CIVIL ENGINEERING STUDY
STRUCTURAL SERIES 85-11

ODSEWS-2D-II
USER'S MANUAL
A COMPUTER PROGRAM FOR OPTIMUM DESIGN OF 2-DIMENSIONAL STEEL STRUCTURES FOR STATIC, SEISMIC AND WIND FORCES

by
Franklin Y. Cheng
Professor

Der-Shin Juang
Graduate Assistant

Department of Civil Engineering
University of Missouri-Rolla
Rolla, Missouri
1985

Report Series
Prepared for the National Science Foundation Under Grant No.
NSF CEE 8213477

CIVIL ENGINEERING STUDY

STRUCTURAL SERIES 85-11

ODSEWS-2D-II

USER'S MANUAL

A COMPUTER PROGRAM FOR
OPTIMUM DESIGN OF 2-DIMENSIONAL STEEL STRUCTURES
FOR STATIC, SEISMIC, AND WIND FORCES

by

Franklin Y. Cheng

Professor

Der-Shin Juang

Graduate Assistant

Department of Civil Engineering

University of Missouri-Rolla

Rolla, Missouri

1985

Report Series

Prepared for the National Science Foundation Under Grant No.

NSF CEE 8213477

ABSTRACT

This report has been prepared as a user's manual for the computer program, ODSEWS-2D-II, for the optimal design of two-dimensional steel structures subjected to static, earthquake, and wind forces.

The structural systems can be trusses, unbraced and braced frames. The seismic input can be one-dimensional and two-dimensional; one-dimension is horizontal, two-dimension is horizontal coupled with vertical. The dynamic forces may be seismic excitations at the base, dynamic forces applied at structural nodes, and wind forces acting on the structural surfaces. The seismic excitations include actual earthquake records, five groups of response spectra, and three seismic design code provisions of the Uniform Building Code, the Chinese Seismic Design Code, and ATC-3-06. The structural formulation is derived on the basis of the matrix displacement method and consistent mass method associated with the consideration of the second-order P-Δ forces. The constituent members of a system are made of either built-up sections or AISC WF sections. The constraints include stresses, displacements, story drifts, natural frequencies, maximum differences between relative stiffnesses, and lower bound of cross sections. The objective function can be either minimum weight or minimum cost.

The main features of the report include the description of the computer program, instructions for the data preparation, listing of the computer program, preparation of the job control language, sample examples, and a guide to modify the program's capacity.

ACKNOWLEDGMENTS

This report is one of a series for the research program on the aseismic optimum structural design in engineering practice and code provisions. Support of the study was provided by the University of Missouri-Rolla and the National Science Foundation under the Grant No. NSF CEE 8213477. The support is gratefully acknowledged.

TABLE OF CONTENTS

I. INSTRUCTION

This publication is to serve as a user's manual of the computer program, ODSEWS-2D-II (Optimum Design of 2-Dimensional Steel Structures for Static, Earthquake, and Wind Forces - Version II). The numerical procedures of the computer program, the description of subroutines, the program capacity and its modification are included in Chapter II. Chapter III contains the detailed instruction for preparing the input data and the required job control language used to run the program on an AMDAHL 470V/7, AMDAHL 470V/8, or IBM 4341 OS/VS1 system. In Chapter IV, three sample examples are used to illustrate the preparation of input data and the printouts of output solutions.

II. DESCRIPTION OF THE ODSEWS-2D-II COMPUTER PROGRAM

2.1 Numerical Procedures of the ODSEWS-2D-II Computer Program

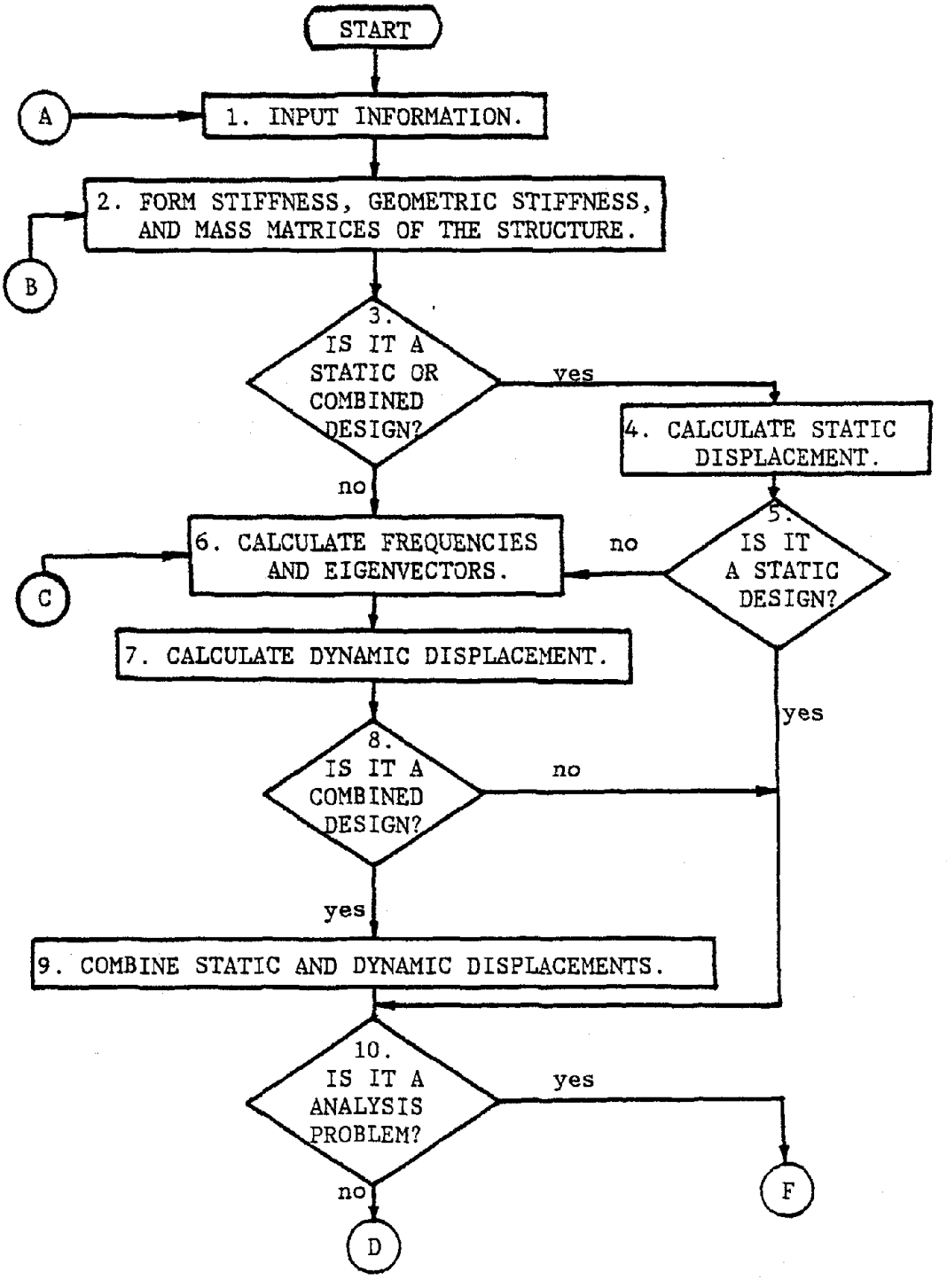
The computer program ODSEWS-2D-II is capable of analyzing and designing two-dimensional steel structures subject to static loads, wind forces, multicomponent earthquake excitations or the combined action of static loads and time-dependent excitations. The numerical procedures are outlined in this section on the basis of the flow chart shown in Figure 2.1.

Step 1. --- Input Data. All analyses or design problems start with reading the input data that are supplied by the user. The input data must be prepared according to the input instructions. The input data are printed out as a user's reference.

Step 2. --- Form Stiffness, Geometric Stiffness and Mass Matrices of the Structure. The initial relative design variables are used to form the stiffness, geometric stiffness, and mass matrices. The initial relative design variables can be supplied by the user in the input data, or else they will be generated automatically as 1.0 for all members. The stiffness and geometric stiffness matrices are formed for all types of loadings. The mass matrix is formed only when the eigen solution is needed.

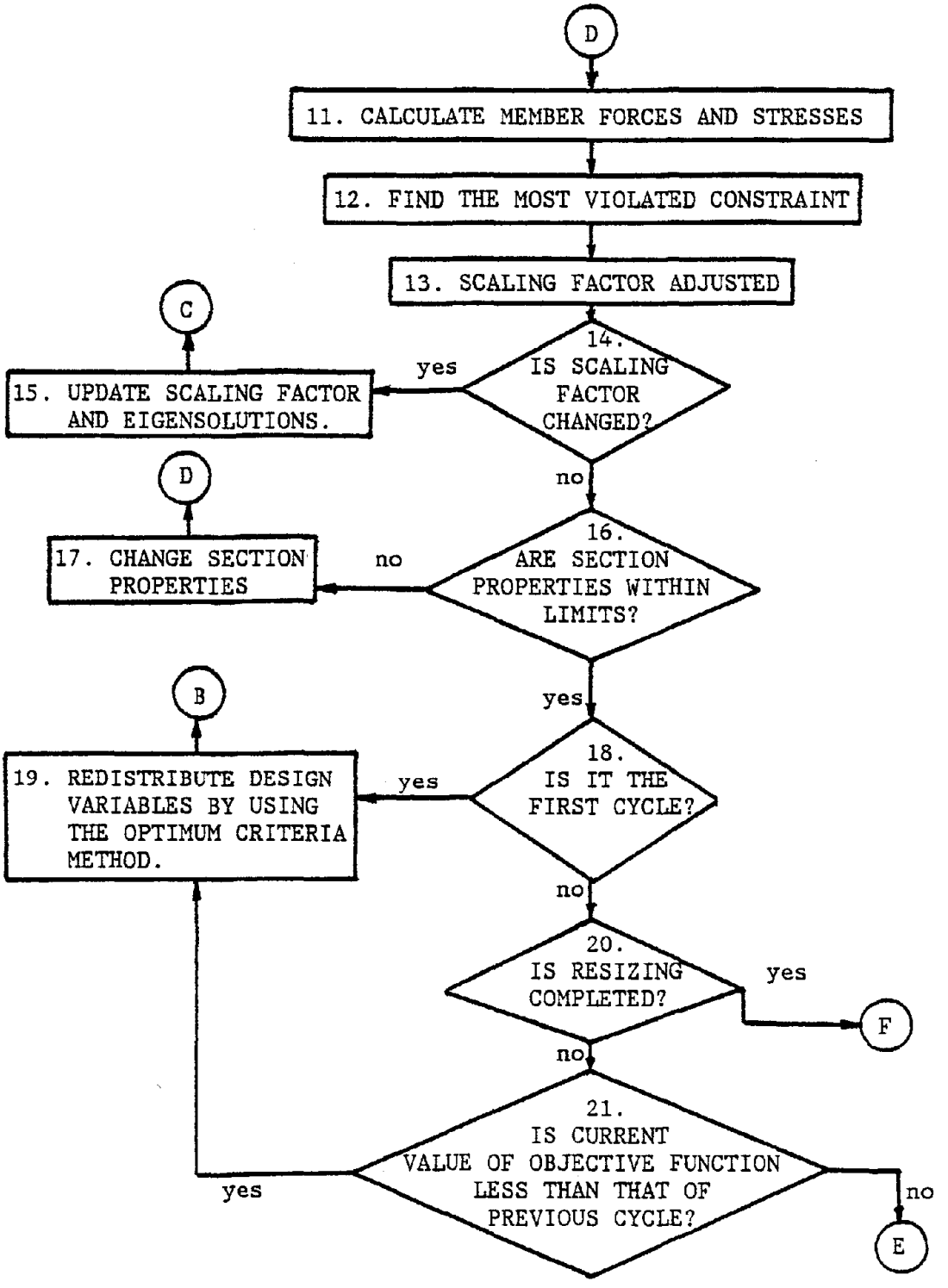
Step 3. --- Is It a Dynamic Design? If it is a dynamic design or an analysis problem, then proceed to Step 6.

Step 4. --- Solve for Static Displacement. The structure is analyzed when it is subjected to static loads. The static loads can be 1) concentrated loads, 2) uniform distributed loads, 3) equivalent



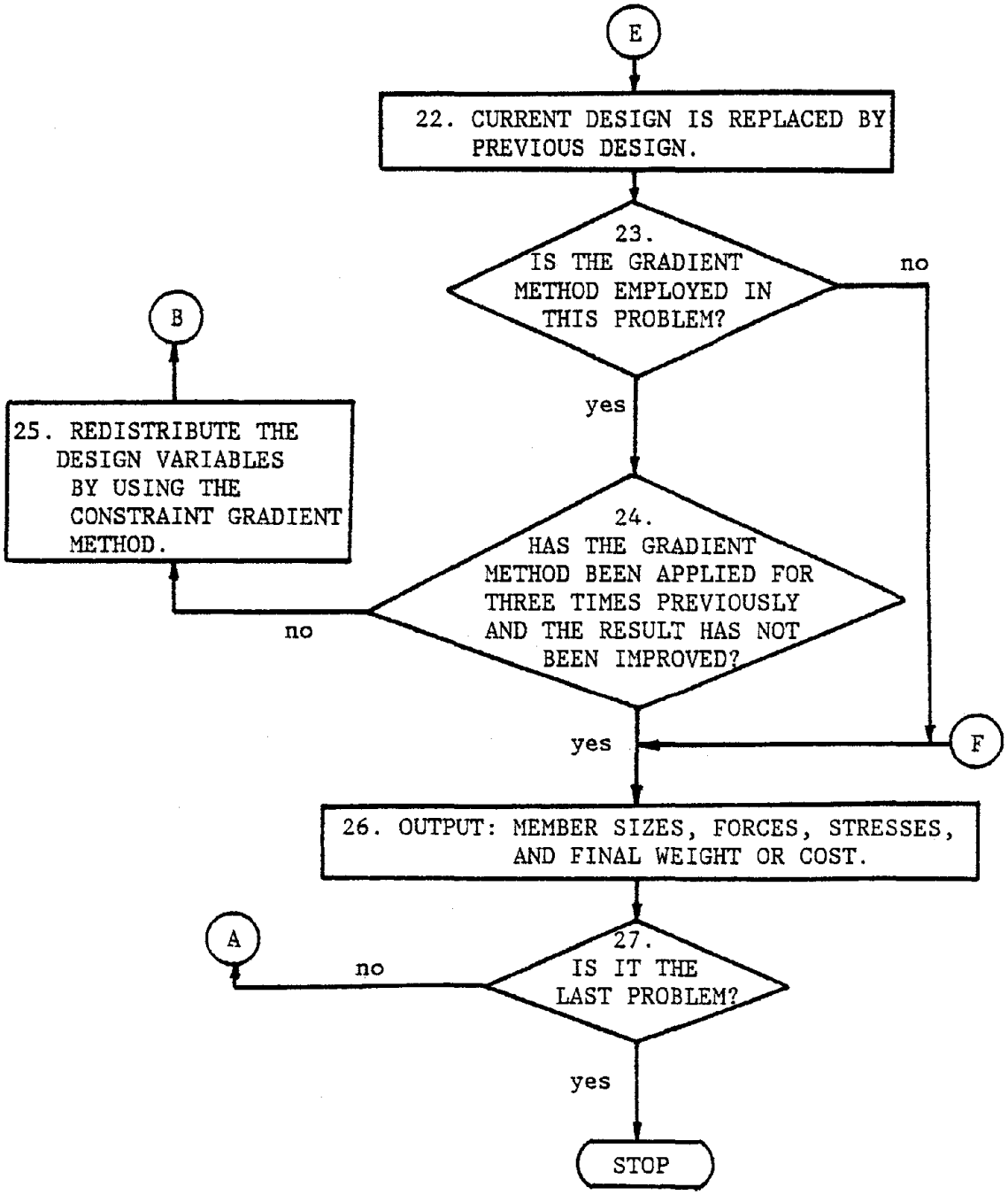
(a) Partial Flow Chart of Figure 2.1

Figure 2.1 Flow Chart of Numerical Procedures



(b) Partial Flow Chart of Figure 2.1

Figure 2.1 Flow Chart of Numerical Procedures (Continued)



(c) Partial Flow Chart of Figure 2.1

Figure 2.1 Flow Chart of Numerical Procedures (Continued)

seismic forces of ATC-3-06, UBC or Chinese Building Code, and 4) equivalent wind forces. In case of 3 and 4, the force vector is formed first by calling subroutine ATCCD, CODE, CHINA, or WIND1. The Gauss elimination method is used to calculate static displacements by calling subroutine GAUSS.

Step 5. --- Is It a Static Design Only? If the structure is subjected to static loads only, then proceed to Step 10.

Step 6. --- Solve for Eigenvalues and Eigenvectors. If the structure is subjected to dynamic loads, then the eigen solution must be found first. The eigenvalues and eigenvectors are determined by using the Sturm sequence property in conjunction with the bisection procedure.

Step 7. --- Compute the Dynamic Displacements. The modal response of each mode is solved first. The total dynamic response is the combination of modal responses and is obtained by using the method of root-mean-square, direct or absolute superposition. The dynamic loads can be multicomponent earthquake acceleration records, time-dependent forcing function, and five groups of acceleration spectra. The spectra of Newmark, Housner, and Seed, as well as those available in the Chinese Building Code and ATC-3-06 are built into the subroutines CURVE1, CURVE2, CURVE3, and CURVE4. One can obtain spectral acceleration by calling each of these subroutines on the basis of natural period of a structure.

Step 8. --- Is It a Combined Design Problem? If the structure is subjected to dynamic loads only, then proceed to Step 10.

Step 9. --- Combination of Static and Dynamic Displacements. If

the structure is subjected to combined loading, the static and dynamic displacements should be computed as

$$\{r\} = \{r(x)\} \pm \{r(x,t)\} \tag{2.1.1}$$

in which

$\{r\}$ = the vector of combined displacements,

$\{r(x)\}$ = the vector of static displacements,

$\{r(x,t)\}$ = the vector of dynamic displacements.

Step 10. --- Is It an Analysis Problem? If it is an analysis problem, then proceed to Step 26.

Step 11. --- Calculate the Member Forces and Stresses. The member forces and stresses due to static loads and dynamic loads are calculated separately. In case of a combined design, the stresses due to static loads and dynamic loads are combined according to the following equation:

$$\{\sigma\} = \{\sigma(x)\} \pm \{\sigma(x,t)\} \tag{2.1.2}$$

in which

$\{\sigma\}$ = the vector of combined stresses,

$\{\sigma(x)\}$ = the vector of stresses due to static loads,

$\{\sigma(x,t)\}$ = the vector of stresses due to dynamic loads.

Step 12. --- Determine the Active Constraints. The member stresses, story drifts, and displacements should be checked with allowable values to determine whether the constraints have been

violated or not. The violated constraints are to be recorded.

Step 13. --- Adjust the Scaling Factor. The scaling factor is linearly adjusted by using the ratio of the actual value to the allowable value of the most violated constraints.

Step 14. --- Is the Scaling Factor Changed Significantly? The change of scaling factor is insignificant, if it satisfies the following relation:

$$\frac{\Lambda_{new} - \Lambda_{old}}{\Lambda_{old}} \leq \varepsilon \qquad (2.1.3)$$

in which Λ_{old} and Λ_{new} are the scaling factors at the beginning and the end of each design cycle, and ε is the prescribed tolerance given by the user in the input data. The procedure is to proceed to Step 16, if the change in scaling factor is insignificant.

Step 15. --- Update the Eigensolutions. If the change in the scaling factor is significant, then the eigen solutions have to be updated. In this case, Steps 6 through 13 should be followed.

Step 16. --- Are the Sectional Properties Within Limits? If the built-up section is used in the design, then the cross sectional properties of all the members have to be checked. When all the sectional properties satisfy the allowable values or the AISC wide-flange sections are used in the design, the procedure is to proceed to Step 18.

Step 17. --- Change Sectional Properties of Built-up Sections. The ratio of flange thickness to depth of the section, t_f/d, is determined by keeping the depth and the ratio of the flange width to

depth as a constant. If the t_f/d is out of limits, then the bound values must be used, depending on whether it exceeds the upper limit or is less than lower bound, to determine the depth of the section. The procedure is to proceed to Step 11 when the sectional properties have been changed.

Step 18. --- Is It the First Cycle? The value of the objective function is determined. If it is not the first cycle, then proceed to Step 20.

Step 19. --- Redistribute Design Variables Based on the Optimum Criterion Recursion Formula. The redistribution of the design variables is based on the method described in the Secs. 2.1 through 2.5 of Ref. 1. The member sizes are checked with the size constraints after redistribution. The bound value is used whenever the member size is out of bounds. After redistribution, the procedure is to proceed to Step 2.

Step 20. --- Is the Resizing Completed? The design is stopped when the number of iterations exceed the maximum allowance.

Step 21. --- Is the Objective Function Value of Current Cycle Less Than the Value of the Previous Cycle? If the value of the objective function is reduced, then proceed to Step 19.

Step 22. --- The Result of Current Cycle Is Replaced by the Previous Result. When the value of the objective function is less than the minimum value obtained in previous cycles, the current design variables are replaced by the design variables of the previous design.

Step 23. --- Is the Method of Redistribution Based on the Constraint Gradient Considered in the Design? If the method of

redistribution based on the constrait gradient is not considered in the design problem, the procedure is to proceed to Step 26.

Step 24. --- Does the Redistribution Method Based on the Constraint Gradient Improve the Design Result? If the method of redistribution based on constraint gradient has been used continuously for more than three times and the design result has not been improved, the procedure is to proceed to Step 26.

Step 25. --- Redistribute the Design Variables Based on Constraint Gradient. The recursion formula and the numerical procedure of the constraint gradient method are given in Sec. 2.6 of Ref. 1. Check the member sizes with the size constraints. For members whose sizes are out of bounds, the bound values are taken and used in the next design cycle. The procedure is to proceed to Step 2 after the design variables have been redistributed.

Step 26. --- Output. Print out the member sizes, forces, stresses, and displacements of the final design.

Step 27. --- Is It the Last Problem for This Job? If it is the last problem to be designed or analyzed, the program is stopped. If it is not, then proceed to Step 1 and read the input data for the next problem.

2.2 Description of Subroutines

The computer program ODSEWS-2D-II includes 54 subroutines. These are depicted in alphabetical order, and the description of each is presented in this section.

(1) Subroutine ADD1 --- ADD1 is called from the main program so

that the static displacements can be combined with the dynamic displacements.

(2) Subroutine ADD2 --- ADD2 is called from the subroutine STRES1 so that the dynamic member forces can be combined with each mode. The combination method is a user's option and is given in the input data.

(3) Subroutine ADD3 --- The MAIN program calls for the subroutine ADD3 so that the energy density of each individual member can be calculated when the structure is subjected to dynamic loadings. The energy density includes the strain energy and kinetic energy.

(4) Subroutine AREA --- AREA is called from the MAIN program, and the subroutine STRSWT is used to calculate the section properties of each member.

(5) Subroutine ASMBL3 --- ASMBL3 is used to assemble the element stiffness, geometric stiffness, and mass matrices in the corresponding matrices of the structural system. This subroutine is called from the MAIN program and subroutine DATA1.

(6) Subroutine ATCCD --- The subroutine ATCCD, which is called from the MAIN program, is used to determine the equivalent seismic forces according to the ATC-3-06 provisions. The subroutines LAT1, LAT2, SOIL1, and MODALA are called from this subroutine. There are three possibilities of calling these subroutines:

i) The subroutine LAT1 and LAT2 are called to compute the seismic forces according to the equivalent lateral force method without considering the effect of the soil-structure interaction.

ii) The subroutine LAT1, LAT2, and SOIL1 are called to compute

the seismic forces according to the equivalent lateral force method with the effect of the soil-structure interaction.

iii) The subroutine MODALA is called to compute the seismic forces according to the modal analysis method. The effect of soil-structure interaction may or may not be considered in the design.

(7) Subroutine ATCIF --- The subroutine ATCIF is called from LOADIN so that the subroutine ATCIF can be used to read and print the required informations for calculating the equivalent seismic forces based on the ATC-3-06 provisions. The subroutine PERFOM is called to determine the seismic performance category.

(8) Subroutine ATCWT --- The MAIN program calls for the subroutine ATCWT to calculate the gravity load of each story, which includes the structural weight and nonstructural weight. The story gravity loads should be used to determine the equivalent seismic forces according to the provisions of ATC-3-06, UBC, or Chinese Building Design Code.

(9) Subroutine BEAMWT --- BEAMWT is called from the subroutine DATA1 to determine the amount of nonstructural weight that is contributed to the columns when the P-Δ effect is considered in the design.

(10) Subroutine BOUND2 --- The subroutine BOUND2 is called from the MAIN program to reduce the stiffness, geometric stiffness, and mass matrices. This is done by taking out the rows and columns that correspond to the fixed degrees of freedom.

(11) Subroutine CHANGE --- CHANGE is called from the MAIN program to combine the modal responses according to the type of combination specified by the user.

(12) Subroutine CHINA --- The MAIN program calls for the subroutine CHINA to compute the equivalent seismic forces according to the provisions of the Chinese Building Design Code.

(13) Subroutine CODE --- CODE is called from the MAIN program to determine the equivalent seismic forces according to the provisions of UBC.

(14) Subroutine COINF --- COINF is called from the subroutine DATA1 to read and print the required information of the minimum cost design.

(15) Subroutine COST1 --- The MAIN program calls for the subroutine COST1 to compute the structural costs.

(16) Subroutine CURVE1 --- The subroutine SPTRUM calls for the subroutine CURVE1 to find the spectral acceleration of Newmark's acceleration spectra which corresponds to the period of the building.

(17) Subroutine CURVE2 --- This subroutine is similar to the subroutine CURVE1. Subroutine CURVE2 is called to find the spectral acceleration of Housner's average response spectrum or Seed's acceleration spectra.

(18) Subroutine CURVE3 --- The response spectra of the Chinese Building Design Code are built into the subroutine CURVE3. In a manner similar to subroutines CURVE1 and CURVE2, the subroutine SPTRUM calls for this subroutine to find the spectral acceleration.

(19) Subroutine CURVE4 --- The spectral acceleration corresponds

to the response design spectra in ATC-3-06. This is found by calling the subroutine CURVE4 from the subroutine SPTRUM.

(20) Subroutine DAMP5 --- DAMP5 is called from the subroutine SOIL1 to find the foundation damping factor when the effect of the soil-structure interaction is considered in using the ATC-3-06 provisions.

(21) Subroutine DATA1 --- The subroutine DATA1 is called from the MAIN program to read and print all the input information.

(22) Subroutine DISP --- The MAIN program calls for the subroutine DISP to calculate the ratios of the displacements to the allowable displacements and the ratios of the story drifts to the allowable story drifts. The active displacement and drift constraints are recorded.

(23) Subroutine EIGEN --- EIGEN is called from the MAIN program to find the eigensolutions. The subroutine STURM is called from this subroutine for using the Sturm sequence property.

(24) Subroutine ELFORC --- The subroutine ELFORC is called to compute the member forces.

(25) Subroutine ELMENT --- The MAIN program calls for the subroutine ELMENT to form the stiffness, geometric stiffness, and mass matrices of each individual element.

(26) Subroutine ENERGY --- The subroutine ENERGY is used to perform the multiplication of two matrices.

(27) Subroutine FIXEND --- The subroutine FIXEND is called to calculate the fixed end forces resulting from the uniform distributed loads.

(28) Subroutine GAUSS --- The Gauss elimination method is built

into the subroutine GAUSS. It is called from the MAIN program to solve the static displacements. It is also called from the subroutine EIGEN to solve eigenvectors.

(29) Subroutine INPUT --- The subroutine INPUT is called from the subroutine DATA1 to read and print the member identification data.

(30) Subroutine INPUT3 --- The subroutine INPUT3 is used to read in and print out the initial relative design variables for the design problem or the member information of the analysis problem.

(31) Subroutine LAT1 --- The subroutine LAT1 is called for the following purposes:

i) to calculate the approximate fundamental period of the building according to the ATC-3-06 provisions,

ii) to determine the equivalent seismic forces according to the equivalent lateral force method of the ATC-3-06 provisions, and

iii) to check the overturning moments and determine the final design forces.

This subroutine is called from the subroutine ATCCD, LAT2, SOIL1, or MODALA for the various purposes mentioned above.

(32) Subroutine LAT2 --- The subroutine Lat2 is called from the subroutine ATCCD, SOIL1, or MODALA to check the story drifts and P-Δ effects and to determine the final design forces.

(33) Subroutine LOADIN --- The subroutine LOADIN, which is called from the subroutine DATA1, is used to read the static and dynamic loading information.

(34) Subroutine MLTPLY --- The subroutine MLTPLY is used to

multiply a matrix with a vector and is called from the MAIN program.

(35) Subroutine MODALA --- The subroutine ATCCD calls for the subroutine MODALA to determine the design seismic forces according to the modal analysis method of the ATC-3-06 provisions. The subroutine LAT2 is called from this subroutine to check the story drifts and to determine the final design forces. The subroutine DAMP5 is called to find the foundation damping factor when the effect of soil-structure interaction is considered.

(36) Subroutine PDELTA --- The subroutine PDELTA is used to store the additional axial forces in columns to account for the P-Δ effects in the design. This subroutine is called from the MAIN program.

(37) Subroutine PERFOM --- The subroutine PERFOM is called from the subroutine COINF to determine:

i) the map area coefficients according to the Table 1-B in the ATC-3-06 provisions,

ii) the seismic index, the seismic hazard exposure group, and the seismic performance catagory according to Table 1-A in the ATC-3-06 provisions, and

iii) the analysis method.

(38) Subroutine POP2 --- The subroutine POP2 is called from the subroutine DATA1 to compute the total number of elements that must be stored in the system stiffness and mass matrices.

(39) Subroutine PRNTDR --- The subroutine PRNTDR is used to print out the displacements of the final design and is called from the MAIN program.

(40) Subroutine REDUCE --- REDUCE is used to reduce the force and

displacement vectors by taking out rows that correspond to the fixed degrees of freedom.

(41) Subroutine RESIZE --- The MAIN program calls for the subroutine RESIZE to prevent the redistributed sizes of the members on the upper floors from being larger than those of the members on the lower floors.

(42) Subroutine RESTOR --- RESTOR is used to restore the force or displacement vector by adding the rows that correspond to the fixed degrees of freedom in the vector.

(43) Subroutine ROOT1 --- ROOT1 is called from the subroutine MODALA to superimpose the base shears of all the required modes. This is done by using the root-mean-square method when the modal analysis method of the ATC-3-06 provisions is considered in the design.

(44) Subroutine ROOT2 --- The subroutine MODALA calls for the subroutine ROOT2 to superimpose story shears, story drifts, and overturning moments of all the required modes. This is done by using the root-mean-square method.

(45) Subroutine SAME --- The subroutine SAME is called from the MAIN program to force the size of those members that have common identification number to be identical.

(46) Subroutine SOIL1 --- The subroutine SOIL1 is called from the subroutine ATCCD to modify the seismic design forces, when the effect of the soil-structure interaction is considered in the equivalent lateral force method of the ATC-3-06 provisions.

(47) Subroutine SPTRUM --- The MAIN program calls for the subroutine SPTRUM to determine spectral acceleration or to perform

Duhamel Integration:

i) If the design is based on the data taken from earthquake acceleration records, then the maximum earthquake acceleration is found by interpolating according to the natural periods of the the building.

ii) If the curve fitted function of the acceleration spectrum is considered, then the spectral acceleration is found by calling the subroutines CURVE1, CURVE2, CURVE3, or CURVE4.

iii) If the input data are the time-history data, then an explicit integration is performed.

(48) Subroutine STRES1 --- The MAIN program calls for the subroutine STRES1 to compute the member forces and stresses. The stress constrains are also checked in this subroutine.

(49) Subroutine STRSW1 --- The subroutine STRSW1 is used to compute the structural weights that contribute to the columns for the analysis problem and is called from the MAIN program.

(50) Subroutine STRSWT --- The subroutine STRSWT is used to compute the structural weights that contribute to the columns for the design problem and is called from the MAIN program.

(51) Subroutine STURM --- The Sturm sequence property of solving eigenvalues and eigenvectors is built into the subroutine STURM which is called from the subroutine EIGEN.

(52) Subroutine TRNSFM --- The subroutine TRNSFM is used to transform the element stiffnesses and mass matrices from a local coordinate to a system coordinate.

(53) Subroutine WFBEAM --- The subroutine WFBEAM is called from

the MAIN program and the subroutine STRES1 to compute member stresses.

(54) Subroutine WIND1 --- The subroutine WIND1 is called from the subroutine LOADIN to determine the wind forces according to the power law.

2.3 Program Capacity and Guide of Modification

The ODSEWS-2D-II computer program is coded in FORTRAN IV language with fixed commons and dimensions. Because of fixed commons and dimensions, the capacity of this program is limited. The program capacity is constrained by the following maximum allowances:

(1) MAXST --- The maximum number of floor levels of the structure is 30.

(2) NMMAX --- The maximum number of members in the structure is 200.

(3) NNMAX --- The maximum number of degrees of freedom is 300.

(4) MAXSK --- The maximum number of elements in the mass and stiffness matrices of the structure is 3500.

(5) NJMAX --- The maximum number of nodes of the structure is 300.

(6) MAXNC --- The maximum number of active constraints is 30.

(7) LDMAX --- The maximum number of loading conditions is 4.

(8) MDMAX --- The maximum number of modes that can be considered in the dynamic analysis is 10.

(9) NGMAX --- The maximum number of members that contribute their weight to columns to account for the P-Δ effect is 200.

(10) NDMAX --- The maximum number of earthquake acceleration

records and time steps is 200.

(11) MBAND --- The half-bandwidth of the stiffness and mass matrices is not more than 50.

(12) NB --- The maximum number of fixed degrees of freedom is 50.

(13) KCOUNT--- The maximum number of iteration cycles is 20.

(14) MBAY --- The maximum number of bays of the structure is 10.

In order to modify the program capacity, the numbers for appropriate variables in the following commons and dimensions should be changed.

(1) Common DATA in subroutines MAIN, DATA1 and LOADIN:
FACTOR(LDMAX), XV(LDMAX), MTYPE(LDMAX), MOTYPE(LDMAX), NTYPE(LDMAX), NTIME(LDMAX), DEL(LDMAX)

(2) Common ATCI in subroutines MAIN, ATCCD, ATCIF, DAMP5, DATA1, LAT1, LAT2, LOADIN, MODALA, PERFOM and SOIL1:
DELA(MAXST)

(3) Common ACODE in subroutines MAIN, CODE, DATA1 and LOADIN:
Z(LDMAX), CI(LDMAX), CK(LDMAX), TS(LDMAX)

(4) Common CODE1 in subroutines MAIN, ATCCD, ATCIF, ATCWT, CHINA, CODE, DATA1, LAT1, LAT2, LOADIN, MODALA, SOIL1, and WIND1:
HT(MAXST), WTT(LDMAX), WWW(MAXST,LDMAX), KNODE(MAXST,LDMAX)

(5) Common ATC1 in subroutines MAIN, ATCCD, LAT1, LAT2, MODALA and SOIL1:
V(MAXST), DIS(MAXST), DELT(MAXST), RM(MAXST), CV(MAXST), TETA(MAXST), PP(MAXST), SUMWF1(MDMAX), SUMWF2(MDMAX),

WBARM(MDMAX), CSM(MDMAX), RMOMNT(MAXST+1), VMODAL(MDMAX), RMMODE(MAXST+1,MDMAX), DRIFMO(MAXST,MDMAX), U(MAXST,MDMAX), CVXM(MAXST,MDMAX), FMODAL(MAXST,MDMAX), DELXEM(MAXST,MDMAX), VMMODE(MAXST,MDMAX)

(6) Common ATC2 in subroutines MAIN, ATCCD, LAT1, LAT2, MODALA and SOIL1:

NBEAM(MAXST), NCONT(MAXST), NOCONT(MAXST,2*MBAY+2), NOBEAM(MAXST,MBAY)

(7) The following dimensions need to be changed in the MAIN program:

TTT(LDMAX), CC(LDMAX), SS(LDMAX), TOTAL(LDMAX), FT(LDMAX), STRENG(MAXNC), ENG2(MAXNC-2*LDMAX), IBND(NB), ICOL(NNMAX), RATIO1(2*LDMAX), CONST(MAXNC), ENG1(MAXNC-2*LDMAX), UMF(LDMAX), NDEFEQ(LDMAX), MDEFEQ(LDMAX), FQ(LDMAX), SUM1(LDMAX), SUM2(LDMAX), RATIO(MAXNC), MA(NMMAX), MB(NMMAX), AE(NMMAX), DEP(NMMAX), TFD(NMMAX), ELENTH(NMMAX), JTYPE(NMMAX), DDD1(NMMAX), FINDMI(KCOUNT), DDDD(NMMAX), BD(NMMAX), FRR(NMMAX), STRES(NMMAX), ENGLTA(NMMAX), NMB(NMMAX), RKAPA(MAXST), ICOLS(NNMAX), IDIAGS(NNMAX), DEFLMT(NNMAX), GN(MAXSK), FRS(NMMAX), VAL(NNMAX), GM(MAXSK), MBC(NMMAX), WWWW(NMMAX), FFF(MAXST), MSOIL(LDMAX), AREA1(NMMAX), SX(NMMAX), NDUCTY(LDMAX), KACTIV(NMMAX), AHMX(LDMAX), AVMX(LDMAX), IDIAG(NNMAX), X(NJMAX), Y(NJMAX), SK(MAXSK), WW(MAXST), PHI1(NMMAX), VALMIN(MDMAX), TT(MDMAX), VWORK(MDMAX), DAMP(MDMAX), AM(NMMAX), AN(NMMAX), FACTDL(LDMAX), FACTLL(LDMAX), FACTSL(LDMAX), FACTEL(LDMAX),

SK1(MAXSK), NLINE(NMMAX), FI(NNMAX,LDMAX), DI(NNMAX,LDMAX), FR(NNMAX,LDMAX), DR(NNMAX,LDMAX), XH(NNMAX,LDMAX), JDEFEQ(MDMAX,LDMAX), FS(NNMAX,LDMAX), DLF1(MDMAX,LDMAX), DLF2(MDMAX,LDMAX), HH(MDMAX,LDMAX), VV(MDMAX,LDMAX), PNT(NDMAX,LDMAX), DS(NNMAX,LDMAX), ENG(NMMAX,MAXNC), H1(NDMAX,LDMAX), FV(NNMAX,LDMAX), FD(NNMAX,LDMAX), S1(6,MAXNC-2*LDMAX), S2(6,MAXNC-2*LDMAX), SS1(6,MAXNC-2*LDMAX), SS2(6,MAXNC-2*LDMAX), DM(NNMAX,MDMAX), EDF(6,MAXNC-2*LDMAX), EFF(6,MAXNC-2*LDMAX), FF(NNMAX,MAXNC-2*LDMAX), DF(NNMAX,MAXNC-2*LDMAX), H2(NDMAX,LDMAX), WT(NMMAX,3), ISGN(NNMAX,MAXNC-2*LDMAX),ISTR1(NNMAX,LDMAX), FSATC(NNMAX,LDMAX), WS(MAXST,LDMAX), XS(NNMAX,LDMAX), MNO(NMMAX,NGMAX), DELTAO(NNMAX,LDMAX), AERECD(NMMAX,KCOUNT), SK1U(NNMAX,1), DELTAR(NNMAX,NMMAX), SK12(NMMAX,1), DSTMAX(NMMAX,NMMAX), ASTRE(NMMAX,LDMAX), SK2U(NNMAX,1)

(8) The following dimension needs to be changed in the subroutine ATCCD:

TTT(MDMAX)

(9) The following dimensions need to be changed in the subroutine CODE:

FX(NNMAX,1), DX(NNMAX,1)

(10) The following dimensions need to be changed in the subroutine DATA1:

UMF(LDMAX), WMASS(NJMAX), AML(6,LDMAX)

(11) The following dimensions need to be changed in the subroutine EIGEN:

VALUP(NNMAX), SKK(MAXSK), FI(NNMAX,1), DI(NNMAX,1),

DRP(NNMAX,1)

(12) The following dimension needs to be changed in the subroutine LOADIN:

XS(NNMAX,1)

(13) The following dimensions need to be changed in the subroutine RESTOR:

TDR1(LDMAX), TDR2(LDMAX)

(14) The following dimension needs to be changed in the subroutine STRES1:

UMF(LDMAX)

(15) The following dimensions need to be changed in the subroutine STURM:

IREC(NNMAX), ICHNG(NNMAX), D(2*MBAND), C(MBAND,2*MBAND)

(16) The following dimensions need to be changed in the subroutine WIND1:

WF(MAXST+1), FFF(MAXST), HEIGHT(MAXST+1)

III. DESCRIPTION OF INPUT DATA

3.1 Contents of the Input Instructions

In this section, 12 input codes included in the input instruction are outlined. The detailed input data instructions of each code are shown in the next section.

(I) TOTAL NUMBER OF PROBLEMS

(II) CONTROL CARDS

(III) STRUCTURAL COSTS INFORMATION CARDS

(IV) MEMBER INFORMATION CARDS

- a. Girder-Column Property Card
  - (i) Built-up section
  - (ii) AISC wide flange section
- b. Bracing Property Card
- c. Bracing Identification Cards
- d. Girder Identification Cards
- e. Column Identification Cards

(V) JOINT INFORMATION CARDS

(VI) INITIAL RELATIVE DESIGN VARIABLE CARDS

(VII) BOUNDARY CONDITION CARDS

(VIII) STATIC LOADING INFORMATION CARDS

- a. Control Cards
- b. Loading Cards
  - (i) Loading parameter > 0
  - (ii) Loading parameter < 0

(1) Story weight information cards

(2) UBC information card

(3) ATC information cards

(4) Chinese Building Design Code information card

(5) Story member information cards

(6) Wind force information cards

c. Load Combination Factor Cards

(IX) DYNAMIC PROPERTY CARDS

a. Control Card

b. Damping Factor Card

c. Additional Nodal Mass Cards

d. Dynamic Loading Information Cards

(i) Control card

(ii) Loading cards

(iii) Acceleration data cards

(1) Periods or time cards

(2) Horizontal acceleration data cards

(3) Vertical acceleration data cards

(4) Curve fitting acceleration card

e. Story Drift Information Cards

f. Story Member Cards

(X) MEMBER INFORMATION CARDS OF ANALYSIS PROBLEM

a. Relative Size Cards

b. Sectional Area Cards

c. Sectional Modulus Cards

d. Member Property Card

(XI) DISPLACEMENT CONSTRAINT CARDS

a. Equal Value for All Displacement Constraints

b. Different Displacement Constraints

(i) Control card

(ii) Allowable values

(XII) FREQUENCY CONSTRAINT CARDS

3.2 Input Data Instructions

The detailed instructions for each of the 12 input codes are as follows:

(I) TOTAL NUMBER OF PROBLEMS (2I5)

Columns	Variable	Entry
1-5	NSTRS	Total number of problems to be designed or analyzed in this job run.
6-10	IOUT1	The logical unit number of the disc or tape on which the plotting data of the first problem will be stored.

(II) CONTROL CARDS (11I5,/,8F10.0,/,8I5,10A4)

Columns	Variable	Entry
1-5	ICODE	EQ. 1; Uniform Building Code. EQ. 2; ATC-3-06. EQ. 3; Chinese Building Design Code. EQ. 4; Wind force. EQ. 5; No code provisions will be considered in

		in the design.
6-10	IDESGT	EQ.-1; Analysis. EQ. 0; Minimum weight design. EQ. 1; Minimum cost design.
11-15	IRELT	EQ. 0; The initial design variables will be equal to 1.0 for all members. EQ. 1; The initial design variables will be read in from the input data.
16-20	IPLOT	EQ. 0; No plot. EQ. 1; The results of design will be plotted.
21-25	NSTORY	Total number of floor levels.
26-30	IGRADT	EQ. 0; The constraint gradient method will not be considered in the design. GE. 1; Total number of times that the method based on constraint gradient will be used.
31-35	LGRADT	A positive number, which is used to determine whether the constraint gradient method has improved the design result or not. If the number of cycles that the method has been used continuously for more than this number and the result has not been improved, then the program will be stopped.
36-40	IMAX	The maximum number of cycles for scaling without changing eigen solutions.
41-45	IIMAX	The maximum number of cycles for scaling by

		reformulating stiffness and mass matrices.
46-50	INSIST	EQ. 1; The energy distribution method will be used until the number of iterations is equal to the maximum allowance. EQ. 0; The program will be stopped when the design result is no longer improved.
51-55	IUNILD	EQ. 1; The uniform distributed loads will be included in the force vector when ATC-3-06, UBC or the Chinese Building Design Code is considered. EQ. 0; The uniform loads will not be included in the force vector.
1-10	EPSI	A prescribed tolerance, which is used to determine the active displacement constraints.
11-20	EPS1	A prescribed tolerance, which is used to determine the convergence of scaling without changing the eigen solutions.
21-30	EPS2	A prescribed tolerance, which is used to determine the convergence of scaling.
31-40	EPS	A prescribed tolerance, which is used to determine whether the constraint gradient method will be used in the next cycle or not.
41-50	URANGE	The upper bound of the change in the relative design variable for the constraint gradient method.

51-60	DRANGE	The lower bound of the change in the relative design variable for the constraint gradient method.
61-70	REFATR	The percentage of reducing the member sizes to compute constraint gradients and have a value of 1%~2%.
71-80	FINCRT	The coefficient that is used to change the design variables for computing the constraint gradient in sensitive analysis with the value ranging from 1.01 to 1.10
1-5	MEMBS	Total number of members.
6-10	JOINTS	Total number of nodes.
11-15	NBNDRY	Total number of fixed degrees of freedom.
16-20	LOADS	Total number of loading conditions.
21-25	LMTDSP	Displacement constraint code: EQ. 0; No displacement constraint. EQ. 1; All degrees of freedom have the same constraint value. EQ. 2; Displacement constraints can be varied per degree of freedom. EQ. 3; Displacement constraints will be set up according to the allowable story drift and the story drifts will be checked.
26-30	INDEX	Type of design: EQ.-1; Static design or analysis. EQ. 0; Static + dynamic design or analysis.

		EQ. 1; Dynamic design or analysis.
31-35	NCOUNT	Maximum number of iterations.
36-40	ISEC	Type of section:
		EQ. 0; Built-up section.
		GT. 0; AISC wide flange section.
		LT. 0; Truss member.
41-80	TITLE	User's option.

(III) STRUCTURAL COSTS INFORMATION CARDS (5F10.0,/,I5,4F10.0,F25.0)

Skip these two cards if it is not a minimum cost design.

Columns	Variable	Entry
1-10	ASTAR	The ground acceleration of the earthquake normalized by the gravity acceleration g.
11-20	CS8	The unit price of steel ($/lb).
21-30	CPT	The unit price of painting ($/in^2).
31-40	CSC	The unit price of steel at connections ($/lb).
41-50	CSW	The unit price of welding metal ($/lb).
1-5	NLIFE	Total life of the structure (years).
6-15	CONONS	The ratio of the nonstructural costs to the construction costs.
16-25	GAMMA6	The coefficient of the power in the equation for computing the seismic frequency; its value is 14.6118 for southern California.
26-35	DELTA6	The coefficient in the equation for computing the seismic frequency; its value is 2.9335 for southern California.

36-45	GACCMX	The maximum expected intensity of an earthquake during the lifetime of the structure.
46-70	RINIST	The initial stiffness of the connection.

(IV) MEMBER INFORMATION CARDS

Omit cards a. and b., when it is a analysis problem.

a. Girder-Column Property Card

(i) Built-up section (2F10.0,10F5.0)

Columns	Variable	Entry
1-10	EE	Modulus of elasticity (psi).
11-20	RHO	Specific weight.
21-25	BDI	Initial value of b_f/d.
26-30	DEPMAX	Maximum depth of the section.
31-35	DEPMIN	Minimum depth of the section.
36-40	TFDMAX	Maximum t_f/d.
41-45	TFDMIN	Minimum t_f/d.
46-50	BTFMAX	Maximum b_f/t_f.
51-55	BTFMIN	Minimum b_f/t_f.
56-60	BDMAX	Maximum b_f/d.
61-65	BDMIN	Minimum b_f/d.
66-70	AENM	The ratio of the minimum moment of inertia to the maximum moment of inertia.

(ii) AISC wide flange section (6F10.0)

Columns	Variable	Entry
1-10	EE	Modulus of elasticity (psi).
11-20	RHO	Specific weight.

21-30	BASEA	Initial moment of inertia.
31-40	AEMNMX	Maximum moment of inertia.
41-50	AEMNMM	Minimum moment of inertia.
66-70	AENM	The ratio of the minimum moment of inertia to the maximum moment of inertia.

b. Bracing Property Card (5F10.0)

Columns	Variable	Entry
1-10	E1	Modulus of elasticity (psi).
11-20	RHO1	Specific weight.
21-30	ABRACE	Initial sectional area.
31-40	ABRMAX	Maximum area.
41-50	ABRMIN	Minimum area.

c. Bracing Identification Cards (4I5,F10.0,30X,2I5)

Columns	Variable	Entry
1-5	ID	Identification number of the member. (Number the independent variables first, the subsequent members are then numbered in the order of common design variables.)
6-10	MA	First node number of the member (the smaller node number of the member).
11-15	MB	Second node number of the member (the larger node number of the member).
16-20	JT	Member type code, 0 for bracings.
21-30	ST	Allowable stress of the member.
31-60		Blank.

61-65	NT	Design variable number. (Use the number of independent variable if that is the common design variable for this member.)
66-70	NLINE	The number defines the bracing line to which this member belongs. (This number is used to redistribute the member sizes if the member sizes on the upper stories are larger than those of lower stories because of the redistribution based on energy.)

Repeat the directions on this card through all of the bracings.

d. Girder Identification Cards (4I5,4F10.0,2I5)

Columns	Variable	Entry
1-5	ID	Identification number of the member. (See bracing identification cards.)
6-10	MA	First node number of the member.
11-15	MB	Second node number of the member.
16-20	JT	Member type code, 2 for girter.
21-30	ST	Allowable stress of the member.
31-40	WTD	Uniform dead load, lb/in.
41-50	WTL	Uniform live load, lb/in.
51-60	WTS	Uniform snow load, lb/in.
61-65	NT	Design variable number. (See bracing identification cards.)
66-70	NLINE	The number defines the girder line to which this member belongs. (See bracing identification

cards.)

Repeat the directions on this card through all of the girders.

e. Column Identification Cards (4I5,2F10.0,20X,3I5,/(16I5))

Columns	Variable	Entry
1-5	ID	Identification number of the member. (See bracing identification cards.)
6-10	MA	First node number of the member.
11-15	MB	Second node number of the member.
16-20	JT	Member type code, 1 for column.
21-30	ST	Allowable stress of the member.
31-40	WTD	Additional axial force (P-Δ force).
41-60		Blank.
61-65	NT	Design variable number. (see bracing identification cards.)
66-70	NLINE	The number defines the column line to which this member belongs. (See bracing identification cards.)
71-75	NB	Total number of members that contribute their weights to this column.

If NB=0, then skip the following card.

1-5	MNO	Identification number of the member that contributes its weight to the column.
6-10		Repeat for each additional member.

Repeat the directions on these cards through all the columns.

(V) JOINT INFORMATION CARDS (I5,2F10.0)

Columns	Variable	Entry
1-5	JT	Joint identification number.
5-15	X	X-coordinate.
16-25	Y	Y-coordinate.

(VI) INITIAL RELATIVE DESIGN VARIABLE CARDS ((8F10.0))

If IRELT=0, then skip these cards.

Columns	Variable	Entry
1-10	AE	Relative design variable of the first member.
11-20		Repeat through all members.

(VII) BOUNDARY CONDITION CARDS (16I5)

Columns	Variable	Entry
1-5	IBND	First degree of freedom that is fixed.
6-10		Repeat for each additional degree of freedom that that is fixed.

(VIII) STATIC LOADING INFORMATION CARDS

The following data set is prepared for one loading case. It is necessary to repeat this data set through all the loading cases. If the problem is one of dynamic design, then skip this data set.

a. Control Cards (I5)

Columns	Variable	Entry
1-5	NJ	Loading parameter: GE. 0; Number of load components for this loading case. LT. 0; The lateral forces are determined by using the provisions of UBC, ATC-3-06, or the

Chinese Building Design Code, or use the power law to find the wind forces.

b. Loading Cards

(i) Loading parameter > 0 (3(F10.0,2I5))

Columns	Variable	Entry
1-10	TFR	Magnitude of the force.
11-15	IM	Direction of the force. EQ. 1; X-direction EQ. 2; Y-direction EQ. 3; Z-direction
16-20	JM	Number of the node to which the load is applied.
21-30		Repeat for each additional load. Three sets of data can be prepared on one card.

(ii) Loading parameter < 0

(1) Story weight information cards (2I5,2F10.0)

These cards are needed for the following cases: 1) for checking the story drifts, 2) for using the code provisions to compute the equivalent seismic forces, or 3) using the power law to determine the wind forces.

Columns	Variable	Entry
1-5	II	Floor level.
6-10	KNODE	Number of the node to which the lateral force is applied. It is also the node number at which the the story drifts will be calculated.
11-20	HT	Height of the floor level from the base.

21-30	WS	Total gravity load on this floor level.

(2) UBC information card (4F5.0)

If UBC is not considered, then skip this card.

Columns	Variable	Entry
1-5	Z	The seismic zone coefficient.
6-10	CI	The importance factor of the structure.
11-15	CK	The structural type coefficient.
16-20	TS	Site period.

Note that it is necessary to repeat cards (1) and (2) for each loading case when UBC is considered.

(3) ATC information cards (12I5/3F10.0/3F10.0,2F20.0,2I5)

If ATC is not considered, then skip these cards.

Columns	Variable	Entry
1-5	NNNNN	Map area number for effective peak ground acceleration.
6-10	MMMMM	Map area number for effective peak ground velocity.
11-15	ISH	Seismic hazard exposure group.
16-20	NBRITL	EQ. 1; Britle type structure. EQ. 0; Non-britle type structure.
21-25	IACTIV	EQ. 1; Active fault. EQ. 0; Inactive fault.
26-30	ISOIL	Soil profile type.
31-35	NPREGR	EQ. 1; Plan configuration is regular. EQ. 0; Plan configuration is irregular.

36-40	NVREGR	EQ. 1; Vertical configuration is regular.
		EQ. 0; Vertical configuration is irregular.
41-45	MR	EQ. 1; Moment resisting frame.
		EQ. 0; All other kinds of structure.
46-50	ISF	EQ. 1; Steel frame.
		EQ. 0; Concrete frame.
51-55	IFIX	EQ. 1; Fixed base.
		EQ. 0; Consider the effect of soil-structure interaction.
56-60	NANALS	EQ. 0; The method of analysis will be automatically determined by the computer program.
		EQ. 1; Equivalent lateral force method.
		EQ. 2; Modal analysis method.
1-10	R	The response modification factor.
11-20	CD	The deflection modification factor.
21-30	RL	The overall length at the base in the direction of analysis.

The following card is needed only when the effect of soil-structure interaction is considered, i.e., IFIX=0.

1-10	RR	The characteristic foundation length, in.
11-20	VS	The shear wave velocity, in./sec.
21-30	DSSSS	The depth of stratum, in.
31-50	RKY	The lateral stiffness of the foundation, lb/in.
51-70	RKTETA	The rocking stiffness of the foundation,

lb-in./rad.

71-75	ISLGL	EQ. 1; Single gravity load. EQ. 0; Non-single gravity load.
76-80	IPILE	EQ. 1; For buildings supported on point bearing piles or in other cases where the foundation soil consists of a soft stratum of reasonably uniform properties underlain by a much stiffer rock-like deposit with an abrupt increase in stiffness. EQ. 0; For all other cases.

(4) Chinese Building Design Code information card (2F10.0,I5)

This card is needed only when the Chinese Building Design Code is considered.

Columns	Variable	Entry
1-10	CII	The structural influence coefficient.
11-20	ALPHMX	The maximum seismic influence coefficient: Earthquake magnitude 7, α_{max}=0.23 Earthquake magnitude 8, α_{max}=0.45 Earthquake magnitude 9, α_{max}=0.90
21-25	NSOIL	Soil profile type.

(5) Story member information cards (16I5)

Skip this input for the following cases: 1) INC=0 and ICODE=5, 2) ICODE=5 and IDESGT=-1, 3) ICODE=4, or 4) NSTORY=0.

Columns	Variable	Entry
1-5	NBBBB	Total number of girders that contribute their

		weights to floor level i.
6-10	NNCON	Total number of columns and bracings that contribute their weights to floor level i.
11-15	NOBEAM	Identification number of girders.
		Repeat through total number of girders, NBBBB.
16-20	NOCONT	Identification number of columns.
		Repeat through total number of columns, NNCON.

Repeat these data from the bottom to top level.

(6) Wind force information cards (8F10.0,/,F10.0)

Skip these cards when the wind forces determined by the power law are not considered.

Columns	Variable	Entry
1-10	BAYWTH	The width of the structural bay in the direction of analysis.
11-20	HGRADT	The gradient height of the wind, in.
21-30	VGRADT	The gradient velocity of the wind, in./sec.
31-40	POWER	The power law coefficient for the gradient height.
41-50	CPEA	External presure coefficient on the windward wall.
51-60	CPEB	External presure coefficient on the leeward wall.
61-70	CPIA	Internal presure coefficient on the windward wall.
71-80	CPIB	Internal presure coefficient on the leeward

		wall.
1-10	GUSTF	Gust factor.

c. Load Combination Factor Cards (4F5.0)

Columns	Variable	Entry
1-5	FACTDL	Load combination factor for the dead load.
6-10	FACTLL	Load combination factor for the live load.
11-15	FACTSL	Load combination factor for the snow load.
16-20	FACTEL	Load combination factor for the equivalent seismic load.

(IX) DYNAMIC PROPERTY CARDS

For the static design, card a. only is needed.

a. Control Card (4I5,F10.0)

Columns	Variable	Entry
1-5	KOPTON	Option code: EQ. 1; Use only the significant modes in the design. EQ. 2; Use all specified modes in the design. EQ. 0; Static design.
6-10	NSIGN	Type of mode superposition: EQ.-1; Direct superposion. EQ. 0; Root-mean-square superposition. EQ. 1; Absolute superposition.
11-15	NBEGIN	The first of the desired modes.
16-20	NDESIR	The last of the desired modes.
21-30	XG	The gravity acceleration.

b. Damping Factor Card (8F10.0)

Skip this card when INDEX=-1.

Columns	Variable	Entry
1-10	DAMP	Damping factor of the first mode.
11-20		Repeat through all the desired modes.

c. Additional Nodal Mass Cards (8F10.0)

Skip this card for 1) static loads, 2) UBC, or 3) wind forces determined by using the power law.

Columns	Variable	Entry
1-10	WMASS	Mass at first node.
11-20		Repeat for each node.

d. Dynamic Loading Information Cards

The following data set is prepared for one loading case only. Repeat this data set for each additional loading case.

(i) Control card (4I5,3F5.0,I5,10A4)

Columns	Variable	Entry
1-5	NJ	Loading parameter:
		GE. 0; Number of load components.
		LT. 0; Seismic excitations.
6-10	MO	Direction of dynamic motion:
		LT. 0; Horizontal + vertical.
		EQ. 1; Horizontal only.
		EQ. 2; Vertical only.
11-15	NZ	Type of input acceleration:
		EQ. 1; Time-history data.

		EQ. 2; Spectrum data.
		EQ. 3; Curve fitted spectrum data.
16-20	NNM	Number of acceleration data or spectrum data.
21-25	F	Load multiplier or scale factor of horizontal motion.
26-30	XV	Scale factor of vertical motion.
31-35	DEL	Time increment for explicit integration.
36-40	NT	Number of time steps for integration purposes.
41-80	TITLE	User's option.

(ii) Loading cards (3(F10.0,2I5))

This data set is needed when the loading parameter is greater than zero.

Columns	Variable	Entry
1-10	TFR	Magnitude of load.
11-15	IM	Direction of load (X=1, Y=2, Z=3).
16-20	JM	Number of node to which the load is applied.
21-30		Repeat for each additional load.

(iii) Acceleration Data Cards

Data sets (1), (2), and (3) are needed when the type of acceleration data is time-history data or spectrum data.

(1) Periods or time cards (8F10.0)

Columns	Variable	Entry
1-10	PT	First datum of period or time.
11-20		Repeat for each additional period or time.

(2) Horizontal acceleration data cards (8F10.0)

Columns	Variable	Entry
1-10	H1	First datum of spectral acceleration or ground acceleration in the horizontal direction.
11-20		Repeat for each additional datum.

(3) Vertical acceleration data cards (8F10.0)

This data set is needed for multicomponent ground motions only.

Columns	Variable	Entry
1-10	H2	First datum of spectral acceleration or ground acceleration in the vertical direction.
11-20		Repeat for each additional datum.

(4) Curve fitting acceleration card (2I5,2F10.0)

Columns	Variable	Entry
1-5	NDUCTY	EQ. 1; Newmark's spectrum (5% damping, 50 percentile alluvium). EQ. 2; Newmark's spectrum (5% damping, 90 percentile alluvium). EQ. 3; Newmark's spectrum (5% damping, and ductility is 3). EQ. 4; Newmark's spectrum (5% damping, and ductility is 4). EQ. 0; All other response spectra.
6-10	MSOIL	EQ. 0; If NDUCTY is also equal to zero, then the Housner's average response spectrum with 5% damping is selected. When NDUCTY is not zero, then it is required to let MSOIL

be equal to zero.

EQ. 1; Seed's spectrum (rock).

EQ. 2; Seed's spectrum (stiff site condition).

EQ. 3; Seed's spectrum (deep cohesionless soil). less soil)

EQ. 4; Seed's spectrum (soft to medium clay and sand).

EQ. 5; Chinese building design spectrum (soil type 1).

EQ. 6; Chinese building design spectrum (soil type 2).

EQ. 7; Chinese building design spectrum (soil type 3).

EQ. 8; ATC-3-06 recommended building design spectrum (soil type 1).

EQ. 9; ATC-3-06 recommended building design spectrum (soil type 2).

EQ.10; ATC-3-06 recommended building design spectrum (soil type 3 and the effective peak ground acceleration is less than 0.3g).

EQ.11; ATC-3-06 recommended building design spectrum (soil type 3 and the effective peak ground acceleration is greater than or equal to 0.3g).

11-20	AHMX	The maximum seismic influence coefficient of horizontal motion for the Chinese building design spectrum: Earthquake magnitude 7, α_{hm}=0.23. Earthquake magnitude 8, α_{hm}=0.45. Earthquake magnitude 9, α_{hm}=0.90.
21-30	AVMX	The maximum seismic influence coefficient of vertical motion for the Chinese building design spectrum: Earthquake magnitude 7, α_{vm}=0.115. Earthquake magnitude 8, α_{vm}=0.23. Earthquake magnitude 9, α_{vm}=0.46.

e. Story Drift Information Cards (2I5)

These cards are needed only when one wants to check story drifts.

Columns	Variable	Entry
1-5	II	Floor level.
6-10	KNODE	Number of the node that will be used to compute story drifts.

f. Story Member Cards (16I5)

Skip these cards for the analysis problem or NSTORY=0.

Columns	Variable	Entry
1-5	NBBBB	Total number of girders on floor level i.
6-10	NNCON	Total number of columns and bracings on floor level i.
11-15	NOBEAM	Identification number of girders.

		Repeat through total number of girders, NBBBB.
16-20	NOCONT	Identification number of columns.
		Repeat through total number of columns, NNCON.

Repeat these data from the bottom to top level.

(X) MEMBER INFORMATION CARDS OF ANALYSIS PROBLEM

Skip this data set for the design problem.

a. Relative Size Cards (8F10.0)

Columns	Variable	Entry
1-10	AE	Relative size of the first member. For girders and columns, this value is I/I_{max}. For bracings, it is A/I_{max}. For members of truss, it is A/A_{max}.
11-20		Repeat for each member.

b. Sectional Area Cards (8F10.0)

Columns	Variable	Entry
1-10	AREA1	Sectional area of the first member.
11-20		Repeat for each member.

c. Sectional Modulus Cards (8F10.0)

Columns	Variable	Entry
1-10	SX	Sectional modulus of the first member. It could be zero if the member stresses are not computed.
11-20		Repeat for each member.

d. Member Property Card (F10.0,2(F15.0,F10.0))

Columns	Variable	Entry
1-10	BASEA	The maximum moment of inertia among all members

		of the frame or the maximum sectional area among all members of truss.
11-25	EE	Modulus of elasticity of girders and columns.
26-35	RHO	Specific weight of girders and columns.
36-50	E1	Modulus of elasticity of bracings.
51-60	RHO1	Specific weight of bracings.

(XI) DISPLACEMENT CONSTRAINT CARDS

Skip this data set for the analysis problem. If the displacement constraint is not considered in the design, then this data set is also skipped. Either a. or b. has to be prepared in accordance with the displacement constraint code.

a. Equal Value for All Displacement Constraints (3F10.0)

This card is needed when LMTDSP=1.

Columns	Variable	Entry
1-10	DEFMAX(1)	The allowable displacement in X-direction.
11-20	DEFMAX(2)	The allowable displacement in Y-direction.
21-30	DEFMAX(3)	The allowable displacement in Z-direction.

b. Displacement Constraints Vary

These cards are needed when LMTDSP=2 or 3.

(i) Control card (I5)

Columns	Variable	Entry
1-5	NLTDEF	Total number of displacement constraints.

(ii) Allowable values (3(F10.0,2I5))

Columns	Variable	Entry
1-10	TFR	The allowable value of the first constraint.

11-15	IM	Direction code (X=1, Y=2, Z=3).
16-20	JM	Node number.
21-30		Repeat for each additional displacement constraint.

(XII) FREQUENCY CONSTRAINT CARDS (8F10.0)

Skip this card if it is a analysis problem or is a static design problem.

Columns	Variable	Entry
1-10	VALMIN	The allowable frequency of the first desired mode.
11-20		Repeat for each additional mode.

3.3 Input Data Stream and Job Control Language

The input data stream for a job is shown in Figure 3.1. Several problems may be run at one time. Figure 3.2 shows the detailed stream of input codes. Code I is required for each job, and codes II through XII are then repeated for each problem. The detailed input information has already been presented in Sec. 3.2.

