A DIRECT COMPUTER SOLUTION FOR PLANE FRAMES

by

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Research Report Number 56-14

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

Research Project 3-5-63-56

conducted for

The Texas Highway Department

in cooperation with the
U. S. Department of Transportation
Federal Highway Administration
Bureau of Public Roads

by the

CENTER FOR HIGHWAY RESEARCH
THE UNIVERSITY OF TEXAS AT AUSTIN

May 1969

PREFACE

This report presents the results of an analytical study undertaken to combine the versatility of discrete-element beam-column modelling and direct solution techniques with conventional frame analysis procedures. The basic beam-column analytical procedure used herein has been well-documented in previous reports. It is presumed that the reader has read these reports and is familiar with discrete-element beam-column modelling.

This is the fourteenth in a series of reports that describe work under Research Project No. 3-5-63-56, "Development of Methods for Computer Simulation of Beam-Columns and Grid-Beam and Slab Systems." The reader will find it advantageous to review Reports No. 56-1, 56-3, 56-4, and 56-7, which provide background information for this report.

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 at Austin.

Thanks are due to the members of the staff of the Center for Highway Research for their assistance in producing this report.

William P. Dawkins
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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.

Report No. 56-11, "A Discrete-Element Solution of Plates and Pavement Slabs Using a Variable-Increment-Length Model" by Charles M. Pearre, III, and W. Ronald Hudson, presents a method of solving for the deflected shape of freely discontinuous plates and pavement slabs subjected to a variety of loads.

Report No. 56-12, "A Discrete-Element Method of Analysis for Combined Bending and Shear Deformations of a Beam" by David F. Tankersley and William P. Dawkins, presents a method of analysis for the combined effects of bending and shear deformations.

Report No. 56-13, "A Discrete-Element Method of Multiple-Loading Analysis for Two-Way Bridge Floor Slabs" by John J. Panak and Hudson Matlock, includes a procedure for analysis of two-way bridge floor slabs continuous over many supports.

Report No. 56-14, "A Direct Computer Solution for Plane Frames" by William P. Dawkins and John R. Ruser, Jr., presents a direct method of solution for the computer analysis of plane frame structures.

ABSTRACT

A direct method of solution for the computer analysis of plane frame structures is presented. The method combines the discrete-element beam-column model for the evaluation of stiffness terms for nonprismatic members with the direct solution techniques of conventional frame analysis. Flexural properties, loads, and elastic spring restraints are allowed to vary at will along any member. The method is not restricted to orthogonal frameworks.

No restrictions are placed on the mode of deformation of the frame. The effect of axial deformations on frame behavior is considered and the investigation of the effects of axial thrust on bending stiffness is allowed.

A reduction in input is achieved by a grid type description of the frame. Several example solutions are presented.

TABLE OF CONTENTS

NOMENCLATURE

Symbol	Typical Units	Definition
A	in^2	Cross section area
C_x , C_y	--	Direction cosines of x_m-axis with respect to x and y-axes, respectively
E	lb/in^2	Modulus of elasticity
$f_{x,i}$, $f_{y,i}$	lb	Member forces at end i in x_m and y_m-directions, respectively
$\bar{F}$	lb and lb-in	(6 $\times$ 1) matrix of member end forces in global coordinate system
$\bar{F}_m$	lb and lb-in	(6 $\times$ 1) matrix of member end forces in member coordinate system
$\bar{F}_s$	lb and lb-in	($3\eta \times 1$) matrix of applied joint forces in global coordinate system
h	inches	Increment length in beam-column
i	--	Integer index
$\bar{I}$	--	Identity matrix
I_z	in^4	Moment of inertia about z-axis
j	--	Integer index
k	--	Integer index
l	--	Integer index
ℓ	--	Number of members framing into a joint
L	inches	Length of a member
m	--	Integer index
$m_{z,i}$	lb-in	Moment at member end i about z_m-axis
n	--	Number of segments in beam column

Symbol	Typical Units	Definition
$\bar{R}$	--	(6 x 6) matrix for transformation from global coordinate system to member coordinate system
$\bar{S}_k$	lb/in and lb-in/rad	(6 x 6) member stiffness matrix in global coordinate system
$S_{k,l}$	lb/in or lb-in/rad	Element of stiffness matrix in k^{th} position of l^{th} column
$\bar{S}_{k_{i,j}}$	lb/in and lb-in/rad	(3 x 3) partition of member stiffness matrix
$\bar{S}_m$	lb/in and lb-in/rad	(6 x 6) member stiffness matrix in member coordinate system
$\bar{S}_s$	lb/in and lb-in/rad	$(3\eta \times 3\eta)$ structure stiffness matrix in global coordinate system
$\bar{S}_{s_{i,j}}$	lb/in and lb-in/rad	(3 x 3) partition of structure stiffness matrix
u_i	inches	Translation of member end i in x_m-direction
U	inches	Joint translation in x-direction
$\bar{U}_m$	inches	(6 x 1) matrix of member end displacements in member coordinate system
$\bar{U}_s$	inches	$(3\eta \times 1)$ matrix of joint displacements in global coordinate system
v_i	inches	Translation of member end i in y_m-direction
V	inches	Joint translation in y-direction
x,y,z	--	Global cartesian coordinate axes
x_m	--	Member centroidal axis
y_m , z_m	--	Principal axes of member cross section
η	--	Number of joints in frame
θ_i	radians	Rotation of member end i about x_m-axis
Θ	radians	Joint rotation about z-direction

CHAPTER 1. INTRODUCTION

Statement of Problem

The plane frame is a frequently recurring structural configuration in highway bridge and elevated freeway structures. It has long been recognized that an accurate and complete analysis of this type of structure can be done efficiently only with the aid of a digital computer.

Two notable attempts to combine the generality of discrete-element beam-column procedures with frame analysis have been reported (Refs 3 and 4). Both of these solutions have relied on the use of alternating-direction iterative (ADI) techniques for the solution of the set of simultaneous equations which result from the analysis. Although the ADI method is efficient from the standpoint of computer storage requirements, closure of the iterative process is dependent on the selection of numerical values for fictitious spring stiffnesses (closure parameters). Experience has shown that the selection of the proper values for the closure parameters requires a trial and error procedure which is time-consuming and therefore prohibitive.

In addition to the requirement for closure parameters, the solutions mentioned above have been restricted to frames composed of orthogonally intersecting beams and columns which are axially rigid and in one solution no translation of the intersections of the beams and columns is permitted.

Purpose of the Study

The purpose of the study reported herein was to develop a direct, non-iterative method of solution for plane structural frames which retained the generality of the discrete-element technique. The method of solution has been extended to allow analysis of frames which include nonorthogonally connected members and to permit investigation of the effects of axial deformations of the beams and columns on the behavior of the frame.

CHAPTER 2. PLANE FRAME THEORY

Definitions and Sign Convention

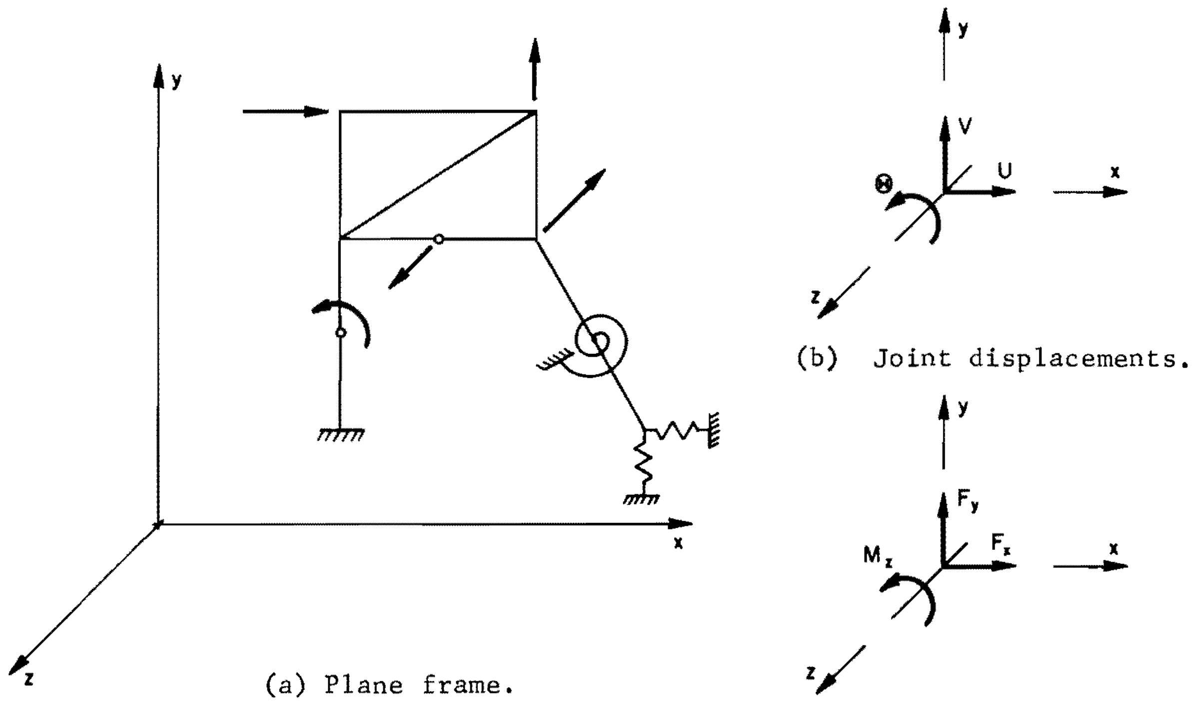
In conventional terminology a plane frame is a structure composed of flexurally and axially deformable members which all lie in a single plane. The principal planes of the cross sections of the members are perpendicular or parallel to the plane. The joints, the intersection of two or more members, are assumed to be rigid; that is, any rotation of a joint about an axis perpendicular to the plane of the structure is experienced by all members connected to that joint. Loads applied to the structure act in the plane of the structure, or, in the case of applied couples, about an axis perpendicular to the plane.

An example of a plane frame is shown in Fig 1(a). The frame is located entirely within the x-y plane. Under the definitions listed above, each point in the frame may undergo three displacements: translations U and V in the x and y-directions, respectively, and a rotation Θ about the z-direction, Fig 1(b). Similarly, three external forces may act at each point on the frame, Fig 1(c). Forces are assumed to be positive when they act in the positive coordinate direction. A moment is positive when the vector, given by the right-hand screw rule, is in the positive z-direction.

Member Force-Deformation Relations for Prismatic Members

A plane frame member is shown in Fig 2. The six member end forces and the six corresponding end displacements are illustrated in Figs 2(a) and 2(b), respectively. For convenience the forces and displacements are shown related to a coordinate system defined by the properties of the member as follows: the x_m axis is the centroidal axis of the member; the y_m and the z_m axes are the principal axes of the member cross section.

The force-deformation relations, neglecting effects of axial thrust on bending stiffness, for a prismatic, linearly elastic plane frame member (Ref 2) related to the member coordinate system are given, in matrix form, in Eq 1.

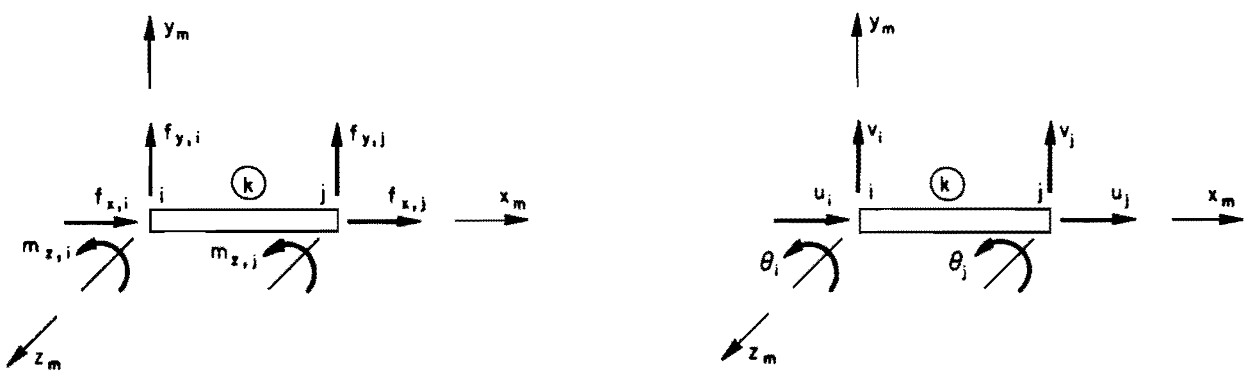


(a) Plane frame.

(b) Joint displacements.

(c) Joint forces.

Fig 1. Plane frame.



(a) Forces.

(b) Displacements.

Fig 2. Plane frame member.

$$\begin{bmatrix} f_{x,i} \\ f_{y,i} \\ m_{z,i} \\ f_{x,j} \\ f_{y,j} \\ m_{z,j} \end{bmatrix} = \begin{bmatrix} \frac{AE}{L} & 0 & 0 & -\frac{AE}{L} & 0 & 0 \\ 0 & \frac{12EI_z}{L^3} & \frac{6EI_z}{L^2} & 0 & -\frac{12EI_z}{L^3} & \frac{6EI_z}{L^2} \\ 0 & \frac{6EI_z}{L^2} & \frac{4EI_z}{L} & 0 & -\frac{6EI_z}{L^2} & \frac{2EI_z}{L} \\ -\frac{AE}{L} & 0 & 0 & \frac{AE}{L} & 0 & 0 \\ 0 & -\frac{12EI_z}{L^3} & -\frac{6EI_z}{L^2} & 0 & \frac{12EI_z}{L^3} & -\frac{6EI_z}{L^2} \\ 0 & \frac{6EI_z}{L^2} & \frac{2EI_z}{L} & 0 & -\frac{6EI_z}{L^2} & \frac{4EI_z}{L} \end{bmatrix} \begin{bmatrix} u_i \\ v_i \\ \theta_i \\ u_j \\ v_j \\ \theta_j \end{bmatrix} \quad (1)$$

where

A = cross section area of the member,

E = modulus of elasticity,

L = length of member, and

I_z = moment of inertia of cross section about z-axis.

The forces f and m and displacements u, v, and θ are defined in Fig 2.

In matrix notation, Eq 1 may be expressed as

$$\bar{F}_m = \bar{S}_m \bar{U}_m \quad (2)$$

where

$\bar{F}_m$ = (6×1) matrix of member end forces,

$\bar{S}_m$ = (6×6) member stiffness matrix, and

$\bar{U}_m$ = (6×1) matrix of member end displacements.

The subscript m indicates that the quantity is derived for the member coordinate system.

Each element of the member stiffness matrix may be defined by imposing unit displacements and examining the reactions which are induced. The member is shown in Fig 3 with end i displaced a unit distance in the y-direction and all other end displacements prevented. The reactions resulting from this

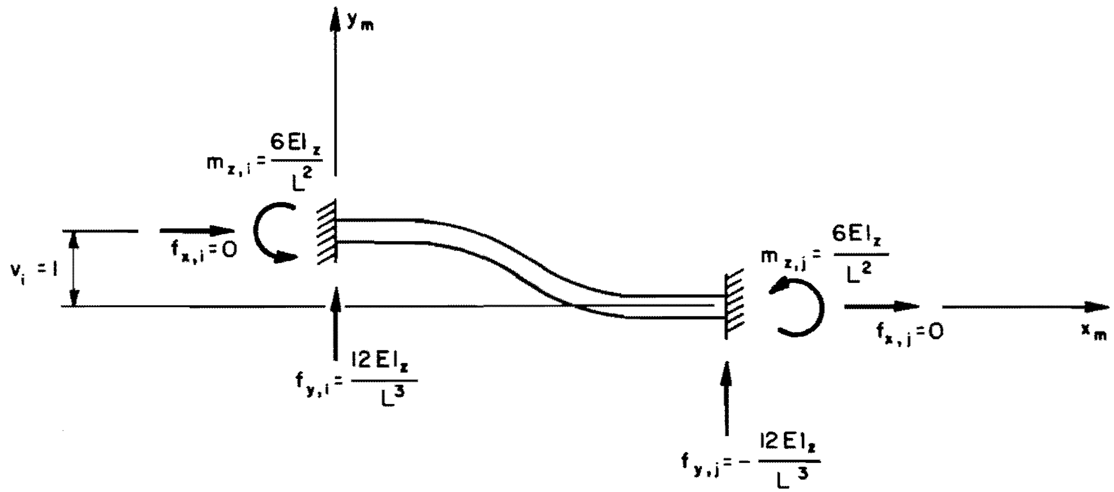


Fig 3. Prismatic, elastic plane frame member subjected to unit displacement.

deformation are shown. If the reactions are arranged in a column matrix in the order indicated by $\bar{F}_m$ in Eqs 1 and 2 it is seen that this matrix is identical with the second column of the member stiffness matrix in Eq 1. Each element of this column is assigned identifying subscripts according to its position in the column and according to the position of the column within the matrix. For instance, element $S_{k,l}$ occupies the k^{th} position of the l^{th} column of the matrix. Each element of the member stiffness matrix $S_{k,l}$ may, therefore, be defined as the reaction corresponding to the k^{th} type of force in the $\bar{F}_m$ matrix due to deformations resulting from a unit displacement of the l^{th} type in the $\bar{U}_m$ matrix while all other displacements are prevented.

Member Stiffness Matrix, Nonprismatic Members

With the above definition of an element of the member stiffness matrix, a member stiffness matrix may readily be developed for nonprismatic frame members using the versatility of the discrete-element method for beam-column analysis (Ref 5). Columns 2 , 3 , 5 , and 6 of the member stiffness matrix are determined from the reactions developed at the end of the beam-column, due to inducing, one at a time, unit displacements v_i , θ_i , v_j , and θ_j , respectively, with all other end displacements prevented each time.

The axial stiffness of a nonprismatic member is assessed in a manner similar to the discrete-element procedure for flexural effects. The member is segmented into a number of prismatic elements. The overall axial stiffness of the member is obtained from the combined stiffness of the prismatic segments from

$$\left(\frac{AE}{L}\right)_e = \frac{1}{\sum_{i=1}^{n}\left(\frac{h}{A_i E_i}\right)} \tag{3}$$

where

$\left(\frac{AE}{L}\right)_e$ = equivalent axial stiffness of nonprismatic member,

h = length of each increment of beam-column,

A_i = cross section area of i^{th} segment,

E_i = modulus of elasticity of i^{th} segment, and

n = number of segments in beam-column.

Structure Stiffness Matrix

A relationship between the forces applied to the joints of a frame and the displacements of the joints, Fig 1, may be established by a procedure identical to that discusssed above for a single member. In matrix notation, the relationship is

$$\bar{F}_s = \bar{S}_s \bar{U}_s \qquad (4)$$

where

$\bar{F}_s$ = $(3\eta \times 1)$ matrix of forces and moments applied to the joints of the structure,

$\bar{S}_s$ = $(3\eta \times 3\eta)$ structure stiffness matrix,

$\bar{U}_s$ = $(3\eta \times 1)$ matrix of joint displacements, and

η = number of joints in the frame.

Each element $S_{k,l}$ of the structure stiffness matrix is equal to the reaction of type k due to a unit displacement of type l when all other displacements are prevented. $S_{k,l}$ is numerically equal to the sum of the reactions of the individual members which are connected to the joint under consideration. The contribution of each member to the structure stiffness matrix is readily obtained from the member stiffness matrix. However, the member stiffness matrix is most conveniently developed for a member-related coordinate system, Eq 1, which does not necessarily coincide with the frame, or global, coordinate system. When required, the member stiffness matrix is transformed to the global coordinate system by the following matrix manipulations (Ref 2).

The i^{th} joint of the frame may undergo displacements U , V , and Θ , Fig 1(b), in the global coordinate system and displacements u , v , and θ , Fig 2(b), in the member coordinate system. Since the joint can occupy only one position, both sets of displacements must lead to the same final position. This requirement is expressed in matrix form by

$$\begin{bmatrix} u_i \\ v_i \\ \theta_i \end{bmatrix} = \begin{bmatrix} C_x & C_y & 0 \\ -C_y & C_x & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} U_i \\ V_i \\ \Theta_i \end{bmatrix} \qquad (5)$$

where

C_x = cosine of the angle between the x_m and x-axes, and

C_y = cosine of the angle between the x_m and y-axes.

Similarly, at joint j,

$$\begin{bmatrix} u_j \\ v_j \\ \theta_j \end{bmatrix} = \begin{bmatrix} C_x & C_y & 0 \\ -C_y & C_x & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} U_j \\ V_j \\ \Theta_j \end{bmatrix} \tag{6}$$

Equations 5 and 6 may be combined into a single equation

$$\begin{bmatrix} u_i \\ v_i \\ \theta_i \\ u_j \\ v_j \\ \theta_j \end{bmatrix} = \begin{bmatrix} C_x & C_y & 0 & 0 & 0 & 0 \\ -C_y & C_x & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & C_x & C_y & 0 \\ 0 & 0 & 0 & -C_y & C_x & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} U_i \\ V_i \\ \Theta_i \\ U_j \\ V_j \\ \Theta_j \end{bmatrix} \tag{7}$$

or, in matrix notation

$$\bar{U}_m = \bar{R}\,\bar{U} \tag{8}$$

where

$\bar{R}$ = (6×6) coordinate transformation matrix, and

$\bar{U}$ = (6×1) matrix of joint displacements of joints i and j in the global coordinate directions.

In a similar manner, the components in the global coordinate direction of the member end reactions are obtained from

$$\bar{F}_m = \bar{R}\,\bar{F} \tag{9}$$

where

$\bar{F}$ = (6×1) matrix of member end reactions in global coordinate directions.

Equations 2, 8, and 9 are combined to yield

$$\bar{R}\,\bar{F} = \bar{S}_m\bar{R}\,\bar{U} \tag{10}$$

It can be shown that $\bar{R}$ is an orthogonal matrix, such that

$$\bar{R}'\bar{R} = \bar{I} \tag{11}$$

where

$\bar{R}'$ = transpose of $\bar{R}$, and

$\bar{I}$ = identity matrix

Hence, equations 10 and 11 reduce to

$$\bar{F} = \bar{R}'\bar{S}_m\bar{R}\,\bar{U} \tag{12}$$

or

$$\bar{F} = \bar{S}_k\bar{U} \tag{13}$$

where

$\bar{S}_k = \bar{R}'\bar{S}_m\bar{R}$ = (6 × 6) stiffness matrix for member k in the global coordinate system.

It follows then that $\bar{S}_k$ is the contribution of the individual member to the overall structural stiffness matrix.

The accumulation of the individual member contributions into the structure stiffness matrix is visualized as follows. The structure stiffness matrix is readily partitioned into η (3 × 3) submatrices $\bar{S}_{s_{i,j}}$. Each of these partitions represents the reactions induced at joint i by unit displacements at joint j. Similarly the member stiffness matrix is partitioned into four (3 × 3) submatrices with each submatrix $\bar{S}_{k_{i,j}}$ representing the reactions at member end i due to unit displacements of end j. Therefore, each submatrix of the structure stiffness matrix may be defined as

$$\bar{S}_{s_{i,i}} = \sum_{k=1}^{\ell} \bar{S}_{k_{i,i}} \tag{14}$$

where

ℓ = number of members framing into joint i and

and

$$\bar{S}_{s_{i,j}} = \bar{S}_{k_{i,j}} \quad , \qquad i \neq j \tag{15}$$

Supports and Restraints

The matrix $\bar{S}_s$ generated by the procedure described above, does not include the effects of supports or restraints. Unless the effects of supports are included, the matrix $\bar{S}_s$ is singular and Eq 4 has no unique solution. Effects of elastic spring supports are incorporated in the stiffness matrix $\bar{S}_s$ by addition of the spring stiffness directly to the appropriate diagonal element of $\bar{S}_s$. Rigid supports may be represented by very stiff springs, hence, only the elastic spring restraint need be considered in the solution. The minimum number of spring supports which must be provided is any combination of translational or rotational springs which will restrain all possible types of rigid body displacements of the entire frame.

Joint Loads and Member Loads

The load matrix $\bar{F}_s$, Eq 4, is composed of the effects of two loading systems. The x and y components of loads and moments about the z-axis applied to the structure at the joints are added directly to the load matrix. Loads and moments applied to members are converted, using the beam-column analytical procedure, to fixed end forces. The fixed end forces are then treated as equivalent joint loads.

It is convenient to generate the fixed end forces for each member in terms of the member coordinate system. When the member coordinate system and the global system do not coincide, a transformation of the type shown in Eq 9 is used, in the form

$$\bar{F} = \bar{R}'\bar{F}_m \tag{16}$$

where

$\bar{F}$ = (6 × 1) matrix of fixed end forces in global coordinate directions,

$\bar{R}'$ = transpose of (6 × 6) coordinate transformation matrix $\bar{R}$, and

$\bar{F}_m$ = (6 × 1) matrix of fixed end forces in member coordinate directions.

The elements of the $\bar{F}$ matrix are added at the appropriate locations to the $\bar{F}_s$ matrix.

<u>Solution of Equations</u>

Equation 4 represents, in matrix form, a system of linear, simultaneous equations in the unknown joint displacements. When control of the joint numbering system is maintained and a limit is placed on the maximum difference between end joint numbers for every member, the matrix $\bar{S}_s$, and, hence, the system of equations, becomes banded about the major diagonal. The band width will be equal to $(6n + 5)$ where n is the maximum difference between member end numbers. Sets of equations of this type are readily solved by the direct solution procedure described in detail in Ref 1.

CHAPTER 3. COMPUTER PROGRAM

The procedures and equations described in the preceding chapter have been programmed for solution on a digital computer. The program, PFRM1, is coded in FORTRAN IV language and has been operated on a Control Data Corporation 6600 computer. A summary flow chart for the FORTRAN program is given in Fig 4. Detailed flow charts and a listing of the program are included in Appendices 2 and 3.

The program is written to generate automatically as much of the required data as possible from a minimum amount of input data. The arrangement and form of the input data are shown subsequently. The following paragraphs describe the assumed configuration of the structure on which the input data are based.

Description of Frame

The frame is assumed to lie in the x-y plane of a right-hand Cartesian coordinate system. The structure may be oriented in any position within the plane; however, the amount of descriptive information required for the program is reduced if as many members of the frame as possible are parallel to either the x or y-axis. In addition, the solution process will usually be more efficient if the "narrow" direction of the frame is parallel to the x-axis.

Grid System

The locations in the x-y plane of the joints of the frame are established by an orthogonal grid, parallel to the x and y-axes, superimposed on the structure. The intersections of these grid lines are the possible locations of the joints, although it is not necessary that the structure have a joint at every grid intersection. The frame of Fig 1 is reproduced in Fig 5 with a grid superimposed. The joints are identified by numbers assigned by the program based on the presence or absence of members at the intersections of the grid lines. The grid may be defined only one time for each frame; therefore, it should provide for any possible additions to the frame in subsequent problems.

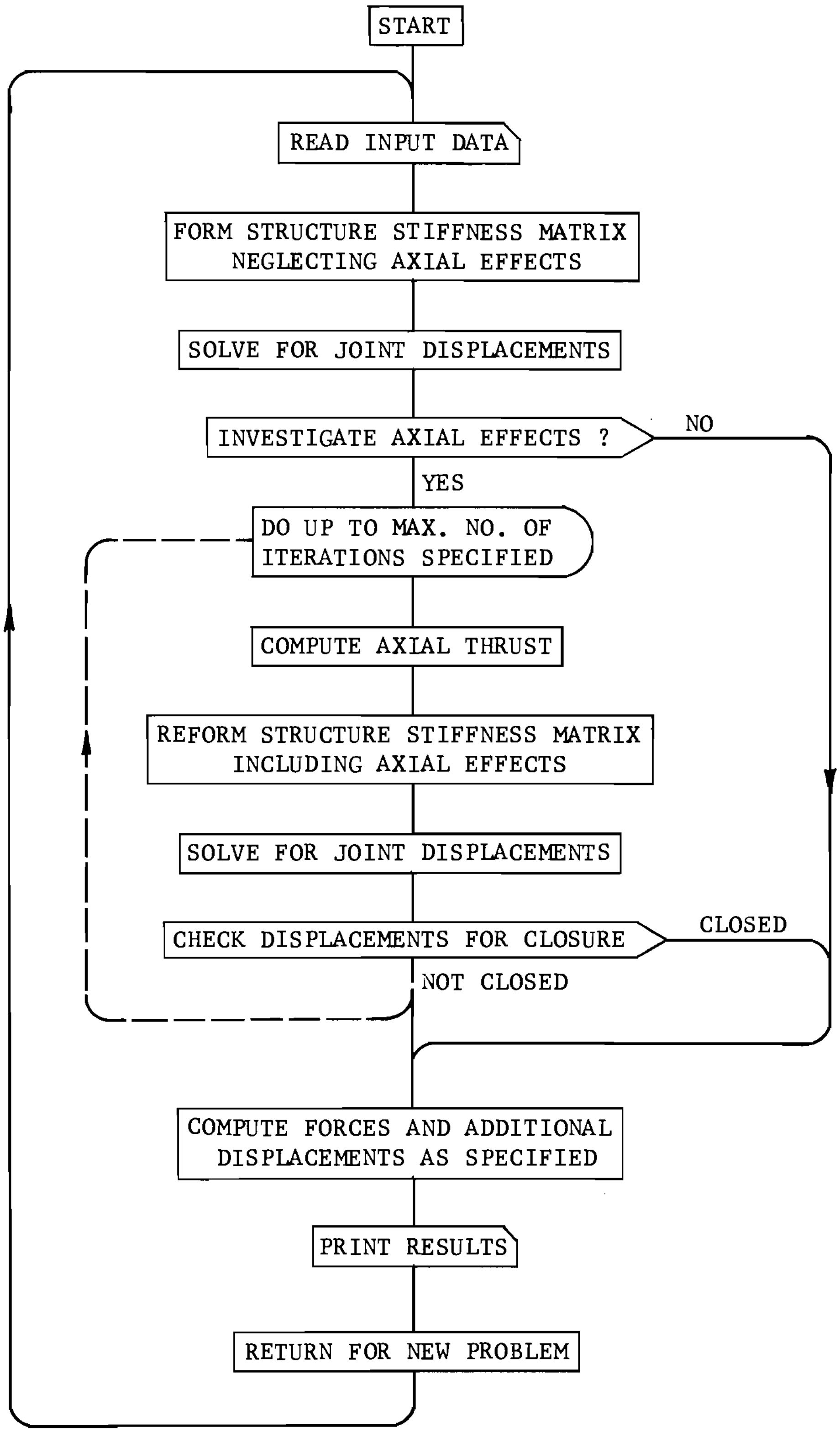


Fig 4. Summary flow chart.

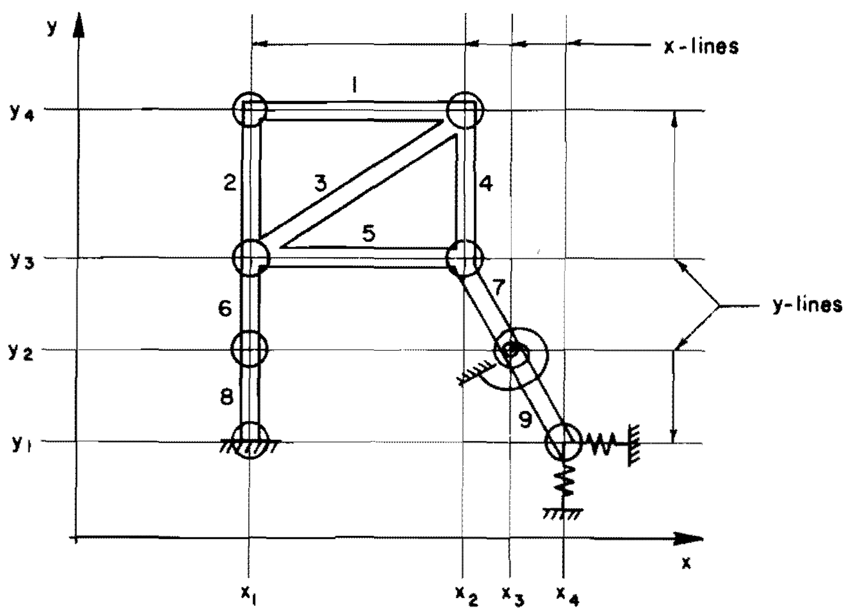


Fig 5. Plane frame with superimposed grid.

Member Types

Whenever several members, columns, beams, or diagonals, are identical in all respects (e.g., length, flexural and axial properties, and loading), the data describing these members need to be supplied only one time. Similarly, the stiffness matrix for each type of member must be determined only one time. Member types are assigned to the frame members by tabulating the member type designator between x-lines along each y-line and between y-lines along each x-line.

Member data are supplied in the member coordinate system according to the beam-column convention (Ref 5). The member coordinate directions coincide with the global coordinate directions when the member is parallel to the global x-axis. For members which are parallel to the global y-axis, the member axis x_m is parallel to and opposite in direction to the global y-axis. For diagonal members, the member axis x_m is positive when directed from the most negative global x coordinate of the end of the member to the most positive x end coordinate.

Compatibility of Member Type and Grid Data

The length of each member is defined by the input data in two separate places. In the member type data, the number of increments and the increment length are specified. The length obtained from the product of these two quantities is used to establish the stiffness characteristics for the member type. When member types are assigned between x and y-grid line intersections, the length of the member is again implied. If the length of the member as determined by the member type data is not the same as the distance between the specified grid line intersections, the program terminates.

Structure Supports

As stated previously, the structure must be supported in such a way that all possible displacements of the frame as a rigid body are restrained. It is assumed in the computer program that restraint is provided by linearly elastic springs. These springs may be applied by two different procedures. Point supports which are located between joints, or restraints distributed along a member, are supplied with the member type data. Spring restraints occuring at joints are supplied with the joint load and restraint data.

Applied Loads

As in the case of spring supports, loads (forces and couples) may be applied directly to the joints. These loads are added directly to the load matrix $\overline{F}_s$, Eq 4. Loads applied to members between joints, concentrated or distributed, are included with member type data. The effects of loads on members are converted to fixed end forces by a beam-column solution and these fixed end forces are then added to the load matrix $\overline{F}_s$.

Successive Problems

The frame analyzed on the first of a succession of problems may be modified as desired on subsequent problems. Member types may be added to those already provided and members of the frame may be omitted or altered. However, as stated above, the x-y grid, once input, may not be altered in a succession of problems dealing with the same basic input.

Axial Effects

The axial thrust, tension or compression, affects the flexural stiffness of a member. Therefore, the level of thrust must be known for each member before the stiffness matrix for the member can be established. In conventional frame analysis procedures, the effect of thrust on the flexural behavior is ignored since this effect is usually small. Provision has been made in PFRM1 to allow investigation of axial effects at the option of the user.

When axial effects are not to be considered, the thrust is assumed to be zero when each member stiffness matrix is determined. An iterative process is required to include the influence of thrust. An initial trial solution is made assuming no axial effects. The resulting thrust is calculated and the stiffness matrix for each member is adjusted for this estimate. A second solution is made and a new estimate of axial thrust is determined. This process is continued until the joint displacements from two successive trial calculations agree within a given tolerance or until a prescribed number of iterations are performed.

Input Data

Formats and additional explanatory information for the required input data are given in Appendix 1. The data for each problem are arranged in tabular form as outlined below. Two alphanumeric cards are required at the beginning of each data deck. These are followed by:

(1) Problem Identification card with alphanumeric description of problem.

(2) Table 1 - Program Control Data - 1 card - Information on this card includes new problem or continuation of previous problem code, number of member types added, number of joint loads or restraints added, output option code, number of diagonal members added, number of changes to orthogonal member incidence, number of iterations for the investigation of axial effects, and closure tolerances for translational and rotational displacements when investigating axial effects.

(3) Table 2 - x-y Grid Data - These data define the coordinates of the x and y grid lines when a new problem is started. If the problem is a continuation of the previous problem, Table 2 is omitted.

(4) Table 3 - Member Type Data - Each member type is described as a beam-column. The number of cards in this table will vary as required to specify bending stiffness, load, support springs, and axial properties for each beam-column.

(5) Table 4 - Orthogonal Member Incidence - These data consist of the member types existing along each y line between adjacent x lines and along each x line between adjacent y lines. The number of cards in this table varies. If a new problem is being solved, the number of cards is equal to the sum of the number of x and y lines in the grid. If the problem is a continuation, only changes in incidence are required. The number of cards will be as specified in Table 1.

(6) Table 5 - Diagonal Member Incidence - The number of cards in Table 5 is equal to the number of diagonal members added in each problem.

(7) Table 6 - Applied Joint Loads and Restraints - The number of cards in Table 6 varies depending on the number of additional joints to which loads or restraints are applied in each problem.

(8) Table 7 - Output Information - The number of cards in Table 7 depends on the Output Option specified in Table 1. If Option 3 is selected, Table 7 will contain the number of cards equal to the sum of the number of x lines and the number of y lines in the x-y grid.

Appendix 4 contains numerical examples of input data for the example problems in Chapter 4.

Output Information

All input data are echo printed as read with the exception of Table 4 - Orthogonal Member Incidence, and Table 7 - Output Information. Table 4 output is continuously updated with each problem and shows only the member type existing between the intersections of the grid lines.

Table 7 - Output Information - is not echo printed; this information is reflected in the form of the output of computed data.

Output of computed data is arranged in tabular form as follows:

Table 11 - Joint Numbers - As previously mentioned, the program assigns a joint number at the appropriate x and y line intersection depending on the presence or absence of members at that intersection. Table 11 of the output information gives the joint numbers assigned to each intersection. The data in this table are arranged so that the structure outline may be superimposed on the joint numbers and used as a guide for interpreting the computed output.

Table 12 - Joint Displacements - This table contains the x and y translation of each joint of the structure and the rotation of the joint about the z-axis. The sign convention for displacements is given in Chapter 2.

Table 13 - Joint Reactions - Each joint of the structure may be restrained by two translational and one rotational restraint. If no value of restraint is input, then a zero value is assumed. Table 13 gives the reaction at each elastically restrained joint calculated from the product of the joint displacement and the appropriate elastic restraint stiffness.

Table 14 - Individual Member Data - The user may select one of three different output options for calculated member data. These options include member end forces only, beam-column output for every member, and selective output of member end forces or beam-column data for each member.

Output data for the example problems of Chapter 4 are given in Appendix 5.

CHAPTER 4. EXAMPLE SOLUTIONS

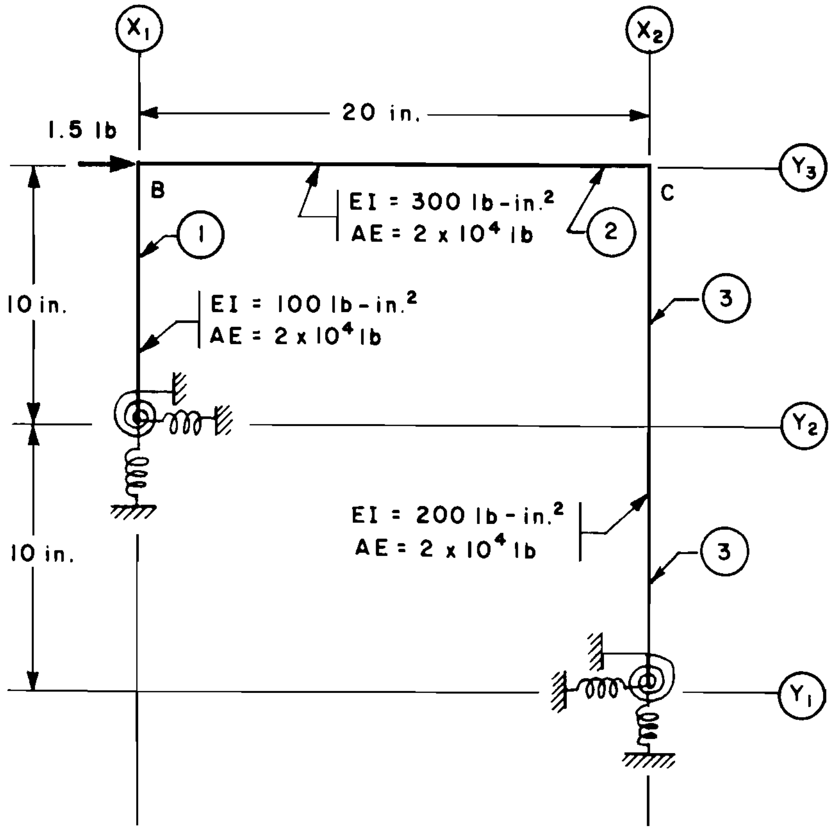
A number of example problems and variations have been solved to demonstrate the use of the program. The accuracy of the method is verified by comparison of the solutions of two problems with those from previously reported techniques (Refs 4 and 5). The input data and program output for the example problems are presented in Appendices 4 and 5, respectively.

Idealized Simple Frame

The idealized simple frame shown in Fig 6(a) is extracted from Ref 5. All members in the frame are prismatic; hence, the member stiffness matrix may be established directly by the program without resorting to the discrete-element beam-column analysis. The results from a slope deflection analysis and the results of the solution technique as reported in Ref 5 along with the solution given by program PFRM1, described herein, are tabulated in Fig 6(b). It is seen that the results from the direct solution program PFRM1 are identical with those from conventional slope-deflection analysis. The complete computer output for this solution is included as problem number PR101 in Appendix 5. The structure shown in Fig 6(a) was resolved as problem number PR102, in which each member was treated as nonprismatic with a 0.5-inch increment length. In this case the beam-column subroutine was used to evaluate the member stiffness matrices. The results of this solution are tabulated in Fig 6(b).

Multistory Frame Without Sidesway

A solution of the complex structure shown in Fig 7 is reported in Ref 4. A programming error in the computer program of Ref 4 requires that the stiffnesses of the lateral, distributed springs on the lower level columns be adjusted to the value shown in Fig 7(a) instead of the value given in Ref 4. Reference 4 contains the flexural rigidities of all members. This frame contains all possible variations in member types. To facilitate comparison of the solution of PFRM1, PR103, with that reported in Ref 4, three members are

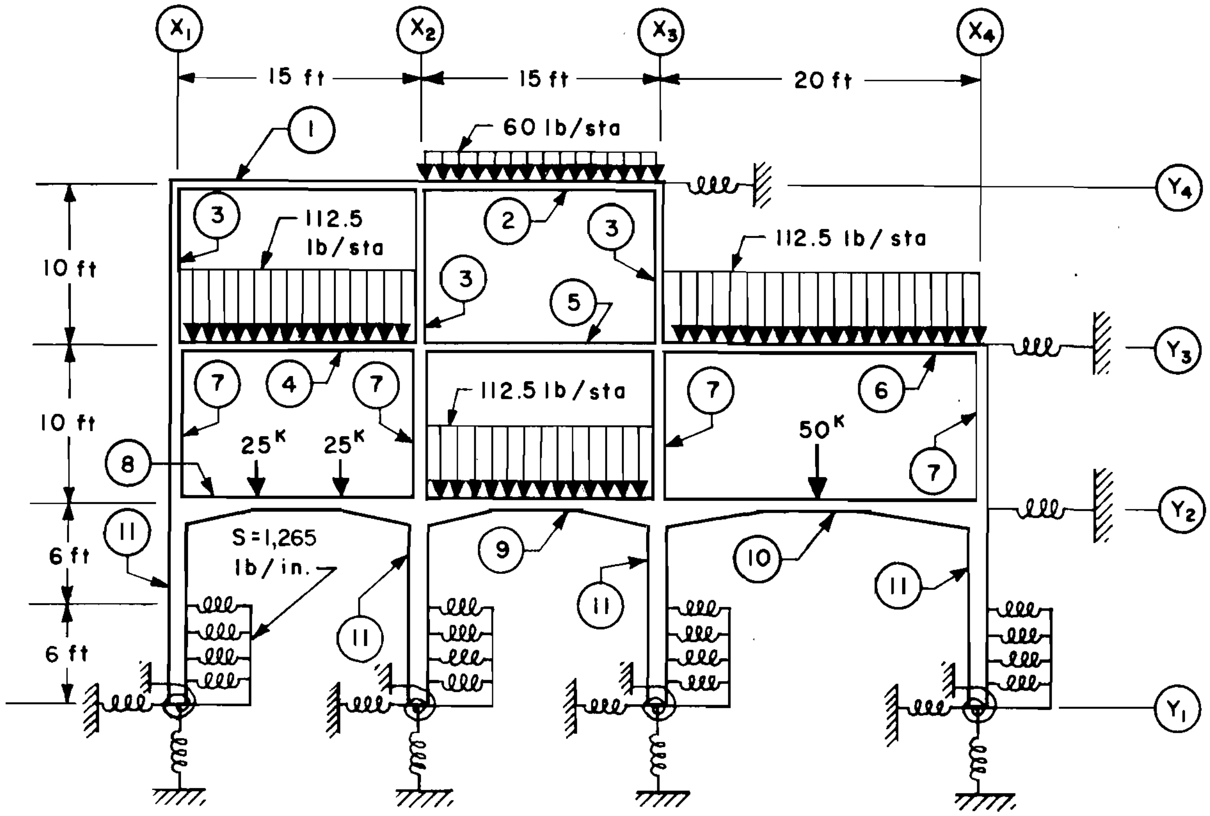


(a) Idealized simple frame (after Ref 5).

VALUE	SLOPE DEFLECTION	REF. 5 h = k = 0.5 in.	PFRM I	
			Prismatic Members	Non Prismatic Members h = 0.5 in.
Δ_B (in.)	1.335	1.310	1.335	1.339
Δ_C (in.)	1.335	1.310	1.334	1.339
θ_B (rad)	-7.481×10^{-2}	-7.443×10^{-2}	-7.482×10^{-2}	-7.480×10^{-2}
θ_C (rad)	-1.761×10^{-2}	-1.662×10^{-2}	-1.761×10^{-2}	-1.775×10^{-2}

(b) Comparison of results.

Fig 6. Simple frame with sidesway.



Point Identification		Deflection		Moment	
Ref 4	PFRM 1	Ref 4	PFRM 1	Ref 4	PFRM 1
BEAM 1, Sta 69	Sta 16, Member Between Joints 14 & 15	−0.1616	−0.1662	1.430×10^4	1.447×10^4
BEAM 3, Sta 120	Sta 20, Member Between Joints 7 & 8	−1.360	−1.391	1.070×10^6	1.077×10^6
BEAM 5, Sta 18	Sta 12, Member Between Joints 2 & 6	−0.1035	0.1042*	2.035×10^5	-2.046×10^5*

* Signs Are Result of Different Sign Conventions for the Two Programs

Fig 7. Multistory frame without sidesway (after Ref 4).

selected for complete beam-column output. These include the centrally loaded, nonprismatic beam between x lines 3 and 4 along y line 2; the prismatic, uniformly loaded beam between x lines 2 and 3 along y line 4; and the nonprismatic column between y lines 1 and 2 along x line 2 (See Fig 7(a)). For ready comparison, selected data from both solutions are tabulated in Fig 7(b).

A comparison of the forces in the members at the intersections is not readily accomplished since the joint model used in the solution technique of Ref 4 tends to obscure the member end forces due to the presence of the fictitious closure springs. Member end forces obtained by PFRM1 conform to those of conventional frame analysis.

Two-Bay, Two-Story Frame

Figure 8 is a representation of a typical two-bay, two-story bridge bent. The bent is analyzed for two different loadings, as shown in Fig 9(a) and 9(b). The input data are coded in several different ways to demonstrate the use of the program. Input data for all problems are listed in Appendix 4 and computer output is included in Appendix 5.

Problem 201 - Loads Applied to Members. The frame is analyzed for the loads shown in Fig 9(a). The horizontal loads applied at intermediate levels on the columns are included with the member type data. This arrangement requires only three x lines and three y lines in the grid and results in the smallest possible number of joints for which the frame can be analyzed. Output options have been exercised to print out member end forces for the horizontal members and beam-column output for all vertical members.

Problem 202 - Loads Applied to Joints. Although the arrangement of the input data of Problem 201 results in the fewest number of joints in the frame, the data are not in the most convenient form for subsequent loading conditions. If the intermediate loads on the columns are to be changed, the procedure used in Problem 201 would require two additional member types to adjust these loads. Therefore, the data for Problem 201 are recoded to permit changes in the loads to be described more easily. This requires the addition of two y lines to the grid system as shown in Fig 9(b). For this grid system, all loads are applied at joints and adjustment of these loads in subsequent problems is more conveniently accomplished. Only member end forces are selected for output in this problem.

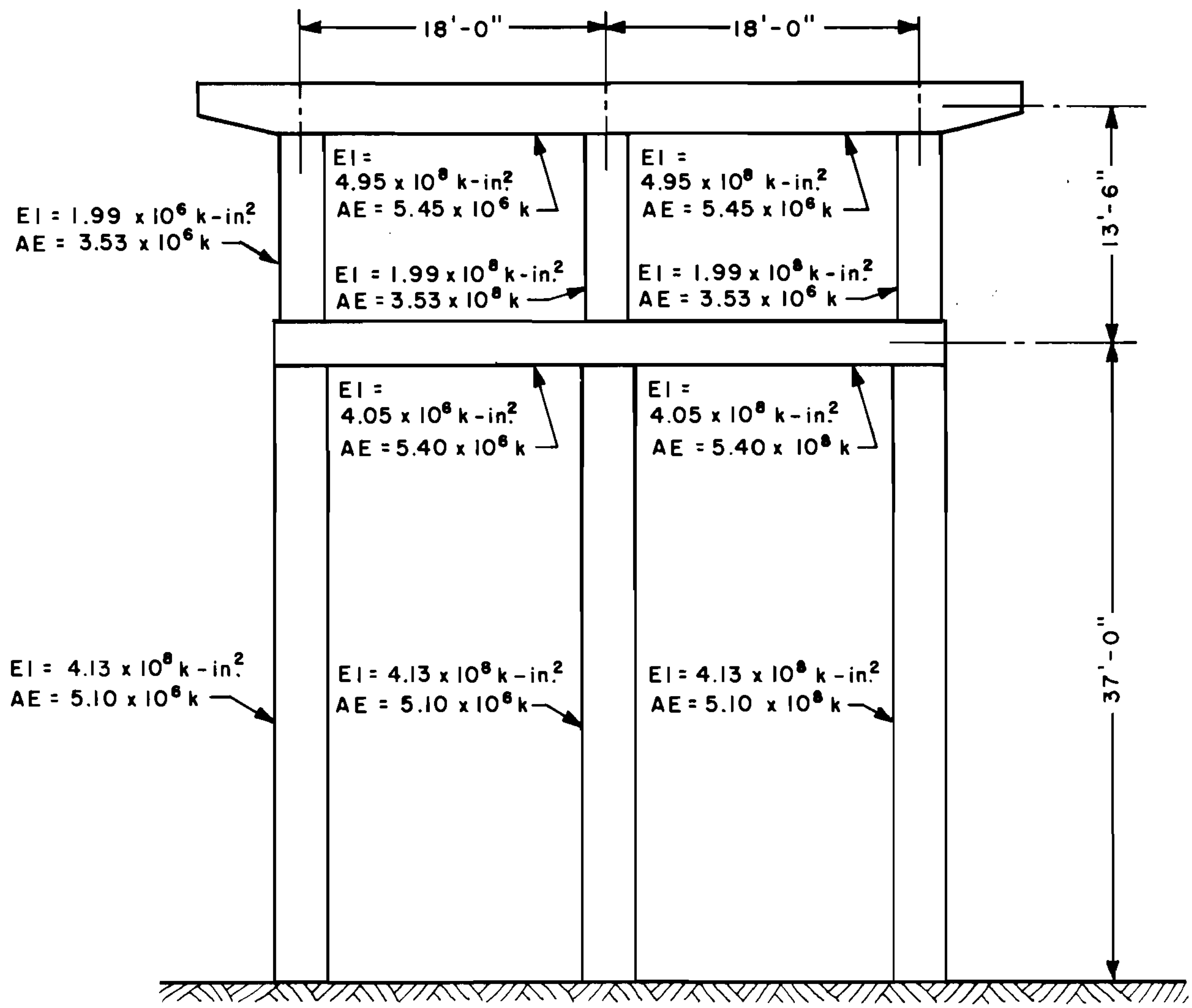
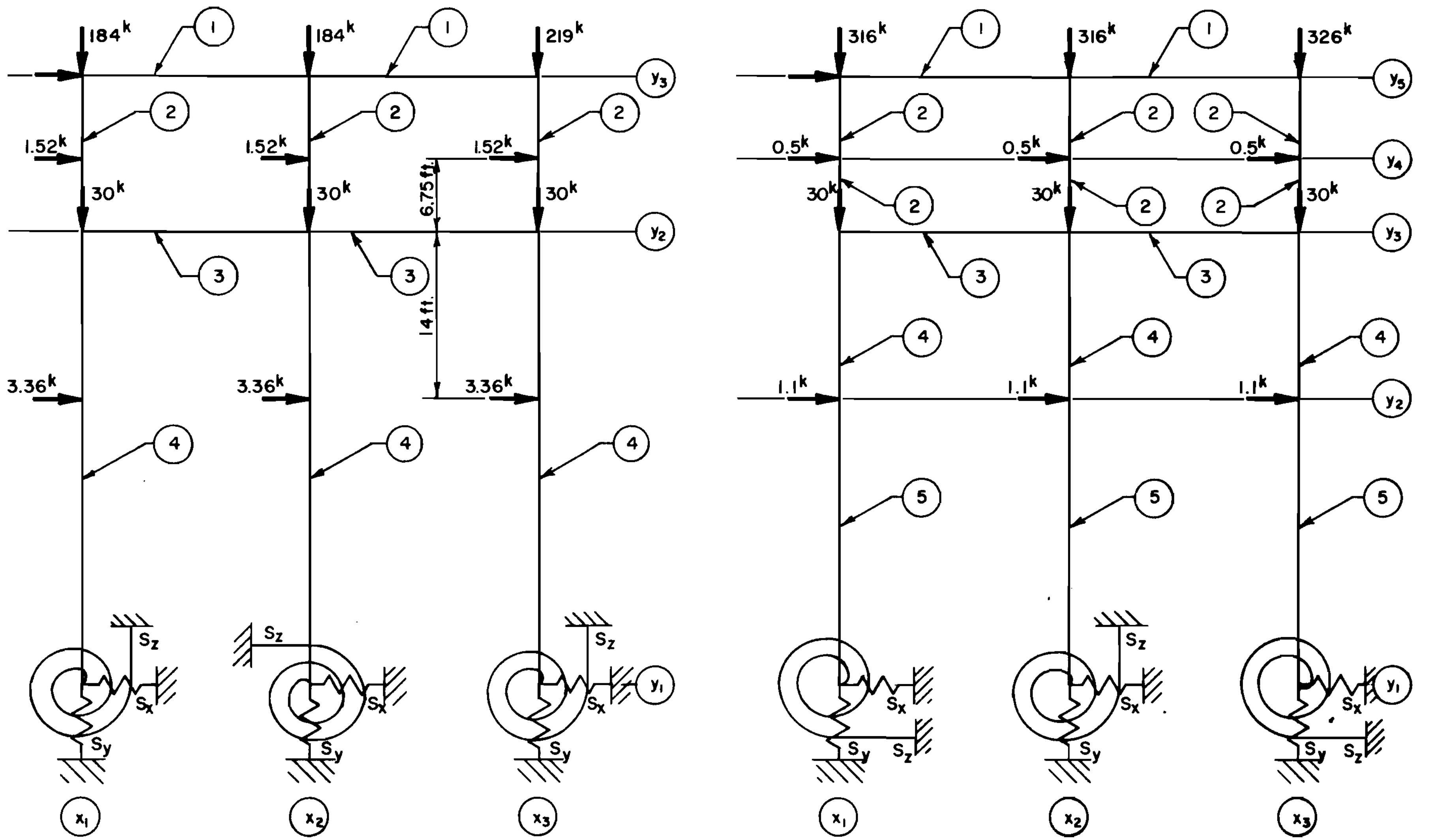


Fig 8. Two-bay, two-story frame.



(a) Load system 1, minimum grid.

(b) Load system 2, expanded grid.

Fig 9. Idealization of two-bay, two-story frame.

Problem 203 - Revised Loading. Problem 203 is a continuation of Problem 202 with the joint loads adjusted to produce the loading situation shown in Fig 9(b). Again only member end forces are called for in the output.

Problem 204 - Investigate Axial Effects. Problem 204 is identical to Problem 203 except that the effects of axial thrust on the flexural stiffness of the members are investigated. The results of this solution may be compared with the results of Problem 203 to determine the influence of thrust on the deflections and forces in the frame.

One-Bay, One-Story Frame

Figure 10 represents a typical single-bay, single-story highway bridge bent supported on piers extending below ground level.

Problem 301 - Vertical Columns. The bent shown in Fig 10 is idealized as shown in Fig 11(a) and analyzed for the loads shown. The support columns are assumed to be vertical.

Problem 302 - Battered Columns. The effects of battering the support columns in the bent of Fig 10 are investigated. Member sizes and magnitudes and points of application of the applied loads are identical to those of Fig 11(a). The grid system required for this analysis is shown in Fig 11(b).

