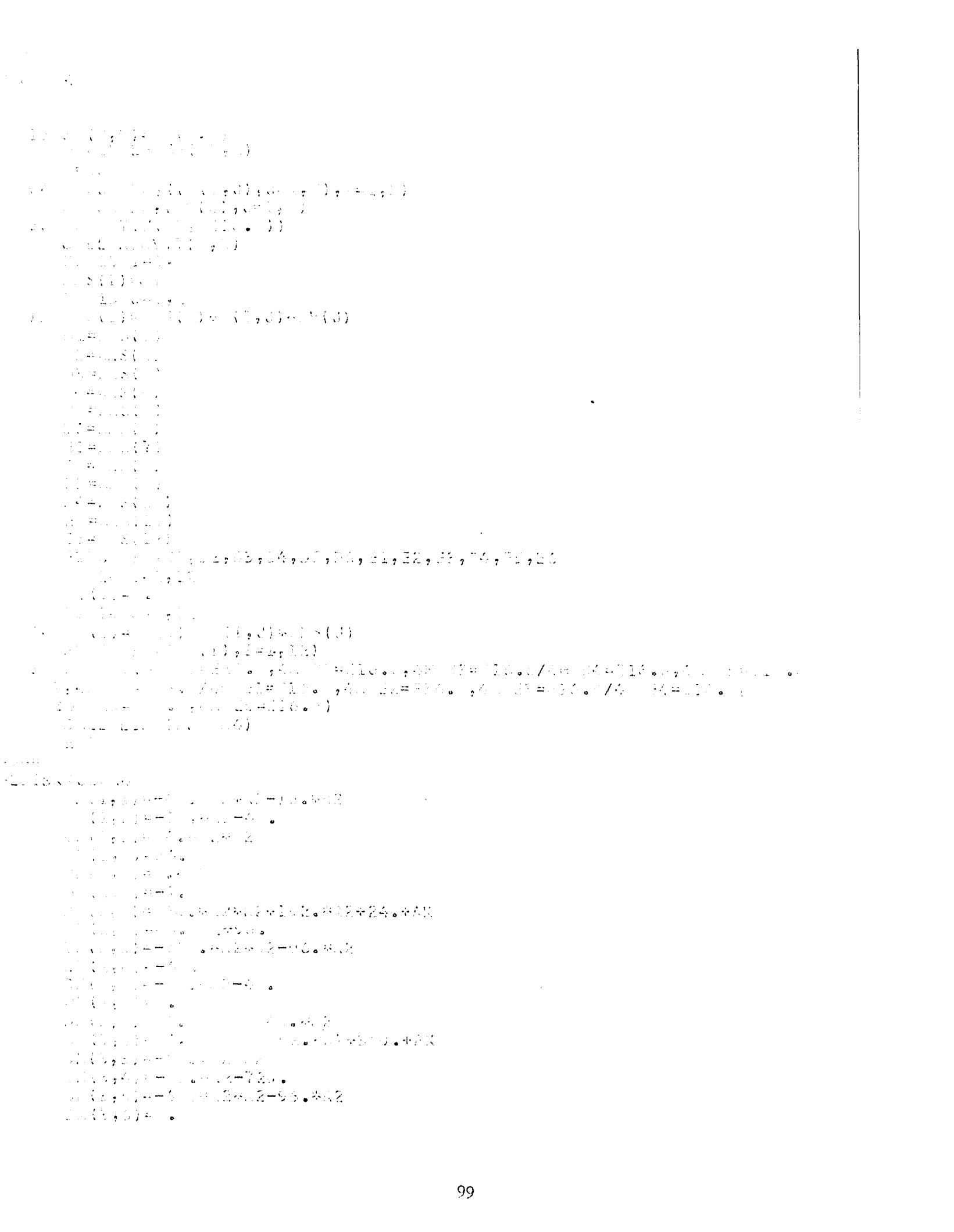
```
                                                                       0.33333  0.24566474E+0.24566474E+0.01011561E+01-1.1E+0
-2.32976702-2.77100217-0.50564E0610.4.23(411.10E+0-2.32
                                                                       .757642560.757642E6-0.07E1.67E-1.07E
-7.3094955-4.2148797-7.2560167-1.7920741E+0.772E+
-7.3094954-7.2560161
                                                                       (12,12),V(6),A(12,12),ANS(12),BB(12,12),EV(12),
                                                                       ,C1,C2,C3,C4,C5,P1,P2,P3,P4,P5,P6,Z1,P8,Z9,P*,
                                                                       P9,Q1,Q2,Q3,Q4,Q5,Q6,R1,R2,R3,R4,R5,R6,Y1,Y2,Y3,
                                                                       ,U,V
                                                                       ,A)
                                                                       ,6)
                                                                       AC=F10.5,4H AK=F10.5)
```

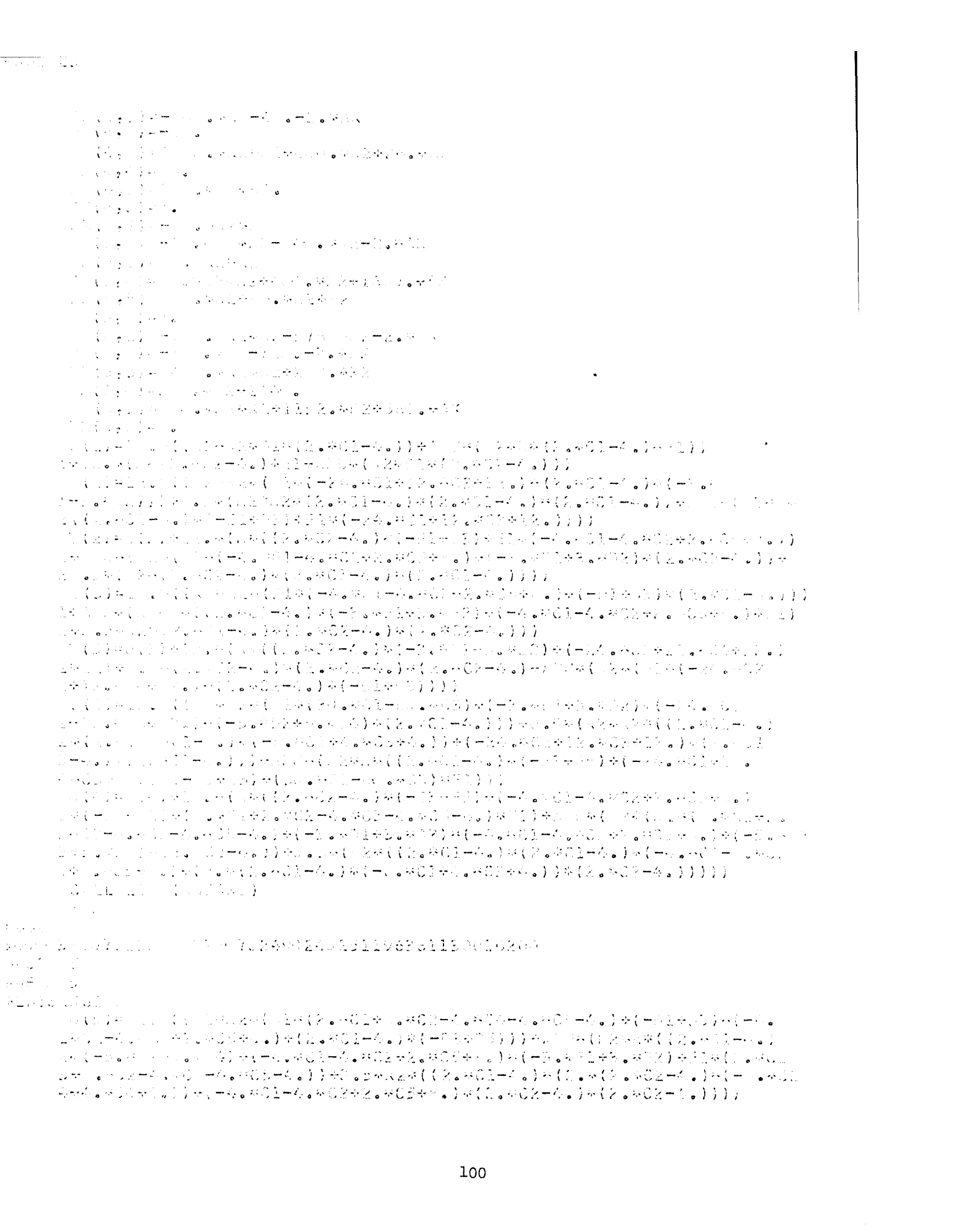
```
      S(2,1)=360.*AK**4+1152.*AK**2+144.
      S(2,2)=-720.*AK**2-576.
      S(2,3)=-720.*AK**4-576.*AK**2
      S(2,4)=-48.
      S(2,5)=-576.*AK**2-48.
      S(2,6)=0.
      S(3,1)=96.*AK**4+48.*AK**2
      S(3,2)=240.*AK**4+1152.*AK**2+360.*AK**
      S(3,3)=-144.*AK**4
      S(3,4)=-960.*AK**2-720.
      S(3,5)=-576.*AK**2-48.*AK**4
      S(3,6)=0.
      S(4,1)=-240.*AK**2-48.-2.*AK
      S(4,2)=-48.
      S(4,3)=144.*AK**4+24.*AK**2+AK
      S(4,4)=24.
      S(4,5)=120.*AK**2+96.
      S(4,6)=0.
      S(5,1)=-48.*AK**4
      S(5,2)=-48.*AK**4-240.*AK**2-2.*AK
      S(5,3)=96.*AK**4
      S(5,4)=24.*AK**4+240.*AK**2+144.*AK
      S(5,5)=120.*AK**2+96.*AK**4
      S(5,6)=0.
      S(6,1)=-720.*AK**4-576.*AK**2-2.*AK
      S(6,2)=-576.*AK**2-720.-2.*AK
      S(6,3)=1440.*AK**4+288.*AK**2
      S(6,4)=288.*AK**2+1440.
      S(6,5)=360.*AK**4+1152.*AK**2+360.*AK
      S(6,6)=0.
      V(1)=-(24.*AK**4+32.*AK**2+24.+AK)
      V(2)=2.*AK-(-96.*AK**2-48.)
      V(3)=2.*AK-(-48.*AK**4-96.*AK**2)
      V(4)=-AK-24.
      V(5)=-AK-24.*AK**4
      V(6)=-240.*AK**2-4.*AK
      DO 15 I=1,6
      DO 15 J=1,6
   15 A(I,J)=S(I,J)
      N=6
      CALL SIMQ(A,C,N,KS)
      WRITE(6,36)((A(I,J),J=1,N),I=1,N)
      WRITE(6,36)(V(J),J=1,N)
   36 FORMAT(/(6X,8E16.8))
      CALL ANSV77(A,N)
      DO 16 I=1,N
      ANS(I)=0.
      DO 16 J=1,N
   16 ANS(I)=ANS(I)+A(I,J)*V(J)
    6 FORMAT(/(6X,4E16.8))
      C1=ANS(1)
      C2=ANS(2)
      C3=ANS(3)
      C4=ANS(4)
```