In order to run the program on an AMDAHL 470V/7, 470V/8, or IBM 4341 OS/VS1 system, the following sets of JCL are required:

(1) To run card decks on an AMDAHL 470V/7 or 470V/8:

```
//jobname JOB (xxxxRL,pswd),'name',MSGLEVEL=(1,1)
/*JOBPARM L=20,T=10,R=1280
// EXEC FRTVCLG,PARM.FORT='SOURCE,MAP',PARM.LKED='SIZE=2048K',
// FVLNSPC='CYL,(1,1)'
```

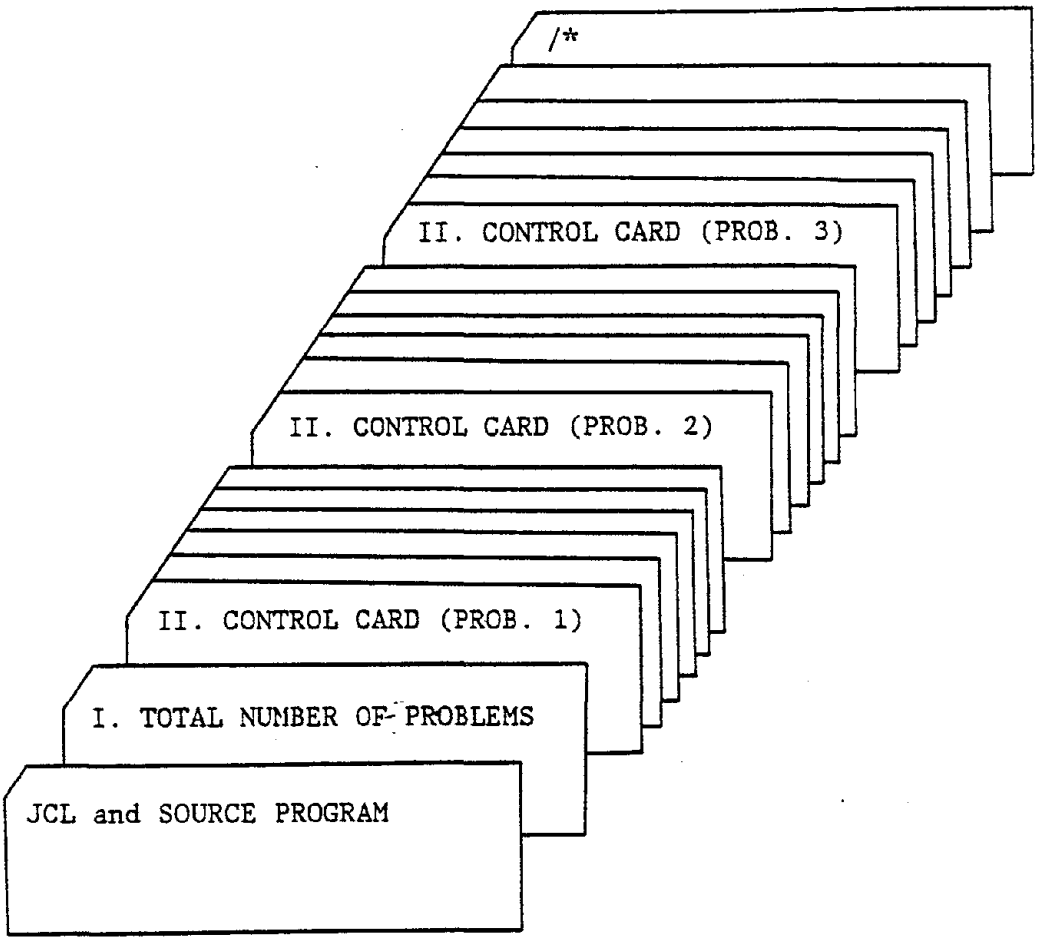


Figure 3.1 Input Data Stream

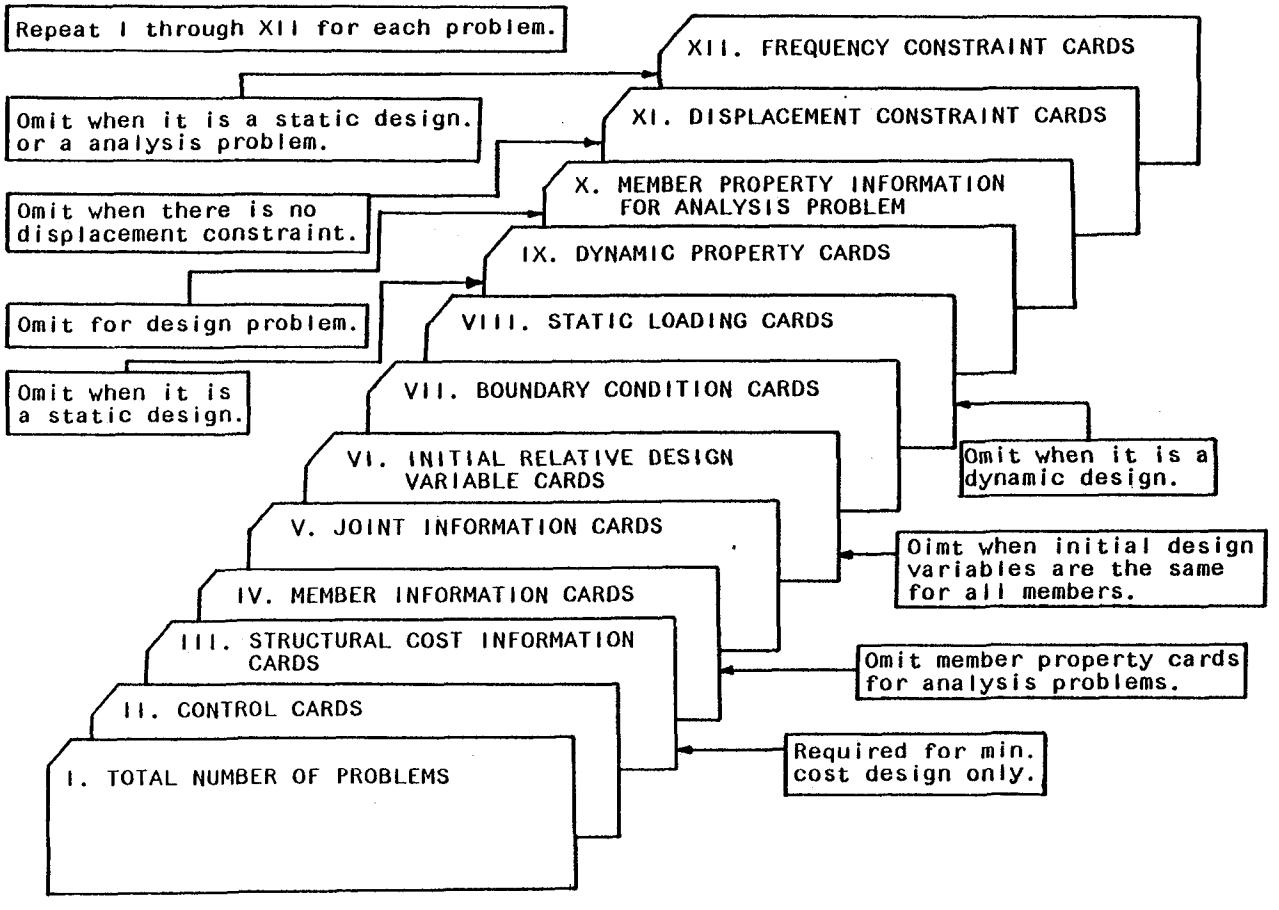


Figure 3.2 Detailed Input Data Stream

```
//FORT.SYSIN DD *
                :
                :
          Source program
                :
                :
//GO.FT01F001  DD DSN=&&FT01,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//GO.FT02F001  DD DSN=&&FT02,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//GO.FT03F001  DD DSN=&&FT03,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//GO.FT15F001 DD DSN=filename of plotting data,
//       DISP=(NEW,CATLG),SPACE=(TRK,(10,10),RLSE),
//       UNIT=UMRDA,DCB=(RECFM=FB,LRECL=80,BLKSIZE=6160)
//GO.SYSIN DD *
                :
                :
              Data
                :
                :
/*
//
```

(2) To run a program by executing a load module on an AMDAHL 470V/7

or 470V/8:

```
//jobname JOB (xxxxRL,pswd),'name',MSGLEVEL=(1,1)
/*JOBPARM L=20,T=10,R=1280
// EXEC PGM=name of the compiled program
//STEPLIB DD DSN=ddname of the compiled program,DISP=SHR
//FT01F001  DD DSN=&&FT01,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//FT02F001  DD DSN=&&FT02,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//FT03F001  DD DSN=&&FT03,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//FT15F001 DD DSN=filename of plotting data,
//       DISP=(NEW,CATLG),SPACE=(TRK,(10,10),RLSE),
//       UNIT=UMRDA,DCB=(RECFM=FB,LRECL=80,BLKSIZE=6160)
//FT05F001 DD *
                :
                :
               Data
                :
                :
/*
//
```

(3) To run card decks on an IBM 4341 OS/VS1 system:

```
//jobname JOB (xxxxVS1C,pswd),'name',MSGLEVEL=(1,1),
```

```
// MSGCLASS=A,TIME=20
//S1 EXEC FORTVCLG,PARM.FORT='SOURCE,MAP',
//   PARM.LKED='SIZE=2048K',FVLNSPC='CYL,(1,1)'
//FORT.SYSPRINT DD SYSOUT=A,OUTLIM=10000
//FORT.SYSIN DD *
              :
              :
        Source program
              :
              :
//LKED.SYSUT1 DD SPACE=(2048,(20,10,1),RLSE),
//  DCB=BLKSIZE=2048
//LKED.SYSLMOD DD SPACE=(2048,(20,10,1),RLSE),
//  DCB=BLKSIZE=2048
//LKED.SYSPRINT DD SYSOUT=A
//GO.FT06F001 DD SYSOUT=A,OUTLIM=10000
//GO.FT07F001 DD DUMMY
//GO.FT01F001  DD DSN=&&FT01,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//GO.FT02F001  DD DSN=&&FT02,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//GO.FT03F001  DD DSN=&&FT03,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//GO.FT15F001 DD DSN=filename of plotting data,
//       DISP=(NEW,CATLG),SPACE=(TRK,(10,10),RLSE),
```

```
//        UNIT=UMRDA,DCB=(RECFM=FB,LRECL=80,BLKSIZE=6160)
//GO.SYSIN DD *
                :
                :
               Data
                :
                :
 /*
 //
```

(4) To run a program by executing a load module on an IBM 4341 OS/VS1 system:

```
//jobname JOB (xxxxVS1C,pswd),'name',MSGLEVEL=(1,1)
// MSGCLASS=A,TIME=20
// EXEC PGM=name of the compiled program
//STEPLIB DD DSN=ddname of the compiled program,DISP=SHR
//FT06F001 DD SYSOUT=A,OUTLIM=10000
//FT07F001 DD DUMMY
//FT01F001  DD DSN=&&FT01,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//FT02F001  DD DSN=&&FT02,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//FT03F001  DD DSN=&&FT03,DISP=(NEW,DELETE),UNIT=SYSDA,
//  DCB=(RECFM=VBS,LRECL=84,BLKSIZE=8440),SPACE=(TRK,(45,3))
//FT15F001 DD DSN=filename of plotting data,
```

```
//        DISP=(NEW,CATLG),SPACE=(TRK,(10,10),RLSE),
//        UNIT=UMRDA,DCB=(RECFM=FB,LRECL=80,BLKSIZE=6160)
//FT05F001 DD *
                  :
                  :
                 Data
                  :
                  :
/*
//
```