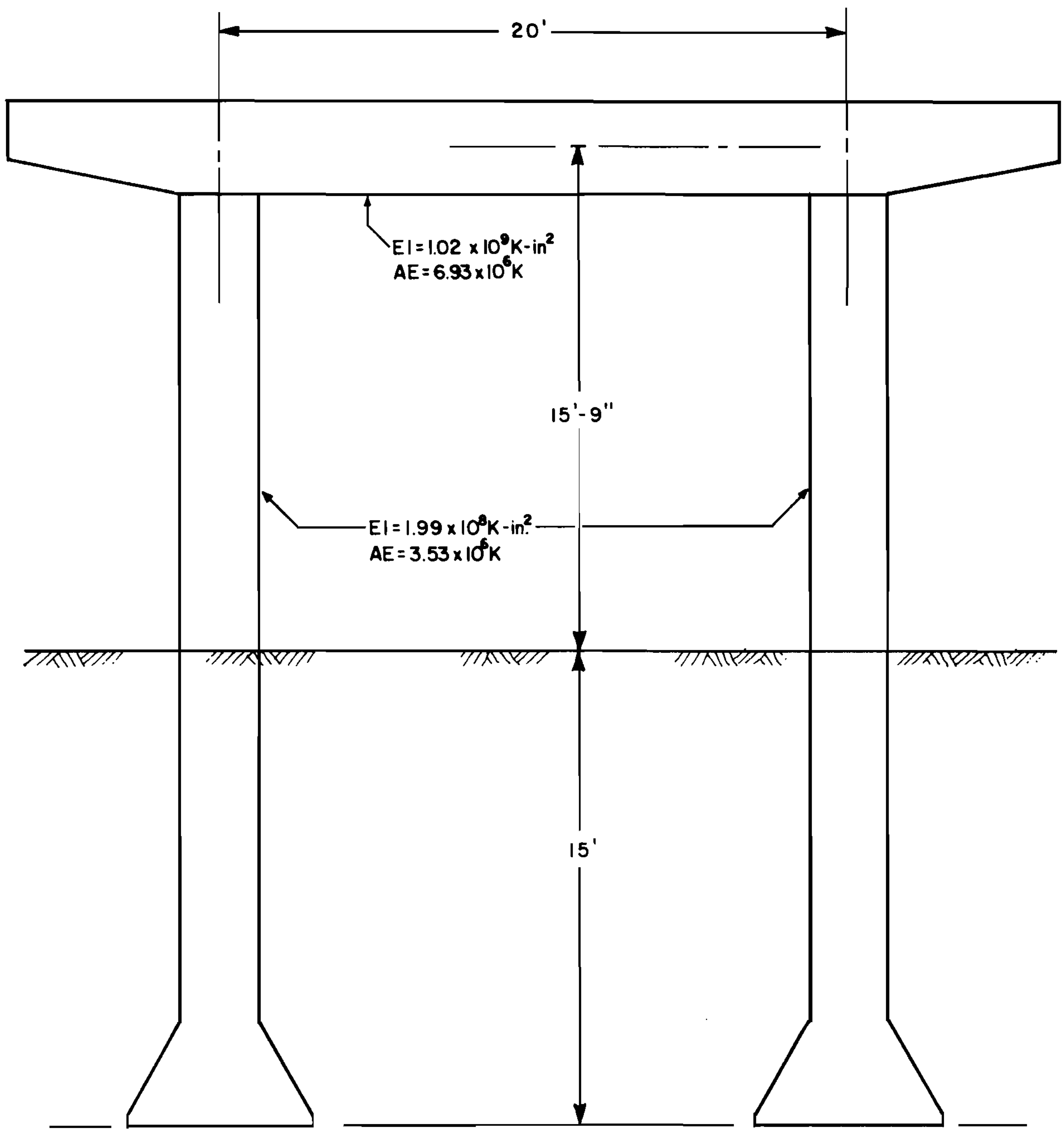
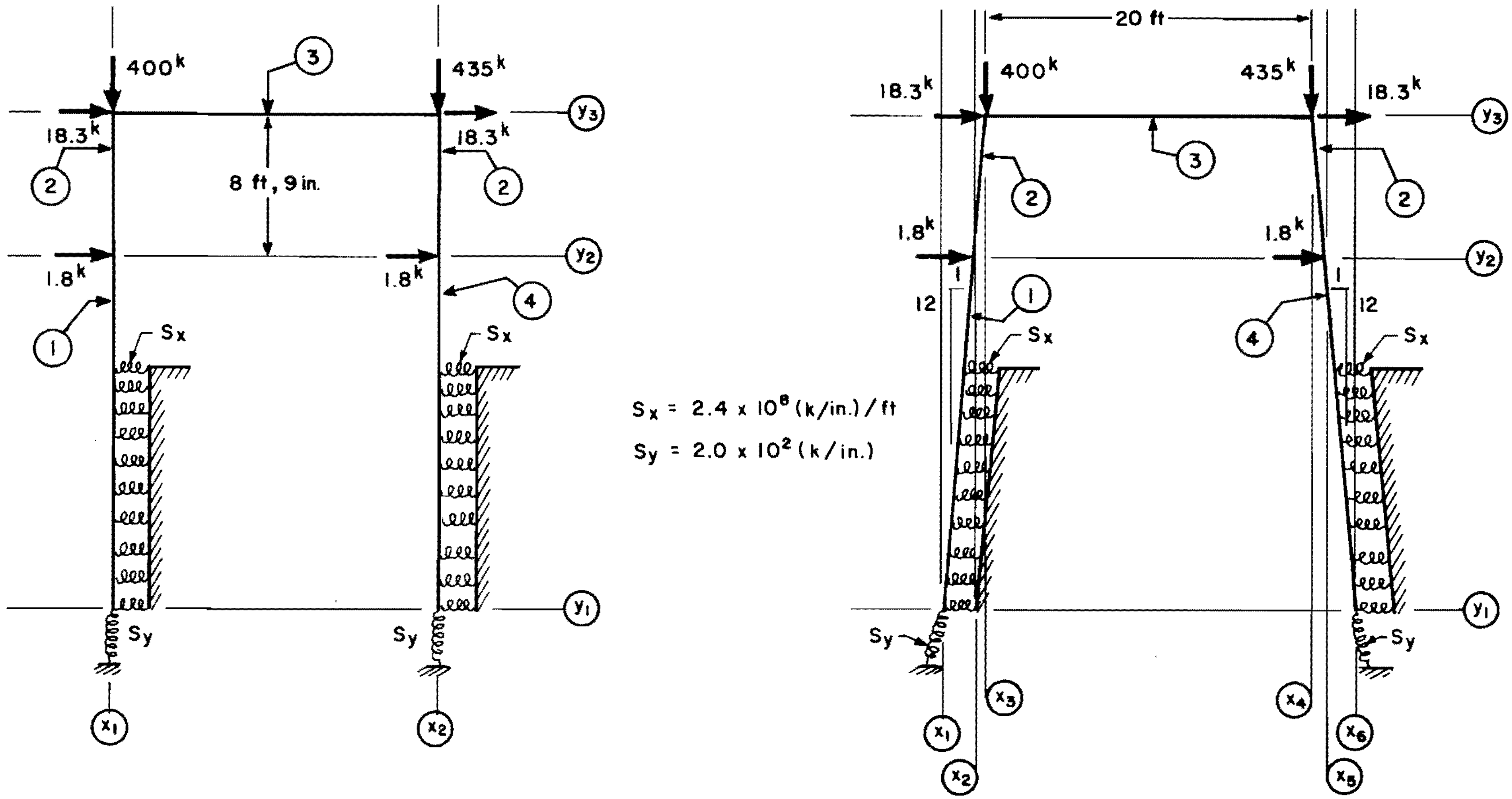


Fig 10. One-bay, one-story frame.



(a) Vertical columns.

(b) Battered columns.

Fig 11. Idealization of one-bay, one-story frame.

CHAPTER 5. SUMMARY

A direct solution process for analysis of plane structural frames has been derived. The procedure relies on the versatility of beam-column analytical methods to develop the stiffness matrix and fixed end forces for each member in the frame. Conventional frame analysis techniques are then used to solve for frame joint translations and rotations by a direct solution of the simultaneous equations.

A computer program PFRM1 has been coded and used to solve a variety of practical example problems. The program is dimensioned to accept frames with as many as 50 joints and 20 different member types. With the computational accuracy provided by the CDC 6600 computer no round-off error has been encountered for the above maximum dimensions.

The method developed herein is comparable to the procedure presented by Haliburton (Ref 3) and maintains the ability to deal with widely varying structural properties. However, since the current analytical procedure uses a direct solution, no calculation of the often troublesome closure parameters needed for iterative solutions is required. In addition, the description of the frame and its members has been simplified so that a particular problem requires less input data than were necessary in the former frame analysis programs.

REFERENCES

1. Endres, Frank L., and Hudson Matlock, "An Algebraic Equation Solution Process Formulated in Anticipation of Banded Linear Equations," Center for Highway Research, The University of Texas at Austin, in preparation.

2. Gere, J. M., and W. Weaver, Jr., Analysis of Framed Structures, D. Van Nostrand Co. Inc., Princeton, New Jersey, 1965.

3. Haliburton, T. Allan, and Hudson Matlock, "A Finite-Element Analysis of Structural Frames," Research Report No. 56-7, Center for Highway Research, The University of Texas, Austin, July 1967.

4. Matlock, Hudson, and Berry Ray Grubbs, "A Finite-Element Method of Solution for Structural Frames," Research Report No. 56-3, Center for Highway Research, The University of Texas, Austin, May 1967.

5. Matlock, Hudson, and T. Allan Haliburton, "A Finite-Element Method of Solution for Linearly Elastic Beam-Columns," Research Report No. 56-1, Center for Highway Research, The University of Texas, Austin, September 1966.

APPENDIX 1

GUIDE FOR DATA INPUT FOR PFRM1

IDENTIFICATION OF RUN (2 alphanumeric cards per run)

Columns 1–80

Columns 1–80

IDENTIFICATION OF PROBLEM (1 card each problem; program stops if NPROB is left blank)

NPROB		DESCRIPTION OF PROBLEM (alphanumeric)
1–5		11–80

TABLE 1: PROGRAM CONTROL DATA (one card per problem)

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM		NIT	DTOL	RTOL
11–15	20	25	31	35	40		46–50	60	70

NEWPR -- New problem or continuation of previous problem.
= 1 New problem.
= 2 Continue previous problem.
NAMT -- Number of additional member types.
NAJLR -- Number of additional joints to which loads and restraints are applied.
KOUT -- Code related to the type of output desired for orthogonal members.
= 1 Member end force output for all members.
= 2 Complete BMCOL output for all orthogonal members.*
= 3 Combination of member end forces and BMCOL output (see Table 7).
NADM -- Number of additional diagonal members.
NCOM -- Number of changes in orthogonal member incidence (Input only if NEWPR = 2).
NIT -- Number of iterations if investigating axial effects (NIT = 0 if not investigating).
DTOL -- Closure tolerance for deflection if investigating axial effects.
RTOL -- Closure tolerance for rotation if investigating axial effects.

*BMCOL output contains full values of moment at end stations.

TABLE 2: X AND Y-LINE COORDINATES (if NEWPR = 1, minimum 3 cards; otherwise, no cards this table)

NXL	NYL
11–15	16–20

NXL = Number of x lines (Max = 10). NYL = Number of y lines (Max = 10).

x line coordinates - NXL Values - 7 values per card

11–20	21–30	31–40	41–50	51–60	61–70	71–80

y line coordinates - NYL Values - 7 values per card

11–20	21–30	31–40	41–50	51–60	61–70	71–80

TABLE 3. MEMBER-TYPE DATA (NAMT sets of data)

Member-Type Control Data

M	KODE	NDC	H
11–15	16–20	21–25	31–40

M -- Number of increments for this member type

KODE -- Code related to stiffness and load characteristics of this member type
= 1 Prismatic* member, not loaded. One data card as shown below.
= 2 Prismatic* member, loaded. NDC data cards as shown below.
= 3 Nonprismatic* member, not loaded. NDC data cards as shown below.
= 4 Nonprismatic* member, loaded. NDC data cards as shown below.

* A member is prismatic if F and AE are constant and no lateral or rotational springs are applied at any point along the member.

NDC -- Number of distributed data cards to follow (NDC = 1 if KODE = 1)

H -- Increment length for this member type.

Distributed Data (NDC cards) - Distributed data are standard beam-column quantities. AE is the product of cross section area and modulus of elasticity at each station.

From Sta	To Sta	1 if Contd.	Bending Stiffness F	Lateral Load Q	Lateral Spring S	Applied Couple T	Rotational Spring R	Axial Stiffness AE
6–10	11–15	16–20	21–30	31–40	41–50	51–60	61–70	71–80

TABLE 4. HORIZONTAL AND VERTICAL MEMBER INCIDENCE (number of cards depends on value of NEWPR)

NEWPR = 1 (NXL plus NYL cards as follows)

11	15	20	25	30	35	40	45	50 55

NYL cards giving member type number for member existing between each pair of x lines along each y line. Enter zero if no member exists.

11	15	20	25	30	35	40	45	50 55

NXL cards giving member type number for member existing between each pair of y lines along each x line. Enter zero if no member exists.

NEWPR = 2 (NCOM cards as follows)

MT	XLL	YLL	XLR	YLR
11	15	20	25	30 35

MT -- Member type number of member to be inserted. Enter zero if member is to be deleted.
XLL, YLL -- x line and y line intersecting at left end of horizontal member or bottom end of vertical member.
XLR, YLR -- x line and y line intersecting at right end of horizontal member or top end of vertical member.

TABLE 5. DIAGONAL MEMBER INCIDENCE (NADM cards)

MT	XLL	YLL	XLR	YLR
11	15	20	25	30 35

MT -- Member type number of member to be inserted. Diagonal members, once inserted, may not be removed. MT must always be greater than zero for diagonal members.
XLL, YLL -- x line and y line intersecting at left end of diagonal member.
XLR, YLR -- x line and y line intersecting at right end of diagonal member.

TABLE 6. APPLIED JOINT LOADS AND ELASTIC JOINT RESTRAINTS (NAJLR cards)

XLL	YLL	PX	PY	PZ	SX	SY	SZ
11–15	20	30	40	50	60	70	80

XLL, YLL -- x line and y line intersecting at joint where load or restraint is applied.
PX, PY -- Joint load in x and y-directions.
PZ -- Moment applied to joint; counterclockwise is positive.
SX, SY -- Elastic translation restraints in x and y-directions.
SZ -- Elastic rotation restraint.

TABLE 7. OUTPUT INFORMATION FOR HORIZONTAL AND VERTICAL MEMBERS* (if KOUT = 3, NYL + NXL cards; otherwise, no cards)

15	20	25	30	35	40	45	50	55

NYL cards specifying output desired for each member between each pair of x lines along each y line. Enter 0 if no member exists. Enter 1 for member end forces only. Enter 2 for complete Beam-Column output.

15	20	25	30	35	40	45	50	55

NXL cards specifying output desired for each vertical member between each pair of y lines along each x line.

* Only member end forces are printed for diagonal members.

TERMINATION OF RUN (1 blank card)

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, e.g., pounds and inches.
All 5-space words are understood to be integers . . . . +4321
All 10-space words are floating point decimal numbers . . . . -4.321E+03
All numbers must be right justified.
The problem number may contain alphanumeric characters.
Blank fields on data cards may be used as desired to aid in coding problems. Information in these fields is ignored by the program.

TABLE 1. PROGRAM CONTROL DATA

NEWPR must have a value of 1 or 2. All other items in this table must have positive values.
Member type data are accumulated for a succession of problems. The total number of member types which may be specified for a succession of problems is 20.
The maximum number of joints in the frame is 50.
The maximum number of diagonal members in the frame is 20.
A maximum of 10 iterations should be sufficient for investigating axial effects. If the closure tolerances are too small, closure within the specified number of iterations may be difficult to achieve. For many structural problems a deflection tolerance in the range of 0.001 to 0.00001 inch and a rotation tolerance in the range of 0.0001 to 0.000001 radians are satisfactory.

TABLE 2. X AND Y LINE COORDINATES

The maximum number of x or y lines is 10. Even though the maximum number of grid line intersections (potential frame joint locations) is 100, the frame must be limited to 50 joints.

TABLE 3. MEMBER TYPE DATA

Member types are assigned identifying numbers according to the order input; i.e., Member Type 1 must be input first, then Member Type 2, etc.
The maximum number of member types, including those held from previous problems is 20.
Member Type Data are conventional beam-column data and are related to a member coordinate system in which the x_m axis is the centroidal axis of the member and the y_m and z_m axes are the principal axes of the cross section. In order for the Member Type Data to be compatible with the frame, or global, coordinate system x,y,z , the conventions as tabulated must be followed:

Member Parallel To	Positive Coordinate Directions Global System		Member System	
	x	y	x_m	y_m
Global x-axis	East	North	East	North
Global y-axis	East	North	South	East
Diagonal (SW-NE)	East	North	Northeast	Northwest
Diagonal (NW-SE)	East	North	Southeast	Northeast

The z_m and z positive directions always coincide.

The maximum number of increments permitted in the beam-column is 50.

TABLE 4. HORIZONTAL AND VERTICAL MEMBER INCIDENCE

For a new problem, one card must be supplied for each x line and one card for each y line. in the grid giving the member type between each adjacent pair of grid line intersections. If no member exists, Member Type must be entered as zero.

For a problem which is a continuation of the previous problem, only changes in incidence are required. A member is deleted from the frame when a Member Type of zero is specified. However, the Member Type data remains in storage. Only the latest member type number is used at any location. Therefore, the effects of two members cannot be superimposed.

TABLE 5. DIAGONAL MEMBER INCIDENCE

Diagonal members, once added to the frame, may not be deleted.

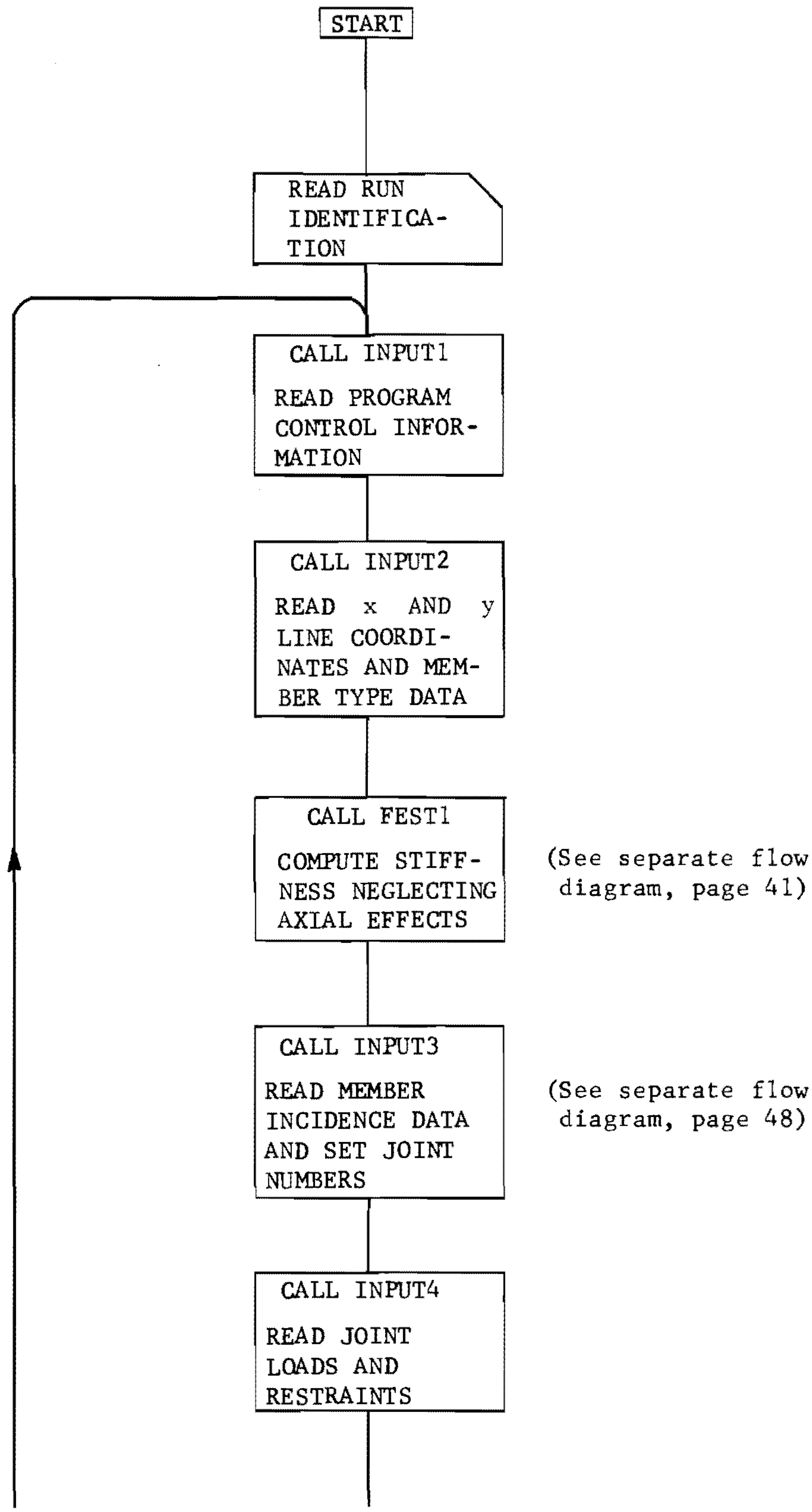
TABLE 6. APPLIED JOINT LOADS AND RESTRAINTS

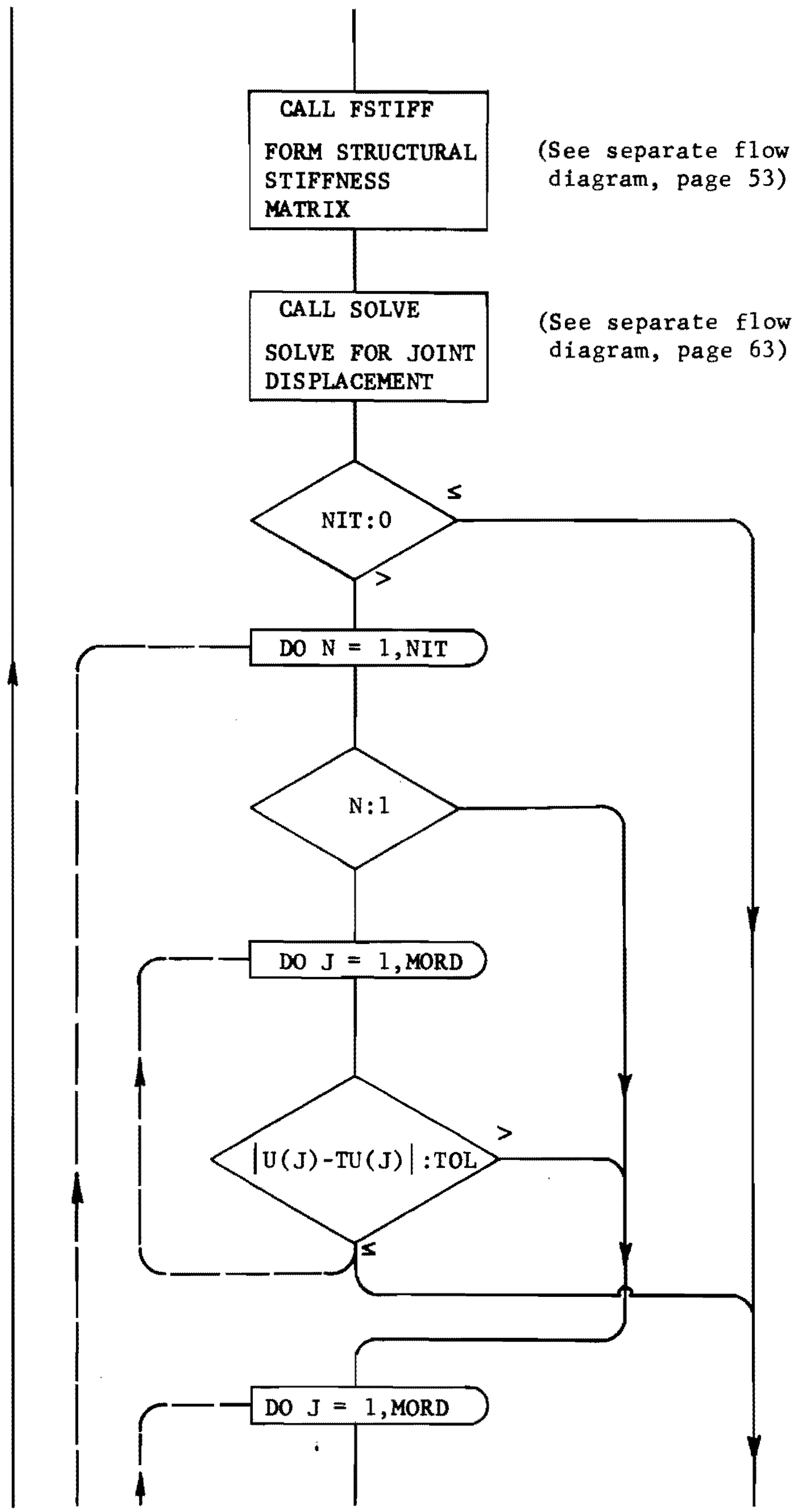
A total of 50 cards, including those for preceding problems, is the maximum permitted for specifying joint loads and restraints. All joint loads and restraints are input in the global coordinate directions.

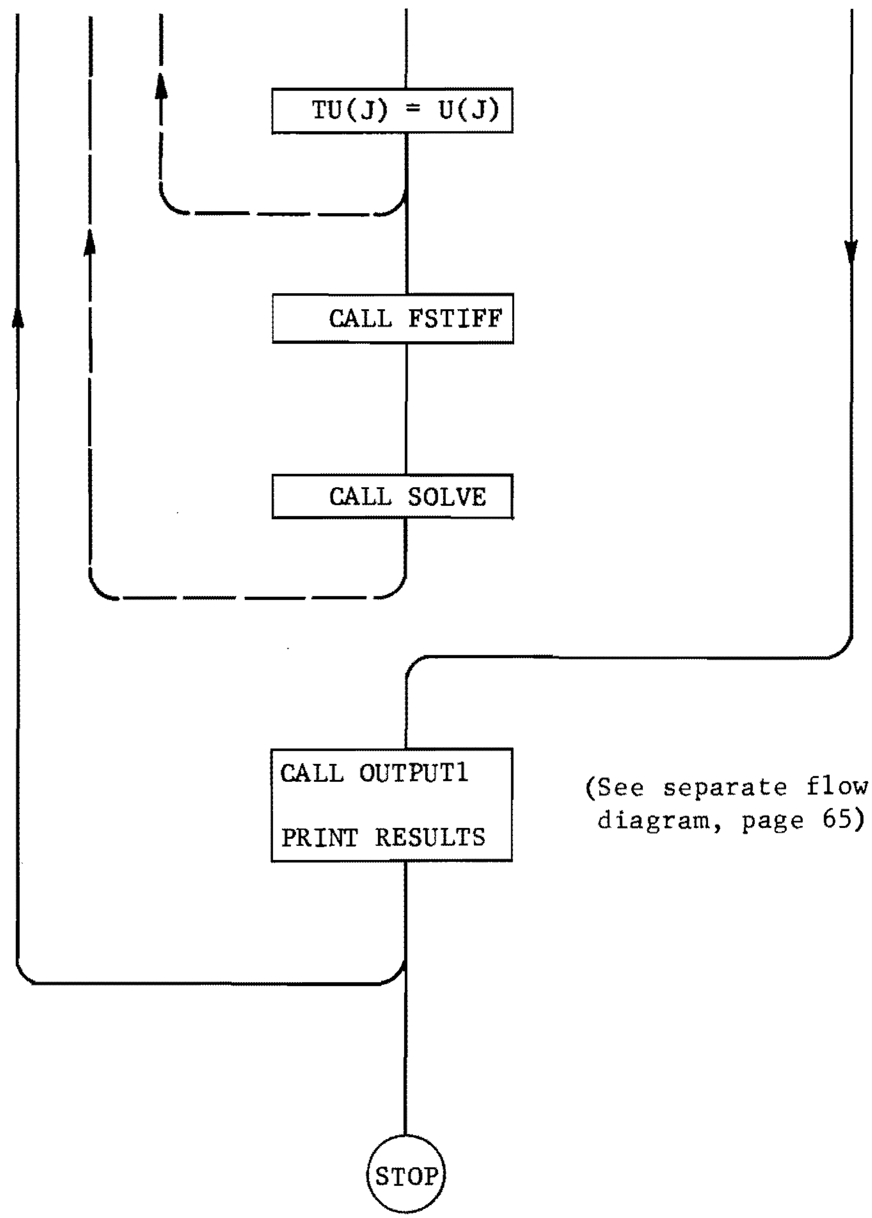
APPENDIX 2

DETAILED FLOW DIAGRAMS

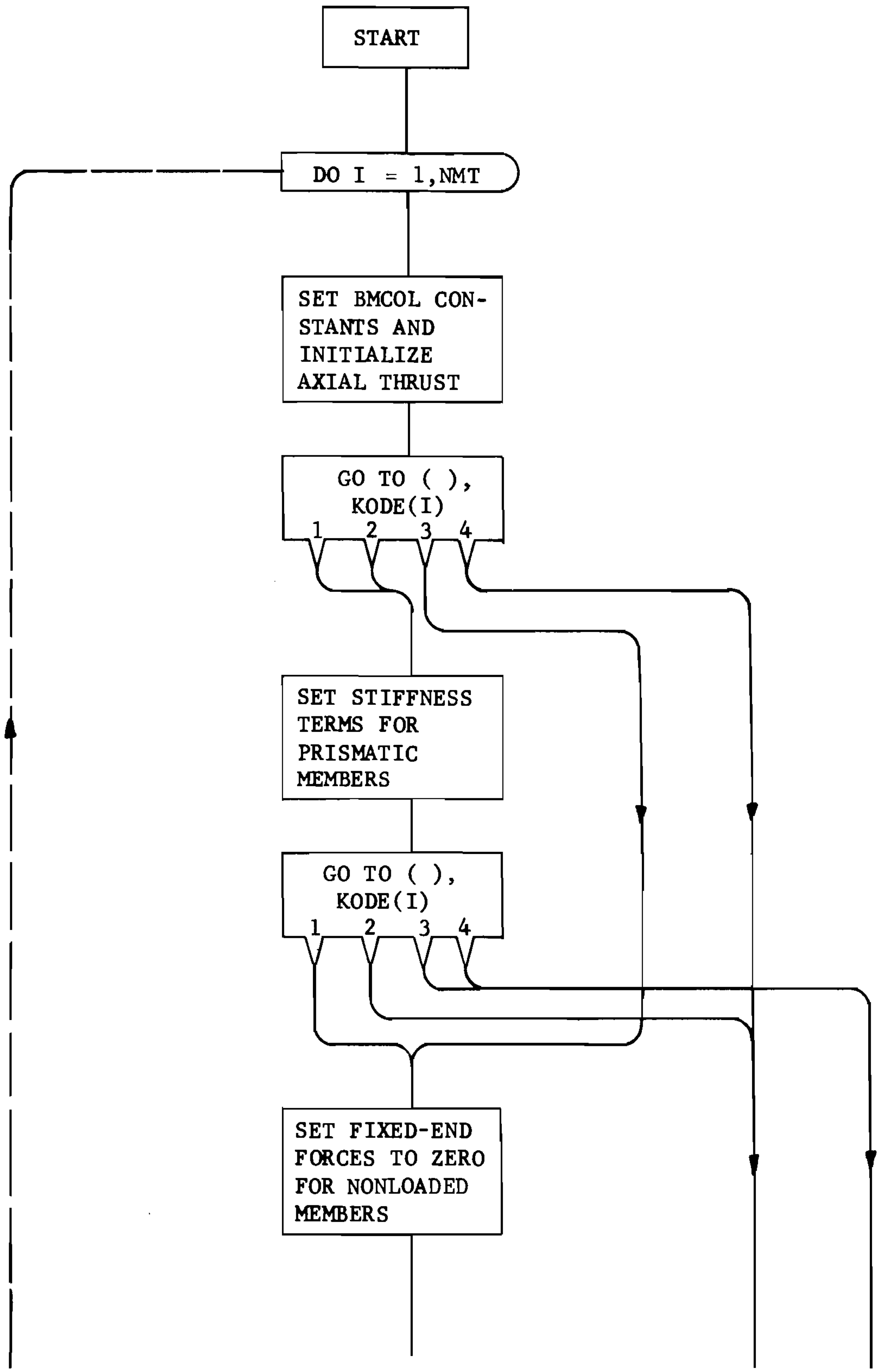
PROGRAM PFRM1

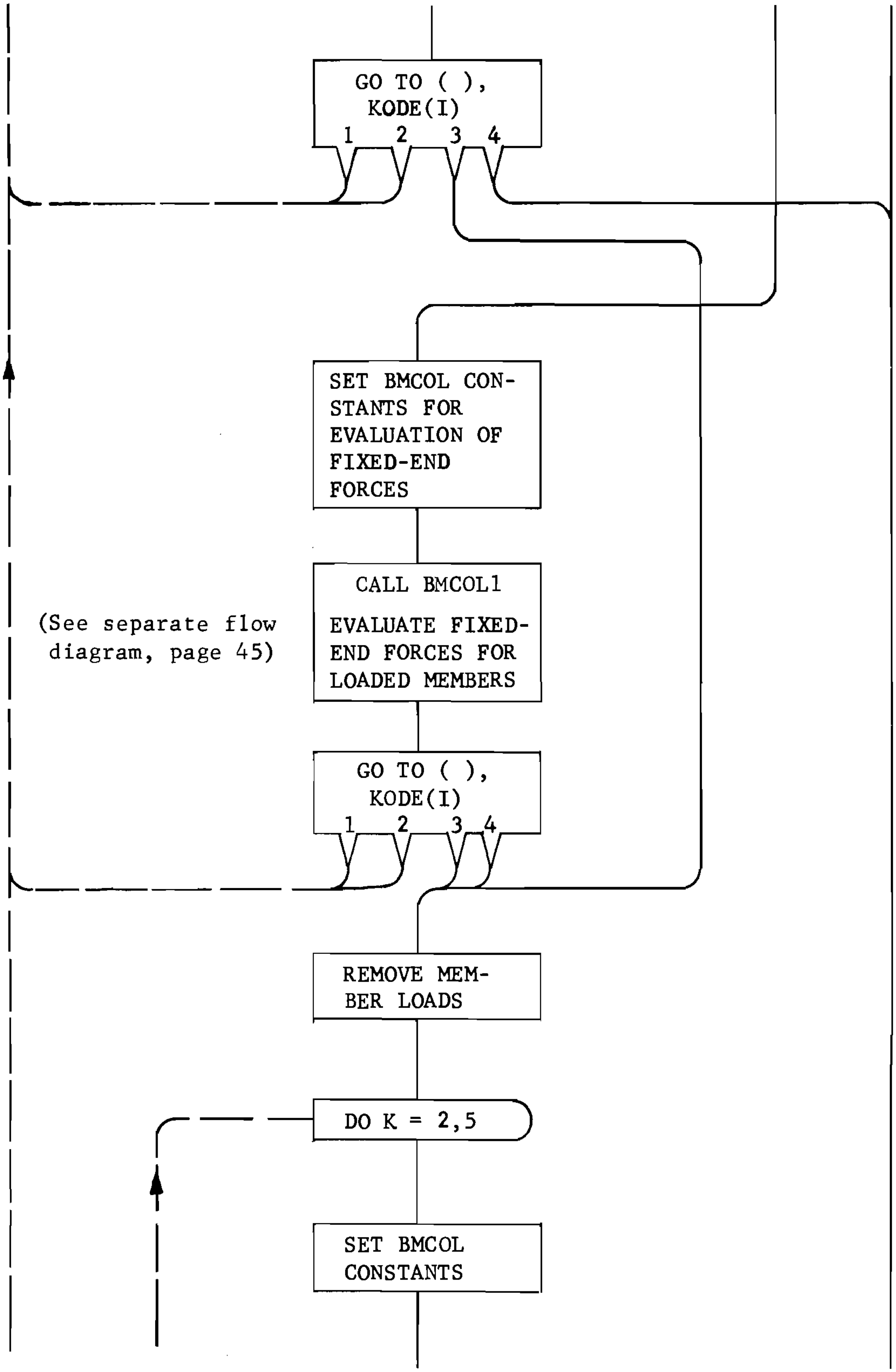


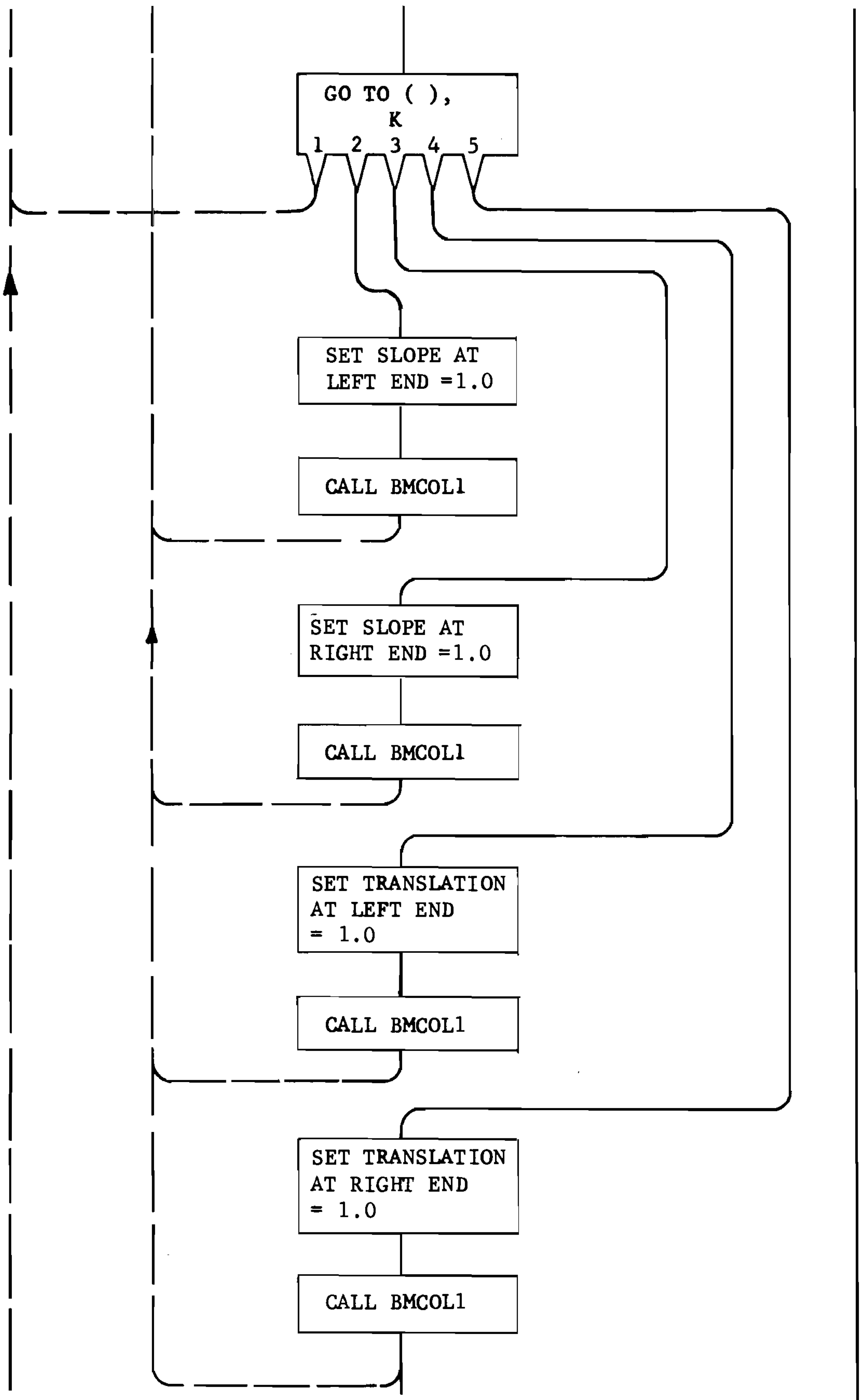

CALL FSTIFF
FORM STRUCTURAL STIFFNESS MATRIX
(See separate flow diagram, page 53)
CALL SOLVE
SOLVE FOR JOINT DISPLACEMENT
(See separate flow diagram, page 63)
NIT:0
≤
>
DO N = 1,NIT
N:1
DO J = 1,MORD
|U(J)-TU(J)| :TOL
>
≤
DO J = 1,MORD

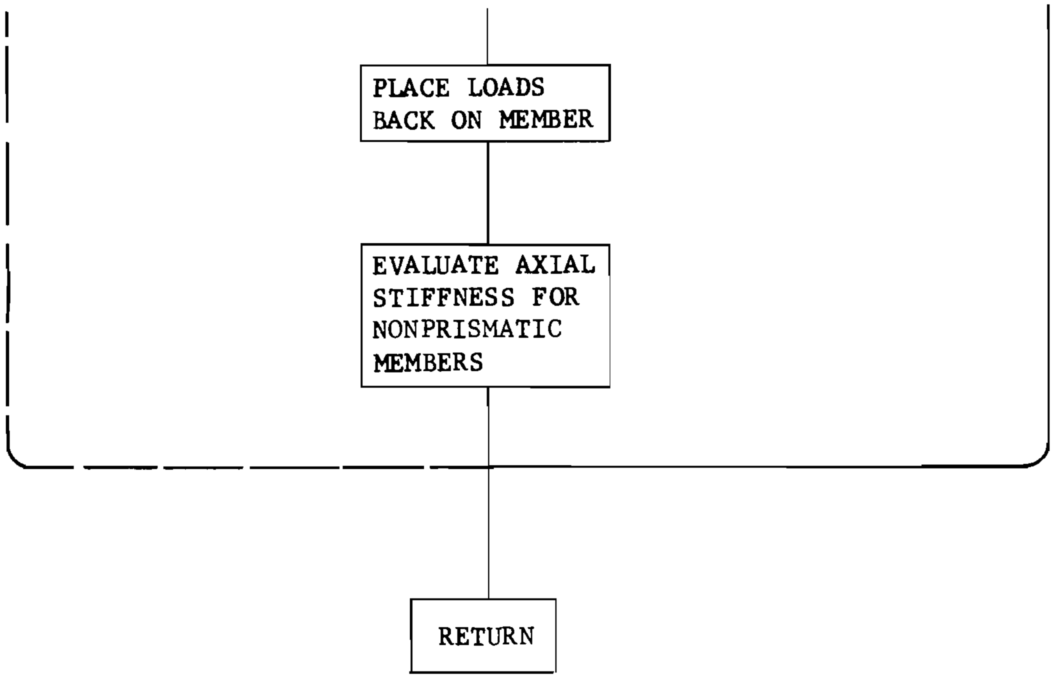

TU(J) = U(J)
CALL FSTIFF
CALL SOLVE
CALL OUTPUT1
PRINT RESULTS
(See separate flow diagram, page 65)
STOP

SUBROUTINE FEST1

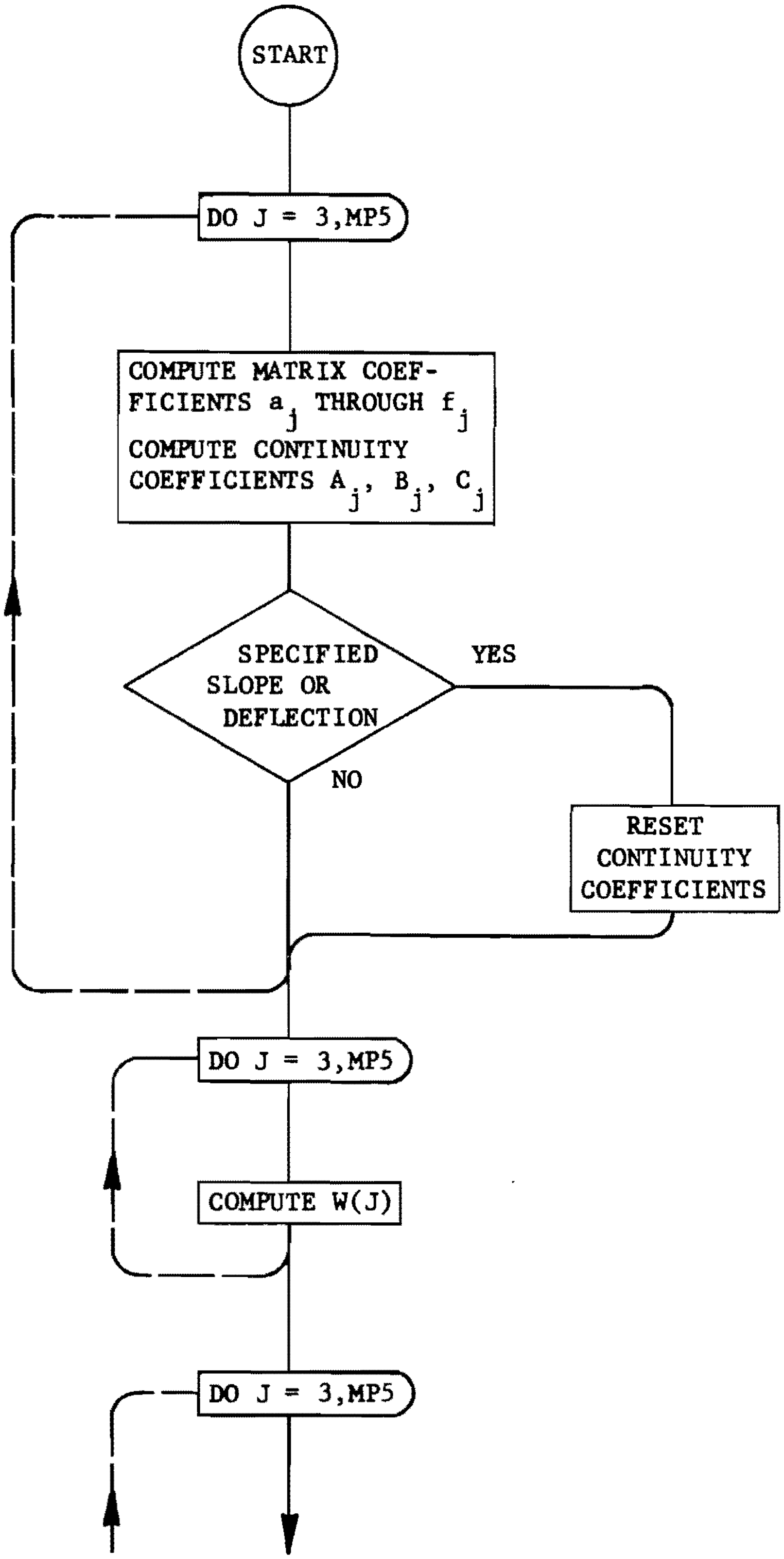


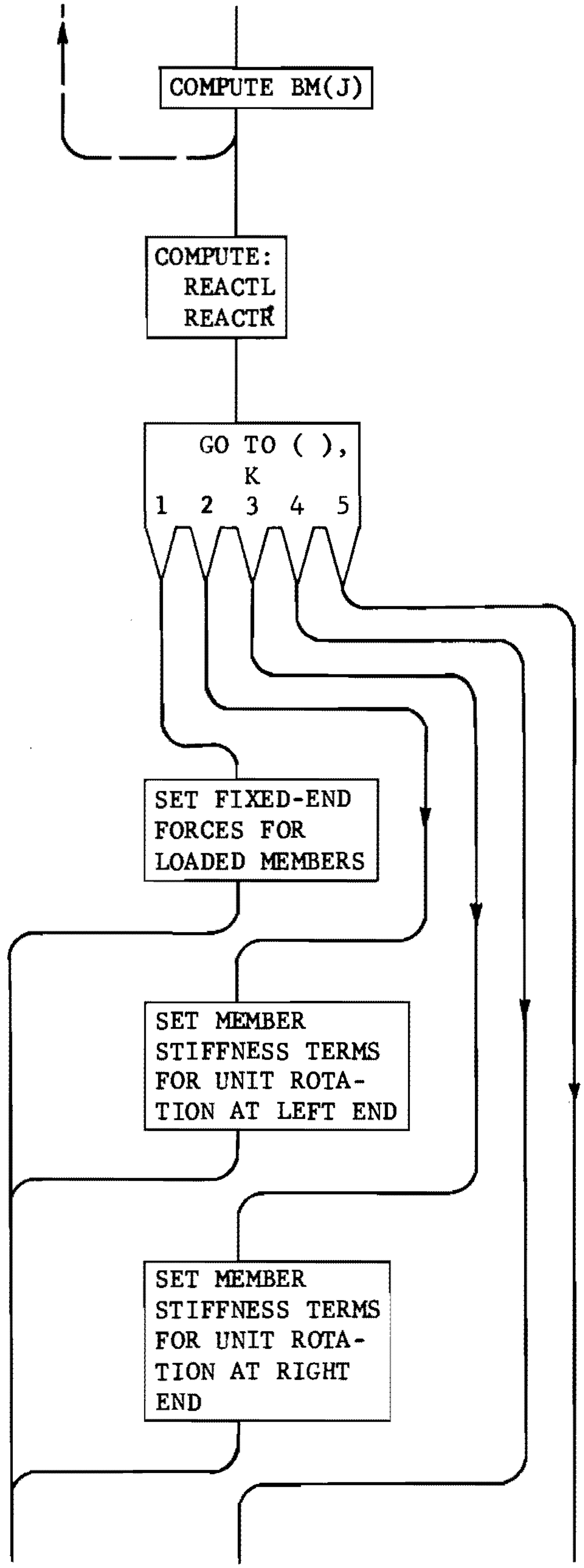

GO TO ( ),
KODE(I)
1 2 3 4
SET BMCOL CONSTANTS FOR EVALUATION OF FIXED-END FORCES
CALL BMCOL1
EVALUATE FIXED-END FORCES FOR LOADED MEMBERS
(See separate flow diagram, page 45)
GO TO ( ),
KODE(I)
1 2 3 4
REMOVE MEMBER LOADS
DO K = 2,5
SET BMCOL CONSTANTS

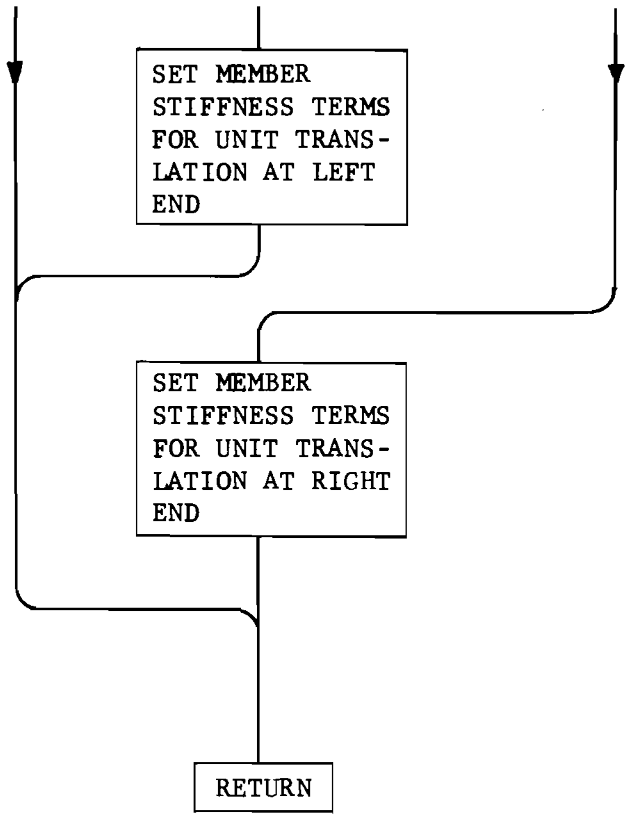

GO TO ( ),
K
1 2 3 4 5
SET SLOPE AT
LEFT END =1.0
CALL BMCOL1
SET SLOPE AT
RIGHT END =1.0
CALL BMCOL1
SET TRANSLATION
AT LEFT END
= 1.0
CALL BMCOL1
SET TRANSLATION
AT RIGHT END
= 1.0
CALL BMCOL1


PLACE LOADS BACK ON MEMBER
EVALUATE AXIAL STIFFNESS FOR NONPRISMATIC MEMBERS
RETURN

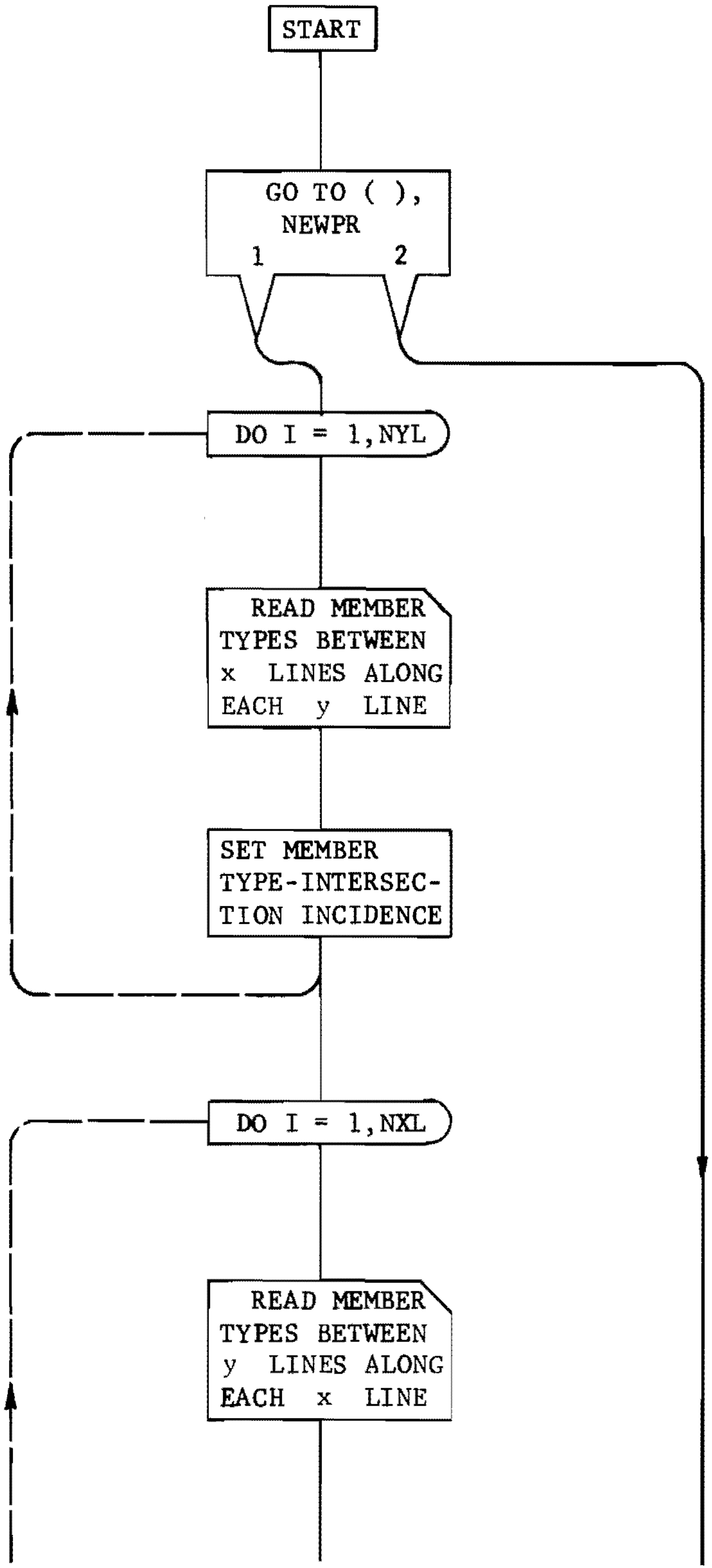
SUBROUTINE BMCOL1

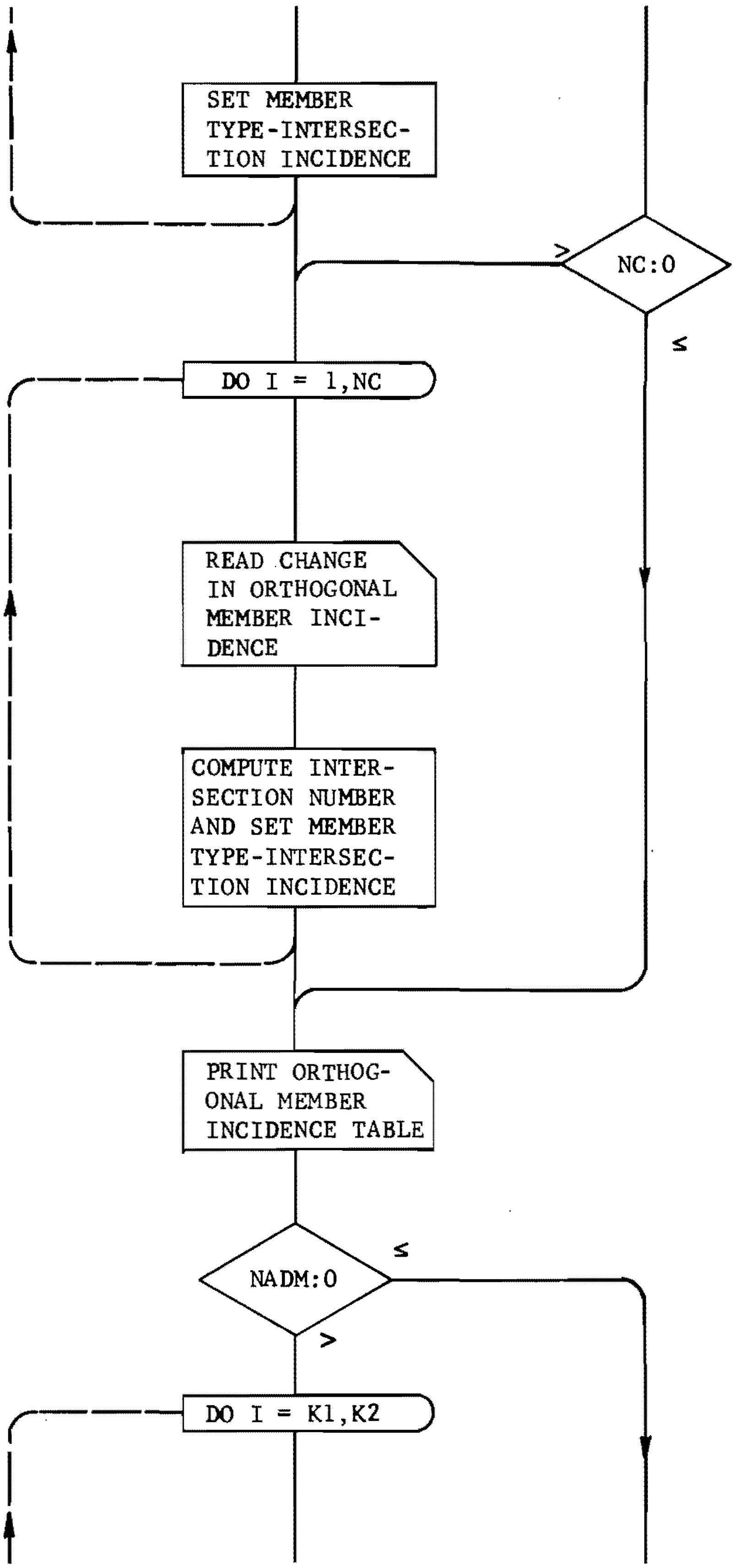


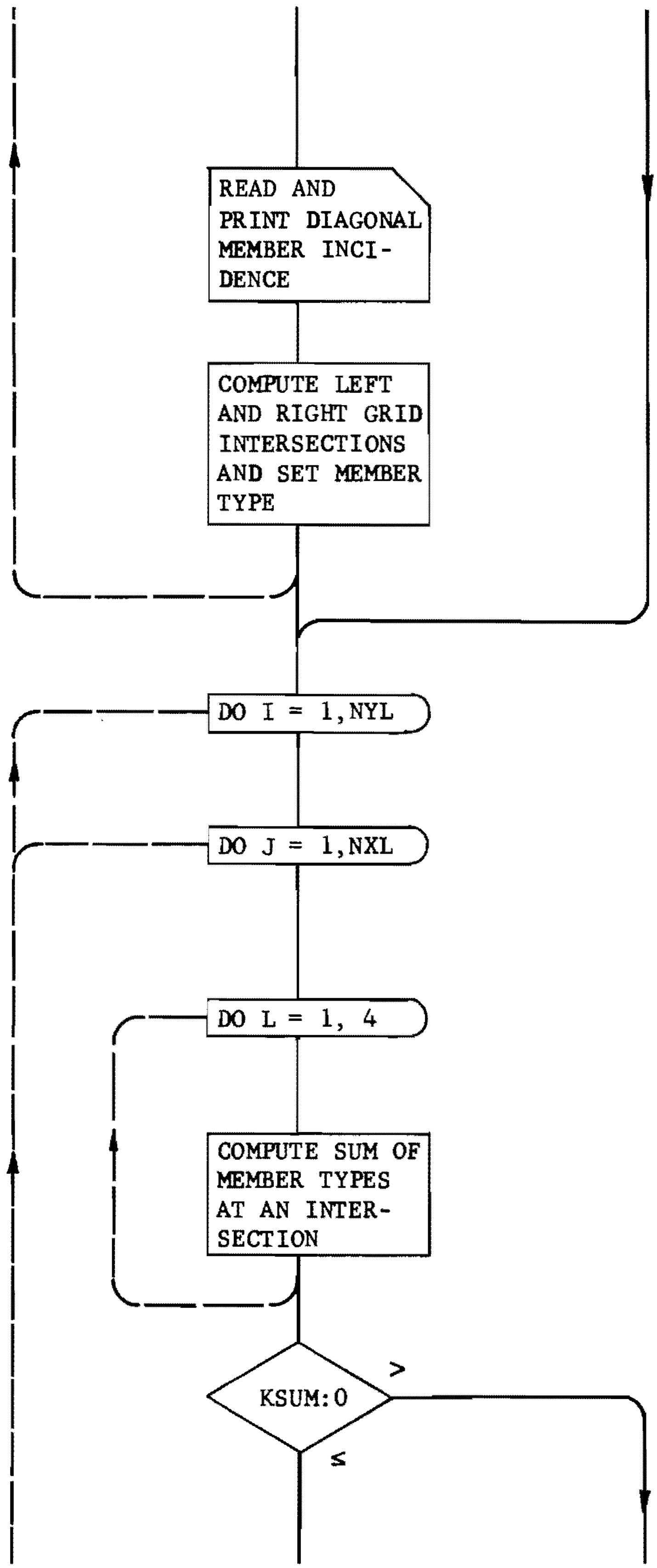

COMPUTE BM(J)
COMPUTE: REACTL REACTR
GO TO ( ), K
1 2 3 4 5
SET FIXED-END FORCES FOR LOADED MEMBERS
SET MEMBER STIFFNESS TERMS FOR UNIT ROTATION AT LEFT END
SET MEMBER STIFFNESS TERMS FOR UNIT ROTATION AT RIGHT END