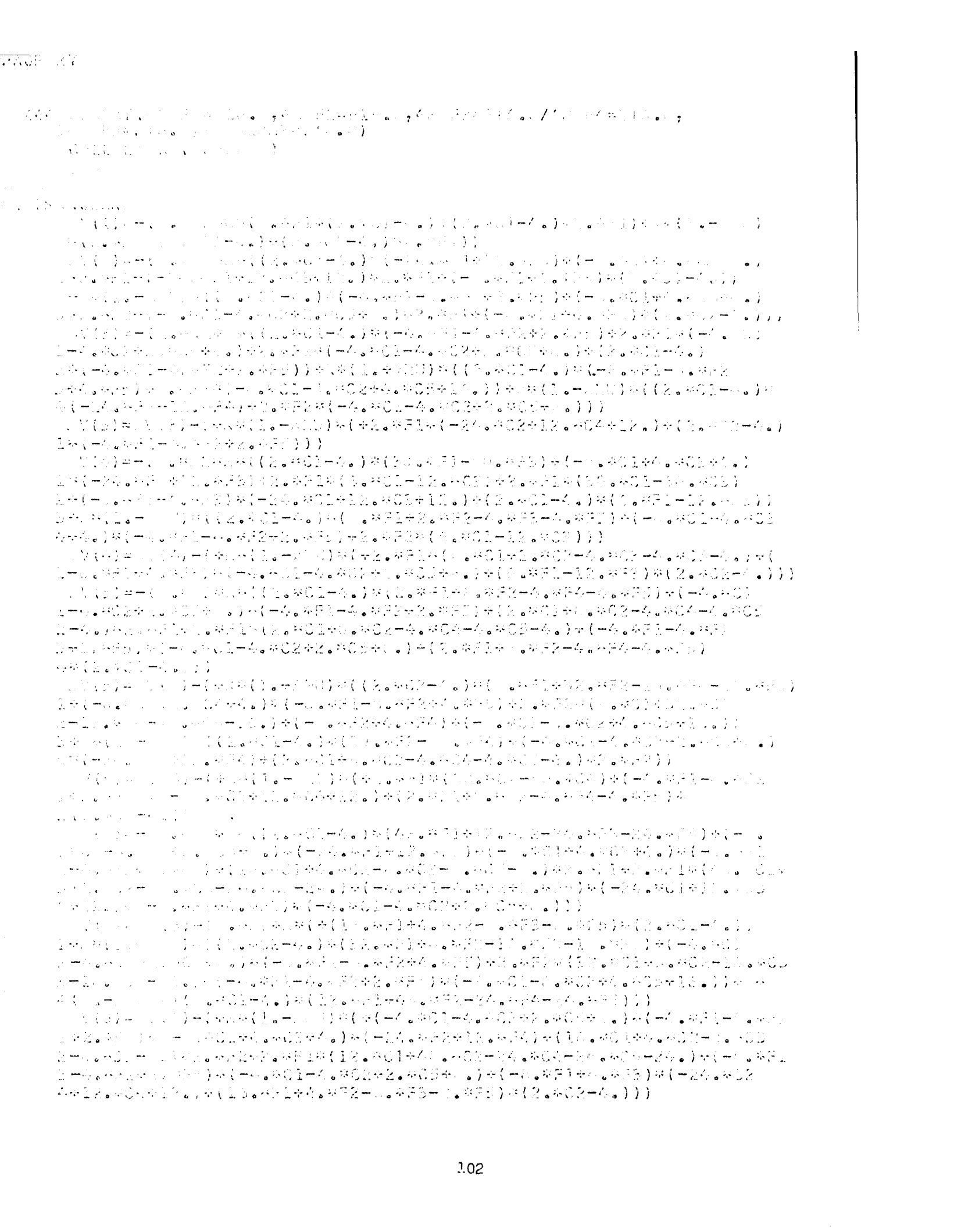
```
PAGE 21
      S0=A(1)
      ALPH1=A(3)
      READ(57,21,C2,C3,C4,C5,ALPH1
     1 (I=1,
      Y(I)=0.
      DO 14 J=1,
   14 Y(I)=Y(I)+ (I,J)*A(J)
      WRITE(6,15)(Y(I),I=1,
   15 FORMAT(4H C1=E16.8,4H C2=E16.8,4H C3=E16.8/4H C4=E16.8,
     1 4H C5=E16.8,7H ALPH1=E16.8)
      CALL EIGEN(X0,N2)
      END
      S
  0.0000      0.00         0.
$ENTRY
*EIGEN,N,D,N2
      N=12
      DO 21 I=1,12
      DO 21 J=1,12
   21 A(I,J)=0.
      A(1,1)=-1.*(2*N-2.*N*(1.-A(1))
      A(1,2)=2.*N2*N
      A(1,3)=2.*N*(1.-A(1))
      A(1,7)=-2.*(1.-A(1))*N2
      A(1,8)=2.*(1.-A(1))*N2
      A(2,1)=2.*N*(1.-A(1))
      A(2,2)=-2.*(1.-A(1))-4.)*N2*N
      A(2,3)=-2.*N*(1.-A(1))
      A(2,8)=2.*N2*N
      A(3,1)= .*N*(1.-A(1))
      A(3,2)=-2.*(1.+A(1))*N2
      A(3,3)=-1.*(1.+A(1))*N2
      A(3,4)=2.*N2*N
      A(3,5)=-12.*N*N*(1.-A(1))
      A(3,6)=12.*N*N*(1.-A(1))
      A(3,7)=2.*(1.+A(1))*N2
      A(3,8)=-2.*(1.+A(1))*N2
      A(3,9)=2.*(1.+A(1))*N2
      A(3,10)=6.*N*(1.+A(1))*N2
      A(4,1)=2.*N*(1.-A(1))
      A(4,2)=-4.*N2*N-2.*N*N*(1.-A(1))
      A(4,3)=-1.*N*N*(1.-A(1))
      A(4,11)=-2.*(1.+A(1))*N2
      A(5,5)=12.*N*N2*N
      A(5,6)=-24.*N2*N-30.*N*N*(1.-A(1))
      A(5,7)=-12.*N*N2*N
      A(5,8)= .*N*(1.+A(1))*N2
      A(5,9)=-2.*N*(3*(1.+A(1))
      A(5,12)=1 .*(1.+A(1))*N2
      A(6,6)=4 .*N2*N
      A(6,8 )=12.*N*N*(1.-A(1))
      A(6, , )=-4.*N2*N
```

```
      SUBROUTINE BLOCK1
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON/BLK1/A(15,15)
      A( 1, 1)=-1.D0*A( 1, 2)-1.D0*(1.D0-A( 1, 1))
      A( 1, 2)=-1.D0*A( 1, 3)-1.D0*A( 1, 2)*(1.D0-A( 1, 1))
      A( 1, 3)=-1.D0*(1.D0-A( 1, 1))*A( 1, 3)
      A( 1, 4)=-1.D0*(1.D0-A( 1, 1))*A( 1, 4)
      A( 1, 5)=-1.D0*(1.D0-A( 1, 1))*A( 1, 5)
      A( 1, 6)=-1.D0*(1.D0-A( 1, 1))*A( 1, 6)
      A( 1, 7)=-1.D0*(1.D0-A( 1, 1))*A( 1, 7)
      A( 1, 8)=-1.D0*(1.D0-A( 1, 1))*A( 1, 8)
      A( 1, 9)=-1.D0*(1.D0-A( 1, 1))*A( 1, 9)
      A( 1,10)=-1.D0*(1.D0-A( 1, 1))*A( 1,10)
      A( 1,11)=-1.D0*(1.D0-A( 1, 1))*A( 1,11)
      A( 1,12)=-1.D0*(1.D0-A( 1, 1))*A( 1,12)
      A( 1,13)=-1.D0*(1.D0-A( 1, 1))*A( 1,13)
      A( 1,14)=-1.D0*(1.D0-A( 1, 1))*A( 1,14)
      A( 1,15)=-1.D0*(1.D0-A( 1, 1))*A( 1,15)
      A( 2, 1)=-1.D0*A( 2, 2)-1.D0*(1.D0-A( 2, 1))*A( 1, 2)
      A( 2, 2)=-1.D0*A( 2, 3)-1.D0*A( 2, 2)*(1.D0-A( 2, 1))
      A( 2, 3)=-1.D0*(1.D0-A( 2, 1))*A( 2, 3)
      A( 2, 4)=-1.D0*(1.D0-A( 2, 1))*A( 2, 4)
      A( 2, 5)=-1.D0*(1.D0-A( 2, 1))*A( 2, 5)
      A( 2, 6)=-1.D0*(1.D0-A( 2, 1))*A( 2, 6)
      A( 2, 7)=-1.D0*(1.D0-A( 2, 1))*A( 2, 7)
      A( 2, 8)=-1.D0*(1.D0-A( 2, 1))*A( 2, 8)
      A( 2, 9)=-1.D0*(1.D0-A( 2, 1))*A( 2, 9)
      A( 2,10)=-1.D0*(1.D0-A( 2, 1))*A( 2,10)
      A( 2,11)=-1.D0*(1.D0-A( 2, 1))*A( 2,11)
      A( 2,12)=-1.D0*(1.D0-A( 2, 1))*A( 2,12)
      A( 2,13)=-1.D0*(1.D0-A( 2, 1))*A( 2,13)
      A( 2,14)=-1.D0*(1.D0-A( 2, 1))*A( 2,14)
      A( 2,15)=-1.D0*(1.D0-A( 2, 1))*A( 2,15)
      A( 3, 1)=-1.D0*A( 3, 2)-1.D0*(1.D0-A( 3, 1))*A( 1, 3)
      A( 3, 2)=-1.D0*A( 3, 3)-1.D0*A( 3, 2)*(1.D0-A( 3, 1))
      A( 3, 3)=-1.D0*(1.D0-A( 3, 1))*A( 3, 3)
      A( 3, 4)=-1.D0*(1.D0-A( 3, 1))*A( 3, 4)
      A( 3, 5)=-1.D0*(1.D0-A( 3, 1))*A( 3, 5)
      A( 3, 6)=-1.D0*(1.D0-A( 3, 1))*A( 3, 6)
      A( 3, 7)=-1.D0*(1.D0-A( 3, 1))*A( 3, 7)
      A( 3, 8)=-1.D0*(1.D0-A( 3, 1))*A( 3, 8)
      A( 3, 9)=-1.D0*(1.D0-A( 3, 1))*A( 3, 9)
      A( 3,10)=-1.D0*(1.D0-A( 3, 1))*A( 3,10)
      A( 3,11)=-1.D0*(1.D0-A( 3, 1))*A( 3,11)
      A( 3,12)=-1.D0*(1.D0-A( 3, 1))*A( 3,12)
      A( 3,13)=-1.D0*(1.D0-A( 3, 1))*A( 3,13)
      A( 3,14)=-1.D0*(1.D0-A( 3, 1))*A( 3,14)
      A( 3,15)=-1.D0*(1.D0-A( 3, 1))*A( 3,15)
      A( 4, 1)=-1.D0*A( 4, 2)-1.D0*(1.D0-A( 4, 1))*A( 1, 4)
      A( 4, 2)=-1.D0*A( 4, 3)-1.D0*A( 4, 2)*(1.D0-A( 4, 1))
      A( 4, 3)=-1.D0*A( 4, 4)-1.D0*A( 4, 3)*(1.D0-A( 4, 1))
      A( 4, 4)=-1.D0*(1.D0-A( 4, 1))*A( 4, 4)
      A( 4, 5)=-1.D0*(1.D0-A( 4, 1))*A( 4, 5)
      A( 4, 6)=-1.D0*(1.D0-A( 4, 1))*A( 4, 6)
      A( 4, 7)=-1.D0*(1.D0-A( 4, 1))*A( 4, 7)
      A( 4, 8)=-1.D0*(1.D0-A( 4, 1))*A( 4, 8)
      A( 4, 9)=-1.D0*(1.D0-A( 4, 1))*A( 4, 9)
      A( 4,10)=-1.D0*(1.D0-A( 4, 1))*A( 4,10)
      A( 4,11)=-1.D0*(1.D0-A( 4, 1))*A( 4,11)
      A( 4,12)=-1.D0*(1.D0-A( 4, 1))*A( 4,12)
      A( 4,13)=-1.D0*(1.D0-A( 4, 1))*A( 4,13)
      A( 4,14)=-1.D0*(1.D0-A( 4, 1))*A( 4,14)
      A( 4,15)=-1.D0*(1.D0-A( 4, 1))*A( 4,15)
      A( 5, 1)=-1.D0*A( 5, 2)-1.D0*(1.D0-A( 5, 1))*A( 1, 5)
      A( 5, 2)=-1.D0*A( 5, 3)-1.D0*A( 5, 2)*(1.D0-A( 5, 1))
      A( 5, 3)=-1.D0*A( 5, 4)-1.D0*A( 5, 3)*(1.D0-A( 5, 1))
      A( 5, 4)=-1.D0*A( 5, 5)-1.D0*A( 5, 4)*(1.D0-A( 5, 1))
      A( 5, 5)=-1.D0*(1.D0-A( 5, 1))*A( 5, 5)
      A( 5, 6)=-1.D0*(1.D0-A( 5, 1))*A( 5, 6)
      A( 5, 7)=-1.D0*(1.D0-A( 5, 1))*A( 5, 7)
      A( 5, 8)=-1.D0*(1.D0-A( 5, 1))*A( 5, 8)
      A( 5, 9)=-1.D0*(1.D0-A( 5, 1))*A( 5, 9)
      A( 5,10)=-1.D0*(1.D0-A( 5, 1))*A( 5,10)
      A( 5,11)=-1.D0*(1.D0-A( 5, 1))*A( 5,11)
      A( 5,12)=-1.D0*(1.D0-A( 5, 1))*A( 5,12)
      A( 5,13)=-1.D0*(1.D0-A( 5, 1))*A( 5,13)
      A( 5,14)=-1.D0*(1.D0-A( 5, 1))*A( 5,14)
      A( 5,15)=-1.D0*(1.D0-A( 5, 1))*A( 5,15)
      A( 6, 1)=-1.D0*A( 6, 2)-1.D0*(1.D0-A( 6, 1))*A( 1, 6)
      A( 6, 2)=-1.D0*A( 6, 3)-1.D0*A( 6, 2)*(1.D0-A( 6, 1))
      A( 6, 3)=-1.D0*A( 6, 4)-1.D0*A( 6, 3)*(1.D0-A( 6, 1))
      A( 6, 4)=-1.D0*A( 6, 5)-1.D0*A( 6, 4)*(1.D0-A( 6, 1))
      A( 6, 5)=-1.D0*A( 6, 6)-1.D0*A( 6, 5)*(1.D0-A( 6, 1))
      A( 6, 6)=-1.D0*(1.D0-A( 6, 1))*A( 6, 6)
      A( 6, 7)=-1.D0*(1.D0-A( 6, 1))*A( 6, 7)
      A( 6, 8)=-1.D0*(1.D0-A( 6, 1))*A( 6, 8)
      A( 6, 9)=-1.D0*(1.D0-A( 6, 1))*A( 6, 9)
      A( 6,10)=-1.D0*(1.D0-A( 6, 1))*A( 6,10)
      A( 6,11)=-1.D0*(1.D0-A( 6, 1))*A( 6,11)
      A( 6,12)=-1.D0*(1.D0-A( 6, 1))*A( 6,12)
      A( 6,13)=-1.D0*(1.D0-A( 6, 1))*A( 6,13)
      A( 6,14)=-1.D0*(1.D0-A( 6, 1))*A( 6,14)
      A( 6,15)=-1.D0*(1.D0-A( 6, 1))*A( 6,15)
      A( 7, 1)=-1.D0*A( 7, 2)-1.D0*(1.D0-A( 7, 1))*A( 1, 7)
      A( 7, 2)=-1.D0*A( 7, 3)-1.D0*A( 7, 2)*(1.D0-A( 7, 1))
      A( 7, 3)=-1.D0*A( 7, 4)-1.D0*A( 7, 3)*(1.D0-A( 7, 1))
      A( 7, 4)=-1.D0*A( 7, 5)-1.D0*A( 7, 4)*(1.D0-A( 7, 1))
      A( 7, 5)=-1.D0*A( 7, 6)-1.D0*A( 7, 5)*(1.D0-A( 7, 1))
      A( 7, 6)=-1.D0*A( 7, 7)-1.D0*A( 7, 6)*(1.D0-A( 7, 1))
      A( 7, 7)=-1.D0*(1.D0-A( 7, 1))*A( 7, 7)
      A( 7, 8)=-1.D0*(1.D0-A( 7, 1))*A( 7, 8)
      A( 7, 9)=-1.D0*(1.D0-A( 7, 1))*A( 7, 9)
      A( 7,10)=-1.D0*(1.D0-A( 7, 1))*A( 7,10)
      A( 7,11)=-1.D0*(1.D0-A( 7, 1))*A( 7,11)
      A( 7,12)=-1.D0*(1.D0-A( 7, 1))*A( 7,12)
      A( 7,13)=-1.D0*(1.D0-A( 7, 1))*A( 7,13)
      A( 7,14)=-1.D0*(1.D0-A( 7, 1))*A( 7,14)
      A( 7,15)=-1.D0*(1.D0-A( 7, 1))*A( 7,15)
      A( 8, 1)=-1.D0*A( 8, 2)-1.D0*(1.D0-A( 8, 1))*A( 1, 8)
      A( 8, 2)=-1.D0*A( 8, 3)-1.D0*A( 8, 2)*(1.D0-A( 8, 1))
      A( 8, 3)=-1.D0*A( 8, 4)-1.D0*A( 8, 3)*(1.D0-A( 8, 1))
      A( 8, 4)=-1.D0*A( 8, 5)-1.D0*A( 8, 4)*(1.D0-A( 8, 1))
      A( 8, 5)=-1.D0*A( 8, 6)-1.D0*A( 8, 5)*(1.D0-A( 8, 1))
      A( 8, 6)=-1.D0*A( 8, 7)-1.D0*A( 8, 6)*(1.D0-A( 8, 1))
      A( 8, 7)=-1.D0*A( 8, 8)-1.D0*A( 8, 7)*(1.D0-A( 8, 1))
      A( 8, 8)=-1.D0*(1.D0-A( 8, 1))*A( 8, 8)
      A( 8, 9)=-1.D0*(1.D0-A( 8, 1))*A( 8, 9)
      A( 8,10)=-1.D0*(1.D0-A( 8, 1))*A( 8,10)
      A( 8,11)=-1.D0*(1.D0-A( 8, 1))*A( 8,11)
      A( 8,12)=-1.D0*(1.D0-A( 8, 1))*A( 8,12)
      A( 8,13)=-1.D0*(1.D0-A( 8, 1))*A( 8,13)
      A( 8,14)=-1.D0*(1.D0-A( 8, 1))*A( 8,14)
      A( 8,15)=-1.D0*(1.D0-A( 8, 1))*A( 8,15)
      A( 9, 1)=-1.D0*A( 9, 2)-1.D0*(1.D0-A( 9, 1))*A( 1, 9)
      A( 9, 2)=-1.D0*A( 9, 3)-1.D0*A( 9, 2)*(1.D0-A( 9, 1))
      A( 9, 3)=-1.D0*A( 9, 4)-1.D0*A( 9, 3)*(1.D0-A( 9, 1))
      A( 9, 4)=-1.D0*A( 9, 5)-1.D0*A( 9, 4)*(1.D0-A( 9, 1))
      A( 9, 5)=-1.D0*A( 9, 6)-1.D0*A( 9, 5)*(1.D0-A( 9, 1))
      A( 9, 6)=-1.D0*A( 9, 7)-1.D0*A( 9, 6)*(1.D0-A( 9, 1))
      A( 9, 7)=-1.D0*A( 9, 8)-1.D0*A( 9, 7)*(1.D0-A( 9, 1))
      A( 9, 8)=-1.D0*A( 9, 9)-1.D0*A( 9, 8)*(1.D0-A( 9, 1))
      A( 9, 9)=-1.D0*(1.D0-A( 9, 1))*A( 9, 9)
      A( 9,10)=-1.D0*(1.D0-A( 9, 1))*A( 9,10)
      A( 9,11)=-1.D0*(1.D0-A( 9, 1))*A( 9,11)
      A( 9,12)=-1.D0*(1.D0-A( 9, 1))*A( 9,12)
      A( 9,13)=-1.D0*(1.D0-A( 9, 1))*A( 9,13)
      A( 9,14)=-1.D0*(1.D0-A( 9, 1))*A( 9,14)
      A( 9,15)=-1.D0*(1.D0-A( 9, 1))*A( 9,15)
      A(10, 1)=-1.D0*A(10, 2)-1.D0*(1.D0-A(10, 1))*A( 1,10)
      A(10, 2)=-1.D0*A(10, 3)-1.D0*A(10, 2)*(1.D0-A(10, 1))
      A(10, 3)=-1.D0*A(10, 4)-1.D0*A(10, 3)*(1.D0-A(10, 1))
      A(10, 4)=-1.D0*A(10, 5)-1.D0*A(10, 4)*(1.D0-A(10, 1))
      A(10, 5)=-1.D0*A(10, 6)-1.D0*A(10, 5)*(1.D0-A(10, 1))
      A(10, 6)=-1.D0*A(10, 7)-1.D0*A(10, 6)*(1.D0-A(10, 1))
      A(10, 7)=-1.D0*A(10, 8)-1.D0*A(10, 7)*(1.D0-A(10, 1))
      A(10, 8)=-1.D0*A(10, 9)-1.D0*A(10, 8)*(1.D0-A(10, 1))
      A(10, 9)=-1.D0*A(10,10)-1.D0*A(10, 9)*(1.D0-A(10, 1))
      A(10,10)=-1.D0*(1.D0-A(10, 1))*A(10,10)
      A(10,11)=-1.D0*(1.D0-A(10, 1))*A(10,11)
      A(10,12)=-1.D0*(1.D0-A(10, 1))*A(10,12)
      A(10,13)=-1.D0*(1.D0-A(10, 1))*A(10,13)
      A(10,14)=-1.D0*(1.D0-A(10, 1))*A(10,14)
      A(10,15)=-1.D0*(1.D0-A(10, 1))*A(10,15)
      A(11, 1)=-1.D0*A(11, 2)-1.D0*(1.D0-A(11, 1))*A( 1,11)
      A(11, 2)=-1.D0*A(11, 3)-1.D0*A(11, 2)*(1.D0-A(11, 1))
      A(11, 3)=-1.D0*A(11, 4)-1.D0*A(11, 3)*(1.D0-A(11, 1))
      A(11, 4)=-1.D0*A(11, 5)-1.D0*A(11, 4)*(1.D0-A(11, 1))
      A(11, 5)=-1.D0*A(11, 6)-1.D0*A(11, 5)*(1.D0-A(11, 1))
      A(11, 6)=-1.D0*A(11, 7)-1.D0*A(11, 6)*(1.D0-A(11, 1))
      A(11, 7)=-1.D0*A(11, 8)-1.D0*A(11, 7)*(1.D0-A(11, 1))
      A(11, 8)=-1.D0*A(11, 9)-1.D0*A(11, 8)*(1.D0-A(11, 1))
      A(11, 9)=-1.D0*A(11,10)-1.D0*A(11, 9)*(1.D0-A(11, 1))
      A(11,10)=-1.D0*A(11,11)-1.D0*A(11,10)*(1.D0-A(11, 1))
      A(11,11)=-1.D0*(1.D0-A(11, 1))*A(11,11)
      A(11,12)=-1.D0*(1.D0-A(11, 1))*A(11,12)
      A(11,13)=-1.D0*(1.D0-A(11, 1))*A(11,13)
      A(11,14)=-1.D0*(1.D0-A(11, 1))*A(11,14)
      A(11,15)=-1.D0*(1.D0-A(11, 1))*A(11,15)
      A(12, 1)=-1.D0*A(12, 2)-1.D0*(1.D0-A(12, 1))*A( 1,12)
      A(12, 2)=-1.D0*A(12, 3)-1.D0*A(12, 2)*(1.D0-A(12, 1))
      A(12, 3)=-1.D0*A(12, 4)-1.D0*A(12, 3)*(1.D0-A(12, 1))
      A(12, 4)=-1.D0*A(12, 5)-1.D0*A(12, 4)*(1.D0-A(12, 1))
      A(12, 5)=-1.D0*A(12, 6)-1.D0*A(12, 5)*(1.D0-A(12, 1))
      A(12, 6)=-1.D0*A(12, 7)-1.D0*A(12, 6)*(1.D0-A(12, 1))
      A(12, 7)=-1.D0*A(12, 8)-1.D0*A(12, 7)*(1.D0-A(12, 1))
      A(12, 8)=-1.D0*A(12, 9)-1.D0*A(12, 8)*(1.D0-A(12, 1))
      A(12, 9)=-1.D0*A(12,10)-1.D0*A(12, 9)*(1.D0-A(12, 1))
      A(12,10)=-1.D0*A(12,11)-1.D0*A(12,10)*(1.D0-A(12, 1))
      A(12,11)=-1.D0*A(12,12)-1.D0*A(12,11)*(1.D0-A(12, 1))
      A(12,12)=-1.D0*(1.D0-A(12, 1))*A(12,12)
      A(12,13)=-1.D0*(1.D0-A(12, 1))*A(12,13)
      A(12,14)=-1.D0*(1.D0-A(12, 1))*A(12,14)
      A(12,15)=-1.D0*(1.D0-A(12, 1))*A(12,15)
      A(13, 1)=-1.D0*A(13, 2)-1.D0*(1.D0-A(13, 1))*A( 1,13)
      A(13, 2)=-1.D0*A(13, 3)-1.D0*A(13, 2)*(1.D0-A(13, 1))
      A(13, 3)=-1.D0*A(13, 4)-1.D0*A(13, 3)*(1.D0-A(13, 1))
      A(13, 4)=-1.D0*A(13, 5)-1.D0*A(13, 4)*(1.D0-A(13, 1))
      A(13, 5)=-1.D0*A(13, 6)-1.D0*A(13, 5)*(1.D0-A(13, 1))
      A(13, 6)=-1.D0*A(13, 7)-1.D0*A(13, 6)*(1.D0-A(13, 1))
      A(13, 7)=-1.D0*A(13, 8)-1.D0*A(13, 7)*(1.D0-A(13, 1))
      A(13, 8)=-1.D0*A(13, 9)-1.D0*A(13, 8)*(1.D0-A(13, 1))
      A(13, 9)=-1.D0*A(13,10)-1.D0*A(13, 9)*(1.D0-A(13, 1))
      A(13,10)=-1.D0*A(13,11)-1.D0*A(13,10)*(1.D0-A(13, 1))
      A(13,11)=-1.D0*A(13,12)-1.D0*A(13,11)*(1.D0-A(13, 1))
      A(13,12)=-1.D0*A(13,13)-1.D0*A(13,12)*(1.D0-A(13, 1))
      A(13,13)=-1.D0*(1.D0-A(13, 1))*A(13,13)
      A(13,14)=-1.D0*(1.D0-A(13, 1))*A(13,14)
      A(13,15)=-1.D0*(1.D0-A(13, 1))*A(13,15)
      A(14, 1)=-1.D0*A(14, 2)-1.D0*(1.D0-A(14, 1))*A( 1,14)
      A(14, 2)=-1.D0*A(14, 3)-1.D0*A(14, 2)*(1.D0-A(14, 1))
      A(14, 3)=-1.D0*A(14, 4)-1.D0*A(14, 3)*(1.D0-A(14, 1))
      A(14, 4)=-1.D0*A(14, 5)-1.D0*A(14, 4)*(1.D0-A(14, 1))
      A(14, 5)=-1.D0*A(14, 6)-1.D0*A(14, 5)*(1.D0-A(14, 1))
      A(14, 6)=-1.D0*A(14, 7)-1.D0*A(14, 6)*(1.D0-A(14, 1))
      A(14, 7)=-1.D0*A(14, 8)-1.D0*A(14, 7)*(1.D0-A(14, 1))
      A(14, 8)=-1.D0*A(14, 9)-1.D0*A(14, 8)*(1.D0-A(14, 1))
      A(14, 9)=-1.D0*A(14,10)-1.D0*A(14, 9)*(1.D0-A(14, 1))
      A(14,10)=-1.D0*A(14,11)-1.D0*A(14,10)*(1.D0-A(14, 1))
      A(14,11)=-1.D0*A(14,12)-1.D0*A(14,11)*(1.D0-A(14, 1))
      A(14,12)=-1.D0*A(14,13)-1.D0*A(14,12)*(1.D0-A(14, 1))
      A(14,13)=-1.D0*A(14,14)-1.D0*A(14,13)*(1.D0-A(14, 1))
      A(14,14)=-1.D0*(1.D0-A(14, 1))*A(14,14)
      A(14,15)=-1.D0*(1.D0-A(14, 1))*A(14,15)
      A(15, 1)=-1.D0*A(15, 2)-1.D0*(1.D0-A(15, 1))*A( 1,15)
      A(15, 2)=-1.D0*A(15, 3)-1.D0*A(15, 2)*(1.D0-A(15, 1))
      A(15, 3)=-1.D0*A(15, 4)-1.D0*A(15, 3)*(1.D0-A(15, 1))
      A(15, 4)=-1.D0*A(15, 5)-1.D0*A(15, 4)*(1.D0-A(15, 1))
      A(15, 5)=-1.D0*A(15, 6)-1.D0*A(15, 5)*(1.D0-A(15, 1))
      A(15, 6)=-1.D0*A(15, 7)-1.D0*A(15, 6)*(1.D0-A(15, 1))
      A(15, 7)=-1.D0*A(15, 8)-1.D0*A(15, 7)*(1.D0-A(15, 1))
      A(15, 8)=-1.D0*A(15, 9)-1.D0*A(15, 8)*(1.D0-A(15, 1))
      A(15, 9)=-1.D0*A(15,10)-1.D0*A(15, 9)*(1.D0-A(15, 1))
      A(15,10)=-1.D0*A(15,11)-1.D0*A(15,10)*(1.D0-A(15, 1))
      A(15,11)=-1.D0*A(15,12)-1.D0*A(15,11)*(1.D0-A(15, 1))
      A(15,12)=-1.D0*A(15,13)-1.D0*A(15,12)*(1.D0-A(15, 1))
      A(15,13)=-1.D0*A(15,14)-1.D0*A(15,13)*(1.D0-A(15, 1))
      A(15,14)=-1.D0*A(15,15)-1.D0*A(15,14)*(1.D0-A(15, 1))
      CALL DGEMM(A,A,3)
      END
C
C
      SUBROUTINE BLOCK2
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON/BLK1/A(15,15)
      A( 1, 1)=-1.D0*A( 2, 2)-3.D0*(2.D0*C1-4.D0)*(2.D0*C1-4.D0)*(1.D0-A(1,1))
     1*(2.D0*C2-4.D0)*(2.D0*C2-4.D0)
      A( 1, 2)=-1.D0*A( 2, 3)-3.D0*((2.D0*C1-4.D0)*(-24.D0*C1+12.D0*C2+12.D0)+(-8.D0*C1*4.D0*C2+8.D0)
     1*(2.D0*C2-8.D0))*(1.D0-A(1,1))*((2.D0*C1-4.D0)*(-4.D0*C1-4.D0*C2+2.D0*C2+8.D0)+
     2(-8.D0*C1-8.D0*C2+4.D0)*(2.D0*C2-4.D0)))
      A( 1, 3)=-1.D0*A( 2, 4)-3.D0*((2.D0*C1-4.D0)*(-4.D0*C1-4.D0*C1*2.D0*C1+8.D0)*(-4.D0*C1-8.D0
```









```
      BV(7)=-(2.*(2.*F2*(2.*C2-4.)+2.*F2*(2.*C2-4.))+R2*(1.-ANU)
     1*(2.*F1*(2.*C2-4.)+(2.*C1-4.)*2.*F2))
      BV(8)=-(2.*((2.*C2-4.)*(-24.*F2+12.*F4)+(-8.*C2+4.*C4+4.)*2.*F2
     1+2.*F2*(-24.*C2+12.*C4+12.)+(-8.*F2+4.*F4)*(2.*C2-4.))+R2*(1.
     2-ANU)*((2.*C2-4.)*(-4.*F1-4.*F2+2.*F5)+2.*F1*(-8.*C2+4.*C4+4.)
     3+(2.*C1-4.)*(-8.*F2+4.*F4)+(-4.*C1-4.*C2+2.*C5+8.)*2.*F2))
      BV(9)=-(2.*((2.*C2-4.)*(-4.*F1-4.*F2+2.*F5)+(-4.*C1-4.*C2+2.*C5
     1+8.)*2.*F2+2.*F2*(-4.*C1-4.*C2+2.*C5+8.)+(-4.*F1-4.*F2+2.*F5)
     2*(2.*C2-4.))+R2*(1.+ANU)*((-8.*C1-8.*C2+4.*C5+16.)*2.*F1+(2.*C1
     3-4.)*(-8.*F1-8.*F2+4.*F5))+R2*(1.-ANU)*((2.*C2-4.)*(-24.*F1
     4+12.*F3)+(-4.*C1-4.*C2+2.*C5+8.)*2.*F1))
      BV(9)=BV(9)-(+R2*(1.-ANU)*(+2.*F2*(-24.*C1+12.*C3+12.)+(-4.*F1
     1-4.*F2+2.*F5)*(2.*C1-4.)))
      CALL LINK(KJEAR7)
*LDISKKJEAR7
      BV(10)=-(2.*((2.*C2-4.)*(30.*F2-60.*F4)+(-8.*C2+4.*C4+4.)*(-24.
     1*F2+12.*F4)+(6.*C2-12.*C4)*2.*F2+2.*F2*(30.*C2-60.*C4)+(-8.*F2
     2+4.*F4)*(-24.*C2+12.*C4+12.)+(6.*F2-12.*F4)*(2.*C2-4.))+R2*(1.
     3-ANU)*((2.*C2-4.)*(2.*F1+8.*F2-4.*F4-4.*F5)+(-8.*C2+4.*C4+4.)
     4*(-4.*F1-4.*F2+2.*F5)+(6.*C2-12.*C4)*2.*F1))
      BV(10)=BV(10)-(+R2*(1.-ANU)*(+2.*F2*(2.*C1+8.*C2-4.*C4-4.*C5
     1-4.)+(-8.*F2+4.*F4)*(-4.*C1-4.*C2+2.*C5+8.)+(6.*F2-12.*F4)
     2*(2.*C1-4.)))
      BV(11)=-(2.*((2.*C2-4.)*(8.*F1+2.*F2-4.*F3-4.*F5)+(-4.*C1-4.*C2
     1+2.*C5+8.)*(-4.*F1-4.*F2+2.*F5)+(8.*C1+2.*C2-4.*C3-4.*C5-4.)
     2*2.*F2+2.*F2*(8.*C1+2.*C2-4.*C3-4.*C5-4.)+(-4.*F1-4.*F2+2.*F5)*
     3(-4.*C1-4.*C2+2.*C5+8.)+(8.*F1+2.*F2-4.*F3-4.*F5)*(2.*C2-4.))
     4+R2*(1.+ANU)*((32.*C1+8.*C2-16.*C3-16.*C5-16.)*2.*F1))
      BV(11)=BV(11)-(+R2*(1.+ANU)*(+(-8.*F1+4.*F3)*(-8.*C1-8.*C2+4.*C5
     1+16.)+(2.*C1-4.)*(32.*F1+8.*F2-16.*F3-16.*F5)+(-8.*C1+4.*C3+4.)
     2*(-8.*F1-8.*F2+4.*F5))+R2*(1.-ANU)*((2.*C2-4.)*(30.*F1-60.*F3)+
     3(-4.*C1-4.*C2+2.*C5+8.)*(-24.*F1+12.*F3)+2.*F1*(8.*C1+2.*C2-4.*C3
     4-4.*C5-4.)+2.*F2*(30.*C1-60.*C3)))
      BV(11)=BV(11)-(+R2*(1.-ANU)*(+(-4.*F1-4.*F2+2.*F5)*(-24.*C1
     1+12.*C3+12.)+(8.*F1+2.*F2-4.*F3-4.*F5)*(2.*C1-4.)))
      BV(12)=-(2.*((2.*C2-4.)*(12.*F1+48.*F2-24.*F4-24.*F5)+(-8.*C2+
     14.*C4+4.)*(-4.*F1-4.*F2+2.*F5)+(-4.*C1-4.*C2+2.*C5+8.)*(-24.*F2
     2+12.*F4)+(4.*C1+16.*C2-8.*C4-8.*C5-8.)*2.*F2+2.*F2*(12.*C1+48.*C2
     3-24.*C4-24.*C5-24.)+(-8.*F2+4.*F4)*(-4.*C1-4.*C2+2.*C5+8.)+(-4.*
     4F1-4.*F2+2.*F5)*(-24.*C2+12.*C4+12.)))
      BV(12)=BV(12)-(2.*(+(4.*F1+16.*F2-8.*F4-8.*F5)*(2.*C2-4.))+R2*
     1(1.+ANU)*(2.*F1*(8.*C1+32.*C2-16.*C4-16.*C5-16.)+(-4.*F1-4.*F2
     2+2.*F5)*(-8.*C1-8.*C2+4.*C5+16.)+(2.*C1-4.)*(8.*F1+32.*F2-16.*F4
     3-16.*F5)+(-4.*C1-4.*C2+2.*C5+8.)*(-8.*F1-8.*F2+4.*F5))+R2*(1.-
     4ANU)*((2.*C2-4.)*(48.*F1+12.*F2-24.*F3-24.*F5)))
      BV(12)=BV(12)-(+R2*(1.-ANU)*(+(-8.*C2+4.*C4+4.)*(-24.*F1+12.*F3)
     1+(-4.*C1-4.*C2+2.*C5+8.)*(-4.*F1-4.*F2+2.*F5)+(4.*C1+16.*C2-8.*C4
     2-8.*C5-8.)*2.*F1+2.*F2*(48.*C1+12.*C2-24.*C3-24.*C5-24.)+(-8.*F2
     3+4.*F4)*(-24.*C1+12.*C3+12.)+(-4.*F1-4.*F2+2.*F5)*(-4.*C1-4.*C2
     4+2.*C5+8.)+(4.*F1+16.*F2-8.*F4-8.*F5)*(2.*C1-4.)))
      DO 15 M=1,12
      DO 15 N=1,12
   15 SM(M,N)=BM(M,N)
      EQUIVALENCE(SM,A)
```

```
      N=12
      PUNCH 36,((A(I,J),J=1,N),I=1,N)
      PUNCH 36,(BV(J),J=1,N)
   36 FORMAT(/(6X,4E16.8))
      CALL AINV77(A,N)
      DO 13 I=1,N
      ANS(I)=0.
      DO 13 J=1,N
   13 ANS(I)=ANS(I)+A(I,J)*BV(J)
      G1=ANS(1)
      G2=ANS(2)
      G3=ANS(3)
      G4=ANS(4)
      G5=ANS(5)
      G6=ANS(6)
      H1=ANS(7)
      H2=ANS(8)
      H3=ANS(9)
      H4=ANS(10)
      H5=ANS(11)
      H6=ANS(12)
      PUNCH 38,G1,G2,G3,G4,G5,G6,H1,H2,H3,H4,H5,H6
      DO 14 I=1,12
      BV(I)=0.
      DO 14 J=1,12
   14 BV(I)=BV(I)+BM(I,J)*ANS(J)
      PUNCH 36,(BV(I),I=1,12)
   38 FORMAT(4H G1=E16.8,4H G2=E16.8,4H G3=E16.8/4H G4=E16.8,4H G5=E16.8
     1,4H G6=E16.8/4H H1=E16.8,4H H2=E16.8,4H H3=E16.8/4H H4=E16.8,
     24H H5=E16.8,4H H6=E16.8)
      CALL LINK(KJEAR8)
      END
**FOR 5
*LDISKKJEAR8
      U(1)=R2*R2*((2.*C1-4.)*G1+2.*F1*D1)+ANU*(R2*R*((2.*C1-4.)*H1
     1+2.*F1*E1))+R*(H1*(2.*C2-4.)+2.*F2*E1)+ANU*(R2*(G1*(2.*C2-4.)
     2+2.*F2*D1))
      U(1)=U(1)*12.
      U(2)=R2*R2*((2.*C1-4.)*(-3.*G1+3.*G2)+(-24.*C1+12.*C3+12.)*G1
     1+2.*F1*(-3.*D1+3.*D2)+D1*(-24.*F1+12.*F3))+0.5*(R2*R2*(2.*(2.*C1
     2-4.)*2.*F1*(2.*C1-4.)+2.*F1*(2.*C1-4.)*(2.*C1-4.)))+ANU*(R2*R*((
     32.*C1-4.)*(-H1+H3)+H1*(-24.*C1+12.*C3+12.)+2.*F1*(-E1+E3)+E1*
     4(-24.*F1+12.*F3)))
      U(2)=U(2)+R*((2.*C2-4.)*(-H1+H3)+(-4.*C1-4.*C2+2.*C5+8.)*H1
     1+2.*F2*(-E1+E3)+(-4.*F1-4.*F2+2.*F5)*E1)+ANU*(R2*(G1*(-4.*C1
     2-4.*C2+2.*C5+8.)+(2.*C2-4.)*(-3.*G1+3.*G2)+2.*F2*(-3.*D1+3.*D2)
     3+(-4.*F1-4.*F2+2.*F5)*D1)+0.5*(R2*(2.*(2.*C2-4.)*2.*F1*(2.*C1
     4-4.)+2.*F2*(2.*C1-4.)*(2.*C1-4.))))
      U(2)=U(2)*12.
      U(3)=R2*R2*((2.*C1-4.)*(-G1+G3)+(-4.*C1-4.*C2+2.*C5+8.)*G1
     1+2.*F1*(-D1+D3)+D1*(-4.*F1-4.*F2+2.*F5))+ANU*(R2*R*((2.*C1-4.)
     2*(-3.*H1+3.*H2)+(-4.*C1-4.*C2+2.*C5+8.)*H1+2.*F1*(-3.*E1+3.*E2)
     3+(-4.*F1-4.*F2+2.*F5)*E1)+0.5*(R2*(2.*(2.*C1-4.)*(2.*C2-4.)*2.*F2
     4+2.*F1*(2.*C2-4.)*(2.*C2-4.))))
```

```
      U(5)=U(3)+R*((2.*C2-4.)*(-3.*H1+3.*H2)+(-24.*C2+12.*C4+12.)*(-3.
     1+2.*F2*(-3.*E1+3.*E2)+(-24.*F2+12.*F4)*F1)+0.5*(2.*(2.*C2-4.)*(2.
     2*F2*(2.*C2-4.)+2.*F2*(2.*C2-4.)*(2.*C2-4.))+ANU*(R2*((2.*C2-4.)
     3*(-G1+G3)+(-24.*C2+12.*C4+12.)*G1+2.*F2*(-D1+D3)+(-24.*F2+12.*F4)
     4*D1))
      U(5)=U(5)*12.
      U(4)=R2*R2*((2.*C1-4.)*(-5.*G2+5.*G4)+(-24.*C1+12.*C3+12.)*(-5.
     1*G1+5.*G2)+(30.*C1-60.*C3)*G1+2.*F1*(-5.*D2+5.*D4)+(-24.*F1
     2+12.*F3)*(-3.*D1+3.*D2)+(30.*F1-60.*F3)*D1)+0.5*(R2*R2*(2.*(2.*
     3C1-4.)*((2.*C1-4.)*(-8.*F1+4.*F3)+(-8.*C1+4.*C3+4.)*2.*F1)+(
     4-24.*C1+12.*C3+12.)*(2.*C1-4.)*2.*F1))
      U(4)=U(4)+0.5*(R2*R2*(+2.*F1*2.*(2.*C1-4.)*(-8.*C1+4.*C3+4.)
     1+(-24.*F1+12.*F3)*(2.*C1-4.)*(2.*C1-4.)))+ANU*(R2*R*((2.*C1-4.)
     2*(-H5+H5)+(-24.*C1+12.*C3+12.)*(-H1+H2)+(30.*C1-60.*C3)*H1
     3+2.*F1*(-E5+E5)+(-24.*F1+12.*F3)*(-E1+E3)+(30.*F1-60.*F3)*E1))
      U(4)=U(4)+R*((2.*C2-4.)*(-H3+H5)+(-4.*G1-4.*C2+2.*C5+8.)*(-H1+H5)
     1+(8.*C1+2.*C2-4.*C3-4.*C5-4.)*H1+2.*F2*(-E3+E5)+(-4.*F1-4.*F2
     2+2.*F5)*(-E1+E3)+(8.*F1+2.*F2-4.*F3-4.*F5)*E1)+ANU*(R2*((2.*C2-4.)
     3*(-5.*G2+5.*G4)+(-4.*C1-4.*C2+2.*C5+8.)*(-3.*G1+3.*G2)+(8.*C1
     4+2.*C2-4.*C3-4.*C5-4.)*G1+2.*F2*(-5.*D2+5.*D4)))
      U(4)=U(4)+ANU*(R2*(+(-4.*F1-4.*F2+2.*F5)*(-3.*D1+3.*D2)+(8.*F1
     1+2.*F2-4.*F3-4.*F5)*D1)+0.5*(R2*(2.*(2.*C2-4.)*((2.*C1-4.)*(-8.*
     2F1+4.*F3)+(-8.*C1+4.*C3+4.)*2.*F1)+(-4.*C1-4.*C2+2.*C5+8.)
     3*2.*F1*(2.*C1-4.)+2.*F2*2.*(2.*C1-4.)*(-8.*C1+4.*C3+4.)+(-4.*F1
     4-4.*F2+2.*F5)*(2.*C1-4.)*(2.*C1-4.))))
      U(4)=U(4)*12.
      U(5)=R2*R2*((2.*C1-4.)*(-G3+G5)+(-4.*C1-4.*C2+2.*C5+8.)*(-G1
     1+G3)+(2.*C1+8.*C2-4.*C4-4.*C5-4.)*G1+2.*F1*(-D3+D5)+(-4.*F1-4.*F2
     2+2.*F5)*(-D1+D3)+(2.*F1+8.*F2-4.*F4-4.*F5)*D1)+ANU*(R2*R*((2.*C1
     3-4.)*(-5.*H2+5.*H4)+(-4.*C1-4.*C2+2.*C5+8.)*(-3.*H1+3.*H2)+(2.*C1
     4+8.*C2-4.*C4-4.*C5-4.)*H1+2.*F1*(-5.*E2+5.*E4)))
      U(5)=U(5)+ANU*(R2*R*(+(-4.*F1-4.*F2+2.*F5)*(-3.*E1+3.*E2)+(2.*F1
     1+8.*F2-4.*F4-4.*F5)*E1)+0.5*(R2*(2.*(2.*C1-4.)*(2.*F2*(-8.*C2
     2+4.*C4+4.)+(2.*C2-4.)*(-8.*F2+4.*F4))+(-4.*C1-4.*C2+2.*C5+8.)
     3*2.*F2*(2.*C2-4.)+2.*F1*2.*(2.*C2-4.)*(-8.*C2+4.*C4+4.)+(-4.*F1
     4-4.*F2+2.*F5)*(2.*C2-4.)*(2.*C2-4.))))
      CALL LINK(KJEAR9)
      END
****
*LDISKKJEAR9
      U(5)=U(5)+R*((2.*C2-4.)*(-5.*H2+5.*H4)+(-24.*C2+12.*C4+12.)*
     1(-3.*H1+3.*H2)+(30.*C2-60.*C4)*H1+2.*F2*(-5.*E2+5.*E4)+(-24.*F2
     2+12.*F4)*(-3.*E1+3.*E2)+(30.*F2-60.*F4)*E1)+0.5*(2.*(2.*C2-4.)*
     3(2.*F2*(-8.*C2+4.*C4+4.)+(2.*C2-4.)*(-8.*F2+4.*F4))+(-24.*C2
     4+12.*C4+12.)*(2.*C2-4.)*2.*F2)
      U(5)=U(5)+0.5*(+2.*F2*(2.*C2-4.)*(-8.*C2+4.*C4+4.)*2.+(-24.*F2
     1+12.*F4)*(2.*C2-4.)*(2.*C2-4.))+ANU*(R2*((2.*C2-4.)*(-G3+G5)
     2+(-24.*C2+12.*C4+12.)*(-G1+G3)+(30.*C2-60.*C4)*G1+2.*F2*(-D3
     3+D5)+(-24.*F2+12.*F4)*(-D1+D3)+(30.*F2-60.*F4)*D1))
      U(5)=U(5)*12.
      U(6)=R2*R2*((2.*C1-4.)*(3.*G1-3.*G2-3.*G3+3.*G6)+(-24.*C1+12.*C3
     1+12.)*(-G1+G3)+(-4.*C1-4.*C2+2.*C5+8.)*(-3.*G1+3.*G2)+(48.*C1
     2+12.*C2-24.*C3-24.*C5-24.)*G1+2.*F1*(3.*D1-3.*D2-3.*D3+3.*D6)+
     3(-24.*F1+12.*F3)*(-D1+D3)+(-4.*F1-4.*F2+2.*F5)*(-3.*D1-3.*D2)+
```

```
     4(48.*F1+12.*F2-24.*F3-24.*F5)*D1)
      U(6)=U(6)+0.5*(R2*R2*(2.*(2.*C1-4.)*((2.*C1-4.)*(-4.*F1-4.*F2
     1+2.*F5)+2.*F1*(-4.*C1-4.*C2+2.*C5+8.))*(-4.*C1-4.*C2+2.*C5+8.)
     2*(2.*C1-4.)*2.*F1+2.*F1*2.*(2.*C1-4.)*(-4.*C1-4.*C2+2.*C5+8.)+
     3(-4.*F1-4.*F2+2.*F5)*(2.*C1-4.)*(2.*C1-4.)))*ANU*(R2*R*((2.*C1-4.)
     4*(3.*H1-3.*H2-3.*H3+3.*H6)+(-24.*C1+12.*C5+12.)*(-3.*H1+3.*H2)))
      U(6)=U(6)+ANU*(R2*R*(+(-4.*C1-4.*C2+2.*C5+8.)*(-H1+H3)+(48.*C1+
     112.*C2-24.*C3-24.*C5-24.)*H1*2.*F1*(3.*F1-3.*F2-3.*F5+3.*F6)*
     2(-24.*F1+12.*F3)*(-3.*F1+3.*E2)+(-4.*F1-4.*F2+2.*F5)*(-E1+E3)+
     3(48.*F1+12.*F2-24.*F3-24.*F5)*E1)+0.5*(R2*(2.*(2.*C1-4.)*(2.*F2*
     4(-4.*C1-4.*C2+2.*C5+8.)+(2.*C2-4.)*(-4.*F1-4.*F2+2.*F5))))
      U(6)=U(6)+ANU*(+0.5*(R2*(+(-24.*C1+12.*C3+12.)*2.*F2*(2.*C2-4.)
     1+2.*F1*2.*(2.*C2-4.)*(-4.*C1-4.*C2+2.*C5+8.)+(-24.*F1+12.*F5)*
     2(2.*C2-4.)*(2.*C2-4.)))+R*((2.*C2-4.)*(3.*H1-3.*H2-3.*H5+3.*H6)
     3*(-4.*C1-4.*C2+2.*C5+8.)*(-3.*H1+3.*H2)+(-24.*C2+12.*C4+12.)*
     4(-H1+H3)+(12.*C1+48.*C2-24.*C4-24.*C5-24.)*H1)
      U(6)=U(6)+R*(+2.*F2*(3.*E1-3.*E2-3.*E3+3.*E6)+(-4.*F1-4.*F2+2.*F5)
     1*(-3.*E1+3.*E2)+(-24.*F2+12.*F4)*(-E1+E3)+(12.*F1+48.*F2-24.*F4
     2-24.*F5)*E1)+0.5*(2.*(2.*C2-4.)*(2.*F2*(-4.*C1-4.*C2+2.*C5+8.)
     3*(2.*C2-4.)*(-4.*F1-4.*F2+2.*F5))+(-4.*C1-4.*C2+2.*C5+8.)*2.*F2*
     4(2.*C2-4.)+2.*F2*2.*(2.*C2-4.)*(-4.*C1-4.*C2+2.*C5+8.))
      U(6)=U(6)+0.5*(+(-4.*F1-4.*F2+2.*F5)*(2.*C2-4.)*(2.*C2-4.))
     1+ANU*(R2*((2.*C2-4.)*(3.*G1-3.*G2-3.*G3+3.*G6)+(-4.*C1-4.*C2+2.*
     2C5+8.)*(-G1+G3)+(-24.*C2+12.*C4+12.)*(-3.*G1+3.*G2)+(12.*C1+48.*
     3C2-24.*C4-24.*C5-24.)*G1+2.*F2*(3.*D1-3.*D2-3.*D3+3.*D6)+(-4.*F1
     4-4.*F2+2.*F5)*(-D1+D3)+(-24.*F2+12.*F4)*(-3.*D1+3.*D2)))
   9  U(6)=U(6)+ANU*(R2*( (12.*F1+48.*F2-24.*F4-24.*F5)*D1)
     1+0.5*(R2*(2.*(2.*C2-4.)*((2.*C1-4.)*(-4.*F1-4.*F2+2.*F5)+2.*F1*(
     2-4.*C1-4.*C2+2.*C5+8.))+(-24.*C2+12.*C4+12.)*2.*F1*(2.*C1-4.)
     3+2.*F2*2.*(2.*C1-4.)*(-4.*C1-4.*C2+2.*C5+8.)+(-24.*F2+12.*F4)
     4*(2.*C1-4.)*(2.*C1-4.))))
      U(6)=U(6)+(1.-ANU)*(R2*((-8.*C1-8.*C2+4.*C5+16.)*(-2.*G1+2.*G3)
     1+(-8.*F1-8.*F2+4.*F5)*(-2.*D1+2.*D3))+R2*R*((-8.*C1-8.*C2+4.*C5+
     216.)*(-2.*H1+2.*H3)+(-8.*F1-8.*F2+4.*F5)*(-2.*E1+2.*E3))+R2*((-8.
     3*C1-8.*C2+4.*C5+16.)*(2.*F1)*(2.*C2-4.)+(-8.*C1-8.*C2+4.*C5+16.)
     4*(2.*C1-4.)*(2.*F2)+(-8.*F1-8.*F2+4.*F5)*(2.*C1-4.)*(2.*C2-4.)))
      U(6)=U(6)*12.
      DO 15 I=1,6
      DO 15 J=1,6
   15 SM(I,J)=DM(I,J)
      EQUIVALENCE(SM,A)
      N=6
      PUNCH 36,((A(I,J),J=1,N),I=1,N)
      PUNCH 36,(U(J),J=1,N)
   36 FORMAT(/(6X,4E16.8))
      CALL MINV77(A,N)
      DO 13 I=1,N
      ANS(I)=0.
      DO 13 J=1,N
   13 ANS(I)=ANS(I)+A(I,J)*U(J)
      Y1=ANS(1)
      Y2=ANS(2)
      Y3=ANS(3)
      Y4=ANS(4)
```

```
      Y5=ANS(5)
      ALPH5=ANS(6)
      PUNCH 444,Y1,Y2,Y3,Y4,Y5,ALPH5
      DO 14 I=1,6
      U(I)=0.
      DO 14 J=1,6
   14 U(I)=U(I)+OM(I,J)*ANS(J)
      PUNCH 36,(U(I),I=1,6)
  444 FORMAT(4H Y1=E16.8,4H Y2=E16.8,4H Y3=E16.8/4H Y4=E16.8,
     14H Y5=E16.8,7H ALPH5=E16.8)
      CALL LINK(KJEA10)
3400032007013600032007024902402511963611300102000
**JOB 5
**FOR 5
*FANOK1510
*LDISKKJEA10
      DIMENSION P(50)
      COMMON R,AK,R2,R4,C1,C2,C3,C4,C5,D1,D2,D3,D4,D5,D6,E1,E2,E3,E4,E5,
     1E6,F1,F2,F3,F4,F5,G1,G2,G3,G4,G5,G6,H1,H2,H3,H4,H5,H6,Y1,Y2,Y3,
     2Y4,Y5,ANU,P
      AXI=0.
      ETA=1.
   77 P(1)=(2.*AXI-8.*(AXI**3)-4.*AXI*(ETA**2)+16.*(AXI**3)*(ETA**2)
     1-12.*(AXI**5)*(ETA**2)+2.*AXI*(ETA**4)-8.*(AXI**3)*(ETA**4)
     2+6.*(AXI**5)*(ETA**4)+6.*(AXI**5))
      P(2)=(-4.*AXI*(ETA**2)+4.*(AXI**3)*(ETA**2)+8.*AXI*(ETA**4)
     1-8.*(AXI**3)*(ETA**4)-4.*AXI*(ETA**6)+4.*(AXI**3)*(ETA**6))
      P(3)=(4.*(AXI**3)-12.*(AXI**5)+8.*(AXI**7)-8.*(AXI**3)*(ETA**2)
     1+24.*(AXI**5)*(ETA**2)-16.*(AXI**7)*(ETA**2)+4.*(AXI**5)*(ETA
     2**4)-12.*(AXI**5)*(ETA**4)+8.*(AXI**7)*(ETA**4))
      P(4)=(-4.*AXI*(ETA**4)+4.*(AXI**3)*(ETA**4)+8.*AXI*(ETA**6)
     1-8.*(AXI**3)*(ETA**6)-4.*AXI*(ETA**8)+4.*(AXI**3)*(ETA**8))
      P(5)=(2.*AXI*(ETA**2)-8.*(AXI**3)*(ETA**2)+6.*(AXI**5)*(ETA**2)
     1-4.*AXI*(ETA**4)+16.*(AXI**3)*(ETA**4)-12.*(AXI**5)*(ETA**4)
     2+2.*AXI*(ETA**6)-8.*(AXI**3)*(ETA**6)+6.*(AXI**5)*(ETA**6))
      P(6)=(-4.*AXI+4.*(AXI**3)+8.*AXI*(ETA**2)-8.*(AXI**3)*(ETA**2)-4.
     1*AXI*(ETA**4)+4.*(AXI**3)*(ETA**4))
      P(7)=(2.-24.*(AXI**2)+30.*(AXI**4)-4.*(ETA**2)+48.*(AXI**2)
     1*(ETA**2)-80.*(AXI**4)*(ETA**2)+2.*(ETA**4)-24.*(AXI**2)*(ETA**4)
     2+30.*(AXI**4)*(ETA**4))
      P(8)=(-4.*(ETA**2)+12.*(AXI**2)*(ETA**2)+8.*(ETA**4)-24.*(AXI**2)
     1*(ETA**4)-4.*(ETA**6)+12.*(AXI**2)*(ETA**6))
      P(9)=(12.*(AXI**2)-60.*(AXI**4)+56.*(AXI**6)-24.*(AXI**2)*(ETA**2)
     1+120.*(AXI**4)*(ETA**2)-112.*(AXI**6)*(ETA**2)+12.*(AXI**2)
     2*(ETA**4)-60.*(AXI**4)*(ETA**4)+56.*(AXI**6)*(ETA**4))
      P(10)=(-4.*(ETA**4)+12.*(AXI**2)*(ETA**4)+8.*(ETA**6)-24.*(
     1AXI**2)*(ETA**6)-4.*(ETA**8)+12.*(AXI**2)*(ETA**8))
      P(11)=(2.*(ETA**2)-24.*(AXI**2)*(ETA**2)+30.*(AXI**4)*(ETA**2)
     1-4.*(ETA**4)+48.*(AXI**2)*(ETA**4)-60.*(AXI**4)*(ETA**4)+2.*(ETA
     2**6)-24.*(AXI**2)*(ETA**6)+30.*(AXI**4)*(ETA**6))
      P(12)=(-4.+12.*(AXI**2)+8.*(ETA**2)-24.*(AXI**2)*(ETA**2)-4.*
     1(ETA**4)+12.*(AXI**2)*(ETA**4))
      P(13)=(-4.*(AXI**2)*ETA+8.*(AXI**4)*ETA-4.*(AXI**6)*ETA+4.
     1*(AXI**2)*(ETA**3)-8.*(AXI**4)*(ETA**3)+4.*(AXI**6)*(ETA**3))
```

```
 P(14)=(4.*ETA-4.*(AXI**2)*ETA+2.*(AXI**4)*ETA-6.*(ETA**3)+16.*
1(AXI**2)*(ETA**3)-8.*(AXI**4)*(ETA**3)+4.*(ETA**3)-12.*(AXI**2)
2*(ETA**5)+6.*(AXI**4)*(ETA**5))
 P(15)=(-4.*(AXI**4)*ETA+6.*(AXI**6)*ETA-4.*(AXI**8)*ETA+4.*
1(AXI**4)*(ETA**3)-8.*(AXI**6)*(ETA**3)+4.*(AXI**8)*(ETA**3))
 P(16)=(4.*(ETA**3)-8.*(AXI**2)*(ETA**3)+4.*(AXI**4)*(ETA**3)
1-12.*(ETA**5)+24.*(AXI**2)*(ETA**5)-12.*(AXI**4)*(ETA**5)+4.*
2(ETA**7)-16.*(AXI**2)*(ETA**7)+8.*(AXI**4)*(ETA**7))
 P(17)=(2.*(AXI**2)*ETA-4.*(AXI**4)*ETA+2.*(AXI**6)*ETA-4.*
1(AXI**2)*(ETA**3)+16.*(AXI**4)*(ETA**3)-8.*(AXI**6)*(ETA**3)
2+6.*(AXI**2)*(ETA**5)-12.*(AXI**4)*(ETA**5)+6.*(AXI**6)*(ETA**5))
 P(18)=(-4.*ETA+8.*(AXI**2)*ETA-4.*(AXI**4)*ETA+4.*(ETA**3)-8.*
1(AXI**2)*(ETA**3)+4.*(AXI**4)*(ETA**3))
 P(19)=(-4.*(AXI**2)+8.*(AXI**4)-4.*(AXI**6)+12.*(AXI**2)*(ETA**2)
1-24.*(AXI**4)*(ETA**2)+12.*(AXI**6)*(ETA**2))
 P(20)=(2.-4.*(AXI**2)+2.*(AXI**4)-24.*(ETA**2)+48.*(AXI**2)*
1(ETA**2)-24.*(AXI**4)*(ETA**2)+30.*(ETA**4)-60.*(AXI**2)*
2(ETA**4)+30.*(AXI**4)*(ETA**4))
 P(21)=(-4.*(AXI**4)+8.*(AXI**6)-4.*(AXI**8)+12.*(AXI**4)*(ETA**2)
1-24.*(AXI**6)*(ETA**2)+12.*(AXI**8)*(ETA**2))
 P(22)=(12.*(ETA**2)-24.*(AXI**2)*(ETA**2)+12.*(AXI**4)*(ETA**2)
1-60.*(ETA**4)+120.*(AXI**2)*(ETA**4)-60.*(AXI**4)*(ETA**4)+56.*
2(ETA**6)-112.*(AXI**2)*(ETA**6)+56.*(AXI**4)*(ETA**6))
 P(23)=(2.*(AXI**2)-4.*(AXI**4)+2.*(AXI**6)-24.*(AXI**2)*(ETA**2)
1+48.*(AXI**4)*(ETA**2)-24.*(AXI**6)*(ETA**2)+30.*(AXI**2)*
2(ETA**4)-60.*(AXI**4)*(ETA**4)+30.*(AXI**6)*(ETA**4))
 P(24)=(-4.+8.*(AXI**2)-4.*(AXI**4)+12.*(ETA**2)-24.*(AXI**2)
1*(ETA**2)+12.*(AXI**4)*(ETA**2))
 P(25)=(1.-3.*(AXI**2)-(ETA**2)+3.*(AXI**2)*(ETA**2))
 P(26)=(3.*(AXI**2)-5.*(AXI**4)-3.*(AXI**2)*(ETA**2)+5.*(AXI**4)
1*(ETA**2))
 P(27)=((ETA**2)-3.*(AXI**2)*(ETA**2)-(ETA**4)+3.*(AXI**2)*(ETA
1**4))
 P(28)=(5.*(AXI**4)-7.*(AXI**6)-5.*(AXI**4)*(ETA**2)+7.*(AXI**6)
1*(ETA**2))
 P(29)=((ETA**4)-3.*(AXI**2)*(ETA**4)-(ETA**6)+3.*(AXI**2)*
1(ETA**6))
 P(30)=(3.*(AXI**2)*(ETA**2)-5.*(AXI**4)*(ETA**2)-3.*(AXI**2)
1*(ETA**4)+5.*(AXI**4)*(ETA**4))
 P(31)=(-2.*AXI*ETA+2.*(AXI**3)*ETA)
 P(32)=(-2.*(AXI**3)*ETA+2.*(AXI**5)*ETA)
 P(33)=(2.*AXI*ETA-2.*(AXI**3)*ETA-4.*AXI*(ETA**3)+4.*(AXI**3)
1*(ETA**3))
 P(34)=(-2.*(AXI**5)*ETA+2.*(AXI**7)*ETA)
 P(35)=(4.*AXI*(ETA**3)-4.*(AXI**3)*(ETA**3)-6.*AXI*(ETA**5)
1+6.*(AXI**3)*(ETA**5))
 P(36)=(2.*(AXI**3)*ETA-2.*(AXI**5)*ETA-4.*(AXI**3)*(ETA**3)+4.*
1(AXI**5)*(ETA**3))
 P(37)=(-2.*ETA*AXI+2.*AXI*(ETA**3))
 P(38)=(-2.*AXI*(ETA**3)+2.*AXI*(ETA**5))
 P(39)=(2.*AXI*ETA-4.*(AXI**3)*ETA-2.*AXI*(ETA**3)+4.*(AXI**3)
1*(ETA**3))
 P(40)=(-2.*AXI*(ETA**5)+2.*AXI*(ETA**7))
 P(41)=(4.*(AXI**3)*ETA-6.*(AXI**5)*ETA-4.*(AXI**3)*(ETA**3)
```

```
     1*6.*(AXI**5)*(ETA**3))
      P(42)=(2.*AXI*(ETA**3)-4.*(AXI**3)*(ETA**3)-2.*AXI*(ETA**5)+4.*
     1(AXI**3)*(ETA**5))
      P(43)=(1.-(AXI**2)-3.*(ETA**2)+3.*(AXI**2)*(ETA**2))
      P(44)=(3.*(ETA**2)-3.*(AXI**2)*(ETA**2)-5.*(ETA**4)+5.*(AXI**2)
     1*(ETA**4))
      P(45)=((AXI**2)-(AXI**4)-3.*(AXI**2)*(ETA**2)+5.*(AXI**4)*
     1(ETA**2))
      P(46)=(3.*(ETA**4)-5.*(AXI**2)*(ETA**4)-7.*(ETA**6)+7.*(AXI**2)
     1*(ETA**6))
      P(47)=((AXI**4)-(AXI**6)-3.*(AXI**4)*(ETA**2)+3.*(AXI**6)
     1*(ETA**2))
      P(48)=(3.*(AXI**2)*(ETA**2)-3.*(AXI**4)*(ETA**2)-5.*(AXI**2)*
     1(ETA**4)+5.*(AXI**4)*(ETA**4))
      IF (ETA-0.5) 23,24,24
   24 CONTINUE
      PUNCH 445
  445 FORMAT(3X,36H BENDING STRESS AT MIDDLE OF LONG EDGE)
   23 W1XX=C1*P(7)+C2*P(8)+C3*P(9)+C4*P(10)+C5*P(11)+P(12)
      W1YY=C1*P(19)+C2*P(20)+C3*P(21)+C4*P(22)+C5*P(23)+P(24)
      W0X=-0.5*(R2*W1XX+ANU*W1YY)
      W3XX=F1*P(7)+F2*P(8)+F3*P(9)+F4*P(10)+F5*P(11)
      W3YY=F1*P(19)+F2*P(20)+F3*P(21)+F4*P(22)+F5*P(23)
      W3X=-0.5*(R2*W3XX+ANU*W3YY)
      W5XX=Y1*P(7)+Y2*P(8)+Y3*P(9)+Y4*P(10)+Y5*P(11)
      W5YY=Y1*P(19)+Y2*P(20)+Y3*P(21)+Y4*P(22)+Y5*P(23)
      W5X=-0.5*(R2*W5XX+ANU*W5YY)
      PUNCH 446,W0X,W3X,W5X
  446 FORMAT(5H W0X=E16.8,5H W3X=E16.8,5H W5X=E16.8)
      W0Y=-0.5*(W1YY+ANU*R2*W1XX)
      W3Y=-0.5*(W3YY+ANU*R2*W3XX)
      W5Y=-0.5*(W5YY+ANU*R2*W5XX)
      PUNCH 447,W0Y,W3Y,W5Y
  447 FORMAT(5H W0Y=E16.8,5H W3Y=E16.8,5H W5Y=E16.8)
      S2X=D1*P(25)+D2*P(26)+D3*P(27)+D4*P(28)+D5*P(29)+D6*P(30)
      S4X=G1*P(25)+G2*P(26)+G3*P(27)+G4*P(28)+G5*P(29)+G6*P(30)
      W1X=C1*P(1)+C2*P(2)+C3*P(3)+C4*P(4)+C5*P(5)+P(6)
      W3X=F1*P(1)+F2*P(2)+F3*P(3)+F4*P(4)+F5*P(5)
      T2Y=E1*P(43)+E2*P(44)+E3*P(45)+E4*P(46)+E5*P(47)+E6*P(48)
      T4Y=H1*P(43)+H2*P(44)+H3*P(45)+H4*P(46)+H5*P(47)+H6*P(48)
      W1Y=C1*P(13)+C2*P(14)+C3*P(15)+C4*P(16)+C5*P(17)+P(18)
      W3Y=F1*P(13)+F2*P(14)+F3*P(15)+F4*P(16)+F5*P(17)
      IF(ETA-0.5)15,16,16
   16 CONTINUE
      PUNCH 111
  111 FORMAT(3X,39H MEMBRANE STRESS AT MIDDLE OF LONG EDGE)
   15 W02X=(R2*S2X+0.5*R2*(W1X*W1X)+ANU*(R*T2Y+0.5*(W1Y*W1Y)))
      W04X=(R2*S4X+0.5*R2*(2.*W1X*W3X)+ANU*(R*T4Y+0.5*(2.*W1Y*W3Y)))
      W02Y=(R*T2Y+0.5*(W1Y*W1Y)+ANU*(R2*S2X+0.5*R2*(W1X*W1X)))
      W04Y=(R*T4Y+0.5*(2.*W1Y*W3Y)+ANU*(R2*S4X+0.5*R2*(2.*W1X*W3X)))
      PUNCH 113,W02X,W04X,W02Y,W04Y
  113 FORMAT(4X,6H W02X=E16.8,6H W04X=E16.8,6H W02Y=E16.8/6H W04Y=E16.8)
      IF (ETA-0.5) 52,51,51
   51 CONTINUE
```

```
      ANI=0.
      ETA=0.
      PUNCH 446
  446 FORMAT(3X,36H BENDING STRESSES AT CENTRE OF PLATE)
      GO TO 77
   52 PUNCH 112
  112 FORMAT(3X,37H MEMBRANE STRESSES AT CENTRE OF PLATE)
      END
****
3400032007013600305200702490240251196361130010200000000000000000000000000000
**JOB 5
**FOR 5
*FANDK1510
*LDISKKJPAN2
      DIMENSION SM(12,12),V(7),A(12,12),ANS(12),BM(12,12),BV(12),
     1DM(12,12),U(6)
      COMMON R,THETA,TH1,S,R2,C1,C2,C3,C4,C5,D2,D3,D4,D5,D6,D7,
     1E2,E5,E4,E5,E6,E7,ANU,BM,DM,U,C
      N=12
      DO 21 I=1,12
      DO 21 J=1,12
   21 BM(I,J)=0.
      BM(1,1)=-12.*C*R2*R+2.*A8-2.*A44
      BM(1,2)=2.*A44
      BM(1,3)=12.*C*R2*R
      BM(1,7)=2.*A11-2.*A10
      BM(1,9)=2.*A10
      BM(2,1)=12.*C*R2*R-6.*A8
      BM(2,2)=-12.*C*R2*R+6.*A8-12.*A44
      BM(2,3)=-12.*C*R2*R
      BM(2,4)=12.*A44
      BM(2,6)=12.*C*R2*R
      BM(2,7)=6.*A10-12.*A11
      BM(2,8)=12.*A11-6.*A10
      BM(2,9)=-6.*A10
      BM(2,12)=6.*A10
      BM(3,1)=-4.*A8+2.*A44
      BM(3,2)=-2.*A44
      BM(3,3)=-8.*A44+4.*A8-40.*C*R2*R
      BM(3,5)=40.*C*R2*R
      BM(3,6)=2.*A44
      BM(3,7)=-2.*A11
      BM(3,8)=8.*A11-4.*A10
      BM(3,11)=4.*A10
      BM(4,2)=12.*C*R2*R-10.*A8
      BM(4,4)=10.*A8-12.*C*R2*R-30.*A44
      BM(4,6)=-12.*C*R2*R
      BM(4,8)=10.*A10-30.*A11
      BM(4,10)=30.*A11-10.*A10
      BM(4,12)=-10.*A10
      BM(5,3)=-6.*A8+2.*A44
      BM(5,5)=-24.*C*R2*R+6.*A8-2.*A44
      BM(5,6)=-2.*A44
      BM(5,9)=-2.*A11
```

```
      BM(5,11)=2.*A11-6.*A10
      BM(6,1)=12.*A6
      BM(6,4)=12.*A44-12.*A6
      BM(6,5)=40.*C*R2*R-12.*A8
      BM(6,6)=-12.*A44
      BM(6,5)=-40.*C*R2*R
      BM(6,8)=12.*A8-12.*A44-40.*C*R2*R
      BM(6,7)=12.*A11
      BM(6,8)=-12.*A11
      BM(6,9)=12.*A10-12.*A11
      BM(6,11)=-12.*A10
      BM(6,12)=12.*A11-12.*A10
      BM(7,1)=-2.*A6*R2*C
      BM(7,2)=2.*A6*R2*C
      BM(7,7)=(-6.*A14+4.*A7*R2*S)-(2.*A7*R2*R)
      BM(7,8)=6.*A14
      BM(7,9)=2.*A7*R2*R
      BM(8,2)=-4.*A6*R2*C
      BM(8,4)=4.*A6*R2*C
      BM(8,7)=2.*A7*R2*R-8.*A7*R2*S
      BM(8,8)=8.*A7*R2*S-20.*A14-2.*A7*R2*R
      BM(8,9)=-2.*A7*R2*R
      BM(8,10)=20.*A14
      BM(8,12)=2.*A7*R2*R
      BM(9,1)=6.*A6*R2*C-6.*A6*R*C*S
      BM(9,4)=6.*A6*R*C*S-6.*A6*R2*C
      BM(9,5)=-6.*A6*R2*C
      BM(9,6)=6.*A6*R2*C
      BM(9,7)=6.*A14-12.*A7*R2*S
      BM(9,8)=-6.*A14
      BM(9,9)=12.*A7*R2*S-6.*A14-12.*A7*R2*R
      BM(9,11)=12.*A7*R2*R
      BM(9,12)=6.*A14
      BM(10,4)=-6.*A6*R2*C
      BM(10,7)=2.*A7*R2*R-12.*A7*R2*S
      BM(10,8)=12.*A7*R2*S-42.*A14-2.*A7*R2*R
      BM(10,12)=-2.*A7*R2*R
      BM(11,1)=6.*A6*R*C*S
      BM(11,4)=-6.*A6*R*C*S
      BM(11,5)=-6.*A6*R*C*S+10.*A6*R2*C
      BM(11,6)=-10.*A6*R2*C
      BM(11,8)=6.*A6*R*C*S-10.*A6*R2*C
      BM(11,9)=6.*A14-20.*A7*R2*S
      BM(11,11)=20.*A7*R2*S-30.*A7*R2*R-6.*A14
      BM(11,12)=-6.*A14
      BM(12,2)=12.*A6*R2*C-20.*A6*R*C*S
      BM(12,4)=20.*A6*R*C*S-12.*A6*R2*C
      BM(12,5)=-12.*A6*R2*C
      BM(12,7)=24.*A7*R2*S
      BM(12,8)=20.*A14-24.*A7*R2*S
      BM(12,9)=12.*A7*R2*R-24.*A7*R2*S
      BM(12,10)=-20.*A14
      BM(12,11)=-12.*A7*R2*R
201   BM(12,12)=24.*A7*R2*S-12.*A7*R2*R-20.*A14
```

```
      CALL LINK(KJPAR3)
      END
****
*LDIS,KKJSAR3
      SV(1)= -(2.*R2**(A16*A16)-2.*R2*S*(-A16)-4.*R2*S*(-A16)*A12
     1+A13 *A13*A17-2.*S*(-A17))
      SV(2)=-(2.*R2**(-A16)-2.*R2*S*(A16*A17)-4.*R2*S+A12*(-A17)
     1+A13*(-A17)-2.*S*(A17*A17))
      SV(3)=0.
      SV(4)=0.
      SV(5)=0.
      SV(6)=-(2.*R2**(A16*A26-A23+A16*A19)-2.*R2*S*(A16*A16+A26-A17
     1-A19)-4.*R2*S*(A16*A33-A26-A26)+A12*(-A19+A17*A26-A33)+A13*(A16
     2*A22-A16+A17*A26)-2.*S*(-A22+A17*A16+A17*A16))
      SV(7)=-(2.*R2**(A16*A16-A19+A16*A19)-2.*R2*S*(A16*A20+A16*A17
     1-A16)-4.*R2*S*(A16*A30-A33-A16)+A12*(-A20+A17*A33-A30)+A13*(A16
     2*A21-A22+A17*A16)-2.*S*(-A21+A17*A22+A17*A20))
      SV(8)=-(2.*(A17*A17)-R**A6*S*(-A17)+A15*(-A17)+R2*A6+R2*A7*A16
     1*A17)
      SV(9)=-(2.*(-A17)-R**A6*S*(A16*A17)+A15+R2*A6*(-A16)+R2*A7* (-A16))
      SV(10)=0.
      SV(11)=0.
      SV(12)=0.
      SV(13)=-(2.*(-A21+A17*A22+A17*A20)-R**A6*S*(A16*A21 -A22+A16*A17)
     1+A15*(-A20+A33*A17-A30)+R2*A6*(A16*A30-A33-A 16) +R2*A7*(A16*A20
     2+A17*A33-A16))
      SV(14)=-(2.*(-A22+A17*A16+A17*A16)-R**A6*S* (A16*A22-A16+A26*A17)
     1+A15*(-A16+A26*A17-A33)+R2*A6*(A16*A33-A26-A26)+R2*A7*(A16*A16
     2+A26*A17-A19))
      CALL EVALEIGS(A,N,A)
      PUNCH 36,((A(I,J),J=1,N),I=1,N)
      PUNCH 36,(SV(J),J=1,N)
   36 FORMAT(/(6X,4E16.8))
      CALL DIV77(A,N)
      PUNCH 36,((A(I,J),J=1,N),I=1,N)
      DO 13 I=1,N
      AMS(I)=0.
      DO 13 J=1,N
   13 AMS(I)=AMS(I)+ A(I,J)*SV(J)
      D2=AMS(1)
      D3=AMS(2)
      D4=AMS ( 3)
      D5=AMS(4)
      D6=AMS(5)
      D7=AMS(6)
      D8=AMS(7)
      E2=AMS(8)
      E3=AMS(9)
      E4=AMS(10)
      E5=AMS(11)
      E6=AMS(12)
      E7=AMS(13)
      E8=AMS(14)
      PUNCH 36,D2,D3,D4,D5,D6,D7,D8,E2,E3,E4,E5,E6,E7,E8
```

```
   30 FORMAT(4H D2=E16.8,4H D3=E16.8,4H D4=E16.8/4H D5=E16.8,4H D6=E16.8
     1,4H D7=E16.8/4H D8=E16.8,4H E2=E16.8,4H E3=E16.8/4H E4=E16.8,
     24H E5=E16.8,4H E6=E16.8/4H E7=E16.8,4H E8=E16.8)
      END
****
*LDISKKJPARG
  444 U(6)=(R2**2*C*((D2*6.*A39)+(D3-D2)*A25+(2.*D4-3.*D2)*A17
     1+5.*(D7-D8-D4+D2)*A16+(-2.*D2*A19))-2.**2*R*S*C* (D2*(5./2.)*A29
     2+(D3-D2)*A26+(3.*D4-3.*D2)*A30+3.*(D7-D8-D4+D2)*(-1.)+(-2.*D2*
     3A33))+R2*C*S*S*((D2*6.*A27)+(D3-D2)*A18+5.*(D4-D2)*A21 +3.*(D7-D2
     4-D4+D2)*A17+(-2.*D2*A22)))
      U(6)=U(6)-R2**3*C*S*((-D2*A18)+3.*(D2-D3)*A16+2.*(D3-D2)*A19)
     1+R2**2*C*S*S*((-D2*A30)+3.*(D2-D3)*(-1.)+2.*(D3-D2)*A33)-R**3*C*S**3*
     2((-D2*A21)+3.*(D2-D3)*A17+2.*(D3-D2)*A22)+(1./2.)*(R2**2*C**2*(D2*
     3(A16*A16*A19)+(2.*A16*A18-2.*A26)*A16+(-2.*A16*A19))-2.**2*R*S*C*S*(
     4A26+(A16*A16*A30)+(2.*A16*A18-2.*A26)*(-1.)+(-2.*A16*A33)))
      U(6)=U(6)+0.5*(R2*S*S*(A18+(A16*A16*A21)+(2.*A16*A18-2.*A26)*A17
     2+(-2.*A16*A22))-2.*R2*R*S*((-A17*A23)+(-A16*A18)+(-A16*A20*A16*A17
     3*A26-A18)*A16+(1.+A17*A16)*A19)+4.*R2*S*S*((-A17*A26)+(-A16*A30)+
     4(-A18*A20*A16+A17*A26-A18)*(-1.)+(1.+A17*A16)*A33))
      U(6)=U(6)+0.5*(-2.*R*S**3*((-A17*A18)+(-A16*A21)+(-A18*A20*A16+
     1A17*A26-A18)*A17+(1.+A17*A16)*A22)+R2*S*S*(A17*A17*A23+A18+(-2.*
     2A20+2.*A17*A18)*A16+(-2.*A17)*A19)-2.*R*S**3*(A17*A17*A26+A30+(
     3-2.*A20+2.*A17*A18)*(-1.)+(-2.*A17)*A33)+S**4*(A17*A17*A18+A21+
     4(-2.*A20+2.*A17*A18)*A17+(-2.*A17)*A22))
      U(6)=U(6)+A10*(R2*R*C*C*((E2*6.*A39)+3.*(E3-E2)*A23+(E4-E2)*A18+
     13.*(E7-E3-E4+E2)*A16+(-2.*E2)*A19)-2.*R2*C*C*S*((E2*(5./2.)*A29)+
     23.*(E3-E2)*A26+(E4-E2)*A30+3.*(E7-E3-E4+E2)*(-1.)+(-2.*E2)*A33)
     3+R*C*C*S*S*((E2*6.*A27)+3.*(E3-E2)*A18+(E4-E2)*A21+3.*(E7-E3-E4+
     4E2)*A17+(-2.*E2)*A22))
      U(6)=U(6)+A10*(0.5*C*C*R2*((A17*A17*A23)+A18+(-2.*A20+2.*A17*A18)*
     1A16-(2.*A17*A19))-R*S*C*C*((A17*A17*A26)+A30+(-2.*A20+2.*A17*A18)*
     2(-1.)-(2.*A17*A33))+0.5*C*C*S*S*((A17*A17*A18)+A21+(-2.*A20+2.*
     3A17*A18)*A17-(2.*A17*A22)))
      U(6)=U(6)*12.
      T1=12.*(R*C**4*((E2*6.*A27)+3.*(E3-E2)*A18+(E4-E2)*A21+3.*(E7-
     1E3-E4+E2)*A17+(-2.*E2)*A22)+0.5*C**4*((A17*A17*A18)*A21+(-2.*A20+
     22.*A17*A18)*A17+(-2.*A17)*A22))
      T2=12.*(A10*(R2*C**3*((D2*6.*A27)+(D3-D2)*A18+5.*(D4-D2)*A21+3.*(D
     17-D3-D4+D2)*A17+(-2.*D2)*A22)-R*S*C**3*((-D2*A21)+3.*(D2-D3)*A17+
     22.*(D3-D2)*A22)+0.5*C*C*(R2*((A18)+(A16*A16*A21)+(2.*A16*A18
     3-2.*A26)*A17+(-2.*A16*A22))-2.*R*S*((-A17*A18)+(-A16*A21)+(-A18
     4*A20*A16+A17*A26-A18)*A17+(1.+A17*A16)*A22)))
      T3=T1+12.*A10*0.5*C*C*(S*S*((A17*A17*A18)+A21+(-2.*A20+2.*A17*
     1A18)*A17+(-2.*A17)*A22))
      T4=12.*(1.-A10)*(R2*C**3*((-D2*A30)+3.*(D2-D3)*(-1.)+2.*(D3-D2)*
     1A33)-R*S*C**3*((-D2*A21)+3.*(D2-D3)*A17+2.*(D3-D2)*A22)+R2**2*C*C
     2*((-E2*A26)+3.*(E2-E4)*(-1.)+2.*(E4-E2)*A33)-R2*S*C*C*((-E2*A18)
     3+3.*(E2-E4)*A17+2.*(E4-E2)*A22)-R2*S*C*C*((E2*(3./2.)*A29)+3.*(E3
     4-E2)*A26+(E4-E2)*A30+3.*(E7-E3-E4+E2)*(-1.)+(-2.*E2)*A33))
      T4=12.*(1.-A10)*(R*S*S*C*C*((E2*6.*A27)+3.*(E3-E2)*A18+(E4-E2)*
     1A21+3.*(E7-E3-E4+E2)*A17+(-2.*E2)*A22)+R2*C*C*((-A17*A26)+(-A16*
     2A30)+(-A18*A20*A16+A17*A26-A18)*(-1.)+(1.+A17*A16)*A33)
     3-R*S*C*C*((-A17*A18)+(-A16*A21)+(-A18+A20*A16+A17*A26-A18)*A17
```

```
     4*(1.+A17*A16)*A22))
      T5=12.*(1.-ANU)*(-R*S*C*C*((A17*A17*A26)*A30*(-2.*A26+2.*A17*A16)
     1*(-1.)+(-2.*A17)*A33)+S*S*C*C*((A17*A17*A16)+A21+(-2.*A26*2.*
     2A17*A16)*A17+(-2.*A17)*A22))
      U(6)=U(6)+T1+T2+T3+T4+T5
      CALL LINK(KJPAR7)
      END
****
*LDISKKJPAR4
      U(1)=12.*(R2*R2*C*D2*(-4.+2.*C2)+2.*R2*R2*S*C*C2*12*C*S*C2*(-4.*
     12.*C1)+ANU*(R2*R*C*C*(-4.+2.*C2)*E2+2.*R2*C*C*S*E2+R*C*C*S*(-4.
     2+2.*C1)*E2))+12.*(R*C**4*(-4.+2.*C1)*D2+ANU*(R2*C**3*(-4.*2.*C1)
     3*D2))+12.*(1.-ANU)*(R2*S*C*C*D2+R*S*S*C*C*(-4.+2.*C1)*E2)
      U(2)=12.*(R2*R2*C*(D2*(12.-24.*C2+12.*C2)+(3.*E4-5.*E2)*(-4.*C2.*
     1C2))-12.*R2*R2*S*C*((D2*A26)+(-1.)*(3.*D4-5.*D2))+R2*C*C*S*(D2*(1
     2+(7.*E4-5.*E2)*A17)-R2*R*C*S*(-D2*A16)+2.*R2*C*S*S*(-D2*(-1.))-R
     3*C*S*S*(-D2*A17)+1./2.*(R2*R2*(A16**3)-2.*R2*R*S*((A16*A16)*
     4(-1.))+R2*S*S*(A17*A16*A16)-2.*R2*R*S*(A16*(-A16))))
      U(2)=U(2)+12.*(1./2.*(4.*R2*S*S*A16-2.*R*S**3*A17*(-A16)+R2*S*S*
     1A16-2.*R*S**3*(-1.)+S**4*A17)
     2+ANU*(R**3*C*C*((E2*A23)+A16*(E4-E2))-2.*R2*C*C*S*((A26*E2)+(-1.)
     3*(E4-E2))+R*C*C*S*S*((A16*E2)+A17*(E4-E2))+(1./2.)*C*R2*A16*C
     4-R*S*C*C*(-1.)+(1./2.)*C*C*S*S*A17))
      U(2)=U(2)+12.*(R*C**4*((A16*E2)+A17*(E4-E2))+1./2.*C**4*A17+ANU
     1*(R2*C**3*(A16*D2+A17*(3.*D4-3.*D2))-R*S*C**3*(-D2*A17)+1./2.*C*
     2C*((R2*A16*A16*A17)-2.*R*S*A17*(-A16)+S*S*A17)))
      U(2)=U(2)+12.*(1.-ANU)*(R2*C**3*D2-R*S*C**3*(-D2*A17)-R2*S*C*C*
     1(A26*E2-(E4-E2))+R*S*S*C*C*(A16*E2+A17*(E4-E2))+R2*C*C*A16-R*S*C
     2*C*(A17*(-A16))-R*S*C*C*(-1.)+S*S*C*C*A17)
      CALL LINK(KJPAR5)
*LDISKKJPAR5
      K=6
      U(3)=12.*(R2*R2*C*(D2*A16+A16*(D3-D2))-2.*R2*R*S*C*(A30*D2-(D3-
     1D2))+R2*C*S*S*(A21*D2+A17*(D3-D2))+0.5*(R2*R2*A16-2.*R2*R*S*(-1.)
     2+R2*S*S*A17-2.*R2*R*S*(-A17*A16)+4.*R2*S*S*A17-2.*R*S**3*A17*
     3(-A17)+R2*S*S*A16*A17*A17-2.*R*S**3*(-A17)*A17+S**4*A17*A17*A17))
      U(3)=U(3)+12.*(ANU*(R2*R*C*C*((E2*A17)+(3.*E3-3.*E2)*A16)-2.*R2*
     1C*C*S*(E2*A30)+(3.*E3-3.*E2)*(-1.))+R*C*C*S*S*(E2*A21+(3.*E3-3.*
     2E2)*A17)+1.5*C*C*R2*(A16*A17*A17)-R*S*C*C*(-1.)*A17*A17+0.5*C*C*S*
     3S*A17*A17*A17))
      U(3)=U(3)+12.*(R*C**4*(E2*A21+(3.*E3-3.*E2)*A17)+0.5*C**4*A17*
     1A17*A17+ANU*(R2*C**3*(D2*A21+(D3-D2)*A17)+0.5*C*C*C*(R2*A17-2.*R*
     2S*(-A17)*A17+S*S*A17*A17*A17)))
      U(3)=U(3)+12.*(1.-ANU)*(R2*R*C*C*E2-R2*S*C*C*(-E2)*A17-R2*S*C*C*
     1(R2*A26+(3.*E3-3.*E2)*(-1.))+R*S*S*C*C*(E2*A21+(3.*E3-3.*E2)*A17
     2)+R2*C*C*A17-R*S*C*C*(-A17)*A17-R*S*C*C*(-1.)*A17*A17+S*S*C*C*
     3A17*A17*A17)
      U(4)=12.*(R2*R2*C*(D2*A35+3.*(D4-D2)*A25+5.*(D6-D4)*A16)-2.*R2*R*
     1S*C*(A30*D2+3.*(D4-D2)*A26+5.*(D6-D4)*(-1.))+R2*C*S*S*(D2*A33+
     23.*(D4-D2)*A21+5.*(D6-D4)*A17)-R2*R*C*S*(-D2*A23+(-D4+D2)*A16)+
     32.*R2*C*S*S*(-D2*A26+(-D4+D2)*(-1.))-R*C*S**3*(-D2*A16+(-D4+D2)
     4*A17)+C.5*(R2*R2*(A16*A16*A25+(2.*A16*A24)*A16)))
      U(4)=U(4)+12.*(0.5*(-2.*R2*R*S*(A16*A16*A26+(2.*A16*A24)*(-1.))
     1+R2*S*S*(A16*A16*A16+2.*A16*A24*A17)-2.*R2*R*S*(-A16*A23+(-A24
```

```
     1+A25*A16)*A16)+4.*R2*S*S*(-A16*A25+(-A24+A25*A16)*(-1.))-2.*C*C
     2*S*(-A16*A17+(-A24+A25*A16)*A17)+R2*S*S*(A25*(-2.*A25*A17)))-2.*
     4*R*S**3*(A25+2.*A25)+S**4*(A17*(-2.*A25*A17))))
      U(4)=U(4)+12.*(R**3*C**3*S*((A2*A35)+(A4-A2)*A25*(A6-A4)*(-1.))*R*C*C*S*S*((A2*
     1-2.*R*R*C*C*S*((A2*A35)+(A4-A2)*A25*(A6-A4)*(-1.))*R*C*C*S*S*((A2*
     2A39)+(A4-A2)*A16+(A6-A4)*A17)*2.*R*C*C*S*2*(A27*(-2.*A25*A17))
     3-R*R*S*C*C*(A26+2.*A25)*2.*R*C*C*S*S*(A17*(-2.*A25*A17))))
      U(5)=U(5)+12.*(R*C**4*(R2*A35*(A4-A2)*A16+(A6-A4)*A17)*2.*R*C*C*S*S*
     1(A16*(-2.*A25*A17))*R*R*(R2*C**3*((A2*A39)+3.*(A4-A2)*A16+(A6-
     2-A4)*A17)-R*S*C**2*(-A2*A16+(-A4+A2)*A17)*2.*R*C*C*(R2*(A16*A16*
     3A16*A16*A17)-2.*R*S*(-A16*A16+(-A24*A25*A16)*A17)
     4*S*S*(A16*(-2.*A25*A17))))))
      U(6)=U(6)+12.*(1.-ANU)*(R2*C**3*((-A4+A2)*(-A4+A2)*(-1.))-R*S*
     1C**2*(-A2*A16)+(-A4+A2)*A17)-R2*S*C*C*((A2*A36)+(A4-A2)*A26*
     2(A6-A4)*(-1.))+R*S*S*C*C*((A2*A39)+(A4-A2)*A16*(A6-A4)*A17)*2*C
     3*C*((-A16*A26)*(-A24+A25*A16)*(-1.))-R*S*C*C*(-A16*A16+(-A24*A25*
     4A16)*A17)-R*S*C*C*(A26+2.*A25)+S*S*C*C*(A16+(-2.*A25*A17)))
      CALL LINK(KJPAR6)
      END
****
```

```
[illegible]
[illegible]
*FORXF501
*PARK1616
C          SI[illegible] JG    STRESSES  IN CL[illegible]PED  SKEWED  PLATES
      DIMENSION THETA(6),TAXI(6),P(90)
      COMMON C1,C2,C3,C4,C5,D2,D3,D4,D5,D6,D7,E2,E3,E4,E5,E6,E7,F1,
     1F2,F3,F4,F5,A,B,ANU,S,C,TAN,SEC,AXI,ETA,I,J,P
      READ 101,(THETA(I),I=1,2),(TAXI(J),J=1,6)
      PUNCH 101,(THETA(I),I=1,2),(TAXI(J),J=1,6)
  101 FORMAT(8F10.5)
  100 READ 10,C1,C2,C3,C4,C5,D2,D3,D4,D5,D6,D7,E2,E3,E4,E5,E6,E7,F1,F2,
     1F3,F4,F5,THETA,A,ANU
      READ 2,Z1,Z2,Z3,Z4
    2 FORMAT(4F10.5)
      PUNCH 10,A,THETA,ANU
   10 FORMAT(3F10.5,7H THETA=F10.5,5H ANU=F10.5)
      PUNCH 1,C1,C2,C3,C4,C5,D2,D3,D4,D5,D6,D7,E2,E3,E4,E5,E6,E7,F1,F2,
     1F3,F4,F5,THETA,A,ANU
   10 FORMAT(8F10.5)
    1 FORMAT(4E16.8)
      TH1=THETA*0.17453292/10.
      S=SINF(TH1)
      C=COSF(TH1)
      TAN=S/C
      TAN2=SQRTF(TAN)
      SEC=1./C
      DO 99 J=1,6
      AXI=TAXI(J)
      DO 99 I=1,2
      ETA=THETA(I)
```

```
     P(1)=-4.*AXI+ .*AXI*BTA*BTA-4.*AXI*(BTA**4)+4.*(AXI**3)- .*(AXI**3
    1)*(BTA**2)+4.*(AXI**5)*(BTA**4)-BTA+2.*(BTA**5)-(BTA**6)+2.*AXI
    2*AXI*BTA-12.*(AXI**2)*(BTA**5)*6.*(AXI**2)*(BTA**5)-5.*(AXI**4)*
    3BTA+10.*(AXI**4)*(BTA**2)-5.*(AXI**4)*(BTA**4)
     CALL KOI
     CALL KO4
     CALL KJ2
     CALL KJ1
     CALL KJ3
     CALL KJ0
     CALL KJ4
     W1XX=P(7)+C1*P(8)+C2*P(9)+C3*P(10)+C4*P(11)+C5*P(12)
     W1YY=P(19)+C1*P(20)+C2*P(21)+C3*P(22)+C4*P(23)+C5*P(24)
     W1XY=P(25)+C1*P(26)+C2*P(27)+C3*P(28)+C4*P(29)+C5*P(30)
     W0X=-0.5*(R*R*W1XX*SEC*SEC-2.*SEC*TAN*R*W1XY+(TAN*TAN+ANU)*W1YY)
     W0Y=-0.5*((1.+ANU*TAN*TAN)*W1YY+ANU*(R*R*SEC*SEC*W1XX-2.*SEC*TAN
    1*R*W1XY))
     W3XX=F1*P(8)+F2*P(9)+F3*P(10)+F4*P(11)+F5*P(12)
     TAU0=R*SEC*W1XY-TAN*W1YY
     W0MAX=(0.5*(W0X+W0Y))+(0.5*SQRTF((W0X-W0Y)**2+4.*(TAU0)**2))
     W0MIN=(0.5*(W0X+W0Y))-(0.5*SQRTF((W0X-W0Y)**2+4.*(TAU0)**2))
     W3YY=F1*P(20)+F2*P(21)+F3*P(22)+F4*P(23)+F5*P(24)
     W3XY=F1*P(26)+F2*P(27)+F3*P(28)+F4*P(29)+F5*P(30)
     W03X=-0.5*(R*R*SEC*SEC*W3XX-2.*SEC*TAN*R*W3XY+(TAN*TAN+ANU)*W3YY)
     W03Y=-0.5*((1.+ANU*TAN*TAN)*W3YY+ANU*(R*R*SEC*SEC*W3XX-2.*SEC
    1*TAN*R*W3XY))
     TAU3=R*SEC*W3XY-TAN*W3YY
     W3MAX=(0.5*(W03X+W03Y))+(0.5*SQRTF((W03X-W03Y)**2+4.*(TAU3)**2))
     W3MIN=(0.5*(W03X+W03Y))-(0.5*SQRTF((W03X-W03Y)**2+4.*(TAU3)**2))
     UX=D2*P(31)+D3*P(32)+D4*P(33)+D5*P(34)+D6*P(35)+D7*P(36)
     UY=D2*P(37)+D3*P(38)+D4*P(39)+D5*P(40)+D6*P(41)+D7*P(42)
     VY=E2*P(43)+E3*P(44)+E4*P(45)+E5*P(46)+E6*P(47)+E7*P(48)
     W1X=P(1)+C1*P(2)+C2*P(3)+C3*P(4)+C4*P(5)+C5*P(6)
     W1Y=P(13)+C1*P(14)+C2*P(15)+C3*P(16)+C4*P(17)+C5*P(18)
     W02X=R*R*SEC*UX-R*TAN*UY+ANU*R*VY+0.5*(R*R*SEC*SEC*W1X*W1X-2.*R*
    1SEC*TAN*W1X*W1Y+(ANU+TAN*TAN)*W1Y*W1Y)
     W02Y=R*R*SEC*UY+0.5*W1Y*W1Y*(1.+ANU*TAN*TAN)+ANU*(R*R*SEC*UX-R*TAN*UY
    1+0.5*(R*R*SEC*W1X*W1X*SEC*SEC-2.*R*SEC*TAN*W1X*W1Y))
     W02XY=R*R*SEC*UY-R*TAN*VY+W1Y*(R*SEC*W1X-TAN*W1Y)
     W2MAX=(0.5*(W02X+W02Y))+(0.5*SQRTF((W02X-W02Y)**2+4.*(W02XY)**2))
     W2MIN=(0.5*(W02X+W02Y))-(0.5*SQRTF((W02X-W02Y)**2+4.*(W02XY)**2))
     IF(AXI-0.005) 25,25,26
25   IF(BTA+0.2) 26,26,27
27   W03Y=0.1*Z1
     W03X=W03X*Z1
     W3MAX=W3MAX*Z1
     W3MIN= W3MIN+0.1*Z1
     W02X=W02X*Z2
     W02Y=W02Y*Z2
     W2MAX=W2MAX*Z2
     W2MIN=W2MIN*Z2
     GO TO 26
26   CONTINUE
     W03Y=W03Y-Z3
```