3.4 Computer Program Listing

```
C*****************************************************************************
C*                              OOSEMS-2D-II                                 *
C*   OPTIMUM DESIGN OF 2-DIMENSIONAL STEEL STRUCTURES FOR STATIC, EARTHQUAKE   *
C*    AND WIND FORCES - VERSION II                                             *
C*   DEVELOPED BY F. Y. CHENG AND D. S. JUANG                                  *
C*   CIVIL ENGINEERING DEPARTMENT, UNIVERSITY OF MISSOURI-ROLLA                *
C*   AUGUST, 1985                                                              *
C*****************************************************************************
C
      COMMON/DATA/FACTOR(4),XV(4),MTYPE(4),MOTYPE(4),NTYPE(4),NTIME(4),  MAIN0001
     1           DEL(4),MNN
      COMMON/PAT1/INN,IOUT,IOUT1                                         MAIN0002
      COMMON/STIFF/BASEA,EE,EI,RG                                        MAIN0003
      COMMON/ABC/NZERO,NBEGIN,NDESIR,NITER,MDMAX,NNMAX                   MAIN0004
      COMMON/BBC/ISEC,TWD,DEPMAX,DEPMIN,TFDMAX,TFDMIN,RHO,RHO1,BTFMAX,   MAIN0005
     1           BTFMIN,BDMAX,BDMIN
      COMMON/BCODE/CII,ALPHNX,NSOIL                                      MAIN0006
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NNNNN,MMMNN,NBRITL,    MAIN0007
     1            ISH,NPRFGR,NVREGR,IS,ISLGL,IPILE,RKY,ARTETA,RR,VS,
     2            DSSSS,HN,AA,AV,SSOIL,RADIUS,CDFACT,RL,DELA(30)
      COMMON/ACODE/Z(4),CI(4),CK(4,15(4)                                 MAIN0008
      COMMON/CODE1/HT(30),WT(4),WNN(30,4),KNODE(30,4)                    MAIN0009
      COMMON/ATC2/V(30),DIS(30),DELT(30),RM(30),CV(30),TETA(30),PP(301,  MAIN0010
     1            SUMWF(10),SUMWF2(10),WBARN(10),SSM(10),RNORMF(5),
     2            VMODAL(10),RMMODE(3,10),DR(RMN(30,10),UI30,10),
     3            CVXM(30,10),RMMODE(3,10),DEEAKE(30,10),VMNODE(30,10)
      COMMON/ATC2/NBEAM(30),NCONT(30),NCONT(30,20),NDBEAM(30,10)         MAIN0011
      DIMENSION TIT(4),CC(5),SS(4),TOTAL(4),FT(4),STRENG(30),ENG2(22),   MAIN0012
     1          IBND(10),ICOL(300),RAITO(10),CONST(30),ENG(22),UMF(4),
     2          NDEFEQ(4),MDEFEQ(4),FQ(4),SUM(4),SUM2(4),RATFOI(30),
     3          MA(200),MB(200),AE(200),DEP(200),TFD(200),ELENTH(200),
     4          JTYPE(200),DDD(200),FINDN(20),DDDD(200),BD(200),
     5          FRR(200),STRES(200),ENGLTA(200),NMB(200),AKAPA(30),
     6          ICOL(300),IDIAGS(300),DEFLMT(30),GMI3500),FRS(200),
     7          VAL(300),GM(3500),MBC(200),WWWW(200),FFFF(30),MSOIL(4),
     8          AREA(200),SX(200),NDUCTY(4),KACTIV(200),AHMX(4),AVMX(4)
     9         ,IDIAG(300),X(100),Y(100),SK(3500),WW(30),PHI(200)
     1          VALMIN(10),TT(10),WORK(10),DAMP(10),AM(200),AN(200),
     2          FACTDL(4),FACTLL(4),FACTSL(4),FACTEL(4),SK(13500)
      DIMENSION NLINE(200),EK(6,6),EM(6,6),A(3,3),B(6,6),C(6,6),D(6,6), MAIN0013
     1          F(300,4),D(300,4),FR(300,4),DR(300,4),XH(300,4),
     2          SI(6,4),SIGMA(6,4),EDR(6,4),DEFEQ(10,4),FS(300,4),
     3          DLF(10,4),DLF2(10,4),HH(10,4),VV(10,4),PNT(200,4),
     4          DS(300,4),ENG(200,30),H1(200,4),FV(300,4),FDI300,4),
     5          S1(6,22),S216,22),S5(16,22),S5216,22),DM(300,10),
     6          EDF(6,22),EFF(6,22),FFF300,22),DF(300,22),H2(200,4),
     7          MT(200,3),ISGN(200,22),ISTA(200,4),EI(6,6)
      DIMENSION FSATC(300,4),WS(30,4),XS(300,4),MNO(200,200),AML(6,4),   MAIN0014
     1          DELTA0(300,4),AEREC0(200,20),SKJU(300,1),DELTAR(300,100)
     3         ,SK12(200,1),DSTMAX(200,200),ASTRE(200,4),SK2U(300,1)
C
C*****************************************************************************
C*                        BUILT-UP SECTION PROPERTIES                        *
C*****************************************************************************
C
      FLANGE(BD,T1,T2)=0.5*(BD)*T1*((1.0-T1)**2)                         MAIN0015
      WEB(T1,T2)=(1.0/12.0)*T2*(1.0-2.0*T1)**3                           MAIN0016
C
      INN=5                                                              MAIN0017
      IOUT=6                                                             MAIN0018
      NJMAX=100                                                          MAIN0019
      NMMAX=200                                                          MAIN0020
      NNMAX=300                                                          MAIN0021
      MAXSK=3500                                                         MAIN0022
      MAXST=30                                                           MAIN0023
      MAXNC=30                                                           MAIN0024
      LDMAX=4                                                            MAIN0025
      NDMAX=10                                                           MAIN0026
      NGMAX=200                                                          MAIN0027
      NDMAX=200                                                          MAIN0028
      KSTRS=1                                                            MAIN0029
C
C
      READ(INN,2) NSTRS,IOUT1                                            MAIN0030
    2 FORMAT(4I5)                                                        MAIN0031
10090 CALL DATA1(ICODE,IDESGT,IPLOT,IGRADT,LGRADT,IMAX,IIMAX,           MAIN0032
     1INSIST,IUNITD,EPS1,EPS2,EPS3,EPS,URANGE,DRANGE,REFATR,FINCRT,DS,
     2MEMBS,JOINTS,NBNDRY,LOADS,LMTDSP,ENDEX,NCOUNT,DLENG,LATD,ABRMAX,
     3FD,FV,MM,PNT,HI,H2,NN,MSOIL,NDUCTY,ICOLS,IDIAGS,ICOL,IDIAG,MAXSK,
     4AEMNNN,WS,NSTORY,RKAPA,NONZRO,IBND,SK,GN,FSATC,DAMP,ABRMIN,IE,
     5ASTAR,CS0,CPT,CSC,CSW,NLIFE,CONDNS,GAMMA6,DELTA6,GACCMX,RINIST,
     6NA,MB,JTYPE,MBC,STRES,NMB,MNO,WT,FRR,MOIFF,NMMAX,NGMAX,BASEAE,
     7NDMAX,KOPTON,VALMIN,DEFLMT,NSIGN,X,Y,AE,AM,AN,AREA1,SX,FS,LDMAX,
     8ELENTH,NM,XH,NSTRS,MBAND,AENM,LOAD,DEP,TFD,KSTRS,BD,NJMAX,
     9FACTDL,FACTLL,FACTSL,FACTEL,MAXST,NLINE,AHMX,AVMX)
      NPASS=0                                                            MAIN0033
      MGRADT=0                                                           MAIN0034
      KCOUNT=1                                                           MAIN0035
      NPAGE=0                                                            MAIN0036
C
C
      WTLAST=10000000000.                                                MAIN0037
15001 CONTINUE                                                           MAIN0038
      WTLAST=10000000000.                                                MAIN0039
      LAST=0                                                             MAIN0040
      KSAVE=1                                                            MAIN0041
      KSTEP=1                                                            MAIN0042
  100 CONTINUE                                                           MAIN0043
      ITER=1                                                             MAIN0044
      NCHANG=0                                                           MAIN0045
  102 KANLYZ=0                                                           MAIN0046
      KH=0                                                               MAIN0047
      ITER=1                                                             MAIN0048
      MTER=0                                                             MAIN0049
      IAREDUC=0                                                          MAIN0050
15000 CONTINUE                                                           MAIN0051
      AREASEA=BASEA                                                      MAIN0052
      AP=BASEA                                                           MAIN0053
      BASEAE=BASEA*EE                                                    MAIN0054
      DO 103 I=1,NN                                                      MAIN0055
      ICOL(I)=ICOLS(I)                                                   MAIN0056
      IDIAG(I)=IDIAGS(I)                                                 MAIN0057
  103 CONTINUE                                                           MAIN0058
C
C*****************************************************************************
C*                    GENERATE STIFFNESS AND MASS MATRICES                   *
C*****************************************************************************
C
      DO 104 I=1,NN                                                      MAIN0059
      DO 11114 J=1,LOADS                                                 MAIN0060
      DR(I,J)=0.                                                         MAIN0061
11114 CONTINUE                                                           MAIN0062
      DO 104 I=NBEGIN,NDESIR                                             MAIN0063
      FR(I,I)=0.                                                         MAIN0064
  104 CONTINUE                                                           MAIN0065
      DO 105 I=1,NONZRO                                                  MAIN0066
      GM(I)=GN(I)                                                        MAIN0067
      SK(I)=0                                                            MAIN0068
  105 CONTINUE                                                           MAIN0069
      JNT=INDEX                                                          MAIN0070
      IF(ICODE.EQ.2 .OR. ICODE.EQ.3) JNT=1                               MAIN0071
      DO 110 L=1,MEMBS                                                   MAIN0072
      FRS(L)=0                                                           MAIN0073
      IF(IDESGT.NE.-1) GO TO 10021                                       MAIN0074
      CALL STRSMI(NMB(L),MNO,ELENTH,JTYPE,FRS(L),L,1,NNMAX,NGMAX,AREA1,  MAIN0075
     *RHO,RHO1)
      SPWT=RHO                                                           MAIN0076
      IF(JTYPE(L).EQ.0)SPWT=RHO1                                         MAIN0077
      AXIAL=FRR(L)*FRS(L)                                                MAIN0078
      AREAA=AREA1(L)                                                     MAIN0079
      GO TO 10022                                                        MAIN0080
10021 CALL STRSMI(NMB(L),MNO,ELENTH,JTYPE,FRS(L),AE,BASEA,BD,DEP,TFD,   MAIN0081
     *I,J,NNMAX,NGMAX)
      AXIAL=FRR(L)*FRS(L)                                                MAIN0082
      CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREAA,SEC,MAIN0083
     *QUE)
10022 CALL ELMENT(EK,EM,AE(L),AM(L),AN(L),JTYPE(L),AXIAL,SPWT,ELENTH(L),MAIN0084
     *A,INT,AREAA)
      CALL TRNSFM(EK,EM,A,B,C,D,E,0)                                     MAIN0085
      CALL ASMBL3(SK,GM,C,E,MA(L),MB(L),NN,6,IDIAG)                      MAIN0086
      GO TO(10023,10023,10023,110,110),ICODE                             MAIN0087
10023 WWWW(L)=ELENTH(L)*AREAA*SPWT                                       MAIN0088
  110 CONTINUE                                                           MAIN0089
      CALL BOUND2(SK,GM,IBND,NN,NBNDRY,ICOL,IDIAG)                       MAIN0090
      NZERO=IDIAG(NN)                                                    MAIN0091
      REWIND 1                                                           MAIN0092
      WRITE(1)(SK(I),I=1,NZERO)                                          MAIN0093
      NDCOMP=0                                                           MAIN0094
      IF(INDEX) 115,115,118                                              MAIN0095
  115 CONTINUE                                                           MAIN0096
      GO TO (10025,10026,10029,10050,10050),ICODE                        MAIN0097
C
C*****************************************************************************
C*                  CALCULATE LATERAL FORCE BY USING UBC CODE                *
C*****************************************************************************
C
10025 CONTINUE                                                           MAIN0098
      IF(LAST.GE.1)GO TO 10050                                           MAIN0099
      CALL ATC1(WWWW,NSTORY,LOADS,WS,WW,NNMAX,MAXST)                     MAIN0100
      DO 117 J=1,LOADS                                                   MAIN0101
      IF(CK(J) .LT. 0.000001) GO TO 10117                                MAIN0102
      IF(MTYPE(J)) 116,10117,10117                                       MAIN0103
  116 CALL CODE(FS,DS,MM,KCOUNT,ITER,TT(J),CC(J),SS(J),TOTAL(J),FT(J),   MAIN0104
     * BASEAE,IBND,NN,NBNDRY,XG,J,LOADS,NNMAX,NSTORY,DLENG,FFF)
10117 CONTINUE                                                           MAIN0105
  117 CONTINUE                                                           MAIN0106
```

```
      GO TO 10050                                                       MAIN0107
C
C ***************************************************************
C *              CALCULATE LATERAL FORCES BY USING ATC-3            *
C ***************************************************************
C
10026 IBASE=0                                                           MAIN0108
      IF(IREDUC.EQ.1.OR.LAST.GE.1)GO TO 10040                           MAIN0109
      DO 10027 I=1,NEMBS                                                MAIN0110
      WWWW(I)=WWWW(I)/1000.                                             MAIN0111
10027 CONTINUE                                                          MAIN0112
      CALL ATCWT(WWWW,NSTORY,1,WS,WW,NMMAX,MAXST)                       MAIN0113
      INCC=0                                                            MAIN0114
      IF(NAMALS.EQ.2)INCC=1                                             MAIN0115
      CALL EIGEN(SK,GM,VAL,DM,NM,MBAND,ICOL,IDIAG,INCC,BASEAE,IREQDM,   MAIN0116
     1NSTORY,TT,ITER,KCOUNT)
      IF(NITER .GE. 78) GO TO 1000                                      MAIN0117
      DO 10028 I=1,NN                                                   MAIN0118
10028 FS(I,1)=FSAT(I,1)                                                 MAIN0119
      CALL ATCCDIT(0,NM,NN,NBNDRY,DM,BASEAE,NSTORY,MAXST,IBASE          MAIN0120
     1,SK,FS,DS,IBND,ICOL,IDIAG,FFF,RKAPA,AMP,IREQDM,RM2,ECC,MAXSK)
      IF(IBASE.EQ.0.OR.IDESGT.EQ.-1) GO TO 10030                        MAIN0121
      BASEA=BASEA*AMP                                                   MAIN0122
      BASEAE=BASEA*EE                                                   MAIN0123
      NTER=NTER+1                                                       MAIN0124
      IF(NTER.GE.2)GO TO 10030                                          MAIN0125
      GO TO 15000                                                       MAIN0126
C
C ***************************************************************
C *            CALCULATE LATERAL FORCES BY USING CHINESE CODE       *
C ***************************************************************
C
10029 IF(LAST.GE.1)GO TO 10040                                          MAIN0127
      CALL ATCWT(WWWW,NSTORY,1,WS,WW,NMMAX,MAXST)                       MAIN0128
      CALL EIGEN(SK,GM,VAL,DM,NM,MBAND,ICOL,IDIAG,0,BASEAE,IREQDM,NSTORYMAIN0129
     *,TT,ITER,KCOUNT)
      IF(NITER .GE. 78) GO TO 1000                                      MAIN0130
      CALL CHINA(NSTORY,FFF,TT(1))                                      MAIN0131
      GO TO 10040                                                       MAIN0132
C
C ***************************************************************
C *         COMBINED SEISMIC LATERAL FORCES WITH STATIC LOADS       *
C ***************************************************************
C
10030 DO 10031 I=1,NSTORY                                               MAIN0133
      FFF(I)=FFF(I)*1000.                                               MAIN0134
10031 CONTINUE                                                          MAIN0135
      AP1=BASEA                                                         MAIN0136
      REWIND 1                                                          MAIN0137
      READ(1)(SK(I),I=1,MZERO)                                          MAIN0138
      DO 10033 I=1,NN                                                   MAIN0139
      DO 10033 J=1,LOADS                                                MAIN0140
      DS(I,J)=0.                                                        MAIN0141
10033 CONTINUE                                                          MAIN0142
10040 DO 10041 L=1,LOADS                                                MAIN0143
      DO 10041 I=1,NN                                                   MAIN0144
      FS(I,L)=FSAT(I,L)                                                 MAIN0145
10041 CONTINUE                                                          MAIN0146
      DO 10042 I=1,NSTORY                                               MAIN0147
      DO 10042 L=1,LOADS                                                MAIN0148
      II=MM*KNODE(I)-2                                                  MAIN0149
      FS(II,L)=FS(II,L)+FACTEL(L)*FFF(I)                                MAIN0150
10042 CONTINUE                                                          MAIN0151
      CALL REDUCE(FS,IBND,NN,NBNDRY,LOADS,NMMAX)                        MAIN0152
C
C ***************************************************************
C *                 CALCULATE STATIC DISPLACEMENTS                  *
C ***************************************************************
C
10050 CONTINUE                                                          MAIN0153
      CALL GAUSS(SK,FS,DS,LOADS,NM,NMMAX,0,ICOL,IDIAG)                  MAIN0154
      CALL RESTORE(DS,IBND,NN,NBNDRY,LOADS,NMMAX)                       MAIN0155
      NDCOMP=1                                                          MAIN0156
C
  118 CONTINUE                                                          MAIN0157
      IF(KOPTON.LE.0 .OR. NBEGIN.LE.0) GO TO 119                        MAIN0158
      REWIND 1                                                          MAIN0159
      READ(1)(SK(I),I=1,MZERO)                                          MAIN0160
      CALL EIGEN(SK,GM,VAL,DM,NM,MBAND,ICOL,IDIAG,0,BASEAE,IREQDM,NSTORMAIN0161
     1Y,TT,ITER,KCOUNT)
      IF(NITER .GE. 78) GO TO 1000                                      MAIN0162
  119 CONTINUE                                                          MAIN0163
      IF(INDEX) 169,120,120                                             MAIN0164
C
C ***************************************************************
C *              CALCULATE DYNAMIC DISPLACEMENTS                    *
C ***************************************************************
C
  120 CONTINUE                                                          MAIN0165
      DO 125 J=1,LOADS                                                  MAIN0166
      IF(ITYPE(J)) 121,11251,11251                                      MAIN0167
  121 CONTINUE                                                          MAIN0168
      DO 122 I=1,NM                                                     MAIN0169
      DI(I,J)=XM(I,J)                                                   MAIN0170
      DI(I,J)=XS(I,J)                                                   MAIN0171
  122 CONTINUE                                                          MAIN0172
      CALL MLTPLY(GM,FI,DI,2,NM,NMMAX,ICOL,IDIAG)                       MAIN0173
      DO 23 I=1,NM                                                      MAIN0174
      FR(I,J)=FI(I,1)                                                   MAIN0175
      FV(I,J)=FI(I,2)                                                   MAIN0176
  123 CONTINUE                                                          MAIN0177
11251 CONTINUE                                                          MAIN0178
  125 CONTINUE                                                          MAIN0179
  131 CONTINUE                                                          MAIN0180
      DO 32 I=1,NN                                                      MAIN0181
      DO 32 J=1,LOADS                                                   MAIN0182
      DR(I,J)=0.                                                        MAIN0183
  132 CONTINUE                                                          MAIN0184
      DO 150 II=NBEGIN,NDESIR                                           MAIN0185
      DO 141 J=1,LOADS                                                  MAIN0186
      HH(II,J)=0.                                                       MAIN0187
      VV(II,J)=0.                                                       MAIN0188
      DO 141 I=1,NM                                                     MAIN0189
      DI(I,J)=DM(I,II)                                                  MAIN0190
  141 CONTINUE                                                          MAIN0191
      CALL MLTPLY(GM,FI,DI,1,NM,NMMAX,ICOL,IDIAG)                       MAIN0192
      CALL ENERGY(ENG1,DI,FI,NM,0,1,NMMAX,0)                            MAIN0193
      ADR=ENG1(1)*VAL(II)                                               MAIN0194
      CALL ENERGY(ENG1,DI,FD,NM,0,LOADS,NMMAX,0)                        MAIN0195
      CALL ENERGY(ENG2,DI,FV,NM,0,LOADS,NMMAX,0)                        MAIN0196
      DO 145 J=1,LOADS                                                  MAIN0197
      CALL SPTRUM(TT(II),DLF1(II,J),DAMP(II),J,PNT,H1,NDMAX,LOADS,      MAIN0198
     1MSO(II),NDUCTY(J),0,AMAX(J))
      HH(II,J)=ENG1(J)*FACTOR(J)*DLF1(II,J)/ADR                         MAIN0199
      VV(II,J)=0.                                                       MAIN0200
      IF(NOTYPE(J)) 143,144,144                                         MAIN0201
  143 CONTINUE                                                          MAIN0202
      CALL SPTRUM(TT(II),DLF2(II,J),DAMP(II),J,PNT,H2,NDMAX,LOADS,      MAIN0203
     1MSO(II),NDUCTY(J),1,AVMX(J))
      VV(II,J)=ENG2(J)*XV(J)*FACTOR(J)*DLF2(II,J)/ADR                   MAIN0204
  144 CONTINUE                                                          MAIN0205
      DO 10145 I=1,NM                                                   MAIN0206
      DR(I,J)=DR(I,J) + DI(I,J)*(HH(II,J)+VV(II,J))                     MAIN0207
10145 CONTINUE                                                          MAIN0208
  145 CONTINUE                                                          MAIN0209
      IF(KSTEP .GT. 1) GO TO 150                                        MAIN0210
      CALL MLTPLY(SK,FR,DR,LOADS,NM,NMMAX,ICOL,IDIAG)                   MAIN0211
      CALL ENERGY(ENG1,FR,DR,NM,0,LOADS,NMMAX,0)                        MAIN0212
      VWORK(II)=0.                                                      MAIN0213
      DO 149 J=1,LOADS                                                  MAIN0214
      IF(VWORK(II)-ENG1(J)) 148,149,149                                 MAIN0215
  148 VWORK(II)=ENG1(J)                                                 MAIN0216
  149 CONTINUE                                                          MAIN0217
  150 CONTINUE                                                          MAIN0218
      IF(KSTEP .GT. 1) GO TO 153                                        MAIN0219
C     WRITE(IOUT,699)(VWORK(I),I=1,NDESIR)                              MAIN0220
C699  FORMAT(2X,'VWORK=',3E12.5)                                        MAIN0221
C
C ***************************************************************
C *                  DETERMINE SIGNIFICANT MODES                    *
C ***************************************************************
C
      DO 151 I=1,NDESIR                                                 MAIN0222
      VWORK(I)=VWORK(I)/VWORK(NDESIR)                                   MAIN0223
  151 CONTINUE                                                          MAIN0224
      IF(KOPTON .GT. 1) GO TO 153                                       MAIN0225
      MAXMDE=NDESIR                                                     MAIN0226
      NBEGIN=1                                                          MAIN0227
      DO 152 I=1,MAXMDE                                                 MAIN0228
      ADR=VWORK(MAXMDE)-VWORK(I)                                        MAIN0229
      IF(ADR .GT. 0.99) GO TO 11152                                     MAIN0230
      IF(NBEGIN .LT. II) NBEGIN=I                                       MAIN0231
      IF(ADR .GT. 0.0) GO TO 11152                                      MAIN0232
      IF(NDESIR .GT. II) NDESIR=I                                       MAIN0233
11152 CONTINUE                                                          MAIN0234
  152 CONTINUE                                                          MAIN0235
      KSTEP=2                                                           MAIN0236
      GO TO 131                                                         MAIN0237
  153 CONTINUE                                                          MAIN0238
C
C ***************************************************************
C *              COMBINE DEFLECTIONS OF ALL MODES                   *
C ***************************************************************
C
      IF(NSIGN) 162,156,159                                             MAIN0239
  156 CONTINUE                                                          MAIN0240
```

```
      DO 158 J=1,LOADS                                                  MAIN0241
      DO 158 I=1,NM                                                     MAIN0242
      SUM=0                                                             MAIN0243
      DO 157 II=NBEGIN,NDESIR                                           MAIN0244
      SUM=SUM + (DM(I,II)**2)*(HH(II,J)**2+VV(II,J)**2)                 MAIN0245
  157 CONTINUE                                                          MAIN0246
      DR(I,J)=SQRT(SUM)                                                 MAIN0247
  158 CONTINUE                                                          MAIN0248
      GO TO 162                                                         MAIN0249
  159 CONTINUE                                                          MAIN0250
      DO 161 J=1,LOADS                                                  MAIN0251
      DO 161 I=1,NM                                                     MAIN0252
      SUM=0.                                                            MAIN0253
      DO 160 II=NBEGIN,NDESIR                                           MAIN0254
      SUM=SUM + DM(I,II)*(ABS(HH(II,J))+ABS(VV(II,J)))                  MAIN0255
  160 CONTINUE                                                          MAIN0256
      DR(I,J)=SUM                                                       MAIN0257
  161 CONTINUE                                                          MAIN0258
  162 CONTINUE                                                          MAIN0259
      CALL RESTOR(DR,IBND,NN,NBNDRY,LOADS,NNMAX)                        MAIN0260
      CALL RESTOR(DM,IBND,NN,NBNDRY,NDESIR,NNMAX)                       MAIN0261
  169 CONTINUE                                                          MAIN0262
C
C ******************************************************************
C *                COMBINE STATIC DISP. WITH DYNAMIC DISP.         *
C ******************************************************************
C
      CALL ADD1(DS,DR,INDEX,LOADS,NN,NNMAX)                             MAIN0263
      IF(IREDUC.EQ.0)GO TO 163                                          MAIN0264
      IF(SMALL.LT.ABSD(I))GO TO 20100                                   MAIN0265
      GO TO 180                                                         MAIN0266
  163 CONTINUE                                                          MAIN0267
      IF(IDESET.EQ.-1) GO TO 245                                        MAIN0268
  170 CONTINUE                                                          MAIN0269
      NTOTAL=LOADS                                                      MAIN0270
      RATIOB=0.                                                         MAIN0271
      DO 171 J=1,LOAD                                                   MAIN0272
      RATIO1(J)=0.                                                      MAIN0273
  171 CONTINUE                                                          MAIN0274
      DO 172 J=1,MAXNC                                                  MAIN0275
      RATIO(J)=0.                                                       MAIN0276
  172 CONTINUE                                                          MAIN0277
      IF(LMTDSP.LE.0)GO TO 180                                          MAIN0278
10401 CALL DISPI(LOADS,LOAD,NTOTAL,RATIOB,RATIO1,LMTDSP,KNODE,MM,       MAIN0279
     .RATIO,DEFLMT,MAXNC,NSTORY,BASEAE,DR,JRATIO,RATIOA,IIII,JJJJ1,
     .MAXST,NM,NNMAX,INDEX,HH,VV,DM,MDMAX,NBEGIN,NDESIR,ABSDR)
C
C ******************************************************************
C *       CALCULATE ELEMENT STRESSES AND CHECK WITH STRESS LIMIT   *
C ******************************************************************
C
  180 CONTINUE                                                          MAIN0280
      CALL STRES1(FBR,FRS,AE,BD,DEP,IFD,ITYPE,LOADS,IL,                 MAIN0281
     .AM,AN,ELENTH,DS,MM,FACIDL,FACILL,FACISL,NT,MA,MB,INDEX,DM,HH,VV,
     .NS,GM,NN,NNB,STRES,ISTRI,RATIOB,RATIO1,ADEFEQ,RATIO,ASTRE,LMTDSP,
     .AML,EI,DI,NNMAX,IUNILD,MEMBS,EK,EM,A,B,C,D,E,S,EDR,SIGMA,SS1,
     .SS2,S1,S2)
C
      IF(IGRADI.EQ.0)GO TO 10061                                        MAIN0282
      IF(IREDUC.EQ.1) GO TO 20089                                       MAIN0283
      RATIOA=0.                                                         MAIN0284
      DO 10060 J=1,LOADS                                                MAIN0285
      IF(RATIOA.LE.RATIO1(J))LLLL=J                                     MAIN0286
10060 CONTINUE                                                          MAIN0287
      SIGMAX=RATIO1(LLLL)                                               MAIN0288
10061 RATIOA=0.                                                         MAIN0289
      DO 200 J=1,LOAD                                                   MAIN0290
      IF(RATIO1(J).GE.RATIOA)RATIOA=RATIO1(J)                           MAIN0291
  200 CONTINUE                                                          MAIN0292
C
      IF(LMTDSP .EQ. 0) GO TO 214                                       MAIN0293
      DO 213 J=1,LOADS                                                  MAIN0294
      NDEFEQ(J)=0                                                       MAIN0295
      IF(IRATIOA-RATIO1(J)) .GT. 0.20*RATIOA) GO TO 213                 MAIN0296
      DO 212 I=1,NM                                                     MAIN0297
      DEFBAE=DEFLMT(I)*BASEAE                                           MAIN0298
      AMAX=ABS(DR(I,J))                                                 MAIN0299
      ADR=AMAX/DEFBAE                                                   MAIN0300
      IF((RATIO1(J)-ADR) .GT. EPSI*RATIO1(J)) GO TO 212                 MAIN0301
      NDEFEQ(J)=NDEFEQ(J)+1                                             MAIN0302
      JDEFEQ(NDEFEQ(J),J)=I                                             MAIN0303
      NTOTAL=NTOTAL+1                                                   MAIN0304
      RATIO(NTOTAL)=ADR                                                 MAIN0305
  212 CONTINUE                                                          MAIN0306
  213 CONTINUE                                                          MAIN0307
      NDISPL=NTOTAL-LOADS                                               MAIN0308
  214 CONTINUE                                                          MAIN0309
C
C ******************************************************************
C *              CHECK FREQUENCIES WITH FREQUENCY LIMIT            *
C ******************************************************************
C
      NFRQCY=0                                                          MAIN0310
      IF(KOPTON.LE.0 .OR. NBEGIN.LE.0) GO TO 217                        MAIN0311
      IF(VALMIN(NBEGIN) .LE. 0.0000001) GO TO 217                       MAIN0312
      DO 216 II=NBEGIN,NDESIR                                           MAIN0313
      NTOTAL=NTOTAL+1                                                   MAIN0314
      VALUE=VALII(II)*BASEAE                                            MAIN0315
      ADR=VALMIN(II)/VALUE                                              MAIN0316
      RATIO(NTOTAL)=ADR                                                 MAIN0317
      IF(LMTDSP .NE. 3) GO TO 216                                       MAIN0318
      IF(RATIOB .LE. ADR) RATIOB=ADR                                    MAIN0319
  216 CONTINUE                                                          MAIN0320
      NFRQCY=(NDESIR-NBEGIN) + 1                                        MAIN0321
  217 CONTINUE                                                          MAIN0322
      NSUBT=NTOTAL-NFRQCY                                               MAIN0323
      IP=0                                                              MAIN0324
      RATIOA=0.                                                         MAIN0325
      DO 218 J=1,NTOTAL                                                 MAIN0326
      IF(RATIO(J) .LT. RATIOA) GO TO 218                                MAIN0327
      RATIOA=RATIO(J)                                                   MAIN0328
      IP=J                                                              MAIN0329
  218 CONTINUE                                                          MAIN0330
      IF(LMTDSP.NE.3) GO TO 2182                                        MAIN0331
      BASEAE=BASEAE*RATIOB                                              MAIN0332
      BASEA=BASEA*RATIOB                                                MAIN0333
      GO TO 2183                                                        MAIN0334
 2182 BASEAE=BASEAE*RATIOA                                              MAIN0335
      BASEA=BASEA*RATIOA                                                MAIN0336
 2183 IF(ABS(BASEA-BASEA).LE.EPS2*BASEA) GO TO 225                      MAIN0337
      IF(ITER.GE.IMAX) GO TO 225                                        MAIN0338
      ITER=ITER+1                                                       MAIN0339
      AP=BASEA                                                          MAIN0340
C     WRITE(IOUT,5907) RATIOA                                           MAIN0341
C5907 FORMAT(1IH RATIOA496=,E15.5)                                      MAIN0342
C     IF(LMTDSP.NE.3) GO TO 102                                         MAIN0343
C     WRITE(IOUT,5919) RATIOB                                           MAIN0344
C5919 FORMAT(11H RATIOB496=,E15.5)                                      MAIN0345
      GO TO 102                                                         MAIN0346
  225 CONTINUE                                                          MAIN0347
      IF(ABS(AP-BASEA).LE.(EPSI*BASEA)) GO TO 224                       MAIN0348
      IF(ITER.GE.IMAX) GO TO 224                                        MAIN0349
      ITER=ITER+1                                                       MAIN0350
      AP=BASEA                                                          MAIN0351
      IF(NDEX) 221,222,222                                              MAIN0352
  221 GO TO 170                                                         MAIN0353
  222 CALL REDUCE(DM,IBND,NN,NBNDRY,NDESIR,NNMAX)                       MAIN0354
      GO TO 131                                                         MAIN0355
  224 CONTINUE                                                          MAIN0356
C
C ******************************************************************
C *            CHECK SECTION PROPERTIES WITH SECTION LIMITS        *
C ******************************************************************
C
      IF(ISEC.GT.0) GO TO 237                                           MAIN0357
      IF(KCHANG.GT.1.AND.KANLYZ.EQ.0) GO TO 237                         MAIN0358
      KDCHNG=0                                                          MAIN0359
      DO 227 I=1,MEMBS                                                  MAIN0360
      IF(ITYPE(I).EQ.0) GO TO 227                                       MAIN0361
      TFDD=0                                                            MAIN0362
      DO 226 K=1,5                                                      MAIN0363
      TFDD=2.0*((AE(I)*BASEA)/(DEP(I)**4)-WEB(ITFDD,TWD))              MAIN0364
     1/BD(I)*(1.0-TFDD)**2)                                             MAIN0365
  226 CONTINUE                                                          MAIN0366
      TFD(I)=TFDD                                                       MAIN0367
      IF(TFD(I).GT.TFDMAX.AND.DEP(I).LE.DEPMAX) KDCHNG=1                MAIN0368
      IF(TFD(I).LT.TFDMIN) KDCHNG=1                                     MAIN0369
  227 CONTINUE                                                          MAIN0370
      IF(KDCHNG.EQ.0) GO TO 237                                         MAIN0371
      IF(KCHANG.GE.3) GO TO 237                                         MAIN0372
      DO 234 I=1,MEMBS                                                  MAIN0373
      IF(TFD(I)-TFDMAX) 231,231,228                                     MAIN0374
  228 DEP(I)=(AE(I)*BASEA)/(FLANGE(BD(I),TFDMAX,TWD)+WEB(TFDMAX,TWD))   MAIN0375
      DEP(I)=SQRT(DEP(I))                                               MAIN0376
      DEP(I)=SQRT(DEP(I))                                               MAIN0377
      TFD(I)=TFDMAX                                                     MAIN0378
      IF(DEP(I) .LE. DEPMAX) GO TO 234                                  MAIN0379
      DEP(I)=DEPMAX                                                     MAIN0380
      TFDD=0                                                            MAIN0381
      DO 230 K=1,5                                                      MAIN0382
      TFDD=2.0*((AE(I)*BASEA)/(DEP(I)**4)-WEB(ITFDD,TWD))              MAIN0383
     1/BD(I)*(1.0-TFDD)**2)                                             MAIN0384
  230 CONTINUE                                                          MAIN0385
      TFD(I)=TFDD                                                       MAIN0386
      GO TO 234                                                         MAIN0387
  231 IF(TFDMIN-TFD(I)) 234,234,233                                     MAIN0388
```

```
      DEP(I)=(AE(I)*BASEA)/(FLANGE(BD(I),TFDMIN,TWD)+WEB(TFDMIN,TWD))   MAIN0384
      WEP(I)=SQRT(DEP(I))                                               MAIN0385
      WEP(I)=SQRT(DEP(I))                                               MAIN0386
      TFD(I)=TFDMIN                                                     MAIN0387
      IF(DEP(I) .LT. DEPMIN) DEP(I)=DEPMIN                              MAIN0388
  234 CONTINUE                                                          MAIN0389
      KCHANG=KCHANG+1                                                   MAIN0390
      KANLYZ=1                                                          MAIN0391
      GO TO 170                                                         MAIN0392
  237 CONTINUE                                                          MAIN0393
  245 WRITE(IOUT,3000)                                                  MAIN0394
      WRITE(IOUT,3002) (AE(I),I=1,MEMBS)                               MAIN0395
      GO TO(10300,11302,11304,10410,10410),ICODE                        MAIN0396
11303 IF(NANALS.EQ.1) GO TO 11300                                       MAIN0397
      WRITE(IOUT,3027) AP1,((I,DELT(I),TETA(I),FFF(I),RNOMNT(I),WWW(I,1)MAIN0398
     1I=1,NSTORY)                                                       MAIN0399
      WRITE(IOUT,3012)                                                  MAIN0400
      DO 11307 I=1,NREQDM                                               MAIN0401
11307 WRITE(IOUT,3013)II,(U(I,II),I=1,NSTORY)                           MAIN0402
      GO TO 11301                                                       MAIN0403
11300 WRITE(IOUT,3027) AP1,((I,DELT(I),TETA(I),FFF(I),RM(I),WWW(I,1)),I=MAIN0404
     1I,NSTORY)                                                         MAIN0405
11301 WRITE(IOUT,3041)RM2,WTT(1)                                        MAIN0406
      IF(NANALS.EQ.2)WRITE(IOUT,3128)((I,TT(I)),I=1,IREQDM)             MAIN0407
      IF(NANALS.EQ.1)WRITE(IOUT,3028) TT(1)                             MAIN0408
      IF(NANALS.EQ.2) GO TO 10410                                       MAIN0409
      WRITE(IOUT,3044) ECC                                              MAIN0410
      GO TO 10410                                                       MAIN0411
11304 WRITE(IOUT,3042)((I,FFF(I)),I=1,NSTORY)                           MAIN0412
      WRITE(IOUT,3028) TT(1)                                            MAIN0413
      GO TO 10410                                                       MAIN0414
10300 DO 246 J=1,LOADS                                                  MAIN0415
      IF(CK(J) .LT. 0.00001) GO TO 246                                  MAIN0416
      CS=CC(J)+SS(J)                                                    MAIN0417
      WRITE(IOUT,3005) J,TTT(J),CC(J),SS(J),CS,FT(J),TOTAL(J)           MAIN0418
  246 CONTINUE                                                          MAIN0419
      WRITE(IOUT,3050)(II,FFF(II),I=1,NSTORY)                           MAIN0420
10410 IF(KOPTON.LE.0 .OR. NBEGIN.LE.0) GO TO 255                        MAIN0421
      WRITE(IOUT,3010)                                                  MAIN0422
      DO 247 I=NBEGIN,NDESIR                                            MAIN0423
  247 CONTINUE                                                          MAIN0424
      WRITE(IOUT,3011) (VAL(I),I=NBEGIN,NDESIR)                         MAIN0425
      IF(INDEX) 255,248,248                                             MAIN0426
  248 WRITE(IOUT,3012)                                                  MAIN0427
      CALL REDUCE(DM,IBND,NM,NBNDRY,NDESIR,NMMAX)                       MAIN0428
      DO 249 II=NBEGIN,NDESIR                                           MAIN0429
      WRITE(IOUT,3013) II,(DM(I,II),I=1,NM)                             MAIN0430
  249 CONTINUE                                                          MAIN0431
      WRITE(IOUT,3014)                                                  MAIN0432
      DO 250 I=NBEGIN,NDESIR                                            MAIN0433
      WRITE(IOUT,3015) I,TT(I),(DLF1(I,J),J=1,LOADS)                    MAIN0434
  250 CONTINUE                                                          MAIN0435
      NOTION=0                                                          MAIN0436
      DO 251 J=1,LOADS                                                  MAIN0437
      IF(NOTYPE(J) .LT. NOTION) NOTION=NOTYPE(J)                        MAIN0438
  251 CONTINUE                                                          MAIN0439
      IF(NOTION .GE. 0) GO TO 253                                       MAIN0440
      WRITE(IOUT,3016)                                                  MAIN0441
      DO 252 I=NBEGIN,NDESIR                                            MAIN0442
      WRITE(IOUT,3015) I,II(I),(DLF2(I,J),J=1,LOADS)                    MAIN0443
  252 CONTINUE                                                          MAIN0444
      IF(IDESGT.EQ.-1)GO TO 507                                         MAIN0445
  253 WRITE(IOUT,3016)                                                  MAIN0446
      NUM=0                                                             MAIN0447
      DO 254 I=NBEGIN,NDESIR                                            MAIN0448
      NUM=NUM+1                                                         MAIN0449
      WRITE(IOUT,3017) NUM,VWORK(I)                                     MAIN0450
  254 CONTINUE                                                          MAIN0451
  255 CONTINUE                                                          MAIN0452
      IF(IDESGT.EQ.-1)GO TO 507                                         MAIN0453
      WRITE(IOUT,3019) FBASEA,BASEA                                     MAIN0454
      DO 256 J=1,LOADS                                                  MAIN0455
      WRITE(IOUT,3021) J,NDEFEQ(J)                                      MAIN0456
  256 CONTINUE                                                          MAIN0457
      IF(LMTDSP) 259,259,257                                            MAIN0458
  257 DO 258 J=1,LOADS                                                  MAIN0459
      KN=NDEFEQ(J)                                                      MAIN0460
      IF(KN.NE.0)WRITE(IOUT,3022) J,(JDEFEQ(I,J),I=1,KN)                MAIN0461
  258 CONTINUE                                                          MAIN0462
      IF(LMTDSP.EQ.3)WRITE(IOUT,3029) JRATIO                            MAIN0463
  259 WRITE(IOUT,3023) IP                                               MAIN0464
      WRITE(IOUT,3026) ITER                                             MAIN0465
  260 WEIGHT=0.                                                         MAIN0466
      IF(IDESGT.NE.1) GO TO 10070                                       MAIN0467
C                                                                       MAIN0468
C ***********************************************************************MAIN0469
C *                    CALCULATE THE STRUCTURAL COST                    *MAIN0470
C ***********************************************************************MAIN0471
C                                                                       MAIN0472
      DO 10066 J=1,LOADS                                                MAIN0473
      DO 10066 I=1,NSTORY                                               MAIN0474
      III=MM*KNODE(I,J)-2                                               MAIN0475
      AMAX=DR(III,J)/BASEAE                                             MAIN0476
      IF(I.EQ.1)GO TO 10065                                             MAIN0477
      DELTAO(I,J)=ABS(AMAX-ADR)                                         MAIN0478
      ADR=AMAX                                                          MAIN0479
      GO TO 10066                                                       MAIN0480
10065 DELTAO(I,J)=ABS(AMAX)                                             MAIN0481
      ADR=AMAX                                                          MAIN0482
10066 CONTINUE                                                          MAIN0483
      DO 10068 I=1,NSTORY                                               MAIN0484
      DELT(I)=0.                                                        MAIN0485
      DO 10067 J=1,LOADS                                                MAIN0486
      IF(DELTAO(I,J).GT.DELT(I)) DELT(I)=DELTAO(I,J)                    MAIN0487
10067 CONTINUE                                                          MAIN0488
      DELT(I)=DELT(I)/ASTAR                                             MAIN0489
10068 CONTINUE                                                          MAIN0490
      CALL COST1(MEMBS,JTYPE,BASEA,AE,BD,DEP,TFD,TODACT,ELENTH          MAIN0491
     *    ,NINIST,CSC,CPT,CSD,C1M,C2MM16,MTIFE,CONONS,DELTAO,GACCMX,    MAIN0492
     *    FINDM,DELT,KCOUNT,BASEAE,WEIGHT,NSTORY,LAST,MCOUNT,NMMAX)     MAIN0493
      GO TO 10071                                                       MAIN0494
10070 DO 265 I=1,MEMBS                                                  MAIN0495
      CALL AREA1(AE(I),BASEA,BD(I),DEP(I),TFD(I),JTYPE(I),SPWT,AREAA,SEC,MAIN0496
     *          QUE)                                                    MAIN0497
  265 WEIGHT=WEIGHT + SPWT*AREAA*ELENTH(I)                              MAIN0498
      IF(LAST.GE.1)GO TO 10072                                          MAIN0499
      WRITE(IOUT,3030) WEIGHT,BASEAE,KCOUNT                             MAIN0500
      FINDM(KCOUNT)=WEIGHT                                              MAIN0501
      GO TO 10071                                                       MAIN0502
10072 WRITE(IOUT,3030) WEIGHT,BASEAE,MCOUNT                             MAIN0503
10071 CONTINUE                                                          MAIN0504
      IF(LAST.GE.1)GO TO 500                                            MAIN0505
      DO 20011 L=1,MEMBS                                                MAIN0506
20011 AE(L)=AE(L)                                                       MAIN0507
      IF(WTLAST.GT.FINDM(KCOUNT)) WTLAST=FINDM(KCOUNT)                  MAIN0508
      IF(WTLAST.GT.WTLST.AND.NPASS.EQ.1) NGRADT=NGRADT+1                MAIN0509
      WTOLF=WTLST-WTLAST                                                MAIN0510
      IF(WTOLF/WTTLST.GT.EPS) NGRADT=0                                  MAIN0511
      NGRADT=0                                                          MAIN0512
      IF(NCOUNT.EQ.1)GO TO 505                                          MAIN0513
      IF(IGRADT.EQ.0)GO TO 20025                                        MAIN0514
      IF(KCOUNT.EQ.1)GO TO 20013                                        MAIN0515
      IF(NGRADT.GE.(GRAD1)GO TO 273                                     MAIN0516
      DEFFSS=(FINDM(KCOUNT)-FINDM(KCOUNT-1))/FINDM(KCOUNT)             MAIN0517
      IF(FINDM(KCOUNT).GT.FINDM(KCOUNT-1).AND.NPASS.EQ.0)GO TO 262      MAIN0518
      IF(DEFFSS.GT.EPS.AND.NPASS.EQ.0) GO TO 262                        MAIN0519
      GO TO 20013                                                       MAIN0520
  262 NGRADT=1                                                          MAIN0521
      WRITE(IOUT,3031)                                                  MAIN0522
      GO TO 20025                                                       MAIN0523
20013 NPASS=0                                                           MAIN0524
      REWIND 1                                                          MAIN0525
      READ(1)(SK1(I),I=1,NZERO)                                         MAIN0526
      REWIND 2                                                          MAIN0527
      WRITE(2)(SK1(I),I=1,NZERO),((TFD(I),DEP(I),BD(I)),I=1,MEMBS),((AST MAIN0528
     .RE(I,J),J=1,LOADS),I=1,MEMBS),(TSTRAIT,LLLII),I=1,MEMBS),LLLL,IIIII MAIN0529
     .JJJJ),BASEA                                                       MAIN0530
      IF(ICODE.EQ.2)WRITE(2)(FFF(I),I=1,NSTORY)                         MAIN0531
      ABSDIF=AUSDR                                                      MAIN0532
      SIGNLL=SIGNXX                                                     MAIN0533
      IF(SIGNXX.GT.ABS(1))WRITE(2)(DR(I,LLLL),I=1,NN)                   MAIN0534
      IF(SIGNXX.LT.ABS(1))WRITE(2)(DR(I,JJJJJ),I=1,NN)                  MAIN0535
C                                                                       MAIN0536
 3000 FORMAT(1H1/2X,27H RELATIVE SIZES OF MEMBERS:)                     MAIN0537
 3002 FORMAT(10F13.10)                                                  MAIN0538
 3005 FORMAT(///2X,50H DATA COMPUTED FROM 1976 UBC FOR LOADING CONDITIONMAIN0539
     1,I2/5X,40H PERIOD OF STRUCTURE, T----------------:,F13.5/         MAIN0540
     2 5X,40H VALUE OF C-------------------------------:,F13.5/         MAIN0541
     3 5X,40H VALUE OF S-------------------------------:,F13.5/         MAIN0542
     4 5X,40H VALUE OF CS------------------------------:,F13.5/         MAIN0543
     5 5X,40H TOP-STOREY FORCE, FT---------------------:,E13.5/         MAIN0544
     6 5X,40H TOTAL SHEAR FORCE, V---------------------:,E13.5)         MAIN0545
 3042 FORMAT(//2X,' DATA COMPUTED FROM CHINESE CODE :',/4X               MAIN0546
     1,' STORY NO.',6X,'LATERAL FORCE(LB)',/,(5X,I5,12X,1PE12.5))       MAIN0547
 3050 FORMAT(//4X,' STORY NO.',6X,'LATERAL FORCE(LB)',/,(5X,I5,12X,     MAIN0548
     1PE12.5))                                                          MAIN0549
 3010 FORMAT(///2X,21H NATURAL FREQUENCIES:)                            MAIN0550
 3011 FORMAT(2X,10E13.6)                                                MAIN0551
 3012 FORMAT(//2X,5H MODE,6X,14H EIGENVECTORS:)                         MAIN0552
 3013 FORMAT(2X,I5,6X,9E13.6/(13X,9E13.6))                              MAIN0553
 3014 FORMAT(//2X,5H MODE,6X,7H PERIOD,5X,                              MAIN0554
     1 48H DYNAMIC LOAD FACTOR FOR EACH LOADING CONDITION:)             MAIN0555
 3015 FORMAT(2X,I5,9F13.5/(20X,8F13.5))                                 MAIN0556
 3016 FORMAT(//2X,30H TOTAL WORKDONE VS TOTAL NUMBER OF NODES INCLUDED:/MAIN0557
     1 2X,7H NUMBER,10X,24H WORKDONE/TOTAL WORKDONE)
```

```
3017  FORMAT(2X,I5,13X,E15.6)                                                  MAIN0537
3018  FORMAT(//2X,5H MODE,6X,7H PERIOD,5X,                                     MAIN0538
     1 37H VERTICAL DYNAMIC LOAD FACTOR FOR EACH LOADING CONDITION:)          MAIN0539
3019  FORMAT(///2X,49H OLD SCALING FACTOR----------------------------,        MAIN0540
     1 E13.5/    2X,49H NEW SCALING FACTOR----------------------------,
     2 E13.5)
3020  FORMAT(///2X,10E13.6)                                                    MAIN0541
3021  FORMAT(2X,35H ACTIVE STRESS IN LOADING CONDITION,I2,'----------'        MAIN0542
     1 ,I5)
3022  FORMAT(2X,41H ACTIVE DISPLACEMENT IN LOADING CONDITION,I2,'-------'     MAIN0543
     1 ,I015)
3029  FORMAT(2X,' STORY NUMBER WHICH HAS MAX. STORY DRIFT----------',I5)       MAIN0544
3023  FORMAT(2X,49H MOST CRITICAL CONSTRAINT----------------------,I5)        MAIN0545
3025  FORMAT(I5,E13.6,2X,10F11.6/12X,10F11.6)                                  MAIN0546
3026  FORMAT(2X,49H NUMBER OF ANALYSIS----------------------------,I5)        MAIN0547
3027  FORMAT(//2X,' AFTER ATC-P-DELT SATISFIED, SCALING FACTOR=',E13.6,/MAIN0548
     1/2X,' STORY NO.',6X,'DRIFT(IN)',3X,'STABILITY COEFF',2X,'LATERAL F
     1ORCE(LB)',3X,'OVERTURNING MOMENT(IN-LB)',3X,'STORY WEIGHT(KIPS)'/
     2(2X,I5,8X,1PE12.5,2X,1PE12.5,5X,1PE12.5,12X,1PE12.5,10X,1PE12.5))
3028  FORMAT(2X,' FUNDAMENTAL PERIOD-----------------------------',          MAIN0549
     1E13.6)
3041  FORMAT(/2X,' BASE MOMENT (IN-LB)----------------------------',        MAIN0550
     1E13.6,/,2X,' TOTAL GRAVITY LOAD (LB)-----------------------',
     2E13.6)
3044  FORMAT(2X,' ECCENTRICITY (IN)-------------------------------',        MAIN0551
     2E13.6)
3128  FORMAT(/,5X,'MODE NO.',3X,' NATURAL PERIOD',/,14X,I5,8X,E10.6)         MAIN0552
3030  FORMAT(///2X,42H **********************************************  ,    MAIN0553
     1 28H TOTAL WEIGHT OF STRUCTURE =,1PE14.6,
     2 42H  **********************************************/
     3 2X,42H **********************************************  ,
     4 10H BASE AE =,1PE14.6,1H;,2X,12H CYCLE NO. =,I3,
     5 42H  **********************************************)
3031  FORMAT(///'***GRADIENT METHOD WILL BE APPLIED IN THE NEXT ITERATION    MAIN0554
     1N BECAUSE OF NO MORE IMPROVEMENT***'///)
C
20025 CONTINUE                                                                 MAIN0555
      IF(NTTLST.LE.FINDMI(KCOUNT))GO TO 20302                                  MAIN0556
      REWIND 3                                                                 MAIN0557
      WRITE(3)((AE(I),DEP(I),TFD(I),BD(I)),I=1,MEMBS)                         MAIN0558
      MCOUNT=KCOUNT                                                            MAIN0559
      NTTLST=FINDMI(KCOUNT)                                                    MAIN0560
      BASEAI=FBASEA                                                            MAIN0561
      GO TO (690,691,80691,20302,20302),ICODE                                  MAIN0562
 690  WRITE(3)(((TT(J),CC(J),SS(J),FT(J),TOTAL(J)),J=1,LOADS),((FS(I,J),MAIN0563
     .I=1,NM),J=1,LOADS),CS,(FFF(I),I=1,NSTORY)
      GO TO 20302                                                              MAIN0564
 691  IF(NANALS.EQ.1) GO TO 80690                                              MAIN0565
      WRITE(3)AP1,((DELT(I),TETA(I),FFF(I),RMOMNT(I),WWW(I,1)),I=1,NSTORMAIN0566
     .Y),((U(I,II),I=1,NSTORY),II=1,IREQDM),RM2,WTT(1),IREQDM,(TT(I),I=1
     .,IREQDM)
      GO TO 20302                                                              MAIN0567
80690 WRITE(3) AP1,((DELT(I),TETA(I),FFF(I),RM(I),WWW(I,1)),I=1,NSTORY),MAIN0568
     1RM2,WTT(1),TT(1),ECC
      GO TO 20302                                                              MAIN0569
80691 WRITE(3)(FFF(I),I=1,NSTORY),TT(1)                                        MAIN0570
20302 IF(KCOUNT.EQ.1)GO TO 290                                                 MAIN0571
      IF(KCOUNT.GE.NCOUNT)GO TO 20310                                          MAIN0572
      IF(IGRADT.EQ.0)GO TO 20303                                               MAIN0573
      IF(NGRADT.EQ.0)GO TO 290                                                 MAIN0574
      GO TO 20042                                                              MAIN0575
20310 IF(FINDMI(KCOUNT).LE.NTTLST)GO TO 500                                    MAIN0576
      GO TO 273                                                                MAIN0577
C
20303 IF(INSIST.EQ.1)GO TO 290                                                 MAIN0578
      IF(FINDMI(KCOUNT).LE.NTTLST) GO TO 290                                   MAIN0579
  273 REWIND 3                                                                 MAIN0580
      READ(3)((AE(I),DEP(I),TFD(I),BD(I)),I=1,MEMBS)                          MAIN0581
      BASEA=BASEAI                                                             MAIN0582
      LAST=LAST+1                                                              MAIN0583
      GO TO (693,694,80694,100,100),ICODE                                      MAIN0584
 693  READ(3)(((TT(J),CC(J),SS(J),FT(J),TOTAL(J)),J=1,LOADS),((FS(I,J),MAIN0585
     .=1,NM),J=1,LOADS),CS,(FFF(I),I=1,NSTORY)
      GO TO 100                                                                MAIN0586
 694  IF(NANALS.EQ.1) GO TO 80695                                              MAIN0587
      READ(3)AP1,((DELT(I),TETA(I),FFF(I),RMOMNT(I),WWW(I,1)),I=1,NSTORYMAIN0588
     .),((U(I,II),I=1,NSTORY),II=1,IREQDM),RM2,WTT(1),IREQDM,(TT(I),I=1,
     .IREQDM)
      GO TO 100                                                                MAIN0589
80695 READ(3) AP1,((DELT(I),TETA(I),FFF(I),RM(I),WWW(I,1)),I=1,NSTORY),RMAIN0590
     .M2,WTT(1),TT(1),ECC
      GO TO 100                                                                MAIN0591
80694 READ(3)(FFF(I),I=1,NSTORY),TT(1)                                         MAIN0592
      GO TO 100                                                                MAIN0593
 290  CONTINUE                                                                 MAIN0594
C
C ***************************************************************
C *          CALCULATE DISPLACEMENTS DUE TO UNIT LOAD IN THE    *
C *          DIRECTION OF THE VIOLATED DISPLACEMENT CONSTRAINT  *
C ***************************************************************
C
      NPASS=0                                                                  MAIN0595
      IF(LNTOSP) 305,305,301                                                   MAIN0596
 301  IF(NDISPL.EQ.0)GO TO 305                                                 MAIN0597
      KJ=0                                                                     MAIN0598
      DO 303 J=1,LOADS                                                         MAIN0599
      KN=NDEFEQ(J)                                                             MAIN0600
      IF(KN.LE.0) GO TO 303                                                    MAIN0601
      DO 7304 K=1,KN                                                           MAIN0602
      KJ=KJ+1                                                                  MAIN0603
      KK=NDEFEQ(K,J)                                                           MAIN0604
      DO 302 I=1,MN                                                            MAIN0605
      FF(I,KJ)=0.                                                              MAIN0606
 302  FF(IR,KJ)=DR(KK,J)/ABS(DR(KK,J))                                        MAIN0607
7304  CONTINUE                                                                 MAIN0608
303   CONTINUE                                                                 MAIN0609
      CALL REDUCE(FF,IBND,NN,NBNDRY,NDISPL,NNMAX)                              MAIN0610
      CALL GAUSSISK,FF,DF,NDISPL,NN,NNMAX,NDCOMP,ICOL,IDIAG)                   MAIN0611
      CALL RESTOR(DF,IBND,NN,NBNDRY,NDISPL,NNMAX)                              MAIN0612
 305  CONTINUE                                                                 MAIN0613
C                                                                              MAIN0614
C ***************************************************************
C *                CALCULATE FREQUENCIES OF STRUCTURE           *
C ***************************************************************
C
      DO 311 J=1,LOADS                                                         MAIN0615
      FQ(J)=0.                                                                 MAIN0616
      SUM1(J)=0.                                                               MAIN0617
      SUM2(J)=0.                                                               MAIN0618
 311  IF(INDEX) 340,320,320                                                    MAIN0619
C
 320  DO 326 II=NBEGIN,NDESIR                                                  MAIN0620
      CALL CHANGE(DI,DA,HH,VV,NSIGN,II,LOADS,NN,NDMAX,NNMAX)                   MAIN0621
      CALL MLTPLY(SK,FI,DI,LOADS,NN,NNMAX,ICOL,IDIAG)                          MAIN0622
      CALL ENERGY(ENG1,DI,FI,NN,0,LOADS,NNMAX,0)                               MAIN0623
      CALL MLTPLY(GM,FI,DI,LOADS,NN,NNMAX,ICOL,IDIAG)                          MAIN0624
      CALL ENERGY(ENG2,DI,FI,NN,0,LOADS,NNMAX,0)                               MAIN0625
      DO 326 J=1,LOADS                                                         MAIN0626
      SUM1(J)=SUM1(J)*ENG1(J)                                                  MAIN0627
      SUM2(J)=SUM2(J)*ENG2(J)                                                  MAIN0628
 326  CONTINUE                                                                 MAIN0629
      DO 330 J=1,LOADS                                                         MAIN0630
 330  FQ(J)=(SUM1(J)/SUM2(J))*BASEAE                                           MAIN0631
      WRITE(IOUT,3300) (FQ(J),J=1,LOADS)                                       MAIN0632
3300  FORMAT(//2X,52H RAYLEIGH'S QUOTIENT APPROXIMATION FOR EACH LOADINMAIN0633
     1G//2X,10E13.6)
      CALL RESTOR(DM,IBND,NN,NBNDRY,NDESIR,NNMAX)                              MAIN0634
 340  CONTINUE                                                                 MAIN0635
C
C ***************************************************************
C *          CALCULATE MASS DENSITY IN EACH MEMBER              *
C ***************************************************************
C
      DO 346 J=1,NTOTAL                                                        MAIN0636
      CONST(J)=1.0E+70                                                         MAIN0637
 346  CONTINUE                                                                 MAIN0638
      DO 400 L=1,MEMBS                                                         MAIN0639
      AXIAL=0.                                                                 MAIN0640
      CALL STRSMT(NMB(L),MNO,ELENTH,JTYPE,AXIAL,AE,BASEA,BD,DEP,TFD,          MAIN0641
     *                  L,0,NNMAX,NGMAX)
      CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREAA,SEC,MAIN0642
     *          QUE)
      CALL ELMENT(EK,EM,AE(L),AMI(L),AN(L),JTYPE(L),AXIAL,SPWT,ELENTH(L),MAIN0643
     *          A,I,AREAA)
      CALL TRNSFM(EK,EM,A,B,C,D,E,1)                                           MAIN0644
      IF(IDESGT.NE.1) GO TO 20039                                              MAIN0645
C
C ***************************************************************
C *          CALCULATE THE EFFECT OF THE COST FUNCTION          *
C ***************************************************************
C
      IF(JTYPE(L)-1) 20031,20032,20033                                         MAIN0646
C                                                                              MAIN0647
20031 CONTINUE                                                                 MAIN0648
      ENGLT(L)=ELENTH(L)*(CSB*SPWT*(7.2364*10.**(-3))*(AREAA**(-0.21))*MAIN0648
     1SPWT+2.*CPT*(AREAA**(-0.5)))                                             MAIN0649
      ENGLT(L)=ENGLT(L)*(1+TODACT)                                             MAIN0650
      GO TO 20040                                                              MAIN0651
C                                                                              MAIN0652
20032 CONTINUE                                                                 MAIN0653
      RINTIA=AE(L)*BASEA                                                       MAIN0654
      ETA=AREAA/RINTIA                                                         MAIN0655
      ENGLT(L)=ELENTH(L)*(CSB*SPWT*ETA+7.2364*10.**(-3)*SPWT*ETA**0.79*MAIN0656
     1RINTIA**(-0.21)+(CPT*5.7476*ETA**1.44241/(2.09-0.5563*ETA**1.9232*
     2RINTIA)*2)
```

```
      ENGLTAIL(I)=ENGLTAIL(I)*(1+TODACT)                                MAIN0655
      GO TO 20040                                                       MAIN0656
C
20033 CONTINUE                                                          MAIN0657
      RINTIA=AE(L)*BASEA                                                MAIN0658
      ETA=AREAA/RINTIA                                                  MAIN0659
      ENGLTAIL(I)=ELENTH(L)*(CS0+SPNT*ETA+7.2364*10.**(-3)*SPNT*        MAIN0660
     1ETA**2.179*RINT/A**(-0.2))*(CP1*ID.3065*ETA**1.6304/(2.09-1.2139*
     2ETA**2.17392*RINTIA**2)+(1.7592*CSC*SPNT*ETA**1.081*RINTIA*
     3(10000./RINIST+0.7330)*ETA**1.087)*CSW*SPNT*10.A9)*(4.*ETA**1.087+
     47.762*10.**(-3)*ETA**2.174*RINTIA+0.12963*ETA**1.6305*RINTIA**0.5)
      ENGLTAIL(I)=ENGLTAIL(I)*(1+TODACT)                                MAIN0661
      GO TO 20040                                                       MAIN0662
20039 CONTINUE                                                          MAIN0663
      ENGLTAIL(I)=AREAA*SPNT*ELENTH(L)/BASEA                            MAIN0664
20040 CONTINUE                                                          MAIN0665
      DO 355 J=1,NTOTAL                                                 MAIN0666
      ISGN(I,J)=0                                                       MAIN0667
      STRENG(J)=0.                                                      MAIN0668
 355  CONTINUE                                                          MAIN0669
C
      IF(INDEX) 395,370,370                                             MAIN0670
C
C ****************************************************************
C *          FLEXIBILITY CONSTRAINTS DUE TO DYNAMIC LOADS        *
C ****************************************************************
C
 370  CONTINUE                                                          MAIN0671
      DO 390 I=NBEGIN,NDESIR                                            MAIN0672
      CALL CHANGE(DI,DM,HH,VV,MSIGN,I,LOADS,NN,MDMAX,NNMAX)             MAIN0673
      CALL ELFORC(A,B,D,CI,EDA,S2,SS2,MAIL),MB(L),LOADS,MM,NNMAX)       MAIN0674
      MAIN0675
      KJ=0                                                              MAIN0676
      IF(LMTDSP .LE. 0) GO TO 380                                       MAIN0677
      IF(NDISPL .EQ. 0) GO TO 380                                       MAIN0678
      KK=LOADS                                                          MAIN0679
      DO 378 J=1,LOADS                                                  MAIN0680
      KN=NDEFEQ(J)                                                      MAIN0681
      IF(KN .LE. 0) GO TO 378                                           MAIN0682
      DO 377 K=1,KN                                                     MAIN0683
      KJ=KJ+1                                                           MAIN0684
      DO 376 I=1,6                                                      MAIN0685
      FF(I,KJ)=EDR(I,J)                                                 MAIN0686
 376  CONTINUE                                                          MAIN0687
      DO 377 I=1,MM                                                     MAIN0688
      FF(I,KJ)=DF(I,KJ)                                                 MAIN0689
 377  CONTINUE                                                          MAIN0690
      CALL ELFORC(A,B,D,FF,EDF,S1,SS1,MAIL),MB(L),KN,MM,NNMAX)          MAIN0691
      INC=0                                                             MAIN0692
      IF(II.GT.NBEGIN)INC=1                                             MAIN0693
      CALL ENERGY(ENG1,S1,EFF,6,KK,KJ,6,INC)                            MAIN0694
      CALL ENERGY(ENG2,SS1,EFF,6,KK,KJ,6,INC)                           MAIN0695
      KK=KK+KN                                                          MAIN0696
 378  CONTINUE                                                          MAIN0697
 380  CONTINUE                                                          MAIN0698
C
C ****************************************************************
C *          STIFFNESS CONSTRAINTS DUE TO DYNAMIC LOADS          *
C ****************************************************************
C
      INC=0                                                             MAIN0699
      IF(II.GT.NBEGIN)INC=1                                             MAIN0700
      CALL ENERGY(ENG1,S2,EDR,6,0,LOADS,6,INC)                          MAIN0701
      CALL ENERGY(ENG2,SS2,EDA,6,0,LOADS,6,INC)                         MAIN0702
 390  CONTINUE                                                          MAIN0703
      CALL ADD3(STRENG,ENG1,ENG2,FQ,BASEAE,-1,0,0,LOADS,ISGN,NNMAX,L)   MAIN0704
      KK=LOADS                                                          MAIN0705
      DO 4399 J=1,LOADS                                                 MAIN0706
      KN=NDEFEQ(J)                                                      MAIN0707
      IF(KN.LE.0)GO TO 4399                                             MAIN0708
      CALL ADD3(STRENG,ENG1,ENG2,FQ,BASEAE,-1,KK,J,KN,ISGN,NNMAX,L)     MAIN0709
      KK=KK+KN                                                          MAIN0710
 4399 CONTINUE                                                          MAIN0711
 395  CONTINUE                                                          MAIN0712
C
      IF(INDEX) 360,360,369                                             MAIN0713
C
C ****************************************************************
C *          FLEXIBILITY CONSTRAINTS DUE TO STATIC LOADS         *
C ****************************************************************
C
 360  CALL ELFORC(A,B,D,DS,EDR,S1,SS1,MAIL),MB(L),LOADS,MM,NNMAX)       MAIN0714
      IF(LMTDSP.LE.0) GO TO 364                                         MAIN0715
      IF(NDISPL.EQ.0) GO TO 364                                         MAIN0716
      KJ=0                                                              MAIN0717
      KK=LOADS                                                          MAIN0718
      DO 363 J=1,LOADS                                                  MAIN0719
      KN=NDEFEQ(J)                                                      MAIN0720
      IF(KN .LE. 0) GO TO 363                                           MAIN0721
      DO 362 K=1,KN                                                     MAIN0722
      KJ=KJ+1                                                           MAIN0723
      DO 361 I=1,6                                                      MAIN0724
      FF(I,KJ)=EDR(I,J)                                                 MAIN0725
 361  CONTINUE                                                          MAIN0726
      DO 362 I=1,MM                                                     MAIN0727
      FF(I,KJ)=DF(I,KJ)                                                 MAIN0728
 362  CONTINUE                                                          MAIN0729
      CALL ELFORC(A,B,D,FF,EDF,S2,SS2,MA(L),MB(L),KN,MM,NNMAX)          MAIN0730
      CALL ENERGY(ENG1,S2,EFF,6,0,KN,6,0)                               MAIN0731
      DO 11363 K=1,KN                                                   MAIN0732
      KK=KK+1                                                           MAIN0733
      STRENG(KK)=STRENG(KK)+ENG1(K)                                     MAIN0734
11363 CONTINUE                                                          MAIN0735
 363  CONTINUE                                                          MAIN0736
 364  CONTINUE
C
C ****************************************************************
C *          STIFFNESS CONSTRAINTS DUE TO STATIC LOADS           *
C ****************************************************************
C
      CALL ENERGY(ENG1,S1,EDR,6,0,LOADS,6,0)                            MAIN0737
C     ADR=WT(L)*WT(L)*(ELENTH(L)*45)/720.0*AE(L))                       MAIN0738
      DO 368 J=1,LOADS                                                  MAIN0739
      UNF(J)=FACTDL(J)*WT(L,1)+FACTLL(J)*WT(L,2)+FACTSL(J)*WT(L,3)      MAIN0740
      ADR=UNF(J)*UNF(J)*(ELENTH(L)*45)/720.0*AE(L))                     MAIN0741
      STRENG(J)=STRENG(J)+ENG1(J)*ADR                                   MAIN0742
 368  CONTINUE                                                          MAIN0743
 369  CONTINUE                                                          MAIN0744
C
      IF(KOPTON.LE.0 .OR. NBEGIN.LE.0) GO TO 398                        MAIN0745
C
C ****************************************************************
C *                  FREQUENCY CONSTRAINTS                       *
C ****************************************************************
C
      IF(VALMIN(NBEGIN) .LE. 0.00000011 GO TO 398                       MAIN0746
      CALL ELFORC(A,B,D,DM,EDF,S1,SS1,MAIL),MB(L),NDESIR,MM,NNMAX)      MAIN0747
      CALL ENERGY(ENG1,S1,EDF,6,0,NDESIR,6,0)                           MAIN0748
      CALL ENERGY(ENG2,SS1,EDF,6,0,NDESIR,6,0)                          MAIN0749
      NI=NSUB                                                           MAIN0750
      DO 396 II=NBEGIN,NDESIR                                           MAIN0751
      NI=NI+1                                                           MAIN0752
C396  STRENG(NI)=ENG1(II) - VAL(II)*ENG2(II)/BASEAE                     MAIN0753
      ENGY=ENG2(II)*VAL(II)/BASEAE                                      MAIN0754
      IF(ENG1(II)-ENGY) 383,384,384                                     MAIN0755
 383  CONTINUE                                                          MAIN0756
      ENGY=0.                                                           MAIN0757
      ISGN(I,NI)=1                                                      MAIN0758
 384  CONTINUE                                                          MAIN0759
      WRITE(IOUT,4020) I,II,ENG1(II),ENGY                               MAIN0760
      STRENG(NI)=ABS (ENG1(II)-ENGY)                                    MAIN0761
 396  CONTINUE                                                          MAIN0762
C
 398  CONTINUE                                                          MAIN0763
C
C ****************************************************************
C *          PICK UP MAXIMUM LAGRANGIAN MULTIPLIER               *
C ****************************************************************
C
      DO 399 J=1,NTOTAL                                                 MAIN0764
      ENG1(J)=STRENG(J)                                                 MAIN0765
 399  CONTINUE                                                          MAIN0766
      DO 11400 J=1,NTOTAL                                               MAIN0767
      ADR=ENG1(J)/ENGLTAIL(J)                                           MAIN0768
      IF(ADR.LT.0.1E-34) ADR=0.1E-34                                    MAIN0769
      ALAMDA=(RATIO(J)/RATIOA)**2)/ADR                                  MAIN0770
      IF(ALAMDA.GT.CONST(J)) GO TO 11401                                MAIN0771
      CONST(J)=ALAMDA                                                   MAIN0772
11401 CONTINUE                                                          MAIN0773
11400 CONTINUE                                                          MAIN0774
 400  CONTINUE                                                          MAIN0775
      WRITE(IOUT,3020) (CONST(J),J=1,NTOTAL)
C
C ****************************************************************
C *                RESIZE RELATIVE SIZES OF MEMBERS              *
C ****************************************************************
C
      AMAXAE=0.                                                         MAIN0776
      WRITE(IOUT,4010)                                                  MAIN0777
4010  FORMAT(///2X,3H NO,11H CONSTRAINT,21H ENERGY DENSITY RATIO)       MAIN0778
      DO 460 L=1,MEMBS                                                  MAIN0779
      ADR=0.                                                            MAIN0780
      JJ=1                                                              MAIN0781
      DO 450 J=1,NTOTAL                                                 MAIN0782
      ELEEN=ENG1(J,JJ)*CONST(J)                                         MAIN0783
      IF(ADR.GT.ELEEN) GO TO 4501                                       MAIN0784
      ADR=ELEEN                                                         MAIN0785
```

```
      JJ=J
 4501 CONTINUE
 450  CONTINUE
      ADRR=ADR/ENGLTA(L)
      WRITE(IOUT,4020) L,JJ,ADRR
 4020 FORMAT(I5,I6,6X,3E15.6)
      AE(L)=1000.D*AE(L)*SQRT(ADRR)
      IF(ISGN(L,JJ).LE.0)GO TO 587
      CALL RESIZE(AE,L,MEMBS,NSTORY,NLINE,JTYPE)
  587 IF(AMAXAE.LT.AE(L)) AMAXAE=AE(L)
  460 CONTINUE
C
C *****************************************************************
C *                NOMALIZE RELATIVE DESIGN VARIABLES             *
C *                AND CHECK WITH SIZE CONSTRAINTS                *
C *****************************************************************
C
20041 AEMAXC=0.
      AEMAXG=0.
      DO 463 I=1,MEMBS
      IF(JTYPE(I)-1)4631,461,462
  461 CONTINUE
      IF(AE(I) .LT. AEMAXC) GO TO 4631
      AEMAXC=AE(I)
      GO TO 4631
  462 CONTINUE
      IF(AE(I) .LT. AEMAXG) GO TO 4631
      AEMAXG=AE(I)
 4631 CONTINUE
  463 CONTINUE
      AEMAXC=AEMAXC/AMAXAE
      AEMAXG=AEMAXG/AMAXAE
      IP=0
      DO 470 I=1,MEMBS
      AE(I)=AE(I)/AMAXAE
      IF(JTYPE(I)-1) 465,467,468
  465 CONTINUE
      IF((AE(I)*BASEAE).LE.ABRMAX) GO TO 466
      IP=IP+1
      AE(I)=ABRMAX/BASEAE
      GO TO 4701
  466 CONTINUE
      IF((AE(I)*BASEAE).GE.ABRMIN) GO TO 4701
      IP=IP+1
      AE(I)=ABRMIN/BASEAE
      GO TO 4701
  467 CONTINUE
      IF(AE(I) .LT. (AENM*AEMAXC)) AE(I)=AENM*AEMAXC
      GO TO 469
  468 CONTINUE
      IF(AE(I) .LT. (AENM*AEMAXG)) AE(I)=AENM*AEMAXG
  469 CONTINUE
      IF((AE(I)*BASEAE).GE.AEMNMM) GO TO 4701
      IP=IP+1
      AE(I)=AEMNMM/BASEAE
 4701 CONTINUE
  470 CONTINUE
C     WRITE(IOUT,3025)IP
      CALL SAME(AE,MBC,MDIFF,MEMBS)
      KCOUNT=KCOUNT+1
      IF(NPASS.EQ.0)GO TO 100
      GO TO 15001
C
C *****************************************************************
C *                        GRADIENT METHOD                        *
C *****************************************************************
C
20042 NPASS=1
      REWIND 2
      READ(2)(SK(I),I=1,NZERO),((TFD(I),DEP(I),BD(I)),I=1,MEMBS),((ASTRE
     *(I,J),J=1,LOADS),I=1,MEMBS),(ISTR1(I,1),I=1,MEMBS),LLLL,IIII,JJJ,
     *BASEA
      IF(ICODE.EQ.2)READ(2)(FFF(I),I=1,NSTORY)
      READ(2)(DR(I,1),I=1,NN)
      BASEAE=BASEA*EE
      CALL REDUCE(DR,IBND,NN,NBNDRY,1,NNMAX)
      DO 20060 L=1,MEMBS
      DO 20051 I=1,NONZRO
20051 SK1(I)=0.
C
C ------ CALCULATE DISPLACEMENT GRADIENT ------
C
      DO 20052 I=1,NN
      ICOL(I)=ICOLS(I)
20052 IDIAG(I)=IDIAGS(I)
      AE(L)=FINCRT*AERECD(L,KCOUNT-1)
      AXIAL=FRR(L)
      CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREAA,SEC,
     1QUE)
      CALL ELMENT(EK,EM,AE(L),AM(L),AN(L),JTYPE(L),AXIAL,SPWT,ELENTH(L),
     1A,-1,AREAA)
      CALL TRNSFM(EK,EM,A,B,C,D,E,0)
      CALL ASMBL3(SK1,GM,C,E,MA(L),MB(L),MM,6,IDIAG)
      CALL BOUND2(SK1,GM,IBND,NN,NBNDRY,ICOL,IDIAG)
      CALL MLTPLY(SK1,SK2U,DR,1,MM,NNMAX,ICOL,IDIAG)
      DO 23051 I=1,NONZRO
23051 SK1(I)=0.
      DO 20053 I=1,NN
      ICOL(I)=ICOLS(I)
20053 IDIAG(I)=IDIAGS(I)
      AE(L)=AERECD(L,KCOUNT-1)
      AXIAL=FRR(L)
      CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREAA
     1,SEC,QUE)
      CALL ELMENT(EK,EM,AE(L),AM(L),AN(L),JTYPE(L),AXIAL,SPWT
     1,ELENTH(L),A,-1,AREAA)
      CALL TRNSFA(EK,EM,A,B,C,D,E,0)
      CALL ASMBL3(SK1,GM,C,E,MA(L),MB(L),MM,6,IDIAG)
      CALL BOUND2(SK1,GM,IBND,NN,NBNDRY,ICOL,IDIAG)
      CALL MLTPLY(SK1,SK1U,DR,1,MM,NNMAX,ICOL,IDIAG)
      DO 20054 I=1,NN
20054 SK12(I,1)=SK1U(I,1)-SK2U(I,1)
      INC=1
      IF(L.EQ.1)INC=0
      CALL GAUSS(SK,SK12,DELTAD,1,MM,NNMAX,INC,ICOL,IDIAG)
      CALL RESTOR(DELTAD,IBND,NN,NBNDRY,1,NNMAX)
      DO 20055 I=1,NN
20055 DELTAR(I,L)=DELTAD(I,1)
20060 CONTINUE
C
      IF(SIGNLL.LT.ABSDI) GO TO 20076
C
C ------ CALCULATE STRESS GRADIENT ------
C
      DO 20070 K=1,MEMBS
      DO 20065 L=1,MEMBS
      AXIAL=FRR(L)
      CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREAA,SEC,
     1QUE)
      CALL ELMENT(EK,EM,AE(L),AM(L),AN(L),JTYPE(L),AXIAL,0.,ELENTH(L),
     *A,-1,AREAA)
      CALL TRNSFM(EK,EM,A,B,C,D,E,1)
      DO 20061 I=1,NN
20061 DELTAD(I,1)=DELTAR(I,K)
      CALL ELFORC(A,B,D,DELTAD,EOR,S1,SS1,MA(L),MB(L),1,MM,NNMAX)
      CALL WFBEAM(S1,SIGMA,AREAA,SEC,QUE,1)
C
C ------ OBTAIN THE MAXIMUM CHANGE OF STRESS IN MEMBER L ------
C ------        DUE TO THE SMALL CHANGE OF ELEMENT K.     ------
C
      IE1=ISTR1(L,1)
      DSTMAX(L,K)=SIGMA(IE1,1)
      IF(ASTRE(L,LLLL).GE.0.)GO TO 20071
      IF(DSTMAX(L,K).LT.0.)DSTMAX(L,K)=0.
      GO TO 20065
20071 IF(DSTMAX(L,K).GE.0)DSTMAX(L,K)=0.
      DSTMAX(L,K)=-DSTMAX(L,K)
20065 CONTINUE
20070 CONTINUE
      GO TO 20081
C
C ------ DROP THE NEGATIVE INCREMENTS ------
C
20076 CONTINUE
      CALL RESTOR(DR,IBND,NN,NBNDRY,1,NNMAX)
      DO 20080 L=1,MEMBS
      DO 20080 I=1,NN
      IF(DR(I,1).GE.0.)GO TO 20079
      IF(DELTAR(I,L).LT.0.)DELTAR(I,L)=0.
      GO TO 20080
20079 IF(DELTAR(I,L).GE.0)DELTAR(I,L)=0.
      DELTAR(I,L)=-DELTAR(I,L)
20080 CONTINUE
C
20081 BASEA=(1.-REFATR)*BASEA
      BASEAE=BASEA*EE
      DO 20085 L=1,MEMBS
      IF(JTYPE(L)-1) 20082,20084,20084
20082 IF((AE(L)*BASEAE).LT.ABRMAX) GO TO 20083
      AE(L)=ABRMAX/BASEAE
      GO TO 20085
20083 IF((AE(L)*BASEAE).LT.ABRMIN)AE(L)=ABRMIN/BASEAE
      GO TO 20085
20084 RINTIA=AE(L)*BASEAE
      IF(RINTIA.LT.AEMNMM) AE(L)=AEMNMM/BASEAE
20085 CONTINUE
```

```
C
C ------ CALCULATE THE DISPLACEMENTS AND STRESSES ------
C ------     USING THE REDUCED DESIGN VARIABLES.    ------
C
      IREDUC=1                                                          MAIN0928
      GO TO 15000                                                       MAIN0929
C
C ------                STRESS IS ACTIVE                        ------
C ------ CALCULATE THE ACTUAL CHANGE IN SIZE OF ELEMENT I ------
C
20089 NACTIV=0                                                          MAIN0930
      DO 20401 I=1,NEMBS                                                MAIN0931
      DDDDI(I)=0.                                                       MAIN0932
      STRSS=STRES(I)                                                    MAIN0933
      ISTR=ISIGN(1,LLLL)                                                MAIN0934
      IF(ISTR.EQ.2.OR.ISTR.EQ.5) STRSS=0.65*STRSS                       MAIN0935
      RATIOA=ABS(ASTRE(I,LLLL))-STRSS                                   MAIN0936
      IF(RATIOA.LT.1.0E-30)GO TO 20401                                  MAIN0937
      NACTIV=NACTIV+1                                                   MAIN0938
      PHI(NACTIV)=RATIOA                                                MAIN0939
      MACT(NACTIV)=I                                                    MAIN0940
20401 CONTINUE                                                          MAIN0941
      IF(NACTIV.EQ.0)GO TO 20113                                        MAIN0942
      DO 20403 J2=1,NACTIV                                              MAIN0943
      SUMSTS=0.                                                         MAIN0944
      JACTIV=MACTIV(J2)                                                 MAIN0945
      DO 20091 I=1,NEMBS                                                MAIN0946
      DDDI(I)=0.                                                        MAIN0947
20091 SUMSTS=SUMSTS+DSTMAX(JACTIV,I)**2/(AE(I)*ELENTH(I))               MAIN0948
      IF(SUMSTS.LE.0.)GO TO 20403                                       MAIN0949
      DO 20099 L=1,NEMBS                                                MAIN0950
      DDDI(L)=(PHI(J2)/SUMSTS)*(DSTMAX(JACTIV,L)/ELENTH(L))             MAIN0951
      IF(DDDI(L).LE.DDDD(L))GO TO 20099                                 MAIN0952
      DDDD(L)=DDDI(L)                                                   MAIN0953
20099 CONTINUE                                                          MAIN0954
20403 CONTINUE                                                          MAIN0955
      GO TO 20116                                                       MAIN0956
C
C ------                DISPLACEMENT IS ACTIVE                  ------
C ------ CALCULATE THE ACTUAL CHANGE IN SIZE OF ELEMENT I ------
C
20100 RATIOA=0.                                                         MAIN0957
      DO 20101 I=1,NN                                                   MAIN0958
      DEFBAE=DEFLMT(I)*BASEAE                                           MAIN0959
      AMAX=ABS(DR(I,JJ))                                                MAIN0960
      ADR=AMAX/DEFBAE                                                   MAIN0961
      IF(RATIOA.GT.ADR)GO TO 20101                                      MAIN0962
      RATIOA=ADR                                                        MAIN0963
      III=I                                                             MAIN0964
20101 CONTINUE                                                          MAIN0965
      PHI=ABS(ABS(DR(III,JJJ))/BASEAE-DEFLMT(III))                      MAIN0966
      SUMDIS=0.                                                         MAIN0967
      DO 20111 I=1,NEMBS                                                MAIN0968
      DELTAR(III,I)=DELTAR(III,I)/BASEAE                                MAIN0969
      DSTMAX(III,I)=DELTAR(III,I)**2/(AE(I)*ELENTH(I))                  MAIN0970
20111 SUMDIS=SUMDIS+DSTMAX(III,I)                                       MAIN0971
      IF(SUMDIS.GT.0.0000000001) GO TO 20114                            MAIN0972
C
20113 WRITE(IOUT,20121)                                                 MAIN0973
20121 FORMAT('******* ALL INCREMENTS ARE NEGATIVE ********',///)        MAIN0974
      GO TO 273                                                         MAIN0975
C
20114 CONTINUE                                                          MAIN0976
      DO 20115 L=1,NEMBS                                                MAIN0977
20115 DDDD(L)=(PHI/SUMDIS)*DELTAR(III,L)/ELENTH(L)                      MAIN0978
C
20116 DFIX=0.                                                           MAIN0979
      DO 20117 L=1,NEMBS                                                MAIN0980
      IF(DFIX.GE.DDDD(L))GO TO 20117                                    MAIN0981
      DFIX=DDDD(L)                                                      MAIN0982
      LDDDMX=L                                                          MAIN0983
20117 CONTINUE                                                          MAIN0984
C
      RATIOA=DFIX                                                       MAIN0985
      IF(RATIOA.GT.URANGE)GO TO 20127                                   MAIN0986
      IF(RATIOA.LT.DRANGE)GO TO 20128                                   MAIN0987
      GO TO 20131                                                       MAIN0988
20127 RATIOA=URANGE                                                     MAIN0989
      GO TO 20129                                                       MAIN0990
20128 RATIOA=DRANGE                                                     MAIN0991
20129 DFIX=RATIOA                                                       MAIN0992
      RATIOA=DDDD(LDDDMX)/DFIX                                          MAIN0993
      DO 20130 L=1,NEMBS                                                MAIN0994
20130 DDDD(L)=DDDD(L)/RATIOA                                            MAIN0995
20131 CONTINUE                                                          MAIN0996
      DO 20136 L=1,NEMBS                                                MAIN0997
20136 AE(L)=AE(L)+DDDD(L)                                               MAIN0998
      AMAXAE=AE(1)                                                      MAIN0999
      DO 20140 L=2,NEMBS                                                MAIN1000
20140 AMAXAE=AMAX1(AMAXAE,AE(L))                                        MAIN1001
      IGRADF=IGRADF-1                                                   MAIN1002
      GO TO 20041                                                       MAIN1003
C
C ***********************************************************************
C *                        FINAL DESIGN OUTPUT                          *
C ***********************************************************************
C
  500 CONTINUE                                                          MAIN1004
      IF(KANLYZ.EQ.1)GO TO 102                                          MAIN1005
  505 CONTINUE                                                          MAIN1006
      IF(INDEX) 507,506,506                                             MAIN1007
  506 CALL RESTOR(DR,IBND,MN,NBNDRY,NDESIR,NNMAX)                       MAIN1008
  507 CONTINUE                                                          MAIN1009
      IF((ICODE.LE.3.AND.IPLOT.EQ.1)WRITE(IOUT1,5555)(FFF(I),I=1,NSTORY) MAIN0010
      NPAGE=NPAGE+1                                                     MAIN1011
      LINES=1                                                           MAIN1012
      DO 530 L=1,NEMBS                                                  MAIN1013
      IF((LINES+2*LOADS).LT.51.AND.L.GT.1) GO TO 510                    MAIN1014
      LINES=1                                                           MAIN1015
      WRITE(IOUT,5011) NPAGE                                            MAIN1016
      NPAGE=NPAGE+1                                                     MAIN1017
      WRITE(IOUT,5012)                                                  MAIN1018
  510 CONTINUE                                                          MAIN1019
      AXIAL=FRR(L)+FRS(L)                                               MAIN1020
C
      IF(IDESGT.NE.-1)GO TO 800                                         MAIN1021
      AREAA=AREAI(L)                                                    MAIN1022
      SEC=SI(L)                                                         MAIN1023
      GO TO 810                                                         MAIN1024
C
  800 CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPNT,AREAA,SEC,MAIN1025
     *                QUE)
  810 CALL ELMENT(EK,EM,AE(L),AN(L),AN(L),JTYPE(L),AXIAL,0.,ELENTH(L),  MAIN1026
     *A1=1,AREAA)
      CALL TRNSFM(EK,EM,A,B,C,D,E,1)                                    MAIN1027
      DO 511 I=1,6                                                      MAIN1028
      DO 511 J=1,LOADS                                                  MAIN1029
      S(I,J)=0                                                          MAIN1030
  511 SUM(I,J)=0                                                        MAIN1031
      IF(INDEX) 512,512,514                                             MAIN1032
C
  512 CALL ELFORC(A,B,D,DS,EDR,S1,SS1,MA(L),MB(L),LOADS,MM,NNMAX)       MAIN1033
      IF(UNILD.EQ.0)GO TO 515                                           MAIN1034
      DO 11122 J=1,LOADS                                                MAIN1035
11122 UNF(J)=FACTDL(J)*WT(L,1)+FACTLL(J)*WT(L,2)+FACTSL(J)*WT(L,3)      MAIN1036
      CALL FIXEND(FL,AML,UNF,MA(L),MB(L),ELENTH(L),1,LOADS,NNMAX,       MAIN1037
     *ANL(1),ANL(1))
      DO 513 I=1,6                                                      MAIN1038
      DO 513 J=1,LOADS                                                  MAIN1039
  513 S(I,J)=ANL(I,J)+S(I,J)                                            MAIN1040
  515 IF(INDEX) 519,514,514                                             MAIN1041
C
  514 DO 516 II=NBEGIN,NDESIR                                           MAIN1042
      CALL CHANGE(DT,DR,MM,VV,NSIGN,II,LOADS,NN,MDMAX,NNMAX)            MAIN1043
      CALL ELFORC(A,B,D,DI,EDR,S2,SS2,MA(L),MB(L),LOADS,MM,NNMAX)       MAIN1044
      CALL ADD2(S,S2,NSIGN,6,LOADS)                                     MAIN1045
  516 CONTINUE                                                          MAIN1046
      IF(NSIGN) 519,517,519                                             MAIN1047
  517 DO 518 I=1,6                                                      MAIN1048
      DO 518 J=1,LOADS                                                  MAIN1049
  518 S(I,J)=SQRT(S(I,J))                                               MAIN1050
C
  519 CALL ADD1(S1,S,INDEX,LOADS,6,6)                                   MAIN1051
      IF(SEC.LT.0.000011 GO TO 542                                      MAIN1052
      CALL WFBEAM(S,SIGMA,AREAA,SEC,QUE,LOADS)                          MAIN1053
  542 IF(JTYPE(L)-11 521,522,522                                        MAIN1054
  521 WRITE(IOUT,5015) L,ELENTH(L),AE(L),AREAA,MA(L),MB(L),S(1,1)       MAIN1055
      IF(SEC.LT.0.00001) GO TO 523                                      MAIN1056
      WRITE(IOUT,5016) SIGMA(1,1)                                       MAIN1057
      IF(IPLOT.EQ.0)GO TO 523                                           MAIN1058
      WRITE(IOUT1,5555)AREAA,S(1,1),SIGMA(1,1)                          MAIN1059
      GO TO 523                                                         MAIN1060
  522 EI=AE(L)*BASEA                                                    MAIN1061
      ENGTA(L)=SEC                                                      MAIN1062
      WRITE(IOUT,5013) L,ELENTH(L),AE(L),EI,AREAA,MA(L),MB(L),(S(I,1),  MAIN1063
     *I=1,6)
      IF(SEC.LT.0.00001) GO TO 523                                      MAIN1064
      WRITE(IOUT,5014) (SIGMA(I,II),I=1,6)                              MAIN1065
      IF(IPLOT.EQ.0)GO TO 523                                           MAIN1066
      WRITE(IOUT1,5555)EI                                               MAIN1067
      WRITE(IOUT1,5555)(S(I,1),I=1,6)                                   MAIN1068
      WRITE(IOUT1,5555)(SIGMA(I,1),I=1,6)                               MAIN1069
  523 IF(LOADS.EQ.1) GO TO 530                                          MAIN1070
      IF(JTYPE(L)-11 524,526,526                                        MAIN1071
  524 DO 525 K=2,LOADS                                                  MAIN1072
      WRITE(IOUT,5014) S(1,K)                                           MAIN1073
```

```
      IF(SEC.LT.0.00001) GO TO 525                                      MAIN1074
      WRITE(IOUT,5014) SIGMA(I,K)                                       MAIN1075
  525 CONTINUE                                                          MAIN1076
      GO TO 530                                                         MAIN1077
  526 DO 527 K=2,LOADS                                                  MAIN1078
      WRITE(IOUT,5014) (S(I,K),I=1,6)                                   MAIN1079
      IF(SEC.LT.0.00001) GO TO 527                                      MAIN1080
      WRITE(IOUT,5014) (SIGMA(I,K),I=1,6)                               MAIN1081
  527 CONTINUE                                                          MAIN1082
  530 LINES=LINES+2*LOADS+1                                             MAIN1083
C
      IF(ISEC.EQ.-1) GO TO 536                                          MAIN1084
      WRITE(IOUT,5011) NPAGE                                            MAIN1085
      WRITE(IOUT,5012)                                                  MAIN1086
      DO 535 I=1,MEMBS                                                  MAIN1087
      IF(JTYPE(I).EQ.0) GO TO 535                                       MAIN1088
      TW=TWO*DEP(I)                                                     MAIN1089
      TF=TFD(I)*DEP(I)                                                  MAIN1090
      WRITE(IOUT,5022) I,JTYPE(I),ENGLTA(I),TFD(I),DEP(I),TW,TF         MAIN1091
  535 CONTINUE                                                          MAIN1092
      NPAGE=NPAGE+1                                                     MAIN1093
C
  536 DO 540 I=1,NN                                                     MAIN1094
      DO 540 J=1,LOADS                                                  MAIN1095
  540 DR(I,J)=DR(I,J)/BASEAE                                            MAIN1096
      CALL PRNTDR(DR,X,Y,NN,MM,LOADS,JOINTS,NPAGE,NNMAX,IPLOT)          MAIN1097
C     IF(IPLOT.EQ.0)GO TO 1000                                          MAIN1098
C     DO 2015 I=1,KCOUNT
C0151 WRITE(IOUT1,5555)IFINDM(I)
 1000 IF(KSTRS.GE.NSTRS) GO TO 1001                                     MAIN1099
      KSTRS=KSTRS+1                                                     MAIN1100
      IOUTI=IOUTI+1                                                     MAIN1101
      GO TO 10090                                                       MAIN1102
 5011 FORMAT(1HI,120X,5HPAGE ,I3////)                                   MAIN1103
 5012 FORMAT(//1X,6HMEMBER,1X,6HLENGTH,4X,2HAE,9X,1HI,6X,4HAREA,4X,    MAIN1104
     12HMA,2X,2HMB,4X,11HAXIAL FORCE,4X,5HSHEAR,8X,6HMOMENT,6X,
     211HAXIAL FORCE,4X,5HSHEAR,8X,6HMOMENT//)
 5013 FORMAT(/15,F9.4,F8.5,F11.4,F9.4,I4,I4,1PE15.5,1PE13.5,            MAIN1105
     1 1PE13.5,1PE14.5,1PE13.5,1PE13.5)
 5014 FORMAT(50X,1PE13.5,1PE13.5,1PE13.5,1PE13.5,1PE14.5,1PE13.5,1PE13.5)MAIN1106
 5015 FORMAT(/15,F9.2,F8.5,11X,F9.4,I4,I4,1PE15.5)                      MAIN1107
 5021 FORMAT(//34H GIRDER-COLUMN SECTION PROPERTIES:///                 MAIN1108
     1 3X,6HMEMBER,2X,4HTYPE,7X,15HSECTION MODULUS,5X,4HTF/D,
     2 5X,5HDEPTH,8X,2HTW,9X,2HIF)
 5022 FORMAT(/2X,I5,1X,I5,8X,F12.3,5X,F9.5,2X,F7.3,4X,F8.4,3X,F8.4)     MAIN1109
 5555 FORMAT(4F20.10)                                                   MAIN1110
 1001 STOP                                                              MAIN1111
C     DEBUG SUBCHK
      END                                                               MAIN1112
C
C     SUBROUTINE ADD1:
C ***************************************************************
C *     ADD STATIC DISPLACEMENTS WITH DYNAMIC DISPLACEMENTS     *
C ***************************************************************
C
      SUBROUTINE ADD1 (S,D,INC,L,N,NN)                                  ADD10010
      DIMENSION S(NN,L),D(NN,L)                                         ADD10020
      DO 30 I=1,N                                                       ADD10030
      DO 30 J=1,L                                                       ADD10040
      DMAX=S(I,J)+D(I,J)                                                ADD10050
      DMIN=S(I,J)-D(I,J)                                                ADD10060
      IF(INC) 20,10,20                                                  ADD10070
   10 IF(ABS(DMAX)-ABS(DMIN)) 15,20,20                                  ADD10080
   15 D(I,J)=DMIN                                                       ADD10090
      GO TO 30                                                          ADD10100
   20 D(I,J)=DMAX                                                       ADD10110
   30 CONTINUE                                                          ADD10120
      RETURN                                                            ADD10130
C     DEBUG SUBCHK
      END                                                               ADD10140
C
C     SUBROUTINE ADD2:
C ***************************************************************
C *   COMBINE DYNAMIC FORCES ACCORDING TO TYPE OF COMBINATION   *
C ***************************************************************
C
      SUBROUTINE ADD2 (S,S2,NS,N,L)                                     ADD20010
      DIMENSION S(N,L),S2(N,L)                                          ADD20020
      DO 30 I=1,N                                                       ADD20030
      DO 30 J=1,L                                                       ADD20040
      IF (NS) 10,15,20                                                  ADD20050
   10 S(I,J)=S(I,J)+S2(I,J)                                             ADD20060
      GO TO 30                                                          ADD20070
   15 S(I,J)=S(I,J)+(S2(I,J))**2                                        ADD20080
      GO TO 30                                                          ADD20090
   20 S(I,J)=S(I,J)+ABS(S2(I,J))                                        ADD20100
   30 CONTINUE                                                          ADD20110
      RETURN                                                            ADD20120
C     DEBUG SUBCHK
      END                                                               ADD20130
C
C     SUBROUTINE ADD3:
C ***************************************************************
C *     COMBINE ENERGIES ACCORDING TO TYPE OF COMBINATION       *
C ***************************************************************
C
      SUBROUTINE ADD3 (S,E1,E2,FQ,BA,NS,KN,JJ,L,INT,MM,MB)              ADD30010
      DIMENSION S(1),E1(1),E2(1),FQ(1),INT(MM,1)                        ADD30020
      KJ=KN                                                             ADD30030
      DO 40 J=1,L                                                       ADD30040
      KJ=KJ+1                                                           ADD30050
      IF(JJ) 10,10,20                                                   ADD30060
   10 JK=J                                                              ADD30070
      GO TO 30                                                          ADD30080
   20 JK=JJ                                                             ADD30090
   30 CONTINUE                                                          ADD30100
      ADR=E1(KJ) - E2(KJ)*FQ(JK)/BA                                     ADD30110
      IF(ADR.GT.0.)GO TO 322                                            ADD30111
      ADR=E1(KJ)                                                        ADD30112
      INT(MB,KJ)=INT(MB,KJ)+1                                           ADD30113
      IF(NS) 31,32,33                                                   ADD30120
   31 S(KJ)=S(KJ)*ADR                                                   ADD30130
      GO TO 40                                                          ADD30140
   32 S(KJ)=S(KJ)+(ADR**2)                                              ADD30150
      GO TO 40                                                          ADD30160
   33 S(KJ)=S(KJ)+ABS(ADR)                                              ADD30170
   40 CONTINUE                                                          ADD30180
      RETURN                                                            ADD30190
C     DEBUG SUBCHK
      END                                                               ADD30020
C
C     SUBROUTINE AREA:
C ***************************************************************
C *                CALCULATE SECTION PROPERTIES                 *
C ***************************************************************
C
      SUBROUTINE AREA(AE,BA,BD,D,TFD,JT,SPWT,AA,SS,QQ)                  AREA0010
      COMMON/PRT1/INN,IOUT,IQUE)                                        AREA0020
      COMMON/BBC/IS,T,DEPMAX,DEPMIN,TFDMAX,TFDMIN,RHO,RHO1,BTFMAX,      AREA0030
     1      BTFMIN,BDMAX,BDMIN
      FLANGE(BD1,TFD1,T1)=D.5*(BD1)*(TFD1)*(1.0-TFD1)**2                AREA0040
      WEB(TFD1,T1)=(1.0/12.0)*T1*(1.0-2.0*TFD1)**3                      AREA0050
      SECMOD(AE1,D1,BA1,TFD1)=(AE1*BA1)/(0.5*D1*(1.0+TFD1))             AREA0060
      SHEMOD(AE1,BD1,D1,BA1,TFD1,T1)=1.0/((1.0*(D1**2))*((FLANGE(BD1,   AREA0070
     1TFD1,T1)/(1.0-TFD1))+(.5*(WEB(TFD1,T1)/(1.0-2.0*TFD1)))/         AREA0080
     2(FLANGE(BD1,TFD1,T1)+WEB(TFD1,T1)))                               AREA0090
      AREAA(BD1,D1,TFD1,T1)=(D1**2)*(T1*2.0*TFD1*(BD1-T1))              AREA0100
C
      IF(JT-1) 10,20,20                                                 AREA0110
C
C     BRACING-TYPE MEMBER
C
   10 SPWT=RHO1                                                         AREA0120
      AA=AE*BA                                                          AREA0130
      SS=1.0                                                            AREA0140
      QQ=0.                                                             AREA0150
      GO TO 100                                                         AREA0160
C
C     COLUMN-GIRDER TYPE MEMBER
C
   20 SPWT=RHO                                                          AREA0170
      IF(IS) 30,30,40                                                   AREA0180
C
C     ----- BUILT-UP SECTION -----
C
   30 TFD=0.                                                            AREA0190
      NT=0                                                              AREA0200
   32 DO 1 K=1,5                                                        AREA0210
      TFD=2.0*((AE*BA)/(D**4)-WEB(TFD,T))/(BD*(1-TFD)**2)               AREA0211
    1 CONTINUE                                                          AREA0212
      IF(TFD.GT.TFDMAX)TFD=TFDMAX                                       AREA0213
      IF(TFD.LT.TFDMIN)TFD=TFDMIN                                       AREA0214
      BTF=0.5*BD/TFD                                                    AREA0215
      IF(BTF.GT.BTFMAX)BD=BTFMAX*2.*TFD                                 AREA0216
      IF(BTF.GT.BTFMAX)BTF=BTFMAX                                       AREA0217
      IF(BTF.LT.BTFMIN)BD=BTFMIN*2.*TFD                                 AREA0218
      IF(BTF.LT.BTFMIN)BTF=BTFMIN                                       AREA0219
      IF(BD.LT.BDMIN)BD=BDMIN                                           AREA1210
      IF(BD.GT.BDMAX)BD=BDMAX                                           AREA1221
      D=AE*BA/(FLANGE(BD,TFD,T)+WEB(TFD,T))                             AREA1222
      D=SQRT(D)                                                         AREA1223
      D=SQRT(D)                                                         AREA1224
      IF(NT.GT.1)GO TO 31                                               AREA1225
      IF(D.LE.DEPMAX.AND.D.GE.DEPMIN)GO TO 31                           AREA1226
      IF(D.GT.DEPMAX)D=DEPMAX                                           AREA1227
      IF(D.LT.DEPMIN)D=DEPMIN                                           AREA1228
```

```
      NT=NT+1                                                           AREA1220
      GO TO 32                                                          AREA1229
   31 AA=ARE4A(BD,D,TFD,T)                                              AREA0220
      SS=SECMOD(AE,0,BA,TFD)                                            AREA0230
      DD=SHEMOD(AE,BD,0,BA,TFD,T)                                       AREA0240
      GO TO 100                                                         AREA0250
C
C     ---- WF SECTION -----
C
   40 EI=AE*BA                                                          AREA0260
      NN=0                                                              AREA0270
      IF(EI-9000.) 11,11,12                                             AREA0280
   11 AA=SQRT(D.21583*EI)                                               AREA0290
      SS=SQRT(60.6*EI+84100.) - 290.                                    AREA0300
      GO TO 100                                                         AREA0310
   12 IF(1.E+13-EI) 13,14,14                                            AREA0320
C  13 IF(1.E+10-EI) 15,14,14                                            AREA0330
   13 WRITE(IOUT,50)                                                    AREA0340
      STOP                                                              AREA0350
   14 AA=EI/((EI+174498.)/12841.)**2                                    AREA0360
      SS=(EI-8056.3171.8)6                                              AREA0370
   50 FORMAT(//2X,56H ***PROGRAM STOP DUE TO SECTION EXCEEDS MAXIMUM LIMAREA0380
     1IT***)                                                            AREA0390
  100 CONTINUE                                                          AREA0400
      RETURN                                                            AREA0410
C     DEBUG SUBCHK
      END                                                               AREA0420
C
C     SUBROUTINE ASMBL3:
C  ***************************************************************
C  *         FORM THE OVERALL STIFFNESS AND MASS MATRICES.       *
C  ***************************************************************
C
      SUBROUTINE ASMBL3(A,G,B,C,MA,MB,MM,M,ID)                          ASMB0010
      DIMENSION A(1),G(1),ID(1),B(A,M),C(M,M)                           ASMB0020
      IX(I,J)=I*(J-1)+J                                                 ASMB0030
      M2=2*MM                                                           ASMB0040
      IA=IX(MM,MA)                                                      ASMB0050
      JA=IX(MM,MB)                                                      ASMB0060
      IAA=IA                                                            ASMB0070
      KH=MM                                                             ASMB0080
      KY=MM                                                             ASMB0090
      KX=JA-IA-MM                                                       ASMB0100
      DO 30 J=1,M2                                                      ASMB0110
      IF(J .LE. KH)GO TO 15                                             ASMB0120
      IAA=JA                                                            ASMB0130
      KH=M2                                                             ASMB0140
   15 CONTINUE                                                          ASMB0150
      JX=ID(IAA)-IAA+IA                                                 ASMB0160
      KY=MM                                                             ASMB0170
      DO 25 I=1,J                                                       ASMB0180
      IF(J .LE. KY .OR. I .LE. MM) GO TO 20                             ASMB0190
      JX=JX+KX                                                          ASMB0200
      KY=M2                                                             ASMB0210
   20 CONTINUE                                                          ASMB0220
      A(JX)=A(JX)+B(I,J)                                                ASMB0230
      G(JX)=G(JX)+C(I,J)                                                ASMB0240
      JX=JX+1                                                           ASMB0250
   25 CONTINUE                                                          ASMB0260
      IAA=IAA+1                                                         ASMB0270
   30 CONTINUE                                                          ASMB0280
      RETURN                                                            ASMB0290
C     DEBUG SUBCHK
      END                                                               ASMB0300
C
C     SUBROUTINE ATCCD:
C  ***************************************************************
C  *         CALCULATE SEISMIC FORCES ACCCRDING TO ATC           *
C  ***************************************************************
C
      SUBROUTINE ATCCD(TT,LOADS,NM,NN,NBNDRY,DM,BASEAE,NSTORY,MT,       ATCC0010
     2IIBASE,SK,FS,DS,IBND,ICOL,IDIAG,FFF,RKAPA,AMP,IREQDM,RM2,ECC,MAX) ATCC0020
      COMMON/ABC/N2ERO,NBEGIN,NDESIR,NITER,RDM,RNA                      ATCC0030
      COMMON/PRI/INN,IOUT,JOUT                                          ATCC0040
      COMMON/CODE1/HT(30),WTI4(4,WWW(30,4),KNODE(30,4)                  ATCC0050
      COMMON/ATC1/VC(30),DIS(30),DELT(30),AA(30),CV(30),TETA(30),PP(30), ATCC0060
     1            SUMWF1(10),SUMWF2(10),ABARM(10),CSM(10),RMOMNT(3L),
     2            VMODAL(10),RMMODE(30,10),DRIFMO(30,10),U(30,10),
     3            CVXME(30,10),FMODAL(30,10),DELXEM(30,10),VRMODE(30,10)
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NMNNN,MMMMM,NBRITL,   ATCC0070
     1            ISH,NPREGR,NVREGR,IS,ISLGL,IPILE,RKY,RKTETA,RR,VS,
     2            OSSSS,HN,44,AV,S,R,CO,RL,DELA(30)
      DIMENSION ICOL(NNA),IDIAG(NNA),TT(NDA),SK(MAX),IBND(50),TT(10),   ATCC0080
     1          AKAPA(MT),FFF(MT),DM(NNA,MDP),FS(NNA,4),DS(NNA,4)
C
C     TO OBTAIN PERIODS AND MODAL MATRIX
C
      IFUNDA=TT(1)                                                      ATCC0090
      WRITE(IOUT,2001)                                                  ATCI0060
      READ(INN,1002) NMNNN,MMMMM,ISH,NBRITL,IACTIV,ISOIL,NPREGR         ATCI0070
     1,NVREGR,MR,ISF,IFIX,NANALS
      READ(INN,1003) A,CO,RL                                            ATCI0080
      CALL PERFOM(IPERFO)                                               ATCI0090
      WRITE(IOUT,2004)R,CO,RL,ISOIL,MR,ISF,NPREGR,NVREGR                ATCI0100
      RL=RL/12.                                                         ATCI0110
      IF(IFIX.EQ.1) GO TO 75                                            ATCI0120
C
C     INPUT DATA FOR SOIL STRUCTURAL INTERACTION
C
      READ(INN,1001) RR,VS,OSSSS,RKY,RKTETA,ISLGL,IPILE                 ATCI0130
      WRITE(IOUT,2005)RR,VS,OSSSS,ISLGL,IPILE,RKY,RKTETA                ATCI0150
      RR=RR/12.                                                         ATCI0160
      VS=VS/12.                                                         ATCI0170
      OSSSS=OSSSS/12.                                                   ATCI0180
      RKY=RKY*12.*1000.                                                 ATCI0190
      RKTETA=RKTETA*12000.                                              ATCI0200
   75 HN=HT(NSTORY)                                                     ATCI0210
      GO TO (74,77,78),ISOIL                                            ATCI0220
   76 S=1.0                                                             ATCI0230
      GO TO 80                                                          ATCI0240
   77 S=1.2                                                             ATCI0250
      GO TO 80                                                          ATCI0260
   78 S=1.5                                                             ATCI0270
   80 WRITE(IOUT,2011)S                                                 ATCI0280
      IF(NANALS.GE.0)GO TO 90                                           ATCI0290
      GO TO (82,83,81),IPERFO                                           ATCI0300
   81 IF(NPREGR.EQ.0)GO TO 85                                           ATCI0310
      IF(NVREGR.EQ.1)GO TO 83                                           ATCI0320
      WRITE(IOUT,2006)                                                  ATCI0330
      NANALS=2                                                          ATCI0340
      GO TO 90                                                          ATCI0350
   82 WRITE(IOUT,2007)                                                  ATCI0360
      STOP                                                              ATCI0370
   83 WRITE(IOUT,2008)                                                  ATCI0380
      NANALS=1                                                          ATCI0390
      GO TO 90                                                          ATCI0400
   85 WRITE(IOUT,2009)                                                  ATCI0410
      STOP                                                              ATCI0420
   90 GO TO(100,110,120),ISH                                            ATCI0430
  100 IF(NBRITL.EQ.1.OR.NSTORY.GT.3)GO TO 110                           ATCI0440
      CDEL4=0.02                                                        ATCI0450
      GO TO 130                                                         ATCI0460
      IF(NANALS.EQ.2)GO TO 10                                           ATCC0100
      CALL LATITFUNDA,VBASE,CS,0,RM2,0.0,RKK,NSTORY,FFF,RKAPA,          ATCC0110
     1AMP,ECC,MT)                                                       ATCC0120
      NP=0                                                              ATCC0130
      IF(IFIX.EQ.0)NP=1                                                 ATCC0140
      CALL LATIIG,RM2,VBASE,0,LOADS,NM,NN,NBNDRY,BASEAE,NP,RKK,NSTORY   ATCC0150
     1,IIBASE,SK,FS,DS,IBND,ICOL,IDIAG,FFF,RKAPA,AMP,ECC,MAX,MT)        ATCC0160
      IF(IFIX.EQ.1)GO TO 10                                             ATCC0170
      CALL SOILII(IFUNDA,VBASE,CS,RM2,RKK,NSTORY,IIBASE,SK,FS,DS,IBND   ATCC0180
     1,ICOL,IDIAG,FFF,RKAPA,AMP,ECC,MAX,MT,NNA)                         ATCC0190
  101 WTTI1=WTTI1*1000.                                                 ATCC0200
      RM2=RM2*12000.                                                    ATCC0210
      ECC=ECC*12.                                                       ATCC0220
      DO 12 I=1,NSTORY                                                  ATCC0230
      RM(I)=RM(I)*12000.                                                ATCC0240
   12 CONTINUE                                                          ATCC0250
      GO TO 100                                                         ATCC0260
   10 CALL RESTOR(DM,IBND,NN,NBNDRY,NDESIR,NNA)                         ATCC0270
      DO 110 I=1,IREQDM                                                 ATCC0280
  110 WTI(I)=WTI(I)                                                     ATCC0290
      DO 120 I=1,IREQDM                                                 ATCC0300
      DO 120 J=1,NSTORY                                                 ATCC0310
      JJJ=3*KNODE(J,1)-2                                                ATCC0320
  120 UI(J,I)=DM(JJJ,I)                                                 ATCC0330
      CALL MODALA(IFUNDA,TTT,NSTORY,IIBASE,SK,DS,FS,IBND,ICOL,IDIAG,FFF ATCC0330
     1,RKAPA,AMP,IREQDM,RM2,MAX,MT,NNA)
      WTT(I)=WTT(I)*1000.                                               ATCC0340
  100 CONTINUE                                                          ATCC0350
      RETURN                                                            ATCC0360
C     DEBUG SUBCHK
      END                                                               ATCC0370
C
C     SUBROUTINE ATCIF:
C  ***************************************************************
C  *                    ATC INFORMATION                          *
C  ***************************************************************
C
      SUBROUTINE ATCIF(NSTORY,RKAPA)                                    ATCI0010
      COMMON/PRI/INN,IOUT,JOUT                                          ATCI0020
      COMMON/CODE1/HT(30),WTI4(4,WWW(30,4),KNODE(30,4)                  ATCI0030
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NMNNN,MMMMM,NBRITL,   ATCI0040
     1            ISH,NPREGR,NVREGR,IS,ISLGL,IPILE,RKY,RKTETA,RR,VS,
     2            OSSSS,HN,44,AV,S,R,CO,RL,DELA(30)
      DIMENSION RKAPA(NSTORY)                                           ATCI0050
C
```

```
      CDELA=0.015                                                       ATC10470
      GO TO 130                                                         ATC10480
  120 CDELA=0.01                                                        ATC10490
  130 DELA(1)=CDELA*HT(1)*12.                                           ATC10500
      DO 140 I=2,NSTORY                                                 ATC10510
      II=I-1                                                            ATC10520
      DELA(I)=(HT(I)-HT(II))*CDELA*12.                                  ATC10530
  140 CONTINUE                                                          ATC10540
      WRITE(IOUT,2010)(I,DELA(I),I=1,NSTORY)                            ATC10550
      IF(NSTORY.LE.10) GO TO 153                                        ATC10560
      IF(NSTORY.GE.20) GO TO 155                                        ATC10570
      N10=NSTORY-9                                                      ATC10580
      DO 151 I=N10,NSTORY                                               ATC10590
  151 RKAPA(I)=1.                                                       ATC10600
      N101=N10-1                                                        ATC10610
      DO 152 I=1,N10                                                    ATC10620
  152 RKAPA(I)=1.-0.02*(NSTORY-1-9)                                     ATC10630
      GO TO 170                                                         ATC10640
  153 DO 154 I=1,NSTORY                                                 ATC10650
  154 RKAPA(I)=1.                                                       ATC10660
      GO TO 170                                                         ATC10670
  155 CONTINUE                                                          ATC10680
      N10=NSTORY-9                                                      ATC10690
      N20=NSTORY-19                                                     ATC10700
      DO 156 I=N10,NSTORY                                               ATC10710
  156 RKAPA(I)=1.                                                       ATC10720
      DO 157 I=1,N20                                                    ATC10730
  157 RKAPA(I)=0.8                                                      ATC10740
      N101=N10-1                                                        ATC10750
      N201=N20+1                                                        ATC10760
      DO 158 I=N201,N10                                                 ATC10770
  158 RKAPA(I)=1.-(N10-I)*0.02                                          ATC10780
  170 CONTINUE                                                          ATC10790
 1000 FORMAT(12I5)                                                      ATC10800
 1001 FORMAT(3F10.0,2F20.0,2I5)                                         ATC10810
 2001 FORMAT(//3X,' ATC-3 SEISMIC PROVISIONS',/'+',' ____________________ATC10820
     1                 '//3X,' GENERAL INFORMATION :',/)
 2004 FORMAT(5X,' RESPONSE MODIFICATION FACTOR  (TABLE 3-B) --------',F10ATC10830
     1.2,/5X,' DEFLECTION AMPLIFICATION FACTOR (TABLE 3-B) --------',F10.2/
     2,5X,' OVERALL LENGTH AT BASE (IN) ------------------------------',F10.2/
     3,5X,' SOIL TYPE ------------------------------------------------',5X,I5/
     4,5X,' STRUCTURAL TYPE ------------------------------------------',5X,I5/
     4,8X,' EQ. 1: MOMENT-RESISTING STRUCTURE',/,
     5,8X,' EQ. 0: NON-MOMENT-RESISTING STRUCTURE',/
     6,5X,' MATERIAL OF THE STRUCTURE --------------------------------',5X,I5/
     7,8X,' EQ. 1: STEEL FRAME',/8X,' EQ. 0: CONCRETE FRAME',/
     8,5X,' STRUCTURAL CONFIGURATION :',/
     1,7X,' PLAN CONFIGURATION ---------------------------------------',5X,I5/
     1,7X,' VERTICAL CONFIGURATION -----------------------------------',5X,I5/
     2,8X,' EQ. 1: REGULAR',/8X,' EQ. 0: IREGULAR')
 2005 FORMAT(//3X,' INFORMATION FOR SOIL-STRUCTURE INTERACTION :',/      ATC10840
     3,5X,' CHARACTERISTIC FOUNDATION LENGTH(IN)----------------------',F10.2,/
     4,5X,' SHEAR WAVE VELOCITY(IN/SEC)-------------------------------',F10.2,/
     5,5X,' TOTAL DEPTH OF STRATUM(IN)--------------------------------',F10.2/
     6,5X,' GRAVITY LOADING TYPE--------------------------------------',5X,I5/
     7,8X,' EQ. 1: SINGLE LEVEL GRAVITY LOAD',/,
     8,8X,' EQ. 0: NON-SINGLE LEVEL GRAVITY LOAD',/,
     9,5X,' TYPE OF SUPPORTS OF THE BUILTING--------------------------',5X,I5/
     1,8X,' EQ. 1: PILE SUPPORTS',/8X,' EQ. 0: NON-PILE SUPPORTS',/)
     1,5X,' LATARAL STIFFNESS OF FOUNDATION(LBS/IN)-------',F16.2,/
     2,5X,' ROCKING STIFFNESS OF FOUNDATION(LB-IN/RAD)---',F16.2)
 2011 FORMAT(5X,' SOIL PROFILE COEFFICIENT ---- (TABLE 3-A) -------',    ATC10850
     1F10.3)
 2006 FORMAT(/,5X,' ATC-3  MODAL ANALYSIS METHOD',/)                    ATC10860
 2007 FORMAT(/,5X,' NO SEISMIC FORCE',/)                                ATC10870
 2008 FORMAT(/,5X,' ATC-3  EQIVALENT LATERAL FORCE METHOD',/)           ATC10880
 2009 FORMAT(/,5X,' GENERAL DYNAMIC ANALYSIS',/)                        ATC10890
 2010 FORMAT(/),3X,' ALLOWABLE DRIFT ACCORDING TO TABLE 3-C',/,'+',' _  ATC10900
     1                 '//
     1,8X,' FLOOR NO.',5X,' ALLOWABLE VALUE (IN)',/,(10X,I5,10X,F10.5))
      RETURN                                                            ATC10910
C     DEBUG SUBCHK
      END                                                               ATC10920
C
C     SUBROUTINE ATCWT:
C ****************************************************************
C *          CALCULATE GRAVITY LOAD ON EACH STORY                *
C ****************************************************************
C
      SUBROUTINE ATCWT(WWWW,NSTORY,LOADS,WS,WW,NM,MT)                   ATCW0010
      COMMON/PRT1/INN,IOUT,JOUT                                         ATCW0020
      COMMON/CODE1/HT(30),WT(4),WWW(30,4),KNCDE(30,4)                   ATCW0030
      COMMON/ATC2/NBEAM(30),NCON(30,20),NOCONT(30,20),NOBEAM(30,10)     ATCW0040
      DIMENSION WW(NSTORY),WWWW(NM),WS(MT,LOADS)                        ATCW0050
      DO 10 I=1,NSTORY                                                  ATCW0060
      WW(I)=0.                                                          ATCW0070
      NBBB=NBEAM(1)                                                     ATCW0080
      DO 10 J=1,NBBB                                                    ATCW0090
      JJ=NOBEAM(I,J)                                                    ATCW0100
   10 WW(I)=WW(I)+WWWW(JJ)                                              ATCW0110
      DO 20 I=1,NSTORY                                                  ATCW0120
      NNCON=NCONT(I)                                                    ATCW0130
      DO 20 J=1,NNCON                                                   ATCW0140
      JJ=NOCONT(I,J)                                                    ATCW0150
   20 WW(I)=WW(I)+0.5*WWWW(JJ)                                          ATCW0160
      DO 40 J=1,LOADS                                                   ATCW0170
      DO 39 I=1,NSTORY                                                  ATCW0180
   39 WW(I,J)=WW(I)*WS(I,J)                                             ATCW0190
      MT(J)=0                                                           ATCW0200
      DO 40 I=1,NSTORY                                                  ATCW0210
   40 MT(J)=MT(J)+WW(I,J)                                               ATCW0220
      RETURN                                                            ATCW0230
C     DEBUG SUBCHK
      END                                                               ATCW0240
C
C     SUBROUTINE BEAMWT:
C ****************************************************************
C *          CALCULATE NONSTRUCTURAL WEIGHTS ON COLUMN           *
C ****************************************************************
C
      SUBROUTINE BEAMWT (NMB,MNO,WT,EL,FR,L,NM,NG)                      BEAM0010
      DIMENSION EL(1),MNO(NM,NG),WT(NM,3)                               BEAM0020
      SUM=FR                                                            BEAM0030
      IF(NMB) 16,16,10                                                  BEAM0040
   10 CONTINUE                                                          BEAM0050
      DO 15 J=1,NMB                                                     BEAM0060
      KK=MNO(L,J)                                                       BEAM0070
      WW=WT(KK,1)+WT(KK,2)+WT(KK,3)                                     BEAM0080
      SUM = SUM+WW*EL(KK)/2.0                                           BEAM0090
   15 CONTINUE                                                          BEAM0100
   16 CONTINUE                                                          BEAM0110
      FR=SUM                                                            BEAM0120
      RETURN                                                            BEAM0130
C     DEBUG SUBCHK
      END                                                               BEAM0140
C
C     SUBROUTINE BOUND2:
C ****************************************************************
C *          REARRANGE STIFFNESS AND MASS MATRICES               *
C *              ACCORDING TO BOUNDARY CONDITION                 *
C ****************************************************************
C
      SUBROUTINE BOUND2(A,B,IB,N,NB,IC,ID)                              BOUN0010
      DIMENSION A(1),IB(1),B(1),IC(1),ID(1)                             BOUN0020
      IM=NB                                                             BOUN0030
      NM=N                                                              BOUN0040
      DO 30 JA=1,NB                                                     BOUN0050
      IA=IB(IM)                                                         BOUN0060
      IF(IA .GE. NM) GO TO 20                                           BOUN0070
      KH=IA+1                                                           BOUN0080
      IF(IA .GT. 1) GO TO 5                                             BOUN0090
      KL=1                                                              BOUN0100
      JJ=1                                                              BOUN0110
      GO TO 6                                                           BOUN0120
    5 CONTINUE                                                          BOUN0130
      JK=ID(IA)-ID(IA-1)                                                BOUN0140
      JJ=ID(IA-1)+1                                                     BOUN0150
    6 CONTINUE                                                          BOUN0160
      DO 10 I=KH,NM                                                     BOUN0170
      KL=KL-1                                                           BOUN0180
      IF(IC(I).LE.IA) GO TO 7                                           BOUN0190
      IC(I)=IC(I)-1                                                     BOUN0200
      JJ=JJ+1                                                           BOUN0210
      KY=0                                                              BOUN0220
      GO TO 8                                                           BOUN0230
    7 CONTINUE                                                          BOUN0240
      IC(I)=IC(I)                                                       BOUN0250
      KY=-1                                                             BOUN0260
    8 CONTINUE                                                          BOUN0270
      K=IC(I)                                                           BOUN0280
      ID(I-1)=ID(I)-JK-KY                                               BOUN0290
      DO 10 J=K,JJ                                                      BOUN0300
      IF(J .EQ. IA) JK=JK+1                                             BOUN0310
      KXX=KX+JJ                                                         BOUN0320
      A(KX)=A(KXX)                                                      BOUN0330
      B(KX)=B(KXX)                                                      BOUN0340
      KX=KX+1                                                           BOUN0350
   10 CONTINUE                                                          BOUN0360
   20 CONTINUE                                                          BOUN0370
      NM=NM-1                                                           BOUN0380
      IM=IM-1                                                           BOUN0390
   30 CONTINUE                                                          BOUN0400
      RETURN                                                            BOUN0410
C     DEBUG SUBCHK
      END                                                               BOUN0420
C
```

```
C     SUBROUTINE CHANGE1
C*****************************************************************
C*                                                               *
C*              COMBINE DYNAMIC DISPLACEMENTS                    *
C*            ACCORDING TO TYPE OF COMBINATION                   *
C*                                                               *
C*****************************************************************
C
      SUBROUTINE CHANGE(DI,DM,HI,VI,NS,II,L,N,MD,NN)                    CHAND010
      DIMENSION DI(NN,LI,DM(NN,MD),HI(MD,L),VI(MD,L)                   CHAND020
      DO 10 I=1,N                                                       CHAND030
      DO 10 J=1,L                                                       CHAND040
      DI(I,J)=0.                                                        CHAND050
   10 CONTINUE                                                          CHAND060
      IF(NS) 20,30,40                                                   CHAND070
   20 CONTINUE                                                          CHAND080
      DO 25 I=1,N                                                       CHAND090
      DO 25 J=1,L                                                       CHAND100
      DI(I,J)=DM(I,II)*(HI(II,J)+VI(II,J))                             CHAND110
   25 CONTINUE                                                          CHAND120
      GO TO 50                                                          CHAND130
   30 CONTINUE                                                          CHAND140
      DO 35 I=1,N                                                       CHAND150
      DO 35 J=1,L                                                       CHAND160
      DI(I,J)=DM(I,II)*SQRT(HI(II,J)**2+VI(II,J)**2)                   CHAND170
   35 CONTINUE                                                          CHAND180
      GO TO 50                                                          CHAND190
   40 CONTINUE                                                          CHAND200
      DO 45 I=1,N                                                       CHAND210
      DO 45 J=1,L                                                       CHAND220
      DI(I,J)=DM(I,II)*(ABS(HI(II,J))+ABS(VI(II,J)))                   CHAND230
   45 CONTINUE                                                          CHAND240
   50 CONTINUE                                                          CHAND250
      RETURN                                                            CHAND260
C     DEBUG SUBCHK                                                      CHAND270
      END
C
C     SUBROUTINE CHINA:
C*****************************************************************
C*                                                               *
C*          CALCULATE EQUIVALENT LATERAL FORCES                  *
C*                ACCORDING TO CHINESE CODE                      *
C*                                                               *
C*****************************************************************
C
      SUBROUTINE CHINA(NSTORY,FFF,TSS)                                  CHIN0010
      COMMON/PRI/INN,IOUT,IOUT)                                         CHIN0020
      COMMON/BCODE/CII,ALPHMX,NSOIL                                     CHIN0030
      COMMON/CODE1/WT(30),WTT(4),WWW(30,4),KNODE(30,4)                  CHIN0040
      DIMENSION FFF(NSTORY)                                             CHIN0050
C
      GO TO (10,20,30),NSOIL                                            CHIN0060
   10 A=0.2                                                             CHIN0070
      B=1.0                                                             CHIN0080
      GO TO 40                                                          CHIN0090
   20 A=0.3                                                             CHIN0100
      B=1.5                                                             CHIN0110
      GO TO 40                                                          CHIN0120
   30 A=0.7                                                             CHIN0130
      B=3.5                                                             CHIN0140
   40 IF(TSS.LE.A) GO TO 50                                             CHIN0150
      IF(TSS.LE.B) GO TO 60                                             CHIN0160
      ALPHA=0.2*ALPHMX                                                  CHIN0170
      GO TO 100                                                         CHIN0180
   50 ALPHA=ALPHMX                                                      CHIN0190
      GO TO 100                                                         CHIN0200
   60 ALPHA=A*ALPHMX/TSS                                                CHIN0210
  100 VBASE=CII*ALPHA*WTT(1)                                            CHIN0220
      SUMWF=0.                                                          CHIN0230
      DO 110 I=1,NSTORY                                                 CHIN0240
      SUMWF=SUMWF+WWW(I,1)*HT(I)                                        CHIN0250
  110 CONTINUE                                                          CHIN0260
      DO 120 I=1,NSTORY                                                 CHIN0270
      FFF(I)=WWW(I,1)*HT(I)*VBASE/SUMWF                                 CHIN0280
  120 CONTINUE                                                          CHIN0290
      RETURN                                                            CHIN0300
C     DEBUG SUBCHK                                                      CHIN0310
      END
C
C     SUBROUTINE CODE:
C*****************************************************************
C*                                                               *
C*              CALCULATE LATERAL EQUIVALENT                     *
C*          STATIC FORCES ACCORDING TO 1976 UBC                  *
C*                                                               *
C*****************************************************************
C
      SUBROUTINE CODE (FS,DS,MM,KCOUNT,ITER,T,C,S,TOTAL,FT,BA,IB,N,NB, CODE0010
     1                 XG,I,L,NN,NSTORY,D,FFF)
      COMMON/ACODE/Z(4),CI(4),CK(4),TS(4)                               CODE0020
      COMMON/CODE1/WT(30),WTT(4),WWW(30,4),KNODE(30,4)                  CODE0030
      DIMENSION FFF(NSTORY),IB(I),FS(NN,L),DS(NN,I),FX(300,I),DX(300,I) CODE0040
      DO 1 I=1,N                                                        CODE0050
      DX(I,I)=DS(I,J)/BA                                                CODE0060
      FX(I,I)=FS(I,J)                                                   CODE0070
    1 CONTINUE                                                          CODE0080
      CALL RESTOR(FX,IB,N,NB,1,NN)                                      CODE0090
      IF(KCOUNT.GT.1.OR.J.GT.1) GO TO 5                                 CODE0100
      H=0.05*HTINSTORY)/SQRT(D)                                         CODE0110
      DRIFT=0.005*HT(I)                                                 CODE0120
      FORCE=0.                                                          CODE0130
      DO 4 I=1,NSTORY                                                   CODE0140
      KK=NN*KNODE(I,J) - 2                                              CODE0150
      IF(I .EQ. 1) GO TO 3                                              CODE0160
      DRIFT=DRIFT+0.005*(HT(I)-HT(I-1))                                 CODE0170
    3 CONTINUE                                                          CODE0180
      FORCE=FORCE+0.14*Z(J)*CI(J)*CK(J)*WWW(I,J)                        CODE0190
      DX(KK,1)=DRIFT                                                    CODE0200
      FX(KK,1)=FORCE                                                    CODE0210
    4 CONTINUE                                                          CODE0220
    5 CONTINUE                                                          CODE0230
      TTS=TS(J)                                                         CODE0240
      IF(TTS .GT. 0.3) T=0.3                                            CODE0250
      IF(TTS .LT. 0.3) TTS=2.5                                          CODE0260
      IF(TTS.GT.0.5.AND.TTS.GT.0.5*TTS-0.5                              CODE0270
      IF(TTS.LE.0.16D TO 9                                              CODE0280
      TTS=1/TTS                                                         CODE0290
      IF(TTS.LE.1.1)S=1.0*TTS-0.5*(TTS**2)                              CODE0300
      IF(TTS.GT.1.1)S=1.2+0.6*TTS-0.3*(TTS**2)                          CODE0310
      GO TO 12                                                          CODE0320
    9 CONTINUE                                                          CODE0330
      C=1.4                                                             CODE0340
   12 CONTINUE                                                          CODE0350
      IF(S .GT. 1.5) S=1.5                                              CODE0360
      IF(S .LT. 1.0) S=1.0                                              CODE0370
      CS=1.0/(15.0*SQRT(T))                                             CODE0380
      IF(C .GT. 0.12) C=0.12                                            CODE0390
      CS=C*S                                                            CODE0400
      IF(CS .GT. 0.14) CS=0.14                                          CODE0410
      WH=0.                                                             CODE0420
      DO 15 I=1,NSTORY                                                  CODE0430
      WH=WH+WWW(I,J)*HT(I)                                              CODE0440
   15 CONTINUE                                                          CODE0450
      TOTAL=Z(J,J)*CI(J)*CK(J)*CS*WTT(J)                                CODE0460
      IF(T-0.7) 16,16,17                                                CODE0470
   16 CONTINUE                                                          CODE0480
      FT=0.                                                             CODE0490
      GO TO 18                                                          CODE0500
   17 CONTINUE                                                          CODE0510
      FT=0.07*T*TOTAL                                                   CODE0520
      IF(FT .GT. 10.25*TOTAL)) FT=0.25*TOTAL                            CODE0530
   18 CONTINUE                                                          CODE0540
      DIFT=TOTAL-FT                                                     CODE0550
      UP=0.                                                             CODE0560
      DOWN=0.                                                           CODE0570
      DO 6 I=1,NSTORY                                                   CODE0580
      KK=NN*KNODE(I,J) - 2                                              CODE0590
      FX(KK,1)=DIFT*WWW(I,J)*HT(I)/WH                                   CODE0600
      UP=UP+WWW(I,J)*(DX(KK,1)**2)                                      CODE0610
      FFF(I)=FX(KK,1)                                                   CODE0620
      DOWN=DOWN+FX(KK,1)*DX(KK,1)                                       CODE0630
    6 CONTINUE                                                          CODE0640
      FX(KK,1)=FX(KK,1)+FT                                              CODE0650
      FFF(NSTORY)=FX(KK,1)                                              CODE0660
      DOWN=DOWN+FT*DX(KK,1)                                             CODE0670
      D=6.28318530T*SQRT(UP/(XG*DOWN))                                  CODE0680
      CALL REDUCE(FX,IB,N,NB,1,NN)                                      CODE0690
      DO 25 I=1,N                                                       CODE0700
      FS(I,J)=FX(I,1)                                                   CODE0710
   25 CONTINUE                                                          CODE0720
      RETURN                                                            CODE0730
C     DEBUG SUBCHK                                                      CODE0740
      END
C
C     SUBROUTINE COINF:
C*****************************************************************
C*                                                               *
C*          READ IN STRUCTURAL COST INFORMATION                  *
C*                                                               *
C*****************************************************************
C
      SUBROUTINE COINF(ASTAR,CSB,CPT,CSC,CSW,NLIFE,CONONS,GAMMA6,DELTA6,COIN0010
     *  ,GACCMX,RINIST)
      COMMON/PRI/INN,IOUT,IOUT)                                         COIN0020
      READ(INN,100) ASTAR,CSB,CPT,CSC,CSW                               COIN0030
      READ(INN,101) NLIFE,CONONS,GAMMA6,DELTA6,GACCMX,RINIST            COIN0040
      WRITE(IOUT,200) NLIFE,ASTAR,CONONS,CSB,CPT,CSC,CSW                COIN0050
      WRITE(IOUT,201) GAMMA6,DELTA6,GACCMX,RINIST                       COIN0060
  100 FORMAT(5F10.0)                                                    COIN0070
  101 FORMAT(I5,5F10.0,F25.0)                                           COIN0080
  200 FORMAT(/6X,'TOTAL LIFE OF STRUCTURE----------------------',I5/COIN0090
     *,6X,'NORMALIZED GROUND ACCELERATION-------------------',E15.5/,
     *6X,'RATIO OF NONSTRUCTURAL COST TO CONSTRUCTION COST-',E15.5/,
     *6X,'PRICE OF STEEL($/LB)------------------------------',E15.5/,
