A DIRECT COMPUTER SOLUTION FOR PLATES AND PAVEMENT SLABS

by

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Development of Methods for Computer Simulation
of Beam-Columns and Grid-Beam and Slab Systems

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PREFACE

This report presents the results of an analytical study undertaken to develop a method for the direct computer solution of plates and pavement slabs. The basic procedure for the structural analysis is an extension of a finite-element method developed by Hudson, and the direct solution of the basic finite-difference equation for plate behavior utilizes a back-and-forth recursive technique described by Professor Hudson Matlock.

This is the ninth in a series of reports that describe the work in Research Project No. 3-5-63-56, entitled "Development of Methods for Computer Simulation of Beam-Columns and Grid-Beam and Slab Systems." The project is divided into two parts. Part I is concerned primarily with bridge structures. Part II deals with pavement slabs. The reader may find it advantageous to review Report Nos. 56-1, 56-4, and 56-6 as they provide background for this report.

This is the second report in the series that deals directly with pavement slabs. Several subsequent reports concerning pavements are planned for submission.

Duplicate copies of the program deck and test data cards for the example problems in this report may be obtained from the Center for Highway Research, The University of Texas.

The excellent facilities of the Computation Center of The University of Texas and the cooperation of its staff have contributed significantly to this report. Thanks are due to Art Frakes, Don Fenner, Beverly Brewster, Kathy Wilson, Joni McKnight, and all others who assisted with the manuscript.

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LIST OF REPORTS

Report No. 56-1, "A Finite-Element Method of Solution for Linearly Elastic Beam-Columns" by Hudson Matlock and T. Allan Haliburton, presents a finite-element solution for beam-columns that is a basic tool in subsequent reports.

Report No. 56-2, "A Computer Program to Analyze Bending of Bent Caps" by Hudson Matlock and Wayne B. Ingram, describes the application of the beam-column solution to the particular problem of bent caps.

Report No. 56-3, "A Finite-Element Method of Solution for Structural Frames" by Hudson Matlock and Berry Ray Grubbs, describes a solution for frames with no sway.

Report No. 56-4, "A Computer Program to Analyze Beam-Columns under Movable Loads" by Hudson Matlock and Thomas P. Taylor, describes the application of the beam-column solution to problems with any configuration of movable non-dynamic loads.

Report No. 56-5, "A Finite-Element Method for Bending Analysis of Layered Structural Systems" by Wayne B. Ingram and Hudson Matlock, describes an alternating-direction iteration method for solving two-dimensional systems of layered grids-over-beams and plates-over-beams.

Report No. 56-6, "Discontinuous Orthotropic Plates and Pavement Slabs" by W. Ronald Hudson and Hudson Matlock, describes an alternating-direction iteration method for solving complex two-dimensional plate and slab problems with emphasis on pavement slabs.

Report No. 56-7, "A Finite-Element Analysis of Structural Frames" by T. Allan Haliburton and Hudson Matlock, describes a method of analysis for rectangular plane frames with three degrees of freedom at each joint.

Report No. 56-8, "A Finite-Element Method for Transverse Vibrations of Beams and Plates" by Harold Salani and Hudson Matlock, describes an implicit procedure for determining the transient and steady-state vibrations of beams and plates, including pavement slabs.

Report No. 56-9, "A Direct Computer Solution for Plates and Pavement Slabs" by C. Fred Stelzer, Jr., and W. Ronald Hudson, describes a direct method for solving complex two-dimensional plate and slab problems.

Report No. 56-10, "A Finite-Element Method of Analysis for Composite Beams" by Thomas P. Taylor and Hudson Matlock, describes a method of analysis for composite beams with any degree of horizontal shear interaction.

ABSTRACT

A method of solving for the deflected shapes of freely discontinuous orthotropic plates and pavement slabs subjected to a variety of loads including transverse loads, in-plane forces, and externally applied couples is presented. The method is applicable to plates and pavement slabs with freely-variable foundation support including holes in the subgrade.

This is a direct method of rapidly solving the finite-element plate equations which are developed and it is unhindered by the closure parameters necessary in iterative techniques of solution. A computer program is presented which utilizes the equations and techniques developed. Several sample problems illustrate the generality of the method and its convenience to the user. The results compare well with closed-form solutions and with previous solutions developed using other techniques.

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NOMENCLATURE

Symbol	Typical Units	Definition
A_j	-	Continuity coefficient
a, b, c, d	-	Temporary bar numbering used in derivations
$a_{i,j}$	lb/in	Term of stiffness matrix
$AA1_j$ to $AA5_j$	lb/in	Sub-matrix of stiffness matrix
$AA6_j$	lb	Sub-matrix of load matrix
B_j	-	Continuity coefficient
$b_{i,j}$	lb/in	Term of stiffness matrix
C_j	-	Continuity coefficient
C_x , C_y	$\frac{\text{in-lb}}{\text{rad}}$	Torsional stiffness of slab element
$C^x_{i,j}$	$\frac{\text{in-lb}}{\text{rad}}$	Torsional stiffness of Slab Element i,j about the x-axis
$C^y_{i,j}$	$\frac{\text{in-lb}}{\text{rad}}$	Torsional stiffness of Slab Element i,j about the y-axis
$C^{x'}_{i,j}$	in-lb	Torque exerted on the x-beam due to the relative rotation in Torsion Bar i,j
$C^{y'}_{i,j}$	in-lb	Torque exerted on the y-beam due to the relative rotation in Torsion Bar i,j
$c_{i,j}$	lb/in	Term of stiffness matrix
D_x , D_y	in-lb	Bending stiffness of plate
$D^x_{i,j}$	in-lb	Bending stiffness of an orthotropic plate in the x-direction
$D^y_{i,j}$	in-lb	Bending stiffness of an orthotropic plate in the y-direction
D_j	-	Continuity coefficient

Symbol	Typical Units	Deflection
$d_{i,j}$	lb/in	Term of stiffness matrix
E_x	lb/in^2	Modulus of elasticity in x-direction
E_y	lb/in^2	Modulus of elasticity in y-direction
E_j	-	Continuity coefficient
$e_{i,j}$	lb/in	Term of stiffness matrix
$f_{i,j}$	lb/in	Term of stiffness matrix
$g_{i,j}$	lb/in	Term of stiffness matrix
$h_{i,j}$	lb/in	Term of stiffness matrix
h_x	in.	The increment length along the x-beams
h_y	in.	The increment length along the y-beams
i	-	An integer used to index mesh points, stations, and bars in the x-direction
j	-	An integer used to index mesh points, stations, and bars in the y-direction
K	lb/in	Stiffness matrix
k	lb/in^3	Modulus of subgrade support
M_x	in-lb	Bending moment acting on an element of the plate in the x-direction
M_y	in-lb	Bending moment acting on an element of the plate in the y-direction
M_{xy}	in-lb	Twisting moment tending to rotate the element about the x-axis (clockwise positive)
$M_{i,j}^{x\,\prime}$	in-lb	The bending moment in the x-beam at Station i,j (equals $h_y M_{i,j}^x$)
$M_{i,j}^{y\,\prime}$	in-lb	The bending moment in the y-beam at Station i,j (equals $h_x M_{i,j}^y$)
$M_{i,j}^x$	lb	Unit bending moment in the slab in the x-direction at Station i,j
$M_{i,j}^y$	lb	Unit bending moment in the slab in the y-direction at Station i,j
m	-	Counting integer

Symbol	Typical Units	Definition
m_x	-	Number of increments in the x-direction
m_y	-	Number of increments in the y-direction
n	-	Counting integer
P_x	lb	Axial load per beam in the x-direction
P_y	lb	Axial load per beam in the y-direction
$\Delta P^x_{i,j}$	lb	Change in axial load in the x-beam occurring at Station i,j
$p_{i,j}$	lb/in	Term of stiffness matrix
Q	lb	Concentrated lateral load
$Q_{i,j}$	lb	Externally applied load at Point i,j
q	lb/in^2	Distributed lateral load
$q_{i,j}$	lb/in	Term of stiffness matrix
$r_{i,j}$	lb/in	Term of stiffness matrix
$S_{i,j}$	lb/in	Elastic restraint used to represent the foundation in the finite-element model
$s_{i,j}$	lb/in	Term in stiffness matrix
$T^x_{i,j}$	lb/in	External torque applied to Bar i on the j^{th} x-beam
$T^y_{i,j}$	lb/in	External torque applied to Bar j on the i^{th} y-beam
$t_{i,j}$	lb/in	Term of stiffness matrix
$u_{i,j}$	lb/in	Term of load matrix
$V^x_{a,j}$	lb	Shear in Bar a of the j^{th} x-beam
$V^x_{i,c}$	lb	Shear in Bar a of the i^{th} y-beam
W_j	in.	Sub-matrix of deflection matrix
$w_{i,j}$	in.	Lateral deflection
x, y, z	-	Standard Cartesian coordinate directions
ν	-	Poisson's ratio

Symbol	Typical Units	Definition
ν_{xy}	-	Poisson's ratio which results in strain in the y-direction if stress is applied in the x-direction
ν_{yx}	-	Poisson's ratio which results in strain in the x-direction if stress is applied in the y-direction

CHAPTER 1. INTRODUCTION

The Problem

A useful method for the solution of discontinuous orthotropic plates and pavement slabs has been described by Hudson (Refs 2, 3). The principal features in his finite-element method are: (1) representation of structural members by a physical model of bars and springs which are grouped for analyses into two orthogonal systems of beams, (2) a rapid method for direct solution of individual beams that serve as line elements of a two-dimensional slab, and (3) an alternating-direction iterative technique which coordinates the solutions of individual beams and, thereby, ties the system together. The alternating-direction iterative technique is dependent on a fictitious closure spring joining the orthogonal beams at each intersection. Efficient solutions require the choosing of proper closure springs as input values for the computer program described by Hudson. Intensive investigations have shown that it is often difficult to choose the proper closure springs for a given slab problem without many time-consuming trials, thus clearly defining a need for an efficient one-pass method of solving discontinuous orthotropic plates and pavement slabs. This report will describe a method to satisfy this need.

Description of Report

Chapter 2 presents a brief discussion of the basic equations connected with the theory of elastic plates and slabs and explains the various types of problems that are of interest in this report. Chapter 3 gives a brief explanation of the finite-element theory used in developing the mechanistic model presented. The input values necessary for complete description of the model and the errors incurred by using the finite-element model as a computational device are discussed.

Chapter 4 presents the derivation of the general plate equation in finite-difference form. Chapter 5 explains the method by which the equations will be solved. A general description of the computer program can be found in Chapter 6.

Chapter 7 handles verification of the method by solving several problems previously solved by other methods. The generality and varied applicability of the method are indicated by additional example problems.

CHAPTER 2. THEORY OF ELASTIC PLATES AND SLABS

General Plate Theory

The bending of a plate depends to a large degree on its thickness in comparison with its other dimensions. Timoshenko (Ref 5) notes three kinds of plate bending: (1) thin plates with small deflections, (2) thin plates with large deflections, and (3) thick plates. This report deals only with the first, making the following assumptions:

(1) There is no deformation in the plate's middle plane.

(2) Planes of the plate initially lying normal to the middle surface of the plate remain normal to the middle surface of the plate after bending.

(3) The normal stresses in the direction transverse to the plate can be disregarded.

With these assumptions, all components of stress can be expressed in terms of the deflected shape of the plate. This function has to satisfy a linear partial differential equation which, together with the boundary conditions, completely defines the deflection w . The solution of this differential equation gives all necessary information for calculating the stresses at any point in the plate.

The Isotropic Plate Equations

Structural plates and pavement slabs are normally subjected to loads applied perpendicular to their surfaces. The deflected surface of such plates is described by the biharmonic equation, a differential equation derived by Timenshenko and others. Timoshenko's equation is given below, changed so that the up direction (z-axis) is considered positive. It becomes

$$\frac{\partial^2 M_x}{\partial x^2} + \frac{\partial^2 M_{yx}}{\partial x \partial y} + \frac{\partial^2 M_y}{\partial x^2} - \frac{\partial^2 M_{xy}}{\partial x \partial y} = q \qquad (2.1)$$

in which M_x is the bending moment acting on an element of the plate in the x-direction, M_y is the bending moment acting on an element of the plate in the y-direction, M_{xy} is a twisting moment tending to rotate the element about the x-axis (clockwise positive), and M_{yx} is a twisting moment tending to rotate the element about the y-axis. Observing that $M_{xy} = -M_{yx}$ for equilibrium, the equation can be condensed into the following form:

$$\frac{\partial^2 M_x}{\partial x^2} + \frac{\partial^2 M_y}{\partial y^2} - 2\frac{\partial^2 M_{xy}}{\partial x \partial y} = q \tag{2.2}$$

To evaluate this equation, it can be assumed that expressions for moment derived for pure bending can also be used for laterally loaded plates. This is equivalent to neglecting the effect on bending of the shearing forces and the compressive stress in the z-direction produced by the lateral load. Errors introduced into these solutions by such assumptions are negligible provided the thickness of the plate is small in comparison with the other dimensions of the plate.

It is shown in Ref 2 that for the special case of isotropy, the moment equations can be stated as follows:

$$M_x = D\left(\frac{\partial^2 w}{\partial x^2} + \nu\frac{\partial^2 w}{\partial y^2}\right) \tag{2.3}$$

$$M_y = D\left(\frac{\partial^2 w}{\partial y^2} + \nu\frac{\partial^2 w}{\partial x^2}\right) \tag{2.4}$$

$$M_{xy} = -M_{yx} = -D\,(1-\nu)\frac{\partial^2 w}{\partial x \partial y} \tag{2.5}$$

where D is the bending stiffness of the plate, ν is the Poisson's ratio, and w is the deflection of the plate in the z-direction. The other terms have been previously defined.

Substituting these expressions into Eq 2.2 obtains

$$D\left[\frac{\partial^4 w}{\partial x^4} + 2\frac{\partial^4 w}{\partial x^2 \partial y^2} + \frac{\partial^4 w}{\partial y^4}\right] = q \tag{2.6}$$

Pavement Slabs

Although much work has been done on the pavement slab problem, the most significant was accomplished by Westergaard (Refs 8, 9, 10, and 11), particularly with reference to the design problems encountered in concrete pavement.

In his solution of this problem Westergaard made the following important assumptions:

(1) The concrete slab acts as a homogeneous, isotropic, elastic solid in equilibrium.

(2) The reactions of the subgrade are vertical only, and they are proportional to the deflections of the slab.

(3) The reaction of the subgrade is equal to the modulus of support multiplied by the deflection at that point. The modulus of support is assumed to be constant at every point, independent of the deflection, and the same at all points within the area of consideration.

(4) The thickness of the slab is uniform.

(5) The slab is infinite in extent in all directions away from the load.

Unfortunately for the designer, most pavement slabs do not meet the stringent assumptions imposed by Westergaard. First, the slabs must in reality be finite. Second, uniform support is hard to obtain since localized loss of support under the pavement is common. In the methods of this paper, the foundation is represented by the modulus of subgrade support k . The freely discontinuous inputs allowed by the method provide the capability of varying k anywhere under the slab.

Cracks

One qualification of the method to be developed should be noted. Cracks will either be treated as hinged discontinuities with no finite width or as holes in the structure with finite width.

Summary of Elastic Theory

Hand solutions of certain special cases of homogeneous, isotropic plates can be accomplished. The addition of elastic support or finite cracks forces the use of approximate methods and limiting assumptions. Furthermore, each solution represents a special case, and a multitude of special-case solutions are required for the problems of interest. For solutions of orthotropic plates one must usually resort to computers. A general computer method is described by Hudson (Ref 2). The research described here is an attempt to make Hudson's technique more efficient.

CHAPTER 3. FINITE-ELEMENT THEORY

The theories discussed in the preceding chapter are based on infinitesimal calculus. There are many rules governing the use of such calculus. In general, the functions must be continuous, and fourth-order systems must have two continuous derivatives. Many complex engineering problems do not properly fulfill these conditions and cannot be solved by resorting to calculus. As a consequence, so-called "numerical" methods have been developed. In numerical methods, the differential equation concerned is replaced by its finite-difference equivalent. The problem then reduces to solving a large number of simultaneous algebraic equations instead of one complex differential equation.

The Physical Model

Numerical methods are most often used as mathematical approximations of a governing differential equation by the substitution of finite-difference forms for derivatives or by the approximation of a continuum problem with a discrete nodal system. A third and perhaps preferable method is to model the plate or slab physically by a system of finite elements whose behavior can properly be described with algebraic equations. The physical model seems preferable because it facilitates visualization of the problem and formulation of proper boundary and loading conditions. Difference equations are used to describe the bending moments in the finite-element beams.

Figure 3.1 is a pictorial representation of the finite-element model of the slab as suggested by Hudson (Ref 2). The torsion bars represent the real torsional stiffness of the slab and are always active in the system. The Poisson's ratio effects and the bending stiffness of the plate are represented by elastic blocks at the node points of the slab. The elastic blocks have a stress-strain relationship equivalent to the real plate and have Poisson's ratio equal to that of the plate. If the beams in the x-direction are bent up, the beams in the orthogonal y-direction bend down due to Poisson's ratio.

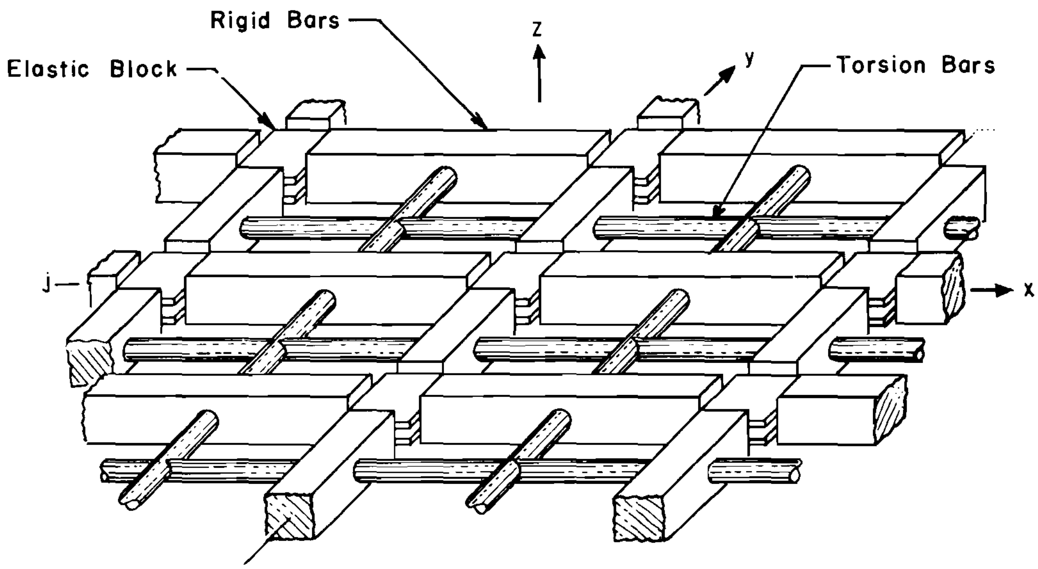


Fig 3.1. Finite-element model of a plate or slab.

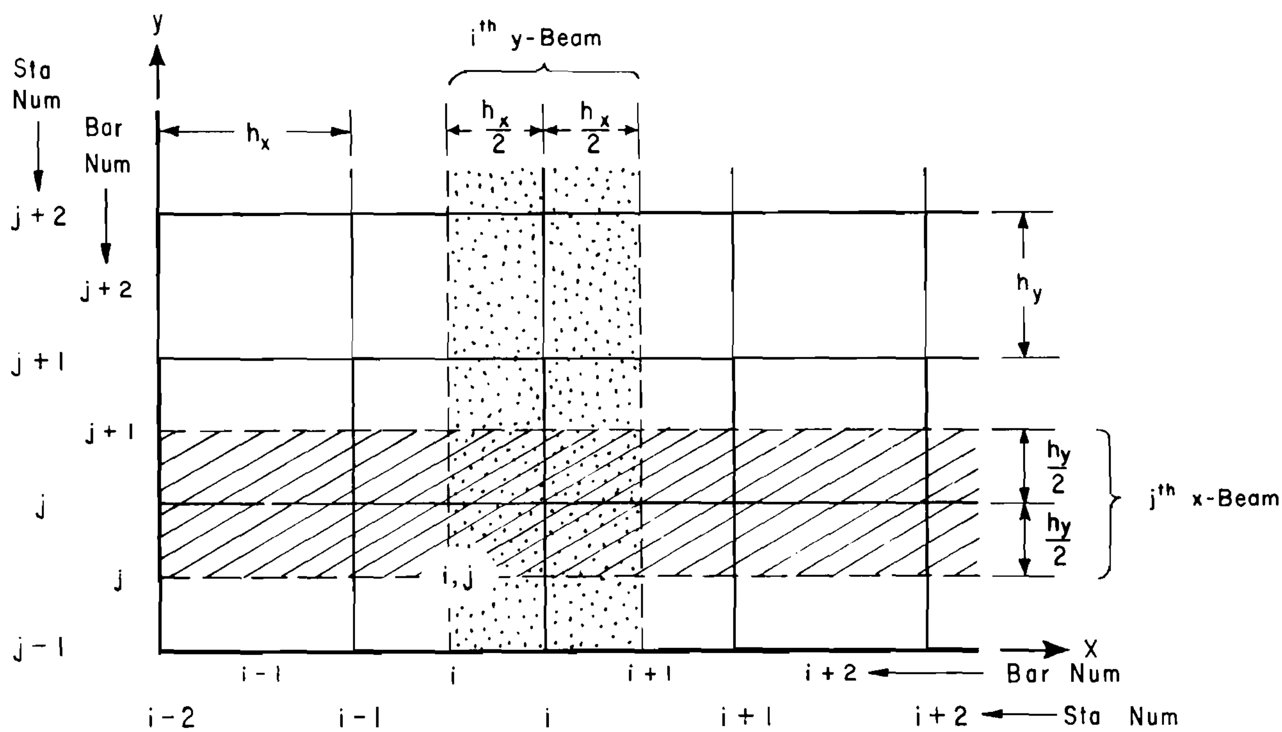


Fig 3.2. Plan view of plate segment divided into x and y-beams.

Input Values for the Model

It is necessary to relate the model to a real plate. The plate is divided into increments in the x and y-directions with increment lengths h_x and h_y respectively. These "beam" increments are designated with i in the x-direction and j in the y-direction. The mesh point or joint on the positive end of each increment is arbitrarily numbered the same as that increment. This numbering system then gives the i,j grid indicated in this plate segment (Fig 3.2). The stiffness $D_{i,j}$ for a plate is a unit value per inch of width. It is convenient for use in computations to input average stiffness over a full increment width. $D^x_{i,j}$ represents the average stiffness in the y-direction, that is, the average bending stiffness of the plate over an area one increment wide and one increment long, centered at Station i,j. The torsional stiffness of the plate segment is represented by torsion bars acting at the midpoint of the model element. Axial tensions P are also input into the bars with the changes ΔP considered to occur at mesh points.

Effects of Modeling

Errors resulting from this method are caused by approximating the real slab with a model. The algebraic solution is exact for the model within computer accuracy. Therefore, the closer the model duplicates the real slab, the more precise the answers computed by this method will be. This leads to the observation that the greater the number of increments used to model a particular problem, the greater the accuracy of the solution. According to Ref 2, reasonable results for certain cases can be obtained using 8 to 20 increments in each direction. The number of increments to be used will certainly depend on the dimensions of the problem as well as the accuracy required and the local complexity to be resolved.

CHAPTER 4. FORMULATION OF EQUATIONS

The purpose of this chapter is to formulate from a free-body analysis the equations needed to solve for the bending of a slab. A readable and concise account of these developments will be presented rather than a complete mathematical treatment. The necessary equations will be formulated so as to be compatible with the method of solution.

Free-Body Analysis

In order to derive the equations for solution of the bending of a plate or slab, it is helpful to refer to a free-body of the model. Consider first a section of the assembled slab model centered at any mesh point i,j (Fig 4.1). Temporarily, the four bars intersecting at Station i,j will be known as Bars a, b, c, and d as shown in Fig 4.1.

Figure 4.2 represents a free-body of the slab mesh point with all appropriate internal and external forces and reactions shown. Summing vertical forces at Joint i,j with up taken as positive gives

$$\Sigma F_{V_{i,j}} = Q_{i,j} + \overset{x}{V}_{a,j} + \overset{y}{V}_{i,c} - \overset{x}{V}_{b,j} - \overset{y}{V}_{i,d} - S_{i,j} w_{i,j} = 0 \qquad (4.1)$$

By taking the summation of moments about each individual bar it is seen that

$$- h_x \overset{x}{V}_{a,j} = \overset{x}{C}'_{i,j} + \overset{x}{C}'_{i,j+1} + \overset{x}{T}_{a,j} + \overset{x}{M}'_{i-1,j} - \overset{x}{M}'_{i,j} + \overset{x}{P}_{a,j} \left(-w_{i-1,j} + w_{i,j}\right) \qquad (4.2)$$

$$- h_x \overset{x}{V}_{b,j} = \overset{x}{C}'_{i+1,j} + \overset{x}{C}'_{i+1,j+1} + \overset{x}{T}_{b,j} + \overset{x}{M}'_{i,j} - \overset{x}{M}'_{i+1,j} + \overset{x}{P}_{b,j} \left(-w_{i,j} + w_{i+1,j}\right) \qquad (4.3)$$

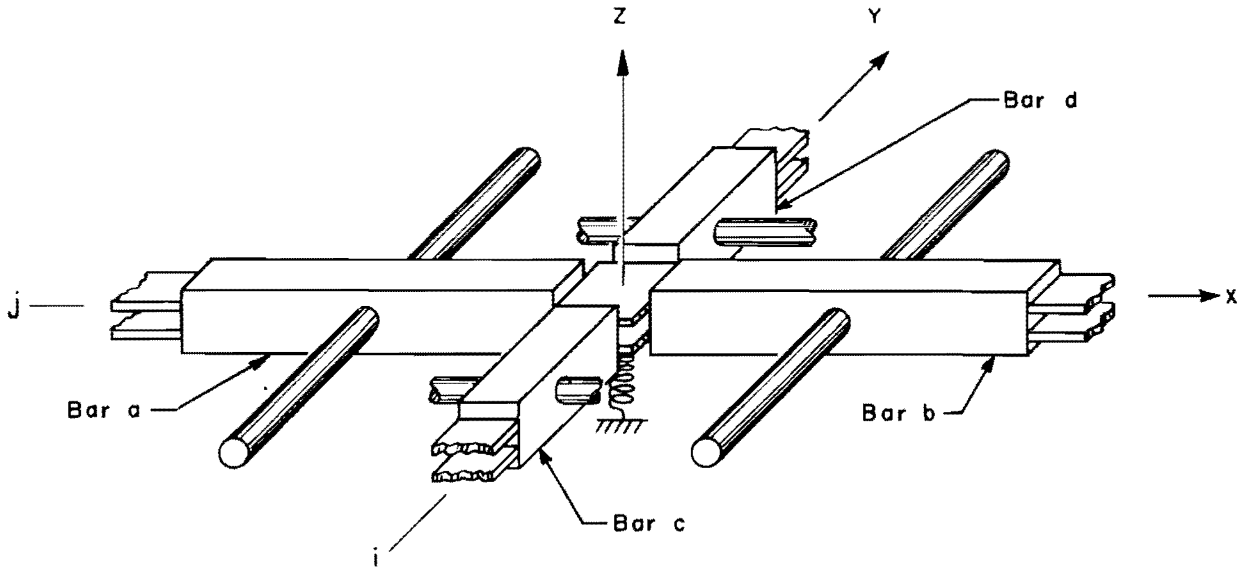


Fig 4.1. Typical Joint i,j taken from finite-element slab model.

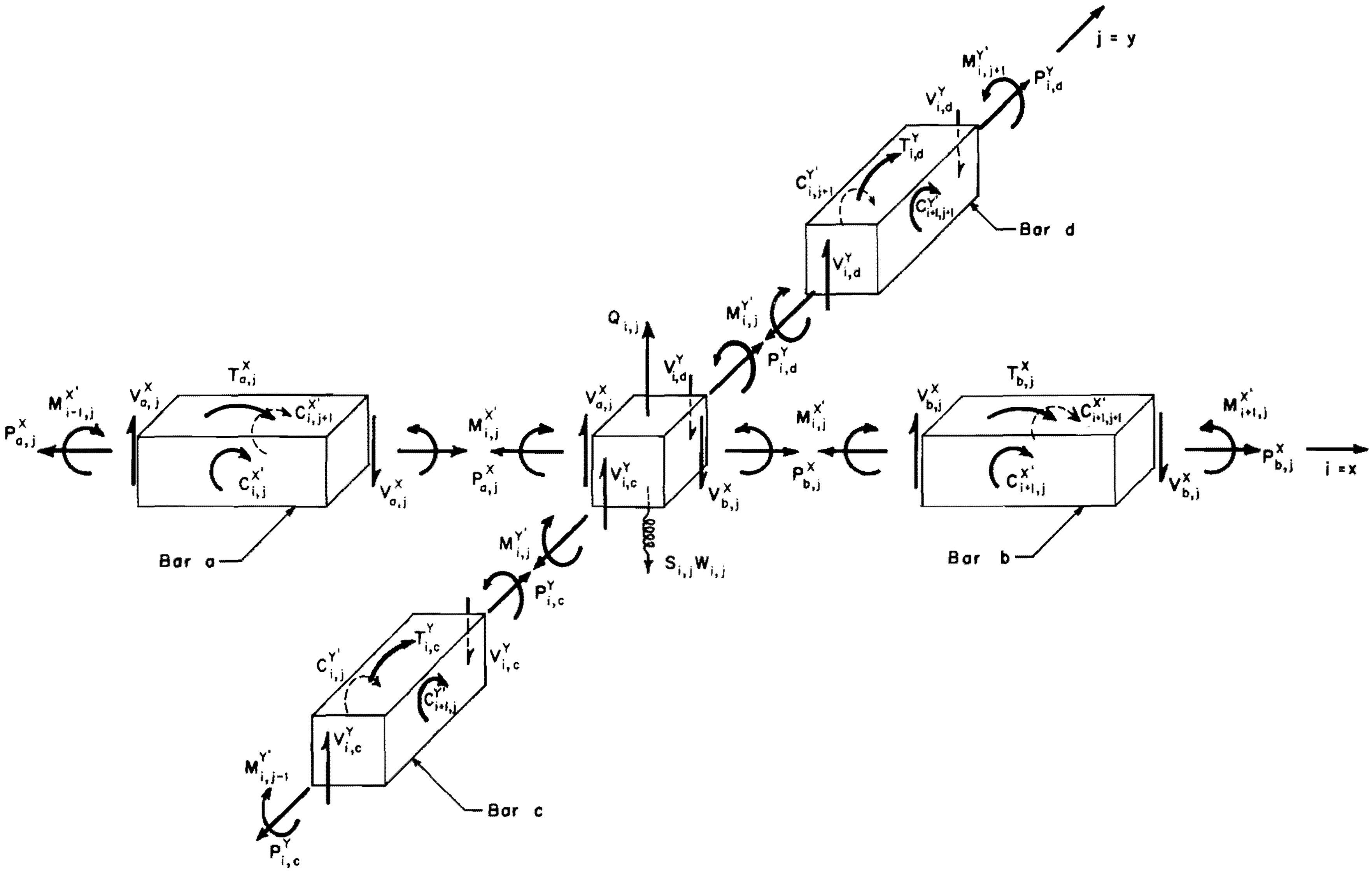


Fig 4.2. Free-body of slab mesh point.

$$- h_y V^{y}_{i,c} = C^{y\prime}_{i,j} + C^{y\prime}_{i+1,j} + T^{y}_{i,c} + M^{y\prime}_{i,j-1} - M^{y\prime}_{i,j}$$

$$+ P^{y}_{i,c} \; (-w_{i,j-1} + w_{i,j}) \qquad (4.4)$$

$$- h_y V^{y}_{i,d} = C^{y\prime}_{i,j+1} + C^{y\prime}_{i+1,j+1} + T^{y}_{i,d} - M^{y\prime}_{i,j+1} + M^{y\prime}_{i,j}$$

$$+ P^{y}_{i,d} \; (-w_{i,j} + w_{i,j+1}) \qquad (4.5)$$

If the values for $V^{x}_{a,j}$, $V^{x}_{b,j}$, $V^{y}_{i,c}$, and $V^{y}_{i,d}$ as defined above are substituted in Eq 4.1, the following equation results:

$$Q_{i,j} = \frac{1}{h_x} \Big[C^{x\prime}_{i,j} + C^{x\prime}_{i,j+1} + T^{x}_{a,j} + M^{x\prime}_{i-1,j} - M^{x\prime}_{i,j}$$

$$+ P^{x}_{a,j} \; (-w_{i-1,j} + w_{i,j}) \Big] + \frac{1}{h_y} \Big[C^{y\prime}_{i,j} + C^{y\prime}_{i+1,j}$$

$$+ T^{y}_{i,c} + M^{y\prime}_{i,j-1} - M^{y\prime}_{i,j} + P^{y}_{i,c} \; (-w_{i,j-1} + w_{i,j}) \Big]$$

$$+ \frac{1}{h_x} \Big[-C^{x\prime}_{i+1,j} - C^{x\prime}_{i+1,j+1} - T^{x}_{b,j} - M^{x\prime}_{i,j} + M^{x\prime}_{i+1,j}$$

$$- P^{x}_{b,j} \; (-w_{i,j} + w_{i+1,j}) \Big] + \frac{1}{h_y} \Big[-C^{y\prime}_{i,j+1} - C^{y\prime}_{i+1,j+1}$$

$$- T^{y}_{i,d} - M^{y\prime}_{i,j} + M^{y\prime}_{i,j+1} - P^{y}_{i,d} \; (-w_{i,j} + w_{i,j+1}) \Big]$$

$$+ S_{i,j} w_{i,j} \qquad (4.6)$$

The expressions for the $C^{x\prime}$ and $C^{y\prime}$ terms can be derived directly from the model. The complete formulation can be found on page 139 of Ref 2. $C^{x\prime}$ and $C^{y\prime}$ terms are listed below.

$$C^{x\prime}_{i,j} = \frac{C^{x}_{i,j}}{h_y} \; (w_{i-1,j-1} - w_{i-1,j} + w_{i,j} - w_{i,j-1}) \qquad (4.7)$$

$$C^{x\prime}_{i,j+1} = \frac{C^{x}_{i,j+1}}{h_y} \; (-w_{i-1,j} + w_{i,j} + w_{i-1,j+1} - w_{i,j+1}) \qquad (4.8)$$

$$C^{x\prime}_{i+1,j} = \frac{C^{x}_{i+1,j}}{h_y}\left(-w_{i,j} + w_{i+1,j} + w_{i,j-1} - w_{i+1,j-1}\right) \tag{4.9}$$

$$C^{x\prime}_{i+1,j+1} = \frac{C^{x}_{i+1,j+1}}{h_y}\left(-w_{i,j} + w_{i+1,j} + w_{i,j+1} - w_{i+1,j+1}\right) \tag{4.10}$$

$$C^{y\prime}_{i,j} = \frac{C^{y}_{i,j}}{h_x}\left(-w_{i-1,j} + w_{i,j} + w_{i-1,j-1} - w_{i,j-1}\right) \tag{4.11}$$

$$C^{y\prime}_{i+1,j} = \frac{C^{y}_{i+1,j}}{h_x}\left(w_{i,j} - w_{i+1,j} - w_{i,j-1} + w_{i+1,j-1}\right) \tag{4.12}$$

$$C^{y\prime}_{i,j+1} = \frac{C^{y}_{i,j+1}}{h_x}\left(w_{i-1,j} - w_{i,j} - w_{i-1,j+1} + w_{i,j+1}\right) \tag{4.13}$$

$$C^{y\prime}_{i+1,j+1} = \frac{C^{y}_{i+1,j+1}}{h_x}\left(-w_{i,j} + w_{i+1,j} + w_{i,j+1} - w_{i+1,j+1}\right) \tag{4.14}$$

$M^{x\prime}$ and $M^{y\prime}$ expressions are found by introducing the finite-difference approximations for the second derivative into Eqs 2.2 and 2.4.

$$M^{x\prime}_{i-1,j} = D^{x}_{i-1,j}\, h_y \left[\frac{(w_{i-2,j} - 2w_{i-1,j} + w_{i,j})}{h_x^2} + \nu_{yx} \frac{(w_{i-1,j-1} - 2w_{i-1,j} + w_{i-1,j+1})}{h_y^2} \right] \tag{4.15}$$

$$M^{x\prime}_{i,j} = D^{x}_{i,j}\, h_y \left[\frac{(w_{i-1,j} - 2w_{i,j} + w_{i+1,j})}{h_x^2} + \nu_{yx} \frac{(w_{i,j-1} - 2w_{i,j} + w_{i,j+1})}{h_y^2} \right] \tag{4.16}$$

$$M^{x\prime}_{i+1,j} = D^{x}_{i+1,j}\, h_y \left[\frac{(w_{i,j} - 2w_{i+1,j} + w_{i+2,j})}{h_x^2} + \nu_{yx} \frac{(w_{i+1,j-1} - 2w_{i+1,j} + w_{i+1,j+1})}{h_y^2} \right] \tag{4.17}$$

$$M^{y\,\prime}_{i,j-1} = D^{y}_{i,j-1}\, h_x \left[\frac{(w_{i,j-2} - 2w_{i,j-1} + w_{i,j})}{h_y^2} + \nu_{xy} \frac{(w_{i-1,j-1} - 2w_{i,j-1} + w_{i+1,j-1})}{h_x^2} \right] \tag{4.18}$$

$$M^{y\,\prime}_{i,j} = D^{y}_{i,j}\, h_x \left[\frac{(w_{i,j-1} - 2w_{i,j} + w_{i,j+1})}{h_y^2} + \nu_{xy} \frac{(w_{i-1,j} - 2w_{i,j} + w_{i+1,j})}{h_x{}^2} \right] \tag{4.19}$$

$$M^{y\,\prime}_{i,j+1} = D^{y}_{i,j+1}\, h_x \left[\frac{(w_{i,j} - 2w_{i,j+1} + w_{i,j+2})}{h_y{}^2} \right] + \nu_{xy} \frac{(w_{i-1,j+1} - 2w_{i,j+1} + w_{i+1,j+1})}{h_x^2} \tag{4.20}$$

At this point an additional note of clarification is helpful. It is convenient in computation to use the same indexing system for bars and torsion bars as for joints. So far, bars have been referred to as Bars a, b, c, and d. Figure 4.3 shows the numbering system used in the computer program. It may be seen that the index a becomes i , b becomes i+1 , c becomes j , and d becomes j+1 . Therefore, for example, $T^{x}_{a,j}$ becomes $T^{x}_{i,j}$, $P^{x}_{b,j}$ becomes $P^{x}_{i+1,j}$, etc. Now, the terms defined by Eqs 4.7 through 4.20 and the above mentioned subscripting changes are introduced in Eq 4.6, terms are collected, and the form of the final equation is shown below.

$$\begin{aligned} & a_{i,j} w_{i,j-2} + b_{i,j} w_{i-1,j-1} + c_{i,j} w_{i,j-1} + d_{i,j} w_{i+1,j-1} \\ & + e_{i,j} w_{i-2,j} + f_{i,j} w_{i-1,j} + g_{i,j} w_{i,j} + h_{i,j} w_{i+1,j} \\ & + p_{i,j} w_{i+2,j} + q_{i,j} w_{i-1,j+1} + r_{i,j} w_{i,j+1} + s_{i,j} w_{i+1,j+1} \\ & + t_{i,j} w_{i,j+2} = u_{i,j} \end{aligned} \tag{4.21}$$

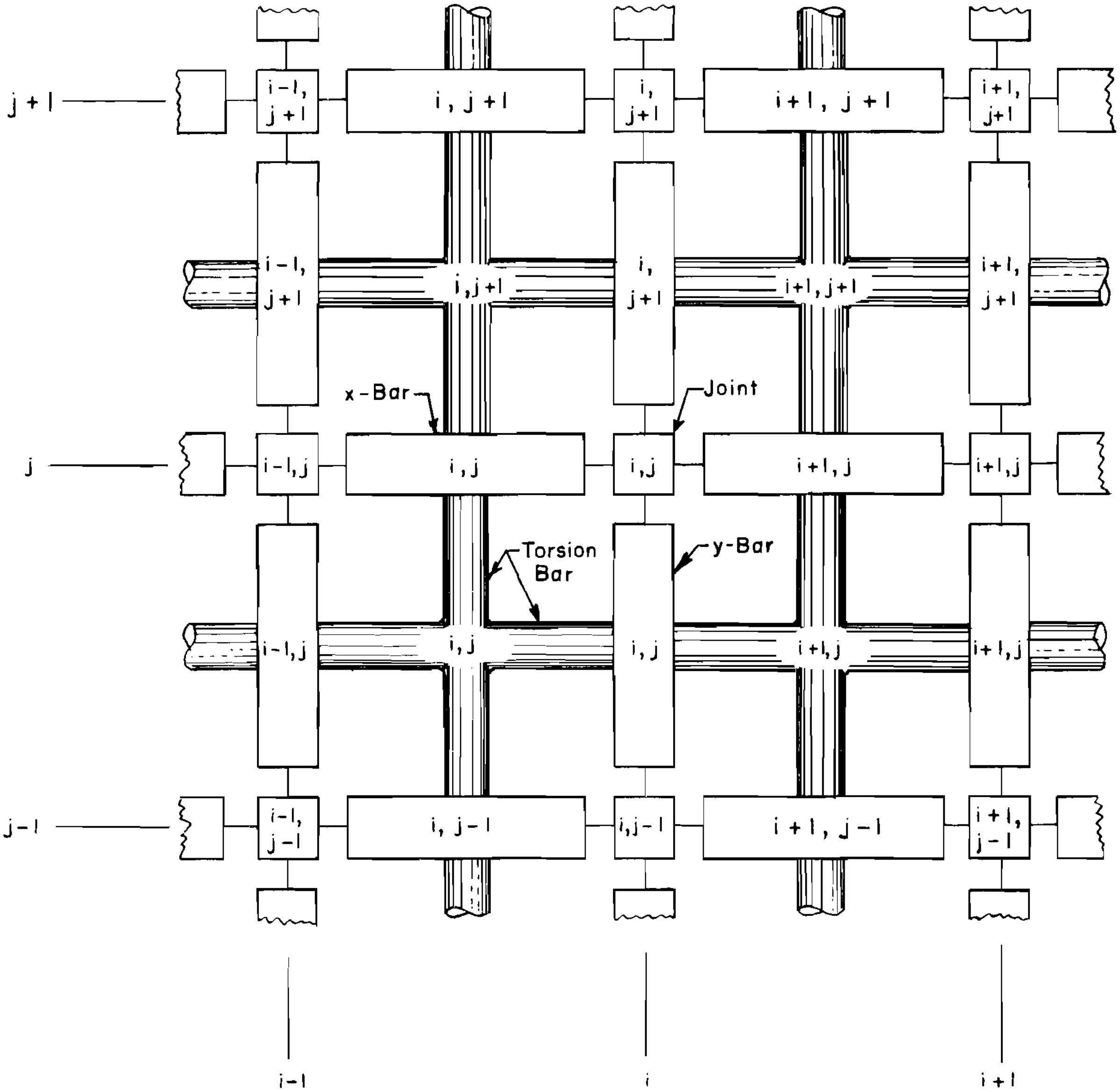


Fig 4.3. Plan view of the slab model showing all parts with generalized numbering system.