PAGE 03

```
      W03X=[illegible]
      [illegible]
      [illegible]
      W03Y=[illegible]
      W02Y=[illegible]
      [illegible]
      [illegible]
  201 PUNCH 100
  100 FORMAT(1H  GENERAL STRESSES)
      PUNCH 102,W02X,W02Y,TAU0,W0MAX,W0MIN,W03X,W03Y,TAU3,W3MAX,W3MIN
  102 FORMAT(6H W0X=E16.8,6H W0Y=E16.8,6H TAU0=E16.8/7H W0MAX=E16.8,
     1 7H W0MIN=E16.8/6H W03X=E16.8,6H W03Y=E16.8,6H TAU3=E16.8/
     2 7H W3MAX=E16.8,7H W3MIN=E16.8)
      PUNCH 103
  103 FORMAT(1H  PERMANALE STRESSES)
      PUNCH 104,W02X,W02Y,W02XY,W2MAX,W2MIN,AXI,ETA
  104 FORMAT(6H W02X=E16.8,6H W02Y=E16.8,7H W02XY=E16.8/7H W2MAX=E16.8,
     1 7H W2MIN=E16.8/5H AXI=F6.3,5H ETA=F6.3)
      GO TO 200
      END
*LOCAL,KJ1,KJ2,KJ2,KJ6,KJ3,KJC,KJ4
   0.        -1.         0.         0.25       0.3        0.35       0.4        0.4
0.02[illegible] 1.0[illegible] -0.[illegible] 0.2871597 0.1639461 1.8056127 -0.1[illegible] -1.[illegible]
3.9[illegible] 0.[illegible] -4.040757 1.2635980 -4.084084 5.6228429 1.7[illegible] -7.[illegible]
17.[illegible] 0.[illegible] 1.1705073 -0.006963 1.7775504 1.2291226     0.        0.3
  0.3333
   0.33       0.35        1.          0.313
-0.[illegible] 0.[illegible] -0.[illegible] -0.027448 0.3244454 1.8628599 -1.[illegible] -3.327
-3.[illegible] -1.[illegible] -0.017219 1.5374749 -4.176846 10.840732 2.947[illegible] -2.249
25.126276 0.[illegible] 1.7693652 -0.086921 3.1558596 1.2253061     15.        0.
  0.3333
    0.4        0.7         0.4      -0.6235
-0.07[illegible] 0.[illegible] -0.[illegible] -0.398525 0.8643556 0.6454967 -4.594[illegible] -9.3[illegible]
-4.[illegible] -3.[illegible] -15.06079 2.0952549 -4.530145 19.005527 3.590[illegible] 1.967[illegible]
39.[illegible] 0.[illegible] 2.3966780 -0.057855 4.9104088 0.0219636     30.        0.
  0.3333
    0.4        0.3         0.38       -1.54
-0.[illegible] 0.[illegible] -0.025627 -0.712415 1.5062099 0.1375416 -3.[illegible] -4.971
-0.[illegible] -3.[illegible] -25.92161 2.9104908 -5.981934 32.506423 3.27[illegible] -6.357
56.[illegible] 0.[illegible] 2.6087051 0.1503837 6.4493865 -2.490418     45.        0.
  0.3333
    0.46       0.59        0.5         0.148
-0.[illegible] 0.[illegible] -0.034446 -0.772948 1.6643584 0.1309978 -2.601147 -10.46
1.51[illegible] -2.[illegible] -28.94166 3.2794362 -6.790375 37.990865 3.0[illegible] -13.20
85.[illegible] 0.[illegible] 2.5343719 0.2528271 6.2652200 -3.042813     50.        0.
  0.3333
    0.46       0.5         0.5         0.0915
-0.[illegible] 0.[illegible] -0.051260 -0.824604 1.8684829 -0.288222 0.2920320 -14.26
5.49[illegible] -0.[illegible] -30.51766 4.3117554 -8.920696 49.123947 2.6110637 -40.43
62.[illegible] 0.[illegible] 1.6915845 0.4800764 4.5664996 -3.236667     60.        0.5
  0.3333
    0.4        0.37       0.4         0.5
0.0E+0
```

```
**JOB 5
**FOR 5
*FAP,X1610
*LDISK
      SUBROUTINE KJI
       P(2)=-6.*AXI*(ETA**2)+6.*AXI*(ETA**4)-4.*AXI*(ETA**6)+4.*(AXI**2)
     1*(ETA**2)-6.*(AXI**3)*(ETA**4)+4.*(AXI**5)*(ETA**6)-(ETA**8)+2.*(
     2ETA**5)-(ETA**7)+6.*(AXI**2)*(ETA**5)-12.*(AXI**2)*(ETA**8)
     3+6.*(AXI**2)*(ETA**7)-5.*(AXI**4)*(ETA**5)+10.*(AXI**4)*(ETA**8)
     4-5.*(AXI**4)*(ETA**7)
       P(3)=2.*AXI-4.*AXI*(ETA**2)+2.*AXI*(ETA**4)-8.*(AXI**3)+16.*(
     1AXI**3)*(ETA**2)-8.*(AXI**3)*(ETA**4)+6.*(AXI**5)-12.*(AXI**5)*
     2(ETA**2)+8.*(AXI**5)*(ETA**4)-3.*(AXI**2)*ETA+6.*(AXI**2)*
     3(ETA**3)-8.*(AXI**2)*(ETA**5)+10.*(AXI**4)*ETA-20.*(AXI**4)*(ETA**
     48)+16.*(AXI**4)*(ETA**5)-7.*(AXI**6)*ETA+14.*(AXI**6)*(ETA**3)
       P(3)=P(3)-7.*(AXI**6)*(ETA**5)
       P(4)=-(ETA**6)+6.*(AXI**2)*(ETA**5)-5.*(AXI**4)*(ETA**5)-4.*
     1AXI*(ETA**4)+4.*(AXI**3)*(ETA**4)+2.*(ETA**7)-12.*(AXI**2)*
     2(ETA**7)+10.*(AXI**4)*(ETA**7)+8.*AXI*(ETA**6)-8.*(AXI**3)*
     3(ETA**6)-(ETA**9)+6.*(AXI**2)*(ETA**9)-5.*(AXI**4)*(ETA**9)
     4-4.*AXI*(ETA**8)+4.*(AXI**3)*(ETA**8)
       P(5)=4.*(AXI**3)-5.*(AXI**4)*ETA-12.*(AXI**5)+14.*(AXI**6)*ETA+8.*
     1(AXI**7)-8.*(AXI**8)*ETA-8.*(AXI**5)*(ETA**2)+10.*(AXI**4)*
     2(ETA**3)+24.*(AXI**5)*(ETA**2)-20.*(AXI**6)*(ETA**5)-16.*
     3(AXI**7)*(ETA**2)+16.*(AXI**6)*(ETA**3)+4.*(AXI**3)*(ETA**4)-5.*
     4(AXI**4)*(ETA**3)-12.*(AXI**5)*(ETA**4)+14.*(AXI**6)*(ETA**5)
       P(5)=P(5)+8.*(AXI**7)*(ETA**4)-9.*(AXI**4)*(ETA**5)
       P(6)=2.*AXI*(ETA**2)-3.*(AXI**2)*(ETA**3)-6.*(AXI**3)*(ETA**2)
     1+10.*(AXI**4)*(ETA**3)+6.*(AXI**5)*(ETA**2)-7.*(AXI**6)*(ETA**3)
     2-4.*AXI*(ETA**4)+6.*(AXI**2)*(ETA**5)+16.*(AXI**3)*(ETA**4)
     3-20.*(AXI**4)*(ETA**5)-12.*(AXI**5)*(ETA**4)+14.*(AXI**6)*(
     4ETA**5)+8.*AXI*(ETA**6)-8.*(AXI**2)*(ETA**7)-6.*(AXI**3)*(ETA**6)
       P(6)=P(6)+10.*(AXI**4)*(ETA**7)+6.*(AXI**5)*(ETA**6)-7.*(AXI**6)
     1*(ETA**7)
       RETURN
       END
****
      SUBROUTINE KJA
       P(7)=-4.**8.*(ETA**2)-4.*(ETA**4)+12.*(AXI**2)-24.*(AXI**2)*(ETA**2
     1)+12.*(AXI**2)*(ETA**4)+12.*AXI*ETA-24.*AXI*(ETA**3)+12.*AXI*
     2(ETA**5)-20.*(AXI**3)*ETA+40.*(AXI**3)*(ETA**3)-20.*(AXI**3)*
     3(ETA**5)
       P(8)=-4.*(ETA**2)+6.*(ETA**4)-4.*(ETA**6)+12.*(AXI**2)*(ETA**2)
     1-24.*(AXI**2)*(ETA**4)+12.*(AXI**2)*(ETA**6)+12.*AXI*(ETA**3)
     2-24.*AXI*(ETA**5)+12.*AXI*(ETA**7)-20.*(AXI**3)*(ETA**3)+40.*
     3(AXI**3)*(ETA**5)-20.*(AXI**3)*(ETA**7)
       P(9)=2.-4.*(ETA**2)+2.*(ETA**4)-24.*(AXI**2)+48.*(AXI**2)*(ETA**2)
     1-24.*(AXI**2)*(ETA**4)+30.*(AXI**4)-60.*(AXI**4)*(ETA**2)+30.*
     2(AXI**4)*(ETA**4)-6.*AXI*ETA+12.*AXI*(ETA**3)-6.*AXI*(ETA**5)
       P(10)=12.*AXI*(ETA**5)-20.*(AXI**3)*(ETA**5)-4.*(ETA**4)+12.*(
       P(11)=12.*(AXI**2)-20.*(AXI**3)*ETA-60.*(AXI**4)+64.*(AXI**5)*ETA+
       P(11)=P(11)+64.*(AXI**5)*(ETA**5)+56.*(AXI**6)*(ETA**4)
       P(12)=2.*(ETA**2)-6.*AXI*(ETA**3)-24.*(AXI**2)*(ETA**2)+40.*
       P(12)=P(12)+40.*(AXI**3)*(ETA**7)+30.*(AXI**4)*(ETA**6)-42.*
```

```
      RETURN
      END
C***
      SUBROUTINE SUB
      P(13)=-4.*ETA**6.*(ETA**3)+6.*(AXI**2)*ETA-P.*(AXI**2)*(ETA**5)
     1-5.*(AXI**4)*ETA+6.*(AXI**4)*(ETA**3)-AXI+6.*AXI*(ETA**2)-5.*
     2AXI*(ETA**4)+2.*(AXI**5)-12.*(AXI**3)*(ETA**2)+10.*(AXI**5)*
     3(ETA**4)-(AXI**7)+6.*(AXI**5)*(ETA**2)-5.*(AXI**5)*(ETA**4)
      P(14)=6.*ETA-9.*(ETA**3)+6.*(ETA**5)-4.*(AXI**2)*ETA+16.*(
     1AXI**2)*(ETA**3)-12.*(AXI**2)*(ETA**5)+2.*(AXI**4)*ETA-P.*(AXI
     2**4)*(ETA**3)+6.*(AXI**4)*(ETA**5)-3.*AXI*(ETA**2)+10.*AXI*(
     3ETA**4)-7.*AXI*(ETA**6)+6.*(AXI**3)*(ETA**2)-20.*(AXI**3)*(ETA**4)
     4+14.*(AXI**3)*(ETA**6)-3.*(AXI**5)*(ETA**2)+10.*(AXI**5)*(ETA**4)
      P(14)=P(14)-7.*(AXI**5)*(ETA**6)
      P(15)=-4.*(AXI**2)*ETA+4.*(AXI**2)*(ETA**3)+P.*(AXI**4)*ETA
     1-6.*(AXI**4)*(ETA**3)-4.*(AXI**6)*ETA+4.*(AXI**6)*(ETA**3)-
     2(AXI**3)+3.*(AXI**3)*(ETA**2)-5.*(AXI**3)*(ETA**4)+2.*(AXI**5)
     3-12.*(AXI**5)*(ETA**2)+10.*(AXI**5)*(ETA**4)-(AXI**7)+6.*(AXI**7)
     4*(ETA**2)-5.*(AXI**7)*(ETA**4)
      P(16)=4.*(ETA**3)-5.*AXI*(ETA**4)-12.*(FTA**5)+14.*AXI*(ETA**6)
     1-9.*AXI*(ETA**6)+6.*(ETA**7)-6.*(AXI**2)*(ETA**3)+10.*(AXI**3)*
     2(ETA**4)+24.*(AXI**2)*(ETA**5)-28.*(AXI**3)*(ETA**6)-16.*(AXI**2)
     3*(ETA**7)+16.*(AXI**3)*(ETA**8)+4.*(AXI**4)*(ETA**3)-5.*(AXI**5)*
     4(ETA**4)-12.*(AXI**4)*(ETA**5)+14.*(AXI**5)*(ETA**6)
      P(16)=P(16)+6.*(AXI**4)*(ETA**7)-9.*(AXI**5)*(ETA**8)
      P(17)=-(AXI**5)+6.*(AXI**5)*(ETA**2)-5.*(AXI**5)*(ETA**4)-4.*
     1(AXI**4)*ETA+4.*(AXI**4)*(ETA**3)+2.*(AXI**7)-12.*(AXI**7)*(ETA**2
     2)+10.*(AXI**7)*(ETA**4)+6.*(AXI**6)*ETA-8.*(AXI**6)*(ETA**3)
     3-(AXI**9)+6.*(AXI**9)*(ETA**2)-5.*(AXI**9)*(ETA**4)-4.*(AXI**8)*
     4ETA+4.*(AXI**8)*(ETA**3)
      SUBROUTINE SUB
      P(18)=2.*(AXI**2)*ETA-3.*(AXI**3)*(ETA**2)-8.*(AXI**2)*(ETA**3)
     1+10.*(AXI**3)*(ETA**4)+6.*(AXI**2)*(ETA**5)-7.*(AXI**3)*(ETA**6)
     2-4.*(AXI**4)*ETA+6.*(AXI**5)*(ETA**2)+16.*(AXI**4)*(ETA**3)
     3-20.*(AXI**5)*(ETA**4)-12.*(AXI**4)*(ETA**5)+14.*(AXI**5)*(ETA
     4**6)+2.*(AXI**6)*ETA-3.*(AXI**7)*(ETA**2)-8.*(AXI**6)*(ETA**3)
      P(18)=P(18)+10.*(AXI**7)*(ETA**4)+6.*(AXI**6)*(ETA**5)-7.*(AXI**7)
     1*(ETA**6)
      P(19)=-4.+12.*(ETA**2)+6.*(AXI**2)-24.*(AXI**2)*(ETA**2)-4.*
      P(20)=2.-24.*(ETA**2)+30.*(ETA**4)-4.*(AXI**2)+48.*(AXI**2)*
      P(20)=P(20)-42.*(AXI**5)*(ETA**5)
      P(21)=-4.*(AXI**2)+12.*(AXI**2)*(ETA**2)+6.*(AXI**4)-24.*(AXI**4)
      P(22)=12.*(ETA**2)-20.*AXI*(ETA**3)-60.*(ETA**4)+64.*AXI*(ETA**5)-
      P(22)=P(22)+56.*(AXI**4)*(ETA**6)-72.*(AXI**5)*(ETA**7)
      P(23)=12.*(AXI**5)*ETA-20.*(AXI**5)*(ETA**3)-4.*(AXI**4)+12.*
      P(24)=2.*(AXI**2)-6.*(AXI**3)*ETA-24.*(AXI**2)*(ETA**2)+40.*
      P(24)=P(24)+30.*(AXI**6)*(ETA**4)-42.*(AXI**7)*(ETA**5)
      RETURN
      END
C***
340003200701360003200702490240251196361130010200
**JOB 5
**FOR 5
*FAMDK1610
```

```
PAGE 08


*LOISK
      SUBROUTINE KJ3
      COMMON C1,C2,C3,C4,C5,D2,D3,D4,D5,D6,D7,E2,E3,E4,E5,E6,E7,F1,
     1F2,F3,F4,F5,G,ANU,S,C,TAU,SEC,AXI,ETA,I,J,P
      P(25)=16.*AXI*ETA-16.*AXI*(ETA**3)-16.*(AXI**3)*ETA+16.*(AXI**5)*
      P(26)=-8.*AXI*ETA+32.*AXI*(ETA**3)-24.*AXI*(ETA**5)+8.*(AXI**3)
      P(27)=-8.*AXI*ETA+8.*AXI*(ETA**3)+32.*(AXI**3)*ETA-32.*(AXI**5)
      P(28)=-5.*(ETA**4)+30.*(AXI**2)*(ETA**4)-25.*(AXI**4)*(ETA**4)
      P(29)=-5.*(AXI**4)+14.*(AXI**6)-9.*(AXI**8)-16.*(AXI**3)*ETA
      P(30)=4.*AXI*ETA-9.*(AXI**2)*(ETA**2)-16.*(AXI**3)*ETA+30.*
      P(30)=P(30)+70.*(AXI**4)*(ETA**6)+36.*(AXI**5)*(ETA**5)
      RETURN
      END
****
      SUBROUTINE KJC
      P(31)=1.-2.*AXI*ETA-3.*(AXI**2)+4.*(AXI**3)*ETA-(ETA**2)+2.*AXI*(
     1ETA**3)+3.*(AXI**2)*(ETA**2)-4.*(AXI**3)*(ETA**3)
      P(32)=(ETA**2)-2.*AXI*(ETA**3)-3.*(AXI**2)*(ETA**2)+4.*(AXI**3)
     1*(ETA**3)-(ETA**4)+2.*AXI*(ETA**5)+3.*(AXI**2)*(ETA**4)
     2-4.*(AXI**3)*(ETA**5)
      P(33)=3.*(AXI**2)-4.*(AXI**3)*ETA-5.*(AXI**4)+6.*(AXI**5)*ETA
     1-5.*(AXI**2)*(ETA**2)+4.*(AXI**3)*(ETA**3)+5.*(AXI**4)*(ETA**2)
     2-6.*(AXI**5)*(ETA**5)
      P(34)=(ETA**4)-2.*AXI*(ETA**5)-3.*(AXI**2)*(ETA**4)+4.*(AXI**3)*
     1(ETA**5)-(ETA**6)+2.*AXI*(ETA**7)+3.*(AXI**2)*(ETA**6)-4.*(AXI**3)
     2*(ETA**7)
      P(35)=5.*(AXI**4)-6.*(AXI**5)*ETA-7.*(AXI**6)+8.*(AXI**7)*ETA-5.
     1*(AXI**4)*(ETA**2)+6.*(AXI**5)*(ETA**3)+7.*(AXI**6)*(ETA**2)
     2-8.*(AXI**7)*(ETA**3)
      P(36)=5.*(AXI**2)*(ETA**2)-4.*(AXI**3)*(ETA**3)-5.*(AXI**4)*
     1(ETA**2)+6.*(AXI**5)*(ETA**3)-3.*(AXI**2)*(ETA**4)+4.*(AXI**3)
     2*(ETA**5)+5.*(AXI**4)*(ETA**4)-6.*(AXI**5)*(ETA**5)
      P(37)=-(AXI**2)+(AXI**4)-2.*AXI*ETA+3.*(AXI**2)*(ETA**2)+2.*(AXI
     1**3)*ETA-3.*(AXI**4)*(ETA**2)
      P(38)=2.*AXI*ETA-3.*(AXI**2)*(ETA**2)-2.*(AXI**3)*ETA+3.*(AXI**4)
     1*(ETA**2)-4.*AXI*(ETA**3)+5.*(AXI**2)*(ETA**4)+4.*(AXI**3)*(ETA**3
     2)-5.*(AXI**4)*(ETA**4)
      P(39)=-(AXI**4)+(AXI**6)-2.*(AXI**3)*ETA+3.*(AXI**4)*(ETA**2)
     1+2.*(AXI**5)*ETA-3.*(AXI**6)*(ETA**2)
      P(40)=4.*AXI*(ETA**3)-5.*(AXI**2)*(ETA**4)-4.*(AXI**3)*(ETA**3)
     1+5.*(AXI**4)*(ETA**4)-6.*AXI*(ETA**5)+7.*(AXI**2)*(ETA**6)+6.
     2*(AXI**5)*(ETA**5)-7.*(AXI**4)*(ETA**6)
      P(41)=-(AXI**6)+(AXI**8)-2.*(AXI**5)*ETA+3.*(AXI**6)*(ETA**2)+
     22.*(AXI**7)*ETA-3.*(AXI**8)*(ETA**2)
      RETURN
      END
$400082007013600320070249024025119636113001020O
**JOB 5
**FOR 5
*FAPDR1610
*LOISK
      SUBROUTINE KJ4
      DIMENSION P(50)
      COMMON C1,C2,C3,C4,C5,D2,D3,D4,D5,D6,D7,E2,E3,E4,E5,E6,E7,F1,
```

```
      1F8,F9,F4,F5,F6,F7,F8,F9,F10,S,C,TAN,SEC,AXI,ETA,I,J,P
       P(42)=2.*(AXI**5)*ETA-5.*(AXI**4)*(ETA**2)-2.*(AXI**5)*ETA+5.
      1*(AXI**3)*(ETA**2)-4.*(AXI**3)*(ETA**3)+5.*(AXI**4)*(ETA**4)
      2+4.*(AXI**5)*(ETA**3)-5.*(AXI**6)*(ETA**4)
       P(43)=1.-1.*AXI*ETA-(AXI**2)+2.*(AXI**3)*ETA-3.*(ETA**2)+4.*AXI
      1*(ETA**3)+5.*(AXI**2)*(ETA**2)-4.*(AXI**3)*(ETA**3)
       P(44)=3.*(ETA**2)-4.*AXI*(ETA**3)-3.*(AXI**2)*(ETA**2)+4.*(AXI
      1**3)*(ETA**3)-5.*(ETA**4)+6.*AXI*(ETA**5)+5.*(AXI**2)*(ETA**4)-6.
      2*(AXI**3)*(ETA**5)
       P(45)=(AXI**2)-2.*(AXI**3)*ETA-(AXI**4)+2.*(AXI**5)*ETA-3.*(AXI
      1**2)*(ETA**2)+4.*(AXI**3)*(ETA**3)+3.*(AXI**4)*(ETA**2)-4.*
      2(AXI**5)*(ETA**3)
       P(46)=3.*(ETA**4)-6.*AXI*(ETA**5)-5.*(AXI**2)*(ETA**4)+6.*(
      1AXI**3)*(ETA**5)-7.*(ETA**6)+8.*AXI*(ETA**7)+7.*(AXI**2)*(ETA**5)
      2-8.*(AXI**3)*(ETA**7)
       P(47)=(AXI**4)-2.*(AXI**5)*ETA-(AXI**6)+2.*(AXI**7)*ETA-3.*(
      1AXI**4)*(ETA**2)+4.*(AXI**5)*(ETA**3)+3.*(AXI**6)*(ETA**2)
      2-4.*(AXI**7)*(ETA**3)
       P(48)=3.*(AXI**2)*(ETA**2)-4.*(AXI**3)*(ETA**3)-3.*(AXI**4)*(ETA**
      12)+4.*(AXI**5)*(ETA**3)-5.*(AXI**2)*(ETA**4)+6.*(AXI**3)*(
      2ETA**5)+5.*(AXI**4)*(ETA**4)-6.*(AXI**5)*(ETA**5)
       RETURN
       END
****
```

```
5400032007013600320070249024025110636113001020C
*+JOB 5
*+ROKX5
*FORK1.10
C     EXPERIMENTAL  RESULTS  FOR  SKEWED  PLATE
  100 READ 10,SA,SB,SC
   10 FORMAT(3F10.5)
      PUNCH 11,SA,SB,SC
   11 FORMAT(4H SA=E16.8,4H SB=E16.8,4H SC=E16.8)
      E2=30000000.
      ANU=0.3333
      AMAXS=E2*((SA+SC)/(1.-ANU)+(1./(1.+ANU))*SQRTF((SA-SC)**2
     1+(2.*SB-(SA+SC))**2))
      AMINS=E2*((SA+SC)/(1.-ANU)-(1./(1.+ANU))*SQRTF((SA-SC)**2+
     1(2.*SB-(SA+SC))**2))
      TAUS=E2/(1.+ANU)*SQRTF((SA-SC)**2+(2.*SB-(SA+SC))**2)
      ANGLE=0.5*ATANF(2.*SB-(SA+SC)/(SA-SC))
      DEGRE=ANGLE/0.017453292
      PUNCH 13,AMAXS,AMINS,DEGRE
   13 FORMAT(7H AMAXS=E16.8,7H AMINS=E16.8,7H DEGRE=F10.5)
      GO TO 100
      END
****
```

