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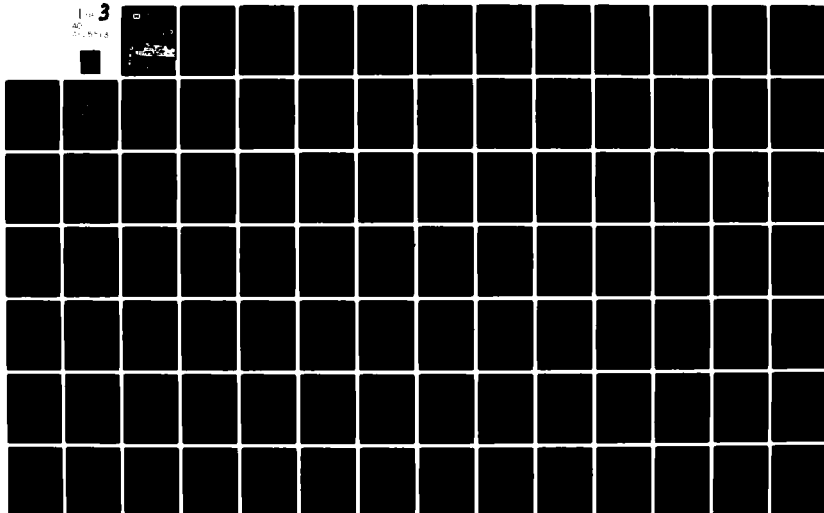
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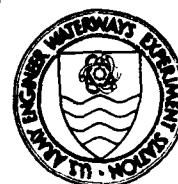
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INSTRUCTION REPORT K-81-9

USER'S GUIDE: COMPUTER PROGRAM FOR THREE-DIMENSIONAL ANALYSIS OF BUILDING SYSTEMS (CTABS80)

by

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August 1981

Final Report

A report under the Computer-Aided Structural Engineering (CASE) Project

Approved For Public Release; Distribution Unlimited

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AD A105513



Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314

Monitored by Automatic Data Processing Center
U. S. Army Engineer Waterways Experiment Station
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20. ABSTRACT (Continued)

vertical columns (or piers) and horizontal beams (or spandrels). However, with special modeling techniques, very complex situations may be considered. A special shear panel element is developed to enable modeling of discontinuous shear walls and shear walls with arbitrary openings. A diagonal bracing element to model braced frames (X-braced, K-braced, or eccentrically braced systems) is also presented.

The column, shear panel, and diagonal formulations include the effects of bending, axial, and shear deformations. Bending and shear deformations are also included in the beam formulation; however, the effects of axial deformations are neglected.

The effects of the finite dimensions of the beams and columns on the stiffness of a frame or shear wall system are automatically included.

The buildings may be unsymmetrical and nonrectangular in plan. Torsional behavior and interstory compatibility are accurately reflected in the results.

Four independent vertical and two independent lateral static load conditions are possible in any one run. These six static load conditions may be combined in any ratio to each other or to a lateral dynamic earthquake input which may be specified as a time-dependent ground acceleration or as an acceleration response spectrum.

Three-dimensional mode shapes and frequencies are evaluated.

The unique solution procedure used by CTABS80 considers the frame and shear walls as substructures, reduced with a modified wave front technique. This method results in a significant reduction in the program data preparation, computational effort, and storage requirements.

The consecutive levels of each of the individual frames can be arbitrarily connected to any (sequential but not necessarily consecutive) level of the structure, thereby making it possible for frames to bypass certain story levels. This option gives the program the capability to model partial diaphragms and multi-diaphragms at any level.

The theoretical basis of the program is presented in Waterways Experiment Station Technical Report K-81-2.

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PREFACE

This user's guide documents a computer program called CTABS80 that can be used for static and dynamic analysis of multistory frame and shear wall buildings. Dr. Edward H. Wilson, University of California, Berkeley, was responsible for developing the original version of the program (TABS), sponsored mainly by a National Science Foundation Research Grant.

Modifications to the program to make it a more useful tool for Corps of Engineers' personnel were made by Mr. Ashraf Habibullah, Computers/Structures International, Oakland, Calif. His work was sponsored with funds provided to the Automatic Data Processing (ADP) Center, U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss., by the Military Programs Directorate of the Office, Chief of Engineers, U. S. Army (OCE), under the Computer-Aided Structural Engineering (CASE) Project. This user's guide and a companion document describing the theoretical basis of CTABS80 are the work of Dr. Wilson and Messrs. H. H. Dovey and Habibullah.

Specifications for the modifications to TABS were provided by the members of the CASE Task Group on Building Systems. The following were members of the Task Group (though all may not have served for the entire period) during the period of modifications to the program:

- Mr. Dan Reynolds, Sacramento District (Chairman)
- Mr. Jerry Foster, Baltimore District
- Mr. Joseph Hartman, St. Louis District
- Mr. David Illias, Portland District
- Mr. Sefton Lucas, Memphis District
- Mr. Jun Ouchi, Pacific Ocean Division
- Mr. David Raisanen, North Pacific Division
- Mr. Pete Rossbach, Baltimore District
- Mr. James Simmons, Baltimore District
- Mr. Ollie Werner, Middle East Division
- Mr. Gene Wyatt, Mobile District

Dr. N. Radhakrishnan, Special Technical Assistant, ADP Center, WES, and CASE Project Manager, and Mr. Paul K. Senter, Computer-Aided Design Group (CADG), ADP Center, coordinated and monitored the work. Ms. Deborah K. Martin, CADG, supported the Task Group in changing the program to accept free-field input. Mr. Seymour Schneider, Military Programs Directorate, was the OCE point of contact. Mr. Donald L. Neumann was Chief, ADP Center.

Directors of WES during this period were COL J. L. Cannon, CE, and COL N. P. Conover, CE. Technical Director was Mr. F. R. Brown.

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CONVERSION FACTORS, INCH-POUND TO METRIC (SI)
UNITS OF MEASUREMENT

Inch-pound units of measurement used in this report can be converted to metric (SI) units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
feet	0.3048	metres
inches	2.54	centimetres
kips (1000 lb force)	4.448222	kilonewtons
kips (force) per foot	14.593904	kilonewtons per metre
pounds (force) per square foot	47.880263	pascals
pounds (mass) per cubic foot	16.01846	kilograms per cubic metre

USER'S GUIDE: COMPUTER PROGRAM
FOR THREE-DIMENSIONAL ANALYSIS
OF BUILDING SYSTEMS (CTABS80)

CHAPTER I: INTRODUCTION

A. Purpose

This report is a user's guide for CTABS80, a computer program for the linear three-dimensional structural analysis of multistory frame and shear wall buildings subjected to static or dynamic loadings. The theoretical basis for the program is presented in Waterways Experiment Station (WES) Technical Report K-81-2 (18).

B. General-Purpose Programs for Structural Analysis

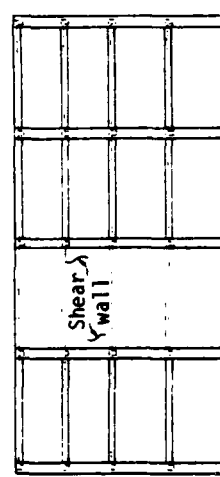
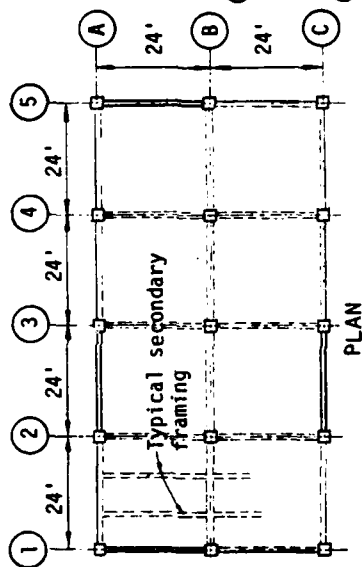
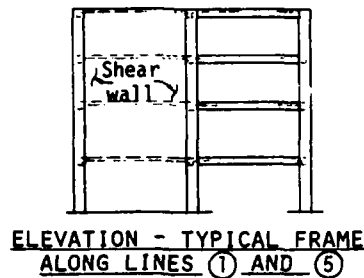
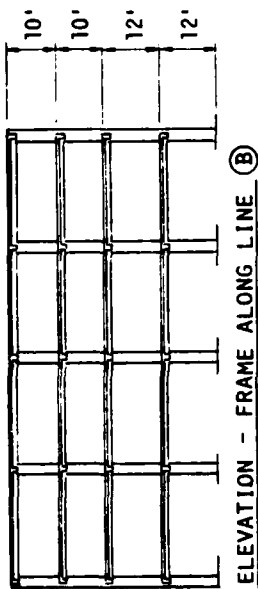
There are many two- and three-dimensional computer programs for the linear analysis of complex structures (1,2). Most of these programs can be used for the static and dynamic analysis of multistory frame and shear wall buildings. However, most of these programs do not give special recognition to the fact that building systems in themselves are a very special class of structures from an analytical point of view. The following are some of the characteristics that are inherent in the nature of a building analysis that a general-purpose analysis program may not recognize, thereby resulting in significant losses in man-hours, computer time, and possibly accuracy:

1. Most buildings are of simple geometry with horizontal beams and vertical columns. A simple rectangular grid can define such a geometry

vertical columns. A simple rectangular grid can define such a geometry with minimal input. See Figure 1.

2. Many of the frames and shear walls are typical. Most general-purpose programs do not recognize this fact; therefore, the input may be large, and some internal calculations may be unnecessarily duplicated.
3. The in-plane stiffnesses of the floor systems of most buildings are very high. General-purpose programs do not necessarily recognize this, resulting in a set of equilibrium equations which may be very large, and thereby causing an increase in computation effort by a factor of 10 to 100. Also, numerical errors may be introduced since the in-plane floor stiffnesses are several orders of magnitude greater than the story-to-story stiffnesses of the structure. Since these two stiffnesses are added in a direct stiffness approach, double precision may be required in the solution.
4. The loading in building systems is of a restricted form. Loads, in general, are either vertically down (dead or live) or lateral (wind or seismic). The vertical loads are usually applied on the beams, and the lateral loads are generated at the floor levels.
5. In many buildings, the dimensions of the members are large and have a significant effect on the stiffness of the frame. Therefore, corrections need to be applied to the member stiffnesses. Most general-purpose programs work on center-line dimensions, and stiffness corrections are usually very tedious to implement.
6. In the dynamic analysis of buildings, the mass of the structure can be accurately lumped at the floor levels. Recognizing this fact

Horizontal rigid diaphragms
connecting the frames at
each level



NOTE/
Structure has 4 typical
frames and 8 total frames

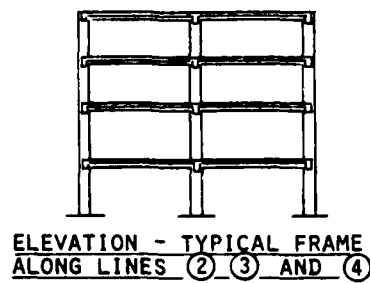


Figure 1. Typical frame and shear wall building

significantly reduces the size of the eigenvalue problem to be solved.

7. Various code loading requirements necessitate special options that allow convenient combinations of the vertical and lateral static and dynamic loadings. Also, the member forces need to be printed out at the support faces of the members. Such transformations are not automatic in general-purpose programs.
8. It is desirable to have a building analysis computer output printed in a special format; i.e., in terms of a particular frame, story, column, and beam. Also, special output such as story shears may be desirable.

In light of the above-mentioned and other reasons, the need for special-purpose programs for building analysis is apparent.

C. Special-Purpose Programs for Building Analysis

Various programs have been developed at the University of California at Berkeley for the linear analysis of multistory buildings in the past two decades (4,5,6). These programs have been used in the profession on many major structures in many different countries. One of the major reasons for the development of computer program TABS (1,2,3) was the direct "feedback" from the profession in the use of these programs.

The first of these programs, FRMSTC, is a static load analysis program for symmetrical buildings with parallel frames and shear walls. Lateral mode shapes and frequencies are also evaluated.

Program FRMDYN is the same as FRMSTC except that the load input is ground accelerations due to a specified earthquake. Time-dependent displacements and member forces are produced but are not combined with static loads.

Program LATERAL is an extension of FRMSTC to the static analysis of a system of frames and shear walls which are not parallel. Three degrees of freedom exist at each story level. This program does not have dynamic options.

The first version of TABS was released in 1972, with the intent of replacing the computer programs described above. CTABS80 is an enhanced version of the original version of TABS and is intended to supercede other enhanced versions such as XTABS and TABS77.

The computer program ETABS ⁽¹⁵⁾ was released in 1975. The program allows three-dimensional frame input in which common column compatibility is enforced. The input data are more complex than those of TABS, and use of this program is only recommended if common column compatibility is important.

For buildings with other complexities, such as discontinuous or flexible diaphragms, sloped diaphragm, nonrectangular framing systems, etc., a general-purpose program such as SAPIV ⁽¹²⁾ or EASE2 ⁽¹¹⁾ is still the most appropriate solution tool.

D. Disclaimer

Considerable time, effort, and expense have gone into the development and documentation of CTABS80, and the program has been thoroughly tested and used. In using the program, however, the user accepts and understands that no warranty is expressed or implied, either by the sponsors, the developers, or the distributors, as to the accuracy or the reliability of the program. The user must clearly understand the basic assumptions of the program and must verify his own results.

CHAPTER II: SETTING UP INPUT DATA

This chapter will outline the steps that need to be taken and the data that need to be accumulated before the coding of the actual computer input can be initiated. Special terminology associated with the input and the output of the program is also described in the following sections.

A. Reference Point and Reference Axis

The reference point is an arbitrary point selected by the user in the plan view of the building. This point is the origin of the global X, Y axis and is the same for all levels of the structure. The story centers of mass, the structural lateral loads, and the positions of the various frames are all located with respect to this reference point and reference axis. The loading and geometry are thereby uniquely located with respect to each other, regardless of the choice of the reference point. The reference point may be chosen to be any dimensionally convenient point in the structural plan. See Figure 2.

B. Load Conditions and Load Cases

It is important to recognize the subtle distinction between a load condition and a load case as defined in the terminology of CTABS80.

The load conditions are the independent loadings for which the structure is analyzed internally. These loadings are: four vertical static loads conditions (I through IV), two lateral static load conditions (A and B), and three dynamic load conditions (1, 2, and 3).

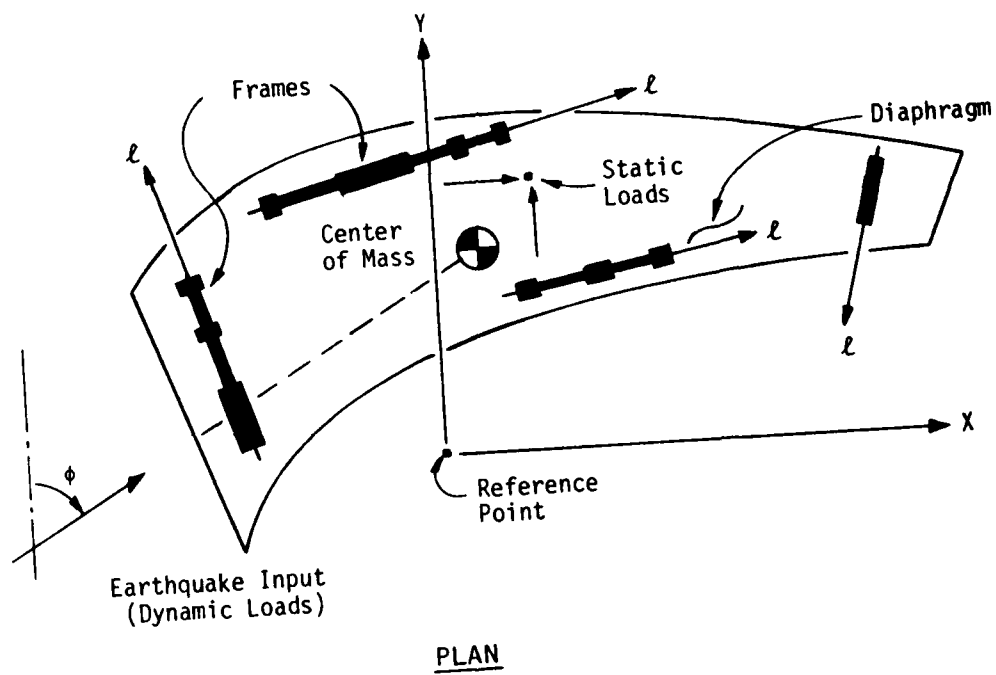


Figure 2. Typical story level

The user defines the loadings for the load conditions. The program always analyzes the structure for the six static load conditions in every run, no more, no less. If the user has not defined any loading in a particular load condition, a null load vector is used.

The dynamic analysis option, in the form of an acceleration response spectrum or time history, determines which of the three dynamic load conditions are active. See Chapter VI, Section 10, Note 1.

Nevertheless, load conditions are internal to the program. They are independent loadings that are never printed by the program.

The load cases are loadings that are assembled as linear combinations of the load conditions. These are loadings that are output by the program. Although the number of independent load conditions is fixed at nine (six for static runs), there is no limit on the number of load cases that may be formulated as linear combinations of the load conditions.

The lateral load conditions (I through IV) are defined with the data associated with each frame.

Dynamic load conditions are defined by the earthquake excitation data.

C. Story Data

The first step in the data preparation sequence is to establish the story levels at which the horizontal rigid floor diaphragms will be located. The beams for all the frames must exist at these levels in each corresponding story. The story mass, mass moments of inertia, and the coordinates of the centers of the mass must be provided if any dynamic options are being activated. These data may be calculated by the program based on simplified

data provided by the user.

Lateral load data including magnitudes and points of application for each story level are needed for defining the lateral load conditions A and B. Lateral loads are applied at the floor levels. They act on the complete structure and are distributed to each individual frame in accordance with the stiffness and location of the frame.

Lateral static loads may be due to wind or earthquake. Tributary story wind loads must be calculated and provided by the user. The equivalent seismic static loads, based on the Uniform Building Code ⁽¹⁴⁾, can either be provided by the user or calculated internally by the program.

D. Frame Data

Since the program views the building system as an assemblage of vertical planar frames arbitrarily located in plan and interconnected to each other by horizontal floor diaphragms, the next step is to decompose the structure into a series of frames and determine which of the frames are typical (have the same geometry and vertical loading).