where

$$a_{i,j} = \frac{h_x}{h_y^3} \left(D^y_{i,j-1} \right) \tag{4.22}$$

$$b_{i,j} = \frac{1}{h_x h_y} \left(\nu_{yx} D^x_{i-1,j} + \nu_{xy} D^y_{i,j-1} + C^x_{i,j} + C^y_{i,j} \right) \tag{4.23}$$

$$c_{i,j} = -\frac{2h_x}{h_y^3} \left(D^y_{i,j-1} + D^y_{i,j} \right) - \frac{1}{h_x h_y} \left(2\nu_{yx} D^x_{i,j} + 2\nu_{xy} D^y_{i,j-1} + C^x_{i,j} + C^x_{i+1,j} + C^y_{i,j} + C^y_{i+1,j} \right) - \frac{P^y_{i,j}}{h_y} \tag{4.24}$$

$$d_{i,j} = \frac{1}{h_x h_y} \left(\nu_{yx} D^x_{i+1,j} + \nu_{xy} D^y_{i,j-1} + C^x_{i+1,j} + C^y_{i+1,j} \right) \tag{4.25}$$

$$e_{i,j} = \frac{h_y}{h_x^3} \left(D^x_{i-1,j} \right) \tag{4.26}$$

$$f_{i,j} = -\frac{2h_y}{h_x^3} \left(D^x_{i-1,j} + D^x_{i,j} \right) - \frac{1}{h_x h_y} \left(2\nu_{yx} D^x_{i-1,j} + 2\nu_{xy} D^y_{i,j} + C^x_{i,j} + C^x_{i,j+1} + C^y_{i,j} + C^y_{i,j+1} \right) - \frac{P^x_{i,j}}{h_x} \tag{4.27}$$

$$g_{i,j} = \frac{h_y}{h_x^3} \left(D^x_{i-1,j} + 4D^x_{i,j} + D^x_{i+1,j} \right) + \frac{h_x}{h_y^3} \left(D^y_{i,j-1} + 4D^y_{i,j} + D^y_{i,j+1} \right) + \frac{1}{h_x h_y} \left(4\nu_{yx} D^x_{i,j} + 4\nu_{xy} D^y_{i,j} + C^x_{i,j} + C^x_{i,j+1} + C^x_{i+1,j} + C^x_{i+1,j+1} + C^y_{i,j} + C^y_{i+1,j} + C^y_{i,j+1} + C^y_{i+1,j+1} \right) + \frac{1}{h_x} \left(P^x_{i,j} + P^x_{i+1,j} \right) + \frac{1}{h_y} \left(P^y_{i,j} + P^y_{i,j+1} \right) + S_{i,j} \tag{4.28}$$

$$h_{i,j} = -\frac{2h_y}{h_x^3}\left(D^x_{i,j} + D^x_{i+1,j}\right) - \frac{1}{h_x h_y}\left(2\nu_{yx} D^x_{i+1,j} + 2\nu_{xy} D^y_{i,j}\right.$$

$$\left. + C^x_{i+1,j} + C^x_{i+1,j+1} + C^y_{i+1,j} + C^y_{i+1,j+1}\right) - \frac{P^x_{i+1,j}}{h_x} \qquad (4.29)$$

$$p_{i,j} = \frac{h_y}{h_x^3}\left(D^x_{i+1,j}\right) \qquad (4.30)$$

$$q_{i,j} = \frac{1}{h_x h_y}\left(\nu_{yx} D^x_{i-1,j} + \nu_{xy} D^y_{i,j+1} + C^x_{i,j+1} + C^y_{i,j+1}\right) \qquad (4.31)$$

$$r_{i,j} = -\frac{2h_x}{h_y^3}\left(D^y_{i,j} + D^y_{i,j+1}\right) - \frac{1}{h_x h_y}\left(2\nu_{yx} D^x_{i,j} + 2\nu_{xy} D^y_{i,j+1}\right.$$

$$\left. + C^x_{i,j+1} + C^x_{i+1,j+1} + C^y_{i,j+1} + C^y_{i+1,j+1}\right) - \frac{P^y_{i,j+1}}{h_y} \qquad (4.32)$$

$$s_{i,j} = \frac{1}{h_x h_y}\left(\nu_{yx} D^x_{i+1,j} + \nu_{xy} D^y_{i,j+1} + C^x_{i+1,j+1} + C^y_{i+1,j+1}\right) \qquad (4.33)$$

$$t_{i,j} = \frac{h_x}{h_y^3}\left(D^y_{i,j+1}\right) \qquad (4.34)$$

$$u_{i,j} = Q_{i,j} - \frac{1}{h_x}\left(T^x_{i,j} - T^x_{i+1,j}\right) - \frac{1}{h_y}\left(T^y_{i,j} - T^y_{i,j+1}\right) \qquad (4.35)$$

Matrix Representation of General Equation

The matrix representation of Eq 4.21 is

$$\left[\ K\ \right]\left[\ W\ \right] = \left[\ Q\ \right] \qquad (4.36)$$

Figure 4.4 shows the form of the K , W , and Q matrices, about which several important things should be noted. The K (stiffness) matrix is of special interest. It is symmetrical about its major diagonal, and it is also banded, that is, the terms lie in lines parallel to the major diagonal. It is a special kind of banded matrix, with the central band five terms wide, the bands on either side of the central band three terms wide, and the two extreme

GENERAL SLAB EQUATION:

$$a_{i,j}w_{i,j-2}+b_{i,j}w_{i-1,j-1}+c_{i,j}w_{i,j-1}+d_{i,j}w_{i+1,j-1}+e_{i,j}w_{i-2,j}+f_{i,j}w_{i-1,j}+g_{i,j}w_{i,j}+h_{i,j}w_{i+1,j}+p_{i,j}w_{i+2,j}+q_{i,j}w_{i-1,j+1}+r_{i,j}w_{i,j+1}+s_{i,j}w_{i+1,j+1}+t_{i,j}w_{i,j+2}=u_{i,j}$$

OR IN MATRIX FORM:

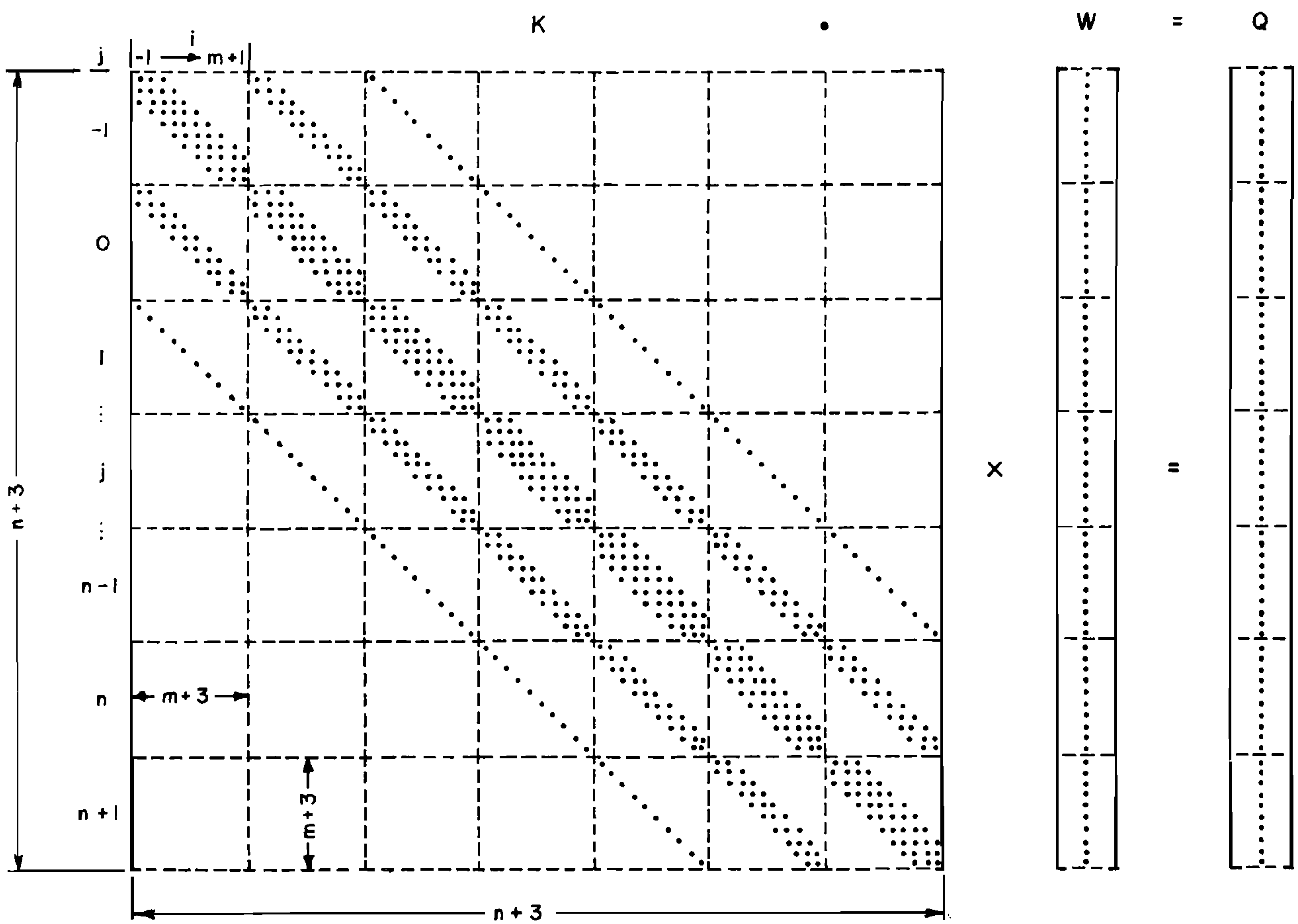
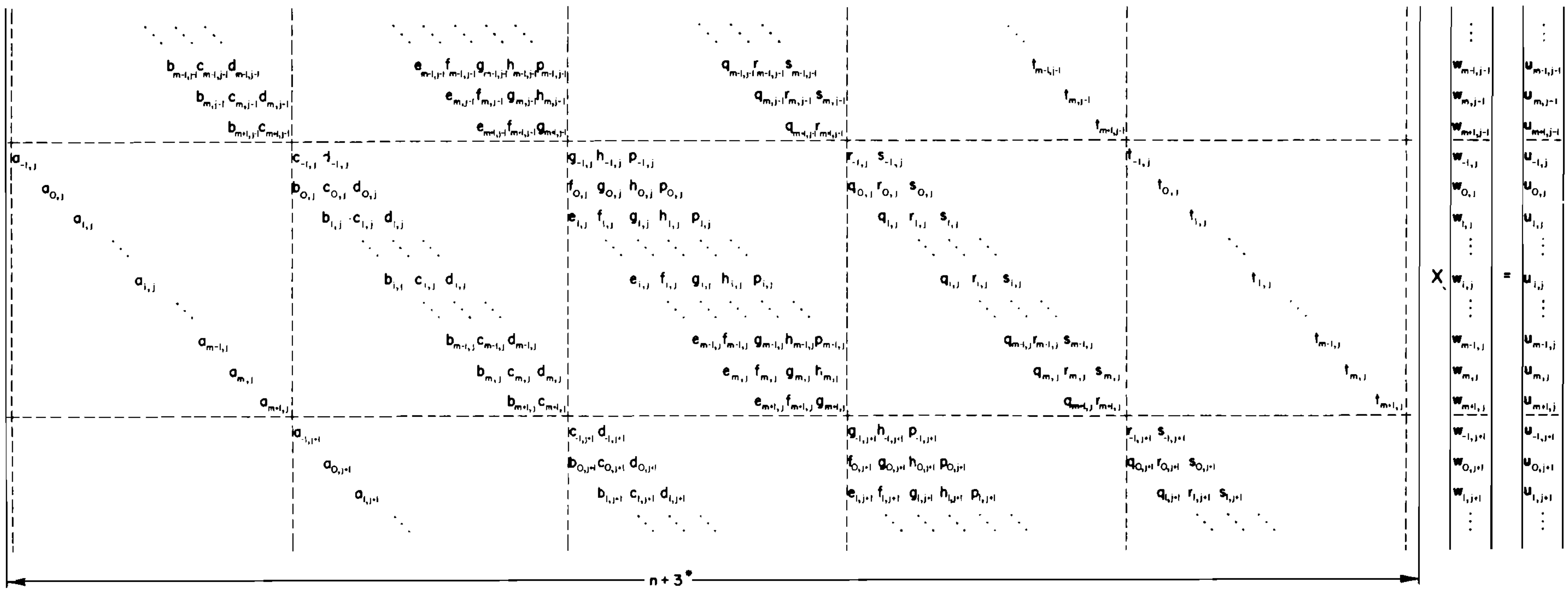


Fig 4.4. Form of K , W , and Q matrices.

bands only one term wide. The stiffness matrix is partitioned into sub-matrices, which are shown by dashed lines. If the slab to be solved has been divided into m increments in the x-direction and n increments in the y-direction, the K matrix will have $n+3$ rows and $n+3$ columns of sub-matrices. The sub-matrices will have $m+3$ rows and $m+3$ columns of terms. Solution of slab problems involve manipulating the sub-matrices. For this reason, rectangular slab problems will be solved more efficiently if m is smaller than n . It is important to notice that no matter how large n becomes, the terms in Eq 4.21 will appear only in the five sub-matrices centered about the major diagonal of the stiffness matrix and that no matter how large m becomes, the sub-matrices will remain either a one, three, or five-wide banded matrix. Figure 4.4 also shows that terms in five-wide banded sub-matrices do not appear in the sub-matrix which contains the three-wide band and vice-versa and that the terms of a three-wide banded sub-matrix do not appear in the sub-matrix which contains the single band and vice-versa. W (deflection matrix) and Q (load matrix) are column matrices. Figure 4.5 shows the part played by the terms of Eq 4.21 in a typical row of the sub-matrices.



*The stiffness matrix is actually n+3 sub-matrices wide; only the five pertinent sub-matrices are shown in this figure

Fig 4.5. Terms in a typical row of sub-matrices.

CHAPTER 5. SOLUTION OF EQUATIONS

The equation derived in the preceding chapter is quite formidable. It has thirteen unknowns and must be solved for each mesh point in the system. To make it useful, there must be some general technique for rapid solution. The high-speed digital computer is a necessary tool in using the method of this paper.

Previous Method for Solution

Hudson (Ref 2) uses an alternating-direction iterative method which is based on the work done by Tucker (Ref 6). Conte and Dames (Ref 1) present a solution of the partial differential equation which governs slab behavior.

In simplest terms, the method divides the partial differential equation into two ordinary differential equations and couples their solution by trial and error in a methodical fashion, proceeding first in the x-Cartesian-direction and then in the y-direction, and thus giving it the name alternating direction. The most difficult part of this method is the selection of proper iteration parameters. Proof of convergence exists for certain parameter selection for regular, well-conditioned systems, but much remains to be done for the diverse systems which normally appear in practical slab or plate problems.

Detail of Present Method

The present method is based on an idea conceived by Tucker (Ref 7). He felt that by using "partitioned" matrices a matrix of five diagonal sub-matrices could be solved in a recursive technique analogous to Matlock's method of solving beams and columns (Ref 4).

Referring back to Figs 4.4 and 4.5 it is readily seen that the multitude of individual terms in the K , W , and Q matrices could be redefined as shown in Fig 5.1. In Fig 5.1 $AA1_j$, $AA2_j$, ... , $AA5_j$ are sub-matrices of the stiffness matrix, W_j is a sub-matrix of the deflection matrix, and $AA6_j$ is a sub-matrix of the load matrix. The sub-matrices $AA1_j$, $AA2_j$,

$$
\begin{bmatrix}
AA3_{-1} & AA4_{-1} & AA5_{-1} \\
AA2_{0} & AA3_{0} & AA4_{0} & AA5_{0} \\
AA1_{1} & AA2_{1} & AA3_{1} & AA4_{1} & AA5_{1} \\
 & \ddots & \ddots & \ddots & \ddots & \ddots \\
 & & AA1_{j-2} & AA2_{j-2} & AA3_{j-2} & AA4_{j-2} & AA5_{j-2} \\
 & & & AA1_{j-1} & AA2_{j-1} & AA3_{j-1} & AA4_{j-1} & AA5_{j-1} \\
 & & & & AA1_{j} & AA2_{j} & AA3_{j} & AA4_{j} & AA5_{j} \\
 & & & & & AA1_{j+1} & AA2_{j+1} & AA3_{j+1} & AA4_{j+1} & AA5_{j+1} \\
 & & & & & & AA1_{j+2} & AA2_{j+2} & AA3_{j+2} & AA4_{j+2} & AA5_{j+2} \\
 & & & & & & & \ddots & \ddots & \ddots & \ddots & \ddots \\
 & & & & & & & & AA1_{n-1} & AA2_{n-1} & AA3_{n-1} & AA4_{n-1} & AA5_{n-1} \\
 & & & & & & & & & AA1_{n} & AA2_{n} & AA3_{n} & AA4_{n} \\
 & & & & & & & & & & AA1_{n+1} & AA2_{n+1} & AA3_{n+1}
\end{bmatrix}
\times
\begin{bmatrix}
W_{-1} \\ W_{0} \\ W_{1} \\ \vdots \\ W_{j-2} \\ W_{j-1} \\ W_{j} \\ W_{j+1} \\ W_{j+2} \\ \vdots \\ W_{n-1} \\ W_{n} \\ W_{n+1}
\end{bmatrix}
=
\begin{bmatrix}
AA6_{-1} \\ AA6_{0} \\ AA6_{1} \\ \vdots \\ AA6_{j-2} \\ AA6_{j-1} \\ AA6_{j} \\ AA6_{j+1} \\ AA6_{j+2} \\ \vdots \\ AA6_{n-1} \\ AA6_{n} \\ AA6_{n+1}
\end{bmatrix}
$$

Fig 5.1. Redefinition of terms in K , W , and Q matrices.

and so on are defined in Fig 5.2. From Fig 5.1 it is seen that the following equation is valid.

$$AA1_j W_{j-2} + AA2_j W_{j-1} + AA3_j W_j + AA4_j W_{j+1} + AA5_j W_{j+2} = AA6_j \quad (5.1)$$

As shown in Fig 5.1, this equation results in a five-wide banded diagonal coefficient matrix, termed the "stiffness matrix," which when multiplied by the single-column "deflection matrix" is equal to a single-column "load matrix." Matlock in Ref 4 discusses a convenient method for the solution of an equation such as Eq 5.1 and states that this system of equations is most easily solved by a back-and-forth recursion process. Proceeding from $j = -1$ to $j = n+1$, two unknown deflections (W_{j-2} and W_{j-1} in Eq 5.1) are eliminated from each equation, resulting in another diagonally-banded system of equations of the form

$$W_j - B_j W_{j+1} - C_j W_{j+2} = A_j \quad (5.2)$$

where

$$A_j = D_j (E_j A_{j-1} + AA1_j A_{j-2} - AA6_j) \quad (5.3)$$

$$B_j = D_j (E_j C_{j-1} + AA4_j) \quad (5.4)$$

$$C_j = D_j AA5_j \quad (5.5)$$

$$D_j = -(E_j B_{j-1} + AA1_j C_{j-2} + AA3_j)^{-1} \quad (5.6)$$

$$E_j = AA1_j B_{j-2} + AA2_j \quad (5.7)$$

To complete the solution for all of the unknown deflections W_j, a reverse pass is made by applying the following version of Eq 5.2 at each station.

$$W_j = A_j + B_j W_{j+1} + C_j W_{j+2} \quad (5.8)$$

$$
AA1_j = \begin{bmatrix}
a_{-1,j} & & & & & & & \\
& a_{0,j} & & & & & & \\
& & a_{1,j} & & & & & \\
& & & \ddots & & & & \\
& & & & a_{i,j} & & & \\
& & & & & \ddots & & \\
& & & & & & a_{m-1,j} & & \\
& & & & & & & a_{m,j} & \\
& & & & & & & & a_{m+1,j}
\end{bmatrix}
\qquad
AA2_j = \begin{bmatrix}
c_{-1,j} & d_{-1,j} & & & & & \\
b_{0,j} & c_{0,j} & d_{0,j} & & & & \\
& b_{1,j} & c_{1,j} & d_{1,j} & & & \\
& & \ddots & \ddots & \ddots & & \\
& & & b_{i,j} & c_{i,j} & d_{i,j} & \\
& & & & \ddots & \ddots & \ddots \\
& & & & b_{m-1,j} & c_{m-1,j} & d_{m-1,j} \\
& & & & & b_{m,j} & c_{m,j} & d_{m,j} \\
& & & & & & b_{m+1,j} & c_{m+1,j}
\end{bmatrix}
$$

$$
AA3_j = \begin{bmatrix}
g_{-1,j} & h_{-1,j} & p_{-1,j} & & & & & \\
f_{0,j} & g_{0,j} & h_{0,j} & p_{0,j} & & & & \\
e_{1,j} & f_{1,j} & g_{1,j} & h_{1,j} & p_{1,j} & & & \\
& \ddots & \ddots & \ddots & \ddots & \ddots & & \\
& & e_{i,j} & f_{i,j} & g_{i,j} & h_{i,j} & p_{i,j} & \\
& & & \ddots & \ddots & \ddots & \ddots & \ddots \\
& & & & e_{m-1,j} & f_{m-1,j} & g_{m-1,j} & h_{m-1,j} & p_{m-1,j} \\
& & & & & e_{m,j} & f_{m,j} & g_{m,j} & h_{m,j} \\
& & & & & & e_{m+1,j} & f_{m+1,j} & g_{m+1,j}
\end{bmatrix}
\qquad
AA4_j = \begin{bmatrix}
r_{-1,j} & s_{-1,j} & & & & & \\
q_{0,j} & r_{0,j} & s_{0,j} & & & & \\
& q_{1,j} & r_{1,j} & s_{1,j} & & & \\
& & \ddots & \ddots & \ddots & & \\
& & & q_{i,j} & r_{i,j} & s_{i,j} & \\
& & & & \ddots & \ddots & \ddots \\
& & & & q_{m-1,j} & r_{m-1,j} & s_{m-1,j} \\
& & & & & q_{m,j} & r_{m,j} & s_{m,j} \\
& & & & & & q_{m+1,j} & r_{m+1,j}
\end{bmatrix}
$$

$$
AA5_j = \begin{bmatrix}
t_{-1,j} & & & & & & & & \\
& t_{0,j} & & & & & & & \\
& & t_{1,j} & & & & & & \\
& & & \ddots & & & & & \\
& & & & t_{i,j} & & & & \\
& & & & & \ddots & & & \\
& & & & & & t_{m-1,j} & & \\
& & & & & & & t_{m,j} & \\
& & & & & & & & t_{m+1,j}
\end{bmatrix}
\qquad
W_j = \begin{bmatrix}
w_{-1,j} \\ w_{0,j} \\ w_{1,j} \\ \vdots \\ w_{i,j} \\ \vdots \\ w_{m-1,j} \\ w_{m,j} \\ w_{m+1,j}
\end{bmatrix}
\qquad
AA6_j = \begin{bmatrix}
u_{-1,j} \\ u_{0,j} \\ u_{1,j} \\ \vdots \\ u_{i,j} \\ \vdots \\ u_{m-1,j} \\ u_{m,j} \\ u_{m+1,j}
\end{bmatrix}
$$

Fig 5.2. Sub-matrices.

By the time the reverse pass is made the deflections W_{j+1} and W_{j+2} will be known. The coefficients A_j , B_j , and C_j are called "continuity coefficients." The development of Eqs 5.3 through 5.8 is given in Ref 4.

This summary intentionally avoids discussing what is required at each end of the diagonally-banded system to allow the elimination process to start and then to turn around for the reverse pass. For this purpose auxiliary fictitious stations are employed beyond the boundaries of the slab. Recall that the stiffness matrix is produced by applying Eq 4.21 at each mesh point, including one fictitious station beyond the boundary of the real slab. $AA1_{-1}$, $AA2_{-1}$, $AA1_0$, $AA5_n$, $AA4_{n+1}$, and $AA5_{n+1}$ (Fig 5.1) would then be automatically calculated as zero provided that no load or stiffness data exist for the fictitious mesh points beyond the slab. In the computation of continuity coefficients (Eqs 5.3 through 5.7) these zero matrices serve to blind the equations to any extraneous effects that might be thought of as existing further beyond the boundaries of the slab. Since the fictitious stations beyond the boundaries of the model slab have no flexural stiffness, they act as multiple hinges and thus isolate the model slab and the recursion equations describing its behavior from consideration of any effects beyond the boundaries.

Matlock uses this recursive technique for the solution of a one-dimensional system (beams and columns) where each of the terms of Eqs 5.3 through 5.8 refer to only one value, but the process is mathematically valid for the five-wide banded matrix described by Eq 5.1 even though each of the individual terms refers to a matrix of numbers. Instead of the normal algebraic manipulations, matrix manipulations will be used to solve for the deflections of the slab by the method outlined above.

CHAPTER 6. THE COMPUTER PROGRAM

The equations derived in Chapter 4 are not useful for hand calculations, but they are extremely well-adapted for digital computer methods. During this investigation a computer program has been developed which is useful for solving slab and plate problems of various types.

The program is written in FORTRAN computer language for the Control Data Corporation 6600 Digital Computer, which has approximately a 16-decimal word length and comes equipped with a Chippewa FORTRAN compiler compatible with FORTRAN II and IV. The compile time for the basic program is about five seconds. The storage requirements of the program as presently dimensioned are about 120,000 words. The program is of little practical value for use on computers with internal storage of less than 64,000 words.

The time required to run problems varies with the size of the system, i.e., the number of increments involved. Eight-by-eight problems can be solved in 4 seconds, while a sixteen-by-sixteen increment problem is solved in about 20 seconds. At the present rates of The University of Texas Computation Center, the computer time costs approximately fifty cents to solve an eight-by-eight problem and approximately two dollars to solve a sixteen-by-sixteen problem.

The FORTRAN Program

A summary flow diagram for the DSLAB Program is given in Fig 6.1. A detailed flow diagram and listing of the program DSLAB 5 are provided in Appendices 2 and 3. Appendix 1 is an instruction and operating manual for DSLAB 5. It includes instructions on the operation of the program and detailed input forms and descriptions.

The format used for inputting data into the program is arranged as conveniently as possible. The problem input deck starts with two cover cards which identify the program and the particular run being made. The information on them is alphanumeric and denotes projects, coding dates, personnel performing the key punching, description of the problems being run, etc. The program will

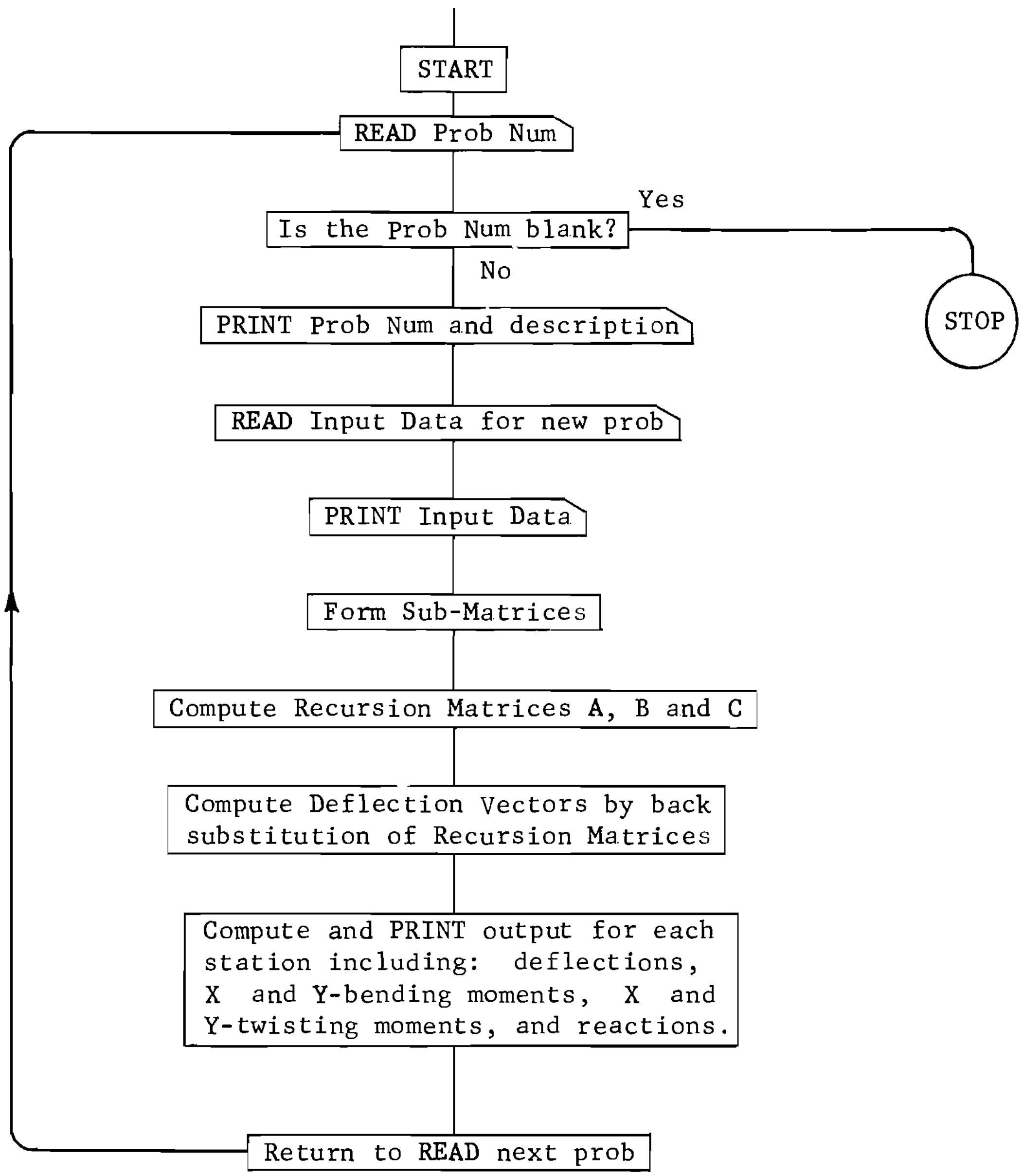


Fig 6.1. Summary flow chart.

not operate without these two cards, which are followed by

(1) problem number card with alphanumeric description of the problem.

(2) Table 1 - Input for Data Control and Constants - 1 card. Information on this card includes the number of cards to be read in Tables 2 and 3, number of increments, increment length, and Poisson's ratio.

(3) Table 2 - Stiffness and Load Data - The number of cards in this table is variable depending on the number required to specify bending stiffness, load, support springs, and torsional stiffness.

(4) Table 3 - Stiffness and Load Data Cont. - The number of cards in this table is variable depending on the number required to specify external couples and axial loads.

Appendices 4 and 5 contain numerical examples of input and output for example problems in Chapter 7.

Output Information

The program output is arranged to be useful to the user. A format which can be trimmed to standard 8-1/2 by 11-inch size is provided. For convenience and help in identifying problems, the program prints out all original input data at the beginning of each problem, in Tables 1, 2, and 3. Table 4 is presented in two parts in keeping with the 8-1/2 by 11-inch format. The first half prints external station numbers, deflections, bending moments in the x and y-directions, and the external load (or reaction) of the slab at each station. Part 2 of Table 4 prints out external station numbers and twisting moments in the x and y-directions.

An automatic plot routine can be coupled with DSLAB 5 and used to plot any of the variables available at mesh points in the system although normally its major use is plotting deflection contours.

As with all finite mathematical techniques, there are approximations in this program. It is not possible to determine both values of a double-valued function by numerical differentiation. Twisting moments are such double-valued functions, being a maximum just inside the plate boundary and zero just outside the boundary, and the best approximation in finite-difference techniques is half value or the average between maximum and zero. The same half-value approximation results for bending moments at fixed ends for cantilevered structures (Ref 4). The bending moment-stiffness diagram is correct for this case since bending stiffness is input as half-value at edges and ends. Bending moments at free or simply-supported edges are calculated correctly by this method. Third derivatives which are related to the shear forces meet the Kirchoff boundary conditions at free edges (Ref 5, p 84). In Ref 2 it is stated that many investigations of intricate calculations of output values for various discontinuous and orthotropic cases show that this finite-element model gives correct results.

Special Programming for Non-Rectangular Slabs or Slabs with Holes

Occasionally there may be a need to solve a slab problem which is not rectangular or which has one or more holes in it. For these cases, load, stiffness, and support values are input only at the mesh points where the slab exists; zero values are automatically stored for input variables which are not specified. The deflections at mesh points not on the real slab are unimportant to the solution of the real problem, but the computer program attempts a solution for the deflection at every mesh point in the minimum rectangle. If we look at the stiffness matrix we see that for this type of slab there are two or more rows which are dependent, therefore making it impossible to calculate an inverse and solve the problem. It can be shown that by placing a spring at the mesh points two or more stations away from all boundaries that no dependency will be introduced and in addition the solution will not be affected. DSLAB 5 is programmed to automatically place the necessary support springs at the proper mesh points.

CHAPTER 7. EXAMPLE PROBLEMS AND VERIFICATION OF THE METHOD

This chapter provides the solution to several example problems to demonstrate program DSLAB 5 and its use in engineering calculations. As stated before, this work is an attempt to improve the efficiency of Hudson's method (Ref 2), which is verified by comparison of solutions with accepted "closed-form solutions." Since the slab model is the same in both cases, similar answers to the same problems would be expected. Therefore, verification of the method of solution of this report can be most conveniently accomplished by re-solving the examples of Ref 2. Sample input and output in Appendices 4 and 5 provide the reader with a step-by-step example of the program in use.

Simply-Supported Plate with Variations

A 48-inch-square, simply-supported, 0.98-inch-thick steel plate is the basic verification problem discussed by Hudson (Fig 7.1). This plate has a modulus of elasticity E of 30,000,000 psi and a Poisson's ratio ν of 0.25. A series of problems utilizing this plate, which have been previously solved by others in closed form, will be solved. The plate will generally be divided into eight six-inch increments in both the x- and y-directions. The bending stiffness in the x and y-directions (D_x and D_y, respectively) can be calculated as shown in Ref 2 through the use of equations 7.1 and 7.2.

$$D_x = \frac{E_x t^3}{12(1 - \nu^2)} \tag{7.1}$$

$$D_y = \frac{E_y t^3}{12(1 - \nu^2)} \tag{7.2}$$

where

- t = thickness of the plate,
- E_x = modulus of elasticity in the x-direction,
- E_y = modulus of elasticity in the y-direction.

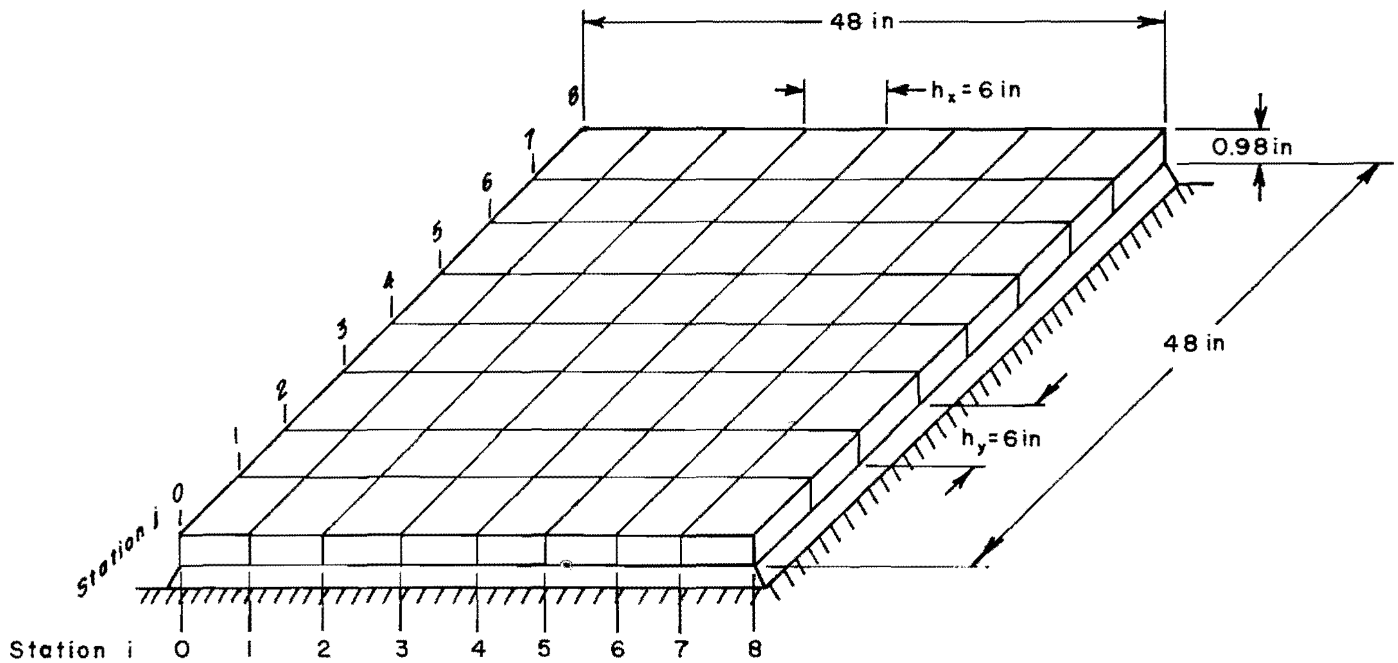


Fig 7.1. Simply-supported square steel plate.

From Eqs 7.1 and 7.2 it is found that $D_x = D_y = 2.5 \times 10^6$ in-lb . For correct representation of the slab one-quarter bending stiffness values are input at the four corner stations and one-half bending stiffness values are input along the edge stations.

The torsional stiffnesses of the slab element about the x and y-axes (C_x and C_y , respectively) are calculated using Eqs 7.3 and 7.4 (Ref 2 p 124).

$$C_x = \frac{E_x t^3}{12(1 + \nu)} \tag{7.3}$$

$$C_y = \frac{E_y t^3}{12(1 + \nu)} \tag{7.4}$$

The torsional stiffnesses for the example plate are $C_x = C_y = 1.875 \times 10^6$ in-lb/rad . Once the reader acquaints himself with the physical properties of this plate, it will be possible to evaluate very rapidly six separate cases of load and parameter variations.

Problem 101 - Concentrated Load. The first problem to be considered is the simply-supported plate described above with a single concentrated load of 100,000 lb in the center. The closed-form solution is 1.07 inches deflection under the load. For an 8 X 8 grid Hudson found a deflection of 1.138 inches, which is exactly the same deflection found from the method presented in this paper. If the number of increments is increased to 16 in each direction, a deflection of 1.09 inches is computed.

Problem 102 - In-Plane Forces. In addition to the concentrated load at the center, a uniform in-plane force (tensile axial load) in the y-direction of 16,667 pounds per inch of plate width is added. The maximum closed-form deflection occurs under the load and is 0.787 inch. The computed solution for an 8 X 8 grid is 0.854 inch, the same as found by Hudson. The accuracy of this solution also is increased by increasing the number of increments into which the plate is divided.

Problem 103 - Two-Way In-Plane Forces. When an equal in-plane tensile force in the x-direction is added to Problem 102, this method computes a maximum deflection of 0.692 inch. Reference 2 reports a maximum deflection for this example of 0.661 inch. However, a rerun of this problem with the methods of Ref 2 using better closure tolerances yielded a deflection of 0.692.

Problem 104 - Uniform Load. If a uniform load of 100 pounds per square inch is substituted for the concentrated load, the closed-form solution is 0.861 inch. Both Hudson's method and this method calculate 0.861 inch for an 8 X 8 grid. This problem points out that it takes a much finer grid-system to accurately model a slab loaded with a concentrated load than it does to model a slab loaded with a uniform load.

Problem 105 - Interior Foundation Support. A uniform interior elastic foundation with support k equal to 100 pounds per square inch per inch is added to Problem 101. Evidently, Refs 2 and 3 contain a misprinted value, 0.70 inch, for the reported deflection under the load. Hudson's original computer results show that this deflection is 0.787 inch, which is the same as calculated by DSLAB 5. This compares to the approximate closed-form solution given by Timoshenko's equation of 0.723 inch (Ref 5).