APPENDIX B

EXPERIMENTAL DATA FOR LATERAL DEFLECTIONS AND UNIT STRAINS

Table 5. Lateral Deflection Results for Plate 1, Test 1.

(inches)

	p.s.i.	qb^4/Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	0.375	46.79	0.042	0.044	0.043	0.344
	0.5	62.40	0.057	-	0.057	0.456
	0.625	78.00	0.067	0.066	0.066	0.532
	0.750	93.6	0.084	0.090	0.087	0.696
	1.000	124.8	0.102	0.107	0.104	0.836
	1.250	156.0	0.117	0.121	0.119	0.952
	1.500	187.2	0.145	0.145	0.145	1.160
	1.750	218.4	0.159	0.160	0.160	1.276
	2.000	245.0	0.174	0.179	0.177	1.412
	2.250	280.8	0.194	0.191	0.193	1.549
	2.500	312.0	0.205	-	0.205	1.640
Dial Gauges Nos. 2 and 3	0.375	46.79	0.035	0.036	0.035	0.284
	0.500	62.4	0.049	-	0.049	0.392
	0.625	78.0	0.057	0.056	0.056	0.452
	0.750	93.6	0.074	0.076	0.075	0.600
	1.000	124.8	0.090	0.093	0.091	0.732
	1.250	156.0	0.103	0.105	0.104	0.832
	1.500	187.3	0.116	0.120	0.118	0.944
	1.750	218.4	0.130	0.131	0.131	1.044
	2.000	245.0	0.142	0.143	0.142	1.140
	2.250	280.8	0.156	0.154	0.155	1.240
	2.500	312.0	0.169	-	0.169	1.352
Dial Gauge No. 4	0.375	46.79	0.021	0.025	0.023	0.184
	0.500	62.4	0.029	-	0.029	0.232
	0.625	78.0	0.035	0.038	0.036	0.292
	0.750	93.6	0.046	0.051	0.049	0.388
	1.000	124.8	0.056	0.060	0.058	0.464
	1.250	156.0	0.065	0.072	0.068	0.548
	1.500	187.2	0.075	0.078	0.077	0.612
	1.750	218.4	0.083	0.087	0.085	0.680
	2.000	245.0	0.092	0.097	0.095	0.756
	2.250	280.8	0.101	0.101	0.101	0.808
	2.500	312.0	0.111	-	0.111	0.888

Table 6. Lateral Deflection Results for Plate 1, Test 2.

(inches)

	p.s.i.	qb^4/Dh	Loading	Unloading	Average	w/h
Dial Gaure No. 1	0.375	46.79	0.045	0.048	0.047	0.372
	0.500	62.4	- -	-	-	-
	0.625	78.0	0.064	0.071	0.067	0.54
	0.75	93.6	0.084	0.089	0.085	0.69
	1.000	124.8	0.101	0.107	0.104	0.832
	1.250	156.0	0.119	0.121	0.120	0.96
	1.500	187.2	0.141	0.147	0.144	1.152
	1.750	218.4	0.157	0.161	0.159	1.272
	2.000	245.0	0.177	0.177	0.177	1.416
	2.250	280.8	0.193	0.193	0.193	1.544
	2.500	312.0	0.206	-	0.206	1.648
Dial Gauges Nos. 2 and 3	0.375	46.79	0.037	0.039	0.038	0.304
	0.500	62.4	-	-	-	-
	0.625	78.0	0.055	0.059	0.057	0.456
	0.750	93.6	0.073	0.075	0.074	0.592
	1.000	124.8	0.089	0.091	0.090	0.720
	1.250	156.0	0.104	0.106	0.105	0.840
	1.500	187.2	0.116	0.120	0.118	0.944
	1.750	218.4	0.129	0.131	0.130	1.040
	2.000	245.0	0.143	0.143	0.143	1.144
	2.250	280.8	0.155	0.155	0.155	1.240
	2.500	312.0	0.165	-	0.165	1.320
Dial Gauge No. 4	0.375	46.79	0.023	0.026	0.024	0.196
	0.500	62.4	-	-	-	-
	0.625	78.0	0.035	0.036	0.036	0.284
	0.750	93.6	0.046	0.048	0.047	0.376
	1.000	124.8	0.056	0.061	0.059	0.468
	1.250	156.0	0.066	0.072	0.069	0.552
	1.500	187.2	0.076	0.081	0.079	0.628
	1.750	218.4	0.084	0.088	0.086	0.688
	2.000	245.0	0.092	0.096	0.094	0.752
	2.250	280.8	0.102	0.102	0.102	0.816
	2.500	312.0	0.109	-	0.109	0.872

Table 7. Lateral Deflection Results for Plate 1, Test 3.

(inches)

	p.s.i.	qb^4/Dh	Loading	Unloading	Average	w/h
Dial Gauge 1	0.625	78.0	0.065	0.079	0.072	0.576
	1.000	124.8	0.101	0.104	0.102	0.82
	1.500	187.3	0.143	0.145	0.144	1.152
	2.000	245.0	0.169	0.170	0.169	1.352
	2.500	312.0	0.204	-	0.204	1.632
Dial Gauges Nos. 2and3	0.625	78.0	0.056	0.057	0.057	0.452
	1.000	124.8	0.089	0.089	0.089	0.712
	1.500	187.2	0.117	0.117	0.117	0.936
	2.000	245.0	0.143	0.140	0.142	1.132
	2.500	312.0	0.164	0.162	0.163	1.304
Dial Gauge 1	0.625	78.0	0.034	0.037	0.036	0.284
	1.000	124.8	0.055	0.059	0.057	0.456
	1.500	187.2	0.075	0.080	0.078	0.620
	2.000	245.0	0.092	0.095	0.094	0.748
	2.500	312.0	0.108	0.107	0.108	0.860

Table 8. Lateral Deflection Results for Plate 2, Test 1.

(inches)

	Height of water (in.)	qb^4/Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	0.5	36.05	0.018	0.020	0.019	0.304
	1.0	72.10	0.036	0.039	0.038	0.60
	1.5	108.15	0.050	0.051	0.050	0.808
	2.0	144.20	0.060	0.064	0.062	0.992
	2.5	180.25	0.070	0.073	0.071	1.14
	3.0	216.30	0.078	0.083	0.080	1.28
	3.5	252.35	0.090	0.094	0.092	1.47
	4.0	288.41	0.096	0.099	0.98	1.56
Dial Gauges No.2 and 3	0.5	36.05	0.013	0.013	0.013	0.208
	1.0	72.10	0.021	0.022	0.021	0.344
	1.5	108.15	0.032	0.033	0.032	0.520
	2.0	144.2	0.036	0.039	0.038	0.608
	2.5	180.25	0.042	0.045	0.044	0.696
	3.0	216.3	0.044	0.051	0.048	0.760
	3.5	252.35	0.052	0.058	0.055	0.880
	4.0	288.41	0.055	0.057	0.056	0.896
Dial Gauge No. 4	0.5	36.05	0.006	0.005	0.006	0.088
	1.0	72.10	0.014	0.013	0.014	0.216
	1.5	108.15	0.020	0.021	0.020	0.328
	2.0	144.20	0.025	0.027	0.026	0.416
	2.5	180.25	0.029	0.034	0.032	0.504
	3.0	216.30	0.035	0.035	0.035	0.560
	3.5	252.35	0.042	0.041	0.041	0.664
	4.0	288.41	0.044	-	0.044	0.704

Table 9. Lateral Deflection Results for Plate 2, Test 2.

(inches)

	Height of water (in)	qb^4/Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	0.5	36.05	0.019	0.021	0.020	0.320
	1.00	72.10	0.029	0.035	0.032	0.512
	1.5	108.15	0.046	0.046	0.046	0.736
	2.0	144.20	0.061	0.062	0.062	0.984
	2.5	180.24	0.069	0.070	0.070	1.112
	3.0	216.30	0.082	0.084	0.083	1.328
	3.5	252.35	0.086	0.090	0.088	1.408
	4.0	288.41	0.096	0.102	0.099	1.584
Dial Gauges No. 2 and 3	0.5	36.05	0.014	0.010	0.012	0.184
	1.0	72.10	0.025	0.021	0.023	0.368
	1.5	108.15	0.030	0.032	0.031	0.496
	2.0	144.20	0.038	0.038	0.038	0.608
	2.5	180.25	0.043	0.045	0.044	0.704
	3.0	216.30	0.050	0.047	0.049	0.776
	3.5	252.35	0.058	0.056	0.057	0.912
	4.0	288.41	0.058	0.060	0.059	0.944
Dial Gauge No. 4	0.5	36.05	0.005	0.006	0.005	0.088
	1.0	72.10	0.011	0.013	0.012	0.192
	1.5	108.15	0.018	0.019	0.019	0.296
	2.0	144.20	0.023	0.023	0.023	0.368
	2.5	180.24	0.028	0.032	0.030	0.480
	3.0	216.30	0.031	0.033	0.032	0.512
	3.5	252.35	0.038	0.040	0.039	0.624
	4.0	288.41	0.041	0.042	0.042	0.664

Table 10. Lateral Deflection Results for Plate 2, Test 3.

(inches)

	Height of water(in.)	qb^4/Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	0.5	36.05	0.018	0.019	0.018	0.296
	1.00	72.10	0.033	0.034	0.034	0.536
	1.50	108.15	0.045	0.046	0.046	0.728
	2.00	144.20	0.061	0.062	0.062	0.984
	2.50	180.25	0.065	0.066	0.066	1.506
	3.0	216.30	0.075	0.076	0.076	1.208
	3.5	252.35	0.087	0.088	0.087	1.400
	4.0	288.41	0.096	0.097	0.097	1.544
Dial Gauges No. 2 and 3	0.5	36.05	0.013	0.014	0.014	0.216
	1.00	72.10	0.022	0.022	0.022	0.352
	1.50	108.15	0.030	0.031	0.031	0.488
	2.00	144.20	0.037	0.038	0.038	0.600
	2.50	180.25	0.044	0.044	0.044	0.704
	3.00	216.30	0.046	0.049	0.047	0.760
	3.50	252.35	0.053	0.057	0.055	0.880
	4.00	288.41	0.059	0.059	0.059	0.944
Dial Gauge No. 4	0.5	36.05	0.005	0.007	0.006	0.096
	1.0	72.10	0.013	0.013	0.013	0.208
	1.5	108.15	0.017	0.019	0.018	0.288
	2.0	144.20	0.025	0.025	0.025	0.400
	2.5	180.25	0.030	0.032	0.031	0.496
	3.0	216.30	0.034	0.033	0.034	0.536
	3.5	252.35	0.041	0.040	0.040	0.648
	4.0	288.41	0.043	0.044	0.044	0.696

Table 11. Lateral Deflection Results for Plate 3, Test 1.

(inches)

	Height of water (in)	qb^4 / Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	1.0	25.24	0.030	0.032	0.031	0.496
	2.0	50.49	0.051	0.051	0.051	0.816
	3.0	75.73	0.066	0.069	0.067	1.072
	4.0	100.98	0.079	0.080	0.079	1.264
	5.0	126.22	0.090	0.094	0.092	1.472
	6.0	151.46	0.099	0.101	0.100	1.600
	7.0	176.71	0.106	0.108	0.107	1.712
	8.0	201.95	0.112	-	0.112	1.792
Dial Gauges No. 2 and3	1.0	25.24	0.018	0.022	0.020	0.320
	2.0	50.49	0.030	0.034	0.032	0.512
	3.0	75.73	0.040	0.042	0.041	0.656
	4.0	100.98	0.048	0.049	0.048	0.768
	5.0	126.22	0.056	0.058	0.057	0.912
	6.0	151.46	0.060	0.061	0.061	0.976
	7.0	176.71	0.065	0.066	0.066	1.056
	8.0	201.95	0.069	-	0.069	1.104
Dial Gauge No. 4	1.0	25.24	0.012	0.012	0.012	0.192
	2.0	50.49	0.019	0.021	0.020	0.320
	3.0	75.73	0.024	0.027	0.026	0.416
	4.0	100.98	0.029	0.031	0.030	0.480
	5.0	126.22	0.034	0.034	0.034	0.544
	6.0	151.46	0.038	0.038	0.038	0.608
	7.0	176.71	0.040	0.040	0.040	0.640
	8.0	201.95	0.042	-	0.042	0.673

Table 12. Lateral Deflection Results for Plate 3, Test 2.

(inches)

Height of water (in.)		qb^4 / Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	1.0	25.244	0.028	0.032	0.030	0.48
	2.0	50.49	0.047	0.050	0.049	0.78
	3.0	75.73	0.062	0.066	0.064	1.024
	4.0	100.98	0.075	0.079	0.077	1.232
	5.0	126.22	0.089	0.089	0.089	1.424
	6.0	151.46	0.095	0.097	0.096	1.536
	7.0	176.71	0.103	0.106	0.104	1.664
	8.0	201.95	0.109	-	0.109	1.744
Dial Gauge No. 2	1.0	25.24	0.018	0.022	0.020	0.032
	2.0	50.49	0.032	0.031	0.031	0.496
	3.0	75.73	0.038	0.042	0.040	0.640
	4.0	100.98	0.045	0.051	0.048	0.768
	5.0	126.22	0.054	0.060	0.057	0.912
	6.0	151.46	0.059	0.061	0.060	0.960
	7.0	176.71	0.065	0.065	0.065	1.040
	8.0	201.95	0.068	-	0.068	1.088
Dial Gauge No. 3	1.0	25.24	0.019	0.022	0.020	0.320
	2.0	50.49	0.028	0.031	0.030	0.480
	3.0	75.73	0.037	0.041	0.039	0.624
	4.0	100.98	0.045	0.048	0.047	0.752
	5.0	126.22	0.052	0.054	0.053	0.848
	6.0	151.46	0.056	0.060	0.058	0.928
	7.0	176.71	0.062	0.063	0.062	0.992
	8.0	201.95	0.065	-	0.065	1.040

Table 13. Lateral Deflection Results for Plate 3, Test 3.

(inches)

	Height of water(in)	q_b^4/Eh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	1.0	25.24	0.028	0.033	0.030	0.48
	2.0	50.49	0.045	0.050	0.048	0.768
	3.0	75.73	0.059	0.063	0.061	0.976
	4.0	100.98	0.075	0.077	0.076	1.216
	5.0	126.22	0.088	0.090	0.089	1.424
	6.0	151.46	0.093	0.098	0.095	1.520
	7.0	176.71	0.100	0.103	0.102	1.632
	8.0	201.95	0.109	-	0.109	1.744
Dial Gauges No. 2 & 3	1.0	25.24	0.018	0.022	0.020	0.320
	2.0	50.49	0.028	0.033	0.030	0.480
	3.0	75.73	0.039	0.040	0.039	0.624
	4.0	100.98	0.046	0.053	0.049	0.784
	5.0	126.22	0.054	0.059	0.056	0.896
	6.0	151.46	0.059	0.061	0.060	0.960
	7.0	176.71	0.063	0.065	0.064	1.024
	8.0	201.95	0.068	-	0.068	1.088
Dial Gauge No. 4	1.0	25.24	0.009	0.013	0.011	0.176
	2.0	50.49	0.018	0.020	0.019	0.304
	3.0	75.73	0.022	0.027	0.024	0.384
	4,0	100.98	0.027	0.032	0.030	0.480
	5.0	126.22	0.030	0.036	0.033	0.528
	6.0	151.464	0.034	0.037	0.036	0.576
	7.0	176.71	0.038	0.040	0.039	0.624
	8.0	201.96	0.041	-	0.041	0.656

Table 14. Lateral Deflection Results for Plate 4, Test 1.
(inches)

	p.s.i.	qb^4 / Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	0.5	21.85	0.050	0.054	0.052	0.416
	1.0	43.69	0.086	0.091	0.088	0.704
	1.5	65.54	0.115	0.119	0.117	0.936
	2.0	87.38	0.147	0.153	0.150	1.200
	2.5	109.23	0.162	0.167	0.165	1.320
	3.0	131.08	0.182	0.187	0.184	1.472
	3.5	152.92	0.200	0.203	0.201	1.608
	4.0	174.77	0.208	0.214	0.211	1.688
	4.5	196.61	0.218	0.222	0.220	1.760
	5.0	218.46	0.228	0.233	0.231	1.848
	5.5	240.31	0.235	0.239	0.237	1.896
	6.0	262.15	0.243	-	0.243	1.944
Dial Gauges Nos. 2 and 3	0.5	21.85	0.027	0.029	0.028	0.232
	1.0	43.69	0.049	0.052	0.051	0.408
	1.5	65.54	0.069	0.071	0.070	0.056
	2.0	87.38	0.086	0.088	0.087	0.696
	2.5	109.23	0.099	0.102	0.100	0.800
	3.0	131.08	0.110	0.115	0.113	0.904
	3.5	152.92	0.121	0.125	0.123	0.984
	4.0	174.77	0.131	0.133	0.131	1.048
	4.5	196.61	0.132	0.139	0.136	1.008
	5.0	218.46	0.141	0.147	0.144	1.152
	5.5	240.31	0.147	0.151	0.149	1.192
	6.0	262.15	0.153	-	0.153	1.224
Dial Gauge No. 4	0.5	21.85	0.018	0.022	0.020	0.160
	1.0	43.69	0.037	0.039	0.038	0.304
	1.5	65.54	0.051	0.057	0.054	0.432
	2.0	87.38	0.064	0.068	0.066	0.528
	2.5	109.23	0.075	0.079	0.077	0.616
	3.0	131.08	0.089	0.089	0.089	0.712
	3.5	152.92	0.100	0.104	0.102	0.816
	4.0	174.77	0.108	0.110	0.109	0.872
	4.5	196.61	0.114	0.114	0.114	0.912
	5.0	218.46	0.122	0.122	0.122	0.976
	5.5	240.31	0.126	0.127	0.126	1.008
	6.0	262.15	0.131	-	0.131	1.048

Table 15. Lateral Deflection Results for Plate 4, Test 2.
(inches)

	p.s.i.	qb^4 / Dh	Loading	Unloading	Average	w/h
Dial Gauge No. 1	0.5	21.85	0.046	0.054	0.050	0.400
	1.0	43.69	0.086	0.083	0.085	0.681
	1.5	65.54	0.116	0.114	0.115	0.920
	2.0	87.38	0.145	0.149	0.147	1.180
	2.5	109.23	0.162	0.166	0.164	1.131
	3.0	131.08	0.180	0.185	0.182	1.460
	3.5	152.92	0.201	0.200	0.200	1.605
	4.0	174.77	0.216	0.210	0.208	1.660
	4.5	196.61	0.220	0.222	0.221	1.770
	5.0	218.46	0.230	0.231	0.230	1.830
	5.5	240.31	0.234	0.235	0.234	1.870
	6.0	262.15	0.243	-	0.243	1.940
Dial Gauges Nos. 2 and 3	0.5	21.85	0.026	0.029	0.027	0.216
	1.0	43.69	0.046	0.052	0.049	0.392
	1.5	65.54	0.068	0.071	0.069	0.551
	2.0	87.38	0.086	0.088	0.087	0.696
	2.5	109.23	0.098	0.098	0.098	0.784
	3.0	131.08	0.110	0.110	0.110	0.880
	3.5	152.92	0.119	0.123	0.121	0.969
	4.0	174.77	0.130	0.129	0.129	1.030
	4.5	196.61	0.130	0.138	0.134	1.070
	5.0	218.46	0.141	0.146	0.143	1.140
	5.5	240.31	0.148	0.149	0.148	1.180
	6.0	262.15	0.153	-	0.153	1.220
Dial Gauge No. 4	0.5	21.85	0.019	0.020	0.019	0.157
	1.0	43.69	0.037	0.038	0.037	0.296
	1.5	65.54	0.054	0.054	0.054	0.432
	2.0	87.38	0.065	0.067	0.066	0.528
	2.5	109.23	0.077	0.077	0.077	0.616
	3.0	131.08	0.092	0.089	0.090	0.671
	3.5	152.92	0.101	0.101	0.101	0.810
	4.0	174.77	0.109	0.107	0.108	0.865
	4.5	196.61	0.113	0.114	0.114	0.912
	5.0	218.46	0.122	0.122	0.122	0.977
	5.5	240.31	0.126	0.126	0.126	1.010
	6.0	262.15	0.131	-	0.131	1.040

Table 16. Lateral Deflection Results for Plate 4, Test 3.
(inches)

	p.s.i.	q_b^4 / D_h	Loading	Unloading	Average	w/h
Dial Gauge No. 1	0.5	21.85	0.049	0.055	0.052	0.416
	1.0	43.69	0.083	0.091	0.087	0.696
	1.5	65.54	0.113	0.123	0.118	0.944
	2.0	87.38	0.140	0.150	0.145	1.160
	2.5	109.23	0.160	0.166	0.163	1.310
	3.0	131.08	0.178	0.186	0.182	1.450
	3.5	152.92	0.195	0.205	0.200	1.600
	4.0	174.77	0.206	0.216	0.211	1.690
	4.5	196.61	0.215	0.225	0.220	1.760
	5.0	218.46	0.229	0.231	0.230	1.840
	5.5	240.31	0.232	0.242	0.237	1.890
	6.0	262.15	0.243	-	0.243	1.940
Dial Gauges No. 2 and 3	0.5	21.85	0.026	0.032	0.029	0.232
	1.0	43.69	0.049	0.053	0.051	0.408
	1.5	65.54	0.068	0.072	0.070	0.560
	2.0	87.38	0.085	0.089	0.087	0.696
	2.5	109.23	0.097	0.101	0.099	0.791
	3.0	131.08	0.112	0.114	0.113	0.903
	3.5	152.92	0.120	0.126	0.123	0.983
	4.0	174.77	0.125	0.137	0.131	1.040
	4.5	196.61	0.133	0.139	0.136	1.090
	5.0	218.46	0.140	0.148	0.144	1.150
	5.5	240.31	0.146	0.152	0.149	1.190
	6.0	262.15	0.153	-	0.153	1.220
Dial Gauge No. 4	0.5	21.85	0.017	0.023	0.020	0.160
	1.0	43.69	0.034	0.037	0.036	0.296
	1.5	65.54	0.050	0.056	0.053	0.424
	2.0	87.38	0.063	0.069	0.066	0.527
	2.5	109.23	0.075	0.077	0.076	0.615
	3.0	131.08	0.086	0.092	0.089	0.712
	3.5	152.92	0.099	0.104	0.101	0.808
	4.0	174.77	0.110	0.108	0.109	0.863
	4.5	196.61	0.111	0.117	0.114	0.911
	5.0	218.46	0.120	0.124	0.122	0.975
	5.5	240.31	0.1[illegible]	0.128	0.126	1.010
	6.0	262.15	0.131	-	0.131	1.040

Table 17. Lateral Deflection Results for Plate 3, Yield Test.

(inches)

Dial Gauge No. 1

p.s.i.	q_b^4/Dh	Deflection	w/h
1.0	699	0.217	3.48
1.5	1047	0.235	3.76
2.0	1400	0.248	3.97
2.5	1750	0.275	4.40
3.0	2100	0.285	4.57
3.5	2450	0.292	4.67
4.0	2800	0.312	5.00
4.5	3150	0.330	5.28
5.0	3500	0.346	5.54
5.5	3850	0.365	5.84
6.0	4200	0.380	6.09
7.0	4900	0.395	6.32
7.5	5200	0.415	6.65
8.0	5600	0.440	7.05
9.0	6300	0.470	7.52
10.0	7000	0.500	8.00

Table 18. Lateral Deflection Results for Plate 4, Yield Test.

(inches)

Dial Gauge No. 1

p.s.i.	qb^4 / Dh	Deflection	w/h
10	436.92	0.275	2.20
15	655.38	0.345	2.76
20	873.84	0.412	3.29
25	1092.3	0.47	3.76
30	1280.76	0.535	4.28
35	1499.22	0.585	4.68
40	1747.68	0.645	5.16
45	1966.14	0.690	5.52
50	2183.60	0.775	6.20
55	2402.06	0.815	6.52
60	2621.52	0.865	6.92
65	2839.98	0.912	7.29
70	3058.44	0.945	7.56
75	3276.90	1.025	8.20
80	3495.36	1.056	8.43
85	3713.82	1.085	8.68
90	3932.28	1.125	9.00
95	4150.74	1.195	9.55

EXPERIMENTAL DATA

FROM DIGITAL STRAIN INDICATOR

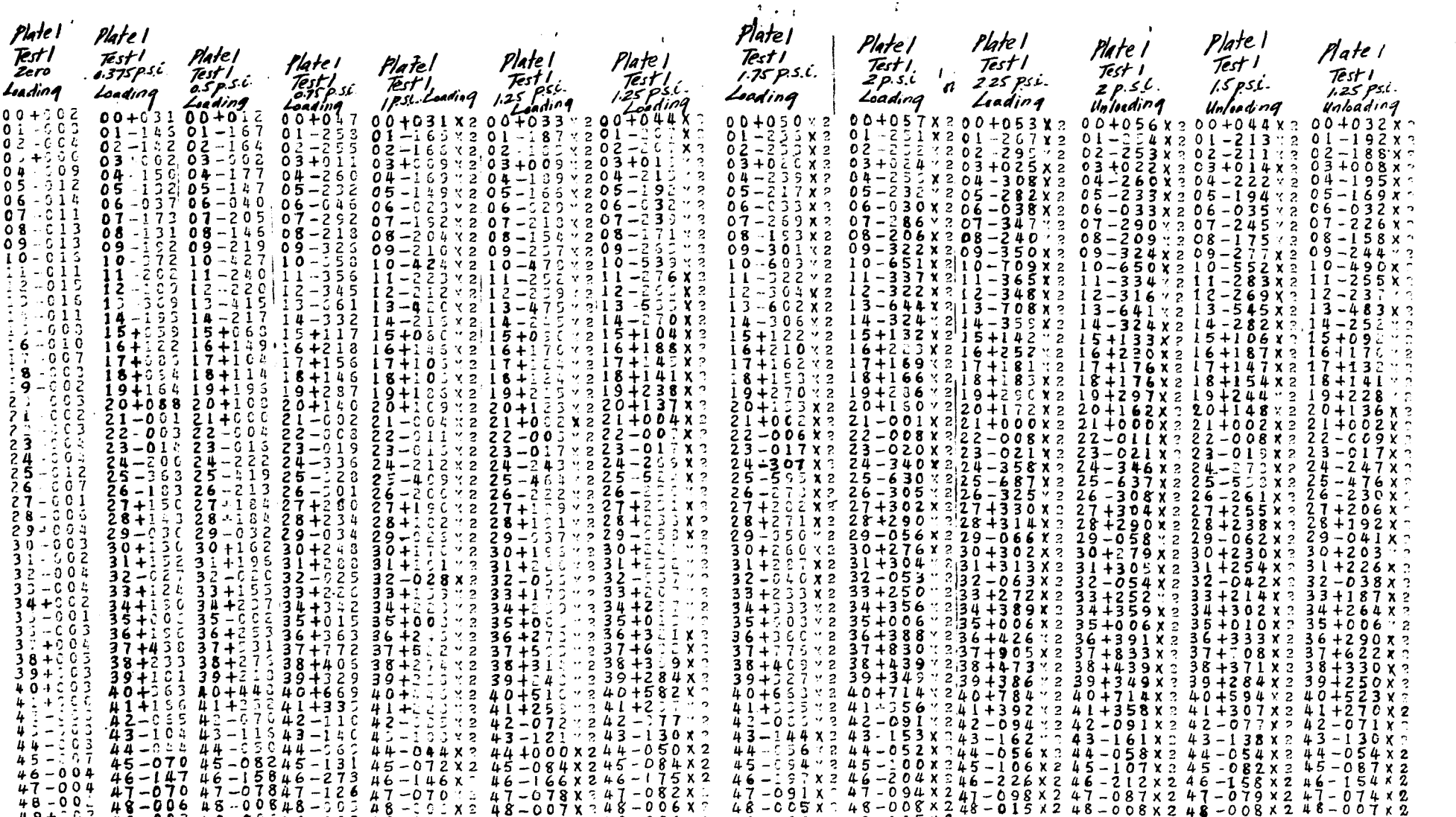


Plate 1 Test 1 Zero Loading
Plate 1 Test 1 0.375 p.s.i. Loading
Plate 1 Test 1 0.5 p.s.i. Loading
Plate 1 Test 1 0.75 p.s.i. Loading
Plate 1 Test 1 1 p.s.i. Loading
Plate 1 Test 1 1.25 p.s.i. Loading
Plate 1 Test 1 1.25 p.s.i. Loading
Plate 1 Test 1 1.75 p.s.i. Loading
Plate 1 Test 1 2 p.s.i Loading
Plate 1 Test 1 2.25 p.s.i. Loading
Plate 1 Test 1 2 p.s.i. Unloading
Plate 1 Test 1 1.5 p.s.i. Unloading
Plate 1 Test 1 1.25 p.s.i. Unloading

Plate 1
Test 1
1 p.s.i.
Unloading

00	+031	x	2
01	-166	x	2
02	-169	x	2
03	+008	x	2
04	-172	x	2
05	-151	x	2
06	-029	x	2
07	-194	x	2
08	-207	x	2
09	-215	x	2
10	-434	x	2
11	-227	x	2
12	-220	x	2
13	-434	x	2
14	-223	x	2
15	+080	x	2
16	+143	x	2
17	+108	x	2
18	+111	x	2
19	+187	x	2
20	+111	x	2
21	-004	x	2
22	-010	x	2
23	-016	x	2
24	-213	x	2
25	-410	x	2
26	-198	x	2
27	+192	x	2
28	+182	x	2
29	-	x	2
30	+	x	2
31	+192	x	2
32	-029	x	2
33	+160	x	2
34	+230	x	2
35	+008	x	2
36	+253	x	2
37	+532	x	2
38	+278	x	2
39	+230	x	2
40	+463	x	2
41	+234	x	2
42	-086	x	2
43	-11	x	2
44	-04	x	2
45	-071	x	2
46	-15	x	2
47	-	x	2
48	-	x	2
49	-007	x	2
50	00	x	2
51	+	x	2
52	+5	x	2
53	12	x	2

Plate 1
Test 1
0.75 p.s.i.
Unloading

00	+048	
01	-263	
02	-260	
03	+009	
04	-265	
05	-232	
06	-051	
07	-302	
08	-221	
09	-334	
10	-669	
11	-358	
12	-336	
13	-666	
14	-344	
15	+126	
16	+220	
17	+163	
18	+182	
19	+318	
20	+176	
21	+001	
22	-008	
23	-017	
24	-344	
25	-655	
26	-322	
27	+299	
28	+355	
29	-026	
30	+266	
31	+203	
32	-029	
33	+245	
34	+255	
35	+014	
36	+377	
37	+818	
38	+422	
39	+331	
40	+693	
41	+355	
42	-107	
43	-154	
44	-071	
45	-130	
46	-	
47	-	
48	-	
49	-004	
50	01	
51	+	
52	+7	
53	+14	

Plate 1
Test 1
0.5 p.s.i.
Unloading

00	+010	
01	-176	
02	-168	
03	-006	
04	-185	
05	-149	
06	-044	
07	-216	
08	-151	
09	-228	
10	-441	
11	-243	
12	-212	
13	-424	
14	-231	
15	+073	
16	+154	
17	+116	
18	+146	
19	+223	
20	+147	
21	-000	
22	-009	
23	-031	
24	-231	
25	-447	
26	-233	
27	+198	
28	+184	
29	-033	
30	+171	
31	+203	
32	-026	
33	+167	
34	+243	
35	-006	
36	+2	
37	+2	
38	+2	
39	+2	
40	+4	
41	+2	
42	-0	
43	-13	
44	-0	
45	-0	
46	-1	
47	-	
48	-	
49	-01	
50	-0	
51	+	
52	+	
53	+	