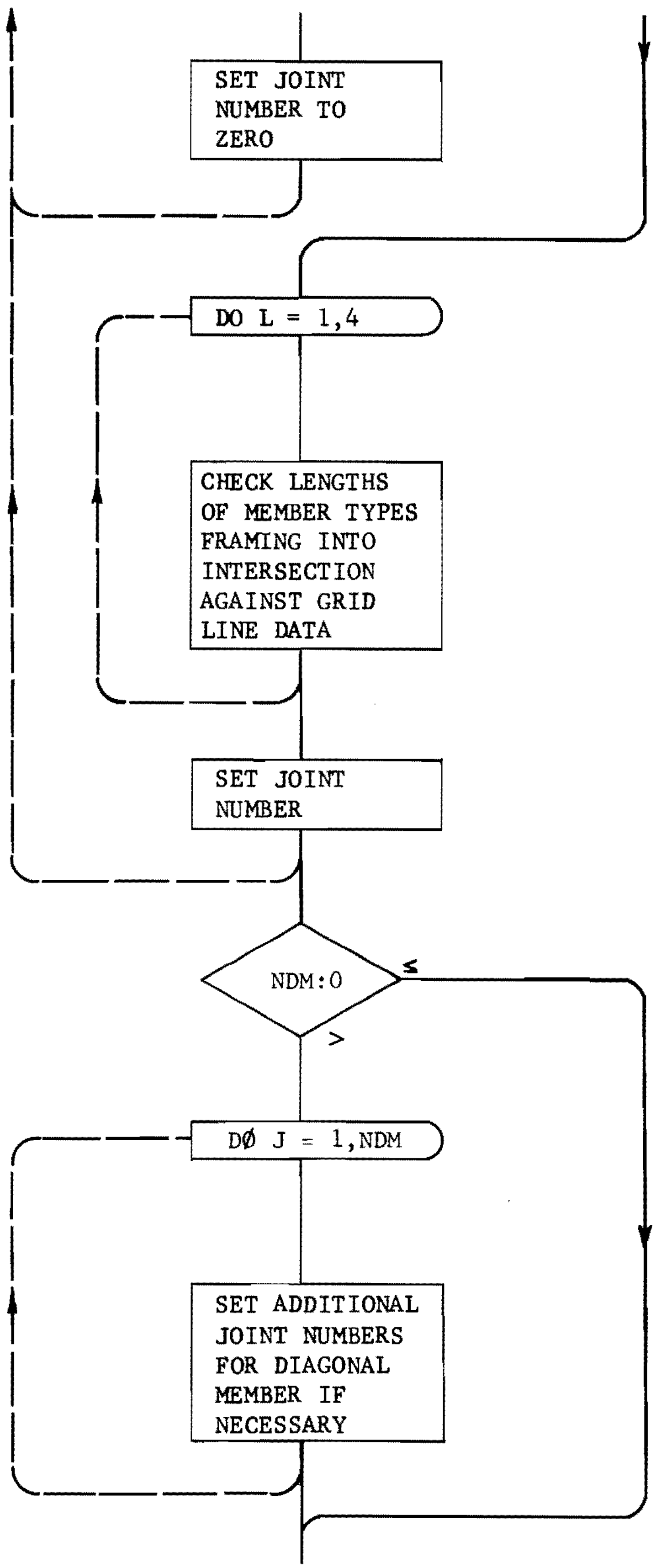

SET MEMBER STIFFNESS TERMS FOR UNIT TRANS-LATION AT LEFT END
SET MEMBER STIFFNESS TERMS FOR UNIT TRANS-LATION AT RIGHT END
RETURN

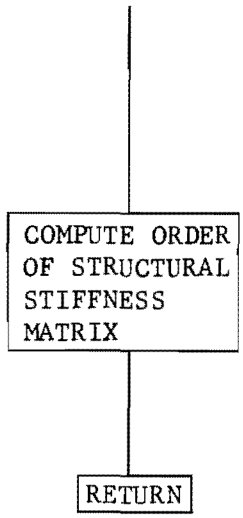
SUBROUTINE INPUT3



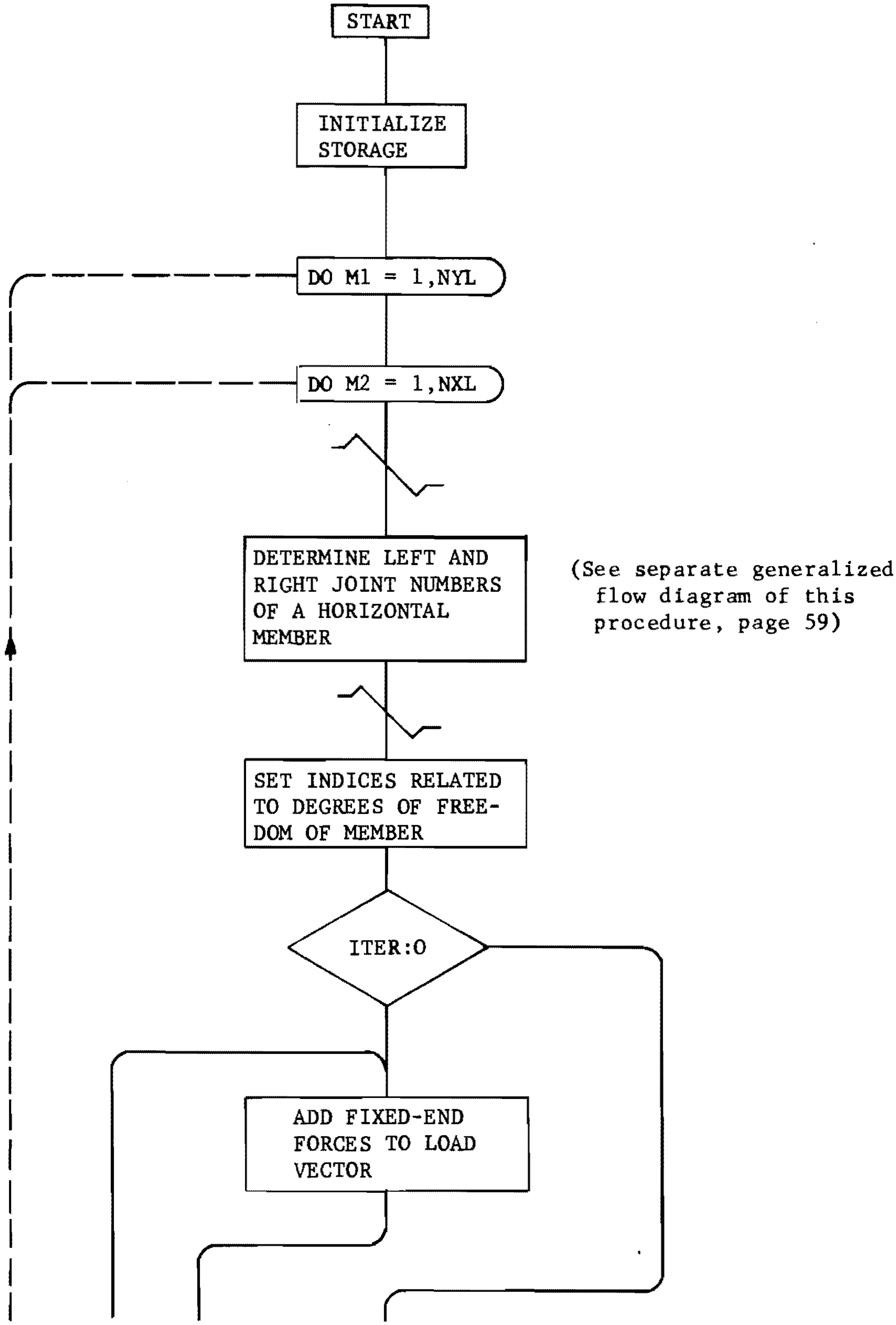

SET MEMBER TYPE-INTERSECTION INCIDENCE
NC:0
>
≤
DO I = 1,NC
READ CHANGE IN ORTHOGONAL MEMBER INCIDENCE
COMPUTE INTERSECTION NUMBER AND SET MEMBER TYPE-INTERSECTION INCIDENCE
PRINT ORTHOGONAL MEMBER INCIDENCE TABLE
NADM:0
≤
>
DO I = K1,K2

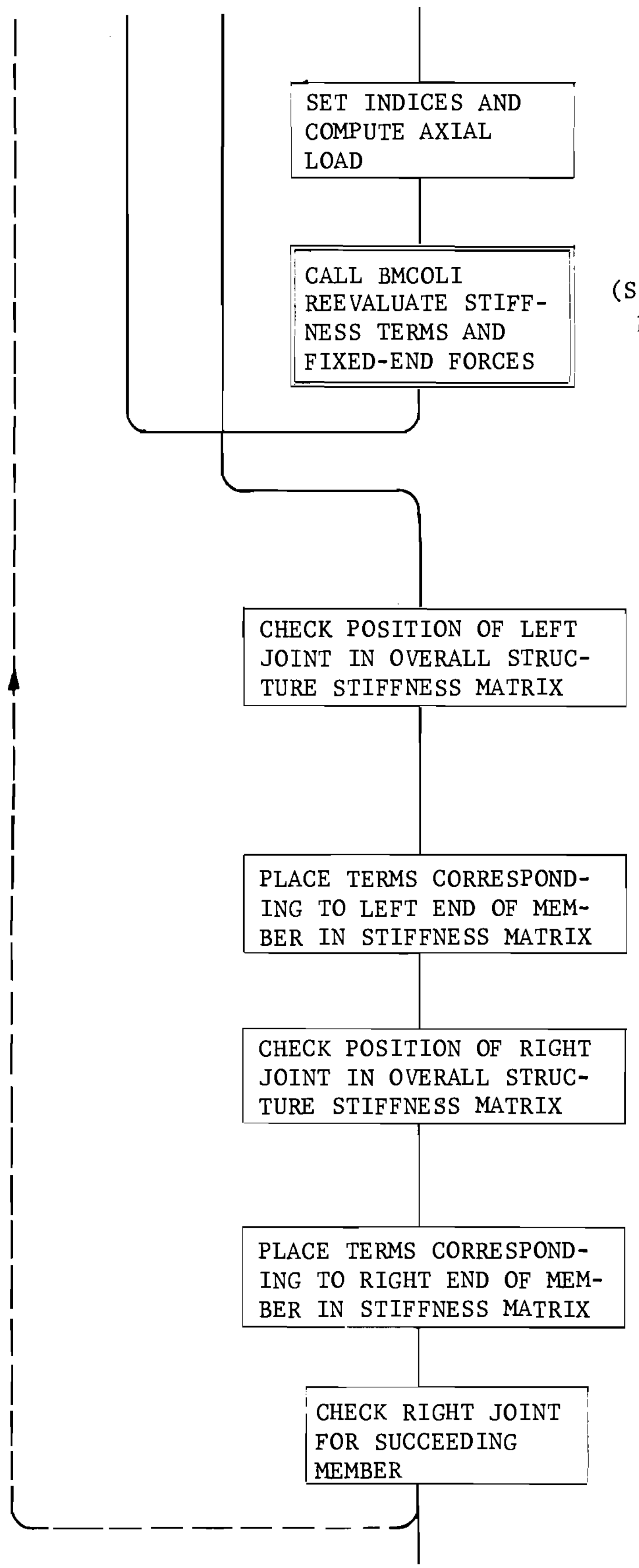

READ AND PRINT DIAGONAL MEMBER INCI-DENCE
COMPUTE LEFT AND RIGHT GRID INTERSECTIONS AND SET MEMBER TYPE
DO I = 1,NYL
DO J = 1,NXL
DO L = 1, 4
COMPUTE SUM OF MEMBER TYPES AT AN INTER-SECTION
KSUM:0
>
≤


SET JOINT NUMBER TO ZERO
DO L = 1,4
CHECK LENGTHS OF MEMBER TYPES FRAMING INTO INTERSECTION AGAINST GRID LINE DATA
SET JOINT NUMBER
NDM:0
≤
>
DØ J = 1,NDM
SET ADDITIONAL JOINT NUMBERS FOR DIAGONAL MEMBER IF NECESSARY


COMPUTE ORDER
OF STRUCTURAL
STIFFNESS
MATRIX
RETURN

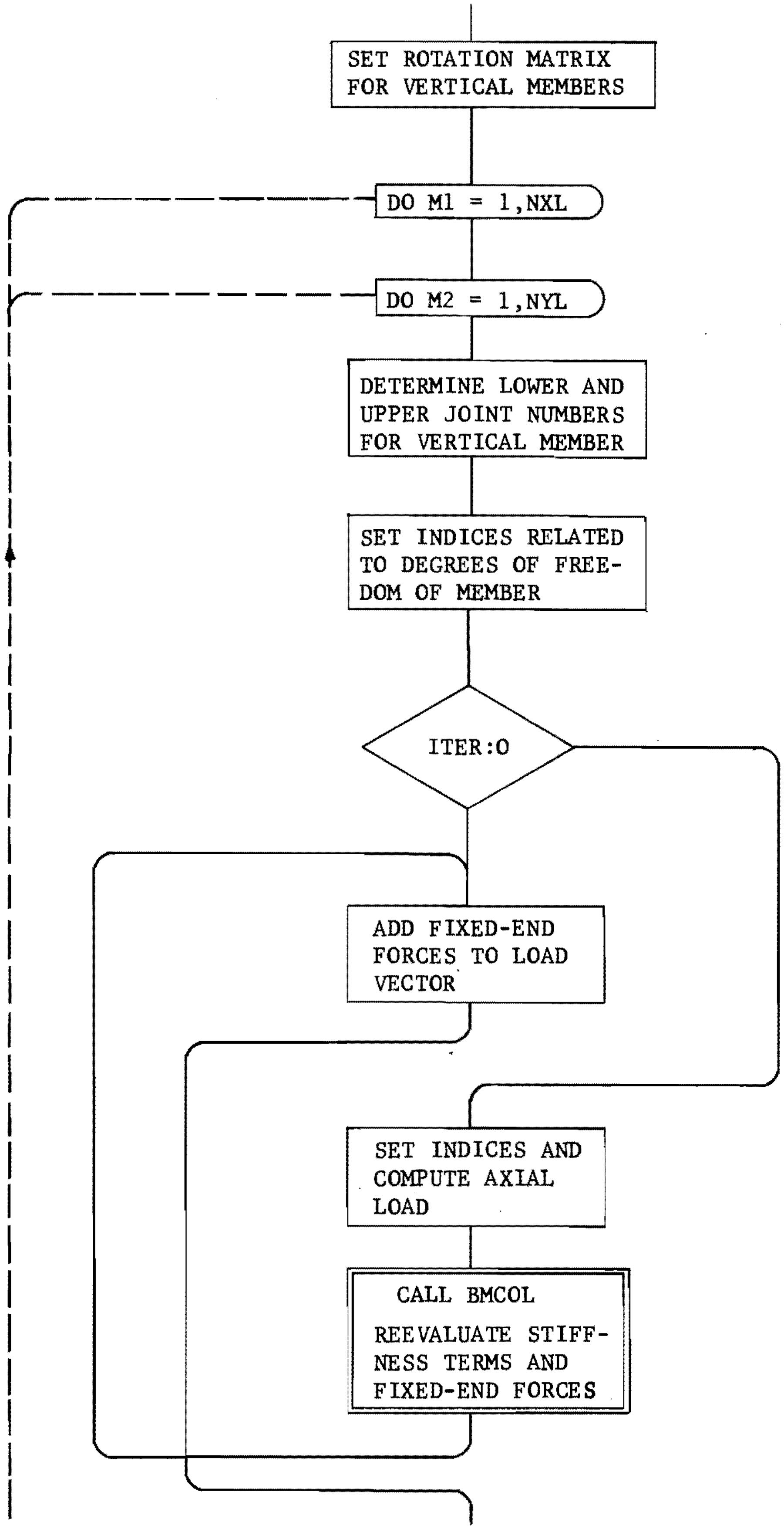
SUBROUTINE FSTIFF

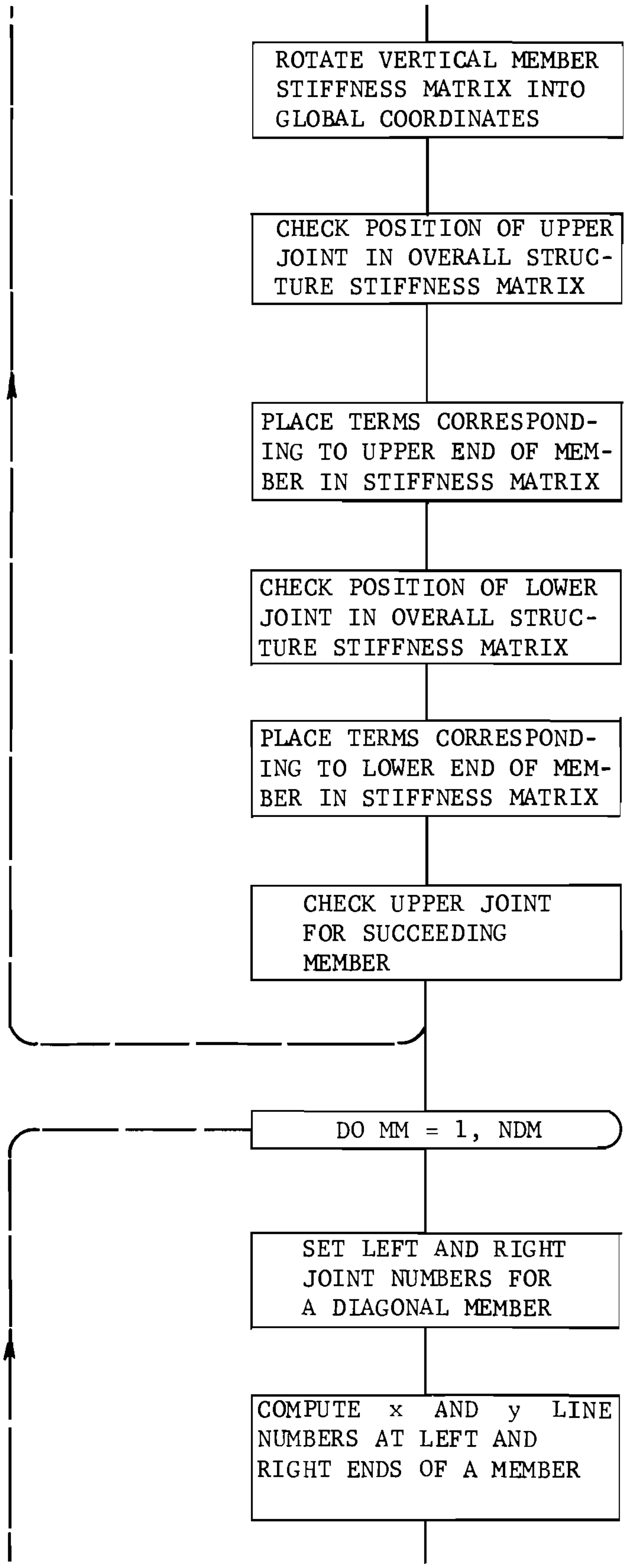


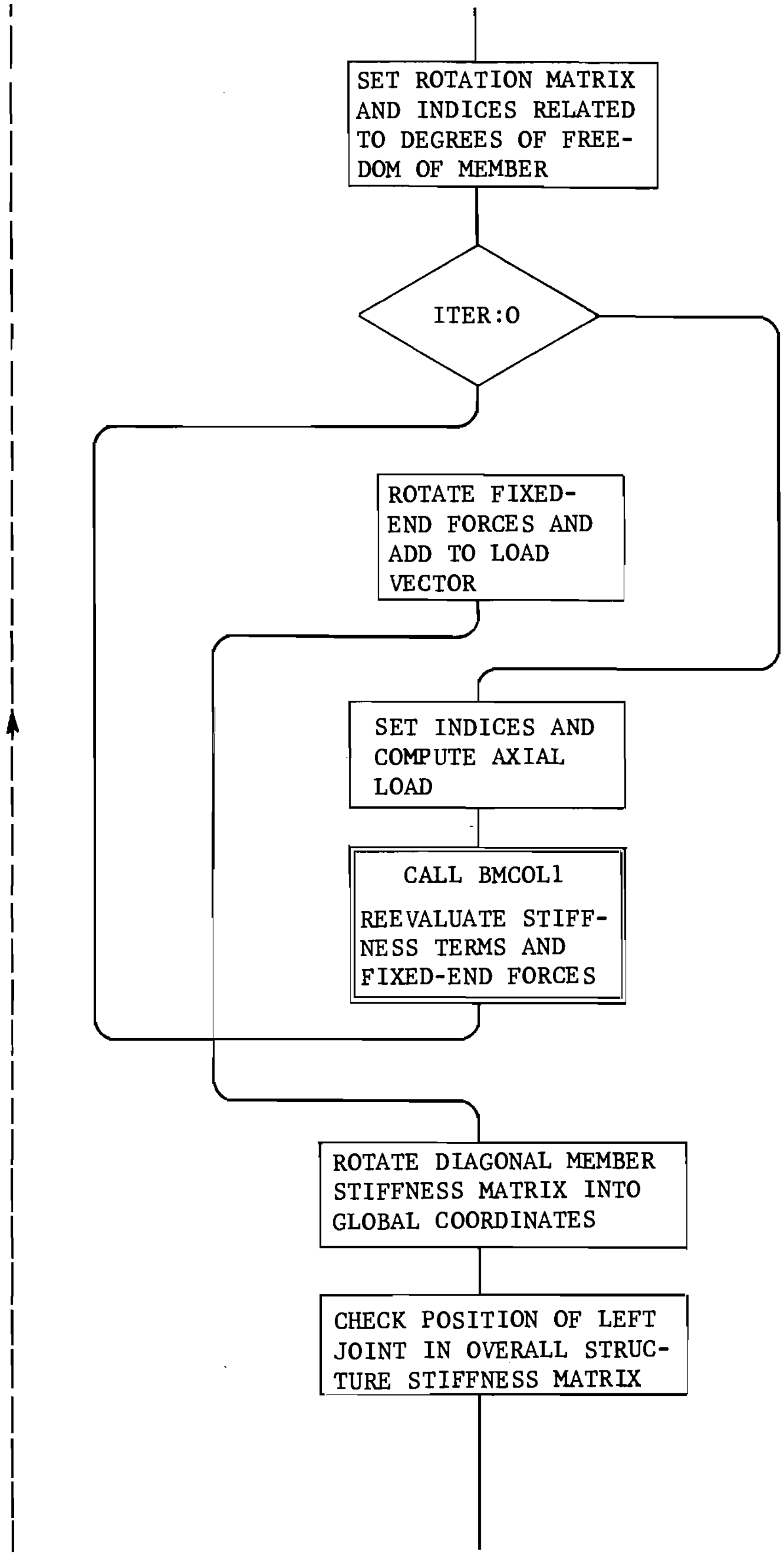


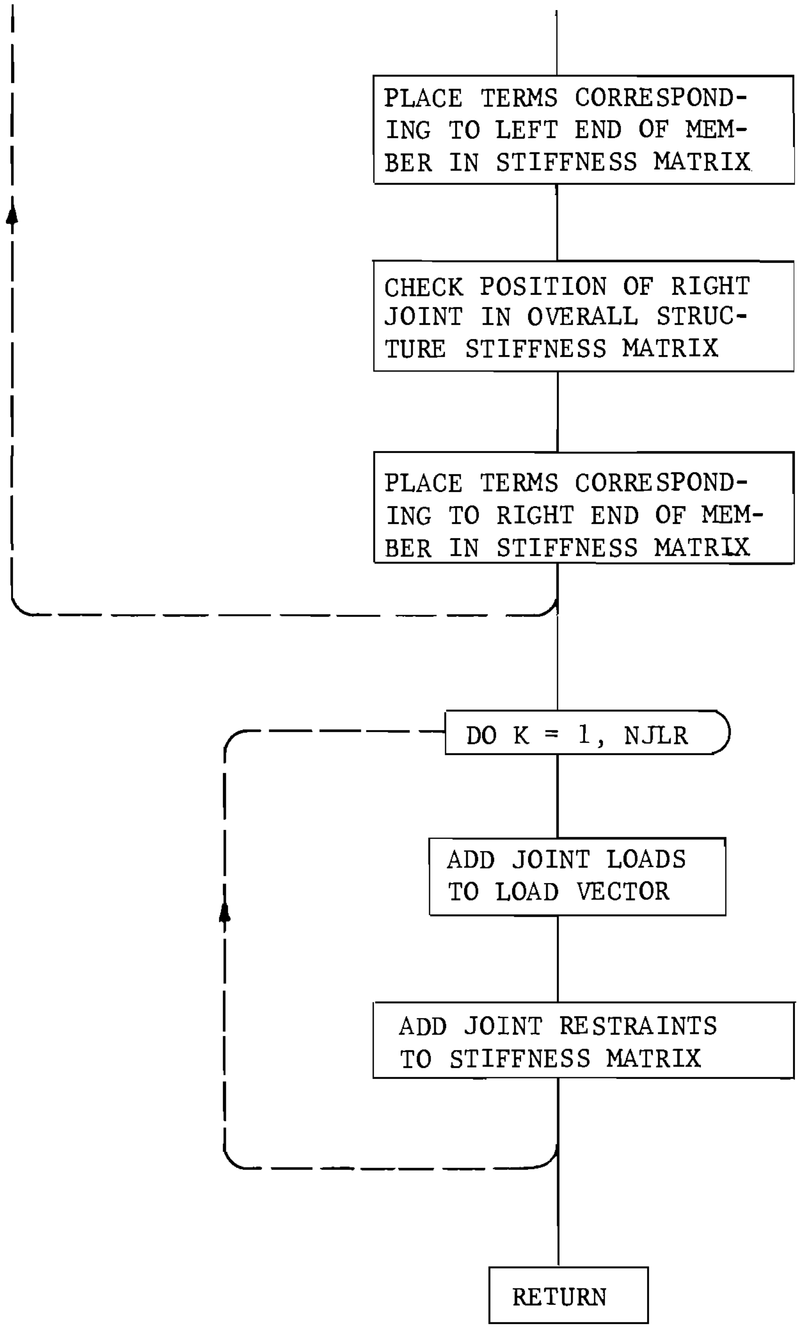
(See Subroutine FEST 1 page 41)

(See separate generalized flow diagram of this procedure, page 61)


SET ROTATION MATRIX FOR VERTICAL MEMBERS
DO M1 = 1,NXL
DO M2 = 1,NYL
DETERMINE LOWER AND UPPER JOINT NUMBERS FOR VERTICAL MEMBER
SET INDICES RELATED TO DEGREES OF FREE-DOM OF MEMBER
ITER:0
ADD FIXED-END FORCES TO LOAD VECTOR
SET INDICES AND COMPUTE AXIAL LOAD
CALL BMCOL
REEVALUATE STIFF-NESS TERMS AND FIXED-END FORCES

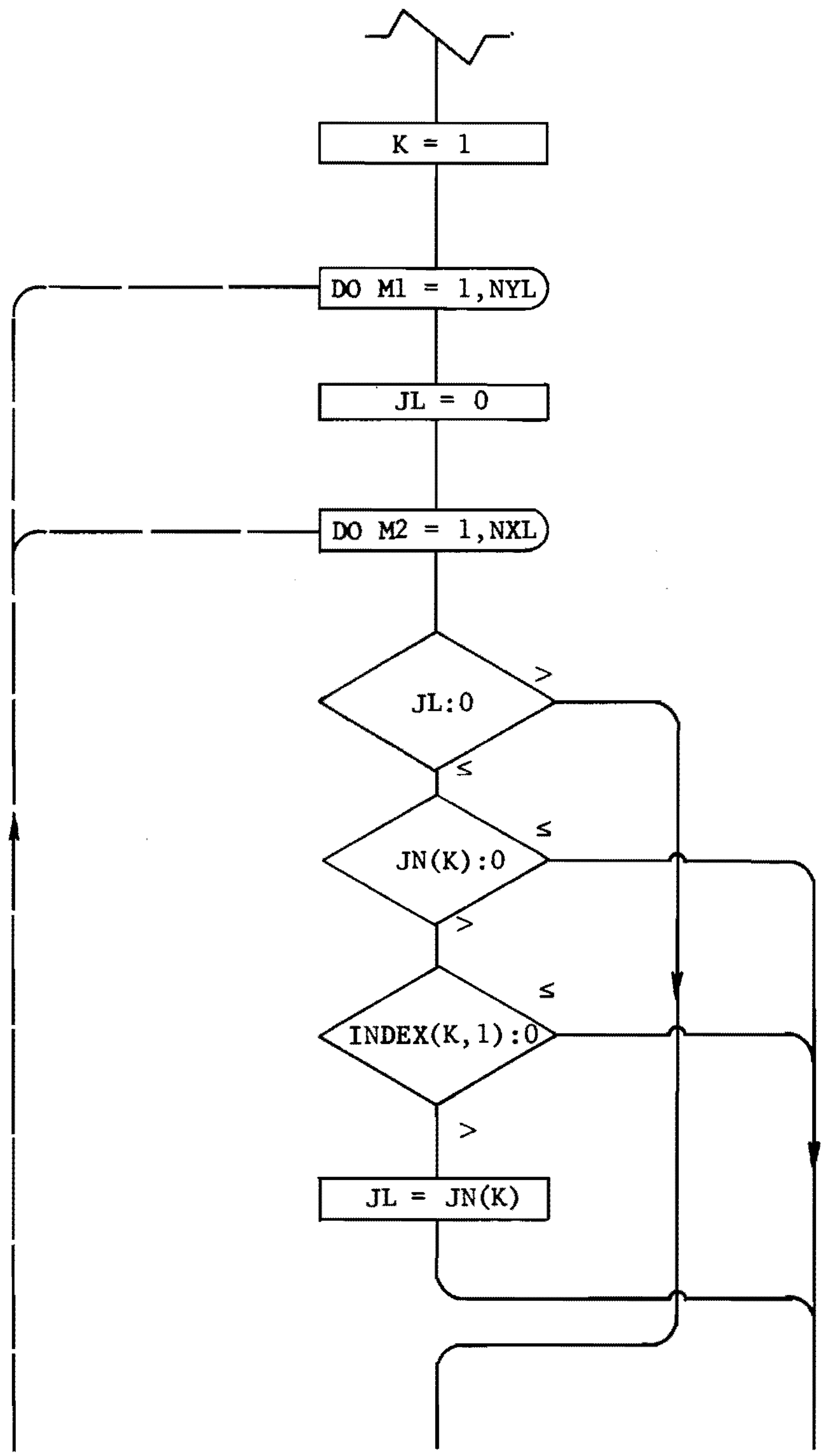

ROTATE VERTICAL MEMBER STIFFNESS MATRIX INTO GLOBAL COORDINATES
CHECK POSITION OF UPPER JOINT IN OVERALL STRUCTURE STIFFNESS MATRIX
PLACE TERMS CORRESPONDING TO UPPER END OF MEMBER IN STIFFNESS MATRIX
CHECK POSITION OF LOWER JOINT IN OVERALL STRUCTURE STIFFNESS MATRIX
PLACE TERMS CORRESPONDING TO LOWER END OF MEMBER IN STIFFNESS MATRIX
CHECK UPPER JOINT FOR SUCCEEDING MEMBER
DO MM = 1, NDM
SET LEFT AND RIGHT JOINT NUMBERS FOR A DIAGONAL MEMBER
COMPUTE x AND y LINE NUMBERS AT LEFT AND RIGHT ENDS OF A MEMBER

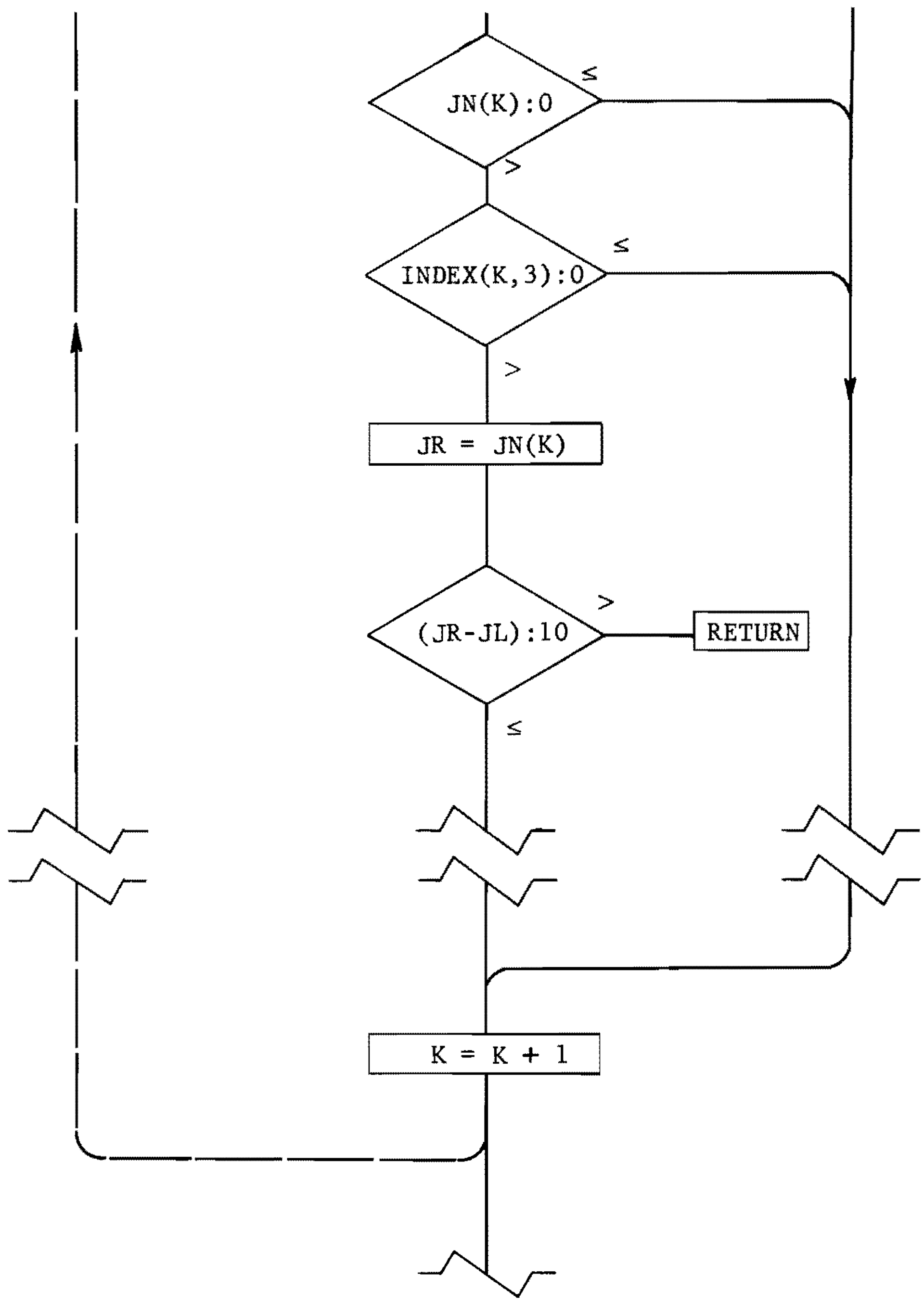

SET ROTATION MATRIX AND INDICES RELATED TO DEGREES OF FREEDOM OF MEMBER
ITER:0
ROTATE FIXED-END FORCES AND ADD TO LOAD VECTOR
SET INDICES AND COMPUTE AXIAL LOAD
CALL BMCOL1
REEVALUATE STIFFNESS TERMS AND FIXED-END FORCES
ROTATE DIAGONAL MEMBER STIFFNESS MATRIX INTO GLOBAL COORDINATES
CHECK POSITION OF LEFT JOINT IN OVERALL STRUCTURE STIFFNESS MATRIX


PLACE TERMS CORRESPOND-ING TO LEFT END OF MEM-BER IN STIFFNESS MATRIX
CHECK POSITION OF RIGHT JOINT IN OVERALL STRUC-TURE STIFFNESS MATRIX
PLACE TERMS CORRESPOND-ING TO RIGHT END OF MEM-BER IN STIFFNESS MATRIX
DO K = 1, NJLR
ADD JOINT LOADS TO LOAD VECTOR
ADD JOINT RESTRAINTS TO STIFFNESS MATRIX
RETURN

DETERMINING MEMBER JOINT NUMBERS
(FROM SUBROUTINE FSTIFF)

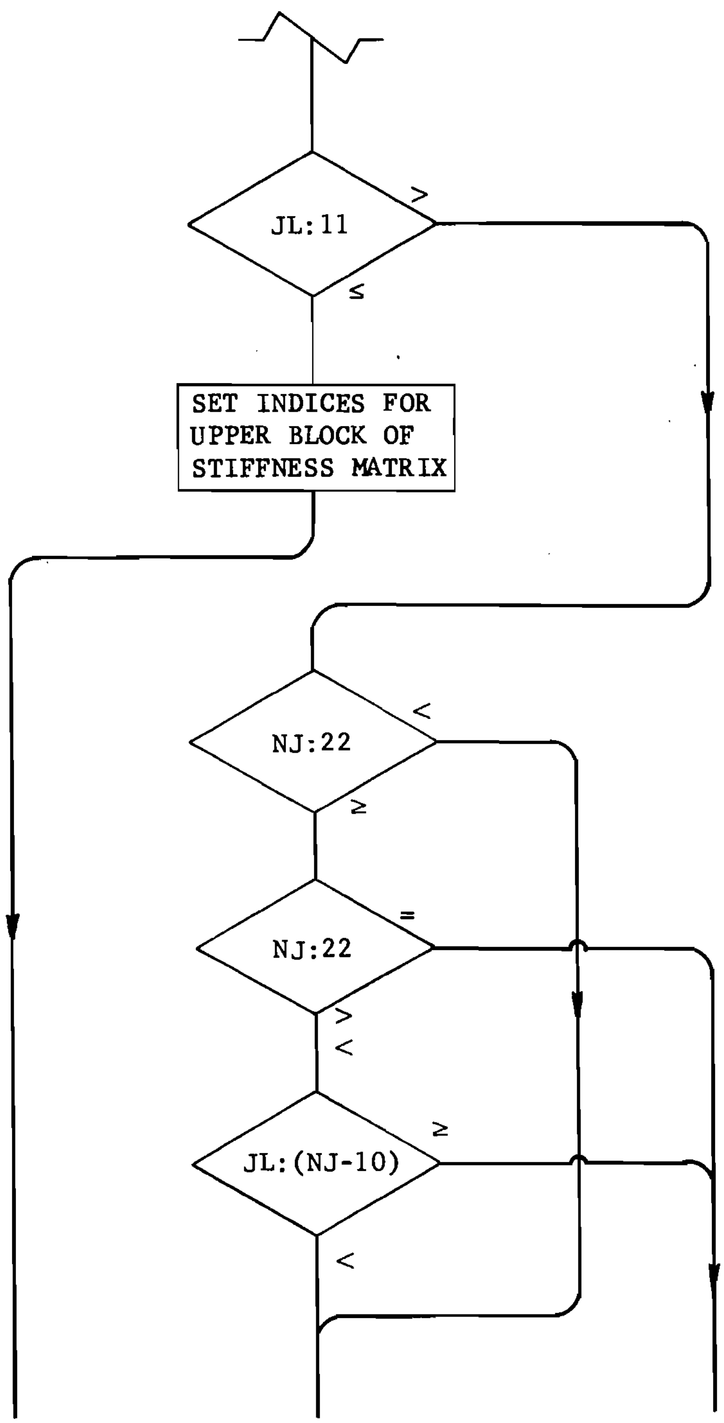
NOTE: The procedure diagrammed below applies only to horizontal members. The procedure for vertical members is similar with the exception of minor changes in indices.

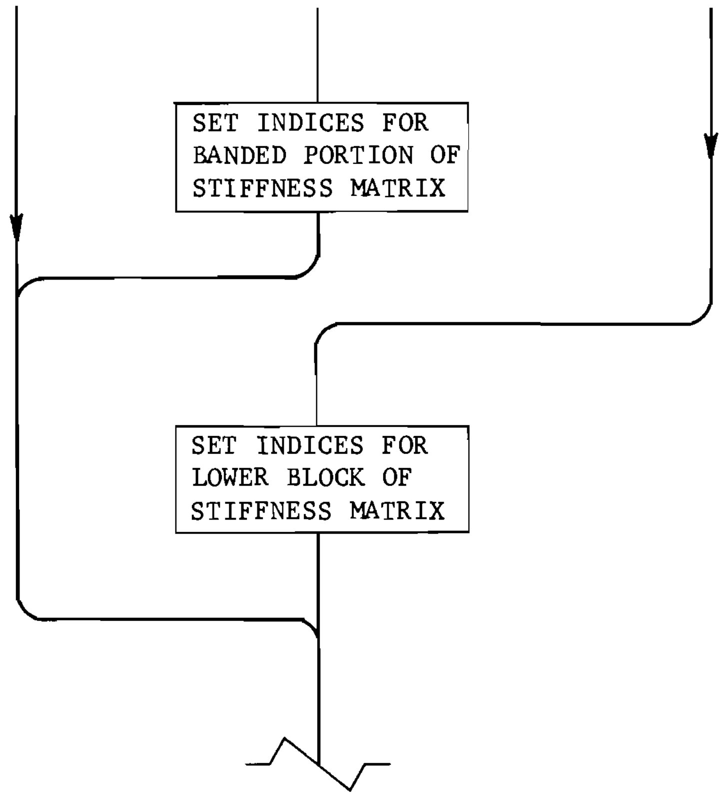



JN(K):0
≤
>
INDEX(K,3):0
≤
>
JR = JN(K)
(JR-JL):10
>
RETURN
≤
K = K + 1

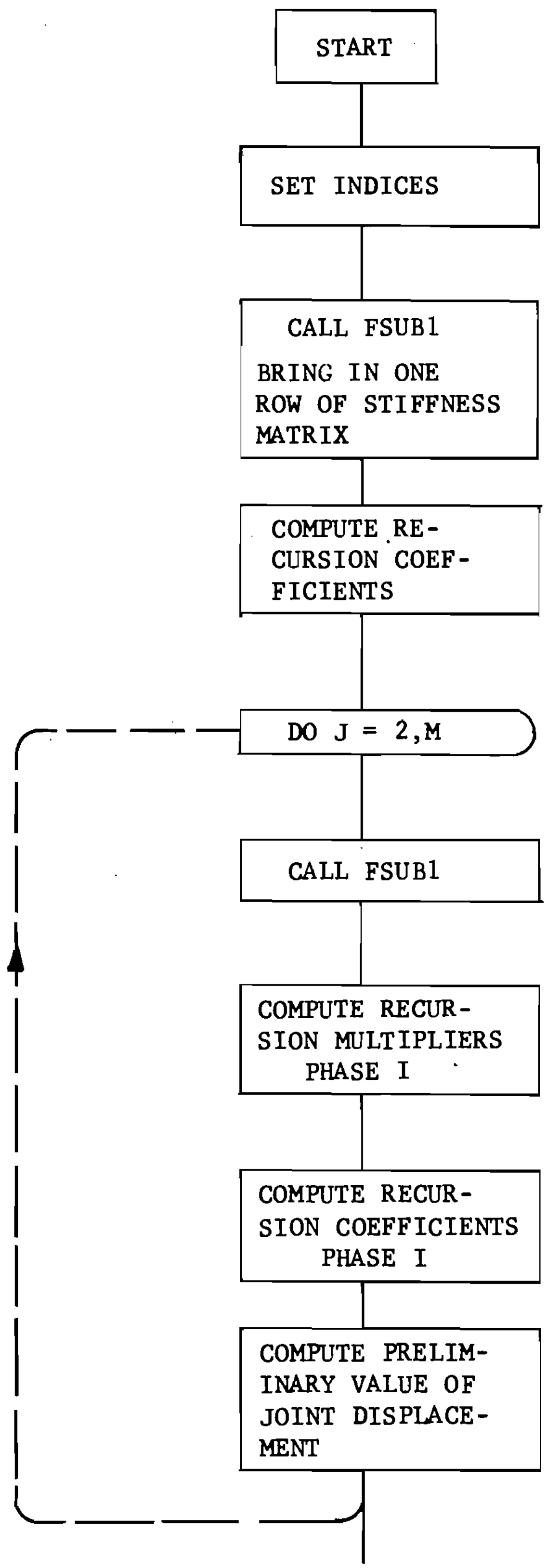
CHECKING POSITION OF JOINT IN
STRUCTURE STIFFNESS MATRIX
(FROM SUBROUTINE FSTIFF)

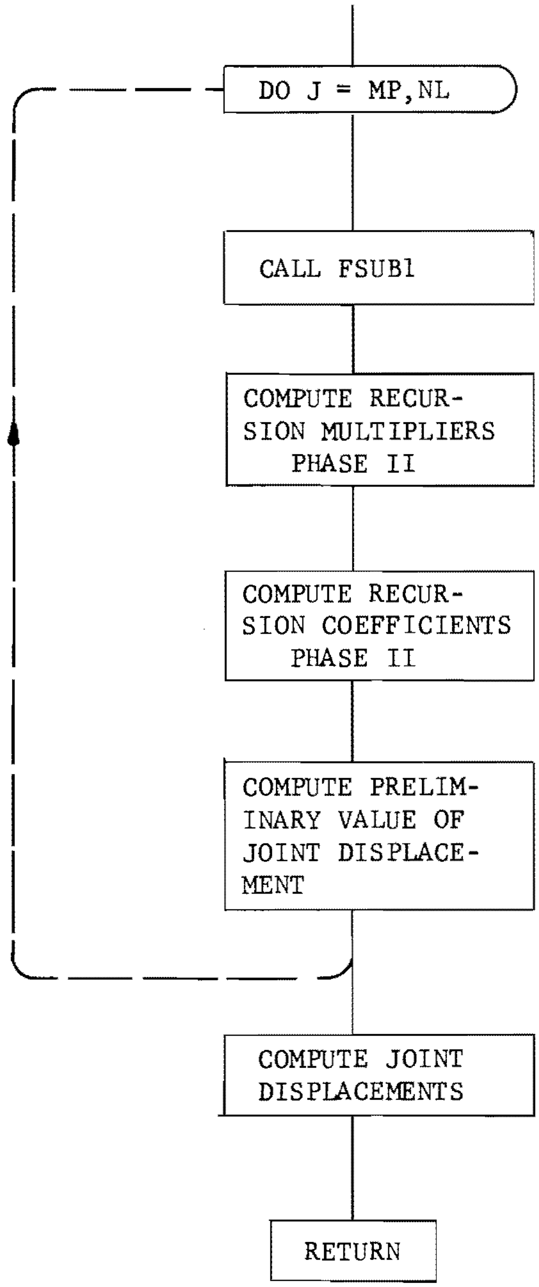
NOTE: The procedure diagrammed below applies to the left or lower joint of a member. The procedure for the right or upper joint of a member is similar.



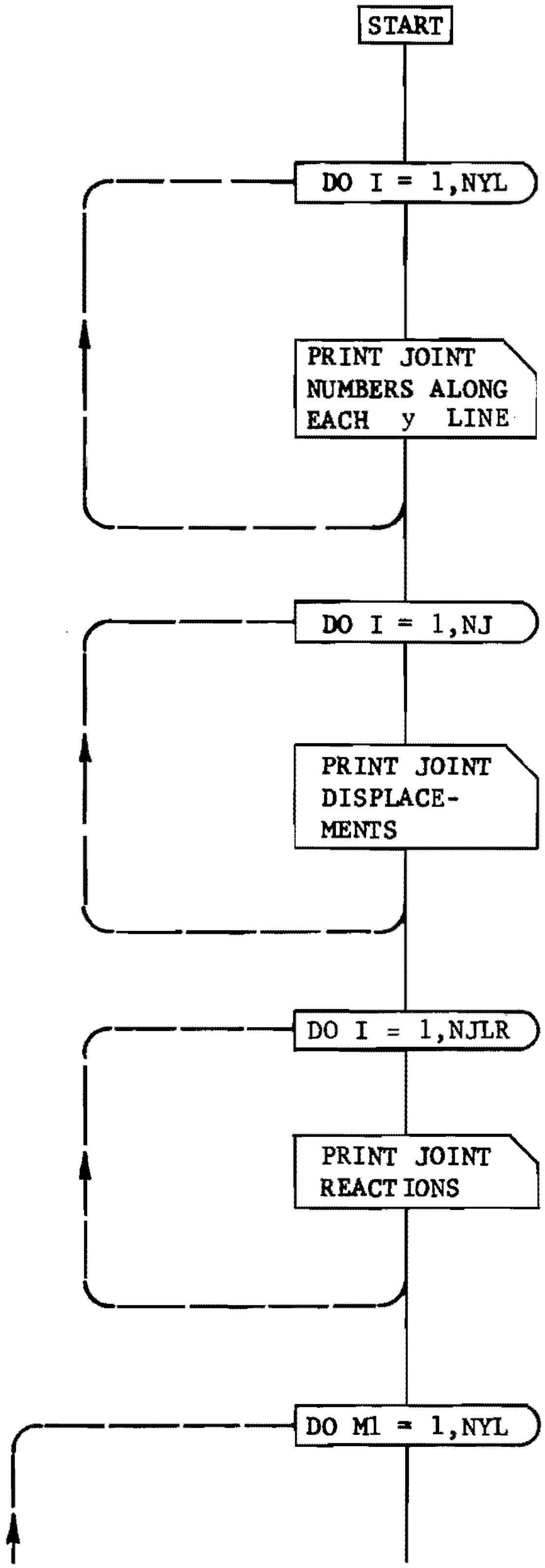

SET INDICES FOR BANDED PORTION OF STIFFNESS MATRIX
SET INDICES FOR LOWER BLOCK OF STIFFNESS MATRIX

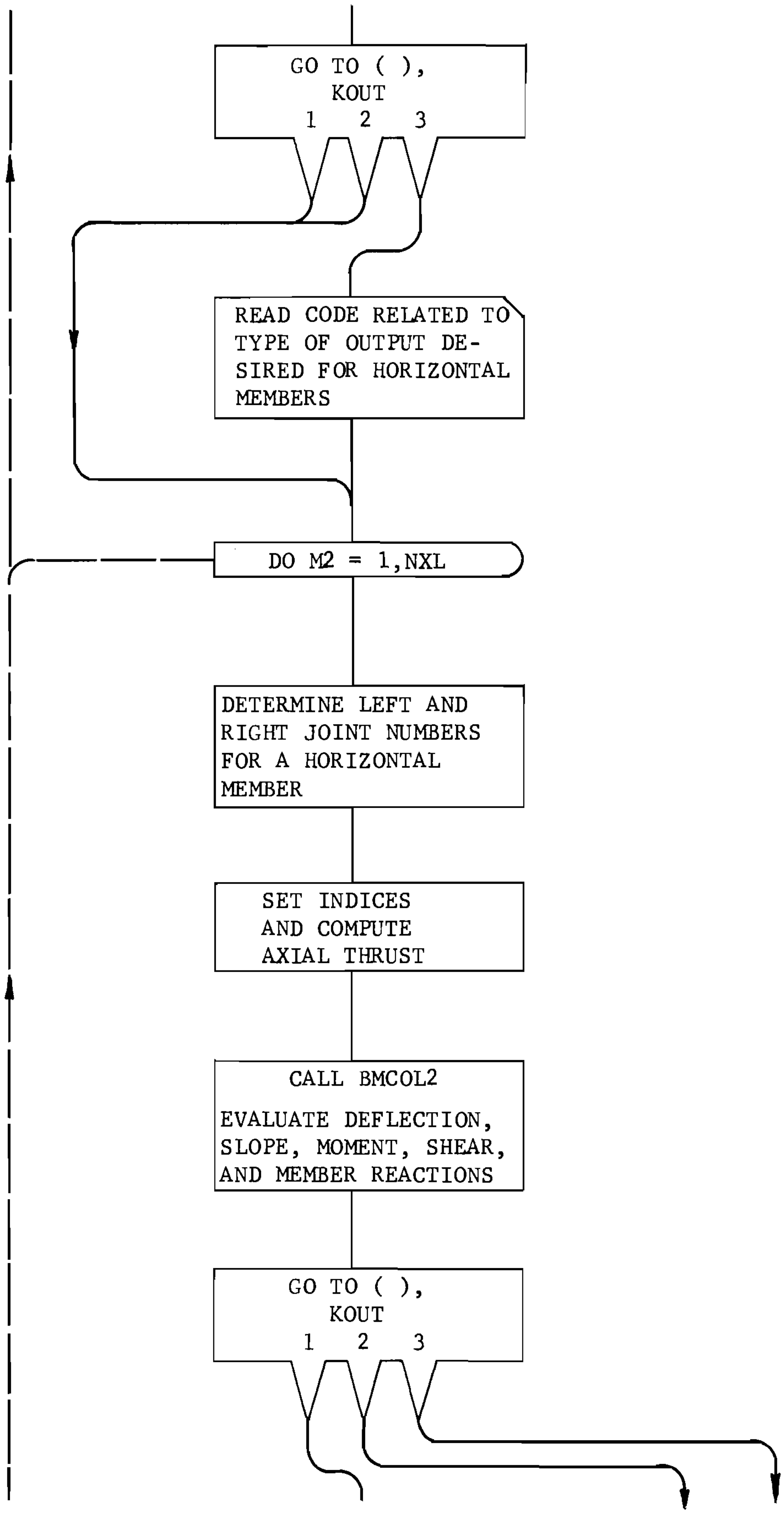
SUBROUTINE SOLVE

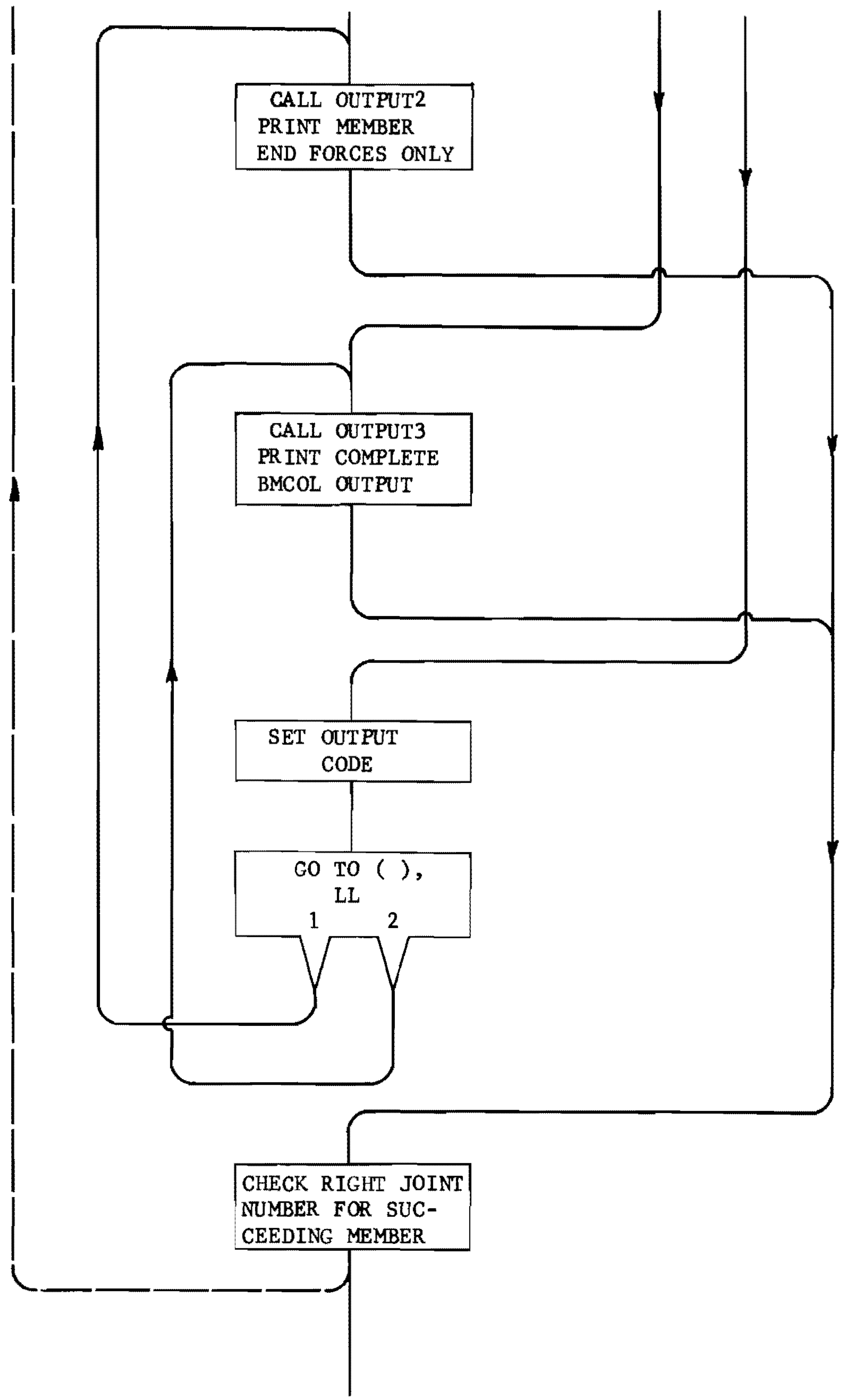


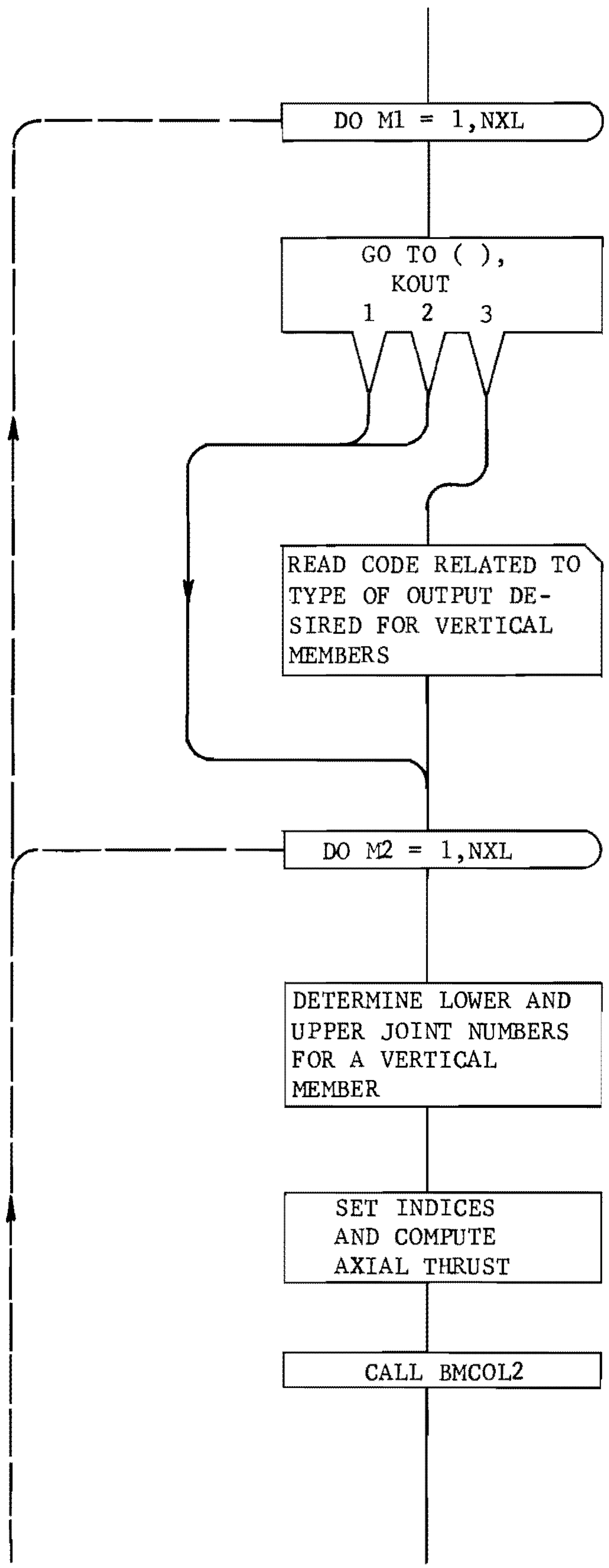

DO J = MP,NL
CALL FSUB1
COMPUTE RECUR-SION MULTIPLIERS PHASE II
COMPUTE RECUR-SION COEFFICIENTS PHASE II
COMPUTE PRELIM-INARY VALUE OF JOINT DISPLACE-MENT
COMPUTE JOINT DISPLACEMENTS
RETURN