Problem 106 - End Supports with Line Loads. The basic problem is modified slightly by removing the simple supports from two opposite edges of the plates. The beam is loaded with line loads of 833 lb/in six inches from and parallel to the remaining two supported edges. This leaves the plate supported as a wide-beam on simple supports. Unlike a beam, however, the plate should exhibit Poisson's ratio effects. Poisson's ratio manifests itself in such a structure by anticlastic bending. A hand solution of this problem gives a deflection at the center of the beam or plate of 0.566 inch. Both computer solutions for an 8 X 8 grid give a center deflection of 0.575 inch. This deflection increases to 0.640 inch at the center of the two unsupported edges due to anticlastic bending. The error of the solution is reduced to less than 1 percent if a 16 X 16 grid is used to model the plate.

Problem 601 - Complex Bridge Approach Slab

One of the main features of this method is the ability to handle complex problems with combination loads and a variety of support conditions. Figure 7.2 illustrates such a problem. A 10-inch-thick, reinforced-concrete bridge approach slab is used. It was supported on one end by the bridge abutment; the other end rests on the embankment. Because of poor compaction, which often results when there is backfill, the soil has settled under the interior of the slab and left a section unsupported. The slab has a center-line joint and a crack which developed from a combination of shrinkage and previous over-stress. For a non-uniformly supported slab such as this, the dead weight of the slab must be considered when evaluating moment and stresses. This weight

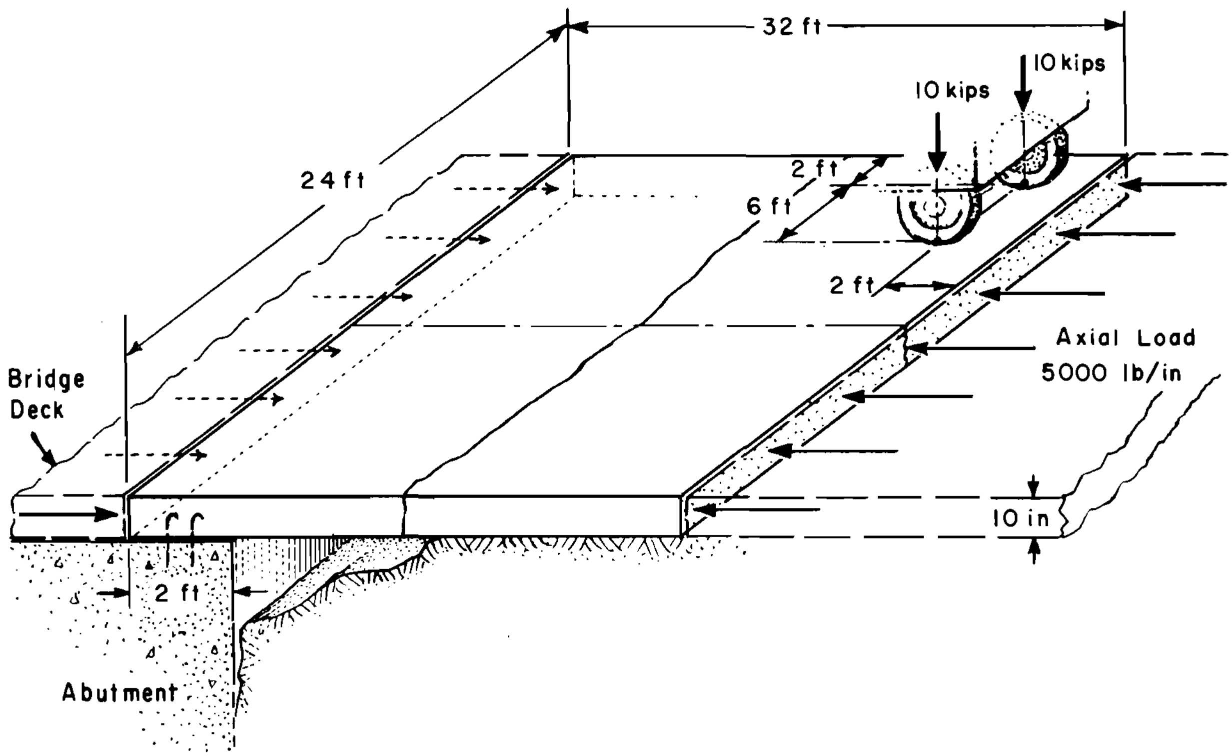


Fig 7.2. Bridge approach slab.

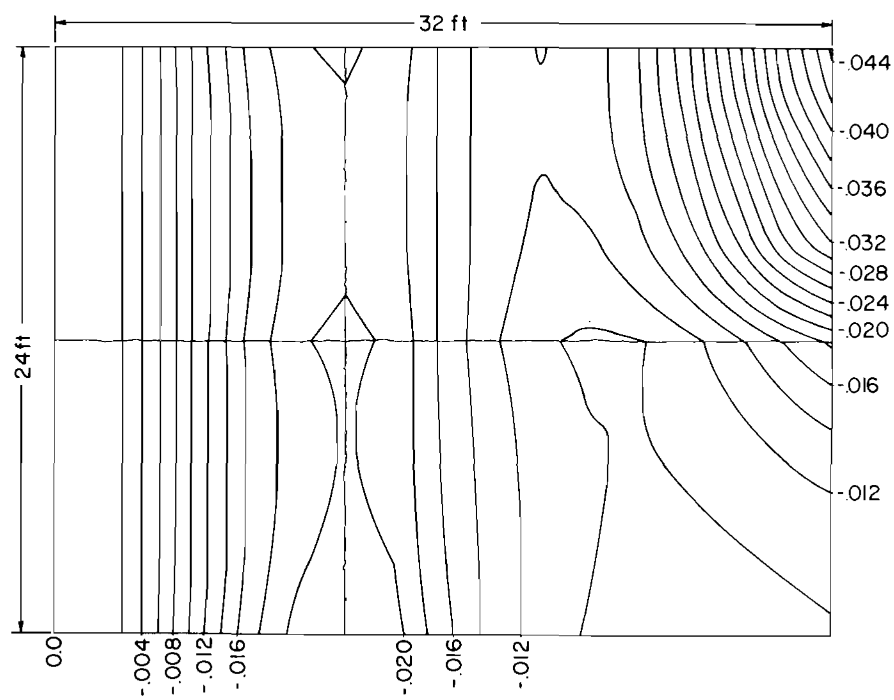


Fig 7.3. Deflection contour of bridge approach slab. Deflection in inches.

acts as a uniform load of 600 lb per station. Two 10-kip wheel loads were considered in this example. An axial load of 5,000 lb per inch has been induced by the expansion of the adjoining pavement. The resulting deflected shape is shown in Fig 7.3. The maximum deflection occurs at the corner near the wheel loads.

Problem 610 - Two-Way Bridge Slab

A second example of a complex problem is the two-way bridge slab illustrated in Fig 7.4. The slab in this problem has a variable thickness. The supporting beams are modeled as fixed supports. The dead weight is input due to the varying thickness and the simple supports. Six 20.8-kip loads act in a line 12 feet from the end of the slab. A maximum deflection of -.3095 inch occurs 12 feet from the end, one foot from the center. The resulting deflected shape is shown in Fig 7.5. The maximum moment in the x-direction is 23,500 in-lb and occurs two feet to the right of the maximum deflection.

Table of Results

A variety of example problems have been presented. The results are listed in tabular form for the convenience of the reader. Table 7.1 compares the results of the closed-form solutions, Hudson's solutions, and the solutions of this report. It also presents the computer time required to solve each of the problems. The deflections compared in Table 7.1 are in general the maximum deflections for the problem under study. The only exceptions are Example Problems 106 and 601. The deflection compared in Problem 106 occurs at the center of the slab. In Problem 601, the deflection compared occurs under the top 10-kip load (see Fig 7.2).

The exact time to run the problems using the SLAB 17 method (Ref 2) depends on the skill of the user. However, by examining the times required to run numerous problems with this program, it was possible to develop Table 7.2, which gives a general idea of the efficiency of SLAB 17 compared with DSLAB 5. Table 7.1 indicates that the time to run a square problem on DSLAB 5 is approximately proportional to m^3 (or n^3) where m and n are the number of increments in the x and y-directions, respectively. Slab solutions (see Chapter 4) involve manipulating sub-matrices. The size of the

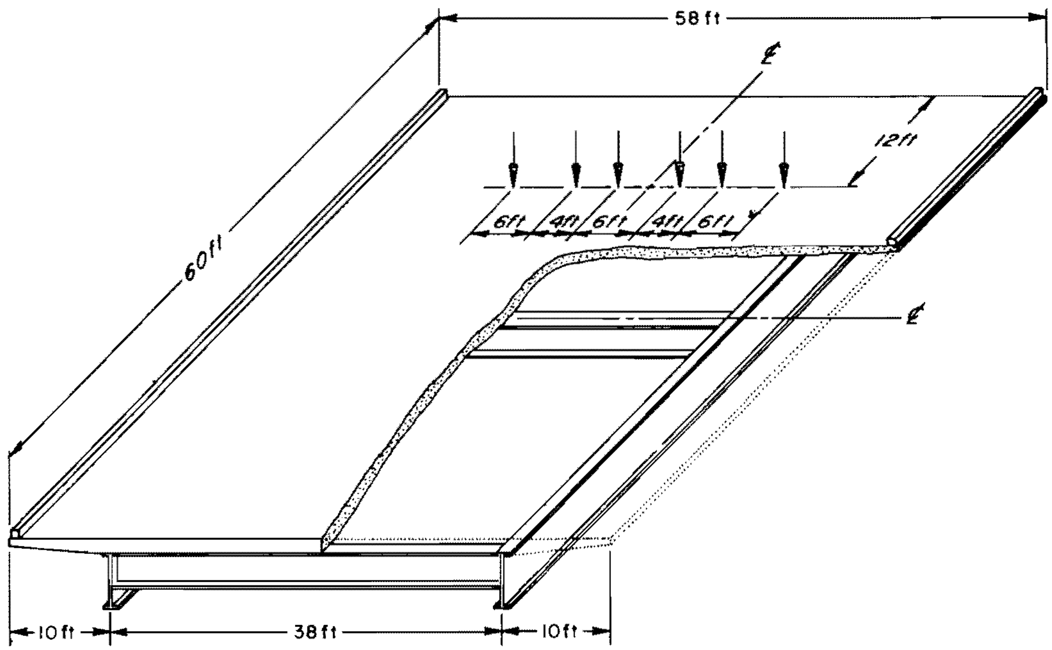


Fig 7.4. Two-way bridge slab.

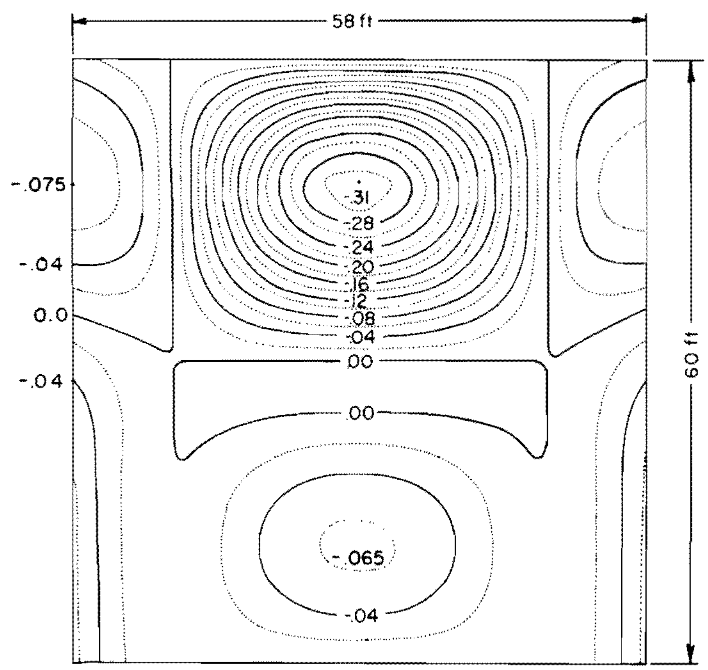


Fig 7.5. Deflection contour of two-way bridge slab. Deflection in inches.

TABLE 7.1. COMPARISON OF RESULTS

Example Number	Increment Mesh	Closed-Form Solution (inches)	Hudson's Solution (inches)	DSLAB 5 Solution (inches)	Time to Run Problem (seconds)
101	8×8	1.07	1.14	1.14	4.1
101	16×16	1.07	1.08	1.09	24.9
102	8×8	0.787	0.854	0.854	3.8
102	16×16	0.787	not run	0.817	23.9
103	8×8	not solved	0.692	0.692	3.3
104	8×8	0.861	0.861	0.861	3.5
104	12×12	0.861	0.862	0.862	9.5
104	16×16	0.861	0.860	0.862	24.0
104	24×24	0.861	not run	0.862	84.0
105	8×8	0.722	0.787	0.787	3.4
105	16×16	0.722	not run	0.752	24.3
106	8×8	0.566	0.575	0.575	3.4
106	16×16	0.566	not run	0.566	23.6
601	16×12	no solution	0.0106	0.0105	18.0

TABLE 7.2. COMPARISON OF SLAB 17 AND DSLAB 5 SOLUTION TIMES

Increment Mesh	Time for SLAB 17 (sec)	Time for DSLAB 5 (sec)
8×8	4 - 7	3 - 5
16×16	25 - 50	23 - 25
24×24	70 - 150	80 - 90

sub-matrix is controlled by m . The number of times the manipulations of the sub-matrices must be performed is controlled by n . Apparently, the time to solve rectangular problems should be proportional to m^2n .

SLAB 17 holds an outstanding advantage over DSLAB 5: it requires less computer storage. For example, SLAB 17 can solve a mesh size of up to 30 $\times$ 30 on the CDC 1604, which has a 32,000-word storage capacity, while DSLAB 5 can solve only a 12 $\times$ 12 system because of storage requirements. However, with the present 131,000-word capability of the CDC 6600, DSLAB 5 can solve a 28 $\times$ 28 problem. By rearranging the DIMENSION statements of the program, DSLAB 5 can solve a long thin slab represented by a 14 $\times$ 100 grid. Although DSLAB 5 is not presently practical on the smaller computers, it is invaluable for solving problems which cause the SLAB 17 program difficulties.

CHAPTER 8. SUMMARY

A useful method for the solution of discontinuous orthotropic plates and pavement slabs has been described by Hudson in Ref 2. Efficient solutions by this method are dependent upon the choice of proper closure springs, which for a given slab problem are quite often difficult to arrive at without several time-consuming trials. There is clearly a need for an efficient one-pass method of solving discontinuous orthotropic plates and pavement slabs. This report provides such a method.

The technique is based on a physical model of the problem which is helpful in visualizing the problem and forming the solution. All properties and loads can be freely variable from point to point. The method developed is not useful for hand calculations. With the normal computational accuracy of the CDC 6600 computer, the method is not hindered by round-off errors for the program size presently dimensioned.

The computer program DSLAB 5 is limited to a maximum size of 28 increments in the x and y-directions, although the dimension statements can easily be changed to solve a long slab with decreased width. The alternating-direction method of solution (Ref 2) requires much less computer storage space and could therefore solve a system which is divided into many more increments.

This method has application to a broad variety of complex plate and slab problems. Although the formulation of the finite-difference equation is based on the same finite-element model used by Hudson in Ref 2, this method is more convenient since the user is not required to calculate the often troublesome closure parameters needed for an iterative solution.

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APPENDIX 1

OPERATING MANUAL FOR PROGRAM DSLAB 5

OPERATING MANUAL FOR PROGRAM DSLAB 5

extract from

DIRECT COMPUTER SOLUTION FOR PLATES
AND PAVEMENT SLABS

by

C. Fred Stelzer, Jr., and W. Ronald Hudson

October 1967

DSLAB 5 is a computer program written to solve problems involving orthotropic plates and pavement slabs. The development of the equations and the overall method of solution are discussed in Chapters 4, 5, and 6 of the basic report. The purpose of this Appendix is to provide the program user with a concise manual which can be extracted for daily use with the program.

Program Operation

The general procedures followed in the program are described in the attached flow chart. A problem number card at the beginning of each problem controls the start of the solution. Unless an error occurs because of unacceptable data the program will work any number of problems in sequence, finally stopping when a blank problem number card is encountered.

The data deck starts with two cover cards used to identify the program and the particular run being made. The problems to be solved together in one run are stacked behind the cover cards in sequence as illustrated in Fig A1. Each problem consists of (a) one problem number card with alphanumeric description of the problem; (b) Table 1, Input for Data Control and Constants, one card containing necessary control data and constants for the problem; and (c) Tables 2 and 3, Stiffness and Load Data, which contain the number of cards required to properly describe the problem and loads being applied. The number of values on each card in Table 2 and the number of cards in Table 3 must be properly specified in Table 1 as indicated in the Input Form.

Guide for Data Input

The following pages provide a Guide for Data Input. It should be expected that revisions of these forms and instructions will be developed in the future and may supersede the present versions.

Example problems are discussed in Chapter 7. Appendix 4 includes example input data for several of these example problems. By comparing these example inputs with the description of the real problem the user can gain practical experience in the preparation of input data. Proficiency in the use of the program can be gained only through actual coding of problems and solution in the computer. Recoding and resolution of the example problems should prove to be helpful.

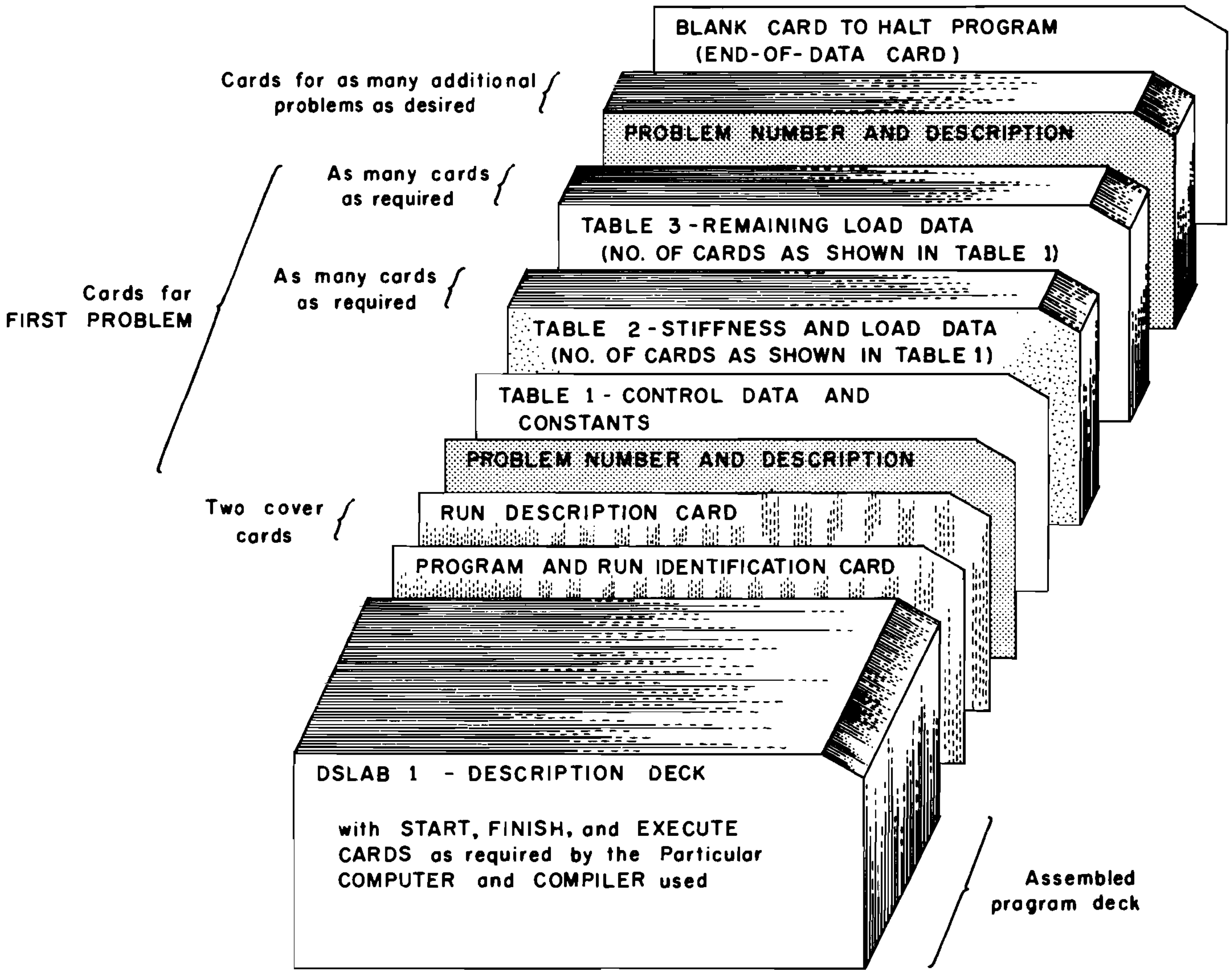


Fig A1. Assembly order for DSLAB 5 program deck with data, ready for run.

DSLAB 5 GUIDE FOR DATA INPUT - CARD FORMS

IDENTIFICATION OF PROGRAM AND RUN (2 alphanumeric cards per run)

1–80
Account number, project, coding, key punching with dates, etc.

1–80
Description of run

IDENTIFICATION OF PROGRAM (one card each problem; program stops if PROB NUM is blank)

Prob Num	1–5
Description of problem (Alphanumeric)	11–80

TABLE 1. PROGRAM-CONTROL DATA AND CONSTANTS (1 card)

Num Cards Table 2	2	1–5
Num Cards Table 3	3	6–10
Num Incrs	MX	11–15
Num Incrs	MY	16–20
Incr Length in x-Direction	HX	21–30
Incr Length in y-Direction	HY	31–40
Poisson's Ratio	PR	41–50

TABLE 2. STIFFNESS AND LOAD DATA (any number of cards as shown in Table 1)

From Sta	I1	1–5
From Sta	J1	6–10
Thru Sta	I2	11–15
Thru Sta	J2	16–20
Bending Stiffness	DX	21–30
Bending Stiffness	DY	31–40
Load	Q	41–50
Spring	S	51–60
Twisting Stiffness	CX	61–70
Twisting Stiffness	CY	71–80

TABLE 3. LOAD DATA CONTINUED (any number of cards as shown in Table 1)

From Sta	I1	1–5
From Sta	J1	6–10
Thru Sta	I2	11–15
Thru Sta	J2	16–20
External Couple	TX	41–50
External Couple	TY	51–60
Axial Tension	PX	61–70
Axial Tension	PY	71–80

GENERAL PROGRAM NOTES

The data cards must be stacked in proper order for the program to run.
A consistent system of units must be used for all input data, for example, pounds and inches.
All 2 to 5-space words are understood to be integers or whole decimal numbers . . . . | + 4 3 2 1 |
All 10-space words are floating-point decimal numbers . . . . | - 4 . 3 2 1 E + 0 3 |
All numbers must be right justified.
The problem number may be alphanumeric.

TABLE 1. PROGRAM-CONTROL DATA AND CONSTANTS

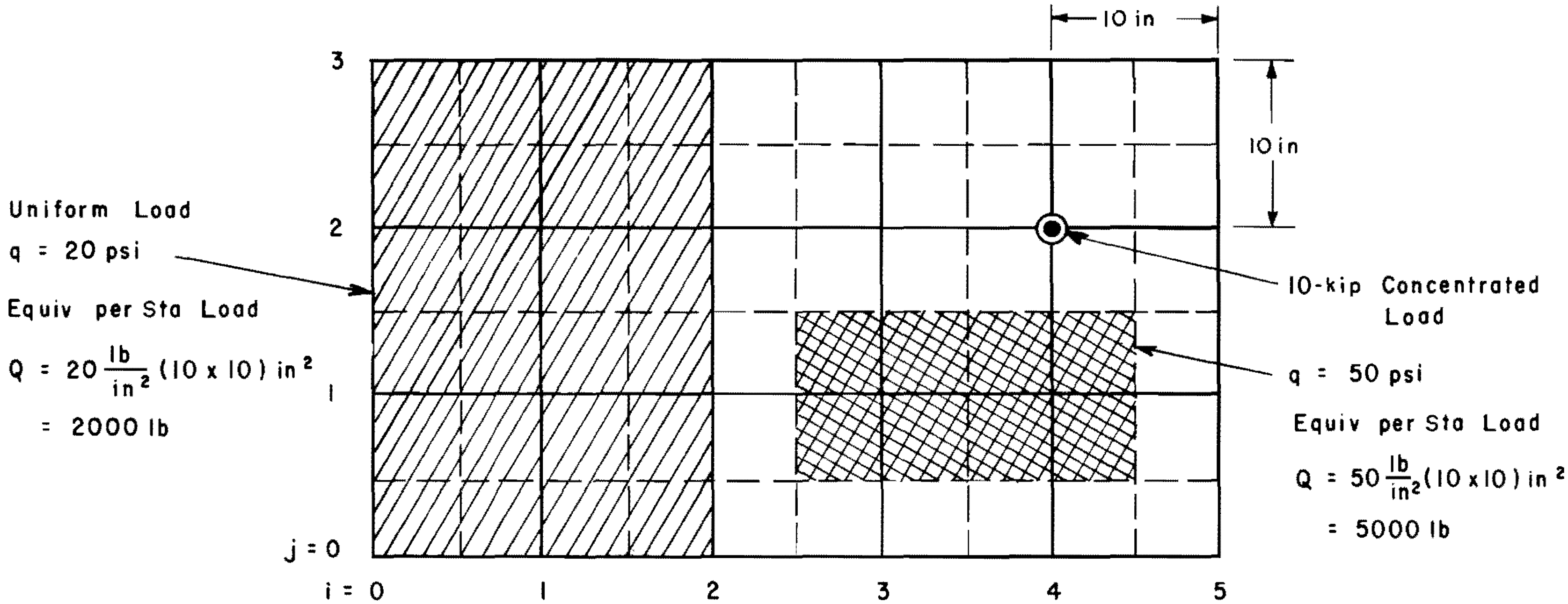
The number of input cards for Table 2 and Table 3 must be shown separately and should be carefully checked.
Poisson's ratio will be taken as zero unless specified (always positive).

TABLE 2. STIFFNESS AND LOAD DATA

Typical Units:

Variables:	DX	DY	Q	S	CX	CY
Input Units:	in-lb	in-lb	lb	lb/in	in-lb	in-lb

To distribute data over a rectangular area, the lower left hand and the upper right hand mesh points of the area must be specified. Figure A2 illustrates this.
To specify data at a single station, the station numbers (i and j) must be specified in both the "From Sta" and "Thru Sta" columns (see Fig A2).
The user must input half-values at mesh points on the edge of the slab and quarter-values at the corners since each mesh point represents the area within 1/2 increment length on all sides.
There are no restrictions on the order of cards in Table 2.
Unit stiffness values DX and DY are input at all full-value stations. The values are reduced proportionally for edges (half-values) and corners (quarter-values).
Unit torsional stiffnesses CX and CY are input in appropriate slab segments where full values are required. The values may be reduced as necessary (half segments rarely occur however).
CX and CY values lie in the increment space below and to the left of the mesh point. Care should be taken to keep from placing CX and CY values outside points with real DX and DY values.



From Sta		Thru Sta		Load Q	
4	2	4	2	1.000 E + 04	Concentrated value at Station 4,2.
3	1	4	1	5.000 E + 03	Distributed load centered over Stations 3,1 and 4,1 such that each gets a full value.
0	0	2	3	0.500 E + 03	Uniform load in rectangle 0,0 - 2,3, added in one-quarter values at a time to provide half-values at edges and quarter-values at corners of the area.
0	1	2	2	0.500 E + 03	
1	0	1	3	0.500 E + 03	
1	1	1	2	0.500 E + 03	

Fig A2. Example load input.

S values for any station are determined by multiplying the support value k by the appropriate area of the real slab assigned to that station (half-values for edges, quarter-values for corners). If k is variable, then $S = \Sigma kA$ over the area A of the station. Pinned supports are provided by using large S values.

TABLE 3. LOAD DATA

Typical Units:

Variable:	TX	TY	PX	PY
Input Units:	in-lb	in-lb	lb	lb

All inputs in this table are lumped. Distributed data must be summed over the width of the increment involved. Concentrated values are applied directly at the nearest station.

Axial tension (+) or compression (-) values P must be stated at each station in the same manner as indicated above. There is no mechanism in the program to automatically distribute the internal effects of any externally applied axial force.

Torques TX and TY are applied to the bar elements to the left and below the station, not at stations.

Dimension Guide

Since the size and the storage capacity of computers vary, it is necessary to make the size of a program variable. This is accomplished by use of a Dimension Statement, which is an integral part of the program deck. In DSLAB 5 it is also necessary to change the Dimension Statement to run rectangular problems. The Dimension Statement appears in the program after the section of comment cards which list the program notation. The following instructions are given so that the program user can change the Dimension Statements to fit his computer capacity or to fit the needs of his problem. The Dimension Guide, Fig A3, shows the Dimension Statement from DSLAB 5, using symbolized arrays. The dimensions of the real slab are replaced by S and L , where S is the short length of the slab and L is the long length. The user changes the numbers in the Dimension Statement by substituting the increment size of the maximum slab which he desires to solve into the arrays of the Dimension Statement following the formulas in the Dimension Guide. This choice of dimension input makes it necessary for the short end of the problem to be always in the x-direction and the long length in the y-direction. By making the short length the x-direction, the problem requires less storage and the computing time required is decreased.

The variables L1 , L2 , and L3 are in this Dimension Guide to be used in the subroutines which are part of the program. By changing L1 , the user automatically changes the subroutines' Dimension Statements to agree with the main Dimension Statement.

```
C---------EXPANSION FORMULAS FOR DIMENSION STATEMENT IN DSLAB5.

      DIMENSION       A(S+7,L+7),                   A1(S+3,1),
     1                A2(S+3,1),                    AA(S+3,1),
     2                AA1(S+3,S+3),                 AA2(S+3,S+3),
     3                AA3(S+3,S+3),                 AA4(S+3,S+3),
     4                AA5(S+3,S+3),                 AA6(S+3,1),
     5                AN1(32),                      AN2(14),
     6                AAUG(S+3,S+3,2),              B(S+3,S+3,L+7),
     7                BB(S+3,S+3),                  BB1(S+3,S+3),
     8                BB2(S+3,S+3),                 BMX(S+7,L+7),
     9                BMY(S+7,L+7),                 C(S+3,S+3,L+7),
     1                CC(S+3,S+3),                  CC1(S+3,S+3),
     2                CC2(S+3,S+3),                 CX(S+7,L+7),
     3                CY(S+7,L+7),                  D(S+3,S+3),
     4                DP(6),                        DX(S+7,L+7),
     5                DY(S+7,L+7),                  E(S+3,S+3),
     6                PX(S+7,L+7),                  PY(S+7,L+7),
     7                Q(S+7,L+7),                   S(S+7,L+7),
     8                TX(S+7,L+7),                  TY(S+7,L+7),
     9                W(S+7,L+7),                   W1(S+3,1),
     1                W2(S+3,1)

C---------VARIABLES FOR USE IN SETTING THE DIMENSION SIZE FOR
C                     SUBROUTINES IN DSLAB5.

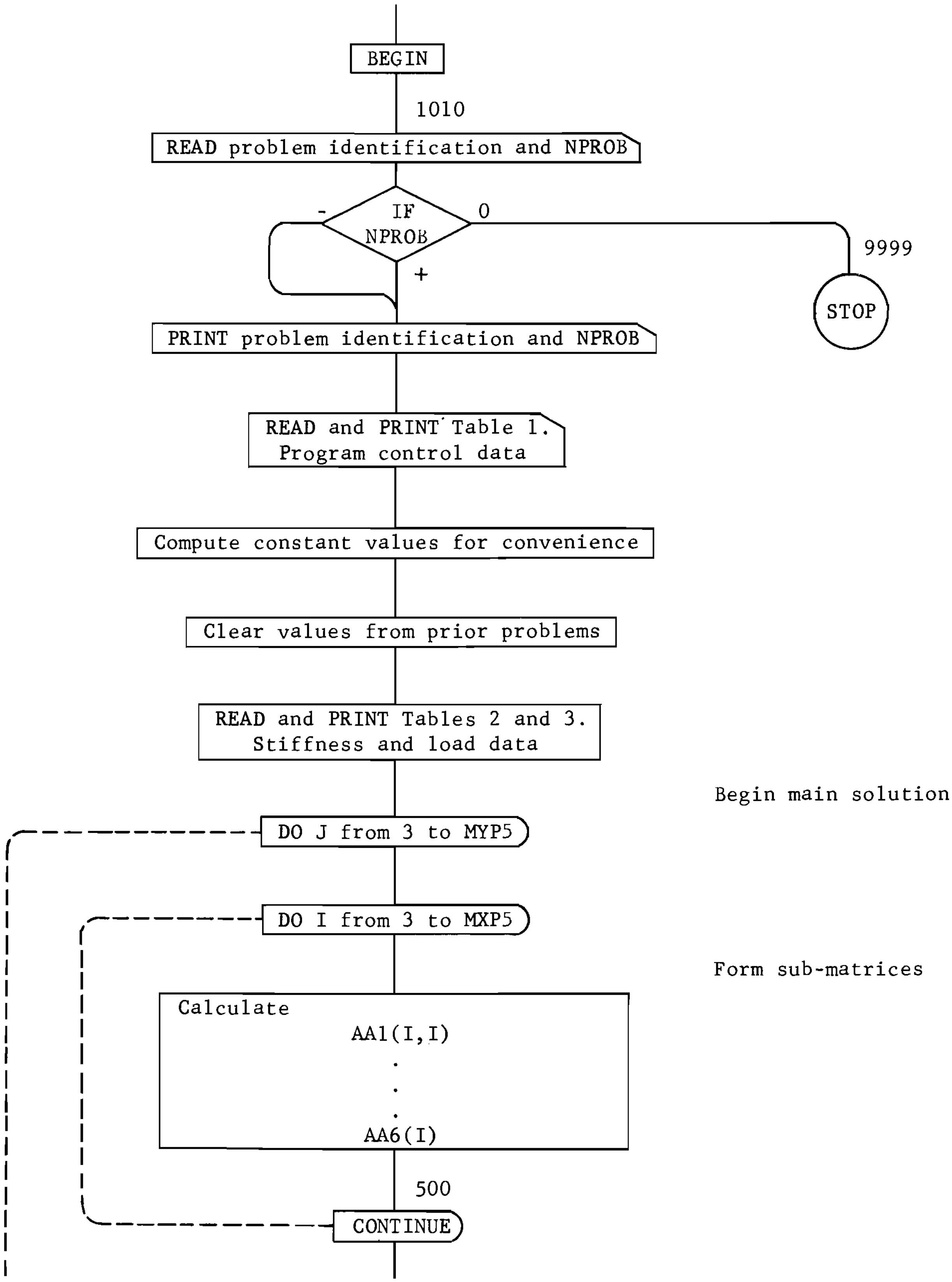
            L1 =  S+3
            L2 =  1
            L3 =  2
```

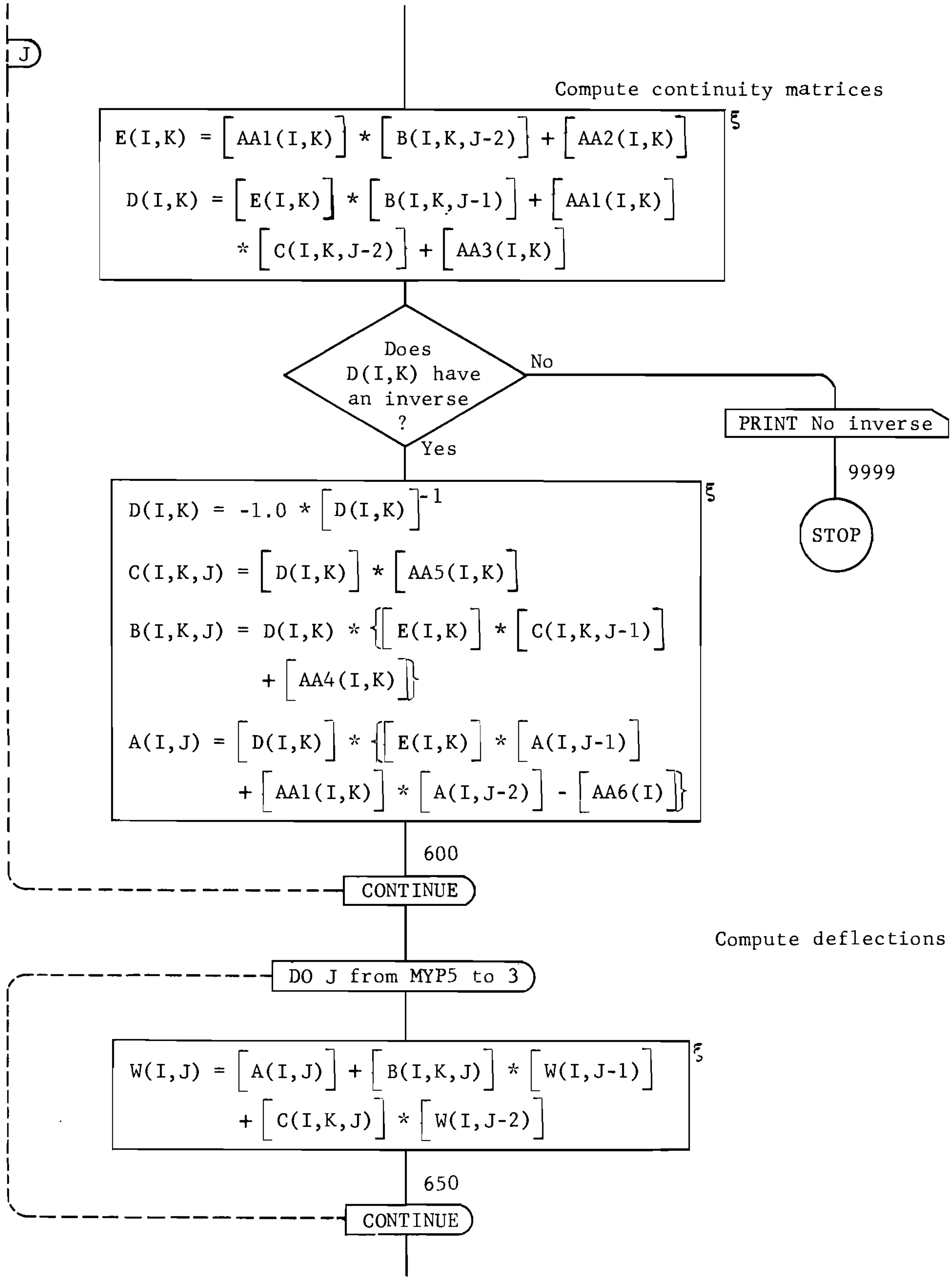
Fig A3. Dimension Guide.