Plate 1
Test 1
0.375 p.s.i.
Unloading

00	+029	
01	-153	
02	-147	
03	+000	
04	-158	
05	-136	
06	-040	
07	-181	
08	-154	
09	-207	
10	-405	
11	-222	
12	-214	
13	-429	
14	-233	
15	+055	
16	+115	
17	+088	
18	+086	
19	+164	
20	+091	
21	-007	
22	-007	
23	-012	
24	-226	
25	-367	
26	-179	
27	+147	
28	+194	
29	-033	
30	+131	
31	+152	
32	-028	
33	+126	
34	+194	
35	+000	
36	+255	
37	+445	
38	+225	
39	+227	
40	+422	
41	+207	
42	-064	
43	-107	
44	-064	
45	-064	
46	-251	
47	-077	
48	-008	
49	-012	
50	-012	
51	+1	
52	+4	
53	+2	

Plate 1
Test 1
Zero
Unloading

00	+000	
01	-010	
02	-004	
03	-000	
04	-009	
05	-010	
06	-012	
07	-010	
08	-012	
09	-012	
10	-012	
11	-014	
12	-015	
13	-015	
14	-003	
15	-011	
16	-011	
17	-006	
18	-006	
19	-002	
20	-002	
21	-002	
22	-002	
23	-003	
24	-007	
25	-012	
26	-007	
27	-002	
28	-004	
29	-003	
30	-002	
31	-002	
32	-004	
33	-006	
34	-000	
35	-000	
36	-001	
37	-004	
38	-003	
39	-002	
40	-006	
41	-003	
42	-003	
43	-006	
44	-003	
45	-003	
46	-004	
47	-002	
48	-002	
49	-001	
50	-000	
51	-	
52	-	
53	-	

Plate 1
Test 2
Zero
Loading

00	+000	
01	-007	
02	-004	
03	-002	
04	-009	
05	-010	
06	-014	
07	-010	
08	-012	
09	-012	
10	-013	
11	-012	
12	-014	
13	-015	
14	-008	
15	-011	
16	-011	
17	-006	
18	-006	
19	-002	
20	-002	
21	-002	
22	-002	
23	-003	
24	-007	
25	-012	
26	-007	
27	-002	
28	-004	
29	-003	
30	-002	
31	-002	
32	-004	
33	-006	
34	-000	
35	-000	
36	-001	
37	-004	
38	-003	
39	-002	
40	-006	
41	-003	
42	-003	
43	-006	
44	-003	
45	-003	
46	-004	
47	-002	
48	-002	
49	-001	
50	-000	
51	-	
52	-	
53	-	

Plate 1
Test 2
0.375 p.s.i.
Loading

00	+028	
01	-148	
02	-143	
03	+002	
04	-152	
05	-133	
06	-038	
07	-174	
08	-131	
09	-192	
10	-378	
11	-207	
12	-194	
13	-376	
14	-195	
15	+056	
16	+115	
17	+003	
18	+009	
19	+165	
20	+088	
21	-000	
22	-000	
23	-014	
24	-200	
25	-369	
26	-184	
27	+148	
28	+148	
29	-032	
30	+130	
31	+152	
32	-028	
33	+122	
34	+190	
35	+005	
36	+196	
37	+332	
38	+232	
39	+180	
40	+362	
41	+186	
42	-064	
43	-104	
44	-045	
45	-073	
46	-148	
47	-070	
48	-008	
49	-002	
50	-017	
51	+198	
52	+026	
53	+032	

Plate 1
Test 2
0.5 p.s.i.
Loading

00	+012	
01	-168	
02	-165	
03	-002	
04	-178	
05	-147	
06	-037	
07	-206	
08	-146	
09	-220	
10	-430	
11	-240	
12	-218	
13	-417	
14	-216	
15	+068	
16	+146	
17	+104	
18	+113	
19	+197	
20	+108	
21	-001	
22	-005	
23	-014	
24	-222	
25	-417	
26	-213	
27	+184	
28	+181	
29	-032	
30	+162	
31	+196	
32	-019	
33	+156	
34	+237	
35	-003	
36	+253	
37	+530	
38	+279	
39	+217	
40	+447	
41	+232	
42	-070	
43	-117	
44	-050	
45	-081	
46	-158	
47	-079	
48	-007	
49	-007	
50	-016	
51	+251	
52	+107	
53	+279	

Plate 1
Test 2
0.75 p.s.i.
Loading

00	+046	
01	-257	
02	-257	
03	+011	
04	-259	
05	-231	
06	-046	
07	-292	
08	-217	
09	-325	
10	-658	
11	-356	
12	-344	
13	-657	
14	-332	
15	+122	
16	+218	
17	+156	
18	+147	
19	+290	
20	+141	
21	+000	
22	-009	
23	-020	
24	-336	
25	-628	
26	-300	
27	+280	
28	+233	
29	-033	
30	+243	
31	+287	
32	-025	
33	+226	
34	+343	
35	+015	
36	+364	
37	+772	
38	+406	
39	+330	
40	+668	
41	+336	
42	-110	
43	-138	
44	-067	
45	-131	
46	-273	
47	-126	
48	-005	
49	-003	
50	-015	
51	+361	
52	+715	
53	+385	

Plate 1
Test 2
1 p.s.i.
Loading

00	+033	x	2
01	-164	x	2
02	-155	x	2
03	+009	x	2
04	-168	x	2
05	-149	x	2
06	-028	x	2
07	-190	x	2
08	-205	x	2
09	-210	x	2
10	-424	x	2
11	-223	x	2
12	-214	x	2
13	-420	x	2
14	-215	x	2
15	+080	x	2
16	+142	x	2
17	+105	x	2
18	+107	x	2
19	+184	x	2
20	+103	x	2
21	-004	x	2
22	-010	x	2
23	-017	x	2
24	-212	x	2
25	-410	x	2
26	-200	x	2
27	+190	x	2
28	+180	x	2
29	-026	x	2
30	+171	x	2
31	+191	x	2
32	-028	x	2
33	+159	x	2
34	+228	x	2
35	+008	x	2
36	+247	x	2
37	+523	x	2
38	+217	x	2
39	+246	x	2
40	+446	x	2
41	+228	x	2
42	-085	x	2
43	-109	x	2
44	-043	x	2
45	-072	x	2
46	-146	x	2
47	-070	x	2
48	-006	x	2
49	-006	x	2
50	-003	x	2
51	+247	x	2
52	+498	x	2
53	+275	x	2

Plate 1
Test 2
1.25 p.s.i.
Loading

00	+034	x	2
01	-100	x	2
02	-084	x	2
03	+	x	2
04	-	x	2
05	-	x	2
06	-02	x	2
07	-	x	2
08	-	x	2
09	-	x	2
10	-	x	2
11	-	x	2
12	-	x	2
13	-	x	2
14	-	x	2
15	+	x	2
16	+	x	2
17	+	x	2
18	+	x	2
19	+	x	2
20	+	x	2
21	+	x	2
22	-	x	2
23	-	x	2
24	-	x	2
25	-	x	2
26	-	x	2
27	+	x	2
28	+	x	2
29	-	x	2
30	+	x	2
31	+	x	2
32	-	x	2
33	+	x	2
34	+	x	2
35	+	x	2
36	+	x	2
37	+	x	2
38	+	x	2
39	+	x	2
40	+	x	2
41	+	x	2
42	-	x	2
43	-	x	2
44	-	x	2
45	-	x	2
46	-	x	2
47	-	x	2
48	-	x	2
49	-	x	2
50	-	x	2
51	+	x	2
52	+	x	2
53	+	x	2

Plate 1
Test 2
1.5 p.s.i.
Loading

00	+044	x	2
01	-	x	2
02	-	x	2
03	+	x	2
04	-	x	2
05	-	x	2
06	-03	x	2
07	-	x	2
08	-	x	2
09	-	x	2
10	-	x	2
11	-	x	2
12	-	x	2
13	-	x	2
14	-	x	2
15	+	x	2
16	+	x	2
17	+	x	2
18	+	x	2
19	+	x	2
20	+	x	2
21	+	x	2
22	-	x	2
23	-	x	2
24	-	x	2
25	-	x	2
26	-	x	2
27	+	x	2
28	+	x	2
29	-	x	2
30	+	x	2
31	+	x	2
32	-	x	2
33	+	x	2
34	+	x	2
35	+	x	2
36	+	x	2
37	+	x	2
38	+	x	2
39	+	x	2
40	+	x	2
41	+	x	2
42	-	x	2
43	-	x	2
44	-	x	2
45	-	x	2
46	-	x	2
47	-	x	2
48	-	x	2
49	-	x	2
50	-	x	2
51	+	x	2
52	+	x	2
53	+	x	2

Plate 1
Test 2
1.75 psi.
Loading

00	+0		2
01	-		2
02	-		2
03	+		2
04	-		2
05	-		2
06	-		2
07	-		2
08	-		2
09	-		2
10	-		2
11	-		2
12	-		2
13	-		2
14	-		2
15	+		2
16	+		2
17	+		2
18	+		2
19	+		2
20	+		2
21	+		2
22	-		2
23	-		2
24	-		2
25	-		2
26	-		2
27	+		2
28	+		2
29	-		2
30	+		2
31	+		2
32	-		2
33	+		2
34	+		2
35	+		2
36	+		2
37	+		2
38	+		2
39	-		2
40	+		2
41	+		2
42	-		2
43	-		2
44	-		2
45	-		2
46	-		2
47	-		2
48	-		2
49	-		2
50	-		2
51	+		2
52	+		2
53	+		2

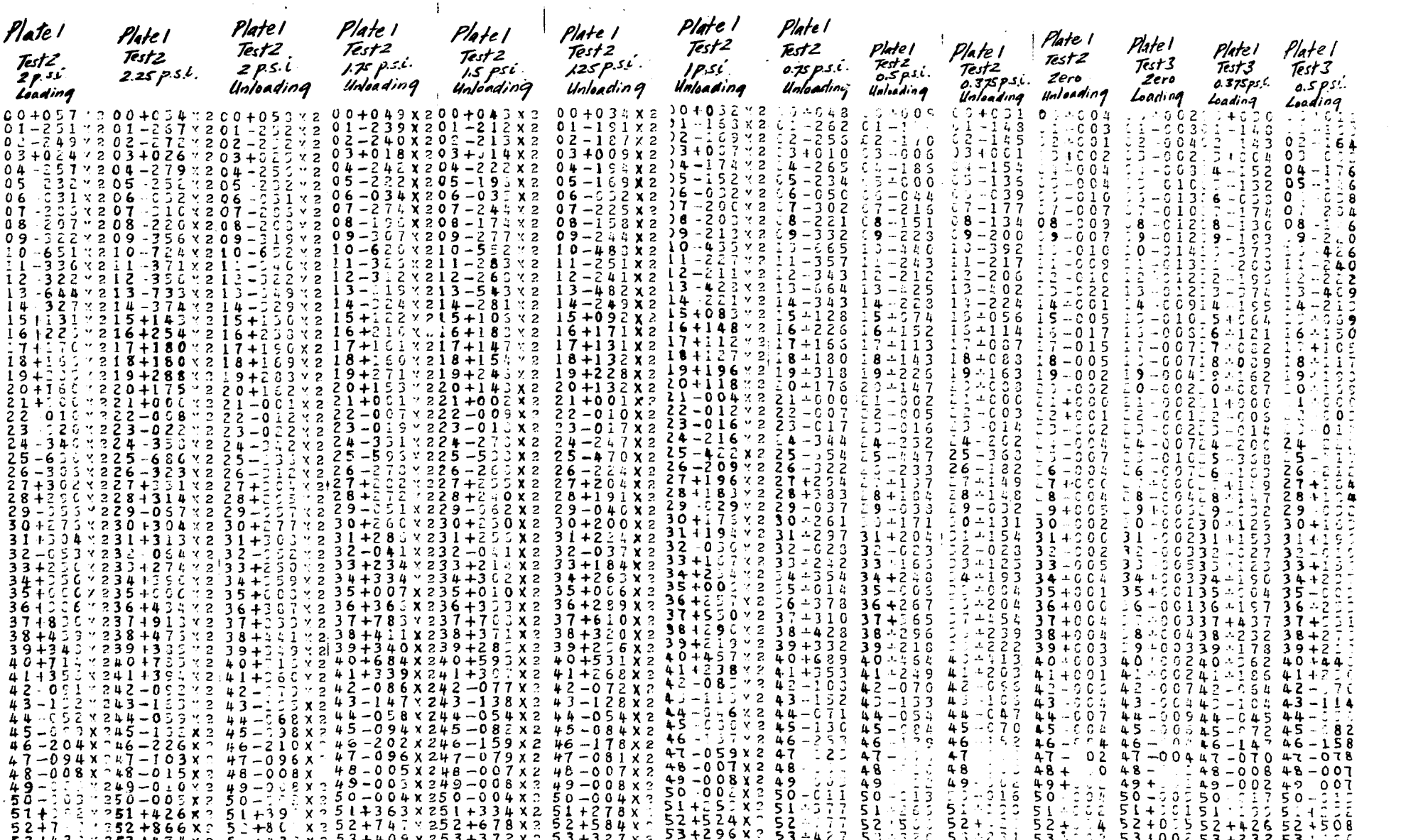


Plate 1
Test 2
2 p.s.i.
Loading
Plate 1
Test 2
2.25 p.s.i.
Plate 1
Test 2
2 p.s.i
Unloading
Plate 1
Test 2
1.75 p.s.i.
Unloading
Plate 1
Test 2
1.5 psi
Unloading
Plate 1
Test 2
1.25 p.s.i.
Unloading
Plate 1
Test 2
1 p.s.i.
Unloading
Plate 1
Test 2
0.75 p.s.i.
Unloading
Plate 1
Test 2
0.5 p.s.i.
Unloading
Plate 1
Test 2
0.375 p.s.i.
Unloading
Plate 1
Test 2
Zero
Unloading
Plate 1
Test 3
Zero
Loading
Plate 1
Test 3
0.375 ps.i.
Loading
Plate 1
Test 3
0.5 psi.
Loading

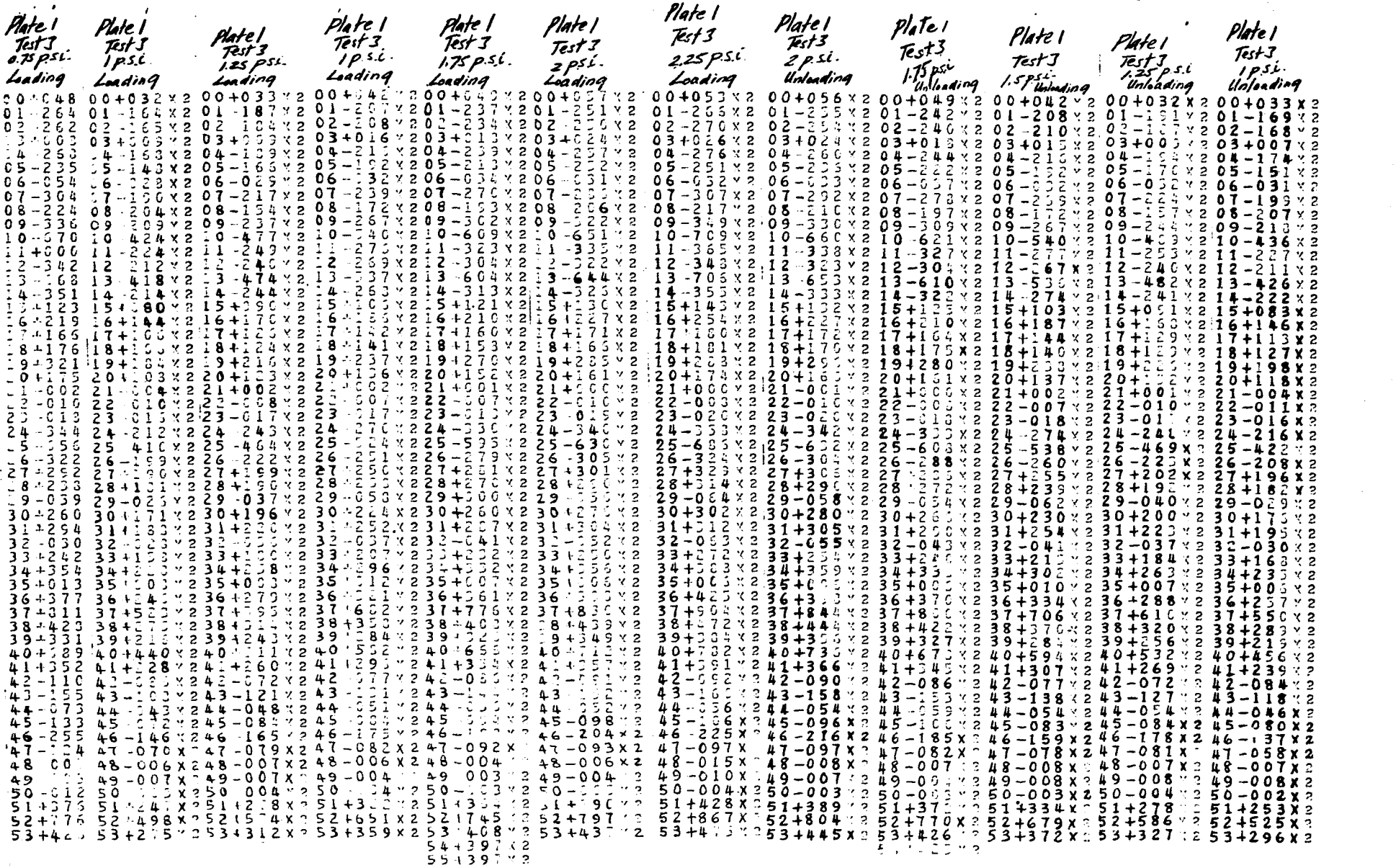


Plate 1
Test 3
0.75 p.s.i.
Loading
Plate 1
Test 3
1 p.s.i.
Loading
Plate 1
Test 3
1.25 p.s.i.
Loading
Plate 1
Test 3
1 p.s.i.
Loading
Plate 1
Test 3
1.75 p.s.i.
Loading
Plate 1
Test 3
2 p.s.i.
Loading
Plate 1
Test 3
2.25 p.s.i.
Loading
Plate 1
Test 3
2 p.s.i.
Unloading
Plate 1
Test 3
1.75 p.s.i.
Unloading
Plate 1
Test 3
1.5 p.s.i.
Unloading
Plate 1
Test 3
1.25 p.s.i.
Unloading
Plate 1
Test 3
1 p.s.i.
Unloading

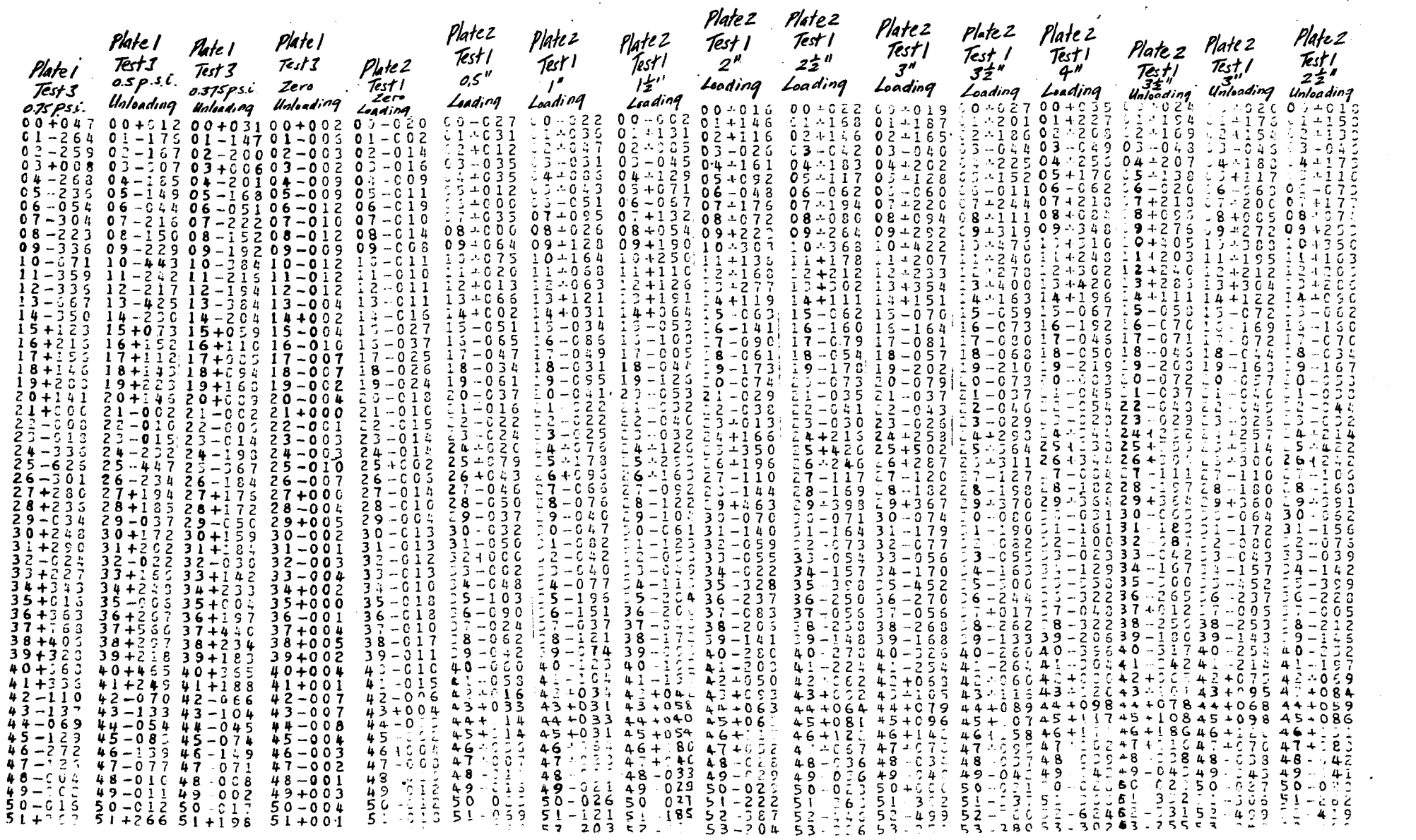


Plate 1 Test 3 0.75 p.s.i.
Plate 1 Test 3 0.5 p.s.i. Unloading
Plate 1 Test 3 0.375 p.s.i. Unloading
Plate 1 Test 3 Zero Unloading
Plate 2 Test 1 Zero Loading
Plate 2 Test 1 0.5" Loading
Plate 2 Test 1 1" Loading
Plate 2 Test 1 1½" Loading
Plate 2 Test 1 2" Loading
Plate 2 Test 1 2½" Loading
Plate 2 Test 1 3" Loading
Plate 2 Test 1 3½" Loading
Plate 2 Test 1 4" Loading
Plate 2 Test 1 3½" Unloading
Plate 2 Test 1 3" Unloading
Plate 2 Test 1 2½" Unloading

Plate 2 Test 1 2" Unloading	Plate 2 Test 1 1½" Unloading	Plate 2 Test 1 1" Unloading	Plate 2 Test 1 0.5" Unloading	Plate 2 Test 1 0" Unloading	Plate 2 Test 2 Zero Loading	Plate 2 Test 2 0.5" Loading	Plate 2 Test 2 1" Loading	Plate 2 Test 2 1½" Loading	Plate 2 Test 2 2" Loading	Plate 2 Test 2 2½" Loading	Plate 2 Test 2 3" Loading	Plate 2 Test 2 3½" Loading	Plate 2 Test 2 4" Loading	Plate 2 Test 2 3½" Unloading	Plate 2 Test 2 3" Unloading
00 +016	00 −007	00 −020	00 +000	00 −013	00 −020	00 −028	00 −021	00 −003	00 +016	00 +018	00 +020	00 +026	00 +034	00 +026	00 +021
01 +141	01 +127	01 −037	01 +032	01 −004	01 −002	01 +032	01 +038	01 +130	01 +146	01 +167	01 +187	01 +202	01 +228	01 +176	01 +174
02 +115	02 +086	02 +046	02 +011	02 −010	02 −012	02 +012	02 +040	02 +065	02 +118	02 +146	02 +164	02 +185	02 +211	02 +155	02 +154
03 −029	03 −046	03 −031	03 −033	03 −012	03 −016	03 −034	03 −032	03 −045	03 −024	03 −043	03 −041	03 −043	03 −052	03 −046	03 −046
04 +156	04 +129	04 +085	04 +035	04 −004	04 −008	04 +034	04 +086	04 +130	04 +161	04 +183	04 +204	04 +228	04 +253	04 +214	04 +187
05 +069	05 +070	05 +042	05 +012	05 −010	05 −011	05 +012	05 +042	05 +070	05 +091	05 +117	05 +130	05 +152	05 +163	05 +145	05 +110
06 −052	06 −063	06 −051	06 +000	06 −013	06 −018	06 −048	06 −050	06 −068	06 −043	06 −062	06 −060	06 −070	06 −059	06 −013	06 −069
07 +169	07 +132	07 +094	07 +034	07 −004	07 −008	07 +036	07 −095	07 +132	07 +177	07 +193	07 +222	07 +246	07 +260	07 +220	07 +202
08 +068	08 +053	08 +026	08 +000	08 −011	08 −014	08 +002	08 −027	08 +054	08 +071	08 +080	08 +096	08 +111	08 +119	08 +103	08 +064
09 +212	09 +188	09 +128	09 +065	09 −002	09 −007	09 +066	09 +130	09 +190	09 +223	09 +264	09 +293	09 +318	09 +333	09 +296	09 +272
10 +238	10 +242	10 +164	10 +079	10 +000	10 −010	10 +080	10 +163	10 +246	10 +307	10 +370	10 +426	10 +473	10 +493	10 +441	10 +390
11 +126	11 +106	11 +064	11 +019	11 −010	11 −010	11 +021	11 +066	11 +110	11 +134	11 +174	11 +206	11 +242	11 +248	11 +255	11 +192
12 +159	12 +119	12 +071	12 +016	12 −011	12 −011	12 +017	12 +070	12 +122	12 +168	12 +203	12 +238	12 +280	12 +286	12 +255	12 +213
13 +115	13 +169	13 +058	13 +011	13 −005	13 −008	13 +062	13 +120	13 +190	13 +272	13 +301	13 +357	13 +402	13 +403	13 +376	13 +301
14 +036	14 +054	14 +011	14 −000	14 −012	14 −016	14 +006	14 +033	14 +060	14 +106	14 +113	14 +168	14 +184	14 +202	14 +159	14 +126
15 −037	15 −054	15 −052	15 −012	15 −021	15 −026	15 −048	15 −034	15 −054	15 −066	15 −065	15 −060	15 −060	15 −069	15 −037	15 −009
16 −086	16 −102	16 −066	16 −027	16 −016	16 −029	16 −062	16 −084	16 −108	16 −142	16 −160	16 −160	16 −074	16 −193	16 −097	16 −063
17 −046	17 −003	17 −048	17 −009	17 −017	17 −026	17 −047	17 −046	17 −096	17 −090	17 −080	17 −082	17 −085	17 −097	17 −077	17 −074
18 −032	18 −044	18 −036	18 −009	18 −013	18 −024	18 −032	18 −032	18 −063	18 −063	18 −051	18 −058	18 −070	18 −075	18 −071	18 −044
19 −095	19 −128	19 −060	19 −024	19 −019	19 −024	19 −059	19 −095	19 −127	19 −173	19 −177	19 −202	19 −224	19 −242	19 −203	19 −176
20 −039	20 −052	20 −036	20 −017	20 −017	20 −017	20 −038	20 −041	20 −058	20 −074	20 −072	20 −079	20 −090	20 −085	20 −073	20 −059
21 −022	21 −034	21 −017	21 −011	21 −010	21 −011	21 −016	21 −022	21 −034	21 −029	21 −034	21 −036	21 −044	21 −044	21 −033	21 −030
22 −042	22 −042	22 −022	22 −009	22 −012	22 −015	22 −020	22 −023	22 −039	22 −033	22 −041	22 −044	22 −045	22 −051	22 −047	22 −035
23 −016	23 −034	23 −024	23 −014	23 −013	23 −015	23 −021	23 −025	23 −041	23 −032	23 −032	23 −027	23 −029	23 −029	23 −029	23 −025
24 +115	24 +124	24 +076	24 +022	24 −012	24 −014	24 +021	24 +076	24 +126	24 +166	24 +216	24 +259	24 +293	24 +326	24 +333	24 +276
25 +433	25 +290	25 +178	25 +080	25 +000	25 +001	25 +080	25 +179	25 +294	25 +350	25 +424	25 +502	25 +564	25 +636	25 +564	25 +514
26 +196	26 +161	26 +096	26 +043	26 −007	26 −008	26 −044	26 −096	26 +168	26 +196	26 +245	26 +287	26 +311	26 +352	26 +352	26 +300
27 −102	27 −092	27 −066	27 −045	27 −014	27 −014	27 −047	27 −066	27 −092	27 −110	27 −117	27 −120	27 −127	27 −134	27 −120	27 −110
28 −142	28 −122	28 −074	28 −039	28 −010	28 −009	28 −049	28 −074	28 −122	28 −144	28 −169	28 −182	28 −199	28 −220	28 −188	28 −166
29 +459	29 −104	29 −038	29 −039	29 −006	29 −006	29 −037	29 −047	29 −104	29 +463	29 +398	29 +367	29 +371	29 +382	29 +364	29 +360
30 −064	30 −062	30 −046	30 −032	30 −012	30 −012	30 −032	30 −040	30 −060	30 −070	30 −071	30 −074	30 −080	30 −076	30 −064	30 −064
31 −136	31 −123	31 −081	31 −050	31 −011	31 −011	31 −052	31 −082	31 −128	31 −139	31 −163	31 −178	31 −190	31 −200	31 −171	31 −171
32 −061	32 −053	32 −043	32 +000	32 −011	32 −012	32 +001	32 −043	32 −058	32 −055	32 −072	32 −077	32 −082	32 −095	32 −080	32 −080
33 −048	33 −043	33 −038	33 −002	33 −013	33 −012	33 −027	33 −038	33 −048	33 −055	33 −054	33 −056	33 −058	33 −059	33 −064	33 −049
34 −015	34 −018	34 −007	34 −007	34 −012	34 −012	34 −047	34 −077	34 −118	34 −022	34 −156	34 −171	34 −180	34 −198	34 −192	34 −157
35 −329	35 −204	35 −196	35 −102	35 −015	35 −017	35 −102	35 −197	35 −284	35 −329	35 −393	35 −451	35 −498	35 +000	35 −452	35 −423
36 −212	36 −194	36 −150	36 −090	37 −010	36 −019	36 −090	36 −151	36 −200	36 −238	36 −251	36 −271	36 −295	36 −298	36 −233	36 −215
37 −056	37 −043	37 −037	37 −023	38 −016	38 −017	37 −025	37 −037	37 −048	37 −082	37 −057	37 −056	38 −058	37 −060	37 −055	37 −053
38 −196	38 −170	38 −120	38 −062	39 −011	39 −011	38 −062	38 −121	38 −174	38 −206	38 −238	38 −268	38 −295	38 −300	38 −253	38 −253
39 −115	39 −084	39 −074	39 −038	40 −010	40 −010	39 −040	39 −074	39 −124	39 −140	39 −149	39 −163	39 −[illegible]	39 −165	39 −152	39 −133
40 −228	40 −163	40 −122	40 −055	41 −014	41 −014	40 −061	40 −124	40 −192	40 −228	40 −278	40 −326	40 −361	40 −331	40 −284	40 −254
41 −179	41 −143	41 −104	41 −047	42 −009	42 −006	41 −053	41 −104	41 −158	41 −205	41 −223	41 −254	41 −276	41 −272	41 −233	41 −211
42 +000	42 −004	42 −004	42 −004	43 −006	43 −004	42 −017	42 −033	42 +042	42 +050	42 +064	42 +077	42 +080	42 +093	42 +077	42 +073
43 +000	43 +000	43 −006	43 −004	44 −006	44 −004	43 −013	43 −050	43 +040	43 +094	43 +092	43 +113	43 +110	43 +118	43 +111	43 +094
44 −000	44 −006	44 −003	44 −004	45 −006	45 −003	44 −014	44 −030	44 +040	44 +063	44 +063	44 +080	44 +090	44 +094	44 +078	44 +066
45 −000	45 −003	45 −003	45 −004	46 −006	46 −003	45 −014	45 −032	45 +054	45 +061	45 +080	45 +097	45 +111	45 +132	45 +100	45 +084
46 −000	46 −007	46 −004	46 −004	47 −006	47 −004	46 +000	46 −026	46 +080	46 +117	46 +123	46 +143	46 +160	46 +170	46 +120	46 +097
47 −000	47 −010	47 −004	47 −004	48 −006	48 −004	47 +000	47 −010	47 +040	47 +051	47 +068	47 +080	47 +093	47 +097	47 +069	47 +060
48 −000	48 −011	48 −004	48 −004	49 −006	49 −004	48 −014	48 −032	48 −032	48 −028	48 −033	48 −036	48 −036	48 −038	48 −038	48 −038
49 −000	49 −011	49 −004	49 −004	50 −006	50 −004	49 −014	49 −032	49 +000	49 −029	49 −037	49 −039	49 −041	49 −042	49 −043	49 −042
50 −000	50 −011	50 −004	50 −004	51 −006	51 −004	50 −014	50 −032	50 −027	50 −029	50 −029	50 −031	50 −026	50 −028	50 −029	50 −027
51 −216	51 −119	51 −[illegible]	51 −[illegible]	52 −[illegible]	52 −[illegible]	51 −[illegible]	51 −[illegible]	51 −186	51 −222	51 −263	51 −300	51 −339	51 −368	51 −332	51 −307
52 −300	52 −203	52 −[illegible]	52 −[illegible]	53 −[illegible]	53 −[illegible]	52 −[illegible]	52 −[illegible]	52 −308	52 −386	52 −448	52 −[illegible]	52 −[illegible]	52 −629	52 −531	52 −500
53 −181	53 −154	53 −103	53 −[illegible]	53 −[illegible]	53 −[illegible]	53 −[illegible]	53 −[illegible]	53 −156	53 −203	53 −[illegible]	53 −[illegible]	53 −[illegible]	53 −306	53 −254	53 −246

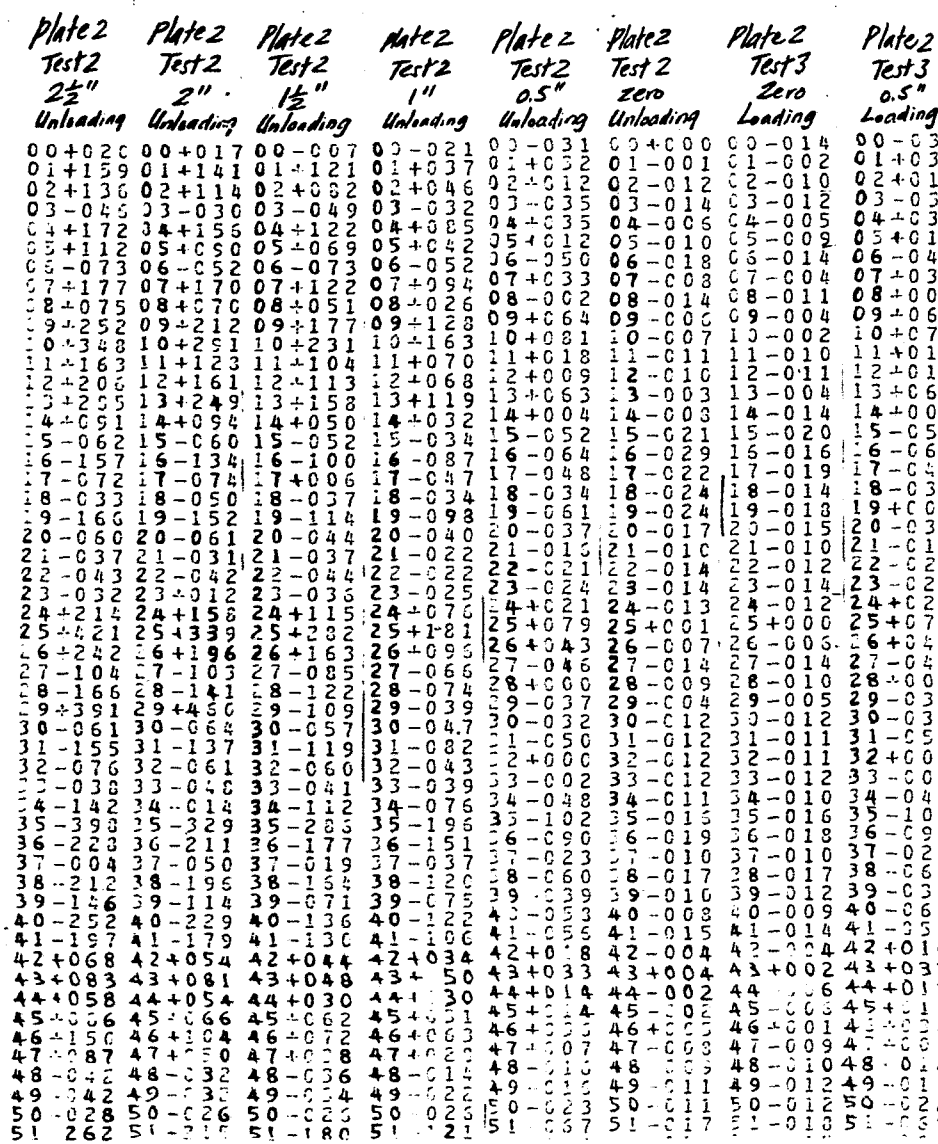


Plate 2 Test 2 2½" Unloading
Plate 2 Test 2 2" Unloading
Plate 2 Test 2 1½" Unloading
Plate 2 Test 2 1" Unloading
Plate 2 Test 2 0.5" Unloading
Plate 2 Test 2 zero Unloading
Plate 2 Test 3 Zero Loading
Plate 2 Test 3 0.5" Loading
Plate 2 Test 3 1" Loading
Plate 2 Test 3 1½" Loading
Plate 2 Test 3 2" Loading
Plate 2 Test 3 2½" Loading
Plate 2 Test 3 3" Loading
Plate 2 Test 3 3½" Loading
Plate 2 Test 3 4" Loading

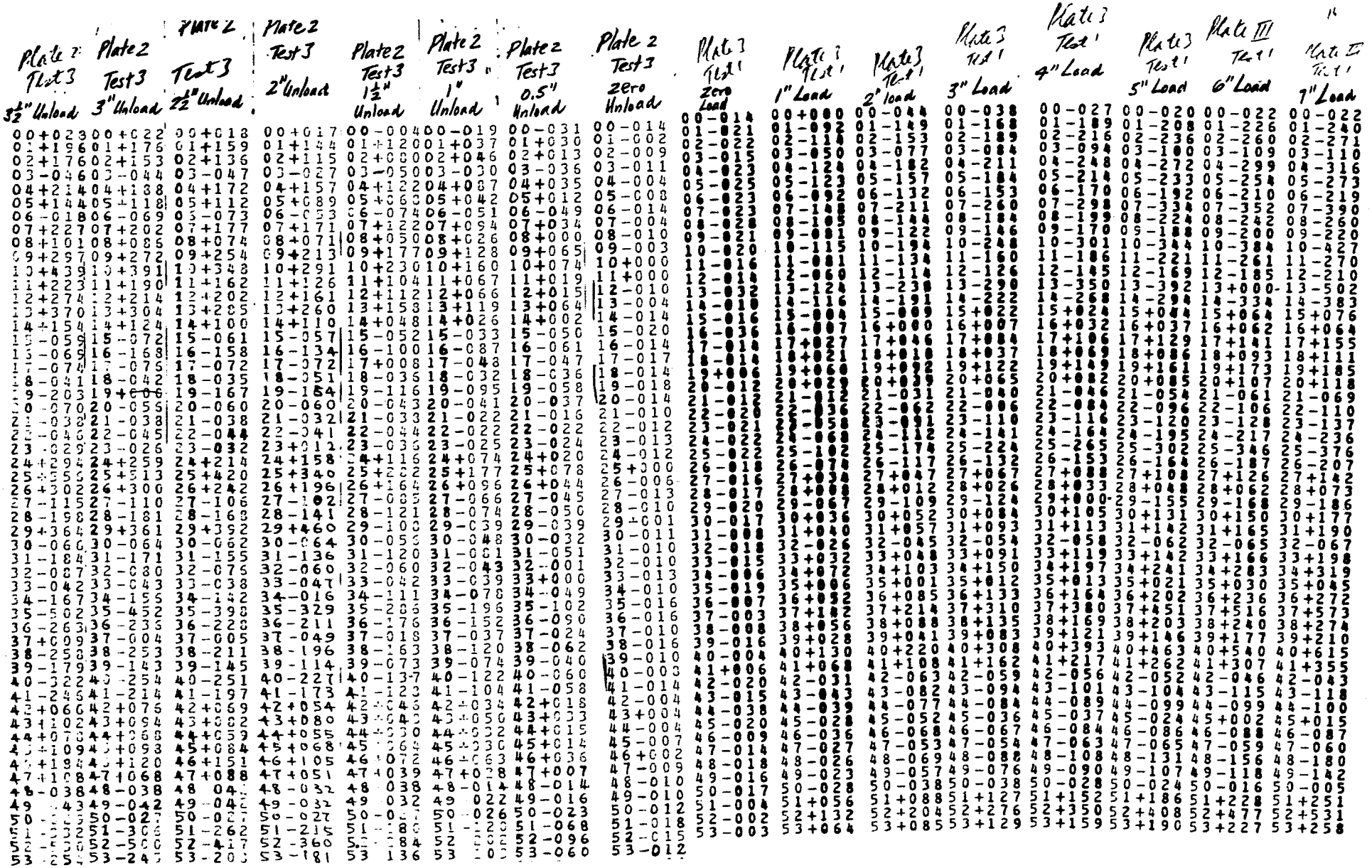


Plate 2 Test 3 3½" Unload
Plate 2 Test 3 3" Unload
Plate 2 Test 3 2½" Unload
Plate 2 Test 3 2" Unload
Plate 2 Test 3 1½" Unload
Plate 2 Test 3 1" Unload
Plate 2 Test 3 0.5" Unload
Plate 2 Test 3 zero Unload
Plate 3 Test 1 zero Load
Plate 3 Test 1 1" Load
Plate 3 Test 1 2" load
Plate 3 Test 1 3" Load
Plate 3 Test 1 4" Load
Plate 3 Test 1 5" Load
Plate III Test 1 6" Load
Plate III Test 1 7" Load