The floor levels of all the frames must be at the same height; however, all frames need not have the same number of stories. It is recommended that frame elevations be drawn of all the typical frames in the structure, such as shown in Figure 3.

The vertical loading tributary to a frame should be shown on the frame elevation. The vertical load data input for load conditions I through IV are prepared as part of the frame data. The self dead load of the frame can be accounted for automatically by assigning unit weights to the frame

materials. The unit weight specification causes the frame self weight to be added into the load vector of load condition I. The unit weight does not cause any change in load conditions II through IV, nor does it affect the structural masses specified as part of the story data described in the previous section.

Each frame is assumed to have stiffness in one direction only, described by the direction ℓ in Figure 3. In other words, the out-of-plane stiffness of the elements of the frame is neglected. Elements which have stiffness in another direction must be defined by additional elements which are a part of a frame in the other direction. For example, columns that are common to two orthogonal frames are input twice, with the section properties associated with the corresponding directions. The axial deformations in these double columns will not be the same, and this common column incompatibility is one of the basic assumptions of the program. For tall structures (over 15 stories) this assumption will cause the structure to be more flexible. However, in short buildings, the axial forces in the same column from the two frames may be added directly to give reasonable results for design purposes.

The frames must be basically of rectangular geometry. The horizontal story levels and the vertical column center lines form the rectangular grid that is the basic reference system for the frame description. This grid work should be marked on the frame elevations previously drawn. The beams associated with a particular story exist at the corresponding story line, whereas the columns, panels, and diagonals associated with a particular story exist below the corresponding story line.

The column lines are numbered consecutively increasing in the positive ℓ

direction. The bays are distances between the column lines and must be numbered similarly. The number of bays is always one less than the number of column lines.

The rectangle formed by any two consecutive story lines and any two consecutive column lines is assumed to be an open bay. However, the bay may be plugged with a shear panel, making it possible to model framing systems resting on shear walls or shear walls resting on frame systems. Complex systems consisting of discontinuous shear walls and shear walls with arbitrarily located openings are effectively modeled via this shear panel using the special modeling techniques described in the next chapter. Any of the columns or beams may be omitted by providing zero properties, and the bays may be spanned by diagonal braces, allowing the modeling of X-braced, K-braced, or eccentrically braced systems. Modeling of A-frames is also possible.

The columns, beams, panels, and diagonals must be assigned property numbers, and these numbers should be displayed on the frame elevations being drawn.

The beam span loadings associated with the load conditions I through IV must be assigned pattern numbers, and these numbers should also be displayed on the frame elevations.

E. Frame Location Data

One set of frame data is set up for each different frame in the structure. Every one of the different frames may then be placed at one or more locations in the structure, via the frame location cards. These cards locate the local ℓ axes of the frames with respect to the global reference

axis. See Chapter VI, Section 6.

F. Dynamic Loading Data

The dynamic seismic loading input may be either in the form of an acceleration response spectrum or in the form of an acceleration time-history input. These data are, in general, provided by the engineer responsible for the geotechnical evaluation of the building site. Time-history data and corresponding response spectrum curves of well known historical earthquakes are available in published reports (16).

Time-history data in card form for well known earthquakes are available from the National Information Service/Earthquake Engineering, University of California, Berkeley. Response spectra can be generated from time-history data using Reference 17.

CHAPTER III: SPECIAL ASPECTS OF THE INPUT DATA

The following sections will focus on some important aspects pertaining to the use of the program. Modeling of complex shear wall systems with the shear panel element, general points of caution associated with the use of each element, and the limitations of the program are specifically discussed.

A. Special Modeling Problems

(i). Simple Pier-Spandrel System

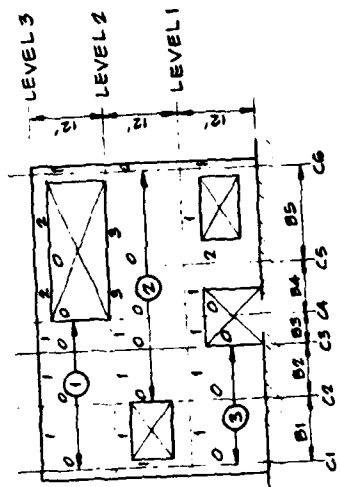
A pier-spandrel system is simply a beam/column system in which the dimension of the elements are large compared to the overall dimensions of the frame. Such systems are conveniently modeled with CTABS80 because the effects of the finite dimensions of the members on the stiffness of the frame are automatically considered. Figure 4 shows the model of a simple pier spandrel system.

(ii). Discontinuous Shear Wall System

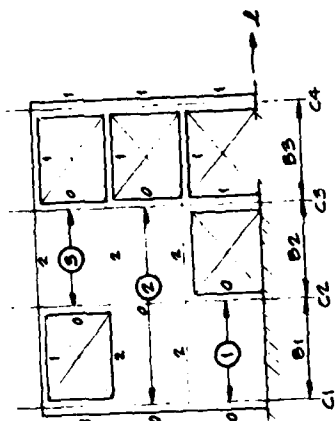
A discontinuous shear wall system is also shown in Figure 4. The modeling of this system calls for four column lines and three shear panels. Details pertaining to the use of the shear panel are described below in Section B.

(iii). Shear Wall with Arbitrarily Located Openings

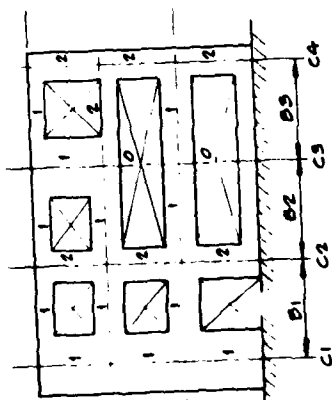
In modeling frames and shear wall systems, the vertical column lines do not necessarily have to represent center lines of columns (or piers). In modeling shear walls with random openings, such as shown



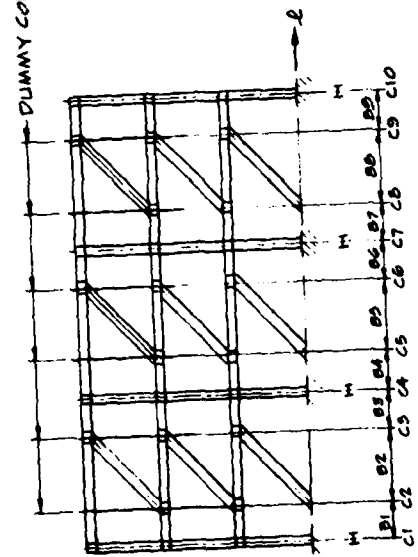
(iii) SHEAR WALL WITH RANDOM OPENING



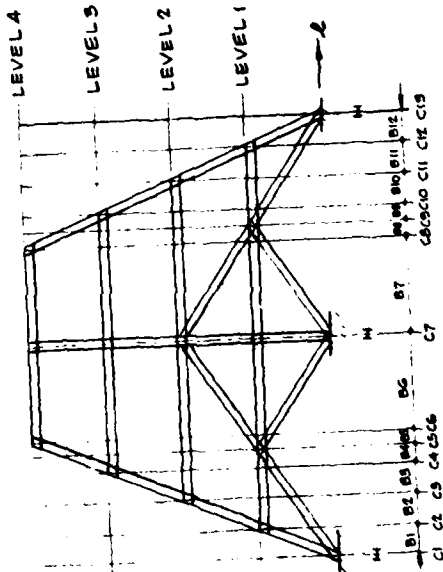
(ii) DISCONTINUOUS SHEAR WALL



(i) SIMPLE PIER SPANDREL SYSTEM



(iv) ECCENTRICALLY BRACED FRAME



(v) A-FRAME

Figure 4. Special modeling situations

in Figure 4, the column lines are used also as basic reference lines to define the extent of openings and wall segments. The bays that are not open are infilled with shear panels. In the example, six column lines are sufficient to define the wall geometry. Note that column lines 2, 3, and 4 are located purely on the basis of the dimensions of the wall openings. Column lines 1, 5, and 6 are located on the center lines of piers. See Section B below for further details of shear panel usage.

(iv). Eccentrically Braced Systems, K- and X-Braced Systems, and A-Frames

By effectively using column lines for definition of the frames as shown in Figures 4 and 5, complex bracing systems can be conveniently modeled. The "dummy" column lines are for geometric definition only and must be assigned zero properties via the zero column location input.

(v). Foundation Flexibility

Vertical and rotational soil springs may be modeled under each column line of the frame by adding a "dummy" story to the structure at the foundation level. The properties of the beams and columns in this level are manipulated and input to simulate the desired restraint conditions. In such situations, the analytical results tend to be very sensitive to the input restraint conditions, and it is important that a practical solution to such problems be based on several analyses so that the sensitivities of restraint parameters are evaluated and their relative importance is established. See Figure 6.

(vi). Pin-Base Conditions

The program assumes that the boundary condition at the base of each column is fixed. However, pin-base conditions may be modeled by adding a "dummy" story to the structure at the foundation level. The beams at this level are assigned zero property identifications, and the columns are assigned a large axial area but a zero moment of inertia. If the columns are to be selectively pinned or fixed, a large moment of inertia, a large axial area, and a zero shear area should be provided in the "dummy" level of the columns that are fixed. The modulus of elasticity should be comparable to that of the material in the stories above.

The three components of the external story stiffness of the "dummy" level should be assigned a large value (10^{15}) to prevent the "dummy" level from spinning or translating. See Figure 5.

B. General Characteristics of the Elements

The following are some important characteristics of the elements that must be recognized by the user in order to correctly use, understand, and apply CTABS80:

(i). Column Element

1. The column width is assumed to be centered on the column center line.
2. The bases of columns in the lowermost story are assumed fixed.
3. Columns must be prismatic from floor level to floor level.

(ii). Beam Element

1. Beams need not be prismatic, but must be symmetrical about the bay center line.
2. Axial deformations in the beams are forced to zero by the assumption that a *rigid diaphragm* exists along the beam line. It should be noted that a zero specification for two consecutive beams at a particular level does not free the common joint. The rigid diaphragm is always there regardless of the presence of the beams, and the lateral displacement of the common joint is constrained to be the same as the displacement of all other joints at that level.
3. Any participation of the structural floors in the bending of the beams must be reflected in the properties of the beams (T-beam or L-beam action) provided by the user, if it is to be included in the analysis.

(iii). Panel Element

1. The panel element can exist between any two column lines (consecutive or nonconsecutive) between any two consecutive levels.
2. One panel element must span the whole series of consecutive bays that need to be infilled. In other words, there must be at least one open bay between panels existing at any one level.
3. In general, *rigid beams* (large moment of inertia, zero shear area) must always be provided at the story levels bounding the panel (i.e., above and below the panel).
4. The column lines bounding and within the panel area

should be assigned zero property identifications.

5. The panel is a vertical bending element. The bending in the panel is associated with horizontal shears. Therefore, using the panel to model situations which require bending deformations associated with vertical shears will lead to questionable results.
6. The panel stiffness is based upon a length equal to the story height with no rigid zone offsets due to the depths of the beams existing on either side of the panel.
7. Panels in the lowermost story are assumed fixed at the bottom.

(iv). Diagonal Element

1. The diagonal element has axial, bending, and shear stiffness, just like the column and panel elements. A zero moment of inertia will degenerate the diagonal to an axial brace.
2. The diagonal can exist between any two column lines (consecutive or nonconsecutive). The diagonal can hook up any two column line/floor line intersections at any two consecutive levels.
3. The diagonal has no rigid zone offsets for stiffness corrections.

C. Program Limitations

CTABS80 is a special-purpose program for building analysis. It is currently the most efficient and effective tool for analyzing building systems that

fall into the category of "TABS" type buildings. CTABS80, however, is not the answer to all building analysis problems. The following are some of the limitations of the program:

- (i). If floor diaphragm deformations are significant, results from a CTABS80 analysis may be questionable. Diaphragms are assumed to be infinitely stiff in plane.
- (ii). CTABS80 does not capture "tubular" behavior that exists in tall structures with closely spaced columns. In other words, common column axial compatibility is not enforced, and the floor diaphragms do not transfer vertical shears.
- (iii). All frames modeled with CTABS80 must exist in vertical planes. Frames have in-plane stiffness only, and no torsion can be carried by any of the elements in the frame.
- (iv). The floor diaphragms must be continuous and horizontal at all levels. The diaphragm at any one level is assumed to hook up to all column lines at that level. Therefore, a partial diaphragm that connects to only a few of the column lines at any level, such as a mezzanine level, cannot be modeled with CTABS80.
- (v). In braced frames, the diagonal axial behavior may cause large axial forces in the beams. It is possible to obtain these axial forces by statics, but they are not output by the program since the rigid diaphragm assumption causes the axial deformations in the beams to be assumed zero. In reality, these beams do have axial deformations and neglecting them could affect the results.
- (vi). CTABS80 can model a shear wall (with openings) as an assemblage of beam and column elements (having bending and shear deformations) with rigid offsets to account for the effects of the finite dimensions of the

members on the stiffness of the frame. However, attempts to describe small wall openings (such as those required for duct and pipe penetrations) as bays encompassed by wide columns and deep beams can introduce modeling difficulties into the analysis, resulting in unrealistic results. In general, it is better to ignore small openings. The loss of accuracy in neglecting them is much less than it is in trying to incorporate them into the structural model.

CHAPTER IV: PROGRAM OUTPUT

The input data are echoed back in a labeled and tabulated form as the first section of the computer output. In addition to the echo of the input data, it is possible to obtain the following output from the program:

A. Output Associated with the Complete Structure

- (i). Calculated structural dynamic properties; viz., masses, mass moments of inertia, and centers of mass.
- (ii). Structural mode shapes and periods and modal participation factors.
- (iii). Lateral seismic static equivalent loads, per the Uniform Building Code of 1979.
- (iv). Lateral story displacement at the center of mass of each story for the six load conditions I, II, III, IV, A, and B. Sign convention shown in Figure 7.
- (v). Maximum inertia forces and torsions generated at the center of mass of each level in every mode in a response spectrum dynamic run.
- (vi). Summary of the structural story shear distribution to the various frames, story-by-story, frame-by-frame.
- (vii). Plots of the structural plan showing location of the frames. These plots may be obtained either on a passive plotter or on an interactive graphics terminal.

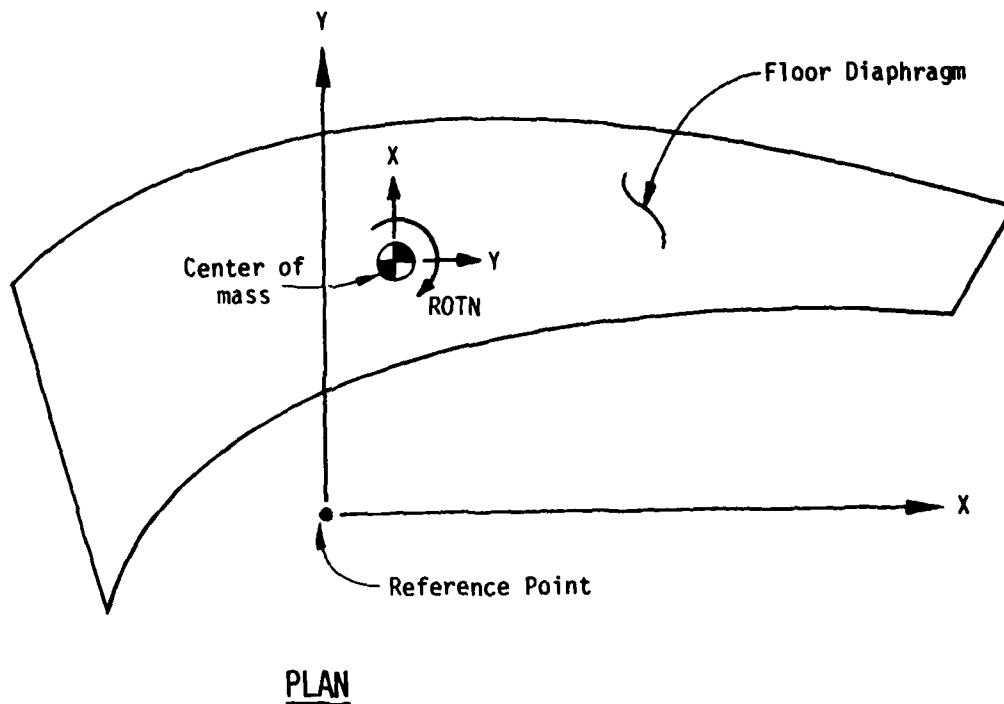


Figure 7. Positive directions for structural lateral displacements

B. Output Associated with Each Frame

(i). Summary of vertical loading applied to each frame, level-by-level.

(ii). Lateral frame displacements in the plane of the frame. Vertical displacements and rotations at each column line, level-by-level. Sign convention is shown in Figure 8. Dynamic displacement printer plots are output in time-history runs for the lateral frame displacements.

(iii). Member forces (output on TAPE 6) and member stresses (output on TAPE 9) for each element type. Element force components along with the sign convention are shown in Figure 9. Bending stresses are based on the gross section moment of inertia. Axial stresses are based upon the axial area and shear stresses are based upon the shear area (5/6 of axial area for rectangular sections). The member stress units maybe different from the member force units, if requested.