```

```
     *6X,'COST OF PAINTING($/IN**2)----------',E15.5/
     *6X,'COST OF STEEL AT CONNECTIONS($/LB)--------',E15.5/
     *6X,'COST OF WELD METALIS/LB)-----------',E15.5)
  201 FORMAT(6X,'COEFF. OF PROBABILITY DENSITY FUN BY N=GAMMA6*EXP(-DELTCOIN0100
     1A6)=',/9X,'GAMMA6----------',E15.5/
     1,9X,'DELTA6----------',E15.5/
     1,6X,'MAXIMUM EXPECTED INTENSITY OF EARTHQUAKE',/9X,'DURING LIFE TI
     1ME----------',E15.5/
     1,6X,'INITIAL STRESS GRADIENT----------',E15.5)
      RETURN                                                          COIN0110
C     DEBUG SUBCHK
      END                                                             COIN0120
C
C     SUBROUTINE COST1:
C*****************************************************************
C*                  CALCULATE STRUCTURAL COST                    *
C*****************************************************************
C
      SUBROUTINE COST1(MEMBS,JTYPE,BASEA,AE,BD,DEP,TFD,TODACT         COST0010
     *,ELENTH,RINIST,CSC,CPT,CSW,GAMMA6,NLIFE,CONDAS,DELTA6,
     *ACCMX,FINDMI,DELA,KCOUNT,BASEAE,WEIGHT,NSTORY,LAST,MCOUNT,NMMAX)
      COMMON/PRT1/INN,IOUT,IOUT1                                      COST0020
      COMMON/BBC/TS,T,DEPMAX,DEPMIN,TFDMAX,TFDMIN,RHO,RHO1,BTFMAX,    COST0030
     1      BTFMIN,BDMAX,BDMIN
      DIMENSION AE(1),DEP(NMMAX),TFD(NMMAX),JTYPE(1),FINDMI(1),       COST0040
     *      DELA(1),ELENTH(1),BD(NMMAX)
      CONNWG=0.                                                       COST0050
      EXTRCO=0.                                                       COST0060
      COSTPT=0.                                                       COST0070
      CONNSL=0.                                                       COST0080
      TODACT=0.                                                       COST0090
      DO 5 I=1,NSTORY                                                 COST0100
    5 TODACT=TODACT+DELA(I)                                           COST0110
      TODACT=TODACT/FLOAT(NSTORY)                                     COST0120
      DELTMX=EXP(-DELTA6*ACCMX)                                       COST0130
      A=(-GACCMX*DELTMX-DELTMX/DELTA6+1./DELTA6)/DELTA6               COST0140
      DACOF=17.04*CONDNS*GAMMA6*NLIFE*A/12.                           COST0150
      TODACT=TODACT*DACOF                                             COST0160
      DO 10 L=1,MEMBS                                                 COST0170
      IF(JTYPE(L).EQ.0)GO TO 1                                        COST0180
      RINTIA=AE(L)*BASEA                                              COST0190
      CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREAA,SEC,COST0200
     *QUE)
      ETA=AREAA/RINTIA                                                COST0210
      IF(JTYPE(L).EQ.2)GO TO 3                                        COST0220
      ETA1=ETA**0.4808                                                COST0230
      ETA2=ETA1**2                                                    COST0240
      ETA3=(ETA2*ETA2)*RINTIA*0.5563                                  COST0250
      ETA2=2.09-ETA3                                                  COST0260
      ETA3=(0.3319/ETA2)**4.946                                       COST0270
      COSTPT=COSTPT+ETA3*ELENTH(L)/ETA1                               COST0280
      GO TO 4                                                         COST0290
    3 ETA1=ETA**0.54348                                               COST0300
      ETA2=ETA1**2                                                    COST0310
      A=RINTIA**2                                                     COST0320
      ETA4=10800./RINIST+0.73301*ETA2                                 COST0330
      CONNSL=CONNSL+SPWT*ETA2*A*ETA4                                  COST0340
      ETA3=ETA1*ETA2                                                  COST0350
      ETA4=ETA1*ETA3                                                  COST0360
      B=2.09-1.211*ETA4*RINTIA                                        COST0370
      C=8.50447E-4.0713                                               COST0380
      COSTPT=COSTPT+ELENTH(L)*C/ETA1                                  COST0390
      B=RINTIA**1.5                                                   COST0400
      CONNWG=CONNWG+SPWT*(0.8918*ETA2*RINTIA+0.0038806*ETA4*A+0.08642*COST0410
     *ETA3*B)
      GO TO 4                                                         COST0420
    1 CALL AREA(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREAA,  COST0430
     *SEQUE)
      A=SQRT(AREAA)                                                   COST0440
      COSTPT=COSTPT+A*ELENTH(L)*4                                     COST0450
    4 A=AREAA**0.79                                                   COST0460
      B=SPWT*ELENTH(L)                                                COST0470
      C=A*B                                                           COST0480
      EXTRCO=EXTRCO+C                                                 COST0490
      A=B*AREAA                                                       COST0500
      WEIGHT=WEIGHT+A                                                 COST0510
   10 CONTINUE                                                        COST0520
C
      COSTPT=COSTPT*CPT                                               COST0530
      CONNSL=CONNSL*CSC*0.8796                                        COST0540
      CONNWG=CONNWG*CSW                                               COST0550
      EXTRCO=EXTRCO*0.00916                                           COST0560
      BASECO=CSB*WEIGHT                                               COST0570
      COSTMA=EXTRCO+BASECO                                            COST0580
      CDCOBM=CONNSL+CONNWG                                            COST0590
      COCOST=COSTMA+CDCOBM+COSTPT                                     COST0600
      TODACT=TODACT*COCOST                                            COST0610
      TOCOST=TODACT+COCOST                                            COST0620
      FINDMI(KCOUNT)=TOCOST                                           COST0630
      WRITE(IOUT,100)                                                 COST0640
      WRITE(IOUT,102) COCOBM,CONNSL,CONNWG,COSTPT,TODACT              COST0650
      WRITE(IOUT,101) COSTMA,BASECO,EXTRCO,COCOST,TOCOST              COST0660
      WRITE(IOUT,103) WEIGHT                                          COST0670
      TODACT=TODACT/COCOST                                            COST0680
      IF(LAST.GE.1)GO TO 80                                           COST0690
      WRITE(IOUT,104) BASEAE,KCOUNT                                   COST0700
      GO TO 81                                                        COST0710
   80 WRITE(IOUT,104) BASEAE,MCOUNT                                   COST0720
   81 WRITE(IOUT,100)                                                 COST0730
  100 FORMAT(//91H ***********************************************************COST0740
     1*****************************/)
  101 FORMAT(9X,'MEMBER COST----------',E15.5,COST0750
     *5/9X,'BASE CHARGE----------',E15.5/,
     *9X,'EXTRA CHARGE----------',E15.5/,
     *9X,'CONSTRUCTION COST (MEMBER+CONNECTION+PAINTING)----',E15.5/,
     *9X,'TOTAL COST (CONSTRUCTION + DAMAGE)----------',E15.5)
  102 FORMAT(9X,'CONNECTION COST----------',E15.5,COST0760
     *5/9X,'STEEL----------',E15.5/,
     *9X,'WELDING COST----------',E15.5/,
     *9X,'PAINTING COST----------',E15.5/,
     *9X,'DAMAGE COST----------',E15.5)
  103 FORMAT(9X,'WEIGHT OF MEMBER STEEL EXCEPT CONNECTION----------',E15.COST0770
     *5)
  104 FORMAT(9X,'BASEAE=',E15.5,3X,'NUMBER OF ITERATION=',I5)         COST0780
      RETURN                                                          COST0790
C     DEBUG SUBCHK
      END                                                             COST0800
C
C     SUBROUTINE CURVE1:
C*****************************************************************
C*              NEWMARK'S SPECTRUM USE CURVE FITTING             *
C*****************************************************************
C
      SUBROUTINE CURVE1(XX,Y,NDUC,INC)                                CUR10010
      COMMON/PRT1/INN,IOUT,IOUT1                                      CUR10020
      Y1(A,B,C,D,E,F)=A*B*C*((E/F)**2)/(D**2)                         CUR10030
      Y2(A,B,C)=A*(B/C)                                               CUR10040
      Y3(A,B,C,D)=EXP(ALOG(A)*ALOG(B*D)/ALOG(B/C))                    CUR10050
C
      X=XX                                                            CUR10060
      GO TO(160,160,3,100),NDUC                                       CUR10070
C
C------  NEWMARK'S ACCELERATION SPECTRA  ------
C------  DUCTILITY = 3, DAMPING RATIO = 5%  ------
C
    3 IF(XX.LE.0.03)GO TO 50                                          CUR10080
      IF(XX.LE.0.1)GO TO 40                                           CUR10090
      IF(XX.LE.0.5)GO TO 30                                           CUR10100
      IF(XX.LE.4.)GO TO 20                                            CUR10110
      IF(XX.GT.10.)X=10.                                              CUR10120
      Y=3.92*Y1(3.14159**2/(386.4*X*X))                               CUR10130
      GO TO 200                                                       CUR10140
   20 Y=6.1592*Y2(3.14159/(386.4*X))                                  CUR10150
      GO TO 200                                                       CUR10160
   30 Y=0.2                                                           CUR10170
      GO TO 200                                                       CUR10180
   40 Y=0.142857+0.5714286*X                                          CUR10190
      GO TO 200                                                       CUR10200
   50 Y=0.16                                                          CUR10210
      GO TO 200                                                       CUR10220
C
C------  NEWMARK'S ACCELERATION SPECTRA  ------
C------  DUCTILITY = 4, DAMPING RATIO = 10%  ------
C
  100 IF(XX.LE.0.1) GO TO 150                                         CUR10230
      IF(XX.LE.0.22)GO TO 140                                         CUR10240
      IF(XX.LE.0.4)GO TO 130                                          CUR10250
      IF(XX.LE.3.5)GO TO 120                                          CUR10260
      IF(XX.GT.10.)X=10.                                              CUR10270
      Y=8.224*Y1(3.14159**2/(386.4*X*X))                              CUR10280
      GO TO 200                                                       CUR10290
  120 Y=14.76*Y2(3.14159/(386.4*X))                                   CUR10300
      GO TO 200                                                       CUR10310
  130 Y=0.6                                                           CUR10320
      GO TO 200                                                       CUR10330
  140 Y=1.3333333-3.33333333*X                                        CUR10340
      GO TO 200                                                       CUR10350
  150 Y=1.                                                            CUR10360
      GO TO 200                                                       CUR10370
C
C*****************************************************************
C*                DESIGN SPECTRA FOR ALLUVIUM SOIL               *
C*****************************************************************
C
  160 GACC=386.4                                                      CUR10380
      GVEL=48.                                                        CUR10390
```

```
      GDIS=36.                                                          CUR10400
      GVACC=386.4*2./3.                                                 CUR10410
      GVVEL=29.                                                         CUR10420
      GVDIS=33.                                                         CUR10430
C                                                                       CUR10440
      IF(INC.EQ.1)GO TO 180
C
C------ 1. HORIZINTAL DIRECTION ------
C
      T1=0.05                                                           CUR10450
      T2=0.167                                                          CUR10460
      T3=0.667                                                          CUR10470
      T4=4.0                                                            CUR10480
      T5=20.                                                            CUR10490
      IF(NDUC.EQ.1)GO TO 165                                            CUR10500
C
C------ 90 PERCENTILE, 5% DAMPING ------
C
      AMPD=2.21                                                         CUR10510
      AMPV=2.51                                                         CUR10520
      AMPA=2.82                                                         CUR10530
      GO TO 170                                                         CUR10540
C
C------ 50 PERCENTILE, 5% DAMPING ------
C
  165 AMPD=1.40                                                         CUR10550
      AMPV=1.66                                                         CUR10560
      AMPA=2.11                                                         CUR10570
      T3=0.6                                                            CUR10580
C
  170 IF(X.LE.T1) Y=1.0                                                 CUR10590
      IF(X.GT.T1 .AND. X.LE.T2) Y=Y3(AMPA,20.,6.,X)                     CUR10600
      IF(X.GT.T2 .AND. X.LE.T3) Y=AMPA                                  CUR10610
      IF(X.GT.T3 .AND. X.LE.T4) Y=Y2(AMPV,GVEL,GACC)*(6.2831853/X)      CUR10620
      IF(X.GT.T4 .AND. X.LE.T5) Y=Y1(AMPD,GACC,GDIS,GVEL,GVEL,GACC)*   CUR10630
     *(6.2831853/X)**2                                                  CUR10640
      GO TO 200                                                         CUR10650
C
C------ 2.  VERTICAL DIRECTION ------
C
  180 GVEL1=0.9*GVEL                                                    CUR10660
      T1=0.02                                                           CUR10670
      T2=0.1                                                            CUR10680
      T3=0.533                                                          CUR10690
      T4=6.667                                                          CUR10700
      T5=20.                                                            CUR10710
      IF(NDUC.EQ.1)GO TO 185                                            CUR10720
C
C------ 90 PERCENTILE ------
C
      AMPD=2.18                                                         CUR10730
      AMPV=2.37                                                         CUR10740
      AMPA=3.04                                                         CUR10750
      GO TO 190                                                         CUR10760
C
C------ 50 PERCENTILE ------
C
  185 AMPD=1.40                                                         CUR10770
      AMPV=1.51                                                         CUR10780
      AMPA=2.05                                                         CUR10790
      T3=0.5                                                            CUR10800
      T4=6.25                                                           CUR10810
  190 IF(X.LE.T1) Y=1.0                                                 CUR10820
      IF(X.GT.T1 .AND. X.LE.T2) Y=Y3(AMPA,50.,10.,X)                    CUR10830
      IF(X.GT.T2 .AND. X.LE.T3) Y=AMPA                                  CUR10840
      IF(X.GT.T3 .AND. X.LE.T4) Y=Y2(AMPV,GVEL1,GACC)*(6.2831853/X)     CUR10850
      IF(X.GT.T4 .AND. X.LE.T5) Y=Y1(AMPD,GVACC,GVDIS,GVVEL,GVEL1,GACC)*CUR10860
     *(6.2831853/X)**2                                                  CUR10870
  200 RETURN
C     DEBUG SUBCHK
      END
C
      SUBROUTINE CURVE2:
C*************************************************************
C*          1.  HOUSNER'S AVERAGE RESPONSE SPECTRUM          *
C*          2.  SEED'S SPECTRUM CURVE FITTING                *
C*************************************************************
C
      SUBROUTINE CURVE2(XX,Y,NSOIL)                                     CUR20010
      COMMON/PRT1/INN,IOUT,IOUT1                                        CUR20020
      X=XX                                                              CUR20030
      IF(NSOIL.NE.0) GO TO 300                                          CUR20040
C
C------ 1.  HOUSNER'S AVERAGE RESPONSE SPECTRUM ------
C
      IF(XX.LE.0.3)GO TO 301                                            CUR20050
      IF(XX.GT.3.)X=3.                                                  CUR20060
      Y=0.25845146-0.22122407*X+0.08188504*X**2-0.0108108*X**3          CUR20070
      GO TO 200                                                         CUR20080
  301 Y=0.12250006+0.239199344*X                                        CUR20090
      GO TO 200                                                         CUR20100
C
C------ 2.  SEED'S SPECTRUM CURVE FITTING ------
C
  300 GO TO (10,50,100,150),NSOIL                                       CUR20110
C
C     A. SOIL TYPE 1
C
   10 IF(XX.GT.0.3) GO TO 160                                           CUR20120
      Y=1.03448255+17.000336*XX-45.001083*XX**2                         CUR20130
      GO TO 200                                                         CUR20140
  160 X1=XX                                                             CUR20150
      IF(X1.GT.3.)X1=3.                                                 CUR20160
      IF(XX.GT.3.)WRITE(IOUT,1000)                                      CUR20170
      X=X1-0.3                                                          CUR20180
      Y=2.0243101-3.9684248*X+3.6514969*X**2-1.525775*X**3+0.2316342*X**CUR20190
     *4                                                                 CUR20200
C
C     B. SOIL TYPE 2
C
   50 IF(XX.GT.0.4)GO TO 110                                            CUR20210
      Y=0.93516338+13.936761*XX-26.141937*XX**2                         CUR20220
      GO TO 200                                                         CUR20230
  110 X1=XX                                                             CUR20240
      IF(X1.GT.3.)X1=3.                                                 CUR20250
      IF(XX.GT.3.)WRITE(IOUT,1000)                                      CUR20260
      X=X1-0.4                                                          CUR20270
      Y=2.229723-3.6186724*X +2.9960575*X**2 -1.1409359*X**3 +0.16060048CUR20280
     1*X**4                                                             CUR20290
      GO TO 200                                                         CUR20300
C
C     C. SOIL TYPE 3
C
  100 IF(XX.GT.0.2) GO TO 90                                            CUR20310
      IF(XX.GT.0.4) GO TO 80                                            CUR20320
      Y=0.9643502+10.203987*XX-15.784999*XX**2                          CUR20330
      GO TO 200                                                         CUR20340
   80 X=XX-0.4                                                          CUR20350
      Y=2.4632187-4.2025547*X+5.5536652*X**2                            CUR20360
      GO TO 200                                                         CUR20370
   90 X1=XX                                                             CUR20380
      IF(X1.GT.3.)X1=3.                                                 CUR20390
      IF(XX.GT.3.)WRITE(IOUT,1000)                                      CUR20400
      X=X1-0.9                                                          CUR20410
      Y=1.736083-1.3109751*X+0.27382255*X**2+0.15717566*X**3-6.2189575E-CUR20420
     1*X**4                                                             CUR20430
      GO TO 200                                                         CUR20440
C
C     D. SOIL TYPE 4
C
  150 IF(XX.GT.-1.2)GO TO 48                                            CUR20450
      IF(XX.GT.-1.)GO TO 40                                             CUR20460
      IF(XX.GT.-0.7)GO TO 30                                            CUR20470
      IF(XX.GT.-0.3)GO TO 20                                            CUR20480
      Y=0.9514998+4.9650021*XX-2.2500134*XX**2                          CUR20490
      GO TO 200                                                         CUR20500
   20 X=XX-0.3                                                          CUR20510
      Y=2.1899109+0.16158056*X -6.1221199*X**2 +29.51915*X**3 -40.011734CUR20520
     1*X**4                                                             CUR20530
      GO TO 200                                                         CUR20540
   30 X=XX-0.7                                                          CUR20550
      Y=2.1389999+2.589987*X-9.4999676*X**2                             CUR20560
      GO TO 200                                                         CUR20570
   40 X=XX-1.0                                                          CUR20580
      Y=2.0599957+2.992556E-4*X-4.0015287*X**2                          CUR20590
      GO TO 200                                                         CUR20600
   48 X1=XX                                                             CUR20610
      IF(X1.GT.-.3)X1=-.3                                               CUR20620
      IF(XX.GT.3.)WRITE(IOUT,1000)                                      CUR20630
      X=X1+.2                                                           CUR20640
      Y=1.9126568-2.5098505*X+0.96162301*X**2+0.32339907*X**3-0.20329118CUR20650
     1*X**4                                                             CUR20660
      GO TO 200                                                         CUR20670
 1000 FORMAT(/2X,'***** PERIOD IS LARGER THAN 3. SEC *****'/)           CUR20680
  200 RETURN                                                            CUR20690
C     DEBUG SUBCHK                                                      CUR20700
      END                                                               CUR20710
C
      SUBROUTINE CURVE3:
C*************************************************************
C*      1.  ACCELERATION SPECTRA OF CHINESE CODE             *
C*************************************************************
C
      SUBROUTINE CURVE3(KSOIL,X,Y,ALPH,INC)                             CUR30010
      NSOIL=KSOIL-4                                                     CUR30011
      GO TO (11,12,13),NSOIL                                            CUR30020
```

```
C
C ------ SOIL TYPE 1 ------
C
   11 A=0.2                                                          CUR30030
      B=1.0                                                          CUR30040
      GO TO 40                                                       CUR30050
C
C ------ SOIL TYPE 2 ------
C
   12 A=0.3                                                          CUR30060
      B=1.5                                                          CUR30070
      GO TO 40                                                       CUR30080
C
C ------ SOIL TYPE 3 ------
C
   13 IF(INC)15,15,16                                                CUR30090
   15 A=0.7                                                          CUR30100
      B=3.5                                                          CUR30110
      GO TO 40                                                       CUR30120
   16 A=0.6                                                          CUR30130
      B=2.61                                                         CUR30140
C
   40 IF(X.LE.A)GO TO 50                                             CUR30150
      IF(X.LE.B)GO TO 60                                             CUR30160
      Y=0.2*ALPH                                                     CUR30170
      GO TO 100                                                      CUR30180
   50 IF(INC.GE.1.AND.NSOIL.EQ.3)GO TO 51                            CUR30190
      Y=ALPH                                                         CUR30200
      GO TO 100                                                      CUR30210
   51 Y=0.87*ALPH                                                    CUR30220
      GO TO 100                                                      CUR30230
   60 IF(INC.GE.1.AND.NSOIL.EQ.3)GO TO 61                            CUR30240
      Y=A*ALPH/X                                                     CUR30250
      GO TO 100                                                      CUR30260
   61 Y=0.87*A*ALPH/X                                                CUR30270
  100 RETURN                                                         CUR30280
C     DEBUG SUBCHK                                                   
      END                                                            CUR30290
C
      SUBROUTINE CURVE4(KSOIL,X,Y)
C ***************************************************************
C *     NORMALIZED ACCELERATION SPECTRA RECOMENED BY ATC-3      *
C ***************************************************************
C
      SUBROUTINE CURVE4(KSOIL,X,Y)                                   CUR40010
      NSOIL=KSOIL-7                                                  CUR40020
      XX=X                                                           CUR40030
      GO TO (10,30,50,50),NSOIL                                      CUR40040
C
C ------ SOIL TYPE 1 ------
C
   10 IF(XX.LE.0.15)GO TO 20                                         CUR40050
      IF(XX.LE.0.4)GO TO 15                                          CUR40060
      IF(XX.GT.3.0)XX=3.0                                            CUR40070
      XX=XX-0.4                                                      CUR40080
      Y=2.4291344-3.9693136*XX+3.4752331*XX**2-1.4541187*XX**3+0.2252370CUR40090
     .*XX**4                                                         
      GO TO 100                                                      CUR40100
   15 Y=2.5                                                          CUR40110
      GO TO 100                                                      CUR40120
   20 Y=1+10.*XX                                                     CUR40130
      GO TO 100                                                      CUR40140
C
C ------ SOIL TYPE 2 ------
C
   30 IF(XX.LE.0.15) GO TO 40                                        CUR40150
      IF(XX.LE.0.57) GO TO 35                                        CUR40160
      IF(XX.GT.3.0)XX=3.0                                            CUR40170
      XX=XX-0.5                                                      CUR40180
      Y=2.5844088-2.9449358*XX+1.8397913*XX**2-0.5847614*XX**3+0.073747CUR40190
     .0396*XX**4                                                     
      GO TO 100                                                      CUR40200
   35 Y=2.5                                                          CUR40210
      GO TO 100                                                      CUR40220
   40 Y=1+10.*XX                                                     CUR40230
      GO TO 100                                                      CUR40240
C
C ------ SOIL TYPE 3 ------
C
   50 IF(NSOIL.EQ.3)GO TO 52                                         CUR40250
      A=0.9                                                          CUR40260
      B=0.2                                                          CUR40270
      GO TO 53                                                       CUR40280
   52 A=0.697674418                                                  CUR40290
      B=0.15                                                         CUR40300
   53 IF(XX.LE.B)GO TO 60                                            CUR40310
      IF(XX.LE.A)GO TO 55                                            CUR40320
      IF(XX.GT.3.0)XX=3.0                                            CUR40330
      XX=XX-0.9                                                      CUR40340
      Y=2.4989138-2.4919176*XX+1.8436747*XX**2-0.8017277*XX**3+0.143532CUR40350
     .4*XX**4                                                        
      Y=0.8*Y                                                        CUR40360
      GO TO 100                                                      CUR40370
   55 IF(NSOIL.EQ.3)Y=2.5                                            CUR40380
      IF(NSOIL.EQ.4)Y=2.0                                            CUR40390
      GO TO 100                                                      CUR40400
   60 IF(NSOIL.EQ.3)Y=1.+10.*XX                                      CUR40410
      IF(NSOIL.EQ.4)Y=0.8*(1.+7.5*XX)                                CUR40420
  100 RETURN                                                         CUR40430
      END                                                            CUR40440
C
C     SUBROUTINE DATA1;
C ***************************************************************
C *                      INPUT DATA                             *
C ***************************************************************
C
      SUBROUTINE DATA1(ICODE,IDESGT,IPLOT,IGRADT,LGRADT,IMAX,IIMAX   DATA0010
     1,INSIST,TUNILD,EPSI,EPSI,EPS2,EPS,URANGE,DRANGE,REFATR,FINCRT,DS,
     2MEMBS,JOINTS,NBNDRY,LOADS,LMTDSP,INDEX,NCOUNT,DLENG,LMTD,ABRMAX,
     3FD,FV,MM,PNT,HI,H2,NN,NSOIL,NDUCTY,ICOLS,IDIAGS,ICOL,IDIAG,NSK,
     4AE,NMM,WS,NSTORY,RAAPA,NDN2RO,IBND,SX,GN,FSATC,DAMP,ABRMIN,IL,
     5ASTAR,CSB,CPT,CSC,CSW,NLIFE,CONONS,GAMMA6,DELTA6,GACCMX,ATAIST,
     6NA,NB,ITYPE,ABC,STRES,NMB,MND,WT,FAR,NDIFF,NMM,NG,BASEAE,
     7NDK,KOPTON,VALMIN,DEFLMT,NSIGN,X,Y,AE,AM,AN,AREA1,SX,FS,LX,
     8ELENTH,NM,XH,XS,FAS,MBAND,AENM,LOAD,DEP,IFD,KSTRS,BD,NJA,
     9FACTDL,FACTLL,FACTSL,FACTEL,MT,NLINE,AHMX,AVMX)
      COMMON/DATA/FACTOR(6),XV(4),MTYPE(4),MOTYPE(4),NTYPE(4),NTIME(4), DATA0020
     1           DEL(4),NMM
      COMMON/PRT1/INN,IOUT,TOUT)                                     DATA0030
      COMMON/STIFF/BASEA,EE,EL,XG                                    DATA0040
      COMMON/ABC/NZERO,NBEGIN,NDESIR,NITER,NDX,NNX                   DATA0050
      COMMON/BBC/ISEC,FWD,DEPMAX,DEPMIN,TFDMAX,TFDMIN,RHO,RHO1,BTFMAX, DATA0060
     1           BTFMIN,BDMAX,BDMIN
      COMMON/BCODE/CII,ALPHMX,NSOIL                                  DATA0070
      COMMON/ATC1/IACTIV,ISOIL,NR,ISF,IFIX,NANALS,NNNNN,MMMMM,NBRITL,  DATA0080
     1           ISH,NPAEGR,NVREGR,IS,ISLGL,IPILE,RKY,AKTETA,RR,VS,
     2           DSSS,HN,AA,AV,SSOIL,RADIUS,COFACT,RL,DELA(30)
      COMMON/ACODE/ZZ(4),CT(4),CK(4),TS(4)                           DATA0090
      COMMON/CODE1/HI(30),WT(4),NMM(30,4),KNODE(30,4)                DATA0100
      COMMON/ATC2/NBEAM(30),NCONT(30),NOCONT(30,20),NOBEAM(30,10)    DATA0110
      INTEGER TITLE(10)                                              DATA0120
      DIMENSION IM(3),JM(3),TFR(3),DEFMAX(3),IBND(50),ICOL(NNX),MA(NMM), DATA0130
     1          MB(NMM),AE(NMM),DEP(NMM),TFD(NMM),ELENTH(NMM),AKAPA(NT),
     2          SK(NSK),ITYPE(NMM),AREA1(NMM),NDUCTY(LX),UMF(4),SX(NMM),
     3          FRS(NG),STRES(NG),NMBENG(NG),MSOIL(LX),AM(NG),AN(NG),
     4          XI(NJA),YI(NJA),IDIAG(NNX),WMASS(100),MBC(NMM),ICOLS(NNX),
     5          IDIAGS(NNX),DEFLMT(NNX),GN(NSK),FRS(NMM),VALMIN(NDX),
     6          DAMP(NDX),FACTDL(LX),FACTLL(LX),FACTSL(LX),FACTEL(LX),
     7          EK(6,6),ER(6,6),AI(3,3),BI(6,6),CI(6,6),DI(6,6),EI(6,6),
     8          FV(NNX,LX),FD(NNX,LX),MS(MT,LX),MT(NAN,3),XS(NNX,LX),
     9          PNT(NDA,LX),HI(NDA,LX),H2(NDM,LX),FSATC(NNX,LX),BD(NMM),
     1          FS(NNX,LX),MNG(NMM,NG),XH(NNX,LX),AML(6,4),DS(NNX,LX),
     2          NLINE(NMM),AHMX(LX),AVMX(LX)
C
      FLANGE(BD1,T1,T2)=0.5*(BD1)*(T1)*(1.0-T1)**2                   DATA0140
      WEB(T1,T2)=(1.0/12.0)*12**1.0-2.0*T1)**3                       DATA0150
      ENRIA(BD1,D1,T1,T2)=(D1**4)*(FLANGE(BD1,T1,T2)+WEB(T1,T2))     DATA0160
C
C ------ GENERAL INFORMATION ------
C
      READ(INN,5)ICODE,IDESGT,IRELT,IPLOT,NSTORY,IGRADT,LGRADT,IMAX,IIMADATA0170
     1X,INSIST,TUNILD
      READ(INN,3)EPSI,EPS1,EPS2,EPS,URANGE,DRANGE,REFATR,FINCRT      DATA0180
      READ(INN,2)MEMBS,JOINTS,NBNDRY,LOADS,LMTDSP,INDEX,NCOUNT,ISEC,TITLDATA0190
     1E
      WRITE(IOUT,2000)KSTRS,TITLE,NSTORY,MEMBS,JOINTS,NBNDRY,LOADS,LMTDSDATA0200
     1P
      WRITE(IOUT,2001) INDEX,NCOUNT,ISEC                             DATA0210
      MM=3                                                           DATA0220
      NN=MM*JOINTS                                                   DATA0230
      NB=NBNDRY                                                      DATA0240
      NM=NN-NB                                                       DATA0250
      MBAND=0                                                        DATA0260
      IF(IDESGT)106,101,100                                          DATA0270
C
C ------ INFORMATION FOR MINIMUM COST DESIGN ------
C
  100 CALL COINF(ASTAR,CSB,CPT,CSC,CSW,NLIFE,CONONS,GAMMA6,DELTA6,GACCMXDATA0280
     *,RINIST)
C
  101 IL=1                                                           DATA0290
      IF(LMTDSP .GT. 0) IL=2                                         DATA0300
      LDAD=IL*LOADS                                                  DATA0310
C
C ------ MEMBER INFORMATION ------
C
```

```
      IF(ISEC) 11,11,13                                                 DATA0320
   11 READ(INN,2004)EE,RHO,BDI,DEPTH,DEPMAX,DEPMIN,TFDMAX,TFDMIN,       DATA0330
     .BTFMAX,BTFMIN,BDMAX,BDMIN,A,AENM
      TWD=0.62                                                          DATA0340
      TFDD=0.03                                                         DATA0350
      DO 12 I=1,MEMBS                                                   DATA0360
      TFD(I)=TFDD                                                       DATA0370
      DEPT(I)=DEPTH                                                     DATA0380
   12 BD(I)=BDI                                                         DATA0390
      IF(DEPTH.GE.0.0000001) BASEA=ENRTIA(BDI,DEPTH,TFDD,TWD)           DATA0400
      IF(DEPMAX.GE.0.0000001) AENMMX=ENRTIA(BDMAX,DEPMAX,TFDMAX,TWD)    DATA0410
      IF(DEPMIN.LT.0.0000001) GO TO 105                                 DATA0420
      AENMNM=ENRTIA(BDMIN,DEPMIN,TFDMIN,TWD)                            DATA0430
      WRITE(IOUT,2005) EE,RHO,BDI,DEPMAX,DEPMIN,TFDMAX,TFDMIN,BTFMAX,   DATA0440
     .BTFMIN,BDMAX,BDMIN
      GO TO 14                                                          DATA0450
   13 READ(INN,3) EE,RHO,BASEA,AENMMX,AENMNM,AENM                       DATA0460
      DO 104 I=1,MEMBS                                                  DATA0470
      DEPT(I)=0.                                                        DATA0480
      TFD(I)=0.                                                         DATA0490
      BD(I)=0.                                                          DATA0500
  104 CONTINUE                                                          DATA0510
      WRITE(IOUT,2010) EE,RHO                                           DATA0520
   14 CONTINUE                                                          DATA0530
      WRITE(IOUT,2011) BASEA,AENMMX,AENMNM,AENM                         DATA0540
  105 CONTINUE                                                          DATA0550
      READ(INN,3) E1,RHO1,ABRACE,ABRMAX,ABRMIN                          DATA0560
      WRITE(IOUT,2015) E1,RHO1,ABRMAX,ABRMIN                            DATA0570
      WRITE(IOUT,2016) IGRAADT,URANGE,DRANGE,REFATR,FINCRT              DATA0580
  106 CONTINUE                                                          DATA0590
      CALL INPUT(MA,MB,JTYPE,MBC,STRES,NMB,MNO,MT,FRR,MDIFF,MEMBS,NMM,  DATA0600
     *           NG,NLINE)
C
C     ------ NODAL JOINT INFORMATION ------
C
      DLENG=0.                                                          DATA0610
      DO 7 I=1,JOINTS                                                   DATA0620
      READ(INN,4) JJ,X(JJ),Y(JJ)                                        DATA0630
      IF(X(JJ).GT.DLENG)DLENG=X(JJ)                                     DATA0640
    7 CONTINUE                                                          DATA0650
      IF(IDESGT.EQ.-1) GO TO 108                                        DATA0660
C
      IF(RHO .LE. 0.) EE=E1                                             DATA0670
      IF(RHO .LE. 0.) BASEA=ABRACE                                      DATA0680
      BASEAE=BASEA*EE                                                   DATA0690
      AENMNM=AENMNM*EE                                                  DATA0700
      ABRACE=ABRACE*EE                                                  DATA0710
      ABRMAX=ABRMAX*EE                                                  DATA0720
      ABRMIN=ABRMIN*EE                                                  DATA0730
C
C     ------ INITIAL RELATIVE DESIGN VARIABLES ------
C
      IF(IRELT.EQ.0)GO TO 107                                           DATA0740
      CALL INPUT3(AE,BASEA,MEMBS,EE,RHO,AREA1,SX,E1,RHO1,1)             DATA0750
      GO TO 108                                                         DATA0760
  107 DO 8 I=1,MEMBS                                                    DATA0770
      AE(I)=1.0                                                         DATA0780
      IF(JTYPE(I) .EQ. 0) AE(I)=ABRACE/BASEAE                           DATA0790
    8 CONTINUE                                                          DATA0800
C
C     ------ BAND WIDTH OF STIFFNESS AND MASS MATRICES ------
C
  108 DO 109 I=1,MEMBS                                                  DATA0810
      IF(MBAND .LT. (MB(I)-MA(I))) MBAND=MB(I)-MA(I)                    DATA0820
  109 CONTINUE                                                          DATA0830
      MBAND=(MBAND+1)*NN - 1                                            DATA0840
      IF(MBAND .GE. NM) MBAND=NM-1                                      DATA0850
      WRITE(IOUT,9) MBAND                                               DATA0860
C
C     ------ INFORMATION FOR RESTRAINED D.O.F. ------
C
      READ(INN,5) (IBND(I),I=1,NB)                                      DATA0870
      WRITE(IOUT,2020) (IBND(I),I=1,NB)                                 DATA0880
C
      CALL POP2(MEMBS,JOINTS,NN,MA,MB,NONZRO,ICOL,IDIAG)                DATA0890
      IF(NONZRO .GT. NSK) STOP                                          DATA0900
      DO 15 I=1,NN                                                      DATA0910
      ICOLS(I)=ICOL(I)                                                  DATA0920
      IDIAGS(I)=IDIAG(I)                                                DATA0930
   15 CONTINUE                                                          DATA0940
      DO 16 I=1,NN                                                      DATA0950
      DO 16 J=1,LOADS                                                   DATA0960
      DS(I,J)=0.                                                        DATA0970
      FS(I,J)=0.                                                        DATA0980
   16 CONTINUE                                                          DATA0990
C
C     ------ MEMBER LENGTH ------
C
      DO 17 I=1,MEMBS                                                   DATA1000
      KX=MA(I)                                                          DATA1010
      KY=MB(I)                                                          DATA1020
      AM(I)=X(KY)-X(KX)                                                 DATA1030
      AN(I)=Y(KY)-Y(KX)                                                 DATA1040
      ELENTH(I)=SQRT(AM(I)**2+AN(I)**2)                                 DATA1050
      FRS(I)=0.                                                         DATA1060
   17 CONTINUE                                                          DATA1070
      DO 18 J=1,LOADS                                                   DATA1080
      DS(I,J)=0.                                                        DATA1090
   18 CONTINUE                                                          DATA1100
      WRITE(IOUT,2021)                                                  DATA1110
      IF(INDEX) 20,20,31                                                DATA1120
   20 CONTINUE                                                          DATA1130
C
C     ------ STATIC LOADING INFORMATION ------
C
      WRITE(IOUT,2025)                                                  DATA1140
      CALL LOAD1(FS,FV,XG,NN,LOADS,0.,PNT,HJ,H2,NDN,NN,NSOIL,NDUCTV,    DATA1150
     *           NNF,NS,NSTORY,ICODE,IDESGT,RKAPA,LMTOSP,FACTDL,
     *           FACELL,FACTSL,FACTEL,MT,AHMX,AVMX)
      IF(IUNILD.EQ.0)GO TO 22                                           DATA1160
C
C     ------ CALCULATE FIXEND FORCES ------
C
      DO 21 L=1,MEMBS                                                   DATA1170
      DO 1121 J=1,LOADS                                                 DATA1180
11121 UNF(J)=FACTD(IJ)*WTIL(,1)+FACTLL(J)*WTIL(,2)+FACTSL(J)*WT(L,3)    DATA1190
      CALL FIXEND(FS,AM(L),UNF,MA(L),MB(L),ELENTH(L),0,LOADS,NNX,       DATA1200
     *AM(L),AN(L))                                                      DATA1210
   21 CONTINUE                                                          DATA1220
   22 CONTINUE                                                          DATA1230
      DO 110 I=1,NN                                                     DATA1240
      DO 110 J=1,LOADS                                                  DATA1250
      FS(I,J)=FS(I,J)                                                   DATA1260
  110 CONTINUE                                                          DATA1270
      CALL REDUCE(FS,IBND,NN,NBNDRY,LOADS,NNX)
C
C     ------ DYNAMIC PROPERTIES ------
C
   31 CONTINUE                                                          DATA1280
      READ(INN,6) KOPTON,NSIGN,NBEGIN,NDESIR,XG                         DATA1290
      WRITE(IOUT,2030) NBEGIN,NDESIR,XG,NSIGN                           DATA1300
      GO TO (50,111,111,50,111),ICODE                                   DATA1310
  111 CONTINUE                                                          DATA1320
      IF(KOPTON.LE.0 .OR. NBEGIN.LE.0) GO TO 50                         DATA1330
C
C     ------ DAMPING RATIO ------
C
      READ(INN,3) (DAMP(I),I=NBEGIN,NDESIR)                             DATA1340
      WRITE(IOUT,2029) (DAMP(I),I=NBEGIN,NDESIR)                        DATA1350
  112 CONTINUE                                                          DATA1360
      DO 32 I=1,NONZRO                                                  DATA1370
      GN(I)=0.                                                          DATA1380
   32 CONTINUE                                                          DATA1390
C
C     ------ NODAL MASSES ------
C
      READ(INN,3) (WMASS(I),I=1,JOINTS)                                 DATA1400
      WRITE(IOUT,2031) (WMASS(I),I=1,JOINTS)                            DATA1410
      DO 33 I=1,JOINTS                                                  DATA1420
      KX=NN*(I-1) + 1                                                   DATA1430
      DO 11033 J=1,NN                                                   DATA1440
      ID=IDIAG(KX)                                                      DATA1450
      GN(ID)=WMASS(I)                                                   DATA1460
      KX=KX+1                                                           DATA1470
11033 CONTINUE                                                          DATA1480
   33 CONTINUE                                                          DATA1490
C
C     ------ CONSISTENT MASSES ------
C
      DO 34 L=1,MEMBS                                                   DATA1500
      UNIF=WTIL(L,1)+WTIL(L,2)+WT(L,3)                                  DATA1510
      CALL ELMENT(EK,EM,AE(L),AM(L),AN(L),JTYPE(L),0.0,UNIF,ELENTH(L),  DATA1520
     *A,Z,AREA1)
      CALL TRNSFM(EK,EM,A,B,C,D,E,0)                                    DATA1530
      CALL ASMBL3(SK,GN,C,E,MA(L),MB(L),NM,6,IDIAG)                     DATA1540
   34 CONTINUE                                                          DATA1550
      GO TO (50,60000,50,50,60001),ICODE                                DATA1560
60001 IF(INDEX) 50,38,38                                                DATA1570
C
C     ------ DYNAMIC LOADING INFORMATION ------
C
   38 CONTINUE                                                          DATA1580
      WRITE(IOUT,2032)                                                  DATA1590
      MN=0                                                              DATA1600
      DO 35 I=1,NN                                                      DATA1610
      DO 35 J=1,LOADS                                                   DATA1620
```

```
      FV(I,J)=0.                                                        DATA1630
      FD(I,J)=0.                                                        DATA1640
   35 CONTINUE                                                          DATA1650
      CALL LOADIN(FD,FV,XG,MM,LOADS,I,PNT,H1,H2,NDM,NN,NSOIL,NDUCTY,    DATA1660
     *            NNX,NS,NSTORY,ICODE,IDESGT,RKAPA,LMTDSP,FACTDL,
     *            FACTLL,FACTSL,FACTEL,MT,AHMX,AVMX)
      CALL REDUCE(FD,IBND,NN,NBNDRY,LOADS,NNX)                          DATA1670
      CALL REDUCE(FV,IBND,NN,NBNDRY,LOADS,NNX)                          DATA1680
      DO 37 I=1,NN                                                      DATA1690
      DO 37 J=1,LOADS                                                   DATA1700
      XH(I,J)=FD(I,J)                                                   DATA1710
      XS(I,J)=FV(I,J)                                                   DATA1720
   37 CONTINUE                                                          DATA1730
60000 DO 39 L=1,MEMBS                                                   DATA1740
      CALL BEAMWT(NMB(L),MNO,WT,ELENTH,FRS(L),L,NMM,NG)                 DATA1750
   39 CONTINUE                                                          DATA1760
      IF(INDEX .EQ. 0) GO TO 50                                         DATA1770
      DO 40 L=1,MEMBS                                                   DATA1780
      FRR(L)=FRR(L)+FRS(L)                                              DATA1790
      FRS(L)=0.                                                         DATA1800
   40 CONTINUE                                                          DATA1810
   50 CONTINUE                                                          DATA1820
      IF(IDESGT.NE.-1)GO TO 51                                          DATA1830
      CALL INPUT3(AE,BASEA,MEMBS,EE,RHO,AREA1,SX,E1,RHO1,0)             DATA1840
      GO TO 95                                                          DATA1850
C
C ------ INFORMATION OF DISPLACEMENT CONSTRAINTS ------
C
   51 CONTINUE                                                          DATA1860
      IF(LMTDSP .GT. 0) WRITE(IOUT,2040)                                DATA1870
   60 LMTD=LMTDSP+1                                                     DATA1880
      GO TO(70,61,63,63),LMTD                                           DATA1890
   61 CONTINUE                                                          DATA1900
C
C    1. DISPLACEMENT CONSTRAINTS ARE IDENTICAL FOR ALL NODES
C
      READ(INN,3) (DEFMAX(I),I=1,MM)                                    DATA1910
      WRITE(IOUT,2041) (DEFMAX(I),I=1,MM)                               DATA1920
      DO 55 I=1,JOINTS                                                  DATA1930
      KX=MM*(I-1) + 1                                                   DATA1940
      DO 62 J=1,MM                                                      DATA1950
      DEFLMT(KX)=DEFMAX(J)                                              DATA1960
      KX=KX+1                                                           DATA1970
   62 CONTINUE                                                          DATA1980
   55 CONTINUE                                                          DATA1990
      GO TO 70                                                          DATA2000
C
C    2. DISPLACEMENT CONSTRAINTS ARE VARIED FOR EACH NODE
C
   63 CONTINUE                                                          DATA2010
      DO 64 I=1,NN                                                      DATA2020
      DEFLMT(I)=1000.0                                                  DATA2030
   64 CONTINUE                                                          DATA2040
      READ(INN,5) NLTDEF                                                DATA2050
      KH=NLTDEF                                                         DATA2060
      WRITE(IOUT,2042)                                                  DATA2070
   65 IF(KH-MM) 66,66,67                                                DATA2080
   66 KX=KH                                                             DATA2090
      GO TO 68                                                          DATA2100
   67 KX=MM                                                             DATA2110
   68 READ(INN,36) (TFR(I),IM(I),JM(I),I=1,KX)                          DATA2130
      DO 69 I=1,KX                                                      DATA2140
      KY=MM*(JM(I)-1) + IM(I)                                           DATA2150
      DEFLMT(KY)=TFR(I)                                                 DATA2160
   69 WRITE(IOUT,2043) JM(I),IM(I),TFR(I)                               DATA2170
      KH=KH-KX                                                          DATA2180
      IF(KH) 70,70,65                                                   DATA2190
   70 CONTINUE                                                          DATA2200
C
C ------ INFORMATION OF FREQUENCY CONSTRAINTS ------
C
      IF(KOPTION.LE.0 .OR. NBEGIN.LE.0) GO TO 95                        DATA2210
   75 READ(INN,3) (VALMIN(I),I=NBEGIN,NDESIR)                           DATA2220
      WRITE(IOUT,2050)                                                  DATA2230
      DO 80 I=NBEGIN,NDESIR                                             DATA2240
   80 WRITE(IOUT,2051) I,VALMIN(I)                                      DATA2250
      DO 81 I=NBEGIN,NDESIR                                             DATA2260
   81 VALMIN(I)=VALMIN(I)*VALMIN(I)                                     DATA2270
C
    2 FORMAT(8I5,10A4)                                                  DATA2280
    3 FORMAT(8F10.0)                                                    DATA2290
    4 FORMAT(I5,2F10.0)                                                 DATA2300
    5 FORMAT(16I5)                                                      DATA2310
    6 FORMAT(4I5,F10.0)                                                 DATA2320
    9 FORMAT(///2X,' MBAND WIDTH =',I3)                                 DATA2330
   36 FORMAT(3(F10.0,2I5))                                              DATA2340
 2000 FORMAT(1H1,14H STRUCTURE NO.,I2,3H:  ,10A4/                       DATA2350
     * /2X,40H TOTAL NUMBER OF STORIES----------------,I5
     1 /2X,40H TOTAL NUMBER OF MEMBERS----------------,I5
     2 /2X,40H TOTAL NUMBER OF NODES------------------,I5
     3 /2X,40H TOTAL NUMBER OF RESTRAINED D.O.F.------,I5
     4 /2X,40H TOTAL NUMBER OF LOADING CONDITIONS-----,I5
     5 /2X,40H DISPLACEMENT CONSTRAINT CODE-----------,I5
     6 /5X,36H EQ. 0:  NO DISPLACEMENT CONSTRAINTS/
     7 /5X,58H EQ. 1:  DISPLACEMENT CONSTRAINT IS THE SAME FOR ALL NODES
     8 /5X,55H EQ. 2:  DISPLACEMENT CONSTRAINT CAN BE VARIED PER NODE
     9 /5X,' EQ. 3:  DRIFT CONSTRAINT ON EACH STORY')
 2001 FORMAT(/2X,40H TYPE OF DESIGN--------------------------,I5/       DATA2360
     1 5X,22H EQ.-1:  STATIC DESIGN/
     2 5X,34H EQ. 0:  STATIC AND DYNAMIC DESIGN/
     3 5X,23H EQ. 1:  DYNAMIC DESIGN/
     4 2X,40H MAXIMUM NUMBER OF ITERATIONS-----------,I5/
     5 2X,40H TYPE OF SECTIONS-----------------------,I5/
     6 5X,40H EQ. 0:  BUILT-UP SECTIONS             /
     7 5X,40H GT. 0:  WF SECTIONS                   /
     8 5X,40H LT. 0:  TRUSS MEMBERS                 )
 2004 FORMAT(2F10.0,10F5.0,F10.0)                                       DATA2370
 2005 FORMAT(////2X,26H GIRDER-COLUMN PROPERTIES:/                      DATA2380
     1 5X,40H MODULUS OF ELASTICITY-------------------,F15.3/
     2 5X,40H SPECIFIC WEIGHT-------------------------,F15.3/
     3 5X,40H B/D-------------------------------------,F15.3/
     4 5X,40H MAXIMUM DEPTH---------------------------,F15.3/
     5 5X,40H MINIMUM DEPTH---------------------------,F15.3/
     6 5X,40H MAXIMUM TF/D----------------------------,F15.3/
     7 5X,40H MINIMUM TF/D----------------------------,F15.3/
     7 5X,40H MAXIMUM B/(2*TF)------------------------,F15.3/
     7 5X,40H MINIMUM B/(2*TF)------------------------,F15.3/
     7 5X,40H MAXIMUM B/D-----------------------------,F15.3/
     7 5X,40H MINIMUM B/D-----------------------------,F15.3)           DATA2390
 2010 FORMAT(////2X,26H GIRDER-COLUMN PROPERTIES:/                      DATA2400
     1 5X,40H MODULUS OF ELASTICITY-------------------,F15.3/
     2 5X,40H SPECIFIC WEIGHT-------------------------,F15.3)
 2011 FORMAT(5X,40H INITIAL MOMENT OF INERTIA-----------------,F15.3/   DATA2410
     1 5X,40H MAXIMUM MOMENT OF INERTIA---------------,F15.3/
     2 5X,40H MINIMUM MOMENT OF INERTIA---------------,F15.3/
     3 5X,40H RATIO OF MINIMUM I TO MAXIMUM I---------,F15.3)
 2015 FORMAT(////2X,20H BRACING PROPERTIES:/                            DATA2420
     1 5X,40H MODULUS OF ELASTICITY-------------------,F15.3/
     2 5X,40H SPECIFIC WEIGHT-------------------------,F15.3/
     3 5X,40H MAXIMUM BRACING AREA--------------------,F15.3/
     4 5X,40H MINIMUM BRACING AREA--------------------,F15.3)
 2016 FORMAT(////2X,21H GRADIENT PARAMETERS:/                           DATA2430
     1 5X,40H GRADIENT ITERATION----------------------,I5/
     2 5X,40H UPPER RANGE FOR DI----------------------,F10.5/
     3 5X,40H LOWER RANGE FOR DI----------------------,F10.5/
     4 5X,40H REDUCTION FACTOR------------------------,F10.5/
     5 5X,40H INCREMENTAL FACTOR----------------------,F10.5)
 2020 FORMAT(////2X,31H RESTRAINED DEGREES OF FREEDOM:/(12I10))         DATA2440
 2021 FORMAT(1H1,2X,' LOADING INFORMATIONS :',/,'*',' _______________DATA2450
     1 ')
 2025 FORMAT(////2X,28H STATIC LOADING INFORMATION:)                    DATA2460
 2030 FORMAT(/////2X,20H DYNAMIC PROPERTIES:/                           DATA2470
     1 5X,40H FIRST MODE NUMBER-----------------------,I5/
     2 5X,40H LAST MODE NUMBER------------------------,I5/
     3 5X,40H GRAVITY ACCELERATION--------------------,F7.2/
     4 5X,40H TYPE OF MODE SUPERPOSITION--------------,I5/
     5 5X,58H    EQ.-1:  DIRECT SUPERPOSITION OF MODES               /
     6 5X,58H    EQ. 0:  ROOT-MEAN-SQUARE SUPERPOSITION OF MODES     /
     7 5X,58H    EQ. 1:  ABSOLUTE SUPERPOSITION OF MODES             )
 2029 FORMAT(//5X,29H DAMPING RATIO FOR EACH MODE:/(10F13.3))           DATA2480
 2031 FORMAT(//5X,25H ADDITIONAL NODAL MASSES:/(10F13.3))               DATA2490
 2032 FORMAT(////2X,29H DYNAMIC LOADING INFORMATION:)                   DATA2500
 2040 FORMAT(////2X,26H DISPLACEMENT CONSTRAINTS:)                      DATA2510
 2041 FORMAT(3X,12H X-DIRECTION,3X,12H Y-DIRECTION,3X,12H Z-DIRECTION/  DATA2520
     1 3F15.3)
 2042 FORMAT(3X,5H NODE,10H DIRECTION,9X,6H VALUE)                      DATA2530
 2043 FORMAT(3X,I5,I6,4X,F15.3)                                         DATA2540
 2050 FORMAT(///2X,23H FREQUENCY CONSTRAINTS:/3X,5H MODE,7X,8H MINIMUM)DATA2550
 2051 FORMAT(3X,I5,F15.3)                                               DATA2560
   95 RETURN                                                            DATA2570
      END                                                               DATA2580
C
C     SUBROUTINE DAMP5:
C ***********************************************************
C *        FIND DAMPING FACTOR BY USING CURVE FITTING       *
C ***********************************************************
C
      SUBROUTINE DAMP5(HEFF,TWAVE,T,BETAC)                              DAMP0010
      COMMON/PRT1/INN,IOUT,IOUT1                                        DAMP0020
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NNNNN,MMMMM,NBRITL,   DAMP0030
     1            ISH,NPREGR,NVREGR,IS,ISLGL,IPILE,RKY,RKTETA,RR,VS,
     2            DSSSS,HN,AA,AV,S,A,CD,RL,DELA(30)
      Y1(X1)=-0.60487151+0.55680692*X1+0.15041691*X1**2                 DAMP0040
     1-0.10824889*X1**3
      Y2(X1)=-0.46392775+0.37995642*X1+0.15577894*X1**2                 DAMP0050
     1-0.083728492*X1**3
```

```
      Y3(X1)=-0.3323189+0.35376275*X1+0.00727446*X1**2                   DAMP0060
     1-0.0287982S6*X1**3
      Y6(X1)=-0.01101684+0.23722118*X1+0.34265029*X1**2                 DAMP0070
     1-0.09369421*X1**3
      Y5(X1)=-0.33025706+0.47274107*X1-0.16139281*X1**2                 DAMP0080
     1+0.01677444*X1**3
      Y8(X1)=-0.085258901+0.03929746Z*X1+0.069869637*X1**2              DAMP0090
     1-0.02424988*X1**3
      Y7(X1)=-0.25009191+0.40143424*X1-0.17905313*X1**2                 DAMP0100
     1+0.02790758*X1**3
      Y8(X1)=-0.05979795+0.067424595*X1-0.0028211528*X1**2              DAMP0110
     1-0.00546769*3*X1**3
C
      RATIO=HEEF/RR                                                     DAMP0120
      X=TWAVE/T                                                         DAMP0130
      IF(X.GT.2.)WRITE(IOUT,1000)                                       DAMP0140
      IF(X.GT.2.)X=2.                                                   DAMP0150
      IF(RATIO.GT.1.) GO TO 620                                         DAMP0160
      BETA01=Y1(X)                                                      DAMP0170
      BETA02=Y2(X)                                                      DAMP0180
      GO TO 660                                                         DAMP0190
  620 CONTINUE                                                          DAMP0200
      IF(RATIO.GT.1.5) GO TO 630                                        DAMP0210
      BETA01=3.*Y1(X)-2.*Y3(X)+2.*(Y3(X)-Y1(X))*RATIO                   DAMP0220
      BETA02=3.*Y2(X)-2.*Y4(X)+2.*(Y4(X)-Y2(X))*RATIO                   DAMP0230
      GO TO 660                                                         DAMP0240
  630 CONTINUE                                                          DAMP0250
      IF(RATIO.GT.2.) GO TO 640                                         DAMP0260
      BETA01=4.*Y3(X)-3.*Y5(X)+2.*(Y5(X)-Y3(X))*RATIO                   DAMP0270
      BETA02=4.*Y4(X)-3.*Y6(X)+2.*(Y6(X)-Y4(X))*RATIO                   DAMP0280
      GO TO 660                                                         DAMP0290
  640 CONTINUE                                                          DAMP0300
      IF(RATIO.GT.5.) GO TO 650                                         DAMP0310
      BETA01=(5./3.)*Y5(X)-(2./3.)*Y7(X)+(1./3.)*(Y7(X)-Y5(X))*RATIO    DAMP0320
      BETA02=(5./3.)*Y6(X)-(2./3.)*Y8(X)+(1./3.)*(Y8(X)-Y6(X))*RATIO    DAMP0330
      GO TO 660                                                         DAMP0340
  650 CONTINUE                                                          DAMP0350
      BETA01=(5.*Y7(X))/RATIO                                           DAMP0360
      BETA02=(5.*Y8(X))/RATIO                                           DAMP0370
  660 CONTINUE                                                          DAMP0380
      IF(AV.GE.0.19) BETA0=BETA01                                       DAMP0390
      IF(AV.LE.0.11) BETA0=BETA02                                       DAMP0400
      IF(AV.LT.0.19 .AND. AV.GT.0.11) BETA0=0.5*(BETA01+BETA02)         DAMP0410
      IF(BETA0.LT.0.)BETA0=0.                                           DAMP0420
 1000 FORMAT(//,2X,'***** THE RATIO OF TWAVE/T IS OUT OF BOUND *****')  DAMP0430
      RETURN                                                            DAMP0440
C     DEBUG SUBCHK
      END                                                               DAMP0450
C
C     SUBROUTINE DISP:
C ***************************************************************
C *                CHECK FLEXIBILITY CONSTRAINTS                *
C ***************************************************************
C
      SUBROUTINE DISP(LOADS,LOAD,NTOTAL,RATIOB,RATIOI,LMTD,KNODE,MM,    DISP0010
     .RATIO,DEFLMT,MAXNC,NSTORY,BASEAE,DR,JRATIO,RATIOA,III,JJJJI,
     .MAXST,NN,NNX,INDEX,HH,VV,DM,MDMAX,NBEGIN,NDESIR,ABSDR)
      DIMENSION RATIOI(1),DEFLMT(1),RATIOI(1),DR(NNX,1),DM(NNX,1),      DISP0020
     .KNODE(MAXST,1),HH(MDMAX,1),VV(MDMAX,1)
C
C ----- CHECK STORY DRIFTS WITH ALLOWABLE STORY DRIFTS -----
C
      GO TO (20,20,10),LMTD                                             DISP0030
   10 DO 19 J=1,LOADS                                                   DISP0040
      DO 18 I=1,NSTORY                                                  DISP0050
      II=MM*KNODE(I,J)-2                                                DISP0060
      DEFBAE=DEFLMT(II)                                                 DISP0070
      IF(II.EQ.1)GO TO 15                                               DISP0080
      DEFBA1=DEFBAE-DEFBA2                                              DISP0090
      IF(INDEX.GE.1)GO TO 11                                            DISP0100
      AMAX=(ABS(DR(II,J))-ABS(DR(II,J)))/BASEAE                         DISP0110
      GO TO 17                                                          DISP0120
   11 AMAX=0.                                                           DISP0130
      DO 12 JM=NBEGIN,NDESIR                                            DISP0140
      AMAX3=DM(II,JM1-DM(II,JM)                                         DISP0150
      AMAX3=AMAX3*((HH(JM,J)+VV(JM,J))/BASEAE)                          DISP0160
      AMAX=AMAX+(AMAX3)**2                                              DISP0170
   12 CONTINUE                                                          DISP0180
      AMAX=SQRT(AMAX)                                                   DISP0190
      GO TO 17                                                          DISP0200
   15 CONTINUE                                                          DISP0210
      DEFBA1=DEFBAE                                                     DISP0220
      IF(INDEX.GE.1)GO TO 14                                            DISP0230
      AMAX=ABS(DR(II,J))/BASEAE                                         DISP0240
      GO TO 17                                                          DISP0250
   14 AMAX=0.                                                           DISP0260
      DO 16 JM=NBEGIN,NDESIR                                            DISP0270
      AMAX3=DM(II,JM)                                                   DISP0280
      AMAX3=AMAX3*((HH(JM,J)+VV(JM,J))/BASEAE)                          DISP0290
      AMAX=AMAX+(AMAX3)**2                                              DISP0300
   16 CONTINUE                                                          DISP0310
      AMAX=SQRT(AMAX)                                                   DISP0320
   17 CONTINUE                                                          DISP0330
      ABSD=AMAX/DEFBA1                                                  DISP0340
      II=II                                                             DISP0350
      DEFBA2=DEFBAE                                                     DISP0360
      IF(RATIOB .GT. ABSD) GO TO 18                                     DISP0370
      RATIOB=ABSD                                                       DISP0380
      JRATIO=I                                                          DISP0390
   18 CONTINUE                                                          DISP0400
   19 CONTINUE                                                          DISP0410
C
C ------ CHECK DISPLACEMENT WITH DISPLACEMENT CONSTRAINTS ------
C
   20 RATIOA=0.                                                         DISP0420
      DO 40 I=1,NN                                                      DISP0430
      DEFBAE=DEFLMT(I)*BASEAE                                           DISP0440
      DO 35 J=1,LOADS                                                   DISP0450
      AMAX=ABS(DR(I,J))                                                 DISP0460
      ABSDR1=AMAX/DEFBAE                                                DISP0470
      IF(RATIOI(J) .GT. ABSDR1) GO TO 30                                DISP0480
      RATIOI(J)=ABSDR1                                                  DISP0490
   30 CONTINUE                                                          DISP0500
      IF(RATIOA.GT.ABSDR1) GO TO 33                                     DISP0510
      RATIOA=ABSDR1                                                     DISP0520
      ABSDR=ABSDR1                                                      DISP0530
      III=I                                                             DISP0540
      JJJJ=J                                                            DISP0550
   33 CONTINUE                                                          DISP0560
   35 CONTINUE                                                          DISP0570
   40 CONTINUE                                                          DISP0580
      RETURN                                                            DISP0590
      END
C
C     SUBROUTINE EIGEN:
C ***************************************************************
C *          CALCULATE EIGEN VALUES AND EIGENVECTORS            *
C ***************************************************************
C
      SUBROUTINE EIGEN(SK,GM,VAL,DM,NM,MBAND,ICOL,IDIAG,INCC,BASEAE     EIGN0010
     1,IREQDM,NSTORY,TI,ITER,KCOUNT)
      COMMON/PRT1/INN,IOUT,IOUT1                                        EIGN0020
      COMMON/ABC/NZERO,NBEGIN,NDESIR,NITER,MD,NN                        EIGN0030
      DIMENSION SK(1),GM(1),VAL(1),ICOL(1),IDIAG(1),TT(1),VALUP(300),   EIGN0040
     1          SKK(3500),FI(300,1),DI(300,1),DRP(300,1),DM(NM,MD)
      DO 10 I=1,NM                                                      EIGN0050
      VALUP(I)=-1.0                                                     EIGN0060
   10 VAL(I)=0.0                                                        EIGN0070
      VALUE=1.0                                                         EIGN0080
      NITER=0                                                           EIGN0090
   11 NITER=NITER+1                                                     EIGN0100
      IF(NITER.GE.78) GO TO 100                                         EIGN0110
      CALL STURM (SK,GM,MBAND,VALUE,NGREAT,NM,ICOL,IDIAG)               EIGN0120
      KH=NM-NGREAT                                                      EIGN0130
      IF(KH.LT.NM)VAL(KH+1)=VALUE                                       EIGN0140
      IF(KH.EQ.0) GO TO 12                                              EIGN0150
      IF(VALUP(KH).LT.0.)VALUP(KH)=VALUE                                EIGN0160
      IF(VALUE.LT.VALUP(KH)) VALUP(KH)=VALUE                            EIGN0170
      VALUE=VALUE/10.0                                                  EIGN0180
      GO TO 11                                                          EIGN0190
   12 DO 13 I=2,NM                                                      EIGN0200
      IF(VAL(I).LT.VAL(I-1)) VAL(I)=VAL(I-1)                            EIGN0210
   13 CONTINUE                                                          EIGN0220
      VALUE=VAL(NM)                                                     EIGN0230
      NITER=0                                                           EIGN0240
   14 VALUE=VALUE*10.                                                   EIGN0250
      NITER=NITER+1                                                     EIGN0260
      IF(NITER.GE.78) GO TO 100                                         EIGN0270
      CALL STURM (SK,GM,MBAND,VALUE,NGREAT,NM,ICOL,IDIAG)               EIGN0280
      KH=NM-NGREAT                                                      EIGN0290
      IF(KH.GE.NM) GO TO 16                                             EIGN0300
      IF(VAL(KH+1).LT.VALUE)VAL(KH+1)=VALUE                             EIGN0310
      IF(VALUP(KH).LT.0.)VALUP(KH)=VALUE                                EIGN0320
      IF(VALUE.LT.VALUP(KH))VALUP(KH)=VALUE                             EIGN0330
      DO 15 I=2,NM                                                      EIGN0340
      IF(VAL(I).LT.VAL(I-1))VAL(I)=VAL(I-1)                             EIGN0350
   15 CONTINUE                                                          EIGN0360
      GO TO 14                                                          EIGN0370
   16 VALHIG=VALUE                                                      EIGN0380
      IF(VALUP(NM).LT.0.)VALUP(NM)=VALHIG                               EIGN0390
      IF(VALHIG.LT.VALUP(NM))VALUP(NM)=VALHIG                           EIGN0400
      KX=NM                                                             EIGN0410
      NM1=NM-1                                                          EIGN0420
      DO 29 I=1,NM1                                                     EIGN0430
      IF(VALUP(KX-1).LT.0.)VALUP(KX-1)=VALUP(KX)                        EIGN0440
   29 KX=KX-1                                                           EIGN0450
```

```
      I=NBEGIN                                                          EIGN0460
   99 CONTINUE                                                          EIGN0470
C     DO 41 I=NBEGIN,NDESIR                                             EIGN0480
   27 VALKY=VALUP(I)                                                    EIGN0490
      VALKX=VALI(I)                                                     EIGN0500
   18 VALUE=(VALKX+VALKY)/2.                                            EIGN0510
   19 CALL STURM (SK,GM,MBAND,VALUE,NGREAT,NM,ICOL,IDIAG)               EIGN0520
      KH=NM-NGREAT                                                      EIGN0530
      KK=KH+1                                                           EIGN0540
      DO 26 J=KK,NM                                                     EIGN0550
      IF(VAL(J).LT.VALUE)VAL(J)=VALUE                                   EIGN0560
   26 CONTINUE                                                          EIGN0570
      IF(I.GE.KH) GO TO 24                                              EIGN0580
      DO 28 J=1,KH                                                      EIGN0590
      IF(VALUP(J).GT.VALUE)VALUP(J)=VALUE                               EIGN0600
   28 CONTINUE                                                          EIGN0610
   24 IF(KH-I)21,22,23                                                  EIGN0620
   21 VALKX=VALUE                                                       EIGN0630
      GO TO 25                                                          EIGN0640
   22 VALKY=VALUE                                                       EIGN0650
      GO TO 25                                                          EIGN0660
   23 VALKY=VALUE                                                       EIGN0670
   25 IF((VALKY-VALKX).GT.(.005*VALUE)) GO TO 18                        EIGN0680
      VAL(I)=VALUE                                                      EIGN0690
C
C------ DETERMINE PERIOD OF EACH MODE ------
C
      TI(I)=6.28318530?/SQRT(VALUE*BASEAE)                              EIGN0700
      IF(INCC.EQ.0)GO TO 20                                             EIGN0710
C
C------ DETERMINE THE REQUIRED NUMBER OF MODES ------
C------       FOR MODEL ANALYSIS OF ATC-3          ------
C
      IF(ITER.NE.1.OR.KCOUNT.NE.1)GO TO 86                              EIGN0020
      IREQDM=NDESIR                                                     EIGN0030
      GO TO 20                                                          EIGN0040
   86 IF(NSTORY.LE.3)GO TO 89                                           EIGN0050
      IF(TI(I).GE.0.4)GO TO 83                                          EIGN0060
      IF(I.LE.3)GO TO 80                                                EIGN0070
      IREQDM=I-1                                                        EIGN0080
      GO TO 87                                                          EIGN0090
   80 IREQDM=3                                                          EIGN0100
      GO TO 87                                                          EIGN0110
   83 IF(I.EQ.NDESIR)NDESIR=NDESIR+1                                    EIGN0120
      IF(NDESIR.LE.MD)GO TO 20                                          EIGN0130
      IF(ITER.NE.1.OR.KCOUNT.EQ.1)IREQDM=MD                             EIGN0140
      GO TO 87                                                          EIGN0150
   89 IREQDM=NSTORY                                                     EIGN0160
   87 NDESIR=IREQDM                                                     EIGN0170
   20 CONTINUE                                                          EIGN0180
      IF(I.GT.NDESIR)GO TO 84                                           EIGN0190
      I=I+1                                                             EIGN0200
      GO TO 99                                                          EIGN0210
C
C------ DETERMINE EIGENVECTORS ------
C
   84 DO 40 II=NBEGIN,NDESIR                                            EIGN0220
      DO 30 I=1,NM                                                      EIGN0230
      DI(I,1)=1.0                                                       EIGN0240
   30 FI(I,1)=0.0                                                       EIGN0250
      DO 31 I=1,NZERO                                                   EIGN0260
   31 SKK(I) = GM(I)-SK(I)/VAL(II)                                      EIGN0270
      NDCOMP=0                                                          EIGN0280
      NITER=0                                                           EIGN0290
   32 DO 33 I=1,NM                                                      EIGN0300
   33 DRP(I,1)=DI(I,1)                                                  EIGN0310
      NITER=NITER+1                                                     EIGN0320
      IF(NITER.GT.30) GO TO 37                                          EIGN0330
      CALL MLTPLY (SK,FI,DRP,1,NM,NN,ICOL,IDIAG)                        EIGN0340
      CALL GAUSS (SKK,FI,DI,1,NM,NN,NDCOMP,ICOL,IDIAG)                  EIGN0350
      NDCOMP=1                                                          EIGN0360
      ADR=0.0                                                           EIGN0370
      DO 34 J=1,NN                                                      EIGN0380
      IF(ABS(DI(J,1)).LT.ADR) GO TO 34                                  EIGN0390
      ADR=ABS(DI(J,1))                                                  EIGN0400
      JJ=J                                                              EIGN0410
   34 CONTINUE                                                          EIGN0420
      IF(II.EQ.NBEGIN)NSIGN=0                                           EIGN0430
      IF(II.EQ.NBEGIN.AND.DI(JJ,1).LT.0.)ADR=-ADR                       EIGN0440
      IF(II.EQ.NBEGIN.AND.DI(JJ,1).LT.0.)NSIGN=1                        EIGN0450
      IF(II.NE.NBEGIN.AND.NSIGN.EQ.1)ADR=-ADR                           EIGN0460
      DO 35 J=1,NM                                                      EIGN0470
   35 DI(J,1)=DI(J,1)/ADR                                               EIGN0480
      DO 36 I=1,NM                                                      EIGN0490
      IF((ABS(DRP(I,1))-ABS(DI(I,1))).GT.0.000001) GO TO 32             EIGN0500
   36 CONTINUE                                                          EIGN0510
   37 DO 38 I=1,NM                                                      EIGN0520
   38 DM(I,II)=DI(I,1)                                                  EIGN0530
```

```
   40 CONTINUE                                                          EIGN0540
      IF(NITER-30) 200,100,100                                          EIGN0550
  100 WRITE(IOUT,101)                                                   EIGN0560
  101 FORMAT(//////46H ERROR: ******NO SOLUTIONS TO EIGENVALUES****** ) EIGN0570
  200 RETURN                                                            EIGN0580
C     DEBUG SUBCHK                                                      EIGN0590
      END
C                                                                       EIGN0600
C     SUBROUTINE ELFORC;
C*****************************************************************
C*                CALCULATE MEMBER FORCES                        *
C*****************************************************************
C
      SUBROUTINE  ELFORC(A,B,D,DR,EDR,S,SS,MA,MB,L,M,NN)                ELF00010
      DIMENSION A(3,3),B(6,6),DR(NN,L),S(6,L),EDR(6,L),D(6,6),SS(6,L)   ELF00020
      MA=3*(MA-1)+1                                                     ELF00030
      MJ=M*(MB-1)+1                                                     ELF00040
      MM=2*M                                                            ELF00050
      DO 86 I=1,6                                                       ELF00060
      JA=M                                                              ELF00070
      NI=NL                                                             ELF00080
      DO 88 K=1,L                                                       ELF00090
      EDR(I,K)=0.                                                       ELF00100
      SS(I,K) = 0.                                                      ELF00110
      S(I,K)=0.                                                         ELF00120
   88 CONTINUE                                                          ELF00130
      IF(I-3)104,104,105                                                ELF00140
  104 CONTINUE                                                          ELF00150
      KH=NJ                                                             ELF00160
      JAA=0                                                             ELF00170
      GO TO 106                                                         ELF00180
  105 CONTINUE                                                          ELF00190
      KH=NJ                                                             ELF00200
      JAA=-M                                                            ELF00210
  106 CONTINUE                                                          ELF00220
      JAA=I+JAA                                                         ELF00230
      DO 108 J=1,M                                                      ELF00240
      DO 107 K=1,L                                                      ELF00250
      EDR(I,K)=EDR(I,K)+A(IAA,J)*DR(KH,K)                               ELF00260
  107 CONTINUE                                                          ELF00270
      KH=KH+1                                                           ELF00280
  108 CONTINUE                                                          ELF00290
      DO  87 J=1,MM                                                     ELF00300
      DO 89 K = 1,L                                                     ELF00310
      SS(I,K) = SS(I,K) + D(I,J)*DR(NI,K)                               ELF00320
      S(I,K) =S(I,K)+B(I,J)*DR(NI,K)                                    ELF00330
   89 CONTINUE                                                          ELF00340
      IF(J.LT.JA) GO TO  85                                             ELF00350
      NI=NJ-1                                                           ELF00360
      JA=MM                                                             ELF00370
   85 CONTINUE                                                          ELF00380
      NI=NI+1                                                           ELF00390
   87 CONTINUE                                                          ELF00400
   86 CONTINUE                                                          ELF00410
      RETURN                                                            ELF00420
C     DEBUG SUBCHK                                                      ELF00430
      END
C
C     SUBROUTINE ELMENT;
C*****************************************************************
C*          FORM ELEMENT STIFFNESS AND ELEMENT MASS              *
C*****************************************************************
C
      SUBROUTINE ELMENT(EK,EM,AE,AM,AN,JT,FR,RHO,AL,A,INC,AREAA)        ELME0010
      COMMON/STIFF/FB,EE,E1,XG                                          ELME0020
      DIMENSION EK(6,6),EM(6,6),A(3,3)                                  ELME0030
      DO 4 I=1,6                                                        ELME0040
      DO 4 J=1,6                                                        ELME0050
      EM(I,J)=0.                                                        ELME0060
    4 EK(I,J)=0.                                                        ELME0070
      IF(INC .EQ. 2) GO TO 16                                           ELME0080
C
C------ ELEMENT STIFFNESS MATRIX FOR GIRDER AND COLUMN ------
C
      IF(JT-1) 30,5,5                                                   ELME0090
    5 AEK=AREAA/(FB*AL)                                                 ELME0100
      BEK=AE/(AL**3)                                                    ELME0110
      CEK=AE/(AL**2)                                                    ELME0120
      DEK=AE/AL                                                         ELME0130
      FO=FR/(FB*EE)                                                     ELME0140
      EK(1,1)=AEK                                                       ELME0150
      EK(4,1)=-AEK                                                      ELME0160
      EK(2,2)=12.*BEK - 1.2*FO/AL                                       ELME0170
      EK(6,2)=6.*CEK - 0.1*FO                                           ELME0180
      EK(5,2)=-12.*BEK + 1.2*FO/AL                                      ELME0190
      EK(6,2)=EK(3,2)                                                   ELME0200
      EK(3,3)=4.*DEK - FO*AL/7.5                                        ELME0210
      EK(5,3)=-EK(3,2)                                                  ELME0220
```

```
      EK(6,3)=2.*DEK + FO*AL/30.0                                       ELME0230
      EK(4,4)=AEK                                                       ELME0240
      EK(5,4)=EK(2,2)                                                   ELME0250
      EK(6,5)=-EK(3,2)                                                  ELME0260
      EK(6,6)=EK(3,3)                                                   ELME0270
      IF(INC) 20,15,15                                                  ELME0280
C
C     ------ ELEMENT MASS MATRIX FOR GIRDER AND COLUMN -------
C
   15 AEM=(RHO/XG)*AREAA                                                ELME0290
      GO TO 18                                                          ELME0300
   16 IF(RHO .EQ. 0.0) GO TO 40                                         ELME0310
      AEM=RHO/XG                                                        ELME0320
   18 BEM=AEM*AL                                                        ELME0330
      CEM=AEM*(AL**2)                                                   ELME0340
      DEM=AEM*(AL**3)                                                   ELME0350
      EM(1,1)=BEM/3.0                                                   ELME0360
      EM(4,1)=BEM/6.0                                                   ELME0370
      EM(2,2)=(13.0/35.0)*BEM                                           ELME0380
      EM(3,2)=(11.0/210.0)*CEM                                          ELME0390
      EM(5,2)=(9.0/70.0)*BEM                                            ELME0400
      EM(6,2)=(-13.0/420.0)*CEM                                         ELME0410
      EM(3,3)=DEM/105.0                                                 ELME0420
      EM(5,3)=-EM(6,2)                                                  ELME0430
      EM(6,3)= -DEM/140.0                                               ELME0440
      EM(4,4)=EM(1,1)                                                   ELME0450
      EM(5,5)=EM(2,2)                                                   ELME0460
      EM(6,5)=-EM(3,2)                                                  ELME0470
      EM(6,6)=EM(3,3)                                                   ELME0480
   20 DO 25 I=1,5                                                       ELME0490
      IP=I+1                                                            ELME0500
      DO 25 J=IP,6                                                      ELME0510
      EM(I,J)=EM(J,I)                                                   ELME0520
   25 EK(I,J)=EK(J,I)                                                   ELME0530
      GO TO 40                                                          ELME0540
C
C     ------ ELEMENT STIFFNESS MATRIX FOR BRACING MEMBER ------
C
   30 AEK=AE*EI/(AL*EE)                                                 ELME0550
      EK(1,1)=AEK                                                       ELME0560
      EK(4,4)=EK(1,1)                                                   ELME0570
      EK(1,4)=-EK(1,1)                                                  ELME0580
      EK(4,1)=EK(1,4)                                                   ELME0590
      FO=FA/(FB*EE)                                                     ELME0600
      EK(2,2)=FO/AL                                                     ELME0610
      EK(5,5)=EK(2,2)                                                   ELME0620
      EK(2,5)=-EK(2,2)                                                  ELME0630
      EK(5,2)=EK(2,5)                                                   ELME0640
      IF(INC) 40,35,35                                                  ELME0650
C
C     ------ ELEMENT MASS MATRIX FOR BRACING MEMBER ------
C
   35 AEM=(RHO/XG)*AE*FB*AL/6.0                                         ELME0660
      EM(1,1)=2.0*AEM                                                   ELME0670
      EM(1,4)=AEM                                                       ELME0680
      EM(2,2)=EM(1,1)                                                   ELME0690
      EM(2,5)=EM(1,4)                                                   ELME0700
      EM(5,5)=EM(1,1)                                                   ELME0710
      EM(4,1)=EM(1,4)                                                   ELME0720
      EM(5,2)=EM(2,5)                                                   ELME0730
   40 AA=AM/AL                                                          ELME0740
      AB=AN/AL                                                          ELME0750
      AI(1,1)=AA                                                        ELME0760
      AI(2,1)=AB                                                        ELME0770
      AI(3,1)=0                                                         ELME0780
      AI(2,1)=-AB                                                       ELME0790
      AI(2,2)=AA                                                        ELME0800
      AI(2,3)=0                                                         ELME0810
      AI(3,1)=0                                                         ELME0820
      AI(3,2)=0                                                         ELME0830
      AI(3,3)=1.0                                                       ELME0840
      RETURN                                                            ELME0850
C     DEBUG SUBCHK                                                      ELME0860
      END                                                               ELME0870
C
      SUBROUTINE ENERGY:
C*****************************************************************
C*                  MULTIPLICATION OF TWO VECTORS                *
C*****************************************************************
C
      SUBROUTINE ENERGY(ENG,A,B,N,KK,L,NN,INC)                          ENER0010
      DIMENSION ENG(L),A(NN,L),B(NN,L)                                  ENER0020
      KM=KK+1                                                           ENER0021
      KL=KK+L                                                           ENER0022
      IF(INC.EQ.1)GO TO 10                                              ENER0023
      DO 1 I = KM,KL                                                    ENER0030
    1 ENG(I) = 0.0                                                      ENER0040
   10 KM=KK                                                             ENER0041
      DO 2 I = 1,L                                                      ENER0042
      KM=KM+1                                                           ENER0043
      DO 2 J = 1,N                                                      ENER0050
    2 ENG(KM) = ENG(KM) + A(J,I)*B(J,I)                                 ENER0060
      CONTINUE                                                          ENER0070
      RETURN                                                            ENER0080
C     DEBUG SUBCHK                                                      ENER0090
      END
C
      SUBROUTINE FIXEND:
C*****************************************************************
C* . CALCULATE FIXEND ACTIONS AND FORM EQUIVALENT JOINT LOADS     *
C*****************************************************************
C
      SUBROUTINE FIXEND (FR,AML,WT,MA,MB,AL,INC,L,NN,AM,AN)             FIXE0010
      DIMENSION WT(L),FR(NN,L),AML(6,L)                                 FIXE0020
      DO 102 J=1,L                                                      FIXE0030
      AML(1,J)=0.                                                       FIXE0040
      AML(2,J)=0.5*WT(J)*AL                                             FIXE0050
      AML(3,J)=WT(J)*(AL**2)/12.0                                       FIXE0060
      AML(5,J)=AML(1,J)                                                 FIXE0070
      AML(6,J)=AML(2,J)                                                 FIXE0080
      AML(4,J)=-AML(3,J)                                                FIXE0090
  102 CONTINUE                                                          FIXE0100
      IF(INC) 20,20,30                                                  FIXE0110
   20 CX=AM/AL                                                          FIXE0120
      CY=AN/AL                                                          FIXE0130
      DO 25 K=1,L                                                       FIXE0140
      FR(3*MA-2,K) = FR(3*MA-2,K)-AML(1,K)*CX+AML(2,K)*CY               FIXE0150
      FR(3*MA-1,K) = FR(3*MA-1,K)-AML(1,K)*CY-AML(2,K)*CX               FIXE0160
      FR(3*MA,K)   = FR(3*MA,K)-AML(3,K)                                FIXE0170
      FR(3*MB-2,K) = FR(3*MB-2,K)-AML(4,K)*CX+AML(5,K)*CY               FIXE0180
      FR(3*MB-1,K) = FR(3*MB-1,K)-AML(4,K)*CY-AML(5,K)*CX               FIXE0190
      FR(3*MB,K)   = FR(3*MB,K)-AML(6,K)                                FIXE0200
   25 CONTINUE                                                          FIXE0210
   30 CONTINUE                                                          FIXE0220
      RETURN                                                            FIXE0230
C     DEBUG SUBCHK                                                      FIXE0240
      END
C
      SUBROUTINE GAUSS
C*****************************************************************
C*                    SOLVE LINEAR EQUATIONS                     *
C*****************************************************************
C
      SUBROUTINE  GAUSS(A,F,D,L,N,NN,NDCOMP,IC,ID)                      GAUS0010
      COMMON/PRT1/INN,IOUT,JOUT                                         GAUS0020
      DIMENSION A(1),ID(1),IC(1),F(NN,L),D(NN,L)                        GAUS0030
      IF(NDCOMP .EQ. 1)GO TO 15                                         GAUS0040
      DO 10 I=1,N                                                       GAUS0050
      II=I-1                                                            GAUS0060
      DO  9 J=I,N                                                       GAUS0070
      IF(IC(J) .GT. II)GO TO 9                                          GAUS0080
      IX=ID(J)-J+I                                                      GAUS0090
      IF(I .EQ. 1)GO TO 8                                               GAUS0100
      DO  7 K=1,II                                                      GAUS0110
      IF(IC(I) .GT. K .OR. IC(I) .GT. K)GO TO 7                         GAUS0120
      KX=ID(I)-I+K                                                      GAUS0130
      KY=ID(J)-J+K                                                      GAUS0140
      KZ=ID(K)                                                          GAUS0150
      A(IX)=A(IX)-(A(KX)*A(KZ)* A(KY))                                  GAUS0160
    7 CONTINUE                                                          GAUS0170
    8 IF(I .EQ. J)GO TO 9                                               GAUS0180
      KZ=ID(I)                                                          GAUS0190
      IF(A(KZ) .EQ. 0.)GO TO 100                                        GAUS0200
      A(IX)=A(IX)/A(KZ)                                                 GAUS0210
    9 CONTINUE                                                          GAUS0220
   10 CONTINUE                                                          GAUS0230
   15 DO 40 K=1,L                                                       GAUS0240
      DO 30 I=1,N                                                       GAUS0250
      D(I,K)=F(I,K)                                                     GAUS0260
      II=I-1                                                            GAUS0270
      IF(II .EQ. 0) GO TO 30                                            GAUS0280
      DO 20 J=1,II                                                      GAUS0290
      IF(IC(J) .GT. J)GO TO 20                                          GAUS0300
      IX=ID(J)-J+I                                                      GAUS0310
      D(I,K)=D(I,K)-A(IX)*D(J,K)                                        GAUS0320
   20 CONTINUE                                                          GAUS0330
   30 CONTINUE                                                          GAUS0340
   40 CONTINUE                                                          GAUS0350
      DO 70 I=1,N                                                       GAUS0360
      KX=ID(I)                                                          GAUS0370
      DO 70 K=1,L                                                       GAUS0380
      D(I,K)=D(I,K)/A(KX)                                               GAUS0390
   70 CONTINUE                                                          GAUS0400
      DO 90 K=1,L                                                       GAUS0410
      IX=N                                                              GAUS0420
```

```
      DO 90 I=2,N                                                       GAUS0430
      IX=IX-1                                                           GAUS0440
      II=I-1                                                            GAUS0450
      KX=IX                                                             GAUS0460
      DO 80 J=1,II                                                      GAUS0470
      KX=KX+1                                                           GAUS0480
      IF(IC(KX) .GT. IX)GO TO 80                                        GAUS0490
      KY=ID(KX)-KX+IX                                                   GAUS0500
      DO IX,K)=D(IX,K)-A(KY)*D(KX,K)                                    GAUS0510
   80 CONTINUE                                                          GAUS0520
   90 CONTINUE                                                          GAUS0530
      GO TO 110                                                         GAUS0540
  100 WRITE(IOUT,120)                                                   GAUS0550
  120 FORMAT(///2X,21HSTRUCTURE IS UNSTABLE///)                         GAUS0560
  110 RETURN                                                            GAUS0570
C     DEBUG SUBCHK                                                      GAUS0580
      END
C
      SUBROUTINE INPUT
C*****************************************************************
C*       READ AND PRINT OF MEMBER IDENTIFICATION DATA            *
C*****************************************************************
C
      SUBROUTINE INPUT (MA,MB,JT,NT,ST,NMB,MNO,W,F,MD,MM,NM,NG,NLINE)   INPT0010
      COMMON/PRT1/INN,IOUT,IOUT1                                        INPT0020
      DIMENSION MA(1),MB(1),JT(1),NT(1),ST(1),F(1),NMB(1),W(NM,3),      INPT0030
     1          MNO(NM,NG),ALINE(1)
      MD=0                                                              INPT0040
      WRITE(IOUT,3)                                                     INPT0050
      DO 30 L=1,MM                                                      INPT0060
      READ(INN,1) ID,MA(ID),MB(ID),JT(ID),ST(ID),WTD,WTL,WTS,NT(ID),    INPT0070
     *NLINE(ID),NB
      IF(NB.GT.0)READ(INN,4)(MNO(ID,J),J=1,NB)                          INPT0080
      NMB(ID)=NB                                                        INPT0090
      IF(NT(ID) .GT. MD) MD=NT(ID)                                      INPT0100
      DO 5 J=1,3                                                        INPT0110
    5 W(ID,J)=0.0                                                       INPT0120
      F(ID)=0.0                                                         INPT0130
      IF(JT(ID)-1) 20,10,15                                             INPT0140
   10 F(ID)=WTD                                                         INPT0150
      GO TO 20                                                          INPT0160
   15 W(ID,1)=WTD                                                       INPT0170
      W(ID,2)=WTL                                                       INPT0180
      W(ID,3)=WTS                                                       INPT0190
   20 WRITE(IOUT,2) ID,MA(ID),MB(ID),JT(ID),ST(ID),WTD,WTL,WTS,NT(ID),NB INPT0200
     1,(MNO(ID,J),J=1,NB)
   30 CONTINUE                                                          INPT0210
    1 FORMAT(4I5,4F10.0,4I5)                                            INPT0220
    4 FORMAT(16I5)                                                      INPT0230
    2 FORMAT(4I5,6F15.3,2I5,5X,7I5,/,(95X,7I5))                         INPT0240
    3 FORMAT(///2X,29H MEMBER IDENTIFICATION DATA: //                   INPT0250
     1 3X,'NO',4X,'J-END',6H K-END,5H TYPE,13H STRESS LIMIT,3X,
     2 'DEAD LOAD',6X,'LIVE LOAD',6X,'SNOW LOAD',4X,4H DWN,3X,'NG',7X,
     3 'GIRDER IDENTIFICATION NUMBERS:')
      RETURN                                                            INPT0260
C     DEBUG SUBCHK                                                      INPT0270
      END
C
      SUBROUTINE INPUT3
C*****************************************************************
C*       READ IN MEMBER INFORMATION FOR ANALYSIS PROBLEM         *
C*****************************************************************
C
      SUBROUTINE INPUT3(AE,BASEA,MEMBS,EE,RHO,AREA1,SX,E1,RHO1,INC)     INP30010
      COMMON/PRT1/INN,IOUT,IOUT1                                        INP30020
      DIMENSION AE(1),AREA1(1),SX(1)                                    INP30030
      READ(INN,1)(AE(L),L=1,MEMBS)                                      INP30040
      IF(INC.EQ.1)GO TO 10                                              INP30050
      READ(INN,1)(AREA1(L),L=1,MEMBS)                                   INP30060
      READ(INN,1)(SX(L),L=1,MEMBS)                                      INP30070
      READ(INN,2)BASEA,EE,RHO,E1,RHO1                                   INP30080
      IF(RHO.EQ.0.)EE=E1                                                INP30090
    1 FORMAT(8F10.0)                                                    INP30100
    2 FORMAT(F10.0,2(F15.0,F10.0))                                      INP30110
   10 RETURN                                                            INP30120
C     DEBUG SUBCHK                                                      INP30130
      END
C
      SUBROUTINE LAT1
C*****************************************************************
C*              ATC EQUIVALENT LATERAL FORCE METHOD              *
C*****************************************************************
C
      SUBROUTINE LAT1(T,VBASE,CS,ISOINT,RM2,IFINAL,MODAL,RKK,NSTORY,    LAT10010
     1IFF,RKAPA,AMP,ECC,MT)
      COMMON/PRT1/INN,IOUT,IOUT1                                        LAT10020
      COMMON/CODE1/HT(30),WTT(4),WWW(30,4),KNODE(30,4)                  LAT10030
      COMMON/ATC1/V(30),DIS(30),DELT(30),RM(30),CV(30),TETA(30),PP(30), LAT10040
     1           SUMWF1(10),SUMWF2(10),WBARM(10),CSM(10),RMOMNT(31),
     2           VMODAL(10),RMMODE(31,10),DRIFMO(30,10),U(30,10),
     3           CVXM(30,10),FMODAL(30,10),DELXEM(30,10),VMMODE(30,10)
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NNNNN,MMMMM,NBRITL,
     1           ISH,NPREGR,NVREGR,IS,ISGL,IPILE,RKY,RKTETA,RR,VS,
     2           DSSS,HN,AA,AV,S,R,CO,RL,DELA(30)
      DIMENSION IFF(MT),RKAPA(MT)                                       LAT10060
      IF(IFINAL.EQ.1) GO TO 30                                          LAT10070
      IF(ISOINT.EQ.1) GO TO 22                                          LAT10080
      IF(MR.EQ.0) GO TO 12                                              LAT10090
      IF(ISF.EQ.1) GO TO 10                                             LAT10100
      CT=0.025                                                          LAT10110
      GO TO 11                                                          LAT10120
   10 CT=0.035                                                          LAT10130
   11 TA=CT*HN**(0.75)                                                  LAT10140
      GO TO 13                                                          LAT10150
   12 TA=0.05*HN/(SQRT(RL))                                             LAT10160
   13 CONTINUE                                                          LAT10170
      IF(MODAL.EQ.1) GO TO 14                                           LAT10180
      IF(T.GT.1.2*TA) T=1.2*TA                                          LAT10190
      GO TO 15                                                          LAT10200
   14 T=1.4*TA                                                          LAT10210
   15 CS=1.2*AV*S/(R*T**(2./3.))                                        LAT10220
      IF(ISOIL.NE.3.OR.AA.LT.0.3) GO TO 16                              LAT10230
      IF(CS.GT.2.0*AA/R)CS=2.0*AA/R                                     LAT10240
      GO TO 17                                                          LAT10250
   16 IF(CS.GT.2.5*AA/R) CS=2.5*AA/R                                    LAT10260
   17 VBASE=CS*WTT(1)                                                   LAT10270
      IF(MODAL.EQ.1) GO TO 100                                          LAT10280
      IF(T.LE.0.3) GO TO 21                                             LAT10290
      IF(T.GE.2.5) GO TO 20                                             LAT10300
      RKK=0.75+0.5*T                                                    LAT10310
      GO TO 22                                                          LAT10320
   20 RKK=2.                                                            LAT10330
      GO TO 22                                                          LAT10340
   21 RKK=1.                                                            LAT10350
   22 SUM1=0.                                                           LAT10360
      DO 23 I=1,NSTORY                                                  LAT10370
   23 SUM1=SUM1+WWW(I,1)*(HT(I)**RKK)                                   LAT10380
      DO 24 I=1,NSTORY                                                  LAT10390
      CV(I)=WWW(I,1)*(HT(I)**RKK)/SUM1                                  LAT10400
   24 FFF(I)=CV(I)*VBASE                                                LAT10410
C
C ------ STORY SHEAR FORCES ------
C
      DO 25 J=1,NSTORY                                                  LAT10420
      V(J)=0.                                                           LAT10430
      DO 25 I=J,NSTORY                                                  LAT10440
   25 V(J)=V(J)+FFF(I)                                                  LAT10450
C
C ------ STORY OVERTURNING MOMENT ------
C
   30 DO 31 J=1,NSTORY                                                  LAT10460
      RM(J)=0.                                                          LAT10470
      DO 31 I=J,NSTORY                                                  LAT10480
   31 RM(J)=RM(J)+FFF(I)*RKAPA(I)*(HT(I)-HT(J))                         LAT10490
      RM2=0.                                                            LAT10500
      DO 32 I=1,NSTORY                                                  LAT10510
   32 RM2=RM2+0.75*FFF(I)*HT(I)                                         LAT10520
      ECC=ABS(RM2/WTT(1))                                               LAT10530
  100 RETURN                                                            LAT10540
C     DEBUG SUBCHK                                                      LAT10550
      END
C
      SUBROUTINE LAT2
C*****************************************************************
C*                      ATC P-DELT EFECT                         *
C*****************************************************************
C
      SUBROUTINE LAT2(ISOINT,RM2,VBASE,MODAL,LOADS,NM,NN,NBNDRY,BASEAE  LAT20010
     1,NP,RKK,NSTORY,IBASE,SK,FS,DS,IBND,ICOL,IDIAG,FFF,RKAPA,AMP,ECC,
     2MAX,MT)
      COMMON/ABC/NZERO,NBEGIN,NDESIR,NITER,MDMAX,NNMAX                  LAT20020
      COMMON/PRT1/INN,IOUT,IOUT1                                        LAT20030
      COMMON/CODE1/HT(30),WTT(4),WWW(30,4),KNODE(30,4)                  LAT20040
      COMMON/ATC1/V(30),DIS(30),DELT(30),RM(30),CV(30),TETA(30),PP(30), LAT20050
     1           SUMWF1(10),SUMWF2(10),WBARM(10),CSM(10),RMOMNT(31),
     2           VMODAL(10),RMMODE(31,10),DRIFMO(30,10),U(30,10),
     3           CVXM(30,10),FMODAL(30,10),DELXEM(30,10),VMMODE(30,10)
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NNNNN,MMMMM,NBRITL,   LAT20060
     1           ISH,NPREGR,NVREGR,IS,ISGL,IPILE,RKY,RKTETA,RR,VS,
     2           DSSS,HN,AA,AV,S,R,CO,RL,DELA(30)
      DIMENSION ICOL(NNMAX),IDIAG(NNMAX),SK(MAX),IBND(50),FFF(MT),      LAT20070
     1          RKAPA(MT),FS(NNMAX,4),DS(NNMAX,4)
      IF(MODAL.EQ.1) GO TO 160                                          LAT20080
      IF(ISOINT.EQ.1) GO TO 140                                         LAT20090
C
C ------ ELASTIC ANALYSIS TO FIND DEFLECTION OF EACH STORY ------
```

```
     1               SUMWF1(10),SUMWF2(10),WBARM(10),CSM(10),RMOMNT(31),
     2               VMODAL(10),RMNODE(31,10),DRIFMO(30,10),U(30,10),
     3               CVXM(30,10),FMODAL(30,10),DELXEM(30,10),VMMODE(30,10)
      COMMON/ATC1/IACTLV,ISOIL,MR,ISF,IFIX,NANALS,NMNNN,MMMMM,NBRITL,
     1            ISH,MPREGR,NVREGR,IS,ISLCL,IPILE,RKY,AKTETA,RR,WS,
     2            DSSS,HN,AA,AV,S,A,CD,RL,DELA(30)                          LAT10050
      DIMENSION FFF(MT),RKAPA(MT)                                           LAT10060
      IF(IFINAL.EQ.1) GO TO 30                                              LAT10070
      IF(ISOINT.EQ.1) GO TO 22                                              LAT10080
      IF(MR.EQ.0) GO TO 12                                                  LAT10090
      IF(ISF.EQ.1) GO TO 10                                                 LAT10100
      CT=0.025                                                              LAT10110
      GO TO 11                                                              LAT10120
   10 CT=0.035                                                              LAT10130
   11 TA=CT*HN**(0.75)                                                      LAT10140
      GO TO 13                                                              LAT10150
   12 TA=0.05*HN/(SQRT(RL))                                                 LAT10160
   13 CONTINUE                                                              LAT10170
      IF(NODAL.EQ.1) GO TO 14                                               LAT10180
      IF(T.GT.1.2*TA) T=1.2*TA                                              LAT10190
      GO TO 15                                                              LAT10200
   14 T=1.4*TA                                                              LAT10210
   15 CS=(1.2*AV*S)/(R*T**(2./3.))                                          LAT10220
      IF((SOIL.NE.3.OR.AA.LT.0.3) GO TO 16                                  LAT10230
      IF(CS.GT.2.0*AA/R)CS=2.0*AA/R                                         LAT10240
      GO TO 17                                                              LAT10250
   16 IF(CS.GT.2.5*AA/R) CS=2.5*AA/R                                        LAT10260
   17 VBASE=CS*WT(1)                                                        LAT10270
      IF(NODAL.EQ.1) GO TO 100                                              LAT10280
      IF(T.LE.0.5) GO TO 21                                                 LAT10290
      IF(T.GE.2.5) GO TO 20                                                 LAT10300
      RKK=0.75+0.5*T                                                        LAT10310
      GO TO 22                                                              LAT10320
   20 RKK=2.                                                                LAT10330
      GO TO 22                                                              LAT10340
   21 RKK=1.                                                                LAT10350
   22 SUM1=0.                                                               LAT10360
      DO 23 I=1,NSTORY                                                      LAT10370
   23 SUM1=SUM1+WWW(I,1)*(HT(I)**RKK)                                       LAT10380
      DO 24 I=1,NSTORY                                                      LAT10390
      CV(I)=WWW(I,1)*(HT(I)**RKK)/SUM1                                      LAT10400
   24 FFF(I)=CV(I)*VBASE                                                    LAT10410
C                                                                           
C     ------ STORY SHEAR FORCES ------                                      
C                                                                           
      DO 25 J=1,NSTORY                                                      LAT10420
      VJ(J)=0.                                                              LAT10430
      DO 25 I=J,NSTORY                                                      LAT10440
   25 VJ(J)=VJ(J)+FFF(I)                                                    LAT10450
C                                                                           
C     ------ STORY OVERTURNING MOMENT ------                                
C                                                                           
   30 DO 31 J=1,NSTORY                                                      LAT10460
      RM(J)=0.                                                              LAT10470
      DO 31 I=J,NSTORY                                                      LAT10480
   31 RM(J)=RM(J)+FFF(I)*RKAPA(I)*(HT(I)-HT(J))                             LAT10490
      RM2=0.                                                                LAT10500
      DO 32 I=1,NSTORY                                                      LAT10510
   32 RM2=RM2+0.75*FFF(I)*HT(I)                                             LAT10520
      ECC=ABS(RM2/WT(1))                                                    LAT10530
  100 RETURN                                                                LAT10540
C     DEBUG SUBCHK                                                          
      END                                                                   LAT10550
C                                                                           
      SUBROUTINE LAT2;                                                      
C*****************************************************************        
C*                                                               *        
C*                        ATC P-DEL1 EFECT                       *        
C*****************************************************************        
C                                                                           
      SUBROUTINE LAT2(ISOINT,RM2,VBASE,NODAL,LOADS,NN,NN1,NBNDRY,BASEAE  LAT20010
     1,NP,RKK,NSTORY,IIBASE,SK,FS,DS,IBND,ICOL,IDIAG,FFF,RKAPA,AMP,ECC,
     2MAX,MT)                                                               
      COMMON/ABC/NZERO,NBEGIN,NDESIR,NITER,MOMAX,NNMAX                  LAT20020
      COMMON/PRT1/INN,IOUT,JOUT                                         LAT20030
      COMMON/CODE1/HT(30),WTT(4),WWW(30,4),KNODE(30,4)                  LAT20040
      COMMON/ATC1/V(30),DIS(30),DELT(30),AM(30),CV(30),TETA(30),PP(30), LAT20050
     1            SUMWF1(10),SUMWF2(10),WBARM(10),CSM(10),RMOMNT(31),
     2            VMODAL(10),RMNODE(31,10),DRIFMO(30,10),U(30,10),
     3            CVXM(30,10),FMODAL(30,10),DELXEM(30,10),VMMODE(30,10)
      COMMON/ATC1/IACTLV,ISOIL,MR,ISF,IFIX,NANALS,NMNNN,MMMMM,NBRITL.   LAT20060
     1            ISH,MPREGR,NVREGR,IS,ISLCL,IPILE,RKY,AKTETA,RR,WS,
     2            DSSS,HN,AA,AV,S,A,CD,RL,DELA(30)                          
      DIMENSION ICOL(NNMAX),IDIAG(NNMAX),SK(MAX),IBND(50),FFF(MT),      LAT20070
     1          RKAPA(MT),FS(NNMAX,4),DS(NNMAX,4)                           
      IF(NODAL.EQ.1) GO TO 160                                          LAT20080
      IF(ISOINT.EQ.1) GO TO 140                                         LAT20090
C                                                                           
C     ------ ELASTIC ANALYSIS TO FIND DEFLECTION OF EACH STORY ------      
C                                                                           
      WRITE(IOUT,1000)                                                  LAT20100
      DO 4965 I=1,NN                                                    LAT20110
 4965 FS(I,1)=0.                                                        LAT20120
C     WRITE(IOUT,1010)(I,FFF(I)),I=1,NSTORY)                            
      DO 110 I=1,NSTORY                                                 LAT20130
      II=3*KNODE(I,1)-2                                                 LAT20140
  110 FS(II,1)=FFF(I)*1000.                                             LAT20150
      CALL REDUCE(IFS,IBND,NN,NBNDRY,1,NNMAX)                           LAT20160
      CALL GAUSSISK,FS,DS,LOADS,NN,NNMAX,0,ICOL,IDIAG)                  LAT20170
      CALL RESTORIDS,IBND,NN,NBNDRY,1,NNMAX)                            LAT20180
      DO 120 I=1,NSTORY                                                 LAT20190
      II=3*KNODE(I,1)-2                                                 LAT20200
  120 DIS(I)=DS(II,1)/BASEAE                                            LAT20210
      DO 130 I=1,NSTORY                                                 LAT20220
  130 DIS(I)=DIS(I)                                                     LAT20230
      IF(NP.EQ.1)GO TO 300                                              LAT20240
C                                                                           
C     ------ STORY DRIFTS ------                                            
C                                                                           
  140 DO 150 I=2,NSTORY                                                 LAT20250
  150 DELT(I)=ABS(DIS(I)-DIS(I-1))                                      LAT20260
      DELT(1)=ABS(DIS(1))                                               LAT20270
C 160 WRITE(IOUT,1050)(I,DELT(I)),I=1,NSTORY)                           LAT20280
  160 CONTINUE                                                          LAT20290
C                                                                           
C     ------ STORY DRIFTS CHECK WITH ALLOWABLE VALUE ------                 
C                                                                           
    2 DO 180 I=1,NSTORY                                                 LAT20300
      IF(DELT(I).GT.DEL(I)) GO TO 200                                   LAT20310
  180 CONTINUE                                                          LAT20320
      IIBASE=0                                                          LAT20330
      GO TO 210                                                         LAT20340
C                                                                           
C     ------ IF STORY DRIFTS LARGER THAN ALLOWABLE VALUE, THEN SCALE ------
C     ------    THE SCALING FACTOR AND REDESIGN THE STRUCTURE.    ------
C                                                                           
  200 AMP=DELT(1)/DEL(1)                                                LAT20350
      DO 201 I=2,NSTORY                                                 LAT20360
      AMP1=DELT(I)/DEL(I)                                               LAT20370
      IF(AMP.LT.AMP1) AMP=AMP1                                          LAT20380
  201 CONTINUE                                                          LAT20390
      IIBASE=1                                                          LAT20400
      GO TO 300                                                         LAT20410
C                                                                           
C     ------ CALCULATE STABILITY COEFFICIENTS ------                        
C                                                                           
  210 CONTINUE                                                          LAT20420
      DO 220 J=1,NSTORY                                                 LAT20430
      PP(J)=0.                                                          LAT20440
      DO 220 I=J,NSTORY                                                 LAT20450
      PP(J)=PP(J)+WWW(I,1)                                              LAT20460
  220 CONTINUE                                                          LAT20470
      DO 230 I=1,NSTORY                                                 LAT20480
  230 TETA(I)=(PP(I)*DELT(I))/(V(I)*HT(I)*CD*12.)                       LAT20490
      IF(TETA(1).GT.0.1)GO TO 241                                       LAT20500
      DO 240 I=1,NSTORY                                                 LAT20510
  240 CONTINUE                                                          LAT20520
      GO TO 270                                                         LAT20530
  241 DO 250 I=1,NSTORY                                                 LAT20540
C     AI=-.4*TETA(I)/(1.-TETA(I))                                       
      AI=0.9/(1.-TETA(I))                                               LAT20550
      IF(AI.LT.1.01)AI=1.0                                              LAT20560
      V(I)=V(I)*AI                                                      LAT20570
  250 DELT(I)=DELT(I)*AI                                                LAT20580
 1160 FFF(NSTORY)=V(NSTORY)                                             LAT20590
      N=NSTORY-1                                                        LAT20600
      DO 260 I=1,N                                                      LAT20610
  260 FFF(I)=V(I)-V(I+1)                                                LAT20620
      IF(NODAL.EQ.1) GO TO 270                                          LAT20630
      CALL LAT1(T,VBASE,CS,0,RM2,1,0,RKK,NSTORY,FFF,RKAPA,AMP,ECC,MT)   LAT20640
  270 CONTINUE                                                          LAT20650
C     WRITE(IOUT,1030)                                                  
C     WRITE(IOUT,1010)(I,FFF(I)),I=1,NSTORY)                            
  300 CONTINUE                                                          LAT20660
 1000 FORMAT(/3X,' INITIAL  LATERAL F TO BE CHECKED BY DIS & P-DELTA',  LAT20670
     1/,'+',3X,'_____',/,'+',5X,'STORY NO.',5X,'_____',/)               
 1050 FORMAT(5X,I10,5X,E15.6)                                           LAT20680
C    1'VALUE (IN)',/,'+',18X,15,5X,E15.6))                              
 1006 FORMAT(5X,' STABILITY COEFFICIENT',/,'+',5X,'_____',//,8X,'STORY' LAT20690
     1 NO.',7X,' VALUE ',/,'+',18X,15,5X,E15.6)                         
 1010 FORMAT(5X,' LATELAL FORCES',/,'+',5X,'_____',//,8X,'STORY'        LAT20700
     1NO.',5X,'VALUE (KIPS)',/,'+',18X,15,5X,E15.6))                    
 1030 FORMAT(/3X,' FINAL DESIGN VALUE CHECKED BY DIS & P-DELTA'/,       LAT20710
     1'+',3X,'_____',/)                                                 
      RETURN                                                            LAT20720
C     DEBUG SUBCHK                                                      
      END                                                               LAT20730
```

```
C
C     SUBROUTINE LOADIN:
C ***********************************************************
C *     READ AND PRINT STATIC OR DYNAMIC LOADING INFORMATION    *
C ***********************************************************
C
      SUBROUTINE LOADIN(FR,FV,XG,NN,L,INC,PT,H1,H2,ND,M,NSOIL                LOAD0010
     *,NDUCTY,NN,WS,NSTORY,ICODE,IDESGT,RKAPA,LATDSP,FACTDL,FACTLL,
     *FACTSL,FACTEL,HTS,AHMX,AVMX)
      COMMON/PRT1/INN,IOUT,IOUT1
      COMMON/ATC1/IACTLY,ISOIL,AR,ISF,IFIX,NANALS,MNNNN,MMMMM,NBRITL,        LOAD0030
     1           ISH,NPAEGR,NVREGR,IS,ISLGL,IPILE,RKY,RKTETA,RR,VS,
     2           DSSS,MM,AA,AV,AA,CO,BL,DELA(30)
      COMMON/ATC2/NBEAM(30),NCONT(30),NOCONT(30,20),NOBEAM(30,10)            LOAD0040
      COMMON/DATA/F(4),XV(4),MT(4),MO(4),NZ(4),NT(4),DEL(4),NNN              LOAD0050
      COMMON/ACODE/Z(4),C1(4),CK(4),TS(4)                                    LOAD0060
      COMMON/BCODE/CII,ALPHMX,NSOIL                                          LOAD0070
      COMMON/CODE1/HT(30),WT(4),NWM(30,4),KNODE(30,4)                        LOAD0080
      INTEGER TITLE(10)                                                      LOAD0090
      DIMENSION RKAPA(NTS),IM(3),JM(3),TFR(3),NSOIL(L),NDUCTY(L),            LOAD0100
     1          FACTDL(L),FACTLL(L),FACTSL(L),FACTEL(L),AHMX(L),AVMX(L),
     2          PT(ND,L),H1(ND,L),H2(ND,L),XS(300,1),WS(NTS,L),
     3          FR(NN,L),FV(NN,L)
C
      LII=L                                                                  LOAD0110
      IF(ICODE.NE.1.AND.ICODE.NE.5)LII=1                                     LOAD0120
      DO 400 J=1,LII                                                         LOAD0130
      READ(INN,1000) NJ,MO,NZ(J),NNM,F(J),XV(J),DEL(J),NT(J),TITLE           LOAD0140
      MT(J)=NJ                                                               LOAD0150
      MO(J)=MO                                                               LOAD0160
      IF(NJ) 20,20,10                                                        LOAD0170
   10 KH=NJ                                                                  LOAD0180
      WRITE(IOUT,2000) J,TITLE                                               LOAD0190
   11 IF(KH-3)12,12,13                                                       LOAD0200
   12 KX=KH                                                                  LOAD0210
      GO TO 14                                                               LOAD0220
   13 KX=3                                                                   LOAD0230
   14 READ(INN,1001) (TFR(I),IM(I),JM(I),I=1,KX)                             LOAD0240
      DO 15 I=1,KX                                                           LOAD0250
      WRITE(IOUT,2001) JM(I),IM(I),TFR(I)                                    LOAD0260
      KY=NN*JM(I)-NN+IM(I)                                                   LOAD0270
      FR(KY,J)=FR(KY,J)+TFR(I)                                               LOAD0280
   15 CONTINUE                                                               LOAD0290
      KH=KH-KX                                                               LOAD0300
      IF(KH)20,20,11                                                         LOAD0310
C
   20 CONTINUE                                                               LOAD0320
      IF(INC) 50,50,21                                                       LOAD0330
   21 KSTEP=1                                                                LOAD0340
      M1=MO                                                                  LOAD0350
      IF(MO.LE.0) M1=1                                                       LOAD0360
      IF(NJ) 22,30,30                                                        LOAD0370
   22 DO 23 I=1,N                                                            LOAD0380
      XS(I,1)=0.                                                             LOAD0390
   23 CONTINUE                                                               LOAD0400
      DO 25 I=M1,N,MM                                                        LOAD0410
      XS(I,1)=1.0                                                            LOAD0420
   25 CONTINUE                                                               LOAD0430
      IF(KSTEP.GT.1) GO TO 27                                                LOAD0440
      DO 26 I=1,N                                                            LOAD0450
      FR(I,J)=XS(I,1)                                                        LOAD0460
   26 CONTINUE                                                               LOAD0470
C
   27 IF(MO) 28,28,30                                                        LOAD0480
   28 KSTEP=KSTEP+1                                                          LOAD0490
      M1=M1+1                                                                LOAD0500
      IF(KSTEP.EQ.2) GO TO 22                                                LOAD0510
      DO 29 I=1,N                                                            LOAD0520
      FV(I,J)=XS(I,1)                                                        LOAD0530
   29 CONTINUE                                                               LOAD0540
   30 WRITE(IOUT,2002) J,TITLE,MO,NNM,F(J),XV(J),NZ(J)                       LOAD0550
C
      NTP=NZ(J)                                                              LOAD0560
      GO TO(36,36,37),NTP                                                    LOAD0570
C
   36 READ(INN,1002) (PT(I,J),I=1,NNM)                                       LOAD0580
      READ(INN,1002) (H1(I,J),I=1,NNM)                                       LOAD0590
      IF(NZ(J).EQ.2) GO TO 31                                                LOAD0600
      WRITE(IOUT,2003) DEL(J),NT(J)                                          LOAD0610
   31 WRITE(IOUT,2004)                                                       LOAD0620
      IF(MO .LT. 0) GO TO 33                                                 LOAD0630
      DO 32 I=1,NNM                                                          LOAD0640
   32 WRITE(IOUT,2005) I,PT(I,J),H1(I,J)                                     LOAD0650
      GO TO 35                                                               LOAD0660
   33 READ(INN,1002) (H2(I,J),I=1,NNM)                                       LOAD0670
      DO 34 I=1,NNM                                                          LOAD0680
   34 WRITE(IOUT,2005) I,PT(I,J),H1(I,J),H2(I,J)                             LOAD0690
   35 IF(NNN .LT.NNM) NNN=NNM                                                LOAD0700
      GO TO 40                                                               LOAD0710
   37 READ(INN,1006)NDUCTY(J),NSOIL(J),AHMX(J),AVMX(J)                       LOAD0720
      IF(NDUCTY(J).EQ.0)GO TO 38                                             LOAD0730
      WRITE(IOUT,2012)NDUCTY(J)                                              LOAD0740
      GO TO 40                                                               LOAD0750
   38 IF(NSOIL(J).EQ.0)GO TO 39                                              LOAD0760
      IF(NSOIL(J).GT.4)GO TO 41                                              LOAD0770
      WRITE(IOUT,2011)NSOIL(J)                                               LOAD0780
      GO TO 40                                                               LOAD0790
   41 IF(NSOIL(J).GT.7)GO TO 42                                              LOAD0791
      LSOIL=NSOIL(J)-4                                                       LOAD0792
      WRITE(IOUT,2018)LSOIL,AHMX(J),AVMX(J)                                  LOAD0793
      GO TO 40                                                               LOAD0794
   42 LSOIL=NSOIL(J)-7                                                       LOAD0795
      WRITE(IOUT,2019)LSOIL                                                  LOAD0796
      GO TO 40                                                               LOAD0797
   39 WRITE(IOUT,2016)                                                       LOAD0800
   40 IF(NJ .LT. 0) F(J)=F(J)*XG                                             LOAD0810
   50 IF(LATDSP.EQ.3)GO TO 61                                                LOAD0820
      IF(ICODE.EQ.5 .AND. IDESGT.NE.1)GO TO 400                              LOAD0830
   61 READ(INN,1006)(KNODE(I,J),HT(I),WS(I,J)),I=1,NSTORY)                  LOAD0840
      GO TO (62,62,62,63,66),ICODE                                           LOAD0850
   62 WRITE(IOUT,2010)(I,KNODE(I,J),HT(I),WS(I,J)),I=1,NSTORY)               LOAD0860
      GO TO 64                                                               LOAD0870
   63 WRITE(IOUT,2009)(I,KNODE(I,J),HT(I),I=1,NSTORY)                        LOAD0880
   64 IF(ICODE.NE.2 .AND. ICODE.NE.4)GO TO 66                                LOAD0890
      DO 52 I=1,NSTORY                                                       LOAD0900
      HT(I)=HT(I)*12.                                                        LOAD0910
   52 WS(I,J)=WS(I,J)/1000.                                                  LOAD0920
C
   66 GO TO (60,65,70,80,4001),ICODE                                         LOAD0930
C
   60 IF(NJ.GE.0)GO TO 400                                                   LOAD0940
      READ(INN,1003) Z(J),C1(J),CK(J),TS(J)                                  LOAD0950
      WRITE(IOUT,2006)J,Z(J),C1(J),CK(J),TS(J)                               LOAD0960
      GO TO 400                                                              LOAD0970
   65 CALL ATC(IF(NSTORY,RKAPA)                                              LOAD0980
      GO TO 410                                                              LOAD0990
   70 READ(INN,1004)CII,ALPHMX,NSOIL                                         LOAD1000
      WRITE(IOUT,2007)CII,ALPHMX,NSOIL                                       LOAD1010
      GO TO 410                                                              LOAD1020
   80 READ(INN,1002)BAYWTH,HGRADT,VGRADT,POWER,CPEA,CPEB,CPIA,CPIB,          LOAD1030
     1GUSTF                                                                  LOAD1040
      WRITE(IOUT,2008)BAYWTH,HGRADT,VGRADT,POWER,GUSTF,CPEA,CPEB,CPIA        LOAD1050
     1,CPIB                                                                  LOAD1060
      M1=NSTORY+1                                                            LOAD1070
      CALL WIND1(NSTORY,FR,NN,L,N1,CPIA,CPIB,CPEA,CPEB,GUSTF,BAYWTH,         LOAD1080
     1HGRADT,VGRADT,POWER)                                                   LOAD1090
C
  410 DO 411 I=1,NSTORY                                                      LOAD1100
      DO 411 K=2,L                                                           LOAD1110
  411 KNODE(I,K)=KNODE(I,1)                                                  LOAD1120
  400 CONTINUE                                                               LOAD1130
      GO TO (72,72,72,501,73),ICODE                                          LOAD1140
   72 WRITE(IOUT,2013)                                                       LOAD1150
   73 IF(INC.EQ.0.AND.ICODE.EQ.5)GO TO 501                                   LOAD1151
      IF(ICODE.EQ.5.AND.IDESGT.EQ.-1)GO TO 501                               LOAD1152
      IF(NSTORY.LE.0)GO TO 501                                               LOAD1153
      DO 76 I=1,NSTORY                                                       LOAD1160
      READ(INN,1005) NBBBB,NNCON,(NOBEAM(I,M),M=1,NBBBB),(NOCONT(I,M),M=     LOAD1170
     *1,NNCON)                                                               LOAD1180
      NBEAM(I)=NBBBB                                                         LOAD1190
      NCONT(I)=NNCON                                                         LOAD1200
      GO TO (74,74,74,76,76),ICODE                                           LOAD1210
   74 WRITE(IOUT,2014)I,(NOBEAM(I,M),M=1,NBBBB),(NOCONT(I,M),M=1,NNCON)      LOAD1220
   76 CONTINUE                                                               LOAD1230
  501 IF(INC.EQ.1)GO TO 500                                                  LOAD1240
      DO 502 J=1,L                                                           LOAD1250
      READ(INN,1003)FACTDL(J),FACTLL(J),FACTSL(J),FACTEL(J)                  LOAD1260
      WRITE(IOUT,2017)J,FACTDL(J),FACTLL(J),FACTSL(J),FACTEL(J)              LOAD1270
  502 CONTINUE                                                               LOAD1280
C
 1000 FORMAT(4I5,3F5.0,I5,10A4)                                              LOAD1290
 1001 FORMAT(3(F10.0,2I5))                                                   LOAD1300
 1002 FORMAT(8F10.0)                                                         LOAD1310
 1003 FORMAT(4F5.0)                                                          LOAD1320
 1004 FORMAT(2F10.0,I5)                                                      LOAD1330
 1005 FORMAT(16I5)                                                           LOAD1340
 1006 FORMAT(2I5,2F10.0)                                                     LOAD1350
 2000 FORMAT(/3X,34H JOINT LOADS FOR LOADING CONDITION,I2,5H ... ,10A4/      LOAD1360
     1 4X,6H JOINT,4X,10H DIRECTION,15X,6H VALUE)
 2001 FORMAT(2I10,13X,F15.5)                                                 LOAD1370
 2002 FORMAT(/3X,27H DATA FOR LOADING CONDITION,I2,5H ... ,10A4/             LOAD1380
     1 5X,40H MOTION TYPE CODE----------------------,I5/
     2 5X,58H     LT. 0:  HORIZONTAL + VERTICAL MOTIONS                  /
     3 5X,58H     GT. 0:  HORIZONTAL = 1 ,  VERTICAL = 2 ,               /
     4 5X,40H NUMBER OF ACCELERATION DATA-----------,I5/
     5 5X,40H LOAD MULTIPLIER-----------------------,F7.3/
```

```
     6 5X,40H SCALE FACTOR FOR VERTICAL MOTION--------,F7.3/
     7 5X,40H TYPE OF INPUT ACCELERATION DATA---------,I5/
     8 5X,'   EQ. 1:  TIME-HISTORY DATA ;   EQ. 2:  SPECTRUM DATA ;',
     9 5X,'   EQ. 3:  CURVE FITTING SPECTRUM DATA',/)
2003 FORMAT(5X,40H TIME INCREMENT----------------------,F7.3/       LOAD1390
     1 5X,40H NUMBER OF TIME STEPS-------------------,I5)
2004 FORMAT(/5X,15H ACCELERATION DATA:)                            LOAD1400
2005 FORMAT(I10,3F15.5)                                            LOAD1410
2006 FORMAT(/3X,110H THE LATERAL EQUIVALENT STATIC LOADS ARE COMPUTED ALOAD1420
     *CCORDING TO THE REQUIREMENTS SPECIFIED IN THE 1976 UNIFORM /
     1 3X,' BUILDING CODE WITH THE FOLLOWING INPUT INFORMATIONS FOR LOAD
     2ING CONDITION :',I5/,
     3 5X,40H EARTHQUAKE-ZONE COEFFICIENT, Z----------,F7.3/
     4 5X,40H IMPORTANT FACTOR OF BUILDING, I---------,F7.3/
     5 5X,40H STIFFNESS COEFFICIENT, K---------------,F7.3/
     6 5X,40H ESTIMATED SITE PERIOD, TS--------------,F7.3//)
2007 FORMAT(/3X,' CHINESE BUILDING CODE GENERAL INFORMATION :',/,      LOAD1430
     2 5X,40H STAUCTURAL INFLUENCE COEFFICIENT, C-----,F7.3/
     3 5X,40H MAX. EARTHQUAKE INFLUENCE COEFF, -------,F7.3/
     4 5X,40H SOIL TYPE ------------------------------,2X,I5//)
2008 FORMAT(/3X,' THE EQUIVALENT STATIC WIND LOADS ARE COMPUTED ACCORDILOAD1440
     *NG TO THE MEAN WIND SPEED WHICH IS CALCULATED BY USING POWER LOW',
     1/3X,' EQUATION WITH THE FOLLOWING INPUT INFORMATIONS :-',/
     2 5X,40H BAY WIDTH (IN)-------------------------,F10.3/
     3 5X,40H GRADIENT HEIGH (IN)--------------------,F10.3/
     4 5X,40H GRADIENT VELOCITY (MILES/HOUR)---------,F10.3/
     5 5X,40H POWER LAW COEFFICIENT------------------,F10.3/
     6 5X,40H GUEST FACTOR ---------------------------,F10.3/
     7 5X,40H EXT. PRES. COEFF. ON WINDWARD WALL-----,F10.3/
     8 5X,40H EXT. PRES. COEFF. ON LEEWARD WALL------,F10.3/
     9 5X,40H INT. PRES. COEFF. ON WINDWARD WALL-----,F10.3/
     1 5X,40H INT. PRES. COEFF. ON LEEWARD WALL------,F10.3//)
2010 FORMAT(//,3X,10H STORY NO.,3X,5H NODE,5X,13H STORY HEIGHT,5X,     LOAD1450
     8 13H STORY WEIGHT,/,(4X,I5,5X,I5,7X,F13.3,5X,F13.3))
2009 FORMAT(//,3X,10H STORY NO.,3X,5H NODE,5X,13H STORY HEIGHT,        LOAD1460
     8/,(4X,I5,5X,I5,7X,F13.3))
2011 FORMAT(//,5X,' SEED''S ACCLERATION SPECTRA :',/,                  LOAD1470
     1 5X,40H SOIL TYPE ------------------------------,I5/
     2 8X,'EQ. 1: ROCK ;',/
     3 8X,'EQ. 2: STIFF SITE CONDITION ;',/
     4 8X,'EQ. 3: DEEP COHESIONLESS SOIL ;',/
     5 8X,'EQ. 4: SOFT TO MEDIUN CLAY AND SAND .',///)
2018 FORMAT(//,5X,' CHINESE CODE ACCLERATION SPECTRA :',/,              LOAD1480
     16X,'SOIL TYPE ----------------------------------',I5/
     26X,'EARTHQUAKE INFLUENCE COEFF. FOR HORIZONTAL DIRECTION--',F10.3/
     36X,'EARTHQUAKE INFLUENCE COEFF. FOR VERTICAL DIRECTION----',F10.3/
     4/)
2019 FORMAT(//,5X,' NORMALIZED ACCELERATION SPECTRA RECOMMENED BY ATC-3LOAD1490
     1 FIGURE (I=9 ;----------',I5/
     28X,'EQ. 1: SOIL TYPE 1 ;',/,8X,'EQ. 2: SOIL TYPE 2 ;',/,
     38X,'EQ. 3: SOIL TYPE 3 AND EFFECTIVE PEAK GROUND ACCELERATION IS L
     4ESS THAN 0.3 ;',/8X,'EQ. 4: SOIL TYPE 3 AND EFFECTIVE PEAK GROUND
     6ACCELERATION IS GREATER THAN OR EQUAL TO 0.3 .',///)
2012 FORMAT(//,3X,' USE NEWMARK SPECTRUN TO FIND MAXIMUM ACCLERATION DALOAD1500
     1TA',/5X,'THE CURVE IS CORRESPONDING TO DESIGN SPECTRA :',I5,/
     4,8X,'EQ. 1: 50 PERCENTILE, 5% DAMPING, ALLUVIUM ;',/
     5,8X,'EQ. 2: 90 PERCENTILE, 5% DAMPING, ALLUVIUM ;',/
     4 8X,'EQ. 3: DUCTILITY 3, 5% DAMPING ;',/
     5 8X,'EQ. 4: DUCTILITY 4, 10% DAMPING .',///)
2013 FORMAT(//4X,'MEMBERS CONTRIBUTING THEIR WEIGHT TO EACH FLOOR :',//LOAD1510
     15X,' FLOOR LEVEL',5X,'NO. OF MEMBERS THAT CONTRIBUTING THEIR WEIGH
     2T TO THE FLOOR')
2014 FORMAT(8X,I5,9X,2015/,(22X,2015))                             LOAD1520
2015 FORMAT(//,15X,' HOUSNER''S AVERAGE RESPONSE SPECTRUM ',/)     LOAD1530
2017 FORMAT(//3X,' LOAD COMBINATION FACTORS FOR LOADING CONDITION',I5,/LOAD1540
     1 5X,40H DEAD LOAD ------------------------------,F5.1/
     2 5X,40H LIVE LOAD ------------------------------,F5.1/
     3 5X,40H SNOW LOAD ------------------------------,F5.1/
     4 5X,40H EARTHQUAKE LOAD ------------------------,F5.1/)
  500 RETURN                                                       LOAD1550
C     DEBUG SUBCHK
      END                                                          LOAD1560

C     SUBROUTINE MLTPLY:
C*****************************************************************
C*          MULTIPLICATION OF A MATRIX WITH A VECTOR             *
C*****************************************************************
C
      SUBROUTINE MLTPLY(A,B,C,L,N,NN,IC,ID)                        MLTP0010
      DIMENSION A(1),ID(1),IC(1),B(NN,L),C(NN,L)                   MLTP0020
      DO 10 I = 1,M                                                MLTP0030
      DO 4 K = 1,L                                                 MLTP0040
    4 B(I,K) = 0.0                                                 MLTP0050
      DO 9 J = 1,N                                                 MLTP0060
      IF (J - 1) 6,6,7                                             MLTP0070
    6 IF (IC(1) .GT. J) GO TO 9                                    MLTP0080
      IX = ID(1) + J - 1                                           MLTP0090
      GO TO 8                                                      MLTP0100
      IF (IC(J) .GT. I) GO TO 9                                    MLTP0110
    7 IX = ID(J) + I - J                                           MLTP0120
    8 DO 5 K = 1,L                                                 MLTP0130
      B(I,K) = B(I,K) + A(IX)*C(J,K)                               MLTP0140
    5 CONTINUE                                                     MLTP0150
    9 CONTINUE                                                     MLTP0160
   10 CONTINUE                                                     MLTP0170
      RETURN                                                       MLTP0180
C     DEBUG SUBCHK
      END                                                          MLTP0190

C     SUBROUTINE MODALA:
C*****************************************************************
C*          ATC MODEL ANALYSIS METHOD                            *
C*****************************************************************
C
      SUBROUTINE MODALA(IT,T,NSTORY,IIBASE,SK,DS,FS,IBND,ICOL,IDIAG,FFF MODA0010
     1,RKAPA,AMP,IREQDM,RM3,MAX,MI,NMAX)
      COMMON/PRI/INN,IOUT,IOUT                                     MODA0020
      COMMON/CODE1/HT(30),WTT(4),WWW(30,4),KNODE(30,4)             MODA0030
      COMMON/ATC1/VI(30),DIS(30),DELTI(30),AMI(30),CVI(30),TETA(30),PP(30), MODA0040
     1           SUMWF1(10),SUMWF2(10),WBARM(10),CSM(10),RMOMNT(311,
     2           VMODAL(10),RMMODE(31,10),DRIFMO(30,10),U(30,10),
     3           CVXM(30,10),FMODAL(30,10),DELXEM(30,10),VMMODE(30,10)
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NNNNN,MMMMM,NBRITL,  MODA0050
     1           ISH,MPAEGR,NYREGR,IS,ISLGL,IPTLE,RKY,AKTETA,RR,VS,
     2           DSSSS,HN,AA,AV,S,R,CD,RL,DELA(30)
      DIMENSION TT(10),SK(MAX),IBND(50),ICOL(NNMAX),IDIAG(NNMAX),      MODA0060
     1          FFF(MI),RKAPA(MI),FS(NNMAX,4),DS(NNMAX,4)

C     ****************************************************************
C     *  FMODAL(I,M) : MODAL FORCE OF I-TH STORY OF M-TH MODE        *
C     *  DRIFMO(I,M) : MODAL DRIFT OF I-TH STORY OF M-TH MODE        *
C     *  VMMODE(J,M) : MODAL STORY SHEAR OF J-TH STORY OF M-TH MODE  *
C     *  RMMODE(NSTORY+1,M) : OVERTURNING MOMENT AT BASE OF MMM-TH MODE *
C     *  VMODE(I)    : COMBINED SHEAR OF I-TH STORY                  *
C     *  VMODAL(M)   : BASE SHEAR OF M-TH MODE                       *
C     *  DELTI(I)    : COMBINED DRIFT OF I-TH FLOOR                  *
C     *  DIS(I)      : COMBINED DEFLECTION OF I-TH FLOOR             *
C     *  RMOMNT(I)   : OVERTURNING MOMENT OF I-TH STORY OF MODAL ANALYSIS *
C     *  VTMODL      : BASE SHEAR                                    *
C     *  VLWAVE      : BASE SHEAR CORRESPONDING TO THE FUNDAMENTAL MODE *
C     *                WHEN SOIL STRUCTURAL INTERACTION IS CONSIDERED *
C     ****************************************************************
C
      ISOINT=0                                                     MODA0070
      CALL  LATI(T,VBASE,CS,0,RM2,0,1,RKK,NSTORY,FFF,RKAPA,AMP,ECC,MI) MODA0080
C                                                                  MODA0090
      KKK=1                                                        MODA0100
C     WRITE(IOUT,800)                                              MODA0110
      DO 35 M=1,IREQDM                                             MODA0120
      SUMWF1(M)=0.                                                 MODA0130
      SUMWF2(M)=0.                                                 MODA0140
      WBARM(M)=0.                                                  MODA0150
      CSM(M)=0.                                                    MODA0160
      DO 30 I=1,NSTORY                                             MODA0170
      SUMWF1(M)=SUMWF1(M)+WWW(I,1)*U(I,M)                          MODA0180
   30 SUMWF2(M)=SUMWF2(M)+WWW(I,1)*U(I,M)*U(I,M)                   MODA0190
      A2=SUMWF1(M)*SUMWF1(M)                                       MODA0200
      WBARM(M)=A2/SUMWF2(M)                                        MODA0210
   35 CONTINUE                                                     MODA0220
 1000 CONTINUE                                                     MODA0230
      MMM=IREQDM                                                   MODA0240
      IF(KKK-EQ.0)MMM=1                                            MODA0250
      DO 100 M=1,MMM                                               MODA0260
      IF(TT(M).GT.4.) GO TO 40                                     MODA0270
      CSM(M)=1.2*AV*S/(R*TT(M)**(2./3.))                           MODA0280
      IF(ISOIL.NE.3) GO TO 49                                      MODA0290
      IF(M.NE.1.AND.TT(M).LT.0.3) CSM(M)=AA*(0.8+4.*TT(M))/R       MODA0300
      GO TO 38                                                     MODA0310
   40 CSM(M)=3.*AV*S/(R*TT(M)**(4./3.))                            MODA0320
   38 IF(ISOIL.EQ.3.AND.AA.GE.0.3)GO TO 41                         MODA0330
   49 IF(CSM(M).GT.(2.5*AA/R)) CSM(M)=2.5*AA/R                     MODA0340
      GO TO 100                                                    MODA0350
   41 IF(CSM(M).GT.(2.*AA/R)) CSM(M)=2.*AA/R                       MODA0360
  100 CONTINUE
C
C     FOLLOWING STATEMENT MEANS RETURN TO SOIL-STRUCTURAL INTERACTION
C     AFTER OBTAINING CSM(1).
C     IF(ISOINT.EQ.1) GO TO 1500                                   MODA0370
C
C
      DO 50 M=1,IREQDM                                             MODA0380
      VMODAL(M)=0.                                                 MODA0390
   50 VMODAL(M)=CSM(M)*WBARM(M)                                    MODA0400
C
```