Plate III Test 1 8" Load
Plate III Test 1 8" Unload
Plate III Test 1 6" Load
Plate III Test 1 6" Unload
Plate III Test 1 3" Load
Plate III Test 1 3" Unload
Plate III Test 1 2" Unload
Plate III Test 1 1" Unload
Plate 3 Test 1 0 Unload
Plate 3 Test 2 0 Load
Plate 3 Test 2 1" Load
Plate 3 Test 2 2" Load
Plate 3 Test 2 3" Load

Plate I Test 1 5" Load

00	-021
01	-208
02	-236
03	-101
04	-273
05	-233
06	-192
07	-334
08	-224
09	-187
10	-339
11	-222
12	-163
13	-393
14	-296
15	+043
16	+034
17	+129
18	+085
19	+160
20	+086
21	-054
22	-096
23	-120
24	-194
25	-302
26	-164
27	+109
28	+048
29	-155
30	+131
31	+143
32	-062
33	+143
34	+242
35	+022
36	+262
37	+451
38	+202
39	+146
40	+463
41	+263
42	-052
43	-103
44	-097
45	-024
46	-086
47	-064
48	-132
49	-108
50	-025
51	+186
52	+408
53	+188

Plate II Test 2 6" Load

00	-022
01	-225
02	-258
03	-108
04	-300
05	-254
06	-210
07	-352
08	-242
09	-200
10	-385
11	-262
12	-180
13	-448
14	-334
15	+064
16	+063
17	+140
18	+094
19	+174
20	+108
21	-062
22	-106
23	-128
24	-216
25	-344
26	-188
27	+126
28	+062
29	-168
30	+151
31	+166
32	-065
33	+167
34	+284
35	+030
36	+237
37	+516
38	+240
39	+176
40	+540
41	+306
42	-045
43	-116
44	-099
45	+004
46	-087
47	-059
48	-156
49	-119
50	-016
51	+228
52	+477
53	+227

Plate III Test 2 7" Load

00	-020
01	-240
02	-273
03	-110
04	-316
05	-274
06	-218
07	+000
08	-261
09	-218
10	-429
11	-272
12	-210
13	-502
14	-378
15	+076
16	+061
17	+154
18	+112
19	+185
20	+118
21	-070
22	-110
23	-138
24	-236
25	-376
26	-207
27	+140
28	+074
29	-186
30	+177
31	+190
32	-067
33	+198
34	+319
35	+044
36	+272
37	+573
38	+274
39	+207
40	+615
41	+355
42	-043
43	-116
44	-100
45	+016
46	-086
47	-059
48	-180
49	-143
50	-005
51	+251
52	+531
53	+258

Plate IV Test 2 8" Load

00	-026
01	-251
02	-286
03	-123
04	-336
05	-287
06	-236
07	-418
08	-279
09	-239
10	-470
11	-302
12	-227
13	-551
14	-414
15	+034
16	+077
17	+169
18	+120
19	+196
20	+128
21	-078
22	-118
23	-148
24	-254
25	-415
26	-230
27	+156
28	+079
29	-198
30	+198
31	+213
32	-076
33	+222
34	+347
35	+045
36	+296
37	+637
38	+306
39	+236
40	+664
41	+397
42	-041
43	-123
44	-104
45	+021
46	-090
47	-068
48	-201
49	-155
50	+004
51	+278
52	+576
53	+284

Plate III Test 2 8" Unload

00	-026
01	-252
02	-292
03	-119
04	-338
05	-287
06	-236
07	-420
08	-282
09	-244
10	-488
11	-312
12	-233
13	-577
14	-435
15	+102
16	+112
17	+204
18	+132
19	+232
20	+152
21	-077
22	-119
23	-152
24	-259
25	-427
26	-234
27	+176
28	+097
29	-204
30	+217
31	+234
32	-075
33	+242
34	+372
35	+053
36	+318
37	+675
38	+327
39	+252
40	+697
41	+416
42	-039
43	-125
44	-107
45	+024
46	-090
47	-066
48	-204
49	-155
50	+005
51	+288
52	+590
53	+291

Plate III Test 2 7" unload

00	-014
01	-252
02	-292
03	-118
04	-336
05	-288
06	-233
07	-420
08	-279
09	-236
10	-465
11	-290
12	-227
13	-539
14	-407
15	+098
16	+098
17	+192
18	+135
19	+225
20	+146
21	-068
22	-114
23	-142
24	-242
25	-392
26	-215
27	+174
28	+098
29	-198
30	+219
31	+228
32	-066
33	+237
34	+374
35	+060
36	+317
37	+662
38	+321
39	+250
40	+700
41	+402
42	-040
43	-120
44	-104
45	+024
46	-084
47	-053
48	-189
49	+000
50	+000
51	+282
52	+595
53	+290

Plate III Test 2 6" unload

00	-014
01	-238
02	-279
03	-112
04	-319
05	-270
06	-219
07	-380
08	-258
09	-214
10	-418
11	-280
12	-198
13	-485
14	-356
15	+082
16	+096
17	+172
18	+112
19	+213
20	+130
21	-060
22	-109
23	-132
24	-222
25	-360
26	-196
27	+155
28	+082
29	-178
30	+181
31	+196
32	-064
33	+198
34	+336
35	+045
36	+276
37	+594
38	+278
39	+213
40	+618
41	+351
42	-043
43	+000
44	-102
45	+013
46	-083
47	-054
48	-166
49	-124
50	-009
51	+261
52	+537
53	+257

Plate II Test 2 4" unload

00	-019
01	-204
02	-235
03	-099
04	-268
05	-231
06	-188
07	-322
08	-216
09	-185
10	-333
11	-204
12	-160
13	-384
14	-287
15	+041
16	+069
17	+138
18	+090
19	+181
20	+104
21	-045
22	-086
23	-117
24	-171
25	-276
26	-158
27	+114
28	+054
29	-149
30	+130
31	+142
32	-058
33	+148
34	+242
35	+025
36	+198
37	+446
38	+206
39	+151
40	+460
41	+255
42	-054
43	-104
44	-095
45	-034
46	-086
47	-060
48	-114
49	-094
50	-025
51	+176
52	+398
53	+183

Plate III Test 2 3" unload

00	-036
01	-170
02	-194
03	-086
04	-215
05	-186
06	-155
07	-265
08	-186
09	-147
10	+000
11	-164
12	-130
13	-293
14	-233
15	+022
16	+010
17	+086
18	+038
19	+123
20	+065
21	-040
22	-006
23	-032
24	-144
25	-226
26	-132
27	+067
28	+026
29	-124
30	+085
31	+094
32	-054
33	+092
34	+152
35	+011
36	+134
37	+311
38	+135
39	+081
40	+310
41	+162
42	-060
43	-093
44	-082
45	-037
46	-068
47	-054
48	-088
49	-077
50	-038
51	+128
52	+276
53	+128

Plate I Test 2 3" unload

00	-042
01	-154
02	-159
03	-078
04	-188
05	-163
06	-135
07	-217
08	-147
09	-126
10	-199
11	-137
12	-116
13	-242
14	-194
15	-007
16	-014
17	+049
18	+019
19	+098
20	+041
21	-030
22	-063
23	-092
24	-113
25	-176
26	-118
27	+048
28	+013
29	-109
30	+053
31	+060
32	-044
33	+049
34	+104
35	+001
36	+086
37	+215
38	+089
39	+042
40	+221
41	+108
42	-063
43	-083
44	-077
45	-053
46	-068
47	-055
48	-069
49	-057
50	-037
51	+088
52	+205
53	+085

Plate I Test 2 2" unload

00	+000
01	-090
02	-110
03	-050
04	-124
05	-122
06	-092
07	-146
08	-105
09	-080
10	-112
11	-076
12	-060
13	-121
14	-110
15	-003
16	-008
17	+027
18	+018
19	+060
20	+029
21	-014
22	-035
23	-059
24	-066
25	-180
26	-071
27	+034
28	+008
29	-067
30	+037
31	+041
32	-026
33	+033
34	+072
35	+007
36	+057
37	+140
38	+054
39	+030
40	+128
41	+066
42	-060
43	-042
44	-027
45	-027
46	-034
47	-026
48	-027
49	-023
50	-028
51	+055
52	+129
53	+063

Plate I Test 2 1" unload

00	-009
01	-013
02	-013
03	-012
04	-020
05	-019
06	-020
07	-022
08	-018
09	-010
10	-020
11	-015
12	-006
13	-019
14	-019
15	-014
16	-029
17	-007
18	-012
19	+007
20	+002
21	+004
22	-006
23	-008
24	-010
25	-008
26	-009
27	+006
28	+006
29	-005
30	+005
31	+007
32	-004
33	+002
34	+006
35	-003
36	+011
37	+012
38	+006
39	-002
40	+005
41	+008
42	-009
43	-004
44	-009
45	-012
46	-005
47	-007
48	-004
49	+000
50	+000
51	+003
52	+013
53	+009

Plate I Test 3 0" Load

00	-015
01	-019
02	-022
03	-017
04	-024
05	-025
06	-024
07	-023
08	-028
09	-021
10	-020
11	-018
12	-008
13	-028
14	-006
15	-015
16	-032
17	-014
18	-012
19	+007
20	-013
21	-010
22	-019
23	-022
24	-023
25	-022
26	-017
27	-018
28	-017
29	-020
30	-018
31	-006
32	-019
33	-015
34	-006
35	-019
36	-007
37	-003
38	-008
39	-016
40	-002
41	+003
42	-020
43	-014
44	-038
45	-021
46	-008
47	-012
48	-018
49	-016
50	-017
51	-004
52	-004
53	-004

Plate I Test 3 1" Load

00	-018
01	-092
02	-111
03	-050
04	-124
05	-123
06	-091
07	-148
08	-105
09	-080
10	-116
11	-078
12	-058
13	-123
14	-114
15	-008
16	-008
17	+027
18	+021
19	+064
20	+029
21	-012
22	-034
23	-058
24	-067
25	-102
26	-074
27	+034
28	+008
29	-067
30	+036
31	+041
32	-026
33	+031
34	+071
35	+006
36	+057
37	+142
38	+056
39	+029
40	+130
41	+068
42	-031
43	-043
44	-037
45	-026
46	-026
47	-026
48	-023
49	-023
50	+000
51	+056
52	+133
53	+063

Plate I Test 3 2" Load

00	-043
01	-148
02	-153
03	-076
04	-180
05	-158
06	-132
07	-211
08	-142
09	-122
10	-192
11	-133
12	-105
13	-233
14	-183
15	-010
16	-018
17	+047
18	+016
19	+088
20	+038
21	-029
22	-062
23	-088
24	-090
25	-110
26	-173
27	-116
28	+049
29	+012
30	-106
31	+052
32	+059
33	-044
34	+048
35	+101
36	+033
37	+086
38	+214
39	+088
40	+043
41	+222
42	+108
43	-062
44	-081
45	-076
46	-050
47	-052
48	-068
49	-056
50	-040
51	+089
52	+205
53	+085

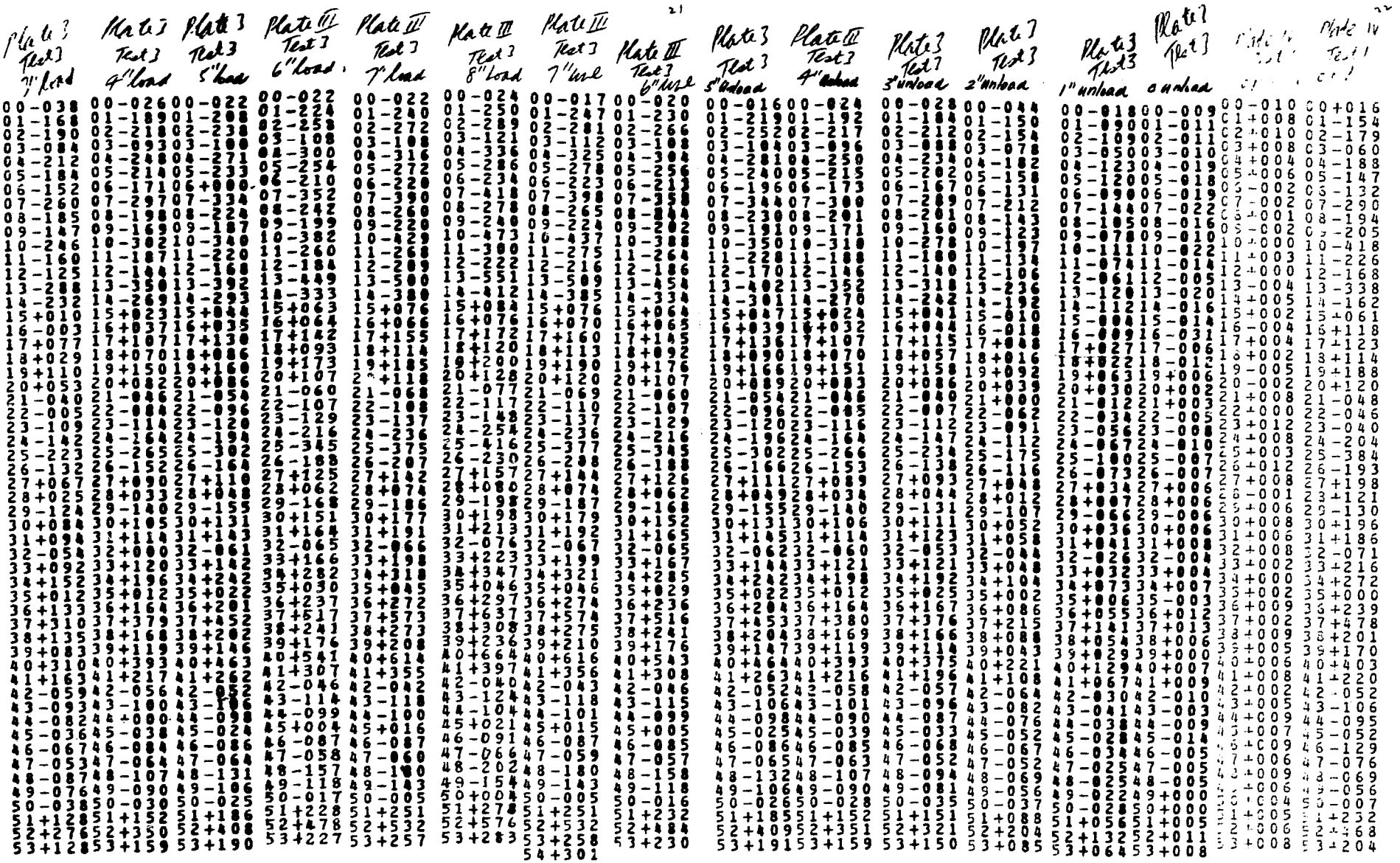


Plate 3 Test 3 7" load
Plate 3 Test 3 4" load
Plate 3 Test 3 5" load
Plate III Test 3 6" load
Plate III Test 3 7" load
Plate III Test 3 8" load
Plate III Test 3 7" unl
Plate III Test 3 6" unl
Plate 3 Test 3 5" unload
Plate III Test 3 4" unload
Plate 3 Test 3 3" unload
Plate 3 Test 3 2" unload
Plate 3 Test 3 1" unload
Plate 3 Test 3 0" unload
Plate 3 Test 3 1" load
Plate 3 Test 3 2" load
Plate IV Test 1 3" load

Plate IV Test 1 Loading 1 p.s.i.

00	+040	00	+040	x2
01	−238	01	−147	x2
02	−296	02	−193	x2
03	−092	03	−056	x2
04	−313	04	−208	x2
05	−246	05	−156	x2
06	−210	06	−135	x2
07	−467	07	−298	x2
08	−300	08	−190	x2
09	−318	09	−197	x2
10	−639	10	−405	x2
11	−352	11	−216	x2
12	−257	12	−162	x2
13	−528	13	−342	x2
14	−332	14	−217	x2
15	+116	15	+079	x2
16	+204	16	+140	x2
17	+224	17	+153	x2
18	+200	18	+132	x2
19	+308	19	+207	x2
20	+205	20	+142	x2
21	−058	21	−025	x2
22	−058	22	−036	x2
23	−057	23	−031	x2
24	−316	24	−197	x2
25	−626	25	−394	x2
26	−331	26	−208	x2
27	+342	27	+232	x2
28	+224	28	+157	x2
29	−205	29	−128	x2
30	+323	30	+234	x2
31	+332	31	+234	x2
32	−082	32	−044	x2
33	+376	33	+271	x2
34	+518	34	+368	x2
35	+060	35	+048	x2
36	+396	36	+267	x2
37	+811	37	+537	x2
38	+397	38	+268	x2
39	+313	39	+218	x2
40	+696	40	+473	x2
41	+396	41	+274	x2
42	−057	42	−028	x2
43	−166	43	−096	x2
44	−137	44	+000	x2
45	−066	45	−025	x2
46	−195	46	−112	x2
47	−086	47	−050	x2
48	−092	48	−058	x2
49	−068	49	−040	x2
50	+012	50	+030	x2
51	+391	51	+277	x2
52	+804	52	+532	x2
53	+380	53	+262	x2

Plate IV Test 1 Loading 1.5 p.s.i.

00	+054	x2		
01	−177	x2		
02	−237	x2		
03	−067	x2		
04	−251	x2		
05	−200	x2		
06	−165	x2		
07	−366	x2		
08	−238	x2		
09	−243	x2		
10	−486	x2		
11	−263	x2		
12	−197	x2		
13	−416	x2		
14	−269	x2		
15	+106	x2		
16	+168	x2		
17	+186	x2		
18	+163	x2		
19	+243	x2		
20	+176	x2		
21	−028	x2		
22	−040	x2		
23	−037	x2		
24	−232	x2		
25	−482	x2		
26	−253	x2		
27	+308	x2		
28	+192	x2		
29	−157	x2		
30	+305	x2		
31	+308	x2		
32	−056	x2		
33	+341	x2		
34	+456	x2		
35	+063	x2		
36	+329	x2		
37	+668	x2		
38	+331	x2		
39	+272	x2		
40	+570	x2		
41	+321	x2		
42	−028	x2		
43	−111	x2		
44	−094	x2		
45	+000	x2		
46	−124	x2		
47	−050	x2		
48	−073	x2		
49	−065	x2		
50	+038	x2		
51	+329	x2		
52	+668	x2		
53	+333	x2		

Plate IV Test 1 Loading 2 p.s.i.

00	+058	x2		
01	−181	x2		
02	−237	x2		
03	−074	x2		
04	−270	x2		
05	−210	x2		
06	−174	x2		
07	−384	x2		
08	−252	x2		
09	−278	x2		
10	−560	x2		
11	−303	x2		
12	−270	x2		
13	−480	x2		
14	−312	x2		
15	+122	x2		
16	+196	x2		
17	+218	x2		
18	+187	x2		
19	+279	x2		
20	+197	x2		
21	−032	x2		
22	−052	x2		
23	−046	x2		
24	−271	x2		
25	−562	x2		
26	−302	x2		
27	+326	x2		
28	+196	x2		
29	−174	x2		
30	+338	x2		
31	+332	x2		
32	−060	x2		
33	+378	x2		
34	+485	x2		
35	+064	x2		
36	+388	x2		
37	+786	x2		
38	+386	x2		
39	+321	x2		
40	+697	x2		
41	+401	x2		
42	−024	x2		
43	−119	x2		
44	−103	x2		
45	−030	x2		
46	−138	x2		
47	−051	x2		
48	−083	x2		
49	−065	x2		
50	+048	x2		
51	+390	x2		
52	+790	x2		
53	+392	x2		

Plate IV Test 1 Loading 3 p.s.i.

00	+066	x2		
01	−294	x2		
02	−256	x2		
03	−076	x2		
04	−296	x2		
05	−235	x2		
06	−189	x2		
07	−420	x2		
08	−268	x2		
09	−314	x2		
10	−638	x2		
11	−331	x2		
12	−250	x2		
13	−550	x2		
14	−346	x2		
15	+136	x2		
16	+217	x2		
17	+244	x2		
18	+216	x2		
19	+315	x2		
20	+233	x2		
21	−033	x2		
22	−056	x2		
23	−055	x2		
24	−310	x2		
25	−647	x2		
26	−336	x2		
27	+362	x2		
28	+220	x2		
29	−189	x2		
30	+363	x2		
31	+364	x2		
32	−067	x2		
33	+419	x2		
34	+524	x2		
35	+070	x2		
36	+450	x2		
37	+894	x2		
38	+437	x2		
39	+370	x2		
40	+792	x2		
41	+454	x2		
42	−024	x2		
43	−124	x2		
44	−108	x2		
45	−026	x2		
46	−150	x2		
47	−052	x2		
48	−107	x2		
49	−072	x2		
50	+062	x2		
51	+452	x2		
52	+910	x2		
53	+446	x2		

Plate IV Test 1 Loading 3.5 p.s.i.

00	+042	x4		
01	−098	x4		
02	−131	x4		
03	−036	x4		
04	−156	x4		
05	−120	x4		
06	−096	x4		
07	−216	x4		
08	−133	x4		
09	−169	x4		
10	−347	x4		
11	−174	x4		
12	−134	x4		
13	−300	x4		
14	−191	x4		
15	+085	x4		
16	+128	x4		
17	+142	x4		
18	+123	x4		
19	+174	x4		
20	+129	x4		
21	−014	x4		
22	−030	x4		
23	−026	x4		
24	−169	x4		
25	−355	x4		
26	−184	x4		
27	+192	x4		
28	+123	x4		
29	−100	x4		
30	+206	x4		
31	+196	x4		
32	−032	x4		
33	+230	x4		
34	+284	x4		
35	+040	x4		
36	+258	x4		
37	+502	x4		
38	+248	x4		
39	+215	x4		
40	+452	x4		
41	+258	x4		
42	−004	x4		
43	−063	x4		
44	−056	x4		
45	−008	x4		
46	−075	x4		
47	−024	x4		
48	−057	x4		
49	−038	x4		
50	+040	x4		
51	+262	x4		
52	+510	x4		
53	+254	x4		

Plate IV Test 1 Loading 4 p.s.i.

00	+045	x4		
01	−106	x4		
02	−144	x4		
03	−039	x4		
04	−174	x4		
05	−127	x4		
06	−103	x4		
07	−236	x4		
08	−147	x4		
09	+000	x4		
10	−378	x4		
11	−194	x4		
12	−141	x4		
13	−329	x4		
14	−206	x4		
15	+094	x4		
16	+131	x4		
17	+156	x4		
18	+134	x4		
19	+188	x4		
20	+144	x4		
21	−019	x4		
22	−034	x4		
23	−036	x4		
24	−188	x4		
25	−394	x4		
26	−207	x4		
27	+219	x4		
28	+128	x4		
29	−119	x4		
30	+229	x4		
31	+196	x4		
32	−042	x4		
33	+246	x4		
34	+304	x4		
35	+032	x4		
36	+280	x4		
37	+554	x4		
38	+266	x4		
39	+226	x4		
40	+480	x4		
41	+272	x4		
42	−004	x4		
43	−068	x4		
44	−062	x4		
45	−012	x4		
46	−083	x4		
47	−027	x4		
48	−071	x4		
49	−043	x4		
50	+052	x4		
51	+285	x4		
52	+564	x4		
53	+276	x4		

Plate IV Test 1 Loading 4.5 p.s.i.

00	+050	x4		
01	−116	x4		
02	−151	x4		
03	−045	x4		
04	−189	x4		
05	−141	x4		
06	−116	x4		
07	−258	x4		
08	−159	x4		
09	−199	x4		
10	−408	x4		
11	−206	x4		
12	−156	x4		
13	−359	x4		
14	−227	x4		
15	+104	x4		
16	+144	x4		
17	+167	x4		
18	+142	x4		
19	+200	x4		
20	+154	x4		
21	−018	x4		
22	−039	x4		
23	−038	x4		
24	−201	x4		
25	−423	x4		
26	−214	x4		
27	+235	x4		
28	+145	x4		
29	−124	x4		
30	+248	x4		
31	+241	x4		
32	−042	x4		
33	+274	x4		
34	+334	x4		
35	+046	x4		
36	+301	x4		
37	+596	x4		
38	+291	x4		
39	+258	x4		
40	+536	x4		
41	+303	x4		
42	+001	x4		
43	−066	x4		
44	−073	x4		
45	−003	x4		
46	−083	x4		
47	−023	x4		
48	−072	x4		
49	−046	x4		
50	+053	x4		
51	+312	x4		
52	+609	x4		
53	+306	x4		

Plate IV Test 1 Loading 5 p.s.i.

00	+050	x4		
01	−110	x4		
02	−152	x4		
03	−045	x4		
04	−190	x4		
05	−143	x4		
06	−116	x4		
07	−262	x4		
08	−162	x4		
09	−215	x4		
10	−433	x4		
11	−216	x4		
12	−168	x4		
13	−380	x4		
14	−245	x4		
15	+109	x4		
16	+153	x4		
17	+179	x4		
18	+150	x4		
19	+214	x4		
20	+164	x4		
21	−021	x4		
22	−042	x4		
23	−045	x4		
24	−218	x4		
25	−454	x4		
26	−225	x4		
27	+234	x4		
28	+143	x4		
29	−128	x4		
30	+254	x4		
31	+242	x4		
32	−042	x4		
33	+280	x4		
34	+346	x4		
35	+048	x4		
36	+326	x4		
37	+640	x4		
38	+314	x4		
39	+279	x4		
40	+575	x4		
41	+325	x4		
42	+001	x4		
43	−067	x4		
44	−066	x4		
45	−004	x4		
46	−083	x4		
47	−024	x4		
48	−081	x4		
49	−051	x4		
50	+058	x4		
51	+337	x4		
52	+657	x4		
53	+329	x4		

Plate IV Test 1 Loading 5.5 p.s.i.

00	+055	x4		
01	−122	x4		
02	−163	x4		
03	−048	x4		
04	−206	x4		
05	−153	x4		
06	−122	x4		
07	−279	x4		
08	−170	x4		
09	−226	x4		
10	−464	x4		
11	−222	x4		
12	−128	x4		
13	−408	x4		
14	−256	x4		
15	+114	x4		
16	+160	x4		
17	+190	x4		
18	+162	x4		
19	+222	x4		
20	+175	x4		
21	−024	x4		
22	−048	x4		
23	−046	x4		
24	−234	x4		
25	−486	x4		
26	−242	x4		
27	+251	x4		
28	+147	x4		
29	−138	x4		
30	+276	x4		
31	+260	x4		
32	−050	x4		
33	+298	x4		
34	+370	x4		
35	+048	x4		
36	+348	x4		
37	+683	x4		
38	+334	x4		
39	+296	x4		
40	+615	x4		
41	+342	x4		
42	+001	x4		
43	−067	x4		
44	−069	x4		
45	+000	x4		
46	−088	x4		
47	−024	x4		
48	−093	x4		
49	−060	x4		
50	+068	x4		
51	+364	x4		
52	+701	x4		
53	+352	x4		

Plate IV Test 1 Unloading 5 p.s.i.

00	+050	x4		
01	−110	x4		
02	−154	x4		
03	−045	x4		
04	−190	x4		
05	−142	x4		
06	−116	x4		
07	−262	x4		
08	−162	x4		
09	−215	x4		
10	−432	x4		
11	−216	x4		
12	−168	x4		
13	−380	x4		
14	−244	x4		
15	+108	x4		
16	+151	x4		
17	+179	x4		
18	+152	x4		
19	+214	x4		
20	+164	x4		
21	−022	x4		
22	−043	x4		
23	−042	x4		
24	−218	x4		
25	−454	x4		
26	−225	x4		
27	+236	x4		
28	+141	x4		
29	−127	x4		
30	+254	x4		
31	+242	x4		
32	−040	x4		
33	+281	x4		
34	+344	x4		
35	+045	x4		
36	+326	x4		
37	+640	x4		
38	+314	x4		
39	+278	x4		
40	+574	x4		
41	+324	x4		
42	+002	x4		
43	−068	x4		
44	−066	x4		
45	−004	x4		
46	−082	x4		
47	−024	x4		
48	−083	x4		
49	−052	x4		
50	+058	x4		
51	+337	x4		
52	+657	x4		
53	+329	x4		

Plate IV Test 1 Unload 4.5 p.s.i.

00	+050	x4		
01	−116	x4		
02	−152	x4		
03	−045	x4		
04	−188	x4		
05	−142	x4		
06	−115	x4		
07	−258	x4		
08	−159	x4		
09	−199	x4		
10	−408	x4		
11	−206	x4		
12	−158	x4		
13	−359	x4		
14	−228	x4		
15	+104	x4		
16	+148	x4		
17	+167	x4		
18	+143	x4		
19	+209	x4		
20	+155	x4		
21	−018	x4		
22	−039	x4		
23	−037	x4		
24	−200	x4		
25	−424	x4		
26	−215	x4		
27	+234	x4		
28	+146	x4		
29	−125	x4		
30	+248	x4		
31	+241	x4		
32	−042	x4		
33	+274	x4		
34	+337	x4		
35	+046	x4		
36	+301	x4		
37	+596	x4		
38	+291	x4		
39	+259	x4		
40	+536	x4		
41	+303	x4		
42	+001	x4		
43	−066	x4		
44	−073	x4		
45	−003	x4		
46	−083	x4		
47	−023	x4		
48	−072	x4		
49	−046	x4		
50	+053	x4		
51	+312	x4		
52	+609	x4		
53	+306	x4		

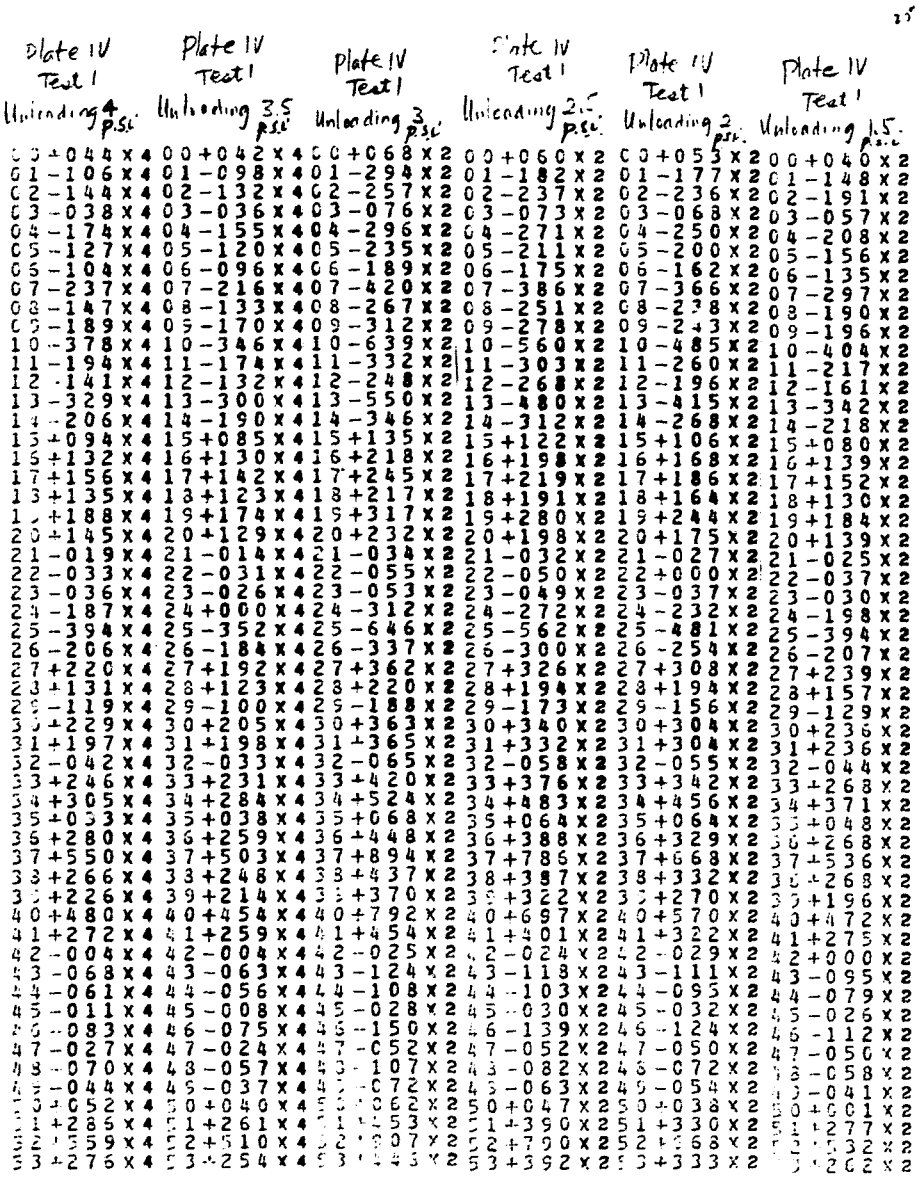


Plate IV Test 1 Unloading 4 psi
Plate IV Test 1 Unloading 3.5 psi
Plate IV Test 1 Unloading 3 psi
Plate IV Test 1 Unloading 2.5 psi
Plate IV Test 1 Unloading 2 psi
Plate IV Test 1 Unloading 1.5 psi
Plate IV Test 1 Unloading 1 psi
Plate IV Test 1 .5 psi
Plate IV Test 1 0 psi Unloading
Plate IV Test 1 0 psi Loading
Plate IV Test 2 .5 psi Load
Plate IV Test 2 Loading 1 psi
Plate IV Test 2 Loading 1.5 psi

Plate IV Test 2 Loading 2 p.s.i.

00	+0541	x2	
01	−1771	x2	
02	−2361	x2	
03	−0681	x2	
04	−2521	x2	
05	−2011	x2	
06	−1641	x2	
07	−3661	x2	
08	−2381	x2	
09	−2401	x2	
10	−4861	x2	
11	−2621	x2	
12	−1971	x2	
13	−4161	x2	
14	−2681	x2	
15	+1051	x2	
16	+1681	x2	
17	+1861	x2	
18	+1641	x2	
19	+2431	x2	
20	+1751	x2	
21	−0271	x2	
22	+0001	x2	
23	−0371	x2	
24	−2321	x2	
25	−4811	x2	
26	−2531	x2	
27	+3081	x2	
28	+1921	x2	
29	−1571	x2	
30	+3051	x2	
31	+3051	x2	
32	−0571	x2	
33	+3421	x2	
34	+4541	x2	
35	+0621	x2	
36	+3281	x2	
37	+5661	x2	
38	+3311	x2	
39	+2711	x2	
40	+5691	x2	
41	+3211	x2	
42	−0281	x2	
43	−1121	x2	
44	−0951	x2	
45	−0321	x2	
46	−1251	x2	
47	−0501	x2	
48	−0741	x2	
49	−0541	x2	
50	+0371	x2	
51	+3301	x2	
52	+6681	x2	
53	+3331	x2	

Plate IV Test 2 Loading 2.5 p.s.i.

00	+0600	x2	
01	−1811	x2	
02	−2381	x2	
03	−0731	x2	
04	−2701	x2	
05	−2101	x2	
06	−1751	x2	
07	−3861	x2	
08	−2521	x2	
09	−2801	x2	
10	−5591	x2	
11	−3031	x2	
12	−2691	x2	
13	−4801	x2	
14	−3121	x2	
15	+1231	x2	
16	+1961	x2	
17	+2181	x2	
18	+1891	x2	
19	+2791	x2	
20	+1981	x2	
21	−0321	x2	
22	−0501	x2	
23	−0471	x2	
24	−2701	x2	
25	−5631	x2	
26	−3021	x2	
27	+3261	x2	
28	+1981	x2	
29	−1731	x2	
30	+3401	x2	
31	+3311	x2	
32	−0591	x2	
33	+3761	x2	
34	+4821	x2	
35	+0631	x2	
36	+3881	x2	
37	+7861	x2	
38	+3861	x2	
39	+3221	x2	
40	+6971	x2	
41	+4001	x2	
42	−0241	x2	
43	−1191	x2	
44	−1031	x2	
45	−0311	x2	
46	−1381	x2	
47	−0521	x2	
48	−0821	x2	
49	−0641	x2	
50	+0471	x2	
51	+3901	x2	
52	+7901	x2	
53	+3921	x2	

Plate IV Test 2 Loading 3 p.s.i.

00	+0651	x2	
01	−2941	x2	
02	−2561	x2	
03	−0761	x2	
04	−2961	x2	
05	−2361	x2	
06	+0001	x2	
07	+0001	x2	
08	−2681	x2	
09	−3131	x2	
10	−6381	x2	
11	−3291	x2	
12	−2491	x2	
13	−5501	x2	
14	−3481	x2	
15	+1351	x2	
16	+2161	x2	
17	+2461	x2	
18	+2181	x2	
19	+3141	x2	
20	+2321	x2	
21	−0351	x2	
22	−0551	x2	
23	−0541	x2	
24	−3111	x2	
25	−6461	x2	
26	−3381	x2	
27	+3621	x2	
28	+2201	x2	
29	−1891	x2	
30	+3641	x2	
31	+3641	x2	
32	−0651	x2	
33	+3821	x2	
34	+5241	x2	
35	+0681	x2	
36	+4501	x2	
37	+8941	x2	
38	+4371	x2	
39	+3701	x2	
40	+7921	x2	
41	+4541	x2	
42	−0251	x2	
43	−1241	x2	
44	−0001	x2	
45	−0281	x2	
46	−1511	x2	
47	−0521	x2	
48	−0731	x2	
49	−0461	x2	
50	+0631	x2	
51	+4521	x2	
52	+5071	x2	
53	+4461	x2	

Plate IV Test 2 Loading 3.5 p.s.i.

00	+0401	x4	
01	−0981	x4	
02	−1301	x4	
03	−0361	x4	
04	−1561	x4	
05	−1191	x4	
06	−0961	x4	
07	−2161	x4	
08	−1341	x4	
09	+0001	x4	
10	−3461	x4	
11	−1751	x4	
12	−1331	x4	
13	−3001	x4	
14	−1901	x4	
15	+0851	x4	
16	+1281	x4	
17	+1421	x4	
18	+1241	x4	
19	+1731	x4	
20	+1291	x4	
21	−0141	x4	
22	−0291	x4	
23	−0271	x4	
24	−1691	x4	
25	−3521	x4	
26	−1841	x4	
27	+1921	x4	
28	+1231	x4	
29	+1001	x4	
30	+2061	x4	
31	+1961	x4	
32	−0331	x4	
33	+2281	x4	
34	+2851	x4	
35	+0381	x4	
36	+2591	x4	
37	+5021	x4	
38	+2471	x4	
39	+2141	x4	
40	+4541	x4	
41	+2591	x4	
42	−0041	x4	
43	−0641	x4	
44	−0571	x4	
45	−0081	x4	
46	−0751	x4	
47	−0241	x4	
48	−0571	x4	
49	−0361	x4	
50	+0401	x4	
51	+2621	x4	
52	+5111	x4	
53	+2541	x4	

Plate IV Test 2 Loading 4 p.s.i.

00	+0441	x4	
01	−1061	x4	
02	−1441	x4	
03	−0001	x4	
04	−1741	x4	
05	−1281	x4	
06	−1031	x4	
07	−2361	x4	
08	−1471	x4	
09	−1911	x4	
10	−3791	x4	
11	−1941	x4	
12	−1421	x4	
13	−3291	x4	
14	−2061	x4	
15	+0981	x4	
16	+1321	x4	
17	+1571	x4	
18	+1361	x4	
19	+1881	x4	
20	+1451	x4	
21	−0171	x4	
22	−0321	x4	
23	−0351	x4	
24	−1881	x4	
25	−3941	x4	
26	−2071	x4	
27	+2191	x4	
28	+1311	x4	
29	−1181	x4	
30	+2301	x4	
31	+1961	x4	
32	−0431	x4	
33	+2481	x4	
34	+3041	x4	
35	+0331	x4	
36	+2791	x4	
37	+5531	x4	
38	+2661	x4	
39	+2261	x4	
40	+4801	x4	
41	+2711	x4	
42	−0031	x4	
43	−0671	x4	
44	−0621	x4	
45	−0111	x4	
46	−0831	x4	
47	−0291	x4	
48	−0701	x4	
49	−0431	x4	
50	+0521	x4	
51	+2851	x4	
52	+5581	x4	
53	+2761	x4	

Plate IV Test 2 Loading 4.5 p.s.i.

00	+0511	x4	
01	−1161	x4	
02	−1511	x4	
03	−0451	x4	
04	−1891	x4	
05	−1411	x4	
06	−1161	x4	
07	−2581	x4	
08	−1591	x4	
09	−2001	x4	
10	−4081	x4	
11	−2061	x4	
12	−1571	x4	
13	−3581	x4	
14	−2281	x4	
15	+1041	x4	
16	+1451	x4	
17	+1671	x4	
18	+1421	x4	
19	+2001	x4	
20	+1541	x4	
21	−0181	x4	
22	−0381	x4	
23	−0381	x4	
24	−2011	x4	
25	−4241	x4	
26	−2151	x4	
27	+2351	x4	
28	+1461	x4	
29	−1241	x4	
30	+2471	x4	
31	+2401	x4	
32	−0421	x4	
33	+2741	x4	
34	+3381	x4	
35	+0461	x4	
36	+3021	x4	
37	+5961	x4	
38	+2921	x4	
39	+2561	x4	
40	+5371	x4	
41	+3021	x4	
42	−0011	x4	
43	−0661	x4	
44	−0721	x4	
45	−0041	x4	
46	−0821	x4	
47	−0241	x4	
48	−0731	x4	
49	−0461	x4	
50	+0521	x4	
51	+3121	x4	
52	+5621	x4	
53	+2761	x4	

Plate IV Test 2 Loading 5 p.s.i.