Column moments are printed at the outer faces of the beams framing into the column at the corresponding level. Beam moments are printed at the outer face of column at the corresponding end. The beam span moment is an average of the beam end moments for the lateral and the dynamic load conditions and for the vertical load conditions if the beam span has no vertical loading specified. If, however, vertical loading is specified, a search is conducted for a point of zero shear in the beam. The moment is calculated at the first point of zero shear encountered from the left end of the beam. However, if no point of zero shear is found, the moment is set to the average of the beam end moments. Bending moments for the panel are evaluated at the outer faces of the beams. Bending moments for the diagonals

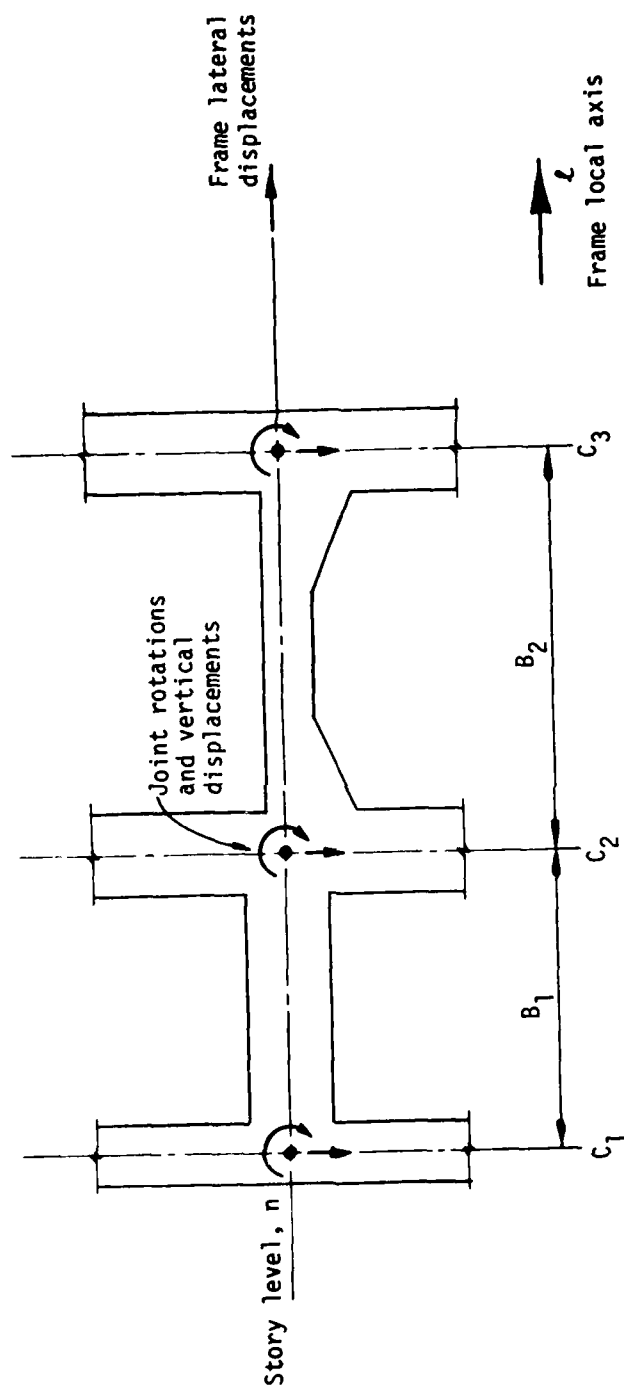


Figure 8. Positive directions for the frame displacements

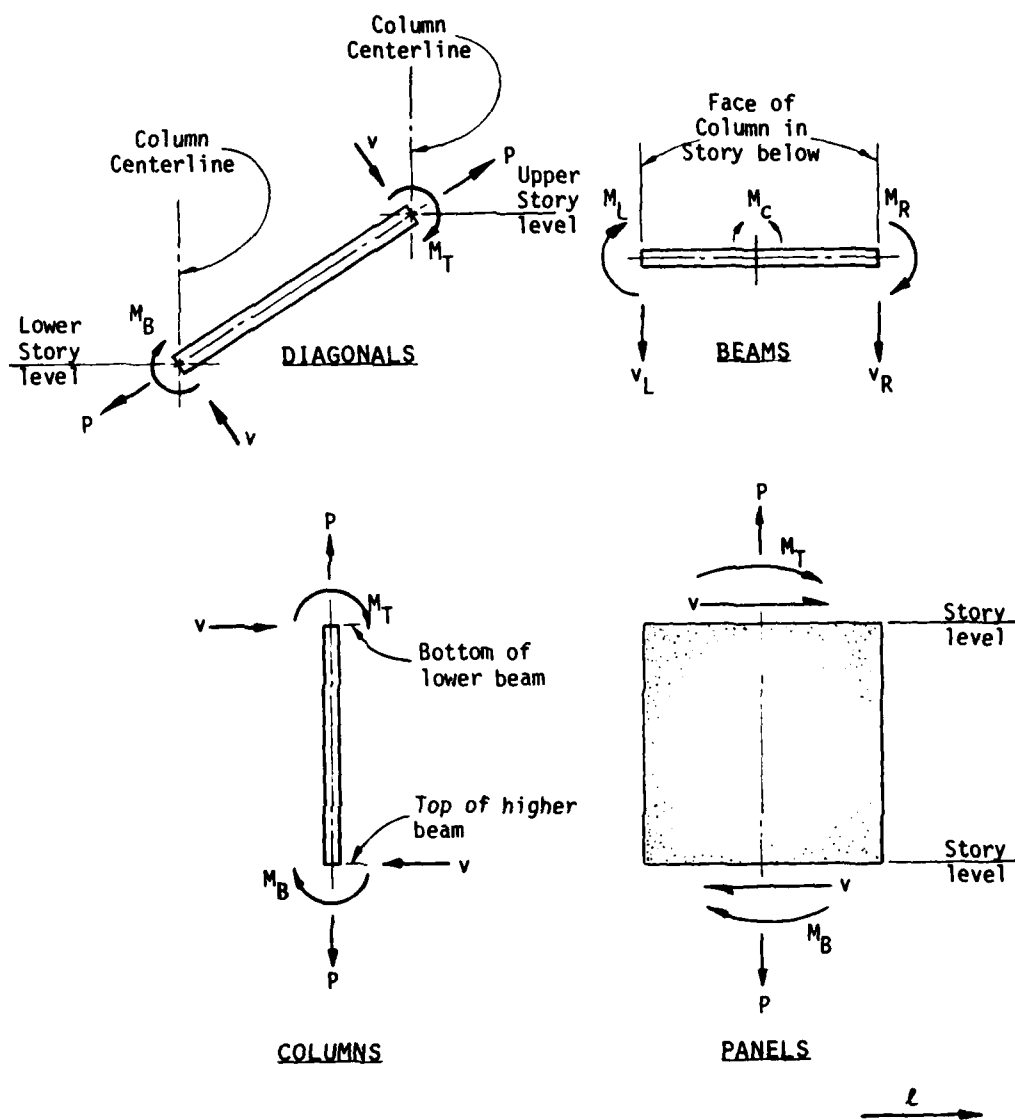


Figure 9. Positive directions for the element member forces

are at the end column center lines.

(iv). Story shear summary at each level for the static load conditions I, II, III, IV, A, and B.

(v). Pen plots of the frame elevation.

The frame output sequence is in the reverse order of the frame input sequence in the frame location data, Chapter IV, Section 6. Output associated with the last frame is printed out first starting with the lowest story and progressing upwards.

C. Statics Check

Results from all static load conditions must satisfy statics. However, as the column and beam moments are evaluated at the out faces of the supports of each of the corresponding members joint moment equilibrium is not readily obvious. Checking joint statics involves transformation of the column and beam moments to the point of intersection of the corresponding column line and story level. Statics will be satisfied once all moments are transformed to this common point. It is obvious that the beam and column shears and the finite dimensions of the joints will need to be a part of the moment equilibrium equations. An illustration of joint static equilibrium is presented in Figure 10.

Results from all dynamic load conditions, in general, will not satisfy statics. In the response spectrum analysis, the analysis technique involves the summation of the modal components by methods which cause the signs of the resultant parameters to be lost. In the time-history

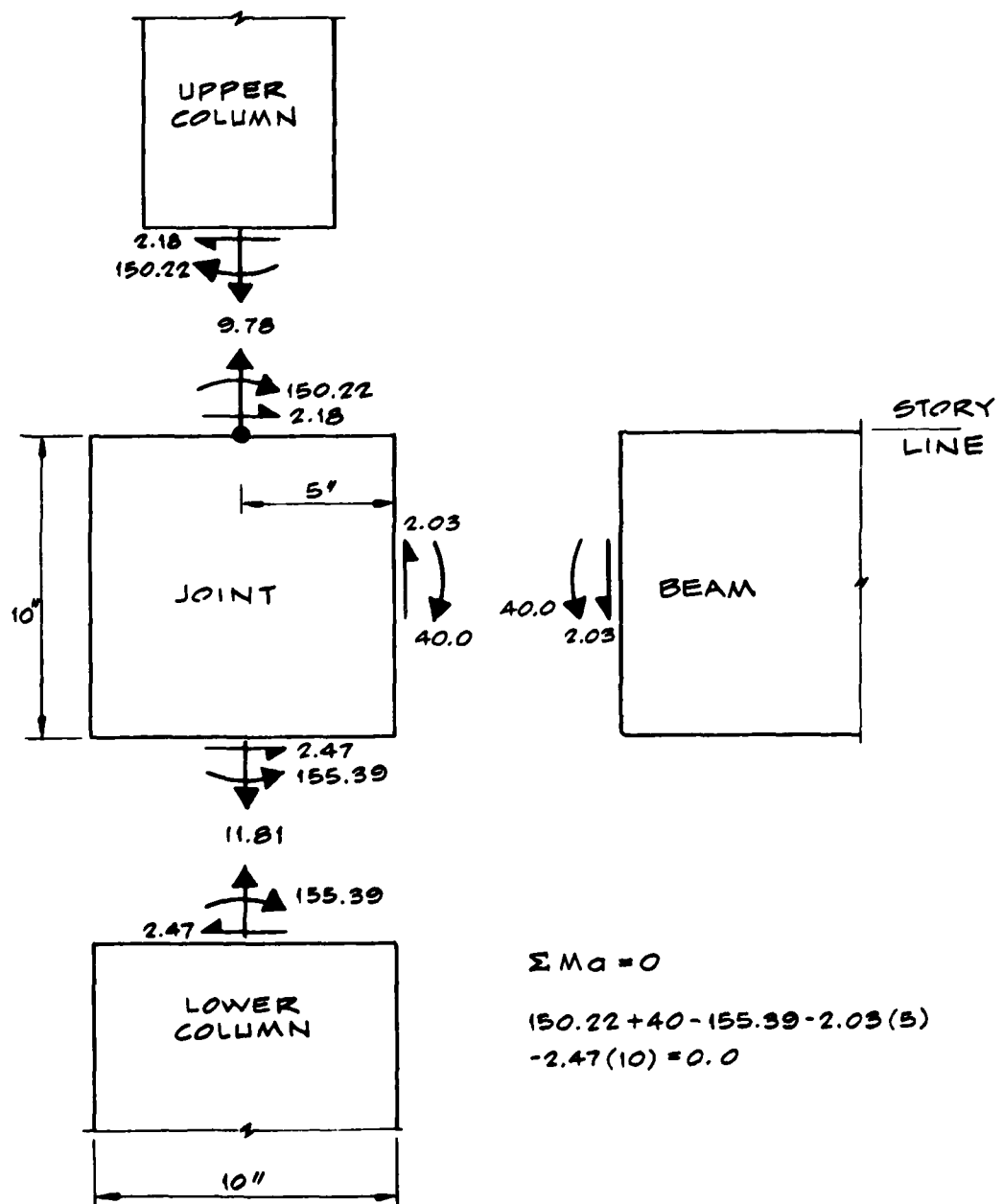


Figure 10. Joint static equilibrium

analysis, absolute maxima of the displacements and member forces are printed, thereby causing the sign to be lost. Besides, these maxima may not exist at the same instant in the analysis time span.

CHAPTER V: PROGRAM CAPACITY

CTABS&O is written in FORTRAN IV with dynamic storage allocation for all major arrays in blank COMMON. Therefore, the capacity of the program may be varied by altering only the following two cards that exist at the beginning of the main program:

```
COMMON      A(n)
DATA MTOT   /n/
```

The value of n for a particular problem must be greater than n_f , n_s , and n_d , the values of which are established by the formulae presented below. These parameters represent storage requirements at the major bottlenecks of the program. Other storage bottlenecks also exist in the program which, in general, seldom govern. Nevertheless, if the value of n specified on the cards shown above is not sufficient, the program will terminate execution and print out the required increase in storage to continue beyond the current checkpoint.

A. Calculating n_f

The storage required to process any one of the frames is given by:

$$\begin{aligned} S_f = & NS*(5*NB+NC) \\ & + 8*(NBP+NCP+2) \\ & + NFEF*(2*MCONL+8) \\ & + 4*(NPAN+NDIG) \\ & + 2*NB \\ & + \text{maximum of } (M_i \text{ \& } M_o) \end{aligned}$$

where $M_i = 20*NST + NN*(NN+3) + NC + NST*NDF$

and $M_0 = (MLD+2)*NST + 11*NLD + NN*(2*NC+MLD) + NST*NDF$

for a response spectrum analysis add an additional $NFQ*(NFQ+11)$
to the value of M_0

n_f is the maximum of all the S_f values calculated for each frame

B. Calculating n_b

For the complete building the storage n_b is given by:

$$n_b = 19*NST + NSS*(2*NSS+3)$$

C. Calculating n_d

In a dynamic time history analysis the storage required is n_d and
is given by:

$$n_d = 19*NST + (5+NTIME) * (NSS+NST) + NTF*(9+NST)$$

where:

NST = number of stories in the building

NS = number of stories in this frame

NC = number of column lines in this frame

NB = number of bays in this frame (equal to NC - 1)

NBP = number of beam property sets in this frame

NFEF = number of beam span loading patterns in this frame

MCONL = maximum number of point loads in any one beam span
loading in this frame

NPAN = number of panel elements in this frame

NDIG = number of diagonal elements in this frame

NN = $4 * NC + NS + 1$

$NSS = 3 * NST$ if three degrees of freedom per story
 are allowed in the analysis
 $= NST$ if only one degree of freedom per story is
 allowed in the analysis
 $NTF =$ total number of frames in the building
 $NTIME =$ number of sampling values in the time history analysis
 $NLD =$ number of load cases in the analysis
 $NFQ =$ number of modes requested
 $MLD = 5$ for static analysis only
 $5 + NFQ$ for response spectrum analysis
 $5 + NTIME$ for time history analysis

For buildings in which the number of stories is small, n_f will
 usually govern, if only one degree of freedom per story is allowed
 in the analysis, but n_b may be the critical value if three degrees of
 freedom per story are allowed. n_d may be critical if a large number
 of sampling times are requested.

CHAPTER VI: DETAILED DESCRIPTION OF THE INPUT DATA

There are basically eleven steps involved in the description of the CTABS80 input data. The sequence of the steps is summarized in the flowchart shown in Figure 11. The execution of these steps should result in a deck setup as illustrated in Figure 12. Each step is identified by a number, one through eleven, in Figure 11. Each step is described below in detail in a section having a corresponding section number.

The input data description provided in this user's guide is directed to execute the program in a batch mode. The program was modified by the WES ADP Center to allow timesharing mode of operation with data input from a file in free field format. Thus, the references to fixed field format no longer apply when using the program. To create a data file in free field format, simply input a line number, a blank space, and the data items in sequence in the line. The data items must be separated by a blank space or a comma.

1. COMMENT CARDS (A1,17A4,A1)

Columns	Note	Variable	Entry
1	(1)	IDLR	The "\$" sign
2-70		ICARD	User convenience information

NOTES/

1. Comment cards are cards that the user may insert in the data for identification convenience. These cards may occur anywhere in the data. The program will ignore them as long as there is a "\$" sign in column 1.