APPENDIX 2

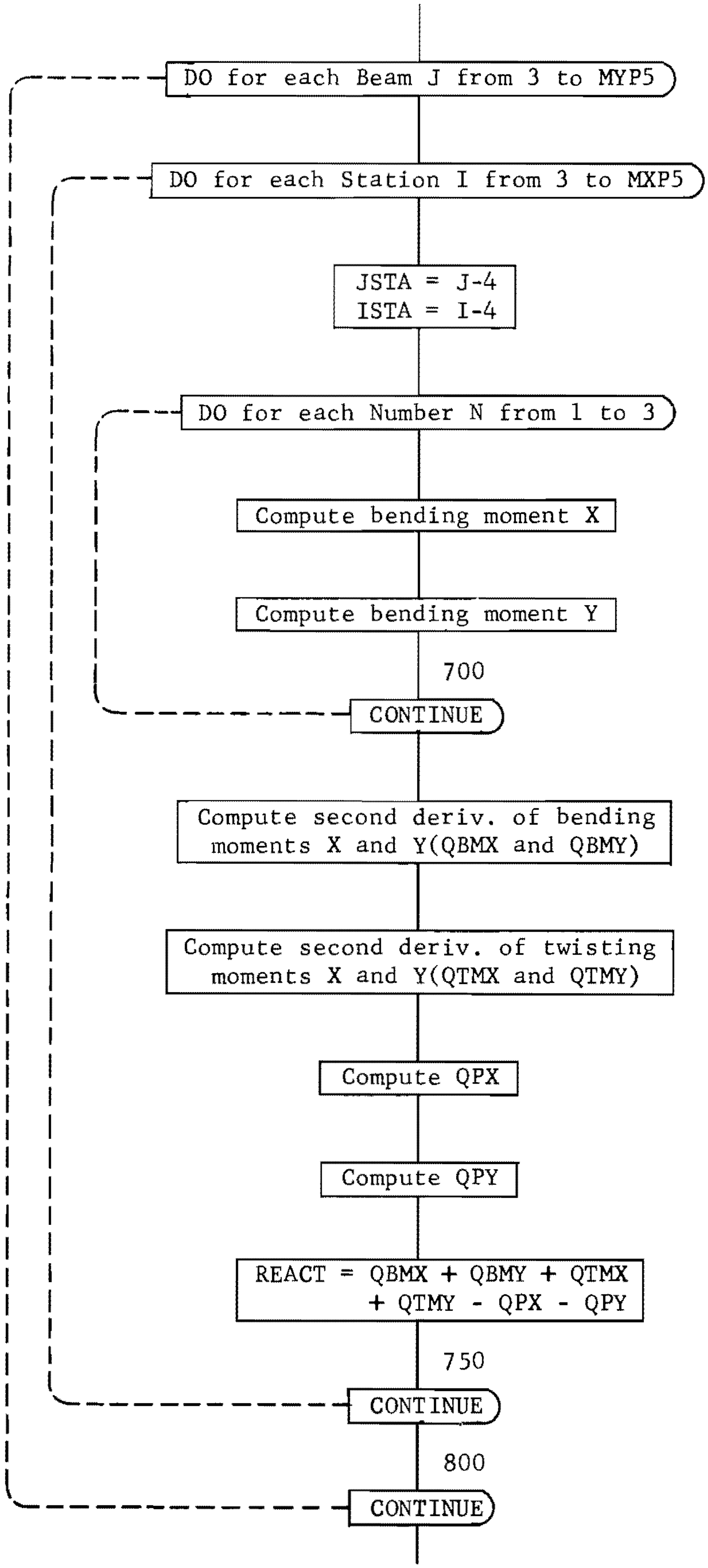
GENERAL FLOW DIAGRAM FOR PROGRAM DSLAB 5

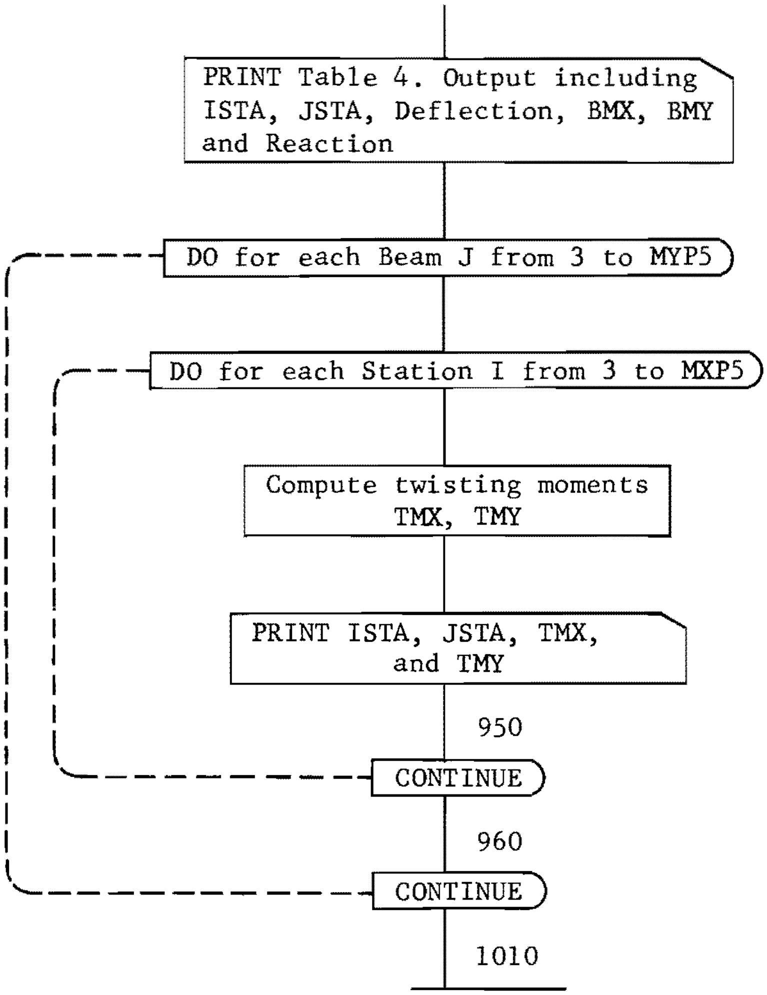
GENERAL FLOW DIAGRAM FOR
PROGRAM DSLAB 5



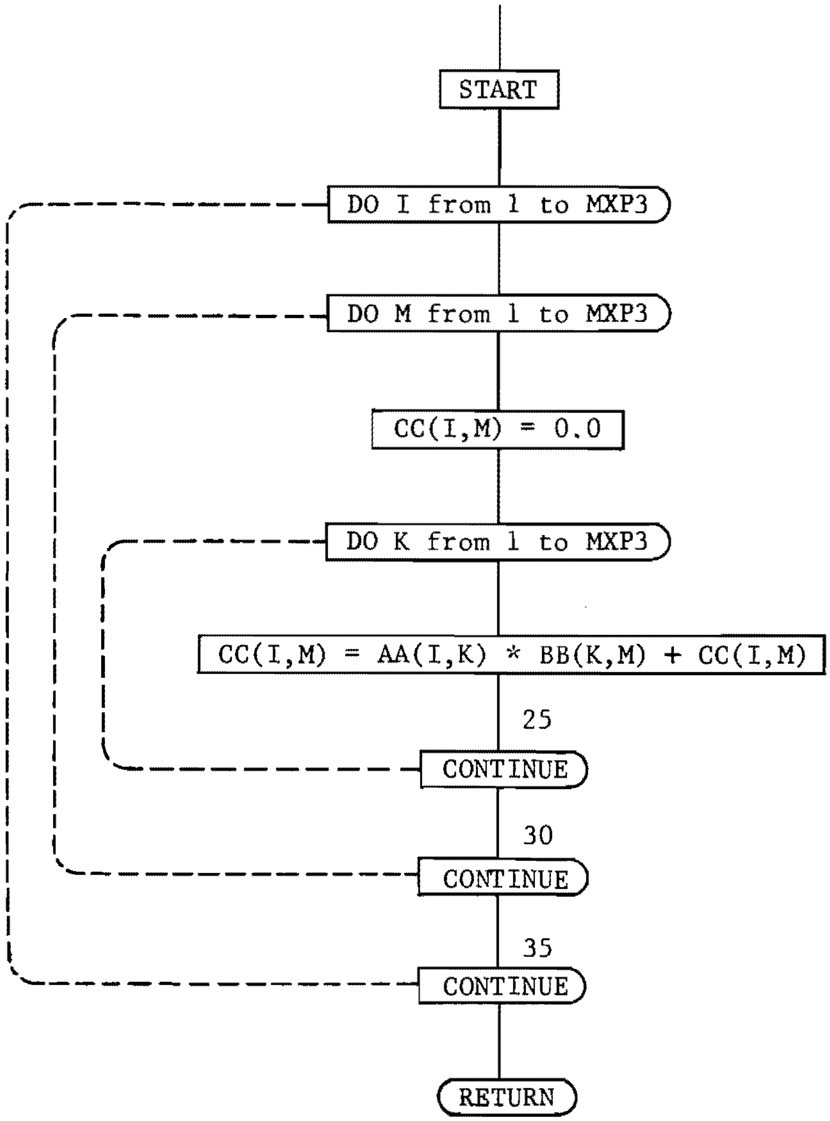


ξ The indicated operations involve numerous matrix multiplications and inversions which require calling the appropriate subroutines at the end of the program.

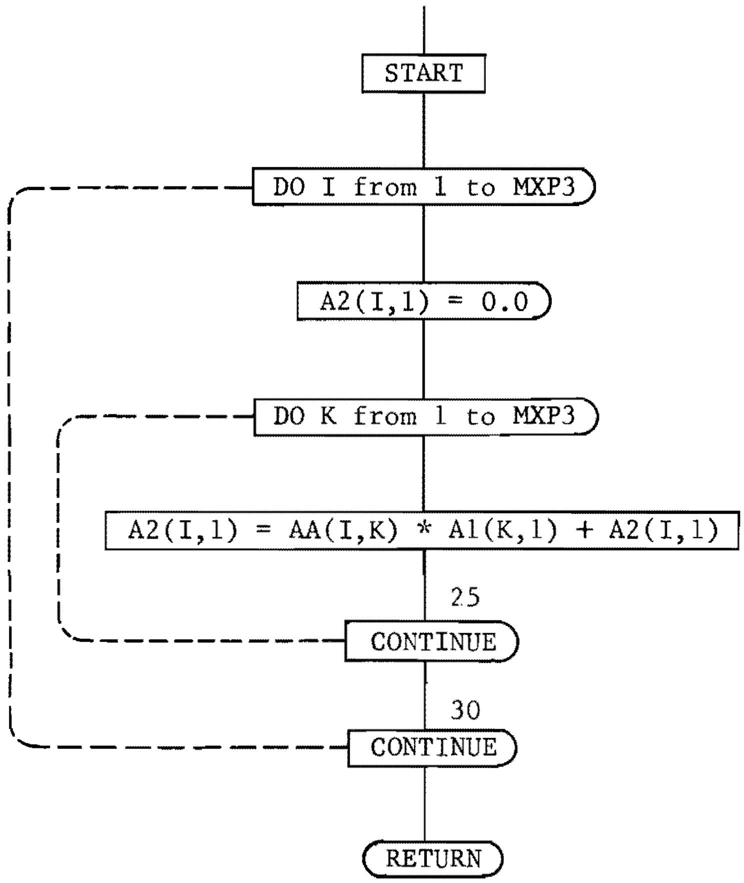

DO for each Beam J from 3 to MYP5
DO for each Station I from 3 to MXP5
JSTA = J-4
ISTA = I-4
DO for each Number N from 1 to 3
Compute bending moment X
Compute bending moment Y
700
CONTINUE
Compute second deriv. of bending moments X and Y(QBMX and QBMY)
Compute second deriv. of twisting moments X and Y(QTMX and QTMY)
Compute QPX
Compute QPY
REACT = QBMX + QBMY + QTMX + QTMY - QPX - QPY
750
CONTINUE
800
CONTINUE


PRINT Table 4. Output including ISTA, JSTA, Deflection, BMX, BMY and Reaction
DO for each Beam J from 3 to MYP5
DO for each Station I from 3 to MXP5
Compute twisting moments TMX, TMY
PRINT ISTA, JSTA, TMX, and TMY
950
CONTINUE
960
CONTINUE
1010

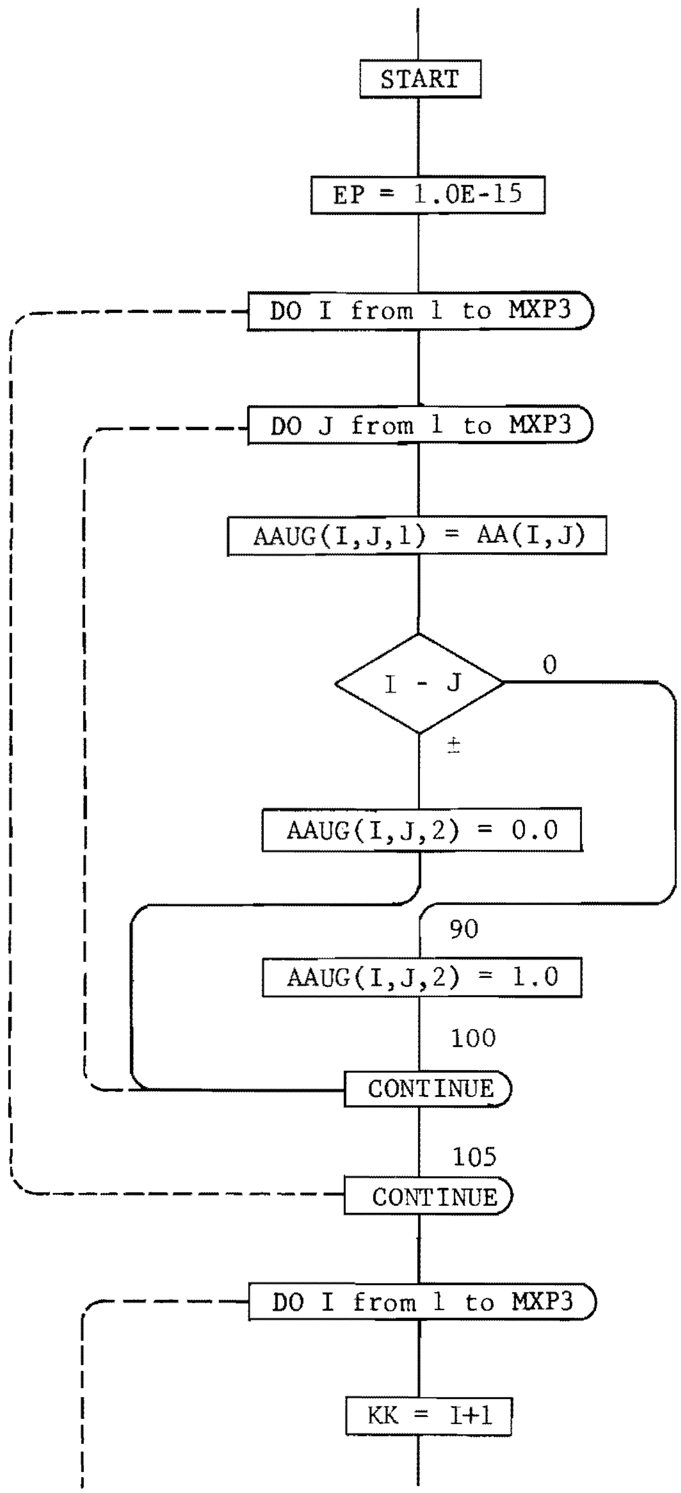
SUBROUTINE MATMPY
(MULTIPLIES TWO SQUARE MATRICES)

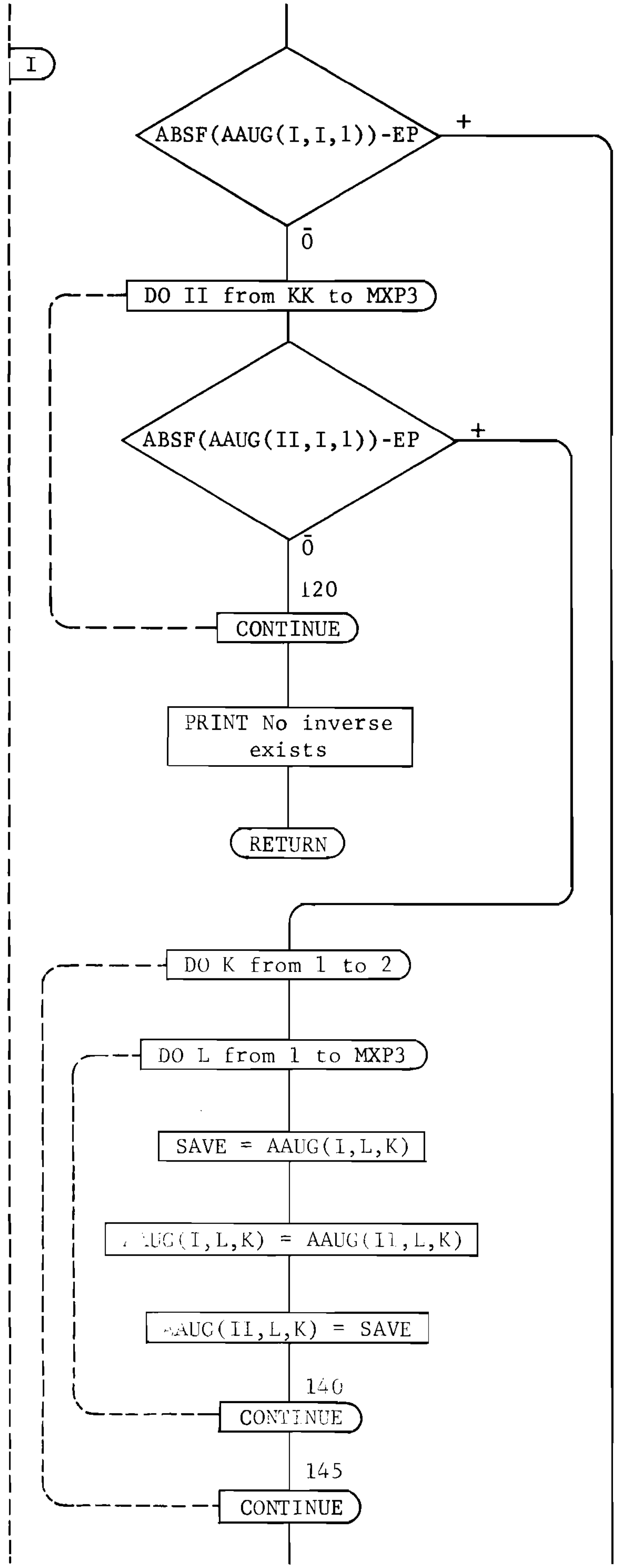


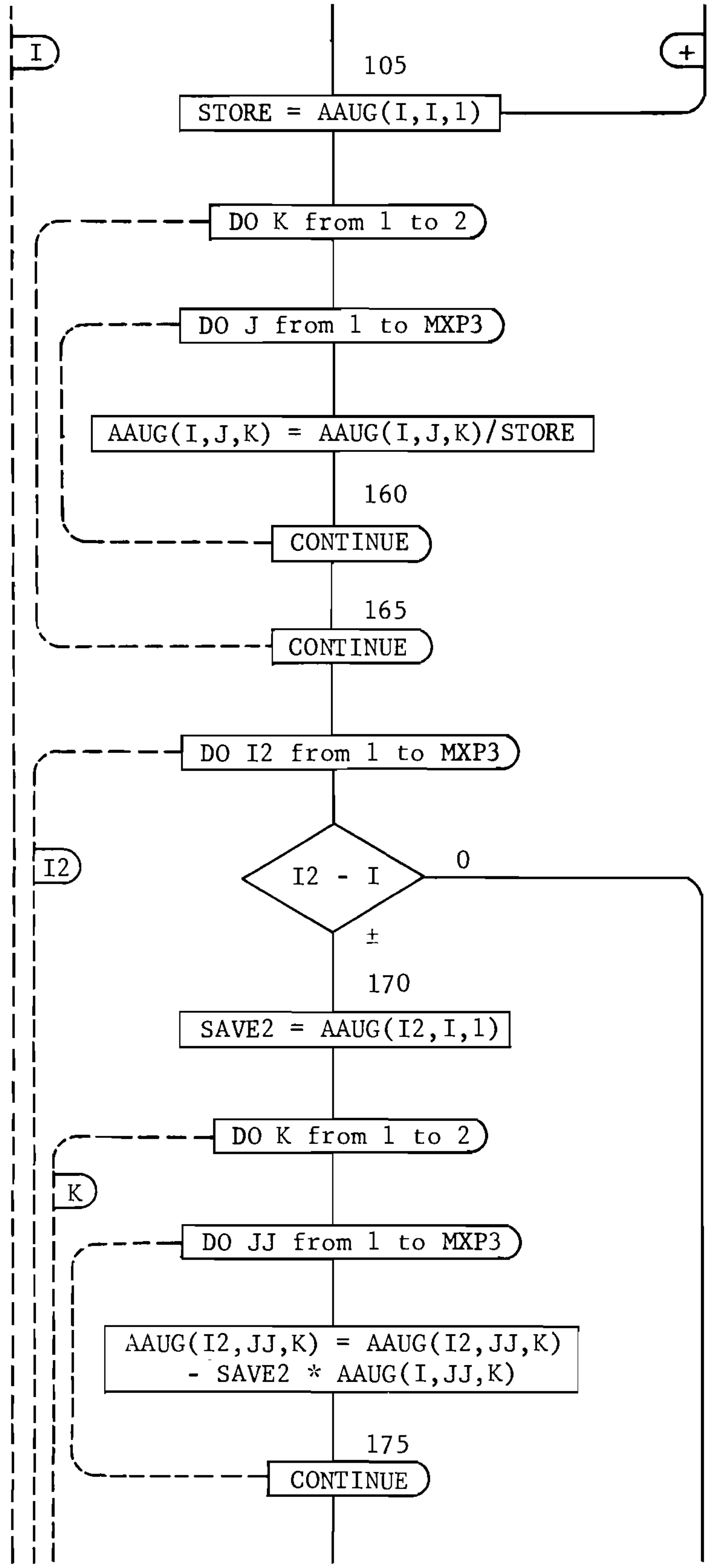
SUBROUTINE MATMP1
(MULTIPLIES A SQUARE MATRIX TIMES A VECTOR MATRIX)

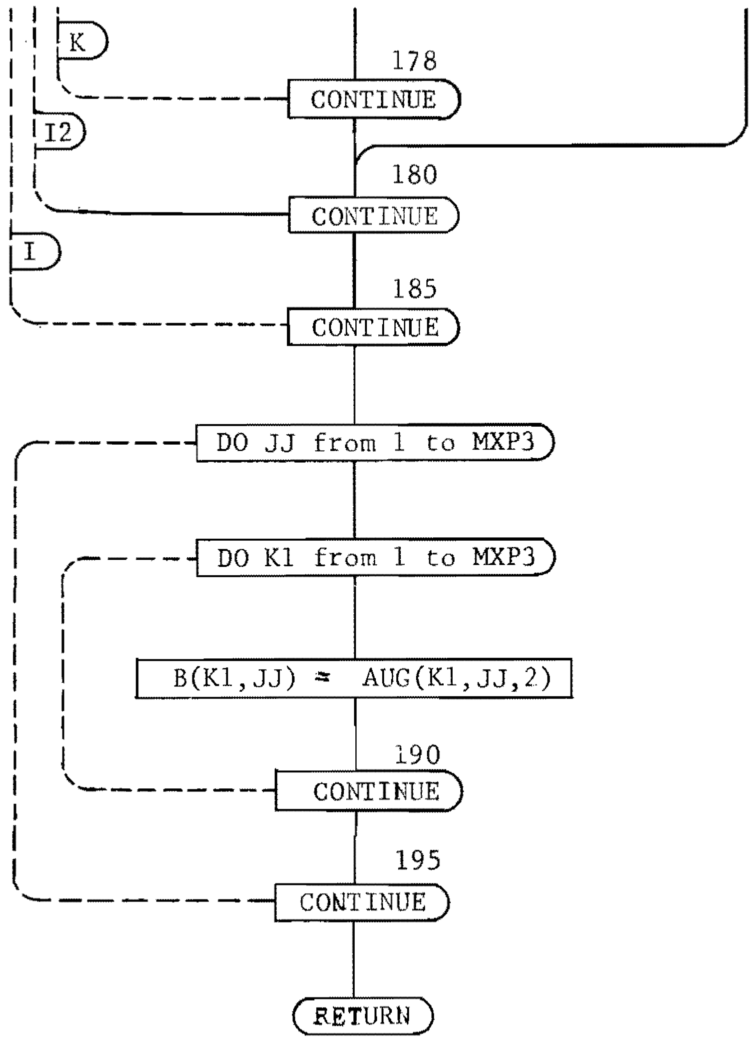


SUBROUTINE INVRSL
(FINDS INVERSE OF MATRIX)




I
ABSF(AAUG(I,I,1))-EP
+
0̄
DO II from KK to MXP3
ABSF(AAUG(II,I,1))-EP
+
0̄
120
CONTINUE
PRINT No inverse exists
RETURN
DO K from 1 to 2
DO L from 1 to MXP3
SAVE = AAUG(I,L,K)
AAUG(I,L,K) = AAUG(II,L,K)
AAUG(II,L,K) = SAVE
140
CONTINUE
145
CONTINUE


I
+
105
STORE = AAUG(I,I,1)
DO K from 1 to 2
DO J from 1 to MXP3
AAUG(I,J,K) = AAUG(I,J,K)/STORE
160
CONTINUE
165
CONTINUE
DO I2 from 1 to MXP3
I2
I2 - I
0
±
170
SAVE2 = AAUG(I2,I,1)
DO K from 1 to 2
K
DO JJ from 1 to MXP3
AAUG(I2,JJ,K) = AAUG(I2,JJ,K) - SAVE2 * AAUG(I,JJ,K)
175
CONTINUE


K
178
CONTINUE
I2
180
CONTINUE
I
185
CONTINUE
DO JJ from 1 to MXP3
DO K1 from 1 to MXP3
B(K1,JJ) = AUG(K1,JJ,2)
190
CONTINUE
195
CONTINUE
RETURN