00	+0501	x4	
01	−1101	x4	
02	−1541	x4	
03	−0441	x4	
04	+0001	x4	
05	−1411	x4	
06	−1161	x4	
07	−2621	x4	
08	−1611	x4	
09	−2151	x4	
10	−4331	x4	
11	−2151	x4	
12	−1661	x4	
13	−3801	x4	
14	−2451	x4	
15	+1091	x4	
16	+1521	x4	
17	+1801	x4	
18	+1531	x4	
19	+2141	x4	
20	+1631	x4	
21	−0221	x4	
22	−0431	x4	
23	−0421	x4	
24	−2171	x4	
25	−4541	x4	
26	−2261	x4	
27	+2361	x4	
28	+1411	x4	
29	−1281	x4	
30	+2541	x4	
31	+2401	x4	
32	−0421	x4	
33	+2801	x4	
34	+3441	x4	
35	+0471	x4	
36	+3271	x4	
37	+6401	x4	
38	+3141	x4	
39	+2781	x4	
40	+5701	x4	
41	+3251	x4	
42	+0011	x4	
43	−0691	x4	
44	−0691	x4	
45	−0051	x4	
46	−0831	x4	
47	−0241	x4	
48	−0811	x4	
49	−0511	x4	
50	+0581	x4	
51	+3371	x4	
52	+6571	x4	
53	+3291	x4	

Plate IV Test 2 Loading 5.5 p.s.i.

00	+0561	x4	
01	−1221	x4	
02	−1641	x4	
03	−0481	x4	
04	−2061	x4	
05	−1531	x4	
06	−1211	x4	
07	−2791	x4	
08	−1701	x4	
09	−2261	x4	
10	−4661	x4	
11	−2221	x4	
12	−1281	x4	
13	−4071	x4	
14	−2561	x4	
15	+1151	x4	
16	+1591	x4	
17	+1901	x4	
18	+1641	x4	
19	+2221	x4	
20	+1751	x4	
21	−0241	x4	
22	+0001	x4	
23	−0451	x4	
24	−2341	x4	
25	−4861	x4	
26	−2421	x4	
27	+2501	x4	
28	+1491	x4	
29	−1381	x4	
30	+2771	x4	
31	+2601	x4	
32	−0501	x4	
33	+2961	x4	
34	+3591	x4	
35	+0481	x4	
36	+3491	x4	
37	+6841	x4	
38	+3341	x4	
39	+2971	x4	
40	+6141	x4	
41	+3421	x4	
42	+0011	x4	
43	−0671	x4	
44	−0691	x4	
45	+0011	x4	
46	−0881	x4	
47	−0231	x4	
48	−0931	x4	
49	−0601	x4	
50	+0671	x4	
51	+3641	x4	
52	+6021	x4	
53	+3511	x4	

Plate IV Test 2 Unloading 5 p.s.i.

00	+0501	x4	
01	−1101	x4	
02	−1541	x4	
03	−0441	x4	
04	−1901	x4	
05	−1421	x4	
06	−1151	x4	
07	−2621	x4	
08	−1601	x4	
09	−2141	x4	
10	−4331	x4	
11	−2151	x4	
12	−1671	x4	
13	−3801	x4	
14	−2441	x4	
15	+1041	x4	
16	+1511	x4	
17	+1791	x4	
18	+1531	x4	
19	+2141	x4	
20	+1631	x4	
21	−0221	x4	
22	−0431	x4	
23	−0431	x4	
24	−2171	x4	
25	−4541	x4	
26	−2261	x4	
27	+2351	x4	
28	+1411	x4	
29	−1381	x4	
30	+2541	x4	
31	+2411	x4	
32	−0421	x4	
33	+2721	x4	
34	+3331	x4	
35	+0461	x4	
36	+3011	x4	
37	+5961	x4	
38	+2921	x4	
39	+2561	x4	
40	+5371	x4	
41	+3031	x4	
42	+0021	x4	
43	−0651	x4	
44	−0721	x4	
45	−0041	x4	
46	−0821	x4	
47	−0231	x4	
48	−0721	x4	
49	−0471	x4	
50	+0521	x4	
51	+3121	x4	
52	+5571	x4	
53	+3291	x4	

Plate IV Test 2 Unload. 4.5 p.s.i.

00	+0501	x4	
01	−1161	x4	
02	−1511	x4	
03	−0441	x4	
04	−1891	x4	
05	−1411	x4	
06	−1151	x4	
07	−2581	x4	
08	−1601	x4	
09	−1991	x4	
10	−4081	x4	
11	−2061	x4	
12	−1571	x4	
13	−3581	x4	
14	−2281	x4	
15	+1041	x4	
16	+1441	x4	
17	+1661	x4	
18	+1421	x4	
19	+1891	x4	
20	+1441	x4	
21	−0181	x4	
22	−0381	x4	
23	−0381	x4	
24	−2011	x4	
25	−4241	x4	
26	−2151	x4	
27	+2351	x4	
28	+1481	x4	
29	−1381	x4	
30	+2771	x4	
31	+2411	x4	
32	−0421	x4	
33	+2721	x4	
34	+3331	x4	
35	+0461	x4	
36	+3011	x4	
37	+5961	x4	
38	+2921	x4	
39	+2561	x4	
40	+5371	x4	
41	+3031	x4	
42	+0021	x4	
43	−0651	x4	
44	−0721	x4	
45	−0041	x4	
46	−0821	x4	
47	−0231	x4	
48	−0721	x4	
49	−0471	x4	
50	+0521	x4	
51	+3121	x4	
52	+5571	x4	
53	+3291	x4	

Plate IV Test 2 Unloading 4 p.s.i.

00	+0461	x4	
01	−1061	x4	
02	−1441	x4	
03	−0381	x4	
04	−1741	x4	
05	−1281	x4	
06	−1041	x4	
07	−2341	x4	
08	−1471	x4	
09	−1901	x4	
10	−3781	x4	
11	−1941	x4	
12	−1421	x4	
13	−3271	x4	
14	−2041	x4	
15	+0951	x4	
16	+1321	x4	
17	+1581	x4	
18	+1361	x4	
19	+1891	x4	
20	+1451	x4	
21	−0181	x4	
22	−0321	x4	
23	−0361	x4	
24	−1871	x4	
25	−3941	x4	
26	−2061	x4	
27	+2191	x4	
28	+1301	x4	
29	−1181	x4	
30	+2471	x4	
31	+2281	x4	
32	−0431	x4	
33	+2761	x4	
34	+3381	x4	
35	+0331	x4	
36	+2801	x4	
37	+5531	x4	
38	+2661	x4	
39	+2261	x4	
40	+4801	x4	
41	+2721	x4	
42	−0041	x4	
43	−0671	x4	
44	−0621	x4	
45	−0121	x4	
46	−0831	x4	
47	−0271	x4	
48	−0711	x4	
49	−0441	x4	
50	+0521	x4	
51	+2851	x4	
52	+5621	x4	
53	+2761	x4	

Plate IV Test 2 Unloading 3.5 p.s.i.

00	+0401	x4	
01	−0981	x4	
02	−1321	x4	
03	−0361	x4	
04	−1551	x4	
05	−1191	x4	
06	−0961	x4	
07	−2161	x4	
08	−1341	x4	
09	−1701	x4	
10	−3461	x4	
11	−1741	x4	
12	−1341	x4	
13	−2991	x4	
14	−1901	x4	
15	+0851	x4	
16	+1301	x4	
17	+1431	x4	
18	+1241	x4	
19	+1741	x4	
20	+1291	x4	
21	−0141	x4	
22	−0301	x4	
23	−0271	x4	
24	−1701	x4	
25	−3561	x4	
26	−1851	x4	
27	+1991	x4	
28	+1221	x4	
29	−1071	x4	
30	+2321	x4	
31	+2181	x4	
32	−0431	x4	
33	+2481	x4	
34	+3041	x4	
35	+0381	x4	
36	+2591	x4	
37	+5021	x4	
38	+2481	x4	
39	+2161	x4	
40	+4521	x4	
41	+2591	x4	
42	−0041	x4	
43	−0641	x4	
44	−0571	x4	
45	−0081	x4	
46	−0751	x4	
47	−0241	x4	
48	−0581	x4	
49	−0361	x4	
50	+0391	x4	
51	+2621	x4	
52	+5101	x4	
53	+2541	x4	

Plate IV Test 3 Loading 1 p.s.i.

00	−009	x2
01	+004	x2
02	+010	x2
03	+008	x2
04	+006	x2
05	+006	x2
06	−001	x2
07	−004	x2
08	+004	x2
09	+000	x2
10	−002	x2
11	+004	x2
12	+002	x2
13	−004	x2
14	+015	x2
15	+004	x2
16	−003	x2
17	+004	x2
18	+004	x2
19	−004	x2
20	+003	x2
21	+008	x2
22	+005	x2
23	+012	x2
24	+006	x2
25	+004	x2
26	+008	x2
27	+006	x2
28	+000	x2
29	+009	x2
30	+008	x2
31	+009	x2
32	+010	x2
33	+002	x2
34	+006	x2
35	+008	x2
36	+014	x2
37	+008	x2
38	+008	x2
39	+006	x2
40	+008	x2
41	+009	x2
42	+003	x2
43	+008	x2
44	+008	x2
45	+008	x2
46	+008	x2
47	+008	x2
48	+008	x2
49	+006	x2
50	+008	x2
51	+008	x2
52	+008	x2
53	+009	x2

Plate IV Test 3 .5 p.s.i.

00	+020	x2
01	−152	x2
02	−178	x2
03	−061	x2
04	−188	x2
05	−147	x2
06	−134	x2
07	−290	x2
08	−194	x2
09	−206	x2
10	−416	x2
11	−225	x2
12	−170	x2
13	−340	x2
14	−166	x2
15	+060	x2
16	+119	x2
17	+124	x2
18	+116	x2
19	+189	x2
20	+119	x2
21	−045	x2
22	−048	x2
23	−039	x2
24	−203	x2
25	−384	x2
26	−192	x2
27	+200	x2
28	+120	x2
29	+000	x2
30	+200	x2
31	+183	x2
32	−071	x2
33	+218	x2
34	+274	x2
35	−004	x2
36	+241	x2
37	+480	x2
38	+201	x2
39	+171	x2
40	+403	x2
41	+220	x2
42	−052	x2
43	−106	x2
44	−089	x2
45	−054	x2
46	−126	x2
47	−076	x2
48	−069	x2
49	−056	x2
50	−009	x2
51	+232	x2
52	+468	x2
53	+204	x2

Plate IV Test 3 Loading 1P.S.I.

00	+043	x2
01	−237	x2
02	−296	x2
03	−092	x2
04	−312	x2
05	−248	x2
06	−212	x2
07	−467	x2
08	−302	x2
09	−316	x2
10	−638	x2
11	−351	x2
12	−256	x2
13	−529	x2
14	−328	x2
15	+114	x2
16	+204	x2
17	+225	x2
18	+192	x2
19	+309	x2
20	+205	x2
21	−058	x2
22	−059	x2
23	−056	x2
24	−317	x2
25	−626	x2
26	−328	x2
27	+343	x2
28	+224	x2
29	−204	x2
30	+325	x2
31	+330	x2
32	−082	x2
33	+380	x2
34	+520	x2
35	+056	x2
36	+396	x2
37	+811	x2
38	+397	x2
39	+314	x2
40	+696	x2
41	+395	x2
42	−058	x2
43	−166	x2
44	−137	x2
45	−067	x2
46	−195	x2
47	−084	x2
48	−090	x2
49	−071	x2
50	+012	x2
51	+391	x2
52	+805	x2
53	+381	x2

Plate IV Test 3 Loading 1.5 p.s.i.

00	+039	x2
01	−148	x2
02	−191	x2
03	−057	x2
04	−208	x2
05	−156	x2
06	−135	x2
07	−298	x2
08	−190	x2
09	−197	x2
10	−405	x2
11	−217	x2
12	−160	x2
13	−342	x2
14	−218	x2
15	+079	x2
16	+140	x2
17	+154	x2
18	+129	x2
19	+206	x2
20	+142	x2
21	−025	x2
22	−036	x2
23	−030	x2
24	−198	x2
25	−394	x2
26	−207	x2
27	+239	x2
28	+158	x2
29	−129	x2
30	+234	x2
31	+234	x2
32	−044	x2
33	+269	x2
34	+356	x2
35	+048	x2
36	+268	x2
37	+536	x2
38	+266	x2
39	+196	x2
40	+475	x2
41	+275	x2
42	−028	x2
43	−095	x2
44	−000	x2
45	−025	x2
46	−112	x2
47	−051	x2
48	−055	x2
49	−001	x2
50	+047	x2
51	+277	x2
52	+533	x2
53	+262	x2

Plate IV Test 3 Loading 2 p.s.i.

00	+054	x2
01	−178	x2
02	−235	x2
03	−068	x2
04	−252	x2
05	−201	x2
06	−162	x2
07	−366	x2
08	−238	x2
09	−242	x2
10	−486	x2
11	−265	x2
12	−197	x2
13	−416	x2
14	−268	x2
15	+105	x2
16	+168	x2
17	+190	x2
18	+166	x2
19	+244	x2
20	+174	x2
21	−027	x2
22	−040	x2
23	−036	x2
24	−233	x2
25	−481	x2
26	−254	x2
27	+308	x2
28	+189	x2
29	−157	x2
30	+304	x2
31	+306	x2
32	−057	x2
33	+341	x2
34	+457	x2
35	+063	x2
36	+327	x2
37	+668	x2
38	+332	x2
39	+272	x2
40	+569	x2
41	+322	x2
42	−028	x2
43	−111	x2
44	−093	x2
45	−031	x2
46	−125	x2
47	−053	x2
48	−073	x2
49	−054	x2
50	+038	x2
51	+329	x2
52	+668	x2
53	+333	x2

Plate IV Test 3 Loading 2.5 p.s.i.

00	+058	x2
01	−181	x2
02	−237	x2
03	−074	x2
04	−270	x2
05	−210	x2
06	−174	x2
07	−384	x2
08	−252	x2
09	−279	x2
10	−559	x2
11	−302	x2
12	−269	x2
13	−480	x2
14	−312	x2
15	+123	x2
16	+196	x2
17	+217	x2
18	+190	x2
19	+280	x2
20	+198	x2
21	−034	x2
22	−050	x2
23	−030	x2
24	−271	x2
25	−563	x2
26	−300	x2
27	+326	x2
28	+198	x2
29	−173	x2
30	+340	x2
31	+330	x2
32	−058	x2
33	+377	x2
34	+482	x2
35	+065	x2
36	+387	x2
37	+786	x2
38	+386	x2
39	+322	x2
40	+697	x2
41	+401	x2
42	−024	x2
43	−118	x2
44	−103	x2
45	−032	x2
46	−138	x2
47	−052	x2
48	−082	x2
49	−064	x2
50	+047	x2
51	+390	x2
52	+790	x2
53	+392	x2

Plate IV Test 3 Loading 3 p.s.i.

00	+065	x2
01	−294	x2
02	−256	x2
03	−077	x2
04	−296	x2
05	−235	x2
06	−188	x2
07	−419	x2
08	−266	x2
09	−313	x2
10	+000	x2
11	−332	x2
12	−249	x2
13	+000	x2
14	−346	x2
15	+135	x2
16	+218	x2
17	+246	x2
18	+217	x2
19	+315	x2
20	+232	x2
21	−034	x2
22	−056	x2
23	−054	x2
24	−312	x2
25	−646	x2
26	−336	x2
27	+362	x2
28	+217	x2
29	−188	x2
30	+364	x2
31	+366	x2
32	−065	x2
33	+421	x2
34	+524	x2
35	+068	x2
36	+449	x2
37	+894	x2
38	+437	x2
39	+370	x2
40	+792	x2
41	+454	x2
42	−024	x2
43	−124	x2
44	−108	x2
45	−027	x2
46	−151	x2
47	−053	x2
48	−106	x2
49	−072	x2
50	+063	x2
51	+453	x2
52	+907	x2
53	+546	x2

Plate IV Test 2 Unloading 3 p.s.i.

00	+065	x2
01	−294	x2
02	−257	x2
03	−076	x2
04	−296	x2
05	−234	x2
06	−189	x2
07	−418	x2
08	−266	x2
09	−313	x2
10	−638	x2
11	−330	x2
12	−250	x2
13	+000	x2
14	−347	x2
15	+138	x2
16	+217	x2
17	+245	x2
18	+218	x2
19	+316	x2
20	+232	x2
21	−034	x2
22	−056	x2
23	−054	x2
24	−312	x2
25	−646	x2
26	−336	x2
27	+362	x2
28	+217	x2
29	−188	x2
30	+364	x2
31	+366	x2
32	−065	x2
33	+421	x2
34	+524	x2
35	+068	x2
36	+449	x2
37	+894	x2
38	+437	x2
39	+370	x2
40	+792	x2
41	+454	x2
42	−024	x2
43	−124	x2
44	−108	x2
45	−027	x2
46	−151	x2
47	−053	x2
48	−106	x2
49	−072	x2
50	+063	x2
51	+453	x2
52	+907	x2
53	+546	x2

Plate IV Test 2 Unloading 2.5 p.s.i.

00	+059	x2
01	−181	x2
02	−237	x2
03	−073	x2
04	−270	x2
05	−210	x2
06	−174	x2
07	−384	x2
08	−252	x2
09	−278	x2
10	−559	x2
11	−304	x2
12	−270	x2
13	−480	x2
14	−312	x2
15	+122	x2
16	+198	x2
17	+218	x2
18	+188	x2
19	+280	x2
20	+198	x2
21	−027	x2
22	−053	x2
23	−050	x2
24	−270	x2
25	−562	x2
26	−302	x2
27	+326	x2
28	+196	x2
29	−172	x2
30	+338	x2
31	+332	x2
32	−059	x2
33	+342	x2
34	+483	x2
35	+063	x2
36	+388	x2
37	+786	x2
38	+386	x2
39	+322	x2
40	+696	x2
41	+400	x2
42	−028	x2
43	−118	x2
44	−103	x2
45	−030	x2
46	−139	x2
47	−052	x2
48	−083	x2
49	−065	x2
50	+047	x2
51	+390	x2
52	+790	x2
53	+392	x2

Plate IV Test 2 Unloading 2 p.s.i.

00	+053	x2
01	−177	x2
02	−236	x2
03	−067	x2
04	−252	x2
05	−202	x2
06	−165	x2
07	−366	x2
08	−238	x2
09	−242	x2
10	−486	x2
11	−263	x2
12	−197	x2
13	−416	x2
14	−269	x2
15	+105	x2
16	+168	x2
17	+190	x2
18	+166	x2
19	+244	x2
20	+175	x2
21	−027	x2
22	−040	x2
23	−037	x2
24	−232	x2
25	−482	x2
26	−254	x2
27	+308	x2
28	+194	x2
29	−157	x2
30	+304	x2
31	+305	x2
32	−057	x2
33	+342	x2
34	+456	x2
35	+064	x2
36	+328	x2
37	+668	x2
38	+332	x2
39	+271	x2
40	+569	x2
41	+321	x2
42	−028	x2
43	−111	x2
44	−094	x2
45	−030	x2
46	−125	x2
47	−050	x2
48	−072	x2
49	−054	x2
50	+037	x2
51	+329	x2
52	+569	x2
53	+332	x2

Plate IV Test 2 Unloading 1.5 p.s.i.

00	+039	x2
01	−147	x2
02	−192	x2
03	−057	x2
04	−207	x2
05	−156	x2
06	−132	x2
07	−298	x2
08	−190	x2
09	−198	x2
10	−404	x2
11	−217	x2
12	−161	x2
13	−342	x2
14	−217	x2
15	+080	x2
16	+141	x2
17	+156	x2
18	+129	x2
19	+183	x2
20	+140	x2
21	−026	x2
22	−036	x2
23	−030	x2
24	−200	x2
25	−394	x2
26	−208	x2
27	+238	x2
28	+152	x2
29	−128	x2
30	+235	x2
31	+235	x2
32	−044	x2
33	+269	x2
34	+356	x2
35	+048	x2
36	+267	x2
37	+536	x2
38	+267	x2
39	+196	x2
40	+473	x2
41	+275	x2
42	−028	x2
43	−096	x2
44	−079	x2
45	−026	x2
46	−112	x2
47	−050	x2
48	−057	x2
49	−042	x2
50	+002	x2
51	+278	x2
52	+534	x2
53	+262	x2

Plate IV Test 2 Unloading 1P.S.I.

00	+042	x2
01	−238	x2
02	−298	x2
03	−092	x2
04	−314	x2
05	−246	x2
06	−210	x2
07	−467	x2
08	−304	x2
09	−317	x2
10	−639	x2
11	−351	x2
12	−256	x2
13	−529	x2
14	−332	x2
15	+115	x2
16	+203	x2
17	+223	x2
18	+192	x2
19	+309	x2
20	+205	x2
21	−058	x2
22	−059	x2
23	−056	x2
24	−316	x2
25	−626	x2
26	−329	x2
27	+342	x2
28	+224	x2
29	−204	x2
30	+324	x2
31	+328	x2
32	−080	x2
33	+368	x2
34	+517	x2
35	+056	x2
36	+394	x2
37	+810	x2
38	+396	x2
39	+310	x2
40	+694	x2
41	+396	x2
42	−058	x2
43	−166	x2
44	−136	x2
45	−064	x2
46	−196	x2
47	−085	x2
48	−093	x2
49	−073	x2
50	+013	x2
51	+392	x2
52	+804	x2
53	+380	x2

Plate IV Test 2 Unloading .5 p.s.i.

00	+042	x2
01	−238	x2
02	−298	x2
03	−092	x2
04	−314	x2
05	−246	x2
06	−210	x2
07	−467	x2
08	−304	x2
09	−317	x2
10	−639	x2
11	−351	x2
12	−256	x2
13	−529	x2
14	−332	x2
15	+115	x2
16	+203	x2
17	+223	x2
18	+192	x2
19	+309	x2
20	+205	x2
21	−058	x2
22	−059	x2
23	−056	x2
24	−316	x2
25	−626	x2
26	−329	x2
27	+342	x2
28	+224	x2
29	−204	x2
30	+324	x2
31	+328	x2
32	−080	x2
33	+368	x2
34	+517	x2
35	+056	x2
36	+394	x2
37	+810	x2
38	+396	x2
39	+310	x2
40	+694	x2
41	+396	x2
42	−058	x2
43	−166	x2
44	−136	x2
45	−064	x2
46	−196	x2
47	−085	x2
48	−093	x2
49	−073	x2
50	+013	x2
51	+392	x2
52	+804	x2
53	+380	x2

Plate IV Test 2 Unloading .25 p.s.i.

00	+150	0 −014
01	−153	01 −007
02	−182	02 −003
03	−062	03 −010
04	−186	04 +002
05	−146	05 −003
06	−136	06 −015
07	−289	07 −019
08	−195	08 −019
09	−204	09 −014
10	−416	10 −023
11	−226	11 −011
12	−169	12 −014
13	−340	13 −016
14	−166	14 −014
15	+061	15 −015
16	+119	16 −008
17	+124	17 −011
18	+117	18 −012
19	+189	19 −014
20	+118	20 −014
21	−042	21 −013
22	−047	22 −012
23	−040	23 −014
24	−202	24 −016
25	−382	25 −018
26	−192	26 −014
27	+198	27 −016
28	+152	28 −004
29	−130	29 −017
30	+194	30 −008
31	+235	31 −013
32	−070	32 −014
33	+218	33 −012
34	+273	34 −016
35	−003	35 −016
36	+247	36 −011
37	+201	37 −013
38	+174	38 −006
39	+196	39 −011
40	+400	40 −008
41	+218	41 −014
42	−051	42 −017
43	−096	43 −014
44	−092	44 −012
45	−054	45 −012
46	−075	46 −016
47	−057	47 −014
48	−057	48 −014
49	−009	49 −015
50	−038	50 −020
51	+239	51 −007
52	+047	52 −011
53	+204	53 −012

Plate IV Test 2 Loading .25 p.s.i.

00	+150	0 −014
01	−153	01 −007
02	−182	02 −003
03	−062	03 −010
04	−186	04 +002
05	−146	05 −003
06	−136	06 −015
07	−289	07 −019
08	−195	08 −019
09	−204	09 −014
10	−416	10 −023
11	−226	11 −011
12	−169	12 −014
13	−340	13 −016
14	−166	14 −014
15	+061	15 −015
16	+119	16 −008
17	+124	17 −011
18	+117	18 −012
19	+189	19 −014
20	+118	20 −014
21	−042	21 −013
22	−047	22 −012
23	−040	23 −014
24	−202	24 −016
25	−382	25 −018
26	−192	26 −014
27	+198	27 −016
28	+152	28 −004
29	−130	29 −017
30	+194	30 −008
31	+235	31 −013
32	−070	32 −014
33	+218	33 −012
34	+273	34 −016
35	−003	35 −016
36	+247	36 −011
37	+201	37 −013
38	+174	38 −006
39	+196	39 −011
40	+400	40 −008
41	+218	41 −014
42	−051	42 −017
43	−096	43 −014
44	−092	44 −012
45	−054	45 −012
46	−075	46 −016
47	−057	47 −014
48	−057	48 −014
49	−009	49 −015
50	−038	50 −020
51	+239	51 −007
52	+047	52 −011
53	+204	53 −012

Plate IV Test 3 Unloading 4.5 p.s.i.

00	+050	x4	
01	−116	x4	
02	−152	x4	
03	−085	x4	
04	−189	x4	
05	−142	x4	
06	−115	x4	
07	−260	x4	
08	−160	x4	
09	−199	x4	
10	−408	x4	
11	−206	x4	
12	−158	x4	
13	−359	x4	
14	−228	x4	
15	+104	x4	
16	+143	x4	
17	+166	x4	
18	+141	x4	
19	+200	x4	
20	+153	x4	
21	−018	x4	
22	−039	x4	
23	−038	x4	
24	−202	x4	
25	−424	x4	
26	−214	x4	
27	+234	x4	
28	+150	x4	
29	−124	x4	
30	+248	x4	
31	+241	x4	
32	−042	x4	
33	+273	x4	
34	+338	x4	
35	+046	x4	
36	+301	x4	
37	+596	x4	
38	+291	x4	
39	+259	x4	
40	+537	x4	
41	+302	x4	
42	+002	x4	
43	−065	x4	
44	−072	x4	
45	−004	x4	
46	−084	x4	
47	−024	x4	
48	−072	x4	
49	−046	x4	
50	+053	x4	
51	+312	x4	
52	+610	x4	
53	+306	x4	

Plate IV Test 3 Unloading 4 p.s.i

00	+044	x4	
01	−106	x4	
02	−144	x4	
03	−038	x4	
04	−174	x4	
05	−127	x4	
06	−104	x4	
07	−236	x4	
08	−148	x4	
09	−189	x4	
10	−378	x4	
11	−194	x4	
12	−141	x4	
13	−329	x4	
14	−205	x4	
15	+096	x4	
16	+132	x4	
17	+158	x4	
18	+136	x4	
19	+188	x4	
20	+144	x4	
21	−018	x4	
22	−034	x4	
23	−036	x4	
24	−188	x4	
25	−394	x4	
26	−206	x4	
27	+219	x4	
28	+131	x4	
29	−119	x4	
30	+229	x4	
31	+198	x4	
32	−042	x4	
33	+252	x4	
34	+306	x4	
35	+032	x4	
36	+280	x4	
37	+553	x4	
38	+266	x4	
39	+226	x4	
40	+479	x4	
41	+272	x4	
42	−004	x4	
43	−067	x4	
44	−061	x4	
45	−012	x4	
46	−083	x4	
47	−029	x4	
48	−070	x4	
49	−044	x4	
50	+052	x4	
51	+286	x4	
52	+558	x4	
53	+276	x4	

Plate IV Test 3 Unloading 3.5 p.s.i.

00	+041	x4	
01	−098	x4	
02	−132	x4	
03	−036	x4	
04	−155	x4	
05	−121	x4	
06	−096	x4	
07	−216	x4	
08	−134	x4	
09	−170	x4	
10	−346	x4	
11	−174	x4	
12	−133	x4	
13	−300	x4	
14	−190	x4	
15	+085	x4	
16	+129	x4	
17	+142	x4	
18	+128	x4	
19	+174	x4	
20	+129	x4	
21	−014	x4	
22	−030	x4	
23	−029	x4	
24	−168	x4	
25	−353	x4	
26	−184	x4	
27	+192	x4	
28	+123	x4	
29	−100	x4	
30	+205	x4	
31	+195	x4	
32	−033	x4	
33	+229	x4	
34	+282	x4	
35	+040	x4	
36	+258	x4	
37	+502	x4	
38	+248	x4	
39	+214	x4	
40	+453	x4	
41	+259	x4	
42	−003	x4	
43	−062	x4	
44	−056	x4	
45	−008	x4	
46	−075	x4	
47	−024	x4	
48	−056	x4	
49	−037	x4	
50	+040	x4	
51	+262	x4	
52	+510	x4	
53	+254	x4	

Plate IV Test 3 Unloading 3 p.s.i.

00	+067	x2	
01	−293	x2	
02	−256	x2	
03	−078	x2	
04	−296	x2	
05	−235	x2	
06	−189	x2	
07	−419	x2	
08	−267	x2	
09	−313	x2	
10	−639	x2	
11	−331	x2	
12	−248	x2	
13	−549	x2	
14	−347	x2	
15	+136	x2	
16	+217	x2	
17	+246	x2	
18	+217	x2	
19	+318	x2	
20	+233	x2	
21	−034	x2	
22	−056	x2	
23	−055	x2	
24	−310	x2	
25	−646	x2	
26	−336	x2	
27	+363	x2	
28	+219	x2	
29	−188	x2	
30	+364	x2	
31	+364	x2	
32	−066	x2	
33	+342	x2	
34	+522	x2	
35	+068	x2	
36	+449	x2	
37	+896	x2	
38	+436	x2	
39	+371	x2	
40	+792	x2	
41	+454	x2	
42	−024	x2	
43	−124	x2	
44	−109	x2	
45	−028	x2	
46	−152	x2	
47	−053	x2	
48	−108	x2	
49	−072	x2	
50	+063	x2	
51	+453	x2	
52	+908	x2	
53	+546	x2	

Plate IV Test 3 Unloading 2.5 p.s.i

00	+058	x2	
01	−182	x2	
02	−237	x2	
03	−074	x2	
04	−270	x2	
05	−210	x2	
06	−174	x2	
07	−386	x2	
08	−252	x2	
09	−280	x2	
10	−560	x2	
11	−302	x2	
12	−269	x2	
13	−480	x2	
14	−312	x2	
15	+123	x2	
16	+197	x2	
17	+218	x2	
18	+190	x2	
19	+280	x2	
20	+198	x2	
21	−034	x2	
22	−052	x2	
23	−047	x2	
24	−272	x2	
25	−564	x2	
26	−302	x2	
27	+326	x2	
28	+196	x2	
29	−173	x2	
30	+340	x2	
31	+330	x2	
32	−058	x2	
33	+376	x2	
34	+484	x2	
35	+064	x2	
36	+388	x2	
37	+786	x2	
38	+386	x2	
39	+322	x2	
40	+697	x2	
41	+400	x2	
42	−024	x2	
43	−118	x2	
44	−102	x2	
45	−030	x2	
46	−138	x2	
47	−052	x2	
48	−083	x2	
49	−064	x2	
50	+047	x2	
51	+389	x2	
52	+789	x2	
53	+392	x2	

Plate IV Test 3 Unloading 2 p.s.i

00	+054	x2	
01	−177	x2	
02	−236	x2	
03	−067	x2	
04	−252	x2	
05	−202	x2	
06	−164	x2	
07	−366	x2	
08	−238	x2	
09	−242	x2	
10	−486	x2	
11	−263	x2	
12	−196	x2	
13	−416	x2	
14	−267	x2	
15	+105	x2	
16	+168	x2	
17	+186	x2	
18	+164	x2	
19	+242	x2	
20	+175	x2	
21	−028	x2	
22	−038	x2	
23	−037	x2	
24	−231	x2	
25	−482	x2	
26	−253	x2	
27	+308	x2	
28	+194	x2	
29	−157	x2	
30	+305	x2	
31	+305	x2	
32	−056	x2	
33	+342	x2	
34	+456	x2	
35	+062	x2	
36	+327	x2	
37	+668	x2	
38	+331	x2	
39	+272	x2	
40	+567	x2	
41	+322	x2	
42	−028	x2	
43	−112	x2	
44	−094	x2	
45	−031	x2	
46	−125	x2	
47	−051	x2	
48	−072	x2	
49	−054	x2	
50	+037	x2	
51	+328	x2	
52	+669	x2	
53	+332	x2	

Plate IV Test 3 Loading 3.5 p.s.i.

00	+041	x4	
01	−098	x4	
02	−132	x4	
03	−036	x4	
04	−156	x4	
05	−120	x4	
06	−096	x4	
07	−217	x4	
08	−134	x4	
09	−170	x4	
10	−346	x4	
11	−175	x4	
12	−134	x4	
13	−300	x4	
14	−190	x4	
15	+085	x4	
16	+127	x4	
17	+142	x4	
18	+123	x4	
19	+175	x4	
20	+130	x4	
21	−015	x4	
22	−030	x4	
23	−028	x4	
24	−170	x4	
25	−352	x4	
26	−184	x4	
27	+192	x4	
28	+123	x4	
29	−100	x4	
30	+205	x4	
31	+197	x4	
32	−033	x4	
33	+230	x4	
34	+283	x4	
35	+040	x4	
36	+258	x4	
37	+502	x4	
38	+248	x4	
39	+214	x4	
40	+452	x4	
41	+258	x4	
42	−004	x4	
43	−063	x4	
44	−056	x4	
45	−008	x4	
46	−075	x4	
47	−024	x4	
48	−056	x4	
49	−037	x4	
50	+040	x4	
51	+261	x4	
52	+610	x4	
53	+306	x4	

Plate IV Test 3 Loading 4 p.s.i.

00	+044	x4	
01	−106	x4	
02	−144	x4	
03	+000	x4	
04	−174	x4	
05	−128	x4	
06	−104	x4	
07	−236	x4	
08	−148	x4	
09	−190	x4	
10	−378	x4	
11	−194	x4	
12	−143	x4	
13	+000	x4	
14	−206	x4	
15	+094	x4	
16	+131	x4	
17	+159	x4	
18	+138	x4	
19	+189	x4	
20	+144	x4	
21	−018	x4	
22	−032	x4	
23	−036	x4	
24	−188	x4	
25	−394	x4	
26	−206	x4	
27	+220	x4	
28	+129	x4	
29	−118	x4	
30	+228	x4	
31	+198	x4	
32	−042	x4	
33	+252	x4	
34	+305	x4	
35	+032	x4	
36	+279	x4	
37	+552	x4	
38	+266	x4	
39	+225	x4	
40	+480	x4	
41	+272	x4	
42	−004	x4	
43	−068	x4	
44	−062	x4	
45	−011	x4	
46	−082	x4	
47	−027	x4	
48	−071	x4	
49	−044	x4	
50	+052	x4	
51	+285	x4	
52	+562	x4	
53	+276	x4	

Plate IV Test 3 Loading 4.5 p.s.i. Loading

00	+050	x4	
01	−116	x4	
02	−152	x4	
03	−045	x4	
04	−189	x4	
05	−141	x4	
06	−116	x4	
07	−260	x4	
08	−160	x4	
09	−199	x4	
10	−408	x4	
11	−205	x4	
12	−157	x4	
13	−358	x4	
14	−228	x4	
15	+103	x4	
16	+144	x4	
17	+166	x4	
18	+142	x4	
19	+199	x4	
20	+153	x4	
21	−019	x4	
22	−039	x4	
23	−038	x4	
24	−200	x4	
25	−424	x4	
26	−214	x4	
27	+235	x4	
28	+146	x4	
29	−125	x4	
30	+247	x4	
31	+241	x4	
32	−042	x4	
33	+273	x4	
34	+338	x4	
35	+046	x4	
36	+300	x4	
37	+596	x4	
38	+291	x4	
39	+257	x4	
40	+537	x4	
41	+303	x4	
42	+002	x4	
43	−065	x4	
44	−072	x4	
45	−004	x4	
46	−082	x4	
47	−024	x4	
48	−073	x4	
49	−046	x4	
50	+052	x4	
51	+312	x4	
52	+610	x4	
53	+306	x4	

Plate IV Test 3 Loading 5 p.s.i.

00	+051	x4	
01	−110	x4	
02	−154	x4	
03	−044	x4	
04	−189	x4	
05	−143	x4	
06	−116	x4	
07	−262	x4	
08	−162	x4	
09	−214	x4	
10	−432	x4	
11	−215	x4	
12	−168	x4	
13	−380	x4	
14	−244	x4	
15	+110	x4	
16	+152	x4	
17	+181	x4	
18	+150	x4	
19	+214	x4	
20	+164	x4	
21	−020	x4	
22	−042	x4	
23	−043	x4	
24	−217	x4	
25	−454	x4	
26	−224	x4	
27	+236	x4	
28	+140	x4	
29	−128	x4	
30	+254	x4	
31	+241	x4	
32	−042	x4	
33	+278	x4	
34	+352	x4	
35	+045	x4	
36	+326	x4	
37	+640	x4	
38	+314	x4	
39	+279	x4	
40	+574	x4	
41	+325	x4	
42	+001	x4	
43	−067	x4	
44	−065	x4	
45	−004	x4	
46	−083	x4	
47	−023	x4	
48	−083	x4	
49	−053	x4	
50	+058	x4	
51	+338	x4	
52	+557	x4	
53	+329	x4	

Plate IV Test 3 Loading 5.5 psi

00	+056	x4	
01	−122	x4	
02	−164	x4	
03	−048	x4	
04	−206	x4	
05	−153	x4	
06	−121	x4	
07	−278	x4	
08	−170	x4	
09	−225	x4	
10	−464	x4	
11	−221	x4	
12	−128	x4	
13	−408	x4	
14	−256	x4	
15	+114	x4	
16	+158	x4	
17	+190	x4	
18	+164	x4	
19	+222	x4	
20	+175	x4	
21	−022	x4	
22	−048	x4	
23	−046	x4	
24	−234	x4	
25	−486	x4	
26	−242	x4	
27	+252	x4	
28	+150	x4	
29	−138	x4	
30	+277	x4	
31	+260	x4	
32	−051	x4	
33	+298	x4	
34	+361	x4	
35	+048	x4	
36	+348	x4	
37	+684	x4	
38	+334	x4	
39	+296	x4	
40	+614	x4	
41	+342	x4	
42	+031	x4	
43	−067	x4	
44	−069	x4	
45	−082	x4	
46	−082	x4	
47	−023	x4	
48	−082	x4	
49	−053	x4	
50	+053	x4	
51	+337	x4	
52	+557	x4	
53	+329	x4	

Plate IV Test 3 Unloading 5 p.s.i.

00	+050	x4	
01	−111	x4	
02	−154	x4	
03	−045	x4	
04	−190	x4	
05	−143	x4	
06	−116	x4	
07	−262	x4	
08	−162	x4	
09	−214	x4	
10	−432	x4	
11	−216	x4	
12	−166	x4	
13	+000	x4	
14	−245	x4	
15	+109	x4	
16	+152	x4	
17	+179	x4	
18	+151	x4	
19	+214	x4	
20	+164	x4	
21	−021	x4	
22	−042	x4	
23	−044	x4	
24	−217	x4	
25	−454	x4	
26	−226	x4	
27	+235	x4	
28	+143	x4	
29	−128	x4	
30	+254	x4	
31	+242	x4	
32	−042	x4	
33	+280	x4	
34	+352	x4	
35	+046	x4	
36	+327	x4	
37	+640	x4	
38	+314	x4	
39	+280	x4	
40	+570	x4	
41	+325	x4	
42	+001	x4	
43	−067	x4	
44	−065	x4	
45	−004	x4	
46	−083	x4	
47	−024	x4	
48	−082	x4	
49	−051	x4	
50	+058	x4	
51	+337	x4	
52	+557	x4	
53	+329	x4	

Plate IV Test 3 Unloading 1.5 psi

00	+040	x2
01	-147	x2
02	-191	x2
03	-058	x2
04	-207	x2
05	-156	x2
06	-135	x2
07	-298	x2
08	-199	x2
09	-199	x2
10	-406	x2
11	-216	x2
12	-162	x2
13	-343	x2
14	-217	x2
15	+079	x2
16	+139	x2
17	+153	x2
18	+133	x2
19	+206	x2
20	+142	x2
21	-025	x2
22	-036	x2
23	-030	x2
24	-198	x2
25	-394	x2
26	-208	x2
27	+239	x2
28	+157	x2
29	-129	x2
30	+234	x2
31	+236	x2
32	-044	x2
33	+264	x2
34	+370	x2
35	+051	x2
36	+268	x2
37	+537	x2
38	+263	x2
39	+218	x2
40	+472	x2
41	+275	x2
42	-029	x2
43	-095	x2
44	-080	x2
45	-025	x2
46	-112	x2
47	-048	x2
48	-057	x2
49	-042	x2
50	+001	x2
51	+277	x2
52	+533	x2
53	+262	x2

Plate IV Test 3 Unloading 1 psi.

00	+042	20
01	-238	0
02	-296	0
03	-092	0
04	-312	04
05	-247	05
06	-209	06
07	-467	07
08	-302	08
09	-318	09
10	+000	10
11	-351	11
12	-257	12
13	-528	13
14	-330	14
15	+115	15
16	+204	16
17	+224	17
18	+198	18
19	+310	19
20	+204	20
21	-058	21
22	+000	22
23	-057	23
24	-316	24
25	-626	25
26	-332	26
27	+341	27
28	+230	28
29	-205	29
30	+323	30
31	+329	31
32	-078	32
33	+367	33
34	+520	34
35	+057	35
36	+395	36
37	+810	37
38	+396	38
39	+313	39
40	+696	40
41	+396	41
42	-058	42
43	-165	43
44	-132	44
45	-069	45
46	-194	46
47	-085	47
48	-091	48
49	-069	49
50	+013	50
51	+391	51
52	+804	52
53	+380	53

Plate IV Test 3 Unloading 0.5 psi.