80

```
C     OBTAIN CVXM(I,M) TO CALCULATE MODAL FORCES FMODAL(I,MMM)
C
 2000 CONTINUE                                                          MODA0410
      DO 60 M=1,NMM                                                     MODA0420
      DO 60 I=1,NSTORY                                                  MODA0430
      CVXM(I,M)=WMM(I,1)*U(I,M)/SUMWF1(M)                               MODA0440
      FMODAL(I,M)=CVXM(I,M)*VMODAL(M)                                   MODA0450
      IF(KKK.EQ.1)DELXEM(I,M)=0.01563*CD*FMODAL(I,M)*(TT(M)**2)/WMM(I,1)MODA0460
   60 CONTINUE                                                          MODA0470
C
C
      DO 62 M=1,NMM                                                     MODA0480
      DO 61 I=2,NSTORY                                                  MODA0490
      I2=I-1                                                            MODA0500
   61 DRIFMO(I,M)=ABS(DELXEM(I,M)-DELXEM(I2,M))                         MODA0510
   62 DRIFMO(1,M)=ABS(DELXEM(1,M))                                      MODA0520
C
C
      DO 70 M=1,NMM                                                     MODA0530
      DO 70 J=1,NSTORY                                                  MODA0540
      VMMODE(J,M)=0.                                                    MODA0550
      RMMODE(J,M)=0.                                                    MODA0560
      DO 65 I=J,NSTORY                                                  MODA0570
      VMMODE(J,M)=VMMODE(J,M)+FMODAL(I,M)                               MODA0580
   65 RMMODE(J,M)=RMMODE(J,M)+FMODAL(I,M)*(HT(I)-HT(J))                 MODA0590
   70 CONTINUE                                                          MODA0600
C
C
      NSTOR1=NSTORY+1                                                   MODA0610
      DO 75 M=1,NMM                                                     MODA0620
      RMMODE(NSTOR1,M)=0.0                                              MODA0630
      DO 71 I=1,NSTORY                                                  MODA0640
   71 RMMODE(NSTOR1,M)=RMMODE(NSTOR1,M)+FMODAL(I,M)*HT(I)               MODA0650
   75 CONTINUE                                                          MODA0660
      IF(IFIX.EQ.1 .OR. KKK.EQ.0)GO TO 118                              MODA0670
C
C
C------ MODAL PROCEDURE CONSIDERING SOIL STRUCTURAL INTERACTION ------
C                          (ATC-3, SEC.6.3)
C
      RKBAR=4.*3.1416**2*WBARM(1)/(32.2*TT(1)**2)                       MODA0680
      SUMWF3=0.                                                         MODA0690
      DO 120 I=1,NSTORY                                                 MODA0700
  120 SUMWF3=SUMWF3+WMM(I,1)*U(I,1)*HT(I)                               MODA0710
      HEFF=SUMWF3/SUMWF1(1)                                             MODA0720
      TIWAVE=TT(1)*SQRT(1.+(RKBAR/RKY)*(1.+(RKY*HEFF**2/RKTETA)))       MODA0730
      CS=CSM(1)                                                         MODA0740
      TTT=TT(1)                                                         MODA0750
      TT(1)=TIWAVE                                                      MODA0760
      ISOINT=1                                                          MODA0770
      KKK=0                                                             MODA0780
C
C------ GO BACK TO CALCULATE CSM(1) -- ATC-3, SEC. 6.3 ------
C     GO TO 1000                                                        MODA0790
C
C------ CSM(1) REPLACED BY CSWAVE -- ATC-3, SEC .6.3.1 ------
C
 1500 CONTINUE                                                          MODA0800
      CSWAVE=CSM(1)                                                     MODA0810
      CALL DAMPS(HEFF,TIWAVE,TTT,BETAO)                                 MODA0820
      IF(IPILE.NE.1) GO TO 140                                          MODA0830
      ADR=4.*DSSSS/(VS*TIWAVE)                                          MODA0840
      IF(ADR.LT.1.)BETAO=BETAO*(ADR**2)                                 MODA0850
  140 CONTINUE                                                          MODA0860
      BETAWV=BETAO+(0.05)/((TIWAVE/TTT)**3)                             MODA0870
      IF(BETAWV.LT.0.05) BETAWV=0.05                                    MODA0880
  150 CONTINUE                                                          MODA0890
C
      VIWAVE=VMODAL(1)-(CS-CSWAVE*((0.05/BETAWV)**0.4))*WBARM(1)        MODA0900
      IF(VIWAVE.LE.0.7*VMODAL(1)) VIWAVE=0.7*VMODAL(1)                  MODA0910
      DO 160 I=1,NSTORY                                                 MODA0920
  160 DELXEM(I,1)=(VIWAVE/VMODAL(1))*(RMMODE(NSTOR1,1)*HT(I)            MODA0930
     1/RKTETA+DELXEM(I,1))                                              MODA0940
      VMODAL(1)=VIWAVE                                                  MODA0950
      GO TO 2000                                                        MODA0960
C
  118 CALL ROOT1(VMODAL,IREQDM,VTMODL)                                  MODA0970
      DO 80 I=1,NSTORY                                                  MODA0980
      CALL ROOT2(VMMODE,IREQDM,SSSS,I,MT)                               MODA0990
      VI(I)=SSSS                                                        MODA1000
      CALL ROOT2(DRIFMO,IREQDM,SSSS,I,MT)                               MODA1010
      DELT(I)=SSSS*12.                                                  MODA1020
      CALL ROOT2(DELXEM,IREQDM,SSSS,I,MT)                               MODA1030
      DIS(I)=SSSS                                                       MODA1040
   80 CONTINUE                                                          MODA1050
      DO 90 I=1,NSTOR1                                                  MODA1060
      CALL ROOT2(RMMODE,IREQDM,SSSS,I,MT)                               MODA1070
      RMOMNT(I)=SSSS                                                    MODA1080
   90 CONTINUE                                                          MODA1090
C
      IF(VTMODL.GE.VBASE) GO TO 110                                     MODA1100
      DO 109 I=1,NSTORY                                                 MODA1110
      RATIO2=VBASE/VTMODL                                               MODA1120
      VI(I)=VI(I)*RATIO2                                                MODA1130
      DELT(I)=DELT(I)*RATIO2                                            MODA1140
      DIS(I)=DIS(I)*RATIO2                                              MODA1150
  109 RMOMNT(I)=RMOMNT(I)*RATIO2                                        MODA1160
  110 CONTINUE                                                          MODA1170
      NI=NSTORY-1                                                       MODA1180
      FFF(NSTORY)=V(NSTORY)                                             MODA1190
      DO 111 I=1,NI                                                     MODA1200
  111 FFF(I)=V(I)-V(I+1)                                                MODA1210
C
C     NEXT SUBROUTINE IS CALLED TO OBTAIN FINAL DESIGN VALUE USING
C     THE INITIAL LATERAL FORCE OBTAINED FROM VMODE(1)  WHICH WILL BE
C     CALCULATED IN SUBROUTINE LAT2
C
      CALL LAT2(ISOINT,RM2,VBASE,I,I,NN,NN,NBNDRY,BASEAE,D,RKK,NSTORY   MODA1220
     1,TIBASE,SK,FS,DS,IBND,ICOL,DIAG,FFF,RKAPA,AMP,ECC,MAX,MI)
C
C     OBTAIN FINAL O-V MOMENT USING FINAL LATERAL FORCE FROM LAT2
C
      DO 116 J=1,NSTORY                                                 MODA1230
      RMOMNT(J)=0.                                                      MODA1240
      DO 115 I=J,NSTORY                                                 MODA1250
  115 RMOMNT(J)=RMOMNT(J)+FFF(I)*(HT(I)-HT(J))                          MODA1260
  116 RMOMNT(J)=RMOMNT(J)*12000.                                        MODA1270
      RM3=0.                                                            MODA1280
      DO 117 I=1,NSTORY                                                 MODA1290
  117 RM3=RM3+FFF(I)*HT(I)                                              MODA1300
      RM3=0.99*12000.*RM3                                               MODA1310
  426 FORMAT(1X,'FOUNDATION DAMPING FACTOR =',F15.5,/,1X,'BETA WAVE =', MODA1320
     *E15.5)
 8001 FORMAT(/3X,' MODAL ANALYSIS PROCEDURE WITHOUT SOIL-ST INTERACTION'MODA1330
     1/,3X,35('*'),/)
 8004 FORMAT(5X,' STORY',5X,'FINAL DESIGN O-V MOMENT',7X,'DX',15X,'DI',MODA1340
     1)
 8002 FORMAT(5X,' FINAL DESIGN BASE MOMNT (KIPS-FT) =',E15.5)          MODA1350
 8003 FORMAT(/3X,' MODAL PROCEDURE CONSIDERING SOIL-ST INTERACTION',/, MODA1360
     1'+',3X,'                                                ',/)
      RETURN                                                            MODA1370
C     DEBUG SUBCHK                                                      MODA1380
      END
C
C     SUBROUTINE PDELTA:
C*****************************************************************
C*          STORE AXIAL FORCE IN COLUMN FOR P-DELTA EFFECT       *
C*****************************************************************
C
      SUBROUTINE PDELTA (S,FS,NMB,L)                                    PDEL0010
      DIMENSION S(6,1)                                                  PDEL0020
      IF(NMB.EQ.0) GO TO 20                                             PDEL0030
      ADR=0.                                                            PDEL0040
      DO 10 J=1,L                                                       PDEL0050
      IF(ABS(S(1,J)).LE.ADR) GO TO 10                                   PDEL0060
      ADR=ABS(S(1,J))                                                   PDEL0070
   10 CONTINUE                                                          PDEL0080
      FS=ADR                                                            PDEL0090
   20 CONTINUE                                                          PDEL0100
      RETURN                                                            PDEL0110
C     DEBUG SUBCHK                                                      PDEL0120
      END
C
C     SUBROUTINE PERFOM:
C*****************************************************************
C*          DETERMINE MAP COEFFICIENT & ANALYSIS METHOD          *
C*****************************************************************
C
      SUBROUTINE PERFOM(IPERFU)                                         PERF0010
      COMMON/PRT1/INN,IOUT,IOUT1                                        PERF0020
      COMMON/ATC1/IACTIV,ISOIL,MR,ISF,IFIX,NANALS,NNNNN,MMMM,NBRITL,    PERF0030
     1           ISH,NPREGR,NVREGR,IS,ISLGL,IPILE,RKY,RKTETA,RR,VS,
     2           DSSSS,HN,AA,AV,S,R,CD,RL,DELA(30)
      GO TO (1,1,3,4,5,6,7),NNNNN                                       PERF0040
    1 AA=0.05                                                           PERF0050
      GO TO 8                                                           PERF0060
    3 AA=0.10                                                           PERF0070
      GO TO 8                                                           PERF0080
    4 AA=0.15                                                           PERF0090
      GO TO 8                                                           PERF0100
    5 AA=0.20                                                           PERF0110
      GO TO 8                                                           PERF0120
    6 AA=0.30                                                           PERF0130
      GO TO 8                                                           PERF0140
```

```
      7 AA=0.40                                                          PERF0150
      8 GO TO(11,12,13,14,15,16,17),MMMMM                                PERF0160
     11 AV=0.05                                                          PERF0170
        IS=1                                                             PERF0180
        GO TO 18                                                         PERF0190
     12 AV=0.05                                                          PERF0200
        IS=2                                                             PERF0210
        GO TO 18                                                         PERF0220
     13 AV=0.10                                                          PERF0230
        IS=2                                                             PERF0240
        GO TO 18                                                         PERF0250
     14 AV=0.15                                                          PERF0260
        IS=3                                                             PERF0270
        GO TO 18                                                         PERF0280
     15 AV=0.2                                                           PERF0290
        IS=4                                                             PERF0300
        GO TO 18                                                         PERF0310
     16 AV=0.3                                                           PERF0320
        IS=4                                                             PERF0330
        GO TO 18                                                         PERF0340
     17 AV=0.4                                                           PERF0350
        IS=4                                                             PERF0360
     18 WRITE(IOUT,101)NNNNN,MMMMM,AA,AV,IS,ISH                          PERF0370
        GO TO (20,30,40,50),IS                                           PERF0380
     20 WRITE(IOUT,102)                                                  PERF0390
        IPERFO=1                                                         PERF0400
        GO TO 100                                                        PERF0410
     30 WRITE(IOUT,103)                                                  PERF0420
        IPERFO=2                                                         PERF0430
        GO TO 100                                                        PERF0440
     40 IF(ISH.NE.1)GO TO 30                                             PERF0450
     41 WRITE(IOUT,104)                                                  PERF0460
        IPERFO=3                                                         PERF0470
        GO TO 100                                                        PERF0480
     50 IF(ISH.NE.3)GO TO 41                                             PERF0490
        WRITE(IOUT,105)                                                  PERF0500
        IPERFO=4                                                         PERF0510
    100 CONTINUE                                                         PERF0520
    101 FORMAT(5X,' AREA MAP NUMBER FOR AA ------------------------------',5X PERF0530
       1,I5/5X,' AREA MAP NUMBER FOR AV ------------------------------',5X,I5/
       2,5X,' SEISMIC COEFFICIENT AA ------- (TABLE 1-B) --------',F10.3/
       3,5X,' SEISMIC COEFFICIENT AV ------- (TABLE 1-B) --------',F10.3/
       4,5X,' SEISMIC INDEX ---------------- (TABLE 1-A) --------',5X,I5/
       5,5X,' SEISMIC HAZARD EXPOSURE GROUP (TABLE 1-A) --------',5X,I5)
    102 FORMAT(5X,' SEISMIC PERFORMANCE CATEGORY  (TABLE 1-A) --------',9X PERF0540
       1,'A')
    103 FORMAT(5X,' SEISMIC PERFORMANCE CATEGORY  (TABLE 1-A) --------',9X PERF0550
       1,'B')
    104 FORMAT(5X,' SEISMIC PERFORMANCE CATEGORY  (TABLE 1-A) --------',9X PERF0560
       1,'C')
    105 FORMAT(5X,' SEISMIC PERFORMANCE CATEGORY  (TABLE 1-A) --------',9X PERF0570
       1,'D')
        RETURN                                                           PERF0580
C       DEBUG SUBCHK                                                     PERF0590
        END
C
C       SUBROUTINE POP2:
C ***************************************************************      *
C *                CALCULATE TOTAL NUMBER OF ELEMENTS           *      *
C *                  IN STIFFNESS MATRIX TO BE STORED           *      *
C ***************************************************************      *
C
        SUBROUTINE POP2(MMB,JN,MM,MA,MB,NZ,IC,ID)                       POP20010
        COMMON/PRT1/INN,IOUT,JOUT                                        POP20020
        DIMENSION MA(1),MB(1),IC(1),ID(1)                                POP20030
        IX(I,J)=I*(J-1)+1                                                POP20040
        NZ=0                                                             POP20050
        NN=MM*JN                                                         POP20060
        DO 10 I=1,NN                                                     POP20070
        IC(I)=NN                                                         POP20080
     10 CONTINUE                                                         POP20090
        DO 20 L=1,MMB                                                    POP20100
        KX=IX(MM,MA(L))                                                  POP20110
        KY=IX(MM,MB(L))                                                  POP20120
        IF(IC(KY) .LT. KX) GO TO 20                                      POP20130
        DO 19 I=1,MM                                                     POP20140
        IC(KY)=KX                                                        POP20150
        KY=KY+1                                                          POP20160
     19 CONTINUE                                                         POP20170
     20 CONTINUE                                                         POP20180
        DO 30 I=1,NN,MM                                                  POP20190
        IF(IC(I) .LT. I)GO TO 30                                         POP20200
        KX=I                                                             POP20210
        DO 25 J=1,MM                                                     POP20220
        IC(KX)=I                                                         POP20230
        KX=KX+1                                                          POP20240
     25 CONTINUE                                                         POP20250
     30 CONTINUE                                                         POP20260
        DO 40 I=1,NN                                                     POP20270
        NZ=NZ+I-IC(I)+1                                                  POP20280
        ID(I)=NZ                                                         POP20290
     40 CONTINUE                                                         POP20300
        KX=(NN*(NN+1))/2                                                 POP20310
        KY=((MM**2)*MMB)+(NN*(MM+1)*JN)/2                                POP20320
        WRITE(IOUT,2)                                                    POP20330
        WRITE(IOUT,3) KX,KY,NZ                                           POP20340
        WRITE(IOUT,4)                                                    POP20350
        WRITE(IOUT,5)(IC(I),I=1,NN)                                      POP20360
        WRITE(IOUT,6)                                                    POP20370
        WRITE(IOUT,5)(ID(I),I=1,NN)                                      POP20380
        WRITE(IOUT,7)                                                    POP20390
     2  FORMAT(1H1,///22X,14HTOTAL ELEMENTS,5X,16HNONZERO ELEMENTS.      POP20400
       1,5X,15HSTORED ELEMENTS///)
     3  FORMAT(10X,I14,,10X,I12///)                                      POP20410
     4  FORMAT(//2X,34HSTARTING ROW NUMBERS FOR EACH COLUMN///)          POP20420
     5  FORMAT(5X,10I12)                                                 POP20430
     6  FORMAT(//22X,61HNUMBERS OF DIAGONAL ELEMENTS IN SINGLE ARRAY STIFFNPOP20440
       1ESS MATRIX///)
     7  FORMAT(///8X,,20HTOTAL ELEMENTS MEAN THE TOTAL NUMBER OF ELEMENTS POP20450
       1IN THE STIFFNESS MATRIX, NONZERO ELEMENTS ARE THE TOTAL NUMBER OF
       2NON- /3X,124HZERO ELEMENTS IN THE STIFFNESS MATRIX, AND STORED ELE
       3MENTS ARE THE ELEMENTS IN THE STIFFNESS MATRIX NEEDED TO BE STORED
       4 BY /3X,125HUSING THIS NUMBERING SCHEME. WHEN THE NUMBERING SCHE
       5ME IS AN EFFICIENT ONE, THE NUMBER OF NONZERO ELEMENTS IS CLOSED T
       60 THE /3X,26HNUMBER OF STORED ELEMENTS.)
        RETURN                                                           POP20460
C       DEBUG SUBCHK                                                     POP20470
        END
C
C       SUBROUTINE PRNTOR:
C ***************************************************************      *
C *                PRINT THE OUTPUT OF DISPLACEMENTS            *      *
C ***************************************************************      *
C
        SUBROUTINE PRNTDR(A,X,Y,N,M,L,NJ,NP,NA,IPLOT)                   PRNT0010
        COMMON/PRT1/INN,IOUT,JOUT                                        PRNT0020
        DIMENSION A(1),X(1),Y(1),A(NN,L)                                 PRNT0030
        LINES=1                                                          PRNT0040
        WRITE(IOUT,1)NP                                                  PRNT0050
        WRITE(IOUT,2)                                                    PRNT0060
        DO 10 I=1,NJ                                                     PRNT0070
        IF (LINES+L-51)4,3,3                                             PRNT0080
     3  LINES=1                                                          PRNT0090
        WRITE(IOUT, 1) NP                                                PRNT0100
        WRITE(IOUT,2)                                                    PRNT0110
        NP=NP+1                                                          PRNT0120
     4  KH=3*I                                                           PRNT0130
        KHH=KH-2                                                         PRNT0140
        WRITE(IOUT,5)I,X(I),Y(I), ( A(J,1),J=KHH,KH)                     PRNT0150
        IF(IPLOT-EQ.0)GO TO 11                                           PRNT0160
        WRITE(IOUT,12)A(KHH,1)                                           PRNT0170
    11  IF( .EQ. 1) GO TO 8                                              PRNT0180
        DO 7 K=2,L                                                       PRNT0190
        WRITE(IOUT,6) (A(J,K),J=KHH,KH)                                  PRNT0200
     7  CONTINUE                                                         PRNT0210
     8  LINES =LINES +L+1                                                PRNT0220
    10  CONTINUE                                                         PRNT0230
        RETURN                                                           PRNT0240
     1  FORMAT(1H1,120X,5HPAGE ,I3////)                                  PRNT0250
     2  FORMAT(//32X,5HJOINT,10X,2H-X,10X,2H-Y,21X,7HDISPL-X,10X,7HDISPL-Y,
       110X,8HROTATION//)
     5  FORMAT(/ 3X,I4,7X,F9.3,3X,F9.3,3X,1PE18.8,1PE17.8,1PE18.8)      PRNT0260
     6  FORMAT( 48X,1PE18.8,1PE17.8,1PE18.8)                            PRNT0270
    12  FORMAT(4F20.10)                                                  PRNT0280
        RETURN                                                           PRNT0290
C       DEBUG SUBCHK                                                     PRNT0300
        END
C
C       SUBROUTINE REDUCE:
C ***************************************************************      *
C *              REDUCE FORCE OR DISPLACEMENT VECTOR            *      *
C *              BY SUBSTITUTING BOUNDARY CONDITION             *      *
C ***************************************************************      *
C
        SUBROUTINE REDUCE (F,IB,N,NB,L,NN)                               REDU0010
        DIMENSION IB(1),F(NN,L)                                          REDU0020
        DO 5 J=1,L                                                       REDU0030
        IH=NB                                                            REDU0040
        NH=N                                                             REDU0050
     1  I=IB(IH)                                                         REDU0060
        IF(I-NH) 2,4,4                                                   REDU0070
     2  NH=NH-1                                                          REDU0080
        DO 3 K=I,NH1                                                     REDU0090
        K1=K+1                                                           REDU0100
        F(K,J) =F(K1,J)                                                  REDU0110
     3  CONTINUE                                                         REDU0120
     4  IH=IH-1                                                          REDU0130
```

```
      NH=NH-1                                                          REDU0140
      IF(IH.EQ.0) GO TO 5                                              REDU0150
      GO TO 1                                                          REDU0160
5     CONTINUE                                                         REDU0170
      RETURN                                                           REDU0180
C     DEBUG SUBCHK                                                     REDU0190
      END
C
C     SUBROUTINE RESIZE:
C*****************************************************************
C*          RESIZE MEMBER SIZE IF ENERGY IS NEGATIVE AND         *
C*  REDISTRIBUTION SIZE IS LARGER THAN THAT OF LOWER STORY'S     *
C*****************************************************************
C
      SUBROUTINE RESIZE(AE,L,MEMBS,NSTORY,NLINE,JTYPE)                 RESI0010
      COMMON/ATC2/NBEAM(30),NCONT(30),NOCONT(30,20),NOBEAM(30,10)      RESI0020
      DIMENSION AE(1),NLINE(1),JTYPE(1)                                RESI0030
      IF(JTYPE(L)-1)10,10,30                                           RESI0040
   10 DO 12 I=1,NSTORY                                                 RESI0050
      NN=NCONT(I)                                                      RESI0060
      DO 15 J=1,NN                                                     RESI0070
      IF(L.EQ.NOCONT(I,J))GO TO 16                                     RESI0080
   15 CONTINUE                                                         RESI0090
   16 II=I-1                                                           RESI0100
      NN=NCONT(I)                                                      RESI0110
      DO 17 J=1,NN                                                     RESI0120
      LL=NOCONT(II,J)                                                  RESI0130
      IF(L.NE.LL.AND.JTYPE(L).EQ.JTYPE(LL).AND.NLINE(L).EQ.NLINE(LL))  RESI0140
     -GO TO 40                                                         RESI0150
   17 CONTINUE                                                         RESI0160
   30 DO 35 I=1,NSTORY                                                 RESI0170
      NN=NBEAM(I)                                                      RESI0180
      DO 35 J=1,NN                                                     RESI0190
      IF(L.EQ.NOBEAM(I,J))GO TO 36                                     RESI0200
   35 CONTINUE                                                         RESI0210
   36 II=I-1                                                           RESI0220
      NN=NBEAM(II)                                                     RESI0230
      DO 37 J=1,NN                                                     RESI0240
      LL=NOBEAM(II,J)                                                  RESI0250
      IF(NLINE(L).EQ.NLINE(LL))GO TO 40                                RESI0260
   37 CONTINUE                                                         RESI0270
   40 IF(AE(L).LT.AE(LL))AE(L)=AE(LL)                                  RESI0280
      RETURN                                                           RESI0290
      END
C
C     SUBROUTINE RESTOR:
C*****************************************************************
C*   RESTORE FORCE OR DISPLACEMENT VECTOR INTO GLOBAL SYSTEM     *
C*****************************************************************
C
      SUBROUTINE RESTOR(D,IB,N,NB,L,NN)                                RESI0010
      DIMENSION IB(1),TDR1(40),TDR2(40),D(NN,L)                        RESI0020
      NH=N-NB                                                          RESI0030
      IH=1                                                             RESI0040
    1 I=IB(IH)                                                         RESI0050
      IF(I.GT.NH) GO TO 7                                              RESI0060
      DO 2 K=1,L                                                       RESI0070
      TDR1(K)=D(I,K)                                                   RESI0080
    2 D(I,K)=0.                                                        RESI0090
    3 J=IB(IH)                                                         RESI0100
      IF(J.GT.NH) GO TO 5                                              RESI0110
      DO 4 K=1,L                                                       RESI0120
    4 TDR2(K)=D(J,K)                                                   RESI0130
    5 DO 6 K=1,L                                                       RESI0140
      D(J,K) =TDR1(K)                                                  RESI0150
    6 TDR1(K)=TDR2(K)                                                  RESI0160
      IF(I.GE.NH) GO TO 9                                              RESI0170
      I=I+1                                                            RESI0180
      GO TO 3                                                          RESI0190
    7 DO 8 K=1,L                                                       RESI0200
    8 D(I,K)=0.                                                        RESI0210
    9 IF(IH.GE.NB) GO TO 10                                            RESI0220
      IH=IH+1                                                          RESI0230
      NH=NH+1                                                          RESI0240
      GO TO 1                                                          RESI0250
   10 CONTINUE                                                         RESI0260
      RETURN                                                           RESI0270
C     DEBUG SUBCHK                                                     RESI0280
      END
C
C     SUBROUTINE ROOT1:
C*****************************************************************
C*          ATC MODEL SUPERPOSITION ROOT-MEAN SQUARE METHOD      *
C*****************************************************************
C
      SUBROUTINE ROOT1(X,N,S)                                          ROOT1 01
      DIMENSION X(10)                                                  ROOT1 02
      S=0.                                                             ROOT1 03
      DO 1 I=1,N                                                       ROOT1 04
    1 S=S+X(I)**2                                                      ROOT1 05
      S=SQRT(S)                                                        ROOT1 06
      RETURN                                                           ROOT1 07
C     DEBUG SUBCHK                                                     ROOT1 08
      END
C
C     SUBROUTINE ROOT2:
C*****************************************************************
C*          ATC MODEL SUPERPOSITION ROOT-MEAN SQUARE METHOD      *
C*****************************************************************
C
      SUBROUTINE ROOT2(X,N,S,I,MT)                                     ROOT2 01
      DIMENSION X(MT,10)                                               ROOT2 02
      S=0                                                              ROOT2 03
      DO 1 J=1,N                                                       ROOT2 04
    1 S=S+X(I,J)**2                                                    ROOT2 05
      S=SQRT(S)                                                        ROOT2 06
      RETURN                                                           ROOT2 07
C     DEBUG SUBCHK                                                     ROOT2 08
      END
C
C     SUBROUTINE SAME:
C*****************************************************************
C*              CONSTRAINTS ON COMMON MEMBERS                    *
C*****************************************************************
C
      SUBROUTINE SAME(A,ITYPE,MTYPE,MEMBS)                             SAME0010
      DIMENSION A(1),ITYPE(1)                                          SAME0020
      IF(MTYPE.EQ.MEMBS) GO TO 10                                      SAME0030
      DO 4 I=1,MTYPE                                                   SAME0040
      L=0                                                              SAME0050
      DO 3 J=1,MEMBS                                                   SAME0060
      IF(ITYPE(J).NE.I) GO TO 31                                       SAME0070
      GO TO(5,5,6                                                      SAME0080
    5 CONTINUE                                                         SAME0090
      L=L+1                                                            SAME0100
      AREAA=A(J)                                                       SAME0110
    6 CONTINUE                                                         SAME0120
      IF(ARE4A-A(J)) 2,31,31                                           SAME0130
    2 CONTINUE                                                         SAME0140
      AREAA=A(J)                                                       SAME0150
   31 CONTINUE                                                         SAME0160
    3 CONTINUE                                                         SAME0170
      DO 9 K=1,MEMBS                                                   SAME0180
      IF(ITYPE(K).NE.I) GO TO 9                                        SAME0190
      A(K)=AREAA                                                       SAME0200
    9 CONTINUE                                                         SAME0210
    4 CONTINUE                                                         SAME0220
   10 CONTINUE                                                         SAME0230
      RETURN                                                           SAME0240
C     DEBUG SUBCHK                                                     SAME0250
      END
C
C     SUBROUTINE SOIL1:
C*****************************************************************
C*    EQUIVALENT LATERAL FORCE METHOD CONSIDER SOIL EFFECT       *
C*****************************************************************
C
      SUBROUTINE SOIL1(T,VBASE,CS,AM2,RKK,NSTORY,IBASE,SK,FS,DS,IBND   SOIL001
     1,ICOL,IDIAG,FFF,RKAPA,AMP,ECC,MAX,MT,NNMAX)
      COMMON/PATI/INN,IOUT,JOUT                                        SOIL002
      COMMON/CODE1/HT(30),NTF(4),WWW(30,4),KACDE(30,4)                 SOIL003
      COMMON/ATC1/V(30),DIS(30),DELT(30),AAI(30),CVI(30),TETA(30),PP(30),SOIL004
     1           SUMWF1(10),SUMWF2(10),BBARM1(10),CSM(10),RMOMN(3),
     2           VMODAL(10),RMMODE(31,10),DRIFMO(30,10),DI(30,10),
     3           CVXM(30,10),FMODAL(30,10),DELXEM(30,10),VMMODE(30,10)
      COMMON/ATC1/IACTIV,SOIL,MR,ISF,IF12,NANALS,NNNN,MMMM,NBAITL,     SOIL005
     1           ISH,NPAEGR,NVREGR,IS,ISLGL,IPILE,RKV,RKTETA,RR,VS,
     2           DSSSS,HN,AA,AV,S,R,CO,RL,DEL(30)
      DIMENSION SK(MAX1),IBND(50),ICOL(NNMAX),IDIAG(NNMAX),FFF(MT),    SOIL0060
     1          RKAPA(MT),FS(NNMAX,4),DS(NNMAX,4)
      IBASE=0                                                          SOIL0070
      IF(ISLGL.EQ.1) GO TO 100                                         SOIL0080
      MEFF=0.7*HT(NSTORY)                                              SOIL0090
      MEFF=0.7*WT(1)                                                   SOIL0100
      GO TO 200                                                        SOIL0110
  100 MEFF=HT(NSTORY)                                                  SOIL0120
      MEFF=WT(1)                                                       SOIL0130
  200 CONTINUE                                                         SOIL0140
C     WRITE(IOUT,5200)                                                 SOIL0150
      RKBAR=4.*3.1416*2*MEFF/(32.2*T**2)                               SOIL0160
      TWAVE=T*SQRT(1.+(RKBAR/RKV)*1.+(RKV*MEFF**2/RKTETA)))            SOIL0170
C     WRITE(IOUT,4251) TWAVE                                           SOIL0180
      CSWAVE=(1.2*AV*S)/(R*TWAVE**(2./3.))                             SOIL0190
      IF(CSWAVE.GT.2.5*AA/R) CSWAVE=2.5*AA/R                           SOIL0200
      IF(ISOIL.EQ.3.AND.AA.GE.0.3) GO TO 1                             SOIL0210
      GO TO 150                                                        SOIL0220
```

```
      IF(CSWAVE.GT.2.0*AA/R)CSWAVE=2.0*AA/R                              SOIL0230
  150 CONTINUE                                                           SOIL0240
      IF(CSWAVE.LE.CS) GO TO 791                                         SOIL0250
      IBASE=1                                                            SOIL0260
      GO TO 601                                                          SOIL0270
  791 CONTINUE                                                           SOIL0280
      CALL DAMPS(MEFF,TWAVE,T,BETAO)                                     SOIL0290
      IF(IPILE.NE.1) GO TO 400                                           SOIL0300
      ADR=4.*DSSSS/(VS*TWAVE)                                            SOIL0310
      IF(ADR.LT.1.) BETAO=(ADR**2)*BETAO                                 SOIL0320
  400 CONTINUE                                                           SOIL0330
      BETAWV=BETAO+(0.05)/((TWAVE/T)**3)                                 SOIL0340
      IF(BETAWV.LT.0.05) BETAWV=0.05                                     SOIL0350
  500 CONTINUE                                                           SOIL0360
      VWAVE=VBASE-(CS-CSWAVE*((0.05/BETAWV)**0.4))*MEFF                  SOIL0370
      IF(VWAVE.LT.(0.7*VBASE))VWAVE=0.7*VBASE                            SOIL0380
      RM3=RM2/0.75                                                       SOIL0390
      CALL LAT1(T,VWAVE,CS,1,RM2,0,0,RKK,NSTORY,FFF,RKAPA,AMP,ECC,MT)    SOIL0400
 1896 DO 4329 I=1,NSTORY                                                 SOIL0410
 4329 DIS(I)=(VWAVE/VBASE)*(RM3*HT(I)/RKTETA+DIS(I))                     SOIL0420
      CALL LAT2(I,RM2,VBASE,0,LOADS,NM,MN,NBNDRY,BASEAE,0,RKK,NSTORY     SOIL0430
     1,IBASE,SK,FS,DS,IBND,ICOL,IDIAG,FFF,RKAPA,AMP,ECC,MAX,MT)          SOIL0440
  601 CONTINUE                                                           SOIL0450
 5200 FORMAT(/3X,49H SOIL STRUCTURAL INTERUCTION OF LATERAL FORCE MTD,/,SOIL0460
     *'+',3X,                                                           ',/)
  425 FORMAT(3X,'PERIOD =',E15.5,/,1X,'WAVE =',E15.5)                    SOIL0460
  426 FORMAT(1X,'FOUNDATION DAMPING FACTER =',E15.5,/,1X,'BETA WAVE =',  SOIL0470
     *E15.5)                                                            SOIL0480
      RETURN                                                             SOIL0480
C     DEBUG SUBCHK                                                       SOIL0490
      END                                                                SOIL0490
C
C     SUBROUTINE SPTRUM;
C ***************************************************************
C *                CALCULATE DYNAMIC LOAD FACTOR                *
C ***************************************************************
C
      SUBROUTINE SPTRUM (X,Y,DAMP,NRU,PT,M,ND,LD,KSOIL,KDUCTY,INC,ALPH)  SPTR0010
      COMMON/DATA/F(4),XV(4),NT(4),ND(4),NZ(4),N1(4),DDT(4),NNN          SPTR0020
      COMMON/PRT1/INN,IOUT,IOUT1                                         SPTR0030
      DIMENSION PT(ND,LD),H(ND,LD)                                       SPTR0040
      XX=X                                                               SPTR0050
      NTP=NZ(NRU)                                                        SPTR0060
      GO TO(20,1,11),NTP                                                 SPTR0070
C
C ------ SPECTRUM INTERPOLATION ------
C
    1 DO 2 L=2,NNN                                                       SPTR0080
      IF(XX .LT. PT(L,NRU)) GO TO 3                                      SPTR0090
    2 CONTINUE                                                           SPTR0100
    3 N=L-1                                                              SPTR0110
      F0=H(N,NRU)                                                        SPTR0120
      F1=H(N+1,NRU)                                                      SPTR0130
      N0=PT(N,NRU)                                                       SPTR0140
      N1=PT(N+1,NRU)                                                     SPTR0150
      Y = F0 + (F1-F0)*(XX-N0)/(N1-N0)                                   SPTR0160
   10 GO TO 700                                                          SPTR0170
C
C ------ SPECTRUM DATA BY USING CURVE FITTING ------
C
   11 IF(KDUCTY.EQ.0)GO TO 15                                            SPTR0180
      CALL CURVE1(XX,Y,KDUCTY,INC)                                       SPTR0190
      GO TO 700                                                          SPTR0200
   15 IF(KSOIL.GT.4)GO TO 16                                             SPTR0201
      CALL CURVE2(XX,Y,KSOIL)                                            SPTR0210
      GO TO 700                                                          SPTR0220
   16 IF(KSOIL.GT.7)GO TO 17                                             SPTR0221
      CALL CURVE3(KSOIL,XX,Y,ALPH,INC)                                   SPTR0222
      GO TO 700                                                          SPTR0223
   17 CALL CURVE4(KSOIL,X,Y)                                             SPTR0224
      GO TO 700                                                          SPTR0225
C
C ------ TIME-HISTORY ... USING EXPLICIT INTEGRATION ------
C
   20 W=6.283185307/XX                                                   SPTR0230
      WW=W*W                                                             SPTR0240
      ZW=DAMP*W                                                          SPTR0250
      TZW=2.0*ZW                                                         SPTR0260
      WD=W*SQRT(1.0-DAMP**2)                                             SPTR0270
      FB=TZW/(WW*WW)                                                     SPTR0280
      FA=ZW/WW                                                           SPTR0290
      FV=ZW*WW                                                           SPTR0300
      FVD=WW*(2.0*DAMP**2-1.0)                                           SPTR0310
      FBB=(2.0*DAMP**2-1.0)/WW                                           SPTR0320
C
      L=0                                                                SPTR0330
      II=1                                                               SPTR0340
      Y=0.                                                               SPTR0350
      VO=0.                                                              SPTR0360
      VDO=0.                                                             SPTR0370
      TO=PT(1,NRU)                                                       SPTR0380
   30 DT=DDT(NRU)                                                        SPTR0390
   50 B=(H(II+1,NRU)-H(II,NRU))/(PT(II+1,NRU)-PT(II,NRU))                SPTR0400
      A=H(II,NRU) + B*(TO-PT(II,NRU))                                    SPTR0410
      TT=TO+DT                                                           SPTR0420
      IF(PT(II+1,NRU) .GT. TT) GO TO 100                                 SPTR0430
      DELT=PT(II+1,NRU)-TO                                               SPTR0440
      GO TO 200                                                          SPTR0450
  100 DELT=DT                                                            SPTR0460
C
  200 EX=EXP(-ZW*DELT)                                                   SPTR0470
      FF=WD*DELT                                                         SPTR0480
      CS=COS(FF)                                                         SPTR0490
      SN=SIN(FF)                                                         SPTR0500
      VT=(VDO+ZW*VO-FA*A+FBB*B)*SN/WD                                    SPTR0510
      VT=VT + (VO-A/WW+FB*B)*CS                                          SPTR0520
      VT=VT*EX + (A/WW-FB*B+B*DELT/WW)                                   SPTR0530
C
      VDT=(A-WW*VO-ZW*(VDO+B/WW))*SN/WD                                  SPTR0540
      VDT=VDT + (VDO-B/WW)*CS                                            SPTR0550
      VDT=VDT*EX + B/WW                                                  SPTR0560
C
      VO=VT                                                              SPTR0570
      VDO=VDT                                                            SPTR0580
      IF(PT(II+1,NRU) .GT. TT) GO TO 500                                 SPTR0590
      DT=DT-DELT                                                         SPTR0600
      II=II+1                                                            SPTR0610
      TO=PT(II,NRU)                                                      SPTR0620
      IF(DT .LT.0.0001)GO TO 600                                         SPTR0630
      GO TO 50                                                           SPTR0640
  500 TO=TO+DT                                                           SPTR0650
  600 L=L+1                                                              SPTR0660
      IF(Y .LT. ABS(VT)) Y=ABS(VT)                                       SPTR0670
      IF(L .LT. NT(NRU)) GO TO 30                                        SPTR0680
      Y=Y*WW                                                             SPTR0690
  700 CONTINUE                                                           SPTR0700
      RETURN                                                             SPTR0710
C     DEBUG SUBCHK                                                       SPTR0720
      END
C
C     SUBROUTINE STRES1;
C ***************************************************************
C *          1.  CALCULATE MEMBER STRESSES                      *
C *          2.  CHECK STIFFNESS CONSTRAINTS                    *
C ***************************************************************
C
      SUBROUTINE STRES1(FRR,FRS,AE,BD,DEP,TFD,JTYPE,LOADS,IL,            STRS0010
     .AM,AN,ELENTH,DS,AM,FACTDL,FACTLL,FACTSL,NT,MA,NB,INDEX,DM,MM,VV,
     .NSIGN,NN,NNB,STRES,ISTA1,RATIOB,RATIO1,NDEFEQ,RATIO,ASIRE,LNIDSP,
     .AML,F1,DI,NMMAX,IUNILD,MEMBS,EK,EM,A,B,C,D,E,S,EDR,SIGMA,SS1,
     .SS2,S1,S2)
      COMMON/PRT1/INN,IOUT,IOUT                                          STRS0020
      COMMON/STIFF/BASEA,EE(3),XG                                        STRS0030
      COMMON/ABC/NZERO,NBEGIN,NDESIR,NITER,MDMAX,NNMAX                   STRS0040
      COMMON/BBC/ISEC,WD,DEPMAX,DEPAIN,TFDMAX,TFDMIN,RHO,RHO1,BTFMAX,    STRS0050
     1          BTFMIN,BDMAX,BDMIN
      DIMENSION FRR(1),FRS(1),AE(1),BD(1),DEP(1),TFD(1),JTYPE(1),AM(1),  STRS0060
     .AN(1),ELENTH(1),FACTDL(1),FACTLL(1),FACTSL(1),MA(1),NB(1),UNF(4),
     .NDEFEQ(1),RATIO(1),RATIO1(1),STRES(1),NMB(1),AML(6,4),SS1(6,22),
     .SS2(6,22),EK(6,6),EM(6,6),A(3,3),B(6,6),C(6,6),D(6,6),E(6,6),
     .F1(21),AF(6,22),S(6,4),SIGMA(6,6),EDR(6,6),NT(NNMAX,3),
     .ISTA(NNMAX,1),ASIRE(MMAX,1),DS(NNMAX,1),HH(MDMAX,1),VV(MDMAX,1),
     .AM(NNMAX,1),FI(NNMAX,1),DI(NNMAX,1)
      DO 200 L=1,MEMBS                                                   STRS0070
      AXIAL=FRR(L)*FRS(L)                                                STRS0080
      CALL AREA1(AE(L),BASEA,BD(L),DEP(L),TFD(L),JTYPE(L),SPWT,AREA4,SEC,STRS0090
     *          QUE)
      CALL ELMENT(EK,EM,AE(L),AM(L),AN(L),JTYPE(L),AXIAL,0.,ELENTH(L),   STRS0100
     *AL,1,AREA4)
      CALL TRNSFM(EK,EM,A,B,C,D,E,1)                                     STRS0110
      DO 10 I=1,6                                                        STRS0120
      DO 10 J=1,LOADS                                                    STRS0130
      S(I,J)=0.                                                          STRS0140
      SS(I,J)=0.                                                         STRS0150
   10 CONTINUE                                                           STRS0160
      IF(INDEX) 15,15,30                                                 STRS0170
C
   15 CONTINUE                                                           STRS0180
      CALL ELFORC(A,B,D,DS,EDR,S1,SS1,MA(L),MB(L),LOADS,MM,NNMAX)        STRS0190
      IF(IUNILD.EQ.0)GO TO 25                                            STRS0200
      DO 18 J=1,LOADS                                                    STRS0210
   18 UNF(J)=FACTDL(J)*WT(L,1)+FACTLL(J)*WT(L,2)+FACTSL(J)*WT(L,3)        STRS0220
      CALL FIXEND(F1,AML,UNF,MA(L),MB(L),ELENTH(L),1,LOADS,NNMAX,        STRS0230
     *AM(L),AN(L))
      DO 20 I=1,6                                                        STRS0240
      DO 20 J=1,LOADS                                                    STRS0250
```

```
      S(I,JJ)=AML(I,J)+S(I,J)                                          STRS0260
   20 CONTINUE                                                         STRS0270
   25 CONTINUE                                                         STRS0280
      IF (INDEX) 50,20,30                                              STRS0290
C
   30 CONTINUE                                                         STRS0300
      DO 35 I=NBEGIN,NOESTR                                            STRS0310
      CALL CHANGEIDI,ON,MM,VV,NSIGN,II,LCASS,NN,MDMAX,NNMAX)           STRS0320
      CALL ELFORC(A,B,D,DI,EDA,S2,SS2,AA(1),ABC(),LOADS,MM,NNMAX)      STRS0330
      CALL ADD2(S,S2,NSIGN,6,LOADS)                                    STRS0340
   35 CONTINUE                                                         STRS0350
      IF(NSIGN) 50,40,50                                               STRS0360
   40 CONTINUE                                                         STRS0370
      DO 45 I=1,6                                                      STRS0380
      DO 45 J=1,LOADS                                                  STRS0390
      S(I,J)=SQRT(S(I,J))                                              STRS0400
   45 CONTINUE                                                         STRS0410
C
   50 CONTINUE                                                         STRS0420
      CALL ADD(S1,S,INDEX,LOADS,6,6)                                   STRS0430
      CALL PDELTA(S,PRS(1),NMD(1),LOADS)                               STRS0440
      CALL MFBEAM(S,STGMA,AREAA,SEC,QUE,LOADS)                         STRS0450
      DO 195 J=1,LOADS                                                 STRS0460
      ADR=0.                                                           STRS0470
      DO 60 I=1,6                                                      STRS0480
      STRSS=STRES(I)                                                   STRS0490
      IF(I.EQ.2.OR.I.EQ.5) STRSS=0.65*STRSS                            STRS0500
      IF(STRSS-ABS(STGMA(I,J)))STRSS                                   STRS0510
      IF(ADSTAS.LE.ADR) GO TO 60                                       STRS0520
      ISTR=I                                                           STRS0530
      ADR=ADSTAS                                                       STRS0540
   60 CONTINUE                                                         STRS0550
      ISTR(L,J)=ISTR                                                   STRS0560
      ASTRE(L,J)=STGMA(ISTR,J)                                         STRS0570
      LL=LOADS*(IL-1) + J                                              STRS0580
      IF(RATIO(LL).GT.ADR) GO TO 100                                   STRS0590
      RATIO(LL)=ADR                                                    STRS0600
      MDEFEQ(J)=L                                                      STRS0610
      RATIO(J)=ADR                                                     STRS0620
  100 CONTINUE                                                         STRS0630
      IF(LNTDSP.NE.3)GO TO 195                                         STRS0640
      IF(RATIOB.LE.ADR)RATIOB=ADR                                      STRS0650
  195 CONTINUE                                                         STRS0660
  200 CONTINUE                                                         STRS0670
      RETURN                                                           STRS0680
      END
C
C     SUBROUTINE STRSW1:
C*****************************************************************
C*   CALCULATE STRUCTURAL WEIGHTS ON COLUMN FOR ANALYSIS PROBLEM  *
C*****************************************************************
C
      SUBROUTINE STRSW1 (NMB,MNO,EL,JT,FS,INC,NN,NG,AA,RHO,RHO1)       STR10010
      DIMENSION EL(1),JT(1),AA(1),MNO(NN,NG)                           STR10020
      SUM=0.                                                           STR10030
      MB=NMB                                                           STR10040
      IF(NB .EQ. 0) GO TO 20                                           STR10050
      DO 10 J=1,NB                                                     STR10060
      KK=MNO(I,J)                                                      STR10070
      IF(INC.EQ.0 .AND. KK.NE.1) GO TO 10                              STR10080
      SPWT=RHO                                                         STR10090
      IF(JT(KK).EQ.0)SPWT=RHO1                                         STR10100
      SUM=SUM + SPWT*AA(KK)*EL(KK)/2.0                                 STR10110
   10 CONTINUE                                                         STR10120
   20 FS=FS+SUM                                                        STR10130
      RETURN                                                           STR10140
C     DEBUG SUBCHK
      END                                                              STR10150
C
C     SUBROUTINE STRSWT:
C*****************************************************************
C*  CALCULATE STRUCTURAL WEIGHTS ON COLUMN FOR DESIGN PROBLEM    *
C*****************************************************************
C
      SUBROUTINE STRSWT (NMB,MNO,EL,JT,FS,AE,BA,BD,D,TFD,I,INC,NN,NG)  STRT0010
      COMMON/BBC/IS,IT,DEPMAX,DEPMIN,TFDMAX,TFDMIN,RHO,RHO1,BTFMAX,    STRT0020
     1    BTFMIN,BDMAX,BDMIN
      DIMENSION EL(1),AE(1),BD(1),JT(1),D(1),TFD(1),MNO(NN,NG)         STRT0030
      SUM=0.                                                           STRT0040
      MB=NMB                                                           STRT0050
      IF(NB .EQ. 0) GO TO 20                                           STRT0060
      DO 10 J=1,NB                                                     STRT0070
      KK=MNO(I,J)                                                      STRT0080
      IF(INC.EQ.0 .AND. KK.NE.1) GO TO 10                              STRT0090
      CALL AREA(AE(KK),BA,BD(KK),D(KK),TFD(KK),JT(KK),SPWT,AA,SS,QQ)   STRT0100
      SUM=SUM + SPWT*AA*EL(KK)/2.0                                     STRT0110
   10 CONTINUE                                                         STRT0120
   20 FS=FS+SUM                                                        STRT0130
      RETURN                                                           STRT0140
C     DEBUG SUBCHK
      END                                                              STRT0150
C
C     SUBROUTINE STURM:
C*****************************************************************
C*    CALCULATE STURM SEQUENCE PROPERTIES OF THE I-TH MODE       *
C*****************************************************************
C
      SUBROUTINE STURM (A,B,MB,VALUE,NGREAT,N,IC,ID)                   STURM010
      COMMON/PRT1/NN,IOUT,JOUT                                         STURM020
      DIMENSION A(1),B(1),C(1),ID(1),IREC(300),ICHNG(300),D(100),      STURM030
     1C(50,100)
      M1 = MB + 1                                                      STURM040
      M21 = 2*MB + 1                                                   STURM050
      IF(N21 .GT. N)N21=N                                              STURM060
      MB2=M21-1                                                        STURM070
      DO 5 I = 1,M1                                                    STURM080
      DO 5 J=1,M21                                                     STURM090
    5 C(I,J)=0.                                                        STURM100
      KH = 1                                                           STURM110
      DO 10 I = 1,M21                                                  STURM120
      IF (I .GT. M1) KH = I - MB                                       STURM130
      DO 9 J = KH,M1                                                   STURM140
      IF (J - I) 6,6,7                                                 STURM150
    6 IF (IC(I) .EQ. J) GO TO 9                                        STURM160
      IX = ID(I) + J - I                                               STURM170
      GO TO 8                                                          STURM180
    7 IF (IC(J) .GT. I) GO TO 9                                        STURM190
      IX = ID(J) + I - J                                               STURM200
    8 C(J,I)=A(IX)-VALUE*B(IX)                                         STURM210
    9 CONTINUE                                                         STURM220
   10 CONTINUE                                                         STURM230
      DO 12 I = 1,N                                                    STURM240
      IREC(I) = 1                                                      STURM250
   12 ICHNG(I) = 0                                                     STURM260
      KFR =                                                            STURM270
      IF (C(1,1) .LT. 0.) KFR = -1                                     STURM280
      IREC(1) = KFR                                                    STURM290
      M1 = M - 1                                                       STURM300
      M21=M21                                                          STURM310
      DO 50 I = 1,M1                                                   STURM320
      IF (I .LE. MB) GO TO 20                                          STURM330
      DO 13 J = 1,M21                                                  STURM340
   13 D(J) = 0.                                                        STURM350
      KR1 = I + 1                                                      STURM360
      IF (I .GE. (N-MB))  M221=M221-1                                  STURM370
      KX=I-MB                                                          STURM380
      DO 17 J = 1,M221                                                 STURM390
      IF (J - M1) 14,14,15                                             STURM400
   14 IF (IC(KR) .GT. (KX+J)) GO TO 17                                 STURM410
      IX = ID(KR) - KR1 + KX + J                                       STURM420
      GO TO 16                                                         STURM430
   15 KX = KR1 + J -M1                                                 STURM440
      IF (IC(KX) .GT. KR1) GO TO 17                                    STURM450
      IX = ID(KX) - KX + KR                                            STURM460
   16 D(J) = A(IX)-VALUE*B(IX)                                         STURM470
   17 CONTINUE                                                         STURM480
      DO 19 J = 1,MB2                                                  STURM490
      DO 18 K = 1,MB                                                   STURM500
   18 C(K,J)=C(K+1,J+1)                                                STURM510
   19 C(M,J)=D(J)                                                      STURM520
      DO 4 K=1,MB                                                      STURM530
    4 C(K,M21)=0.                                                      STURM540
      C(M1,M21)=D(M21)                                                 STURM550
   20 IMB=MB                                                           STURM560
      IF(I .LT. MB)IMB=I                                               STURM570
      DO 40 J = 1,IMB                                                  STURM580
      IF(ABS(C(J,J)).GE. ABS(C(IMB+1,J)))GO TO 25                      STURM590
      IF(C(J,J)/C(IMB+1,J) .GE. 0.)KFR=KFR*(-1)                        STURM600
      DO 102 K=J,M21                                                   STURM610
      SAVE=C(IMB+1,K)                                                  STURM620
      C(IMB+1,K)=C(J,K)                                                STURM630
  105 C(J,K)=SAVE                                                      STURM640
      ICHNG(J) = ICHNG(J) + 1                                          STURM650
   25 C(IMB+1,J)=C(IMB+1,J)/C(J,J)                                     STURM660
      JJ = J + 1                                                       STURM670
      DO 30 K = JJ,M21                                                 STURM680
   30 C(IMB+1,K)=C(IMB+1,K)-C(IMB+1,J)*C(J,K)                          STURM690
   40 CONTINUE                                                         STURM700
      IF(C(IMB+1,IMB+1) .LT. 0.)KFR=KFR*(-1)                           STURM710
      IREC(I+1) = KFR                                                  STURM720
   50 CONTINUE                                                         STURM730
      NGREAT = 0                                                       STURM740
      IF (IREC(1) .GT. 0) NGREAT = NGREAT + 1                          STURM750
      DO 70 I = 2,N                                                    STURM760
      IF (IREC(I) .EQ. IREC(I-1)) NGREAT = NGREAT + 1                  STURM770
   70 CONTINUE                                                         STURM780
      RETURN                                                           STRT0140
C     DEBUG SUBCHK
      END                                                              STRT0150
```

```
 100  FORMAT (1HO,112X,E13.6,5(5X,E13.6)/1)                          STURM790
 101  FORMAT (1X,25(5)                                               STURM800
      RETURN                                                         STURM810
C     DEBUG SUBCHK
      END                                                            STURM820
C
C     SUBROUTINE TRNSFM:
C ****************************************************************
C *       TRANSFORM MEMBER MATRICES INTO GLOBAL MATRICES         *
C ****************************************************************
C
      SUBROUTINE TRNSFM(EK,EM,A,B,C,D,E,INC)                         TRNSF010
      DIMENSION A(3,3),B(6,6),C(6,6),D(6,6),E(6,6),EK(6,6),EM(6,6)   TRNSF020
      DO  30 I=1,6                                                   TRNSF030
      MD=0                                                           TRNSF040
      DO  29 J=1,6                                                   TRNSF050
      JA=J-MD                                                        TRNSF060
      D(I,J)=0.                                                      TRNSF070
      E(I,J)=0.                                                      TRNSF080
      DO  28 K=1,3                                                   TRNSF090
      KB=K+MD                                                        TRNSF100
      D(I,J)=D(I,J)+ EM(I,KB)*A(K,JA)                                TRNSF110
      E(I,J)= B(I,J) +EK(I,KB)*A(K,JA)                               TRNSF120
   28 CONTINUE                                                       TRNSF130
      IF(J .LT. 3) GO TO 29                                          TRNSF140
      MD=3                                                           TRNSF150
   29 CONTINUE                                                       TRNSF160
   30 CONTINUE                                                       TRNSF170
      IF (INC .EQ. 1) RETURN                                         TRNSF180
C
      MD=0                                                           TRNSF190
      DO  34 I=1,6                                                   TRNSF200
      DO  33 J=1,6                                                   TRNSF210
      JA= J-MD                                                       TRNSF220
      C(I,J)=0.                                                      TRNSF230
      E(I,J)=0.                                                      TRNSF240
      DO  32 K=1,3                                                   TRNSF250
      KB=K+MD                                                        TRNSF260
      E(I,J)= E(I,J)+A(K,IA)*D(KB,J)                                 TRNSF270
      C(I,J)=C(I,J)+A(K,IA)*B(KB,J)                                  TRNSF280
   32 CONTINUE                                                       TRNSF290
   33 CONTINUE                                                       TRNSF300
      IF(I .LT. 3) GO TO  34                                         TRNSF310
      MD=3                                                           TRNSF320
   34 CONTINUE                                                       TRNSF330
      RETURN                                                         TRNSF340
C     DEBUG SUBCHK
      END                                                            TRNSF350
C
C     SUBROUTINE WFBEAM:
C ****************************************************************
C *                  CALCULATE MEMBER STRESSES                   *
C ****************************************************************
C
      SUBROUTINE WFBEAM (S,SIGMA,AREAA,SEC,SHE,L)                    WFBE0010
      DIMENSION S(6,L),BETA(3,6),SIGMA(6,L)                          WFBE0020
      DO 132 I=1,3                                                   WFBE0030
      DO 132 J=1,6                                                   WFBE0040
      BETA(I,J)=0.                                                   WFBE0050
  132 CONTINUE                                                       WFBE0060
      BETA(1,1)=1.0/AREAA                                            WFBE0070
      BETA(1,3)=-1.0/SEC                                             WFBE0080
      BETA(1,4)=-BETA(1,1)                                           WFBE0090
      BETA(1,6)=-BETA(1,3)                                           WFBE0100
      BETA(2,2)=SHE                                                  WFBE0110
      BETA(2,5)=BETA(2,2)                                            WFBE0120
      BETA(3,1)=-BETA(1,1)                                           WFBE0130
      BETA(3,3)= -BETA(1,3)                                          WFBE0140
      BETA(3,4)= -BETA(1,1)                                          WFBE0150
      BETA(3,6)=BETA(1,3)                                            WFBE0160
      DO 131 K=1,L                                                   WFBE0170
      DO 131 I=1,3                                                   WFBE0180
      SIGMA(I,K)=0.                                                  WFBE0190
      SIGMA(I+3,K)=0.                                                WFBE0200
      DO 131 J=1,3                                                   WFBE0210
      SIGMA(I,K)=SIGMA(I,K)+BETA(I,J)*S(J,K)                         WFBE0220
      SIGMA(I+3,K)=SIGMA(I+3,K)+BETA(I,J+3)*S(J+3,K)                 WFBE0230
  131 CONTINUE                                                       WFBE0240
      RETURN                                                         WFBE0250
C     DEBUG SUBCHK
      END                                                            WFBE0260
C
C     SUBROUTINE WIND1:
C ****************************************************************
C *        CALCULATE WIND FORCES ACCORDING TO POWER LAW          *
C ****************************************************************
C
      SUBROUTINE WIND1(NSTORY,FR,NN,L,N1,CPIA,CPIB,CPEA,CPEB,GUSTF,  WIND0010
     1BAYWTH,HGRADT,VGRADT,POWER)                                    WIND0020
      COMMON/PRT1/INN,IOUT,JOUT                                      WIND0030
      COMMON/CODE1/HT(30),WTT(4),WWW(30,4),KNODE(30,4)               WIND0040
      DIMENSION WF(31),FFF(30),HEIGHT(31),FR(NN,L)                   WIND0050
C     DO 10 I=1,N1                                                   WIND0060
   10 HEIGHT(I)=0.                                                   WIND0070
      HEIGHT(1)=0.5*HT(1)                                            WIND0080
      DO 20 I=2,NSTORY                                               WIND0090
      II=I-1                                                         WIND0100
   20 HEIGHT(I)=HEIGHT(II)+(HT(II)+HT(I))/2.+HT(II)                  WIND0110
      HEIGHT(N1)=HEIGHT(NSTORY)                                      WIND0120
      BAYWTH=BAYWTH/12.                                              WIND0130
      HGRADT=HGRADT/12.                                              WIND0140
      CP=(CPEA+CPEB+CPIA+CPIB)*GUSTF*BAYWTH                          WIND0150
      DO 30 I=1,N1                                                   WIND0160
      VEL=(HEIGHT(I)/HGRADT)**POWER*VGRADT                           WIND0170
      DYPRES=VEL*VEL*0.002558                                        WIND0180
      WF(I)=CP*DYPRES                                                WIND0190
   30 CONTINUE                                                       WIND0200
      DO 40 I=1,NSTORY                                               WIND0210
      II=I+1                                                         WIND0220
      H1=HEIGHT(II)-HEIGHT(I)                                        WIND0230
      WF1=WF(II)+WF(I)                                               WIND0240
      FFF(I)=H1*WF1/2.                                               WIND0250
   40 CONTINUE                                                       WIND0260
      WRITE(IOUT,200)                                                WIND0270
      WRITE(IOUT,210)(I,FFF(I)),I=1,NSTORY)                          WIND0280
      L=2                                                            WIND0290
      DO 100 I=1,NSTORY                                              WIND0300
      KKK=3*KNODE(I,1)-2                                             WIND0310
      DO 100 J=1,L                                                   WIND0320
      IF(J.EQ.2)FFF(I)=-FFF(I)                                       WIND0330
      FR(KKK,J)=FR(KKK,J)+FFF(I)                                     WIND0340
  100 CONTINUE                                                       WIND0350
  200 FORMAT(//5X,' THE LATERAL WIND LOADS BASED ON POWER LAW ARE :',/  WIND0360
     1 8X,'STORY NO.',5X,'LATERAL FORCE (LB)')
  210 FORMAT(8X,15,11X,E12.6)                                        WIND0370
      RETURN                                                         WIND0380
C     DEBUG SUBCHK
      END                                                            WIND0390
```