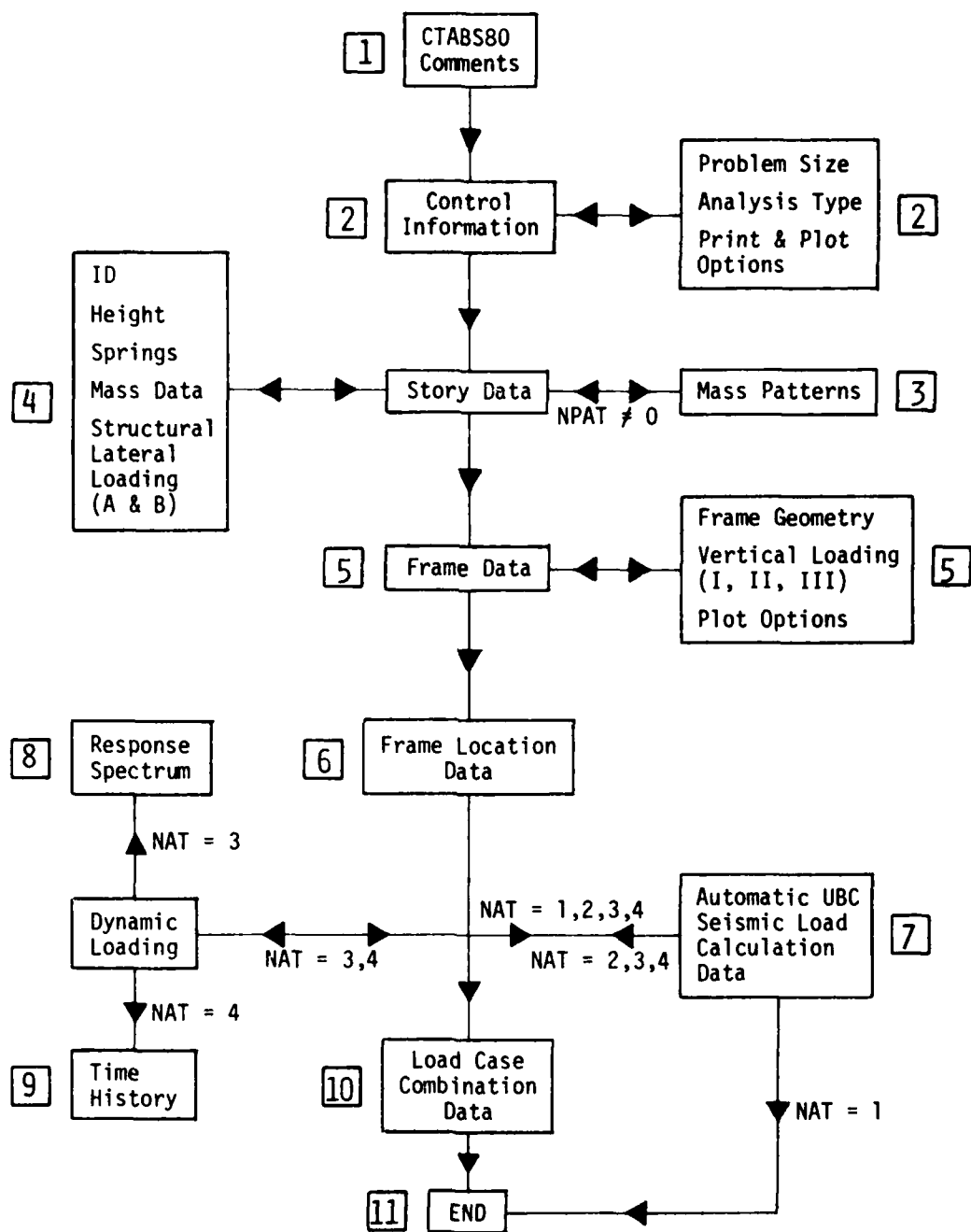


Figure 11. Flowchart for setup of input data

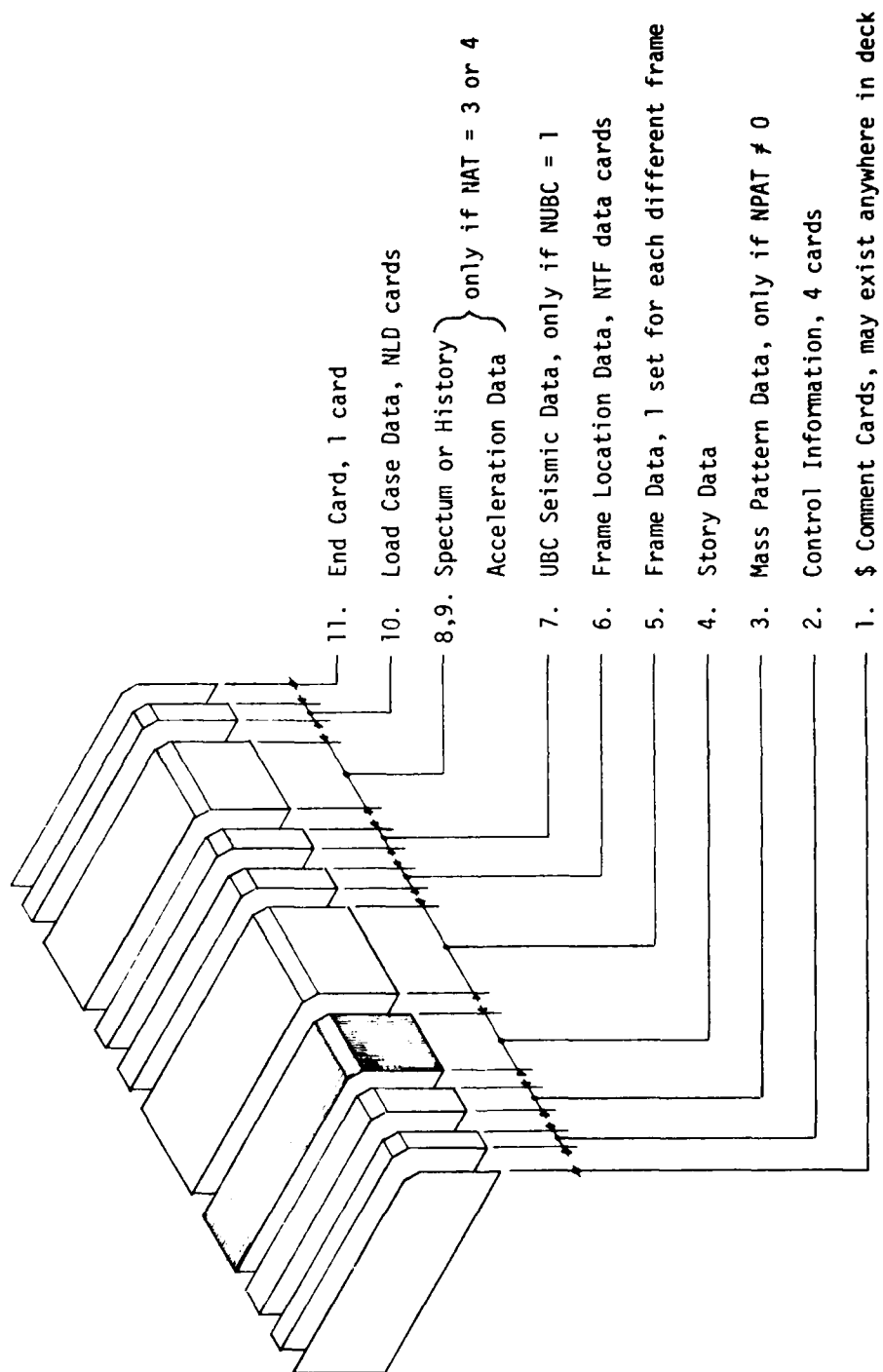


Figure 12. Typical deck setup

2. CONTROL INFORMATION CARDS

Prepare four cards for the whole building as follows:

a.	<u>First Two Cards</u>	(14A5/14A5)	Heading Cards	
	Column	Note	Variable	Entry
	1-70	(1)	IHED	Building identification information to be printed with the output.

NOTES/

1. These two lines are printed as header information on every output page.

Control Information Cards (continued)

b. Third Card (1215) Control Data

Column	Note	Variable	Entry
1-5	(1)	NST	Number of stories in complete building
6-10	(2)	NDF	Number of frames with different properties or different vertical loading
11-15	(3)	NTF	Total number of frames or shear wall systems in the structure
16-20	(4)	NLD	Total number of load cases
25	(5)	NAT	Analysis type code: EQ.0; Static analysis only EQ.1; Mode shapes and periods only EQ.2; Static load analysis and mode shapes and periods EQ.3; Lateral earthquake spectrum analysis in addition to analysis type 2 EQ.4; Lateral earthquake history analysis in addition to analysis type 2
26-30	(6)	NFQ	Number of periods to be calculated
35	(7)	NSD	Allowable story degrees of freedom: EQ.0; X,Y translations and story rotations EQ.1; X translations only EQ.2; Y translations only
40	(8)	NOPT	Execution mode: EQ.0; Normal execution EQ.1; Data check mode, no calculations Program stops after input echo of the data EQ.2; Complete execution, but only static structural displacements and summary of static story shears is output. No input echo EQ.3; Complete execution and printout; however, no input echo
45	(9)	NRGD	Frame joint rigid zone control: EQ.0; Modify rigid zone EQ.1; No reduction in rigid zone dimensions

Control Information Cards (continued)

Column	Note	Variable	Entry
50	(10)	NDSP	Frame joint displacement code: EQ.0; Suppress frame joint displacements EQ.1; Print joint vertical and rotational displacements
55	(11)	NUBC	Automatic lateral seismic force calculation flag UBC 1979 (or SEAOC) code: EQ.0; No automatic UBC load calculation EQ.1; Modify load conditions A and B to reflect UBC 1976 seismic loads
60	(12)	NPAT	Number of story mass types EQ.0; No automatic mass, mass moment of inertia and center of mass calculations
65	(13)	NPLT	Master plot flag EQ.0; Do not plot EQ.1; Plot frame elevations and plan EQ.2; Plot frame elevations only EQ.3; Plot plan only

NOTES/

1. The number of stories in the building is the number of levels above the ground level.
2. Input data for frames with identical properties and vertical loading need only be prepared once.
3. The NTF total frames consisting of NDF different frames, are located via the frame location cards (Section 6) below. NTF is always greater than or equal to NDF.
4. Load cases are defined as linear combinations of the eight basic load conditions. See load case definition data (Section 10) below.

5. NAT basically defines the type of analysis being performed, thereby controlling the type of loading data required by the program in the input stream. Mass properties of the structure are not required for analysis type 0.
6. The number of frequencies must be less than the number of stories times the number of degrees of freedom per story.
7. This option allows the user to lock the plan torsional rotation of the floor diaphragms, thereby enabling the user to study the effects of the floor rotations on the behavior of the structure. In cases of symmetrical structures with loadings that cause no story rotations, the capacity and speed of solution of the program is improved if the story rotation is set to zero, i.e., NSD is 1 or 2.
8. Normal execution includes complete input data echo and complete output. It should be noted that NOPT should not be set equal to 2 in a dynamic run, as this option will suppress all output associated with the dynamics.
9. The rigid zone modification (25% reduction) is defined in Chapter II, Section A(iii) of the theoretical manual ⁽¹⁸⁾.
10. Frame joint vertical displacements and rotations are printed level by level for each frame if NDSP equals 1. The volume of the output is approximately doubled by triggering this option.
11. If NUBC equals 1, extra data defined in Section 7 below are required.
12. This variable controls the number of data sets to be provided in Section 3 below.

13. If NPLT equals 0, no plot output file is created and the frame plot flags (Section 5.b.) are ignored. If NPLT equals 2 or 3, the frame elevations of only those frames having active frame plot flags (See Section 5.b.) are plotted.

c. Fourth Card (2F10.0) Stress Transformation Data

Column	Note	Variable	Entry
1-10	(1)	ANI	Number of stress units in input length unit: EQ.0; Default set to 1.0
11-20		ANP	Number of stress units in input force unit: EQ.0; Default set to 1.0

NOTES/

1. Every member force has a corresponding member stress, such as, axial force/axial stress, shear force/shear stress, bending moment/bending stress, etc. Member forces are output on the standard output file with all the other data, (TAPE 6). However, the corresponding stresses are simultaneously printed on an alternate print file, (TAPE 9).

The stresses may be obtained in units other than those of the member force units. In other words, if the forces are output in kip foot units and all the stresses are preferred in pounds per square inch (psi), ANI should be set to 12.0 and ANP should be set to 1000.0.

3. DATA FOR CALCULATION OF STORY MASS, MASS MOMENT OF INERTIA AND CENTER OF MASS

Skip this section if NPAT (Section 2.b.) equals 0; otherwise, provide one set of data (a and b below) for each of the NPAT mass types. Each mass type is discretised as a series of NSEG rectangular segments, each having its own mass AM uniformly distributed over an area BB by DD. See Figure 13.

a. First Card (2I5,F10.0)

Column	Note	Variable	Entry
1-5	(1)	M	Mass type identification number
6-10	(2)	NSEG	Number of rectangular segments defining mass distribution
11-20		SF	Scale factor LE.0; Set to 1.0

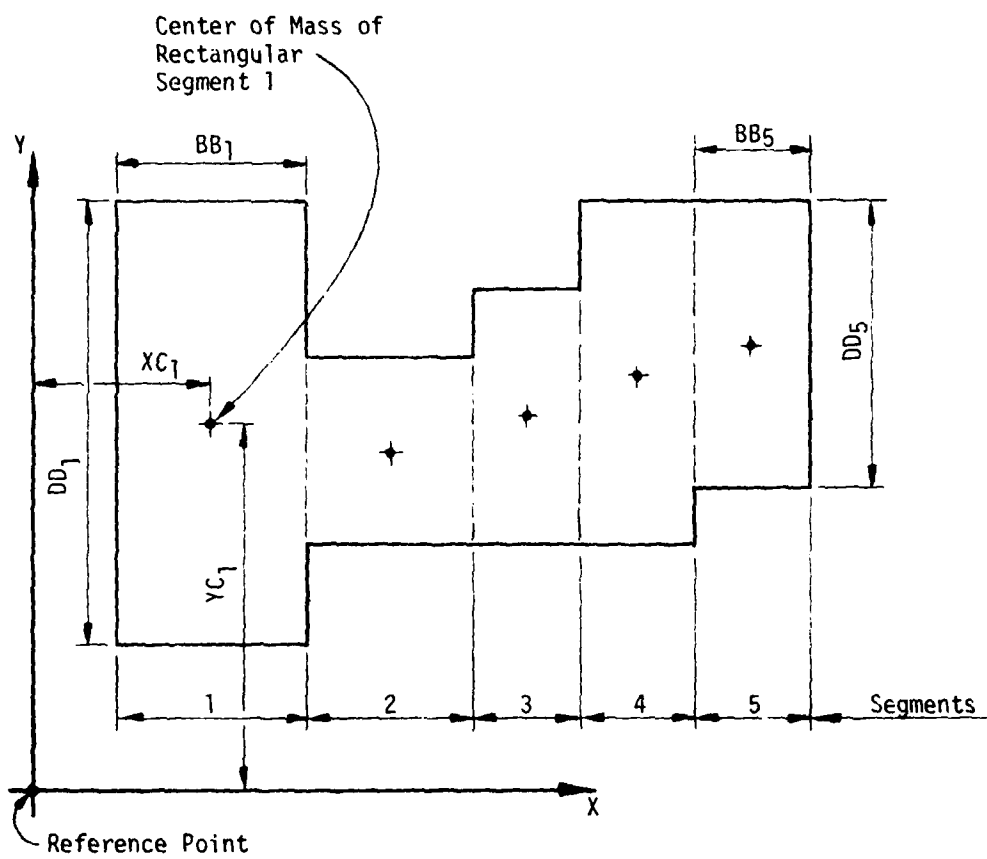
b. Segment Data Cards (5F10.0)

Provide NSEG data cards as described below:

Column	Note	Variable	Entry
1-10	(3)	AM	Mass of rectangular segment
11-20	(4)	XC	X distance of center of mass of this segment from the reference point
21-30		YC	Y distance of center of mass of this segment from the reference point
31-40	(5)	BB	B dimension of rectangular segment
41-50		DD	D dimension of rectangular segment

NOTES/

1. Mass type numbers must start with 1 and increase consecutively.
2. The story is discretised as a series of rectangular segments each



PLAN

Figure 13. Example of mass type having 5 segments

having a mass AM , B , and D dimensions and X and Y distances from the reference point. From these data the program calculates a total mass, center of mass coordinates from the reference point of the complete system and a mass moment of inertia about a vertical axis passing through the center of mass of the complete system. There is no limit on the number of rectangular segments used to define a mass type.

3. Mass has units of force divided by gravitational acceleration (W/g).
4. The reference point and reference axis are defined in Chapter II.
5. BB and DD are the two dimensions of the rectangle. BB and DD need not be parallel or perpendicular to the reference axis.

If BB is zero, the mass is a line mass of length DD

If DD is zero, the mass is a line mass of length BB

If both BB and DD are zero, the mass is a point mass

4. STORY DATA

Prepare four cards for each story level in sequence from the top to the bottom of the structure, i.e., four cards followed by four cards, level by level.

a. <u>First Card</u>		(A5,I5,3F10.0)	Structural Story Data	
Column	Note	Variable	Entry	
1-5		SDI	Five characters to be used for identification of this level	
6-10	(1)	IMST	Mass type, not used if NPAT equals 0 (Section 2.b.): EQ.0; Mass properties of this story are as input on second card below GT.0; Mass properties are those of mass type IMST, as previously defined	
11-20	(2)	SH	Story height distance from the floor (or roof) level to the floor (or foundation) level below	
21-30	(3)	SKX	External story stiffness in the X direction	
31-40		SKY	External story stiffness in the Y direction	
41-50		SKR	External story stiffness in the story rotational direction	

b. <u>Second Card</u>		(4F10.0)	Structural Mass Data	
Column	Note	Variable	Entry	
1-10	(4)	XMASS	Translational mass	
11-20	(5)	XMMI	Rotational mass moment of inertia of the story about a vertical axis through the center of mass of the story	
21-30	(6)	XM	X distance to the center of mass measured from the reference point	
31-40		YM	Y distance to the center of mass measured from the reference point	

Story Data (continued)

c. Third Card (4F10.0) Structural Lateral Load Condition A
See Figure 14.

Column	Note	Variable	Entry
1-10	(7)	FXA	X load for lateral load condition A
11-20		FYA	Y load for lateral load condition A
21-30		XA	X ordinate of the point of load application for load condition A
31-40		YA	Y ordinate of the point of load application for load condition A

d. Fourth Card (4F10.0) Structural Lateral Load Condition B
See Figure 14

Column	Note	Variable	Entry
1-10	(7)	FXB	X load for lateral load condition B
11-20		FYB	Y load for lateral load condition B
21-30		XB	X ordinate of the point of load application for load condition B
31-40		YB	Y ordinate of the point of load application for load condition B

NOTES/

1. This entry must be less than or equal to NPAT (Section 2.b.). If this entry is nonzero, data on Card 2 below are ignored.
2. This defines the level of the horizontal rigid diaphragm of this story. Story lateral loads are assumed to be generated at this level. Frame levels must correspond to structural levels defined in the story data. A zero story height will set the story level of the diaphragm at the same elevation as that of the following diaphragm (below).

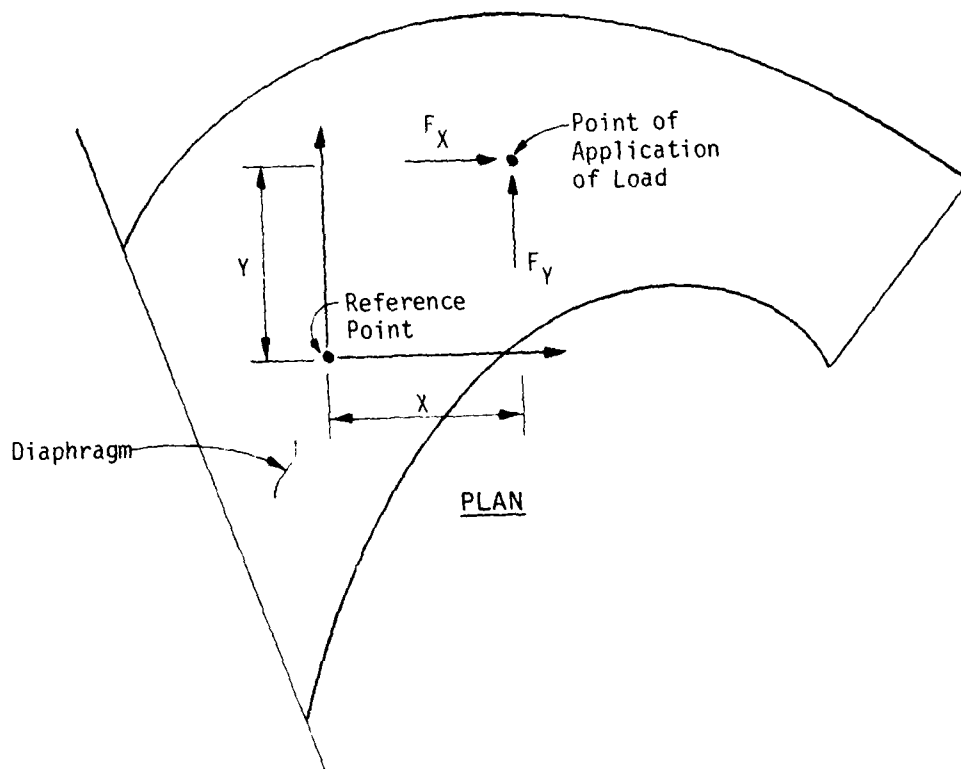


Figure 14. Static lateral load conditions A and B

3. These are extra story stiffnesses acting on lines through the center of mass of the story and can be used to represent restraints (or braces) at the story level or can be used to represent soil stiffness in levels below the ground.
4. The translational mass has units of force divided by acceleration (W/g). The rotational mass moment of inertia is not required if the allowable story degrees of freedom (NSD, Section 2.b.) do not include rotation. Mass properties need not be supplied if NAT equals 0.