00	+020	0
01	-052	
02	-074	
03	-015	
04	-080	
05	-066	
06	-951	
07	-106	
08	-071	
09	-065	
10	-126	
11	-063	
12	-059	
13	+000	
14	-086	
15	+055	
16	+090	
17	+100	
18	+058	
19	+108	
20	+073	
21	-008	
22	-017	
23	-024	
24	-039	
25	-071	
26	-042	
27	+097	
28	+070	
29	-044	
30	+111	
31	+124	
32	-006	
33	+128	
34	+185	
35	+045	
36	+142	
37	+277	
38	+142	
39	+134	
40	+276	
41	+150	
42	+010	
43	+000	
44	-002	
45	+036	
46	+018	
47	+019	
48	-042	
49	-030	
50	+014	
51	+116	
52	+223	
53	+114	

Plate IV Test 3 Unloading 0 p.s.i.

00	-017	
01	-007	
02	-003	
03	-010	
04	+002	
05	-005	
06	-014	
07	-019	
08	-014	
09	-014	
10	-022	
11	-012	
12	-014	
13	-022	
14	-015	
15	-014	
16	-008	
17	-009	
18	-014	
19	-016	
20	-013	
21	-016	
22	-014	
23	-014	
24	-016	
25	-018	
26	-014	
27	-016	
28	-005	
29	-015	
30	-008	
31	-012	
32	-013	
33	-016	
34	-016	
35	-013	
36	-011	
37	-014	
38	-014	
39	-016	
40	-006	
41	-014	
42	-020	
43	-017	
44	-014	
45	-011	
46	-017	
47	-017	
48	-015	
49	+000	
50	-018	
51	-010	
52	-012	
53	-011	

Plate III Yield 0 p.s.i. Loading

00	-010	
01	-005	
02	-004	
03	-005	
04	-009	
05	-006	
06	-008	
07	-007	
08	-008	
09	-009	
10	-012	
11	-004	
12	-009	
13	-009	
14	-011	
15	-014	
16	-016	
17	-004	
18	-008	
19	-010	
20	-003	
21	-001	
22	-004	
23	-006	
24	-008	
25	-004	
26	-008	
27	+000	
28	-006	
29	-003	
30	-001	
31	-002	
32	-005	
33	+002	
34	+002	
35	-004	
36	-003	
37	+001	
38	-002	
39	-003	
40	+002	
41	-005	
42	-008	
43	-007	
44	+000	
45	+000	
46	-003	
47	+002	
48	-001	
49	+000	
50	-005	
51	+002	
52	-003	
53	-003	

Plate III Yield 0.25 psi. Loading

00	+020	0
01	-052	
02	-074	
03	-015	
04	-080	
05	-066	
06	-062	
07	-138	
08	-088	
09	-079	
10	-154	
11	-080	
12	-075	
13	-166	
14	-107	
15	+073	
16	+128	
17	+139	
18	+071	
19	+136	
20	+088	
21	-007	
22	-019	
23	-031	
24	-088	
25	-089	
26	-053	
27	+128	
28	+092	
29	-056	
30	+147	
31	+165	
32	-006	
33	+168	
34	+242	
35	+061	
36	+183	
37	+361	
38	+182	
39	+171	
40	+361	
41	+193	
42	+019	
43	+010	
44	+004	
45	+056	
46	+038	
47	+036	
48	-054	
49	-037	
50	+022	
51	+152	
52	+296	
53	+155	

Plate III Yield Loading 0.375 psi.

00	+030	
01	-060	
02	-090	
03	-019	
04	-100	
05	-084	
06	-062	
07	-138	
08	-088	
09	-079	
10	-154	
11	-080	
12	-075	
13	-166	
14	-107	
15	+073	
16	+128	
17	+139	
18	+071	
19	+136	
20	+088	
21	-007	
22	-019	
23	-031	
24	-088	
25	-089	
26	-053	
27	+128	
28	+092	
29	-056	
30	+147	
31	+165	
32	-006	
33	+168	
34	+242	
35	+061	
36	+183	
37	+361	
38	+182	
39	+171	
40	+361	
41	+193	
42	+019	
43	+010	
44	+004	
45	+056	
46	+038	
47	+036	
48	-054	
49	-037	
50	+022	
51	+152	
52	+296	
53	+155	

Plate 3 Yield 2.5 psi.

00	+062	x2
01	-060	x2
02	-094	x2
03	-026	x2
04	-139	x2
05	-122	x2
06	-086	x2
07	-174	x2
08	-111	x2
09	-086	x2
10	-172	x2
11	-095	x2
12	-080	x2
13	-174	x2
14	-118	x2
15	+113	x2
16	+176	x2
17	+186	x2
18	+128	x2
19	+201	x2
20	+140	x2
21	+085	x2
22	-024	x2
23	-054	x2
24	-058	x2
25	-114	x2
26	-065	x2
27	+169	x2
28	+118	x2
29	-100	x2
30	+241	x2
31	+261	x2
32	-010	x2
33	+258	x2
34	+366	x2
35	+090	x2
36	+265	x2
37	+500	x2
38	+256	x2
39	+238	x2
40	+486	x2
41	+269	x2
42	+052	x2
43	+053	x2
44	+047	x2
45	+081	x2
46	+079	x2
47	+072	x2
48	-096	x2
49	-064	x2
50	+046	x2
51	+221	x2
52	+436	x2
53	+233	x2

Plate 3 Yield 2.5 p.s.i.

00	+068	x2
01	-060	x2
02	-096	x2
03	-028	x2
04	-149	x2
05	-130	x2
06	-092	x2
07	-184	x2
08	-119	x2
09	-088	x2
10	-178	x2
11	-098	x2
12	-082	x2
13	-184	x2
14	-120	x2
15	+121	x2
16	+189	x2
17	+200	x2
18	+138	x2
19	+214	x2
20	+150	x2
21	+097	x2
22	-025	x2
23	-060	x2
24	-060	x2
25	-119	x2
26	-068	x2
27	+179	x2
28	+124	x2
29	-109	x2
30	+258	x2
31	+280	x2
32	-010	x2
33	+276	x2
34	+390	x2
35	+096	x2
36	+281	x2
37	+534	x2
38	+270	x2
39	+252	x2
40	+519	x2
41	+288	x2
42	+058	x2
43	+059	x2
44	+055	x2
45	+088	x2
46	+088	x2
47	+079	x2
48	-106	x2
49	-076	x2
50	+052	x2
51	+237	x2
52	+465	x2
53	+250	x2

Plate 3 Yield 2.75 psi.

00	+072	x2
01	-061	x2
02	-099	x2
03	-030	x2
04	-159	x2
05	-142	x2
06	-102	x2
07	-202	x2
08	-128	x2
09	-098	x2
10	-188	x2
11	-105	x2
12	-083	x2
13	-190	x2
14	-128	x2
15	+131	x2
16	+201	x2
17	+211	x2
18	+151	x2
19	+229	x2
20	+161	x2
21	+088	x2
22	-027	x2
23	-064	x2
24	-065	x2
25	-123	x2
26	-071	x2
27	+188	x2
28	+131	x2
29	-119	x2
30	+277	x2
31	+302	x2
32	-012	x2
33	+296	x2
34	+419	x2
35	+103	x2
36	+299	x2
37	+566	x2
38	+286	x2
39	+267	x2
40	+550	x2
41	+306	x2
42	+063	x2
43	+066	x2
44	+062	x2
45	+096	x2
46	+103	x2
47	+086	x2
48	-114	x2
49	-070	x2
50	+058	x2
51	+252	x2
52	+495	x2
53	+267	x2
54	+286	x2

Plate 3 Yield 3 p.s.i.

00	+080	x2
01	-061	x2
02	-100	x2
03	-030	x2
04	-167	x2
05	-142	x2
06	-102	x2
07	-202	x2
08	-128	x2
09	-094	x2
10	-188	x2
11	-105	x2
12	-083	x2
13	-190	x2
14	-128	x2
15	+140	x2
16	+213	x2
17	+223	x2
18	+160	x2
19	+243	x2
20	+109	x2
21	+011	x2
22	-026	x2
23	-070	x2
24	-065	x2
25	-129	x2
26	-074	x2
27	+200	x2
28	+138	x2
29	-128	x2
30	+296	x2
31	+321	x2
32	-014	x2
33	+315	x2
34	+445	x2
35	+108	x2
36	+317	x2
37	+596	x2
38	+303	x2
39	+281	x2
40	+578	x2
41	+324	x2
42	+068	x2
43	+071	x2
44	+067	x2
45	+102	x2
46	+103	x2
47	+093	x2
48	-125	x2
49	-082	x2
50	+062	x2
51	+266	x2
52	+525	x2
53	+283	x2

Plate 3 Yield 3.25 p.s.i.

00	+085	x2
01	-062	x2
02	-101	x2
03	-033	x2
04	-177	x2
05	+000	x2
06	-110	x2
07	-212	x2
08	-131	x2
09	-098	x2
10	-194	x2
11	-110	x2
12	-086	x2
13	-196	x2
14	-134	x2
15	+147	x2
16	+224	x2
17	+238	x2
18	+168	x2
19	+258	x2
20	+181	x2
21	+011	x2
22	-027	x2
23	-075	x2
24	-070	x2
25	-134	x2
26	-077	x2
27	+210	x2
28	+143	x2
29	-137	x2
30	+315	x2
31	+342	x2
32	-017	x2
33	+336	x2
34	+470	x2
35	+118	x2
36	+333	x2
37	+627	x2
38	+317	x2
39	+294	x2
40	+606	x2
41	+342	x2
42	+073	x2
43	+077	x2
44	+073	x2
45	+108	x2
46	+109	x2
47	+100	x2
48	-134	x2
49	-088	x2
50	+067	x2
51	+280	x2
52	+555	x2
53	+300	x2

Plate 3 Yield 3.5 p.s.i.

00	+091	x2
01	-061	x2
02	-102	x2
03	-035	x2
04	-184	x2
05	-156	x2
06	-114	x2
07	-221	x2
08	-135	x2
09	-100	x2
10	-200	x2
11	-111	x2
12	-088	x2
13	-201	x2
14	-137	x2
15	+155	x2
16	+234	x2
17	+249	x2
18	+177	x2
19	+268	x2
20	+191	x2
21	+014	x2
22	-027	x2
23	-080	x2
24	-071	x2
25	-138	x2
26	-080	x2
27	+219	x2
28	+147	x2
29	-145	x2
30	+332	x2
31	+358	x2
32	-019	x2
33	+352	x2
34	+490	x2
35	+118	x2
36	+349	x2
37	+652	x2
38	+330	x2
39	+307	x2
40	+631	x2
41	+356	x2
42	+078	x2
43	+081	x2
44	+078	x2
45	+113	x2
46	+115	x2
47	+106	x2
48	-141	x2
49	-094	x2
50	+072	x2
51	+293	x2
52	+579	x2
53	+314	x2

Plate 3
Yield
7P S.I.
Plate 3
Yield
6P S.I.
Plate 3
Yield
5.5 P.S.I.
Plate 3
Yield
5 P.S.I.
Plate 3
Yield
4.5 P.S.I.
Plate 3
Yield
4 P.S.I.
Plate 3
Yield
2.125 P.S.I.
Plate 3
Yield
1.25 P.S.I.
Plate 3
Yield
1P S.I.
Plate 3
Yield
.875 P.S.I.
Plate 3
Yield
.75 P.S.I.
Plate 3
Yield
.625 P.S.I.
Plate 3
Yield
.5 P.S.I.

Plate 3 Yield 7 p.s.i.

00	+081	x4	
01	-026	x4	
02	-046	x4	
03	-038	x4	
04	-145	x4	
05	-118	x4	
06	-098	x4	
07	-156	x4	
08	-089	x4	
09	-060	x4	
10	-128	x4	
11	-073	x4	
12	-047	x4	
13	-127	x4	
14	-094	x4	
15	+125	x4	
16	+178	x4	
17	+198	x4	
18	+155	x4	
19	+212	x4	
20	+164	x4	
21	+022	x4	
22	-019	x4	
23	-079	x4	
24	-053	x4	
25	-119	x4	
26	-075	x4	
27	+157	x4	
28	+086	x4	
29	-153	x4	
30	+276	x4	
31	+288	x4	
32	-036	x4	
33	+289	x4	
34	+392	x4	
35	+080	x4	
36	+264	x4	
37	+486	x4	
38	+242	x4	
39	+222	x4	
40	+470	x4	
41	+274	x4	
42	+074	x4	
43	+069	x4	
44	+077	x4	
45	+094	x4	
46	+090	x4	
47	+094	x4	
48	-153	x4	
49	-100	x4	
50	+068	x4	
51	+237	x4	
52	+472	x4	
53	+265	x4	

Plate 3 Yield 8 p.s.i.

00	+086	x4	
01	-024	x4	
02	-044	x4	
03	-039	x4	
04	+000	x4	
05	-120	x4	
06	-102	x4	
07	-160	x4	
08	-090	x4	
09	-064	x4	
10	-130	x4	
11	-076	x4	
12	-048	x4	
13	-130	x4	
14	-097	x4	
15	+132	x4	
16	+184	x4	
17	+205	x4	
18	+162	x4	
19	+220	x4	
20	+170	x4	
21	+025	x4	
22	-018	x4	
23	-083	x4	
24	-057	x4	
25	-126	x4	
26	-078	x4	
27	+161	x4	
28	+086	x4	
29	-161	x4	
30	+287	x4	
31	+300	x4	
32	-039	x4	
33	+302	x4	
34	+408	x4	
35	+081	x4	
36	+274	x4	
37	+504	x4	
38	+250	x4	
39	+229	x4	
40	+486	x4	
41	+283	x4	
42	+078	x4	
43	+073	x4	
44	+082	x4	
45	+100	x4	
46	+094	x4	
47	+100	x4	
48	-162	x4	
49	-108	x4	
50	+072	x4	
51	+246	x4	
52	+492	x4	
53	+276	x4	

Plate 3 Yield 9 p.s.i.

00	+094	x4	
01	-021	x4	
02	-042	x4	
03	-042	x4	
04	-158	x4	
05	-126	x4	
06	-108	x4	
07	-167	x4	
08	-096	x4	
09	-066	x4	
10	-134	x4	
11	-080	x4	
12	-086	x4	
13	-129	x4	
14	-098	x4	
15	+142	x4	
16	+200	x4	
17	+220	x4	
18	+174	x4	
19	+237	x4	
20	+184	x4	
21	+031	x4	
22	-016	x4	
23	-091	x4	
24	-060	x4	
25	-132	x4	
26	-085	x4	
27	+168	x4	
28	+088	x4	
29	-178	x4	
30	+308	x4	
31	+322	x4	
32	-044	x4	
33	+327	x4	
34	+440	x4	
35	+085	x4	
36	+295	x4	
37	+540	x4	
38	+270	x4	
39	+240	x4	
40	+515	x4	
41	+304	x4	
42	+086	x4	
43	+080	x4	
44	+091	x4	
45	+108	x4	
46	+102	x4	
47	+110	x4	
48	-181	x4	
49	-120	x4	
50	+079	x4	
51	+266	x4	
52	+531	x4	
53	+297	x4	

Plate 3 Yield 11 p.s.i.

00	+108	x4	
01	-016	x4	
02	-035	x4	
03	-052	x4	
04	-177	x4	
05	-133	x4	
06	-128	x4	
07	-188	x4	
08	-104	x4	
09	-079	x4	
10	-155	x4	
11	-092	x4	
12	-047	x4	
13	-137	x4	
14	-105	x4	
15	+161	x4	
16	+218	x4	
17	+248	x4	
18	+200	x4	
19	+259	x4	
20	+210	x4	
21	+044	x4	
22	-016	x4	
23	-107	x4	
24	-071	x4	
25	-150	x4	
26	-098	x4	
27	+180	x4	
28	+085	x4	
29	-215	x4	
30	+347	x4	
31	+359	x4	
32	-057	x4	
33	+375	x4	
34	+494	x4	
35	+091	x4	
36	+328	x4	
37	+600	x4	
38	+304	x4	
39	+260	x4	
40	+564	x4	
41	+340	x4	
42	+102	x4	
43	+089	x4	
44	+105	x4	
45	+124	x4	
46	+110	x4	
47	+126	x4	
48	-220	x4	
49	-160	x4	
50	+092	x4	
51	+303	x4	
52	+594	x4	
53	+333	x4	

Plate 3 Yield 12 p.s.i.

00	+116	x4	
01	-014	x4	
02	-032	x4	
03	-057	x4	
04	-186	x4	
05	-137	x4	
06	-136	x4	
07	-196	x4	
08	-108	x4	
09	-082	x4	
10	+080	x4	
11	-098	x4	
12	-044	x4	
13	-135	x4	
14	-107	x4	
15	+170	x4	
16	+227	x4	
17	+263	x4	
18	+212	x4	
19	+270	x4	
20	+224	x4	
21	+048	x4	
22	-015	x4	
23	-115	x4	
24	-074	x4	
25	-154	x4	
26	-096	x4	
27	+188	x4	
28	+085	x4	
29	-234	x4	
30	+366	x4	
31	+376	x4	
32	-065	x4	
33	+399	x4	
34	+526	x4	
35	+098	x4	
36	+345	x4	
37	+628	x4	
38	+320	x4	
39	+267	x4	
40	+587	x4	
41	+357	x4	
42	+110	x4	
43	+094	x4	
44	+114	x4	
45	+134	x4	
46	+116	x4	
47	+135	x4	
48	-242	x4	
49	-160	x4	
50	+098	x4	
51	+320	x4	
52	+625	x4	
53	+350	x4	

Plate 3 Yield 13 p.s.i.

00	+124	x4	
01	-011	x4	
02	-026	x4	
03	-060	x4	
04	-194	x4	
05	-140	x4	
06	-146	x4	
07	-205	x4	
08	-112	x4	
09	-084	x4	
10	-162	x4	
11	-098	x4	
12	-041	x4	
13	-132	x4	
14	-107	x4	
15	+180	x4	
16	+240	x4	
17	+276	x4	
18	+224	x4	
19	+283	x4	
20	+237	x4	
21	+056	x4	
22	-014	x4	
23	-123	x4	
24	-078	x4	
25	-154	x4	
26	-098	x4	
27	+193	x4	
28	+084	x4	
29	-248	x4	
30	+383	x4	
31	+397	x4	
32	-070	x4	
33	+421	x4	
34	+555	x4	
35	+104	x4	
36	+360	x4	
37	+653	x4	
38	+333	x4	
39	+274	x4	
40	+606	x4	
41	+370	x4	
42	+118	x4	
43	+098	x4	
44	+121	x4	
45	+142	x4	
46	+121	x4	
47	+142	x4	
48	-263	x4	
49	-176	x4	
50	+103	x4	
51	+337	x4	
52	+651	x4	
53	+362	x4	

Plate 3 Yield 14 p.s.i.

00	+128	x4	
01	-010	x4	
02	-024	x4	
03	-067	x4	
04	-205	x4	
05	-145	x4	
06	-160	x4	
07	-217	x4	
08	-115	x4	
09	-089	x4	
10	-168	x4	
11	-100	x4	
12	-040	x4	
13	-134	x4	
14	-110	x4	
15	+188	x4	
16	+245	x4	
17	+286	x4	
18	+234	x4	
19	+292	x4	
20	+247	x4	
21	+062	x4	
22	-012	x4	
23	-129	x4	
24	-075	x4	
25	-156	x4	
26	-097	x4	
27	+199	x4	
28	+082	x4	
29	-265	x4	
30	+402	x4	
31	+414	x4	
32	-076	x4	
33	+442	x4	
34	+576	x4	
35	+106	x4	
36	+370	x4	
37	+673	x4	
38	+346	x4	
39	+280	x4	
40	+621	x4	
41	+380	x4	
42	+124	x4	
43	+102	x4	
44	+127	x4	
45	+150	x4	
46	+123	x4	
47	+150	x4	
48	-285	x4	
49	-190	x4	
50	+110	x4	
51	+388	x4	
52	+668	x4	
53	+370	x4	

Plate 3 Yield 15 p.s.i.

00	+138	x4	
01	-008	x4	
02	-016	x4	
03	-073	x4	
04	-215	x4	
05	-151	x4	
06	-173	x4	
07	-225	x4	
08	-119	x4	
09	-090	x4	
10	-171	x4	
11	-104	x4	
12	-034	x4	
13	-128	x4	
14	-111	x4	
15	+200	x4	
16	+257	x4	
17	+302	x4	
18	+249	x4	
19	+306	x4	
20	+262	x4	
21	+070	x4	
22	-011	x4	
23	-137	x4	
24	-073	x4	
25	-149	x4	
26	-094	x4	
27	+204	x4	
28	+082	x4	
29	-286	x4	
30	+425	x4	
31	+438	x4	
32	-082	x4	
33	+465	x4	
34	+610	x4	
35	+112	x4	
36	+388	x4	
37	+699	x4	
38	+360	x4	
39	+286	x4	
40	+641	x4	
41	+394	x4	
42	+133	x4	
43	+107	x4	
44	+138	x4	
45	+159	x4	
46	+129	x4	
47	+161	x4	
48	-312	x4	
49	-208	x4	
50	+117	x4	
51	+363	x4	
52	+690	x4	
53	+380	x4	

Plate 3 Yield 16 p.s.i.

00	+143	x4	
01	-003	x4	
02	-006	x4	
03	-079	x4	
04	-223	x4	
05	-154	x4	
06	-187	x4	
07	-235	x4	
08	-120	x4	
09	-097	x4	
10	-181	x4	
11	-111	x4	
12	-032	x4	
13	-131	x4	
14	-115	x4	
15	+210	x4	
16	+262	x4	
17	+318	x4	
18	+262	x4	
19	+313	x4	
20	+276	x4	
21	+087	x4	
22	-008	x4	
23	-142	x4	
24	-068	x4	
25	-149	x4	
26	-093	x4	
27	+213	x4	
28	+078	x4	
29	-309	x4	
30	+451	x4	
31	+460	x4	
32	-092	x4	
33	+510	x4	
34	+637	x4	
35	+114	x4	
36	+414	x4	
37	+721	x4	
38	+370	x4	
39	+291	x4	
40	+657	x4	
41	+388	x4	
42	+140	x4	
43	+109	x4	
44	+144	x4	
45	+165	x4	
46	+133	x4	
47	+168	x4	
48	-332	x4	
49	-222	x4	
50	+122	x4	
51	+372	x4	
52	+709	x4	
53	+387	x4	

Plate 3 Yield 17 p.s.i.

00	+147	x4	
01	-001	x4	
02	+000	x4	
03	-088	x4	
04	-236	x4	
05	-160	x4	
06	-198	x4	
07	-244	x4	
08	-123	x4	
09	-098	x4	
10	-182	x4	
11	-113	x4	
12	-028	x4	
13	-129	x4	
14	-118	x4	
15	+220	x4	
16	+269	x4	
17	+328	x4	
18	+274	x4	
19	+323	x4	
20	+286	x4	
21	+087	x4	
22	-006	x4	
23	-153	x4	
24	-068	x4	
25	-144	x4	
26	-090	x4	
27	+216	x4	
28	+075	x4	
29	-328	x4	
30	+471	x4	
31	+476	x4	
32	-099	x4	
33	+526	x4	
34	+660	x4	
35	+116	x4	
36	+423	x4	
37	+739	x4	
38	+380	x4	
39	+294	x4	
40	+668	x4	
41	+419	x4	
42	+149	x4	
43	+112	x4	
44	+149	x4	
45	+172	x4	
46	+133	x4	
47	+175	x4	
48	-359	x4	
49	-238	x4	
50	+131	x4	
51	+379	x4	
52	+720	x4	
53	+394	x4	

Plate 3 Yield 18 p.s.i.

00	+153	x4	
01	+002	x4	
02	+008	x4	
03	-094	x4	
04	-243	x4	
05	-167	x4	
06	-206	x4	
07	-248	x4	
08	-124	x4	
09	-097	x4	
10	-180	x4	
11	-114	x4	
12	-021	x4	
13	-124	x4	
14	-118	x4	
15	+229	x4	
16	+276	x4	
17	+340	x4	
18	+285	x4	
19	+332	x4	
20	+298	x4	
21	+096	x4	
22	-004	x4	
23	-160	x4	
24	-062	x4	
25	-134	x4	
26	-085	x4	
27	+219	x4	
28	+072	x4	
29	-343	x4	
30	+492	x4	
31	+495	x4	
32	-106	x4	
33	+526	x4	
34	+678	x4	
35	+116	x4	
36	+423	x4	
37	+752	x4	
38	+386	x4	
39	+295	x4	
40	+678	x4	
41	+428	x4	
42	+157	x4	
43	+115	x4	
44	+157	x4	
45	+180	x4	
46	+135	x4	
47	+182	x4	
48	-387	x4	
49	-254	x4	
50	+138	x4	
51	+386	x4	
52	+729	x4	
53	+398	x4	

Plate 3 Yield 20 p.s.i.

00	+164	x4	
01	+008	x4	
02	+024	x4	
03	-100	x4	
04	-254	x4	
05	-174	x4	
06	-218	x4	
07	-246	x4	
08	-121	x4	
09	-091	x4	
10	-168	x4	
11	-108	x4	
12	-008	x4	
13	-104	x4	
14	-110	x4	
15	+247	x4	
16	+292	x4	
17	+363	x4	
18	+308	x4	
19	+350	x4	
20	+323	x4	
21	+114	x4	
22	+001	x4	
23	-176	x4	
24	-047	x4	
25	-104	x4	
26	-068	x4	
27	+228	x4	
28	+068	x4	
29	-377	x4	
30	+534	x4	
31	+528	x4	
32	-124	x4	
33	+557	x4	
34	+708	x4	
35	+111	x4	
36	+399	x4	
37	+772	x4	
38	+397	x4	
39	+296	x4	
40	+692	x4	
41	+443	x4	
42	+170	x4	
43	+121	x4	
44	+170	x4	
45	+199	x4	
46	+140	x4	
47	+198	x4	
48	-435	x4	
49	-285	x4	
50	+150	x4	
51	+396	x4	
52	+742	x4	
53	+403	x4	

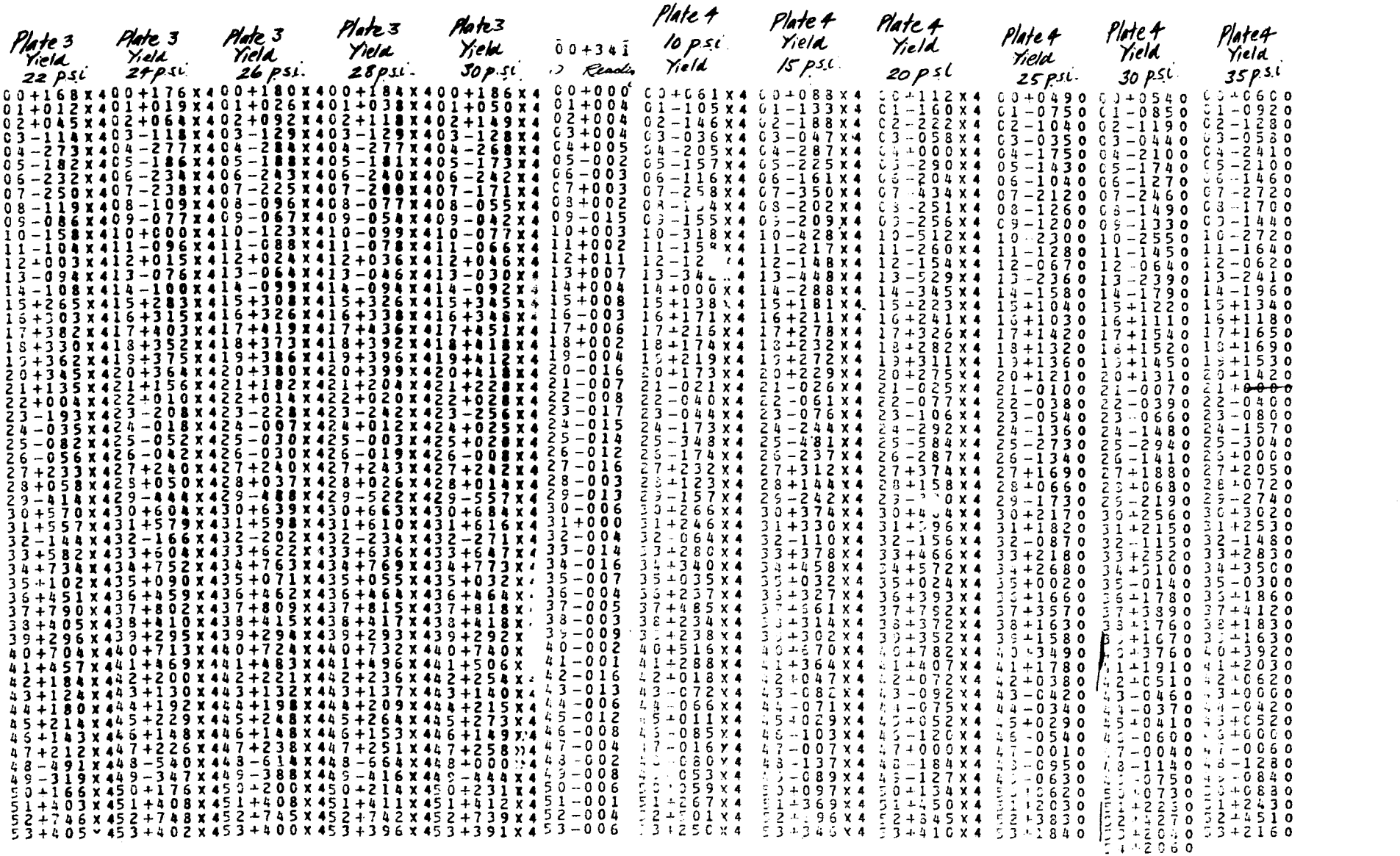


Plate 3 Yield 22 p.s.i.
Plate 3 Yield 24 p.s.i.
Plate 3 Yield 26 p.s.i.
Plate 3 Yield 28 p.s.i.
Plate 3 Yield 30 p.s.i.
Plate 4 10 p.s.i. Yield
Plate 4 Yield 15 p.s.i.
Plate 4 Yield 20 p.s.i.
Plate 4 Yield 25 p.s.i.
Plate 4 Yield 30 p.s.i.
Plate 4 Yield 35 p.s.i.

Plate 4 Yield 40 p.s.i.	Plate 4 Yield 45 p.s.i.	Plate 4 Yield 50 p.s.i.	Plate 4 Yield 55 p.s.i.	Plate 4 Yield 60 p.s.i.	Plate 4 Yield 65 p.s.i.	Plate 4 Yield 70 p.s.i.	Plate 4 Yield 75 p.s.i.	Plate 4 Yield 80 p.s.i.	Plate 4 Yield 85 p.s.i.	Plate 4 Yield 90 p.s.i.	Plate 4 Yield 95 p.s.i.	Plate 4 Yield 100 p.s.i.
00+0660	00+0720	00+0790	00+0900	00+1020	00+1120	00+1230	00+1400	00+1490	00+1600	00+1520	00+1520	00+1480
01-0930	01-0930	01-0950	01-0740	01-0490	01-0550	01-0140						
02-1300	02-1260	02-1290	02-0960	02-0540	02-0540	02+0140						
03-0670	03-0660	03-0670	03-0580	03-0500	03-0440	03-0320						
04-2720	04-2860	04-3110	04-2990	04-2820	04-2980	04-2520						
05-2430	05-2580	05-2980	05-2960	05-2920	05-3100	05-2780						
06-1570	06-1580	06-1640	06-1640	06-1740	06-1720	06-1800						
07-2790	07-2800	07-2780	07-2440	07-2130	07-2180	07-1630						
08-1790	08-1810	08-1900	08-1680	08-1450	08-1550	08-1160						
09-1520	09-1490	09-1510	09-1520	09-1540	09-1440	09-1520						
10-2760	10-2710	10-2720	10-2610	10-2510	10-2420	10-2320						
11-1770	11-1780	11-1940	11-1920	11-1940	11-1920	11-1890						
12-0560	12-0460	12-0450	12-0410	12-0420	12-0370	12-0430						
13-2370	13+0000	13-2280	13-2150	13-2070	13-2060	13-2040						
14-2070	14-2[illegible]0	14-2200	14-2190	14-2200	14-2210	14-2190						
15+1500	15+1670	15+1980	15+2080	15+2180	15+2470	15+2500						
16+1260	16+1340	16+1360	16+1450	16+1520	16+1500	16+1610						
17+1760	17+1830	17+1820	17+1910	17+2030	17+2010	17+2140						
18+1880	18+2050	18+2280	18+2440	18+2600	18+2760	18+2850						
19+1630	19+1660	19+1670	19+1720	19+1780	19+1790	19+1850						
20+1520	20+1620	20+1730	20+1820	20+1890	20+2050	20+2160						
21+0080	21+0150	21+0400	21+0520	21+0630	21+0900	21+0950						
22-0440	22-0500	22-0540	22-0580	22-0660	22-0680	22-0950						
23-0990	23-1160	23-1410	23-1620	23-1920	23-2300	23-2740						
24-1600	24-1610	24-1780	24-1750	24-1720	24-1780	24-1710						
25-2990	25-2920	25-2910	25-2830	25-2680	25-2520	25-2430						
26-1380	26-1380	26-1520	26-1420	26-1380	26-1480	26-1380						
27+2180	27+2240	27+2220	27+2130	27+1920	27+1850	27+1570						
28+0660	28+0580	28+0350	28+0080	28-0340	28-0520	28-1150						
29-3330	29-3660	29-4380	29-5060	29-5940	29-6320	29-7320						
30+3500	30+3780	30+4220	30+4540	30+4770	30+4940	30+5130						
31+2870	31+3080	31+3380	31+3540	31+3690	31+3750	31+3860						
32-1900	32-2150	32-2740	32-3370	32-4100	32-4420	32-5380						
33+3080	33+3230	33+3340	33+3350	33+3300	33+3340	33+3190						
34+3790	34+3900	34+4040	34+4040	34+4080	34+4140	34+4130						
35-0560	35-0720	35-1060	35-1360	35-1600	35-1690	35-1940						
36+1880	36+1920	36+1850	36+1800	36+1750	36+1760	36+1730						
37+4260	37+4340	37+4400	37+4360	37+4340	37+4320	37+4240						
38+1840	38+1860	38+1830	38+1750	38+1640	38+1510	38+1510						
39+1520	39+1540	39+1390	39+1240	39+1100	39+1100	39+0920						
40+3980	40+4000	40+4000	40+3950	40+3940	40+3980	40+3920						
41+2080	41+2140	41+2170	41+2150	41+2120	41+2210	41+2180						
42+0740	42+0860	42+1100	42+1210	42+1310	42+1550	42+1580						
43-0500	43-0500	43-0600	43-0580	43-0560	43-0650	43-0620						
44-0460	44-0460	44-0610	44-0620	44-0630	44-0750	44-0720						
45+0620	45+0740	45+0890	45+0990	45+1090	45+1220	45+1260						
46-0760	46-0790	46-1000	46-1030	46-1080	46-1230	46-1240						
47-0090	47-0070	47-0160	47-0140	47-0140	47-0140	47-0100						
48-1440	48-1630	48-1580	48-1820	48-2050	48-2320	48-2920						
49-0940	49-1050	49-1070	49-1140	49-1210	49-1240	49-1460						
50+1020	50+1140	50+1260	50+1430	50+1620	50+2010	50+2340						
51+2470	51+2470	51+2300	51+2300	51+2300	51+2130	51+2150						
52+4660	52+4660	52+4670	52+4700	52+4710	52+4560	52+4590						
53+2200	53+2150	53+1940	53+1970	53+1960	53+1640	53+1680	53+1420	53+1480	53+1090	53+1120	53+0720	53+0740

REFERENCES

(1) S. P. Timoshenko and S. Woinowski-Krieger, Theory of Plates and Shells, 2nd Edition, (McGraw Hill, 1959).

(2) S. Way, Uniformly Loaded Rectangular Plates With Large Deflections, Proceedings of the Fifth International Congress for Applied Mechanics, Cambridge, Mass.,1938.

(3) S. Levy, Square Plates With Clamped Edges Under Normal Pressure Producing Large Deflections, NACA TR 740, 1942.

(4) L. S. D. Morley, Skew Plates and Structures, Pergamon Press, 1963, p.119.

(5) J. B. Kennedy, On the Bending of Clamped Skewed Plates Under Uniform Pressure, Journal of the Royal Aeronautical Society, May 1965.

(6) J. B. Kennedy and S. Ng, Analysis of Skewed Plate Structures With Fixed Edges, Transactions of the Engineering Institute of Canada, October, 1965.

(7) S. F. Ng, Analysis of Clamped Skewed Plates Subjected to Lateral Uniform Loading, thesis, submitted to the University of Windsor in partial fulfilment for the degree of Master of Applied Science in Civil Engineering, 1964.

(8) Van Dyke, Perturbation Methods in Fluid Mechanics,Academic Press, 1964.

(9) E. H. Mansfield, The Bending and Stretching of Plates, Pergamon Press, 1964.

(10) C. V. Brigatti, Applicazione del metodo di H. Marcus al calcolo della piastra parallelogrammica, Ricerche di Ingegneria, Vol. XVI, No. 2, Mar-Apr. 1938, p.42.

(11) A. Anzelius, Uber die dlastische Deformation Parallelogrammformiger Platten, Der Bauingenieur, Vol. 20, No. 35-36, Sept. 1939, p. 478.

(12) V. P. Jensen, Analysis of Skew Slabs, Bulletin No. 332, University of Illinois Eng. Experimental Station, Urbana, Ill., Sept. 1941.

(13) F. H. Dorman, The Thin Clamped Parallelogram Plate Under Uniform Normal Pressure, Dept. of Supply, Australia, Aeronautical Research Laboratories, Report SM 214, 1953.

(14) I. Mirsky, The Deflection of a Thin Flat Clamped Parallogram Plate Subjected to Uniform Normal Loading, Dept. of Supply, Australia, Aeronautical Research Laboratories, Report SM 175, 1951.

(15) P. D. Jones, Small Deflection Theory of Flat Plates Using Complex Variables, Dept. of Supply, Australia, Aeronautical Research Laboratories, Report SM 260, 1958.

(16) J. B. Kennedy and M. W. Huggins, Series Solution of Skewed Stiffened Plates, Proceedings of the American Society of Civil Engineers, Feb. 1964.

(17) J. B. Kennedy and I. C. Martens, Stresses Near Corners of Skewed Stiffened Plates, The Structural Engineer, Nov. 1965.

(18) W. Z. Chien, Large Deflection of A Circular Plate Under Uniform Pressure, Chinese Journal of Physics, Vol. 7, 1947, pp. 102-113.

(19) C. T. Wang, Nonlinear Large-Deformation Boundary-Value Problems of Rectangular Plates, NACA TN 1425, 1948.

(20) N.A. Weil and N. M. Newmark, Large Deflections of Elliptical Plates, Journal of Applied Mechanics, Trans. A.S.M.E., March 1956.

(21) S. N. Sinha, Large Deflections of Plates on Elastic Foundations, Proceedings of the ASCE, Vol. 89, No. EM1, February 1963.

(22) S. F. Ng and J. B. Kennedy, Linear and Nonlinear Analyses of Rectangular Plates on Elastic Foundations, presented to the 80th Annual General and Professional Meeting of the EIC, June, 1966.

(23) A. M. Freudenthal, The Inelastic Behaviour of Engineering Materials and Structures, John Wiley and Sons, 1950, pp.249-263.

(24) Aluminum Company of America Handbook, Pittsburgh, Pennsylvania, 1960 Edition.

(25) T. Kato, On the Convergence of the Perturbation Method, Progress in Theoretical Physics, Vol. 4, 1949, and Vol. 5, 1950.

(26) M. Van Dyke, Perturbation Methods in Fluid Mechanics, Academic Press, 1964, pp. 30-32.

NOMENCLATURE

D	=	flexural rigidity of plate
E	=	modulus of elasticity of plate material
G	=	shear modulus
Q	=	dimensionless uniformly distributed load
R	=	aspect ratio, b/a
U, V, W	=	dimensionless displacement components parallel to x, y, and z directions respectively.
W_o	=	dimensionless lateral displacement at center of plate
$C_i, D_j, E_k, F_l, G_m, H_n$	=	unknown constants
$2a, 2b$	=	sides of plates along α and β axes respectively
c, s	=	cos θ and sin θ
h	=	thickness of plate
n	=	outwardly drawn normal
q	=	intensity of uniformly distributed load
u, v, w	=	displacement of point on the middle plane of plate parallel to x, y, and z axes respectively
x, y, z	=	rectangular cartesian coordinates
θ	=	skew angle
α, β	=	oblique coordinates
γ_i	=	undetermined constants
$\zeta \quad \eta$	=	dimensionless oblique coordinates
ν	=	Poisson's ratio
$\sigma''_x, \sigma''_y, \tau''_{xy}$	=	extreme fibre bending and shearing stresses

$\sigma'_x, \sigma'_y, \tau'_{xy}$ = membrane stresses in the middle surface of plate

S''_x, S''_y, S''_{xy} = nondimensional bending stresses

S'_x, S'_y, S'_{xy} = nondimensional membrane stresses

∇ = Laplacian operator

VITA AUCTORIS

1937 Simon Shung Fun Ng was born in Canton, China, on March 6, 1937.

1945 In September, 1945, he entered Pui Ying School, Canton, China, where he obtained his elementary Education.

1950 In September, 1950, he enrolled at Wah Yan College, Hong Kong, where he obtained his secondary education.

1957 In September, 1957, he enrolled in first year Science at McGill University, Montreal, Canada.

1958 In September, 1958, he entered the University of British Columbia, Vancouver, Canada to study Civil Engineering.

1962 In May, 1962, he was graduated from the University of British Cokumbia with a Bachelor of Applied Science Degree. In June, he was employed as junior engineer in the hydro-electric design division of the International Power and Engineering Consultants, Ltd., Vancouver, British Columbia.

1963 In September, 1963, he enrolled at the University of Windsor for graduate studies.

1964 In October, 1964, he graduated from the University of Windsor with a Master's Degree in Applied Science. In the same year, he enrolled as a Ph. D. student in the Department of Civil Engineering.

1967 In January, 1967, He was employed as an engineer in the IBM datacentre, Toronto, Ontario.