IV. SAMPLE EXAMPLES

There are three examples illustrated in this chapter. The geometry and dimensions of each are shown in Figures 4.1 through 4.3. The description of the design loading and other input information is given in Sec. 4.1. The input and ouput listings of each example are shown in Sec. 4.2 for which the sign convension of the member forces and deformations are illustrated in Figure 4.4.

4.1 Description of Input Information for Sample Problems

The loading and other input information for these three examples are given as follows:

a. Static design of ten-bar truss. The geometry and dimensions of the ten-bar truss is shown in Figure 4.1. There are 100 kips (444.8 kN) of static concentrated load acting downward on nodes 2 and 4 simultaneously. The material properties are the modulus of elasticity, 1.0×10^7 psi (68950 N/mm^2), and the specific weight, 0.1 lbs/in^3 (0.0271 N/cm^3). The lower bound of the sectional area is 0.1 in^2 (64.52 mm^2), and the allowable stress is 25,000 psi (172.375 N/mm^2) for all members. The allowable displacement is $\pm$ 2.0 in. (5.08 cm) in the y-direction at nodes 1, 2, 3, and 4. The maximun number of iterations is 20. The incremental and reduction factors that are used to calculate the constraint gradients are 1 and 10% respectively. The upper bound of the change of member size, δ, for the constraint gradient method is 0.5, and the lower bound is 0.2.

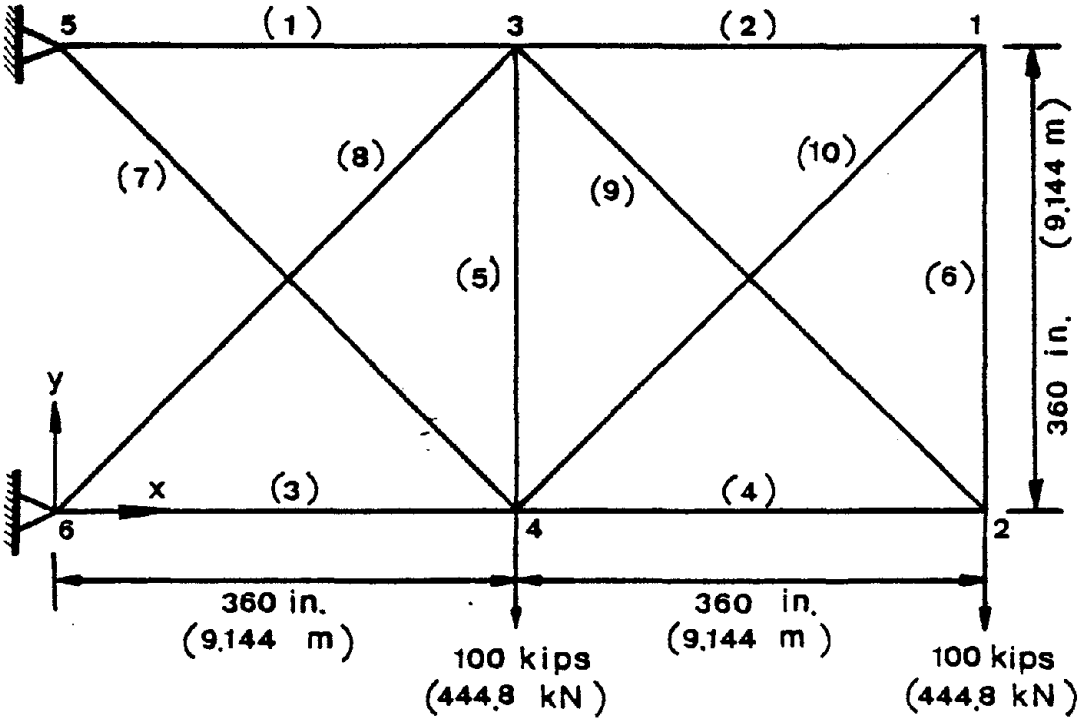


Figure 4.1 Ten-Bar Truss of Sample Example 1

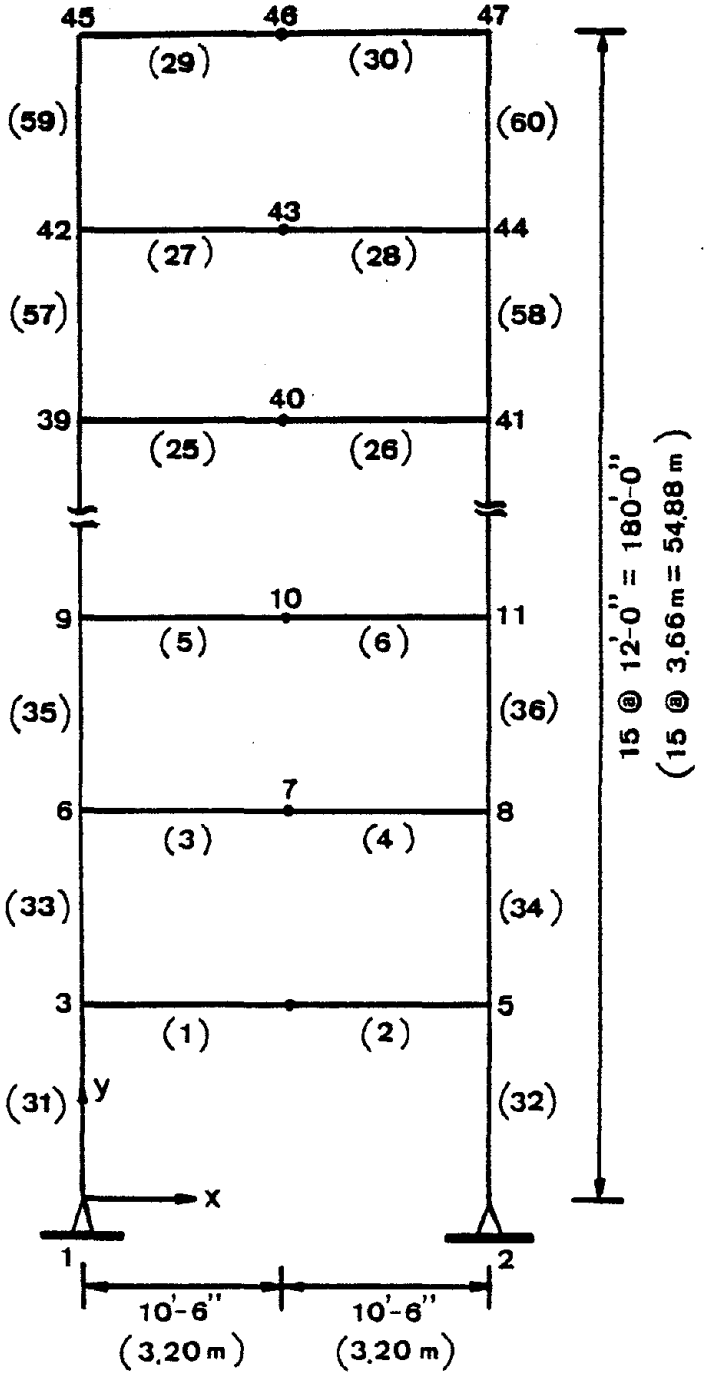


Figure 4.2 Fifteen-Story One-Bay Unbraced Frame of Sample Example 2.

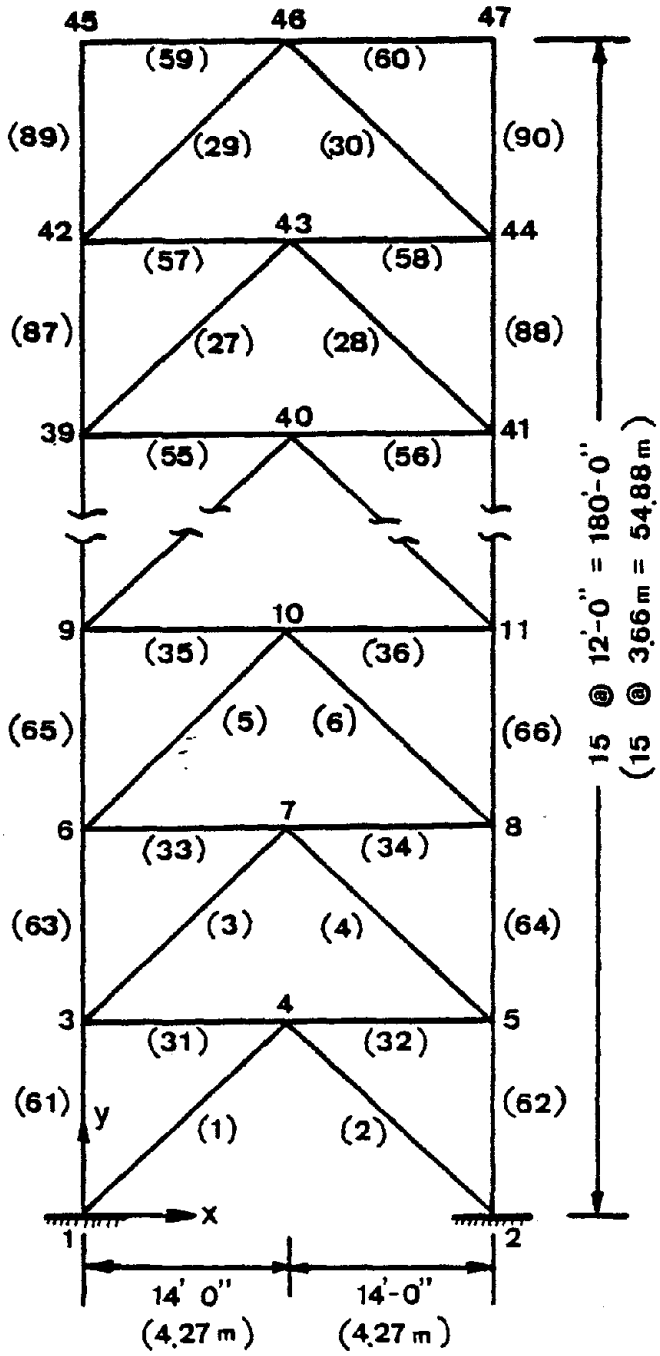
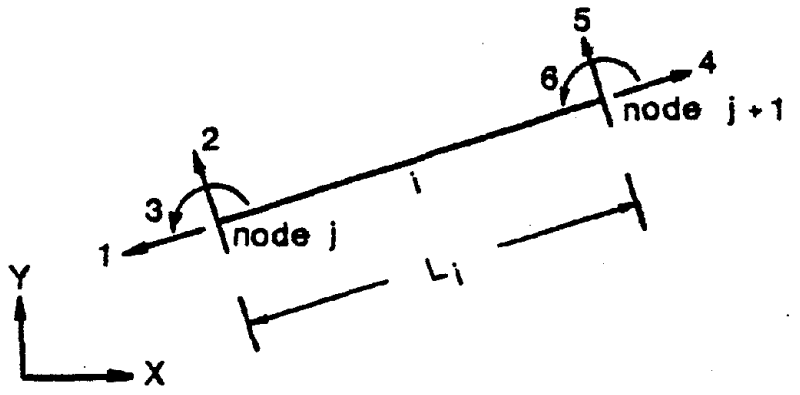
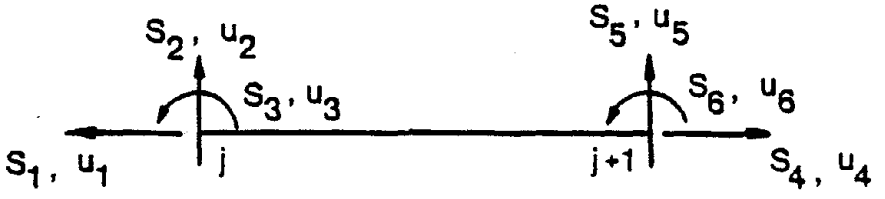


Figure 4.3 Fifteen-Story One-Bay K-Braced Frame of Sample Example 3.



(a) Coordinates of Planar Members



(b) Sign Convention of the Forces and Deformations for Girders and Columns.

(c) Sign Convention of Forces and Deformations for Bracings

Figure 4.4 Positive Forces and Deformations of Typical Members

b. Fifteen-story, one-bay, unbraced frame dynamic design based on Newmark's design spectra. The fifteen-story, one-bay, unbraced frame shown in Figure 4.2 is composed of AISC wide-flange sections. The modulus of elasticity, E, is 29×10^6 psi (199.955 kN/mm^2), and the specific weight, ρ, is 0.283 lbs/in^3 (0.0768 N/cm^3). The allowable stress for bending combined with the axial force is assumed to be 29,000 psi (199.955 N/mm^2), and the allowable displacement is $0.00375h_x$ for which h_x is the height of floor level, x, measured from the ground surface. The spectral acceleration is obtained from the Newmark's design spectra with 5% damping and 90 percentile alluvium. The maximum ground acceleration is 0.0893g for the horizontal motion and a scale factor of 0.67 for the vertical motion. The P-Δ effect is also considered in the design. The uniform nonstructural mass on each floor level is 180 lbs/in. (31.52 kN/m). The dynamic analysis, however, does not include the effect of the static loads.

c. Seismic-resistant optimum weight design of a fifteen-story, one-bay, K-braced frame based on ATC-3-06 equivalent lateral force method. Figure 4.3 shows the schematic diagram and dimensions of the K-braced frame. The girders and columns are designed on the basis of AISC wide-flange sections, and the sections of the braces can be either rectangular or circular. The modulus of elasticity, E, is 29×10^6 psi (199.955 kN/mm^2), and the specific weight, ρ, is 0.283 lbs/in^3 (0.0768 N/cm^3). The lower bound of the moment of inertia of the wide-flange section is 10 in^4 (416.23 cm^4). The sectional area of the braces can not be larger than 6 in^2 (38.71 cm^2) nor smaller than 0.5

in^2 (3.23 cm^2). The frame is subjected to a gravity load of 50,000 lbs (222.4 kN) on each floor level, and the seismic lateral forces are determined in accordance with the requirements of the ATC-3-06 equivalent lateral force method. The map area numbers of A_a and A_v for the location of structure are both 7. The site condition is an S_3 soil profile type. The response modification factor, R, and the deflection amplification factor, C_d, are 6.0 and 5.0 respectively. The frame is classified as in seismic hazard exposure group II for which the allowable drift based on the elastic analysis is $0.015h_{sx}/C_d$, for which h_{sx} is the story height below level x. The incremental factor and the reduction factor used in the constraint gradient method are both 1%. The upper bound and the lower bound of δ are 0.8 and 0.3 respectively.

All of the input data for these three examples are respectively shown in Sections 4.2(a), 4.2(c), and 4.2(e). The design results of the first cycle and the optimum design cycle including the member forces, combined stresses, and nodal displacements of the optimum design cycle are given in the rest of the sections in this chapter.

4.2 Typical Input and Output Solutions

a. Input Data of Example 1.

```
    1    0
    5    0    0    0    1   10    4    1   10    0    0
      0.02       0.01       0.01      0.0001       0.5       0.2      0.10      1.01
   10    6   10    1    2   -1   20   -ITEN BAR TRUSS, WT, GRADIENT,  EXAMPLE 1
0.
10000000. 0.1       100.      1000.     0.1
    1    3    5    0    25000.         0.         0.         0.    1
    2    1    3    0    25000.         0.         0.         0.    2
    3    4    6    0    25000.         0.         0.         0.    3
    4    2    4    0    25000.         0.         0.         0.    4
    5    3    4    0    25000.         0.         0.         0.    5
    6    1    2    0    25000.         0.         0.         0.    6
    7    4    5    0    25000.         0.         0.         0.    7
    8    3    6    0    25000.         0.         0.         0.    8
    9    2    3    0    25000.         0.         0.         0.    9
   10    1    4    0    25000.         0.         0.         0.   10
    1      720.      360.
    2      720.        0.
    3      360.      360.
    4      360.        0.
    5        0.      360.
    6        0.        0.
    3    6    9   12   13   14   15   16   17   18
    2
-100000.      2    2-100000.      2    4
    0.   0.   0.   0.
    0    0    0    3386.4
    4
    2.        2    1       2.    2    2       2.    2    3
    2.        2    4
```

b. Output Solution of Example 1.

```
STRUCTURE NO. 1:  TEN BAR TRUSS, WT, GRADIENT,  EXAMPLE 1

 TOTAL NUMBER OF STORIES----------------    1
 TOTAL NUMBER OF MEMBERS----------------   10
 TOTAL NUMBER OF NODES------------------    6
 TOTAL NUMBER OF RESTRAINED D.O.F.------   10
 TOTAL NUMBER OF LOADING CONDITIONS-----    1
 DISPLACEMENT CONSTRAINT CODE-----------    2
    EQ. 0:  NO DISPLACEMENT CONSTRAINTS
    EQ. 1:  DISPLACEMENT CONSTRAINT IS THE SAME FOR ALL NODES
    EQ. 2:  DISPLACEMENT CONSTRAINT CAN BE VARIED PER NODE
    EQ. 3:  DRIFT CONSTRAINT ON EACH STORY

 TYPE OF DESIGN-------------------------   -1
    EQ.-1:  STATIC DESIGN
    EQ. 0:  STATIC AND DYNAMIC DESIGN
    EQ. 1:  DYNAMIC DESIGN
 MAXIMUM NUMBER OF ITERATIONS-----------   20
 TYPE OF SECTIONS-----------------------   -1
    EQ. 0:  BUILT-UP SECTIONS
    GT. 0:  WF SECTIONS
    LT. 0:  TRUSS MEMBERS


 BRACING PROPERTIES:
    MODULUS OF ELASTICITY----------------   10000000.0
    SPECIFIC WEIGHT----------------------         0.100
    MAXIMUM BRACING AREA-----------------      1000.000
    MINIMUM BRACING AREA-----------------         0.100


 GRADIENT PARAMETERS:
    GRADIENT ITERATION-------------------   10
    UPPER RANGE FOR OI-------------------   0.50000
    LOWER RANGE FOR OI-------------------   0.20000
    REDUCTION FACTOR---------------------   0.10000
    INCREMENTAL FACTOR-------------------   1.01000


 MEMBER IDENTIFICATION DATA:

 NO J-END K-END TYPE STRESS LIMIT   DEAD LOAD      LIVE LOAD      SNOW LOAD      DVN  NO       GIRDER IDENTIFICATION NUMBERS:
  1    3    5    0      25000.000          0.0            0.0            0.0      1   0        0
  2    1    3    0      25000.000          0.0            0.0            0.0      2   0        0
  3    4    6    0      25000.000          0.0            0.0            0.0      3   0        0
  4    2    4    0      25000.000          0.0            0.0            0.0      4   0        0
  5    3    4    0      25000.000          0.0            0.0            0.0      5   0        0
  6    1    2    0      25000.000          0.0            0.0            0.0      6   0        0
  7    4    5    0      25000.000          0.0            0.0            0.0      7   0        0
  8    3    6    0      25000.000          0.0            0.0            0.0      8   0        0
  9    2    3    0      25000.000          0.0            0.0            0.0      9   0        0
 10    1    4    0      25000.000          0.0            0.0            0.0     10   0        0
```

MBAND WIDTH = 7

RESTRAINED DEGREES OF FREEDOM:

3	6	9	12	13	14	15	16	17	18

TOTAL ELEMENTS	NONZERO ELEMENTS	STORED ELEMENTS
171	126	135

STARTING ROW NUMBERS FOR EACH COLUMN

1	1	1	1	1	1	1	1	1	1
1	1	7	7	7	7	7	7		

NUMBERS OF DIAGONAL ELEMENTS IN SINGLE ARRAY STIFFNESS MATRIX

1	3	6	10	15	21	28	36	45	55
66	78	85	93	102	112	123	135		

TOTAL ELEMENTS MEAN THE TOTAL NUMBER OF ELEMENTS IN THE STIFFNESS MATRIX, NONZERO ELEMENTS ARE THE TOTAL NUMBER OF NONZERO ELEMENTS IN THE STIFFNESS MATRIX, AND STORED ELEMENTS ARE THE ELEMENTS IN THE STIFFNESS MATRIX NEEDED TO BE STORED BY USING THIS NUMBERING SCHEME. WHEN THE NUMBERING SCHEME IS AN EFFICIENT ONE, THE NUMBER OF NONZERO ELEMENTS IS CLOSE TO THE NUMBER OF STORED ELEMENTS.

LOADING INFORMATIONS :

STATIC LOADING INFORMATION:

JOINT LOADS FOR LOADING CONDITION 1 ...

JOINT	DIRECTION	VALUE
2	2	-100000.000
4	2	-100000.000

LOAD COMBINATION FACTORS FOR LOADING CONDITION 1

DEAD LOAD	0.0
LIVE LOAD	0.0
SNOW LOAD	0.0
EARTHQUAKE LOAD	0.0

DYNAMIC PROPERTIES:

FIRST MODE NUMBER	0
LAST MODE NUMBER	0
GRAVITY ACCELERATION	386.40
TYPE OF MODE SUPERPOSITION	0

EQ.-1: DIRECT SUPERPOSITION OF MODES
EQ. 0: ROOT-MEAN-SQUARE SUPERPOSITION OF MODES
EQ. 1: ABSOLUTE SUPERPOSITION OF MODES

DISPLACEMENT CONSTRAINTS:

NODE	DIRECTION	VALUE
1	2	2.000
2	2	2.000
3	2	2.000
4	2	2.000

```
 RELATIVE SIZES OF MEMBERS:
1.00000000   1.00000000   1.00000000   1.00000000   1.00000000   1.00000000   1.00000000   1.00000000   1.00000000   1.00000000

 OLD SCALING FACTOR---------------------------------  0.19698E+02
 NEW SCALING FACTOR---------------------------------  0.19698E+02
 ACTIVE STRESS IN LOADING CONDITION 1---------------    3
 ACTIVE DISPLACEMENT IN LOADING CONDITION 1---------    5
 MOST CRITICAL CONSTRAINT---------------------------    2
 NUMBER OF ANALYSIS---------------------------------    2

 ************************************** TOTAL WEIGHT OF STRUCTURE =  8.266156E+03 **************************************
 ************************************** BASE AE =  1.969792E+08;   CYCLE NO. =  1 **************************************

 NO CONSTRAINT ENERGY DENSITY RATIO
  1     2          0.962437E+00
  2     2          0.587448E-01
  3     2          0.100000E+01
  4     2          0.108189E+00
  5     1          0.519373E-02
  6     2          0.587493E-01
  7     2          0.338125E+00
  8     2          0.315723E+00
  9     2          0.216378E+00
 10     2          0.117490E+00

                                                    .
                                                    .
                                                    .
                                                    .
                                                    .
                                                    .
                                                    .
                                                    .

 RELATIVE SIZES OF MEMBERS:
1.00000000   0.0032081190 0.726809536  0.492967963  0.0033842870 0.0172402486 0.249490201  0.700974107  0.697161853  0.0032081190

 OLD SCALING FACTOR---------------------------------  0.30718E+02
 NEW SCALING FACTOR---------------------------------  0.30718E+02
 ACTIVE STRESS IN LOADING CONDITION 1---------------    5
 ACTIVE DISPLACEMENT IN LOADING CONDITION 1---------    2    5
 MOST CRITICAL CONSTRAINT---------------------------    2
 NUMBER OF ANALYSIS---------------------------------    1

 ************************************** TOTAL WEIGHT OF STRUCTURE =  5.065000E+03 **************************************
 ************************************** BASE AE =  3.071770E+08;   CYCLE NO. = 11 **************************************
```

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
1	360.00	1.00000		30.7177	3	5	-2.02680E+05	-6.59814E+03				
2	360.00	0.00321		0.0985	1	3	1.18091E+02	1.19834E+03				
3	360.00	0.72881		22.3874	4	6	1.97319E+05	8.81386E+03				
4	360.00	0.49297		15.1428	2	4	1.00118E+05	6.61156E+03				
5	360.00	0.00338		0.1040	3	4	-2.56207E+03	-2.46454E+04				
6	360.00	0.01724		0.5296	1	2	1.18062E+02	2.22936E+02				

7	509.12	0.24949	7.6638	4	5	-1.37631E+05 -1.79587E+04
8	509.12	0.70097	21.5323	3	6	1.45211E+05 6.74388E+03
9	509.12	0.69716	21.4152	2	3	-1.41588E+05 -6.61157E+03
10	509.12	0.00321	0.0985	1	4	-1.67006E+02 -1.69470E+03

JOINT	-X	-Y	DISPL-X	DISPL-Y	ROTATION
1	720.000	360.000	1.94392979E-01	-2.00000000E+00	0.0
2	720.000	0.0	-5.55315733E-01	-1.99197483E+00	0.0
3	360.000	360.000	2.37533092E-01	-7.23092675E-01	0.0
4	360.000	0.0	-3.17299247E-01	-1.61032677E+00	0.0
5	0.0	360.000	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0

c. Input Data of Example 2.

```
  1    0
  5    0    0    0   15    5    2    1   10    0
     0.02      0.01      0.01    0.0001       0.6      0.3        0.01       1.01
 40   47    6    1    2    1    8   115-ST, 1 BAY, NEWMARK SPECTRA, EXAMPLE 8.
29000000.      0.283       700.    20300.       10.       0.1
0.
  1    3    4    2    29000.       180.        0.         0.    1    1
  2    4    5    2    29000.       180.        0.         0.    1    2
  3    6    7    2    29000.       180.        0.         0.    3    1
  4    7    8    2    29000.       180.        0.         0.    3    2
  5    9   10    2    29000.       180.        0.         0.    5    1
  6   10   11    2    29000.       180.        0.         0.    5    2
  7   12   13    2    29000.       180.        0.         0.    7    1
  8   13   14    2    29000.       180.        0.         0.    7    2
  9   15   16    2    29000.       180.        0.         0.    9    1
 10   16   17    2    29000.       180.        0.         0.    9    2
 11   18   19    2    29000.       180.        0.         0.   11    1
 12   19   20    2    29000.       180.        0.         0.   11    2
 13   21   22    2    29000.       180.        0.         0.   13    1
 14   22   23    2    29000.       180.        0.         0.   13    2
 15   24   25    2    29000.       180.        0.         0.   15    1
 16   25   26    2    29000.       180.        0.         0.   15    2
 17   27   28    2    29000.       180.        0.         0.   17    1
 18   28   29    2    29000.       180.        0.         0.   17    2
 19   30   31    2    29000.       180.        0.         0.   19    1
 20   31   32    2    29000.       180.        0.         0.   19    2
 21   33   34    2    29000.       180.        0.         0.   21    1
 22   34   35    2    29000.       180.        0.         0.   21    2
 23   36   37    2    29000.       180.        0.         0.   23    1
 24   37   38    2    29000.       180.        0.         0.   23    2
 25   39   40    2    29000.       180.        0.         0.   25    1
 26   40   41    2    29000.       180.        0.         0.   25    2
 27   42   43    2    29000.       180.        0.         0.   27    1
 28   43   44    2    29000.       180.        0.         0.   27    2
 29   45   46    2    29000.       180.        0.         0.   29    1
 30   46   47    2    29000.       180.        0.         0.   29    2
 31    1    3    1    29000.         0.        0.         0.   31    1   59
  1    1    3    3     5    5    7    7    9    9   11   11   13   13   15   15
 17   17   19   19    21   21   23   23   25   25   27   27   29   29   33   33
 35   35   37   37    39   39   41   41   43   43   45   45   47   47   49   49
 51   51   53   53    55   55   57   57   59   59   31
 32    2    5    1    29000.         0.        0.         0.   31    2   59
  2    2    4    4     6    6    8    8   10   10   12   12   14   14   16   16
```

```
18  18  20  20  22  22  24  24  26  26  28  28  30  30  34  34
36  36  38  38  40  40  42  42  44  44  46  46  48  48  50  50
52  52  54  54  56  56  58  58  60  60  32
33   3   6   1   29000.      0.      0.      0.  33   1  55
 3   3   5   5   7   7   9   9  11  11  13  13  15  15  17  17
19  19  21  21  23  23  25  25  27  27  29  29  35  35  37  37
39  39  41  41  43  43  45  45  47  47  49  49  51  51  53  53
55  55  57  57  59  59  33
34   5   8   1   29000.      0.      0.      0.  33   2  55
 4   4   6   6   8   8  10  10  12  12  14  14  16  16  18  18
20  20  22  22  24  24  26  26  28  28  30  30  36  36  38  38
40  40  42  42  44  44  46  46  48  48  50  50  52  52  54  54
56  56  58  58  60  60  34
35   6   9   1   29000.      0.      0.      0.  35   1  51
 5   5   7   7   9   9  11  11  13  13  15  15  17  17  19  19
21  21  23  23  25  25  27  27  29  29  37  37  39  39  41  41
43  43  45  45  47  47  49  49  51  51  53  53  55  55  57  57
59  59  35
36   8  11   1   29000.      0.      0.      0.  35   2  51
 6   6   8   8  10  10  12  12  14  14  16  16  18  18  20  20
22  22  24  24  26  26  28  28  30  30  38  38  40  40  42  42
44  44  46  46  48  48  50  50  52  52  54  54  56  56  58  58
60  60  36
37   9  12   1   29000.      0.      0.      0.  37   1  47
 7   7   9   9  11  11  13  13  15  15  17  17  19  19  21  21
23  23  25  25  27  27  29  29  39  39  41  41  43  43  45  45
47  47  49  49  51  51  53  53  55  55  57  37  59  59  37
38  11  14   1   29000.      0.      0.      0.  37   2  47
 8   8  10  10  12  12  14  14  16  16  18  18  20  20  22  22
24  24  26  26  28  28  30  30  40  40  42  42  44  44  46  46
48  48  50  50  52  52  54  54  56  56  58  58  60  60  38
39  12  15   1   29000.      0.      0.      0.  39   1  43
 9   9  11  11  13  13  15  15  17  17  19  19  21  21  23  23
25  25  27  27  29  29  41  41  43  43  45  45  47  47  49  49
51  51  53  53  55  55  57  57  59  59  39
40  14  17   1   29000.      0.      0.      0.  39   2  43
10  10  12  12  14  14  16  16  18  18  20  20  22  22  24  24
26  26  28  28  30  30  42  42  44  44  46  46  48  48  50  50
52  52  54  54  56  56  58  58  60  60  40
41  15  18   1   29000.      0.      0.      0.  41   1  39
11  11  13  13  15  15  17  17  19  19  21  21  23  23  25  25
27  27  29  29  43  43  45  45  47  47  49  49  51  51  53  53
55  55  57  57  59  59  41
42  17  20   1   29000.      0.      0.      0.  41   2  39
12  12  14  14  16  16  18  18  20  20  22  22  24  24  26  26
28  28  30  30  44  44  46  46  48  48  50  50  52  52  54  54
56  56  58  58  60  60  42
43  18  21   1   29000.      0.      0.      0.  43   1  35
13  13  15  15  17  17  19  19  21  21  23  23  25  25  27  27
29  29  45  45  47  47  49  49  51  51  53  53  55  55  57  57
59  59  43
44  20  23   1   29000.      0.      0.      0.  43   2  35
14  14  16  16  18  18  20  20  22  22  24  24  26  26  28  28
30  30  46  46  48  48  50  50  52  52  54  54  56  56  58  58
60  60  44
45  21  24   1   29000.      0.      0.      0.  45   1  31
15  15  17  17  19  19  21  21  23  23  25  25  27  27  29  29
47  47  49  49  51  51  53  53  55  55  57  57  59  59  45
46  23  26   1   29000.      0.      0.      0.  45   2  31
16  16  18  18  20  20  22  22  24  24  26  26  28  28  30  30
48  48  50  50  52  52  54  54  56  56  58  58  60  60  46
47  24  27   1   29000.      0.      0.      0.  47   1  27
17  17  19  19  21  21  23  23  25  25  27  27  29  29  49  49
51  51  53  53  55  55  57  57  59  59  47
48  26  29   1   29000.      0.      0.      0.  47   2  27
18  18  20  20  22  22  24  24  26  26  28  28  30  30  50  50
52  52  54  54  56  56  58  58  60  60  48
49  27  30   1   29000.      0.      0.      0.  49   1  23
19  19  21  21  23  23  25  25  27  27  29  29  51  51  53  53
55  55  57  57  59  59  49
50  29  32   1   29000.      0.      0.      0.  49   2  23
20  20  22  22  24  24  26  26  28  28  30  38  52  52  54  54
56  56  58  58  60  60  50
51  30  33   1   29000.      0.      0.      0.  51   1  19
21  21  23  23  25  25  27  27  29  29  53  53  55  55  57  57
59  59  51
52  32  35   1   29000.      0.      0.      0.  51   2  19
22  22  24  24  26  26  28  28  30  30  54  54  56  56  58  58
60  60  52
53  33  36   1   29000.      0.      0.      0.  53   1  15
23  23  25  25  27  27  29  29  55  55  57  57  59  59  53
54  35  38   1   29000.      0.      0.      0.  53   2  15
24  24  26  26  28  28  30  30  56  56  58  58  60  60  54
55  36  39   1   29000.      0.      0.      0.  55   1  11
25  25  27  27  29  29  57  57  59  59  55
56  38  41   1   29000.      0.      0.      0.  55   2  11
26  26  28  28  30  30  58  58  60  60  56
57  39  42   1   29000.      0.      0.      0.  57   1   7
27  27  29  29  59  59  57
58  41  44   1   29000.      0.      0.      0.  57   2   7
28  28  30  30  60  60  58
59  42  45   1   29000.      0.      0.      0.  59   1   3
29  29  59
60  44  47   1   29000.      0.      0.      0.  59   2   3
30  30  60
```

1	0.	0.
2	252.	0.
3	0.	144.
4	126.	144.
5	252.	144.
6	0.	288.
7	126.	288.
8	252.	288.
9	0.	432.
10	126.	432.
11	252.	432.
12	0.	576.

```
 13      126.      576.
 14      252.      576.
 15        0.      720.
 16      126.      720.
 17      252.      720.
 18        0.      864.
 19      126.      864.
 20      252.      864.
 21        0.     1008.
 22      126.     1008.
 23      252.     1008.
 24        0.     1152.
 25      126.     1152.
 26      252.     1152.
 27        0.     1296.
 28      126.     1296.
 29      252.     1296.
 30        0.     1440.
 31      126.     1440.
 32      252.     1440.
 33        0.     1584.
 34      126.     1584.
 35      252.     1584.
 36        0.     1728.
 37      126.     1728.
 38      252.     1728.
 39        0.     1872.
 40      126.     1872.
 41      252.     1872.
 42        0.     2016.
 43      126.     2016.
 44      252.     2016.
 45        0.     2160.
 46      126.     2160.
 47      252.     2160.
  1    2    3    4    5    6
  2    0    1    5  386.4
    0.05      0.05      0.05      0.05      0.05
      0.        0.
```

```
 -1   -1    3    09.089 0.67          NEWMARK SPECTRUM, 90 PERCENTILE ALLUVIUM
  2    0
  2    4    1    2   31   32   33   34
  2    4    3    4   33   34   35   36
  2    4    5    6   35   36   37   38
  2    4    7    8   37   38   39   40
  2    4    9   10   39   40   41   42
  2    4   11   12   41   42   43   44
  2    4   13   14   43   44   45   46
  2    4   15   16   45   46   47   48
  2    4   17   18   47   48   49   50
  2    4   19   20   49   50   51   52
  2    4   21   22   51   52   53   54
  2    4   23   24   53   54   55   56
  2    4   25   26   55   56   57   58
  2    4   27   28   57   58   59   60
  2    2   29   30   59   60
 15
0.54          1    31.08          1    61.62          1    9
2.16          1   122.7           1   153.24          1   18
3.78          1   214.32          1   244.86          1   27
5.4           1   305.94          1   336.48          1   36
7.02          1   397.56          1   428.1           1   45
0.
```

d. Output Solution of Example 2.

```
STRUCTURE NO. 1:  15-ST. 1 BAY. NEWMARK SPECTRA. EXAMPLE A

 TOTAL NUMBER OF STORIES----------------   15
 TOTAL NUMBER OF MEMBERS----------------   60
 TOTAL NUMBER OF NODES------------------   47
 TOTAL NUMBER OF RESTRAINED D.O.F.------    6
 TOTAL NUMBER OF LOADING CONDITIONS-----    1
 DISPLACEMENT CONSTRAINT CODE-----------    2
    EQ. 0:  NO DISPLACEMENT CONSTRAINTS
    EQ. 1:  DISPLACEMENT CONSTRAINT IS THE SAME FOR ALL NODES
    EQ. 2:  DISPLACEMENT CONSTRAINT CAN BE VARIED PER NODE
    EQ. 3:  DRIFT CONSTRAINT ON EACH STORY

 TYPE OF DESIGN-------------------------    1
    EQ.-1:  STATIC DESIGN
    EQ. 0:  STATIC AND DYNAMIC DESIGN
    EQ. 1:  DYNAMIC DESIGN
 MAXIMUM NUMBER OF ITERATIONS-----------    8
 TYPE OF SECTIONS-----------------------    1
    EQ. 0:  BUILT-UP SECTIONS
    GT. 0:  WF SECTIONS
    LT. 0:  TRUSS MEMBERS
```

GIRDER-COLUMN PROPERTIES:

MODULUS OF ELASTICITY	29000000.0
SPECIFIC WEIGHT	0.283
INITIAL MOMENT OF INERTIA	700.000
MAXIMUM MOMENT OF INERTIA	20300.000
MINIMUM MOMENT OF INERTIA	10.000
RATIO OF MINIMUM I TO MAXIMUM I	0.100

BRACING PROPERTIES:

MODULUS OF ELASTICITY	0.0
SPECIFIC WEIGHT	0.0
MAXIMUM BRACING AREA	0.0
MINIMUM BRACING AREA	0.0

GRADIENT PARAMETERS:

GRADIENT ITERATION	5
UPPER RANGE FOR OI	0.80000
LOWER RANGE FOR OI	0.30000
REDUCTION FACTOR	0.01000
INCREMENTAL FACTOR	1.01000

MEMBER IDENTIFICATION DATA:

NO	J-END	K-END	TYPE	STRESS LIMIT	DEAD LOAD	LIVE LOAD	SNOW LOAD	DVN	NO	GIRDER IDENTIFICATION NUMBERS:
1	3	4	2	29000.000	180.000	0.0	0.0	1	0	0
2	4	5	2	29000.000	180.000	0.0	0.0	1	0	0
3	6	7	2	29000.000	180.000	0.0	0.0	3	0	0
4	7	8	2	29000.000	180.000	0.0	0.0	3	0	0
5	9	10	2	29000.000	180.000	0.0	0.0	5	0	0
6	10	11	2	29000.000	180.000	0.0	0.0	5	0	0
7	12	13	2	29000.000	180.000	0.0	0.0	7	0	0
8	13	14	2	29000.000	180.000	0.0	0.0	7	0	0
9	15	16	2	29000.000	180.000	0.0	0.0	9	0	0
10	16	17	2	29000.000	180.000	0.0	0.0	9	0	0
11	18	19	2	29000.000	180.000	0.0	0.0	11	0	0
12	19	20	2	29000.000	180.000	0.0	0.0	11	0	0
13	21	22	2	29000.000	180.000	0.0	0.0	13	0	0
14	22	23	2	29000.000	180.000	0.0	0.0	13	0	0
15	24	25	2	29000.000	180.000	0.0	0.0	15	0	0
16	25	26	2	29000.000	180.000	0.0	0.0	15	0	0
17	27	28	2	29000.000	180.000	0.0	0.0	17	0	0
18	28	29	2	29000.000	180.000	0.0	0.0	17	0	0
19	30	31	2	29000.000	180.000	0.0	0.0	19	0	0
20	31	32	2	29000.000	180.000	0.0	0.0	19	0	0
21	33	34	2	29000.000	180.000	0.0	0.0	21	0	0
22	34	35	2	29000.000	180.000	0.0	0.0	21	0	0
23	36	37	2	29000.000	180.000	0.0	0.0	23	0	0
24	37	38	2	29000.000	180.000	0.0	0.0	23	0	0
25	39	40	2	29000.000	180.000	0.0	0.0	25	0	0
26	40	41	2	29000.000	180.000	0.0	0.0	25	0	0
27	42	43	2	29000.000	180.000	0.0	0.0	27	0	0
28	43	44	2	29000.000	180.000	0.0	0.0	27	0	0
29	45	46	2	29000.000	180.000	0.0	0.0	29	0	0
30	46	47	2	29000.000	180.000	0.0	0.0	29	0	0
31	1	3	1	29000.000	0.0	0.0	0.0	31	59	1 1 3 3 5 5 7 7 9 9 11 11 13 13 15 15 17 17 19 19 21 21 23 23 25 25 27 27 29 29 33 33 35 35 37 37 39 39 41 41 43 43 45 45 47 47 49 49 51 51 53 53 55 55 57 57 59 59 31
32	2	5	1	29000.000	0.0	0.0	0.0	31	59	2 2 4 4 6 6 8 8 10 10 12 12 14 14 16 16 18 18 20 20 22 22 24 24 26 26 28 28 30 30 34 34 36 36 38 38 40 40 42 42 44 44 46 46 48 48 50 50 52 52 54 54 56 56 58 58 60 60 32
33	3	6	1	29000.000	0.0	0.0	0.0	33	55	3 3 5 5 7 7 9 9 11 11 13 13 15 15 17 17 19 19 21 21 23 23 25 25 27 27 29 29 35 35 37 37 39 39 41 41 43 43 45 45 47 47 49 49 51 51 53 53 55 55 57 57 59 59 33
34	5	8	1	29000.000	0.0	0.0	0.0	33	55	4 4 6 6 8 8 10 10 12 12 14 14 16 16 18 18 20 20 22 22 24 24 26 26 28 28 30 30 36 36 38 38 40 40 42 42 44 44 46 46 48 48 50 50 52 52 54 54 56 56 58 58 60 60 34
35	6	9	1	29000.000	0.0	0.0	0.0	35	51	5 5 7 7 9 9 11 11 13 13 15 15 17 17 19 19 21 21 23 23 25 25 27 27 29 29 37 37 39 39 41 41 43 43 45 45 47 47 49 49 51 51 53 53 55 55 57 57 59 59 35

36	8	11	1	29000.000	0.0	0.0	0.0	35	51	6	6	8	8	10	10	12		
										12	14	14	16	16	18	18		
										20	20	22	22	24	24	26		
										26	28	28	30	30	38	38		
										40	40	42	42	44	44	46		
										46	48	48	50	50	52	52		
										54	54	56	56	58	58	60		
										60	36							
37	9	12	1	29000.000	0.0	0.0	0.0	37	47	7	7	9	9	11	11	13		
										13	15	15	17	17	19	19		
										21	21	23	23	25	25	27		
										27	29	29	39	39	41	41		
										43	43	45	45	47	47	49		
										49	51	51	53	53	55	55		
										57	57	59	59	37				
38	11	14	1	29000.000	0.0	0.0	0.0	37	47	8	8	10	10	12	12	14		
										14	16	16	18	18	20	20		
										22	22	24	24	26	26	28		
										28	30	30	40	40	42	42		
										44	44	46	46	48	48	50		
										50	52	52	54	54	56	56		
										58	58	60	60	38				
39	12	15	1	29000.000	0.0	0.0	0.0	39	43	9	9	11	11	13	13	15		
										15	17	17	19	19	21	21		
										23	23	25	25	27	27	29		
										29	41	41	43	43	45	45		
										47	47	49	49	51	51	53		
										53	55	55	57	57	59	59		
										39								
40	14	17	1	29000.000	0.0	0.0	0.0	39	43	10	10	12	12	14	14	16		
										16	18	18	20	20	22	22		
										24	24	26	26	28	28	30		
										30	42	42	44	44	46	46		
										48	48	50	50	52	52	54		
										54	56	56	58	58	60	60		
										40								
41	15	18	1	29000.000	0.0	0.0	0.0	41	39	11	11	13	13	15	15	17		
										17	19	19	21	21	23	23		
										25	25	27	27	29	29	43		
										43	45	45	47	47	49	49		
										51	51	53	53	55	55	57		
										57	59	59	41					
42	17	20	1	29000.000	0.0	0.0	0.0	41	39	12	12	14	14	16	16	18		
										18	20	20	22	22	24	24		
										26	26	28	28	30	30	44		
										44	46	46	48	48	50	50		
										52	52	54	54	56	56	58		
										58	60	60	42					
43	18	21	1	29000.000	0.0	0.0	0.0	43	35	13	13	15	15	17	17	19		
										19	21	21	23	23	25	25		
										27	27	29	29	45	45	47		
										47	49	49	51	51	53	53		
										55	55	57	57	59	59	43		
44	20	23	1	29000.000	0.0	0.0	0.0	43	35	14	14	16	16	18	18	20		
										20	22	22	24	24	26	26		
										28	28	30	30	46	46	48		
										48	50	50	52	52	54	54		
										56	56	58	58	60	60	44		
45	21	24	1	29000.000	0.0	0.0	0.0	45	31	15	15	17	17	19	19	21		
										21	23	23	25	25	27	27		
										29	29	47	47	49	49	51		
										51	53	53	55	55	57	57		
										59	59	45						
46	23	26	1	29000.000	0.0	0.0	0.0	45	31	16	16	18	18	20	20	22		
										22	24	24	26	26	28	28		
										30	30	48	48	50	50	52		
										52	54	54	56	56	58	58		
										60	60	46						
47	24	27	1	29000.000	0.0	0.0	0.0	47	27	17	17	19	19	21	21	23		
										23	25	25	27	27	29	29		
										49	49	51	51	53	53	55		
										55	57	57	59	59	47			
48	26	29	1	29000.000	0.0	0.0	0.0	47	27	18	18	20	20	22	22	24		
										24	26	26	28	28	30	30		
										50	50	52	52	54	54	56		
										56	58	58	60	60	48			
49	27	30	1	29000.000	0.0	0.0	0.0	49	23	19	19	21	21	23	23	25		
										25	27	27	29	29	51	51		
										53	53	55	55	57	57	59		
										59	49							
50	29	32	1	29000.000	0.0	0.0	0.0	49	23	20	20	22	22	24	24	26		
										26	28	28	30	30	52	52		
										54	54	56	56	58	58	60		
										60	50							
51	30	33	1	29000.000	0.0	0.0	0.0	51	19	21	21	23	23	25	25	27		
										27	29	29	53	53	55	55		
										57	57	59	59	51				
52	32	35	1	29000.000	0.0	0.0	0.0	51	19	22	22	24	24	26	26	28		
										28	30	30	54	54	56	56		
										58	58	60	60	52				
53	33	36	1	29000.000	0.0	0.0	0.0	53	15	23	23	25	25	27	27	29		
										29	55	55	57	57	59	59		
										53								
54	35	38	1	29000.000	0.0	0.0	0.0	53	15	24	24	26	26	28	28	30		
										30	56	56	58	58	60	60		
										54								
55	36	39	1	29000.000	0.0	0.0	0.0	55	11	25	25	27	27	29	29	57		
										57	59	59	55					
56	38	41	1	29000.000	0.0	0.0	0.0	55	11	26	26	28	28	30	30	58		
										58	60	60	56					
57	39	42	1	29000.000	0.0	0.0	0.0	57	7	27	27	29	29	59	59	57		
58	41	44	1	29000.000	0.0	0.0	0.0	57	7	28	28	30	30	60	60	58		
59	42	45	1	29000.000	0.0	0.0	0.0	59	3	29	29	59						
60	44	47	1	29000.000	0.0	0.0	0.0	59	3	30	30	60						

MBAND WIDTH = 11

RESTRAINED DEGREES OF FREEDOM:

1	2	3	4	5	6

TOTAL ELEMENTS	NONZERO ELEMENTS	STORED ELEMENTS
10011	822	1218

STARTING ROW NUMBERS FOR EACH COLUMN

1	1	1	4	4	4	1	1	1	7
7	7	4	4	4	7	7	7	16	16
16	13	13	13	16	16	16	25	25	25
22	22	22	25	25	25	34	34	34	31
31	31	34	34	34	43	43	43	40	40
40	43	43	43	52	52	52	49	49	49
52	52	52	61	61	61	58	58	58	61
61	61	70	70	70	67	67	67	70	70
70	79	79	79	76	76	76	79	79	79
88	88	88	85	85	85	88	88	88	97
97	97	94	94	94	97	97	97	106	106
106	103	103	103	106	106	106	115	115	115
112	112	112	115	115	115	124	124	124	121
121	121	124	124	124	133	133	133	130	130
130									

NUMBERS OF DIAGONAL ELEMENTS IN SINGLE ARRAY STIFFNESS MATRIX

1	3	6	7	9	12	19	27	36	40
45	51	61	72	84	94	105	117	121	126
132	142	153	165	175	186	198	202	207	213
223	234	246	256	267	279	283	288	294	304
315	327	337	346	360	364	369	375	385	396
408	418	429	441	445	458	456	466	477	489
499	510	522	526	531	537	547	558	570	580
591	603	607	612	618	628	639	651	661	672
684	688	693	699	709	720	732	742	753	769
769	774	780	790	801	813	823	834	846	850
855	861	871	882	894	904	915	927	931	936
942	952	963	975	985	996	1008	1012	1017	1023
1033	1044	1056	1066	1077	1089	1093	1098	1104	1114
1125	1137	1147	1158	1170	1174	1179	1185	1195	1206
1218									

TOTAL ELEMENTS MEAN THE TOTAL NUMBER OF ELEMENTS IN THE STIFFNESS MATRIX, NONZERO ELEMENTS ARE THE TOTAL NUMBER OF NONZERO ELEMENTS IN THE STIFFNESS MATRIX, AND STORED ELEMENTS ARE THE ELEMENTS IN THE STIFFNESS MATRIX NEEDED TO BE STORED BY USING THIS NUMBERING SCHEME. WHEN THE NUMBERING SCHEME IS AN EFFICIENT ONE, THE NUMBER OF NONZERO ELEMENTS IS CLOSE TO THE NUMBER OF STORED ELEMENTS.