5. Expressions for evaluating the mass moment of inertia of various diaphragm configurations are presented in Figure 15.
6. The center of mass is related to the following aspects of the solution process:
 - a. The dynamic lateral forces and torsional moments of the diaphragm are generated at this point.
 - b. The external story stiffnesses, if any, are assumed to be at this point.
 - c. The story static structural displacements, (lateral displacements and rotations) are printed at this point.

For a dynamic analysis the location of the center of mass must be defined.

In a static analysis no entries need necessarily be made for the center of mass coordinates. In such a case the story static displacements will be printed at the reference point.

The location of the point of action of the static lateral loads is not defined by the coordinates of the center of mass.

7. The Third and Fourth cards define the lateral loads acting on the horizontal rigid diaphragm for the two lateral load conditions A and B. The story load is applied at a point on the diaphragm in the form of X and Y components. The load data on these cards is superceded if NUBC is 1.

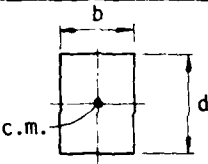
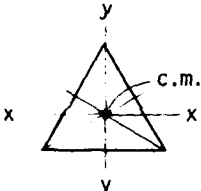
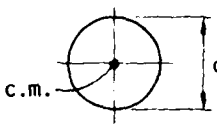
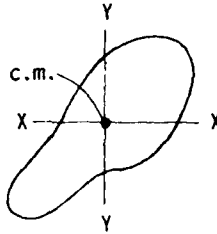
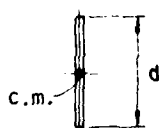
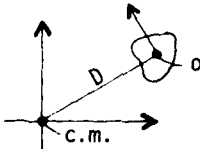
Shape in plan	Mass Moment of Inertia about vertical axis (normal to paper) through center of mass	Formula
	Rectangular diaphragm Uniformly distributed mass per unit area Total mass of diaphragm = $M(\frac{W}{g})$	$MMI_{cm} = \frac{M}{12}(b^2 + d^2)$
	Triangular diaphragm Uniformly distributed mass per unit area Total mass of diaphragm = $M(\frac{W}{g})$	Use general diaphragm formula
	Circular diaphragm Uniformly distributed mass per unit area Total mass of diaphragm = $M(\frac{W}{g})$	$MMI_{cm} = \frac{Md^2}{8}$
	General diaphragm Uniformly distributed mass per unit area Total mass of diaphragm = $M(\frac{W}{g})$ Area of diaphragm = A Moment of inertia of area about XX = I_x Moment of inertia of area about YY = I_y	$MMI_{cm} = \frac{M}{A}(I_x + I_y)$
	Line mass Uniformly distributed mass per unit length Total mass of line = $M(\frac{W}{g})$	$MMI_{cm} = \frac{Md^2}{12}$
	Axis transformation for a mass M If mass is a point mass $MMI_o = 0$	$MMI_{cm} = MMI_o + MD^2$

Figure 15. Formulae for mass moment of inertia

5. FRAME DATA

Prepare one set of data for each different frame. Data for frames with different locations but with identical properties and vertical loadings are entered only once. See Figure 3.

a. Frame Control Cards

Card 1 (14A5)

Column	Note	Variable	Entry
1-70		FHED	Label information to be used to identify this frame type

Card 2 (1015)

Column	Note	Variable	Entry
1-5	(1)	M	Frame identification number
6-10	(2)	NC	Number of vertical column lines in this frame
11-15	(3)	NS	Number of story levels (diaphragms) in frame
16-20	(4)	NCP	Number of sets of different column/panel/diagonal properties
21-25	(5)	NBP	Number of sets of different beam (girder) properties
26-30	(6)	NFEF	Number of sets of different beam span vertical loading patterns
31-35	(7)	MCONL	Maximum number of concentrated loads in any one beam span load pattern of this frame
36-40	(8)	NPAN	Number of infill shear panels in this frame
41-45	(9)	NDIG	Number of diagonals in this frame
50	(10)	IPLT	Frame plot flag EQ.0; Do not plot frame elevation EQ.1; Plot frame elevation EQ.2; Plot frame elevation with element type and vertical loading identification

Frame Control Card (continued)

Column	Note	Variable	Entry
55	(11)	NSSC	Story connectivity code EQ.0; Normal connectivity EQ.1; Special connectivity

NOTES/

1. Frame identification numbers must be entered in an ascending consecutive numerical sequence, beginning with number one. This frame may be located (repeated) at different positions in the structure via the frame location cards. See Section 6 below.
2. An isolated shear wall may be modeled as a single column line frame. In this case all data pertaining to the beams are meaningless and must be omitted in the data input sections below. Note that the number of bays in a frame is always one less than the number of column lines.

Panels and bracing elements need at least two column lines for definition. Therefore, a single column line frame can have no panels or braces.

Application of vertical loads (except column self weight) is only possible via beam span loads. Definition of a beam requires two column lines. Therefore, a single column line frame can have no superimposed vertical load applied.

3. The number of levels in the frame corresponds to the number of story diaphragms to which the frame is connected, the frame levels may connect sequentially (but not necessarily consecutively) to any story diaphragm (See Section 5.b. below).

4. This entry controls the number of cards to be read in Section 5.e. below. The column, panel, and diagonal elements are all axial/bending elements and this entry defines the number of different section properties that exist in the columns, panels, and/or diagonals of this frame. These properties are assignable to any or all of the columns, panels, or diagonals in the frame.
5. This entry controls the number of cards to be read in Section 5.f. below. This entry defines the number of different types of beam sections that exist in this frame. Beam properties may be referenced by any number of beams in the frame.
6. This entry controls the number of different beam span loadings on the various beams of this frame.

If no vertical loads are applied to the structure or if this is a single column frame, enter zero for this number and skip Section 5.g. below.
7. This number is required to pre-allocate memory storage for the concentrated loads that may exist in the beam span loading patterns.
8. This entry controls the number of cards to be read in Section 5.h. (iii) below.
9. This entry controls the number of cards to be read in Section 5.h. (iv) below.
10. If IPLT equals 1, the plot file will contain a plot of an elevation of this frame, provided that the master plot control flag (Section 2.b.) is set at 2 or 3. If IPLT equals 2 the element property

identification numbers along with the beam span loading identifications (for loading conditions I through IV) will be plotted on the elevation of the frame.

11. If NSCC equals 0 the program assumes that the frame levels correspond to the lowest NS levels of the structure. If NSCC equals 1 the user must specify the structural levels to which the frame levels are connected by providing data in Section 5.b.

b. Story Connectivity Data (1415)

Skip this section of input data if the story connectivity code (Section 5.a.) is 0. Otherwise provide one entry for each of the NS levels of this frame (from top to bottom) up to fourteen entries per card.

Column	Note	Variable	Entry
1-5	(1)	NSC	Structural level number connecting to the NS-th (top) level of this frame
....			
66-70			Structural level number connecting to the (NS-13)th level of this frame

NOTES/

1. The structural level numbers are NST (Section 2.b.) for the top level of the structure and 1 for the lowest level of the structure. All the entries in this data section must be greater than or equal to 1 and less than or equal to NST. Also the entries must be in a decreasing numerical sequence, though not necessarily consecutive.

In other words, the structural level number that the NS-th frame level connects to must be greater than the structural level number connecting to the (NS-1)th frame level, and so on.

The story connectivity data allows arbitrary frame/structure assembly. With this data option it is not necessary for a frame to connect to all diaphragms of the structure that intercept it. For example consider an eight story structure with 12-foot story heights (96 feet tall). It is possible to model a wall which connects only to top level (level 8) and the ground, by-passing all other levels. Such a wall will be a one story wall with story connectivity data for the one level of the wall being 8.

The frame level heights are automatically established based upon the story heights of the by-passed structural levels.

This option makes it possible to model structures having more than one independent diaphragm at any one level, structures with partial diaphragms and buildings having supports at different elevations.

Frame Data (continued)

c. Bay Width Data (7F10.0)

Skip this section of the input if the number of column lines in this frame is one (Section 5.a.). Otherwise provide seven entries per card.

Column	Note	Variable	Entry
1-10	(1)	BW	Bay width between column lines 1 and 2
.....			
61-70			Bay width between column lines 7 and 8

d. Sill Height Data (7F10.0)

Skip this section of input if the number of column lines in this frame is one (Section 5.a.). Otherwise provide seven entries per card.

Column	Note	Variable	Entry
1-10	(2)	SL	Sill height between columns 1 and 2
.....			
61-70			Sill height between columns 7 and 8

NOTES/

1. The bay width is the center-to-center distance between adjacent column lines; see Figure 3 . Bay widths are input from left to right as one views the frame in elevation. The column line numbers increase in the positive "L" direction, where "L" is directed from the viewer's left to his right. Input as many cards in this section as are required to define all bays in this frame, at seven bay widths per card. The number of bays is always one less than the number of column lines in the frame.

2. The sill depths are merely used to reduce the effective column heights, due to sills that may exist at the foundation level in the frame (See Figure 3). The sill heights may exist in every bay. The number of sill height entries is the same as the number of bay widths and must be entered similarly from left to right along the positive "L" direction of the frame.

Frame Data (continued)

e. Column/Panel/Diagonal Property Cards (I5,F5.0,6F10.0)

Provide one card in this section for each different column/panel/diagonal section properties in this frame. The same property may be referenced by different element types or elements.

Column	Notes	Variable	Entry
1-5	(1)	M	Identification number for this property set
6-10	(2)	U	Unit weight (Not for story mass calculation)
11-20		E	Modulus of elasticity
21-30		A	Axial cross-sectional area
31-40	(3)	XI	Moment of inertia
41-50	(4)	AV	Effective shear area
51-60	(5)	W	Column width
61-70	(6)	T	Column thickness

NOTES/

1. Property set identification numbers must be in ascending consecutive numerical sequence beginning with one.

A (-) sign in column 1 will indicate that this section is a rectangular section. In this case entries for A, XI, and AV are not needed. The program will calculate these properties from the entries for W and T as follows:

$$A = W * T$$

$$XI = W * W * W * T / 12.$$

$$AV = A * 5./6.$$

2. U is the unit weight of the element material in force/unit volume units (e.g., 150 pounds/cu ft* for concrete). This is used to calculate the weight of the element. The weight is lumped into vertical load condition I at the top ends of the corresponding elements. The weight is based upon the clear heights for columns, the story-to-story heights for panels and the full lengths for diagonals. For the purpose of determining the element volume for weight calculation the axial area (not the shear area) is used.
3. Columns, panels and diagonals must be prismatic from story level to story level.
4. A shear area of pure zero (blank) will cause the program to exclude the effect of shear deformations. In other words, the shear deformations will be assumed to be zero. Effectively a pure zero shear area is defaulted to an infinite shear area by the program. The shear modulus is calculated from the elastic modulus assuming a Poisson's ratio of 0.2. See Figure 16.
5. The column width is used to reduce the effective length of the beams connecting to the column. See the theoretical manual, Chapter II Section A(iii)⁽¹⁸⁾. For single column line frames, this use of the column width is not applicable, as there are no beams. The column width is also used in the automatic rectangular section property calculation option.
6. This entry is only used if there is a (-) sign in column 1 to activate the automatic rectangular section property calculation.

* A table of factors for converting inch-pound units of measurement to metric (SI) units is presented on page 3.

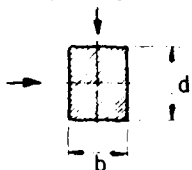
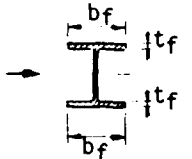
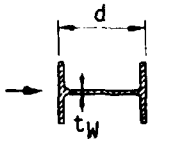
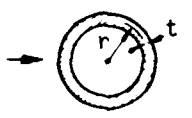
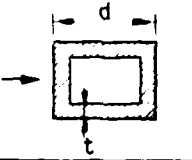
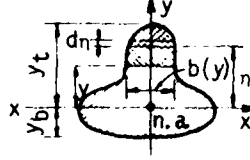
Section	Description	Equivalent Shear Area
	Rectangular Section Shear forces parallel to the b or d directions	$\frac{5}{6} bd$
	Wide Flange Section Shear forces parallel to the flange	$\frac{5}{3} t_f b_f$
	Wide Flange Section Shear forces parallel to web	$\frac{5}{6} t_w d$
	Thin Walled Circular Tube Section Shear forces from any direction	$\frac{\pi r t}{2}$
	Solid Circular Section Shear forces from any direction	$0.9 \pi r^2$
	Thin Walled Rectangular Tube Section Shear forces parallel to d direction	$2td$
	General Section Shear forces parallel to Y-direction I_x = moment of inertia of section about x-x $Q(y) = \int_y^{y_t} b(n) dn$	$\frac{I_x^2}{\int_{y_b}^{y_t} \frac{Q^2(y)}{b y} dy}$

Figure 16. Formulae for calculating shear areas

Frame Data (continued)

f. Beam Property Cards (I5,F5.0,2F10.0,2F5.0,3F10.0)

Provide one card in this section for each different beam in the frame; skip this input if the frame has only one column line or if NBP equals 0, (Section 5.a.). See Figure 17.

Column	Note	Variable	Entry
1-5	(1)	M	Identification number for this beam property
6-10	(2)	U	Unit of weight (Not for story mass calculation)
11-20		E	Modulus of elasticity
21-30	(3)	XI	Reference moment of inertia
31-35		AK	Stiffness factor 4.0
36-40		AC	Carry-over factor
41-50	(4)	DB	Beam depth, below diaphragm level
51-60		DA	Beam depth, above diaphragm level
61-70	(5)	AV or T	Beam shear area or thickness

NOTES/

1. Property set identification numbers must be input in ascending consecutive numerical sequence beginning with one.

A (-) sign in column 1 will indicate that this section is a rectangular section. In this case an entry for XI is not needed. The program will interpret the entry in columns 61-70 as the beam thickness, T, and not the beam shear area, AV. The values of AV and XI will be calculated by the program as follows:

$$XI = D * D * D * T/12, \text{ where, } D = DA + DB$$

$$AV = D * T * 5./6.$$

2. U is the unit weight of the material in force/unit volume. This is used to calculate the self weight of the beam, in weight/unit length as follows: Weight/unit length = $AV * U$. This weight is added to the uniform weight of load condition I for this beam. It should be noted that the weight is based upon the shear area, and if the shear area is not equal to the actual area of the cross section of the beam, a compensating correction should be made to the input value of U .

3. Beams need not be prismatic but must be symmetrical.

For prismatic sections:

XI is the moment of inertia of the section,

$AK = 4.0$, $AC = 0.5$

For non-prismatic sections:

XI is the reference moment of inertia for AK and AC

See Figure 17.

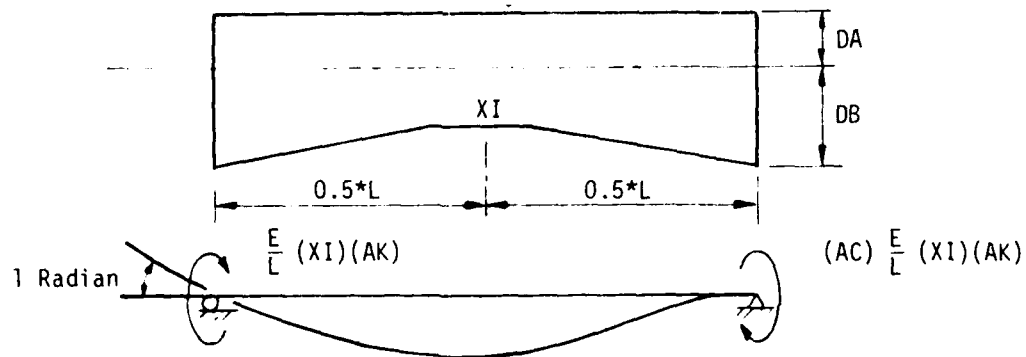


Figure 17. Beam properties

4. The beam depth below diaphragm, DB, is used to shorten the effective lengths of the columns below the beam.

The beam depth above the diaphragm, DA, is used to shorten the effective length of the column above the beam.

DA and DB are also used in the automatic beam rectangular section property calculation.

5. This entry is the beam shear area if there is no (-) sign in column 1. If a negative sign exists in column 1, this entry is interpreted as the beam thickness as described in note 1 above. Also see Section 5.e. note 4.

Frame Data (continued)

g. Beam Span Loading Data

Prepare one set of data for each different type of vertical beam loading; omit these data if this is a single column line frame or if NFEF equals 0, (Section 5.a.). See Figure 18.

(i) First Card (2I5,4F10.0)

Column	Note	Variable	Entry
1-5	(1)	M	Identification number for this vertical loading set
6-10	(2)	NCON	Number of concentrated loads for this set
11-20	(3)	XML	Left fixed-end moment
21-30		VL	Left fixed-end shear
31-40		XMR	Right fixed-end moment
41-50		VR	Right fixed-end shear

(ii) Second Card (3F10.0)

Column	Note	Variable	Entry
1-10	(4)	WW	Uniform force per unit length acting downward to be added to fixed-end forces
11-20	(5)	FL	Point load, acting downwards on left column center line
21-30		FR	Point load, acting downwards on right column center line

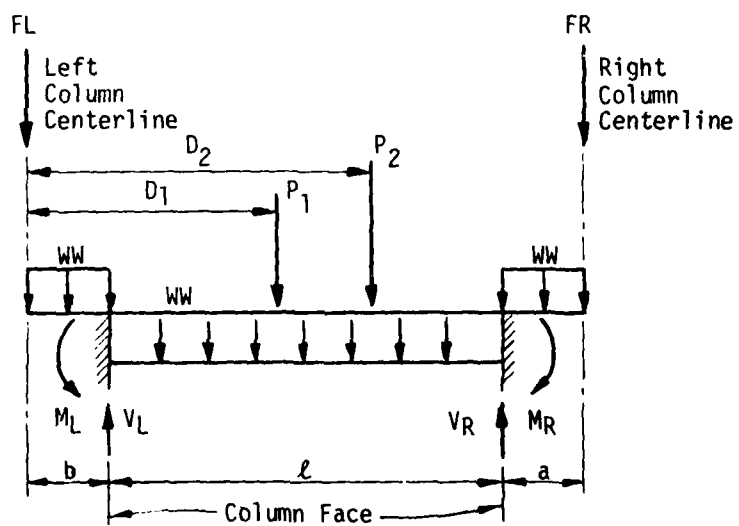


Figure 18. Beam span loading

Frame Data (continued)

(iii) Concentrated Load Cards (6F10.0)

Skip these cards if the number of concentrated loads is 0 otherwise provide NCON pairs of values. Three pairs per card. Start with the load at the extreme left and move right.