SUBROUTINE OUTPUT1

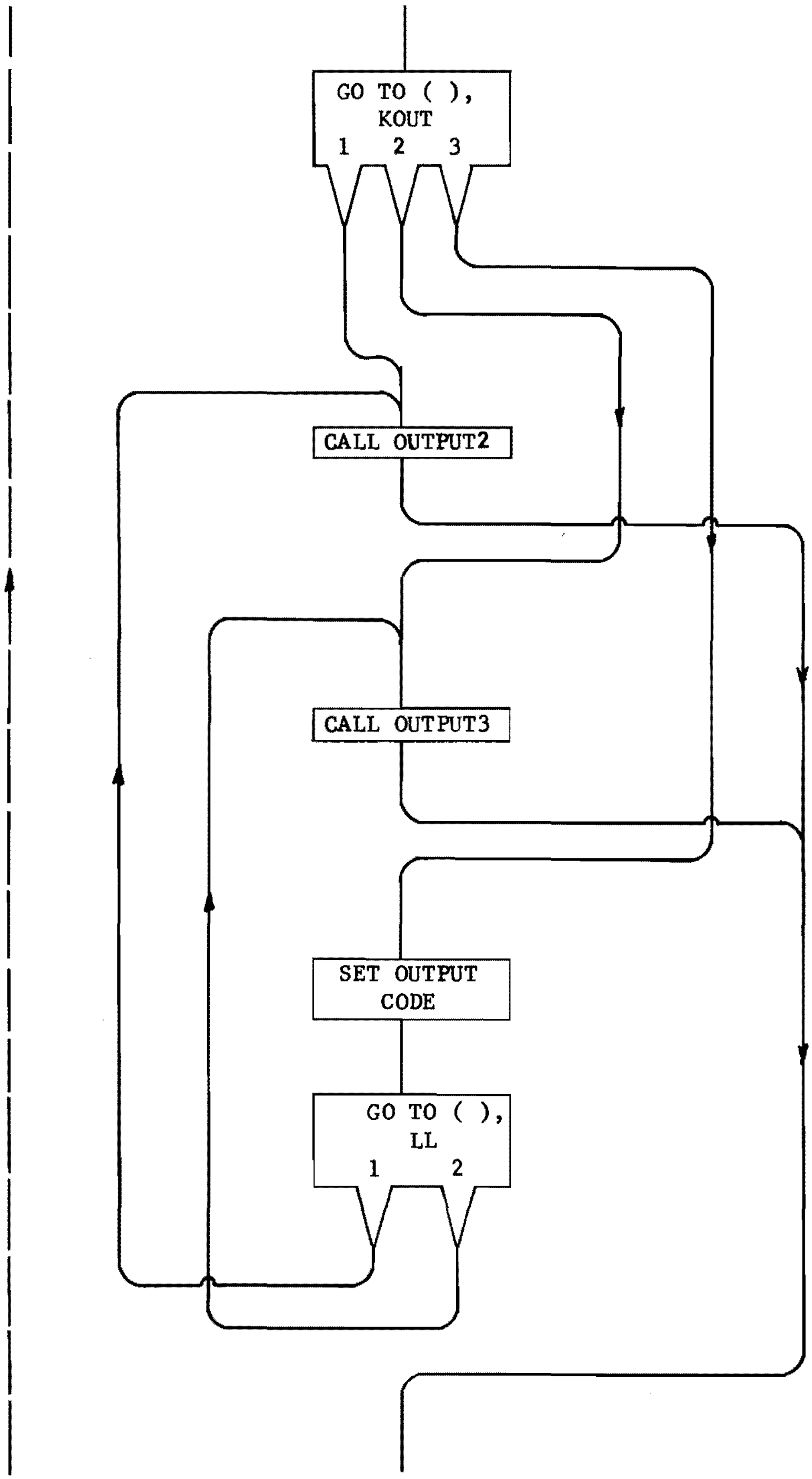


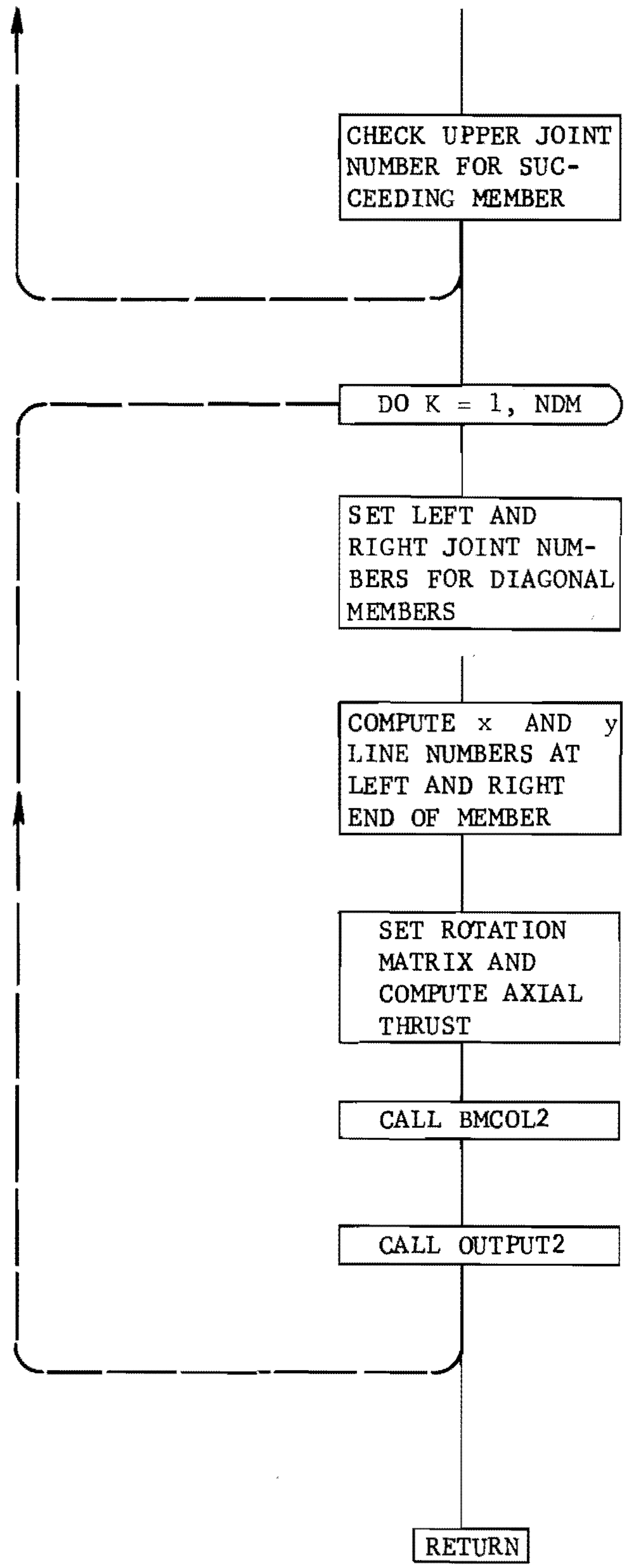

GO TO ( ),
KOUT
1 2 3
READ CODE RELATED TO TYPE OF OUTPUT DESIRED FOR HORIZONTAL MEMBERS
DO M2 = 1,NXL
DETERMINE LEFT AND RIGHT JOINT NUMBERS FOR A HORIZONTAL MEMBER
SET INDICES AND COMPUTE AXIAL THRUST
CALL BMCOL2
EVALUATE DEFLECTION, SLOPE, MOMENT, SHEAR, AND MEMBER REACTIONS
GO TO ( ),
KOUT
1 2 3


CALL OUTPUT2
PRINT MEMBER
END FORCES ONLY
CALL OUTPUT3
PRINT COMPLETE
BMCOL OUTPUT
SET OUTPUT
CODE
GO TO ( ),
LL
1
2
CHECK RIGHT JOINT
NUMBER FOR SUC-
CEEDING MEMBER



DO M1 = 1,NXL
GO TO ( ),
KOUT
1 2 3
READ CODE RELATED TO TYPE OF OUTPUT DESIRED FOR VERTICAL MEMBERS
DO M2 = 1,NXL
DETERMINE LOWER AND UPPER JOINT NUMBERS FOR A VERTICAL MEMBER
SET INDICES AND COMPUTE AXIAL THRUST
CALL BMCOL2


GO TO ( ),
KOUT
1 2 3
CALL OUTPUT2
CALL OUTPUT3
SET OUTPUT
CODE
GO TO ( ),
LL
1 2



CHECK UPPER JOINT NUMBER FOR SUC-CEEDING MEMBER
DO K = 1, NDM
SET LEFT AND RIGHT JOINT NUM-BERS FOR DIAGONAL MEMBERS
COMPUTE x AND y LINE NUMBERS AT LEFT AND RIGHT END OF MEMBER
SET ROTATION MATRIX AND COMPUTE AXIAL THRUST
CALL BMCOL2
CALL OUTPUT2
RETURN

APPENDIX 3

LISTING OF PROGRAM DECK OF PFRM1

```
RUSER,1,100,150000,400.CE909099,RUSER.
NOREDUCE.
INPUT.
RUN(G)
LGO.
-
      PROGRAM PFRM1 ( INPUT, OUTPUT )
C                                                                        06MY9
C-----DATE OF LATEST REVISION  15 SEPTEMBER 1969                         15SE9
C                                                                        06MY9
C***** CARDS MARKED WITH AN ASTERISK IN COLUMNS 79 AND 80 MAY REQUIRE     06MY9
C      CHANGES IN ORDER TO BE COMPATIBLE WITH COMPUTER SYSTEMS           06MY9
C      OTHER THAN THE CDC 6600.                                          06MY9
C                                                                        06MY9
C                                                                        06MY9
C*****NOTATION                                                           06MY9
C                                                                        06MY9
C        A ( ), ATEMP, AREV  RECURSION COEFFICIENTS                      06MY9
C        AA, BB, CC, DD      TERMS IN DISCRETE ELEMENT MEMBER            06MY9
C                                 STIFFNESS MATRIX                       06MY9
C        AE1, AE2, AE( , )   A - E PRODUCT ( INPUT AND TOTAL )           06MY9
C        B ( ), BTEMP, BREV  RECURSION COEFFICIENTS                      06MY9
C        BM ( )              MEMBER MOMENT                               06MY9
C        C ( ), CTEMP, CREV  RECURSION COEFFICIENTS                      06MY9
C        CX, CY              DIRECTION COSINES                           06MY9
C        D, DTEMP, DREV      RECURSION MULTIPLIER                        06MY9
C        DENOM               DENOMINATOR                                 06MY9
C        DBM ( )             MEMBER SHEAR                                06MY9
C        DTOL                DEFLECTION TOLERANCE IF INVESTIGATING       06MY9
C                                 AXIAL EFFECTS                          06MY9
C        DW ( )              MEMBER SLOPE                                06MY9
C        DWS ( )             SPECIFIED CONDITION OF SLOPE                06MY9
C        EE, FF              TERMS IN DISCRETE ELEMENT MEMBER            06MY9
C                                 STIFFNESS MATRIX.                      06MY9
C        ERR, TOL            INTERNAL VARIABLES USE IN CHECKING          06MY9
C                                 COMPATIBILITY OF MEMBER TYPE AND       06MY9
C                                 GRID DATA                              06MY9
C        ESM                 MULTIPLIER FOR HALF VALUES AT END           06MY9
C                                 STATIONS                               06MY9
C        FEF ( , )           MEMBER TYPE FIXED END FORCES                06MY9
C        FL ( )              JOINT LOAD VECTOR                           06MY9
C        FLENG               MEMBER LENGTH                               06MY9
C        FMOML, FMOMR        MOMENT AT LEFT AND RIGHT END OF A MEMBER    06MY9
C        FN1, FN2, F( , )    FLEXURAL STIFFNESS ( INPUT AND TOTAL )      06MY9
C        FX, FY              JOINT REACTIONS IN X AND Y DIRECTIONS       06MY9
C        FZ                  JOINT MOMENT REACTION ABOUT Z DIRECTION     06MY9
C        H ( )               INCREMENT LENGTH FOR A MEMBER TYPE          06MY9
C        HED ( )             PROBLEM DESCRIPTION                         06MY9
C        HE2                 H SQUARED                                   06MY9
C        HE3                 H CUBED                                     06MY9
C        HT2                 H TIMES 2                                   06MY9
C        IN1, IN2, ISTA      EXTERNAL STATION NUMBER                     06MY9
C        INDEX ( , )         INTERSECTION MEMBER TYPE CODE               06MY9
C        INTL                INTERSECTION AT LEFT END OF A MEMBER        06MY9
C        INTLD ( )           INTERSECTION AT LEFT END OF DIAGONAL        06MY9
```

```
C                                    MEMBER                                06MY9
C          INTR                  INTERSECTION AT RIGHT END OF A MEMBER     06MY9
C          INTRD ( )             INTERSECTION AT RIGHT END OF DIAGONAL     06MY9
C                                    MEMBER                                06MY9
C          INTS ( )              INTERSECTION WHERE A JOINT LOAD OR        06MY9
C                                    RESTRAINT OCCURS                      06MY9
C          ISW, KSW              ROUTING SWITCH FOR DISTRIBUTED DATA       06MY9
C                                    INPUT                                 06MY9
C          ITER                  ITERATION NUMBER                          06MY9
C          ITEST                 PROGRAM TERMINATION CHECK VARIABLE        06MY9
C          JINCR                 INCREMENTATION INDEX                      06MY9
C          JL                    JOINT NUMBER AT LEFT END OF A MEMBER      06MY9
C          JN ( )                JOINT NUMBERS                             06MY9
C          JR                    JOINT NUMBER AT RIGHT END OF A MEMBER     06MY9
C          K1, K2, K3            INDEXES USED IN PLACING MEMBER            06MY9
C                                    STIFFNESS TERMS IN STRUCTURE          06MY9
C                                    STIFFNESS MATRIX                      06MY9
C          KEY ( ), KEYJ         ROUTING SWITCH FOR SPECIFIED CONDITIONS   06MY9
C          KLINE                 LINE COUNTER                              06MY9
C          KN1, KN2              ROUTING SWITCHES IN BMCOL INTERPOLATION   06MY9
C                                    SCHEME                                06MY9
C          KODE ( )              MEMBER STIFFNESS CHARACTERISTICS CODE     06MY9
C          KOUT                  OUTPUT OPTION CODE                        06MY9
C          KPAGE                 MAXIMUM NUMBER OF LINES PER PAGE          06MY9
C          KZ ( )                TEMPORARY STORAGE OF MEMBER INCIDENCE     06MY9
C                                    INPUT AND OUTPUT CODES                06MY9
C          L1, L2, L3            INDEXES USED IN PLACING MEMBER            06MY9
C                                    STIFFNESS TERMS IN STRUCTURE          06MY9
C                                    STIFFNESS MATRIX                      06MY9
C          M ( )                 NUMBER OF INCREMENTS FOR A MEMBER TYPE    06MY9
C          MORD                  ORDER OF STRUCTURAL STIFFNESS MATRIX      06MY9
C          MP1 THRU MP7          M + 1  THRU M + 7                         06MY9
C          MT                    MEMBER TYPE                               06MY9
C          MTYPE ( )             MEMBER TYPE OF A DIAGONAL MEMBER          06MY9
C          MTYPE1                ALPHANUMERIC DESCRIPTION OF A MEMBER      06MY9
C                                    TYPE                                  06MY9
C          NADM                  NUMBER OF ADDITIONAL DIAGONAL MEMBER      06MY9
C                                    INCIDENCE INPUT                       06MY9
C          NAJLR                 NUMBER OF ADDITIONAL JOINT LOADS AND      06MY9
C                                    RESTRAINTS INPUT                      06MY9
C          NAMT                  NUMBER OF ADDITIONAL MEMBER TYPES INPUT   06MY9
C          NCOM                  NUMBER OF CHANGES IN ORTHOGONAL MEMBER    06MY9
C                                    INCIDENCE                             06MY9
C          NDC                   NUMBER OF DISTRIBUTED DATA CARDS          06MY9
C          NDM                   TOTAL NUMBER OF DIAGONAL MEMBER           06MY9
C                                    INCIDENCE DATA IN STORAGE             06MY9
C          NEWPR                 NEW PROBLEM OR CONTINUATION OF PREVIOUS   06MY9
C                                    CODE                                  06MY9
C          NIT                   NUMBER OF ITERATIONS IF INVESTIGATING     06MY9
C                                    AXIAL EFFECTS                         06MY9
C          NJ                    NUMBER OF JOINTS IN STRUCTURE             06MY9
C          NJLR                  TOTAL NUMBER OF JOINT LOADS AND           06MY9
C                                    RESTRAINTS IN STORAGE                 06MY9
C          NMT                   TOTAL NUMBER OF MEMBER TYPES IN STORAGE   06MY9
C          NPROB                 PROBLEM NUMBER                            06MY9
```

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C        NXL                     NUMBER OF X LINES IN STRUCTURE          06MY9
C        NYL                     NUMBER OF Y LINES IN STRUCTURE          06MY9
C        P ( , )                 AXIAL LOAD ( TOTAL )                    06MY9
C        PART                    INTERPOLATION FRACTION                  06MY9
C        PP                      AXIAL THRUST IN A MEMBER                06MY9
C        PX ( )                  JOINT LOAD IN X DIRECTION               06MY9
C        PY ( )                  JOINT LOAD IN Y DIRECTION               06MY9
C        PZ ( )                  JOINT COUPLE ABOUT Z DIRECTION          06MY9
C        QN1, QN2, Q( , )        TRANSVERSE LOAD ( INPUT AND TOTAL )     06MY9
C        REACT ( )               MEMBER REACTION                         06MY9
C        REACTL                  REACTION AT LEFT END OF A MEMBER        06MY9
C        REACTR                  REACTION AT RIGHT END OF A MEMBER       06MY9
C        RN1, RN2, R( , )        MEMBER ROTATIONAL RESTRAINTS ( INPUT    06MY9
C                                     AND TOTAL )                        06MY9
C        ROT ( )                 COORDINATE TRANSFORMATION MATRIX        06MY9
C        RTOL                    ROTATION TOLERANCE IF INVESTIGATING     06MY9
C                                     AXIAL EFFECTS                      06MY9
C        RUN  ( )                RUN IDENTIFICATION                      06MY9
C        SHRL, SHRR              SHEAR AT LEFT AND RIGHT END OF A MEMBER 06MY9
C        SL ( )                  LEFT HALF BAND PLUS DIAGONAL TERM       06MY9
C        SM( , , )               MEMBER TYPE STIFFNESS MATRICES          06MY9
C        SN1, SN2, S( , )        TRANSVERSE SPRING STIFFNESS ( INPUT AND 06MY9
C                                     TOTAL )                            06MY9
C        SRT ( )                 COORDINATE TRANSFORMATION MATRIX        06MY9
C        ST ( , )                STRUCTURAL STIFFNESS MATRIX             06MY9
C        SU ( )                  RIGHT HALF BAND                         06MY9
C        SX ( )                  JOINT TRANSLATIONAL RESTRAINT IN X      06MY9
C                                     DIRECTION                          06MY9
C        SY ( )                  JOINT TRANSLATIONAL RESTRAINT IN Y      06MY9
C                                     DIRECTION                          06MY9
C        SZ ( )                  JOINT ROTATIONAL RESTRAINT ABOUT Z      06MY9
C                                     DIRECTION                          06MY9
C        TN1, TN2, T( , )        APPLIED COUPLES ( INPUT AND TOTAL )     06MY9
C        TU ( )                  TEMPORARY JOINT DISPLACEMENT VECTOR     06MY9
C        U ( )                   VECTOR OF JOINT DISPLACEMENTS           06MY9
C        V                       JOINT LOAD TERM                         06MY9
C        W ( )                   MEMBER DEFLECTION                       06MY9
C        WS ( )                  SPECIFIED CONDITION OF DEFLECTION       06MY9
C        X ( )                   TEMPORARY STORAGE OF TRANSVERSE LOADS   06MY9
C                                     FOR A MEMBER TYPE                  06MY9
C        XLC ( )                 X LINE COORDINATE                       06MY9
C        Y ( )                   TEMPORARY STORAGE OF APPLIED COUPLES FOR 06MY9
C                                     A MEMBER TYPE                      06MY9
C        YLC ( )                 Y LINE COORDINATE                       06MY9
C        Z ( , ), TZ ( , )       TEMPORARY STORAGE OF MEMBER STIFFNESS   06MY9
C                                     MATRIX                             06MY9
      DIMENSION  RUN(32), TU(150)                                        06MY9 **
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,      06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                      06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                              06MY9
      COMMON / BLOCK3 / XLC(10), YLC(10)                                 06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                          06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),          06MY9
     2                  R(57,20), AE(57,20), P(57,20)                    06MY9
      COMMON / BLOCK5 / SM(6,6,20), FEF(6,20)                            06MY9
```

```
      COMMON / BLOCK6 / A(57), B(57), C(57), W(57), DW(57), BM(57),      06MY9
     1                  DBM(57), REACT(57)                                06MY9
      COMMON / BLOCK7 / INDEX(110,4), JN(110), INTLD(20), INTRD(20),     06MY9
     1                  MTYPE(20), MORD                                   06MY9
      COMMON / BLOCK8 / ITER                                              06MY9
      COMMON / BLOCK9 / ST(150,65), U(150), FL(150)                       06MY9
      COMMON / BLOC10 / X(57), Y(57)                                      06MY9
      COMMON / BLOC11 / INTS(50), SX(50), SY(50), SZ(50),                 06MY9
     1                  PX(50), PY(50), PZ(50)                            06MY9
      COMMON / BLOC12 / NCOM, DTOL, RTOL, KOUT                            06MY9
C                                                                         06MY9
C*****SET NUMBER OF LINES PER PAGE.  MINIMUM = 25. ********************06MY9
C                                                                         06MY9
               KPAGE = 58                                                 06MY9
      PRINT 1000                                                          06MY9
 1000 FORMAT ( 1H1 )                                                      06MY9
C                                                                         06MY9
C*****READ AND PRINT RUN IDENTIFICATION ********************************06MY9
C                                                                         06MY9
      READ 1010, ( RUN(I), I = 1, 32 )                                    06MY9 **
 1010 FORMAT ( 16A5 )                                                     06MY9 **
      PRINT 1010, ( RUN(I), I = 1, 32 )                                   06MY9 **
   10     CONTINUE                                                        06MY9
      PRINT 1000                                                          06MY9
               KSTOP = 1                                                  06MY9
               KLINE = 0                                                  06MY9
C                                                                         06MY9
C*****READ PROBLEM IDENTIFICATION AND PROGRAM CONTROL DATA  ************06MY9
C                                                                         06MY9
      CALL INPUT1                                                         06MY9
   20     CONTINUE                                                        06MY9
          GO TO ( 30, 230 ), KSTOP                                        06MY9
   30     CONTINUE                                                        06MY9
C                                                                         06MY9
C*****READ X AND Y LINE COORDINATES AND MEMBER TYPE DATA  *************06MY9
C                                                                         06MY9
      CALL INPUT2                                                         06MY9
   40     CONTINUE                                                        06MY9
          GO TO ( 50, 230 ), KSTOP                                        06MY9
   50     CONTINUE                                                        06MY9
C                                                                         06MY9
C*****COMPUTE STIFFNESSES NEGLECTING AXIAL EFECTS  ********************06MY9
C                                                                         06MY9
      CALL FEST1                                                          06MY9
   60     CONTINUE                                                        06MY9
C                                                                         06MY9
C*****READ MEMBER INCIDENCE DATA AND SET JOINT NUMBERS  ***************06MY9
C                                                                         06MY9
      CALL INPUT3                                                         06MY9
   70     CONTINUE                                                        06MY9
          GO TO ( 75, 230 ), KSTOP                                        06MY9
   75     CONTINUE                                                        06MY9
C                                                                         06MY9
C*****READ APPLIED JOINT LOADS AND RESTRAINTS  ************************06MY9
C                                                                         06MY9
```

```
      CALL INPUT4                                                       06MY9
   80      CONTINUE                                                     06MY9
                ITER = 0                                                06MY9
C                                                                       06MY9
C*****FORMULATE BLOCKED STIFFNESS MATRIX  ******************************06MY9
C                                                                       06MY9
      CALL FSTIFF                                                       06MY9
   90      CONTINUE                                                     06MY9
           GO TO ( 100, 230 ), KSTOP                                    06MY9
  100      CONTINUE                                                     06MY9
C                                                                       06MY9
C*****SOLVE MATRIX EQUATION FOR JOINT DISPLACEMENTS  *******************06MY9
C                                                                       06MY9
      CALL SOLVE                                                        06MY9
  110      CONTINUE                                                     06MY9
           IF ( NIT.EQ.0 ) GO TO 220                                    06MY9
  120           ITER = 1                                                06MY9
C                                                                       06MY9
C*****COMPARE JOINT DISPLACEMEMTS WITH THOSE FROM PREVIOUS ITERATION    06MY9
C*****IF INVESTIGATING AXIAL EFFECTS  **********************************06MY9
C                                                                       06MY9
           DO 210  N = 1, NIT                                           06MY9
           IF ( N.EQ.1 ) GO TO 170                                      06MY9
  130           K = 1                                                   06MY9
           DO 160  J = 1, MORD                                          06MY9
           IF ( K .NE. 3 ) GO TO 140                                    06MY9
           IF ( ABS( U(J) - TU(J) ).GT. RTOL ) GO TO 170                06MY9
                K = 1                                                   06MY9
           GO TO 160                                                    06MY9
  140      IF ( ABS( U(J) - TU(J) ).GT. DTOL ) GO TO 170                06MY9
                K = K + 1                                               06MY9
  160      CONTINUE                                                     06MY9
      PRINT 1020, ITER                                                  06MY9
 1020 FORMAT (//,27H      CLOSURE OBTAINED AFTER , I5, 11H ITERATIONS  ) 06MY9
           GO TO 220                                                    06MY9
C                                                                       06MY9
C*****IF NO CLOSURE MAKE ANOTHER SOLUTION  *****************************06MY9
C                                                                       06MY9
  170      DO 180  J = 1, MORD                                          06MY9
                TU(J) = U(J)                                            06MY9
  180      CONTINUE                                                     06MY9
      CALL FSTIFF                                                       06MY9
  190      CONTINUE                                                     06MY9
      CALL SOLVE                                                        06MY9
  200      CONTINUE                                                     06MY9
                ITER = ITER + 1                                         06MY9
  210      CONTINUE                                                     06MY9
      PRINT 1000                                                        06MY9
      PRINT 1030                                                        06MY9
 1030 FORMAT ( ////// )                                                 06MY9
      PRINT 1040                                                        06MY9
 1040 FORMAT (   45H      ****************************************   )  06MY9
      PRINT 1040                                                        06MY9
      PRINT 1050                                                        06MY9
 1050 FORMAT (   45H      ***                                  ***   )  06MY9
```

```
      PRINT 1050                                                          06MY9
      PRINT 1060                                                          06MY9
 1060 FORMAT (    45H      ***   THE SOLUTION HAS NOT CLOSED     ***   )  06MY9
      PRINT 1070                                                          06MY9
 1070 FORMAT (    45H      ***   WITHIN THE SPECIFIED TOLERANCES***   )   06MY9
      PRINT 1080                                                          06MY9
 1080 FORMAT (    45H      ***   IN THE DESIGNATED NUMBER OF     ***   )  06MY9
      PRINT 1090                                                          06MY9
 1090 FORMAT (    45H      ***   ITERATIONS.  THE RESULTS IN     ***     ) 06MY9
      PRINT 1100                                                          06MY9
 1100 FORMAT (    45H      ***   TABLES 12, 13, AND 14 ARE THOSE*** )     06MY9
      PRINT 1110                                                          06MY9
 1110 FORMAT (    45H      ***   FROM THE LAST ITERATION.        *** )    06MY9
      PRINT 1050                                                          06MY9
      PRINT 1050                                                          06MY9
      PRINT 1040                                                          06MY9
      PRINT 1040                                                          06MY9
  220 CALL OUTPUT1                                                        06MY9
          GO TO 10                                                        06MY9
  230     CONTINUE                                                        06MY9
      CALL EXIT                                                           06MY9
      END                                                                 06MY9
C                                                                         06MY9
C                                                                         06MY9
      SUBROUTINE INPUT1                                                   06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,       06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                       06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                               06MY9
      COMMON / BLOC12 / NCOM, DTOL, RTOL, KOUT                            06MY9
      DATA ITEST / 5H       /                                             06MY9 **
C                                                                         06MY9
C*****READ AND PRINT PROBLEM IDENTIFICATION AND PROGRAM CONTROL DATA   **06MY9
C                                                                         06MY9
   10     CONTINUE                                                        06MY9
      READ 500, NPROB, ( HED(I), I = 1, 14 )                              06MY9 **
  500 FORMAT ( A5, 5X, 14A5 )                                             06MY9 **
          IF ( NPROB - ITEST ) 30, 20, 30                                 06MY9
   20     CONTINUE                                                        06MY9
               KSTOP = 2                                                  06MY9
          RETURN                                                          06MY9
   30     CONTINUE                                                        06MY9
      PRINT 510, NPROB, ( HED(I), I = 1, 14 )                             06MY9 **
  510 FORMAT (     5H      , 80X, 10HI-----TRIM, /,                       06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ////,              06MY9 **
     2            33H      **** INPUT INFORMATION **** , /////,           06MY9
     3            36H      TABLE 1 -- PROGRAM CONTROL DATA , /// )        06MY9
      PRINT 520                                                           06MY9
  520 FORMAT (    42H           NEWPR NAMT NAJLR KOUT NADM NCOM   ,       06MY9
     1            33H       NIT        DTOL        RTOL   , / )           06MY9
      READ 530, NEWPR, NAMT, NAJLR, KOUT, NADM, NCOM, NIT, DTOL, RTOL     06MY9
  530 FORMAT ( 10X, 6I5, 5X, I5, 2E10.5 )                                 06MY9
      PRINT 540, NEWPR, NAMT, NAJLR, KOUT, NADM, NCOM, NIT, DTOL, RTOL    06MY9
  540 FORMAT ( 10X, 2I5, 1X, 4I5, 5X, I5, 2E12.3 )                        06MY9
   40     CONTINUE                                                        06MY9
          RETURN                                                          06MY9
```

```
      END                                                                   06MY9
C                                                                           06MY9
C                                                                           06MY9
      SUBROUTINE INPUT2                                                     06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,         06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                         06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                                 06MY9
      COMMON / BLOCK3 / XLC(10), YLC(10)                                    06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                             06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),             06MY9
     2                  R(57,20), AE(57,20), P(57,20)                       06MY9
   10     CONTINUE                                                          06MY9
      PRINT 500                                                             06MY9
  500 FORMAT ( 1H1 )                                                        06MY9
C                                                                           06MY9
C*****READ AND PRINT X AND Y LINE COORDINATES   ************************06MY9
C                                                                           06MY9
      PRINT 510, NPROB, ( HED(I), I = 1, 14 )                               06MY9 **
  510 FORMAT (    5H      , 80X, 10HI-----TRIM, /,                          06MY9
     1           10H      PROB , /, 5X, A5, 5X, 14A5, ///,                  06MY9 **
     2           40H      TABLE 2 -- X AND Y LINE COORDINATES, // )         06MY9
          GO TO ( 30, 20 ), NEWPR                                           06MY9
   20     CONTINUE                                                          06MY9
      PRINT 520                                                             06MY9
  520 FORMAT (    47H           USING X AND Y LINE DATA FROM PREVIOUS ,     06MY9
     1           10H PROBLEM  )                                             06MY9
          GO TO 145                                                         06MY9
   30     CONTINUE                                                          06MY9
      READ 525, NXL, NYL                                                    06MY9
  525 FORMAT ( 10X, 2I5 )                                                   06MY9
      PRINT 526, NXL, NYL                                                   06MY9
  526 FORMAT ( 15X, 6H NXL = , I5, /, 15X, 6H NYL = , I5, / )               06MY9
          DO 40  I = 1, NXL                                                 06MY9
               XLC(I) = 0.0                                                 06MY9
   40     CONTINUE                                                          06MY9
          DO 50  I = 1, NYL                                                 06MY9
               YLC(I) = 0.0                                                 06MY9
   50     CONTINUE                                                          06MY9
      PRINT 530                                                             06MY9
  530 FORMAT (    39H                 X LINE       COORDINATE , / )         06MY9
               KLINE = 16                                                   06MY9
      READ 540, ( XLC(I), I = 1, NXL )                                      06MY9
      READ 540, ( YLC(I), I = 1, NYL )                                      06MY9
  540 FORMAT ( 10X, 7E10.5 )                                                06MY9
          DO 80  I = 1, NXL                                                 06MY9
          IF ( KLINE + 1 - KPAGE ) 60, 60, 70                               06MY9
   60 PRINT 550, I, XLC(I)                                                  06MY9
  550 FORMAT ( 15X, I5, 5X, E15.3 )                                         06MY9
               KLINE = KLINE + 1                                            06MY9
          GO TO 80                                                          06MY9
   70 PRINT 500                                                             06MY9
      PRINT 560, NPROB, ( HED(J), J = 1, 14 )                               06MY9 **
  560 FORMAT (    5H       , 80X, 10HI-----TRIM , /,                        06MY9
     1           10H      PROB , /, 5X, A5, 5X, 14A5, ///,                  06MY9 **
     2           20H      TABLE 2 (CONT) , // )                             06MY9
```

```
      PRINT 530                                                         06MY9
      PRINT 550, I, XLC(I)                                              06MY9
            KLINE = 15                                                  06MY9
   80     CONTINUE                                                      06MY9
          IF ( KLINE + 6 - KPAGE ) 90, 90, 100                          06MY9
   90 PRINT 570                                                         06MY9
  570 FORMAT ( // )                                                     06MY9
      PRINT 580                                                         06MY9
  580 FORMAT (    39H               Y LINE         COORDINATE , / )     06MY9
            KLINE = KLINE + 4                                           06MY9
          GO TO 110                                                     06MY9
  100 PRINT 500                                                         06MY9
      PRINT 560, NPROB, ( HED(J), J = 1, 14 )                           06MY9 **
      PRINT 580                                                         06MY9
            KLINE = 12                                                  06MY9
  110     CONTINUE                                                      06MY9
          DO 140  I = 1, NYL                                            06MY9
          IF ( KLINE + 1 - KPAGE ) 120, 120, 130                        06MY9
  120 PRINT 550, I, YLC(I)                                              06MY9
            KLINE = KLINE + 1                                           06MY9
          GO TO 140                                                     06MY9
  130 PRINT 500                                                         06MY9
      PRINT 560, NPROB, ( HED(J), J = 1, 14 )                           06MY9 **
      PRINT 580                                                         06MY9
      PRINT 550, I, YLC(I)                                              06MY9
            KLINE = 13                                                  06MY9
  140     CONTINUE                                                      06MY9
  145     CONTINUE                                                      06MY9
C                                                                       06MY9
C*****READ AND PRINT MEMBER TYPE DATA  **********************************06MY9
C                                                                       06MY9
      PRINT 500                                                         06MY9
      PRINT 590, NPROB, ( HED(I), I = 1, 14 )                           06MY9 **
  590 FORMAT (     5H      , 80X, 10HI-----TRIM, /,                     06MY9
     1            10H     PROB , /, 5X, A5, 5X, 14A5, ///,              06MY9 **
     2            35H     TABLE 3 -- MEMBER TYPE DATA    , // )         06MY9
          GO TO ( 150, 180 ), NEWPR                                     06MY9
  150       K1 = 1                                                      06MY9
            K2 = NAMT                                                   06MY9
            NMT = K2                                                    06MY9
          DO 160  I = 1, 20                                             06MY9
            M(I) = 0                                                    06MY9
            H(I) = 0.0                                                  06MY9
            KODE(I) = 0                                                 06MY9
  160     CONTINUE                                                      06MY9
          DO 170  J = 1, 20                                             06MY9
          DO 170  I = 1, 57                                             06MY9
            F(I,J) = 0.0                                                06MY9
            Q(I,J) = 0.0                                                06MY9
            S(I,J) = 0.0                                                06MY9
            T(I,J) = 0.0                                                06MY9
            R(I,J) = 0.0                                                06MY9
            P(I,J) = 0.0                                                06MY9
            AE(I,J) = 0.0                                               06MY9
  170     CONTINUE                                                      06MY9
```

```
          KLINE = 11                                                   06MY9
       GO TO 190                                                       06MY9
180       K1 = NMT + 1                                                 06MY9
          K2 = NMT + NAMT                                              06MY9
          NMT = K2                                                     06MY9
    PRINT 600                                                          06MY9
600 FORMAT (    47H           USING DATA FROM PREVIOUS PROBLEM PLUS ,  06MY9
   1            15H THE FOLLOWING , // )                               06MY9
          KLINE = 15                                                   06MY9
       IF ( K1 - K2 ) 190, 190, 185                                    15SE9
185 PRINT 605                                                          06MY9
605 FORMAT (    15H           NONE     )                               06MY9
       GO TO 1000                                                      06MY9
190    CONTINUE                                                        06MY9
       DO 480  J = K1, K2                                              06MY9
    READ 610, M(J), KODE(J), NDC, H(J)                                 06MY9
610 FORMAT ( 10X, 3I5, 5X, 3E10.5 )                                    06MY9
       IF ( KLINE + 4 - KPAGE ) 200, 200, 210                          06MY9
200 PRINT 620                                                          06MY9
620 FORMAT (/, 36H            TYPE    M KODE   NDC       H    / )      06MY9
    PRINT 630, J, M(J), KODE(J), NDC, H(J)                             06MY9
630 FORMAT ( 9X, 4I5, 3E10.3 )                                         06MY9
          KLINE = KLINE + 4                                            06MY9
       GO TO 220                                                       06MY9
210 PRINT 500                                                          06MY9
    PRINT 640, NPROB, ( HED(I), I = 1, 14 )                            06MY9 **
640 FORMAT (     5H      , 80X, 10HI-----TRIM, / ,                     06MY9
   1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,              06MY9 **
   2            20H      TABLE 3 (CONT) , // )                         06MY9
    PRINT 620                                                          06MY9
    PRINT 630, J, M(J), KODE(J), NDC, H(J)                             06MY9
          KLINE = 15                                                   06MY9
220    CONTINUE                                                        06MY9
          JJJ = KODE(J)                                                06MY9
       IF ( KLINE + 4 - KPAGE ) 270, 270, 280                          06MY9
270 PRINT 650                                                          06MY9
650 FORMAT ( / )                                                       06MY9
    PRINT 660                                                          06MY9
660 FORMAT (    51H      FROM TO CONTD      F           Q          S  ,06MY9
   1            30H       T           R          AE , / )              06MY9
          KLINE = KLINE + 4                                            06MY9
       GO TO 290                                                       06MY9
280 PRINT 500                                                          06MY9
    PRINT 640, NPROB, ( HED(L), L = 1, 14 )                            06MY9 **
    PRINT 660                                                          06MY9
          KLINE = 13                                                   06MY9
290    CONTINUE                                                        06MY9
          KR2 = 0                                                      06MY9
       DO 450  N = 1, NDC                                              06MY9
          KR1 = KR2                                                    06MY9
    READ 670, IN1, IN2, KR2, FN2, QN2, SN2, TN2, RN2, AE2              06MY9
670 FORMAT ( 5X, 3I5, 6E10.5 )                                         06MY9
          JN = IN1 + 4                                                 06MY9
          J2 = IN2 + 4                                                 06MY9
          KSW = 1 + KR2 + 2 * KR1                                      06MY9
```

```
      IF ( KLINE + 1 - KPAGE ) 310, 310, 300                           06MY9
  300 PRINT 500                                                        06MY9
      PRINT 640, NPROB, ( HED(L), L = 1, 14 )                          06MY9 **
      PRINT 660                                                        06MY9
            KLINE = 13                                                 06MY9
  310      CONTINUE                                                    06MY9
       GO TO ( 320, 330, 340, 340 ), KSW                               06MY9
  320 PRINT 680, IN1, IN2, KR2, FN2, QN2, SN2, TN2, RN2, AE2           06MY9
  680 FORMAT ( 5X, 2I4, I3, 1X, 6E11.3 )                               06MY9
            KLINE = KLINE + 1                                          06MY9
       GO TO 350                                                       06MY9
  330 PRINT 690, IN1, KR2, FN2, QN2, SN2, TN2, RN2, AE2                06MY9
  690 FORMAT ( 5X, I4, 4X, I3, 1X, 6E11.3 )                            06MY9
            KLINE = KLINE + 1                                          06MY9
       GO TO 350                                                       06MY9
  340 PRINT 700, IN2, KR2, FN2, QN2, SN2, TN2, RN2, AE2                06MY9
  700 FORMAT ( 9X, I4, I3, 1X, 6E11.3 )                                06MY9
            KLINE = KLINE + 1                                          06MY9
       GO TO 370                                                       06MY9
C                                                                      06MY9
C*****STANDARD BMCOL DATA DISTRIBUTION  *******************************06MY9
C                                                                      06MY9
  350       J1 = JN                                                    06MY9
  360       FN1 = FN2                                                  06MY9
            QN1 = QN2                                                  06MY9
            SN1 = SN2                                                  06MY9
            TN1 = TN2                                                  06MY9
            RN1 = RN2                                                  06MY9
            AE1 = AE2                                                  06MY9
       GO TO ( 370, 450, 495, 450 ), KSW                               06MY9
  370       JINCR = 1                                                  06MY9
            ESM = 1.0                                                  06MY9
       IF ( J2 - J1 ) 495, 390, 380                                    06MY9
  380       DENOM = J2 - J1                                            06MY9
            ISW = 1                                                    06MY9
       GO TO 400                                                       06MY9
  390       DENOM = 1.0                                                06MY9
            ISW = 0                                                    06MY9
  400  DO 410  K = J1, J2, JINCR                                       06MY9
            DIFF = K - J1                                              06MY9
            PART = DIFF / DENOM                                        06MY9
            F(K,J)  = F(K,J)  + ( FN1 + PART * ( FN2 - FN1 )) * ESM    06MY9
            Q(K,J)  = Q(K,J)  + ( QN1 + PART * ( QN2 - QN1 )) * ESM    06MY9
            S(K,J)  = S(K,J)  + ( SN1 + PART * ( SN2 - SN1 )) * ESM    06MY9
            T(K,J)  = T(K,J)  + ( TN1 + PART * ( TN2 - TN1 )) * ESM    06MY9
            R(K,J)  = R(K,J)  + ( RN1 + PART * ( RN2 - RN1 )) * ESM    06MY9
            AE(K,J) = AE(K,J) + ( AE1 + PART * ( AE2 - AE1 )) * ESM    06MY9
  410  CONTINUE                                                        06MY9
       IF ( ISW ) 495, 430, 420                                        06MY9
  420       JINCR = J2 - J1                                            06MY9
            ESM = -0.5                                                 06MY9
            ISW = 0                                                    06MY9
       GO TO 400                                                       06MY9
  430  GO TO ( 450, 495, 450, 440 ), KSW                               06MY9
  440       J1 = J2                                                    06MY9
```

```
        GO TO 360                                                       06MY9
  450   CONTINUE                                                        06MY9
  460   CONTINUE                                                        06MY9
        IF ( KLINE + 1 - KPAGE ) 470, 470, 480                          06MY9
  470 PRINT 650                                                         06MY9
            KLINE = KLINE + 1                                           06MY9
  480   CONTINUE                                                        06MY9
  490   GO TO 1000                                                      06MY9
  495 PRINT 710, J                                                      06MY9
  710 FORMAT ( /, 48H         UNDESIGNATED ERROR STOP -- MEMBER TYPE ,  06MY9
     1       I5 )                                                       06MY9
            KSTOP = 2                                                   06MY9
 1000   CONTINUE                                                        06MY9
        RETURN                                                          06MY9
        END                                                             06MY9
C                                                                       06MY9
C                                                                       06MY9
      SUBROUTINE FEST1                                                  06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,     06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                     06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                         06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),         06MY9
     2                  R(57,20), AE(57,20), P(57,20)                   06MY9
      COMMON / BLOCK5 / SM(6,6,20), FEF(6,20)                           06MY9
      COMMON / BLOCK6 / A(57), B(57), C(57), W(57), DW(57), BM(57),     06MY9
     1                  DBM(57), REACT(57)                              06MY9
      COMMON / BLOC10 / X(57), Y(57)                                    06MY9
      COMMON / SBLOC1 / I, K, KEY(57), WS(5), DWS(5)                    06MY9
C                                                                       06MY9
C*****EVALUATE STIFFNESS FOR EACH MEMBER TYPE  ************************06MY9
C                                                                       06MY9
            K1 = NMT                                                    06MY9
        DO 210  I = 1, K1                                               06MY9
        DO 10  J = 1, 6                                                 06MY9
        DO 10  K = 1, 6                                                 06MY9
            SM(J,K,I) = 0.0                                             06MY9
   10   CONTINUE                                                        06MY9
            FM = M(I)                                                   06MY9
            FLENG = FM * H(I)                                           06MY9
            MP3 = M(I) + 3                                              06MY9
            MP4 = M(I) + 4                                              06MY9
            MP5 = M(I) + 5                                              06MY9
        DO 20  J = 4, MP4                                               06MY9
            P(J,I) = 0.0                                                06MY9
   20   CONTINUE                                                        06MY9
            JJJ = KODE(I)                                               06MY9
        GO TO ( 30, 30, 40, 60 ), JJJ                                   06MY9
   30   CONTINUE                                                        06MY9
C                                                                       06MY9
C*****STIFFNESS TERMS FOR PRISMATIC MEMBER  ***************************06MY9
C                                                                       06MY9
            SM(1,1,I) = AE(5,I) / FLENG                                 06MY9
            SM(4,4,I) = SM(1,1,I)                                       06MY9
            SM(1,4,I) = -SM(1,1,I)                                      06MY9
            SM(4,1,I) = SM(1,4,I)                                       06MY9
```

```
               SM(2,2,I) = 12.0 * F(5,I) / ( FLENG ** 3 )                    06MY9
               SM(5,5,I) = SM(2,2,I)                                         06MY9
               SM(2,5,I) = -SM(2,2,I)                                        06MY9
               SM(5,2,I) = SM(2,5,I)                                         06MY9
               SM(2,3,I) = 6.0 * F(5,I) / ( FLENG ** 2 )                     06MY9
               SM(2,6,I) = SM(2,3,I)                                         06MY9
               SM(3,2,I) = SM(2,3,I)                                         06MY9
               SM(6,2,I) = SM(2,3,I)                                         06MY9
               SM(3,5,I) = -SM(2,3,I)                                        06MY9
               SM(5,3,I) = SM(3,5,I)                                         06MY9
               SM(5,6,I) = SM(3,5,I)                                         06MY9
               SM(6,5,I) = SM(3,5,I)                                         06MY9
               SM(3,3,I) = 4.0 * F(5,I) / FLENG                              06MY9
               SM(6,6,I) = SM(3,3,I)                                         06MY9
               SM(3,6,I) = 2.0 * F(5,I) / FLENG                              06MY9
               SM(6,3,I) = SM(3,6,I)                                         06MY9
          GO TO ( 40, 60, 210, 210 ), JJJ                                    06MY9
   40     CONTINUE                                                           06MY9
          DO 50  J = 1, 6                                                    06MY9
               FEF(J,I) = 0.0                                                06MY9
   50     CONTINUE                                                           06MY9
          GO TO ( 210, 210, 100, 210 ), JJJ                                  06MY9
   60     CONTINUE                                                           06MY9
          DO 70  J = 1, 5                                                    06MY9
               WS(J) = 0.0                                                   06MY9
               DWS(J) = 0.0                                                  06MY9
   70     CONTINUE                                                           06MY9
          DO 80  J = 3, MP5                                                  06MY9
               KEY(J)*=*1*****                                               06MY9***
   80     CONTINUE                                                           06MY9
C                                                                            06MY9
C*****EVALUATE MEMBER END FORCES FOR LOADED MEMBERS  ******************06MY9
C                                                                            06MY9
               K = 1                                                         06MY9
               KEY(3) = 3                                                    06MY9
               KEY(4) = 4                                                    06MY9
               KEY(5) = 5                                                    06MY9
               KEY(MP3) = 3                                                  06MY9
               KEY(MP4) = 4                                                  06MY9
               KEY(MP5) = 5                                                  06MY9
       CALL BMCOL1                                                           06MY9
   90     CONTINUE                                                           06MY9
          GO TO ( 210, 210, 100, 100 ), JJJ                                  06MY9
  100     CONTINUE                                                           06MY9
C                                                                            06MY9
C*****APPLY UNIT DISPLACEMENTS AND EVALUATE STIFFNESS TERMS FOR              06MY9
C*****NON-PRISMATIC MEMBERS  ******************************************06MY9
C                                                                            06MY9
          DO 110  J = 4, MP4                                                 06MY9
               X(J) = Q(J,I)                                                 06MY9
               Y(J) = T(J,I)                                                 06MY9
               Q(J,I) = 0.0                                                  06MY9
               T(J,I) = 0.0                                                  06MY9
  110     CONTINUE                                                           06MY9
          DO 180  K = 2, 5                                                   06MY9
```

```
        DO 120  J = 3, MP5                                              06MY9
              KEY(J) = 1                                                06MY9
  120   CONTINUE                                                        06MY9
        DO 130  J = 1, 5                                                06MY9
              WS(J) = 0.0                                               06MY9
              DWS(J) = 0.0                                              06MY9
  130   CONTINUE                                                        06MY9
              KEY(3) = 3                                                06MY9
              KEY(4) = 4                                                06MY9
              KEY(5) = 5                                                06MY9
              KEY(MP3) = 3                                              06MY9
              KEY(MP4) = 4                                              06MY9
              KEY(MP5) = 5                                              06MY9
        GO TO ( 210, 140, 150, 160, 170 ), K                            06MY9
  140         DWS(1) = 1.0                                              06MY9
      CALL BMCOL1                                                       06MY9
        GO TO 180                                                       06MY9
  150         DWS(2) = 1.0                                              06MY9
      CALL BMCOL1                                                       06MY9
        GO TO 180                                                       06MY9
  160         WS(1) = 1.0                                               06MY9
      CALL BMCOL1                                                       06MY9
        GO TO 180                                                       06MY9
  170         WS(2) = 1.0                                               06MY9
      CALL BMCOL1                                                       06MY9
  180   CONTINUE                                                        06MY9
        DO 190  J = 4, MP4                                              06MY9
              Q(J,I) = X(J)                                             06MY9
              T(J,I) = Y(J)                                             06MY9
              X(J) = 0.0                                                06MY9
              Y(J) = 0.0                                                06MY9
  190   CONTINUE                                                        06MY9
C                                                                       06MY9
C*****COMPUTE AXIAL STIFFNESS FOR NON-PRISMATIC MEMBERS  ***************06MY9
C                                                                       06MY9
              AE(4,I) = 2.0 * AE(4,I)                                   06MY9
              AE(MP4,I) = 2.0 * AE(MP4,I)                               06MY9
              SUM = 0.0                                                 06MY9
        DO 200  J = 4, MP3                                              06MY9
              AVG = ( AE(J,I) + AE(J+1,I) ) / 2.0                       06MY9
              SUM = SUM + H(I) / AVG                                    06MY9
  200   CONTINUE                                                        06MY9
              SM(1,1,I) = 1.0 / SUM                                     06MY9
              SM(4,4,I) = SM(1,1,I)                                     06MY9
              SM(1,4,I) = -SM(1,1,I)                                    06MY9
              SM(4,1,I) = SM(1,4,I)                                     06MY9
  210   CONTINUE                                                        06MY9
  220   CONTINUE                                                        06MY9
        RETURN                                                          06MY9
        END                                                             06MY9
C                                                                       06MY9
C                                                                       06MY9
      SUBROUTINE BMCOL1                                                 06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                         06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),         06MY9
```

```
     2                   R(57,20), AE(57,20), P(57,20)                   06MY9
      COMMON / BLOCK5 / SM(6,6,20), FEF(6,20)                           06MY9
      COMMON / SBLOC1 / I, K, KEY(57), WS(5), DWS(5)                    06MY9
      COMMON / BLOCK6 / A(57), B(57), C(57), W(57), DW(57), BM(57),     06MY9
     1                   DBM(57), REACT(57)                             06MY9
C                                                                       06MY9
C*****STANDARD BMCOL PROGRAM USED FOR EVALUATION OF FIXED END FORCES     06MY9
C*****AND STIFFNESS TERMS.  THIS ROUTINE IS ALSO USED FOR EVALUATING     06MY9
C*****STIFFNESSES WHEN INVESTIGATING AXIAL EFFECTS  *******************06MY9
C                                                                       06MY9
   10      CONTINUE                                                     06MY9
             HT2 = H(I) + H(I)                                          06MY9
             HE2 = H(I) * H(I)                                          06MY9
             HE3 = H(I) * HE2                                           06MY9
             MP1 = M(I) + 1                                             06MY9
             MP2 = M(I) + 2                                             06MY9
             MP3 = M(I) + 3                                             06MY9
             MP4 = M(I) + 4                                             06MY9
             MP5 = M(I) + 5                                             06MY9
             MP6 = M(I) + 6                                             06MY9
             MP7 = M(I) + 7                                             06MY9
             NS = 1                                                     06MY9
             A(1) = 0.0                                                 06MY9
             A(2) = 0.0                                                 06MY9
             B(1) = 0.0                                                 06MY9
             B(2) = 0.0                                                 06MY9
             C(1) = 0.0                                                 06MY9
             C(2) = 0.0                                                 06MY9
           DO 90  J = 3, MP5                                            06MY9
             AA = F(J-1,I) - 0.25 * H(I) * R(J-1,I)                     06MY9
             BB = -2.0 * ( F(J-1,I) + F(J,I) ) - HE2 * P(J,I)           06MY9
             CC = F(J-1,I) + 4.0 * F(J,I) + F(J+1,I) + HE3 * S(J,I)     06MY9
     1              + 0.25 * H(I) * ( R(J-1,I) + R(J+1,I) ) +           06MY9
     2              HE2 * ( P(J,I) + P(J+1,I) )                         06MY9
             DD = -2.0 * ( F(J,I) + F(J+1,I) ) - HE2 * P(J+1,I)         06MY9
             EE = F(J+1,I) - 0.25 * H(I) * R(J+1,I)                     06MY9
             FF = HE3 * Q(J,I) - 0.5 * HE2 * ( T(J-1,I) -               06MY9
     2              T(J+1,I) )                                          06MY9
             E = AA * B(J-2) + BB                                       06MY9
             DENOM = E * B(J-1) + AA * C(J-2) + CC                      06MY9
           IF ( DENOM ) 30, 20, 30                                      06MY9
   20        D = 0.0                                                    06MY9
           GO TO 40                                                     06MY9
   30        D = -1.0 / DENOM                                           06MY9
   40        C(J) = D * EE                                              06MY9
             B(J) = D * ( E * C(J-1) + DD )                             06MY9
             A(J) = D * ( E * A(J-1) + AA * A(J-2) - FF )               06MY9
             KEYJ = KEY(J)                                              06MY9
           GO TO ( 90, 50, 60, 50, 70 ), KEYJ                           06MY9
   50        C(J) = 0.0                                                 06MY9
             B(J) = 0.0                                                 06MY9
             A(J) = WS(NS)                                              06MY9
           IF ( KEYJ - 3 ) 80, 60, 90                                   06MY9
   60        DTEMP = D                                                  06MY9
             CTEMP = C(J)                                               06MY9
```