APPENDIX 3

PROGRAM LISTING OF DSLAB 5

```
      PROGRAM DSLAB 5  ( INPUT, OUTPUT )
C
    1 FORMAT (    52H     PROGRAM DSLAB 5   -  DECK 1        -  STELZER   28JE7
     1    ,                                 28H  REVISION DATE 24 JULY 1967 )
C
C---------THIS PROGRAM IS MATHEMATICALLY IDENTICAL TO DSLAB1.
C
C---------THIS PROGRAM SOLVES ORTHOTROPIC PLATES AND PAVEMENT SLABS BY
C       A DIRECT METHOD. THE DIRECT SOLUTION IS CARRIED OUT
C       BY USING A BACK AND FORTH RECURSIVE TECHNIQUE DESCRIBED
C       BY HUDSON MATLOCK.
C
C
C---------NOTATION
C
C         A()                   CONTINUITY OR RECURSION COEFFICIENT
C         AA(), A1(), A2()      TEMPORARY A( ) TERMS
C         AA1(), AA2(), AA3(),TERMS WHICH MAKE UP THE SUB-MATRICES OF
C         AA4(), AA5(), AA6()        THE STIFFNESS MATRIX AND LOAD MATRIX
C         AAUG()                AUGMENTED MATRIX
C         AN1(N)                ALPHANUMERIC REMARK, INFORMATION ONLY
C         AN2(N)                ALPHANUMERIC REMARK, INFORMATION ONLY
C         B()                   CONTINUITY OR RECURSION COEFFICIENT
C         BB(), BB1(), BB2()    TEMPORARY B() TERMS
C         BMX(I,J)              BENDING MOMENT IN THE X DIRECTION
C         BMY(I,J)              BENDING MOMENT IN THE Y DIRECTION
C         CXN                   TEMPORARY INPUT VALUE OF TWISTING STIFFNESS
C         CX(I,J)               TORSIONAL STIFFNESS
C         CY(I,J)               TORSIONAL STIFFNESS
C         CYN                   TEMPORARY INPUT VALUE OF TWISTING STIFFNESS
C         C()                   CONTINUITY OR RECURSION COEFFICIENT
C         CC(), CC1(), CC2()    TEMPORARY C() TERMS
C         DP(N)                 SQUARE ROOT OF PRODUCT OF BENDING STIFFNESS
C         DX(I,J)               BENDING STIFFNESS (SLAB)
C         DXN                   TEMPORARY INPUT VALUE OF BENDING STIFFNESS
C         DY(I,J)               BENDING STIFFNESS (SLAB)
C         DYN                   TEMPORARY INPUT VALUE OF BENDING STIFFNESS
C         E()                   CONTINUITY OR RECURSION COEFFICIENT
C         D()                   CONTINUITY OR RECURSION COEFFICIENT
C         HX                    INCREMENT LENGTH IN X DIRECTION
C         HXDHY3                HX DIVIDED BY HY CUBED
C         HY                    INCREMENT LENGTH IN Y DIRECTION
C         HYDHX3                HY DIVIDED BY HX CUBED
C         I                     STATION NUMBE X DIRECTION
C         II, I1                TEMPORARY VALUE OF I
C         IN1                   X COORDINATE OF THE FROM STATION
C         IN2                   X COORDINATE OF THE THRU STATION
C         ISTA                  EXTERNAL X STATION NUMBER
C         ITEST                 BLANK FIELD FOR ALPHANUMERIC ZERO
C         J                     STATION NUMBE Y DIRECTION
C         J1, J2                TEMPORARY VALUE OF J
C         JN1                   Y COORDINATE OF THE FROM STATION
C         JN2                   Y COORDINATE OF THE THRU STATION
C         JSTA                  EXTERNAL Y STATION NUMBER
C         MX                    NUMBER OF INCREMENTS IN X DIRECTION
C         MXP3                  MX PLUS THREE
C         MXP5                  MX PLUS FIVE
C         MXP7                  MX PLUS SEVEN
C         MY                    NUMBER OF INCREMENTS IN Y DIRECTION
```

```
C         MYP5                    MY PLUS FIVE
C         MYP7                    MY PLUS SEVEN
C         NCT2                    NUMBER OF VALUES IN TABLE 2
C         NCT3                    NUMBER OF CARDS IN TABLE 3
C         NPROB                   NUMBER OF PROBLEM, PROG STOPS IF ZERO
C         ODHX                    ONE DIVIDED BY HX
C         ODHY                    ONE DIVIDED BY HY
C         ODHXHY                  ONE DIVIDED BY HX TIMES HY
C         PDHXHY                  POISSONS RATIO DIVIDED BY HX TIMES HY
C         PR                      POISSONS RATIO
C         PX(I,J)                 AXIAL LOAD IN X DIRECTION
C         PXN                     TEMPORARY INPUT VALUE OF AXIAL LOAD
C         PY(I,J)                 AXIAL LOAD IN Y DIRECTION
C         PYN                     TEMPORARY INPUT VALUE OF AXIAL LOAD
C         Q(I,J)                  TRANSVERSE FORCE PER MESH POINT
C         QBMX                    HXHY * SECOND DERIV BEND MOMENT (X)
C         QBMY                    HYHX * SECOND DERIV BEND MOMENT (Y)
C         QN                      TEMPORARY INPUT VALUE OF LOAD
C         QPX                     VERTICAL REACTION DUE TO AXIAL FORCES
C         QPY                     VERTICAL REACTION DUE TO AXIAL FORCES
C         QTMX                    HXHY * SECOND DERIV TWIST MOMENT (XY)
C         QTMY                    HYHX * SECOND DERIV TWIST MOMENT (YX)
C         REACT                   NET TRANSVERSE FORCE
C         S(I,J)                  SPRING SUPPORT, VALUE PER MESH POINT
C         SN                      TEMPORARY INPUT VALUE OF SUPPORT SPRINGS
C         TMX                     TWISTING MOMENT (XY)
C         TMY                     TWISTING MOMENT (YX)
C         TX(I,J)                 EXTERNAL COUPLE IN X DIRECTION
C         TXN                     TEMPORARY INPUT VALUE OF EXTERNAL COUPLE
C         TY(I,J)                 EXTERNAL COUPLE IN Y DIRECTION
C         TYN                     TEMPORARY INPUT VALUE OF EXTERNAL COUPLE
C         W()                     VERTICAL DEFLECTION
C         W1(), W2()              TEMPORARY VALUES OF W()
C
C
C-----FOR DIFFERENT SIZED PROBLEMS, ONLY THE DIMENSION CARDS AND THE
C          L1 CARD NEED BE CHANGED.  FOR EXAMPLE, AA1(S+3,S+3),
C          AA6(S+3,1), AAUG(S+3,S+3,2), A(S+7,L+7), B(S+3,S+3,L+7)
C          WHERE THE S AND THE L REFER TO THE SHORT AND LONG LENGTHS
C          OF THE REAL PROBLEM.  ALSO, L1 IS S+3.
C
C-----THIS PROGRAM IS NOW DIMENSIONED TO SOLVE A GRID WITH MAXIMUN SIZE
C          OF 20 BY 29 MESH POINTS.
C
      DIMENSION      A(27,36),         A1(23,1),          A2(23,1),      22JL7
     1               AA(23,1),         AA1(23,23),        AA2(23,23),    24JL7
     2               AA3(23,23),       AA4(23,23),        AA5(23,23),    22JL7
     3               AA6(23,1),        AN1(32),           AN2(14),       22JL7
     4               AAUG(23,23,2),    B(23,23,36),       BB(23,23),     22JL7
     5               BB1(23,23),       BB2(23,23),        BMX(27,36),    22JL7
     6               BMY(27,36),       C(23,23,36),       CC(23,23),     22JL7
     7               CC1(23,23),       CC2(23,23),        CX(27,36),     22JL7
     8               CY(27,36),        D(23,23),          DP(6),         22JL7
     9               DX(27,36),        DY(27,36),         E(23,23),      22JL7
     1               PX(27,36),        PY(27,36),         Q(27,36),      22JL7
     2               S(27,36),         TX(27,36),         TY(27,36),     22JL7
     3               W(27,36),         W1(23,1),          W2(23,1)       22JL7
      EQUIVALENCE    (W,S),  (B,BMX),  (C,BMY)                           22JL7
             L1  =  23                                                   20JL7
             L2  =  1                                                    20JL7
```

```
                L3  =  2                                                20JL7
    6 FORMAT ( )                                                        04MY3
   10 FORMAT (    5H     , 80X, 10HI-----TRIM )                         03FE4 ID
   11 FORMAT (    5H1    , 80X, 10HI-----TRIM )                         03FE4 ID
   12 FORMAT (  16A5  )                                                 04MY3 ID
   13 FORMAT (    5X, 16A5 )                                            26AG3 ID
   14 FORMAT ( A5, 5X, 14A5 )                                           19MR5 ID
   15 FORMAT (///10H     PROB , /5X, A5, 5X, 14A5 )                     19MR5 ID
   16 FORMAT (///17H     PROB (CONTD), /5X, A5, 5X, 14A5 )              19MR5 ID
   19 FORMAT (///48H     RETURN THIS PAGE TO TIME RECORD FILE -- HM   ) 26AG3 ID
   20 FORMAT ( 4I5, 4E10.3 )                                            02NO6
   23 FORMAT (  4( 2X, I3 ),   6E10.3 )                                 21JL7
   24 FORMAT (  4( 2X, I3 ),  20X,  4E10.3 )                            21JL7
   30 FORMAT ( //30H     TABLE 1.  CONTROL DATA     ,            /      15AP3
    1          / 30H           NUM CARDS TABLE 2    , 42X, I3,    /      20JL7
    2            30H           NUM CARDS TABLE 3    , 42X, I3,    /      20JL7
    4            30H           NUM INCREMENTS  MX   , 42X, I3,    /      20JL7
    5            30H           NUM INCREMENTS  MY   , 42X, I3,    /      20JL7
    6            30H           INCR LENGTH  HX      , 35X,   E10.3,/     25MY4
    7            30H           INCR LENGTH  HY      , 35X,   E10.3,/     15AP3
    9            30H           POISSONS RATIO       , 35X,   E10.3,/     15MR5
    2            30H                                , 35X,   E10.3 )     16SE5
   33 FORMAT ( //51H     TABLE 2.  STIFFNESS AND LOAD DATA, FULL VALUES,15SE6
    1            35H ADDED AT ALL STAS I,J IN RECT.    , /              15AP3
    2          / 50H         FROM   THRU     DX          DY          Q   26AP5
    3            45H          S          CX         CY               ,/) 26AP5
   37 FORMAT ( //44H     TABLE 3.  STIFFNESS AND LOAD DATA, FULL,       20JL7
    1            45H VALUES ADDED AT ALL STAS I,J IN RECT.        , /   26AP5
    2          / 50H         FROM   THRU                            TX   26AP5
    3            45H        TY          PX          PY               ,/) 26AP5
   39 FORMAT ( //25H     TABLE 4.  RESULTS      ///                     20JL7
    1            50H         I,J       DEFL        BMX          BMY      20JL7
    2            20H REACT               / )                            20JL7
   40 FORMAT ( //30H     TABLE 4.  RESULTS(CONTD)      ///
    1            40H         I,J       TMX         TMY          / )      20JL7
   43 FORMAT  ( 5X,  2( 1X,  I3,  I3   ),  6E11.3)                      21JL7
   44 FORMAT  ( 5X,  2(   1X,  I3,  I3 ), 22X, 4E11.3 )                 21JL7
   45 FORMAT  ( 7X, I2, I3, 9E12.3 )                                    02NO6
   60 FORMAT ( 15X, 2I5, 5X, E10.3 )                                    14SE6
C
C-----PROGRAM AND PROBLEM IDENTIFICATION
C
                ITEST = 5H                                              19MR5 ID
      CALL TIC TOC (1)                                                  26SE66
      READ  12, ( AN1(N), N = 1, 32 )                                   19MR5 ID
 1010 READ  14,  NPROB, ( AN2(N), N = 1, 14 )                           28AG3 ID
           IF ( NPROB - ITEST ) 1020, 9990, 1020                        19MR5 ID
 1020 PRINT 11                                                          26AG3 ID
      PRINT  1                                                          19MR5 ID
      PRINT 13, ( AN1(N), N = 1, 32 )                                   19MR5 ID
      PRINT 15, NPROB, ( AN2(N), N = 1, 14 )                            26AG3 ID
C
C-----INPUT TABLE 1
C
      READ  20, NCT2, NCT3, MX, MY, HX, HY, PR                          21JL7
      PRINT 30, NCT2, NCT3, MX, MY, HX, HY, PR                          02NO6
C
C-----COMPUTE FOR CONVENIENCE
C
                MXP7 = MX + 7                                           07NO6
```

```
             MYP7 = MY + 7                                                          07NO6
             MXP5 = MX + 5                                                          12OC6
             MYP5 = MY + 5                                                          12OC6
             MXP3 = MX + 3                                                          12OC6
             HYDHX3 = HY / HX**3                                                    14SE6
             HXDHY3 = HX / HY**3                                                    14SE6
             PDHXHY = PR / ( HY * HX )                                              14SE6
             ODHXHY = 1.0 / ( HY * HX )                                             14SE6
             ODHX = 1.0 / HX                                                        14SE6
             ODHY = 1.0 / HY                                                        14SE6
        DO  105  J = 1, MYP7                                                        21JL7
        DO  100  I = 1, MXP7                                                        21JL7
             A(I,J) = 0.0                                                           07NO6
             BMX(I,J) = 0.0                                                         07NO6
             BMY(I,J) = 0.0                                                         07NO6
             DX(I,J) = 0.0                                                          01NO6
             DY(I,J) = 0.0                                                          01NO6
              Q(I,J) = 0.0                                                          01NO6
              S(I,J) = 0.0                                                          01NO6
             CX(I,J) = 0.0                                                          01NO6
             CY(I,J) = 0.0                                                          01NO6
             TX(I,J) = 0.0                                                          23JE7
             TY(I,J) = 0.0                                                          23JE7
             PX(I,J) = 0.0                                                          23JE7
             PY(I,J) = 0.0                                                          23JE7
             W(I,J) = 0.0                                                           02NO6
  100   CONTINUE                                                                    04MY7
  105   CONTINUE                                                                    23JE7
        DO  140  J = 1, 2                                                           22JE7
        DO  135  II = 1, MXP3                                                       22JE7
        DO  130  I = 1, MXP3                                                        21JL7
             B(I,II,J) = 0.0                                                        07NO6
             C(I,II,J) = 0.0                                                        07NO6
  130   CONTINUE                                                                    04MY7
  135   CONTINUE                                                                    22JE7
  140   CONTINUE                                                                    22JE7
C
C-----INPUT TABLE 2
C
      PRINT 33                                                                      14SE6
        IF ( 1.GT.NCT2 )     GO TO 365                                              21JL7
        DO  360  N = 1, NCT2                                                        21JL7
      READ  23,  IN1, JN1, IN2, JN2, DXN, DYN, QN, SN, CXN, CYN                     22AP5
      PRINT 43,  IN1, JN1, IN2, JN2, DXN, DYN, QN, SN, CXN, CYN                     22AP5
             I1  =   IN1 + 4                                                        20AP5
             J1  =   JN1 + 4                                                        20AP5
             I2  =   IN2 + 4                                                        20AP5
             J2  =   JN2 + 4                                                        20AP5
        IF ( I1.GT.I2 )      GO TO 360                                              16AG6
        DO  355  I = I1, I2                                                         21JL7
        IF ( J1.GT.J2 )      GO TO 360                                              16AG6
        DO  350  J = J1, J2                                                         21JL7
             DX(I,J) = DX(I,J) + DXN                                                4SE64
             DY(I,J) = DY(I,J) + DYN                                                4SE64
              Q(I,J) =  Q(I,J) +  QN                                                13AP3
              S(I,J) =  S(I,J) +  SN                                                13AP3
             CX(I,J) = CX(I,J) + CXN                                                15AP5
             CY(I,J) = CY(I,J) + CYN                                                15AP5
  350   CONTINUE                                                                    13AP3
  355   CONTINUE                                                                    22JE7
```

```
  360     CONTINUE                                                        13AP3
  365     CONTINUE                                                        04MY7
C
C-----INPUT TABLE 3
C
      PRINT 37                                                            22AP5
          IF ( 1.GT.NCT3   )    GO TO 385                                 15SE6
          DO  380  N = 1, NCT3                                            21JL7
      READ  24,  IN1, JN1, IN2, JN2,           TXN, TYN, PXN, PYN         15SE6
      PRINT 44,  IN1, JN1, IN2, JN2,           TXN, TYN, PXN, PYN         15SE6
               I1   =    IN1 + 4                                          13AP5
               J1   =    JN1 + 4                                          13AP5
               I2   =    IN2 + 4                                          16AP5
               J2   =    JN2 + 4                                          13AP5
          IF ( I1.GT.I2 )      GO TO 380                                  16AG6
          DO  375  I = I1,.I2                                             21JL7
          IF ( J1.GT.J2 )      GO TO 380                                  16AG6
          DO  370  J = J1, J2                                             21JL7
               TX(I,J) = TX(I,J) + TXN                                    20AP5
               TY(I,J) = TY(I,J) + TYN                                    20AP5
               PX(I,J) = PX(I,J) + PXN                                    20AP5
               PY(I,J) = PY(I,J) + PYN                                    20AP5
  370     CONTINUE                                                        20AP5
  375     CONTINUE                                                        21JL7
  380     CONTINUE                                                        20AP5
  385     CONTINUE                                                        20AP5
C
C-----PLACE SPRING AT MESH PTS BEYOND BOUNDARIES OF REAL SLAB TO MAKE
C        SOLUTION OF NON-RECTANGULAR SLABS OR SLABS WITH HOLES POSSIBLE.
C
          DO  400  J = 3, MYP5                                            22JE7
          DO  395  I = 3, MXP5                                            22DE6
               SUM = DX(I-1,J) + DX(I,J) + DX(I+1,J)                      21JL7
     1               + DY(I,J-1) + DY(I,J) + DY(I,J+1)                    21JL7
          IF ( SUM ) 395, 390, 395                                        22DE6
  390          S(I,J) = 1.0E+20                                           22DE6
  395     CONTINUE                                                        22DE6
  400     CONTINUE                                                        22JE7
C
C-----FORM SUB-MATRICES
C
          DO  600  J = 3, MYP5                                            04MY7
          DO  500  I = 3, MXP5                                            21JL7
               II = I - 2                                                 120C6
               AA1(II,II) = DY(I,J-1) * HXDHY3                            120C6
               AA2(II,II) = -2.0 * ( PDHXHY * ( DX(I,J) + DY(I,J-1) )    120C6
     1                        + HXDHY3 * ( DY(I,J-1) + DY(I,J) ) )        14SE6
     2                        + ODHXHY * ( - CX(I,J) - CX(I+1,J)          14SE6
     3                        - CY(I,J) - CY(I+1,J) ) - ODHY * PY(I,J)    14SE6
               AA3(II,II) = HYDHX3 * ( DX(I-1,J) + 4.0 * DX(I,J)          120C6
     1                        + DX(I+1,J) ) + HXDHY3 * ( DY(I,J-1) + 4.014SE6
     2                        * DY(I,J) + DY(I,J+1) ) + PDHXHY * 4.0      14SE6
     3                        * ( DX(I,J) + DY(I,J) ) + ODHXHY            14SE6
     4                        * ( CX(I,J) + CX(I,J+1) + CX(I+1,J)         14SE6
     5                        + CX(I+1,J+1) + CY(I,J) + CY(I+1,J)         14SE6
     6                        + CY(I,J+1) + CY(I+1,J+1) ) + ODHX          14SE6
     7                        * ( PX(I,J) + PX(I+1,J) ) + ODHY            14SE6
     8                        * ( PY(I,J) + PY(I,J+1) ) + S(I,J)          14SE6
               AA4(II,II) = -2.0 * ( HXDHY3 * ( DY(I,J) + DY(I,J+1) )    120C6
     1                        + PDHXHY * ( DX(I,J) + DY(I,J+1) ) )        14SE6
```

```
    2                        + ODHXHY * ( - CX(I,J+1) - CX(I+1,J+1)     14SE6
    3                        - CY(I,J+1) - CY(I+1,J+1) ) - ODHY         14SE6
    4                        * PY(I,J+1)                                14SE6
             AA5(II,II) = HXDHY3 * DY(I,J+1)                            120C6
             AA6(II,1)= Q(I,J) - ODHX * ( TX(I,J) - TX(I+1,J) ) -       120C6
    1                        ODHY * ( TY(I,J) - TY(I,J+1) )             15SE6
         IF(II-1) 410, 410, 405                                         21JL7
  405        AA2(II,II-1) = DX(I-1,J) * PDHXHY + DY(I,J-1) * PDHXHY +   21JL7
    1                        ODHXHY * ( CX(I,J) + CY(I,J) )             14SE6
             AA3(II,II-1) = -2.0 * ( HYDHX3 * ( DX(I-1,J) + DX(I,J) )   14SE6
    1                        + PDHXHY * ( DX(I-1,J) + DY(I,J) ) )       14SE6
    2                        + ODHXHY * ( - CX(I,J) - CX(I,J+1)         14SE6
    3                        - CY(I,J) - CY(I,J+1) ) - ODHX * PX(I,J)   14SE6
             AA4(II,II-1) = PDHXHY * ( DX(I-1,J) + DY(I,J+1) )          120C6
    1                        + ODHXHY * ( CX(I,J+1) + CY(I,J+1) )       14SE6
  410    IF(II-2) 430, 430, 420                                         04MY7
  420        AA3(II,II-2) = DX(I-1,J) * HYDHX3                          04MY7
  430    IF(II-MXP3) 440, 450, 450                                      04MY7
  440        AA2(II,II+1) = PDHXHY * ( DX(I+1,J) + DY(I,J-1) )          04MY7
    1                        + ODHXHY * ( CX(I+1,J) + CY(I+1,J) )       14SE6
             AA3(II,II+1) = -2.0 * ( HYDHX3 * ( DX(I,J) + DX(I+1,J) )   120C6
    1                        + PDHXHY * ( DX(I+1,J) + DY(I,J) ) )       14SE6
    2                        + ODHXHY * ( - CX(I+1,J) - CX(I+1,J+1)     14SE6
    3                        - CY(I+1,J) - CY(I+1,J+1) ) - ODHX         14SE6
    4                        * PX(I+1,J)                                14SE6
             AA4(II,II+1) = PDHXHY * ( DX(I+1,J) + DY(I,J+1) )          120C6
    1                        + ODHXHY * ( CX(I+1,J+1) + CY(I+1,J+1) )   15SE6
  450    IF(II+1-MXP3) 460, 500, 500                                    04MY7
  460        AA3(II,II+2) = HYDHX3 * DX(I+1,J)                          04MY7
  500    CONTINUE                                                       04MY7
C
C-----BEGIN MAIN SOLUTION
C
         DO  515  I = 1, MXP3                                           21JL7
             A1(I,1) = A(I,J-1)                                         120C6
             A2(I,1) = A(I,J-2)                                         120C6
         DO  510  K = 1, MXP3                                           21JL7
             BB1(I,K) = B(I,K,J-1)                                      120C6
             BB2(I,K) = B(I,K,J-2)                                      120C6
             CC1(I,K) = C(I,K,J-1)                                      120C6
             CC2(I,K) = C(I,K,J-2)                                      120C6
  510    CONTINUE                                                       04MY7
  515    CONTINUE                                                       30JE7
      CALL MATMPY ( MX, MX, AA1, MX, MX, BB2, E, L1 )                   14FE7
         DO  525  K = 1, MXP3                                           21JL7
         DO  520  I = 1, MXP3                                           21JL7
             E(I,K) = E(I,K) + AA2(I,K)                                 200C6
  520    CONTINUE                                                       30JE7
  525    CONTINUE                                                       22JE7
      CALL MATMPY ( MX, MX, E, MX, MX, BB1, D, L1 )                     14FE7
      CALL MATMPY ( MX, MX, AA1, MX, MX, CC2, CC, L1 )                  14FE7
         DO  535  K = 1, MXP3                                           21JL7
         DO  530  I = 1, MXP3                                           21JL7
             D(I,K) = D(I,K) + CC(I,K)                                  200C6
  530    CONTINUE                                                       04MY7
  535    CONTINUE                                                       22JE7
         DO  545  K = 1, MXP3                                           21JL7
         DO  540  I = 1, MXP3                                           21JL7
             D(I,K) = - 1.0 * ( D(I,K) + AA3(I,K) )                     200C6
  540    CONTINUE                                                       04MY7
```

```
  545      CONTINUE                                                        22JE7
      CALL INVRSL ( MXP3, D, D, J, MY, AAUG, L1, L3 )                      17FE7
      CALL MATMPY ( MX, MX, D, MX, MX, AA5, CC, L1 )                       14FE7
      CALL MATMPY ( MX, MX, E, MX, MX, CC1, BB, L1 )                       14FE7
           DO  555  K = 1, MXP3                                            21JL7
           DO  550  I = 1, MXP3                                            21JL7
                BB1(I,K) = BB(I,K) + AA4(I,K)                              200C6
  550      CONTINUE                                                        04MY7
  555      CONTINUE                                                        22JE7
      CALL MATMPY ( MX, MX, D, MX, MX, BB1, BB, L1 )                       14FE7
      CALL MATMP1 ( MX, MX, E, MX, A1, AA, L1, L2 )                        14FE7
      CALL MATMP1 ( MX, MX, AA1, MX, A2, A1, L1, L2 )                      14FE7
           DO  560  I = 1, MXP3                                            21JL7
                A2(I,1) = AA(I,1) + A1(I,1)                                200C6
  560      CONTINUE                                                        04MY7
           DO  570  I = 1, MXP3                                            21JL7
                A1(I,1) = A2(I,1) - AA6(I,1)                               200C6
  570      CONTINUE                                                        04MY7
      CALL MATMP1 ( MX, MX, D, MX, A1, AA, L1, L2 )                        14FE7
           DO  585  I = 1, MXP3                                            21JL7
                A(I,J) = AA(I,1)                                           120C6
           DO  580  K = 1, MXP3                                            21JL7
                B(I,K,J) = BB(I,K)                                         120C6
                C(I,K,J) = CC(I,K)                                         120C6
  580      CONTINUE                                                        04MY7
  585      CONTINUE                                                        22JE7
  600      CONTINUE                                                        04MY7
C
C-----COMPUTE AND PRINT RESULTS
C
           DO  650  LL = 3, MYP5                                           21JL7
                J = MY + 8 - LL                                            120C6
           DO  625  I = 1, MXP3                                            21JL7
                W1(I,1) = W(I,J+1)                                         120C6
                W2(I,1) = W(I,J+2)                                         120C6
                AA(I,1) = A(I,J)                                           120C6
           DO  620  K = 1, MXP3                                            21JL7
                BB(I,K) = B(I,K,J)                                         120C6
                CC(I,K) = C(I,K,J)                                         120C6
  620      CONTINUE                                                        05MY7
  625      CONTINUE                                                        22JE7
      CALL MATMP1 ( MX, MX, BB, MX, W1, A1, L1, L2 )                       14FE7
      CALL MATMP1 ( MX, MX, CC, MX, W2, A2, L1, L2 )                       14FE7
           DO  630  I = 1, MXP3                                            21JL7
                W(I,J) = AA(I,1) + A1(I,1) + A2(I,1)                       200C6
  630      CONTINUE                                                        04MY7
  650      CONTINUE                                                        04MY7
                W(1,3)= 2.0 * W(1,4) - W(1,5)                              02N06
                W(MXP3,3) = 2.0* W( MXP3,4) -W(MXP3,5)                     02N06
                W(1,MYP5) = 2.0* W(1,MY+4) -W (1,MY+3)                     02N06
                W(MXP3,MYP5) = 2.0 * W(MXP3,MY+4) -W(MXP3,MY+3)            02N06
           DO  665  J = 3, MYP5                                            21JL7
           DO  660  I = 3, MXP5                                            21JL7
                II = MXP5 + 3 - I                                          07N06
                W(II,J) = W(II-2,J)                                        07N06
  660      CONTINUE                                                        04MY7
  665      CONTINUE                                                        22JE7
           DO  670  J = 3, MYP5                                            21JL7
                W(1,J) = 0.0                                               07N06
                W(2,J) = 0.0                                               07N06
```

```
              W(MX+6,J) = 0.0                                          07N06
              W(MX+7,J) = 0.0                                          07N06
 670      CONTINUE                                                     04MY7
      PRINT 11                                                         15SE6
      PRINT  1                                                         21JL7
      PRINT 13, ( AN1(N), N = 1, 32 )                                  19MR5 ID
      PRINT 16, NPROB, ( AN2(N), N = 1, 14 )                           28AG3 ID
      PRINT 39                                                         02N06
          DO  800  J = 3, MYP5                                         21JL7
      PRINT  6                                                         21JL7
          DO  750  I = 3, MXP5                                         21JL7
              ISTA = I - 4                                             02N06
              JSTA = J - 4                                             02N06
          DO  700  N = 1, 3                                            21JL7
              K = I + N - 2                                            02N06
              DP(N+3) = SQRT ( DX(K,J) * DY(K,J) )                     02N06
              BMX(K,J) = DX(K,J) * ( W(K-1,J) - W(K,J) - W(K,J)        02N06
     1                + W(K+1,J) ) /(HX*HX)+ DP(N+3) * PR * (W(K,J-1)02N06
     2                - W(K,J) - W(K,J) + W(K,J+1) )/ ( HY * HY )      02N06
              L = J + N - 2                                            02N06
              DP(N) = SQRT ( DX(I,L) * DY(I,L) )                       02N06
              BMY(I,L) = DY(I,L) * ( W(I,L-1) - 2.0 * W(I,L)           02N06
     1                + W(I,L+1) ) /(HY * HY) + PR * DP(N)             02N06
     2                * ( W(I-1, L) - 2.0 * W(I,L)+ W(I+1,L) )/ ( HX 02N06
     3                * HX )                                           02N06
 700      CONTINUE                                                     04MY7
              QBMX = ( BMX(I-1,J) - 2.0 * BMX(I,J) + BMX(I+1,J) )      02N06
     1                * HY / HX                                        02N06
              QBMY = ( BMY(I,J-1) - 2.0 * BMY(I,J) + BMY(I,J+1) )      02N06
     1                * HX / HY                                        02N06
              QTMX = ( W(I-1,J-1) * CX(I,J) - W(I-1,J) * ( CX(I,J)     02N06
     1                + CX(I,J+1) ) + W(I-1,J+1) * CX(I,J+1)           02N06
     2                - W(I,J-1) * ( CX(I,J) + CX(I+1,J))+ W(I,J)      02N06
     3                * ( CX(I,J) + CX(I,J+1) + CX(I+1,J) + CX(I+1,J 02N06
     4                +1) ) - W(I,J+1) * ( CX(I,J+1) + CX(I+1,J+1) ) 02N06
     5                + W(I+1,J-1) * CX(I+1,J) - W(I+1,J) * ( CX(I    02N06
     6                +1,J) + CX(I+1,J+1) ) + W(I+1,J+1) * CX(I+1,J   02N06
     7                +1) ) /(HY * HX)                                 02N06
              QTMY = ( W(I-1,J-1) * CY(I,J) - W(I-1,J) * ( CY(I,J)     02N06
     1                + CY(I,J+1) ) + W(I-1,J+1) * CY(I,J+1)           02N06
     2                - W(I,J-1) * ( CY(I,J) + CY(I+1,J) ) + W(I,J)    02N06
     3                * ( CY(I,J) + CY(I,J+1) + CY(I+1,J) + CY(I+1,J 02N06
     4                +1) ) - W(I,J+1) * (CY(I,J+1)+CY(I+1,J+1) )     02N06
     5                + W(I+1,J-1)                                     07N06
     5                * CY(I+1,J) - W(I+1,J) * (CY(I+1,J) + CY(I+1,J 02N06
     6                +1) ) + W(I+1,J+1) * CY(I+1,J+1) ) /( HX * HY )02N06
              QPX = ( 1.0 / HX ) * ( PX(I,J) * W(I-1,J) - ( PX(I,J)    02N06
     1                + PX(I+1,J) ) * W(I,J) + PX(I+1,J) * W(I+1,J) )02N06
              QPY = ( 1.0 / HY ) * ( PY(I,J) * W(I,J-1) - (PY(I,J)     02N06
     1                + PY(I,J+1) ) * W(I,J) + PY(I,J+1) * W(I,J+1) )02N06
              REACT = QBMX + QBMY + QTMX + QTMY - QPX - QPY            02N06
      PRINT 45, ISTA, JSTA, W(I,J), BMX(I,J), BMY(I,J), REACT          02N06
 750      CONTINUE                                                     04MY7
 800      CONTINUE                                                     04MY7
      PRINT  6                                                         21JL7
      PRINT  6                                                         21JL7
      PRINT 16, NPROB, ( AN2(N), N = 1, 14 )                           02N06
      PRINT 40                                                         02N06
          DO  960  J = 3, MYP5                                         21JL7
      PRINT  6                                                         21JL7
```

```
          DO  950  I = 3, MXP5                                     21JL7
                ISTA = I - 4                                       02NO6
                JSTA = J - 4                                       02NO6
                TMX = ( CX(I,J) + CX(I,J+1) + CX(I+1,J) + CX(I+1,J+1 ) )  02NO6
     1                     * 0.250 * ( W(I-1,J-1) - W(I-1,J+1) - W(I+1,J  02NO6
     2                     -1) + W(I+1,J+1) ) / ( 4.0 * HX * HY )  02NO6
                TMY = ( CY(I,J) + CY(I,J+1) + CY(I+1,J) + CY(I+1,J+1) )   02NO6
     1                     * ( -0.250 ) * ( W(I-1,J-1) - W(I-1,J+1)  02NO6
     2                     - W(I+1,J-1) + W(I+1,J+1) ) / ( 4.0 * HX * HY)  02NO6
      PRINT 45, ISTA, JSTA, TMX, TMY                               04MY7
  950     CONTINUE                                                 04MY7
  960     CONTINUE                                                 04MY7
      CALL TIC TOC (4)                                             25SE6
          GO TO 1010                                               26AG3 ID
 9990     CONTINUE                                                 19MR5 ID
 9999     CONTINUE                                                 04MY3 ID
      PRINT 11                                                     08MY3 ID
      PRINT 1                                                      21JL7
      PRINT 13, ( AN1(N), N = 1, 32 )                              19MR5 ID
      CALL TIC TOC (2)                                             26SE6
      PRINT 19                                                     26AG3 ID
      END
```

```
      SUBROUTINE MATMPY ( M1, N1, AA, M2, N2, BB, CC, L1 )                14FE7
      DIMENSION     AA(L1,L1), BB(L1,L1), CC(L1,L1)                       14FE7
               M13 = M1 + 3                                               20OC6
               N13 = N1 + 3                                               20OC6
               LX = N2 + 3                                                20OC6
          DO  35  I =1, M13                                               21JL7
          DO  30  M = 1, LX                                               21JL7
               CC(I,M) = 0.0                                              20OC6
          DO  25  K = 1, N13                                              21JL7
               CC(I,M) = AA(I,K) * BB(K,M) +  CC(I,M)                     20OC6
   25     CONTINUE                                                        30JE7
   30     CONTINUE                                                        22JE7
   35     CONTINUE                                                        22JE7
      RETURN                                                              04MY7
      END                                                                 14SE6
```

```
      SUBROUTINE MATMP1 ( M1, N1, AA, M2, A1, A2, L1, L2 )                21AP7
      DIMENSION     AA(L1,L1), A1(L1,L2), A2(L1,L2)                       21AP7
              M13 = M1 + 3                                                200C6
              N13 = N1 + 3                                                200C6
          DO  30  I = 1, M13                                              21JL7
              A2(I,1) = 0.0                                               200C6
          DO  25  K = 1, N13                                              21JL7
              A2(I,1) = AA(I,K) * A1(K,1) + A2(I,1)                       250C6
   25     CONTINUE                                                        30JE7
   30     CONTINUE                                                        22JE7
      RETURN                                                              04MY7
      END
```

```
      SUBROUTINE INVRSL ( MX3, AA, BB, JX, MY, AAUG, L1, L3 )          21AP7
      DIMENSION     AA(L1,L1), BB(L1,L1), AAUG(L1,L1,L3)               21AP7
   23 FORMAT  ( 5X, 20H NO INVERSE EXISTS      )                       15SE6
               EP = 1.0E-15                                            14SE6
               MYP5 = MY + 5                                           310C6
               MM = MX3                                                02NO6
               NN = 1                                                  200C6
          IF(JX-3) 60, 50, 60                                          04MY7
   50          MM = MX3 - 1                                            04MY7
               NN = 2                                                  280C6
          GO TO 70                                                     04MY7
   60     IF(JX-MYP5) 70, 50, 70                                       04MY7
   70     DO  105  I = NN, MM                                          21JL7
          DO  100 J = NN, MM                                           21JL7
               AAUG(I,J,1) = AA(I,J)                                   200C6
          IF ( I - J ) 80, 90, 80                                      04MY7
   80          AAUG(I,J,2) = 0.0                                       04MY7
          GO TO 100                                                    04MY7
   90          AAUG(I,J,2) = 1.0                                       04MY7
  100     CONTINUE                                                     04MY7
  105     CONTINUE                                                     22JE7
          DO  185  I = NN, MM                                          21JL7
               KK = I + 1                                              14SE6
          IF ( ABSF( AAUG(I,I,1) ) - EP ) 110, 110, 150                04MY7
  110     DO  120  II = KK, MM                                         21JL7
          IF ( ABSF( AAUG(II,I,1) ) - EP ) 120, 120, 130               04MY7
  120     CONTINUE                                                     04MY7
          GO TO 990                                                    14SE6
  130     DO  145  K = 1, 2                                            21JL7
          DO  140  L = NN, MM                                          21JL7
               SAVE = AAUG(I,L,K)                                      14SE6
               AAUG(I,L,K) = AAUG(II,L,K)                              14SE6
               AAUG(II,L,K) = SAVE                                     14SE6
  140     CONTINUE                                                     04MY7
  145     CONTINUE                                                     22JE7
  150          STORE = AAUG(I,I,1)                                     04MY7
          DO  165  K = 1, 2                                            21JY7
          DO  160  J = NN, MM                                          21JY7
               AAUG(I,J,K) = AAUG(I,J,K) / STORE                       14SE6
  160     CONTINUE                                                     04MY7
  165     CONTINUE                                                     22JE7
          DO  180  I2 = NN, MM                                         21JY7
          IF ( I2 - I ) 170, 180, 170                                  04MY7
  170          SAVE2 = AAUG(I2,I,1)                                    04MY7
          DO  178  K = 1, 2                                            21JY7
          DO  175  JJ = NN, MM                                         21JY7
               AAUG(I2,JJ,K) = AAUG(I2,JJ,K) - SAVE2 * AAUG(I,JJ,K)    14SE6
  175     CONTINUE                                                     21JY7
  178     CONTINUE                                                     21JY7
  180     CONTINUE                                                     04MY7
  185     CONTINUE                                                     22JE7
          DO  195  JJ = NN, MM                                         21JY7
          DO  190  K1 = NN, MM                                         21JY7
               BB(K1,JJ) = AAUG(K1,JJ,2)                               200C6
  190     CONTINUE                                                     04MY7
  195     CONTINUE                                                     22JE7
      RETURN                                                           04MY7
  990 PRINT 23                                                         15SE6
      END                                                              14SE6
```

APPENDIX 4

SAMPLE INPUT FOR DSLAB 5

```
CE313126   HWY SLAB PROJECT    DSLAB 5     CF STELZER
SAMPLE INPUT FOR EXAMPLE PROBLEMS FOR DSLAB5 FOR USE IN SLAB REPORT APPENDIX 4


  101       8 X 8 SLAB WITH 100,000 LB CENTER LOAD
    6    0    8    8 6.000E+00 6.000E+00 2.500E-01
    0    0    8    8 0.625E+06 0.625E+06           1.000E+99
    1    0    7    8 0.625E+06 0.625E+06
    0    1    8    7 0.625E+06 0.625E+06
    1    1    7    7 0.625E+06 0.625E+06          -1.000E+99
    4    4    4    4                     1.000E+05
    1    1    8    8                                         1.875E+06 1.875E+06


  102       48 INCH SQ PLATE SIMPLE SUPPORTS,     PY = 10E5, Q = 10E5 AT CENTER
    6    1    8    8 6.000E+00 6.000E+00 2.500E-01
    0    0    8    8 6.250E+05 6.250E+05           1.000E+99
    1    0    7    8 6.250E+05 6.250E+05
    0    1    8    7 6.250E+05 6.250E+05
    1    1    7    7 6.250E+05 6.250E+05          -1.000E+99
    4    4    4    4                     1.000E+05
    1    1    8    8                                         1.875E+06 1.875E+06
    0    1    8    8                                                   1.000E+05


  103       48 INCH SQ PLATE SIMPLE SUPPORTS,   PX=PY=10E5, Q=10E5
    6    2    8    8 6.000E+00 6.000E+00 2.500E-01
    0    0    8    8 6.250E+05 6.250E+05           1.000E+99
    1    0    7    8 6.250E+05 6.250E+05
    0    1    8    7 6.250E+05 6.250E+05
    1    1    7    7 6.250E+05 6.250E+05          -1.000E+99
    4    4    4    4                     1.000E+05
    1    1    8    8                                         1.875E+06 1.875E+06
    1    0    8    8                                         1.000E+05
    0    1    8    8                                                   1.000E+05


  104       48 INCH SQ PLATE SIMPLE SUPPORTS,     UNIFORM LOAD 1000 LB
    5    0    8    8 6.000E+00 6.000E+00 2.500E-01
    0    0    8    8 6.250E+05 6.250E+05 9.000E+03 1.000E+99
    1    1    7    7 6.250E+05 6.250E+05 9.000E+03-1.000E+99
    0    1    8    7 6.250E+05 6.250E+05 9.000E+03
    1    0    7    8 6.250E+05 6.250E+05 9.000E+03
    1    1    8    8                                         1.875E+06 1.875E+06
```

```
 105      48 INCH SQ PLATE SIMPLE SUPPORTS,      K = 3600 LBS
   7    0    8    8 6.000E+00 6.000E+00 2.500E-01
   0    0    8    8 6.250E+05 6.250E+05           1.000E+99
   1    0    7    8 6.250E+05 6.250E+05
   0    1    8    7 6.250E+05 6.250E+05
   1    1    7    7 6.250E+05 6.250E+05          -1.000E+99
   1    1    7    7                               3.600E+03
   4    4    4    4                     1.000E+05
   1    1    8    8                                         1.875E+06 1.875E+06


106A      48 INCH SQ PLATE SIMPLE SUPPORTS,      5000 LB LINE LOADS
   9    0    8    8 6.000E+00 6.000E+00 2.500E-01
   0    0    8    8 6.250E+05 6.250E+05           1.000E+99
   1    0    7    8 6.250E+05 6.250E+05          -1.000E+99
   0    1    8    7 6.250E+05 6.250E+05
   1    1    7    7 6.250E+05 6.250E+05
   1    1    8    8                                         1.875E+06 1.875E+06
   1    0    1    8                     2.500E+03
   7    0    7    8                     2.500E+03
   1    1    1    7                     2.500E+03
   7    1    7    7                     2.500E+03


 601     EXAMPLE PROBLEM  BRIDGE  APPROACH SLAB
  16    2   12   16 2.400E+01 2.400E+01 2.500E-01
   0    0   12   16 8.890E+07 8.890E+07-1.500E+02
   0    1   12   15 8.890E+07 8.890E+07-1.500E+02
   1    0   11   16 8.890E+07 8.890E+07-1.500E+02
   1    1   11   15 8.890E+07 8.890E+07-1.500E+02
   0    7   12    7          -1.777E+08
   1    7   11    7          -1.777E+08
   6    0    6   16-1.777E+08
   6    1    6   15-1.777E+08
   1    1   12   16                                         2.667E+08 2.667E+08
   0    0   12    1                               1.000E+99
   0    7   12   15                               1.440E+04
   1    7   11   15                               1.440E+04
   0    7   12   16                               1.440E+04
   1    7   11   16                               1.440E+04
   4   15    4   15                    -1.000E+04
   1   15    1   15                    -1.000E+04
   0    1   12   16                                        -6.000E+04
   1    1   11   16                                        -6.000E+04
```

```
  610   60 X 58   SLAB   SIMPLE SUPPORTS AND CONCENTRATED LOADS
   41    0   20   29 3.600E+01 2.400E+01 1.500E-01
    0    0   20    0 3.328E+08 3.328E+08-3.248E+02
    1    0   19    0 3.328E+08 3.328E+08-3.248E+02
    0   29   20   29 3.328E+08 3.328E+08-3.248E+02
    1   29   19   29 3.328E+08 3.328E+08-3.248E+02
    0    1   20    1 7.313E+07 7.313E+07-3.105E+02
    1    1   19    1 7.313E+07 7.313E+07-3.105E+02
    0   28   20   28 7.313E+07 7.313E+07-3.105E+02
    1   28   19   28 7.313E+07 7.313E+07-3.105E+02
    0    2   20    2 1.132E+08 1.132E+08-3.600E+02
    1    2   19    2 1.132E+08 1.132E+08-3.600E+02
    0   27   20   27 1.132E+08 1.132E+08-3.600E+02
    1   27   19   27 1.132E+08 1.132E+08-3.600E+02
    0    4   20    4 2.322E+08 2.322E+08-4.575E+02
    1    4   19    4 2.322E+08 2.322E+08-4.575E+02
    0   25   20   25 2.322E+08 2.322E+08-4.575E+02
    1   25   19   25 2.322E+08 2.322E+08-4.575E+02
    0    5   20   24 3.147E+08 3.147E+08-5.063E+02 1.000E+99
    1    5   19   24 3.147E+08 3.147E+08-5.063E+02
   16    8   16    8                    -2.080E+04
   16   11   16   11                    -2.080E+04
    0    3   20    3 1.656E+08 1.656E+08-4.080E+02
    1    3   19    3 1.656E+08 1.656E+08-4.080E+02
    0   26   20   26 1.656E+08 1.656E+08-4.080E+02
    1   26   19   26 1.656E+08 1.656E+08-4.080E+02
   16   13   16   13                    -2.080E+04
   16   16   16   16                    -2.080E+04
   16   18   16   18                    -2.080E+04
   16   21   16   21                    -2.080E+04
    1    6   19   23                              -1.000E+99
   10    5   10   24                               1.000E+99
    1    6   19   23                                         5.351E+08 5.351E+08
    1    1   19    1                                         4.425E+08 4.425E+08
    1    2   19    2                                         1.559E+08 1.559E+08
    1    3   19    3                                         2.342E+08 2.342E+08
    1    4   19    4                                         3.351E+08 3.351E+08
    1    5   19    5                                         4.878E+08 4.878E+08
    1   29   19   29                                         4.425E+08 4.425E+08
    1   28   19   28                                         1.559E+08 1.559E+08
    1   27   19   27                                         2.342E+08 2.342E+08
    1   26   19   26                                         3.351E+08 3.351E+08
    1   25   19   25                                         4.878E+08 4.878E+08
```

IDENTIFICATION EXAMPLE PROBLEMS   CODED BY GAA   DATE 4-1-67   PAGE 1 OF 8

```
CE313126 HWY SLAB PROJECT DSLAB 5   CF STELZER
SAMPLE INPUT FOR EXAMPLE PROBLEMS FOR DSLAB5 FOR USE IN SLAB REPORT APPENDIX 4
 101      8 X 8 SLAB WITH 100,000 LB CENTER LOAD
    6    0    8    8+6.000E+00+6.000E+00+2.500E-01
    0    0    8    8+0.625E+06+0.625E+06          +1.000E+99
    1    0    7    8+0.625E+06+0.625E+06
    0    1    8    7+0.625E+06+0.625E+06
    1    1    7    7+0.625E+06+0.625E+06          -1.000E+99
    4    4    4    4                    +1.000E+05
    1    1    8    8                                        +1.875E+06+1.875E+06
 102     48 INCH SQ PLATE SIMPLE SUPPORTS,   PY = 10E5, Q = 10E5 AT CENTER
    6    1    8    8+6.000E+00+6.000E+00+2.500E-01
    0    0    8    8+6.250E+05+6.250E+05          +1.000E+99
    1    0    7    8+6.250E+05+6.250E+05
    0    1    8    7+6.250E+05+6.250E+05
    1    1    7    7+6.250E+05+6.250E+05          -1.000E+99
```