Column	Note	Variable	Entry
1-10	(6)	D1	Distance of load 1 from left-hand column center line
11-20		P1	Magnitude of load 1
21-30		D2	Distance of load 2 from left-hand column center line
31-40		P2	Magnitude of load 2
.....		..	

Skip to next card if number of concentrated loads is greater than 3 and so on.

NOTES/

1. Load Set Identification Numbers must increase in consecutive numerical sequence starting with 1.
2. NCON should be less than or equal to MCONL (Section 5.a.). NCON controls the number of concentrated load entries to be made on the concentrated load cards below.
3. These forces, XML, VL, XMR, and VR, must be calculated at the outer faces of the columns below the beam, because that is where the final member forces for the beam will be output. The input (+) sign convention is shown in Figure 18. In most practical situations these forces need not be calculated as the loading can

be defined by the uniform load and concentrated load options below, where the fixed-end moments are automatically calculated internally. Also by defining the loading via the uniform load and concentrated load options the user provides the span load distribution which enables the program to calculate a correct span moment (moment at the first point of zero shear, from the left column), which otherwise will not be available in a correct form.

4. This is the superimposed uniform load. The beam self weight is added to this load internally, if this load set is defining load condition I for the beam. The internal calculation of the fixed end forces is exact only for prismatic beams. The uniform load over the column widths below, is lumped at the column center lines.
5. Loads occurring from any out-of-plane framing may be applied onto the frame via this option.
6. Positive loads act downwards. The distances $D1, D2, \dots$ which define the points of load application will be interpreted as a ratio of the total bay width if $D1, D2, \dots$ are less than 0, (negative) and as actual distances measured from the left column center line if $D1, D2, \dots$ are greater than 0. Therefore, on a bay width of 12 feet, a concentrated load of 2^k at midspan may be input as either ($D1 = 6.0$ and $P1 = 2.$) or
($D1 = -0.5$ and $P1 = 2.$)
 $D1, D2, \dots$ must be in increasing (absolute) numerical sequence. The fixed-end forces calculated are exact only for prismatic beams neglecting the effects of shear deformations.

Frame Data (continued)

h. Member Location Data

(i) Column Cards (2I5)

Provide one card per column from top to bottom and from left to right of the frame (unless the data generation option is used).

Column	Note	Variable	Entry
1-5	(1)	LC	Column/Panel/Diagonal property set identification number
6-10	(2)	K	Number of columns in sequence below to be generated having the same properties

Skip the following data sections (ii), (iii), and (iv) if this is a single column line frame.

(ii) Beam Cards (2I5)

Provide one card per bay from top to bottom and from left to right in the frame (unless the data generation option is used).

Column	Note	Variable	Entry
1-5	(3)	LB	Beam property set identification number for this girder
6-10	(4)	K	Number of beams in sequence below to be generated having the same properties

(iii) Panel Cards (5I5)

Skip this data section if the number of panels in this frame is zero; otherwise enter one card per panel in any order unless generation is used.

Column	Note	Variable	Entry
1-5	(5)	LP	Level identification number at the top of this panel

Frame Data (continued)

Column	Note	Variable	Entry
6-10			Bay number in which panel starts
11-15			Bay number in which panel ends
16-20	(1)	PP	Column/Panel/Diagonal set identification number, defining properties of the panel
21-25		K	Number of panels to be generated below having the same properties and location in lower levels

(iv) Diagonal Cards (5I5)

Skip this data section if the number of diagonals in this frame is zero; otherwise enter one card per diagonal in any order unless generation is used.

Column	Note	Variable	Entry
1-5	(5)	LDIG	Level identification number at the top of this panel
6-10			Column line number at the lower end of this diagonal
11-15			Column line number at the upper end of this diagonal
16-20	(1)	PDIG	Column/Panel/Diagonal property set identification number, defining properties of diagonal
21-25		K	Number of diagonals to be generated below having the same properties and location in lower levels

NOTES/

1. This number references the column/panel/diagonal property data table defined in Section 5.e. above. Missing columns are input as having a property set identification number 0.

2. Generation is allowed only within the current column line; every new column line must start with a new card.
3. This number references the beam property data table defined in Section 5.f. above. Missing beams are input as having a beam property set identification number 0.
4. Generation is allowed only within the current bay; every new bay must start with a new card.
5. The foundation line is defined as level number zero, and the roof level number is equal to the total number of stories in the building.

Frame Data (continued)

i. Vertical Loading Data (515)

Provide one card per girder from top to bottom and from left to right for every girder in the frame (unless the data generation option is used). This data section must be omitted entirely for single column line frames, or if NFEF (Section 5.a.) is zero.

Column	Note	Variable	Entry
1-5	(1)	LDB	Beam span loading set identification number for vertical load condition I
6-10			Beam span loading set identification number for vertical load condition II
11-15			Beam span loading set identification number for vertical load condition III
16-20			Beam span loading set identification number for vertical load condition IV
21-25	(2)	K	Number of beams in sequence below having the same vertical loading as this beam

NOTES/

1. This number references the beam span loading sets previously defined in Section 5.g. If any beam has no superimposed loading for any load condition the corresponding beam span loading number may be input as 0. The self weight of the beam in load condition I is also ignored if the entry in columns 1-5 above is zero. Loadings applied on beams having a beam property identification (Section 5.a. (ii) above) of zero are ignored.
2. Generation is allowed only within the current bay; every new bay must start with a new card.

6. FRAME LOCATION CARDS (2I5,4F10.0,4A5)

Provide one card in this section for each frame in the building; the total number of frame location cards must equal NTF, (Section 2.b.). See Figure 19.

Column	Note	Variable	Entry
1-5	(1)	M	Frame identification number
6-10		IFC	Force calculation code: EQ.0; Frame forces will be calculated EQ.1; Frame forces will not be calculated
11-20	(2)	X1	Distance, X1
21-30		Y1	Distance, Y1
31-40		X2	Distance, X2
41-50		Y2	Distance, Y2
51-70			Information to be printed with the output to identify this particular frame.

NOTES/

1. This entry refers to the frame identification number (Section 5.a.) of the frame being placed via this frame location card. Frame identification numbers may be repeated, but the location cards must be input such that the frame identification numbers are in an ascending numerical sequence starting with one.
2. The frame location is established by providing the coordinates of two points, (X1, Y1) and (X2, Y2) along the line defining the direction of the frame. The local axis of the frame is then defined by the vector directed from point 1 toward point 2. If the plan of the structure is to be plotted these points must be located such that they define a line which represents a plan view of the frame in length (and, of course, in direction).

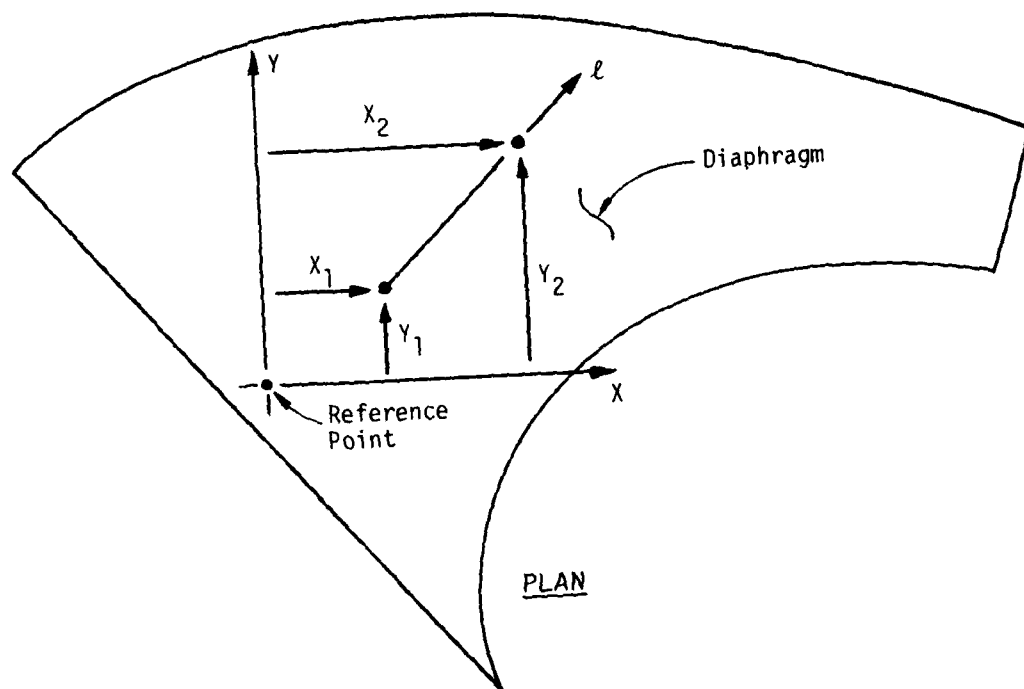


Figure 19. Frame location coordinates

7. DATA FOR CALCULATING LATERAL SEISMIC LOADS BASED ON UNIFORM BUILDING
CODE 1979 (SEAOC CODE)

Skip this section if NUBC equals 0, (Section 2.b.); otherwise, provide three cards as follows:

a. First Card (4F10.0)

Column	Note	Variable	Entry
1-10	(1)	Z	UBC zone factor, Z (default = 1.0)
11-20	(1,3)	TS	Predominant period of the soil in seconds
21-30	(1)	UBCI	UBC importance factor, I (default = 1.0)
31-40	(2)	GRAV	Acceleration due to gravity EQ.0; set to 32.2 ft/sec ²

b. Second Card (2I5,2F10.0)

Data associated with X direction loads or load condition A. Y direction loads in condition A are set to 0. See Note 6 below.

Column	Note	Variable	Entry
1-5	(4)	NTOPX	Level number at top of UBC triangular distribution in X-direction LE.0; set to NST
6-10	(4)	NBOTX	Level number at bottom of UBC triangular distribution in X direction LE.0; set to 0
11-20	(5)	TX	Time period of predominant X mode LE.0; set by program, if NAT is not 0
21-30	(1)	KX	UBC structural type factor, K for X direction

Data for Calculating Lateral Seismic Loads (continued)

c. Third Card (215,2F10.0)

Data associated with Y direction loads or load condition B. X direction loads in condition B are set to 0. See Note 6 below.

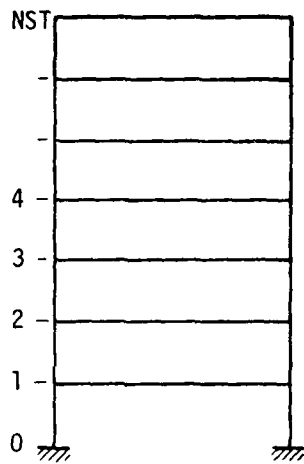
Column	Note	Variable	Entry
1-5	(4)	NTOPY	Level number at top of UBC triangular distribution in Y direction LE.0; set to NST
6-10	(4)	NBOTY	Level number at bottom of UBC triangular distribution in Y direction LE.0; set to 0
11-20	(5)	TY	Time period of predominant Y mode LE.0; set by program, if NAT is not zero
21-30	(1)	KY	UBC structural type factor, K for Y direction

NOTES/

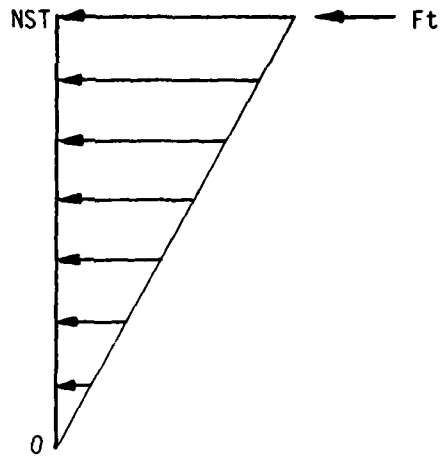
1. Details of the seismic load calculation method and the definitions of the various factors are presented in Chapter 23 of Reference 14.
2. The gravitational acceleration is used for converting the story masses defined in Section 4 into weights for use in calculating the UBC seismic loads.
3. TS is required for calculating the UBC soil factor, S. If TS is not input S is assumed to be 1.5.
4. It is possible for the structural model to have levels for pent-houses, basements or dummy storys for special modeling. Such levels should not be part of the overall structural triangular lateral force distribution as defined by the UBC. The variables NTOPX

and NBOTX (or NTOPY and NBOTY) define the extent of the triangular distribution pattern. See Figure 20.

5. If this entry is not provided, and NAT is not 0, the program will set this period equal to that of the mode having the largest participation factor in the X direction for TX (Y direction for TY).
6. The UBC loads generated replace any lateral loads provided in Section 4.c. and 4.d. above. However, the coordinates of the points of application of the loads are not changed by this option.

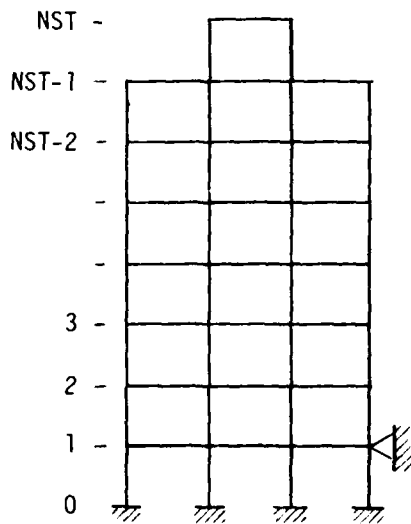


FRAME



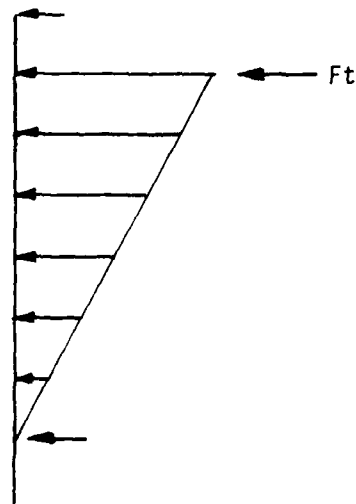
NOTE/

UBC lateral distribution is over
all stories
NTOP = NST
NBOT = 0



FRAME

SMALL PENTHOUSE



NOTE/

UBC lateral distribution is not
over all stories
NTOP = NST-1
NBOT = 1

Figure 20. UBC lateral force distribution convention

8. EARTHQUAKE ACCELERATION SPECTRUM CARDS

These data cards are required only if NAT equals 3 (Section 2.b.).

a. Control Card (I5,5X,2F10.0,6A5)

Column	Note	Variable	Entry
1-5	(1)	NPER	Number of period cards used to define the acceleration spectrum
6-10	(2)	NMD	Number of modes to be printed separately
11-20	(3)	SF	Scale factor for accelerations
21-30	(4)	FI	Direction of earthquake input (degrees). See Figure 2
31-40	(5)	SDAMP	Damping ratio of response spectrum
41-70		SHED	User information to be printed with output

b. Period Cards (2F10.0)

Provide NPER cards to define spectrum curve.

Column	Note	Variable	Entry
1-10	(6)	PA	Period entered in increasing numerical sequence
11-20			Spectrum acceleration

NOTES/

1. At least two cards must be provided.
2. If the responses in each mode are required to be printed separately the output will consist of NMD extra load cases; thus the total number of load cases printed will become (NLD + NMD) where NLD is defined in Section 2.b. The last NMD load cases are associated with the NMD modes requested separately. NMD must be less than or equal to NFQ defined in Section 2.b.

3. This is just a multiplying factor to scale the spectrum acceleration value input below, to amplify or reduce the spectrum intensity or to transform the acceleration into consistent units.
4. The direction angle is measured positively clockwise from the global Y direction.
5. The damping ratio is required for use in the CQC combination technique as outlined in the theoretical manual Chapter IV, Section E⁽¹⁸⁾.
6. If the period of the mode being considered is out of the range covered by the period range of the spectrum curve the spectral value for the mode will be set equal to that associated with the closest time period on the period cards that are provided.

9. TIME HISTORY CARDS

These data cards are required only if NAT equals 4. (See Section 2.b.)

a. Heading and Format Card (10A3,10A4)

Column	Note	Variable	Entry
1-30		SHED	User information to be printed with output
31-40	(1)	SFMT	Time history format If blank default format is assumed as: (2F10.0) if IHTYP equals U, see below (8F9.0) if IHTYP equals E, see below

b. Control Card (2I5,3F10.0,9X,A1,F10.0)

Column	Note	Variable	Entry
1-5	(2)	NPC	Number of acceleration cards
6-10	(2)	NTIME	Number of sampling values
11-20	(3)	SF	Scale factor for accelerations
21-30	(4)	FI	Direction of earthquake input, (degrees) See Figure 2
31-40	(5,2)	DT	Time increment for sampling
50	(6)	IHTYP	Time history type EQ.U; Variable time interval; pairs are input for each point in the history EQ.E; Constant time interval; time spacing HDT input once and h(t) input (only) for each point in the history
51-60	(6)	HDT	Time interval spacing for IHTYP equals E type history must be greater than zero

c. Damping Cards (I5,F10.0)

One card must be supplied for each of the NFQ modes (See Section 2.b.)

Column	Note	Variable	Entry
1-5		N	Mode number (in ascending order)
6-15	(7)	DAMP	Damping ratio: Modal Damping/Critical Damping

Time History (continued)

d. Acceleration Data Cards

The acceleration data depends upon the type of time history (U or E).

(i) If IHTYP equals U (using default format)

Provide one card for each time point on the history

Column	Note	Variable	Entry
1-10	(6)	PA(1,1)	Time at point 1
11-20		PA(2,1)	Acceleration value at point 1

(ii) If IHTYP equals E (using default format)

Provide as many cards needed to define the history at eight points per card.