```
                BTEMP = B(J)                                               06MY9
                ATEMP = A(J)                                               06MY9
                C(J) = 1.0                                                 06MY9
                B(J) = 0.0                                                 06MY9
                A(J) = -HT2 * DWS(NS)                                      06MY9
            GO TO 90                                                       06MY9
   70           DREV = 1.0 / ( 1.0 - ( BTEMP * B(J-1) + CTEMP - 1.0 )      06MY9
     1                 * D / DTEMP )                                       06MY9
                CREV = DREV * C(J)                                         06MY9
                BREV = DREV * ( B(J) + ( BTEMP * C(J-1) ) * D / DTEMP )    06MY9
                AREV = DREV * ( A(J) + ( HT2 * DWS(NS) + ATEMP +           06MY9
     1                 BTEMP * A(J-1) ) * D / DTEMP )                      06MY9
                C(J) = CREV                                                06MY9
                B(J) = BREV                                                06MY9
                A(J) = AREV                                                06MY9
   80           NS = NS + 1                                                06MY9
   90       CONTINUE                                                       06MY9
                W(MP6) = 0.0                                               06MY9
                W(MP7) = 0.0                                               06MY9
            DO 100  L = 3, MP5                                             06MY9
                J = M(I) + 8 - L                                           06MY9
                W(J) = A(J) + B(J) * W(J+1) + C(J) * W(J+2)                06MY9
  100       CONTINUE                                                       06MY9
                W(2) = 2.0 * W(3) - W(4)                                   06MY9
                W(MP6) = 2.0 * W(MP5) - W(MP4)                             06MY9
            DO 110  J = 3, MP5                                             06MY9
                BM(J) = F(J,I) * ( W(J-1) - 2.0 * W(J) + W(J+1) ) / HE2    06MY9
  110       CONTINUE                                                       06MY9
                BM(2) = 0.0                                                06MY9
                BM(MP6) = 0.0                                              06MY9
                REACTL = ( BM(3) - 2.0 * BM(4) + BM(5) ) / H(I)            06MY9
     1                  - Q(4,I) + ( T(3,I) - T(5,I) ) / ( 2.0 * H(I) )    06MY9
     2                  - ( R(3,I) * W(2) - R(3,I) * W(4) - R(5,I)         06MY9
     3                  * W(4) + R(5,I) * W(6) ) / ( 4.0 * HE2 ) - (       06MY9
     4                  P(4,I) * W(3) - P(4,I) * W(4) - P(5,I) * W(4)      06MY9
     5                  + P(5,I) * W(5) ) / H(I) + S(4,I) * W(4)           06MY9
                REACTR = ( BM(MP3) - 2.0 * BM(MP4) + BM(MP5) ) / H(I)      06MY9
     1                  - Q(MP4,I) + ( T(MP3,I) - T(MP5,I) ) / ( 2.0 *     06MY9
     2                  H(I) ) - ( R(MP3,I) * W(MP2) - R(MP3,I) * W(MP4)06MY9
     3                  - R(MP5,I) * W(MP4) + R(MP5,I) * W(MP6) ) / (      06MY9
     4                  4.0 * HE2 ) - ( P(MP4,I) * W(MP3) - P(MP4,I)       06MY9
     5                  * W(MP4) - P(MP5,I) * W(MP4) + P(MP5,I) * W(MP5)06MY9
     6                  ) / H(I) + S(MP4,I) * W(MP4)                       06MY9
            GO TO ( 120, 130, 140, 150, 160 ), K                           06MY9
C                                                                          06MY9
C*****SET FIXED END FORCES   ******************************************06MY9
C                                                                          06MY9
  120           FEF(1,I) = 0.0                                             06MY9
                FEF(2,I) = -REACTL                                         06MY9
                FEF(3,I) = 2.0 * BM(4)                                     06MY9
                FEF(4,I) = 0.0                                             06MY9
                FEF(5,I) = -REACTR                                         06MY9
                FEF(6,I) = - 2.0 * BM(MP4)                                 06MY9
            GO TO 170                                                      06MY9
C                                                                          06MY9
```

```
C*****SET STIFFNESS TERMS DEPENDING ON UNIT DISPLACEMENT APPLIED  ******06MY9
C                                                                       06MY9
  130         SM(2,3,I) = REACTL                                        06MY9
              SM(3,3,I) =-2.0 * BM(4)                                   06MY9
              SM(5,3,I) = REACTR                                        06MY9
              SM(6,3,I) = 2.0 * BM(MP4)                                 06MY9
        GO TO 170                                                       06MY9
  140         SM(2,6,I) = REACTL                                        06MY9
              SM(3,6,I) =-2.0 * BM(4)                                   06MY9
              SM(5,6,I) = REACTR                                        06MY9
              SM(6,6,I) = 2.0 * BM(MP4)                                 06MY9
        GO TO 170                                                       06MY9
  150         SM(2,2,I) = REACTL                                        06MY9
              SM(3,2,I) =-2.0 * BM(4)                                   06MY9
              SM(5,2,I) = REACTR                                        06MY9
              SM(6,2,I) = 2.0 * BM(MP4)                                 06MY9
        GO TO 170                                                       06MY9
  160         SM(2,5,I) = REACTL                                        06MY9
              SM(3,5,I) =-2.0 * BM(4)                                   06MY9
              SM(5,5,I) = REACTR                                        06MY9
              SM(6,5,I) = 2.0 * BM(MP4)                                 06MY9
  170   CONTINUE                                                        06MY9
        RETURN                                                          06MY9
        END                                                             06MY9
C                                                                       06MY9
C                                                                       06MY9
      SUBROUTINE INPUT3                                                 06MY9
      DIMENSION  KZ(10)                                                 06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,     06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                     06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                             06MY9
      COMMON / BLOCK3 / XLC(10), YLC(10)                                06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                         06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),         06MY9
     2                  R(57,20), AE(57,20), P(57,20)                   06MY9
      COMMON / BLOCK7 / INDEX(110,4), JN(110), INTLD(20), INTRD(20),    06MY9
     1                  MTYPE(20), MORD                                 06MY9
      COMMON / BLOC12 / NCOM, DTOL, RTOL, KOUT                          06MY9
C                                                                       06MY9
C*****READ AND PRINT MEMBER INCIDENCE  *********************************06MY9
C                                                                       06MY9
   10   CONTINUE                                                        06MY9
      PRINT 500                                                         06MY9
  500 FORMAT ( 1H1 )                                                    06MY9
      PRINT 510, NPROB, ( HED(K), K = 1, 14 )                           06MY9 **
  510 FORMAT (     5H     , 80X, 10HI-----TRIM , /,                     06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,            06MY9 **
     2            38H      TABLE 4 -- MEMBER INCIDENCE DATA  , // )     06MY9
        GO TO ( 20, 150 ), NEWPR                                        06MY9
   20   CONTINUE                                                        06MY9
              NXLM = NXL - 1                                            06MY9
              NYLM = NYL - 1                                            06MY9
              K = 1                                                     06MY9
        DO 80  I = 1, NYL                                               06MY9
      READ 520, ( KZ(J), J = 1, NXLM )                                  06MY9
```

```
520 FORMAT ( 10X, 10I5 )                                          06MY9
        DO 80  J = 1, NXL                                         06MY9
        IF ( J.NE.1 ) GO TO 40                                    06MY9
 30          INDEX(K,3) = 0                                       06MY9
             INDEX(K,1) = KZ(1)                                   06MY9
        GO TO 70                                                  06MY9
 40     IF ( J.NE.NXL ) GO TO 60                                  06MY9
 50          INDEX(K,3) = KZ(NXLM)                                06MY9
             INDEX(K,1) = 0                                       06MY9
        GO TO 70                                                  06MY9
 60          INDEX(K,3) = KZ(J-1)                                 06MY9
             INDEX(K,1) = KZ(J)                                   06MY9
 70          K = K + 1                                            06MY9
 80     CONTINUE                                                  06MY9
        DO 140  I = 1, NXL                                        06MY9
    READ 520, ( KZ(J), J = 1, NYLM )                              06MY9
             K = I                                                06MY9
        DO 140  J = 1, NYL                                        06MY9
        IF ( J.NE.1 ) GO TO 100                                   06MY9
 90          INDEX(K,4) = 0                                       06MY9
             INDEX(K,2) = KZ(1)                                   06MY9
        GO TO 130                                                 06MY9
100     IF ( J.NE.NYL ) GO TO 120                                 06MY9
110          INDEX(K,4) = KZ(NYLM)                                06MY9
             INDEX(K,2) = 0                                       06MY9
        GO TO 130                                                 06MY9
120          INDEX(K,4) = KZ(J-1)                                 06MY9
             INDEX(K,2) = KZ(J)                                   06MY9
130          K = K + NXL                                          06MY9
140     CONTINUE                                                  06MY9
        GO TO 250                                                 06MY9
150     CONTINUE                                                  06MY9
        IF ( NCOM.EQ.0 ) GO TO 250                                06MY9
160     DO 240  I = 1, NCOM                                       06MY9
    READ 540, MT, KLL, LLL, MLR, NLR                              06MY9
540 FORMAT ( 10X, 5I5 )                                           06MY9
        IF ( MT .LE. 0 ) MT = 0                                   06MY9
             INTL = KLL + ( LLL - 1 ) * NXL                       06MY9
             INTR = MLR + ( NLR - 1 ) * NXL                       06MY9
        IF ( KLL.NE. MLR ) GO TO 210                              06MY9
170          INDEX(INTL,2) = MT                                   06MY9
             INDEX(INTR,4) = MT                                   06MY9
180          INTL = INTL + NXL                                    06MY9
        IF ( INTL.EQ. INTR ) GO TO 200                            06MY9
190          INDEX(INTL,2) = MT                                   06MY9
             INDEX(INTL,4) = MT                                   06MY9
        GO TO 180                                                 06MY9
200     GO TO 240                                                 06MY9
210          INDEX(INTL,1) = MT                                   06MY9
             INDEX(INTR,3) = MT                                   06MY9
220          INTL = INTL + 1                                      06MY9
        IF ( INTL.EQ.INTR ) GO TO 240                             06MY9
230          INDEX(INTL,1) = MT                                   06MY9
             INDEX(INTL,3) = MT                                   06MY9
        GO TO 220                                                 06MY9
```

```
240      CONTINUE                                                          06MY9
250      DO 260  I = 1, NXL                                                06MY9
              KZ(I) = I                                                    06MY9
260      CONTINUE                                                          06MY9
    PRINT 550, ( KZ(I), I = 1, NXL )                                       06MY9
550 FORMAT (    51H           ALONG         MEMBER TYPES BETWEEN X LINES,06MY9
   1         /, 17H           Y LINE , I3, 9(2X,I3), / )                   06MY9
    PRINT 565                                                              06MY9
              KLINE = 15                                                   06MY9
              K1 = 1                                                       06MY9
              K2 = NXLM                                                    06MY9
              DO 300  I = 1, NYL                                           06MY9
         IF ( KLINE + 2 - KPAGE ) 270, 270, 280                            06MY9
270 PRINT 560, I, ( INDEX(J,1), J = K1, K2 )                               06MY9
560 FORMAT ( 10X, I3, 5X, 10(2X,I3) )                                      06MY9
    PRINT 565                                                              06MY9
565 FORMAT ( / )                                                           06MY9
              KLINE = KLINE + 2                                            06MY9
         GO TO 290                                                         06MY9
280 PRINT 500                                                              06MY9
    PRINT 570, NPROB, ( HED(J), J = 1, 14 )                                06MY9 **
570 FORMAT (     5H      , 80X, 10HI-----TRIM , /,                         06MY9
   1            10H      PROB , /, 5X, A5,5X, 14A5, ///,                   06MY9 **
   2            20H      TABLE 4 (CONT) , // )                             06MY9
    PRINT 550, ( KZ(J), J = 1, NXL )                                       06MY9
    PRINT 560, I, ( INDEX(J,1), J = K1, K2 )                               06MY9
    PRINT 565                                                              06MY9
              KLINE = 16                                                   06MY9
290           K1 = K1 + NXL                                                06MY9
              K2 = K1 + NXL - 2                                            06MY9
300      CONTINUE                                                          06MY9
         DO 310  I = 1, NYL                                                06MY9
              KZ(I) = I                                                    06MY9
310      CONTINUE                                                          06MY9
         IF ( KLINE + 7 - KPAGE ) 320, 320, 330                            06MY9
320 PRINT 580                                                              06MY9
580 FORMAT ( // )                                                          06MY9
    PRINT 590, ( KZ(I), I = 1, NYL )                                       06MY9
590 FORMAT (    51H           ALONG         MEMBER TYPES BETWEEN Y LINES,06MY9
   1        /,  17H           X LINE , I3, 9(2X,I3), / )                   06MY9
    PRINT 565                                                              06MY9
              KLINE = KLINE + 5                                            06MY9
         GO TO 340                                                         06MY9
330 PRINT 500                                                              06MY9
    PRINT 570, NPROB, (HED(I), I = 1, 14 )                                 06MY9 **
    PRINT 590, ( KZ(I), I = 1, NYL )                                       06MY9
              KLINE = 15                                                   06MY9
340           K1 = 1                                                       06MY9
              K2 = K1 + NXL * ( NYL - 2 )                                  06MY9
         DO 380  I = 1, NXL                                                06MY9
         IF ( KLINE + 2 - KPAGE ) 350, 350, 360                            06MY9
350 PRINT 560, I, ( INDEX(J,2),  J = K1, K2, NXL )                         06MY9
    PRINT 565                                                              06MY9
              KLINE = KLINE + 2                                            06MY9
         GO TO 370                                                         06MY9
```

```
  360 PRINT 500                                                          06MY9
      PRINT 570, NPROB, ( HED(J), J = 1, 14 )                            06MY9 **
      PRINT 590, ( KZ(J), J = 1, NYL )                                   06MY9
      PRINT 560, I, ( INDEX(J,2),  J = K1, K2, NXL )                     06MY9
              KLINE = 16                                                 06MY9
  370         K1 = K1 + 1                                                06MY9
              K2 = K1 + NXL * ( NYL - 2 )                                06MY9
  380     CONTINUE                                                       06MY9
C                                                                        06MY9
C*****READ AND PRINT DIAGONAL MEMBER INCIDENCE  ***********************06MY9
C                                                                        06MY9
      PRINT 500                                                          06MY9
      PRINT 600, NPROB, ( HED(I), I = 1, 14 )                            06MY9 **
  600 FORMAT (     5H      , 80X, 10HI-----TRIM , /,                     06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,              06MY9 **
     2            41H      TABLE 5 -- DIAGONAL MEMBER INCIDENCE, // )    06MY9
      PRINT 610                                                          06MY9
  610 FORMAT (    51H            LEFT END       RIGHT END     MEMBER TYPE,06MY9
     1         /, 37H          X LINE Y LINE  X LINE Y LINE , / )        06MY9
          GO TO ( 390, 410 ), NEWPR                                      06MY9
  390     IF ( NADM.LE.0 ) GO TO 470                                     06MY9
  400         K1 = 1                                                     06MY9
              K2 = NADM                                                  06MY9
              NDM = K2                                                   06MY9
              KLINE = 15                                                 06MY9
          GO TO 430                                                      06MY9
  410     IF ( NADM.LE.0 ) GO TO 480                                     06MY9
  420         K1 = NDM + 1                                               06MY9
              K2 = NDM + NADM                                            06MY9
              NDM = K2                                                   06MY9
              KLINE = 17                                                 06MY9
      PRINT 620                                                          06MY9
  620 FORMAT (    47H          USING DATA FROM PREVIOUS PROBLEM PLUS,/ ) 06MY9
  430     DO 460  I = K1, K2                                             06MY9
      READ 540, MT, KLL, LLL, MLR, NLR                                   06MY9
              XCL = XLC(MLR) - XLC(KLL)                                  06MY9
              YCL = YLC(NLR) - YLC(LLL)                                  06MY9
              FM = M(MT)                                                 06MY9
              FLENG = FM * H(MT)                                         06MY9
              ERR = ABS ( SQRT ( XCL * XCL + YCL * YCL ) - FLENG )       06MY9
              TOL = 0.01 * FLENG                                         06MY9
         IF ( ERR .GT. TOL ) GO TO 1100                                  06MY9
              INTLD(I) = KLL + ( LLL - 1 ) * NXL                         06MY9
              INTRD(I) = MLR + ( NLR - 1 ) * NXL                         06MY9
              MTYPE(I) = MT                                              06MY9
          IF ( KLINE + 1 - KPAGE ) 440, 440, 450                         06MY9
  440 PRINT 630, KLL, LLL, MLR, NLR, MT                                  06MY9
  630 FORMAT ( 11X, I3, 4X, I3, 5X, I3, 4X, I3, 8X, I3 )                 06MY9
              KLINE = KLINE + 1                                          06MY9
          GO TO 460                                                      06MY9
  450 PRINT 500                                                          06MY9
      PRINT 640, NPROB, ( HED(J), J = 1, 14 )                            06MY9 **
  640 FORMAT (     5H      , 80X, 10HI-----TRIM, /,                      06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,              06MY9 **
     2            20H      TABLE 5 (CONT) , // )                         06MY9
```

```
      PRINT 610                                                         06MY9
      PRINT 630, KLL, LLL, MLR, NLR, MT                                 06MY9
              KLINE = 15                                                06MY9
  460     CONTINUE                                                      06MY9
          GO TO 1000                                                    06MY9
  470 PRINT 650                                                         06MY9
  650 FORMAT (    15H             NONE )                                06MY9
              NDM = 0                                                   06MY9
          GO TO 1000                                                    06MY9
  480 PRINT 660                                                         06MY9
  660 FORMAT (    29H             NO ADDITIONAL DATA )                  06MY9
 1000     CONTINUE                                                      06MY9
C                                                                       06MY9
C*****SET JOINT NUMBERS FOR HORIZONTAL AND VERTICAL MEMBERS  ***********06MY9
C                                                                       06MY9
              K = 1                                                     06MY9
              N = 1                                                     06MY9
          DO 1090 I = 1, NYL                                            06MY9
          DO 1090  J = 1, NXL                                           06MY9
              KSUM = 0                                                  06MY9
          DO 1010  L = 1, 4                                             06MY9
              KSUM = KSUM + INDEX(K,L)                                  06MY9
 1010     CONTINUE                                                      06MY9
          IF ( KSUM .GT. 0 ) GO TO 1020                                 06MY9
              JN(K) = 0                                                 06MY9
          GO TO 1085                                                    06MY9
 1020     DO 1080  L = 1, 4                                             06MY9
          IF ( INDEX(K,L) .LE. 0 ) GO TO 1080                           06MY9
              MT = INDEX(K,L)                                           06MY9
              FM = M(MT)                                                06MY9
              FLENG = FM * H(MT)                                        06MY9
              TOL = 0.01 * FLENG                                        06MY9
          GO TO ( 1030, 1040, 1050, 1060 ), L                           06MY9
 1030         MM = J + 1                                                06MY9
              ERR = ABS ( XLC(MM) - XLC(J) - FLENG )                    06MY9
          GO TO 1070                                                    06MY9
 1040         MM = I + 1                                                06MY9
              ERR = ABS ( YLC(MM) - YLC(I) - FLENG )                    06MY9
          GO TO 1070                                                    06MY9
 1050         MM = J - 1                                                06MY9
              ERR = ABS ( XLC(J) - XLC(MM) - FLENG )                    06MY9
          GO TO 1070                                                    06MY9
 1060         MM = I - 1                                                06MY9
              ERR = ABS ( YLC(I) - YLC(MM) - FLENG )                    06MY9
 1070     IF  ( ERR .GT. TOL ) GO TO 1100                               06MY9
 1080     CONTINUE                                                      06MY9
              JN(K) = N                                                 06MY9
              N = N + 1                                                 06MY9
 1085         K = K + 1                                                 06MY9
 1090     CONTINUE                                                      06MY9
          GO TO 1110                                                    06MY9
 1100 PRINT 670, MT                                                     06MY9
  670 FORMAT ( 5X, 27H **** LENGTH OF MEMBER TYPE , I5 , 9H DOES NOT ,  06MY9
     1             38H AGREE WITH GRID DATA ** RUN ABANDONED )          06MY9
              KSTOP = 2                                                 06MY9
```

```
      RETURN                                                            06MY9
C                                                                       06MY9
C*****SET ADDITIONAL JOINT NUMBERS FOR DIAGONAL MEMBERS IF NECESSARY   **06MY9
C                                                                       06MY9
 1110          NZ = NDM                                                 06MY9
          IF ( NZ .LE. 0 ) GO TO 1140                                   06MY9
          DO 1130  J = 1, NZ                                            06MY9
               I = INTLD(J)                                             06MY9
          IF ( JN(I) .GT. 0 ) GO TO 1120                                06MY9
               JN(I) = N                                                06MY9
               N = N + 1                                                06MY9
 1120          I = INTRD(J)                                             06MY9
          IF ( JN(I) .GT. 0 ) GO TO 1130                                06MY9
               JN(I) = N                                                06MY9
               N = N + 1                                                06MY9
 1130     CONTINUE                                                      06MY9
C                                                                       06MY9
C*****COMPUTE ORDER OF STIFFNESS MATRIX                                 06MY9
C                                                                       06MY9
 1140          N = N - 1                                                06MY9
          IF ( N .LE. 50 ) GO TO 1150                                   06MY9
      PRINT 680                                                         06MY9
  680 FORMAT ( 5X, 45H NUMBER OF JOINTS EXCEEDS 50 ** RUN ABANDONED )   06MY9
               KSTOP = 2                                                06MY9
          GO TO 1160                                                    06MY9
 1150          MORD = 3 * N                                             06MY9
 1160     CONTINUE                                                      06MY9
      RETURN                                                            06MY9
      END                                                               06MY9
C                                                                       06MY9
C                                                                       06MY9
      SUBROUTINE INPUT4                                                 06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMI,     06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                     06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                             06MY9
      COMMON / BLOC11 / INTS(50), SX(50), SY(50), SZ(50),               06MY9
     1                  PX(50), PY(50), PZ(50)                          06MY9
C                                                                       06MY9
C*****READ AND PRINT APPLIED JOINT LOADS AND RESTRAINTS  ***************06MY9
C                                                                       06MY9
      PRINT 500                                                         06MY9
  500 FORMAT ( 1H1 )                                                    06MY9
      PRINT 510, NPROB, ( HED(I), I = 1, 14 )                           06MY9 **
  510 FORMAT (     5H      , 80X, 10HI-----TRIM, / ,                    06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,             06MY9 **
     2            50H      TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS, 06MY9
     3               // )                                               06MY9
         GO TO ( 10, 40 ), NEWPR                                        06MY9
   10    IF ( NAJLR.LE.0 ) GO TO 30                                     06MY9
   20          K1 = 1                                                   06MY9
               K2 = NAJLR                                               06MY9
               NJLR = K2                                                06MY9
               KLINE = 11                                               06MY9
         GO TO 70                                                       06MY9
   30 PRINT 520                                                         06MY9
```

```
  520 FORMAT (    40H          NO APPLIED LOADS OR RESTRAINTS )            06MY9
               NJLR = 0                                                     06MY9
          GO TO 120                                                         06MY9
   40     IF ( NAJLR.LE.0 ) GO TO 60                                        06MY9
   50 PRINT 530                                                             06MY9
  530 FORMAT (    35H          USING PREVIOUS DATA PLUS , // )              06MY9
               KLINE = 14                                                   06MY9
               K1 = NJLR + 1                                                06MY9
               K2 = NJLR + NAJLR                                            06MY9
               NJLR = K2                                                    06MY9
          GO TO 70                                                          06MY9
   60 PRINT 540                                                             06MY9
  540 FORMAT (    28H          NO ADDITIONAL DATA )                         06MY9
          GO TO 120                                                         06MY9
   70 PRINT 550                                                             06MY9
  550 FORMAT (    49H     X LINE Y LINE         PX         PY          PZ , 06MY9
     1            30H         SX          SY         SZ , / )               06MY9
               KLINE = KLINE + 2                                            06MY9
          DO 100  I = K1, K2                                                06MY9
      READ 560, KLL, LLL, PX(I), PY(I), PZ(I), SX(I), SY(I), SZ(I)          06MY9
  560 FORMAT ( 10X, 2I5, 6E10.5 )                                           06MY9
               INTS(I) = KLL + ( LLL - 1 ) * NXL                            06MY9
          IF ( KLINE + I - KPAGE ) 80, 80, 90                               06MY9
   80 PRINT 570, KLL, LLL, PX(I), PY(I), PZ(I), SX(I), SY(I), SZ(I)         06MY9
  570 FORMAT ( 5X, I5, 2X, I5, 5X, 6E10.3 )                                 06MY9
               KLINE = KLINE + 1                                            06MY9
          GO TO 100                                                         06MY9
   90 PRINT 500                                                             06MY9
      PRINT 580, NPROB, ( HED(J), J = 1, 14 )                               06MY9 **
  580 FORMAT (     5H      , 80X, 10HI-----TRIM, /,                         06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,                 06MY9 **
     2            20H      TABLE 6 (CONT) , // )                            06MY9
      PRINT 550                                                             06MY9
               KLINE = 15                                                   06MY9
      PRINT 570, KLL, LLL, PX(I), PY(I), PZ(I), SX(I), SY(I), SZ(I)         06MY9
  100     CONTINUE                                                          06MY9
          IF ( NJLR.LE.0 ) GO TO 120                                        06MY9
               NZ = NJLR - 1                                                06MY9
          DO  110  I = 1, NZ                                                06MY9
               K = I + 1                                                    06MY9
          DO 110  J = K, NJLR                                               06MY9
          IF ( INTS(I) .NE. INTS(J) ) GO TO 110                             06MY9
               SX(I) = SX(I) + SX(J)                                        06MY9
               SY(I) = SY(I) + SY(J)                                        06MY9
               SZ(I) = SZ(I) + SZ(J)                                        06MY9
               SX(J) = 0.0                                                  06MY9
               SY(J) = 0.0                                                  06MY9
               SZ(J) = 0.0                                                  06MY9
  110     CONTINUE                                                          06MY9
  120     CONTINUE                                                          06MY9
      RETURN                                                                06MY9
      END                                                                   06MY9
C                                                                           06MY9
C                                                                           06MY9
      SUBROUTINE FSTIFF                                                     06MY9
```

```
      DIMENSION  SRT(9), Z(6,6), TZ(6,6)                                 06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,      06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                      06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                              06MY9
      COMMON / BLOCK3 / XLC(10), YLC(10)                                 06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                          06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),          06MY9
     2                  R(57,20), AE(57,20), P(57,20)                    06MY9
      COMMON / BLOCK5 / SM(6,6,20), FEF(6,20)                            06MY9
      COMMON / BLOCK6 / A(57), B(57), C(57), W(57), DW(57), BM(57),      06MY9
     1                  DBM(57), REACT(57)                               06MY9
      COMMON / BLOCK7 / INDEX(110,4), JN(110), INTLD(20), INTRD(20),     06MY9
     1                  MTYPE(20), MORD                                  06MY9
      COMMON / BLOCK8 / ITER                                             06MY9
      COMMON / BLOCK9 / ST(150,65), U(150), FL(150)                      06MY9
      COMMON / BLOC10 / X(57), Y(57)                                     06MY9
      COMMON / BLOC11 / INTS(50), SX(50), SY(50), SZ(50),                06MY9
     1                  PX(50), PY(50), PZ(50)                           06MY9
      COMMON / SBLOC1 / I, K, KEY(57), WS(5), DWS(5)                     06MY9
C                                                                        06MY9
C*****THIS ROUTINE FORMULATES OVERALL STIFFNESS MATRIX AND LOAD VECTOR *06MY9
C                                                                        06MY9
              NJ = MORD / 3                                              06MY9
          DO 10  I = 1, 150                                              06MY9
          DO 10  J = 1, 65                                               06MY9
              ST(I,J) = 0.0                                              06MY9
   10     CONTINUE                                                       06MY9
   20     DO 30  I = 1, 150                                              06MY9
              FL(I) = 0.0                                                06MY9
   30     CONTINUE                                                       06MY9
C                                                                        06MY9
C*****PLACING HORIZONTAL MEMBER STIFFNESS MATRICES IN OVERALL MATRIX  **06MY9
C                                                                        06MY9
   40         K = 1                                                      06MY9
          DO 630  M1 = 1, NYL                                            06MY9
              JL = 0                                                     06MY9
          DO 630  M2 = 1, NXL                                            06MY9
          IF ( JL.GT.0 ) GO TO 80                                        06MY9
   50     IF ( JN(K).LE.0 ) GO TO 620                                    06MY9
   60     IF ( INDEX(K,1).LE.0 ) GO TO 620                               06MY9
   70         JL = JN(K)                                                 06MY9
          GO TO 620                                                      06MY9
   80     IF ( JN(K).LE.0 ) GO TO 620                                    06MY9
   90     IF ( INDEX(K,3).LE.0 ) GO TO 620                               06MY9
  100         JR = JN(K)                                                 06MY9
              I = INDEX(K,3)                                             06MY9
          IF ( ( JR - JL ).LE.10 ) GO TO 120                             06MY9
  110         KSTOP = 2                                                  06MY9
      PRINT 5000                                                         06MY9
 5000 FORMAT (   45H     MAXIMUM DIFFERENCE BETWEEN JOINT NUMBERS ,      06MY9
     1            46H     EXCEEDS 10, RUN ABANDONED FROM SUBROUTINE ,    06MY9
     2            11H     FSTIFF   )                                     06MY9
      RETURN                                                             06MY9
  120         K1 = 3 * JL - 2                                            06MY9
              K2 = 3 * JL - 1                                            06MY9
```

```
            K3 = 3 * JL                                                  06MY9
            L1 = 3 * JR - 2                                              06MY9
            L2 = 3 * JR - 1                                              06MY9
            L3 = 3 * JR                                                  06MY9
        IF ( ITER.NE.0 ) GO TO 140                                       06MY9
C                                                                        06MY9
C*****ADD FIXED END FORCES TO LOAD VECTOR  ****************************06MY9
C                                                                        06MY9
  130       FL(K1) = FL(K1) + FEF(1,I)                                   06MY9
            FL(K2) = FL(K2) + FEF(2,I)                                   06MY9
            FL(K3) = FL(K3) + FEF(3,I)                                   06MY9
            FL(L1) = FL(L1) + FEF(4,I)                                   06MY9
            FL(L2) = FL(L2) + FEF(5,I)                                   06MY9
            FL(L3) = FL(L3) + FEF(6,I)                                   06MY9
        GO TO 250                                                        06MY9
  140       KKK = K                                                      06MY9
            PP = SM(4,1,I) * U(K1) + SM(4,4,I) * U(L1)                   06MY9
            MP4 = M(I) + 4                                               06MY9
        DO 150  J = 5, MP4                                               07AG9
            P(J,I) = PP                                                  06MY9
  150   CONTINUE                                                         06MY9
            MP3 = M(I) + 3                                               06MY9
            MP5 = M(I) + 5                                               06MY9
            K = 1                                                        07AG9
        DO 155  J = 3, MP5                                               07AG9
            KEY(J) = 1                                                   07AG9
  155   CONTINUE                                                         07AG9
            WS(1) = 0.0                                                  07AG9
            DWS(1) = 0.0                                                 07AG9
            WS(2) = 0.0                                                  07AG9
            DWS(2) = 0.0                                                 07AG9
            KEY(3) = 3                                                   07AG9
            KEY(4) = 4                                                   07AG9
            KEY(5) = 5                                                   07AG9
            KEY(MP3) = 3                                                 07AG9
            KEY(MP4)*=*4***                                              07AG9***
            KEY(MP5) = 5                                                 07AG9
      CALL BMCOL1                                                        07AG9
        DO 160  J = 4, MP4                                               06MY9
            X(J) = Q(J,I)                                                06MY9
            Y(J) = T(J,I)                                                06MY9
            Q(J,I) = 0.0                                                 06MY9
            T(J,I) = 0.0                                                 06MY9
  160   CONTINUE                                                         06MY9
C                                                                        06MY9
C*****REEVALUATE STIFFNESS TERMS IF INVESTIGATING AXIAL EFFECTS  *******06MY9
C                                                                        06MY9
        DO 230  K = 2, 5                                                 06MY9
        DO 170  J = 3, MP5                                               06MY9
            KEY(J) = 1                                                   06MY9
  170   CONTINUE                                                         06MY9
        DO 180  J = 1, 5                                                 06MY9
            WS(J) = 0.0                                                  06MY9
            DWS(J) = 0.0                                                 06MY9
  180   CONTINUE                                                         06MY9
```

```
                KEY(3) = 3                                                06MY9
                KEY(4) = 4                                                06MY9
                KEY(5) = 5                                                06MY9
                KEY(MP3) = 3                                              06MY9
                KEY(MP4) = 4                                              06MY9
                KEY(MP5) = 5                                              06MY9
           GO TO ( 230, 190, 200, 210, 220 ), K                           06MY9
  190           DWS(1) = 1.0                                              06MY9
       CALL BMCOL1                                                        06MY9
           GO TO 230                                                      06MY9
  200           DWS(2) = 1.0                                              06MY9
       CALL BMCOL1                                                        06MY9
           GO TO 230                                                      06MY9
  210           WS(1) = 1.0                                               06MY9
       CALL BMCOL1                                                        06MY9
           GO TO 230                                                      06MY9
  220           WS(2) = 1.0                                               06MY9
       CALL BMCOL1                                                        06MY9
  230      CONTINUE                                                       06MY9
           DO 240  J = 4, MP4                                             06MY9
                Q(J,I) = X(J)                                             06MY9
                T(J,I) = Y(J)                                             06MY9
                X(J) = 0.0                                                06MY9
                Y(J) = 0.0                                                06MY9
  240      CONTINUE                                                       06MY9
                K = KKK                                                   06MY9
           GO TO 130                                                      07AG9
C                                                                         06MY9
C*****CHECKING POSITION OF MEMBER STIFFNESS ELEMENTS IN OVERALL MATRIX *06MY9
C                                                                         06MY9
  250      IF ( JL.GT.11 ) GO TO 270                                      06MY9
  260           N1 = K1                                                   06MY9
                N2 = K3                                                   06MY9
                N3 = L1                                                   06MY9
                N4 = L3                                                   06MY9
                KEY1 = 1                                                  06MY9
           GO TO 320                                                      06MY9
  270      IF ( NJ.LT.22 ) GO TO 300                                      06MY9
  280      IF ( NJ.EQ.22 ) GO TO 310                                      06MY9
  290      IF ( JL.GE.(NJ-10) ) GO TO 310                                 06MY9
  300           N1 = K1 - 3 * ( JL - 12 ) - 1                             06MY9
                N2 = N1 + 2                                               06MY9
                N3 = N1 + 3 * ( JR - JL )                                 06MY9
                N4 = N3 + 2                                               06MY9
                KEY1 = 2                                                  06MY9
           GO TO 320                                                      06MY9
  310           N1 = K1 - 3 * ( NJ - 22 ) - 1                             06MY9
                N2 = N1 + 2                                               06MY9
                N3 = N1 + 3 * ( JR - JL )                                 06MY9
                N4 = N3 + 2                                               06MY9
                KEY1 = 1                                                  06MY9
C                                                                         06MY9
C*****PLACING ELEMENTS IN OVERALL MATRIX  ******************************06MY9
C                                                                         06MY9
  320      DO 420  L = 1, 2                                               06MY9
```

```
      GO TO ( 330, 340 ), L                                             06MY9
330      I1 = N1                                                        06MY9
         I2 = N2                                                        06MY9
      GO TO 350                                                         06MY9
340      I1 = N3                                                        06MY9
         I2 = N4                                                        06MY9
350      LL = 1                                                         06MY9
      DO 410  J = K1, K3                                                06MY9
      GO TO ( 360, 370 ), L                                             06MY9
360      KK = 1                                                         06MY9
      GO TO 380                                                         06MY9
370      KK = 4                                                         06MY9
380   DO 390  N = I1, I2                                                06MY9
         ST(J,N) = ST(J,N) + SM(LL,KK,I)                                06MY9
         KK = KK + 1                                                    06MY9
390   CONTINUE                                                          06MY9
         LL = LL + 1                                                    06MY9
      GO TO ( 410, 400 ), KEY1                                          06MY9
400      I1 = I1 - 1                                                    06MY9
         I2 = I2 - 1                                                    06MY9
410   CONTINUE                                                          06MY9
420   CONTINUE                                                          06MY9
         K1 = 3 * JR - 2                                                06MY9
         K3 = 3 * JR                                                    06MY9
         L1 = 3 * JL - 2                                                06MY9
         L3 = 3 * JL                                                    06MY9
      IF ( JR.GT.11 ) GO TO 440                                         06MY9
430      N1 = L1                                                        06MY9
         N2 = L3                                                        06MY9
         N3 = K1                                                        06MY9
         N4 = K3                                                        06MY9
         KEY1 = 1                                                       06MY9
      GO TO 490                                                         06MY9
440   IF ( NJ.LT.22 ) GO TO 470                                         06MY9
450   IF ( NJ.EQ.22 ) GO TO 480                                         06MY9
460   IF ( JR.GE.(NJ-10) ) GO TO 480                                    06MY9
470      N1 = L1 - 3 * ( JR - 12 ) - 1                                  06MY9
         N2 = N1 + 2                                                    06MY9
         N3 = N1 + 3 * ( JR - JL )                                      06MY9
         N4 = N3 + 2                                                    06MY9
         KEY1 = 2                                                       06MY9
      GO TO 490                                                         06MY9
480      N1 = L1 - 3 * ( NJ - 22 ) - 1                                  06MY9
         N2 = N1 + 2                                                    06MY9
         N3 = N1 + 3 * ( JR - JL )                                      06MY9
         N4 = N3 + 2                                                    06MY9
         KEY1 = 1                                                       06MY9
490   DO 590  L = 1, 2                                                  06MY9
      GO TO ( 500, 510 ), L                                             06MY9
500      I1 = N1                                                        06MY9
         I2 = N2                                                        06MY9
      GO TO 520                                                         06MY9
510      I1 = N3                                                        06MY9
         I2 = N4                                                        06MY9
520      LL = 4                                                         06MY9
```

```
         DO 580  J = K1, K3                                                06MY9
         GO TO ( 530, 540 ), L                                             06MY9
  530         KK = 1                                                       06MY9
         GO TO 550                                                         06MY9
  540         KK = 4                                                       06MY9
  550    DO 560  N = I1, I2                                                06MY9
              ST(J,N) = ST(J,N) + SM(LL,KK,I)                              06MY9
              KK = KK + 1                                                  06MY9
  560    CONTINUE                                                          06MY9
              LL = LL + 1                                                  06MY9
         GO TO ( 580, 570 ), KEY1                                          06MY9
  570         I1 = I1 - 1                                                  06MY9
              I2 = I2 - 1                                                  06MY9
  580    CONTINUE                                                          06MY9
  590    CONTINUE                                                          06MY9
         IF ( INDEX(K,1).LE.0 ) GO TO 610                                  06MY9
  600         JL = JN(K)                                                   06MY9
         GO TO 620                                                         06MY9
  610         JL = 0                                                       06MY9
  620         K = K + 1                                                    06MY9
  630    CONTINUE                                                          06MY9
C                                                                          06MY9
C*****SETTING ROTATION MATRIX FOR VERTICAL MEMBERS  *******************06MY9
C                                                                          06MY9
              SRT(1)  = 0.0                                                06MY9
              SRT(2)  = -1.0                                               06MY9
              SRT(3)  = 0.0                                                06MY9
              SRT(4)  = 1.0                                                06MY9
              SRT(5)  = 0.0                                                06MY9
              SRT(6)  = 0.0                                                06MY9
              SRT(7)  = 0.0                                                06MY9
              SRT(8)  = 0.0                                                06MY9
              SRT(9)  = 1.0                                                06MY9
C                                                                          06MY9
C*****PLACING VERTICAL MEMBER STIFFNESS MATRICES IN OVERALL MATRIX  ****06MY9
C                                                                          06MY9
         DO 1250  M1 = 1, NXL                                              06MY9
              K = M1                                                       06MY9
              JL = 0                                                       06MY9
         DO 1250  M2 = 1, NYL                                              06MY9
         IF ( JL.GT.0 ) GO TO 670                                          06MY9
  640    IF ( JN(K).LE.0 ) GO TO 1240                                      06MY9
  650    IF ( INDEX(K,2).LE.0 ) GO TO 1240                                 06MY9
  660         JL = JN(K)                                                   06MY9
         GO TO 1240                                                        06MY9
  670    IF ( JN(K).LE.0 ) GO TO 1240                                      06MY9
  680    IF ( INDEX(K,4).LE.0 ) GO TO 1240                                 06MY9
  690         JR = JN(K)                                                   06MY9
              I = INDEX(K,4)                                               06MY9
         IF ( ( JR - JL ).LE.10 ) GO TO 710                                06MY9
  700         KSTOP = 2                                                    06MY9
      PRINT 5000                                                           06MY9
      RETURN                                                               06MY9
  710         K1 = 3 * JR - 2                                              06MY9
              K2 = 3 * JR - 1                                              06MY9
```

```
            K3 = 3 * JR                                                     06MY9
            L1 = 3 * JL - 2                                                 06MY9
            L2 = 3 * JL - 1                                                 06MY9
            L3 = 3 * JL                                                     06MY9
         IF ( ITER.GT.0 ) GO TO 730                                         06MY9
C                                                                           06MY9
C*****ADD FIXED END FORCES TO LOAD VECTOR  *****************************06MY9
C                                                                           06MY9
  720       FL(K1) = FL(K1) + FEF(2,I)                                      06MY9
            FL(K2) = FL(K2) + FEF(1,I)                                      06MY9
            FL(K3) = FL(K3) + FEF(3,I)                                      06MY9
            FL(L1) = FL(L1) + FEF(5,I)                                      06MY9
            FL(L2) = FL(L2) + FEF(4,I)                                      06MY9
            FL(L3) = FL(L3) + FEF(6,I)                                      06MY9
         GO TO 840                                                          06MY9
  730       KKK = K                                                         06MY9
            PP = SM(1,1,I) * U(K2) + SM(1,4,I) * U(L2 )                     06MY9
            MP4 = M(I) + 4                                                  06MY9
            MP3 = M(I) + 3                                                  06MY9
            MP5 = M(I) + 5                                                  06MY9
         DO 740  J = 5, MP4                                                 07AG9
            P(J,I) = PP                                                     06MY9
  740    CONTINUE                                                           06MY9
            K = 1                                                           07AG9
         DO 745  J = 3, MP5                                                 07AG9
            KEY(J) = 1                                                      07AG9
  745    CONTINUE                                                           07AG9
            WS(1) = 0.0                                                     07AG9
            DWS(1) = 0.0                                                    07AG9
            WS(2) = 0.0                                                     07AG9
            DWS(2) = 0.0                                                    07AG9
            KEY(3) = 3                                                      07AG9
            KEY(4) = 4                                                      07AG9
            KEY(5) = 5                                                      07AG9
            KEY(MP3) = 3                                                    07AG9
            KEY(MP4) = 4                                                    07AG9
            KEY(MP5) = 5                                                    07AG9
      CALL BMCOL1                                                           07AG9
         DO 750  J = 4, MP4                                                 06MY9
            X(J) = Q(J,I)                                                   06MY9
            Y(J) = T(J,I)                                                   06MY9
            Q(J,I) = 0.0                                                    06MY9
            T(J,I) = 0.0                                                    06MY9
  750    CONTINUE                                                           06MY9
C                                                                           06MY9
C*****REEVALUATE STIFFNESS TERMS IF INVESTIGATING AXIAL EFFECTS  *******06MY9
C                                                                           06MY9
         DO 820  K = 2, 5                                                   06MY9
         DO 760  J = 3, MP5                                                 06MY9
            KEY(J) = 1                                                      06MY9
  760    CONTINUE                                                           06MY9
         DO 770  J = 1, 5                                                   06MY9
            WS(J) = 0.0                                                     06MY9
            DWS(J) = 0.0                                                    06MY9
  770    CONTINUE                                                           06MY9
```

```
            KEY(3) = 3                                                  06MY9
            KEY(4) = 4                                                  06MY9
            KEY(5) = 5                                                  06MY9
            KEY(MP3) = 3                                                06MY9
            KEY(MP4) = 4                                                06MY9
            KEY(MP5)= 5                                                 06MY9
         GO TO ( 820, 780, 790, 800, 810 ), K                           06MY9
  780       DWS(1) = 1.0                                                06MY9
      CALL BMCOL1                                                       06MY9
         GO TO 820                                                      06MY9
  790       DWS(2) = 1.0                                                06MY9
      CALL BMCOL1                                                       06MY9
         GO TO 820                                                      06MY9
  800       WS(1) = 1.0                                                 06MY9
      CALL BMCOL1                                                       06MY9
         GO TO 820                                                      06MY9
  810       WS(2) = 1.0                                                 06MY9
      CALL BMCOL1                                                       06MY9
  820    CONTINUE                                                       06MY9
         DO 830  J = 4, MP4                                             06MY9
            Q(J,I) = X(J)                                               06MY9
            T(J,I) = Y(J)                                               06MY9
            X(J) = 0.0                                                  06MY9
            Y(J) = 0.0                                                  06MY9
  830    CONTINUE                                                       06MY9
            K = KKK                                                     06MY9
         GO TO 720                                                      07AG9
  840    DO 850  L = 1, 6                                               06MY9
         DO 850  J = 1, 6                                               06MY9
            Z(L,J) = SM(L,J,I)                                          06MY9
  850    CONTINUE                                                       06MY9
C                                                                       06MY9
C*****ROTATING VERTICAL MEMBER STIFFNESS MATRIX INTO GLOBAL COORDINATES 06MY9
C                                                                       06MY9
         DO 860  N = 1, 2                                               06MY9
         DO 860  J = 1, 6                                               06MY9
            TZ(J,3*N-2) = Z(J,3*N-2) * SRT(1) + Z(J,3*N-1) * SRT(4)     06MY9
     1                    + Z(J,3*N) * SRT(7)                           06MY9
            TZ(J,3*N-1) = Z(J,3*N-2) * SRT(2) + Z(J,3*N-1) * SRT(5)     06MY9
     1                    + Z(J,3*N) * SRT(8)                           06MY9
            TZ(J,3*N)    = Z(J,3*N-2) * SRT(3) + Z(J,3*N-1) * SRT(6)    06MY9
     1                    + Z(J,3*N) * SRT(9)                           06MY9
  860    CONTINUE                                                       06MY9
         DO 870  J = 1, 2                                               06MY9
         DO 870  N = 1, 6                                               06MY9
            Z(3*J-2,N) = SRT(1) * TZ(3*J-2,N) + SRT(4) * TZ(3*J-1,N)    06MY9
     1                  + SRT(7) * TZ(3*J,N)                            06MY9
            Z(3*J-1,N) = SRT(2) * TZ(3*J-2,N) + SRT(5) * TZ(3*J-1,N)    06MY9
     1                  + SRT(8) * TZ(3*J,N)                            06MY9
            Z(3*J,N)   = SRT(3) * TZ(3*J-2,N) + SRT(6) * TZ(3*J-1,N)    06MY9
     1                  + SRT(9) * TZ(3*J,N)                            06MY9
  870    CONTINUE                                                       06MY9
C                                                                       06MY9
C*****CHECKING POSITION OF MEMBER STIFFNESS ELEMENTS IN OVERALL MATRIX  06MY9
C                                                                       06MY9
```

```
        IF ( JR.GT.11 ) GO TO 890                                    06MY9
  880       N1 = K1                                                  06MY9
            N2 = K3                                                  06MY9
            N3 = L1                                                  06MY9
            N4 = L3                                                  06MY9
            KEY1 = 1                                                 06MY9
        GO TO 940                                                    06MY9
  890   IF ( NJ.LT.22 ) GO TO 920                                    06MY9
  900   IF ( NJ.EQ.22 ) GO TO 930                                    06MY9
  910   IF ( JR.GE.(NJ-10) ) GO TO 930                               06MY9
  920       N1 = K1 - 3 * ( JR - 12 ) - 1                            06MY9
            N2 = N1 + 2                                              06MY9
            N3 = N1 - 3 * ( JR - JL )                                06MY9
            N4 = N3 + 2                                              06MY9
            KEY1 = 2                                                 06MY9
        GO TO 940                                                    06MY9
  930       N1 = K1 - 3 * ( NJ - 22 ) - 1                            06MY9
            N2 = N1 + 2                                              06MY9
            N3 = N1 - 3 * ( JR - JL )                                06MY9
            N4 = N3 + 2                                              06MY9
            KEY1 = 1                                                 06MY9
C                                                                    06MY9
C*****PLACING ELEMENTS IN OVERALL MATRIX  ******************************06MY9
C                                                                    06MY9
  940   DO 1040  L = 1, 2                                            06MY9
        GO TO ( 950, 960 ), L                                        06MY9
  950       I1 = N1                                                  06MY9
            I2 = N2                                                  06MY9
        GO TO 970                                                    06MY9
  960       I1 = N3                                                  06MY9
            I2 = N4                                                  06MY9
  970       LL = 1                                                   06MY9
        DO 1030  J = K1, K3                                          06MY9
        GO TO ( 980, 990 ), L                                        06MY9
  980       KK = 1                                                   06MY9
        GO TO 1000                                                   06MY9
  990       KK = 4                                                   06MY9
 1000   DO 1010  N = I1, I2                                          06MY9
            ST(J,N) = ST(J,N) + Z(LL,KK)                             06MY9
            KK = KK + 1                                              06MY9
 1010   CONTINUE                                                     06MY9
            LL = LL + 1                                              06MY9
        GO TO ( 1030, 1020 ), KEY1                                   06MY9
 1020       I1 = I1 -1                                               06MY9
            I2 = I2 - 1                                              06MY9
 1030   CONTINUE                                                     06MY9
 1040   CONTINUE                                                     06MY9
            K1 = 3 * JL - 2                                          06MY9
            K3 = 3 * JL                                              06MY9
            L1 = 3 * JR - 2                                          06MY9
            L3 = 3 * JR                                              06MY9
        IF ( JL.GT.11 ) GO TO 1060                                   06MY9
 1050       N1 = L1                                                  06MY9
            N2 = L3                                                  06MY9
            N3 = K1                                                  06MY9
```

```
              N4 = K3                                                    06MY9
              KEY1 = 1                                                   06MY9
         GO TO 1110                                                      06MY9
 1060    IF ( NJ.LT.22 ) GO TO 1090                                      06MY9
 1070    IF ( NJ.EQ.22 ) GO TO 1100                                      06MY9
 1080    IF ( JL.GE.(NJ-10) ) GO TO 1100                                 06MY9
 1090         N1 = L1 - 3 * ( JL - 12 ) - 1                              06MY9
              N2 = N1 + 2                                                06MY9
              N3 = N1 - 3 * ( JR - JL )                                  06MY9
              N4 = N3 + 2                                                06MY9
              KEY1 = 2                                                   06MY9
         GO TO 1110                                                      06MY9
 1100         N1 = L1 - 3 * ( NJ - 22 ) - 1                              06MY9
              N2 = N1 + 2                                                06MY9
              N3 = N1 - 3 * ( JR - JL )                                  06MY9
              N4 = N3 + 2                                                06MY9
              KEY1 = 1                                                   06MY9
 1110    DO 1210  L = 1, 2                                               06MY9
         GO TO ( 1120, 1130 ), L                                         06MY9
 1120         I1 = N1                                                    06MY9
              I2 = N2                                                    06MY9
         GO TO 1140                                                      06MY9
 1130         I1 = N3                                                    06MY9
              I2 = N4                                                    06MY9
 1140         LL = 4                                                     06MY9
         DO 1200  J = K1, K3                                             06MY9
         GO TO ( 1150, 1160 ), L                                         06MY9
 1150         KK = 1                                                     06MY9
         GO TO 1170                                                      06MY9
 1160         KK = 4                                                     06MY9
 1170    DO 1180  N = I1, I2                                             06MY9
              ST(J,N) = ST(J,N) + Z(LL,KK)                               06MY9
              KK = KK + 1                                                06MY9
 1180    CONTINUE                                                        06MY9
              LL = LL + 1                                                06MY9
         GO TO ( 1200, 1190 ), KEY1                                      06MY9
 1190         I1 = I1 - 1                                                06MY9
              I2 = I2 - 1                                                06MY9
 1200    CONTINUE                                                        06MY9
 1210    CONTINUE                                                        06MY9
         IF ( INDEX(K,2).LE.0 ) GO TO 1230                               06MY9
 1220         JL = JN(K)                                                 06MY9
         GO TO 1240                                                      06MY9
 1230         JL = 0                                                     06MY9
 1240         K = K + NXL                                                06MY9
 1250    CONTINUE                                                        06MY9
C                                                                        06MY9
C*****PLACING DIAGONAL MEMBER STIFFNESS MATRICES IN OVERALL MATRIX  ****06MY9
C                                                                        06MY9
              NZ = NDM                                                   06MY9
         IF ( NZ.LE.0 ) GO TO 1990                                       06MY9
 1260    DO 1980  MM = 1, NZ                                             06MY9
              I = INTLD(MM)                                              06MY9
              JL = JN(I)                                                 06MY9
              I = INTRD(MM)                                              06MY9
```

```
              JR = JN(I)                                          06MY9
              I = MTYPE(MM)                                       06MY9
          IF ( ABS( JR - JL ).LE.10 ) GO TO 1280                  06MY9
 1270         KSTOP = 2                                           06MY9
      PRINT 5000                                                  06MY9
      RETURN                                                      06MY9
 1280     IF ( JL.LE.JR ) GO TO 1300                              06MY9
 1290         KEY2 = 1                                            06MY9
          GO TO 1310                                              06MY9
 1300         KEY2 = 2                                            06MY9
 1310         NN = INTLD(MM)                                      06MY9
              N = 1                                               06MY9
 1320     IF ( NN.GT.NXL ) GO TO 1340                             06MY9
 1330         KKK = NN                                            06MY9
              LLL = N                                             06MY9
          GO TO 1350                                              06MY9
 1340         NN = NN - NXL                                       06MY9
              N = N + 1                                           06MY9
          GO TO 1320                                              06MY9
 1350         NN = INTRD(MM)                                      06MY9
              N = 1                                               06MY9
 1360     IF ( NN.GT.NXL ) GO TO 1380                             06MY9
 1370         MMM = NN                                            06MY9
              NNN = N                                             06MY9
          GO TO 1390                                              06MY9
 1380         NN = NN - NXL                                       06MY9
              N = N + 1                                           06MY9
          GO TO 1360                                              06MY9
C                                                                 06MY9
C*****SET ROTATION MATRIX FOR DIAGONAL MEMBERS  ***********************06MY9
C                                                                 06MY9
 1390         XCL = XLC(MMM) - XLC(KKK)                           06MY9
              YCL = YLC(NNN) - YLC(LLL)                           06MY9
              FLENG = SQRT ( XCL * XCL + YCL * YCL )              06MY9
              CX = XCL / FLENG                                    06MY9
              CY = YCL / FLENG                                    06MY9
              SRT(1) = CX                                         06MY9
              SRT(2) = CY                                         06MY9
              SRT(3) = 0.0                                        06MY9
              SRT(4) = -CY                                        06MY9
              SRT(5) = CX                                         06MY9
              SRT(6) = 0.0                                        06MY9
              SRT(7) = 0.0                                        06MY9
              SRT(8) = 0.0                                        06MY9
              SRT(9) = 1.0                                        06MY9
              K1 = 3 * JL - 2                                     06MY9
              K2 = 3 * JL - 1                                     06MY9
              K3 = 3 * JL                                         06MY9
              L1 = 3 * JR - 2                                     06MY9
              L2 = 3 * JR - 1                                     06MY9
              L3 = 3 * JR                                         06MY9
          IF ( ITER.NE.0 ) GO TO 1410                             06MY9
C                                                                 06MY9
C*****ADD FIXED END FORCES TO LOAD VECTOR  ****************************06MY9
C                                                                 06MY9
```

```
 1400          FL(K1) = FL(K1) + SRT(1) * FEF(1,I) + SRT(4) * FEF(2,I)  06MY9
               FL(K2) = FL(K2) + SRT(2) * FEF(1,I) + SRT(5) * FEF(2,I)  06MY9
               FL(K3) = FL(K3) + FEF(3,I)                               06MY9
               FL(L1) = FL(L1) + SRT(1) * FEF(4,I) + SRT(4) * FEF(5,I)  06MY9
               FL(L2) = FL(L2) + SRT(2) * FEF(4,I) + SRT(5) * FEF(5,I)  06MY9
               FL(L3) = FL(L3) + FEF(6,I)                               06MY9
          GO TO 1520                                                    06MY9
 1410          PP = SM(4,1,I) * ( SRT(1) * U(K1) + SRT(2) * U(K2) ) +   06MY9
     1              SM(4,4,I) * ( SRT(1) * U(L1) + SRT(2) * U(L2) )     06MY9
               MP3 = M(I) + 3                                           06MY9
               MP4 = M(I) + 4                                           06MY9
               MP5 = M(I) + 5                                           06MY9
               DO 1420  J = 5, MP4                                      07AG9
               P(J,I) = PP                                              06MY9
 1420     CONTINUE                                                      06MY9
               K = 1                                                    07AG9
          DO 1425  J = 3, MP5                                           07AG9
               KEY(J) = 1                                               07AG9
 1425     CONTINUE                                                      07AG9
               WS(1) = 0.0                                              07AG9
               DWS(1) = 0.0                                             07AG9
               WS(2) = 0.0                                              07AG9
               DWS(2) = 0.0                                             07AG9
               KEY(3) = 3                                               07AG9
               KEY(4) = 4                                               07AG9
               KEY(5) = 5                                               07AG9
               KEY(MP3) = 3                                             07AG9
               KEY(MP4) = 4                                             07AG9
               KEY(MP5) = 5                                             07AG9
      CALL BMCOL1                                                       07AG9
          DO 1430  J = 4, MP4                                           06MY9
               X(J) = Q(J,I)                                            06MY9
               Y(J) = T(J,I)                                            06MY9
               Q(J,I) = 0.0                                             06MY9
               T(J,I) = 0.0                                             06MY9
 1430     CONTINUE                                                      06MY9
C                                                                       06MY9
C*****REEVALUATE STIFFNESS TERMS IF INVESTIGATING AXIAL EFFECTS  *******06MY9
C                                                                       06MY9
          DO 1500  K = 2, 5                                             06MY9
          DO 1440  J = 3, MP5                                           06MY9
               KEY(J) = 1                                               06MY9
 1440     CONTINUE                                                      06MY9
          DO 1450  J = 1, 5                                             06MY9
               WS(J) = 0.0                                              06MY9
               DWS(J) = 0.0                                             06MY9
 1450     CONTINUE                                                      06MY9
               KEY(3) = 3                                               06MY9
               KEY(4) = 4                                               06MY9
               KEY(5) = 5                                               06MY9
               KEY(MP3) = 3                                             06MY9
               KEY(MP4) = 4                                             06MY9
               KEY(MP5) = 5                                             06MY9
          GO TO ( 1500, 1460, 1470, 1480, 1490 ), K                     06MY9
 1460          DWS(1) = 1.0                                             06MY9
```