LOADING INFORMATIONS :

DYNAMIC PROPERTIES:

FIRST MODE NUMBER----------	1
LAST MODE NUMBER----------	5
GRAVITY ACCELERATION----------	386.40
TYPE OF MODE SUPERPOSITION----------	0

EQ.-1: DIRECT SUPERPOSITION OF MODES
EQ. 0: ROOT-MEAN-SQUARE SUPERPOSITION OF MODES
EQ. 1: ABSOLUTE SUPERPOSITION OF MODES

DAMPING RATIO FOR EACH MODE:

0.050	0.050	0.050	0.050	0.050

ADDITIONAL NODAL MASSES:

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0			

DYNAMIC LOADING INFORMATION:

DATA FOR LOADING CONDITION 1 ... NEWMARK SPECTRUM, 90 PERCENTILE ALLUVIUM
MOTION TYPE CODE----------------------- -1
LT. 0: HORIZONTAL + VERTICAL MOTIONS
GT. 0: HORIZONTAL = 1 ; VERTICAL = 2 .
NUMBER OF ACCELERATION DATA------------ 0
LOAD MULTIPLIER------------------------ 0.089
SCALE FACTOR FOR VERTICAL MOTION------- 0.670
TYPE OF INPUT ACCELERATION DATA-------- 3
EQ. 1: TIME-HISTORY DATA ; EQ. 2: SPECTRUM DATA ; EQ. 3: CURVE FITTING SPECTRUM DATA

USE NEWMARK SPECTRUM TO FIND MAXIMUM ACCLERATION DATA
THE CURVE IS CORRESPONDING TO DESIGN SPECTRA : 2
EQ. 1: 50 PERCENTILE, 5% DAMPING, ALLUVIUM ;
EQ. 2: 90 PERCENTILE, 5% DAMPING, ALLUVIUM ;
EQ. 3: DUCTILITY 3, 5% DAMPING ;
EQ. 4: DUCTILITY 4, 10% DAMPING .

DISPLACEMENT CONSTRAINTS:

NODE	DIRECTION	VALUE
3	1	0.540
6	1	1.080
9	1	1.620
12	1	2.160
15	1	2.700
18	1	3.240
21	1	3.780
24	1	4.320
27	1	4.860
30	1	5.400
33	1	5.940
36	1	6.480
39	1	7.020
42	1	7.560
45	1	8.100

FREQUENCY CONSTRAINTS:

MODE	MINIMUM
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0

RELATIVE SIZES OF MEMBERS:

1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000

NATURAL FREQUENCIES:
0.370261E+01 0.425228E+02 0.158026E+03 0.343234E+03 0.556162E+03

MODE	EIGENVECTORS:								
1	0.315075E-01	0.618247E-02	-0.277675E-03	0.315084E-01	0.114646E-06	0.652414E-04	0.315075E-01	-0.618220E-02	-0.277674E-03
	0.897400E-01	0.118581E-01	-0.367038E-03	0.897422E-01	0.188658E-06	0.423552E-04	0.897397E-01	-0.118575E-01	-0.367036E-03
	0.157598E+00	0.169283E-01	-0.412189E-03	0.157602E+00	0.492688E-06	0.456969E-05	0.157597E+00	-0.169275E-01	-0.412191E-03
	0.230635E+00	0.213823E-01	-0.442113E-03	0.230641E+00	0.632005E-06	-0.334938E-04	0.230635E+00	-0.213812E-01	-0.442114E-03
	0.306949E+00	0.252317E-01	-0.462802E-03	0.306957E+00	0.745926E-06	-0.689771E-04	0.306949E+00	-0.252303E-01	-0.462803E-03
	0.385192E+00	0.284983E-01	-0.475567E-03	0.385203E+00	0.105286E-05	-0.101484E-03	0.385192E+00	-0.284968E-01	-0.475573E-03
	0.464119E+00	0.312113E-01	-0.480915E-03	0.464131E+00	0.910639E-06	-0.131110E-03	0.464119E+00	-0.312095E-01	-0.480914E-03
	0.542584E+00	0.334063E-01	-0.479282E-03	0.542599E+00	0.727786E-06	-0.158060E-03	0.542584E+00	-0.334044E-01	-0.479274E-03
	0.619485E+00	0.351255E-01	-0.471042E-03	0.619501E+00	0.637810E-06	-0.182649E-03	0.619483E+00	-0.351235E-01	-0.471029E-03
	0.693808E+00	0.364175E-01	-0.456951E-03	0.693825E+00	0.127054E-05	-0.205071E-03	0.693805E+00	-0.364154E-01	-0.456955E-03
	0.764678E+00	0.373362E-01	-0.437761E-03	0.764697E+00	0.130682E-05	-0.225605E-03	0.764676E+00	-0.373339E-01	-0.437764E-03
	0.831313E+00	0.379401E-01	-0.413930E-03	0.831334E+00	0.154264E-05	-0.244710E-03	0.831312E+00	-0.379377E-01	-0.413936E-03
	0.892993E+00	0.382928E-01	-0.386135E-03	0.893017E+00	0.137648E-05	-0.262806E-03	0.892993E+00	-0.382902E-01	-0.386137E-03
	0.949195E+00	0.384619E-01	-0.356291E-03	0.949219E+00	0.809054E-06	-0.279747E-03	0.949193E+00	-0.384592E-01	-0.356274E-03
	0.999975E+00	0.385167E-01	-0.329908E-03	0.100000E+01	0.166019E-05	-0.293586E-03	0.999973E+00	-0.385140E-01	-0.329915E-03
	-0.156824E+00	0.778102E-03	0.125676E-02	-0.156874E+00	-0.109199E-06	-0.638115E-03	-0.156824E+00	-0.778507E-03	0.125675E-02
	-0.410572E+00	0.434618E-02	0.136427E-02	-0.410701E+00	-0.372599E-06	-0.734429E-03	-0.410571E+00	-0.434699E-02	0.136427E-02
	-0.649206E+00	0.110032E-01	0.114389E-02	-0.649411E+00	-0.416941E-06	-0.703484E-03	-0.649205E+00	-0.110044E-01	0.114388E-02
	-0.834516E+00	0.203770E-01	0.779318E-03	-0.834779E+00	-0.975509E-06	-0.632766E-03	-0.834514E+00	-0.203785E-01	0.779324E-03
	-0.947290E+00	0.318234E-01	0.334368E-03	-0.947589E+00	-0.100529E-05	-0.546522E-03	-0.947289E+00	-0.318253E-01	0.334367E-03
	-0.977364E+00	0.445565E-01	-0.147065E-03	-0.977673E+00	-0.100132E-05	-0.457356E-03	-0.977363E+00	-0.445589E-01	-0.147072E-03
	-0.922118E+00	0.577322E-01	-0.623606E-03	-0.922409E+00	-0.126009E-05	-0.375911E-03	-0.922117E+00	-0.577349E-01	-0.623612E-03
	-0.786180E+00	0.705242E-01	-0.105600E-02	-0.786429E+00	-0.172005E-05	-0.311989E-03	-0.786179E+00	-0.705273E-01	-0.105599E-02
	-0.580803E+00	0.821978E-01	-0.140980E-02	-0.580986E+00	-0.174586E-05	-0.274061E-03	-0.580802E+00	-0.822011E-01	-0.140980E-02
	-0.322762E+00	0.921724E-01	-0.165789E-02	-0.322865E+00	-0.171541E-05	-0.268778E-03	-0.322762E+00	-0.921758E-01	-0.165789E-02
	-0.328752E-01	0.100071E+00	-0.178254E-02	-0.328856E-01	-0.169423E-05	-0.300532E-03	-0.328751E-01	-0.100075E+00	-0.178255E-02
	0.265832E+00	0.105756E+00	-0.177681E-02	0.265916E+00	-0.288020E-05	-0.371147E-03	0.265832E+00	-0.105760E+00	-0.177678E-02
	0.550137E+00	0.109336E+00	-0.164595E-02	0.550311E+00	-0.206816E-05	-0.479279E-03	0.550137E+00	-0.109340E+00	-0.164595E-02
	0.799183E+00	0.111163E+00	-0.141339E-02	0.799434E+00	-0.214030E-05	-0.617417E-03	0.799181E+00	-0.111167E+00	-0.141338E-02
	0.999685E+00	0.111782E+00	-0.115206E-02	0.100000E+01	-0.209662E-05	-0.755553E-03	0.999683E+00	-0.111786E+00	-0.115206E-02

```
  3    0.286136E+00 0.555393E-02-0.221864E-02 0.286472E+00 0.413532E-06 0.104601E-02 0.286136E+00-0.555399E-02-0.221866E-02
       0.698726E+00 0.634323E-02-0.197028E-02 0.699548E+00 0.281860E-06 0.912052E-03 0.698728E+00-0.634335E-02-0.197029E-02
       0.969545E+00 0.292415E-02-0.852429E-03 0.970686E+00 0.191336E-06 0.392444E-03 0.969547E+00-0.292435E-02-0.852433E-03
       0.998824E+00-0.231274E-02 0.547909E-03 0.100000E+01 0.703622E-06-0.247074E-03 0.998828E+00 0.231247E-02 0.547893E-03
       0.775075E+00-0.638824E-02 0.180666E-02 0.775987E+00-0.174877E-06-0.829485E-03 0.775077E+00 0.638791E-02 0.180667E-02
       0.357336E+00-0.661410E-02 0.258539E-02 0.357756E+00-0.193393E-06-0.121721E-02 0.357336E+00 0.661370E-02 0.258539E-02
      -0.144813E+00-0.129004E-02 0.268265E-02-0.144983E+00-0.432049E-06-0.132958E-02-0.144813E+00 0.128958E-02 0.268266E-02
      -0.600945E+00 0.988305E-02 0.207690E-02-0.601653E+00-0.113567E-05-0.115935E-02-0.600948E+00-0.988359E-02 0.207693E-02
      -0.893767E+00 0.257608E-01 0.927590E-03-0.894820E+00-0.553434E-06-0.772799E-03-0.893771E+00-0.257615E-01 0.927592E-03
      -0.949086E+00 0.440859E-01-0.469248E-03-0.950123E+00-0.106983E-05-0.291387E-03-0.949089E+00-0.440866E-01-0.469233E-03
      -0.753729E+00 0.620988E-01-0.175917E-02-0.754617E+00-0.388844E-06 0.140160E-03-0.753732E+00-0.620996E-01-0.175918E-02
      -0.358642E+00 0.772690E-01-0.262115E-02-0.359063E+00-0.409417E-06 0.391100E-03-0.358642E+00-0.772699E-01-0.262115E-02
       0.136055E+00 0.879563E-01-0.285162E-02 0.136215E+00 0.125500E-06 0.378983E-03 0.136056E+00-0.879571E-01-0.285164E-02
       0.608760E+00 0.938296E-01-0.243446E-02 0.609478E+00-0.320950E-06 0.996673E-04 0.608764E+00-0.938305E-01-0.243446E-02
       0.959099E+00 0.958969E-01-0.165696E-02 0.960226E+00-0.625442E-06-0.314839E-03 0.959100E+00-0.958978E-01-0.165696E-02
  4   -0.409139E+00 0.492851E-02 0.293165E-02-0.410186E+00 0.402838E-06-0.153364E-02-0.409139E+00 0.492785E-02 0.293165E-02
      -0.882321E+00 0.162436E-01 0.161176E-02-0.884579E+00 0.863225E-06-0.100549E-02-0.882320E+00-0.162421E-01 0.161175E-02
      -0.952650E+00 0.312666E-01-0.101480E-02-0.955088E+00 0.982748E-06 0.135401E-03-0.952649E+00-0.312646E-01-0.101479E-02
      -0.547001E+00 0.445597E-01-0.322508E-02-0.548401E+00 0.156266E-05 0.108767E-02-0.547001E+00-0.445571E-01-0.322509E-02
       0.135319E+00 0.515556E-01-0.384896E-02 0.135666E+00 0.111998E-05 0.131755E-02 0.135319E+00-0.515524E-01-0.384894E-02
       0.752541E+00 0.510127E-01-0.258039E-02 0.754467E+00 0.187779E-05 0.686015E-03 0.752540E+00-0.510089E-01-0.258038E-02
       0.997047E+00 0.456553E-01-0.704599E-04 0.100000E+01 0.232407E-05-0.512140E-03 0.997446E+00-0.456509E-01-0.704630E-04
       0.750671E+00 0.408115E-01 0.241853E-02 0.752592E+00 0.289078E-05-0.170593E-02 0.750671E+00-0.408066E-01 0.241852E-02
       0.137810E+00 0.417719E-01 0.364886E-02 0.138162E+00 0.204075E-05-0.233627E-02 0.137810E+00-0.417665E-01 0.364888E-02
      -0.535571E+00 0.812004E-01 0.301832E-02-0.536942E+00 0.336879E-05-0.213220E-02-0.535571E+00-0.811945E-01 0.301831E-02
      -0.936666E+00 0.678762E-01 0.844653E-03-0.939063E+00 0.350160E-05-0.123992E-02-0.936664E+00-0.678700E-01 0.844628E-03
      -0.869106E+00 0.873650E-01-0.179639E-02-0.871330E+00 0.270477E-05-0.144325E-03-0.869106E+00-0.873583E-01-0.179636E-02
      -0.366836E+00 0.104258E+00-0.361149E-02-0.367774E+00 0.741468E-05 0.576095E-03-0.366835E+00-0.104251E+00-0.361160E-02
       0.328945E+00 0.114848E+00-0.383537E-02 0.329791E+00-0.398612E-06 0.551419E-03 0.328953E+00-0.114841E+00-0.383506E-02
       0.912379E+00 0.118851E+00-0.266796E-02 0.914713E+00-0.424972E-06-0.836280E-04 0.912377E+00-0.118844E+00-0.266784E-02
  5    0.198579E-03 0.891428E-01 0.344478E-04-0.387527E-05 0.977525E-01-0.686177E-08-0.206297E-03 0.891436E-01-0.343941E-04
       0.201321E-03 0.177372E+00 0.707884E-04-0.766612E-05 0.194656E+00 0.403248E-08-0.216550E-03 0.177374E+00-0.707688E-04
       0.198042E-03 0.263782E+00 0.104863E-03-0.661779E-05 0.289462E+00 0.227742E-07-0.207224E-03 0.263785E+00-0.104897E-03
       0.192512E-03 0.347687E+00 0.138164E-03-0.127588E-05 0.381318E+00 0.335397E-07-0.195042E-03 0.347691E+00-0.138226E-03
       0.189044E-03 0.427629E+00 0.169998E-03 0.477399E-05 0.469258E+00 0.374231E-07-0.179537E-03 0.427633E+00-0.170043E-03
       0.179906E-03 0.503385E+00 0.200117E-03 0.689718E-05 0.552387E+00 0.268506E-07-0.166160E-03 0.503391E+00-0.200095E-03
       0.162814E-03 0.573979E+00 0.228168E-03 0.286042E-05 0.629851E+00 0.199813E-07-0.157111E-03 0.573986E+00-0.228088E-03
       0.139842E-03 0.638687E+00 0.253855E-03-0.545901E-05 0.700855E+00 0.151776E-07-0.150698E-03 0.638695E+00-0.253733E-03
       0.116089E-03 0.696845E+00 0.276897E-03-0.128175E-04 0.764471E+00 0.351673E-07-0.141609E-03 0.696853E+00-0.276845E-03
       0.101447E-03 0.747887E+00 0.296939E-03-0.114524E-04 0.820637E+00 0.576550E-07-0.124268E-03 0.747866E+00-0.296983E-03
       0.825308E-04 0.791200E+00 0.314770E-03-0.301334E-05 0.868241E+00 0.787176E-07-0.885506E-04 0.791210E+00-0.314657E-03
       0.120876E-03 0.826429E+00 0.324757E-03 0.604331E-05 0.906629E+00 0.764050E-07-0.108837E-03 0.826440E+00-0.324806E-03
      -0.170848E-03 0.853185E+00 0.357754E-03 0.937867E-05 0.937483E+00 0.575178E-07 0.189523E-03 0.853197E+00-0.357726E-03
       0.125908E-02 0.871184E+00 0.240246E-03 0.513535E-05 0.948897E+00 0.389490E-07-0.124888E-02 0.871197E+00-0.240150E-03
      -0.309627E-02 0.880294E+00 0.858669E-03-0.442903E-05 0.100000E+01 0.412177E-07 0.308747E-02 0.880306E+00-0.858538E-03


MODE       PERIOD       DYNAMIC LOAD FACTOR FOR EACH LOADING CONDITION:
   1      3.26532      0.59997
   2      0.96354      2.03324
   3      0.49982      2.82000
   4      0.33914      2.82000
   5      0.26643      2.82000

MODE       PERIOD       VERTICAL DYNAMIC LOAD FACTOR FOR EACH LOADING CONDITION:
   1      3.26532      0.50986
   2      0.96354      1.72785
   3      0.49982      3.04000
   4      0.33914      3.04000
   5      0.26643      3.04000


TOTAL WORKDONE VS TOTAL NUMBER OF MODES INCLUDED:
NUMBER          WORKDONE/TOTAL WORKDONE
   1                 0.753666
   2                 0.910669
   3                 0.930658
   4                 0.933939
   5                 1.000000


OLD SCALING FACTOR---------------------------------  0.14329E+04
NEW SCALING FACTOR---------------------------------  0.14413E+04
ACTIVE STRESS IN LOADING CONDITION 1----------------  31
ACTIVE DISPLACEMENT IN LOADING CONDITION 1----------  61   70   79   88   97  106  115  124
MOST CRITICAL CONSTRAINT---------------------------  6
NUMBER OF ANALYSIS---------------------------------  8


**************************************  TOTAL WEIGHT OF STRUCTURE =  4.043053E+04  **************************************
**************************************  BASE AE =  4.179889E+10;   CYCLE NO. =  1  **************************************


RAYLEIGH'S QUOTIENT APPROXIMATION FOR EACH LOADING:
0.484428E+01


NO CONSTRAINT ENERGY DENSITY RATIO
 1     1          0.349397E+00
 2     1          0.349396E+00
 3     1          0.468393E+00
 4     1          0.468390E+00
 5     1          0.444522E+00
 6     1          0.444525E+00
 7     1          0.390798E+00
 8     1          0.390799E+00
 9     2          0.391645E+00
10     2          0.377076E+00
```

11	2	0.370687E+00
12	2	0.351135E+00
13	3	0.342573E+00
14	3	0.322845E+00
15	4	0.328396E+00
16	4	0.308668E+00
17	5	0.327106E+00
18	6	0.307712E+00
19	6	0.328976E+00
20	7	0.310445E+00
21	7	0.318634E+00
22	8	0.300654E+00
23	8	0.281690E+00
24	9	0.264182E+00
25	9	0.212027E+00
26	9	0.196476E+00
27	9	0.647285E-01
28	9	0.465033E-01
29	1	0.126792E-01
30	1	0.126827E-01
31	6	0.100000E+01
32	1	0.844511E+00
33	7	0.866258E+00
34	1	0.654315E+00
35	8	0.763098E+00
36	1	0.549272E+00
37	8	0.666122E+00
38	1	0.456248E+00
39	9	0.573720E+00
40	1	0.374474E+00
41	9	0.485138E+00
42	1	0.303552E+00
43	9	0.401539E+00
44	1	0.241777E+00
45	9	0.325643E+00
46	1	0.180581E+00
47	9	0.259495E+00
48	1	0.142564E+00
49	9	0.202718E+00
50	9	0.112271E+00
51	9	0.154018E+00
52	9	0.895352E-01
53	9	0.111227E+00
54	8	0.677202E-01
55	8	0.726025E-01
56	8	0.462842E-01
57	9	0.403748E-01
58	1	0.227701E-01
59	9	0.106282E-01
60	1	0.101467E-01

RELATIVE SIZES OF MEMBERS:

0.224269271	0.224269271	0.463381350	0.463381350	0.455495000	0.455495000	0.413136244	0.413136244	0.382830560	0.382830560
0.350688159	0.350688159	0.322603226	0.322603226	0.297408700	0.297408700	0.271259606	0.271259606	0.232683778	0.232683778
0.219056129	0.219056129	0.223232388	0.223232388	0.209799409	0.209799409	0.145036101	0.145036101	0.0655871034	0.0655871034
1.00000000	1.00000000	0.685976207	0.685976207	0.575019419	0.575019419	0.478204846	0.478204846	0.395420969	0.395420969
0.326416850	0.326416850	0.269402623	0.269402623	0.221590579	0.221590579	0.187514961	0.187514961	0.157270491	0.157270491
0.131040156	0.131040156	0.113263428	0.113263428	0.110837042	0.110837042	0.101707220	0.101707220	0.100000024	0.100000024

NATURAL FREQUENCIES:

0.371983E+01 0.346449E+02 0.109773E+03 0.222709E+03 0.408462E+03

MODE EIGENVECTORS:

1	0.187548E-01	0.335324E-02	-0.208280E-03	0.187558E-01	-0.641655E-07	0.642256E-04	0.187548E-01	-0.335331E-02	-0.208279E-03
	0.575623E-01	0.722307E-02	-0.252827E-03	0.575635E-01	-0.649576E-07	0.404250E-04	0.575621E-01	-0.722323E-02	-0.252828E-03
	0.103333E+00	0.110154E-01	-0.290235E-03	0.103336E+00	-0.683244E-07	0.139795E-04	0.103333E+00	-0.110156E-01	-0.290236E-03
	0.156204E+00	0.146881E-01	-0.333854E-03	0.156208E+00	-0.214479E-06	-0.793698E-05	0.156204E+00	-0.146884E-01	-0.333851E-03
	0.216597E+00	0.182076E-01	-0.374153E-03	0.216603E+00	-0.253284E-06	-0.296889E-04	0.216596E+00	-0.182081E-01	-0.374154E-03
	0.284269E+00	0.215215E-01	-0.412064E-03	0.284277E+00	-0.216063E-06	-0.501863E-04	0.284269E+00	-0.215220E-01	-0.412066E-03
	0.358741E+00	0.245759E-01	-0.444076E-03	0.358752E+00	-0.349544E-06	-0.705472E-04	0.358741E+00	-0.245766E-01	-0.444075E-03
	0.439146E+00	0.273227E-01	-0.469357E-03	0.439160E+00	-0.267752E-06	-0.906094E-04	0.439146E+00	-0.273234E-01	-0.469360E-03
	0.524164E+00	0.296773E-01	-0.489482E-03	0.524182E+00	-0.350138E-06	-0.108582E-03	0.524165E+00	-0.296781E-01	-0.489484E-03
	0.613253E+00	0.316158E-01	-0.509010E-03	0.613275E+00	-0.592343E-06	-0.121902E-03	0.613253E+00	-0.316167E-01	-0.509006E-03
	0.703758E+00	0.331352E-01	-0.497994E-03	0.703784E+00	-0.748399E-06	-0.145504E-03	0.703758E+00	-0.331362E-01	-0.497984E-03
	0.790030E+00	0.342121E-01	-0.460262E-03	0.790059E+00	0.119023E-06	-0.177187E-03	0.790030E+00	-0.342131E-01	-0.460283E-03
	0.867446E+00	0.348391E-01	-0.425933E-03	0.867481E+00	-0.404599E-06	-0.201827E-03	0.867452E+00	-0.348402E-01	-0.425936E-03
	0.937609E+00	0.351347E-01	-0.407780E-03	0.937653E+00	-0.200822E-07	-0.214437E-03	0.937613E+00	-0.351358E-01	-0.407792E-03
	0.999933E+00	0.352162E-01	-0.385386E-03	0.100000E+01	-0.820685E-06	-0.226674E-03	0.999937E+00	-0.352173E-01	-0.385387E-03
2	0.824038E-01	0.188118E-02	-0.888779E-03	0.824311E-01	-0.718088E-08	0.422406E-03	0.824039E-01	-0.188120E-02	-0.888778E-03
	0.239735E+00	0.329593E-02	-0.924344E-03	0.239791E+00	-0.646279E-07	0.423132E-03	0.239735E+00	-0.329599E-02	-0.924342E-03
	0.399164E+00	0.284963E-02	-0.875499E-03	0.399258E+00	-0.181916E-06	0.404016E-03	0.399164E+00	-0.284972E-02	-0.875495E-03
	0.550849E+00	0.321962E-03	-0.791828E-03	0.550983E+00	0.148405E-06	0.392294E-03	0.550848E+00	-0.322090E-03	-0.791838E-03
	0.684192E+00	-0.433818E-02	-0.626850E-03	0.684367E+00	0.383429E-06	0.365293E-03	0.684194E+00	-0.433802E-02	-0.626865E-03
	0.784007E+00	-0.110726E-01	-0.382038E-03	0.784217E+00	0.213781E-06	0.323063E-03	0.784010E+00	-0.110724E-01	-0.382046E-03
	0.833677E+00	-0.196330E-01	-0.553318E-04	0.833908E+00	-0.247441E-06	0.261612E-03	0.833679E+00	-0.196327E-01	-0.553291E-04
	0.816376E+00	-0.295897E-01	0.338913E-03	0.816611E+00	0.201065E-06	0.183009E-03	0.816377E+00	-0.295893E-01	0.338902E-03
	0.718223E+00	-0.401440E-01	0.772387E-03	0.718440E+00	-0.315959E-06	0.918860E-04	0.718225E+00	0.401435E-01	0.772391E-03
	0.529663E+00	-0.505290E-01	0.122918E-02	0.529883E+00	-0.725269E-06	0.129187E-04	0.529662E+00	0.505285E-01	0.122919E-02
	0.255589E+00	-0.599583E-01	0.156080E-02	0.255674E+00	-0.232182E-06	0.664852E-04	0.255589E+00	0.599579E-01	0.156079E-02
	-0.717640E-01	-0.675187E-01	0.166415E-02	-0.717877E-01	-0.210639E-06	0.280995E-04	-0.717639E-01	0.675182E-01	0.166415E-02
	-0.403562E+00	-0.723931E-01	0.165124E-02	-0.403700E+00	-0.335108E-06	0.364823E-04	-0.403562E+00	0.723926E-01	0.165124E-02
	-0.722959E+00	-0.748855E-01	0.165504E-02	-0.723253E+00	-0.421279E-06	0.644303E-04	-0.722958E+00	0.748850E-01	0.165504E-02
	-0.999392E+00	-0.756079E-01	0.152694E-02	-0.100000E+01	-0.612769E-06	0.137882E-03	-0.999393E+00	0.756074E-01	0.152695E-02

```
 3      0.130452E+00 0.248703E-02-0.138789E-02 0.130589E+00 0.125127E-06 0.666387E-03 0.130452E+00-0.248702E-02-0.138789E-02
        0.367331E+00 0.416160E-02-0.131422E-02 0.367601E+00 0.113806E-06 0.608474E-03 0.367332E+00-0.416158E-02-0.131422E-02
        0.572928E+00 0.316227E-02-0.982047E-03 0.573353E+00 0.120361E-06 0.454066E-03 0.572929E+00-0.316225E-02-0.982050E-03
        0.706761E+00-0.210429E-03-0.476501E-03 0.707310E+00-0.345590E-07 0.238162E-03 0.706762E+00 0.210447E-03-0.476500E-03
        0.731801E+00-0.503781E-02 0.218190E-03 0.732391E+00 0.201395E-06-0.491811E-04 0.731802E+00 0.503785E-02 0.218188E-03
        0.618346E+00-0.991635E-02 0.978052E-03 0.618866E+00 0.637553E-07-0.371656E-03 0.618347E+00 0.991641E-02 0.978055E-03
        0.360527E+00-0.130892E-01 0.163773E-02 0.360843E+00-0.104869E-06-0.664397E-03 0.360528E+00 0.130893E-01 0.163774E-02
       -0.105342E-01-0.127924E-01 0.198647E-02-0.105438E-01 0.324139E-06-0.842831E-03-0.105342E-01 0.127925E-01 0.198646E-02
       -0.415574E+00-0.780235E-02 0.184699E-02-0.415970E+00-0.744805E-07-0.832693E-03-0.415575E+00 0.780250E-02 0.184699E-02
       -0.743211E+00 0.203981E-02 0.114513E-02-0.743974E+00 0.572011E-07-0.598662E-03-0.743211E+00-0.203968E-02 0.114513E-02
       -0.859651E+00 0.154941E-01-0.167196E-03-0.860560E+00-0.136448E-06-0.101337E-03-0.859651E+00-0.154940E-01-0.167192E-03
       -0.673481E+00 0.298410E-01-0.152668E-02-0.674187E+00 0.381340E-07 0.409076E-03-0.673482E+00-0.298410E-01-0.152669E-02
       -0.225480E+00 0.412048E-01-0.250043E-02-0.225724E+00-0.858016E-07 0.761779E-03-0.225481E+00-0.412047E-01-0.250043E-02
        0.998089E+00 0.499467E-01-0.316648E-02 0.100000E+01-0.953351E-08 0.997440E-03 0.998089E+00-0.499466E-01-0.316648E-02
 4      0.200864E+00-0.121804E-02-0.208983E-02 0.201290E+00 0.351017E-07 0.106616E-02 0.200864E+00 0.121796E-02-0.208983E-02
        0.537341E+00-0.469114E-02-0.167663E-02 0.538141E+00 0.296171E-07 0.896971E-03 0.537341E+00 0.469096E-02-0.167662E-02
        0.754289E+00-0.122293E-01-0.676031E-03 0.755421E+00-0.138761E-06 0.485244E-03 0.754289E+00 0.122290E-01-0.676029E-03
        0.762293E+00-0.223008E-01 0.649495E-03 0.763493E+00-0.425608E-06-0.592492E-04 0.762293E+00 0.223004E-01 0.649497E-03
        0.518935E+00-0.322512E-01 0.196865E-02 0.519783E+00 0.456322E-06-0.602475E-03 0.518936E+00 0.322507E-01 0.196862E-02
        0.597987E-01-0.390070E-01 0.277464E-02 0.599007E-01-0.449302E-05-0.926244E-03 0.597987E-01 0.390063E-01 0.277477E-02
       -0.473903E+00-0.404544E-01 0.255950E-02-0.474744E+00 0.149182E-06-0.801111E-03-0.473903E+00 0.404536E-01 0.255948E-02
       -0.853827E+00-0.365073E-01 0.113967E-02-0.855405E+00-0.513362E-06-0.135322E-03-0.853827E+00 0.365065E-01 0.113967E-02
       -0.849249E+00-0.300611E-01-0.105436E-02-0.850890E+00-0.539689E-06 0.890196E-03-0.849249E+00 0.300602E-01-0.105436E-02
       -0.368841E+00-0.260830E-01-0.306641E-02-0.369610E+00-0.184284E-06 0.185550E-02-0.368841E+00 0.260821E-01-0.306642E-02
        0.392680E+00-0.290808E-01-0.322659E-02 0.393523E+00-0.402762E-06 0.197281E-02 0.392680E+00 0.290799E-01-0.322658E-02
        0.944740E+00-0.401492E-01-0.101440E-02 0.944749E+00-0.394894E-06 0.992253E-03 0.944740E+00 0.401483E-01-0.101440E-02
        0.855175E+00-0.543729E-01 0.206665E-02 0.857050E+00-0.728360E-06-0.387479E-03 0.855175E+00 0.543720E-01 0.206665E-02
        0.760657E-01-0.632746E-01 0.495753E-02 0.762658E-01 0.298365E-06-0.171631E-02 0.760660E-01 0.632736E-01 0.495752E-02
       -0.996127E+00-0.690171E-01 0.578337E-02-0.100000E+01-0.421220E-06-0.211008E-02-0.996125E+00 0.690160E-01 0.578336E-02
 5      0.265388E+00-0.465505E-03-0.268797E-02 0.266407E+00-0.122227E-06 0.136505E-02 0.265388E+00 0.464988E-03-0.268798E-02
        0.665281E+00-0.353039E-02-0.170090E-02 0.667873E+00-0.242004E-06 0.897533E-03 0.665284E+00 0.352925E-02-0.170091E-02
        0.881763E+00-0.106072E-01 0.256355E-03 0.883940E+00-0.857895E-06-0.173268E-05 0.881765E+00 0.106054E-01 0.256357E-03
        0.555121E+00-0.179384E-01 0.235390E-02 0.556701E+00-0.144136E-05-0.969097E-03 0.555121E+00 0.179358E-01 0.235390E-02
       -0.153663E-01-0.208253E-01 0.345047E-02-0.154116E-01-0.694463E-06-0.148687E-02-0.153662E-01 0.208220E-01 0.345045E-02
       -0.634074E+00-0.161938E-01 0.261288E-02-0.636029E+00-0.292883E-05-0.112152E-02-0.634075E+00 0.161895E-01 0.261290E-02
       -0.898138E+00-0.515319E-02-0.125107E-03-0.901025E+00-0.249989E-05 0.124995E-03-0.898142E+00 0.514799E-02-0.125114E-03
       -0.531379E+00 0.664216E-02-0.316787E-02-0.533155E+00-0.348232E-05 0.151770E-02-0.531379E+00-0.664828E-02-0.316786E-02
        0.302161E+00 0.119830E-01-0.403177E-02 0.303217E+00-0.294959E-05 0.189064E-02 0.302160E+00-0.119900E-01-0.403181E-02
        0.958107E+00 0.841660E-02-0.138752E-02 0.961719E+00-0.433099E-05 0.599764E-03 0.958110E+00-0.842663E-02-0.138751E-02
        0.737475E+00 0.155091E-02 0.312139E-02 0.740339E+00-0.408653E-05-0.159784E-02 0.737477E+00-0.155988E-02 0.312137E-02
       -0.277713E+00 0.115354E-02 0.436288E-02-0.278781E+00-0.122504E-04-0.222055E-02-0.277713E+00-0.116345E-02 0.436289E-02
       -0.996050E+00 0.108142E-01 0.844997E-03-0.100000E+01-0.678936E-05-0.558499E-03-0.996052E+00-0.108248E-01 0.845027E-03
       -0.527725E+00 0.229360E-01-0.497459E-02-0.530234E+00 0.258291E-06 0.225221E-02-0.527724E+00-0.229472E-01-0.497478E-02
        0.853510E+00 0.277232E-01-0.779642E-02 0.859522E+00-0.208478E-04 0.370490E-02 0.853509E+00-0.277348E-01-0.779618E-02
```

```
MODE       PERIOD       DYNAMIC LOAD FACTOR FOR EACH LOADING CONDITION:
   1       3.25776      0.60137
   2       1.06748      1.83526
   3       0.59970      2.82000
   4       0.42103      2.82000
   5       0.31398      2.82000

MODE       PERIOD       VERTICAL DYNAMIC LOAD FACTOR FOR EACH LOADING CONDITION:
   1       3.25776      0.51104
   2       1.06748      1.55960
   3       0.59970      2.77614
   4       0.42103      3.04000
   5       0.31398      3.04000

TOTAL WORKDONE VS TOTAL NUMBER OF MODES INCLUDED:
NUMBER          WORKDONE/TOTAL WORKDONE
   1                 0.750446
   2                 0.945017
   3                 0.983232
   4                 0.996634
   5                 1.000000


OLD SCALING FACTOR------------------------------  0.38530E+04
NEW SCALING FACTOR------------------------------  0.38861E+04
ACTIVE STRESS IN LOADING CONDITION 1------------   53
ACTIVE DISPLACEMENT IN LOADING CONDITION 1------   115  124  133
MOST CRITICAL CONSTRAINT------------------------    4
NUMBER OF ANALYSIS------------------------------    1


**************************************  TOTAL WEIGHT OF STRUCTURE =  3.498082E+04  **************************************
**************************************  BASE AE =  1.126965E+11   CYCLE NO. =  7  **************************************
```

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
1	126.00	0.22427	871.5298	13.7150	3	4	2.77136E+02	9.00384E+03	1.13499E+06	2.77136E+02	9.00384E+03	1.07819E+03
							-1.41637E+04	0.0	1.42041E+04	-6.73267E+00	0.0	-3.36808E+01
2	126.00	0.22427	871.5298	13.7150	4	5	2.76911E+02	9.00385E+03	1.07836E+03	2.76911E+02	9.00385E+03	1.13499E+06
							6.71407E+00	0.0	3.36665E+01	1.41637E+04	0.0	-1.42041E+04
3	126.00	0.46338	1800.7400	19.7143	6	7	7.56026E+02	1.94960E+04	2.45691E+06	7.56026E+02	1.94960E+04	9.13397E+02
							-1.63878E+04	0.0	1.64645E+04	-3.22425E+01	0.0	-4.44558E+01

4	126.00	0.46338	1800.7400	19.7143	7	8	7.56002E+02 3.22375E+01	1.94960E+04 0.0	9.13946E+02 4.44582E+01	7.56002E+02 1.63878E+04	1.94960E+04 0.0	2.45692E+06 -1.64645E+04
5	126.00	0.45549	1770.0930	19.5458	9	10	1.10178E+03 -1.62123E+04	1.90369E+04 0.0	2.39892E+06 1.63251E+04	1.10178E+03 -5.21802E+01	1.90369E+04 0.0	6.17706E+02 -6.85584E+01
6	126.00	0.45549	1770.0930	19.5458	10	11	1.10120E+03 5.21599E+01	1.90369E+04 0.0	6.16307E+02 6.05191E+01	1.10120E+03 1.62124E+04	1.90369E+04 0.0	2.39892E+06 -1.63251E+04
7	126.00	0.41314	1605.4832	18.6148	12	13	1.25568E+03 -1.62642E+04	1.76136E+04 0.0	2.21950E+06 1.63991E+04	1.25568E+03 -6.31472E+01	1.76136E+04 0.0	5.85587E+02 -7.17650E+01
8	126.00	0.41314	1605.4832	18.6148	13	14	1.25797E+03 6.32746E+01	1.76135E+04 0.0	5.84992E+02 7.18837E+01	1.25797E+03 1.62641E+04	1.76135E+04 0.0	2.21950E+06 -1.63992E+04
9	126.00	0.38283	1487.7126	17.9191	15	16	1.28591E+03 -1.62546E+04	1.65115E+04 0.0	2.08061E+06 1.63981E+04	1.28591E+03 -6.57543E+01	1.65115E+04 0.0	7.65593E+02 -7.77694E+01
10	126.00	0.38283	1487.7126	17.9191	16	17	1.27885E+03 6.53507E+01	1.65114E+04 0.0	7.66863E+02 7.73860E+01	1.27885E+03 1.62550E+04	1.65114E+04 0.0	2.08061E+06 -1.63977E+04
11	126.00	0.35069	1362.8044	17.1503	18	19	1.31289E+03 -1.63038E+04	1.53745E+04 0.0	1.93734E+06 1.64569E+04	1.31289E+03 -8.99063E+01	1.53745E+04 0.0	7.85953E+02 -8.31969E+01
12	126.00	0.35069	1362.8044	17.1503	19	20	1.29937E+03 6.90803E+01	1.53745E+04 0.0	7.90467E+02 8.24472E+01	1.29937E+03 1.63046E+04	1.53745E+04 0.0	1.93734E+06 -1.64562E+04
13	126.00	0.32260	1253.6641	16.4493	21	22	1.34724E+03 -1.63441E+04	1.43510E+04 0.0	1.80834E+06 1.65079E+04	1.34724E+03 -7.52557E+01	1.43510E+04 0.0	7.31737E+02 -8.85491E+01
14	126.00	0.32260	1253.6641	16.4493	22	23	1.34050E+03 7.48554E+01	1.43510E+04 0.0	7.30751E+02 8.81309E+01	1.34050E+03 1.63445E+04	1.43510E+04 0.0	1.80834E+06 -1.65075E+04
15	126.00	0.29741	1155.7559	15.7939	24	25	1.32794E+03 -1.64708E+04	1.34802E+04 0.0	1.69862E+06 1.66398E+04	1.32794E+03 -7.45649E+01	1.34802E+04 0.0	9.76254E+02 -9.35942E+01
16	126.00	0.29741	1155.7559	15.7939	25	26	1.32307E+03 7.42593E+01	1.34802E+04 0.0	9.75935E+02 9.32824E+01	1.32307E+03 1.64712E+04	1.34802E+04 0.0	1.69862E+06 -1.66387E+04

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
17	126.00	0.27126	1054.1382	15.0836	27	28	1.31515E+03 -1.68542E+04	1.27297E+04 0.0	1.60406E+06 1.70286E+04	1.31515E+03 -7.44856E+01	1.27297E+04 0.0	1.20294E+03 -9.98957E+01
18	126.00	0.27126	1054.1382	15.0836	28	29	1.30506E+03 7.38206E+01	1.27297E+04 0.0	1.20260E+03 9.92233E+01	1.30506E+03 1.66550E+04	1.27297E+04 0.0	1.60407E+06 -1.70280E+04
19	126.00	0.23268	904.2292	13.9700	30	31	1.35240E+03 -1.77620E+04	1.17194E+04 0.0	1.47671E+06 1.79556E+04	1.35240E+03 -8.18865E+01	1.17194E+04 0.0	1.23382E+03 -1.11729E+02
20	126.00	0.23268	904.2292	13.9700	31	32	1.35109E+03 8.17788E+01	1.17195E+04 0.0	1.23495E+03 1.11649E+02	1.35109E+03 1.77621E+04	1.17195E+04 0.0	1.47671E+06 -1.79556E+04
21	126.00	0.21906	851.2718	13.5547	33	34	1.30819E+03 -1.74869E+04	1.09342E+04 0.0	1.37774E+06 1.76787E+04	1.30819E+03 -7.86647E+01	1.09342E+04 0.0	1.35223E+03 -1.13179E+02
22	126.00	0.21906	851.2718	13.5547	34	35	1.30077E+03 7.86904E+01	1.09342E+04 0.0	1.35354E+03 1.13238E+02	1.30077E+03 1.74866E+04	1.09342E+04 0.0	1.37772E+06 -1.76785E+04
23	126.00	0.22323	867.5002	13.6833	36	37	1.26442E+03 -1.58062E+04	1.00559E+04 0.0	1.26696E+06 1.59910E+04	1.26442E+03 -7.75004E+01	1.00559E+04 0.0	1.18784E+03 -1.07312E+02
24	126.00	0.22323	867.5002	13.6833	37	38	1.26394E+03 7.75026E+01	1.00559E+04 0.0	1.18488E+03 1.07240E+02	1.26394E+03 1.58066E+04	1.00559E+04 0.0	1.26698E+06 -1.59913E+04
25	126.00	0.20980	815.2986	13.2652	39	40	1.32611E+03 -1.44026E+04	8.67771E+03 0.0	1.09329E+06 1.46025E+04	1.32611E+03 -9.07964E+01	8.67771E+03 0.0	6.91486E+02 -1.09142E+02
26	126.00	0.20980	815.2986	13.2652	40	41	1.24911E+03 8.50435E+01	8.67765E+03 0.0	6.67604E+02 1.03286E+02	1.24911E+03 1.44084E+04	8.67765E+03 0.0	1.09329E+06 -1.45967E+04
27	126.00	0.14504	563.6228	11.0294	42	43	1.39247E+03 -1.42906E+04	6.16245E+03 0.0	7.76812E+05 1.45429E+04	1.39247E+03 -9.85608E+01	6.16245E+03 0.0	1.49207E+03 -1.53942E+02
28	126.00	0.14504	563.6228	11.0294	43	44	1.34501E+03 9.43232E+01	6.16233E+03 0.0	1.48854E+03 1.49574E+02	1.34501E+03 1.42947E+04	6.16233E+03 0.0	7.76812E+05 -1.45386E+04
29	126.00	0.06559	254.8772	7.4169	45	46	2.10705E+03 -1.23486E+04	2.55248E+03 0.0	3.22237E+05 1.29167E+04	2.10705E+03 -2.06198E+02	2.55248E+03 0.0	1.98684E+03 -3.61977E+02
30	126.00	0.06559	254.8772	7.4169	46	47	2.08747E+03 2.03574E+02	2.55258E+03 0.0	1.98646E+03 3.59324E+02	2.08747E+03 1.23515E+04	2.55258E+03 0.0	3.22244E+05 -1.29144E+04
31	144.00	1.00000	3886.0867	28.9609	1	3	1.57084E+05 -5.07977E+03	1.72637E+04 0.0	2.89199E+06 1.59278E+04	1.57084E+05 -4.20461E+03	1.72637E+04 0.0	3.35735E+05 -6.64340E+03
32	144.00	1.00000	3886.0867	28.9609	2	5	1.57087E+05 -5.07968E+03	1.72639E+04 0.0	2.89200E+06 1.59279E+04	1.57087E+05 -4.20479E+03	1.72639E+04 0.0	3.35718E+05 -6.64345E+03

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
33	144.00	0.68598	2665.7629	23.9865	3	6	1.49787E+05	1.67977E+04	1.45390E+06	1.49787E+05	1.67977E+04	1.15225E+06
							-8.25945E+02	0.0	1.33152E+04	-6.41039E+02	0.0	-1.18462E+04
34	144.00	0.68598	2665.7629	23.9865	5	8	1.49790E+05	1.67974E+04	1.45388E+06	1.49790E+05	1.67974E+04	1.15223E+06
							-8.25734E+02	0.0	1.33153E+04	-6.41281E+02	0.0	-1.18463E+04
35	144.00	0.57502	2234.5752	21.9611	6	9	1.34233E+05	1.60237E+04	1.32784E+06	1.34233E+05	1.60237E+04	1.17491E+06
							-1.32551E+03	0.0	1.35501E+04	4.68910E+02	0.0	-1.26935E+04
36	144.00	0.57502	2234.5752	21.9611	8	11	1.34236E+05	1.60239E+04	1.32785E+06	1.34236E+05	1.60239E+04	1.17492E+06
							-1.32548E+03	0.0	1.35504E+04	4.68832E+02	0.0	-1.26937E+04
37	144.00	0.47820	1858.3455	20.0271	9	12	1.19319E+05	1.50034E+04	1.25959E+06	1.19319E+05	1.50034E+04	1.09809E+06
							-2.24648E+03	0.0	1.41622E+04	1.19456E+03	0.0	-1.31103E+04
38	144.00	0.47820	1858.3455	20.0271	11	14	1.19323E+05	1.50032E+04	1.25957E+06	1.19323E+05	1.50032E+04	1.09808E+06
							-2.24621E+03	0.0	1.41623E+04	1.19434E+03	0.0	-1.31104E+04
39	144.00	0.39542	1536.6401	18.2113	12	15	1.05622E+05	1.39568E+04	1.16347E+06	1.05622E+05	1.39568E+04	1.04166E+06
							-3.08327E+03	0.0	1.46829E+04	2.15329E+03	0.0	-1.37529E+04
40	144.00	0.39542	1536.6401	18.2113	14	17	1.05625E+05	1.39566E+04	1.16346E+06	1.05625E+05	1.39566E+04	1.04164E+06
							-3.08302E+03	0.0	1.46830E+04	2.15293E+03	0.0	-1.37529E+04
41	144.00	0.32642	1268.4841	16.5462	15	18	9.27637E+04	1.29717E+04	1.08861E+06	9.27637E+04	1.29717E+04	9.77470E+05
							-4.11038E+03	0.0	1.53231E+04	3.18299E+03	0.0	-1.43957E+04
42	144.00	0.32642	1268.4841	16.5462	17	20	9.27657E+04	1.29719E+04	1.08864E+06	9.27657E+04	1.29719E+04	9.77496E+05
							-4.11057E+03	0.0	1.53235E+04	3.18310E+03	0.0	-1.43960E+04
43	144.00	0.26940	1046.9219	15.0319	18	21	8.06660E+04	1.20612E+04	1.00868E+06	8.06660E+04	1.20612E+04	9.19060E+05
							-5.26634E+03	0.0	1.59990E+04	4.39909E+03	0.0	-1.51317E+04
44	144.00	0.26940	1046.9219	15.0319	20	23	8.06679E+04	1.20608E+04	1.00864E+06	8.06679E+04	1.20608E+04	9.19033E+05
							-5.26573E+03	0.0	1.59986E+04	4.39867E+03	0.0	-1.51316E+04
45	144.00	0.22159	861.1201	13.6329	21	24	6.91502E+04	1.12372E+04	9.29828E+05	6.91502E+04	1.12372E+04	8.61065E+05
							-6.67291E+03	0.0	1.68175E+04	5.80432E+03	0.0	-1.59489E+04
46	144.00	0.22159	861.1201	13.6329	23	26	6.91517E+04	1.12375E+04	9.29854E+05	6.91517E+04	1.12375E+04	8.61082E+05
							-6.67312E+03	0.0	1.68180E+04	5.80443E+03	0.0	-1.59493E+04
47	144.00	0.18751	728.6992	12.5409	24	27	5.80341E+04	1.06006E+04	8.75649E+05	5.80341E+04	1.06006E+04	8.10270E+05
							-8.22452E+03	0.0	1.74796E+04	7.26494E+03	0.0	-1.65201E+04
48	144.00	0.18751	728.6992	12.5409	26	29	5.80356E+04	1.06005E+04	8.75660E+05	5.80356E+04	1.06005E+04	8.10264E+05
							-8.22456E+03	0.0	1.74799E+04	7.26474E+03	0.0	-1.65201E+04

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
49	144.00	0.15727	611.1667	11.4851	27	30	4.71880E+04	1.00210E+04	8.30048E+05	4.71880E+04	1.00210E+04	7.57844E+05
							-1.01910E+04	0.0	1.84082E+04	8.94710E+03	0.0	-1.71643E+04
50	144.00	0.15727	611.1667	11.4851	29	32	4.71890E+04	1.00212E+04	8.30061E+05	4.71890E+04	1.00212E+04	7.57861E+05
							-1.01911E+04	0.0	1.84085E+04	8.94731E+03	0.0	-1.71647E+04
51	144.00	0.13104	509.2334	10.4837	30	33	3.68267E+04	9.46760E+03	7.55033E+05	3.68267E+04	9.46760E+03	7.33167E+05
							-1.18782E+04	0.0	1.69037E+04	1.14325E+04	0.0	-1.84580E+04
52	144.00	0.13104	509.2334	10.4837	32	35	3.68274E+04	9.46788E+03	7.55055E+05	3.68274E+04	9.46788E+03	7.33205E+05
							-1.18786E+04	0.0	1.69042E+04	1.14332E+04	0.0	-1.84588E+04
53	144.00	0.11326	440.1514	9.7467	33	36	2.67993E+04	8.86754E+03	6.76590E+05	2.67993E+04	8.86754E+03	6.97192E+05
							-1.30490E+04	0.0	1.85482E+04	1.35301E+04	0.0	-1.90292E+04
54	144.00	0.11326	440.1514	9.7467	35	38	2.67998E+04	8.86731E+03	6.76591E+05	2.67998E+04	8.86731E+03	6.97159E+05
							-1.30490E+04	0.0	1.85482E+04	1.35293E+04	0.0	-1.90285E+04
55	144.00	0.11084	430.7222	9.6417	36	39	1.72379E+04	7.97316E+03	5.98995E+05	1.72379E+04	7.97316E+03	6.15482E+05
							-1.24853E+04	0.0	1.60610E+04	1.28782E+04	0.0	-1.64539E+04
56	144.00	0.11084	430.7222	9.6417	38	41	1.72385E+04	7.97407E+03	5.99051E+05	1.72385E+04	7.97407E+03	6.15551E+05
							-1.24866E+04	0.0	1.60624E+04	1.28797E+04	0.0	-1.64555E+04
57	144.00	0.10171	395.2429	9.2361	39	42	8.71030E+03	6.63042E+03	5.06335E+05	8.71030E+03	6.63042E+03	4.88362E+05
							-1.21364E+04	0.0	1.40226E+04	1.16721E+04	0.0	-1.35583E+04
58	144.00	0.10171	395.2429	9.2361	41	44	8.71055E+03	6.62987E+03	5.06284E+05	8.71055E+03	6.62987E+03	4.88295E+05
							-1.21351E+04	0.0	1.40213E+04	1.16704E+04	0.0	-1.35566E+04

59	144.00	0.10000	388.6086	9.1582	42	45	2.55603E+03	4.23690E+03	3.03550E+05	2.55603E+03	4.23690E+03	3.22657E+05
							-7.68797E+03	0.0	8.24634E+03	8.18948E+03	0.0	-8.74785E+03
60	144.00	0.10000	388.6086	9.1582	44	47	2.55695E+03	4.23667E+03	3.03525E+05	2.55695E+03	4.23667E+03	3.22636E+05
							-7.68732E+03	0.0	8.24572E+03	8.18892E+03	0.0	-8.74732E+03

GIRDER-COLUMN SECTION PROPERTIES:

MEMBER	TYPE	SECTION MODULUS	TF/D	DEPTH	TW	TF
1	2	80.020	0.0	0.0	0.0	0.0
2	2	80.020	0.0	0.0	0.0	0.0
3	2	149.573	0.0	0.0	0.0	0.0
4	2	149.573	0.0	0.0	0.0	0.0
5	2	147.456	0.0	0.0	0.0	0.0
6	2	147.456	0.0	0.0	0.0	0.0
7	2	138.902	0.0	0.0	0.0	0.0
8	2	135.902	0.0	0.0	0.0	0.0
9	2	127.439	0.0	0.0	0.0	0.0
10	2	127.439	0.0	0.0	0.0	0.0
11	2	118.272	0.0	0.0	0.0	0.0
12	2	118.272	0.0	0.0	0.0	0.0
13	2	110.090	0.0	0.0	0.0	0.0
14	2	110.090	0.0	0.0	0.0	0.0
15	2	102.605	0.0	0.0	0.0	0.0
16	2	102.605	0.0	0.0	0.0	0.0
17	2	94.683	0.0	0.0	0.0	0.0
18	2	94.683	0.0	0.0	0.0	0.0
19	2	82.688	0.0	0.0	0.0	0.0
20	2	82.688	0.0	0.0	0.0	0.0
21	2	78.357	0.0	0.0	0.0	0.0
22	2	78.357	0.0	0.0	0.0	0.0
23	2	79.690	0.0	0.0	0.0	0.0
24	2	79.690	0.0	0.0	0.0	0.0
25	2	75.386	0.0	0.0	0.0	0.0
26	2	75.386	0.0	0.0	0.0	0.0
27	2	53.883	0.0	0.0	0.0	0.0
28	2	53.883	0.0	0.0	0.0	0.0
29	2	25.508	0.0	0.0	0.0	0.0
30	2	25.508	0.0	0.0	0.0	0.0
31	1	275.329	0.0	0.0	0.0	0.0
32	1	275.329	0.0	0.0	0.0	0.0
33	1	205.626	0.0	0.0	0.0	0.0
34	1	205.626	0.0	0.0	0.0	0.0
35	1	178.525	0.0	0.0	0.0	0.0
36	1	178.525	0.0	0.0	0.0	0.0
37	1	153.526	0.0	0.0	0.0	0.0
38	1	153.526	0.0	0.0	0.0	0.0
39	1	130.976	0.0	0.0	0.0	0.0
40	1	130.976	0.0	0.0	0.0	0.0
41	1	111.211	0.0	0.0	0.0	0.0
42	1	111.211	0.0	0.0	0.0	0.0
43	1	94.114	0.0	0.0	0.0	0.0

44	1	94.114	0.0	0.0	0.0	0.0
45	1	79.167	0.0	0.0	0.0	0.0
46	1	79.167	0.0	0.0	0.0	0.0
47	1	68.133	0.0	0.0	0.0	0.0
48	1	68.133	0.0	0.0	0.0	0.0
49	1	58.047	0.0	0.0	0.0	0.0
50	1	58.047	0.0	0.0	0.0	0.0
51	1	49.057	0.0	0.0	0.0	0.0
52	1	49.057	0.0	0.0	0.0	0.0
53	1	42.826	0.0	0.0	0.0	0.0
54	1	42.826	0.0	0.0	0.0	0.0
55	1	41.967	0.0	0.0	0.0	0.0
56	1	41.967	0.0	0.0	0.0	0.0
57	1	38.712	0.0	0.0	0.0	0.0
58	1	38.712	0.0	0.0	0.0	0.0
59	1	38.100	0.0	0.0	0.0	0.0
60	1	38.100	0.0	0.0	0.0	0.0

JOINT	-X	-Y	DISPL-X	DISPL-Y	ROTATION
1	0.0	0.0	0.0	0.0	0.0
2	252.000	0.0	0.0	0.0	0.0
3	0.0	144.000	1.88266575E-01	2.69330218E-02	2.06606323E-03
4	126.000	144.000	1.88308358E-01	5.15056115E-07	7.77550275E-04
5	252.000	144.000	1.88266575E-01	2.69335806E-02	2.06605811E-03
6	0.0	288.000	5.65244853E-01	5.79326898E-02	2.37279106E-03
7	126.000	288.000	5.65322816E-01	5.27161717E-07	6.56869030E-04
8	252.000	288.000	5.65243781E-01	5.79339229E-02	2.37279339E-03
9	0.0	432.000	9.85852599E-01	8.81890059E-02	2.58336333E-03
10	126.000	432.000	9.85970880E-01	5.93775667E-07	5.36622712E-04
11	252.000	432.000	9.85852599E-01	8.81908536E-02	2.58337241E-03
12	0.0	576.000	1.44517612E+00	1.17503703E-01	2.85106082E-03
13	126.000	576.000	1.44532108E+00	1.72712225E-06	4.97363042E-04
14	252.000	576.000	1.44517517E+00	1.17506325E-01	2.85104732E-03
15	0.0	720.000	1.94414234E+00	1.45778418E-01	3.10354796E-03
16	126.000	720.000	1.94430447E+00	1.31737397E-06	5.19002322E-04
17	252.000	720.000	1.94413948E+00	1.45781875E-01	3.10356379E-03
18	0.0	864.000	2.48023033E+00	1.72757447E-01	3.36169801E-03
19	126.000	864.000	2.48040581E+00	1.82163421E-06	5.90927200E-04
20	252.000	864.000	2.48023129E+00	1.72761559E-01	3.36171384E-03
21	0.0	1008.000	3.05155182E+00	1.98146820E-01	3.60625726E-03
22	126.000	1008.000	3.05173683E+00	2.81493865E-06	6.93573364E-04
23	252.000	1008.000	3.05155087E+00	1.98151708E-01	3.60624585E-03
24	0.0	1152.000	3.65544319E+00	2.21639693E-01	3.84128466E-03
25	126.000	1152.000	3.65563679E+00	2.16535227E-06	8.14049505E-04

JOINT	-X	-Y	DISPL-X	DISPL-Y	ROTATION
26	252.000	1152.000	3.65544415E+00	2.21645296E-01	3.84130282E-03
27	0.0	1296.000	4.28842258E+00	2.42519081E-01	4.08346578E-03
28	126.000	1296.000	4.28862000E+00	2.83147347E-06	9.29287169E-04
29	252.000	1296.000	4.28842545E+00	2.42525280E-01	4.08348069E-03
30	0.0	1440.000	4.95495319E+00	2.60467350E-01	4.37562168E-03
31	126.000	1440.000	4.95516777E+00	4.62573159E-06	1.01691484E-03
32	252.000	1440.000	4.95495415E+00	2.60473967E-01	4.37559932E-03
33	0.0	1584.000	5.64523029E+00	2.75236189E-01	4.44186479E-03
34	126.000	1584.000	5.64545631E+00	5.99605755E-06	1.18938112E-03
35	252.000	1584.000	5.64523029E+00	2.75243223E-01	4.44179401E-03
36	0.0	1728.000	6.32421303E+00	2.86266029E-01	4.25393507E-03
37	126.000	1728.000	6.32445335E+00	1.13903479E-06	1.43214758E-03
38	252.000	1728.000	6.32421494E+00	2.86273360E-01	4.25407663E-03
39	0.0	1872.000	6.95668343E+00	2.93031037E-01	4.06607613E-03
40	126.000	1872.000	6.95717812E+00	3.27853286E-06	1.63600827E-03
41	252.000	1872.000	6.95692825E+00	2.93038666E-01	4.06609476E-03
42	0.0	2016.000	7.55313683E+00	2.96369612E-01	4.04322147E-03
43	126.000	2016.000	7.55353165E+00	6.09043980E-07	1.76585838E-03
44	252.000	2016.000	7.55316925E+00	2.96377480E-01	4.04330343E-03
45	0.0	2160.000	8.10000610E+00	2.97316372E-01	3.83905857E-03
46	126.000	2160.000	8.10067940E+00	6.67753739E-06	1.87419890E-03
47	252.000	2160.000	8.10003165E+00	2.97324479E-01	3.83906765E-03

e. Input Data of Example 3.

```
  1    0
  2    0    0    0   15   10    5    1   10    0    0
    0.02      0.01      0.01    0.0001      0.6      0.3      0.01      1.01
  90   47    6    2    3   -1    5    1 15-ST, 1-BAY K-BRACED FRAME, EXAMPLE 3
29000000.     0.283      700.    20300.      10.
29000000.     0.283        4.       6.       0.5
  1    1    4     0100000000.   0.                              1
  2    2    4     0100000000.   0.                              1
  3    3    7     0100000000.   0.                              3
  4    5    7     0100000000.   0.                              3
  5    6   10     0100000000.   0.                              5
  6    8   10     0100000000.   0.                              5
  7    9   13     0100000000.   0.                              7
  8   11   13     0100000000.   0.                              7
  9   12   16     0100000000.   0.                              9
 10   14   16     0100000000.   0.                              9
 11   15   19     0100000000.   0.                             11
 12   17   19     0100000000.   0.                             11
 13   18   22     0100000000.   0.                             13
 14   20   22     0100000000.   0.                             13
 15   21   25     0100000000.   0.                             15
 16   23   25     0100000000.   0.                             15
 17   24   28     0100000000.   0.                             17
 18   26   28     0100000000.   0.                             17
 19   27   31     0100000000.   0.                             19
 20   29   31     0100000000.   0.                             19
 21   30   34     0100000000.   0.                             21
 22   32   34     0100000000.   0.                             21
 23   33   37     0100000000.   0.                             23
 24   35   37     0100000000.   0.                             23
 25   36   40     0100000000.   0.                             25
 26   38   40     0100000000.   0.                             25
 27   39   43     0100000000.   0.                             27
 28   41   43     0100000000.   0.                             27
 29   42   46     0100000000.   0.                             29
 30   44   46     0100000000.   0.                             29
```

31	3	4	2100000000.	0.	31
32	4	5	2100000000.	0.	31
33	6	7	2100000000.	0.	33
34	7	8	2100000000.	0.	33
35	9	10	2100000000.	0.	35
36	10	11	2100000000.	0.	35
37	12	13	2100000000.	0.	37
38	13	14	2100000000.	0.	37
39	15	16	2100000000.	0.	39
40	16	17	2100000000.	0.	39
41	18	19	2100000000.	0.	41
42	19	20	2100000000.	0.	41
43	21	22	2100000000.	0.	43
44	22	23	2100000000.	0.	43
45	24	25	2100000000.	0.	45
46	25	26	2100000000.	0.	45
47	27	28	2100000000.	0.	47
48	28	29	2100000000.	0.	47
49	30	31	2100000000.	0.	49
50	31	32	2100000000.	0.	49
51	33	34	2100000000.	0.	51
52	34	35	2100000000.	0.	51
53	36	37	2100000000.	0.	53
54	37	38	2100000000.	0.	53
55	39	40	2100000000.	0.	55
56	40	41	2100000000.	0.	55
57	42	43	2100000000.	0.	57
58	43	44	2100000000.	0.	57
59	45	46	2100000000.	0.	59
60	46	47	2100000000.	0.	59
61	1	3	1100000000.	0.	61
62	2	5	1100000000.	0.	61
63	3	6	1100000000.	0.	63
64	5	8	1100000000.	0.	63
65	6	9	1100000000.	0.	65
66	8	11	1100000000.	0.	65
67	9	12	1100000000.	0.	67
68	11	14	1100000000.	0.	67
69	12	15	1100000000.	0.	69
70	14	17	1100000000.	0.	69
71	15	18	1100000000.	0.	71
72	17	20	1100000000.	0.	71
73	18	21	1100000000.	0.	73
74	20	23	1100000000.	0.	73
75	21	24	1100000000.	0.	75
76	23	26	1100000000.	0.	75
77	24	27	1100000000.	0.	77
78	26	29	1100000000.	0.	77
79	27	30	1100000000.	0.	79
80	29	32	1100000000.	0.	79
81	30	33	1100000000.	0.	81
82	32	35	1100000000.	0.	81
83	33	36	1100000000.	0.	83
84	35	38	1100000000.	0.	83
85	36	39	1100000000.	0.	85
86	38	41	1100000000.	0.	85
87	39	42	1100000000.	0.	87
88	41	44	1100000000.	0.	87
89	42	45	1100000000.	0.	89
90	44	47	1100000000.	0.	89

1	0.	0.
2	336.	0.
3	0.	144.
4	168.	144.
5	336.	144.
6	0.	288.
7	168.	288.
8	336.	288.
9	0.	432.
10	168.	432.
11	336.	432.
12	0.	576.
13	168.	576.
14	336.	576.
15	0.	720.
16	168.	720.
17	336.	720.
18	0.	864.
19	168.	864.
20	336.	864.
21	0.	1008.
22	168.	1008.
23	336.	1008.
24	0.	1152.
25	168.	1152.
26	336.	1152.
27	0.	1296.
28	168.	1296.
29	336.	1296.
30	0.	1440.
31	168.	1440.
32	336.	1440.
33	0.	1584.
34	168.	1584.
35	336.	1584.
36	0.	1728.
37	168.	1728.
38	336.	1728.
39	0.	1872.
40	168.	1872.
41	336.	1872.
42	0.	2016.
43	168.	2016.
44	336.	2016.
45	0.	2160.
46	168.	2160.
47	336.	2160.

```
  1    2    3    4    5    6
  0                                   ATC, ELF, AA=7, AV=7, SOIL TYPE 3
  1    3        144.     50000.
  2    6        288.     50000.
  3    9        432.     50000.
  4   12        576.     50000.
  5   15        720.     50000.
  6   18        864.     50000.
  7   21       1008.     50000.
  8   24       1152.     50000.
  9   27       1296.     50000.
 10   30       1440.     50000.
 11   33       1584.     50000.
 12   36       1728.     50000.
 13   39       1872.     50000.
 14   42       2016.     50000.
 15   45       2160.     50000.
  7    7    2    1    0    3    1    1    0    1    1    1
       6.        5.        336.
  2    8   31   32    1    2    3    4   61   62   63   64
  2    8   33   34    3    4    5    6   63   64   65   66
  2    8   35   36    5    6    7    8   65   66   67   68
  2    8   37   38    7    8    9   10   67   68   69   70
  2    8   39   40    9   10   11   12   69   70   71   72
  2    8   41   42   11   12   13   14   71   72   73   74
  2    8   43   44   13   14   15   16   73   74   75   76
  2    8   45   46   15   16   17   18   75   76   77   78
  2    8   47   48   17   18   19   20   77   78   79   80
  2    8   49   50   19   20   21   22   79   80   81   82
  2    8   51   52   21   22   23   24   81   82   83   84
  2    8   53   54   23   24   25   26   83   84   85   86
  2    8   55   56   25   26   27   28   85   86   87   88
  2    8   57   58   27   28   29   30   87   88   89   90
  2    4   59   60   29   30   89   90
 0.   0.   0.   1.
 0.   0.   0.  -1.
  0    0    1    1  386.4
      0.        0.       32.5       65.       32.5       32.5       65.       32.5
     32.5       65.       32.5       32.5       65.       32.5       32.5       65.
     32.5       32.5       65.       32.5       32.5       65.       32.5       32.5
      65.       32.5       32.5       65.       32.5       32.5       65.       32.5
     32.5       65.       32.5       32.5       65.       32.5       32.5       65.
     32.5       32.5       65.       32.5       32.5       65.       32.5
   15
0.432          1    30.864          1    61.296          1    9
1.728          1    122.16          1    152.592         1    18
3.024          1    213.456         1    243.888         1    27
4.32           1    304.752         1    335.182         1    36
5.616          1    396.048         1    426.48          1    45
```

f. Output Solution of Example 3.

```
STRUCTURE NO. 1:   15-ST, 1-BAY K-BRACED FRAME,EXAMPLE 3

 TOTAL NUMBER OF STORIES----------------   15
 TOTAL NUMBER OF MEMBERS----------------   90
 TOTAL NUMBER OF NODES------------------   47
 TOTAL NUMBER OF RESTRAINED D.O.F.------    6
 TOTAL NUMBER OF LOADING CONDITIONS-----    2
 DISPLACEMENT CONSTRAINT CODE-----------    3
    EQ. 0:  NO DISPLACEMENT CONSTRAINTS
    EQ. 1:  DISPLACEMENT CONSTRAINT IS THE SAME FOR ALL NODES
    EQ. 2:  DISPLACEMENT CONSTRAINT CAN BE VARIED PER NODE
    EQ. 3:  DRIFT CONSTRAINT ON EACH STORY

 TYPE OF DESIGN-------------------------   -1
    EQ.-1:  STATIC DESIGN
    EQ. 0:  STATIC AND DYNAMIC DESIGN
    EQ. 1:  DYNAMIC DESIGN
 MAXIMUM NUMBER OF ITERATIONS-----------    5
 TYPE OF SECTIONS-----------------------    1
    EQ. 0:  BUILT-UP SECTIONS
    GT. 0:  WF SECTIONS
    LT. 0:  TRUSS MEMBERS


 GIRDER-COLUMN PROPERTIES:
    MODULUS OF ELASTICITY----------------   29000000.0
    SPECIFIC WEIGHT----------------------         0.283
    INITIAL MOMENT OF INERTIA------------       700.000
    MAXIMUM MOMENT OF INERTIA------------     20300.000
    MINIMUM MOMENT OF INERTIA------------        10.000
    RATIO OF MINIMUM I TO MAXIMUM I------         0.0
```