IDENTIFICATION EXAMPLE PROBLEMS   CODED BY GAA   DATE 4-1-67   PAGE 2 OF 8

```
    4    4    4    4                    +1.000E+05
    1    1    8    8                                        +1.875E+06+1.875E+06
    0    1    8    8                                                  +1.000E+05
 103     48 INCH SQ PLATE SIMPLE SUPPORTS,   PX = PY = 10E5, Q = 10E5
    6    2    8    8+6.000E+00+6.000E+00+2.500E-01
    0    0    8    8+6.250E+05+6.250E+05          +1.000E+99
    1    0    7    8+6.250E+05+6.250E+05
    0    1    8    7+6.250E+05+6.250E+05
    1    1    7    7+6.250E+05+6.250E+05          -1.000E+99
    4    4    4    4                    +1.000E+05
    1    1    8    8                                        +1.875E+06+1.875E+06
    1    0    8    8                                        +1.000E+05
    0    1    8    8                                                  +1.000E+05
 104     48 INCH SQ PLATE SIMPLE SUPPORTS,  UNIFORM LOAD 1000 LB
    5    0    8    8 6.000E+00 6.000E+00 2.500E-01
    0    0    8    8 6.250E+05 6.250E+05 9.000E+03 1.000E+99
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IDENTIFICATION *EXAMPLE PROBLEMS* CODED BY *GAA* DATE *4-1-67* PAGE *3* OF *8*

1	1	7	7	6.250E+05	6.250E+05	9.000E+03	-1.000E+99		
0	1	8	7	6.250E+05	6.250E+05	9.000E+03			
1	0	7	8	6.250E+05	6.250E+05	9.000E+03			
1	1	8	8					1.875E+06	1.875E+06
105		48 INCH SQ PLATE SIMPLE SUPPORTS, K = 3600 LBS							
7	0	8	8	6.000E+00	6.000E+00	2.500E-01			
0	0	8	8	6.250E+05	6.250E+05		1.000E+99		
1	0	7	8	6.250E+05	6.250E+05				
0	1	8	7	6.250E+05	6.250E+05				
1	1	7	7	6.250E+05	6.250E+05		-1.000E+99		
1	1	7	7				3.600E+03		
4	4	4	4			1.000E+05			
1	1	8	8					1.875E+06	1.875E+06
106A		48 INCH SQ PLATE SIMPLE SUPPORTS, 5000 LB LINE LOADS							
9	0	8	8	6.000E+00	6.000E+00	2.500E-01			
0	0	8	8	6.250E+05	6.250E+05		1.000E+99		

IDENTIFICATION *EXAMPLE PROBLEMS* CODED BY *GAA* DATE *4-1-67* PAGE *4* OF *8*

1	0	7	8	6.250E+05	6.250E+05		-1.000E+99		
0	1	8	7	6.250E+05	6.250E+05				
1	1	7	7	6.250E+05	6.250E+05				
1	1	8	8					1.875E+06	1.875E+06
1	0	1	8			2.500E+03			
7	0	7	8			2.500E+03			
1	1	1	7			2.500E+03			
7	1	7	7			2.500E+03			
601		EXAMPLE PROBLEM BRIDGE APPROACH SLAB							
16	2	12	16	2.400E+01	2.400E+01	2.500E-01			
0	0	12	16	8.890E+07	8.890E+07	-1.500E+02			
0	1	12	15	8.890E+07	8.890E+07	-1.500E+02			
1	0	11	16	8.890E+07	8.890E+07	-1.500E+02			
1	1	11	15	8.890E+07	8.890E+07	-1.500E+02			
0	7	12	7		-1.777E+08				
1	7	11	7		-1.777E+08				

IDENTIFICATION EXAMPLE PROBLEMS CODED BY GAA DATE 4-1-67 PAGE 5 OF 8

1-5	6-10	11-15	16-20	21-30	31-40	41-50	51-60	61-70	71-80
6	0	6	16	-1.777E+08					
6	1	6	15	-1.777E+08					
1	1	12	16					2.667E+08	2.667E+08
0	0	12	1				1.000E+99		
0	7	12	15				1.440E+04		
1	7	11	15				1.440E+04		
0	7	12	16				1.440E+04		
1	7	11	16				1.440E+04		
4	15	4	15			-1.000E+04			
1	15	1	15			-1.000E+04			
0	1	12	16					-6.000E+04	
1	1	11	16					-6.000E+04	
610		60 X 58 SLAB SIMPLE SUPPORTS AND CONCENTRATED LOADS							
41	0	20	29	3.600E+01	2.400E+01	1.500E-01			
0	0	20	0	3.328E+08	3.328E+08	-3.248E+02			
1	0	19	0	3.328E+08	3.328E+08	-3.248E+02			

IDENTIFICATION EXAMPLE PROBLEMS CODED BY GAA DATE 4-1-67 PAGE 6 OF 8

1-5	6-10	11-15	16-20	21-30	31-40	41-50	51-60	61-70	71-80
0	29	20	29	3.328E+08	3.328E+08	-3.248E+02			
1	29	19	29	3.328E+08	3.328E+08	-3.248E+02			
0	1	20	1	7.313E+07	7.313E+07	-3.105E+02			
1	1	19	1	7.313E+07	7.313E+07	-3.105E+02			
0	28	20	28	7.313E+07	7.313E+07	-3.105E+02			
1	28	19	28	7.313E+07	7.313E+07	-3.105E+02			
0	2	20	2	1.132E+08	1.132E+08	-3.600E+02			
1	2	19	2	1.132E+08	1.132E+08	-3.600E+02			
0	27	20	27	1.132E+08	1.132E+08	-3.600E+02			
1	27	19	27	1.132E+08	1.132E+08	-3.600E+02			
0	4	20	4	2.322E+08	2.322E+08	-4.575E+02			
1	4	19	4	2.322E+08	2.322E+08	-4.575E+02			
0	25	20	25	2.322E+08	2.322E+08	-4.575E+02			
1	25	19	25	2.322E+08	2.322E+08	-4.575E+02			
0	5	20	24	3.147E+08	3.147E+08	-5.063E+02	1.000E+99		
1	5	19	24	3.147E+08	3.147E+08	-5.063E+02			

IDENTIFICATION EXAMPLE PROBLEMS CODED BY GAA DATE 4-1-67 PAGE 7 OF 8

1–5	6–10	11–15	16–20	21–30	31–40	41–50	51–60	61–70	71–80
16	8	16	8			-2.080E+04			
16	11	16	11			-2.080E+04			
0	3	20	3	1.656E+08	1.656E+08	-4.080E+02			
1	3	19	3	1.656E+08	1.656E+08	-4.080E+02			
0	26	20	26	1.656E+08	1.656E+08	-4.080E+02			
1	26	19	26	1.656E+08	1.656E+08	-4.080E+02			
16	13	16	13			-2.080E+04			
16	16	16	16			-2.080E+04			
16	18	16	18			-2.080E+04			
16	21	16	21			-2.080E+04			
1	6	19	23				-1.000E+99		
10	5	10	24				1.000E+99		
1	6	19	23					5.351E+08	5.351E+08
1	1	19	1					4.425E+08	4.425E+08
1	2	19	2					1.559E+08	1.559E+08
1	3	19	3					2.342E+08	2.342E+08

IDENTIFICATION EXAMPLE PROBLEMS CODED BY GAA DATE 4-1-67 PAGE 8 OF 8

1–5	6–10	11–15	16–20	21–30	31–40	41–50	51–60	61–70	71–80
1	4	19	4					3.351E+08	3.351E+08
1	5	19	5					4.878E+08	4.878E+08
1	29	19	29					4.425E+08	4.425E+08
1	28	19	28					1.559E+08	1.559E+08
1	27	19	27					2.342E+08	2.342E+08
1	26	19	26					3.351E+08	3.351E+08
1	25	19	25					4.878E+08	4.878E+08

APPENDIX 5

SAMPLE COMPUTER OUTPUT

PROGRAM DSLAB 5 - DECK 1 - STELZER REVISION DATE 24 JULY 1967
CE313126 HWY SLAB PROJECT DSLAB 5 CF STELZER
RUN EXAMPLE PROBLEMS FOR USE IN SLAB REPORT APPENDIX 5

PROB (CONTD)
601 EXAMPLE PROBLEM BRIDGE APPROACH SLAB

TABLE 4. RESULTS

I,J		DEFL	BMX	BMY	REACT
-1	-1	-1.207E-03	0.	0.	0.
0	-1	4.452E-96	0.	0.	-7.701-105
1	-1	1.160E-95	0.	0.	-3.575-104
2	-1	1.043E-95	0.	0.	-4.517-104
3	-1	1.034E-95	0.	0.	-2.977-104
4	-1	1.039E-95	0.	0.	-4.005-104
5	-1	1.135E-95	0.	0.	-3.902-104
6	-1	9.412E-96	0.	0.	5.576E-93
7	-1	1.139E-95	0.	0.	-3.902-104
8	-1	1.048E-95	0.	0.	-3.800-104
9	-1	1.047E-95	0.	0.	-4.005-104
10	-1	1.060E-95	0.	0.	-3.800-104
11	-1	1.206E-95	0.	0.	-4.665-104
12	-1	4.560E-96	0.	0.	-1.152-104
13	-1	-1.229E-03	0.	0.	0.
-1	0	-1.259E-97	0.	0.	0.
0	0	1.235E-96	0.	-7.701-105	-1.385E+03
1	0	2.596E-96	-4.100E-91	-3.575-104	-2.896E+03
2	0	2.541E-96	9.898E-93	-4.517-104	-2.841E+03
3	0	2.519E-96	9.542E-93	-2.977-104	-2.819E+03
4	0	2.530E-96	9.111E-93	-4.005-104	-2.830E+03
5	0	2.573E-96	1.969E-94	-3.902-104	-2.873E+03
6	0	2.617E-96	2.101E-95	5.576E-93	-2.917E+03
7	0	2.587E-96	1.811E-94	-3.902-104	-2.887E+03
8	0	2.557E-96	9.121E-93	-3.800-104	-2.857E+03
9	0	2.558E-96	9.621E-93	-4.005-104	-2.858E+03
10	0	2.593E-96	9.957E-93	-3.800-104	-2.893E+03
11	0	2.663E-96	-4.224E-91	-4.665-104	-2.963E+03
12	0	1.273E-96	-1.412-105	-1.152-104	-1.423E+03
13	0	-1.176E-97	0.	0.	-1.412-105
-1	1	1.207E-03	0.	0.	-5.954E-12
0	1	-1.981E-96	3.018E+00	-1.385E+03	1.681E+03
1	1	-6.258E-96	-7.241E+02	-2.896E+03	5.658E+03
2	1	-5.353E-96	-7.102E+02	-2.841E+03	4.753E+03
3	1	-5.313E-96	-7.048E+02	-2.819E+03	4.713E+03
4	1	-5.338E-96	-7.076E+02	-2.830E+03	4.738E+03
5	1	-6.206E-96	-7.183E+02	-2.873E+03	5.589E+03
6	1	-4.160E-96	-1.729E+01	-2.917E+03	3.576E+03
7	1	-6.222E-96	-7.216E+02	-2.887E+03	5.605E+03
8	1	-5.371E-96	-7.142E+02	-2.857E+03	4.771E+03
9	1	-5.362E-96	-7.146E+02	-2.858E+03	4.762E+03

10	1	-5.421E-96	-7.233E+02	-2.893E+03	4.821E+03
11	1	-6.366E-96	-7.407E+02	-2.963E+03	5.766E+03
12	1	-2.035E-96	-1.819E-12	-1.423E+03	1.735E+03
13	1	1.229E-03	0.	0.	-1.819E-12
-1	2	-4.494E-03	0.	0.	-6.593E-11
0	2	-4.789E-03	7.397E-01	-4.527E+02	-3.000E+02
1	2	-4.692E-03	-2.216E+02	-8.692E+02	-6.000E+02
2	2	-4.601E-03	-2.491E+02	-8.680E+02	-6.000E+02
3	2	-4.566E-03	-2.479E+02	-8.679E+02	-6.000E+02
4	2	-4.585E-03	-2.465E+02	-8.678E+02	-6.000E+02
5	2	-4.654E-03	-2.178E+02	-8.686E+02	-6.056E+02
6	2	-4.725E-03	-5.675E+00	-9.638E+02	-6.332E+02
7	2	-4.676E-03	-2.203E+02	-8.787E+02	-6.056E+02
8	2	-4.627E-03	-2.515E+02	-8.876E+02	-6.000E+02
9	2	-4.630E-03	-2.554E+02	-8.969E+02	-6.000E+02
10	2	-4.687E-03	-2.586E+02	-9.054E+02	-6.000E+02
11	2	-4.799E-03	-2.309E+02	-9.136E+02	-6.000E+02
12	2	-4.916E-03	2.592E-11	-4.779E+02	-3.000E+02
13	2	-4.620E-03	0.	0.	2.592E-11
-1	3	-1.172E-02	0.	0.	-1.683E-10
0	3	-1.114E-02	-1.449E+00	2.543E+02	-3.000E+02
1	3	-1.079E-02	3.171E+01	4.975E+02	-6.000E+02
2	3	-1.059E-02	5.000E+01	4.894E+02	-6.000E+02
3	3	-1.053E-02	5.895E+01	4.835E+02	-6.000E+02
4	3	-1.056E-02	5.330E+01	4.803E+02	-6.000E+02
5	3	-1.072E-02	3.641E+01	4.780E+02	-5.971E+02
6	3	-1.101E-02	3.197E+00	5.099E+02	-6.003E+02
7	3	-1.077E-02	3.496E+01	4.707E+02	-5.971E+02
8	3	-1.068E-02	5.021E+01	4.660E+02	-6.000E+02
9	3	-1.070E-02	5.408E+01	4.631E+02	-6.000E+02
10	3	-1.083E-02	4.399E+01	4.638E+02	-6.000E+02
11	3	-1.108E-02	2.715E+01	4.677E+02	-6.000E+02
12	3	-1.148E-02	1.028E-10	2.375E+02	-3.000E+02
13	3	-1.209E-02	0.	0.	1.028E-10
-1	4	-1.777E-02	0.	0.	1.018E-10
0	4	-1.662E-02	-2.890E+00	6.581E+02	-3.000E+02
1	4	-1.604E-02	1.432E+02	1.268E+03	-6.000E+02
2	4	-1.576E-02	2.043E+02	1.250E+03	-6.000E+02
3	4	-1.567E-02	2.234E+02	1.240E+03	-6.000E+02
4	4	-1.573E-02	2.082E+02	1.234E+03	-6.000E+02
5	4	-1.597E-02	1.488E+02	1.236E+03	-5.922E+02
6	4	-1.648E-02	8.302E+00	1.350E+03	-5.809E+02
7	4	-1.607E-02	1.487E+02	1.231E+03	-5.922E+02
8	4	-1.595E-02	2.076E+02	1.224E+03	-6.000E+02
9	4	-1.599E-02	2.215E+02	1.226E+03	-6.000E+02
10	4	-1.618E-02	2.013E+02	1.233E+03	-6.000E+02
11	4	-1.656E-02	1.414E+02	1.249E+03	-6.000E+02
12	4	-1.723E-02	-4.275E-11	6.472E+02	-3.000E+02
13	4	-1.846E-02	0.	0.	-4.275E-11
-1	5	-2.113E-02	0.	0.	3.662E-10
0	5	-1.982E-02	-3.279E+00	7.488E+02	-3.000E+02
1	5	-1.916E-02	1.569E+02	1.445E+03	-6.000E+02
2	5	-1.886E-02	2.309E+02	1.422E+03	-6.000E+02
3	5	-1.878E-02	2.545E+02	1.410E+03	-6.000E+02
4	5	-1.886E-02	2.353E+02	1.405E+03	-6.000E+02
5	5	-1.915E-02	1.623E+02	1.408E+03	-5.911E+02

6	5	-1.976E-02	9.457E+00	1.537E+03	-5.805E+02
7	5	-1.931E-02	1.640E+02	1.405E+03	-5.911E+02
8	5	-1.919E-02	2.378E+02	1.398E+03	-6.000E+02
9	5	-1.926E-02	2.562E+02	1.401E+03	-6.000E+02
10	5	-1.950E-02	2.302E+02	1.412E+03	-6.000E+02
11	5	-1.994E-02	1.552E+02	1.434E+03	-6.000E+02
12	5	-2.074E-02	1.728E-11	7.423E+02	-3.000E+02
13	5	-2.218E-02	0.	0.	1.728E-11
-1	6	-2.145E-02	0.	0.	-1.028E-10
0	6	-2.042E-02	-2.576E+00	5.264E+02	-3.011E+02
1	6	-1.986E-02	7.409E+01	1.025E+03	-6.009E+02
2	6	-1.960E-02	1.348E+02	1.007E+03	-6.006E+02
3	6	-1.955E-02	1.566E+02	9.974E+02	-6.005E+02
4	6	-1.966E-02	1.396E+02	9.932E+02	-6.005E+02
5	6	-1.996E-02	7.707E+01	9.948E+02	-5.948E+02
6	6	-2.056E-02	6.595E+00	1.060E+03	-4.833E+02
7	6	-2.019E-02	8.120E+01	9.929E+02	-5.948E+02
8	6	-2.012E-02	1.464E+02	9.896E+02	-6.004E+02
9	6	-2.022E-02	1.630E+02	9.927E+02	-6.004E+02
10	6	-2.047E-02	1.363E+02	1.002E+03	-6.005E+02
11	6	-2.092E-02	6.799E+01	1.022E+03	-6.010E+02
12	6	-2.169E-02	-2.310E-10	5.231E+02	-3.015E+02
13	6	-2.291E-02	0.	0.	-2.310E-10
-1	7	-2.024E-02	0.	0.	-1.879E+02
0	7	-1.921E-02	-1.905E+02	-7.235E-01	2.824E+02
1	7	-1.881E-02	-1.475E+02	-1.207E-01	6.440E+02
2	7	-1.867E-02	-8.760E+01	2.396E-01	4.664E+02
3	7	-1.868E-02	-6.892E+01	3.769E-01	4.693E+02
4	7	-1.881E-02	-8.080E+01	3.487E-01	4.738E+02
5	7	-1.909E-02	-1.564E+02	-3.403E-02	9.455E+02
6	7	-1.964E-02	5.541E-01	1.175E+00	-4.566E+02
7	7	-1.940E-02	-1.481E+02	7.222E-02	9.649E+02
8	7	-1.940E-02	-6.600E+01	5.455E-01	5.114E+02
9	7	-1.954E-02	-5.263E+01	6.272E-01	5.229E+02
10	7	-1.977E-02	-7.960E+01	4.767E-01	5.336E+02
11	7	-2.015E-02	-1.670E+02	-1.847E-02	7.773E+02
12	7	-2.082E-02	-2.462E+02	-9.276E-01	3.451E+02
13	7	-2.231E-02	0.	0.	-2.462E+02
-1	8	-1.528E-02	0.	0.	1.949E-10
0	8	-1.550E-02	5.523E-01	-3.128E+02	1.453E+02
1	8	-1.545E-02	-1.420E+02	-5.771E+02	2.890E+02
2	8	-1.539E-02	-1.650E+02	-5.585E+02	2.862E+02
3	8	-1.538E-02	-1.603E+02	-5.407E+02	2.856E+02
4	8	-1.542E-02	-1.490E+02	-5.203E+02	2.874E+02
5	8	-1.548E-02	-1.278E+02	-5.014E+02	2.875E+02
6	8	-1.555E-02	-3.339E+00	-5.599E+02	3.852E+02
7	8	-1.563E-02	-1.169E+02	-4.653E+02	2.990E+02
8	8	-1.581E-02	-1.278E+02	-4.523E+02	3.102E+02
9	8	-1.597E-02	-1.329E+02	-4.473E+02	3.193E+02
10	8	-1.616E-02	-1.420E+02	-4.452E+02	3.303E+02
11	8	-1.641E-02	-1.362E+02	-4.481E+02	3.439E+02
12	8	-1.669E-02	1.883E-10	-2.458E+02	1.793E+02
13	8	-1.677E-02	0.	0.	1.883E-10
-1	9	-1.231E-02	0.	0.	-2.227E-10
0	9	-1.287E-02	1.408E+00	-4.722E+02	7.078E+01
1	9	-1.302E-02	-1.312E+02	-8.887E+02	1.502E+02

2	9	-1.302E-02	-1.799E+02	-8.463E+02	1.498E+02
3	9	-1.296E-02	-1.774E+02	-8.041E+02	1.463E+02
4	9	-1.285E-02	-1.465E+02	-7.570E+02	1.404E+02
5	9	-1.268E-02	-9.481E+01	-7.085E+02	1.261E+02
6	9	-1.236E-02	-4.533E+00	-7.275E+02	1.002E+02
7	9	-1.272E-02	-7.968E+01	-6.175E+02	1.282E+02
8	9	-1.294E-02	-1.134E+02	-5.856E+02	1.455E+02
9	9	-1.311E-02	-1.269E+02	-5.687E+02	1.553E+02
10	9	-1.326E-02	-1.257E+02	-5.613E+02	1.635E+02
11	9	-1.337E-02	-9.630E+01	-5.663E+02	1.703E+02
12	9	-1.341E-02	-2.487E-10	-2.998E+02	8.631E+01
13	9	-1.319E-02	0.	0.	-2.487E-10
-1	10	-1.118E-02	0.	0.	3.609E-11
0	10	-1.188E-02	1.741E+00	-5.699E+02	4.215E+01
1	10	-1.208E-02	-1.249E+02	-1.079E+03	9.571E+01
2	10	-1.203E-02	-1.779E+02	-1.015E+03	9.269E+01
3	10	-1.184E-02	-1.664E+02	-9.461E+02	8.212E+01
4	10	-1.154E-02	-1.165E+02	-8.684E+02	6.458E+01
5	10	-1.106E-02	-5.848E+01	-7.798E+02	3.271E+01
6	10	-1.035E-02	-4.820E+00	-7.497E+02	-2.635E+00
7	10	-1.078E-02	-4.607E+01	-6.166E+02	1.689E+01
8	10	-1.104E-02	-7.977E+01	-5.619E+02	3.575E+01
9	10	-1.119E-02	-9.369E+01	-5.285E+02	4.427E+01
10	10	-1.127E-02	-8.739E+01	-5.113E+02	4.896E+01
11	10	-1.128E-02	-5.764E+01	-5.094E+02	4.962E+01
12	10	-1.117E-02	8.595E-11	-2.631E+02	7.167E+01
13	10	-1.083E-02	0.	0.	8.595E-11
-1	11	-1.221E-02	0.	0.	-1.851E-10
0	11	-1.286E-02	1.624E+00	-6.458E+02	7.028E+01
1	11	-1.294E-02	-1.223E+02	-1.226E+03	1.455E+02
2	11	-1.271E-02	-1.760E+02	-1.138E+03	1.321E+02
3	11	-1.229E-02	-1.453E+02	-1.044E+03	1.080E+02
4	11	-1.167E-02	-6.715E+01	-9.383E+02	7.228E+01
5	11	-1.076E-02	-1.788E+01	-8.027E+02	1.581E+01
6	11	-9.538E-03	-4.771E+00	-7.177E+02	-3.860E+01
7	11	-9.899E-03	-2.876E+01	-5.582E+02	-2.393E+01
8	11	-1.007E-02	-5.805E+01	-4.807E+02	-2.005E+01
9	11	-1.013E-02	-6.727E+01	-4.307E+02	-1.646E+01
10	11	-1.012E-02	-5.554E+01	-4.019E+02	-1.690E+01
11	11	-1.004E-02	-2.889E+01	-3.904E+02	-2.181E+01
12	11	-9.834E-03	-1.030E-10	-1.965E+02	-1.678E+01
13	11	-9.460E-03	0.	0.	-1.030E-10
-1	12	-1.567E-02	0.	0.	-7.078E-11
0	12	-1.607E-02	9.975E-01	-6.826E+02	1.627E+02
1	12	-1.587E-02	-9.882E+01	-1.305E+03	3.143E+02
2	12	-1.529E-02	-1.711E+02	-1.190E+03	2.804E+02
3	12	-1.448E-02	-1.097E+02	-1.080E+03	2.340E+02
4	12	-1.340E-02	2.959E+01	-9.686E+02	1.717E+02
5	12	-1.185E-02	3.987E+01	-7.875E+02	7.853E+01
6	12	-9.884E-03	-4.555E+00	-6.562E+02	-9.997E+00
7	12	-9.965E-03	-3.775E+01	-4.790E+02	-2.974E+01
8	12	-9.905E-03	-6.604E+01	-3.880E+02	-2.946E+01
9	12	-9.791E-03	-6.622E+01	-3.281E+02	-3.601E+01
10	12	-9.650E-03	-4.430E+01	-2.914E+02	-4.414E+01
11	12	-9.460E-03	-1.496E+01	-2.722E+02	-5.510E+01
12	12	-9.178E-03	-4.093E-12	-1.329E+02	-3.568E+01
13	12	-8.781E-03	0.	0.	-4.093E-12

-1	13	-2.175E-02	0.	0.	2.547E-10
0	13	-2.164E-02	-2.731E-01	-5.950E+02	3.231E+02
1	13	-2.101E-02	2.393E+01	-1.174E+03	6.104E+02
2	13	-1.984E-02	-1.525E+02	-1.037E+03	5.429E+02
3	13	-1.849E-02	-4.623E+01	-9.338E+02	4.649E+02
4	13	-1.681E-02	2.619E+02	-8.631E+02	3.682E+02
5	13	-1.431E-02	1.369E+02	-6.581E+02	2.210E+02
6	13	-1.128E-02	-3.953E+00	-5.248E+02	7.558E+01
7	13	-1.084E-02	-7.998E+01	-3.700E+02	2.158E+01
8	13	-1.038E-02	-1.113E+02	-2.922E+02	-1.897E+00
9	13	-9.991E-03	-9.690E+01	-2.381E+02	-2.455E+01
10	13	-9.662E-03	-5.768E+01	-2.014E+02	-4.348E+01
11	13	-9.346E-03	-1.669E+01	-1.796E+02	-6.168E+01
12	13	-8.981E-03	4.320E-12	-8.522E+01	-4.134E+01
13	13	-8.543E-03	0.	0.	4.320E-12
-1	14	-3.014E-02	0.	0.	7.918E-11
0	14	-2.926E-02	-2.197E+00	-2.275E+02	5.427E+02
1	14	-2.819E-02	4.516E+02	-5.091E+02	1.024E+03
2	14	-2.613E-02	-1.322E+02	-4.553E+02	9.048E+02
3	14	-2.409E-02	3.308E+01	-3.938E+02	7.875E+02
4	14	-2.183E-02	8.391E+02	-3.485E+02	6.572E+02
5	14	-1.796E-02	2.762E+02	-2.514E+02	4.332E+02
6	14	-1.351E-02	-2.531E+00	-2.477E+02	1.935E+02
7	14	-1.233E-02	-1.564E+02	-2.085E+02	1.086E+02
8	14	-1.132E-02	-1.896E+02	-1.876E+02	5.198E+01
9	14	-1.056E-02	-1.540E+02	-1.593E+02	8.202E+00
10	14	-9.996E-03	-9.156E+01	-1.321E+02	-2.421E+01
11	14	-9.535E-03	-3.154E+01	-1.132E+02	-5.080E+01
12	14	-9.079E-03	8.572E-11	-5.330E+01	-3.853E+01
13	14	-8.577E-03	0.	0.	8.572E-11
-1	15	-3.933E-02	0.	0.	-2.444E-10
0	15	-3.767E-02	-4.156E+00	4.924E+02	7.849E+02
1	15	-3.645E-02	1.614E+03	1.624E+03	-8.501E+03
2	15	-3.314E-02	-1.806E+02	5.694E+02	1.309E+03
3	15	-3.039E-02	4.289E+01	5.743E+02	1.150E+03
4	15	-2.781E-02	2.157E+03	1.554E+03	-8.998E+03
5	15	-2.217E-02	3.690E+02	5.227E+02	6.783E+02
6	15	-1.613E-02	-1.769E-01	1.910E+02	-4.473E+01
7	15	-1.410E-02	-2.492E+02	-2.223E+01	2.134E+02
8	15	-1.250E-02	-2.776E+02	-8.283E+01	1.198E+02
9	15	-1.134E-02	-2.202E+02	-8.559E+01	5.297E+01
10	15	-1.052E-02	-1.354E+02	-7.190E+01	5.927E+00
11	15	-9.906E-03	-5.483E+01	-5.956E+01	-2.944E+01
12	15	-9.361E-03	-4.283E-11	-2.932E+01	-3.041E+01
13	15	-8.790E-03	0.	0.	-4.283E-11
-1	16	-4.619E-02	0.	0.	-6.173E-11
0	16	-4.438E-02	-4.529E+00	3.941E-10	4.890E+02
1	16	-4.259E-02	4.996E+02	8.395E-10	9.267E+02
2	16	-3.909E-02	-3.651E+01	4.969E-10	8.257E+02
3	16	-3.571E-02	8.432E+01	4.627E-10	7.284E+02
4	16	-3.204E-02	7.887E+02	3.929E-10	6.226E+02
5	16	-2.564E-02	2.419E+02	2.228E-10	4.405E+02
6	16	-1.841E-02	1.316E+00	3.491E+02	1.337E+02
7	16	-1.581E-02	-1.419E+02	2.269E-10	1.573E+02
8	16	-1.370E-02	-1.673E+02	1.073E-10	9.448E+01
9	16	-1.217E-02	-1.369E+02	3.001E-11	5.039E+01

10	16	-1.111E-02	-8.824E+01	1.370E-10	1.993E+01
11	16	-1.036E-02	-4.080E+01	3.001E-11	-1.757E+00
12	16	-9.744E-03	1.714E-11	-4.284E-12	-9.690E+00
13	16	-9.132E-03	0.	0.	1.714E-11
-1	17	-5.304E-02	0.	0.	0.
0	17	-5.107E-02	0.	0.	3.941E-10
1	17	-4.917E-02	0.	0.	8.395E-10
2	17	-4.501E-02	0.	0.	4.969E-10
3	17	-4.110E-02	0.	0.	4.627E-10
4	17	-3.695E-02	0.	0.	3.929E-10
5	17	-2.931E-02	0.	0.	2.228E-10
6	17	-1.953E-02	0.	0.	3.491E+02
7	17	-1.739E-02	0.	0.	2.269E-10
8	17	-1.475E-02	0.	0.	1.073E-10
9	17	-1.288E-02	0.	0.	3.001E-11
10	17	-1.162E-02	0.	0.	1.370E-10
11	17	-1.077E-02	0.	0.	3.001E-11
12	17	-1.013E-02	0.	0.	-4.284E-12
13	17	-9.473E-03	0.	0.	0.

PROB (CONTD)
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TABLE 4. RESULTS(CONTD)

I	J	TMX	TMY
-1	-1	0.	0.
0	-1	0.	0.
1	-1	0.	0.
2	-1	0.	0.
3	-1	0.	0.
4	-1	0.	0.
5	-1	0.	0.
6	-1	0.	0.
7	-1	0.	0.
8	-1	0.	0.
9	-1	0.	0.
10	-1	0.	0.
11	-1	0.	0.
12	-1	0.	0.
13	-1	0.	0.
-1	0	0.	0.
0	0	-6.987E+01	6.987E+01
1	0	-5.410E-91	5.410E-91
2	0	1.393E-91	-1.393E-91
3	0	2.909E-93	-2.909E-93
4	0	-1.101E-91	1.101E-91
5	0	1.248E-91	-1.248E-91
6	0	-3.413E-93	3.413E-93
7	0	-1.316E-91	1.316E-91

8	0	1.033E-91	-1.033E-91
9	0	-1.005E-92	1.005E-92
10	0	-1.499E-91	1.499E-91
11	0	5.444E-91	-5.444E-91
12	0	7.113E+01	-7.113E+01
13	0	0.	0.
-1	1	0.	0.
0	1	-1.146E+01	1.146E+01
1	1	2.178E+01	-2.178E+01
2	1	1.450E+01	-1.450E+01
3	1	1.903E+00	-1.903E+00
4	1	-1.018E+01	1.018E+01
5	1	-1.621E+01	1.621E+01
6	1	-2.464E+00	2.464E+00
7	1	1.129E+01	-1.129E+01
8	1	5.267E+00	-5.267E+00
9	1	-6.876E+00	6.876E+00
10	1	-1.956E+01	1.956E+01
11	1	-2.651E+01	2.651E+01
12	1	1.039E+01	-1.039E+01
13	1	0.	0.
-1	2	0.	0.
0	2	1.239E+02	-1.239E+02
1	2	6.358E+01	-6.358E+01
2	2	3.058E+01	-3.058E+01
3	2	3.721E+00	-3.721E+00
4	2	-2.202E+01	2.202E+01
5	2	-5.199E+01	5.199E+01
6	2	-6.815E+00	6.815E+00
7	2	3.844E+01	-3.844E+01
8	2	8.641E+00	-8.641E+00
9	2	-1.696E+01	1.696E+01
10	2	-4.369E+01	4.369E+01
11	2	-7.604E+01	7.604E+01
12	2	-1.300E+02	1.300E+02
13	2	0.	0.
-1	3	0.	0.
0	3	1.118E+02	-1.118E+02
1	3	7.712E+01	-7.712E+01
2	3	2.799E+01	-2.799E+01
3	3	1.649E+00	-1.649E+00
4	3	-2.364E+01	2.364E+01
5	3	-6.972E+01	6.972E+01
6	3	-1.010E+01	1.010E+01
7	3	4.975E+01	-4.975E+01
8	3	4.272E+00	-4.272E+00
9	3	-2.029E+01	2.029E+01
10	3	-4.599E+01	4.599E+01
11	3	-9.463E+01	9.463E+01
12	3	-1.204E+02	1.204E+02
13	3	0.	0.
-1	4	0.	0.
0	4	5.966E+01	-5.966E+01
1	4	4.681E+01	-4.681E+01
2	4	1.406E+01	-1.406E+01
3	4	-3.594E+00	3.594E+00

4	4	-2.064E+01	2.064E+01
5	4	-5.179E+01	5.179E+01
6	4	-1.253E+01	1.253E+01
7	4	2.717E+01	-2.717E+01
8	4	-2.812E+00	2.812E+00
9	4	-1.840E+01	1.840E+01
10	4	-3.503E+01	3.503E+01
11	4	-6.788E+01	6.788E+01
12	4	-7.054E+01	7.054E+01
13	4	0.	0.
-1	5	0.	0.
0	5	-7.865E+00	7.865E+00
1	5	-4.085E+00	4.085E+00
2	5	-7.484E+00	7.484E+00
3	5	-1.048E+01	1.048E+01
4	5	-1.341E+01	1.341E+01
5	5	-1.738E+01	1.738E+01
6	5	-1.435E+01	1.435E+01
7	5	-1.063E+01	1.063E+01
8	5	-1.273E+01	1.273E+01
9	5	-1.326E+01	1.326E+01
10	5	-1.474E+01	1.474E+01
11	5	-1.946E+01	1.946E+01
12	5	-5.173E+00	5.173E+00
13	5	0.	0.
-1	6	0.	0.
0	6	-3.102E+01	3.102E+01
1	6	-4.740E+01	4.740E+01
2	6	-2.892E+01	2.892E+01
3	6	-1.701E+01	1.701E+01
4	6	-5.704E+00	5.704E+00
5	6	7.319E+00	-7.319E+00
6	6	-1.573E+01	1.573E+01
7	6	-3.784E+01	3.784E+01
8	6	-2.217E+01	2.217E+01
9	6	-7.192E+00	7.192E+00
10	6	7.404E+00	-7.404E+00
11	6	2.231E+01	-2.231E+01
12	6	4.642E+00	-4.642E+00
13	6	0.	0.
-1	7	0.	0.
0	7	-1.023E+02	1.023E+02
1	7	-8.249E+01	8.249E+01
2	7	-2.730E+01	2.730E+01
3	7	4.540E+00	-4.540E+00
4	7	3.605E+01	-3.605E+01
5	7	8.786E+01	-8.786E+01
6	7	3.863E+00	-3.863E+00
7	7	-8.068E+01	8.068E+01
8	7	-3.012E+01	3.012E+01
9	7	-2.339E-02	2.339E-02
10	7	2.950E+01	-2.950E+01
11	7	7.885E+01	-7.885E+01
12	7	9.419E+01	-9.419E+01
13	7	0.	0.
-1	8	0.	0.

0	8	-1.240E+02	1.240E+02
1	8	-7.963E+01	7.963E+01
2	8	-7.832E+00	7.832E+00
3	8	3.584E+01	-3.584E+01
4	8	8.058E+01	-8.058E+01
5	8	1.537E+02	-1.537E+02
6	8	3.073E+01	-3.073E+01
7	8	-9.520E+01	9.520E+01
8	8	-2.955E+01	2.955E+01
9	8	6.316E+00	-6.316E+00
10	8	4.107E+01	-4.107E+01
11	8	1.033E+02	-1.033E+02
12	8	1.351E+02	-1.351E+02
13	8	0.	0.
-1	9	0.	0.
0	9	-4.194E+01	4.194E+01
1	9	-2.918E+01	2.918E+01
2	9	1.959E+01	-1.959E+01
3	9	5.887E+01	-5.887E+01
4	9	1.018E+02	-1.018E+02
5	9	1.535E+02	-1.535E+02
6	9	5.485E+01	-5.485E+01
7	9	-4.985E+01	4.985E+01
8	9	-1.305E+01	1.305E+01
9	9	1.392E+01	-1.392E+01
10	9	4.003E+01	-4.003E+01
11	9	7.303E+01	-7.303E+01
12	9	4.677E+01	-4.677E+01
13	9	0.	0.
-1	10	0.	0.
0	10	-1.261E+00	1.261E+00
1	10	3.357E+01	-3.357E+01
2	10	6.758E+01	-6.758E+01
3	10	1.013E+02	-1.013E+02
4	10	1.447E+02	-1.447E+02
5	10	1.897E+02	-1.897E+02
6	10	1.043E+02	-1.043E+02
7	10	6.028E+00	-6.028E+00
8	10	1.907E+01	-1.907E+01
9	10	2.990E+01	-2.990E+01
10	10	4.099E+01	-4.099E+01
11	10	5.175E+01	-5.175E+01
12	10	2.305E+01	-2.305E+01
13	10	0.	0.
-1	11	0.	0.
0	11	3.991E+01	-3.991E+01
1	11	1.073E+02	-1.073E+02
2	11	1.339E+02	-1.339E+02
3	11	1.621E+02	-1.621E+02
4	11	2.143E+02	-2.143E+02
5	11	2.686E+02	-2.686E+02
6	11	1.858E+02	-1.858E+02
7	11	7.766E+01	-7.766E+01
8	11	6.650E+01	-6.650E+01
9	11	5.603E+01	-5.603E+01
10	11	4.913E+01	-4.913E+01
11	11	4.342E+01	-4.342E+01

12	11	1.354E+01	-1.354E+01
13	11	0.	0.
-1	12	0.	0.
0	12	8.490E+01	-8.490E+01
1	12	1.906E+02	-1.906E+02
2	12	2.169E+02	-2.169E+02
3	12	2.309E+02	-2.309E+02
4	12	3.072E+02	-3.072E+02
5	12	3.930E+02	-3.930E+02
6	12	3.008E+02	-3.008E+02
7	12	1.653E+02	-1.653E+02
8	12	1.255E+02	-1.255E+02
9	12	8.989E+01	-8.989E+01
10	12	6.388E+01	-6.388E+01
11	12	4.533E+01	-4.533E+01
12	12	1.305E+01	-1.305E+01
13	12	0.	0.
-1	13	0.	0.
0	13	1.245E+02	-1.245E+02
1	13	2.725E+02	-2.725E+02
2	13	3.139E+02	-3.139E+02
3	13	2.792E+02	-2.792E+02
4	13	4.043E+02	-4.043E+02
5	13	5.557E+02	-5.557E+02
6	13	4.349E+02	-4.349E+02
7	13	2.563E+02	-2.563E+02
8	13	1.843E+02	-1.843E+02
9	13	1.236E+02	-1.236E+02
10	13	8.020E+01	-8.020E+01
11	13	5.152E+01	-5.152E+01
12	13	1.615E+01	-1.615E+01
13	13	0.	0.
-1	14	0.	0.
0	14	1.246E+02	-1.246E+02
1	14	3.172E+02	-3.172E+02
2	14	4.094E+02	-4.094E+02
3	14	2.659E+02	-2.659E+02
4	14	4.666E+02	-4.666E+02
5	14	7.122E+02	-7.122E+02
6	14	5.335E+02	-5.335E+02
7	14	3.162E+02	-3.162E+02
8	14	2.213E+02	-2.213E+02
9	14	1.453E+02	-1.453E+02
10	14	9.099E+01	-9.099E+01
11	14	5.535E+01	-5.535E+01
12	14	1.807E+01	-1.807E+01
13	14	0.	0.
-1	15	0.	0.
0	15	9.524E+01	-9.524E+01
1	15	2.490E+02	-2.490E+02
2	15	3.221E+02	-3.221E+02
3	15	3.186E+02	-3.186E+02
4	15	4.563E+02	-4.563E+02
5	15	6.154E+02	-6.154E+02
6	15	4.857E+02	-4.857E+02
7	15	2.911E+02	-2.911E+02

8	15	2.169E+02	-2.169E+02
9	15	1.466E+02	-1.466E+02
10	15	9.103E+01	-9.103E+01
11	15	5.176E+01	-5.176E+01
12	15	1.538E+01	-1.538E+01
13	15	0.	0.
-1	16	0.	0.
0	16	2.842E+01	-2.842E+01
1	16	8.864E+01	-8.864E+01
2	16	1.162E+02	-1.162E+02
3	16	1.580E+02	-1.580E+02
4	16	2.069E+02	-2.069E+02
5	16	3.321E+02	-3.321E+02
6	16	2.230E+02	-2.230E+02
7	16	6.626E+01	-6.626E+01
8	16	1.011E+02	-1.011E+02
9	16	6.686E+01	-6.686E+01
10	16	3.918E+01	-3.918E+01
11	16	1.941E+01	-1.941E+01
12	16	5.259E+00	-5.259E+00
13	16	0.	0.
-1	17	0.	0.
0	17	0.	0.
1	17	0.	0.
2	17	0.	0.
3	17	0.	0.
4	17	0.	0.
5	17	0.	0.
6	17	0.	0.
7	17	0.	0.
8	17	0.	0.
9	17	0.	0.
10	17	0.	0.
11	17	0.	0.
12	17	0.	0.
13	17	0.	0.

TIME FOR THIS PROBLEM = 0 MINUTES 7.784 SECONDS

ELAPSED CPU TIME = 0 MINUTES 11.898 SECONDS

PROGRAM DSLAB 5 - DECK 1 - STELZER REVISION DATE 24 JULY 1967
CE313126 HWY SLAB PROJECT DSLAB 5 CF STELZER
RUN EXAMPLE PROBLEMS FOR USE IN SLAB REPORT APPENDIX 5

PROB
610 60 X 58 SLAB SIMPLE SUPPORTS AND CONCENTRATED LOADS

TABLE 1. CONTROL DATA

NUM CARDS TABLE 2	41
NUM CARDS TABLE 3	0
NUM INCREMENTS MX	20
NUM INCREMENTS MY	29
INCR LENGTH HX	3.600E+01
INCR LENGTH HY	2.400E+01
POISSONS RATIO	1.500E-01

TABLE 2. STIFFNESS AND LOAD DATA, FULL VALUES ADDED AT ALL STAS I,J IN RECT.

FROM		THRU		DX	DY	Q	S	CX	CY
0	0	20	0	3.328E+08	3.328E+08	-3.248E+02	-0.	-0.	-0.
1	0	19	0	3.328E+08	3.328E+08	-3.248E+02	-0.	-0.	-0.
0	29	20	29	3.328E+08	3.328E+08	-3.248E+02	-0.	-0.	-0.
1	29	19	29	3.328E+08	3.328E+08	-3.248E+02	-0.	-0.	-0.
0	1	20	1	7.313E+07	7.313E+07	-3.105E+02	-0.	-0.	-0.
1	1	19	1	7.313E+07	7.313E+07	-3.105E+02	-0.	-0.	-0.
0	28	20	28	7.313E+07	7.313E+07	-3.105E+02	-0.	-0.	-0.
1	28	19	28	7.313E+07	7.313E+07	-3.105E+02	-0.	-0.	-0.
0	2	20	2	1.132E+08	1.132E+08	-3.600E+02	-0.	-0.	-0.
1	2	19	2	1.132E+08	1.132E+08	-3.600E+02	-0.	-0.	-0.
0	27	20	27	1.132E+08	1.132E+08	-3.600E+02	-0.	-0.	-0.
1	27	19	27	1.132E+08	1.132E+08	-3.600E+02	-0.	-0.	-0.
0	4	20	4	2.322E+08	2.322E+08	-4.575E+02	-0.	-0.	-0.
1	4	19	4	2.322E+08	2.322E+08	-4.575E+02	-0.	-0.	-0.
0	25	20	25	2.322E+08	2.322E+08	-4.575E+02	-0.	-0.	-0.
1	25	19	25	2.322E+08	2.322E+08	-4.575E+02	-0.	-0.	-0.
0	5	20	24	3.147E+08	3.147E+08	-5.063E+02	1.000E+99	-0.	-0.
1	5	19	24	3.147E+08	3.147E+08	-5.063E+02	-0.	-0.	-0.
16	8	16	8	-0.	-0.	-2.080E+04	-0.	-0.	-0.
16	11	16	11	-0.	-0.	-2.080E+04	-0.	-0.	-0.
0	3	20	3	1.656E+08	1.656E+08	-4.080E+02	-0.	-0.	-0.
1	3	19	3	1.656E+08	1.656E+08	-4.080E+02	-0.	-0.	-0.
0	26	20	26	1.656E+08	1.656E+08	-4.080E+02	-0.	-0.	-0.