```
      CALL BMCOL1                                                       06MY9
          GO TO 1500                                                    06MY9
 1470          DWS(2) = 1.0                                             06MY9
      CALL BMCOL1                                                       06MY9
          GO TO 1500                                                    06MY9
 1480          WS(1) = 1.0                                              06MY9
      CALL BMCOL1                                                       06MY9
          GO TO 1500                                                    06MY9
 1490          WS(2) = 1.0                                              06MY9
      CALL BMCOL1                                                       06MY9
 1500     CONTINUE                                                      06MY9
          DO 1510  J = 4, MP4                                           06MY9
               Q(J,I) = X(J)                                            06MY9
               T(J,I) = Y(J)                                            06MY9
               X(J) = 0.0                                               06MY9
               Y(J) = 0.0                                               06MY9
 1510     CONTINUE                                                      06MY9
          GO TO 1400                                                    07AG9
 1520     DO 1530  L = 1, 6                                             06MY9
          DO 1530  J = 1, 6                                             06MY9
               Z(L,J) = SM(L,J,I)                                       06MY9
 1530     CONTINUE                                                      06MY9
C                                                                       06MY9
C*****ROTATING DIAGONAL MEMBER STIFFNESS MATRIX INTO GLOBAL COORDINATES 06MY9
C                                                                       06MY9
          DO 1540  N = 1, 2                                             06MY9
          DO 1540  J = 1, 6                                             06MY9
               TZ(J,3*N-2) = Z(J,3*N-2) * SRT(1) + Z(J,3*N-1) * SRT(4)  06MY9
     1                       + Z(J,3*N) * SRT(7)                        06MY9
               TZ(J,3*N-1) = Z(J,3*N-2) * SRT(2) + Z(J,3*N-1) * SRT(5)  06MY9
     1                       + Z(J,3*N) * SRT(8)                        06MY9
               TZ(J,3*N)   = Z(J,3*N-2) * SRT(3) + Z(J,3*N-1) * SRT(6)  06MY9
     1                       + Z(J,3*N) * SRT(9)                        06MY9
 1540     CONTINUE                                                      06MY9
          DO 1550  J = 1, 2                                             06MY9
          DO 1550  N = 1, 6                                             06MY9
               Z(3*J-2,N) = SRT(1) * TZ(3*J-2,N) + SRT(4) * TZ(3*J-1,N) 06MY9
     1                    + SRT(7) * TZ(3*J,N)                          06MY9
               Z(3*J-1,N) = SRT(2) * TZ(3*J-2,N) + SRT(5) * TZ(3*J-1,N) 06MY9
     1                    + SRT(8) * TZ(3*J,N)                          06MY9
               Z(3*J,N)   = SRT(3) * TZ(3*J-2,N) + SRT(6) * TZ(3*J-1,N) 06MY9
     1                    + SRT(9) * TZ(3*J,N)                          06MY9
 1550     CONTINUE                                                      06MY9
C                                                                       06MY9
C*****CHECKING POSITION OF STIFFNESS TERMS IN OVERALL MATRIX  **********06MY9
C                                                                       06MY9
          IF ( JL.GT.11 ) GO TO 1570                                    06MY9
 1560          N1 = K1                                                  06MY9
               N2 = K3                                                  06MY9
               N3 = L1                                                  06MY9
               N4 = L3                                                  06MY9
               KEY1 = 1                                                 06MY9
          GO TO 1660                                                    06MY9
 1570     IF ( NJ.LT.22 ) GO TO 1600                                    06MY9
 1580     IF ( NJ.EQ.22 ) GO TO 1630                                    06MY9
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```
1590      IF ( JL.GE.(NJ-10) ) GO TO 1630                                        06MY9
1600           N1 = K1 - 3 * ( JL - 12 ) - 1                                     06MY9
               N2 = N1 + 2                                                       06MY9
          GO TO ( 1620, 1610 ), KEY2                                             06MY9
1610           N3 = N1 + 3 * ( JR - JL )                                         06MY9
               N4 = N3 + 2                                                       06MY9
               KEY1 = 2                                                          06MY9
          GO TO 1660                                                             06MY9
1620           N3 = N1 - 3 * ( JL - JR )                                         06MY9
               N4 = N3 + 2                                                       06MY9
               KEY1 = 2                                                          06MY9
          GO TO 1660                                                             06MY9
1630           N1 = K1 - 3 * ( NJ - 22 ) - 1                                     06MY9
               N2 = N1 + 2                                                       06MY9
          GO TO ( 1650, 1640 ), KEY2                                             06MY9
1640           N3 = N1 + 3 * ( JR - JL )                                         06MY9
               N4 = N3 + 2                                                       06MY9
               KEY1 = 1                                                          06MY9
          GO TO 1660                                                             06MY9
1650           N3 = N1 - 3 * ( JL - JR )                                         06MY9
               N4 = N3 + 2                                                       06MY9
               KEY1 = 1                                                          06MY9
C                                                                                06MY9
C*****PLACING ELEMENTS IN OVERALL MATRIX  ******************************06MY9
C                                                                                06MY9
1660      DO 1760  L = 1, 2                                                      06MY9
          GO TO ( 1670, 1680 ), L                                                06MY9
1670           I1 = N1                                                           06MY9
               I2 = N2                                                           06MY9
          GO TO 1690                                                             06MY9
1680           I1 = N3                                                           06MY9
               I2 = N4                                                           06MY9
1690           LL = 1                                                            06MY9
          DO 1750  J = K1, K3                                                    06MY9
          GO TO ( 1700, 1710 ), L                                                06MY9
1700           KK = 1                                                            06MY9
          GO TO 1720                                                             06MY9
1710           KK = 4                                                            06MY9
1720      DO 1730  N = I1, I2                                                    06MY9
               ST(J,N) = ST(J,N) + Z(LL,KK)                                      06MY9
               KK = KK + 1                                                       06MY9
1730      CONTINUE                                                               06MY9
               LL = LL + 1                                                       06MY9
          GO TO ( 1750, 1740 ), KEY1                                             06MY9
1740           I1 = I1 - 1                                                       06MY9
               I2 = I2 - 1                                                       06MY9
1750      CONTINUE                                                               06MY9
1760      CONTINUE                                                               06MY9
               K1 = 3 * JR - 2                                                   06MY9
               K3 = 3 * JR                                                       06MY9
               L1 = 3 * JL - 2                                                   06MY9
               L3 = 3 * JL                                                       06MY9
          IF ( JR.GT.11 ) GO TO 1780                                             06MY9
1770           N1 = L1                                                           06MY9
               N2 = L3                                                           06MY9
```

```
            N3 = K1                                                     06MY9
            N4 = K3                                                     06MY9
            KEY1 = 1                                                    06MY9
         GO TO 1870                                                     06MY9
 1780    IF ( NJ.LT.22 ) GO TO 1810                                     06MY9
 1790    IF ( NJ.EQ.22 ) GO TO 1840                                     06MY9
 1800    IF ( JR.GE.(NJ-10) ) GO TO 1840                                06MY9
 1810       N1 = 3 * ( JR - 12 ) - 1                                    06MY9
            N2 = N1 + 2                                                 06MY9
         GO TO ( 1830, 1820 ), KEY2                                     06MY9
 1820       N3 = N1 + 3 * ( JR - JL )                                   06MY9
            N4 = N3 + 2                                                 06MY9
            KEY1 = 2                                                    06MY9
         GO TO 1870                                                     06MY9
 1830       N3 = N1 - 3 * ( JL - JR )                                   06MY9
            N4 = N3 + 2                                                 06MY9
            KEY1 = 2                                                    06MY9
         GO TO 1870                                                     06MY9
 1840       N1 = L1 - 3 * ( NJ - 22 ) - 1                               06MY9
            N2 = N1 + 2                                                 06MY9
            KEY1 = 1                                                    06MY9
         GO TO ( 1860, 1850 ), KEY2                                     06MY9
 1850       N3 = N1 + 3 * ( JR - JL )                                   06MY9
            N4 = N3 + 2                                                 06MY9
            KEY1 = 1                                                    06MY9
         GO TO 1870                                                     06MY9
 1860       N3 = N1 - 3 * ( JL - JR )                                   06MY9
            N4 = N3 + 2                                                 06MY9
            KEY1 = 1                                                    06MY9
 1870    DO 1970  L = 1, 2                                              06MY9
         GO TO ( 1880, 1890 ), L                                        06MY9
 1880       I1 = N1                                                     06MY9
            I2 = N2                                                     06MY9
         GO TO 1900                                                     06MY9
 1890       I1 = N3                                                     06MY9
            I2 = N4                                                     06MY9
 1900       LL = 4                                                      06MY9
         DO 1960  J = K1, K3                                            06MY9
            GO TO ( 1910, 1920 ), L                                     06MY9
 1910       KK = 1                                                      06MY9
         GO TO 1930                                                     06MY9
 1920       KK = 4                                                      06MY9
 1930    DO 1940  N = I1, I2                                            06MY9
            ST(J,N) = ST(J,N) + Z(LL,KK)                                06MY9
            KK = KK + 1                                                 06MY9
 1940    CONTINUE                                                       06MY9
            LL = LL + 1                                                 06MY9
         GO TO ( 1960, 1950 ), KEY1                                     06MY9
 1950       I1 = I1 - 1                                                 06MY9
            I2 = I2 - 1                                                 06MY9
 1960    CONTINUE                                                       06MY9
 1970    CONTINUE                                                       06MY9
 1980    CONTINUE                                                       06MY9
C                                                                       06MY9
C*****ADDING APPLIED JOINT LOADS AND RESTRAINTS  ***********************06MY9
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C                                                                       06MY9
 1990          NZ = NJLR                                                06MY9
      IF ( NZ.LE.0 ) GO TO 2100                                         06MY9
 2000 DO 2090  K = 1, NZ                                                06MY9
           N = INTS(K)                                                  06MY9
           JL = JN(N)                                                   06MY9
           K1 = 3 * JL - 2                                              06MY9
           K2 = 3 * JL - 1                                              06MY9
           K3 = 3 * JL                                                  06MY9
 2010      FL(K1) = FL(K1) + PX(K)                                      06MY9
           FL(K2) = FL(K2) + PY(K)                                      06MY9
           FL(K3) = FL(K3) + PZ(K)                                      06MY9
 2020 IF ( JL.GT.11 ) GO TO 2040                                        06MY9
 2030      ST(K1,K1) = ST(K1,K1) + SX(K)                                06MY9
           ST(K2,K2) = ST(K2,K2) + SY(K)                                06MY9
           ST(K3,K3) = ST(K3,K3) + SZ(K)                                06MY9
      GO TO 2090                                                        06MY9
 2040 IF ( NJ.LT.22 ) GO TO 2070                                        06MY9
 2050 IF ( NJ.EQ.22 ) GO TO 2080                                        06MY9
 2060 IF ( JL.GE.(NJ-10) ) GO TO 2080                                   06MY9
 2070      N1 = K1 - 3 * ( JL - 12 ) - 1                                06MY9
           ST(K1,N1) = ST(K1,N1) + SX(K)                                06MY9
           ST(K2,N1) = ST(K2,N1) + SY(K)                                06MY9
           ST(K3,N1) = ST(K3,N1) + SZ(K)                                06MY9
      GO TO 2090                                                        06MY9
 2080      N1 = K1 - 3 * ( NJ - 22 ) - 1                                06MY9
           N2 = N1 + 1                                                  06MY9
           N3 = N1 + 2                                                  06MY9
           ST(K1,N1) = ST(K1,N1) + SX(K)                                06MY9
           ST(K2,N2) = ST(K2,N2) + SY(K)                                06MY9
           ST(K3,N3) = ST(K3,N3) + SZ(K)                                06MY9
 2090 CONTINUE                                                          06MY9
 2100 CONTINUE                                                          06MY9
      RETURN                                                            06MY9
      END                                                               06MY9
C                                                                       06MY9
C                                                                       06MY9
      SUBROUTINE SOLVE                                                  06MY9
      COMMON / BLOCK9 / ST(150,65), U(150), FL(150)                     06MY9
      COMMON / BLOCK7 / INDEX(110,4), JN(110), INTLD(20), INTRD(20),    06MY9
     1                  MTYPE(20), MORD                                 06MY9
      COMMON / SBLOC5 / SL(33), SU(32), V, J1, NJ, M                    06MY9
           M = 32                                                       06MY9
           NL = MORD                                                    06MY9
      IF ( NL.LT.33 )   M = NL - 1                                      06MY9
           ML = 1                                                       06MY9
           NJ = MORD / 3                                                06MY9
           J1 = 1                                                       11JL8
           M1 = M - 1                                                   11JL8
           MP = M + 1                                                   11JL8
           NLM1 = NL - 1                                                11JL8
           NLMM = NL - M                                                11JL8
           IT = NL - M1                                                 11JL8
           IE = 2                                                       11JL8
C*************************************************************************
```

```
C                                              CALCULATE RECURSION COEFFICIENTS 06MY9   *
C************************************************************************************
      CALL FSUB1                                                              06MY9
          IF ( ML ) 210, 100, 100                                             11JL8
  100          ST(1,2*M) = - 1.0 / SL(MP)                                     06MY9
          DO 200  I = 1 , M                                                   11JL8
               ST(1,I) = ST(1,2*M) * SU(I)                                    06MY9
  200     CONTINUE                                                            11JL8
  210          U(1) = ST(1,2*M) * ( -V )                                      06MY9
          IF ( M.EQ.1 )        GO TO 1010                                     25JL8
C. . . . . . . . . . . . . . . . . . . . . . . . . . . . . PHASE I          25JL8
          DO 1000  J = 2 , M                                                  11JL8
               J1 = J                                                         11JL8
      CALL FSUB1                                                              06MY9
               J1 = J-1                                                       11JL8
          IF ( ML ) 750, 290, 290                                             11JL8
C        COMPUTE RECURSION MULTIPLIERS                                        25JL8
  290     DO 300  I = 1 , J                                                   01AG8
               IB = MP - I                                                    11JL8
               ST(J,IB+M) = SL(IB+1)                                          06MY9
  300     CONTINUE                                                            11JL8
  310          JB = M + 2 - J                                                 11JL8
               JB1 = JB - 1                                                   11JL8
          DO 400  I = JB , M                                                  11JL8
               I1 = I - 1                                                     11JL8
               L = MP - I                                                     11JL8
          DO 390  K = JB1 , I1                                                11JL8
               ST(J,I+M) = ST(J,I+M) + ST(J,K+M) * ST(J-M+K,L+K)              06MY9
  390     CONTINUE                                                            11JL8
  400     CONTINUE                                                            11JL8
               ST(J,2*M) = - 1.0 / ST(J,2*M)                                  06MY9
C        COMPUTE RECURSION COEFFICIENTS                                       25JL8
               ST(J,1) = ST(J,2*M) * SU(1)                                    06MY9
          DO 500  I = IE , M                                                  11JL8
               ST(J,I) = SU(I)                                                06MY9
  500     CONTINUE                                                            11JL8
          IF ( J.GT.IT )       IE = IE + 1                                    25JL8
          DO 600  I = IE , M                                                  11JL8
               I1 = I - 1                                                     11JL8
          IF ( I1.GT.J1 )      I1 = J1                                        25JL8
          DO 590  K = 1 , I1                                                  11JL8
               L = M - K                                                      11JL8
               ST(J,I) = ST(J,I) + ST(J,L+M) * ST(J-K,I-K)                    06MY9
  590     CONTINUE                                                            11JL8
  600     CONTINUE                                                            11JL8
          DO 700  I = IE , M                                                  11JL8
               ST(J,I) = ST(J,2*M) * ST(J,I)                                  06MY9
  700     CONTINUE                                                            11JL8
C        COMPUTE PRELIMINARY VALUE FOR U(J)                                   06MY9
  750          U(J) = 0.0                                                     06MY9
          DO 800  I = 1 , J1                                                  11JL8
               U(J) = U(J) + ST(J,2*M-I) * U(J-I)                             06MY9
  800     CONTINUE                                                            11JL8
               U(J) = ST(J,2*M) * ( U(J) - V )                                06MY9
 1000     CONTINUE                                                            11JL8
```

```
 1010     CONTINUE                                                     25JL8
C. . . . . . . . . . . . . . . . . . . . . . . . . . . . . PHASE II    25JL8
          DO 2000  J = MP , NL                                         11JL8
               J1 = J                                                  11JL8
C        COMPUTE RECURSION MULTIPLIERS                                 25JL8
      CALL FSUB1                                                       06MY9
          IF ( ML ) 1550, 1050, 1050                                   11JL8
 1050     DO 1100  I = 1 , M                                           11JL8
               IB = MP - I                                             11JL8
               ST(J,I+M) = SL(1) * ST(J-M,IB) + SL(I+1)                06MY9
 1100     CONTINUE                                                     11JL8
          IF( M.EQ.1 )        GO TO 1250                               25JL8
          DO 1200  I = 2 , M                                           11JL8
               I1 = I - 1                                              11JL8
               L = MP - I                                              11JL8
          DO 1150  K = 1 , I1                                          11JL8
               ST(J,I+M) = ST(J,I+M) + ST(J,K+M) * ST(J-M+K,L+K)       06MY9
 1150     CONTINUE                                                     11JL8
 1200     CONTINUE                                                     11JL8
 1250          ST(J,2*M) = - 1.0 / ST(J,2*M)                           06MY9
C        COMPUTE RECURSION COEFFICIENTS                                25JL8
          IF ( J.GT.IT )       IE = IE + 1                             25JL8
               ST(J,1) = ST(J,2*M) * SU(1)                             06MY9
          IF ( M.EQ.1 )       GO TO 1550                               25JL8
          IF ( IE.GT.M )      GO TO 1550                               25JL8
          DO 1300  I = IE , M                                          11JL8
               ST(J,I) = SU(I)                                         06MY9
 1300     CONTINUE                                                     11JL8
          DO 1400  I = IE , M                                          11JL8
               I1 = I - 1                                              11JL8
          DO 1390  K = 1 , I1                                          11JL8
               L = M - K                                               11JL8
               ST(J,I) = ST(J,I) + ST(J,L+M) * ST(J-K,I-K)             06MY9
 1390     CONTINUE                                                     11JL8
 1400     CONTINUE                                                     11JL8
          DO 1500  I = IE , M                                          11JL8
               ST(J,I) = ST(J,2*M) * ST(J,I)                           06MY9
 1500     CONTINUE                                                     11JL8
C        COMPUTE PRELIMINARY VALUE FOR U(J)                            06MY9
 1550          U(J) = 0.0                                              06MY9
          IF ( M.EQ.1 )       GO TO 1610                               25JL8
          DO 1600  I = 1 , M1                                          11JL8
               U(J) = U(J) + ST(J,2*M-I) * U(J-I)                      06MY9
 1600     CONTINUE                                                     11JL8
 1610          U(J) = ST(J,2*M) * ( U(J) + SL(1) * U(J-M) - V )        06MY9
 2000     CONTINUE                                                     11JL8
C*************************************************************************
C                                     CALCULATE RECURSION EQUATION      *
C*************************************************************************
          IF ( M.EQ.1 )       GO TO 3010                               25JL8
               K = 0                                                   11JL8
C. . . . . . . . . . . . . . . . . . . . . . . . . . . . . PHASE I     25JL8
          DO 3000  L = IT , NLM1                                       25JL8
               J = 2 * NL - M - L                                      11JL8
               K = K + 1                                               11JL8
```

```
      DO 2100  I = 1 , M                                          11JL8
           IB = MP - I                                            11JL8
           U(J) = U(J) + ST(J,IB) * U(J+I)                        06MY9
      IF ( I.EQ.K )      GO TO 3000                               25JL8
 2100 CONTINUE                                                    11JL8
 3000 CONTINUE                                                    11JL8
C. . . . . . . . . . . . . . . . . . . . . . . . . . . . PHASE II 25JL8
 3010 DO 4000  L = 1 , NLMM                                       11JL8
           J = NLMM + 1 - L                                       11JL8
      DO 3500  I = 1 , M                                          11JL8
           IB = MP - I                                            11JL8
           U(J) = U(J) + ST(J,IB) * U(J+I)                        06MY9
 3500 CONTINUE                                                    11JL8
 4000 CONTINUE                                                    11JL8
      RETURN                                                      11JL8
      END                                                         11JL8
      SUBROUTINE FSUB1                                            06MY9
      COMMON / BLOCK9 / ST(150,65), U(150), FL(150)               06MY9
      COMMON / SBLOC5 / SL(33), SU(32), V, J1, NJ, M              06MY9
           V = FL(J1)                                             06MY9
           M1 = M + 1                                             06MY9
           M2 = M + 2                                             06MY9
      DO 5  I = 1, 32                                             06MY9
           SL(I) = 0.0                                            06MY9
           SU(I) = 0.0                                            06MY9
    5 CONTINUE                                                    06MY9
           SL(33) = 0.0                                           06MY9
      IF ( J1.GT.33 ) GO TO 40                                    06MY9
   10      J = M2 - J1                                            06MY9
      DO 20  I = 1, J1                                            06MY9
           SL(J) = ST(J1,I)                                       06MY9
           J = J + 1                                              06MY9
   20 CONTINUE                                                    06MY9
           J = J1 + 1                                             06MY9
      DO 30  I = 1, M                                             06MY9
           K = M1 - I                                             06MY9
           SU(K) = ST(J1,J)                                       06MY9
           J = J + 1                                              06MY9
   30 CONTINUE                                                    06MY9
      GO TO 130                                                   06MY9
   40 IF ( NJ.LE.22 ) GO TO 60                                    06MY9
   50      KKK = 3 * NJ - 32                                      06MY9
      IF ( J1 - KKK ) 70, 100, 100                                06MY9
   60 IF ( NJ.EQ.22 ) GO TO 100                                   06MY9
   70 DO 80  I = 1, 33                                            06MY9
           SL(I) = ST(J1,I)                                       06MY9
   80 CONTINUE                                                    06MY9
           K = 32                                                 06MY9
      DO 90  I = 34, 65                                           06MY9
           SU(K) = ST(J1,I)                                       06MY9
           K = K - 1                                              06MY9
   90 CONTINUE                                                    06MY9
      GO TO 130                                                   06MY9
  100      KKK = 3 * NJ - 32                                      06MY9
           J = J1 - KKK + 1                                       06MY9
```

```
          DO 110  I = 1, 33                                                06MY9
               SL(I) = ST(J1,J)                                            06MY9
               J = J + 1                                                   06MY9
  110     CONTINUE                                                         06MY9
               MM3 = 3 * NJ                                                06MY9
          IF ( J1.EQ.MM3 ) GO TO 130                                       06MY9
  115          K = 32                                                      06MY9
               J = J1 - KKK + 34                                           06MY9
          DO 120  I = J, 65                                                06MY9
               SU(K) = ST(J1,I)                                            06MY9
               K = K - 1                                                   06MY9
  120     CONTINUE                                                         06MY9
  130     CONTINUE                                                         06MY9
      RETURN                                                               06MY9
      END                                                                  06MY9
      SUBROUTINE OUTPUT1                                                   06MY9
      DIMENSION  KZ1(10), ROT(9)                                           06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMI,       06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                        06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                                06MY9
      COMMON / BLOCK3 / XLC(10), YLC(10)                                   06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                            06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),            06MY9
     2                  R(57,20), AE(57,20), P(57,20)                      06MY9
      COMMON / BLOCK5 / SM(6,6,20), FEF(6,20)                              06MY9
      COMMON / BLOCK6 / A(57), B(57), C(57), W(57), DW(57), BM(57),        06MY9
     1                  DBM(57), REACT(57)                                 06MY9
      COMMON / BLOCK7 / INDEX(110,4), JN(110), INTLD(20), INTRD(20),       06MY9
     1                  MTYPE(20), MORD                                    06MY9
      COMMON / BLOCK9 / ST(150,65), U(150), FL(150)                        06MY9
      COMMON / BLOC11 / INTS(50), SX(50), SY(50), SZ(50),                  06MY9
     1                  PX(50), PY(50), PZ(50)                             06MY9
      COMMON / BLOC12 / NCOM , DTOL, RTOL, KOUT                            06MY9
      COMMON / SBLOC1 / I, K, KEY(57), WS(5), DWS(5)                       06MY9
      COMMON / SBLOC6 / MTYPE1, JL, JR, PP                                 06MY9
      COMMON / SBLOC9 / FMOML, FMOMR, SHRL, SHRR                           06MY9
      DATA MTYPE2 / 5HHORIZ /, MTYPE3 / 5HVERTL /, MTYPE4 / 5HDIAGL /     06MY9 **
C                                                                          06MY9
C*****OUTPUT OF RESULTS   ********************************************06MY9
C                                                                          06MY9
               NJ = MORD / 3                                               06MY9
      PRINT 1000                                                           06MY9
 1000 FORMAT ( 1H1 )                                                       06MY9
      PRINT 1010, NPROB, ( HED(I), I = 1, 14 )                             06MY9 **
 1010 FORMAT (      5H      , 80X, 10HI-----TRIM , /,                      06MY9
     1             10H      PROB , /, 5X, A5, 5X, 14A5, ////,              06MY9 **
     2             34H      **** OUTPUT INFORMATION **** , /////,          06MY9
     3             31H      TABLE 11 -- JOINT NUMBERS , // )               06MY9
C                                                                          06MY9
C*****PRINT JOINT NUMBERS  ********************************************06MY9
C                                                                          06MY9
          DO 10  I = 1, NXL                                                06MY9
               KZ1(I) = I                                                  06MY9
   10     CONTINUE                                                         06MY9
      PRINT 1020, ( KZ1(I), I = 1, NXL )                                   06MY9
```

```
 1020 FORMAT ( 35X, 7H X LINE , //, 9X,  7H Y LINE , 4X, 10(2X,I3), / ) 06MY9
      PRINT 1021                                                         06MY9
 1021 FORMAT ( / )                                                       06MY9
               KLINE = 21                                                06MY9
               K = NXL * ( NYL - 1 ) + 1                                 06MY9
               K1 = K + NXL - 1                                          06MY9
               L = NYL                                                   06MY9
           DO 50  I = 1, NYL                                             06MY9
           IF ( KLINE + 2 - KPAGE ) 20, 20, 30                           06MY9
   20 PRINT 1030, L, ( JN(J), J = K, K1 )                                06MY9
 1030 FORMAT ( 12X, I3, 5X, 10(2X,I3), / )                               06MY9
      PRINT 1021                                                         06MY9
               KLINE = KLINE + 2                                         06MY9
           GO TO 40                                                      06MY9
   30 PRINT 1000                                                         06MY9
      PRINT 1040, NPROB, ( HED(J), J = 1, 14 )                           06MY9 **
 1040 FORMAT (     5H      , 80X, 10HI-----TRIM , / ,                    06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,              06MY9 **
     2            20H      TABLE 11 (CONT) , // )                        06MY9
      PRINT 1020, ( KZ1(J), J = 1, NXL )                                 06MY9
      PRINT 1030, L, ( JN(J), J = K, K1 )                                06MY9
               KLINE = 17                                                06MY9
   40          L = L - 1                                                 06MY9
               K = K - NXL                                               06MY9
               K1 = K + NXL - 1                                          06MY9
   50      CONTINUE                                                      06MY9
      PRINT 1000                                                         06MY9
      PRINT 1050, NPROB, ( HED(I), I = 1, 14 )                           06MY9 **
 1050 FORMAT (     5H      , 80X, 10HI-----TRIM, / ,                     06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,              06MY9 **
     2            36H      TABLE 12-- JOINT DISPLACEMENTS , // )         06MY9
      PRINT 1060                                                         06MY9
 1060 FORMAT (    45H            JOINT       X DISPL         Y DISPL  ,  06MY9
     1            15H      THETA Z    , / )                              06MY9
               KLINE = 13                                                06MY9
C                                                                        06MY9
C*****PRINT JOINT DISPLACEMENTS  ***************************************06MY9
C                                                                        06MY9
           DO 80  I = 1, NJ                                              06MY9
               K1 = 3 * I - 2                                            06MY9
               K3 = K1 + 2                                               06MY9
           IF ( KLINE + 1 - KPAGE ) 60, 60, 70                           06MY9
   60 PRINT 1070, I, ( U(J), J = K1, K3 )                                06MY9
 1070 FORMAT ( 11X, I3, 1X, 3(3X,E12.3) )                                06MY9
               KLINE = KLINE + 1                                         06MY9
           GO TO 80                                                      06MY9
   70 PRINT 1000                                                         06MY9
      PRINT 1080, NPROB, ( HED(J), J = 1, 14 )                           06MY9 **
 1080 FORMAT (     5H      , 80X, 10HI-----TRIM , / ,                    06MY9
     1            10H      PROB , / , 5X, A5, 5X, 14A5, ///,             06MY9 **
     2            21H      TABLE 12(CONT) , // )                         06MY9
      PRINT 1060                                                         06MY9
      PRINT 1070, I, ( U(J), J = K1, K3 )                                06MY9
               KLINE = 14                                                06MY9
   80      CONTINUE                                                      06MY9
```

```
      PRINT 1000                                                        06MY9
      PRINT 1090, NPROB, ( HED(I), I = 1, 14 )                          06MY9 **
 1090 FORMAT (     5H      , 80X, 10HI-----TRIM , / ,                   06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,             06MY9 **
     2            32H      TABLE 13-- JOINT REACTIONS , // )            06MY9
      PRINT 1100                                                        06MY9
 1100 FORMAT (    45H          JOINT          FX              FY     ,  06MY9
     1            15H          MZ      , / )                            06MY9
C                                                                       06MY9
C*****PRINT JOINT REACTIONS  ******************************************06MY9
C                                                                       06MY9
               NZ = NJLR                                                06MY9
               KLINE = 13                                               06MY9
          IF ( NZ.GT.0 ) GO TO 100                                      06MY9
   90 PRINT 1110                                                        06MY9
 1110 FORMAT (    15H          NONE   )                                 06MY9
          GO TO 140                                                     06MY9
  100     DO 130  I = 1, NZ                                             06MY9
    0     IF ( SX(I) .LE. 0.0 .AND. SY(I) .LE. 0.0 .AND. SZ(I) .LE. 0.0 06MY9
    1        ) GO TO 130                                                06MY9
               J = INTS(I)                                              06MY9
               K1 = 3 * JN(J) - 2                                       06MY9
               K2 = K1 + 1                                              06MY9
               K3 = K2 + 1                                              06MY9
               FX = - SX(I) * U(K1)                                     06MY9
               FY = - SY(I) * U(K2)                                     06MY9
               FZ = - SZ(I) * U(K3)                                     06MY9
          IF ( KLINE + 1 - KPAGE ) 110, 110, 120                        06MY9
  110 PRINT 1070, JN(J), FX, FY, FZ                                     06MY9
               KLINE = KLINE + 1                                        06MY9
          GO TO 130                                                     06MY9
  120 PRINT 1000                                                        06MY9
      PRINT 1120, NPROB, ( HED(L), L = 1, 14 )                          06MY9 **
 1120 FORMAT (     5H      , 80X, 10HI-----TRIM , /,                    06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,             06MY9 **
     2            21H      TABLE 13(CONT) , // )                        06MY9
      PRINT 1100                                                        06MY9
      PRINT 1070, JN(J), FX, FY, FZ                                     06MY9
               KLINE = 14                                               06MY9
  130     CONTINUE                                                      06MY9
  140 PRINT 1000                                                        06MY9
C                                                                       06MY9
C*****PRINT MEMBER END FORCES FOR HORIZONTAL MEMBERS  *****************06MY9
C                                                                       06MY9
      PRINT 1130, NPROB, ( HED(I), I = 1, 14 )                          06MY9 **
 1130 FORMAT (     5H      , 80X, 10HI-----TRIM , / ,                   06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,             06MY9 **
     2            40H      TABLE 14--- INDIVIDUAL MEMBER DATA , /,      06MY9
     3            44H               (DESIGNERS SIGN CONVENTION) , // )  06MY9
               KLINE = 12                                               06MY9
               K = 1                                                    06MY9
               MTYPE1 = MTYPE2                                          06MY9
          DO 330  M1 = 1, NYL                                           06MY9
               JL = 0                                                   06MY9
          GO TO ( 160, 160, 150 ), KOUT                                 06MY9
```

```
  150         NXLM = NXL - 1                                              06MY9
      READ 1150, ( KZ1(J), J = 1, NXLM )                                  06MY9
 1150 FORMAT ( 10X, 10I5 )                                                06MY9
  160     DO 330  M2 = 1, NXL                                             06MY9
          IF ( JL.GT.0 ) GO TO 200                                        06MY9
  170     IF ( JN(K).LE.0 ) GO TO 320                                     06MY9
  180     IF ( INDEX(K,1).LE.0 ) GO TO 320                                06MY9
  190         JL = JN(K)                                                  06MY9
          GO TO 320                                                       06MY9
  200     IF ( JN(K).LE.0 ) GO TO 320                                     06MY9
  210     IF ( INDEX(K,3).LE.0 ) GO TO 320                                06MY9
  220         JR = JN(K)                                                  06MY9
              I = INDEX(K,3)                                              06MY9
              K1 = 3 * JL - 2                                             06MY9
              K2 = K1 + 1                                                 06MY9
              K3 = K2 + 1                                                 06MY9
              L1 = 3 * JR - 2                                             06MY9
              L2 = L1 + 1                                                 06MY9
              L3 = L2 + 1                                                 06MY9
              MP3 = M(I) + 3                                              06MY9
              MP4 = MP3 + 1                                               06MY9
              MP5 = MP4 + 1                                               06MY9
              PP = SM(4,1,I) * U(K1) + SM(4,4,I) * U(L1)                  06MY9
          IF ( NIT.EQ.0 ) GO TO 235                                       06MY9
          DO 230  J = 5, MP4                                              07AG9
              P(J,I) = PP                                                 06MY9
  230     CONTINUE                                                        06MY9
  235     DO 240  J = 3, MP5                                              06MY9
              KEY(J) = 1                                                  06MY9
  240     CONTINUE                                                        06MY9
C                                                                         06MY9
C*****SET JOINT DISPLACEMENTS, CALL BMCOL2 AND EVALUATE                   06MY9
C*****MEMBER END FORCES  ***********************************************06MY9
C                                                                         06MY9
              KEY(3) = 3                                                  06MY9
              KEY(4) = 4                                                  06MY9
              KEY(5) = 5                                                  06MY9
              KEY(MP3) = 3                                                06MY9
              KEY(MP4) = 4                                                06MY9
              KEY(MP5) = 5                                                06MY9
              WS(1) = U(K2)                                               06MY9
              DWS(1) = U(K3)                                              06MY9
              WS(2) = U(L2)                                               06MY9
              DWS(2) = U(L3)                                              06MY9
      CALL BMCOL2                                                         06MY9
          DO 250  J = 4, MP4                                              06MY9
              P(J,I) = 0.0                                                06MY9
  250     CONTINUE                                                        06MY9
          GO TO ( 260, 270, 280 ), KOUT                                   06MY9
C                                                                         06MY9
C*****CALL OUTPUT2 FOR MEMBER END FORCES ONLY  *************************06MY9
C                                                                         06MY9
  260 CALL OUTPUT2                                                        06MY9
          GO TO 290                                                       06MY9
C                                                                         06MY9
```

```
C*****CALL OUTPUT3 FOR COMPLETE BMCOL OUTPUT  ***************************06MY9
C                                                                       06MY9
  270 CALL OUTPUT3                                                      06MY9
      GO TO 290                                                         06MY9
  280      L = M2 - 1                                                   06MY9
           LL = KZ1(L)                                                  06MY9
      GO TO ( 260, 270 ), LL                                            06MY9
  290 IF ( INDEX(K,1).LE.0 ) GO TO 310                                  06MY9
  300      JL = JN(K)                                                   06MY9
      GO TO 320                                                         06MY9
  310      JL = 0                                                       06MY9
  320      K = K + 1                                                    06MY9
  330 CONTINUE                                                          06MY9
C                                                                       06MY9
C*****REPEAT ABOVE PROCEDURE FOR VERTICAL MEMBERS  *********************06MY9
C                                                                       06MY9
           MTYPE1 = MTYPE3                                              06MY9
      DO 520  M1 = 1, NXL                                               06MY9
           K = M1                                                       06MY9
           JL = 0                                                       06MY9
      GO TO ( 350, 350, 340 ), KOUT                                     06MY9
  340      NYLM = NYL - 1                                               06MY9
   READ 1150, ( KZ1(J), J = 1, NYLM )                                   06MY9
  350 DO 520  M2 = 1, NYL                                               06MY9
      IF ( JL.GT.0 ) GO TO 390                                          06MY9
  360 IF ( JN(K).LE.0 ) GO TO 510                                       06MY9
  370 IF ( INDEX(K,2).LE.0 ) GO TO 510                                  06MY9
  380      JL = JN(K)                                                   06MY9
      GO TO 510                                                         06MY9
  390 IF ( JN(K).LE.0 ) GO TO 510                                       06MY9
  400 IF ( INDEX(K,4).LE.0 ) GO TO 510                                  06MY9
  410      JR = JN(K)                                                   06MY9
           I = INDEX(K,4)                                               06MY9
           K1 = 3 * JL - 2                                              06MY9
           K2 = K1 + 1                                                  06MY9
           K3 = K2 + 1                                                  06MY9
           L1 = 3 * JR - 2                                              06MY9
           L2 = L1 + 1                                                  06MY9
           L3 = L2 + 1                                                  06MY9
           MP3 = M(I) + 3                                               06MY9
           MP4 = MP3 + 1                                                06MY9
           MP5 = MP4 + 1                                                06MY9
           PP = SM(1,1,I) * U(L2) + SM(1,4,I) * U(K2)                   06MY9
      IF ( NIT.EQ.0 ) GO TO 425                                         06MY9
      DO 420  J = 5, MP4                                                07AG9
           P(J,I) = PP                                                  06MY9
  420 CONTINUE                                                          06MY9
  425 DO 430  J = 3, MP5                                                06MY9
           KEY(J) = 1                                                   06MY9
  430 CONTINUE                                                          06MY9
           KEY(3) = 3                                                   06MY9
           KEY(4) = 4                                                   06MY9
           KEY(5) = 5                                                   06MY9
           KEY(MP3) = 3                                                 06MY9
           KEY(MP4) = 4                                                 06MY9
```

```
              KEY(MP5) = 5                                                 06MY9
              WS(1) = U(L1)                                                06MY9
              DWS(1) = U(L3)                                               06MY9
              WS(2) = U(K1)                                                06MY9
              DWS(2) = U(K3)                                               06MY9
      CALL BMCOL2                                                          06MY9
          DO 440  J = 4, MP4                                               06MY9
              P(J,I) = 0.0                                                 06MY9
  440     CONTINUE                                                         06MY9
          GO TO ( 450, 460, 470 ), KOUT                                    06MY9
  450 CALL OUTPUT2                                                         06MY9
          GO TO 480                                                        06MY9
  460 CALL OUTPUT3                                                         06MY9
          GO TO 480                                                        06MY9
  470         L = M2 - 1                                                   06MY9
              LL = KZ1(L)                                                  06MY9
          GO TO ( 450, 460 ), LL                                           06MY9
  480     IF ( INDEX(K,2).LE.0 ) GO TO 500                                 06MY9
  490         JL = JN(K)                                                   06MY9
          GO TO 510                                                        06MY9
  500         JL = 0                                                       06MY9
  510         K = K + NXL                                                  06MY9
  520     CONTINUE                                                         06MY9
C                                                                          06MY9
C*****PRINT MEMBER END FORCES ONLY FOR DIAGONAL MEMBERS  ***************06MY9
C                                                                          06MY9
              NZ = NDM                                                     06MY9
          IF ( NZ.LE.0 ) GO TO 670                                         06MY9
              MTYPE1 = MTYPE4                                              06MY9
          DO 660  K = 1, NZ                                                06MY9
              I = INTLD(K)                                                 06MY9
              JL = JN(I)                                                   06MY9
              I = INTRD(K)                                                 06MY9
              JR = JN(I)                                                   06MY9
              I = MTYPE(K)                                                 06MY9
              NN = INTLD(K)                                                06MY9
              N = 1                                                        06MY9
  540     IF ( NN.GT.NXL ) GO TO 560                                       06MY9
  550               KKK = NN                                               06MY9
              LLL = N                                                      06MY9
          GO TO 570                                                        06MY9
  560         NN = NN - NXL                                                06MY9
              N = N + 1                                                    06MY9
          GO TO 540                                                        06MY9
  570         NN = INTRD(K)                                                06MY9
              N = 1                                                        06MY9
  580     IF ( NN.GT.NXL ) GO TO 600                                       06MY9
  590         MMM = NN                                                     06MY9
              NNN = N                                                      06MY9
          GO TO 610                                                        06MY9
  600         NN = NN - NXL                                                06MY9
              N = N + 1                                                    06MY9
          GO TO 580                                                        06MY9
  610         XCL = XLC(MMM) - XLC(KKK)                                    06MY9
              YCL = YLC(NNN) - YLC(LLL)                                    06MY9
```

```
            FLENG = SQRT ( XCL* XCL + YCL * YCL )                            06MY9
            CX = XCL / FLENG                                                 06MY9
            CY = YCL / FLENG                                                 06MY9
            ROT(1) = CX                                                      06MY9
            ROT(2) = CY                                                      06MY9
            ROT(3) = 0.0                                                     06MY9
            ROT(4) = -CY                                                     06MY9
            ROT(5) = CX                                                      06MY9
            ROT(6) = 0.0                                                     06MY9
            ROT(7) = 0.0                                                     06MY9
            ROT(8) = 0.0                                                     06MY9
            ROT(9) = 1.0                                                     06MY9
            K1 = 3 * JL - 2                                                  06MY9
            K2 = K1 + 1                                                      06MY9
            K3 = K2 + 1                                                      06MY9
            L1 = 3 * JR - 2                                                  06MY9
            L2 = L1 + 1                                                      06MY9
            L3 = L2 + 1                                                      06MY9
            MP3 = M(I) + 3                                                   06MY9
            MP4 = MP3 + 1                                                    06MY9
            MP5 = MP4 + 1                                                    06MY9
            PP = SM(4,1,I) * ( ROT(1) * U(K1) + ROT(2) * U(K2) ) +           06MY9
     1           SM(4,4,I) * ( ROT(1) * U(L1) + ROT(2) * U(L2) )             06MY9
        IF ( NIT.EQ.0 ) GO TO 625                                            06MY9
        DO 620  J = 5, MP4                                                   07AG9
            P(J,I) = PP                                                      06MY9
  620   CONTINUE                                                             06MY9
  625   DO 630  J = 3, MP5                                                   06MY9
            KEY(J) = 1                                                       06MY9
  630   CONTINUE                                                             06MY9
            KEY(3) = 3                                                       06MY9
            KEY(4) = 4                                                       06MY9
            KEY(5) = 5                                                       06MY9
            KEY(MP3) = 3                                                     06MY9
            KEY(MP4) = 4                                                     06MY9
            KEY(MP5) = 5                                                     06MY9
            WS(1) = ROT(4) * U(K1) + ROT(5) * U(K2)                          06MY9
            DWS(1) = U(K3)                                                   06MY9
            WS(2) = ROT(4) * U(L1) + ROT(5) * U(L2)                          06MY9
            DWS(2) = U(L3)                                                   06MY9
      CALL BMCOL2                                                            06MY9
  640   CONTINUE                                                             06MY9
        DO 650  J = 4, MP4                                                   06MY9
            P(J,I) = 0.0                                                     06MY9
  650   CONTINUE                                                             06MY9
      CALL OUTPUT2                                                           06MY9
  660   CONTINUE                                                             06MY9
  670   CONTINUE                                                             06MY9
      RETURN                                                                 06MY9
      END                                                                    06MY9
C                                                                            06MY9
C                                                                            06MY9
      SUBROUTINE OUTPUT2                                                     06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,          06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                          06MY9
```

```
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                              06MY9
      COMMON / SBLOC1 / I, K, KEY(57), WS(5), DWS(5)                     06MY9
      COMMON / SBLOC6 / MTYPE1, JL, JR, PP                               06MY9
      COMMON / SBLOC9 / FMOML, FMOMR, SHRL, SHRR                         06MY9
C                                                                        06MY9
C*****PRINT MEMBER END FORCES ONLY  ***********************************06MY9
C                                                                        06MY9
          IF ( KLINE + 9 - KPAGE ) 10, 10, 20                            13AG9
   10 PRINT 510, MTYPE1, I, JL, JR, PP, FMOML, SHRL, FMOMR, SHRR         06MY9
  510 FORMAT ( //, 14X, 5H **   , A5, 20H  ** MEMBER OF TYPE , I3,       13AG9 **
     1            16H BETWEEN JOINTS , I3, 5H AND , I3, //, 20X,         06MY9
     2            23HAXIAL FORCE           =, E12.3, /, 20X,             06MY9
     3            23HMOMENT AT LEFT END    =, E12.3, /, 20X,             06MY9
     4            23HSHEAR AT LEFT END     =, E12.3, /, 20X,             06MY9
     5            23HMOMENT AT RIGHT END   =, E12.3, /, 20X,             06MY9
     6            23HSHEAR AT RIGHT END    =, E12.3  )                   06MY9
              KLINE = KLINE + 9                                          13AG9
          GO TO 30                                                       06MY9
   20 PRINT 520                                                          06MY9
  520 FORMAT ( 1H1 )                                                     06MY9
      PRINT 530, NPROB, ( HED(J), J = 1, 14 )                            06MY9 **
  530 FORMAT (     5H      , 80X, 10HI-----TRIM , /,                     06MY9
     1            10H      PROB , /, 5X, A5, 5X, 14A5, ///,              06MY9 **
     2            20H      TABLE 14 (CONT) , // )                        06MY9
      PRINT 510, MTYPE1, I, JL, JR, PP, FMOML, SHRL, FMOMR, SHRR         06MY9
              KLINE = 20                                                 06MY9
   30     IF ( KLINE + 2 - KPAGE ) 40, 40, 50                            06MY9
   40 PRINT 540                                                          06MY9
  540 FORMAT ( // )                                                      06MY9
              KLINE = KLINE + 2                                          06MY9
   50     CONTINUE                                                       06MY9
      RETURN                                                             06MY9
      END                                                                06MY9
C                                                                        06MY9
C                                                                        06MY9
      SUBROUTINE OUTPUT3                                                 06MY9
      COMMON / BLOCK1 / NPROB, HED(14), NEWPR, NIT, NXL, NYL, NAMT,      06MY9 **
     1                  NADM, NAJLR, NMT, NDM, NJLR                      06MY9
      COMMON / BLOCK2 / KLINE, KSTOP, KPAGE                              06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                          06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),          06MY9
     2                  R(57,20), AE(57,20), P(57,20)                    06MY9
      COMMON / BLOCK6 / A(57), B(57), C(57), W(57), DW(57), BM(57),      06MY9
     1                  DBM(57), REACT(57)                               06MY9
      COMMON / SBLOC1 / I, K, KEY(57), WS(5), DWS(5)                     06MY9
      COMMON / SBLOC6 / MTYPE1, JL, JR, PP                               06MY9
      COMMON / SBLOC9 / FMOML, FMOMR, SHRL, SHRR                         06MY9
C                                                                        06MY9
C*****PRINT COMPLETE BMCOL OUTPUT  ************************************06MY9
C                                                                        06MY9
          IF ( KLINE + 4 - KPAGE ) 10, 10, 20                            06MY9
   10 PRINT 500, MTYPE1, I, JL, JR, PP                                   06MY9
  500 FORMAT (/14X, 5H **   , A5, 20H  ** MEMBER OF TYPE , I3,           06MY9 **
     1            16H BETWEEN JOINTS , I3, 5H AND , I3, //, 20X,         06MY9
     2            23HAXIAL FORCE           =, E12.3 )                    15SE9
```

```
            KLINE = KLINE + 4                                        06MY9
        GO TO 30                                                     06MY9
   20 PRINT 510                                                      06MY9
  510 FORMAT (1H1 )                                                  06MY9
      PRINT 520, NPROB, ( HED(L), L = 1, 14 )                        06MY9 **
  520 FORMAT (     5H      , 80X, 10HI-----TRIM , /,                 06MY9
     1             10H     PROB , /, 5X, A5, 5X, 14A5, ///,          06MY9 **
     2             20H     TABLE 14 (CONT) , // )                    06MY9
      PRINT 500, MTYPE1, I, JL, JR, PP                               06MY9
            KLINE = 14                                               06MY9
   30   IF ( KLINE + 5 - KPAGE ) 40, 40, 50                          06MY9
   40 PRINT 530                                                      06MY9
  530 FORMAT (// 48H      STA I        DIST          DEFL         SLOPE    ,  06MY9
     1             36H   MOM        SHEAR     SUP REACT      , / )    06MY9
            ISTA = 0                                                 06MY9
            X = 0.0                                                  06MY9
      PRINT 540, ISTA, X, W(4), BM(4), REACT(4)                      06MY9
  540 FORMAT ( 5X, I4, 2X, 2E12.3, 10X, E12.3, 10X, E12.3 )          06MY9
            KLINE = KLINE + 5                                        06MY9
        GO TO 60                                                     06MY9
   50 PRINT 510                                                      06MY9
      PRINT 520, NPROB, ( HED(L), L = 1, 14 )                        06MY9 **
      PRINT 530                                                      06MY9
            ISTA = 0                                                 06MY9
            X = 0.0                                                  06MY9
      PRINT 540, ISTA, X, W(4), BM(4), REACT(4)                      06MY9
            KLINE = 14                                               06MY9
   60       MP4 = M(I) + 4                                           06MY9
        DO 120  J = 5, MP4                                           06MY9
            ISTA = J - 4                                             06MY9
            Z1 = ISTA                                                06MY9
            X = Z1 * H(I)                                            06MY9
        IF ( KLINE + 1 - KPAGE ) 70, 70, 80                          06MY9
   70 PRINT 550, DW(J), DBM(J)                                       06MY9
  550 FORMAT ( 34X, E12.3, 10X, E12.3 )                              06MY9
            KLINE = KLINE + 1                                        06MY9
        GO TO 90                                                     06MY9
   80 PRINT 510                                                      06MY9
      PRINT 520, NPROB, ( HED(L), L = 1, 14 )                        06MY9 **
      PRINT 530                                                      06MY9
      PRINT 550, DW(J), DBM(J)                                       06MY9
            KLINE = 16                                               06MY9
   90   IF ( KLINE + 1 - KPAGE ) 100, 100, 110                       06MY9
  100 PRINT 540, ISTA, X, W(J), BM(J), REACT(J)                      06MY9
            KLINE = KLINE + 1                                        06MY9
        GO TO 120                                                    06MY9
  110 PRINT 510                                                      06MY9
      PRINT 520, NPROB, ( HED(L), L = 1, 14 )                        06MY9 **
      PRINT 530                                                      06MY9
       PRINT 540, ISTA, X, W(J), BM(J), REACT(J)                     06MY9
            KLINE = 16                                               06MY9
  120   CONTINUE                                                     06MY9
      RETURN                                                         06MY9
      END                                                            06MY9
C                                                                    06MY9
```

```
C                                                                          06MY9
      SUBROUTINE BMCOL2                                                    06MY9
      COMMON / BLOCK4 / M(20), H(20), KODE(20),                            06MY9
     1                  F(57,20), Q(57,20), S(57,20), T(57,20),            06MY9
     2                  R(57,20), AE(57,20), P(57,20)                      06MY9
      COMMON / BLOCK6 / A(57), B(57), C(57), W(57), DW(57), BM(57),        06MY9
     1                  DBM(57), REACT(57)                                 06MY9
      COMMON / SBLOC1 / I, K, KEY(57), WS(5), DWS(5)                       06MY9
      COMMON / SBLOC9 / FMOML, FMOMR, SHRL, SHRR                           06MY9
C                                                                          06MY9
C*****COMPUTE BMCOL QUANTITIES AND SET MEMBER END FORCES  **************06MY9
C                                                                          06MY9
   10     CONTINUE                                                         06MY9
             HT2 = H(I) + H(I)                                             06MY9
             HE2 = H(I) * H(I)                                             06MY9
             HE3 = H(I) * HE2                                              06MY9
             MP1 = M(I) + 1                                                06MY9
             MP2 = MP1 + 1                                                 06MY9
             MP3 = MP2 + 1                                                 06MY9
             MP4 = MP3 + 1                                                 06MY9
             MP5 = MP4 + 1                                                 06MY9
             MP6 = MP5 + 1                                                 06MY9
             MP7 = MP6 + 1                                                 06MY9
             NS = 1                                                        06MY9
             A(1) = 0.0                                                    06MY9
             A(2) = 0.0                                                    06MY9
             B(1) = 0.0                                                    06MY9
             B(2) = 0.0                                                    06MY9
             C(1) = 0.0                                                    06MY9
             C(2) = 0.0                                                    06MY9
          DO 90  J = 3, MP5                                                06MY9
             AA = F(J-1,I) - 0.25 * H(I) * R(J-1,I)                        06MY9
             BB = -2.0 * ( F(J-1,I) + F(J,I) ) - HE2 * P(J,I)              06MY9
             CC = F(J-1,I) + 4.0 * F(J,I) + F(J+1,I) + HE3 * S(J,I)        06MY9
     1             + 0.25 * H(I) * ( R(J-1,I) + R(J+1,I) ) +               06MY9
     2             HE2 * ( P(J,I) + P(J+1,I) )                             06MY9
             DD = -2.0 * ( F(J,I) + F(J+1,I) ) - HE2 * P(J+1,I)            06MY9
             EE = F(J+1,I) - 0.25 * H(I) * R(J+1,I)                        06MY9
             FF = HE3 * Q(J,I) - 0.5 * HE2 * ( T(J-1,I) -                  06MY9
     1             T(J+1,I) )                                              06MY9
             E = AA * B(J-2) + BB                                          06MY9
             DENOM = E * B(J-1) + AA * C(J-2) + CC                         06MY9
          IF ( DENOM ) 30, 20, 30                                          06MY9
   20        D = 0.0                                                       06MY9
          GO TO 40                                                         06MY9
   30        D = -1.0 / DENOM                                              06MY9
   40        C(J) = D * EE                                                 06MY9
             B(J) = D * ( E * C(J-1) + DD )                                06MY9
             A(J) = D * ( E * A(J-1) + AA * A(J-2) - FF )                  06MY9
             KEYJ = KEY(J)                                                 06MY9
          GO TO ( 90, 50, 60, 50, 70 ), KEYJ                               06MY9
   50        C(J) = 0.0                                                    06MY9
             B(J) = 0.0                                                    06MY9
             A(J) = WS(NS)                                                 06MY9
          IF ( KEYJ - 3 ) 80, 60, 90                                       06MY9
```

```
 60          DTEMP = D                                                      06MY9
             CTEMP = C(J)                                                   06MY9
             BTEMP = B(J)                                                   06MY9
             ATEMP = A(J)                                                   06MY9
             C(J) = 1.0                                                     06MY9
             B(J) = 0.0                                                     06MY9
             A(J) = -HT2 * DWS(NS)                                          06MY9
          GO TO 90                                                          06MY9
 70          DREV = 1.0 / ( 1.0 - ( BTEMP * B(J-1) + CTEMP - 1.0 )          06MY9
   1                * D / DTEMP )                                           06MY9
             CREV = DREV * C(J)                                             06MY9
             BREV = DREV * ( B(J) + ( BTEMP * C(J-1) ) * D / DTEMP )        06MY9
             AREV = DREV * ( A(J) + ( HT2 * DWS(NS) + ATEMP +               06MY9
   1                BTEMP * A(J-1) ) * D / DTEMP )                          06MY9
             C(J) = CREV                                                    06MY9
             B(J) = BREV                                                    06MY9
             A(J) = AREV                                                    06MY9
 80          NS = NS + 1                                                    06MY9
 90       CONTINUE                                                          06MY9
             W(MP6) = 0.0                                                   06MY9
             W(MP7) = 0.0                                                   06MY9
          DO 100  L = 3, MP5                                                06MY9
             J = M(I) + 8 - L                                               06MY9
             W(J) = A(J) + B(J) * W(J+1) + C(J) * W(J+2)                    06MY9
100       CONTINUE                                                          06MY9
             W(2) = 2.0 * W(3) - W(4)                                       06MY9
             W(MP6) = 2.0 * W(MP5) - W(MP4)                                 06MY9
          DO 110  J = 3, MP5                                                06MY9
             DW(J) = ( -W(J-1) + W(J) ) / H(I)                              06MY9
             BM(J) = F(J,I) * ( W(J-1) - 2.0 * W(J) + W(J+1) ) / HE2        06MY9
110       CONTINUE                                                          06MY9
             BM(2) = 0.0                                                    06MY9
             BM(MP6) = 0.0                                                  06MY9
          DO 120  J = 3, MP5                                                06MY9
             DBM(J) = ( -BM(J-1) + BM(J) ) / H(I)                           06MY9
   1                  - P(J,I) * ( -W(J-1) + W(J) ) / H(I)                  06MY9
             REACT(J) = ( BM(J-1) - 2.0 * BM(J) + BM(J+1) ) / H(I)          06MY9
   1                    - Q(J,I) + ( T(J-1,I) - T(J+1,I) ) / ( 2.0          06MY9
   2                    * H(I) ) - ( R(J-1,I) * W(J-2) - R(J-1,I)           06MY9
   3                    * W(J) - R(J+1,I) * W(J) + R(J+1,I) * W(J+2) )06MY9
   4                    / ( 4.0 * HE2 ) - ( P(J,I) * W(J-1) - P(J,I)        06MY9
   5                    * W(J) - P(J+1,I) * W(J) + P(J+1,I) * W(J+1)        06MY9
   6                    ) / H(I) + S(J,I) * W(J)                            06MY9
120       CONTINUE                                                          06MY9
             DBM(5) = DBM(5) - BM(4) / H(I)                                 15SE9
             DBM(MP4) = DBM(MP4) + BM(MP4) / H(I)                           15SE9
             REACT(5) = REACT(5) + BM(4) / H(I)                             15SE9
             REACT(MP3) = REACT(MP3) + BM(MP4) / H(I)                       15SE9
             BM(4) = 2.0 * BM(4)                                            06MY9
             BM(MP4) = 2.0 * BM(MP4)                                        06MY9
             FMOML = BM(4)                                                  06MY9
             FMOMR = BM(MP4)                                                06MY9
             SHRL = REACT(4)                                                06MY9
             SHRR = - REACT(MP4)                                            06MY9
130       CONTINUE                                                          06MY9