BRACING PROPERTIES:

MODULUS OF ELASTICITY	29000000.0
SPECIFIC WEIGHT	0.283
MAXIMUM BRACING AREA	6.000
MINIMUM BRACING AREA	0.500

GRADIENT PARAMETERS:

GRADIENT ITERATION	10
UPPER RANGE FOR DI	0.60000
LOWER RANGE FOR DI	0.30000
REDUCTION FACTOR	0.01000
INCREMENTAL FACTOR	1.01000

MEMBER IDENTIFICATION DATA:

NO	J-END	K-END	TYPE	STRESS LIMIT	DEAD LOAD	LIVE LOAD	SNOW LOAD	DVN	MO	GIRDER IDENTIFICATION NUMBERS:
1	1	4	0	100000000.	0.0	0.0	0.0	1	0	0
2	2	4	0	100000000.	0.0	0.0	0.0	1	0	0
3	3	7	0	100000000.	0.0	0.0	0.0	3	0	0
4	5	7	0	100000000.	0.0	0.0	0.0	3	0	0
5	6	10	0	100000000.	0.0	0.0	0.0	5	0	0
6	8	10	0	100000000.	0.0	0.0	0.0	5	0	0
7	9	13	0	100000000.	0.0	0.0	0.0	7	0	0
8	11	13	0	100000000.	0.0	0.0	0.0	7	0	0
9	12	16	0	100000000.	0.0	0.0	0.0	9	0	0
10	14	16	0	100000000.	0.0	0.0	0.0	9	0	0
11	15	19	0	100000000.	0.0	0.0	0.0	11	0	0
12	17	19	0	100000000.	0.0	0.0	0.0	11	0	0
13	18	22	0	100000000.	0.0	0.0	0.0	13	0	0
14	20	22	0	100000000.	0.0	0.0	0.0	13	0	0
15	21	25	0	100000000.	0.0	0.0	0.0	15	0	0
16	23	25	0	100000000.	0.0	0.0	0.0	15	0	0
17	24	28	0	100000000.	0.0	0.0	0.0	17	0	0
18	26	28	0	100000000.	0.0	0.0	0.0	17	0	0
19	27	31	0	100000000.	0.0	0.0	0.0	19	0	0
20	29	31	0	100000000.	0.0	0.0	0.0	19	0	0
21	30	34	0	100000000.	0.0	0.0	0.0	21	0	0
22	32	34	0	100000000.	0.0	0.0	0.0	21	0	0
23	33	37	0	100000000.	0.0	0.0	0.0	23	0	0
24	35	37	0	100000000.	0.0	0.0	0.0	23	0	0
25	36	40	0	100000000.	0.0	0.0	0.0	25	0	0
26	38	40	0	100000000.	0.0	0.0	0.0	25	0	0
27	39	43	0	100000000.	0.0	0.0	0.0	27	0	0
28	41	43	0	100000000.	0.0	0.0	0.0	27	0	0
29	42	46	0	100000000.	0.0	0.0	0.0	29	0	0
30	44	46	0	100000000.	0.0	0.0	0.0	29	0	0
31	3	4	2	100000000.	0.0	0.0	0.0	31	0	0
32	4	5	2	100000000.	0.0	0.0	0.0	31	0	0
33	6	7	2	100000000.	0.0	0.0	0.0	33	0	0
34	7	8	2	100000000.	0.0	0.0	0.0	33	0	0
35	9	10	2	100000000.	0.0	0.0	0.0	35	0	0
36	10	11	2	100000000.	0.0	0.0	0.0	35	0	0
37	12	13	2	100000000.	0.0	0.0	0.0	37	0	0
38	13	14	2	100000000.	0.0	0.0	0.0	37	0	0
39	15	16	2	100000000.	0.0	0.0	0.0	39	0	0
40	16	17	2	100000000.	0.0	0.0	0.0	39	0	0
41	18	19	2	100000000.	0.0	0.0	0.0	41	0	0
42	19	20	2	100000000.	0.0	0.0	0.0	41	0	0
43	21	22	2	100000000.	0.0	0.0	0.0	43	0	0
44	22	23	2	100000000.	0.0	0.0	0.0	43	0	0
45	24	25	2	100000000.	0.0	0.0	0.0	45	0	0
46	25	26	2	100000000.	0.0	0.0	0.0	45	0	0
47	27	28	2	100000000.	0.0	0.0	0.0	47	0	0
48	28	29	2	100000000.	0.0	0.0	0.0	47	0	0
49	30	31	2	100000000.	0.0	0.0	0.0	49	0	0
50	31	32	2	100000000.	0.0	0.0	0.0	49	0	0
51	33	34	2	100000000.	0.0	0.0	0.0	51	0	0
52	34	35	2	100000000.	0.0	0.0	0.0	51	0	0
53	36	37	2	100000000.	0.0	0.0	0.0	53	0	0
54	37	38	2	100000000.	0.0	0.0	0.0	53	0	0
55	39	40	2	100000000.	0.0	0.0	0.0	55	0	0
56	40	41	2	100000000.	0.0	0.0	0.0	55	0	0
57	42	43	2	100000000.	0.0	0.0	0.0	57	0	0
58	43	44	2	100000000.	0.0	0.0	0.0	57	0	0
59	45	46	2	100000000.	0.0	0.0	0.0	59	0	0
60	46	47	2	100000000.	0.0	0.0	0.0	59	0	0
61	1	3	1	100000000.	0.0	0.0	0.0	61	0	0
62	2	5	1	100000000.	0.0	0.0	0.0	61	0	0
63	3	6	1	100000000.	0.0	0.0	0.0	63	0	0
64	5	8	1	100000000.	0.0	0.0	0.0	63	0	0
65	6	9	1	100000000.	0.0	0.0	0.0	65	0	0
66	8	11	1	100000000.	0.0	0.0	0.0	65	0	0
67	9	12	1	100000000.	0.0	0.0	0.0	67	0	0
68	11	14	1	100000000.	0.0	0.0	0.0	67	0	0
69	12	15	1	100000000.	0.0	0.0	0.0	69	0	0
70	14	17	1	100000000.	0.0	0.0	0.0	69	0	0
71	15	18	1	100000000.	0.0	0.0	0.0	71	0	0
72	17	20	1	100000000.	0.0	0.0	0.0	71	0	0
73	18	21	1	100000000.	0.0	0.0	0.0	73	0	0
74	20	23	1	100000000.	0.0	0.0	0.0	73	0	0
75	21	24	1	100000000.	0.0	0.0	0.0	75	0	0
76	23	26	1	100000000.	0.0	0.0	0.0	75	0	0
77	24	27	1	100000000.	0.0	0.0	0.0	77	0	0
78	26	29	1	100000000.	0.0	0.0	0.0	77	0	0
79	27	30	1	100000000.	0.0	0.0	0.0	79	0	0
80	29	32	1	100000000.	0.0	0.0	0.0	79	0	0
81	30	33	1	100000000.	0.0	0.0	0.0	81	0	0
82	32	35	1	100000000.	0.0	0.0	0.0	81	0	0
83	33	36	1	100000000.	0.0	0.0	0.0	83	0	0

84	35	38	1	100000000.	0.0	0.0	0.0	83	0	0
85	36	39	1	100000000.	0.0	0.0	0.0	85	0	0
86	38	41	1	100000000.	0.0	0.0	0.0	85	0	0
87	39	42	1	100000000.	0.0	0.0	0.0	87	0	0
88	41	44	1	100000000.	0.0	0.0	0.0	87	0	0
89	42	45	1	100000000.	0.0	0.0	0.0	89	0	0
90	44	47	1	100000000.	0.0	0.0	0.0	89	0	0

MBAND WIDTH = 14

RESTRAINED DEGREES OF FREEDOM:

1	2	3	4	5	6

TOTAL ELEMENTS	NONZERO ELEMENTS	STORED ELEMENTS
10011	1092	1614

STARTING ROW NUMBERS FOR EACH COLUMN

1	1	1	4	4	4	1	1	1	1
1	1	4	4	4	7	7	7	7	7
7	13	13	13	16	16	16	16	16	16
22	22	22	25	25	25	25	25	25	31
31	31	34	34	34	34	34	34	40	40
40	43	43	43	43	43	43	49	49	49
52	52	52	52	52	52	58	58	58	61
61	61	61	61	61	67	67	67	70	70
70	70	70	70	76	76	76	79	79	79
79	79	79	85	85	85	88	88	88	88
88	88	94	94	94	97	97	97	97	97
97	103	103	103	106	106	106	106	106	106
112	112	112	115	115	115	115	115	115	121
121	121	124	124	124	124	124	124	130	130
130									

NUMBERS OF DIAGONAL ELEMENTS IN SINGLE ARRAY STIFFNESS MATRIX

1	3	6	7	9	12	19	27	36	46
57	69	79	90	102	112	123	135	148	162
177	187	198	210	220	231	243	256	270	285
295	306	318	328	339	351	364	378	393	403
414	426	436	447	459	472	486	501	511	522
534	544	555	567	580	594	609	619	630	642
652	663	675	688	702	717	727	738	750	760
771	783	796	810	825	835	846	858	868	879
891	904	918	933	943	954	966	976	987	999
1012	1026	1041	1051	1062	1074	1084	1095	1107	1120
1134	1149	1159	1170	1182	1192	1203	1215	1228	1242
1257	1267	1278	1290	1300	1311	1323	1336	1350	1365
1375	1386	1398	1408	1419	1431	1444	1458	1473	1483
1494	1506	1516	1527	1539	1552	1566	1581	1591	1602
1614									

TOTAL ELEMENTS MEAN THE TOTAL NUMBER OF ELEMENTS IN THE STIFFNESS MATRIX, NONZERO ELEMENTS ARE THE TOTAL NUMBER OF NONZERO ELEMENTS IN THE STIFFNESS MATRIX, AND STORED ELEMENTS ARE THE ELEMENTS IN THE STIFFNESS MATRIX NEEDED TO BE STORED BY USING THIS NUMBERING SCHEME. WHEN THE NUMBERING SCHEME IS AN EFFICIENT ONE, THE NUMBER OF NONZERO ELEMENTS IS CLOSE TO THE NUMBER OF STORED ELEMENTS.

LOADING INFORMATIONS :

STATIC LOADING INFORMATION:

STORY NO.	NODE	STORY HEIGHT	STORY WEIGHT
1	3	144.000	50000.000
2	6	288.000	50000.000
3	9	432.000	50000.000
4	12	576.000	50000.000
5	15	720.000	50000.000
6	18	864.000	50000.000
7	21	1008.000	50000.000
8	24	1152.000	50000.000
9	27	1296.000	50000.000
10	30	1440.000	50000.000
11	33	1584.000	50000.000
12	36	1728.000	50000.000
13	39	1872.000	50000.000
14	42	2016.000	50000.000
15	45	2160.000	50000.000

ATC-3 SEISMIC PROVISIONS

GENERAL INFORMATION :

AREA MAP NUMBER FOR AA	7
AREA MAP NUMBER FOR AV	7
SEISMIC COEFFICIENT AA ------ (TABLE 1-B)	0.400
SEISMIC COEFFICIENT AV ------ (TABLE 1-B)	0.400
SEISMIC INDEX ---------- (TABLE 1-A)	4
SEISMIC HAZARD EXPOSURE GROUP (TABLE 1-A)	2
SEISMIC PERFORMANCE CATEGORY (TABLE 1-A)	C
RESPONSE MODIFICATION FACTOR (TABLE 3-B)	6.00
DEFLECTION AMPLICATION FACTOR (TABLE 3-B)	5.00
OVERALL LENGTH AT BASE (IN)	336.00
SOIL TYPE	3
STRUCTURAL TYPE	0
EQ. 1: MOMENT-RESISTING STRUCTURE	
EQ. 0: NON-MOMENT-RESISTING STRUCTURE	
MATERIAL OF THE STRUCTURE	1
EQ. 1: STEEL FRAME	
EQ. 0: CONCRETE FRAME	
STRUCTURAL CONFIGURATION :	
PLAN CONFIGURATION	1
VERTICAL CONFIGURATION	1
EQ. 1: REGULAR	
EQ. 0: IREGULAR	
SOIL PROFILE COEFFICIENT ---- (TABLE 3-A)	1.500

ALLOWABLE DRIFT ACCORDING TO TABLE 3-C

FLOOR NO.	ALLOWABLE VALUE (IN)
1	2.16000
2	2.16000
3	2.16000
4	2.16000
5	2.16000
6	2.16000
7	2.16000
8	2.16000
9	2.16000
10	2.16000
11	2.16000
12	2.16000
13	2.16000
14	2.16000
15	2.16000

MEMBERS CONTRIBUTING THEIR WEIGHT TO EACH FLOOR :

FLOOR LEVEL	NO. OF MEMBERS THAT CONTRIBUTING THEIR WEIGHT TO THE FLOOR									
1	31	32	1	2	3	4	61	62	63	64
2	33	34	3	4	5	6	63	64	65	66
3	35	36	5	6	7	8	65	66	67	68
4	37	38	7	8	9	10	67	68	69	70
5	39	40	9	10	11	12	69	70	71	72
6	41	42	11	12	13	14	71	72	73	74
7	43	44	13	14	15	16	73	74	75	76
8	45	46	15	16	17	18	75	76	77	78
9	47	48	17	18	19	20	77	78	79	80
10	49	50	19	20	21	22	79	80	81	82
11	51	52	21	22	23	24	81	82	83	84
12	53	54	23	24	25	26	83	84	85	86
13	55	56	25	26	27	28	85	86	87	88
14	57	58	27	28	29	30	87	88	89	90
15	59	60	29	30	89	90				

LOAD COMBINATION FACTORS FOR LOADING CONDITION 1

DEAD LOAD	0.0
LIVE LOAD	0.0
SNOW LOAD	0.0
EARTHQUAKE LOAD	1.0

```
LOAD COMBINATION FACTORS FOR LOADING CONDITION    2
  DEAD LOAD ----------------------------   0.0
  LIVE LOAD ----------------------------   0.0
  SNOW LOAD ----------------------------   0.0
  EARTHQUAKE LOAD ----------------------  -1.0
```

```
DYNAMIC PROPERTIES:
  FIRST MODE NUMBER---------------------      1
  LAST MODE NUMBER----------------------      1
  GRAVITY ACCELERATION------------------ 386.40
  TYPE OF MODE SUPERPOSITION------------      0
```

```
EQ.-1:  DIRECT SUPERPOSITION OF MODES
EQ. 0:  ROOT-MEAN-SQUARE SUPERPOSITION OF MODES
EQ. 1:  ABSOLUTE SUPERPOSITION OF MODES
```

ADDITIONAL NODAL MASSES:

0.0	0.0	32.500	65.000	32.500	32.500	65.000	32.500	32.500	65.000
32.500	32.500	65.000	32.500	32.500	65.000	32.500	32.500	65.000	32.500
32.500	65.000	32.500	32.500	65.000	32.500	32.500	65.000	32.500	32.500
65.000	32.500	32.500	65.000	32.500	32.500	65.000	32.500	32.500	65.000
32.500	32.500	65.000	32.500	32.500	65.000	32.500			

DISPLACEMENT CONSTRAINTS:

NODE	DIRECTION	VALUE
3	1	0.432
6	1	0.864
9	1	1.296
12	1	1.728
15	1	2.160
18	1	2.592
21	1	3.024
24	1	3.456
27	1	3.888
30	1	4.320
33	1	4.752
36	1	5.182
39	1	5.616
42	1	6.048
45	1	6.480

RELATIVE SIZES OF MEMBERS:

0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861
0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861
0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861	0.0057142861
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000
1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000

AFTER ATC-P-DELT SATISFIED, SCALING FACTOR= 0.174661E+04

STORY NO.	DRIFT(IN)	STABILITY COEFF	LATERAL FORCE(LB)	OVERTURNING MOMENT(IN-LB)	STORY WEIGHT(KIPS)
1	2.75692E-01	4.36217E-03	1.70028E+02	1.04511E+08	5.46643E+01
2	6.25047E-01	4.62566E-03	4.97596E+02	9.42172E+07	5.46643E+01
3	9.27550E-01	4.27844E-03	9.32563E+02	8.39891E+07	5.46643E+01
4	1.19683E+00	3.87199E-03	1.45624E+03	7.38873E+07	5.46643E+01
5	1.43104E+00	3.46632E-03	2.05763E+03	6.39867E+07	5.46643E+01
6	1.63085E+00	3.08420E-03	2.72919E+03	5.43765E+07	5.46643E+01
7	1.79692E+00	2.73251E-03	3.46536E+03	4.51594E+07	5.46643E+01
8	1.93031E+00	2.41286E-03	4.26177E+03	3.64412E+07	5.46643E+01
9	2.03239E+00	2.12455E-03	5.11488E+03	2.83367E+07	5.46643E+01
10	2.10491E+00	1.86595E-03	6.02176E+03	2.09688E+07	5.46643E+01
11	2.15010E+00	1.63514E-03	6.97990E+03	1.44680E+07	5.46643E+01
12	2.17047E+00	1.42999E-03	7.98714E+03	8.97228E+06	5.46643E+01
13	2.16920E+00	1.24857E-03	9.04160E+03	4.62673E+06	5.46643E+01
14	2.14984E+00	1.08898E-03	1.01416E+04	1.58317E+06	5.46643E+01
15	2.11682E+00	9.49379E-04	1.09942E+04	0.0	5.32530E+01

```
BASE MOMENT (IN-LB)------------------------------ 0.861965E+08
TOTAL GRAVITY LOAD (LB)-------------------------- 0.818553E+06
FUNDAMENTAL PERIOD------------------------------- 0.159841E+01
ECCENTRICITY (IN)-------------------------------- 0.105303E+03
```

```
OLD SCALING FACTOR---------------------------------  0.17382E+04
NEW SCALING FACTOR---------------------------------  0.17547E+04
ACTIVE STRESS IN LOADING CONDITION 1---------------   61
ACTIVE STRESS IN LOADING CONDITION 2---------------   61
ACTIVE DISPLACEMENT IN LOADING CONDITION 1---------  133
ACTIVE DISPLACEMENT IN LOADING CONDITION 2---------  133
STORY NUMBER WHICH HAS MAX. STORY DRIFT------------   12
MOST CRITICAL CONSTRAINT---------------------------   4
NUMBER OF ANALYSIS---------------------------------   5

**************************************** TOTAL WEIGHT OF STRUCTURE =  7.038569E+04 ****************************************
**************************************** BASE AE =  5.088725E+10;   CYCLE NO. =  1 ****************************************
```

NO	CONSTRAINT	ENERGY DENSITY RATIO
1	4	0.581659E-01
2	4	0.581729E-01
3	4	0.607040E-01
4	4	0.607239E-01
5	4	0.594666E-01
6	4	0.595075E-01
7	4	0.583727E-01
8	4	0.584413E-01
9	4	0.567945E-01
10	4	0.568957E-01
11	4	0.547558E-01
12	4	0.548942E-01
13	4	0.521945E-01
14	4	0.523783E-01
15	4	0.490906E-01
16	4	0.493035E-01
17	4	0.453657E-01
18	4	0.456176E-01
19	4	0.409949E-01
20	4	0.413003E-01
21	4	0.359500E-01
22	4	0.363104E-01
23	4	0.301772E-01
24	4	0.306000E-01
25	4	0.237010E-01
26	4	0.241064E-01
27	4	0.162719E-01
28	4	0.171174E-01
29	4	0.818794E-02
30	4	0.896758E-02
31	4	0.909178E-02
32	4	0.904932E-02
33	4	0.955225E-02
34	4	0.942516E-02
35	4	0.952803E-02
36	4	0.928989E-02
37	4	0.953311E-02
38	4	0.916128E-02
39	4	0.947861E-02
40	4	0.895230E-02
41	4	0.935757E-02
42	4	0.866296E-02
43	4	0.915364E-02
44	4	0.827862E-02
45	4	0.885597E-02
46	4	0.778327E-02
47	4	0.845345E-02
48	4	0.716554E-02
49	4	0.792433E-02
50	4	0.640834E-02
51	4	0.726083E-02
52	4	0.550301E-02
53	4	0.645533E-02
54	4	0.442342E-02
55	4	0.534905E-02
56	4	0.323373E-02
57	4	0.444660E-02
58	4	0.165389E-02
59	4	0.567803E-02
60	4	0.141105E-03
61	4	0.999999E+00
62	4	0.999946E+00
63	4	0.835242E+00
64	4	0.835175E+00
65	4	0.667946E+00
66	4	0.667858E+00
67	4	0.555163E+00
68	4	0.555044E+00
69	4	0.437541E+00
70	4	0.437397E+00
71	4	0.335129E+00
72	4	0.334955E+00
73	4	0.247863E+00
74	4	0.247671E+00
75	4	0.175441E+00

76	4	0.175241E+00
77	4	0.117342E+00
78	4	0.117133E+00
79	4	0.727364E-01
80	4	0.725273E-01
81	4	0.4049386-01
82	4	0.402904E-01
83	4	0.191442E-01
84	4	0.189628E-01
85	4	0.685644E-02
86	4	0.669444E-02
87	4	0.135510E-02
88	4	0.130305E-02
89	4	0.227205E-03
90	4	0.835006E-04

RELATIVE SIZES OF MEMBERS:

0.0004031763	0.0004031763	0.0007743090	0.0007743090	0.0007413938	0.0007413938	0.0007405721	0.0007405721	0.0007327534	0.0007327534
0.0007220474	0.0007220474	0.0007073549	0.0007073549	0.0006881570	0.0006881570	0.0006637240	0.0006637240	0.0006330854	0.0006330854
0.0005949838	0.0005949838	0.0005475802	0.0005475802	0.0004874018	0.0004874018	0.0004105263	0.0004105263	0.0002964544	0.0002964544
0.0050658621	0.0050658621	0.0127803087	0.0127803087	0.0120712072	0.0120712072	0.0121065006	0.0121065006	0.0119775459	0.0119775459
0.0117728077	0.0117728077	0.0114667863	0.0114667863	0.0110501722	0.0110501722	0.0105096810	0.0105096810	0.0098331422	0.0098331422
0.0090118833	0.0090118833	0.0080148056	0.0080148056	0.0066588182	0.0066588182	0.0071417727	0.0071417727	0.0075049363	0.0075049363
1.00000000	1.00000000	0.783860087	0.783860087	0.654557347	0.654557347	0.534735322	0.534735322	0.427345932	0.427345932
0.332400620	0.332400620	0.250131428	0.250131428	0.180557072	0.180557072	0.123513520	0.123513520	0.0785982609	0.0785982609
0.0451299101	0.0451299101	0.0221235640	0.0221235640	0.0082353912	0.0082353912	0.0017615687	0.0017615687	0.0017615687	0.0017615687

AFTER ATC-P-DELT SATISFIED, SCALING FACTOR= 0.643744E+04

STORY NO.	DRIFT(IN)	STABILITY COEFF	LATERAL FORCE(LB)	OVERTURNING MOMENT(IN-LB)	STORY WEIGHT(KIPS)
1	5.53349E-01	8.67530E-03	1.74566E+02	1.00192E+08	5.35624E+01
2	8.92768E-01	6.53495E-03	5.06956E+02	9.02804E+07	5.35561E+01
3	1.05508E+00	4.80500E-03	9.41357E+02	8.04361E+07	5.32991E+01
4	1.22088E+00	3.89380E-03	1.45883E+03	7.07191E+07	5.30619E+01
5	1.37698E+00	3.28388E-03	2.04665E+03	6.12037E+07	5.28191E+01
6	1.52476E+00	2.83611E-03	2.69692E+03	5.19772E+07	5.25741E+01
7	1.66276E+00	2.48485E-03	3.40253E+03	4.31392E+07	5.23269E+01
8	1.78969E+00	2.19713E-03	4.15854E+03	3.47910E+07	5.20784E+01
9	1.90410E+00	1.95406E-03	4.96071E+03	2.70416E+07	5.18293E+01
10	2.00411E+00	1.74368E-03	5.80552E+03	2.00066E+07	5.15804E+01
11	2.08743E+00	1.55793E-03	6.69000E+03	1.38076E+07	5.13331E+01
12	2.15120E+00	1.39100E-03	7.61156E+03	8.57201E+06	5.10877E+01
13	2.19057E+00	1.23778E-03	8.56859E+03	4.43243E+06	5.08486E+01
14	2.17934E+00	1.08422E-03	9.57613E+03	1.52674E+06	5.07050E+01
15	2.12563E+00	9.37202E-04	1.06023E+04	0.0	5.04860E+01

BASE MOMENT (IN-LB)----------	0.826709E+08
TOTAL GRAVITY LOAD (LB)----------	0.781147E+06
FUNDAMENTAL PERIOD----------	0.157651E+01
ECCENTRICITY (IN)----------	0.105833E+03

OLD SCALING FACTOR----------	0.63476E+04
NEW SCALING FACTOR----------	0.64078E+04
ACTIVE STRESS IN LOADING CONDITION 1----------	61
ACTIVE STRESS IN LOADING CONDITION 2----------	61
ACTIVE DISPLACEMENT IN LOADING CONDITION 1------	133
ACTIVE DISPLACEMENT IN LOADING CONDITION 2------	133
STORY NUMBER WHICH HAS MAX. STORY DRIFT---------	13
MOST CRITICAL CONSTRAINT----------	4
NUMBER OF ANALYSIS----------	2

********** TOTAL WEIGHT OF STRUCTURE = 3.300637E+04 **********
********** BASE AE = 1.858254E+11; CYCLE NO. = 5 **********

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
1	221.27	0.00040		2.5835	1	4	-1.97516E+04 -7.64539E+03 1.97516E+04 7.64539E+03					
2	221.27	0.00040		2.5835	2	4	1.97524E+04 7.64571E+03 -1.97524E+04 -7.64571E+03					
3	221.27	0.00077		4.9616	3	7	-4.65463E+04 -9.38130E+03 4.65463E+04 9.38130E+03					
4	221.27	0.00077		4.9616	5	7	4.65516E+04 9.38238E+03 -4.65516E+04 -9.38238E+03					
5	221.27	0.00074		4.7507	6	10	-4.40663E+04 -9.27577E+03 4.40663E+04 9.27577E+03					
6	221.27	0.00074		4.7507	8	10	4.40763E+04 9.27788E+03 -4.40763E+04 -9.27788E+03					
7	221.27	0.00074		4.7454	9	13	-4.38094E+04 -9.23194E+03 4.38094E+04 9.23194E+03					
8	221.27	0.00074		4.7454	11	13	4.38254E+04 9.23531E+03 -4.38254E+04 -9.23531E+03					
9	221.27	0.00073		4.6953	12	16	-4.28652E+04 -9.12935E+03 4.28652E+04 9.12935E+03					
10	221.27	0.00073		4.6953	14	16	4.28883E+04 9.13426E+03 -4.28883E+04 -9.13426E+03					

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
11	221.27	0.00072		4.6267	15	19	-4.15819E+04 -8.98735E+03 4.15819E+04 8.98735E+03					
12	221.27	0.00072		4.6267	17	19	4.16123E+04 8.99392E+03 -4.16123E+04 -8.99392E+03					
13	221.27	0.00071		4.5326	18	22	-3.98667E+04 -8.79560E+03 3.98667E+04 8.79560E+03					
14	221.27	0.00071		4.5326	20	22	3.99063E+04 8.80434E+03 -3.99063E+04 -8.80434E+03					
15	221.27	0.00069		4.4096	21	25	-3.76904E+04 -8.54743E+03 3.76904E+04 8.54743E+03					
16	221.27	0.00069		4.4096	23	25	3.77387E+04 8.55840E+03 -3.77387E+04 -8.55840E+03					

17	221.27	0.00066		4.2539	24	28	-3.50176E+04 -8.23364E+03 3.50176E+04 8.23364E+03					
18	221.27	0.00066		4.2539	26	28	3.50743E+04 8.24697E+03 -3.50743E+04 -8.24697E+03					
19	221.27	0.00063		4.0567	27	31	-3.18172E+04 -7.84319E+03 3.18172E+04 7.84319E+03					
20	221.27	0.00063		4.0567	29	31	3.18808E+04 7.85886E+03 -3.18808E+04 -7.85886E+03					

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
21	221.27	0.00059		3.8125	30	34	-2.80610E+04 -7.36023E+03 2.80610E+04 7.36023E+03					
22	221.27	0.00059		3.8125	32	34	2.81290E+04 7.37805E+03 -2.81290E+04 -7.37805E+03					
23	221.27	0.00055		3.5088	33	37	-2.37187E+04 -6.75982E+03 2.37187E+04 6.75982E+03					
24	221.27	0.00055		3.5088	35	37	2.37893E+04 6.77996E+03 -2.37893E+04 -6.77996E+03					
25	221.27	0.00049		3.1232	36	40	-1.87710E+04 -6.01025E+03 1.87710E+04 6.01025E+03					
26	221.27	0.00049		3.1232	38	40	1.88330E+04 6.03011E+03 -1.88330E+04 -6.03011E+03					
27	221.27	0.00041		2.6306	39	43	-1.32114E+04 -5.02226E+03 1.32114E+04 5.02226E+03					
28	221.27	0.00041		2.6306	41	43	1.32696E+04 5.04441E+03 -1.32696E+04 -5.04441E+03					
29	221.27	0.00030		1.8996	42	46	-6.90875E+03 -3.63693E+03 6.90875E+03 3.63693E+03					
30	221.27	0.00030		1.8996	44	46	6.95881E+03 3.66328E+03 -6.95881E+03 -3.66328E+03					

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
31	168.00	0.00507	32.4609	2.6469	3	4	1.49859E+04	-9.24761E+01	-1.55210E+04	-1.49859E+04	9.24761E+01	-1.50000E+01
							1.02645E+04	0.0	1.05886E+03	5.65723E+03	0.0	5.66612E+03
							-1.49859E+04	9.24761E+01	1.55210E+04	1.49859E+04	-9.24761E+01	1.50000E+01
							-1.02645E+04	0.0	-1.05886E+03	-5.65723E+03	0.0	-5.66612E+03
32	168.00	0.00507	32.4609	2.6469	4	5	-1.48668E+04	-9.19336E+01	1.50078E+01	1.48668E+04	9.19336E+01	-1.54599E+04
							-5.62116E+03	0.0	-5.61226E+03	-1.02014E+04	0.0	-1.03202E+03
							1.48668E+04	9.19336E+01	-1.50078E+01	-1.48668E+04	-9.19336E+01	1.54599E+04
							5.62116E+03	0.0	5.61226E+03	1.02014E+04	0.0	1.03202E+03
33	168.00	0.01278	81.8933	4.2042	6	7	3.54321E+04	-2.14543E+02	-3.59206E+04	-3.54321E+04	2.14543E+02	-1.22638E+02
							1.26869E+04	0.0	4.16874E+03	8.41329E+03	0.0	8.44237E+03
							-3.54321E+04	2.14543E+02	3.59206E+04	3.54321E+04	-2.14543E+02	1.22638E+02
							-1.26869E+04	0.0	-4.16874E+03	-8.41329E+03	0.0	-8.44237E+03
34	168.00	0.01278	81.8933	4.2042	7	8	-3.49208E+04	-2.11029E+02	1.22781E+02	3.49208E+04	2.11029E+02	-3.55756E+04
							-8.32079E+03	0.0	-8.29167E+03	-1.25244E+04	0.0	-4.08804E+03
							3.49208E+04	2.11029E+02	-1.22781E+02	-3.49208E+04	-2.11029E+02	3.55756E+04
							8.32079E+03	0.0	8.29167E+03	1.25244E+04	0.0	4.08804E+03
35	168.00	0.01287	77.3495	4.0859	9	10	3.37652E+04	-2.06728E+02	-3.44797E+04	-3.37652E+04	2.06728E+02	-2.50551E+02
							1.25889E+04	0.0	3.93889E+03	8.23246E+03	0.0	8.29531E+03
							-3.37652E+04	2.06728E+02	3.44797E+04	3.37652E+04	-2.06728E+02	2.50551E+02
							-1.25889E+04	0.0	-3.93889E+03	-8.23246E+03	0.0	-8.29531E+03
36	168.00	0.01287	77.3495	4.0859	10	11	-3.28438E+04	-2.00030E+02	2.58758E+02	3.28438E+04	2.00030E+02	-3.38558E+04
							-8.06984E+03	0.0	-8.00693E+03	-1.22851E+04	0.0	-3.79164E+03
							3.28438E+04	2.00030E+02	-2.58758E+02	-3.28438E+04	-2.00030E+02	3.38558E+04
							8.06984E+03	0.0	8.00693E+03	1.22851E+04	0.0	3.79164E+03
37	168.00	0.01211	77.5757	4.0918	12	13	3.38312E+04	-2.07115E+02	-3.43708E+04	-3.38312E+04	2.07115E+02	-4.24535E+02
							1.25669E+04	0.0	3.96899E+03	8.21486E+03	0.0	8.32106E+03
							-3.38312E+04	2.07115E+02	3.43708E+04	3.38312E+04	-2.07115E+02	4.24535E+02
							-1.25669E+04	0.0	-3.96899E+03	-8.21486E+03	0.0	-8.32106E+03
38	168.00	0.01211	77.5757	4.0918	13	14	-3.23956E+04	-1.96167E+02	4.24457E+02	3.23956E+04	1.96167E+02	-3.33805E+04
							-7.97021E+03	0.0	-7.86404E+03	-1.20922E+04	0.0	-3.74202E+03
							3.23956E+04	1.96167E+02	-4.24457E+02	-3.23956E+04	-1.96167E+02	3.33805E+04
							7.97021E+03	0.0	7.86404E+03	1.20922E+04	0.0	3.74202E+03
39	168.00	0.01198	76.7494	4.0788	15	16	3.34094E+04	-2.04662E+02	-3.37585E+04	-3.34094E+04	2.04662E+02	-6.24617E+02
							1.24759E+04	0.0	3.94151E+03	8.12977E+03	0.0	8.28768E+03
							-3.34094E+04	2.04662E+02	3.37585E+04	3.34094E+04	-2.04662E+02	6.24617E+02
							-1.24759E+04	0.0	-3.94151E+03	-8.12977E+03	0.0	-8.28768E+03
40	168.00	0.01198	76.7494	4.0788	16	17	-3.13951E+04	-1.88856E+02	6.24477E+02	3.13951E+04	1.88856E+02	-3.23523E+04
							-7.79273E+03	0.0	-7.63486E+03	-1.18033E+04	0.0	-3.62433E+03
							3.13951E+04	1.88856E+02	-6.24477E+02	-3.13951E+04	-1.88856E+02	3.23523E+04
							7.79273E+03	0.0	7.63486E+03	1.18033E+04	0.0	3.62433E+03

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
41	168.00	0.01177	75.4375	4.0351	18	19	3.27633E+04	-2.00003E+02	-3.27573E+04	-3.27633E+04	2.00003E+02	-8.43285E+02
							1.23314E+04	0.0	3.90791E+03	8.01124E+03	0.0	8.22809E+03
							-3.27633E+04	2.00003E+02	3.27573E+04	3.27633E+04	-2.00003E+02	8.43285E+02
							-1.23314E+04	0.0	-3.90791E+03	-8.01124E+03	0.0	-8.22809E+03
42	168.00	0.01177	75.4375	4.0351	19	20	-3.01076E+04	-1.78915E+02	8.43086E+02	3.01076E+04	1.78915E+02	-3.09010E+04
							-7.56990E+03	0.0	-7.35310E+03	-1.14346E+04	0.0	-3.48642E+03
							3.01076E+04	1.78915E+02	-8.43086E+02	-3.01076E+04	-1.78915E+02	3.09010E+04
							7.56990E+03	0.0	7.35310E+03	1.14346E+04	0.0	3.48642E+03
43	168.00	0.01147	73.4766	3.9823	21	22	3.18190E+04	-1.92697E+02	-3.13011E+04	-3.18190E+04	1.92697E+02	-1.07205E+03
							1.21208E+04	0.0	3.85959E+03	7.84870E+03	0.0	8.13164E+03
							-3.18190E+04	1.92697E+02	3.13011E+04	3.18190E+04	-1.92697E+02	1.07205E+03
							-1.21208E+04	0.0	-3.85959E+03	-7.84870E+03	0.0	-8.13164E+03
44	168.00	0.01147	73.4766	3.9823	22	23	-2.84670E+04	-1.66094E+02	1.07234E+03	2.84670E+04	1.66094E+02	-2.89763E+04
							-7.28995E+03	0.0	-7.00693E+03	-1.09722E+04	0.0	-3.32464E+03
							2.84670E+04	1.66094E+02	-1.07234E+03	-2.84670E+04	-1.66094E+02	2.89763E+04
							7.28995E+03	0.0	7.00693E+03	1.09722E+04	0.0	3.32464E+03
45	168.00	0.01105	70.8070	3.9093	24	25	3.05510E+04	-1.82488E+02	-2.93543E+04	-3.05510E+04	1.82488E+02	-1.30387E+03
							1.18329E+04	0.0	3.79715E+03	7.63657E+03	0.0	7.99350E+03
							-3.05510E+04	1.82488E+02	2.93543E+04	3.05510E+04	-1.82488E+02	1.30387E+03
							-1.18329E+04	0.0	-3.79715E+03	-7.63657E+03	0.0	-7.99350E+03

46	168.00	0.01105	70.8070	3.9093	25	26	-2.64530E+04	-1.50330E+02	1.30419E+03	2.64530E+04	1.50330E+02	-2.65597E+04
							-6.94527E+03	0.0	-6.58825E+03	-1.04021E+04	0.0	-3.13138E+03
							2.64530E+04	1.50330E+02	-1.30419E+03	-2.64530E+04	-1.50330E+02	2.65597E+04
							6.94527E+03	0.0	6.58825E+03	1.04021E+04	0.0	3.13138E+03
47	168.00	0.01051	67.3436	3.8125	27	28	2.89320E+04	-1.69107E+02	-2.66827E+04	-2.89320E+04	1.69107E+02	-1.52750E+03
							1.14552E+04	0.0	3.72241E+03	7.36912E+03	0.0	7.80851E+03
							-2.89320E+04	1.69107E+02	2.66827E+04	2.89320E+04	-1.69107E+02	1.52750E+03
							-1.14552E+04	0.0	-3.72241E+03	-7.36912E+03	0.0	-7.80851E+03
48	168.00	0.01051	67.3436	3.8125	28	29	-2.40400E+04	-1.31626E+02	1.52793E+03	2.40400E+04	1.31626E+02	-2.36411E+04
							-6.52541E+03	0.0	-6.08589E+03	-9.70583E+03	0.0	-2.90547E+03
							2.40400E+04	1.31626E+02	-1.52793E+03	-2.40400E+04	-1.31626E+02	2.36411E+04
							6.52541E+03	0.0	6.08589E+03	9.70583E+03	0.0	2.90547E+03
49	168.00	0.00983	63.0085	3.6877	30	31	2.69340E+04	-1.52281E+02	-2.38536E+04	-2.69340E+04	1.52281E+02	-1.72975E+03
							1.09677E+04	0.0	3.63973E+03	7.03804E+03	0.0	7.56943E+03
							-2.69340E+04	1.52281E+02	2.38536E+04	2.69340E+04	-1.52281E+02	1.72975E+03
							-1.09677E+04	0.0	-3.63973E+03	-7.03804E+03	0.0	-7.56943E+03
50	168.00	0.00983	63.0085	3.6877	31	32	-2.12070E+04	-1.10066E+02	1.73032E+03	2.12070E+04	1.10066E+02	-2.02215E+04
							-6.01652E+03	0.0	-5.48495E+03	-8.85683E+03	0.0	-2.64464E+03
							2.12070E+04	1.10066E+02	-1.73032E+03	-2.12070E+04	-1.10066E+02	2.02215E+04
							6.01652E+03	0.0	5.48495E+03	8.85683E+03	0.0	2.64464E+03

MEMBER	LENGTH	AE	I	AREA	NA	NB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
51	168.00	0.00901	57.7461	3.5303	33	34	2.45350E+04	-1.31629E+02	-2.02248E+04	-2.45350E+04	1.31629E+02	-1.88894E+03
							1.03364E+04	0.0	3.56310E+03	6.63344E+03	0.0	7.26604E+03
							-2.45350E+04	1.31629E+02	2.02248E+04	2.45350E+04	-1.31629E+02	1.88894E+03
							-1.03364E+04	0.0	-3.56310E+03	-6.63344E+03	0.0	-7.26604E+03
52	168.00	0.00901	57.7461	3.5303	34	35	-1.79300E+04	-8.58762E+01	1.68960E+03	1.79300E+04	8.58762E+01	-1.63168E+04
							-5.39523E+03	0.0	-4.76241E+03	-7.81107E+03	0.0	-2.34657E+03
							1.79300E+04	8.58762E+01	-1.68960E+03	-1.79300E+04	-8.58762E+01	1.63168E+04
							5.39523E+03	0.0	4.76241E+03	7.81107E+03	0.0	2.34657E+03
53	168.00	0.00801	51.3571	3.3293	36	37	2.17160E+04	-1.06326E+02	-1.58942E+04	-2.17160E+04	1.06326E+02	-1.96869E+03
							9.51248E+03	0.0	3.53401E+03	6.15299E+03	0.0	6.89350E+03
							-2.17160E+04	1.06326E+02	1.58942E+04	2.17160E+04	-1.06326E+02	1.96869E+03
							-9.51248E+03	0.0	-3.53401E+03	-6.15299E+03	0.0	-6.89350E+03
54	168.00	0.00801	51.3571	3.3293	37	38	-1.41880E+04	-5.93083E+01	1.96904E+03	1.41880E+04	5.93083E+01	-1.19329E+04
							-4.63184E+03	0.0	-3.89121E+03	-6.50575E+03	0.0	-2.01729E+03
							1.41880E+04	5.93083E+01	-1.96904E+03	-1.41880E+04	-5.93083E+01	1.19329E+04
							4.63184E+03	0.0	3.89121E+03	6.50575E+03	0.0	2.01729E+03
55	168.00	0.00686	43.9498	3.0799	39	40	1.84450E+04	-7.11689E+01	-1.01398E+04	-1.84450E+04	7.11689E+01	-1.81694E+03
							8.21438E+03	0.0	3.76334E+03	5.59007E+03	0.0	6.38765E+03
							-1.84450E+04	7.11689E+01	1.01398E+04	1.84450E+04	-7.11689E+01	1.81694E+03
							-8.21438E+03	0.0	-3.76334E+03	-5.59007E+03	0.0	-6.38765E+03
56	168.00	0.00686	43.9498	3.0799	40	41	-9.97500E+03	-3.04521E+01	1.81734E+03	9.97500E+03	3.04521E+01	-6.93350E+03
							-3.63763E+03	0.0	-2.83988E+03	-4.76055E+03	0.0	-1.71697E+03
							9.97500E+03	3.04521E+01	-1.81734E+03	-9.97500E+03	-3.04521E+01	6.93350E+03
							3.63763E+03	0.0	2.83988E+03	4.76055E+03	0.0	1.71697E+03
57	168.00	0.00714	45.7628	3.1428	42	43	1.47600E+04	-4.56147E+01	-5.75248E+03	-1.47600E+04	4.56147E+01	-1.91106E+03
							5.90941E+03	0.0	3.48357E+03	4.29354E+03	0.0	5.09944E+03
							-1.47600E+04	4.56147E+01	5.75248E+03	1.47600E+04	-4.56147E+01	1.91106E+03
							-5.90941E+03	0.0	-3.48357E+03	-4.29354E+03	0.0	-5.09944E+03
58	168.00	0.00714	45.7628	3.1428	43	44	-5.25900E+03	-7.93311E+00	1.91154E+03	5.25900E+03	7.93311E+00	-3.24456E+03
							-2.07642E+03	0.0	-1.27031E+03	-2.35749E+03	0.0	-9.89244E+02
							5.25900E+03	7.93311E+00	-1.91154E+03	-5.25900E+03	-7.93311E+00	3.24456E+03
							2.07642E+03	0.0	1.27031E+03	2.35749E+03	0.0	9.89244E+02
59	168.00	0.00750	48.0899	3.2217	45	46	1.05070E+04	-3.15923E+01	-3.40415E+03	-1.05070E+04	3.15923E+01	-1.90350E+03
							3.94467E+03	0.0	2.57800E+03	2.87924E+03	0.0	3.64344E+03
							-1.05070E+04	3.15923E+01	3.40415E+03	1.05070E+04	-3.15923E+01	1.90350E+03
							-3.94467E+03	0.0	-2.57800E+03	-2.87924E+03	0.0	-3.64344E+03
60	168.00	0.00750	48.0899	3.2217	46	47	2.30000E+01	1.06006E+00	1.90372E+03	-2.30000E+01	-1.06006E+00	-1.72569E+03
							-3.75004E+02	0.0	3.89282E+02	-3.39267E+02	0.0	3.53545E+02
							-2.30000E+01	-1.06006E+00	-1.90372E+03	2.30000E+01	1.06006E+00	1.72569E+03
							3.75004E+02	0.0	-3.89282E+02	3.39267E+02	0.0	-3.53545E+02

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
61	144.00	1.00000	6407.7734	37.1686	1	3	-2.96245E+05	1.95892E+04	2.90519E+06	2.96245E+05	-1.95892E+04	-6.43510E+04
							-1.52779E+04	0.0	-6.54090E+02	-8.17832E+03	0.0	-7.75372E+03
							2.96245E+05	-1.95892E+04	-2.90519E+06	-2.96245E+05	1.95892E+04	6.43510E+04
							1.52779E+04	0.0	6.54090E+02	8.17832E+03	0.0	7.75372E+03
62	144.00	1.00000	6407.7734	37.1686	2	5	2.96232E+05	1.95440E+04	2.89835E+06	-2.96232E+05	-1.95440E+04	-6.40230E+04
							6.70941E+02	0.0	1.52604E+04	7.75418E+03	0.0	8.17713E+03
							-2.96232E+05	-1.95440E+04	-2.89835E+06	2.96232E+05	1.95440E+04	6.40230E+04
							-6.70941E+02	0.0	-1.52604E+04	-7.75418E+03	0.0	-8.17713E+03
63	144.00	0.78386	5022.7969	32.9252	3	6	-2.66004E+05	-8.69055E+02	9.98720E+04	2.66004E+05	8.69055E+02	-2.25024E+05
							-8.37869E+03	0.0	-7.77937E+03	-8.75420E+03	0.0	-7.40386E+03
							2.66004E+05	8.69055E+02	-9.98720E+04	-2.66004E+05	-8.69055E+02	2.25024E+05
							8.37869E+03	0.0	7.77937E+03	8.75420E+03	0.0	7.40386E+03
64	144.00	0.78386	5022.7969	32.9252	5	8	2.65988E+05	-8.63500E+02	9.95240E+04	-2.65988E+05	8.63500E+02	-2.23862E+05
							7.77992E+03	0.0	8.37715E+03	7.40685E+03	0.0	8.75022E+03
							-2.65988E+05	8.63500E+02	-9.95240E+04	2.65988E+05	-8.63500E+02	2.23862E+05
							-7.77992E+03	0.0	-8.37715E+03	-7.40685E+03	0.0	-8.75022E+03
65	144.00	0.65456	4194.2539	30.0873	6	9	-2.37247E+05	7.65984E+02	2.60948E+05	2.37247E+05	-7.65984E+02	-1.50664E+05
							-8.78014E+03	0.0	-6.99044E+03	-8.40195E+03	0.0	-7.36863E+03
							2.37247E+05	-7.65984E+02	-2.60948E+05	-2.37247E+05	7.65984E+02	1.50664E+05
							8.78014E+03	0.0	6.99044E+03	8.40195E+03	0.0	7.36863E+03
66	144.00	0.65456	4194.2539	30.0873	8	11	2.37228E+05	7.57402E+02	2.59434E+05	-2.37228E+05	-7.57402E+02	-1.50373E+05
							6.99498E+03	0.0	8.77429E+03	7.36897E+03	0.0	8.40030E+03
							-2.37228E+05	-7.57402E+02	-2.59434E+05	2.37228E+05	7.57402E+02	1.50373E+05
							-6.99498E+03	0.0	-8.77429E+03	-7.36897E+03	0.0	-8.40030E+03
67	144.00	0.53474	3426.4626	27.1944	9	12	-2.08664E+05	4.88219E+02	1.85138E+05	2.08664E+05	-4.88219E+02	-1.14843E+05
							-8.41323E+03	0.0	-6.93291E+03	-8.13220E+03	0.0	-7.21395E+03
							2.08664E+05	-4.88219E+02	-1.85138E+05	-2.08664E+05	4.88219E+02	1.14843E+05
							8.41323E+03	0.0	6.93291E+03	8.13220E+03	0.0	7.21395E+03
68	144.00	0.53474	3426.4626	27.1944	11	14	2.08640E+05	4.81887E+02	1.84210E+05	-2.08640E+05	-4.81887E+02	-1.14836E+05
							6.93573E+03	0.0	8.40863E+03	7.21308E+03	0.0	8.13128E+03
							-2.08640E+05	-4.81887E+02	-1.84210E+05	2.08640E+05	4.81887E+02	1.14836E+05
							-6.93573E+03	0.0	-8.40863E+03	-7.21308E+03	0.0	-8.13128E+03
69	144.00	0.42735	2738.3357	24.3108	12	15	-1.80692E+05	4.76000E+02	1.49234E+05	1.80692E+05	-4.76000E+02	-8.06520E+04
							-8.14308E+03	0.0	-6.72210E+03	-7.81657E+03	0.0	-7.04861E+03
							1.80692E+05	-4.76000E+02	-1.49234E+05	-1.80692E+05	4.76000E+02	8.06520E+04
							8.14308E+03	0.0	6.72210E+03	7.81657E+03	0.0	7.04861E+03
70	144.00	0.42735	2738.3357	24.3108	14	17	1.80664E+05	4.67090E+02	1.48224E+05	-1.80664E+05	-4.67090E+02	-8.09450E+04
							6.72575E+03	0.0	8.13711E+03	7.04605E+03	0.0	7.81680E+03
							-1.80664E+05	-4.67090E+02	-1.48224E+05	1.80664E+05	4.67090E+02	8.09450E+04
							-6.72575E+03	0.0	-8.13711E+03	-7.04605E+03	0.0	-7.81680E+03

MEMBER	LENGTH	AE	I	AREA	MA	MB	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
71	144.00	0.33240	2129.9478	21.4408	15	18	-1.53554E+05	4.27562E+02	1.14443E+05	1.53554E+05	-4.27562E+02	-5.28750E+04
							-7.82825E+03	0.0	-6.49526E+03	-7.46969E+03	0.0	-6.85382E+03
							1.53554E+05	-4.27562E+02	-1.14443E+05	-1.53554E+05	4.27562E+02	5.28750E+04
							7.82825E+03	0.0	6.49526E+03	7.46969E+03	0.0	6.85382E+03
72	144.00	0.33240	2129.9478	21.4408	17	20	1.53521E+05	4.15473E+02	1.13322E+05	-1.53521E+05	-4.15473E+02	-5.34840E+04
							6.50025E+03	0.0	7.82019E+03	6.84874E+03	0.0	7.47170E+03
							-1.53521E+05	-4.15473E+02	-1.13322E+05	1.53521E+05	4.15473E+02	5.34840E+04
							-6.50025E+03	0.0	-7.82019E+03	-6.84874E+03	0.0	-7.47170E+03
73	144.00	0.25013	1602.7854	18.5992	18	21	-1.27530E+05	3.81484E+02	8.56650E+04	1.27530E+05	-3.81484E+02	-3.87030E+04
							-7.48798E+03	0.0	-6.22550E+03	-7.08298E+03	0.0	-6.63050E+03
							1.27530E+05	-3.81484E+02	-8.56650E+04	-1.27530E+05	3.81484E+02	3.87030E+04
							7.48798E+03	0.0	6.22550E+03	7.08298E+03	0.0	6.63050E+03
74	144.00	0.25013	1602.7854	18.5992	20	23	1.27492E+05	3.66270E+02	8.43680E+04	-1.27492E+05	-3.66270E+02	-3.16160E+04
							6.23304E+03	0.0	7.47640E+03	6.62175E+03	0.0	7.08766E+03
							-1.27492E+05	-3.66270E+02	-8.43680E+04	1.27492E+05	3.66270E+02	3.16160E+04
							-6.23304E+03	0.0	-7.47640E+03	-6.62175E+03	0.0	-7.08768E+03
75	144.00	0.18056	1156.9687	15.8022	21	24	-1.02921E+05	3.33262E+02	6.19960E+04	1.02921E+05	-3.33262E+02	-1.39930E+04
							-7.11676E+03	0.0	-5.90942E+03	-6.64934E+03	0.0	-6.37684E+03
							1.02921E+05	-3.33262E+02	-6.19960E+04	-1.02921E+05	3.33262E+02	1.39930E+04
							7.11676E+03	0.0	5.90942E+03	6.64934E+03	0.0	6.37684E+03

76	144.00	0.18056	1156.9687	15.8022	23	26	1.02879E+05	3.15121E+02	6.05610E+04	-1.02879E+05	-3.15121E+02	-1.51980E+04
							5.92074E+03	0.0	7.10013E+03	6.36245E+03	0.0	6.65842E+03
							-1.02879E+05	-3.15121E+02	-6.05610E+04	1.02879E+05	3.15121E+02	1.51980E+04
							-5.92074E+03	0.0	-7.10013E+03	-6.36245E+03	0.0	-6.65842E+03
77	144.00	0.12351	791.4465	13.0697	24	27	-8.00541E+04	2.85090E+02	4.33362E+04	8.00541E+04	-2.85090E+02	-2.28300E+03
							-6.71553E+03	0.0	-5.53475E+03	-6.15625E+03	0.0	-6.09404E+03
							8.00541E+04	-2.85090E+02	-4.33362E+04	-8.00541E+04	2.85090E+02	2.28300E+03
							6.71553E+03	0.0	5.53475E+03	6.15625E+03	0.0	6.09404E+03
78	144.00	0.12351	791.4465	13.0697	26	29	8.00061E+04	2.63496E+02	4.17187E+04	-8.00061E+04	-2.63496E+02	-3.77900E+03
							5.55312E+03	0.0	6.68982E+03	6.06999E+03	0.0	6.17295E+03
							-8.00061E+04	-2.63496E+02	-4.17187E+04	8.00061E+04	2.63496E+02	3.77900E+03
							-5.55312E+03	0.0	-6.68982E+03	-6.06999E+03	0.0	-6.17295E+03
79	144.00	0.07860	503.6396	10.4260	27	30	-5.92730E+04	2.37129E+02	2.91361E+04	5.92730E+04	-2.37129E+02	5.01100E+03
							-6.28517E+03	0.0	-5.08509E+03	-5.58193E+03	0.0	-5.78833E+03
							5.92730E+04	-2.37129E+02	-2.91361E+04	-5.92730E+04	2.37129E+02	-5.01100E+03
							6.28517E+03	0.0	5.08509E+03	5.58193E+03	0.0	5.78833E+03
80	144.00	0.07860	503.6396	10.4260	29	32	5.92203E+04	2.12707E+02	2.73859E+04	-5.92203E+04	-2.12707E+02	3.24100E+03
							5.11608E+03	0.0	6.24408E+03	5.74683E+03	0.0	5.61333E+03
							-5.92203E+04	-2.12707E+02	-2.73859E+04	5.92203E+04	2.12707E+02	-3.24100E+03
							-5.11608E+03	0.0	-6.24408E+03	-5.74683E+03	0.0	-5.61333E+03

MEMBER	LENGTH	AE	I	AREA	MA	ME	AXIAL FORCE	SHEAR	MOMENT	AXIAL FORCE	SHEAR	MOMENT
81	144.00	0.04513	289.1821	7.9803	30	33	-4.09438E+04	1.90559E+02	1.88427E+04	4.09438E+04	-1.90559E+02	8.59744E+03
							-5.83717E+03	0.0	-4.52800E+03	-4.88391E+03	0.0	-5.48125E+03
							4.09438E+04	-1.90559E+02	-1.88427E+04	-4.09438E+04	1.90559E+02	-8.59744E+03
							5.83717E+03	0.0	4.52800E+03	4.88391E+03	0.0	5.48125E+03
82	144.00	0.04513	289.1821	7.9803	32	35	4.08892E+04	1.63516E+02	1.69746E+04	-4.08892E+04	-1.63516E+02	6.56425E+03
							4.58598E+03	0.0	5.76536E+03	5.40371E+03	0.0	4.94763E+03
							-4.08892E+04	-1.63516E+02	-1.69746E+04	4.08892E+04	1.63516E+02	-6.56425E+03
							-4.58598E+03	0.0	-5.76536E+03	-5.40371E+03	0.0	-4.94763E+03
83	144.00	0.02212	141.7628	5.5314	33	36	-2.54472E+04	1.43438E+02	1.16241E+04	2.54472E+04	-1.43438E+02	9.03012E+03
							-5.40482E+03	0.0	-3.79614E+03	-3.97563E+03	0.0	-5.22533E+03
							2.54472E+04	-1.43438E+02	-1.16241E+04	-2.54472E+04	1.43438E+02	-9.03012E+03
							5.40482E+03	0.0	3.79614E+03	3.97563E+03	0.0	5.22533E+03
84	144.00	0.02212	141.7628	5.5314	35	38	2.53950E+04	1.15369E+02	9.75162E+03	-2.53950E+04	-1.15369E+02	6.86319E+03
							3.91626E+03	0.0	5.26581E+03	5.06595E+03	0.0	4.11613E+03
							-2.53950E+04	-1.15369E+02	-9.75162E+03	2.53950E+04	1.15369E+02	-6.86319E+03
							-3.91626E+03	0.0	-5.26581E+03	-5.06595E+03	0.0	-4.11613E+03
85	144.00	0.00824	52.7705	3.3748	36	39	-1.31802E+04	1.02315E+02	6.86073E+03	1.31802E+04	-1.02315E+02	7.87250E+03
							-5.16148E+03	0.0	-2.64939E+03	-2.46416E+03	0.0	-5.34672E+03
							1.31802E+04	-1.02315E+02	-6.86073E+03	-1.31802E+04	1.02315E+02	-7.87250E+03
							5.16148E+03	0.0	2.64939E+03	2.46416E+03	0.0	5.34672E+03
86	144.00	0.00824	52.7705	3.3748	38	41	1.31385E+04	7.30259E+01	5.06648E+03	-1.31385E+04	-7.30259E+01	5.45000E+03
							2.96553E+03	0.0	4.82065E+03	4.89086E+03	0.0	2.89531E+03
							-1.31385E+04	-7.30259E+01	-5.06648E+03	1.31385E+04	7.30259E+01	-5.45000E+03
							-2.96553E+03	0.0	-4.82065E+03	-4.89086E+03	0.0	-2.89531E+03
87	144.00	0.00176	11.2877	1.5608	39	42	-4.55131E+03	3.54927E+01	2.26664E+03	4.55131E+03	-3.54927E+01	2.84371E+03
							-4.84170E+03	0.0	-9.90156E+02	-4.99872E+02	0.0	-5.33199E+03
							4.55131E+03	-3.54927E+01	-2.26664E+03	-4.55131E+03	3.54927E+01	-2.84371E+03
							4.84170E+03	0.0	9.90156E+02	4.99872E+02	0.0	5.33199E+03
88	144.00	0.00176	11.2877	1.5608	41	44	4.51381E+03	2.28582E+01	1.48225E+03	-4.51381E+03	-2.28582E+01	1.80923E+03
							1.63257E+03	0.0	4.15124E+03	4.42905E+03	0.0	1.35475E+03
							-4.51381E+03	-2.28582E+01	-1.48225E+03	4.51381E+03	2.28582E+01	-1.80923E+03
							-1.63257E+03	0.0	-4.15124E+03	-4.42905E+03	0.0	-1.35475E+03
89	144.00	0.00176	11.2877	1.5608	42	45	-3.08125E+01	4.38454E+01	2.90864E+03	3.08125E+01	-4.38454E+01	3.40446E+03
							-2.49097E+03	0.0	2.45149E+03	2.87274E+03	0.0	-2.91222E+03
							3.08125E+01	-4.38454E+01	-2.90864E+03	-3.08125E+01	4.38454E+01	-3.40446E+03
							2.49097E+03	0.0	-2.45149E+03	-2.87274E+03	0.0	2.91222E+03
90	144.00	0.00176	11.2877	1.5608	44	47	-1.18750E+00	2.19478E+01	1.43449E+03	1.18750E+00	-2.19478E+01	1.72566E+03
							-1.21953E+03	0.0	1.21801E+03	1.46539E+03	0.0	-1.46691E+03
							1.18750E+00	-2.19478E+01	-1.43449E+03	-1.18750E+00	2.19478E+01	-1.72566E+03
							1.21953E+03	0.0	-1.21801E+03	-1.46539E+03	0.0	1.46691E+03

GIRDER-COLUMN SECTION PROPERTIES:

MEMBER	TYPE	SECTION MODULUS	TF/D	DEPTH	TW	TF
31	2	3.372	0.0	0.0	0.0	0.0
32	2	3.372	0.0	0.0	0.0	0.0
33	2	8.434	0.0	0.0	0.0	0.0
34	2	8.434	0.0	0.0	0.0	0.0
35	2	7.972	0.0	0.0	0.0	0.0
36	2	7.972	0.0	0.0	0.0	0.0
37	2	7.995	0.0	0.0	0.0	0.0
38	2	7.995	0.0	0.0	0.0	0.0
39	2	7.911	0.0	0.0	0.0	0.0
40	2	7.911	0.0	0.0	0.0	0.0
41	2	7.778	0.0	0.0	0.0	0.0
42	2	7.778	0.0	0.0	0.0	0.0
43	2	7.578	0.0	0.0	0.0	0.0
44	2	7.578	0.0	0.0	0.0	0.0
45	2	7.306	0.0	0.0	0.0	0.0
46	2	7.306	0.0	0.0	0.0	0.0
47	2	6.953	0.0	0.0	0.0	0.0
48	2	6.953	0.0	0.0	0.0	0.0
49	2	6.510	0.0	0.0	0.0	0.0
50	2	6.510	0.0	0.0	0.0	0.0
51	2	5.972	0.0	0.0	0.0	0.0
52	2	5.972	0.0	0.0	0.0	0.0
53	2	5.317	0.0	0.0	0.0	0.0
54	2	5.317	0.0	0.0	0.0	0.0
55	2	4.556	0.0	0.0	0.0	0.0
56	2	4.556	0.0	0.0	0.0	0.0
57	2	4.743	0.0	0.0	0.0	0.0
58	2	4.743	0.0	0.0	0.0	0.0
59	2	4.982	0.0	0.0	0.0	0.0
60	2	4.982	0.0	0.0	0.0	0.0
61	1	397.322	0.0	0.0	0.0	0.0
62	1	397.322	0.0	0.0	0.0	0.0
63	1	333.283	0.0	0.0	0.0	0.0
64	1	333.283	0.0	0.0	0.0	0.0
65	1	291.611	0.0	0.0	0.0	0.0
66	1	291.611	0.0	0.0	0.0	0.0
67	1	250.133	0.0	0.0	0.0	0.0
68	1	250.133	0.0	0.0	0.0	0.0
69	1	210.043	0.0	0.0	0.0	0.0
70	1	210.043	0.0	0.0	0.0	0.0

71	1	171.708	0.0	0.0	0.0	0.0
72	1	171.708	0.0	0.0	0.0	0.0
73	1	135.718	0.0	0.0	0.0	0.0
74	1	135.718	0.0	0.0	0.0	0.0
75	1	102.699	0.0	0.0	0.0	0.0
76	1	102.699	0.0	0.0	0.0	0.0
77	1	73.403	0.0	0.0	0.0	0.0
78	1	73.403	0.0	0.0	0.0	0.0
79	1	48.557	0.0	0.0	0.0	0.0
80	1	48.557	0.0	0.0	0.0	0.0
81	1	28.786	0.0	0.0	0.0	0.0
82	1	28.786	0.0	0.0	0.0	0.0
83	1	14.452	0.0	0.0	0.0	0.0
84	1	14.452	0.0	0.0	0.0	0.0
85	1	5.462	0.0	0.0	0.0	0.0
86	1	5.462	0.0	0.0	0.0	0.0
87	1	1.177	0.0	0.0	0.0	0.0
88	1	1.177	0.0	0.0	0.0	0.0
89	1	1.177	0.0	0.0	0.0	0.0
90	1	1.177	0.0	0.0	0.0	0.0

JOINT	-X	-Y	DISPL-X	DISPL-Y	ROTATION
1	0.0	0.0	0.0	0.0	0.0
			0.0	0.0	0.0
2	336.000	0.0	0.0	0.0	0.0
			0.0	0.0	0.0
3	0.0	144.000	1.09630823E-01	3.95554192E-02	-1.15832896E-03
			-1.09630823E-01	-3.95554192E-02	1.15832896E-03
4	168.000	144.000	7.68321753E-02	-1.88956528E-06	2.25305310E-04
			-7.68321753E-02	1.88956528E-06	-2.25305310E-04
5	336.000	144.000	1.09370351E-01	-3.95536348E-02	-1.15555199E-03
			-1.09370351E-01	3.95536348E-02	1.15555199E-03
6	0.0	288.000	2.86508381E-01	7.96719790E-02	-1.31892436E-03
			-2.86508381E-01	-7.96719790E-02	1.31892436E-03
7	168.000	288.000	2.37685025E-01	1.46518927E-04	-5.27555094E-05
			-2.37685025E-01	-1.46518927E-04	5.27555094E-05
8	336.000	288.000	2.85803914E-01	-7.96677470E-02	-1.31540117E-03
			-2.85803914E-01	7.96677470E-02	1.31540117E-03
9	0.0	432.000	4.95543420E-01	1.18826568E-01	-1.56257511E-03
			-4.95543420E-01	-1.18826568E-01	1.56257511E-03
10	168.000	432.000	4.47669864E-01	4.00811899E-04	-2.80776527E-04
			-4.47669864E-01	-4.00811899E-04	2.80776527E-04
11	336.000	432.000	4.94237065E-01	-1.18819058E-01	-1.55798346E-03
			-4.94237065E-01	1.18819058E-01	1.55798346E-03
12	0.0	576.000	7.37426639E-01	1.56927347E-01	-1.77993602E-03
			-7.37426639E-01	-1.56927347E-01	1.77993602E-03
13	168.000	576.000	6.89529479E-01	7.45907892E-04	-5.12434868E-04
			-6.89529479E-01	-7.45907892E-04	5.12434868E-04
14	336.000	576.000	7.35394180E-01	-1.56915426E-01	-1.77466101E-03
			-7.35394180E-01	1.56915426E-01	1.77466101E-03

15	0.0	720.000	1.01023579E+00	1.93834066E-01	-1.98836974E-03
			-1.01023579E+00	-1.93834066E-01	1.98836974E-03
16	168.000	720.000	9.62662366E-01	1.16273738E-03	-7.37881055E-04
			-9.62662366E-01	-1.16273738E-03	7.37881055E-04

JOINT	-X	-Y	DISPL-X	DISPL-Y	ROTATION
17	336.000	720.000	1.00736904E+00	-1.93816364E-01	-1.98243864E-03
			-1.00736904E+00	1.93816364E-01	1.98243864E-03
18	0.0	864.000	1.31232548E+00	2.29395926E-01	-2.18339614E-03
			-1.31232548E+00	-2.29395926E-01	2.18339614E-03
19	168.000	864.000	1.26526740E+00	1.64296012E-03	-9.57999611E-04
			-1.26526740E+00	-1.64296012E-03	9.57999611E-04
20	336.000	864.000	1.30851269E+00	-2.29370594E-01	-2.17686896E-03
			-1.30851269E+00	2.29370594E-01	2.17686696E-03
21	0.0	1008.000	1.64175415E+00	2.63443232E-01	-2.36364221E-03
			-1.64175415E+00	-2.63443232E-01	2.36364221E-03
22	168.000	1008.000	1.59546661E+00	2.18554540E-03	-1.17196748E-03
			-1.59546661E+00	-2.18554540E-03	1.17196748E-03
23	336.000	1008.000	1.63687801E+00	-2.63407826E-01	-2.35652947E-03
			-1.63687801E+00	2.63407826E-01	2.35652947E-03
24	0.0	1152.000	1.99633312E+00	2.95784116E-01	-2.52673239E-03
			-1.99633312E+00	-2.95784116E-01	2.52673239E-03
25	168.000	1152.000	1.95106030E+00	2.79774796E-03	-1.37925078E-03
			-1.95106030E+00	-2.79774796E-03	1.37925078E-03
26	336.000	1152.000	1.99026012E+00	-2.95735538E-01	-2.51909881E-03
			-1.99026012E+00	2.95735538E-01	2.51909881E-03
27	0.0	1296.000	2.37357712E+00	3.26198637E-01	-2.66983989E-03
			-2.37357712E+00	-3.26198637E-01	2.66983989E-03
28	168.000	1296.000	2.32961464E+00	3.48858209E-03	-1.57926790E-03
			-2.32961464E+00	-3.48858209E-03	1.57926790E-03
29	336.000	1296.000	2.36614323E+00	-3.26131880E-01	-2.66182609E-03
			-2.36614323E+00	3.26131880E-01	2.66182609E-03
30	0.0	1440.000	2.77063656E+00	3.54428351E-01	-2.78877141E-03
			-2.77063656E+00	-3.54428351E-01	2.78877141E-03
31	168.000	1440.000	2.72832584E+00	4.27796692E-03	-1.77171407E-03
			-2.72832584E+00	-4.27796692E-03	1.77171407E-03
32	336.000	1440.000	2.76163960E+00	-3.54336381E-01	-2.78065540E-03
			-2.76163960E+00	3.54336381E-01	2.78065540E-03

JOINT	-X	-Y	DISPL-X	DISPL-Y	ROTATION
33	0.0	1584.000	3.18420696E+00	3.80162537E-01	-2.87672784E-03
			-3.18420696E+00	-3.80162537E-01	2.87672784E-03
34	168.000	1584.000	3.14394665E+00	5.18789515E-03	-1.95699674E-03
			-3.14394665E+00	-5.18789515E-03	1.95699674E-03
35	336.000	1584.000	3.17336750E+00	-3.80036294E-01	-2.87022954E-03
			-3.17336750E+00	3.80036294E-01	2.87022954E-03

36	0.0	1728.000	3.61040783E+00	4.03006375E-01	-2.92215683E-03
			-3.61040783E+00	-4.03006375E-01	2.92215683E-03
37	168.000	1728.000	3.57261944E+00	6.26730546E-03	-2.13674945E-03
			-3.57261944E+00	-6.26730546E-03	2.13674945E-03
38	336.000	1728.000	3.59730625E+00	-4.02833223E-01	-2.92081642E-03
			-3.59730625E+00	4.02833223E-01	2.92081642E-03
39	0.0	1872.000	4.04440880E+00	4.22398925E-01	-2.87456508E-03
			-4.04440880E+00	-4.22398925E-01	2.87456508E-03
40	168.000	1872.000	4.00971317E+00	7.61288777E-03	-2.32603261E-03
			-4.00971317E+00	-7.61288777E-03	2.32603261E-03
41	336.000	1872.000	4.02847672E+00	-4.22164381E-01	-2.90275831E-03
			-4.02847672E+00	4.22164381E-01	2.90275831E-03
42	0.0	2016.000	4.47618294E+00	4.36878026E-01	-2.74763792E-03
			-4.47618294E+00	-4.36878026E-01	2.74763792E-03
43	168.000	2016.000	4.44897747E+00	9.28089023E-03	-2.50448752E-03
			-4.44897747E+00	-9.28089023E-03	2.50448752E-03
44	336.000	2016.000	4.45866966E+00	-4.36524272E-01	-2.83083878E-03
			-4.45866966E+00	4.36524272E-01	2.83083878E-03
45	0.0	2160.000	4.89731693E+00	4.36976075E-01	-2.63858261E-03
			-4.89731693E+00	-4.36976075E-01	2.63858261E-03
46	168.000	2160.000	4.87842274E+00	1.02383569E-02	-2.54819030E-03
			-4.87842274E+00	-1.02383569E-02	2.54819030E-03
47	336.000	2160.000	4.87838173E+00	-4.36520398E-01	-2.76679243E-03
			-4.87838173E+00	4.36520398E-01	2.76679243E-03

REFERENCES

1. Cheng, F. Y. and Juang, D. S., "Optimum Design of Braced and Unbraced Frames for Static, Earthquake, and Wind Forces with UBC ATC-3 and TJ-11," Final Report for NSF, UMR Structural Series 85-11, 1985.

2. Cheng, F. Y. and Juang, D. S., "Assesment of ATC-3-06 for Steel Structures Based on Optimization Algorithm," Proceedings of the 8th World Conference on Earthquake Engineering, San Francisco, July, 1984, Vol. 5, PP. 435-442.

3. Cheng, F. Y., "Optimum Design of 2-D and 3-D Structures Subjected to Multicomponent Seismic Excitations," Proceedings of the AIT-CCNNA (U.S.-Taiwan) Joint Seminar on Research for Multiple Hazards Mitigation, Taiwan, January, 1984, pp. 182-202.

4. Cheng, F. Y. and Juang, D. S., "Computer Aided Structural Optimization for Static and Wind Forces," Proceedings of the 5th U.S. National Conference on Wind Engineering, Texas Tech University, Nov. 1985.

5. Cheng, F. Y., "Evaluation of Frame Systems Based on Optimality Criteria with Multicomponent Seismic Inputs, Performance Constraints, and P-Delta Effect," published in Vol. I of the NSF-NATO Advanced Study Institute on Optimization of Distributed Parameter Structural Systems, Sijthoff & Noordhoff International, pp. 650-684.

6. Cheng, F. Y., "Optimum Design of Seismic Structures with Risk Consideration," Proceedings of the U.S.-Japan Joint Seminar on Seismic Risk and Its Use in Code Formulation, Hawaii, March, 1983, pp #10, 1-28.