Column	Note	Variable	Entry
1-9	(6)	PA(2,1)	History value at time 0*HDT
10-18		PA(2,2)	History value at time 1*HDT
19-27		PA(2,3)	History value at time 2*HDT
...		...	...
64-72		PA(2,8)	History value at time 7*HDT

NOTES/

1. SFMT is used as a variable format by the program. As such, it must be enclosed in parentheses and conform to the rules of FORTRAN; for example:

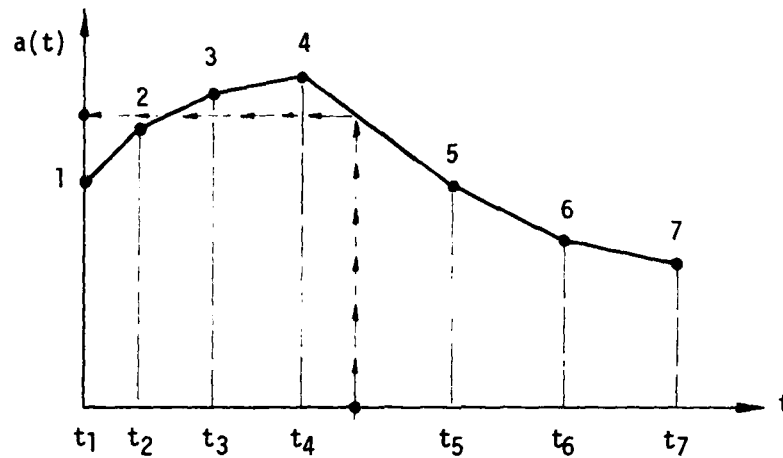
(8F10.0)

(12F6.0)

(6E12.3)

The program does not decode the format and therefore cannot detect an illegal format; illegal formats will cause the program to abort.

2. This history is input as a table of NPC points. Suppose, for example, the history appears as follows:



In this case, NPC is 7. The value of the acceleration at any time between two successive input time ordinates (t_4 and t_5 , say) is calculated by linear interpolation. NPC must be greater than 1. By convention, the first acceleration value must be associated with a time equal to 0. Time must always increase from time step to time step. Constant time over two consecutive time steps is an error condition. The time span covered by the NPC specifications must be greater than $\text{NTIME} * \text{DT}$

3. This is just a multiplying factor to scale the time history acceleration values provided below to amplify or reduce the acceleration intensity or to transform the acceleration into consistent units.
4. The direction angle is measured positively clockwise from the global Y direction.

5. The time span over which the time history analysis is carried out is given by $NTIME * DT$. Member forces and displacements are calculated after every DT seconds, ending up with $NTIME$ values for each output component. The maximum of the $NTIME$ values for each component is what is printed. Since explicit integration is used in computing the response, numerical instability problems are never encountered and the time increment may be any desired sampling value that is deemed fine enough to capture the maximum response values. One-tenth of the time period of the highest mode is usually a good recommended value; however, a larger value may give just as accurate a sampling if the contribution of the higher modes is small.
6. $IHTYP$ defines the method that the program is to use in reading the time history input. If $IHTYP$ is "U", the program expects to read pairs of time and associated history value according to the format $SFMT$; with this method of input HDT is ignored by the program.

If, $IHTYP$ is "E", the program will read history values (only) at equal intervals along the t -axis, using the input format $SFMT$; HDT is the t axis spacing for history value input.
7. The damping is represented as a fraction of the critical damping; therefore, it must be less than 1.0.

10. LOAD CASE DEFINITION CARDS (2I5,9F5.0,2A6)

Load cases for the complete building are defined as a linear combination of the vertical loading conditions (I through IV), the lateral loading conditions (A and B), and the earthquake spectrum and time-history loading conditions. One card must be entered in this section for each different structural load case; the total number of building load cases is controlled by NLD (Section 2.b.). These data cards should not be supplied if NAT equals 1 (Section 2.b.).

Column	Note	Variable	Entry
1-5		M	Load case number
6-10		IXM	Absolute load condition code: EQ.1; The absolute values (signs ignored) of the forces and displacements from the load conditions are used in the formulation of a load case. Signs on the multipliers are not ignored EQ.0; No signs are ignored
11-15	(1)	XM	Multiplier for vertical load condition I
16-20			Multiplier for vertical load condition II
21-25			Multiplier for vertical load condition III
26-30			Multiplier for vertical load condition IV
31-35			Multiplier for lateral load condition A
36-40			Multiplier for lateral load condition B
41-45			Multiplier for dynamic loading 1
46-50			Multiplier for dynamic loading 2
51-55			Multiplier for dynamic loading 3
56-67			Load case identification information

NOTES/

1. If NAT (Section 2.b.) equals 0 or 2 (i.e. static analysis),
dynamic loadings 1, 2, and 3 are inactive, any multipliers entered in
the columns associated with these loadings will have a null effect on
the load case.

If NAT equals 3 (i.e., static analysis with response spectrum analysis),
all dynamic loading conditions are active as follows:

Dynamic loading 1 : Response spectrum combination by SRSS

Dynamic loading 2 : Response spectrum combination by ABS

Dynamic loading 3 : Response spectrum combination by CQC

If NAT equals 4 (i.e., static analysis with time-history analysis),
only dynamic loading 3 is active and contain the response maxima
from the time-history analysis.

11. LAST CARD

The last card in the input stream must be an end card to terminate execution.

Column	Note	Variable	Entry
1-3	(1)	ISTOP	The word "END"

NOTES/

1. If this card is not there the program will "bomb".

CHAPTER VII: EXAMPLES

The following are a set of data cases compiled to demonstrate the capabilities of the CTABS80 computer program.

In order to limit the volume of the material presented here, only representative samples of the complete output produced by the program are included.

A. Example 1

(i) Description

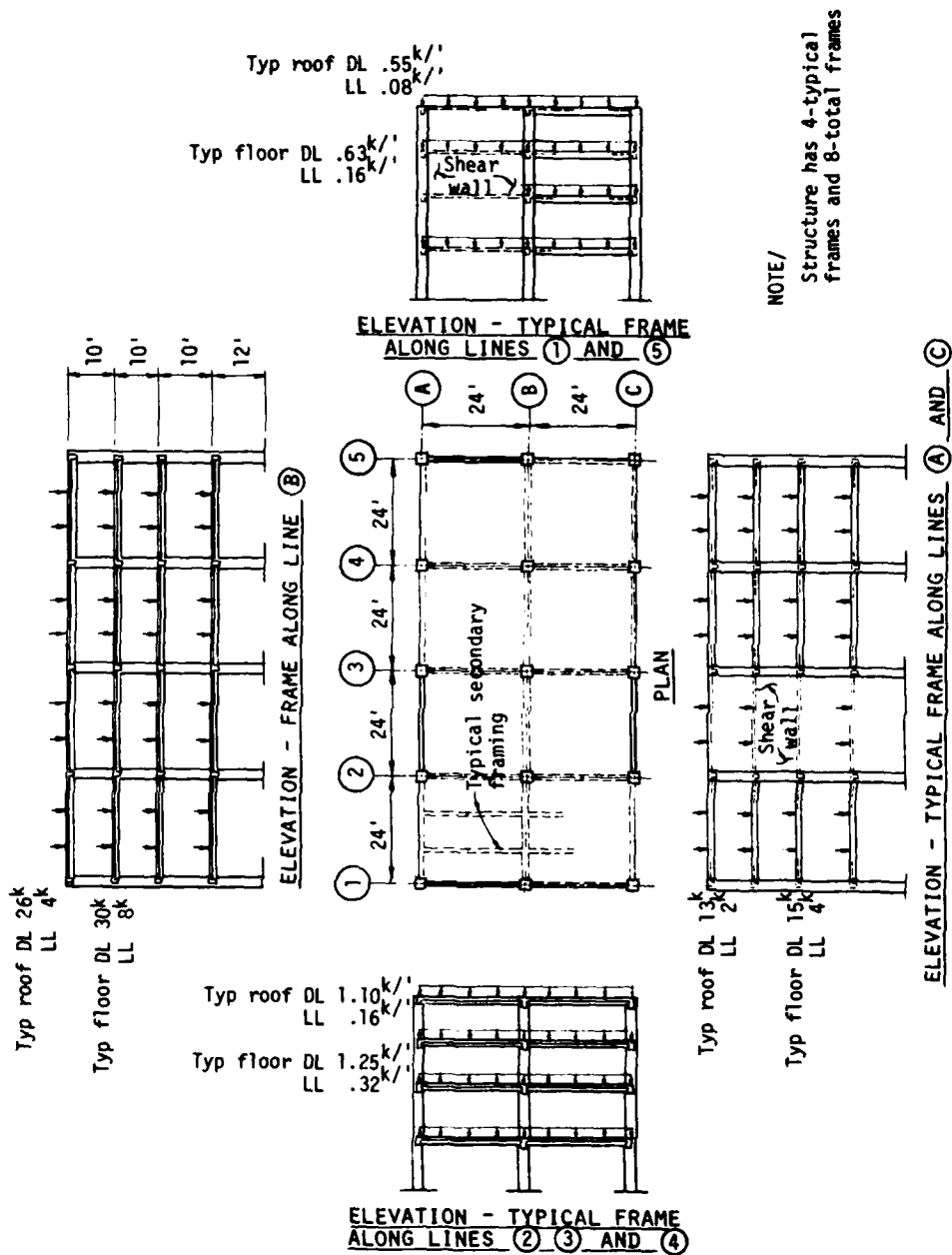
This is a four story structure consisting of a series of frame and shear walls. The structure is analyzed for dead and live loads and for lateral static seismic loads acting in the longitudinal and transverse directions of the structure. Time periods and mode shapes are evaluated.

(ii) Significant options of CTABS80 activated

1. Mass properties calculated automatically
2. Section properties calculated automatically
3. Automatic fixed-end force calculations
4. UBC lateral loads calculated automatically
5. Plotting
6. Static analysis, vertical and lateral
7. Stress output

(iii) Comments

The example demonstrates modeling of frames and shear walls with beam and column elements, shear walls being modeled as wide columns.



Computers/Structures International
4009 Webster Street
OAKLAND, CALIFORNIA 94609
(415) 655-9151

JOB CTAB580 / Example 1

SHEET NO _____ OF _____

CALCULATED BY 74 DATE 5/15/80

CHECKED BY _____ DATE _____

SCALE _____

<u>Basic Loads</u>	<u>psf</u>	
	<u>vertical</u>	<u>lateral</u>
<u>Roof</u>		
Roofing	6	6
Slab 8"	100	100
Ceiling/Mech	10	10
Beams	20	20
Columns	-	2
Walls	-	12
Partitions	-	10
Misc	2	2
DL	138	162
LL	20	-

Roof weight, W_r
 $= 48 \times 96 \times .162$
 $= 746^k$

<u>7/oor</u>		
Flooring	2	2
Slab 8"	100	100
Ceiling/Mech	10	10
Beams	20	20
Columns	-	4
Walls	-	24
Partitions	20	20
Misc	2	2
DL	154	182
LL	40	-

7/oor weight, W_f
 $= 48 \times 96 \times .182$
 $= 839^k$

AD-A105 513

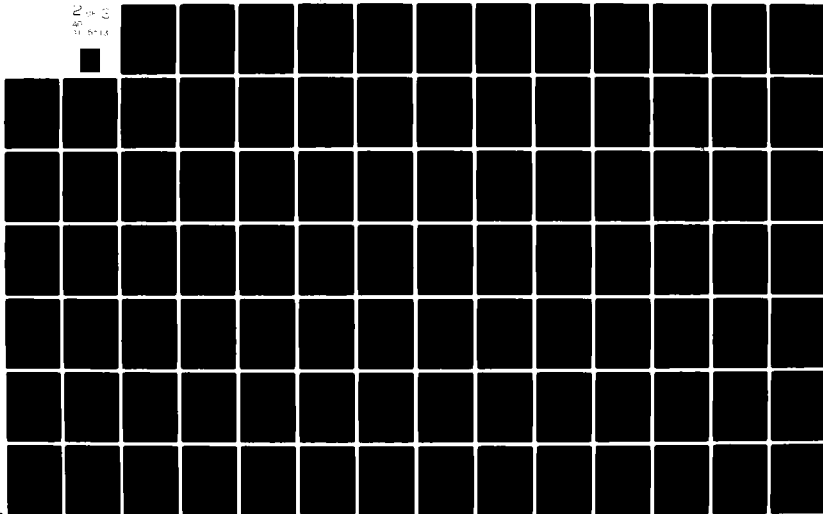
COMPUTERS/STRUCTURES INTERNATIONAL OAKLAND CA F/G 13/13
USER'S GUIDE: COMPUTER PROGRAM FOR THREE-DIMENSIONAL ANALYSIS O--ETC(U)
AUG 81 E L WILSON, H H DOVEY, A HABIBULLAH

UNCLASSIFIED

WES-IR-K-81-9

NL

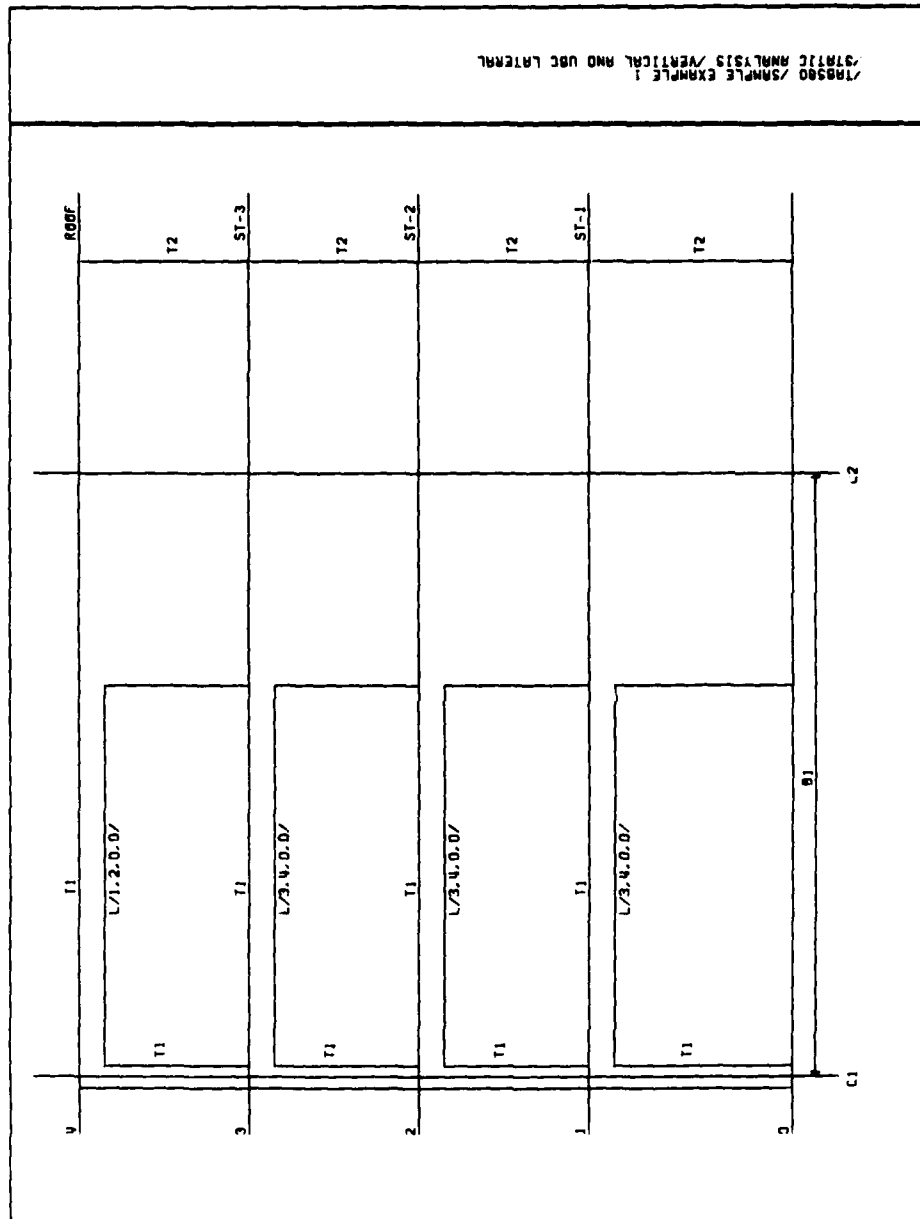
2 of 6
40
10 5/10



The diagram illustrates a four-story frame structure with the following details:

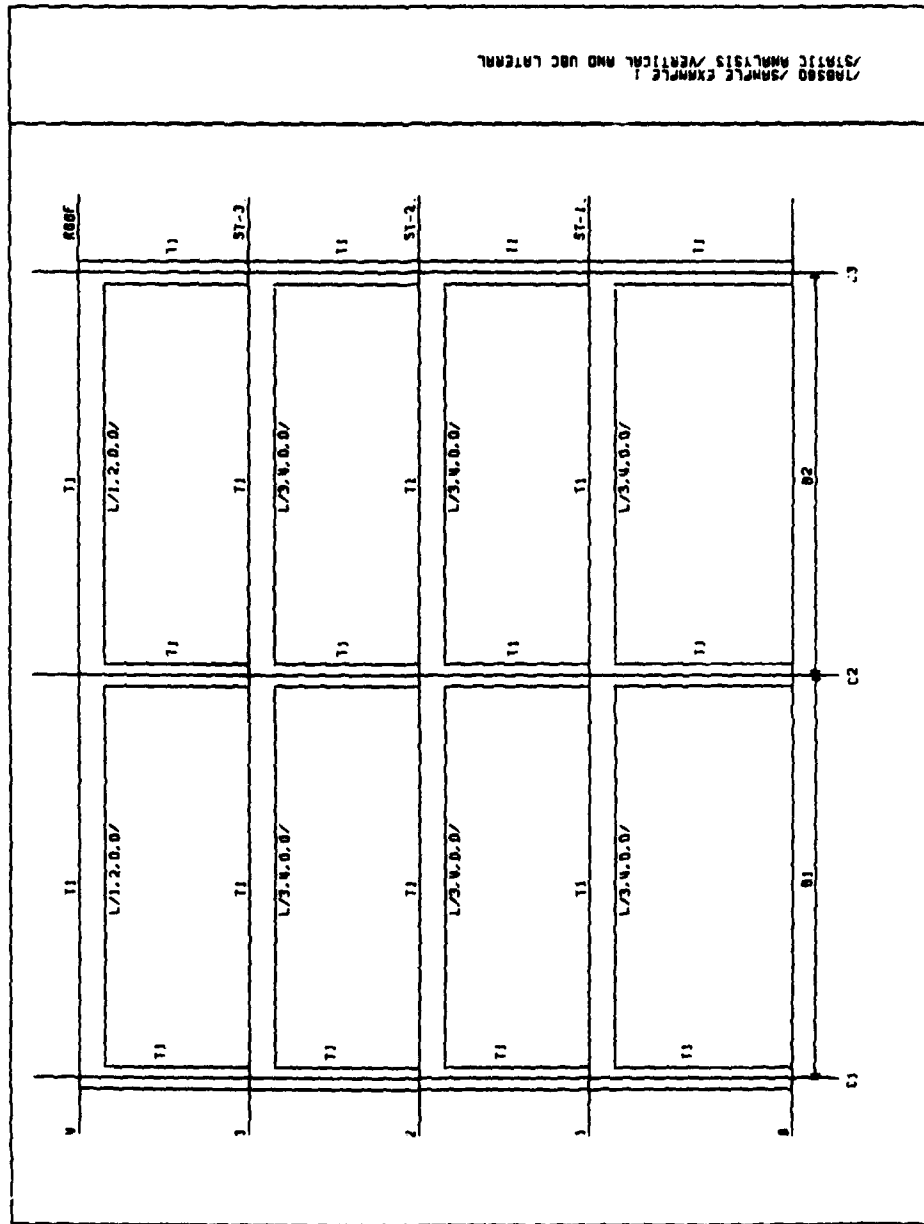
- Dimensions:**
 - Story heights: 8.1, 8.2, 8.3, 8.4
 - Column spacing: 8.1, 8.2, 8.3, 8.4
- Member Labels:**
 - Columns: C1, C2, C3, C4
 - Beams: B1, B2, B3, B4
 - Roof: ROOF
- Member Properties:**
 - Columns: T1, T2, T3, T4
 - Beams: L/3.4.0.0/, L/3.4.0.0/, L/3.4.0.0/, L/3.4.0.0/
 - Roof: L/1.2.0.0/, L/3.4.0.0/, L/3.4.0.0/, L/3.4.0.0/
- Supports:**
 - Fixed supports at C1 and C4.
 - Roller supports at C2 and C3.
- Labels:**
 - ST-1, ST-2, ST-3, ST-4