      RETURN                                                                06MY9
      END                                                                   06MY9
```

APPENDIX 4

INPUT DATA FOR EXAMPLE PROBLEMS

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-21-69 PAGE 1 OF 7

```
    EXAMPLE PROBLEMS - DIRECT PLANE FRAME SOLUTION - WPD/JRR
    SAMPLE INPUT AND PROBLEMS FOR APPENDICES 4 AND 5 - CODED 3/69
PR101    SIMPLE FRAME AFTER HM/TAH -- PRISMATIC MEMBERS
              1    3    3    1    0    0         0
              2    3
     0.000E00  2.000E01
     0.000E00  1.000E01  2.000E01
    1        20    1    1        5.000E-01
         0   20         1.000E02                                   2.000E04
    2        40    1    1        5.000E-01
         0   40         3.000E02                                   2.000E04
    3        20    1    1        5.000E-01
         0   20         2.000E02                                   2.000E04
              0
              0
              2
```

IDENTIFICATION: EXAMPLE PROBLEMS — CODED BY: WPD/JRR — DATE: 3-21-69 — PAGE 2 OF 7

```
    4    0    5    0    5    0    5    0    5    0    5    0    5    0    5    0
1   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
              0    1
              3    3
              1    2                                1.000E20  1.000E20  1.000E20
              1    3  1.500E00
              2    1                                1.000E20  1.000E20  1.000E20
PR102     SIMPLE FRAME AFTER HM/TAH -- NON-PRISMATIC MEMBERS
              2    3    0    1    0    4         0
    4        20    3    1      5.000E-01
         0   20    0  1.000E02                                          2.000E04
    5        40    3    1      5.000E-01
         0   40    0  3.000E02                                          2.000E04
    6        20    3    1      5.000E-01
         0   20    0  2.000E02                                          2.000E04
              4    1    2    1    3
              5    1    3    2    3
              6    2    2    2    3
```

IDENTIFICATION EXAMPLE PRØBLEMS CODED BY WPD/JRR DATE 3-21-69 PAGE 3 OF 7

```
              6    2    1    2    2
PR103     MULTI-STØRY FRAME AFTER HM/BRG - NØ SIDESWAY
              1   11    7    3    0    0         0
              4    4
            0.000E00  1.800E02  3.600E02  6.000E02
            0.000E00  1.440E02  2.640E02  3.840E02
    1        30    1    1       6.000E00
         0   30       1.920E08                                          1.000E10
    2        30    2    1       6.000E00
         0   30       1.920E08 -6.000E01                                1.000E10
    3        20    1    1       6.000E00
         0   20       6.480E08                                          1.000E10
    4        30    2    1       6.000E00
         0   30       6.480E08 -1.125E02                                1.000E10
    5        30    1    1       6.000E00
         0   30       6.480E08                                          1.000E10
```

IDENTIFICATION EXAMPLE PRØBLEMS CODED BY WPD/JRR DATE 2-21-69 PAGE 4 OF 7

1–5	6–10	11–15	16–20	21–30	31–40	41–70	71–80
6		40	2	1	6.000E00		
	0	40		6.480E08	-1.125E02		1.000E10
7		20	1	1	6.000E00		
	0	20		1.536E09			1.000E10
8		30	4	7	6.000E00		
	10	10			-2.500E04		
	20	20			-2.500E04		
	0	30		1.536E09			1.000E10
	0		1	1.596E10			
		10		0.000E00			
	20		1	0.000E00			
		30		1.596E10			
9		30	4	5	6.000E00		
	0	30		1.536E09	-1.125E02		1.000E10
	0		1	1.596E10			
		10		0.000E00			

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-21-69 PAGE 5 OF 7

```
        20         1  0.000E00
             30       1.596E10
   10        40    4    6       6.000E00
        20   20                -5.000E04
         0   40       1.536E09                                          1.000E10
         0         1  1.596E10
             14       0.000E00
        26         1  0.000E00
             40       1.596E10
   11        24    3    2       6.000E00
         0   24       5.184E09                                          1.000E10
        12   24                           1.265E03
              0
              8    9   10
              4    5    6
              1    2    0
```

IDENTIFICATION EXAMPLE PROBLEMS / CODED BY WPD/JRR DATE 3-21-69 PAGE 6 OF 7

1–15	16–20	21–25	51–60	61–70	71–80
11	7	3			
11	7	3			
11	7	3			
11	7	0			
1	1		1.000E20	1.000E20	1.000E20
2	1		1.000E20	1.000E20	1.000E20
3	1		1.000E20	1.000E20	1.000E20
4	1		1.000E20	1.000E20	1.000E20
3	4		1.000E20		
4	2		1.000E20		
4	3		1.000E20		
0	0				
1	1	2			
1	1	1			
1	2	0			
1	1	1			

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-21-69 PAGE 7 OF 7

```
              2    1    1
              1    1    1
              1    1    0
```

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-27-69 PAGE 1 OF 9

1–5	6–10	11–15	16–20	21–25	26–30	31–35	36–40	41–50	51–70	71–80
PR201		TWØ BAY BENT, LØADS APPLIED TØ MEMBERS								
		1	4	9	3	0	0	0		
		3	3							
			0.000E00		2.160E02		4.320E02			
			0.000E00		4.440E02		6.060E02			
1		18	1	1			1.200E01			
	0	18			4.950E08					5.450E06
2		18	2	2			9.000E00			
	0	18			1.990E08					3.530E06
	9	9					1.520E00			
3		18	1	1			1.200E01			
	0	18			4.050E08					5.400E06
4		37	2	2			1.200E01			
	0	37			4.130E08					5.100E06
	14	14					3.360E00			
		0	0							

IDENTIFICATION EXAMPLE PROBLEMS — CODED BY WPD/JRR — DATE 3-27-69 — PAGE 2 OF 9

1–10	11–15	16–20	21–30	31–40	41–50	51–60	61–70	71–80
	3	3						
	1	1						
	4	2						
	4	2						
	4	2						
	1	1				1.000E20	1.000E20	1.000E20
	2	1				1.000E20	1.000E20	1.000E20
	3	1				1.000E20	1.000E20	1.000E20
	1	2		-3.000E01				
	2	2		-3.000E01				
	3	2		-3.000E01				
	1	3	2.160E01	-1.840E02				
	2	3		-1.840E02				
	3	3		-2.190E02				
	0	0						
	1	1						

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-27-69 PAGE 3 OF 9

1–5	6–10	11–15	16–20	21–25	26–30	31–40	41–50	51–60	61–70	71–80
		1	1							
		2	2							
		2	2							
		2	2							
PR202		TWO-BAY BENT, LOADS APPLIED TO JOINTS								
		1	5	15	1	0 0	0			
		3	5							
			0.000E00		2.760E02	4.320E02				
			0.000E00		2.760E02	4.440E02	5.250E02	6.060E02		
1		18	1	1		1.200E01				
	0	18			4.950E08					5.450E06
2		9	1	1		9.000E00				
	0	9			1.990E08					3.530E06
3		18	1	1		1.200E01				
	0	18			4.050E08					5.400E06
4		14	1	1		1.200E01				

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-27-69 PAGE 4 OF 9

1-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-60	61-70	71-80
	0	14			4.130E08					5.100E06
5		23	1	1		1.200E01				
	0	23			4.130E08					5.100E06
		0	0							
		0	0							
		3	3							
		0	0							
		1	1							
		5	4	2	2					
		5	4	2	2					
		5	4	2	2					
		1	1					1.000E20	1.000E20	1.000E20
		2	1					1.000E20	1.000E20	1.000E20
		3	1					1.000E20	1.000E20	1.000E20
		2	5			-1.840E02				
		1	5		2.160E01	-1.840E02				

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-27-69 PAGE 5 OF 9

```
              3    4  1.520E00
              2    4  1.520E00
              1    4  1.520E00
              1    3           -3.000E01
              2    3           -3.000E01
              3    3           -3.000E01
              1    2  3.360E00
              2    2  3.360E00
              3    2  3.360E00
              3    5           -2.190E02
PR203     TWO-BAY BENT, SECOND LOADING CONDITION
              2    0    9    1    0    0         0
              1    2 -2.260E00
              2    2 -2.260E00
              3    2 -2.260E00
              1    4 -1.020E00
```

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-27-69 PAGE 6 OF 9

```
              2    4 -1.020E00
              3    4 -1.020E00
              1    5 -7.400E00 -1.320E02
              2    5           -1.320E02
              3    5           -1.070E02
PR204     PR203 WITH INVESTIGATION OF AXIAL EFFECTS
              2    0    0    1    0    0        10  1.00E-04  1.00E-05
PR301     ONE BAY BENT WITH VERTICAL COLUMNS
              1    3    6    1    0    0         0
              2    3
            0.000E00  2.400E02
            0.000E00  2.640E02  3.690E02
    1        22    3    2       1.200E01
         0   22       1.990E08                                          3.530E06
         7   22                                  2.400E08
    2        15    1    1       7.000E00
```

IDENTIFICATION *EXAMPLE PROBLEMS* CODED BY *WPD/JRR* DATE *3-27-69* PAGE *7* OF *9*

```
         0   15       1.990E08                                          3.530E06
    3        20    1    1       1.200E01
         0   20       1.020E09                                          6.930E06
         0
         0
         3
         1    2
         1    2
         1    1                                               2.000E02
         2    1                                               2.000E02
         1    2  1.100E00
         2    2  1.800E00
         1    3  1.830E01 -4.000E02
         2    3  1.830E01 -4.350E02
PR302     ONE-BAY BENT WITH BATTERED COLUMNS
              1    4    6    1    4    0         0
```

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-27-69 PAGE 8 OF 9

1–5	6–10	11–15	16–20	21–25	26–30	31–35	36–40	41–50	51–60	61–70	71–80
		6	3								
			0.000E00		2.200E01		3.075E01	2.7075E02	2.795E02	3.015E02	
			0.000E00		2.640E02		3.690E02				
1		22	3	2			1.204E01				
	0	22			1.990E08						3.530E06
	0	15						2.408E08			
2		15	1	1			7.024E00				
	0	15			1.990E08						3.530E06
3		20	1	1			1.200E01				
	0	20			1.020E09						6.930E06
4		22	3	2			1.204E01				
	0	22			1.990E08						3.530E06
	7	22						2.408E08			
		0	0	0	0	0					
		0	0	0	0	0					
		0	0	3	0	0					

IDENTIFICATION EXAMPLE PROBLEMS CODED BY WPD/JRR DATE 3-27-69 PAGE 9 OF 9

1–15	16–20	21–30	31–40	61–70
0	0			
0	0			
0	0			
0	0			
0	0			
0	0			
1	1	1 2	2	
2	2	2 3	3	
2	4	3 5	2	
4	5	2 6	1	
1	1			2.000E02
6	1			2.000E02
2	2	1.800E00		
5	2	1.800E00		
3	3	1.830E01	-4.000E02	
4	3	1.830E01	-4.350E02	

```
     EXAMPLE PROBLEMS - DIRECT PLANE FRAME SOLUTION - WPD/JRR
     SAMPLE INPUT AND PROBLEMS FOR APPENDICES 4 AND 5 - CODED 3/69
PR101     SIMPLE FRAME AFTER HM/TAH -- PRISMATIC MEMBERS
             1    3    3    1    0    0         0
             2    3
          0.000E00  2.000E01
          0.000E00  1.000E01  2.000E01
    1       20    1    1      5.000E-01
         0  20         1.000E02                                                   2.000E04
    2       40    1    1        0.500E00
         0  40         3.000E02                                                   2.000E04
    3       20    1    1        0.500E00
         0  20         2.000E02                                                   2.000E04
             0
             0
             2
             0    1
             3    3
             1    2                                   1.000E20  1.000E20  1.000E20
             1    3    1.500E00
             2    1                                   1.000E20  1.000E20  1.000E20
PR102     SIMPLE FRAME AFTER HM/TAH -- NON-PRISMATIC MEMBERS
             2    3    0    1    0    4         0
    4       20    3    1      5.000E-01
         0  20    0    1.000E02                                                   2.000E04
    5       40    3    1      5.000E-01
         0  40    0    3.000E02                                                   2.000E04
    6       20    3    1      5.000E-01
         0  20    0    2.000E02                                                   2.000E04
             4    1    2    1    3
             5    1    3    2    3
             6    2    2    2    3
             6    2    1    2    2
PR103     MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY
             1   11    7    3    0    0         0
             4    4
          0.000E00  1.800E02  3.600E02  6.000E02
          0.000E00  1.440E02  2.640E02  3.840E02
    1       30    1    1        6.000E00
         0  30         1.920E08                                                   1.000E10
    2       30    2    1        6.000E00
         0  30         1.920E08 -6.000E01                                         1.000E10
    3       20    1    1        6.000E00
         0  20         6.480E08                                                   1.000E10
    4       30    2    1        6.000E00
         0  30         6.480E08 -1.125E02                                         1.000E10
    5       30    1    1        6.000E00
         0  30         6.480E08                                                   1.000E10
    6       40    2    1        6.000E00
         0  40         6.480E08 -1.125E02                                         1.000E10
    7       20    1    1        6.000E00
         0  20         1.536E09                                                   1.000E10
    8       30    4    7        6.000E00
        10  10                 -2.500E04
        20  20                 -2.500E04
```

```
         0   30       1.536E09                                         1.000E10
         0        1   1.596E10
             10       0.000E00
        20        1   0.000E00
             30       1.596E10
    9        30   4     5       6.000E00
         0   30       1.536E09 -1.125E02                               1.000E10
         0        1   1.596E10
             10       0.000E00
        20        1   0.000E00
             30       1.596E10
   10        40   4     6       6.000E00
        20   20                -5.000E04
         0   40       1.536E09                                         1.000E10
         0        1   1.596E10
             14       0.000E00
        26        1   0.000E00
             40       1.596E10
   11        24   3     2       6.000E00
         0   24       5.184E09                                         1.000E10
        12   24                           1.265E03
              0
              8   9    10
              4   5     6
              1   2     0
             11   7     3
             11   7     3
             11   7     3
             11   7     0
              1   1                                 1.000E20  1.000E20  1.000E20
              2   1                                 1.000E20  1.000E20  1.000E20
              3   1                                 1.000E20  1.000E20  1.000E20
              4   1                                 1.000E20  1.000E20  1.000E20
              3   4                                 1.000E20
              4   2                                 1.000E20
              4   3                                 1.000E20
              0   0
              1   1     2
              1   1     1
              1   2     0
              1   1     1
              2   1     1
              1   1     1
              1   1     0
PR201     TWO-BAY BENT, LOADS APPLIED TO MEMBERS
              1   4     9    3    0               0
              3   3
           0.000E00   2.160E02  4.320E02
           0.000E00   4.440E02  6.060E02
    1        18   1     1       1.200E01
         0   18       4.950E08                                         5.450E06
    2        18   2     2       9.000E00
         0   18       1.990E08                                         3.530E06
         9    9                 1.520E00
    3        18   1     1       1.200E01
```

```
         0   18       4.050E08                                                5.400E06
    4        37    2    2       1.200E01
         0   37       4.130E08                                                5.100E06
        14   14                 3.360E00
              0    0
              3    3
              1    1
              4    2
              4    2
              4    2
              1    1                                1.000E20  1.000E20  1.000E20
              2    1                                1.000E20  1.000E20  1.000E20
              3    1                                1.000E20  1.000E20  1.000E20
              1    2           -3.000E01
              2    2           -3.000E01
              3    2           -3.000E01
              1    3  2.160E01 -1.840E02
              2    3           -1.840E02
              3    3           -2.190E02
              0    0
              1    1
              1    1
              2    2
              2    2
              2    2
PR202     TWO-BAY BENT, LOADS APPLIED TO JOINTS
              1    5   15    1    0              0
              3    5
            0.000E00  2.160E02  4.320E02
            0.000E00  2.760E02  4.440E02  5.250E02  6.060E02
    1        18    1    1       1.200E01
         0   18       4.950E08                                                5.450E06
    2         9    1    1       9.000E00
         0    9       1.990E08                                                3.530E06
    3        18    1    1       1.200E01
         0   18       4.050E08                                                5.400E06
    4        14    1    1       1.200E01
         0   14       4.130E08                                                5.100E06
    5        23    1    1       1.200E01
         0   23       4.130E08                                                5.100E06
              0    0
              0    0
              3    3
              0    0
              1    1
              5    4    2    2
              5    4    2    2
              5    4    2    2
              1    1                                1.000E20  1.000E20  1.000E20
              2    1                                1.000E20  1.000E20  1.000E20
              3    1                                1.000E20  1.000E20  1.000E20
              2    5           -1.840E02
              1    5  2.160E01 -1.840E02
              3    4  1.520E00
              2    4  1.520E00
```

```
              1    4   1.520E00
              1    3            -3.000E01
              2    3            -3.000E01
              3    3            -3.000E01
              1    2   3.360E00
              2    2   3.360E00
              3    2   3.360E00
              3    5            -2.190E02
PR203      TWO-BAY BENT, SECOND LOADING CONDITION
              2    0    9    1    0    0         0
              1    2 -2.260E00
              2    2 -2.260E00
              3    2 -2.260E00
              1    4 -1.020E00
              2    4 -1.020E00
              3    4 -1.020E00
              1    5 -7.400E00 -1.320E02
              2    5            -1.320E02
              3    5            -1.070E02
PR204      PR203 WITH INVESTIGATION OF AXIAL EFFECTS
              2    0    0    1    0    0         10  1.00E-04  1.00E-05
PR301      ONE BAY BENT WITH VERTICAL COLUMNS
              1    3    6    1    0    0         0
              2    3
           0.000E00  2.400E02
           0.000E00  2.640E02  3.690E02
    1        22    3    2       1.200E01
         0   22        1.990E08                                               3.530E06
         7   22                          2.400E08
    2        15    1    1       7.000E00
         0   15        1.990E08                                               3.530E06
    3        20    1    1       1.200E01
         0   20        1.020E09                                               6.930E06
              0
              0
              3
              1    2
              1    2
              1    1                                             2.000E02
              2    1                                             2.000E02
              1    2   1.800E00
              2    2   1.800E00
              1    3   1.830E01 -4.000E02
              2    3   1.830E01 -4.350E02
PR302      ONE BAY BENT WITH BATTERED COLUMNS
              1    4    6    1    4    0         0
              6    3
           0.000E00  2.200E01  3.075E01 2.7075E02  2.795E02  3.015E02
           0.000E00  2.640E02  3.690E02
    1        22    3    2       1.204E01
         0   22        1.990E08                                               3.530E06
         0   15                          2.408E08
    2        15    1    1       7.024E00
         0   15        1.990E08                                               3.530E06
    3        20    1    1       1.200E01
```

```
     0   20        1.020E09                                                 6.930E06
4        22    3    2       1.204E01
     0   22        1.990E08                                                 3.530E06
     7   22                           2.408E08

          0    0    3    0    0
          0    0
          0    0
          0    0
          0    0
          0    0
          0    0
          1    1    1    2    2
          2    2    2    3    3
          2    4    3    5    2
          4    5    2    6    1
          1    1                                               2.000E02
          6    1                                               2.000E02
          2    2   1.800E00
          5    2   1.800E00
          3    3   1.830E01 -4.000E02
          4    3   1.830E01 -4.350E02
      TERMINATE
```

APPENDIX 5

COMPUTER RESULTS FOR EXAMPLE PROBLEMS

PROB
PR101 SIMPLE FRAME AFTER HM/TAH -- PRISMATIC MEMBERS

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
1	3	3	1	0	0	0	-0.	-0.

TABLE 2 -- X AND Y LINE COORDINATES

NXL = 2
NYL = 3

X LINE	COORDINATE
1	0.
2	2.000E+01

Y LINE	COORDINATE
1	0.
2	1.000E+01
3	2.000E+01

```
PROB
PR101      SIMPLE FRAME AFTER HM/TAH -- PRISMATIC MEMBERS

TABLE 3 -- MEMBER TYPE DATA


      TYPE   M KODE  NDC       H

        1   20     1     1 5.000E-01

FROM TO CONTD      F           Q           S           T           R           AF

   0  20 -0   1.000E+02 -0.         -0.         -0.         -0.         2.000E+04


      TYPE   M KODE  NDC       H

        2   40     1     1 5.000E-01

FROM TO CONTD      F           Q           S           T           R           AE

   0  40 -0   3.000E+02 -0.         -0.         -0.         -0.         2.000E+04


      TYPE   M KODE  NDC       H

        3   20     1     1 5.000E-01

FROM TO CONTD      F           Q           S           T           R           AF

   0  20 -0   2.000E+02 -0.         -0.         -0.         -0.         2.000E+04

TABLE 4 -- MEMBER INCIDENCE DATA

     ALONG         MEMBER TYPES BETWEEN X LINES
     Y LINE    1    2

       1          0

       2          0

       3          2



     ALONG         MEMBER TYPES BETWEEN Y LINES
     X LINE    1    2    3

       1          0    1

       2          3    3
```

PROB
PR101 SIMPLE FRAME AFTER HM/TAH -- PRISMATIC MEMBERS

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

LEFT END		RIGHT END		MEMBER TYPE
X LINE	Y LINE	X LINE	Y LINE	
NONE				

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

X LINE	Y LINE	PX	PY	PZ	SX	SY	SZ
1	2	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
1	3	1.500E+00	-0.	-0.	-0.	-0.	-0.
2	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20

PROB
PR101 SIMPLE FRAME AFTER HM/TAH -- PRISMATIC MEMBERS

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE	
Y LINE	1	2
3	4	5
2	2	3
1	0	1

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	3.474E-21	-4.156E-21	-3.650E-20
2	1.153E-20	4.156E-21	-6.511E-20
3	6.231E-01	-2.078E-04	-9.566E-02
4	1.335E+00	2.078E-04	-7.482E-02
5	1.334E+00	-4.156E-04	-1.761E-02

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
2	-1.153E+00	-4.156E-01	6.511E+00
1	-3.474E-01	4.156E-01	3.650E+00

```
PROB
PR101      SIMPLE FRAME AFTER HM/TAH -- PRISMATIC MEMBERS


TABLE 14--- INDIVIDUAL MEMBER DATA
            (DESIGNERS SIGN CONVENTION)



    **  HORIZ  ** MEMBER OF TYPE   2 BETWEEN JOINTS   4 AND   5

         AXIAL FORCE             =  -3.474E-01
         MOMENT AT LEFT END      =   5.009E+00
         SHEAR AT LEFT END       =  -4.151E-01
         MOMENT AT RIGHT END     =  -3.293E+00
         SHEAR AT RIGHT END      =  -4.151E-01



    **  VERTL  ** MEMBER OF TYPE   1 BETWEEN JOINTS   2 AND   4

         AXIAL FORCE             =   4.156E-01
         MOMENT AT LEFT END      =  -4.986E+00
         SHEAR AT LEFT END       =   1.147E+00
         MOMENT AT RIGHT END     =   6.482E+00
         SHEAR AT RIGHT END      =   1.147E+00



    **  VERTL  ** MEMBER OF TYPE   3 BETWEEN JOINTS   1 AND   3

         AXIAL FORCE             =  -4.156E-01
         MOMENT AT LEFT END      =   1.847E-01
         SHEAR AT LEFT END       =   3.457E-01
         MOMENT AT RIGHT END     =   3.642E+00
         SHEAR AT RIGHT END      =   3.457E-01



    **  VERTL  ** MEMBER OF TYPE   3 BETWEEN JOINTS   3 AND   5

         AXIAL FORCE             =  -4.156E-01
         MOMENT AT LEFT END      =  -3.290E+00
         SHEAR AT LEFT END       =   3.457E-01
         MOMENT AT RIGHT END     =   1.674E-01
         SHEAR AT RIGHT END      =   3.457E-01
```

PROB
PR102 SIMPLE FRAME AFTER HM/TAH -- NON-PRISMATIC MEMBERS

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
2	3	0	1	0	4	0	-0.	-0.

TABLE 2 -- X AND Y LINE COORDINATES

USING X AND Y LINE DATA FROM PREVIOUS PROBLEM

TABLE 3 -- MEMBER TYPE DATA

USING DATA FROM PREVIOUS PROBLEM PLUS THE FOLLOWING

TYPE	M	KODE	NDC	H
4	20	3	1	5.000E-01

FROM	TO	CONTD	F	Q	S	T	R	AE
0	20	0	1.000E+02	-0.	-0.	-0.	-0.	2.000E+04

TYPE	M	KODE	NDC	H
5	40	3	1	5.000E-01

FROM	TO	CONTD	F	Q	S	T	R	AE
0	40	0	3.000E+02	-0.	-0.	-0.	-0.	2.000E+04

TYPE	M	KODE	NDC	H
6	20	3	1	5.000E-01

FROM	TO	CONTD	F	Q	S	T	R	AE
0	20	0	2.000E+02	-0.	-0.	-0.	-0.	2.000E+04

PROB
PR102 SIMPLE FRAME AFTER HM/TAH -- NON-PRISMATIC MEMBERS

TABLE 4 -- MEMBER INCIDENCE DATA

ALONG Y LINE	MEMBER TYPES BETWEEN X LINES 1 2
1	0
2	0
3	5

ALONG X LINE	MEMBER TYPES BETWEEN Y LINES 1 2	3
1	0	4
2	6	6

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

LEFT END X LINE	LEFT END Y LINE	RIGHT END X LINE	RIGHT END Y LINE	MEMBER TYPE

NO ADDITIONAL DATA

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

NO ADDITIONAL DATA

PROB
PR102 SIMPLE FRAME AFTER HM/TAH -- NON-PRISMATIC MEMBERS

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE	
Y LINE	1	2
3	4	5
2	2	3
1	0	1

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	3.479E-21	-4.157E-21	-3.656E-20
2	1.152E-20	4.157E-21	-6.509E-20
3	6.249E-01	-2.078E-04	-9.585E-02
4	1.339E+00	2.078E-04	-7.480E-02
5	1.339E+00	-4.157E-04	-1.775E-02

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
2	-1.152E+00	-4.157E-01	6.509E+00
1	-3.479E-01	4.157E-01	3.656E+00

```
PR08
PR102      SIMPLE FRAME AFTER HM/TAH -- NON-PRISMATIC MEMBERS

TABLE 14--- INDIVIDUAL MEMBER DATA
            (DESIGNERS SIGN CONVENTION)


        **  HORIZ  ** MEMBER OF TYPE   5 BETWEEN JOINTS   4 AND   5

             AXIAL FORCE            =  -3.479E-01
             MOMENT AT LEFT END     =   5.013E+00
             SHEAR AT LEFT END      =  -4.157E-01
             MOMENT AT RIGHT END    =  -3.301E+00
             SHEAR AT RIGHT END     =  -4.157E-01


        **  VERTL  ** MEMBER OF TYPE   4 BETWEEN JOINTS   2 AND   4

             AXIAL FORCE            =   4.157E-01
             MOMENT AT LEFT END     =  -5.013E+00
             SHEAR AT LEFT END      =   1.152E+00
             MOMENT AT RIGHT END    =   6.509E+00
             SHEAR AT RIGHT END     =   1.152E+00


        **  VERTL  ** MEMBER OF TYPE   6 BETWEEN JOINTS   1 AND   3

             AXIAL FORCE            =  -4.157E-01
             MOMENT AT LEFT END     =   1.775E-01
             SHEAR AT LEFT END      =   3.479E-01
             MOMENT AT RIGHT END    =   3.656E+00
             SHEAR AT RIGHT END     =   3.479E-01


        **  VERTL  ** MEMBER OF TYPE   6 BETWEEN JOINTS   3 AND   5

             AXIAL FORCE            =  -4.157E-01
             MOMENT AT LEFT END     =  -3.301E+00
             SHEAR AT LEFT END      =   3.479E-01
             MOMENT AT RIGHT END    =   1.775E-01
             SHEAR AT RIGHT END     =   3.479E-01
```

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
1	11	7	3	0	0	0	-0.	-0.

TABLE 2 -- X AND Y LINE COORDINATES

NXL = 4
NYL = 4

X LINE	COORDINATE
1	0.
2	1.800E+02
3	3.600E+02
4	6.000E+02

Y LINE	COORDINATE
1	0.
2	1.440E+02
3	2.640E+02
4	3.840E+02

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 3 -- MEMBER TYPE DATA

TYPE	M	KODE	NDC	H
1	30	1	1	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	30	-0	1.920E+08	-0.	-0.	-0.	-0.	1.000E+10

TYPE	M	KODE	NDC	H
2	30	2	1	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	30	-0	1.920E+08	-6.000E+01	-0.	-0.	-0.	1.000E+10

TYPE	M	KODE	NDC	H
3	20	1	1	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	20	-0	6.480E+08	-0.	-0.	-0.	-0.	1.000E+10

TYPE	M	KODE	NDC	H
4	30	2	1	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	30	-0	6.480E+08	-1.125E+02	-0.	-0.	-0.	1.000E+10

TYPE	M	KODE	NDC	H
5	30	1	1	6.000E+00

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 3 (CONT)

FROM	TO	CONTD	F	Q	S	T	R	AF
0	30	-0	6.480E+08	-0.	-0.	-0.	-0.	1.000E+10

TYPE	M	KODE	NDC	H
6	40	2	1	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	40	-0	6.480E+08	-1.125E+02	-0.	-0.	-0.	1.000E+10

TYPE	M	KODE	NDC	H
7	20	1	1	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	20	-0	1.536E+09	-0.	-0.	-0.	-0.	1.000E+10

TYPE	M	KODE	NDC	H
8	30	4	7	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
10	10	-0	-0.	-2.500E+04	-0.	-0.	-0.	-0.
20	20	-0	-0.	-2.500E+04	-0.	-0.	-0.	-0.
0	30	-0	1.536E+09	-0.	-0.	-0.	-0.	1.000E+10
0		1	1.596E+10	-0.	-0.	-0.	-0.	-0.
	10	-0	0.	-0.	-0.	-0.	-0.	-0.
20		1	0.	-0.	-0.	-0.	-0.	-0.
	30	-0	1.596E+10	-0.	-0.	-0.	-0.	-0.

TYPE	M	KODE	NDC	H
9	30	4	5	6.000E+00

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 3 (CONT)

FROM	TO	CONTD	F	Q	S	T	R	AF
0	30	-0	1.536E+09	-1.125E+02	-0.	-0.	-0.	1.000E+10
0		1	1.596E+10	-0.	-0.	-0.	-0.	-0.
	10	-0	0.	-0.	-0.	-0.	-0.	-0.
20		1	0.	-0.	-0.	-0.	-0.	-0.
	30	-0	1.596E+10	-0.	-0.	-0.	-0.	-0.

TYPE	M	KODE	NDC	H
10	40	4	6	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
20	20	-0	-0.	-5.000E+04	-0.	-0.	-0.	-0.
0	40	-0	1.536E+09	-0.	-0.	-0.	-0.	1.000E+10
0		1	1.596E+10	-0.	-0.	-0.	-0.	-0.
	14	-0	0.	-0.	-0.	-0.	-0.	-0.
26		1	0.	-0.	-0.	-0.	-0.	-0.
	40	-0	1.596E+10	-0.	-0.	-0.	-0.	-0.

TYPE	M	KODE	NDC	H
11	24	3	2	6.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	24	-0	5.184E+09	-0.	-0.	-0.	-0.	1.000E+10
12	24	-0	-0.	-0.	1.265E+03	-0.	-0.	-0.

PROB
PR103   MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 4 -- MEMBER INCIDENCE DATA

```
ALONG          MEMBER TYPES BETWEEN X LINES
Y LINE    1      2      3      4

  1           0      0      0

  2           8      9     10

  3           4      5      6

  4           1      2      0
```

```
ALONG          MEMBER TYPES BETWEEN Y LINES
X LINE    1      2      3      4

  1          11      7      3

  2          11      7      3

  3          11      7      3

  4          11      7      0
```

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

```
  LEFT END        RIGHT END      MEMBER TYPE
X LINE Y LINE   X LINE Y LINE

 NONE
```

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

X LINE	Y LINE	PX	PY	PZ	SX	SY	SZ
1	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
2	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
3	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
4	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
3	4	-0.	-0.	-0.	1.000E+20	-0.	-0.
4	2	-0.	-0.	-0.	1.000E+20	-0.	-0.
4	3	-0.	-0.	-0.	1.000E+20	-0.	-0.

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE			
Y LINE	1	2	3	4
4	13	14	15	0
3	9	10	11	12
2	5	6	7	8
1	1	2	3	4

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	-8.448E-17	-2.654E-16	4.137E-15
2	8.323E-17	-2.650E-16	-4.078E-15
3	-1.115E-16	-3.398E-16	5.461E-15
4	1.323E-16	-2.603E-16	-6.478E-15
5	3.072E-04	-3.821E-04	-5.965E-03
6	1.966E-04	-3.816E-04	5.870E-03
7	1.928E-04	-4.893E-04	-7.871E-03
8	-1.874E-17	-3.748E-04	9.332E-03
9	1.581E-04	-4.023E-04	1.328E-03
10	1.007E-04	-4.131E-04	-1.114E-03
11	1.059E-04	-5.259E-04	1.300E-03
12	5.127E-19	-4.028E-04	-2.515E-03
13	-7.066E-08	-4.018E-04	-5.120E-04
14	3.884E-06	-4.243E-04	-4.972E-04
15	-2.810E-18	-5.366E-04	5.419E-04

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
1	8.448E+03	2.654E+04	-4.137E+05
2	-8.323E+03	2.650E+04	4.078E+05
3	1.115E+04	3.398E+04	-5.461E+05
4	-1.323E+04	2.603E+04	6.478E+05
15	2.810E+02	-0.	-0.
8	1.874E+03	-0.	-0.
12	-5.127E+01	-0.	-0.

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14--- INDIVIDUAL MEMBER DATA
(DESIGNERS SIGN CONVENTION)

** HORIZ ** MEMBER OF TYPE 8 BETWEEN JOINTS 5 AND 6

AXIAL FORCE	=	-6.146E+03
MOMENT AT LEFT END	=	-1.136E+06
SHEAR AT LEFT END	=	2.486E+04
MOMENT AT RIGHT END	=	-1.161E+06
SHEAR AT RIGHT END	=	-2.514E+04

** HORIZ ** MEMBER OF TYPE 9 BETWEEN JOINTS 6 AND 7

AXIAL FORCE	=	-2.082E+02
MOMENT AT LEFT END	=	-3.779E+04
SHEAR AT LEFT END	=	-1.260E+03
MOMENT AT RIGHT END	=	-5.684E+05
SHEAR AT RIGHT END	=	-4.635E+03

** HORIZ ** MEMBER OF TYPE 10 BETWEEN JOINTS 7 AND 8

AXIAL FORCE = -8.034E+03

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	-4.893E-04		-2.079E+06		2.630E+04
			-8.227E-03		2.630E+04	
1	6.000E+00	-4.905E-02		-1.921E+06		6.258E-07
			-8.932E-03		2.630E+04	
2	1.200E+01	-1.034E-01		-1.763E+06		-4.470E-08
			-9.627E-03		2.630E+04	
3	1.800E+01	-1.612E-01		-1.605E+06		6.432E-07
			-1.031E-02		2.630E+04	
4	2.400E+01	-2.231E-01		-1.448E+06		4.210E-07
			-1.098E-02		2.630E+04	
5	3.000E+01	-2.890E-01		-1.290E+06		4.756E-07
			-1.164E-02		2.630E+04	
6	3.600E+01	-3.588E-01		-1.132E+06		1.076E-06
			-1.228E-02		2.630E+04	
7	4.200E+01	-4.325E-01		-9.741E+05		5.712E-07
			-1.289E-02		2.630E+04	

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
8	4.800E+01	-5.098E-01		-8.163E+05		3.645E-07
			-1.348E-02		2.630E+04	
9	5.400E+01	-5.907E-01		-6.585E+05		4.948E-07
			-1.402E-02		2.630E+04	
10	6.000E+01	-6.748E-01		-5.007E+05		-5.430E-07
			-1.451E-02		2.630E+04	
11	6.600E+01	-7.619E-01		-3.429E+05		3.570E-07
			-1.493E-02		2.630E+04	
12	7.200E+01	-8.514E-01		-1.850E+05		4.587E-07
			-1.522E-02		2.630E+04	
13	7.800E+01	-9.428E-01		-2.723E+04		-9.282E-08
			-1.528E-02		2.630E+04	
14	8.400E+01	-1.034E+00		1.306E+05		2.114E-07
			-1.477E-02		2.630E+04	
15	9.000E+01	-1.123E+00		2.884E+05		-2.015E-07
			-1.364E-02		2.630E+04	
16	9.600E+01	-1.205E+00		4.462E+05		4.036E-07
			-1.190E-02		2.630E+04	
17	1.020E+02	-1.276E+00		6.040E+05		1.242E-09
			-9.542E-03		2.630E+04	
18	1.080E+02	-1.334E+00		7.619E+05		6.209E-10
			-6.566E-03		2.630E+04	
19	1.140E+02	-1.373E+00		9.197E+05		5.042E-07
			-2.973E-03		2.630E+04	
20	1.200E+02	-1.391E+00		1.077E+06		-2.806E-07
			1.235E-03		-2.370E+04	
21	1.260E+02	-1.383E+00		9.353E+05		5.042E-07
			4.889E-03		-2.370E+04	
22	1.320E+02	-1.354E+00		7.931E+05		0.
			7.987E-03		-2.370E+04	
23	1.380E+02	-1.306E+00		6.509E+05		5.122E-08
			1.053E-02		-2.370E+04	
24	1.440E+02	-1.243E+00		5.087E+05		-3.104E-10
			1.252E-02		-2.370E+04	
25	1.500E+02	-1.168E+00		3.666E+05		1.014E-07
			1.395E-02		-2.370E+04	
26	1.560E+02	-1.084E+00		2.244E+05		1.996E-07
			1.483E-02		-2.370E+04	
27	1.620E+02	-9.952E-01		8.220E+04		3.539E-07
			1.501E-02		-2.370E+04	
28	1.680E+02	-9.052E-01		-5.999E+04		1.692E-08
			1.492E-02		-2.370E+04	
29	1.740E+02	-8.157E-01		-2.022E+05		7.031E-07

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
			1.467E-02		-2.370E+04	
30	1.800E+02	-7.277E-01		-3.444E+05		-6.072E-07
			1.433E-02		-2.370E+04	
31	1.860E+02	-6.417E-01		-4.865E+05		7.302E-07
			1.393E-02		-2.370E+04	
32	1.920E+02	-5.591E-01		-6.287E+05		1.484E-07
			1.348E-02		-2.370E+04	
33	1.980E+02	-4.772E-01		-7.709E+05		4.172E-07
			1.299E-02		-2.370E+04	
34	2.040E+02	-3.993E-01		-9.131E+05		-4.843E-08
			1.248E-02		-2.370E+04	
35	2.100E+02	-3.244E-01		-1.055E+06		5.191E-07
			1.194E-02		-2.370E+04	
36	2.160E+02	-2.578E-01		-1.197E+06		-1.304E-07
			1.139E-02		-2.370E+04	
37	2.220E+02	-1.845E-01		-1.340E+06		-7.128E-07
			1.081E-02		-2.370E+04	
38	2.280E+02	-1.196E-01		-1.482E+06		3.104E-07
			1.023E-02		-2.370E+04	
39	2.340E+02	-5.818E-02		-1.624E+06		-1.490E-07
			9.635E-03		-2.370E+04	
40	2.400E+02	-3.748E-04		-1.766E+06		2.370E+04

** HORIZ ** MEMBER OF TYPE 4 BETWEEN JOINTS 9 AND 10

AXIAL FORCE	=	-3.189E+03
MOMENT AT LEFT END	=	-6.167E+04
SHEAR AT LEFT END	=	1.713E+03
MOMENT AT RIGHT END	=	-5.705E+04
SHEAR AT RIGHT END	=	-1.662E+03

** HORIZ ** MEMBER OF TYPE 5 BETWEEN JOINTS 10 AND 11

AXIAL FORCE	=	2.894E+02
MOMENT AT LEFT END	=	6.674E+03
SHEAR AT LEFT END	=	2.239E+01
MOMENT AT RIGHT END	=	1.070E+04
SHEAR AT RIGHT END	=	2.239E+01

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

** HORIZ ** MEMBER OF TYPE 6 BETWEEN JOINTS 11 AND 12

```
AXIAL FORCE            =  -4.414E+03
MOMENT AT LEFT END     =  -9.040E+04
SHEAR AT LEFT END      =   2.168E+03
MOMENT AT RIGHT END    =  -1.101E+05
SHEAR AT RIGHT END     =  -2.332E+03
```

** HORIZ ** MEMBER OF TYPE 1 BETWEEN JOINTS 13 AND 14

```
AXIAL FORCE            =   2.197E+02
MOMENT AT LEFT END     =   3.237E+03
SHEAR AT LEFT END      =  -3.579E+01
MOMENT AT RIGHT END    =  -3.205E+03
SHEAR AT RIGHT END     =  -3.579E+01
```

** HORIZ ** MEMBER OF TYPE 2 BETWEEN JOINTS 14 AND 15

```
AXIAL FORCE            =  -2.158E+02
```

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	-4.243E-04		-2.601E+04		9.016E+02
			-9.036E-04		8.716E+02	
1	6.000E+00	-5.846E-03		-2.078E+04		3.929E-10
			-1.553E-03		8.116E+02	
2	1.200E+01	-1.516E-02		-1.591E+04		4.463E-10
			-2.050E-03		7.516E+02	
3	1.800E+01	-2.746E-02		-1.140E+04		4.075E-10
			-2.406E-03		6.916E+02	
4	2.400E+01	-4.190E-02		-7.249E+03		2.071E-09
			-2.633E-03		6.316E+02	
5	3.000E+01	-5.770E-02		-3.460E+03		-9.641E-11
			-2.741E-03		5.716E+02	
6	3.600E+01	-7.414E-02		-2.977E+01		3.459E-09
			-2.742E-03		5.116E+02	
7	4.200E+01	-9.059E-02		3.040E+03		-1.673E-09
			-2.647E-03		4.516E+02	
8	4.800E+01	-1.065E-01		5.750E+03		3.851E-09

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
			-2.467E-03		3.916E+02	
9	5.400E+01	-1.213E-01		8.100E+03		6.985E-10
			-2.214E-03		3.316E+02	
10	6.000E+01	-1.346E-01		1.009E+04		3.861E-09
			-1.899E-03		2.716E+02	
11	6.600E+01	-1.460E-01		1.172E+04		6.219E-09
			-1.533E-03		2.116E+02	
12	7.200E+01	-1.552E-01		1.299E+04		-4.821E-09
			-1.127E-03		1.516E+02	
13	7.800E+01	-1.619E-01		1.390E+04		4.637E-09
			-6.923E-04		9.163E+01	
14	8.400E+01	-1.661E-01		1.445E+04		-7.753E-11
			-2.408E-04		3.163E+01	
15	9.000E+01	-1.675E-01		1.464E+04		4.637E-09
			2.167E-04		-2.837E+01	
16	9.600E+01	-1.662E-01		1.447E+04		3.056E-09
			6.688E-04		-8.837E+01	
17	1.020E+02	-1.622E-01		1.394E+04		3.066E-09
			1.104E-03		-1.484E+02	
18	1.080E+02	-1.556E-01		1.305E+04		6.985E-10
			1.512E-03		-2.084E+02	
19	1.140E+02	-1.465E-01		1.180E+04		2.280E-09
			1.881E-03		-2.684E+02	
20	1.200E+02	-1.352E-01		1.019E+04		3.832E-09
			2.199E-03		-3.284E+02	
21	1.260E+02	-1.220E-01		8.217E+03		1.513E-09
			2.456E-03		-3.884E+02	
22	1.320E+02	-1.073E-01		5.887E+03		1.870E-09
			2.640E-03		-4.484E+02	
23	1.380E+02	-9.144E-02		3.197E+03		2.666E-09
			2.740E-03		-5.084E+02	
24	1.440E+02	-7.500E-02		1.465E+02		-4.948E-10
			2.744E-03		-5.684E+02	
25	1.500E+02	-5.854E-02		-3.264E+03		2.076E-09
			2.642E-03		-6.284E+02	
26	1.560E+02	-4.268E-02		-7.034E+03		9.709E-11
			2.423E-03		-6.884E+02	
27	1.620E+02	-2.815E-02		-1.116E+04		1.591E-09
			2.074E-03		-7.484E+02	
28	1.680E+02	-1.571E-02		-1.565E+04		2.135E-10
			1.584E-03		-8.084E+02	
29	1.740E+02	-6.199E-03		-2.050E+04		1.164E-10
			9.437E-04		-8.684E+02	

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
30	1.800E+02	-5.366E-04		-2.571E+04		8.984E+02

** VERTL ** MEMBER OF TYPE 11 BETWEEN JOINTS 1 AND 5

AXIAL FORCE	=	-2.654E+04
MOMENT AT LEFT END	=	8.643E+05
SHEAR AT LEFT END	=	-9.115E+03
MOMENT AT RIGHT END	=	-4.137E+05
SHEAR AT RIGHT END	=	-8.448E+03

** VERTL ** MEMBER OF TYPE 7 BETWEEN JOINTS 5 AND 9

AXIAL FORCE	=	-1.677E+03
MOMENT AT LEFT END	=	8.391E+04
SHEAR AT LEFT END	=	-2.954E+03
MOMENT AT RIGHT END	=	-2.706E+05
SHEAR AT RIGHT END	=	-2.954E+03

** VERTL ** MEMBER OF TYPE 3 BETWEEN JOINTS 9 AND 13

AXIAL FORCE	=	3.587E+01
MOMENT AT LEFT END	=	-3.179E+03
SHEAR AT LEFT END	=	2.186E+02
MOMENT AT RIGHT END	=	2.305E+04
SHEAR AT RIGHT END	=	2.186E+02

** VERTL ** MEMBER OF TYPE 11 BETWEEN JOINTS 2 AND 6

AXIAL FORCE = -2.650E+04

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	1.966E-04		-8.513E+05		8.981E+03

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
			5.377E-03		8.981E+03	
1	6.000E+00	3.246E-02		-7.974E+05		-1.229E-07
			4.454E-03		8.981E+03	
2	1.200E+01	5.919E-02		-7.435E+05		-7.513E-08
			3.594E-03		8.981E+03	
3	1.800E+01	8.075E-02		-6.896E+05		-7.575E-08
			2.796E-03		8.981E+03	
4	2.400E+01	9.753E-02		-6.357E+05		-6.395E-08
			2.060E-03		8.981E+03	
5	3.000E+01	1.099E-01		-5.818E+05		-4.284E-08
			1.387E-03		8.981E+03	
6	3.600E+01	1.182E-01		-5.280E+05		-1.499E-07
			7.755E-04		8.981E+03	
7	4.200E+01	1.229E-01		-4.741E+05		-1.068E-07
			2.268E-04		8.981E+03	
8	4.800E+01	1.242E-01		-4.202E+05		-1.707E-07
			-2.595E-04		8.981E+03	
9	5.400E+01	1.227E-01		-3.663E+05		-1.062E-07
			-6.835E-04		8.981E+03	
10	6.000E+01	1.186E-01		-3.124E+05		-1.711E-07
			-1.045E-03		8.981E+03	
11	6.600E+01	1.123E-01		-2.585E+05		-1.276E-07
			-1.344E-03		8.981E+03	
12	7.200E+01	1.042E-01		-2.046E+05		-8.130E-08
			-1.581E-03		8.915E+03	
13	7.800E+01	9.474E-02		-1.512E+05		-1.211E-08
			-1.756E-03		8.795E+03	
14	8.400E+01	8.420E-02		-9.838E+04		-5.440E-08
			-1.870E-03		8.689E+03	
15	9.000E+01	7.298E-02		-4.625E+04		-3.289E-08
			-1.923E-03		8.596E+03	
16	9.600E+01	6.144E-02		5.325E+03		-5.503E-08
			-1.917E-03		8.518E+03	
17	1.020E+02	4.994E-02		5.644E+04		-6.881E-08
			-1.852E-03		8.455E+03	
18	1.080E+02	3.883E-02		1.072E+05		-2.728E-08
			-1.728E-03		8.406E+03	
19	1.140E+02	2.846E-02		1.576E+05		-3.337E-08
			-1.546E-03		8.370E+03	
20	1.200E+02	1.919E-02		2.078E+05		-8.480E-09
			-1.305E-03		8.346E+03	
21	1.260E+02	1.136E-02		2.579E+05		-1.007E-08
			-1.007E-03		8.332E+03	

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
22	1.320E+02	5.317E-03		3.079E+05		-1.072E-08
			-6.501E-04		8.325E+03	
23	1.380E+02	1.416E-03		3.578E+05		-1.397E-09
			-2.360E-04		8.323E+03	
24	1.440E+02	8.323E-17		4.078E+05		-8.323E+03

** VERTL ** MEMBER OF TYPE 7 BETWEEN JOINTS 6 AND 10

AXIAL FORCE = -2.622E+03
MOMENT AT LEFT END = -9.227E+04
SHEAR AT LEFT END = 3.028E+03
MOMENT AT RIGHT END = 2.711E+05
SHEAR AT RIGHT END = 3.028E+03

** VERTL ** MEMBER OF TYPE 3 BETWEEN JOINTS 10 AND 14

AXIAL FORCE = -9.375E+02
MOMENT AT LEFT END = 2.267E+04
SHEAR AT LEFT END = -4.333E+02
MOMENT AT RIGHT END = -2.933E+04
SHEAR AT RIGHT END = -4.333E+02

** VERTL ** MEMBER OF TYPE 11 BETWEEN JOINTS 3 AND 7

AXIAL FORCE = -3.398E+04
MOMENT AT LEFT END = 1.141E+06
SHEAR AT LEFT END = -1.203E+04
MOMENT AT RIGHT END = -5.461E+05
SHEAR AT RIGHT END = -1.115E+04

PROB
PR103 MULTI-STORY FRAME AFTER HM/BRG - NO SIDESWAY

TABLE 14 (CONT)

** VERTL ** MEMBER OF TYPE 7 BETWEEN JOINTS 7 AND 11

AXIAL FORCE	=	-3.044E+03
MOMENT AT LEFT END	=	1.337E+05
SHEAR AT LEFT END	=	-4.185E+03
MOMENT AT RIGHT END	=	-3.685E+05
SHEAR AT RIGHT END	=	-4.185E+03

** VERTL ** MEMBER OF TYPE 3 BETWEEN JOINTS 11 AND 15

AXIAL FORCE	=	-8.984E+02
MOMENT AT LEFT END	=	-2.557E+04
SHEAR AT LEFT END	=	4.943E+02
MOMENT AT RIGHT END	=	3.375E+04
SHEAR AT RIGHT END	=	4.943E+02

** VERTL ** MEMBER OF TYPE 11 BETWEEN JOINTS 4 AND 8

AXIAL FORCE	=	-2.603E+04
MOMENT AT LEFT END	=	-1.353E+06
SHEAR AT LEFT END	=	1.427E+04
MOMENT AT RIGHT END	=	6.478E+05
SHEAR AT RIGHT END	=	1.323E+04

** VERTL ** MEMBER OF TYPE 7 BETWEEN JOINTS 8 AND 12

AXIAL FORCE	=	-2.332E+03
MOMENT AT LEFT END	=	-1.088E+05
SHEAR AT LEFT END	=	4.341E+03
MOMENT AT RIGHT END	=	4.121E+05
SHEAR AT RIGHT END	=	4.341E+03

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
1	4	9	3	0	-0	0	-0.	-0.

TABLE 2 -- X AND Y LINE COORDINATES

NXL = 3
NYL = 3

X LINE	COORDINATE
1	0.
2	2.160E+02
3	4.320E+02

Y LINE	COORDINATE
1	0.
2	4.440E+02
3	6.060E+02

```
PROB
PR201     TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 3 -- MEMBER TYPE DATA


      TYPE    M KODE   NDC        H

        1    18     1     1 1.200E+01

FROM TO CONTD      F            Q            S            T            R            AF

   0  18 -0    4.950E+08 -0.          -0.          -0.          -0.          5.450E+06


      TYPE    M KODE   NDC        H

        2    18     2     2 9.000E+00

FROM TO CONTD      F            Q            S            T            R            AF

   0  18 -0    1.990E+08 -0.          -0.          -0.          -0.          3.530E+06
   9   9 -0   -0.          1.520E+00 -0.          -0.          -0.         -0.