1	26	19	26	1.656E+08	1.656E+08	-4.080E+02	-0.	-0.	-0.
16	13	16	13	-0.	-0.	-2.080E+04	-0.	-0.	-0.
16	16	16	16	-0.	-0.	-2.080E+04	-0.	-0.	-0.
16	18	16	18	-0.	-0.	-2.080E+04	-0.	-0.	-0.
16	21	16	21	-0.	-0.	-2.080E+04	-0.	-0.	-0.
1	6	19	23	-0.	-0.	-0.	-1.000E+99	-0.	-0.
10	5	10	24	-0.	-0.	-0.	1.000E+99	-0.	-0.
1	6	19	23	-0.	-0.	-0.	-0.	5.351E+08	5.351E+08
1	1	19	1	-0.	-0.	-0.	-0.	4.425E+08	4.425E+08
1	2	19	2	-0.	-0.	-0.	-0.	1.559E+08	1.559E+08

1	3	19	3	-0.	-0.	-0.	-0.	2.342E+08	2.342E+08
1	4	19	4	-0.	-0.	-0.	-0.	3.351E+08	3.351E+08
1	5	19	5	-0.	-0.	-0.	-0.	4.878E+08	4.878E+08
1	29	19	29	-0.	-0.	-0.	-0.	4.425E+08	4.425E+08
1	28	19	28	-0.	-0.	-0.	-0.	1.559E+08	1.559E+08
1	27	19	27	-0.	-0.	-0.	-0.	2.342E+08	2.342E+08
1	26	19	26	-0.	-0.	-0.	-0.	3.351E+08	3.351E+08
1	25	19	25	-0.	-0.	-0.	-0.	4.878E+08	4.878E+08

TABLE 3. STIFFNESS AND LOAD DATA, FULL VALUES ADDED AT ALL STAS I,J IN RECT.

FROM	THRU	TX	TY	PX	PY

PROGRAM DSLAB 5 - DECK 1 - STELZER REVISION DATE 24 JULY 1967
CE313126 HWY SLAB PROJECT DSLAB 5 CF STELZER
RUN EXAMPLE PROBLEMS FOR USE IN SLAB REPORT APPENDIX 5

PROB (CONTD)
610 60 X 58 SLAB SIMPLE SUPPORTS AND CONCENTRATED LOADS

TABLE 4. RESULTS

I,J	DEFL	BMX	BMY	REACT
-1 -1	-8.503E-02	0.	0.	0.
0 -1	-8.371E-02	0.	0.	2.515E-09
1 -1	-8.293E-02	0.	0.	1.001E-09
2 -1	-8.207E-02	0.	0.	2.463E-09
3 -1	-8.127E-02	0.	0.	1.617E-09
4 -1	-8.062E-02	0.	0.	2.822E-09
5 -1	-7.990E-02	0.	0.	2.283E-09
6 -1	-7.844E-02	0.	0.	3.079E-09
7 -1	-7.515E-02	0.	0.	1.462E-09
8 -1	-6.874E-02	0.	0.	9.986E-10
9 -1	-5.810E-02	0.	0.	2.106E-09
10 -1	-4.271E-02	0.	0.	1.490E-09
11 -1	-2.306E-02	0.	0.	8.513E-10
12 -1	-7.719E-04	0.	0.	-1.027E-10
13 -1	2.160E-02	0.	0.	-7.708E-10
14 -1	4.110E-02	0.	0.	-2.256E-09
15 -1	5.506E-02	0.	0.	-1.539E-09
16 -1	6.174E-02	0.	0.	-3.645E-09
17 -1	6.085E-02	0.	0.	-1.490E-09
18 -1	5.358E-02	0.	0.	-2.104E-09
19 -1	4.229E-02	0.	0.	-1.155E-09
20 -1	3.223E-02	0.	0.	-3.977E-10
21 -1	2.230E-02	0.	0.	0.
-1 0	-6.558E-02	0.	0.	-3.526E-10
0 0	-6.487E-02	-5.288E-10	1.676E-09	-3.248E+02
1 0	-6.415E-02	7.163E+01	6.671E-10	-6.496E+02
2 0	-6.329E-02	-5.838E+01	1.642E-09	-6.496E+02
3 0	-6.255E-02	-1.575E+02	1.745E-09	-6.496E+02
4 0	-6.213E-02	-8.777E+01	1.882E-09	-6.496E+02
5 0	-6.187E-02	2.091E+02	1.522E-09	-6.496E+02
6 0	-6.121E-02	7.171E+02	2.053E-09	-6.496E+02
7 0	-5.911E-02	1.346E+03	9.750E-10	-6.496E+02
8 0	-5.433E-02	1.929E+03	6.658E-10	-6.496E+02
9 0	-4.571E-02	2.244E+03	1.404E-09	-6.496E+02
10 0	-3.262E-02	2.076E+03	9.932E-10	-6.496E+02
11 0	-1.539E-02	1.334E+03	5.675E-10	-6.496E+02
12 0	4.493E-03	1.252E+02	-6.844E-11	-6.496E+02
13 0	2.462E-02	-1.290E+03	-5.139E-10	-6.496E+02
14 0	4.219E-02	-2.590E+03	-1.504E-09	-6.496E+02
15 0	5.459E-02	-3.456E+03	-1.026E-09	-6.496E+02
16 0	6.011E-02	-3.631E+03	-2.430E-09	-6.496E+02
17 0	5.840E-02	-3.052E+03	-9.932E-10	-6.496E+02

18	0	5.061E-02	-1.965E+03	-1.402E-09	-6.496E+02
19	0	3.890E-02	-5.362E+02	-7.699E-10	-6.496E+02
20	0	2.613E-02	-9.551E-11	-2.651E-10	-3.248E+02
21	0	1.335E-02	0.	0.	-6.367E-11
-1	1	-4.613E-02	0.	0.	4.525E-11
0	1	-4.602E-02	6.787E-11	-1.959E+02	-3.105E+02
1	1	-4.539E-02	-3.502E+01	-4.089E+02	-6.210E+02
2	1	-4.451E-02	-8.037E+01	-4.013E+02	-6.210E+02
3	1	-4.382E-02	-1.123E+02	-3.835E+02	-6.210E+02
4	1	-4.362E-02	-1.016E+02	-3.464E+02	-6.210E+02
5	1	-4.387E-02	-3.589E+01	-2.838E+02	-6.210E+02
6	1	-4.406E-02	8.128E+01	-2.021E+02	-6.210E+02
7	1	-4.325E-02	2.304E+02	-1.211E+02	-6.210E+02
8	1	-4.017E-02	3.741E+02	-6.910E+01	-6.210E+02
9	1	-3.361E-02	4.588E+02	-7.244E+01	-6.210E+02
10	1	-2.280E-02	4.289E+02	-1.442E+02	-6.210E+02
11	1	-7.899E-03	2.598E+02	-2.828E+02	-6.210E+02
12	1	9.740E-03	-2.217E+01	-4.723E+02	-6.210E+02
13	1	2.762E-02	-3.537E+02	-6.786E+02	-6.210E+02
14	1	4.362E-02	-6.605E+02	-8.515E+02	-6.210E+02
15	1	5.459E-02	-8.682E+02	-9.428E+02	-6.210E+02
16	1	5.897E-02	-9.112E+02	-9.292E+02	-6.210E+02
17	1	5.635E-02	-7.676E+02	-8.196E+02	-6.210E+02
18	1	4.789E-02	-5.189E+02	-6.329E+02	-6.210E+02
19	1	3.558E-02	-4.261E+02	-4.447E+02	-6.210E+02
20	1	2.002E-02	-9.349E-11	2.176E+01	-3.105E+02
21	1	4.403E-03	0.	0.	-6.233E-11
-1	2	-2.821E-02	0.	0.	6.852E-11
0	2	-2.876E-02	1.028E-10	-6.057E+02	-3.600E+02
1	2	-2.825E-02	-1.064E+02	-1.210E+03	-7.200E+02
2	2	-2.729E-02	-2.260E+02	-1.260E+03	-7.200E+02
3	2	-2.656E-02	-3.010E+02	-1.293E+03	-7.200E+02
4	2	-2.645E-02	-3.023E+02	-1.269E+03	-7.200E+02
5	2	-2.699E-02	-2.186E+02	-1.173E+03	-7.200E+02
6	2	-2.779E-02	-5.392E+01	-1.011E+03	-7.200E+02
7	2	-2.801E-02	1.700E+02	-8.155E+02	-7.200E+02
8	2	-2.652E-02	4.061E+02	-6.393E+02	-7.200E+02
9	2	-2.209E-02	5.724E+02	-5.526E+02	-7.200E+02
10	2	-1.382E-02	5.646E+02	-6.182E+02	-7.200E+02
11	2	-1.705E-03	3.299E+02	-8.596E+02	-7.200E+02
12	2	1.310E-02	-8.482E+01	-1.243E+03	-7.200E+02
13	2	2.850E-02	-5.734E+02	-1.685E+03	-7.200E+02
14	2	4.202E-02	-1.034E+03	-2.080E+03	-7.200E+02
15	2	5.131E-02	-1.367E+03	-2.319E+03	-7.200E+02
16	2	5.463E-02	-1.455E+03	-2.317E+03	-7.200E+02
17	2	5.146E-02	-1.224E+03	-2.055E+03	-7.200E+02
18	2	4.294E-02	-8.676E+02	-1.604E+03	-7.200E+02
19	2	3.074E-02	-9.110E+02	-1.018E+03	-7.200E+02
20	2	1.410E-02	2.177E-11	2.590E+01	-3.600E+02
21	2	-2.589E-03	0.	0.	1.451E-11
-1	3	-1.363E-02	0.	0.	5.639E-11
0	3	-1.465E-02	8.458E-11	-1.209E+03	-4.080E+02
1	3	-1.422E-02	-2.412E+02	-2.464E+03	-8.160E+02
2	3	-1.327E-02	-4.496E+02	-2.624E+03	-8.160E+02
3	3	-1.255E-02	-5.707E+02	-2.743E+03	-8.160E+02
4	3	-1.246E-02	-5.873E+02	-2.742E+03	-8.160E+02
5	3	-1.308E-02	-4.939E+02	-2.591E+03	-8.160E+02

6	3	-1.412E-02	-2.947E+02	-2.298E+03	-8.160E+02
7	3	-1.496E-02	-7.859E+00	-1.910E+03	-8.160E+02
8	3	-1.469E-02	3.190E+02	-1.518E+03	-8.160E+02
9	3	-1.223E-02	5.818E+02	-1.266E+03	-8.160E+02
10	3	-6.674E-03	6.143E+02	-1.309E+03	-8.160E+02
11	3	2.124E-03	3.250E+02	-1.722E+03	-8.160E+02
12	3	1.326E-02	-2.093E+02	-2.433E+03	-8.160E+02
13	3	2.501E-02	-8.309E+02	-3.273E+03	-8.160E+02
14	3	3.541E-02	-1.425E+03	-4.046E+03	-8.160E+02
15	3	4.253E-02	-1.886E+03	-4.552E+03	-8.160E+02
16	3	4.483E-02	-2.044E+03	-4.587E+03	-8.160E+02
17	3	4.170E-02	-1.714E+03	-4.046E+03	-8.160E+02
18	3	3.415E-02	-1.211E+03	-3.079E+03	-8.160E+02
19	3	2.359E-02	-1.472E+03	-1.926E+03	-8.160E+02
20	3	8.304E-03	-5.457E-11	1.949E+02	-4.080E+02
21	3	-7.220E-03	0.	0.	-3.638E-11
-1	4	-3.502E-03	0.	0.	-2.425E-12
0	4	-4.841E-03	-3.638E-12	-1.957E+03	-4.575E+02
1	4	-4.504E-03	-4.950E+02	-4.178E+03	-9.150E+02
2	4	-3.792E-03	-7.536E+02	-4.594E+03	-9.150E+02
3	4	-3.263E-03	-8.933E+02	-4.879E+03	-9.150E+02
4	4	-3.196E-03	-9.194E+02	-4.922E+03	-9.150E+02
5	4	-3.645E-03	-8.330E+02	-4.688E+03	-9.150E+02
6	4	-4.466E-03	-6.368E+02	-4.186E+03	-9.150E+02
7	4	-5.312E-03	-3.406E+02	-3.470E+03	-9.150E+02
8	4	-5.645E-03	2.118E+01	-2.676E+03	-9.150E+02
9	4	-4.770E-03	3.476E+02	-2.064E+03	-9.150E+02
10	4	-2.020E-03	4.235E+02	-2.013E+03	-9.150E+02
11	4	2.802E-03	1.230E+02	-2.724E+03	-9.150E+02
12	4	9.141E-03	-4.478E+02	-4.028E+03	-9.150E+02
13	4	1.593E-02	-1.090E+03	-5.554E+03	-9.150E+02
14	4	2.198E-02	-1.707E+03	-6.993E+03	-9.150E+02
15	4	2.615E-02	-2.224E+03	-8.034E+03	-9.150E+02
16	4	2.741E-02	-2.453E+03	-8.246E+03	-9.150E+02
17	4	2.520E-02	-2.054E+03	-7.169E+03	-9.150E+02
18	4	2.020E-02	-1.397E+03	-5.142E+03	-9.150E+02
19	4	1.342E-02	-1.619E+03	-2.795E+03	-9.150E+02
20	4	3.205E-03	7.731E-12	7.462E+02	-4.575E+02
21	4	-7.645E-03	0.	0.	5.154E-12
-1	5	1.634E-03	0.	0.	-3.638E-12
0	5	-3.398E-96	-5.457E-12	-2.586E+03	2.892E+03
1	5	-1.069E-95	-9.594E+02	-6.396E+03	9.681E+03
2	5	-1.089E-95	-1.102E+03	-7.345E+03	9.881E+03
3	5	-1.154E-95	-1.190E+03	-7.931E+03	1.052E+04
4	5	-1.164E-95	-1.208E+03	-8.054E+03	1.063E+04
5	5	-1.117E-95	-1.154E+03	-7.696E+03	1.016E+04
6	5	-1.006E-95	-1.030E+03	-6.864E+03	9.044E+03
7	5	-8.184E-96	-8.392E+02	-5.595E+03	7.171E+03
8	5	-5.441E-96	-6.042E+02	-4.028E+03	4.428E+03
9	5	-2.191E-96	-3.863E+02	-2.576E+03	1.178E+03
10	5	-9.755E-97	-3.311E+02	-2.207E+03	9.384E+02
11	5	-3.258E-96	-5.244E+02	-3.496E+03	2.245E+03
12	5	-7.771E-96	-8.933E+02	-5.956E+03	6.758E+03
13	5	-1.221E-95	-1.303E+03	-8.685E+03	1.120E+04
14	5	-1.656E-95	-1.693E+03	-1.129E+04	1.555E+04
15	5	-2.131E-95	-2.018E+03	-1.346E+04	2.030E+04
16	5	-2.569E-95	-2.159E+03	-1.440E+04	2.468E+04
17	5	-2.135E-95	-1.841E+03	-1.227E+04	2.034E+04

18	5	-1.477E-95	-1.221E+03	-8.142E+03	1.376E+04
19	5	8.220E-96	-2.897E+02	-1.931E+03	-9.233E+03
20	5	3.703E-96	-3.638E-12	1.712E+03	-4.209E+03
21	5	-1.082E-03	0.	0.	-2.425E-12
-1	6	1.349E-03	0.	0.	-8.947E-91
0	6	6.650E-96	-1.342E-90	-8.947E-90	-7.157E+03
1	6	-1.349E-03	-5.025E+02	-2.613E+03	-1.013E+03
2	6	-2.930E-03	-3.278E+02	-3.821E+03	-1.013E+03
3	6	-3.995E-03	-2.372E+02	-4.380E+03	-1.013E+03
4	6	-4.175E-03	-2.252E+02	-4.532E+03	-1.013E+03
5	6	-3.398E-03	-2.703E+02	-4.350E+03	-1.013E+03
6	6	-1.815E-03	-3.792E+02	-3.873E+03	-1.013E+03
7	6	1.921E-04	-5.864E+02	-3.145E+03	-1.013E+03
8	6	1.958E-03	-9.592E+02	-2.247E+03	-1.013E+03
9	6	2.413E-03	-1.553E+03	-1.273E+03	-1.013E+03
10	6	5.174E-96	-1.742E+03	-2.614E+02	-6.186E+03
11	6	-6.001E-03	-1.484E+03	-1.698E+03	-1.013E+03
12	6	-1.459E-02	-7.976E+02	-3.123E+03	-1.013E+03
13	6	-2.387E-02	-2.724E+02	-4.505E+03	-1.013E+03
14	6	-3.231E-02	2.252E+02	-5.710E+03	-1.013E+03
15	6	-3.846E-02	9.283E+02	-6.567E+03	-1.013E+03
16	6	-4.059E-02	1.949E+03	-6.867E+03	-1.013E+03
17	6	-3.644E-02	1.347E+03	-5.675E+03	-1.013E+03
18	6	-2.765E-02	1.179E+03	-3.810E+03	-1.013E+03
19	6	-1.518E-02	1.026E+03	-1.749E+03	-1.013E+03
20	6	-3.758E-96	7.435E-91	4.957E-90	3.251E+03
21	6	1.518E-02	0.	0.	4.957E-91
-1	7	5.073E-03	0.	0.	2.671E-91
0	7	3.227E-97	4.006E-91	2.671E-90	-8.290E+02
1	7	-5.073E-03	2.363E+02	-8.153E+02	-1.013E+03
2	7	-9.391E-03	5.676E+02	-1.445E+03	-1.013E+03
3	7	-1.206E-02	7.568E+02	-1.794E+03	-1.013E+03
4	7	-1.256E-02	7.726E+02	-1.924E+03	-1.013E+03
5	7	-1.083E-02	6.172E+02	-1.887E+03	-1.013E+03
6	7	-7.203E-03	2.633E+02	-1.717E+03	-1.013E+03
7	7	-2.478E-03	-3.594E+02	-1.449E+03	-1.013E+03
8	7	1.948E-03	-1.365E+03	-1.125E+03	-1.013E+03
9	7	3.853E-03	-2.855E+03	-8.077E+02	-1.013E+03
10	7	-2.651E-96	-4.629E+03	-6.943E+02	1.639E+03
11	7	-1.338E-02	-2.590E+03	-7.250E+02	-1.013E+03
12	7	-3.199E-02	-7.704E+02	-9.468E+02	-1.013E+03
13	7	-5.193E-02	7.181E+02	-1.129E+03	-1.013E+03
14	7	-6.999E-02	2.132E+03	-1.143E+03	-1.013E+03
15	7	-8.320E-02	3.920E+03	-8.895E+02	-1.013E+03
16	7	-8.788E-02	6.634E+03	-6.314E+02	-1.013E+03
17	7	-7.838E-02	4.606E+03	-4.158E+02	-1.013E+03
18	7	-5.904E-02	3.541E+03	-3.102E+02	-1.013E+03
19	7	-3.215E-02	2.459E+03	-2.425E+02	-1.013E+03
20	7	-2.146E-96	-5.392E-11	-8.088E-12	1.639E+03
21	7	3.215E-02	0.	0.	-3.595E-11
-1	8	9.595E-03	0.	0.	2.914E-92
0	8	-1.116E-96	4.370E-92	2.914E-91	6.098E+02
1	8	-9.595E-03	9.237E+02	1.334E+02	-1.013E+03
2	8	-1.729E-02	1.471E+03	8.369E+01	-1.013E+03
3	8	-2.191E-02	1.741E+03	5.936E+00	-1.013E+03
4	8	-2.286E-02	1.744E+03	-6.518E+01	-1.013E+03
5	8	-2.012E-02	1.470E+03	-1.372E+02	-1.013E+03

6	8	-1.424E-02	8.681E+02	-2.251E+02	-1.013E+03
7	8	-6.455E-03	-1.710E+02	-3.452E+02	-1.013E+03
8	8	1.076E-03	-1.819E+03	-5.149E+02	-1.013E+03
9	8	4.937E-03	-4.292E+03	-7.659E+02	-1.013E+03
10	8	-6.361E-96	-7.841E+03	-1.176E+03	5.348E+03
11	8	-2.108E-02	-3.834E+03	-2.067E+02	-1.013E+03
12	8	-5.018E-02	-7.932E+02	6.329E+02	-1.013E+03
13	8	-8.114E-02	1.671E+03	1.466E+03	-1.013E+03
14	8	-1.090E-01	3.983E+03	2.420E+03	-1.013E+03
15	8	-1.293E-01	6.705E+03	3.805E+03	-1.013E+03
16	8	-1.367E-01	1.175E+04	6.519E+03	-2.181E+04
17	8	-1.214E-01	7.615E+03	3.937E+03	-1.013E+03
18	8	-9.122E-02	5.792E+03	2.550E+03	-1.013E+03
19	8	-4.969E-02	4.079E+03	1.378E+03	-1.013E+03
20	8	-3.226E-96	-8.862E-94	-5.908E-93	2.719E+03
21	8	4.969E-02	0.	0.	-5.908E-94
-1	9	1.412E-02	0.	0.	1.715E-92
0	9	-2.022E-96	2.573E-92	1.715E-91	1.515E+03
1	9	-1.412E-02	1.493E+03	6.721E+02	-1.013E+03
2	9	-2.531E-02	2.295E+03	1.050E+03	-1.013E+03
3	9	-3.199E-02	2.658E+03	1.213E+03	-1.013E+03
4	9	-3.346E-02	2.646E+03	1.211E+03	-1.013E+03
5	9	-2.974E-02	2.255E+03	1.058E+03	-1.013E+03
6	9	-2.160E-02	1.412E+03	7.605E+02	-1.013E+03
7	9	-1.073E-02	-2.954E+01	3.221E+02	-1.013E+03
8	9	-2.325E-05	-2.305E+03	-2.460E+02	-1.013E+03
9	9	5.907E-03	-5.758E+03	-9.225E+02	-1.013E+03
10	9	-9.317E-96	-1.094E+04	-1.641E+03	8.304E+03
11	9	-2.844E-02	-5.111E+03	5.432E+01	-1.013E+03
12	9	-6.765E-02	-8.526E+02	1.732E+03	-1.013E+03
13	9	-1.092E-01	2.581E+03	3.342E+03	-1.013E+03
14	9	-1.464E-01	5.826E+03	4.841E+03	-1.013E+03
15	9	-1.728E-01	9.555E+03	6.032E+03	-1.013E+03
16	9	-1.810E-01	1.402E+04	6.241E+03	-1.013E+03
17	9	-1.617E-01	1.065E+04	5.930E+03	-1.013E+03
18	9	-1.218E-01	7.999E+03	4.532E+03	-1.013E+03
19	9	-6.651E-02	5.715E+03	2.669E+03	-1.013E+03
20	9	-4.316E-96	9.732E-93	6.488E-92	3.810E+03
21	9	6.651E-02	0.	0.	6.488E-93
-1	10	1.823E-02	0.	0.	1.100E-92
0	10	-2.613E-96	1.651E-92	1.100E-91	2.107E+03
1	10	-1.823E-02	1.945E+03	9.902E+02	-1.013E+03
2	10	-3.267E-02	2.999E+03	1.653E+03	-1.013E+03
3	10	-4.132E-02	3.462E+03	1.997E+03	-1.013E+03
4	10	-4.330E-02	3.442E+03	2.052E+03	-1.013E+03
5	10	-3.869E-02	2.942E+03	1.839E+03	-1.013E+03
6	10	-2.845E-02	1.877E+03	1.376E+03	-1.013E+03
7	10	-1.470E-02	6.468E+01	6.885E+02	-1.013E+03
8	10	-1.029E-03	-2.791E+03	-1.813E+02	-1.013E+03
9	10	6.822E-03	-7.138E+03	-1.153E+03	-1.013E+03
10	10	-1.161E-95	-1.369E+04	-2.054E+03	1.060E+04
11	10	-3.502E-02	-6.312E+03	1.706E+02	-1.013E+03
12	10	-8.339E-02	-9.399E+02	2.478E+03	-1.013E+03
13	10	-1.345E-01	3.375E+03	4.691E+03	-1.013E+03
14	10	-1.800E-01	7.410E+03	6.666E+03	-1.013E+03
15	10	-2.120E-01	1.190E+04	8.104E+03	-1.013E+03
16	10	-2.215E-01	1.692E+04	8.262E+03	-1.013E+03
17	10	-1.980E-01	1.314E+04	7.850E+03	-1.013E+03

18	10	-1.493E-01	9.909E+03	6.080E+03	-1.013E+03
19	10	-8.163E-02	7.173E+03	3.634E+03	-1.013E+03
20	10	-5.289E-96	1.495E-92	9.965E-92	4.782E+03
21	10	8.163E-02	0.	0.	9.965E-93
-1	11	2.168E-02	0.	0.	7.547E-93
0	11	-3.003E-96	1.132E-92	7.547E-92	2.497E+03
1	11	-2.168E-02	2.292E+03	1.179E+03	-1.013E+03
2	11	-3.890E-02	3.566E+03	2.020E+03	-1.013E+03
3	11	-4.926E-02	4.125E+03	2.487E+03	-1.013E+03
4	11	-5.171E-02	4.104E+03	2.583E+03	-1.013E+03
5	11	-4.632E-02	3.513E+03	2.324E+03	-1.013E+03
6	11	-3.428E-02	2.254E+03	1.736E+03	-1.013E+03
7	11	-1.803E-02	1.187E+02	8.631E+02	-1.013E+03
8	11	-1.812E-03	-3.238E+03	-2.223E+02	-1.013E+03
9	11	7.659E-03	-8.340E+03	-1.389E+03	-1.013E+03
10	11	-1.333E-95	-1.598E+04	-2.397E+03	1.232E+04
11	11	-4.056E-02	-7.354E+03	2.078E+02	-1.013E+03
12	11	-9.667E-02	-1.037E+03	2.971E+03	-1.013E+03
13	11	-1.559E-01	4.023E+03	5.642E+03	-1.013E+03
14	11	-2.085E-01	8.664E+03	8.082E+03	-1.013E+03
15	11	-2.453E-01	1.365E+04	1.031E+04	-1.013E+03
16	11	-2.567E-01	2.055E+04	1.294E+04	-2.181E+04
17	11	-2.288E-01	1.502E+04	9.962E+03	-1.013E+03
18	11	-1.725E-01	1.144E+04	7.314E+03	-1.013E+03
19	11	-9.436E-02	8.358E+03	4.322E+03	-1.013E+03
20	11	-6.078E-96	1.542E-92	1.028E-91	5.572E+03
21	11	9.436E-02	0.	0.	1.028E-92
-1	12	2.435E-02	0.	0.	5.504E-93
0	12	-3.255E-96	8.255E-93	5.504E-92	2.749E+03
1	12	-2.435E-02	2.544E+03	1.290E+03	-1.013E+03
2	12	-4.375E-02	3.991E+03	2.237E+03	-1.013E+03
3	12	-5.545E-02	4.633E+03	2.780E+03	-1.013E+03
4	12	-5.827E-02	4.614E+03	2.900E+03	-1.013E+03
5	12	-5.228E-02	3.951E+03	2.607E+03	-1.013E+03
6	12	-3.880E-02	2.538E+03	1.931E+03	-1.013E+03
7	12	-2.058E-02	1.436E+02	9.277E+02	-1.013E+03
8	12	-2.348E-03	-3.612E+03	-3.021E+02	-1.013E+03
9	12	8.367E-03	-9.298E+03	-1.591E+03	-1.013E+03
10	12	-1.456E-95	-1.773E+04	-2.659E+03	1.355E+04
11	12	-4.487E-02	-8.178E+03	2.050E+02	-1.013E+03
12	12	-1.070E-01	-1.120E+03	3.272E+03	-1.013E+03
13	12	-1.726E-01	4.541E+03	6.233E+03	-1.013E+03
14	12	-2.305E-01	9.708E+03	8.870E+03	-1.013E+03
15	12	-2.709E-01	1.522E+04	1.092E+04	-1.013E+03
16	12	-2.826E-01	2.160E+04	1.149E+04	-1.013E+03
17	12	-2.524E-01	1.667E+04	1.050E+04	-1.013E+03
18	12	-1.904E-01	1.270E+04	7.977E+03	-1.013E+03
19	12	-1.042E-01	9.260E+03	4.725E+03	-1.013E+03
20	12	-6.680E-96	1.620E-92	1.080E-91	6.173E+03
21	12	1.042E-01	0.	0.	1.080E-92
-1	13	2.617E-02	0.	0.	4.326E-93
0	13	-3.407E-96	6.488E-93	4.326E-92	2.900E+03
1	13	-2.617E-02	2.709E+03	1.350E+03	-1.013E+03
2	13	-4.706E-02	4.276E+03	2.355E+03	-1.013E+03
3	13	-5.969E-02	4.977E+03	2.941E+03	-1.013E+03
4	13	-6.276E-02	4.962E+03	3.074E+03	-1.013E+03
5	13	-5.635E-02	4.249E+03	2.758E+03	-1.013E+03

6	13	-4.186E-02	2.727E+03	2.024E+03	-1.013E+03
7	13	-2.227E-02	1.504E+02	9.401E+02	-1.013E+03
8	13	-2.661E-03	-3.883E+03	-3.775E+02	-1.013E+03
9	13	8.892E-03	-9.965E+03	-1.736E+03	-1.013E+03
10	13	-1.535E-95	-1.892E+04	-2.837E+03	1.433E+04
11	13	-4.784E-02	-8.748E+03	1.887E+02	-1.013E+03
12	13	-1.142E-01	-1.176E+03	3.437E+03	-1.013E+03
13	13	-1.841E-01	4.909E+03	6.563E+03	-1.013E+03
14	13	-2.457E-01	1.042E+04	9.327E+03	-1.013E+03
15	13	-2.883E-01	1.610E+04	1.169E+04	-1.013E+03
16	13	-3.007E-01	2.335E+04	1.430E+04	-2.181E+04
17	13	-2.685E-01	1.762E+04	1.124E+04	-1.013E+03
18	13	-2.027E-01	1.355E+04	8.351E+03	-1.013E+03
19	13	-1.109E-01	9.866E+03	4.924E+03	-1.013E+03
20	13	-7.083E-96	1.508E-92	1.006E-91	6.577E+03
21	13	1.109E-01	0.	0.	1.006E-92
-1	14	2.711E-02	0.	0.	3.769E-93
0	14	-3.479E-96	5.654E-93	3.769E-92	2.972E+03
1	14	-2.711E-02	2.793E+03	1.377E+03	-1.013E+03
2	14	-4.877E-02	4.421E+03	2.408E+03	-1.013E+03
3	14	-6.187E-02	5.155E+03	3.012E+03	-1.013E+03
4	14	-6.507E-02	5.142E+03	3.150E+03	-1.013E+03
5	14	-5.844E-02	4.402E+03	2.821E+03	-1.013E+03
6	14	-4.342E-02	2.821E+03	2.060E+03	-1.013E+03
7	14	-2.311E-02	1.482E+02	9.364E+02	-1.013E+03
8	14	-2.781E-03	-4.030E+03	-4.230E+02	-1.013E+03
9	14	9.190E-03	-1.032E+04	-1.814E+03	-1.013E+03
10	14	-1.574E-95	-1.953E+04	-2.930E+03	1.473E+04
11	14	-4.941E-02	-9.046E+03	1.777E+02	-1.013E+03
12	14	-1.179E-01	-1.202E+03	3.511E+03	-1.013E+03
13	14	-1.901E-01	5.124E+03	6.688E+03	-1.013E+03
14	14	-2.536E-01	1.087E+04	9.360E+03	-1.013E+03
15	14	-2.971E-01	1.677E+04	1.110E+04	-1.013E+03
16	14	-3.088E-01	2.256E+04	1.120E+04	-1.013E+03
17	14	-2.765E-01	1.833E+04	1.062E+04	-1.013E+03
18	14	-2.090E-01	1.408E+04	8.340E+03	-1.013E+03
19	14	-1.145E-01	1.020E+04	4.974E+03	-1.013E+03
20	14	-7.303E-96	1.624E-92	1.083E-91	6.797E+03
21	14	1.145E-01	0.	0.	1.083E-92
-1	15	2.715E-02	0.	0.	3.739E-93
0	15	-3.482E-96	5.609E-93	3.739E-92	2.975E+03
1	15	-2.715E-02	2.797E+03	1.378E+03	-1.013E+03
2	15	-4.884E-02	4.428E+03	2.409E+03	-1.013E+03
3	15	-6.196E-02	5.165E+03	3.013E+03	-1.013E+03
4	15	-6.516E-02	5.153E+03	3.150E+03	-1.013E+03
5	15	-5.850E-02	4.409E+03	2.821E+03	-1.013E+03
6	15	-4.344E-02	2.822E+03	2.059E+03	-1.013E+03
7	15	-2.309E-02	1.417E+02	9.346E+02	-1.013E+03
8	15	-2.731E-03	-4.045E+03	-4.261E+02	-1.013E+03
9	15	9.239E-03	-1.034E+04	-1.819E+03	-1.013E+03
10	15	-1.578E-95	-1.957E+04	-2.935E+03	1.477E+04
11	15	-4.953E-02	-9.064E+03	1.842E+02	-1.013E+03
12	15	-1.182E-01	-1.205E+03	3.530E+03	-1.013E+03
13	15	-1.906E-01	5.138E+03	6.715E+03	-1.013E+03
14	15	-2.542E-01	1.091E+04	9.393E+03	-1.013E+03
15	15	-2.978E-01	1.682E+04	1.113E+04	-1.013E+03
16	15	-3.095E-01	2.261E+04	1.123E+04	-1.013E+03
17	15	-2.772E-01	1.837E+04	1.066E+04	-1.013E+03

18	15	-2.095E-01	1.412E+04	8.376E+03	-1.013E+03
19	15	-1.147E-01	1.023E+04	4.999E+03	-1.013E+03
20	15	-7.325E-96	1.645E-92	1.097E-91	6.819E+03
21	15	1.147E-01	0.	0.	1.097E-92

-1	16	2.629E-02	0.	0.	4.234E-93
0	16	-3.416E-96	6.351E-93	4.234E-92	2.910E+03
1	16	-2.629E-02	2.721E+03	1.354E+03	-1.013E+03
2	16	-4.728E-02	4.298E+03	2.361E+03	-1.013E+03
3	16	-5.996E-02	5.007E+03	2.945E+03	-1.013E+03
4	16	-6.302E-02	4.993E+03	3.077E+03	-1.013E+03
5	16	-5.654E-02	4.270E+03	2.758E+03	-1.013E+03
6	16	-4.193E-02	2.730E+03	2.022E+03	-1.013E+03
7	16	-2.221E-02	1.308E+02	9.352E+02	-1.013E+03
8	16	-2.513E-03	-3.927E+03	-3.861E+02	-1.013E+03
9	16	9.037E-03	-1.004E+04	-1.751E+03	-1.013E+03
10	16	-1.545E-95	-1.903E+04	-2.854E+03	1.443E+04
11	16	-4.822E-02	-8.803E+03	2.098E+02	-1.013E+03
12	16	-1.150E-01	-1.185E+03	3.496E+03	-1.013E+03
13	16	-1.855E-01	4.951E+03	6.649E+03	-1.013E+03
14	16	-2.476E-01	1.051E+04	9.428E+03	-1.013E+03
15	16	-2.905E-01	1.624E+04	1.180E+04	-1.013E+03
16	16	-3.030E-01	2.350E+04	1.440E+04	-2.181E+04
17	16	-2.705E-01	1.775E+04	1.135E+04	-1.013E+03
18	16	-2.042E-01	1.365E+04	8.462E+03	-1.013E+03
19	16	-1.118E-01	9.959E+03	5.007E+03	-1.013E+03
20	16	-7.146E-96	-2.157E-10	-3.235E-11	6.639E+03
21	16	1.118E-01	0.	0.	-1.438E-10

-1	17	2.455E-02	0.	0.	5.351E-93
0	17	-3.274E-96	8.026E-93	5.351E-92	2.767E+03
1	17	-2.455E-02	2.562E+03	1.298E+03	-1.013E+03
2	17	-4.411E-02	4.028E+03	2.249E+03	-1.013E+03
3	17	-5.590E-02	4.683E+03	2.791E+03	-1.013E+03
4	17	-5.870E-02	4.666E+03	2.909E+03	-1.013E+03
5	17	-5.260E-02	3.988E+03	2.610E+03	-1.013E+03
6	17	-3.891E-02	2.545E+03	1.928E+03	-1.013E+03
7	17	-2.048E-02	1.106E+02	9.212E+02	-1.013E+03
8	17	-2.104E-03	-3.687E+03	-3.140E+02	-1.013E+03
9	17	8.605E-03	-9.411E+03	-1.612E+03	-1.013E+03
10	17	-1.472E-95	-1.790E+04	-2.685E+03	1.371E+04
11	17	-4.547E-02	-8.267E+03	2.453E+02	-1.013E+03
12	17	-1.084E-01	-1.139E+03	3.376E+03	-1.013E+03
13	17	-1.749E-01	4.607E+03	6.385E+03	-1.013E+03
14	17	-2.336E-01	9.866E+03	9.050E+03	-1.013E+03
15	17	-2.744E-01	1.545E+04	1.111E+04	-1.013E+03
16	17	-2.862E-01	2.186E+04	1.168E+04	-1.013E+03
17	17	-2.556E-01	1.689E+04	1.070E+04	-1.013E+03
18	17	-1.928E-01	1.285E+04	8.176E+03	-1.013E+03
19	17	-1.055E-01	9.399E+03	4.882E+03	-1.013E+03
20	17	-6.772E-96	1.833E-92	1.222E-91	6.266E+03
21	17	1.055E-01	0.	0.	1.222E-92

-1	18	2.195E-02	0.	0.	7.342E-93
0	18	-3.033E-96	1.101E-92	7.342E-92	2.527E+03
1	18	-2.195E-02	2.316E+03	1.195E+03	-1.013E+03
2	18	-3.940E-02	3.617E+03	2.044E+03	-1.013E+03
3	18	-4.988E-02	4.196E+03	2.512E+03	-1.013E+03
4	18	-5.232E-02	4.178E+03	2.603E+03	-1.013E+03
5	18	-4.677E-02	3.567E+03	2.336E+03	-1.013E+03

6	18	-3.445E-02	2.266E+03	1.737E+03	-1.013E+03
7	18	-1.790E-02	7.218E+01	8.560E+02	-1.013E+03
8	18	-1.471E-03	-3.345E+03	-2.355E+02	-1.013E+03
9	18	7.986E-03	-8.493E+03	-1.413E+03	-1.013E+03
10	18	-1.354E-95	-1.619E+04	-2.429E+03	1.253E+04
11	18	-4.133E-02	-7.476E+03	2.742E+02	-1.013E+03
12	18	-9.849E-02	-1.074E+03	3.130E+03	-1.013E+03
13	18	-1.589E-01	4.104E+03	5.873E+03	-1.013E+03
14	18	-2.125E-01	8.880E+03	8.360E+03	-1.013E+03
15	18	-2.501E-01	1.399E+04	1.061E+04	-1.013E+03
16	18	-2.615E-01	2.093E+04	1.323E+04	-7.181E+04
17	18	-2.331E-01	1.533E+04	1.026E+04	-1.013E+03
18	18	-1.756E-01	1.162E+04	7.614E+03	-1.013E+03
19	18	-9.603E-02	8.504E+03	4.582E+03	-1.013E+03
20	18	-6.175E-96	2.014E-92	1.343E-91	5.669E+03
21	18	9.603E-02	0.	0.	1.343E-92
-1	19	1.856E-02	0.	0.	1.080E-92
0	19	-2.658E-96	1.620E-92	1.080E-91	2.151E+03
1	19	-1.856E-02	1.972E+03	1.017E+03	-1.013E+03
2	19	-3.329E-02	3.063E+03	1.696E+03	-1.013E+03
3	19	-4.210E-02	3.554E+03	2.045E+03	-1.013E+03
4	19	-4.408E-02	3.540E+03	2.096E+03	-1.013E+03
5	19	-3.926E-02	3.017E+03	1.868E+03	-1.013E+03
6	19	-2.867E-02	1.897E+03	1.384E+03	-1.013E+03
7	19	-1.453E-02	5.380E+00	6.796E+02	-1.013E+03
8	19	-5.895E-04	-2.932E+03	-1.971E+02	-1.013E+03
9	19	7.236E-03	-7.327E+03	-1.175E+03	-1.013E+03
10	19	-1.183E-95	-1.391E+04	-2.087E+03	1.082E+04
11	19	-3.588E-02	-6.468E+03	2.700E+02	-1.013E+03
12	19	-8.547E-02	-1.005E+03	2.698E+03	-1.013E+03
13	19	-1.380E-01	3.463E+03	5.015E+03	-1.013E+03
14	19	-1.849E-01	7.676E+03	7.070E+03	-1.013E+03
15	19	-2.178E-01	1.233E+04	8.544E+03	-1.013E+03
16	19	-2.275E-01	1.743E+04	8.692E+03	-1.013E+03
17	19	-2.031E-01	1.355E+04	8.259E+03	-1.013E+03
18	19	-1.529E-01	1.009E+04	6.482E+03	-1.013E+03
19	19	-8.343E-02	7.239E+03	4.019E+03	-1.013E+03
20	19	-5.332E-96	-1.078E-10	-1.618E-11	4.826E+03
21	19	8.343E-02	0.	0.	-7.189E-11
-1	20	1.450E-02	0.	0.	1.711E-92
0	20	-2.085E-96	2.567E-92	1.711E-91	1.579E+03
1	20	-1.450E-02	1.518E+03	7.165E+02	-1.013E+03
2	20	-2.602E-02	2.369E+03	1.123E+03	-1.013E+03
3	20	-3.291E-02	2.770E+03	1.301E+03	-1.013E+03
4	20	-3.438E-02	2.768E+03	1.295E+03	-1.013E+03
5	20	-3.042E-02	2.350E+03	1.118E+03	-1.013E+03
6	20	-2.187E-02	1.443E+03	7.803E+02	-1.013E+03
7	20	-1.052E-02	-9.799E+01	3.048E+02	-1.013E+03
8	20	5.195E-04	-2.485E+03	-2.769E+02	-1.013E+03
9	20	6.415E-03	-5.986E+03	-9.446E+02	-1.013E+03
10	20	-9.464E-96	-1.110E+04	-1.665E+03	8.452E+03
11	20	-2.927E-02	-5.309E+03	1.856E+02	-1.013E+03
12	20	-6.979E-02	-9.583E+02	2.005E+03	-1.013E+03
13	20	-1.130E-01	2.663E+03	3.768E+03	-1.013E+03
14	20	-1.517E-01	6.130E+03	5.411E+03	-1.013E+03
15	20	-1.793E-01	1.008E+04	6.682E+03	-1.013E+03
16	20	-1.877E-01	1.468E+04	6.874E+03	-1.013E+03
17	20	-1.673E-01	1.117E+04	6.487E+03	-1.013E+03

18	20	-1.255E-01	8.165E+03	5.007E+03	-1.013E+03
19	20	-6.809E-02	5.532E+03	3.157E+03	-1.013E+03
20	20	-4.194E-96	2.537E-92	1.692E-91	3.688E+03
21	20	6.809E-02	0.	0.	1.692E-92
-1	21	9.971E-03	0.	0.	2.981E-92
0	21	-1.199E-96	4.471E-92	2.981E-91	6.926E+02
1	21	-9.971E-03	9.376E+02	1.989E+02	-1.013E+03
2	21	-1.803E-02	1.551E+03	2.003E+02	-1.013E+03
3	21	-2.289E-02	1.871E+03	1.572E+02	-1.013E+03
4	21	-2.385E-02	1.886E+03	8.813E+01	-1.013E+03
5	21	-2.087E-02	1.586E+03	-2.258E+01	-1.013E+03
6	21	-1.454E-02	9.165E+02	-1.833E+02	-1.013E+03
7	21	-6.218E-03	-2.394E+02	-3.851E+02	-1.013E+03
8	21	1.718E-03	-2.038E+03	-5.991E+02	-1.013E+03
9	21	5.551E-03	-4.577E+03	-8.182E+02	-1.013E+03
10	21	-6.232E-96	-7.865E+03	-1.180E+03	5.220E+03
11	21	-2.175E-02	-4.094E+03	-7.600E+01	-1.013E+03
12	21	-5.209E-02	-9.471E+02	9.199E+02	-1.013E+03
13	21	-8.472E-02	1.741E+03	1.989E+03	-1.013E+03
14	21	-1.143E-01	4.304E+03	3.203E+03	-1.013E+03
15	21	-1.359E-01	7.306E+03	4.770E+03	-1.013E+03
16	21	-1.435E-01	1.257E+04	7.488E+03	-2.181E+04
17	21	-1.271E-01	8.285E+03	4.723E+03	-1.013E+03
18	21	-9.463E-02	5.974E+03	3.019E+03	-1.013E+03
19	21	-5.057E-02	3.360E+03	1.784E+03	-1.013E+03
20	21	-2.746E-96	-5.392E-11	-8.088E-12	2.240E+03
21	21	5.057E-02	0.	0.	-3.595E-11
-1	22	5.393E-03	0.	0.	3.656E-91
0	22	2.327E-97	5.483E-91	3.656E-90	-7.390E+02
1	22	-5.393E-03	2.291E+02	-7.346E+02	-1.013E+03
2	22	-1.007E-02	6.509E+02	-1.267E+03	-1.013E+03
3	22	-1.298E-02	8.981E+02	-1.542E+03	-1.013E+03
4	22	-1.351E-02	9.266E+02	-1.658E+03	-1.013E+03
5	22	-1.156E-02	7.477E+02	-1.678E+03	-1.013E+03
6	22	-7.506E-03	3.313E+02	-1.631E+03	-1.013E+03
7	22	-2.240E-03	-4.117E+02	-1.530E+03	-1.013E+03
8	22	2.642E-03	-1.608E+03	-1.349E+03	-1.013E+03
9	22	4.563E-03	-3.230E+03	-1.011E+03	-1.013E+03
10	22	-1.804E-96	-4.445E+03	-6.668E+02	7.912E+02
11	22	-1.372E-02	-2.943E+03	-7.239E+02	-1.013E+03
12	22	-3.340E-02	-9.598E+02	-7.468E+02	-1.013E+03
13	22	-5.487E-02	7.795E+02	-5.345E+02	-1.013E+03
14	22	-7.454E-02	2.441E+03	-9.611E+01	-1.013E+03
15	22	-8.902E-02	4.544E+03	5.472E+02	-1.013E+03