      TYPE    M KODE   NDC        H

        3    18     1     1 1.200E+01

FROM TO CONTD      F            Q            S            T            R            AF

   0  18 -0    4.050E+08 -0.          -0.          -0.          -0.          5.400E+06


      TYPE    M KODE   NDC        H

        4    37     2     2 1.200E+01

FROM TO CONTD      F            Q            S            T            R            AE

   0  37 -0    4.130E+08 -0.          -0.          -0.          -0.          5.100E+06
  14  14 -0   -0.          3.360E+00 -0.          -0.          -0.         -0.
```

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 4 -- MEMBER INCIDENCE DATA

ALONG Y LINE	MEMBER TYPES BETWEEN X LINES 1 2	2 3
1	0	0
2	3	3
3	1	1

ALONG X LINE	MEMBER TYPES BETWEEN Y LINES 1 2	2 3
1	4	2
2	4	2
3	4	2

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

LEFT END X LINE	LEFT END Y LINE	RIGHT END X LINE	RIGHT END Y LINE	MEMBER TYPE
NONE				

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

X LINE	Y LINE	PX	PY	PZ	SX	SY	SZ
1	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
2	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
3	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
1	2	-0.	-3.000E+01	-0.	-0.	-0.	-0.
2	2	-0.	-3.000E+01	-0.	-0.	-0.	-0.
3	2	-0.	-3.000E+01	-0.	-0.	-0.	-0.
1	3	2.160E+01	-1.840E+02	-0.	-0.	-0.	-0.
2	3	-0.	-1.840E+02	-0.	-0.	-0.	-0.
3	3	-0.	-2.190E+02	-0.	-0.	-0.	-0.

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE		
Y LINE	1	2	3
3	7	8	9
2	4	5	6
1	1	2	3

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	1.156E-19	-1.898E-18	-2.690E-17
2	1.317E-19	-2.163E-18	-2.930E-17
3	1.151E-19	-2.709E-18	-2.683E-17
4	2.403E-01	-1.652E-02	-2.488E-04
5	2.403E-01	-1.884E-02	-1.203E-04
6	2.402E-01	-2.358E-02	-2.523E-04
7	2.772E-01	-2.468E-02	-6.884E-05
8	2.766E-01	-2.734E-02	-5.205E-05
9	2.764E-01	-3.385E-02	-8.320E-05

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
1	-1.156E+01	1.898E+02	2.690E+03
2	-1.317E+01	2.163E+02	2.930E+03
3	-1.151E+01	2.709E+02	2.683E+03

```
PROB
PR201     TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14--- INDIVIDUAL MEMBER DATA
            (DESIGNERS SIGN CONVENTION)


        **   HORIZ   ** MEMBER OF TYPE   3 BETWEEN JOINTS   4 AND   5

             AXIAL FORCE             =   1.138E+00
             MOMENT AT LEFT END      =   2.184E+03
             SHEAR AT LEFT END       =  -1.800E+01
             MOMENT AT RIGHT END     =  -1.703E+03
             SHEAR AT RIGHT END      =  -1.800E+01


        **   HORIZ   ** MEMBER OF TYPE   3 BETWEEN JOINTS   5 AND   6

             AXIAL FORCE             =  -2.330E+00
             MOMENT AT LEFT END      =   1.590E+03
             SHEAR AT LEFT END       =  -1.701E+01
             MOMENT AT RIGHT END     =  -2.085E+03
             SHEAR AT RIGHT END      =  -1.701E+01


        **   HORIZ   ** MEMBER OF TYPE   1 BETWEEN JOINTS   7 AND   8

             AXIAL FORCE             =  -1.606E+01
             MOMENT AT LEFT END      =   6.963E+02
             SHEAR AT LEFT END       =  -6.091E+00
             MOMENT AT RIGHT END     =  -6.194E+02
             SHEAR AT RIGHT END      =  -6.091E+00


        **   HORIZ   ** MEMBER OF TYPE   1 BETWEEN JOINTS   8 AND   9

             AXIAL FORCE             =  -4.300E+00
             MOMENT AT LEFT END      =   4.408E+02
             SHEAR AT LEFT END       =  -4.742E+00
             MOMENT AT RIGHT END     =  -5.836E+02
             SHEAR AT RIGHT END      =  -4.742E+00
```

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 1 AND 4

AXIAL FORCE = -1.898E+02

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	2.403E-01		-1.873E+03		8.181E+00
			-2.760E-04		8.181E+00	
1	1.200E+01	2.370E-01		-1.775E+03		-5.096E-09
			-3.275E-04		8.181E+00	
2	2.400E+01	2.330E-01		-1.677E+03		-2.548E-09
			-3.763E-04		8.181E+00	
3	3.600E+01	2.285E-01		-1.579E+03		-2.122E-09
			-4.221E-04		8.181E+00	
4	4.800E+01	2.234E-01		-1.480E+03		-4.244E-10
			-4.651E-04		8.181E+00	
5	6.000E+01	2.179E-01		-1.382E+03		4.244E-10
			-5.053E-04		8.181E+00	
6	7.200E+01	2.118E-01		-1.284E+03		-2.547E-09
			-5.426E-04		8.181E+00	
7	8.400E+01	2.053E-01		-1.186E+03		4.244E-10
			-5.771E-04		8.181E+00	
8	9.600E+01	1.984E-01		-1.088E+03		-8.501E-10
			-6.087E-04		8.181E+00	
9	1.080E+02	1.911E-01		-9.895E+02		-1.273E-09
			-6.374E-04		8.181E+00	
10	1.200E+02	1.834E-01		-8.913E+02		-8.495E-10
			-6.633E-04		8.181E+00	
11	1.320E+02	1.754E-01		-7.932E+02		-1.698E-09
			-6.864E-04		8.181E+00	
12	1.440E+02	1.672E-01		-6.950E+02		-8.495E-10
			-7.066E-04		8.181E+00	
13	1.560E+02	1.587E-01		-5.968E+02		6.369E-10
			-7.239E-04		8.181E+00	
14	1.680E+02	1.500E-01		-4.986E+02		-1.333E-09
			-7.384E-04		1.154E+01	
15	1.800E+02	1.412E-01		-3.601E+02		1.061E-09
			-7.489E-04		1.154E+01	
16	1.920E+02	1.322E-01		-2.216E+02		-1.274E-09
			-7.553E-04		1.154E+01	
17	2.040E+02	1.231E-01		-8.315E+01		2.122E-10
			-7.577E-04		1.154E+01	
18	2.160E+02	1.140E-01		5.535E+01		-2.122E-10
			-7.561E-04		1.154E+01	
19	2.280E+02	1.050E-01		1.938E+02		2.124E-10
			-7.505E-04		1.154E+01	

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
20	2.400E+02	9.596E-02		3.323E+02		-6.366E-10
			-7.408E-04		1.154E+01	
21	2.520E+02	8.707E-02		4.708E+02		-2.122E-10
			-7.271E-04		1.154E+01	
22	2.640E+02	7.835E-02		6.093E+02		-1.058E-10
			-7.094E-04		1.154E+01	
23	2.760E+02	6.983E-02		7.478E+02		-1.064E-10
			-6.877E-04		1.154E+01	
24	2.880E+02	6.158E-02		8.863E+02		-3.183E-10
			-6.619E-04		1.154E+01	
25	3.000E+02	5.364E-02		1.025E+03		-2.638E-10
			-6.322E-04		1.154E+01	
26	3.120E+02	4.605E-02		1.163E+03		-1.055E-10
			-5.984E-04		1.154E+01	
27	3.240E+02	3.887E-02		1.302E+03		2.122E-10
			-5.605E-04		1.154E+01	
28	3.360E+02	3.215E-02		1.440E+03		-3.978E-10
			-5.187E-04		1.154E+01	
29	3.480E+02	2.592E-02		1.579E+03		5.275E-11
			-4.728E-04		1.154E+01	
30	3.600E+02	2.025E-02		1.717E+03		1.067E-10
			-4.229E-04		1.154E+01	
31	3.720E+02	1.517E-02		1.856E+03		-1.328E-10
			-3.690E-04		1.154E+01	
32	3.840E+02	1.074E-02		1.994E+03		-6.063E-12
			-3.111E-04		1.154E+01	
33	3.960E+02	7.011E-03		2.133E+03		-3.395E-11
			-2.491E-04		1.154E+01	
34	4.080E+02	4.022E-03		2.271E+03		-3.274E-11
			-1.831E-04		1.154E+01	
35	4.200E+02	1.825E-03		2.410E+03		4.851E-12
			-1.131E-04		1.154E+01	
36	4.320E+02	4.684E-04		2.548E+03		-1.683E-11
			-3.903E-05		1.154E+01	
37	4.440E+02	1.156E-19		2.687E+03		-1.154E+01

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 4 AND 7

AXIAL FORCE = -1.779E+02

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	2.772E-01		-6.973E+02		5.500E+00
			-8.461E-05		5.500E+00	
1	9.000E+00	2.764E-01		-6.478E+02		-1.018E-08
			-1.139E-04		5.500E+00	
2	1.800E+01	2.754E-01		-5.983E+02		-3.395E-09
			-1.410E-04		5.500E+00	
3	2.700E+01	2.741E-01		-5.488E+02		-2.909E-09
			-1.658E-04		5.500E+00	
4	3.600E+01	2.727E-01		-4.993E+02		-2.424E-09
			-1.884E-04		5.500E+00	
5	4.500E+01	2.710E-01		-4.498E+02		-2.021E-13
			-2.087E-04		5.500E+00	
6	5.400E+01	2.691E-01		-4.003E+02		-3.395E-09
			-2.268E-04		5.500E+00	
7	6.300E+01	2.670E-01		-3.508E+02		-1.940E-09
			-2.427E-04		5.500E+00	
8	7.200E+01	2.649E-01		-3.013E+02		-4.848E-10
			-2.563E-04		5.500E+00	
9	8.100E+01	2.625E-01		-2.518E+02		2.146E-09
			-2.677E-04		7.020E+00	
10	9.000E+01	2.601E-01		-1.886E+02		-1.455E-09
			-2.762E-04		7.020E+00	
11	9.900E+01	2.577E-01		-1.254E+02		-1.940E-09
			-2.819E-04		7.020E+00	
12	1.080E+02	2.551E-01		-6.226E+01		-1.455E-09
			-2.847E-04		7.020E+00	
13	1.170E+02	2.526E-01		9.186E-01		-4.849E-10
			-2.847E-04		7.020E+00	
14	1.260E+02	2.500E-01		6.410E+01		-1.940E-09
			-2.818E-04		7.020E+00	
15	1.350E+02	2.475E-01		1.273E+02		-2.424E-10
			-2.760E-04		7.020E+00	
16	1.440E+02	2.450E-01		1.905E+02		-2.667E-09
			-2.674E-04		7.020E+00	
17	1.530E+02	2.426E-01		2.536E+02		1.137E-13
			-2.559E-04		7.020E+00	
18	1.620E+02	2.403E-01		3.168E+02		-7.020E+00

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 2 AND 5

AXIAL FORCE = -2.163E+02

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	2.403E-01		-2.351E+03		9.796E+00
			-1.545E-04		9.796E+00	
1	1.200E+01	2.395E-01		-2.233E+03		-7.218E-09
			-2.194E-04		9.796E+00	
2	2.400E+01	2.358E-01		-2.116E+03		-2.970E-09
			-2.809E-04		9.796E+00	
3	3.600E+01	2.325E-01		-1.998E+03		-4.262E-10
			-3.389E-04		9.796E+00	
4	4.800E+01	2.294E-01		-1.881E+03		-1.273E-09
			-3.936E-04		9.796E+00	
5	6.000E+01	2.237E-01		-1.763E+03		-1.213E-12
			-4.448E-04		9.796E+00	
6	7.200E+01	2.193E-01		-1.646E+03		-2.122E-09
			-4.926E-04		9.796E+00	
7	8.400E+01	2.124E-01		-1.528E+03		4.244E-10
			-5.370E-04		9.796E+00	
8	9.600E+01	2.060E-01		-1.411E+03		-1.274E-09
			-5.780E-04		9.796E+00	
9	1.080E+02	1.990E-01		-1.293E+03		-1.273E-09
			-6.156E-04		9.796E+00	
10	1.200E+02	1.916E-01		-1.175E+03		-1.213E-12
			-6.497E-04		9.796E+00	
11	1.320E+02	1.838E-01		-1.058E+03		-2.547E-09
			-6.805E-04		9.796E+00	
12	1.440E+02	1.757E-01		-9.404E+02		-8.483E-10
			-7.078E-04		9.796E+00	
13	1.560E+02	1.672E-01		-8.228E+02		4.238E-10
			-7.317E-04		9.796E+00	
14	1.680E+02	1.584E-01		-7.053E+02		-6.967E-10
			-7.522E-04		1.316E+01	
15	1.800E+02	1.494E-01		-5.474E+02		4.250E-10
			-7.681E-04		1.316E+01	
16	1.920E+02	1.402E-01		-3.895E+02		-1.061E-09
			-7.794E-04		1.316E+01	
17	2.040E+02	1.308E-01		-2.317E+02		4.244E-10
			-7.861E-04		1.316E+01	
18	2.160E+02	1.214E-01		-7.379E+01		-6.368E-10
			-7.883E-04		1.316E+01	
19	2.280E+02	1.119E-01		8.408E+01		8.490E-10
			-7.858E-04		1.316E+01	
20	2.400E+02	1.025E-01		2.419E+02		-1.273E-09
			-7.788E-04		1.316E+01	
21	2.520E+02	9.314E-02		3.998E+02		1.061E-10
			-7.672E-04		1.316E+01	
22	2.640E+02	8.394E-02		5.577E+02		-1.055E-10

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
			-7.510E-04		1.316E+01	
23	2.760E+02	7.493E-02		7.156E+02		-3.183E-10
			-7.302E-04		1.316E+01	
24	2.880E+02	6.616E-02		8.734E+02		-4.250E-10
			-7.048E-04		1.316E+01	
25	3.000E+02	5.771E-02		1.031E+03		-1.055E-10
			-6.749E-04		1.316E+01	
26	3.120E+02	4.961E-02		1.189E+03		6.063E-13
			-6.403E-04		1.316E+01	
27	3.240E+02	4.192E-02		1.347E+03		-1.595E-10
			-6.012E-04		1.316E+01	
28	3.360E+02	3.471E-02		1.505E+03		1.213E-12
			-5.574E-04		1.316E+01	
29	3.480E+02	2.802E-02		1.663E+03		-8.004E-11
			-5.091E-04		1.316E+01	
30	3.600E+02	2.191E-02		1.821E+03		0.
			-4.562E-04		1.316E+01	
31	3.720E+02	1.644E-02		1.979E+03		0.
			-3.987E-04		1.316E+01	
32	3.840E+02	1.165E-02		2.136E+03		-8.974E-11
			-3.367E-04		1.316E+01	
33	3.960E+02	7.610E-03		2.294E+03		-5.214E-11
			-2.700E-04		1.316E+01	
34	4.080E+02	4.370E-03		2.452E+03		2.910E-11
			-1.988E-04		1.316E+01	
35	4.200E+02	1.985E-03		2.610E+03		-4.123E-11
			-1.229E-04		1.316E+01	
36	4.320E+02	5.101E-04		2.768E+03		-4.547E-12
			-4.250E-05		1.316E+01	
37	4.440E+02	1.317E-19		2.926E+03		-1.316E+01

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 5 AND 8

AXIAL FORCE = -1.854E+02

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	2.766E-01		-1.061E+03		1.169E+01
			-7.604E-05		1.169E+01	
1	9.000E+00	2.759E-01		-9.560E+02		-1.212E-08
			-1.193E-04		1.169E+01	
2	1.800E+01	2.748E-01		-8.508E+02		-2.425E-09

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
			-1.578E-04		1.169E+01	
3	2.700E+01	2.734E-01		-7.457E+02		-2.909E-09
			-1.915E-04		1.169E+01	
4	3.600E+01	2.717E-01		-6.405E+02		-1.455E-09
			-2.204E-04		1.169E+01	
5	4.500E+01	2.697E-01		-5.353E+02		-1.940E-09
			-2.447E-04		1.169E+01	
6	5.400E+01	2.675E-01		-4.302E+02		-9.697E-10
			-2.641E-04		1.169E+01	
7	6.300E+01	2.651E-01		-3.250E+02		-3.879E-09
			-2.788E-04		1.169E+01	
8	7.200E+01	2.626E-01		-2.198E+02		9.698E-10
			-2.888E-04		1.169E+01	
9	8.100E+01	2.600E-01		-1.147E+02		2.068E-10
			-2.939E-04		1.321E+01	
10	9.000E+01	2.573E-01		4.176E+00		9.699E-10
			-2.938E-04		1.321E+01	
11	9.900E+01	2.547E-01		1.230E+02		-3.394E-09
			-2.882E-04		1.321E+01	
12	1.080E+02	2.521E-01		2.419E+02		-4.849E-10
			-2.773E-04		1.321E+01	
13	1.170E+02	2.496E-01		3.607E+02		-1.455E-09
			-2.609E-04		1.321E+01	
14	1.260E+02	2.473E-01		4.796E+02		-1.454E-09
			-2.392E-04		1.321E+01	
15	1.350E+02	2.451E-01		5.984E+02		-9.697E-10
			-2.122E-04		1.321E+01	
16	1.440E+02	2.432E-01		7.172E+02		-1.454E-09
			-1.797E-04		1.321E+01	
17	1.530E+02	2.416E-01		8.361E+02		-1.213E-09
			-1.419E-04		1.321E+01	
18	1.620E+02	2.403E-01		9.549E+02		-1.321E+01

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 3 AND 6

AXIAL FORCE = -2.709E+02

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	2.402E-01		-1.860E+03		8.135E+00
			-2.793E-04		8.135E+00	
1	1.200E+01	2.369E-01		-1.762E+03		-6.369E-09

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
			-3.305E-04		8.135E+00	
2	2.400E+01	2.329E-01		-1.664E+03		-1.274E-09
			-3.788E-04		8.135E+00	
3	3.600E+01	2.284E-01		-1.567E+03		-2.547E-09
			-4.243E-04		8.135E+00	
4	4.800E+01	2.233E-01		-1.469E+03		-4.250E-10
			-4.670E-04		8.135E+00	
5	6.000E+01	2.177E-01		-1.371E+03		-4.256E-10
			-5.069E-04		8.135E+00	
6	7.200E+01	2.116E-01		-1.274E+03		-8.495E-10
			-5.439E-04		8.135E+00	
7	8.400E+01	2.050E-01		-1.176E+03		-8.489E-10
			-5.781E-04		8.135E+00	
8	9.600E+01	1.981E-01		-1.079E+03		-8.504E-10
			-6.094E-04		8.135E+00	
9	1.080E+02	1.908E-01		-9.810E+02		-4.247E-10
			-6.379E-04		8.135E+00	
10	1.200E+02	1.831E-01		-8.833E+02		-8.489E-10
			-6.636E-04		8.135E+00	
11	1.320E+02	1.752E-01		-7.857E+02		-1.699E-09
			-6.864E-04		8.135E+00	
12	1.440E+02	1.669E-01		-6.881E+02		-1.698E-09
			-7.064E-04		8.135E+00	
13	1.560E+02	1.585E-01		-5.905E+02		2.116E-10
			-7.235E-04		8.135E+00	
14	1.680E+02	1.498E-01		-4.929E+02		7.897E-10
			-7.379E-04		1.149E+01	
15	1.800E+02	1.409E-01		-3.549E+02		-6.367E-10
			-7.482E-04		1.149E+01	
16	1.920E+02	1.320E-01		-2.170E+02		-6.369E-10
			-7.545E-04		1.149E+01	
17	2.040E+02	1.229E-01		-7.906E+01		-2.123E-10
			-7.568E-04		1.149E+01	
18	2.160E+02	1.138E-01		5.888E+01		2.124E-10
			-7.551E-04		1.149E+01	
19	2.280E+02	1.048E-01		1.968E+02		1.516E-13
			-7.493E-04		1.149E+01	
20	2.400E+02	9.576E-02		3.348E+02		-6.369E-10
			-7.396E-04		1.149E+01	
21	2.520E+02	8.689E-02		4.727E+02		-1.061E-10
			-7.259E-04		1.149E+01	
22	2.640E+02	7.818E-02		6.106E+02		1.064E-10
			-7.081E-04		1.149E+01	

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
23	2.760E+02	6.968E-02		7.486E+02		-6.363E-10
			-6.864E-04		1.149E+01	
24	2.880E+02	6.144E-02		8.865E+02		-1.067E-10
			-6.606E-04		1.149E+01	
25	3.000E+02	5.352E-02		1.024E+03		-1.570E-10
			-6.309E-04		1.149E+01	
26	3.120E+02	4.595E-02		1.162E+03		0.
			-5.971E-04		1.149E+01	
27	3.240E+02	3.878E-02		1.300E+03		-1.061E-10
			-5.593E-04		1.149E+01	
28	3.360E+02	3.207E-02		1.438E+03		-1.861E-10
			-5.175E-04		1.149E+01	
29	3.480E+02	2.586E-02		1.576E+03		5.457E-11
			-4.717E-04		1.149E+01	
30	3.600E+02	2.020E-02		1.714E+03		8.004E-11
			-4.219E-04		1.149E+01	
31	3.720E+02	1.513E-02		1.852E+03		-1.201E-10
			-3.681E-04		1.149E+01	
32	3.840E+02	1.072E-02		1.990E+03		-3.274E-11
			-3.103E-04		1.149E+01	
33	3.960E+02	6.994E-03		2.128E+03		-3.274E-11
			-2.485E-04		1.149E+01	
34	4.080E+02	4.012E-03		2.266E+03		-2.183E-11
			-1.826E-04		1.149E+01	
35	4.200E+02	1.821E-03		2.404E+03		-8.489E-12
			-1.128E-04		1.149E+01	
36	4.320E+02	4.672E-04		2.542E+03		-1.273E-11
			-3.893E-05		1.149E+01	
37	4.440E+02	1.151E-19		2.680E+03		-1.149E+01

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 6 AND 9

AXIAL FORCE = -2.238E+02

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
0	0.	2.764E-01		-5.842E+02		4.269E+00
			-9.641E-05		4.269E+00	
1	9.000E+00	2.755E-01		-5.458E+02		-9.699E-09
			-1.211E-04		4.269E+00	
2	1.800E+01	2.744E-01		-5.074E+02		-2.424E-09
			-1.440E-04		4.269E+00	

PROB
PR201 TWO-BAY BENT, LOADS APPLIED TO MEMBERS

TABLE 14 (CONT)

STA I	DIST	DEFL	SLOPE	MOM	SHEAR	SUP REACT
3	2.700E+01	2.731E-01		-4.690E+02		-4.364E-09
			-1.652E-04		4.269E+00	
4	3.600E+01	2.717E-01		-4.305E+02		-1.455E-09
			-1.847E-04		4.269E+00	
5	4.500E+01	2.700E-01		-3.921E+02		-4.851E-10
			-2.025E-04		4.269E+00	
6	5.400E+01	2.682E-01		-3.537E+02		-2.425E-09
			-2.185E-04		4.269E+00	
7	6.300E+01	2.662E-01		-3.153E+02		-2.425E-09
			-2.327E-04		4.269E+00	
8	7.200E+01	2.641E-01		-2.769E+02		-4.853E-10
			-2.452E-04		4.269E+00	
9	8.100E+01	2.619E-01		-2.384E+02		2.147E-09
			-2.560E-04		5.789E+00	
10	9.000E+01	2.596E-01		-1.863E+02		-1.455E-09
			-2.644E-04		5.789E+00	
11	9.900E+01	2.572E-01		-1.342E+02		-1.455E-09
			-2.705E-04		5.789E+00	
12	1.080E+02	2.548E-01		-8.215E+01		-1.940E-09
			-2.742E-04		5.789E+00	
13	1.170E+02	2.523E-01		-3.005E+01		-4.849E-10
			-2.756E-04		5.789E+00	
14	1.260E+02	2.498E-01		2.205E+01		-2.909E-09
			-2.746E-04		5.789E+00	
15	1.350E+02	2.474E-01		7.415E+01		1.212E-09
			-2.712E-04		5.789E+00	
16	1.440E+02	2.449E-01		1.262E+02		-3.152E-09
			-2.655E-04		5.789E+00	
17	1.530E+02	2.425E-01		1.783E+02		-2.424E-10
			-2.575E-04		5.789E+00	
18	1.620E+02	2.402E-01		2.304E+02		-5.789E+00

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
1	5	15	1	0	-0	0	-0.	-0.

TABLE 2 -- X AND Y LINE COORDINATES

NXL = 3
NYL = 5

X LINE	COORDINATE
1	0.
2	2.160E+02
3	4.320E+02

Y LINE	COORDINATE
1	0.
2	2.760E+02
3	4.440E+02
4	5.250E+02
5	6.060E+02

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

TABLE 3 -- MEMBER TYPE DATA

TYPE	M	KODE	NDC	H
1	18	1	1	1.200E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	18	-0	4.950E+08	-0.	-0.	-0.	-0.	5.450E+06

TYPE	M	KODE	NDC	H
2	9	1	1	9.000E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	9	-0	1.990E+08	-0.	-0.	-0.	-0.	3.530E+06

TYPE	M	KODE	NDC	H
3	18	1	1	1.200E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	18	-0	4.050E+08	-0.	-0.	-0.	-0.	5.400E+06

TYPE	M	KODE	NDC	H
4	14	1	1	1.200E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	14	-0	4.130E+08	-0.	-0.	-0.	-0.	5.100E+06

TYPE	M	KODE	NDC	H
5	23	1	1	1.200E+01

TABLE 3 (CONT)

FROM	TO	CONTD	F	Q	S	T	R	AF
0	23	-0	4.130E+08	-0.	-0.	-0.	-0.	5.100E+06

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

TABLE 4 -- MEMBER INCIDENCE DATA

ALONG Y LINE	MEMBER TYPES BETWEEN X LINES 1	2	3
1	0	0	
2	0	0	
3	3	3	
4	0	0	
5	1	1	

ALONG X LINE	MEMBER TYPES BETWEEN Y LINES 1	2	3	4	5
1	5	4	2	2	
2	5	4	2	2	
3	5	4	2	2	

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

LEFT END X LINE	LEFT END Y LINE	RIGHT END X LINE	RIGHT END Y LINE	MEMBER TYPE

NONE

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

X LINE	Y LINE	PX	PY	PZ	SX	SY	SZ
1	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
2	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
3	1	-0.	-0.	-0.	1.000E+20	1.000E+20	1.000E+20
2	5	-0.	-1.840E+02	-0.	-0.	-0.	-0.
1	5	2.160E+01	-1.840E+02	-0.	-0.	-0.	-0.
3	4	1.520E+00	-0.	-0.	-0.	-0.	-0.
2	4	1.520E+00	-0.	-0.	-0.	-0.	-0.
1	4	1.520E+00	-0.	-0.	-0.	-0.	-0.
1	3	-0.	-3.000E+01	-0.	-0.	-0.	-0.
2	3	-0.	-3.000E+01	-0.	-0.	-0.	-0.
3	3	-0.	-3.000E+01	-0.	-0.	-0.	-0.
1	2	3.360E+00	-0.	-0.	-0.	-0.	-0.
2	2	3.360E+00	-0.	-0.	-0.	-0.	-0.
3	2	3.360E+00	-0.	-0.	-0.	-0.	-0.
3	5	-0.	-2.190E+02	-0.	-0.	-0.	-0.

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE		
Y LINE	1	2	3
5	13	14	15
4	10	11	12
3	7	8	9
2	4	5	6
1	1	2	3

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	1.156E-19	-1.898E-18	-2.690E-17
2	1.317E-19	-2.163E-18	-2.930E-17
3	1.151E-19	-2.709E-18	-2.683E-17
4	1.500E-01	-1.027E-02	-7.320E-04
5	1.584E-01	-1.171E-02	-7.429E-04
6	1.498E-01	-1.466E-02	-7.316E-04
7	2.403E-01	-1.652E-02	-2.488E-04
8	2.403E-01	-1.884E-02	-1.203E-04
9	2.402E-01	-2.358E-02	-2.523E-04
10	2.626E-01	-2.060E-02	-2.626E-04
11	2.600E-01	-2.309E-02	-2.926E-04
12	2.619E-01	-2.872E-02	-2.511E-04
13	2.772E-01	-2.468E-02	-6.884E-05
14	2.766E-01	-2.734E-02	-5.205E-05
15	2.764E-01	-3.385E-02	-8.320E-05

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
1	-1.156E+01	1.898E+02	2.690E+03
2	-1.317E+01	2.163E+02	2.930E+03
3	-1.151E+01	2.709E+02	2.683E+03

```
PROB
PR202      TWO-BAY BENT, LOADS APPLIED TO JOINTS


TABLE 14---- INDIVIDUAL MEMBER DATA
             (DESIGNERS SIGN CONVENTION)



        **  HORIZ  ** MEMBER OF TYPE   3 BETWEEN JOINTS   7 AND   8

             AXIAL FORCE               =   1.138E+00
             MOMENT AT LEFT END        =   2.184E+03
             SHEAR AT LEFT END         =  -1.800E+01
             MOMENT AT RIGHT END       =  -1.703E+03
             SHEAR AT RIGHT END        =  -1.800E+01



        **  HORIZ  ** MEMBER OF TYPE   3 BETWEEN JOINTS   8 AND   9

             AXIAL FORCE               =  -2.330E+00
             MOMENT AT LEFT END        =   1.590E+03
             SHEAR AT LEFT END         =  -1.701E+01
             MOMENT AT RIGHT END       =  -2.085E+03
             SHEAR AT RIGHT END        =  -1.701E+01



        **  HORIZ  ** MEMBER OF TYPE   1 BETWEEN JOINTS  13 AND  14

             AXIAL FORCE               =  -1.606E+01
             MOMENT AT LEFT END        =   6.963E+02
             SHEAR AT LEFT END         =  -6.091E+00
             MOMENT AT RIGHT END       =  -6.194E+02
             SHEAR AT RIGHT END        =  -6.091E+00



        **  HORIZ  ** MEMBER OF TYPE   1 BETWEEN JOINTS  14 AND  15

             AXIAL FORCE               =  -4.300E+00
             MOMENT AT LEFT END        =   4.408E+02
             SHEAR AT LEFT END         =  -4.742E+00
             MOMENT AT RIGHT END       =  -5.836E+02
             SHEAR AT RIGHT END        =  -4.742E+00
```

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

TABLE 14 (CONT)

** VERTL ** MEMBER OF TYPE 5 BETWEEN JOINTS 1 AND 4

AXIAL FORCE	=	-1.898E+02
MOMENT AT LEFT END	=	-4.935E+02
SHEAR AT LEFT END	=	1.151E+01
MOMENT AT RIGHT END	=	2.684E+03
SHEAR AT RIGHT END	=	1.151E+01

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 4 AND 7

AXIAL FORCE	=	-1.898E+02
MOMENT AT LEFT END	=	-1.870E+03
SHEAR AT LEFT END	=	8.114E+00
MOMENT AT RIGHT END	=	-5.064E+02
SHEAR AT RIGHT END	=	8.114E+00

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 7 AND 10

AXIAL FORCE	=	-1.779E+02
MOMENT AT LEFT END	=	-2.449E+02
SHEAR AT LEFT END	=	6.888E+00
MOMENT AT RIGHT END	=	3.130E+02
SHEAR AT RIGHT END	=	6.888E+00

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 10 AND 13

AXIAL FORCE	=	-1.779E+02
MOMENT AT LEFT END	=	-6.950E+02
SHEAR AT LEFT END	=	5.405E+00
MOMENT AT RIGHT END	=	-2.572E+02
SHEAR AT RIGHT END	=	5.405E+00

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

TABLE 14 (CONT)

** VERTL ** MEMBER OF TYPE 5 BETWEEN JOINTS 2 AND 5

```
AXIAL FORCE            = -2.163E+02
MOMENT AT LEFT END     = -6.994E+02
SHEAR AT LEFT END      =  1.312E+01
MOMENT AT RIGHT END    =  2.923E+03
SHEAR AT RIGHT END     =  1.312E+01
```

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 5 AND 8

```
AXIAL FORCE            = -2.163E+02
MOMENT AT LEFT END     = -2.347E+03
SHEAR AT LEFT END      =  9.714E+00
MOMENT AT RIGHT END    = -7.145E+02
SHEAR AT RIGHT END     =  9.714E+00
```

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 8 AND 11

```
AXIAL FORCE            = -1.854E+02
MOMENT AT LEFT END     = -1.017E+02
SHEAR AT LEFT END      =  1.296E+01
MOMENT AT RIGHT END    =  9.482E+02
SHEAR AT RIGHT END     =  1.296E+01
```

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 11 AND 14

```
AXIAL FORCE            = -1.854E+02
MOMENT AT LEFT END     = -1.056E+03
SHEAR AT LEFT END      =  1.148E+01
MOMENT AT RIGHT END    = -1.261E+02
SHEAR AT RIGHT END     =  1.148E+01
```

PROB
PR202 TWO-BAY BENT, LOADS APPLIED TO JOINTS

TABLE 14 (CONT)

```
**  VERTL  ** MEMBER OF TYPE   5 BETWEEN JOINTS   3 AND   6

     AXIAL FORCE              =  -2.709E+02
     MOMENT AT LEFT END       =  -4.877E+02
     SHEAR AT LEFT END        =   1.147E+01
     MOMENT AT RIGHT END      =   2.677E+03
     SHEAR AT RIGHT END       =   1.147E+01


**  VERTL  ** MEMBER OF TYPE   4 BETWEEN JOINTS   6 AND   9

     AXIAL FORCE              =  -2.709E+02
     MOMENT AT LEFT END       =  -1.856E+03
     SHEAR AT LEFT END        =   8.068E+00
     MOMENT AT RIGHT END      =  -5.006E+02
     SHEAR AT RIGHT END       =   8.068E+00


**  VERTL  ** MEMBER OF TYPE   2 BETWEEN JOINTS   9 AND  12

     AXIAL FORCE              =  -2.238E+02
     MOMENT AT LEFT END       =  -2.328E+02
     SHEAR AT LEFT END        =   5.680E+00
     MOMENT AT RIGHT END      =   2.273E+02
     SHEAR AT RIGHT END       =   5.680E+00


**  VERTL  ** MEMBER OF TYPE   2 BETWEEN JOINTS  12 AND  15

     AXIAL FORCE              =  -2.238E+02
     MOMENT AT LEFT END       =  -5.825E+02
     SHEAR AT LEFT END        =   4.196E+00
     MOMENT AT RIGHT END      =  -2.426E+02
     SHEAR AT RIGHT END       =   4.196E+00
```

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
2	0	9	1	0	0	0	-0.	-0.

TABLE 2 -- X AND Y LINE COORDINATES

USING X AND Y LINE DATA FROM PREVIOUS PROBLEM

TABLE 3 -- MEMBER TYPE DATA

USING DATA FROM PREVIOUS PROBLEM PLUS THE FOLLOWING

NONE

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

TABLE 4 -- MEMBER INCIDENCE DATA

ALONG Y LINE	MEMBER TYPES BETWEEN X LINES 1	2	3
1		0	0
2		0	0
3		3	3
4		0	0
5		1	1

ALONG X LINE	MEMBER TYPES BETWEEN Y LINES 1	2	3	4	5
1		5	4	2	2
2		5	4	2	2
3		5	4	2	2

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

LEFT END X LINE	LEFT END Y LINE	RIGHT END X LINE	RIGHT END Y LINE	MEMBER TYPE

NO ADDITIONAL DATA

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

USING PREVIOUS DATA PLUS

X LINE	Y LINE	PX	PY	PZ	SX	SY	SZ
1	2	-2.260E+00	-0.	-0.	-0.	-0.	-0.
2	2	-2.260E+00	-0.	-0.	-0.	-0.	-0.
3	2	-2.260E+00	-0.	-0.	-0.	-0.	-0.
1	4	-1.020E+00	-0.	-0.	-0.	-0.	-0.
2	4	-1.020E+00	-0.	-0.	-0.	-0.	-0.
3	4	-1.020E+00	-0.	-0.	-0.	-0.	-0.
1	5	-7.400E+00	-1.320E+02	-0.	-0.	-0.	-0.
2	5	-0.	-1.320E+02	-0.	-0.	-0.	-0.
3	5	-0.	-1.070E+02	-0.	-0.	-0.	-0.

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

Y LINE	X LINE 1	2	3
5	13	14	15
4	10	11	12
3	7	8	9
2	4	5	6
1	1	2	3

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	6.021E-20	-3.321E-18	-1.434E-17
2	6.961E-20	-3.467E-18	-1.573E-17
3	6.018E-20	-3.692E-18	-1.434E-17
4	8.117E-02	-1.797E-02	-4.031E-04
5	8.604E-02	-1.877E-02	-4.095E-04
6	8.115E-02	-1.998E-02	-4.030E-04
7	1.317E-01	-2.891E-02	-1.423E-04
8	1.317E-01	-3.019E-02	-6.770E-05
9	1.317E-01	-3.214E-02	-1.425E-04
10	1.447E-01	-3.608E-02	-1.561E-04
11	1.433E-01	-3.745E-02	-1.743E-04
12	1.444E-01	-3.970E-02	-1.504E-04
13	1.536E-01	-4.324E-02	-4.263E-05
14	1.531E-01	-4.471E-02	-2.784E-05
15	1.530E-01	-4.725E-02	-4.575E-05

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
1	-6.021E+00	3.321E+02	1.434E+03
2	-6.961E+00	3.467E+02	1.573E+03
3	-6.018E+00	3.692E+02	1.434E+03

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

TABLE 14--- INDIVIDUAL MEMBER DATA
(DESIGNERS SIGN CONVENTION)

** HORIZ ** MEMBER OF TYPE 3 BETWEEN JOINTS 7 AND 8

```
AXIAL FORCE             =   8.103E-01
MOMENT AT LEFT END      =   1.248E+03
SHEAR AT LEFT END       =  -1.026E+01
MOMENT AT RIGHT END     =  -9.681E+02
SHEAR AT RIGHT END      =  -1.026E+01
```

** HORIZ ** MEMBER OF TYPE 3 BETWEEN JOINTS 8 AND 9

```
AXIAL FORCE             =  -1.254E+00
MOMENT AT LEFT END      =   9.339E+02
SHEAR AT LEFT END       =  -9.947E+00
MOMENT AT RIGHT END     =  -1.215E+03
SHEAR AT RIGHT END      =  -9.947E+00
```

** HORIZ ** MEMBER OF TYPE 1 BETWEEN JOINTS 13 AND 14

```
AXIAL FORCE             =  -1.059E+01
MOMENT AT LEFT END      =   4.227E+02
SHEAR AT LEFT END       =  -3.600E+00
MOMENT AT RIGHT END     =  -3.549E+02
SHEAR AT RIGHT END      =  -3.600E+00
```

** HORIZ ** MEMBER OF TYPE 1 BETWEEN JOINTS 14 AND 15

```
AXIAL FORCE             =  -3.164E+00
MOMENT AT LEFT END      =   3.011E+02
SHEAR AT LEFT END       =  -3.168E+00
MOMENT AT RIGHT END     =  -3.832E+02
SHEAR AT RIGHT END      =  -3.168E+00
```

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

TABLE 14 (CONT)

```
**   VERTL   ** MEMBER OF TYPE   5 BETWEEN JOINTS    1 AND    4

     AXIAL FORCE              =  -3.321E+02
     MOMENT AT LEFT END       =  -2.246E+02
     SHEAR AT LEFT END        =   5.998E+00
     MOMENT AT RIGHT END      =   1.431E+03
     SHEAR AT RIGHT END       =   5.998E+00


**   VERTL   ** MEMBER OF TYPE   4 BETWEEN JOINTS    4 AND    7

     AXIAL FORCE              =  -3.321E+02
     MOMENT AT LEFT END       =  -1.050E+03
     SHEAR AT LEFT END        =   4.871E+00
     MOMENT AT RIGHT END      =  -2.319E+02
     SHEAR AT RIGHT END       =   4.871E+00


**   VERTL   ** MEMBER OF TYPE   2 BETWEEN JOINTS    7 AND   10

     AXIAL FORCE              =  -3.124E+02
     MOMENT AT LEFT END       =  -1.286E+02
     SHEAR AT LEFT END        =   4.012E+00
     MOMENT AT RIGHT END      =   1.964E+02
     SHEAR AT RIGHT END       =   4.012E+00


**   VERTL   ** MEMBER OF TYPE   2 BETWEEN JOINTS   10 AND   13

     AXIAL FORCE              =  -3.124E+02
     MOMENT AT LEFT END       =  -4.216E+02
     SHEAR AT LEFT END        =   3.524E+00
     MOMENT AT RIGHT END      =  -1.361E+02
     SHEAR AT RIGHT END       =   3.524E+00
```

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

TABLE 14 (CONT)

```
**  VERTL  ** MEMBER OF TYPE   5 BETWEEN JOINTS   2 AND   5

     AXIAL FORCE             =  -3.467E+02
     MOMENT AT LEFT END      =  -3.443E+02
     SHEAR AT LEFT END       =   6.935E+00
     MOMENT AT RIGHT END     =   1.570E+03
     SHEAR AT RIGHT END      =   6.935E+00


**  VERTL  ** MEMBER OF TYPE   4 BETWEEN JOINTS   5 AND   8

     AXIAL FORCE             =  -3.467E+02
     MOMENT AT LEFT END      =  -1.328E+03
     SHEAR AT LEFT END       =   5.802E+00
     MOMENT AT RIGHT END     =  -3.529E+02
     SHEAR AT RIGHT END      =   5.802E+00


**  VERTL  ** MEMBER OF TYPE   2 BETWEEN JOINTS   8 AND  11

     AXIAL FORCE             =  -3.164E+02
     MOMENT AT LEFT END      =  -5.135E+01
     SHEAR AT LEFT END       =   7.735E+00
     MOMENT AT RIGHT END     =   5.751E+02
     SHEAR AT RIGHT END      =   7.735E+00


**  VERTL  ** MEMBER OF TYPE   2 BETWEEN JOINTS  11 AND  14

     AXIAL FORCE             =  -3.164E+02
     MOMENT AT LEFT END      =  -6.533E+02
     SHEAR AT LEFT END       =   7.247E+00
     MOMENT AT RIGHT END     =  -6.634E+01
     SHEAR AT RIGHT END      =   7.247E+00
```

PROB
PR203 TWO-BAY BENT, SECOND LOADING CONDITION

TABLE 14 (CONT)

** VERTL ** MEMBER OF TYPE 5 BETWEEN JOINTS 3 AND 6

```
AXIAL FORCE             =  -3.692E+02
MOMENT AT LEFT END      =  -2.242E+02
SHEAR AT LEFT END       =   5.995E+00
MOMENT AT RIGHT END     =   1.430E+03
SHEAR AT RIGHT END      =   5.995E+00
```

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 6 AND 9

```
AXIAL FORCE             =  -3.692E+02
MOMENT AT LEFT END      =  -1.049E+03
SHEAR AT LEFT END       =   4.868E+00
MOMENT AT RIGHT END     =  -2.315E+02
SHEAR AT RIGHT END      =   4.868E+00
```

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 9 AND 12

```
AXIAL FORCE             =  -3.292E+02
MOMENT AT LEFT END      =  -1.255E+02
SHEAR AT LEFT END       =   3.575E+00
MOMENT AT RIGHT END     =   1.641E+02
SHEAR AT RIGHT END      =   3.575E+00
```

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 12 AND 15

```
AXIAL FORCE             =  -3.292E+02
MOMENT AT LEFT END      =  -3.822E+02
SHEAR AT LEFT END       =   3.087E+00
MOMENT AT RIGHT END     =  -1.321E+02
SHEAR AT RIGHT END      =   3.087E+00
```

PROB
PR204 PR203 WITH INVESTIGATION OF AXIAL EFFECTS

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
2	0	0	1	0	0	10	1.000E-04	1.000E-05

TABLE 2 -- X AND Y LINE COORDINATES

USING X AND Y LINE DATA FROM PREVIOUS PROBLEM

TABLE 3 -- MEMBER TYPE DATA

USING DATA FROM PREVIOUS PROBLEM PLUS THE FOLLOWING

NONE

PROB
PR?04   PR203 WITH INVFSTIGATION OF AXIAL EFFECTS

TABLE 4 -- MEMBER INCIDENCE DATA

ALONG Y LINE	MEMBER TYPES BETWEEN X LINES 1 2	2 3
1	0	0
2	0	0
3	3	3
4	0	0
5	1	1

ALONG X LINE	MEMBER TYPES BETWEEN Y LINES 1 2	2 3	3 4	4 5
1	5	4	2	2
2	5	4	2	2
3	5	4	2	2

TABLE 5 -- DIAGONAL MEMBFR INCIDENCE

LEFT END X LINE	LEFT END Y LINE	RIGHT END X LINE	RIGHT END Y LINE	MEMBER TYPE

NO ADDITIONAL DATA

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

NO ADDITIONAL DATA

CLOSURE OBTAINED AFTER   3 ITERATIONS

PROB
PR204 PR203 WITH INVESTIGATION OF AXIAL EFFECTS

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE		
Y LINE	1	2	3
5	13	14	15
4	10	11	12
3	7	8	9
2	4	5	6
1	1	2	3

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	6.022E-20	-3.319E-18	-1.458E-17
2	6.972E-20	-3.467E-18	-1.600E-17
3	6.006E-20	-3.694E-18	-1.457E-17
4	8.293E-02	-1.796E-02	-4.118E-04
5	8.791E-02	-1.877E-02	-4.182E-04
6	8.290E-02	-1.999E-02	-4.118E-04
7	1.346E-01	-2.889E-02	-1.454E-04
8	1.346E-01	-3.019E-02	-6.923E-05
9	1.346E-01	-3.216E-02	-1.456E-04
10	1.478E-01	-3.606E-02	-1.585E-04
11	1.464E-01	-3.745E-02	-1.767E-04
12	1.475E-01	-3.971E-02	-1.528E-04
13	1.568E-01	-4.322E-02	-4.329E-05
14	1.564E-01	-4.471E-02	-2.830E-05
15	1.563E-01	-4.727E-02	-4.641E-05

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
1	-6.022E+00	3.319E+02	1.458E+03
2	-6.972E+00	3.467E+02	1.600E+03
3	-6.006E+00	3.694E+02	1.457E+03

PROB
PR204 PR203 WITH INVESTIGATION OF AXIAL EFFECTS

TABLE 14--- INDIVIDUAL MEMBER DATA
(DESIGNERS SIGN CONVENTION)

** HORIZ ** MEMBER OF TYPE 3 BETWEEN JOINTS 7 AND 8

AXIAL FORCE	=	8.293E-01
MOMENT AT LEFT END	=	1.276E+03
SHEAR AT LEFT END	=	-1.049E+01
MOMENT AT RIGHT END	=	-9.899E+02
SHEAR AT RIGHT END	=	-1.049E+01

** HORIZ ** MEMBER OF TYPE 3 BETWEEN JOINTS 8 AND 9

AXIAL FORCE	=	-1.258E+00
MOMENT AT LEFT END	=	9.557E+02
SHEAR AT LEFT END	=	-1.018E+01
MOMENT AT RIGHT END	=	-1.242E+03
SHEAR AT RIGHT END	=	-1.018E+01

** HORIZ ** MEMBER OF TYPE 1 BETWEEN JOINTS 13 AND 14

AXIAL FORCE	=	-1.061E+01
MOMENT AT LEFT END	=	4.296E+02
SHEAR AT LEFT END	=	-3.660E+00
MOMENT AT RIGHT END	=	-3.609E+02
SHEAR AT RIGHT END	=	-3.660E+00

** HORIZ ** MEMBER OF TYPE 1 BETWEEN JOINTS 14 AND 15

AXIAL FORCE	=	-3.147E+00
MOMENT AT LEFT END	=	3.070E+02
SHEAR AT LEFT END	=	-3.227E+00
MOMENT AT RIGHT END	=	-3.900E+02
SHEAR AT RIGHT END	=	-3.227E+00

PROB
PR204 PR203 WITH INVESTIGATION OF AXIAL EFFECTS

TABLE 14 (CONT)

** VERTL ** MEMBER OF TYPE 5 BETWEEN JOINTS 1 AND 4

AXIAL FORCE	=	-3.319E+02
MOMENT AT LEFT END	=	-2.317E+02
SHEAR AT LEFT END	=	6.022E+00
MOMENT AT RIGHT END	=	1.458E+03
SHEAR AT RIGHT END	=	6.022E+00

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 4 AND 7

AXIAL FORCE	=	-3.319E+02
MOMENT AT LEFT END	=	-1.076E+03
SHEAR AT LEFT END	=	4.922E+00
MOMENT AT RIGHT END	=	-2.317E+02
SHEAR AT RIGHT END	=	4.922E+00

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 7 AND 10

AXIAL FORCE	=	-3.123E+02
MOMENT AT LEFT END	=	-1.358E+02
SHEAR AT LEFT END	=	4.093E+00
MOMENT AT RIGHT END	=	1.999E+02
SHEAR AT RIGHT END	=	4.093E+00

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 10 AND 13

AXIAL FORCE	=	-3.123E+02
MOMENT AT LEFT END	=	-4.296E+02
SHEAR AT LEFT END	=	3.593E+00
MOMENT AT RIGHT END	=	-1.358E+02
SHEAR AT RIGHT END	=	3.593E+00

PROB
PR204   PR203 WITH INVESTIGATION OF AXIAL EFFECTS

TABLE 14 (CONT)

```
** VERTL ** MEMBER OF TYPE  5 BETWEEN JOINTS  2 AND  5

   AXIAL FORCE            =  -3.467E+02
   MOMENT AT LEFT END     =  -3.549E+02
   SHEAR AT LEFT END      =   6.972E+00
   MOMENT AT RIGHT END    =   1.600E+03
   SHEAR AT RIGHT END     =   6.972E+00


** VERTL ** MEMBER OF TYPE  4 BETWEEN JOINTS  5 AND  8

   AXIAL FORCE            =  -3.467E+02
   MOMENT AT LEFT END     =  -1.358E+03
   SHEAR AT LEFT END      =   5.872E+00
   MOMENT AT RIGHT END    =  -3.549E+02
   SHEAR AT RIGHT END     =   5.872E+00


** VERTL ** MEMBER OF TYPE  2 BETWEEN JOINTS  8 AND 11

   AXIAL FORCE            =  -3.164E+02
   MOMENT AT LEFT END     =  -6.050E+01
   SHEAR AT LEFT END      =   7.960E+00
   MOMENT AT RIGHT END    =   5.880E+02
   SHEAR AT RIGHT END     =   7.960E+00


** VERTL ** MEMBER OF TYPE  2 BETWEEN JOINTS 11 AND 14

   AXIAL FORCE            =  -3.164E+02
   MOMENT AT LEFT END     =  -6.679E+02
   SHEAR AT LEFT END      =   7.460E+00
   MOMENT AT RIGHT END    =  -6.050E+01
   SHEAR AT RIGHT END     =   7.460E+00
```

PROB
PR204 PR203 WITH INVESTIGATION OF AXIAL EFFECTS

TABLE 14 (CONT)

** VERTL ** MEMBER OF TYPE 5 BETWEEN JOINTS 3 AND 6

```
AXIAL FORCE           =  -3.694E+02
MOMENT AT LEFT END    =  -2.314E+02
SHEAR AT LEFT END     =   6.006E+00
MOMENT AT RIGHT END   =   1.457E+03
SHEAR AT RIGHT END    =   6.006E+00
```

** VERTL ** MEMBER OF TYPE 4 BETWEEN JOINTS 6 AND 9

```
AXIAL FORCE           =  -3.694E+02
MOMENT AT LEFT END    =  -1.075E+03
SHEAR AT LEFT END     =   4.906E+00
MOMENT AT RIGHT END   =  -2.314E+02
SHEAR AT RIGHT END    =   4.906E+00
```

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 9 AND 12

```
AXIAL FORCE           =  -3.292E+02
MOMENT AT LEFT END    =  -1.322E+02
SHEAR AT LEFT END     =   3.647E+00
MOMENT AT RIGHT END   =   1.675E+02
SHEAR AT RIGHT END    =   3.647E+00
```

** VERTL ** MEMBER OF TYPE 2 BETWEEN JOINTS 12 AND 15

```
AXIAL FORCE           =  -3.292E+02
MOMENT AT LEFT END    =  -3.900E+02
SHEAR AT LEFT END     =   3.147E+00
MOMENT AT RIGHT END   =  -1.322E+02
SHEAR AT RIGHT END    =   3.147E+00
```

```
PROB
PR301      ONE BAY BENT WITH VERTICAL COLUMNS


**** INPUT INFORMATION ****



TABLE 1 -- PROGRAM CONTROL DATA


     NEWPR NAMT NAJLR KOUT NADM NCOM         NIT         DTOL          RTOL

         1    3     6    1    0    0           0  -0.            -0.




TABLE 2 -- X AND Y LINE COORDINATES

           NXL  =      2
           NYL  =      3

          X LINE          COORDINATE

              1              0.
              2              2.400E+02


          Y LINE          COORDINATE

              1              0.
              2              2.640E+02
              3              3.690E+02
```

```
PROB
PR301      ONE BAY BENT WITH VERTICAL COLUMNS

TABLE 3 -- MEMBER TYPE DATA


      TYPE    M KODE   NDC        H

        1    22     3     2 1.200E+01

FROM TO CONTD       F              Q              S              T              R            AE

   0  22 -0    1.990E+08 -0.          -0.          -0.          -0.          3.530E+06
   7  22 -0   -0.          -0.         2.400E+08 -0.          -0.          -0.


      TYPE    M KODE   NDC        H

        2    15     1     1 7.000E+00

FROM TO CONTD       F              Q              S              T              R            AE

   0  15 -0    1.990E+08 -0.          -0.          -0.          -0.          3.530E+06


      TYPE    M KODE   NDC        H

        3    20     1     1 1.200E+01

FROM TO CONTD       F              Q              S              T              R            AE

   0  20 -0    1.020E+09 -0.          -0.          -0.          -0.          6.930E+06


TABLE 4 -- MEMBER INCIDENCE DATA

     ALONG          MEMBER TYPES BETWEEN X LINES
     Y LINE    1     2

       1          0

       2          0

       3          3


     ALONG          MEMBER TYPES BETWEEN Y LINES
     X LINE    1     2     3

       1          1     2

       2          1     2
```

PROB
PR301 ONE BAY BENT WITH VERTICAL COLUMNS

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

LEFT END		RIGHT END		MEMBER TYPE
X LINE	Y LINE	X LINE	Y LINE	

NONE

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

X LINE	Y LINE	PX	PY	PZ	SX	SY	SZ
1	1	-0.	-0.	-0.	-0.	2.000E+02	-0.
2	1	-0.	-0.	-0.	-0.	2.000E+02	-0.
1	2	1.800E+00	-0.	-0.	-0.	-0.	-0.
2	2	1.800E+00	-0.	-0.	-0.	-0.	-0.
1	3	1.830E+01	-4.000E+02	-0.	-0.	-0.	-0.
2	3	1.830E+01	-4.350E+02	-0.	-0.	-0.	-0.

PRnB
PR301   ONE BAY BENT WITH VERTICAL COLUMNS

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE	
Y LINE	1	2
3	5	6
2	3	4
1	1	2

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	8.994E-30	-1.968E+00	1.403E-29
2	8.994E-30	-2.207E+00	1.403E-29
3	4.806E-02	-1.998E+00	-9.344E-04
4	4.806E-02	-2.240E+00	-9.344E-04
5	1.607E-01	-2.010E+00	-1.042E-03
6	1.607E-01	-2.253E+00	-1.042E-03

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
1	-0.	3.937E+02	-0.
2	-0.	4.413E+02	-0.

```
PROB
PR301      ONE BAY BENT WITH VERTICAL COLUMNS

TABLE 14--- INDIVIDUAL MEMBER DATA
            (DESIGNERS SIGN CONVENTION)


          **  HORIZ  ** MEMBER OF TYPE   3 BETWEEN JOINTS   5 AND   6

               AXIAL FORCE               =   5.821E-11
               MOMENT AT LEFT END        =   7.527E+02
               SHEAR AT LEFT END         =  -6.272E+00
               MOMENT AT RIGHT END       =  -7.527E+02
               SHEAR AT RIGHT END        =  -6.272E+00


          **  VERTL  ** MEMBER OF TYPE   1 BETWEEN JOINTS   1 AND   3

               AXIAL FORCE               =  -3.937E+02
               MOMENT AT LEFT END        =   1.165E+03
               SHEAR AT LEFT END         =   2.010E+01
               MOMENT AT RIGHT END       =  -2.181E-35
               SHEAR AT RIGHT END        =   5.417E-35


          **  VERTL  ** MEMBER OF TYPE   2 BETWEEN JOINTS   3 AND   5

               AXIAL FORCE               =  -3.937E+02
               MOMENT AT LEFT END        =  -7.480E+02
               SHEAR AT LEFT END         =   1.814E+01
               MOMENT AT RIGHT END       =   1.157E+03
               SHEAR AT RIGHT END        =   1.814E+01


          **  VERTL  ** MEMBER OF TYPE   1 BETWEEN JOINTS   2 AND   4

               AXIAL FORCE               =  -4.413E+02
               MOMENT AT LEFT END        =   1.165E+03
               SHEAR AT LEFT END         =   2.010E+01
               MOMENT AT RIGHT END       =   3.966E-36
               SHEAR AT RIGHT END        =  -6.019E-36


          **  VERTL  ** MEMBER OF TYPE   2 BETWEEN JOINTS   4 AND   6

               AXIAL FORCE               =  -4.413E+02
               MOMENT AT LEFT END        =  -7.480E+02
               SHEAR AT LEFT END         =   1.814E+01
               MOMENT AT RIGHT END       =   1.157E+03
               SHEAR AT RIGHT END        =   1.814E+01
```

PROB
PR302 ONE BAY BENT WITH BATTERED COLUMNS

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
1	4	6	1	4	0	0	-0.	-0.

TABLE 2 -- X AND Y LINE COORDINATES

NXL = 6
NYL = 3

X LINE	COORDINATE
1	0.
2	2.200E+01
3	3.075E+01
4	2.707E+02
5	2.795E+02
6	3.015E+02

Y LINE	COORDINATE
1	0.
2	2.640E+02
3	3.690E+02

PROB
PR302 ONE BAY BENT WITH BATTERED COLUMNS

TABLE 3 -- MEMBER TYPE DATA

TYPE	M	KODE	NDC	H
1	22	3	2	1.204E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	22	-0	1.990E+08	-0.	-0.	-0.	-0.	3.530E+06
0	15	-0	-0.	-0.	2.408E+08	-0.	-0.	-0.

TYPE	M	KODE	NDC	H
2	15	1	1	7.024E+00

FROM	TO	CONTD	F	Q	S	T	R	AF
0	15	-0	1.990E+08	-0.	-0.	-0.	-0.	3.530E+06

TYPE	M	KODE	NDC	H
3	20	1	1	1.200E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	20	-0	1.020E+09	-0.	-0.	-0.	-0.	6.930E+06

TYPE	M	KODE	NDC	H
4	22	3	2	1.204E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	22	-0	1.990E+08	-0.	-0.	-0.	-0.	3.530E+06
7	22	-0	-0.	-0.	2.408E+08	-0.	-0.	-0.

PROB
PR302 ONE BAY BENT WITH BATTERED COLUMNS

TABLE 4 -- MEMBER INCIDENCE DATA

ALONG Y LINE	MEMBER TYPES BETWEEN X LINES 1	2	3	4	5	6
1		0	0	0	0	0
2		0	0	0	0	0
3		0	0	3	0	0

ALONG X LINE	MEMBER TYPES BETWEEN Y LINES 1	2	3
1		0	0
2		0	0
3		0	0
4		0	0
5		0	0
6		0	0

TABLE 5 -- DIAGONAL MEMBER INCIDENCE

LEFT END X LINE	LEFT END Y LINE	RIGHT END X LINE	RIGHT END Y LINE	MEMBER TYPE
1	1	2	2	1
2	2	3	3	2
4	3	5	2	2
5	2	6	1	4

PROB
PR302 ONE BAY BENT WITH BATTERED COLUMNS

TABLE 6 -- APPLIED JOINT LOADS AND RESTRAINTS

X LINE	Y LINE	PX	PY	PZ	SX	SY	SZ
1	1	-0.	-0.	-0.	-0.	2.000E+02	-0.
6	1	-0.	-0.	-0.	-0.	2.000E+02	-0.
2	2	1.800E+00	-0.	-0.	-0.	-0.	-0.
5	2	1.800E+00	-0.	-0.	-0.	-0.	-0.
3	3	1.830E+01	-4.000E+02	-0.	-0.	-0.	-0.
4	3	1.830E+01	-4.350E+02	-0.	-0.	-0.	-0.

PROB
PR302   ONE BAY BENT WITH BATTERED COLUMNS

**** OUTPUT INFORMATION ****

TABLE 11 -- JOINT NUMBERS

	X LINE					
Y LINE	1	2	3	4	5	6
3	0	0	1	2	0	0
2	0	4	0	0	5	0
1	3	0	0	0	0	6

TABLE 12-- JOINT DISPLACEMENTS

JOINT	X DISPL	Y DISPL	THETA Z
1	1.581E-01	-2.029E+00	-1.410E-03
2	1.584E-01	-2.255E+00	-5.269E-04
3	-1.634E-01	-1.961E+00	-2.243E-08
4	-5.344E-02	-2.000E+00	-2.086E-03
5	1.622E-01	-2.242E+00	3.732E-04
6	1.839E-01	-2.207E+00	2.524E-08

TABLE 13-- JOINT REACTIONS

JOINT	FX	FY	MZ
3	-0.	3.922E+02	-0.
6	-0.	4.414E+02	-0.

```
PROB
PR302      ONE BAY BENT WITH BATTERED COLUMNS


TABLE 14--- INDIVIDUAL MEMBER DATA
            (DESIGNERS SIGN CONVENTION)



     **  HORIZ  ** MEMBER OF TYPE   3 BETWEEN JOINTS   1 AND   2

          AXIAL FORCE            =   8.349E+00
          MOMENT AT LEFT END     =   4.399E+03
          SHEAR AT LEFT END      =  -5.381E+00
          MOMENT AT RIGHT END    =   3.108E+03
          SHEAR AT RIGHT END     =  -5.381E+00



     **  DIAGL  ** MEMBER OF TYPE   1 BETWEEN JOINTS   3 AND   4

          AXIAL FORCE            =  -3.909E+02
          MOMENT AT LEFT END     =   4.680E-09
          SHEAR AT LEFT END      =   3.257E+01
          MOMENT AT RIGHT END    =  -1.848E+03
          SHEAR AT RIGHT END     =   6.112E+01



     **  DIAGL  ** MEMBER OF TYPE   2 BETWEEN JOINTS   4 AND   1

          AXIAL FORCE            =  -3.910E+02
          MOMENT AT LEFT END     =  -1.821E+03
          SHEAR AT LEFT END      =   5.880E+01
          MOMENT AT RIGHT END    =   4.375E+03
          SHEAR AT RIGHT END     =   5.880E+01



     **  DIAGL  ** MEMBER OF TYPE   2 BETWEEN JOINTS   2 AND   5

          AXIAL FORCE            =  -4.397E+02
          MOMENT AT LEFT END     =   3.092E+03
          SHEAR AT LEFT END      =  -2.642E+01
          MOMENT AT RIGHT END    =   3.080E+02
          SHEAR AT RIGHT END     =  -2.642E+01



     **  DIAGL  ** MEMBER OF TYPE   4 BETWEEN JOINTS   5 AND   6

          AXIAL FORCE            =  -4.399E+02
          MOMENT AT LEFT END     =   2.956E+02
          SHEAR AT LEFT END      =  -2.486E+01
          MOMENT AT RIGHT END    =   5.895E-09
          SHEAR AT RIGHT END     =  -3.666E+01
```

PROB
11001 SINGLE STORY FRAME MY MASTERS AXIAL LOAD ≠ 0 , 3 NOV 69

**** INPUT INFORMATION ****

TABLE 1 -- PROGRAM CONTROL DATA

NEWPR	NAMT	NAJLR	KOUT	NADM	NCOM	NIT	DTOL	RTOL
1	2	3	2	-0	-0	-0	-0.	-0.

TABLE 3 -- MEMBER TYPE DATA

TYPE	M	KODE	NDC	H
1	25	3	1	1.896E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	25	-0	1.338E+08	-0.	-0.	-0.	-0.	9.531E+05

TYPE	M	KODE	NDC	H
2	25	3	1	2.507E+01

FROM	TO	CONTD	F	Q	S	T	R	AF
0	25	-0	1.726E+08	-0.	-0.	-0.	-0.	1.165E+06

TABLE 2 -- X AND Y LINE COORDINATES

NXL = 2
NYL = 2

X LINE	COORDINATE
1	-0.
2	6.268E+02

Y LINE	COORDINATE
1	-0.
2	4.740E+02