16	22	-9.411E-02	7.596E+03	9.396E+02	-1.013E+03
17	22	-8.350E-02	5.414E+03	8.133E+02	-1.013E+03
18	22	-6.174E-02	3.872E+03	9.246E+01	-1.013E+03
19	22	-3.185E-02	8.443E+02	-5.851E+02	-1.013E+03
20	22	-1.069E-96	-2.161E-91	-1.441E-90	5.629E+02
21	22	3.185E-02	0.	0.	-1.441E-91
-1	23	1.535E-03	0.	0.	-1.170E-90
0	23	8.355E-96	-1.754E-90	-1.170E-89	-8.861E+03
1	23	-1.535E-03	-5.367E+02	-2.563E+03	-1.013E+03
2	23	-3.390E-03	-2.452E+02	-3.552E+03	-1.013E+03
3	23	-4.640E-03	-9.912E+01	-3.965E+03	-1.013E+03
4	23	-4.846E-03	-7.853E+01	-4.087E+03	-1.013E+03
5	23	-3.926E-03	-1.426E+02	-3.982E+03	-1.013E+03

6	23	-2.048E-03	-2.996E+02	-3.688E+03	-1.013E+03
7	23	3.642E-04	-6.065E+02	-3.261E+03	-1.013E+03
8	23	2.529E-03	-1.179E+03	-2.757E+03	-1.013E+03
9	23	3.083E-03	-2.029E+03	-2.016E+03	-1.013E+03
10	23	1.103E-95	-1.392E+03	-2.088E+02	-1.204E+04
11	23	-5.949E-03	-1.938E+03	-2.231E+03	-1.013E+03
12	23	-1.528E-02	-9.682E+02	-3.190E+03	-1.013E+03
13	23	-2.563E-02	-2.000E+02	-3.883E+03	-1.013E+03
14	23	-3.519E-02	4.937E+02	-4.374E+03	-1.013E+03
15	23	-4.232E-02	1.488E+03	-4.468E+03	-1.013E+03
16	23	-4.490E-02	2.953E+03	-4.164E+03	-1.013E+03
17	23	-3.995E-02	2.172E+03	-3.521E+03	-1.013E+03
18	23	-2.931E-02	1.854E+03	-3.055E+03	-1.013E+03
19	23	-1.380E-02	-1.528E+03	-4.772E+03	-1.013E+03
20	23	-2.030E-96	5.110E-91	3.406E-90	1.523E+03
21	23	1.380E-02	0.	0.	3.406E-91
-1	24	1.569E-03	0.	0.	1.213E-12
0	24	-4.931E-96	1.819E-12	-2.483E+03	4.424E+03
1	24	-1.080E-95	-9.433E+02	-6.289E+03	9.783E+03
2	24	-1.077E-95	-1.111E+03	-7.410E+03	9.759E+03
3	24	-1.139E-95	-1.217E+03	-8.111E+03	1.038E+04
4	24	-1.151E-95	-1.240E+03	-8.267E+03	1.050E+04
5	24	-1.105E-95	-1.180E+03	-7.867E+03	1.004E+04
6	24	-9.937E-96	-1.037E+03	-6.914E+03	8.924E+03
7	24	-8.081E-96	-8.156E+02	-5.438E+03	7.068E+03
8	24	-5.555E-96	-5.403E+02	-3.602E+03	4.543E+03
9	24	-3.543E-96	-3.007E+02	-2.005E+03	2.530E+03
10	24	-3.238E-96	-3.096E+02	-2.064E+03	5.463E+03
11	24	-4.584E-96	-4.418E+02	-2.945E+03	3.571E+03
12	24	-7.843E-96	-8.394E+02	-5.596E+03	6.830E+03
13	24	-1.208E-95	-1.306E+03	-8.703E+03	1.106E+04
14	24	-1.644E-95	-1.760E+03	-1.173E+04	1.543E+04
15	24	-2.102E-95	-2.156E+03	-1.438E+04	2.000E+04
16	24	-2.433E-95	-2.353E+03	-1.569E+04	2.332E+04
17	24	-2.063E-95	-1.987E+03	-1.324E+04	1.961E+04
18	24	-1.157E-95	-1.231E+03	-8.204E+03	1.056E+04
19	24	1.421E-96	8.437E+00	5.625E+01	-2.434E+03
20	24	3.245E-96	0.	1.695E+03	-3.751E+03
21	24	-1.071E-03	0.	0.	0.
-1	25	-3.434E-03	0.	0.	-1.285E-10
0	25	-4.649E-03	-1.928E-10	-1.919E+03	-4.575E+02
1	25	-4.221E-03	-4.804E+02	-4.140E+03	-9.150E+02
2	25	-3.391E-03	-7.710E+02	-4.624E+03	-9.150E+02
3	25	-2.782E-03	-9.356E+02	-4.962E+03	-9.150E+02
4	25	-2.720E-03	-9.688E+02	-5.020E+03	-9.150E+02
5	25	-3.274E-03	-8.719E+02	-4.758E+03	-9.150E+02
6	25	-4.279E-03	-6.470E+02	-4.183E+03	-9.150E+02
7	25	-5.340E-03	-3.021E+02	-3.359E+03	-9.150E+02
8	25	-5.825E-03	1.203E+02	-2.451E+03	-9.150E+02
9	25	-4.917E-03	4.738E+02	-1.793E+03	-9.150E+02
10	25	-1.889E-03	4.686E+02	-1.814E+03	-9.150E+02
11	25	3.254E-03	2.430E+02	-2.483E+03	-9.150E+02
12	25	1.015E-02	-3.671E+02	-3.881E+03	-9.150E+02
13	25	1.767E-02	-1.097E+03	-5.601E+03	-9.150E+02
14	25	2.445E-02	-1.816E+03	-7.272E+03	-9.150E+02
15	25	2.916E-02	-2.445E+03	-8.531E+03	-9.150E+02
16	25	3.054E-02	-2.760E+03	-8.839E+03	-9.150E+02
17	25	2.783E-02	-2.296E+03	-7.570E+03	-9.150E+02

18	25	2.180E-02	-1.436E+03	-5.082E+03	-9.150E+02
19	25	1.385E-02	-1.280E+03	-2.169E+03	-9.150E+02
20	25	3.173E-03	-6.366E-12	8.848E+02	-4.575E+02
21	25	-8.262E-03	0.	0.	-4.244E-12
-1	26	-1.330E-02	0.	0.	-6.548E-11
0	26	-1.417E-02	-9.823E-11	-1.196E+03	-4.080E+02
1	26	-1.360E-02	-2.342E+02	-2.452E+03	-8.160E+02
2	26	-1.250E-02	-4.660E+02	-2.639E+03	-8.160E+02
3	26	-1.168E-02	-6.077E+02	-2.781E+03	-8.160E+02
4	26	-1.163E-02	-6.298E+02	-2.784E+03	-8.160E+02
5	26	-1.242E-02	-5.249E+02	-2.614E+03	-8.160E+02
6	26	-1.374E-02	-2.966E+02	-2.280E+03	-8.160E+02
7	26	-1.489E-02	3.525E+01	-1.837E+03	-8.160E+02
8	26	-1.478E-02	4.111E+02	-1.394E+03	-8.160E+02
9	26	-1.220E-02	6.926E+02	-1.120E+03	-8.160E+02
10	26	-6.170E-03	6.857E+02	-1.176E+03	-8.160E+02
11	26	3.311E-03	4.244E+02	-1.606E+03	-8.160E+02
12	26	1.545E-02	-1.466E+02	-2.377E+03	-8.160E+02
13	26	2.844E-02	-8.487E+02	-3.319E+03	-8.160E+02
14	26	4.002E-02	-1.540E+03	-4.212E+03	-8.160E+02
15	26	4.796E-02	-2.099E+03	-4.813E+03	-8.160E+02
16	26	5.039E-02	-2.313E+03	-4.867E+03	-8.160E+02
17	26	4.649E-02	-1.922E+03	-4.223E+03	-8.160E+02
18	26	3.743E-02	-1.252E+03	-3.058E+03	-8.160E+02
19	26	2.519E-02	-1.350E+03	-1.735E+03	-8.160E+02
20	26	8.592E-03	-1.155E-10	3.389E+02	-4.080E+02
21	26	-8.416E-03	0.	0.	-7.700E-11
-1	27	-2.754E-02	0.	0.	-1.310E-10
0	27	-2.794E-02	-1.965E-10	-6.017E+02	-3.600E+02
1	27	-2.729E-02	-1.052E+02	-1.208E+03	-7.200E+02
2	27	-2.618E-02	-2.389E+02	-1.268E+03	-7.200E+02
3	27	-2.537E-02	-3.268E+02	-1.308E+03	-7.200E+02
4	27	-2.532E-02	-3.307E+02	-1.284E+03	-7.200E+02
5	27	-2.607E-02	-2.365E+02	-1.175E+03	-7.200E+02
6	27	-2.718E-02	-4.837E+01	-9.918E+02	-7.200E+02
7	27	-2.771E-02	2.088E+02	-7.691E+02	-7.200E+02
8	27	-2.633E-02	4.775E+02	-5.700E+02	-7.200E+02
9	27	-2.166E-02	6.567E+02	-4.733E+02	-7.200E+02
10	27	-1.272E-02	6.336E+02	-5.432E+02	-7.200E+02
11	27	3.973E-04	3.994E+02	-8.049E+02	-7.200E+02
12	27	1.657E-02	-4.786E+01	-1.225E+03	-7.200E+02
13	27	3.353E-02	-5.980E+02	-1.721E+03	-7.200E+02
14	27	4.850E-02	-1.132E+03	-2.173E+03	-7.200E+02
15	27	5.876E-02	-1.531E+03	-2.451E+03	-7.200E+02
16	27	6.220E-02	-1.647E+03	-2.449E+03	-7.200E+02
17	27	5.815E-02	-1.371E+03	-2.139E+03	-7.200E+02
18	27	4.795E-02	-9.138E+02	-1.608E+03	-7.200E+02
19	27	3.381E-02	-9.042E+02	-9.603E+02	-7.200E+02
20	27	1.522E-02	-1.043E-10	1.212E+02	-3.600E+02
21	27	-3.588E-03	0.	0.	-6.950E-11
-1	28	-4.509E-02	0.	0.	1.871E-10
0	28	-4.485E-02	2.807E-10	-1.967E+02	-3.105E+02
1	28	-4.407E-02	-3.676E+01	-4.115E+02	-6.210E+02
2	28	-4.307E-02	-8.928E+01	-4.046E+02	-6.210E+02
3	28	-4.233E-02	-1.274E+02	-3.859E+02	-6.210E+02
4	28	-4.222E-02	-1.168E+02	-3.450E+02	-6.210E+02
5	28	-4.270E-02	-4.288E+01	-2.749E+02	-6.210E+02

6	28	-4.319E-02	9.051E+01	-1.829E+02	-6.210E+02
7	28	-4.261E-02	2.606E+02	-9.155E+01	-6.210E+02
8	28	-3.955E-02	4.232E+02	-3.221E+01	-6.210E+02
9	28	-3.261E-02	5.162E+02	-3.248E+01	-6.210E+02
10	28	-2.094E-02	4.811E+02	-1.075E+02	-6.210E+02
11	28	-4.767E-03	3.023E+02	-2.636E+02	-6.210E+02
12	28	1.451E-02	-5.670E+00	-4.762E+02	-6.210E+02
13	28	3.437E-02	-3.783E+02	-7.073E+02	-6.210E+02
14	28	5.178E-02	-7.313E+02	-9.008E+02	-6.210E+02
15	28	6.377E-02	-9.763E+02	-1.001E+03	-6.210E+02
16	28	6.828E-02	-1.031E+03	-9.813E+02	-6.210E+02
17	28	6.478E-02	-8.608E+02	-8.555E+02	-6.210E+02
18	28	5.464E-02	-5.628E+02	-6.475E+02	-6.210E+02
19	28	4.028E-02	-4.443E+02	-4.285E+02	-6.210E+02
20	28	2.247E-02	-6.378E-11	6.538E+01	-3.105E+02
21	28	4.489E-03	0.	0.	-4.252E-11
-1	29	-6.418E-02	0.	0.	6.472E-10
0	29	-6.334E-02	9.707E-10	6.244E-10	-3.248E+02
1	29	-6.250E-02	5.903E+01	3.763E-09	-6.496E+02
2	29	-6.154E-02	-9.752E+01	4.755E-09	-6.496E+02
3	29	-6.077E-02	-2.183E+02	3.387E-09	-6.496E+02
4	29	-6.044E-02	-1.458E+02	4.550E-09	-6.496E+02
5	29	-6.040E-02	1.883E+02	4.430E-09	-6.496E+02
6	29	-5.998E-02	7.658E+02	2.994E-09	-6.496E+02
7	29	-5.804E-02	1.481E+03	4.909E-09	-6.496E+02
8	29	-5.315E-02	2.141E+03	4.378E-09	-6.496E+02
9	29	-4.400E-02	2.490E+03	3.283E-09	-6.496E+02
10	29	-2.988E-02	2.303E+03	1.011E-09	-6.496E+02
11	29	-1.118E-02	1.507E+03	5.048E-10	-6.496E+02
12	29	1.053E-02	1.813E+02	-6.502E-10	-6.496E+02
13	29	3.260E-02	-1.409E+03	-1.060E-09	-6.496E+02
14	29	5.186E-02	-2.901E+03	-1.814E-09	-6.496E+02
15	29	6.534E-02	-3.916E+03	-1.673E-09	-6.496E+02
16	29	7.103E-02	-4.131E+03	-9.240E-10	-6.496E+02
17	29	6.848E-02	-3.452E+03	-1.095E-09	-6.496E+02
18	29	5.906E-02	-2.184E+03	-1.419E-09	-6.496E+02
19	29	4.529E-02	-6.343E+02	-1.197E-09	-6.496E+02
20	29	3.025E-02	-3.236E-10	-2.993E-10	-3.248E+02
21	29	1.522E-02	0.	0.	-2.157E-10
-1	30	-8.327E-02	0.	0.	0.
0	30	-8.183E-02	0.	0.	9.365E-10
1	30	-8.093E-02	0.	0.	5.645E-09
2	30	-7.999E-02	0.	0.	7.133E-09
3	30	-7.918E-02	0.	0.	5.080E-09
4	30	-7.864E-02	0.	0.	6.825E-09
5	30	-7.813E-02	0.	0.	6.645E-09
6	30	-7.688E-02	0.	0.	4.490E-09
7	30	-7.367E-02	0.	0.	7.363E-09
8	30	-6.704E-02	0.	0.	6.567E-09
9	30	-5.572E-02	0.	0.	4.925E-09
10	30	-3.913E-02	0.	0.	1.517E-09
11	30	-1.779E-02	0.	0.	7.572E-10
12	30	6.531E-03	0.	0.	-9.753E-10
13	30	3.101E-02	0.	0.	-1.591E-09
14	30	5.233E-02	0.	0.	-2.720E-09
15	30	6.744E-02	0.	0.	-2.510E-09
16	30	7.432E-02	0.	0.	-1.386E-09
17	30	7.264E-02	0.	0.	-1.643E-09

18	30	6.377E-02	0.	0.	-2.128E-09
19	30	5.039E-02	0.	0.	-1.795E-09
20	30	3.804E-02	0.	0.	-4.490E-10
21	30	2.595E-02	0.	0.	0.

PROB (CONTD)
610 60 X 58 SLAB SIMPLE SUPPORTS AND CONCENTRATED LOADS

TABLE 4. RESULTS(CONTD)

I,J		TMX	TMY
-1	-1	0.	0.
0	-1	0.	0.
1	-1	0.	0.
2	-1	0.	0.
3	-1	0.	0.
4	-1	0.	0.
5	-1	0.	0.
6	-1	0.	0.
7	-1	0.	0.
8	-1	0.	0.
9	-1	0.	0.
10	-1	0.	0.
11	-1	0.	0.
12	-1	C.	0.
13	-1	0.	0.
14	-1	0.	0.
15	-1	0.	0.
16	-1	0.	0.
17	-1	0.	0.
18	-1	0.	0.
19	-1	0.	0.
20	-1	0.	0.
21	-1	0.	0.
-1	0	0.	0.
0	0	-4.364E+01	4.364E+01
1	0	-7.910E+00	7.910E+00
2	0	-5.626E+00	5.626E+00
3	0	-3.583E+01	3.583E+01
4	0	-9.101E+01	9.101E+01
5	0	-1.680E+02	1.680E+02
6	0	-2.642E+02	2.642E+02
7	0	-3.716E+02	3.716E+02
8	0	-4.749E+02	4.749E+02
9	0	-5.544E+02	5.544E+02
10	0	-5.971E+02	5.971E+02
11	0	-6.017E+02	6.017E+02
12	0	-5.721E+02	5.721E+02
13	0	-5.118E+02	5.118E+02
14	0	-4.284E+02	4.284E+02
15	0	-3.386E+02	3.386E+02

16	0	-2.582E+02	2.582E+02
17	0	-1.871E+02	1.871E+02
18	0	-1.407E+02	1.407E+02
19	0	-2.084E+02	2.084E+02
20	0	0.	0.
21	0	0.	0.
-1	1	0.	0.
0	1	-6.351E+01	6.351E+01
1	1	-9.141E+00	9.141E+00
2	1	7.921E+00	-7.921E+00
3	1	-2.785E+01	2.785E+01
4	1	-9.652E+01	9.652E+01
5	1	-1.958E+02	1.958E+02
6	1	-3.275E+02	3.275E+02
7	1	-4.854E+02	4.854E+02
8	1	-6.475E+02	6.475E+02
9	1	-7.805E+02	7.805E+02
10	1	-8.600E+02	8.600E+02
11	1	-8.821E+02	8.821E+02
12	1	-8.495E+02	8.495E+02
13	1	-7.598E+02	7.598E+02
14	1	-6.196E+02	6.196E+02
15	1	-4.599E+02	4.599E+02
16	1	-3.161E+02	3.161E+02
17	1	-1.894E+02	1.894E+02
18	1	-1.063E+02	1.063E+02
19	1	-1.887E+02	1.887E+02
20	1	0.	0.
21	1	0.	0.
-1	2	0.	0.
0	2	-3.749E+01	3.749E+01
1	2	-7.533E+00	7.533E+00
2	2	5.672E+00	-5.672E+00
3	2	-4.651E+00	4.651E+00
4	2	-2.702E+01	2.702E+01
5	2	-6.863E+01	6.863E+01
6	2	-1.416E+02	1.416E+02
7	2	-2.517E+02	2.517E+02
8	2	-3.891E+02	3.891E+02
9	2	-5.282E+02	5.282E+02
10	2	-6.414E+02	6.414E+02
11	2	-7.116E+02	7.116E+02
12	2	-7.242E+02	7.242E+02
13	2	-6.619E+02	6.619E+02
14	2	-5.222E+02	5.222E+02
15	2	-3.345E+02	3.345E+02
16	2	-1.459E+02	1.459E+02
17	2	2.238E+01	-2.238E+01
18	2	1.498E+02	-1.498E+02
19	2	5.706E+01	-5.706E+01
20	2	0.	0.
21	2	0.	0.
-1	3	0.	0.
0	3	-3.970E+01	3.970E+01
1	3	-3.429E+01	3.429E+01
2	3	-3.691E+01	3.691E+01
3	3	-2.062E+01	2.062E+01

4	3	4.355E+00	-4.355E+00
5	3	5.731E+00	-5.731E+00
6	3	-5.352E+01	5.352E+01
7	3	-2.015E+02	2.015E+02
8	3	-4.430E+02	4.430E+02
9	3	-7.473E+02	7.473E+02
10	3	-1.055E+03	1.055E+03
11	3	-1.298E+03	1.298E+03
12	3	-1.407E+03	1.407E+03
13	3	-1.325E+03	1.325E+03
14	3	-1.037E+03	1.037E+03
15	3	-5.910E+02	5.910E+02
16	3	-9.048E+01	9.048E+01
17	3	3.693E+02	-3.693E+02
18	3	7.361E+02	-7.361E+02
19	3	4.876E+02	-4.876E+02
20	3	0.	0.
21	3	0.	0.
-1	4	0.	0.
0	4	-6.238E+01	6.238E+01
1	4	-1.643E+02	1.643E+02
2	4	-1.988E+02	1.988E+02
3	4	-9.617E+01	9.617E+01
4	4	6.363E+01	-6.363E+01
5	4	1.977E+02	-1.977E+02
6	4	2.241E+02	-2.241E+02
7	4	6.751E+01	-6.751E+01
8	4	-3.258E+02	3.258E+02
9	4	-9.542E+02	9.542E+02
10	4	-1.708E+03	1.708E+03
11	4	-2.373E+03	2.373E+03
12	4	-2.725E+03	2.725E+03
13	4	-2.637E+03	2.637E+03
14	4	-2.085E+03	2.085E+03
15	4	-1.122E+03	1.122E+03
16	4	9.789E+01	-9.789E+01
17	4	1.272E+03	-1.272E+03
18	4	2.156E+03	-2.156E+03
19	4	1.538E+03	-1.538E+03
20	4	0.	0.
21	4	0.	0.
-1	5	0.	0.
0	5	-1.254E+02	1.254E+02
1	5	-5.890E+02	5.890E+02
2	5	-5.753E+02	5.753E+02
3	5	-2.724E+02	2.724E+02
4	5	1.450E+02	-1.450E+02
5	5	5.372E+02	-5.372E+02
6	5	7.779E+02	-7.779E+02
7	5	7.328E+02	-7.328E+02
8	5	2.485E+02	-2.485E+02
9	5	-8.262E+02	8.262E+02
10	5	-2.366E+03	2.366E+03
11	5	-3.811E+03	3.811E+03
12	5	-4.587E+03	4.587E+03
13	5	-4.522E+03	4.522E+03
14	5	-3.672E+03	3.672E+03
15	5	-2.030E+03	2.030E+03

16	5	4.396E+02	-4.396E+02
17	5	2.981E+03	-2.981E+03
18	5	4.890E+03	-4.890E+03
19	5	3.304E+03	-3.304E+03
20	5	0.	0.
21	5	0.	0.
-1	6	0.	0.
0	6	-6.590E+02	6.590E+02
1	6	-1.454E+03	1.454E+03
2	6	-1.081E+03	1.081E+03
3	6	-4.909E+02	4.909E+02
4	6	1.899E+02	-1.899E+02
5	6	8.297E+02	-8.297E+02
6	6	1.293E+03	-1.293E+03
7	6	1.417E+03	-1.417E+03
8	6	9.802E+02	-9.802E+02
9	6	-3.015E+02	3.015E+02
10	6	-2.669E+03	2.669E+03
11	6	-4.954E+03	4.954E+03
12	6	-5.968E+03	5.968E+03
13	6	-5.883E+03	5.883E+03
14	6	-4.842E+03	4.842E+03
15	6	-2.769E+03	2.769E+03
16	6	7.476E+02	-7.476E+02
17	6	4.465E+03	-4.465E+03
18	6	7.157E+03	-7.157E+03
19	6	4.571E+03	-4.571E+03
20	6	0.	0.
21	6	0.	0.
-1	7	0.	0.
0	7	-1.277E+03	1.277E+03
1	7	-2.223E+03	2.223E+03
2	7	-1.496E+03	1.496E+03
3	7	-6.701E+02	6.701E+02
4	7	1.844E+02	-1.844E+02
5	7	9.697E+02	-9.697E+02
6	7	1.560E+03	-1.560E+03
7	7	1.786E+03	-1.786E+03
8	7	1.420E+03	-1.420E+03
9	7	1.366E+02	-1.366E+02
10	7	-2.726E+03	2.726E+03
11	7	-5.510E+03	5.510E+03
12	7	-6.532E+03	6.532E+03
13	7	-6.372E+03	6.372E+03
14	7	-5.202E+03	5.202E+03
15	7	-2.998E+03	2.998E+03
16	7	9.215E+02	-9.215E+02
17	7	5.038E+03	-5.038E+03
18	7	7.805E+03	-7.805E+03
19	7	4.921E+03	-4.921E+03
20	7	0.	0.
21	7	0.	0.
-1	8	0.	0.
0	8	-1.401E+03	1.401E+03
1	8	-2.464E+03	2.464E+03
2	8	-1.686E+03	1.686E+03
3	8	-7.715E+02	7.715E+02

4	8	1.590E+02	-1.590E+02
5	8	1.007E+03	-1.007E+03
6	8	1.650E+03	-1.650E+03
7	8	1.924E+03	-1.924E+03
8	8	1.596E+03	-1.596E+03
9	8	3.051E+02	-3.051E+02
10	8	-2.648E+03	2.648E+03
11	8	-5.521E+03	5.521E+03
12	8	-6.539E+03	6.539E+03
13	8	-6.308E+03	6.308E+03
14	8	-5.008E+03	5.008E+03
15	8	-2.597E+03	2.597E+03
16	8	9.746E+02	-9.746E+02
17	8	4.706E+03	-4.706E+03
18	8	7.583E+03	-7.583E+03
19	8	4.860E+03	-4.860E+03
20	8	0.	0.
21	8	0.	0.
-1	9	0.	0.
0	9	-1.337E+03	1.337E+03
1	9	-2.382E+03	2.382E+03
2	9	-1.669E+03	1.669E+03
3	9	-7.834E+02	7.834E+02
4	9	1.304E+02	-1.304E+02
5	9	9.641E+02	-9.641E+02
6	9	1.598E+03	-1.598E+03
7	9	1.875E+03	-1.875E+03
8	9	1.568E+03	-1.568E+03
9	9	3.258E+02	-3.258E+02
10	9	-2.450E+03	2.450E+03
11	9	-5.143E+03	5.143E+03
12	9	-6.107E+03	6.107E+03
13	9	-5.847E+03	5.847E+03
14	9	-4.540E+03	4.540E+03
15	9	-2.147E+03	2.147E+03
16	9	9.353E+02	-9.353E+02
17	9	4.144E+03	-4.144E+03
18	9	6.924E+03	-6.924E+03
19	9	4.496E+03	-4.496E+03
20	9	0.	0.
21	9	0.	0.
-1	10	0.	0.
0	10	-1.170E+03	1.170E+03
1	10	-2.105E+03	2.105E+03
2	10	-1.503E+03	1.503E+03
3	10	-7.196E+02	7.196E+02
4	10	1.051E+02	-1.051E+02
5	10	8.618E+02	-8.618E+02
6	10	1.437E+03	-1.437E+03
7	10	1.686E+03	-1.686E+03
8	10	1.402E+03	-1.402E+03
9	10	2.769E+02	-2.769E+02
10	10	-2.148E+03	2.148E+03
11	10	-4.493E+03	4.493E+03
12	10	-5.353E+03	5.353E+03
13	10	-5.117E+03	5.117E+03
14	10	-3.992E+03	3.992E+03
15	10	-2.097E+03	2.097E+03

16	10	8.328E+02	-8.328E+02
17	10	3.863E+03	-3.863E+03
18	10	6.077E+03	-6.077E+03
19	10	3.922E+03	-3.922E+03
20	10	0.	0.
21	10	0.	0.
-1	11	0.	0.
0	11	-9.480E+02	9.480E+02
1	11	-1.716E+03	1.716E+03
2	11	-1.240E+03	1.240E+03
3	11	-6.015E+02	6.015E+02
4	11	8.318E+01	-8.318E+01
5	11	7.154E+02	-7.154E+02
6	11	1.195E+03	-1.195E+03
7	11	1.397E+03	-1.397E+03
8	11	1.149E+03	-1.149E+03
9	11	2.043E+02	-2.043E+02
10	11	-1.764E+03	1.764E+03
11	11	-3.660E+03	3.660E+03
12	11	-4.368E+03	4.368E+03
13	11	-4.161E+03	4.161E+03
14	11	-3.215E+03	3.215E+03
15	11	-1.627E+03	1.627E+03
16	11	6.885E+02	-6.885E+02
17	11	3.082E+03	-3.082E+03
18	11	4.923E+03	-4.923E+03
19	11	3.183E+03	-3.183E+03
20	11	0.	0.
21	11	0.	0.
-1	12	0.	0.
0	12	-6.953E+02	6.953E+02
1	12	-1.263E+03	1.263E+03
2	12	-9.199E+02	9.199E+02
3	12	-4.490E+02	4.490E+02
4	12	6.267E+01	-6.267E+01
5	12	5.375E+02	-5.375E+02
6	12	8.963E+02	-8.963E+02
7	12	1.043E+03	-1.043E+03
8	12	8.469E+02	-8.469E+02
9	12	1.314E+02	-1.314E+02
10	12	-1.318E+03	1.318E+03
11	12	-2.709E+03	2.709E+03
12	12	-3.231E+03	3.231E+03
13	12	-3.055E+03	3.055E+03
14	12	-2.300E+03	2.300E+03
15	12	-1.060E+03	1.060E+03
16	12	5.161E+02	-5.161E+02
17	12	2.149E+03	-2.149E+03
18	12	3.574E+03	-3.574E+03
19	12	2.337E+03	-2.337E+03
20	12	0.	0.
21	12	0.	0.
-1	13	0.	0.
0	13	-4.269E+02	4.269E+02
1	13	-7.768E+02	7.768E+02
2	13	-5.680E+02	5.680E+02
3	13	-2.772E+02	2.772E+02

4	13	4.179E+01	-4.179E+01
5	13	3.385E+02	-3.385E+02
6	13	5.613E+02	-5.613E+02
7	13	6.485E+02	-6.485E+02
8	13	5.192E+02	-5.192E+02
9	13	6.696E+01	-6.696E+01
10	13	-8.297E+02	8.297E+02
11	13	-1.686E+03	1.686E+03
12	13	-2.006E+03	2.006E+03
13	13	-1.877E+03	1.877E+03
14	13	-1.353E+03	1.353E+03
15	13	-4.990E+02	4.990E+02
16	13	3.251E+02	-3.251E+02
17	13	1.184E+03	-1.184E+03
18	13	2.151E+03	-2.151E+03
19	13	1.439E+03	-1.439E+03
20	13	0.	0.
21	13	0.	0.
-1	14	0.	0.
0	14	-1.513E+02	1.513E+02
1	14	-2.754E+02	2.754E+02
2	14	-2.010E+02	2.010E+02
3	14	-9.608E+01	9.608E+01
4	14	1.989E+01	-1.989E+01
5	14	1.274E+02	-1.274E+02
6	14	2.062E+02	-2.062E+02
7	14	2.332E+02	-2.332E+02
8	14	1.800E+02	-1.800E+02
9	14	1.094E+01	-1.094E+01
10	14	-3.161E+02	3.161E+02
11	14	-6.273E+02	6.273E+02
12	14	-7.438E+02	7.438E+02
13	14	-6.901E+02	6.901E+02
14	14	-4.664E+02	4.664E+02
15	14	-4.777E+01	4.777E+01
16	14	1.234E+02	-1.234E+02
17	14	3.055E+02	-3.055E+02
18	14	7.620E+02	-7.620E+02
19	14	5.299E+02	-5.299E+02
20	14	0.	0.
21	14	0.	0.
-1	15	0.	0.
0	15	1.264E+02	-1.264E+02
1	15	2.304E+02	-2.304E+02
2	15	1.702E+02	-1.702E+02
3	15	8.748E+01	-8.748E+01
4	15	-2.678E+00	2.678E+00
5	15	-8.774E+01	8.774E+01
6	15	-1.553E+02	1.553E+02
7	15	-1.886E+02	1.886E+02
8	15	-1.623E+02	1.623E+02
9	15	-4.156E+01	4.156E+01
10	15	2.076E+02	-2.076E+02
11	15	4.457E+02	-4.457E+02
12	15	5.297E+02	-5.297E+02
13	15	4.816E+02	-4.816E+02
14	15	3.062E+02	-3.062E+02
15	15	-2.350E+01	2.350E+01

16	15	-8.139E+01	8.139E+01
17	15	-1.535E+02	1.535E+02
18	15	-5.240E+02	5.240E+02
19	15	-3.752E+02	3.752E+02
20	15	0.	0.
21	15	0.	0.
-1	16	0.	0.
0	16	4.023E+02	-4.023E+02
1	16	7.321E+02	-7.321E+02
2	16	5.368E+02	-5.368E+02
3	16	2.678E+02	-2.678E+02
4	16	-2.522E+01	2.522E+01
5	16	-2.991E+02	2.991E+02
6	16	-5.102E+02	5.102E+02
7	16	-6.037E+02	6.037E+02
8	16	-5.019E+02	5.019E+02
9	16	-9.716E+01	9.716E+01
10	16	7.277E+02	-7.277E+02
11	16	1.516E+03	-1.516E+03
12	16	1.802E+03	-1.802E+03
13	16	1.674E+03	-1.674E+03
14	16	1.194E+03	-1.194E+03
15	16	4.276E+02	-4.276E+02
16	16	-2.816E+02	2.816E+02
17	16	-1.030E+03	1.030E+03
18	16	-1.918E+03	1.918E+03
19	16	-1.294E+03	1.294E+03
20	16	0.	0.
21	16	0.	0.
-1	17	0.	0.
0	17	6.718E+02	-6.718E+02
1	17	1.219E+03	-1.219E+03
2	17	8.882E+02	-8.882E+02
3	17	4.383E+02	-4.383E+02
4	17	-4.755E+01	4.755E+01
5	17	-4.988E+02	4.988E+02
6	17	-8.449E+02	8.449E+02
7	17	-9.976E+02	9.976E+02
8	17	-8.304E+02	8.304E+02
9	17	-1.612E+02	1.612E+02
10	17	1.229E+03	-1.229E+03
11	17	2.563E+03	-2.563E+03
12	17	3.046E+03	-3.046E+03
13	17	2.862E+03	-2.862E+03
14	17	2.144E+03	-2.144E+03
15	17	9.874E+02	-9.874E+02
16	17	-4.700E+02	4.700E+02
17	17	-1.989E+03	1.989E+03
18	17	-3.348E+03	3.348E+03
19	17	-2.212E+03	2.212E+03
20	17	0.	0.
21	17	0.	0.
-1	18	0.	0.
0	18	9.271E+02	-9.271E+02
1	18	1.675E+03	-1.675E+03
2	18	1.209E+03	-1.209E+03
3	18	5.889E+02	-5.889E+02

4	18	-7.060E+01	7.060E+01
5	18	-6.787E+02	6.787E+02
6	18	-1.144E+03	1.144E+03
7	18	-1.351E+03	1.351E+03
8	18	-1.133E+03	1.133E+03
9	18	-2.345E+02	2.345E+02
10	18	1.696E+03	-1.696E+03
11	18	3.554E+03	-3.554E+03
12	18	4.216E+03	-4.216E+03
13	18	3.987E+03	-3.987E+03
14	18	3.064E+03	-3.064E+03
15	18	1.553E+03	-1.553E+03
16	18	-6.407E+02	6.407E+02
17	18	-2.913E+03	2.913E+03
18	18	-4.702E+03	4.702E+03
19	18	-3.090E+03	3.090E+03
20	18	0.	0.
21	18	0.	0.
-1	19	0.	0.
0	19	1.155E+03	-1.155E+03
1	19	2.072E+03	-2.072E+03
2	19	1.473E+03	-1.473E+03
3	19	7.054E+02	-7.054E+02
4	19	-9.662E+01	9.662E+01
5	19	-8.300E+02	8.300E+02
6	19	-1.389E+03	1.389E+03
7	19	-1.639E+03	1.639E+03
8	19	-1.385E+03	1.385E+03
9	19	-3.082E+02	3.082E+02
10	19	2.110E+03	-2.110E+03
11	19	4.444E+03	-4.444E+03
12	19	5.248E+03	-5.248E+03
13	19	4.974E+03	-4.974E+03
14	19	3.854E+03	-3.854E+03
15	19	2.020E+03	-2.020E+03
16	19	-7.887E+02	7.887E+02
17	19	-3.686E+03	3.686E+03
18	19	-5.854E+03	5.854E+03
19	19	-3.876E+03	3.876E+03
20	19	0.	0.
21	19	0.	0.
-1	20	0.	0.
0	20	1.330E+03	-1.330E+03
1	20	2.363E+03	-2.363E+03
2	20	1.646E+03	-1.646E+03
3	20	7.692E+02	-7.692E+02
4	20	-1.282E+02	1.282E+02
5	20	-9.433E+02	9.433E+02
6	20	-1.560E+03	1.560E+03
7	20	-1.831E+03	1.831E+03
8	20	-1.548E+03	1.548E+03
9	20	-3.573E+02	3.573E+02
10	20	2.449E+03	-2.449E+03
11	20	5.169E+03	-5.169E+03
12	20	6.066E+03	-6.066E+03
13	20	5.758E+03	-5.758E+03
14	20	4.434E+03	-4.434E+03
15	20	2.069E+03	-2.069E+03

16	20	-9.086E+02	9.086E+02
17	20	-3.976E+03	3.976E+03
18	20	-6.692E+03	6.692E+03
19	20	-4.510E+03	4.510E+03
20	20	0.	0.
21	20	0.	0.

-1	21	0.	0.
0	21	1.409E+03	-1.409E+03
1	21	2.469E+03	-2.469E+03
2	21	1.677E+03	-1.677E+03
3	21	7.619E+02	-7.619E+02
4	21	-1.655E+02	1.655E+02
5	21	-1.007E+03	1.007E+03
6	21	-1.638E+03	1.638E+03
7	21	-1.895E+03	1.895E+03
8	21	-1.569E+03	1.569E+03
9	21	-3.287E+02	3.287E+02
10	21	2.696E+03	-2.696E+03
11	21	5.634E+03	-5.634E+03
12	21	6.584E+03	-6.584E+03
13	21	6.315E+03	-6.315E+03
14	21	4.977E+03	-4.977E+03
15	21	2.537E+03	-2.537E+03
16	21	-9.888E+02	9.888E+02
17	21	-4.609E+03	4.609E+03
18	21	-7.370E+03	7.370E+03
19	21	-4.938E+03	4.938E+03
20	21	0.	0.
21	21	0.	0.

-1	22	0.	0.
0	22	1.306E+03	-1.306E+03
1	22	2.267E+03	-2.267E+03
2	22	1.519E+03	-1.519E+03
3	22	6.757E+02	-6.757E+02
4	22	-2.019E+02	2.019E+02
5	22	-1.009E+03	1.009E+03
6	22	-1.604E+03	1.604E+03
7	22	-1.808E+03	1.808E+03
8	22	-1.401E+03	1.401E+03
9	22	-1.255E+02	1.255E+02
10	22	2.828E+03	-2.828E+03
11	22	5.700E+03	-5.700E+03
12	22	6.703E+03	-6.703E+03
13	22	6.552E+03	-6.552E+03
14	22	5.334E+03	-5.334E+03
15	22	3.016E+03	-3.016E+03
16	22	-9.972E+02	9.972E+02
17	22	-5.156E+03	5.156E+03
18	22	-7.793E+03	7.793E+03
19	22	-5.057E+03	5.057E+03
20	22	0.	0.
21	22	0.	0.

-1	23	0.	0.
0	23	3.568E+02	-3.568E+02
1	23	7.797E+02	-7.797E+02
2	23	5.872E+02	-5.872E+02
3	23	2.659E+02	-2.659E+02

4	23	-1.099E+02	1.099E+02
5	23	-4.646E+02	4.646E+02
6	23	-7.214E+02	7.214E+02
7	23	-7.856E+02	7.856E+02
8	23	-5.267E+02	5.267E+02
9	23	2.046E+02	-2.046E+02
10	23	1.415E+03	-1.415E+03
11	23	2.586E+03	-2.586E+03
12	23	3.186E+03	-3.186E+03
13	23	3.184E+03	-3.184E+03
14	23	2.644E+03	-2.644E+03
15	23	1.516E+03	-1.516E+03
16	23	-4.276E+02	4.276E+02
17	23	-2.506E+03	2.506E+03
18	23	-3.998E+03	3.998E+03
19	23	-2.390E+03	2.390E+03
20	23	0.	0.
21	23	0.	0.
-1	24	0.	0.
0	24	8.053E+01	-8.053E+01
1	24	3.280E+02	-3.280E+02
2	24	3.207E+02	-3.207E+02
3	24	1.501E+02	-1.501E+02
4	24	-8.511E+01	8.511E+01
5	24	-3.075E+02	3.075E+02
6	24	-4.486E+02	4.486E+02
7	24	-4.321E+02	4.321E+02
8	24	-1.620E+02	1.620E+02
9	24	4.563E+02	-4.563E+02
10	24	1.214E+03	-1.214E+03
11	24	1.928E+03	-1.928E+03
12	24	2.406E+03	-2.406E+03
13	24	2.414E+03	-2.414E+03
14	24	1.988E+03	-1.988E+03
15	24	1.116E+03	-1.116E+03
16	24	-2.609E+02	2.609E+02
17	24	-1.717E+03	1.717E+03
18	24	-2.832E+03	2.832E+03
19	24	-1.692E+03	1.692E+03
20	24	0.	0.
21	24	0.	0.
-1	25	0.	0.
0	25	7.526E+01	-7.526E+01
1	25	1.984E+02	-1.984E+02
2	25	2.286E+02	-2.286E+02
3	25	1.043E+02	-1.043E+02
4	25	-8.763E+01	8.763E+01
5	25	-2.521E+02	2.521E+02
6	25	-2.937E+02	2.937E+02
7	25	-1.239E+02	1.239E+02
8	25	3.198E+02	-3.198E+02
9	25	1.026E+03	-1.026E+03
10	25	1.847E+03	-1.847E+03
11	25	2.574E+03	-2.574E+03
12	25	2.992E+03	-2.992E+03
13	25	2.924E+03	-2.924E+03
14	25	2.324E+03	-2.324E+03
15	25	1.235E+03	-1.235E+03

16	25	-1.751E+02	1.751E+02
17	25	-1.543E+03	1.543E+03
18	25	-2.536E+03	2.536E+03
19	25	-1.717E+03	1.717E+03
20	25	0.	0.
21	25	0.	0.
-1	26	0.	0.
0	26	4.293E+01	-4.293E+01
1	26	4.117E+01	-4.117E+01
2	26	3.949E+01	-3.949E+01
3	26	1.620E+01	-1.620E+01
4	26	-1.770E+01	1.770E+01
5	26	-2.547E+01	2.547E+01
6	26	3.569E+01	-3.569E+01
7	26	1.976E+02	-1.976E+02
8	26	4.633E+02	-4.633E+02
9	26	7.965E+02	-7.965E+02
10	26	1.144E+03	-1.144E+03
11	26	1.420E+03	-1.420E+03
12	26	1.542E+03	-1.542E+03
13	26	1.453E+03	-1.453E+03
14	26	1.131E+03	-1.131E+03
15	26	6.265E+02	-6.265E+02
16	26	5.961E+01	-5.961E+01
17	26	-4.541E+02	4.541E+02
18	26	-8.536E+02	8.536E+02
19	26	-5.808E+02	5.808E+02
20	26	0.	0.
21	26	0.	0.
-1	27	0.	0.
0	27	3.722E+01	-3.722E+01
1	27	6.159E+00	-6.159E+00
2	27	-1.004E+01	1.004E+01
3	27	-1.303E+00	1.303E+00
4	27	2.088E+01	-2.088E+01
5	27	6.472E+01	-6.472E+01
6	27	1.439E+02	-1.439E+02
7	27	2.641E+02	-2.641E+02
8	27	4.131E+02	-4.131E+02
9	27	5.641E+02	-5.641E+02
10	27	6.958E+02	-6.958E+02
11	27	7.801E+02	-7.801E+02
12	27	7.909E+02	-7.909E+02
13	27	7.171E+02	-7.171E+02
14	27	5.574E+02	-5.574E+02
15	27	3.459E+02	-3.459E+02
16	27	1.399E+02	-1.399E+02
17	27	-3.816E+01	3.816E+01
18	27	-1.808E+02	1.808E+02
19	27	-9.398E+01	9.398E+01
20	27	0.	0.
21	27	0.	0.
-1	28	0.	0.
0	28	6.184E+01	-6.184E+01
1	28	3.787E+00	-3.787E+00
2	28	-1.670E+01	1.670E+01
3	28	1.975E+01	-1.975E+01

4	28	9.322E+01	-9.322E+01
5	28	2.012E+02	-2.012E+02
6	28	3.453E+02	-3.453E+02
7	28	5.176E+02	-5.176E+02
8	28	6.925E+02	-6.925E+02
9	28	8.368E+02	-8.368E+02
10	28	9.319E+02	-9.319E+02
11	28	9.628E+02	-9.628E+02
12	28	9.214E+02	-9.214E+02
13	28	8.131E+02	-8.131E+02
14	28	6.508E+02	-6.508E+02
15	28	4.735E+02	-4.735E+02
16	28	3.243E+02	-3.243E+02
17	28	1.980E+02	-1.980E+02
18	28	9.949E+01	-9.949E+01
19	28	1.699E+02	-1.699E+02
20	28	0.	0.
21	28	0.	0.
-1	29	0.	0.
0	29	4.263E+01	-4.263E+01
1	29	4.191E+00	-4.191E+00
2	29	1.174E-01	-1.174E-01
3	29	3.145E+01	-3.145E+01
4	29	9.085E+01	-9.085E+01
5	29	1.748E+02	-1.748E+02
6	29	2.799E+02	-2.799E+02
7	29	3.970E+02	-3.970E+02
8	29	5.088E+02	-5.088E+02
9	29	5.957E+02	-5.957E+02
10	29	6.462E+02	-6.462E+02
11	29	6.537E+02	-6.537E+02
12	29	6.180E+02	-6.180E+02
13	29	5.461E+02	-5.461E+02
14	29	4.500E+02	-4.500E+02
15	29	3.514E+02	-3.514E+02
16	29	2.689E+02	-2.689E+02
17	29	1.979E+02	-1.979E+02
18	29	1.436E+02	-1.436E+02
19	29	2.058E+02	-2.058E+02
20	29	0.	0.
21	29	0.	0.
-1	30	0.	0.
0	30	0.	0.
1	30	0.	0.
2	30	0.	0.
3	30	0.	0.
4	30	0.	0.
5	30	0.	0.
6	30	0.	0.
7	30	0.	0.
8	30	0.	0.
9	30	0.	0.
10	30	0.	0.
11	30	0.	0.
12	30	0.	0.
13	30	0.	0.
14	30	0.	0.
15	30	0.	0.

16	30	0.	0.
17	30	0.	0.
18	30	0.	0.
19	30	0.	0.
20	30	0.	0.
21	30	0.	0.

TIME FOR THIS PROBLEM = 0 MINUTES 39.256 SECONDS

ELAPSED CPU TIME = 0 MINUTES 51.154 SECONDS