	C1	C2	C3	C4	C5	
4	T1 L/1.2.0.0/	T1 L/1.2.0.0/	T1 L/1.2.0.0/	T1 L/1.2.0.0/	T1 L/1.2.0.0/	ROOF
3	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	ST-3
2	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	ST-2
1	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	ST-1
0	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	T1 L/3.4.0.0/	
	B1	B2	B3	B4		



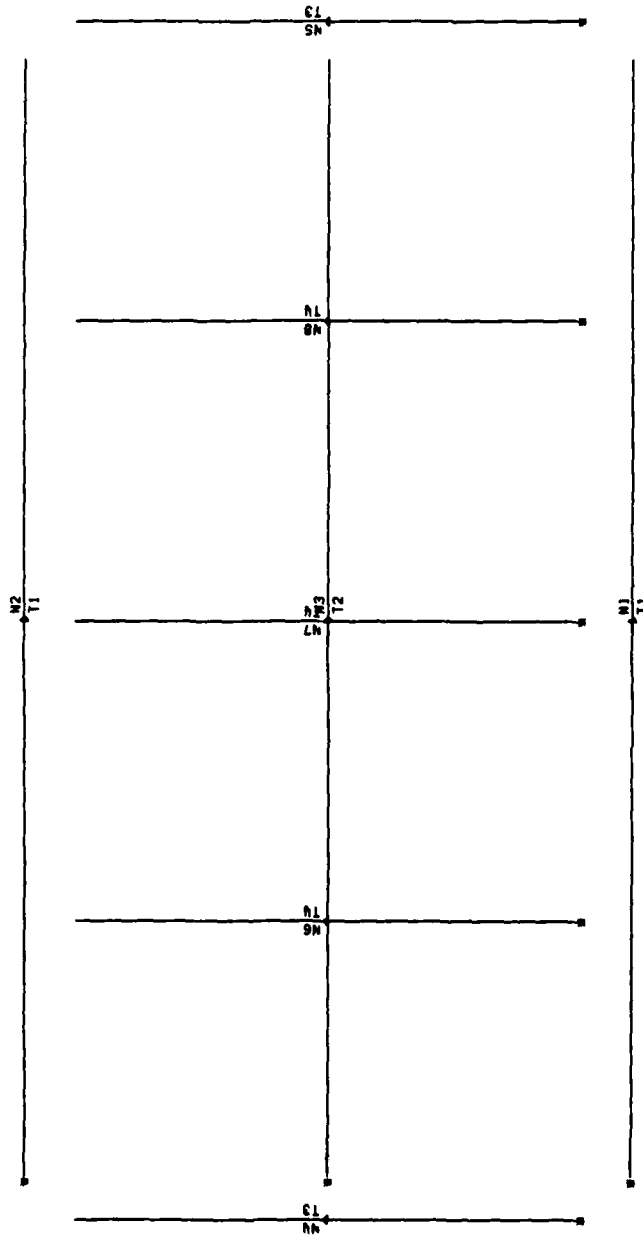
198380 / SAMPLE EXAMPLE 1
/ STATIC ANALYSIS / VERTICAL AND UBC LATERAL

198380 FRAME TYPE 3 / FRAMES 1 AND 5



780500 FRAME TYPE N / FRAMES 2, 3 AND 4

/STATIS /SAMPLE EXHIBIT 1
/STATIS /SAMPLE EXHIBIT 1



TAB500 PLAN VIEW OF FRAMES. DISPLAYING FRAME NUMBERS (N1, TYPES (T1) AND LOCAL AXES (N1)

/TABS00 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

PAGE 1
06/08/PL

/TABS00 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

TOTAL NUMBER OF STORIES IN STRUCTURE-----
NUMBER OF DIFFERENT FRAMES IN STRUCTURE-----
TOTAL NUMBER OF FRAMES IN STRUCTURE-----
TOTAL NUMBER OF STRUCTURAL LOAD CASES-----
TYPE OF ANALYSIS-----
NUMBER OF MODES CONSIDERED-----
LATERAL STORY TRANSLATION CODE-----
PRECAUTION CODE-----
FRAME JOINT RIGID ZONE MODIFICATION CODE-----
FRAME JOINT DISPLACEMENT PRINT FLAG-----
UNC LATERAL SEISMIC FORCE CODE-----
NUMBER OF STORY PASS PATTERNS-----
MASTER PEA PLOT FLAG-----

CONVERSION DATA FOR STRESSES

LENGTH CONVERSION FACTOR----- 12.000
FORCE CONVERSION FACTOR----- 1000.000

STORY PASS TYPE NUMBER-----
NUMBER OF PASS SEGMENTS-----
MASS SCALE FACTOR-----

SEGMENT SEGMENT COORDINATES OF CENTER
NUMBER PASS X Y
1 746.00 0.00 0.00

CALCULATED STORY PASS PROPERTIES

STORY PASS-----
MASS MOMENT OF INERTIA-----
X-COORDINATE OF CENTER OF MASS-----
Y-COORDINATE OF CENTER OF MASS-----

/TABS00 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

/TABS00 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

STORY PASS TYPE NUMBER-----
NUMBER OF PASS SEGMENTS-----
MASS SCALE FACTOR-----

SEGMENT SEGMENT COORDINATES OF CENTER
NUMBER PASS X Y
1 839.00 0.00 0.00

CALCULATED STORY PASS PROPERTIES

STORY PASS-----
MASS MOMENT OF INERTIA-----
X-COORDINATE OF CENTER OF MASS-----
Y-COORDINATE OF CENTER OF MASS-----

JTARSBC /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

PAGE 4
06/08/80

FRAME IDENTIFICATION NUMBER-----
NUMBER OF COLUMN LINES IN FRAME-----
NUMBER OF STORY LEVELS IN FRAME-----
NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
NUMBER OF BEAR PROPERTIES-----
NUMBER OF BEAR SPAN LOADING PATTERNS-----
MAXIMUM POINT LOADS IN ANY SPAN LOADING-----
NUMBER OF PANEL ELEMENTS IN ANY SPAN LOADING-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
FRAME PER PLOT FLAG-----
STORY CONNECTIVITY CODE-----

/FRAMES A AND C

BAY WIDTHS 36.00 36.00 24.00
SILL DEPTHS 0.00 0.00 0.00

COLUMN SECTION PROPERTY DATA

	U	E	A	I	AV	W	I
10	.150	.432000.0	.177E+01	.261E+00	1.47	1.33	1.33
2	.150	.432000.0	.253E+02	.135E+04	21.11	25.33	1.00

BEAM SECTION PROPERTY DATA

	U	E	I	K	C	DB	DA	AV	I
10	.180	.432000.0	.281E+00	.4.00	.50	1.50	0.00	1.25	1.00

BEAR LOADING DATA - - - FIXED END FORCES

ID	MCON	ML	VL	HR	VR
1	2	0.00	0.00	0.00	0.00
2	2	0.00	0.00	0.00	0.00
3	2	0.00	0.00	0.00	0.00
4	2	0.00	0.00	0.00	0.00
5	2	0.00	0.00	0.00	0.00
6	2	0.00	0.00	0.00	0.00
7	2	0.00	0.00	0.00	0.00
8	2	0.00	0.00	0.00	0.00

BEAR LOADING DATA - - - UNIFORM AND COLUMN POINT LOS

ID	WM	FL	FR
1	0.000	0.00	0.00
2	0.000	0.00	0.00

STRUCTURAL STORY DATA - - -

LEVEL	PASS TYPE	HEIGHT	K-X	K-Y	K-ROTH
10C	1	10.00	0.	0.	0.
SI-3	2	10.00	0.	0.	0.
SI-2	2	10.00	0.	0.	0.
SI-1	2	12.00	0.	0.	0.

STRUCTURAL PASS DATA - - -

LEVEL	MASS	PRI	YP
RUCF	23.108	22241.1	0.00
SI-3	26.056	25013.7	0.00
SI-2	26.056	25013.7	0.00
SI-1	26.056	25013.7	0.00

STRUCTURAL LATERAL LOAD CONDITION A - - -

LEVEL	FX	FY	X	Y
RUCF	0.00	0.00	4.80	4.80
SI-3	0.00	0.00	4.80	4.80
SI-2	0.00	0.00	4.80	4.80
SI-1	0.00	0.00	4.80	4.80

STRUCTURAL LATERAL LOAD CONDITION B - - -

LEVEL	FX	FY	X	Y
RUCF	0.00	0.00	4.80	4.80
SI-3	0.00	0.00	4.80	4.80
SI-2	0.00	0.00	4.80	4.80
SI-1	0.00	0.00	4.80	4.80

PAGE 6 /TABSD0 /SAMPLE EXAMPLE 1
04/09/81 /STATIC ANALYSIS /VERTICAL AND UBC LATERAL

/TABSD0 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

BEAM LOADING DATA . . . UNIFORM AND COLUMN POINT LOS

IO	M	WM	FL	PR
1	1	0.000	0.00	0.00
2	2	0.000	0.00	0.00
3	1	0.000	26.00	0.00
4	2	0.000	4.00	0.00
5	1	0.000	30.00	0.00
6	2	0.000	6.00	0.00

BEAM LOADING DATA . . . CONCENTRATED LOADS

IO	M	DIST	P
1	1	8.00	13.00
2	2	16.00	13.00
3	1	8.00	2.00
4	2	16.00	2.00
5	1	8.00	15.00
6	2	16.00	15.00
7	1	8.00	4.00
8	2	16.00	4.00
9	1	20.00	13.00
10	2	28.00	13.00
11	1	20.00	2.00
12	2	28.00	2.00
13	1	20.00	15.00
14	2	28.00	15.00
15	1	20.00	4.00
16	2	28.00	4.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2	3	4
ROOF	1	2	1	1
ST-3	1	2	1	1
ST-2	1	2	1	1
ST-1	1	2	1	1

INPUT/GENERATED BEAM LOCATIONS

LEVEL	1	2	3
ROOF	1	1	1
ST-3	1	1	1
ST-2	1	1	1
ST-1	1	1	1

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION I

LEVEL	1	2	3
ROOF	1	1	1
ST-3	1	1	1
ST-2	1	1	1
ST-1	1	1	1

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION II

LEVEL	1	2	3
ROOF	2	6	2
ST-3	4	8	4
ST-2	4	8	4
ST-1	4	8	4

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION III

LEVEL	1	2	3
ROOF	0	0	0
ST-3	0	0	0
ST-2	0	0	0
ST-1	0	0	0

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION IV

LEVEL	1	2	3
ROOF	0	0	0
ST-3	0	0	0
ST-2	0	0	0
ST-1	0	0	0

PAGE 8 /TABSD0 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

/FRAME 8
FRAME IDENTIFICATION NUMBER-----
NUMBER OF COLUMN LINES IN FRAME-----
NUMBER OF STORY LEVELS IN FRAME-----
NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
NUMBER OF BEAR PROPERTIES-----
NUMBER OF BEAR SPAN LOADING PATTERNS-----
MAXIMUM POINT LOADS IN ANY SPAN LOADING-----
NUMBER OF PANEL ELEMENTS IN FRAME-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
FRAME PER PLOT FLAG-----
STORY CONNECTIVITY CODE-----

RAY WIDTHS 24.00 24.00 24.00 24.00
SILL DEPTHS 0.00 0.00 0.00 0.00

COLUMN SECTION PROPERTY DATA

ID	U	E	A	I	AV	W	T
1	.150	432000.0	.177E+01	.261E+00	1.47	1.33	1.33

BEAR SECTION PROPERTY DATA

ID	U	E	I	K	C	OB	OA	AV	T
1	.180	432000.0	.281E+00	4.00	.50	1.50	0.00	1.25	1.00

BEAR LOADING DATA . . . FIXED END FORCES

ID	MCUN	ML	YL	MR	VR
1	2	0.00	0.00	0.00	0.00
2	2	0.00	0.00	0.00	0.00
3	2	0.00	0.00	0.00	0.00
4	2	0.00	0.00	0.00	0.00

BEAR LOADING DATA . . . UNIFORM AND COLUMN POINT LBS

ID	WM	FL	FR
1	0.000	0.00	0.00
2	0.000	0.00	0.00
3	0.000	0.00	0.00
4	0.000	0.00	0.00

/TABSD0 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

LEVEL 1 2 3
ST-1 0 0 0

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL	1	2	3	4
ST-1	165.26	32.00	0.00	0.00
ST-2	161.26	32.00	0.00	0.00
ST-3	161.26	32.00	0.00	0.00
ST-4	160.45	32.00	0.00	0.00

FRAME NO. 1
TIME .11

BEAM LOADING DATA . . . CONCENTRATED LOADS

ID	N	DIST	P
1	1	8.00	26.00
2	2	16.00	26.00
3	1	8.00	4.00
4	2	16.00	4.00
5	1	8.00	30.00
6	2	16.00	30.00
7	1	8.00	8.00
8	2	16.00	8.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2	3	4	5
ROOF	1	1	1	1	1
ST-3	1	1	1	1	1
ST-2	1	1	1	1	1
ST-1	1	1	1	1	1

INPUT/GENERATED BEAM LOCATIONS

LEVEL	1	2	3	4
ROOF	1	1	1	1
ST-3	1	1	1	1
ST-2	1	1	1	1
ST-1	1	1	1	1

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION I

LEVEL	1	2	3	4
ROOF	1	1	1	1
ST-3	3	3	3	3
ST-2	3	3	3	3
ST-1	3	3	3	3

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION II

LEVEL	1	2	3	4
ROOF	2	2	2	2
ST-3	4	4	4	4
ST-2	4	4	4	4
ST-1	4	4	4	4

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION III

LEVEL	1	2	3	4
ROOF	0	0	0	0
ST-3	0	0	0	0
ST-2	0	0	0	0
ST-1	0	0	0	0

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION IV

LEVEL	1	2	3	4
ROOF	0	0	0	0
ST-3	0	0	0	0
ST-2	0	0	0	0
ST-1	0	0	0	0

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-NY-LEVEL

LEVEL	1	2	3	4
ROOF	241.67	32.00	0.00	0.00
ST-3	273.67	64.00	0.00	0.00
ST-2	273.67	64.00	0.00	0.00
ST-1	276.32	64.00	0.00	0.00

FRAME NO. = 2
TIME = .11

PAGE 12 /1.0500 /SAMPLE EXAMPLE 1
04/09/81 /STATIC ANALYSIS /VERTICAL AND UBC LATERAL

/1.0500 /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND UBC LATERAL

FRAMES 1 AND 5
FRAME IDENTIFICATION NUMBER-----
NUMBER OF COLUMN LINES IN FRAME-----
NUMBER OF STORY LEVELS IN FRAME-----
NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
NUMBER OF BEAM PROPERTIES-----
NUMBER OF BEAM SPAN LOADING PATTERNS-----
NUMBER OF BEAM POINT LOADS IN ANY SPAN-----
NUMBER OF PANEL ELEMENTS IN FRAME-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
FRAME PEN PLOT FLAG-----
STORY CONNECTIVITY CODE-----

RAY WIDTHS
36.00
SILL DEPTHS
0.00

COLUMN SECTION PROPERTY DATA

	U	E	A	I	K	C	DB	DA	AV	T
10	.150	.150	.177E+01	.261E+00	1.47	1.33	1.33	1.00	1.25	1.00
2	.150	.150	.253E+02	.135E+04	21.11	25.33	1.00			

BEAM SECTION PROPERTY DATA

	U	E	I	K	C	DB	DA	AV	T
10	.140	.140	.281E+00	4.00	.50	1.50	0.00	1.25	1.00

BEAM LOADING DATA . . . FIXED END FORCES

ID	MCDM	ML	VL	MR	VR
1	0	0.00	0.00	0.00	0.00
2	0	0.00	0.00	0.00	0.00
3	0	0.00	0.00	0.00	0.00
4	0	0.00	0.00	0.00	0.00

SEAP LOADING DATA . . . UNIFORM AND COLUMN POINT LOS

ID	WM	FL	FR
1	.550	0.00	0.00
2	.080	0.00	0.00
3	.630	0.00	0.00
4	.160	0.00	0.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2
ROOF	1	2
ST-3	1	2
ST-2	1	2
ST-1	1	2

INPUT/GENERATED BEAM LOCATIONS

LEVEL	1
ROOF	1
ST-3	1
ST-2	1
ST-1	1

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION 1

LEVEL	1
ROOF	1
ST-3	1
ST-2	1
ST-1	1

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION 11

LEVEL	1
ROOF	1
ST-3	1
ST-2	1
ST-1	1

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION 111

LEVEL	1
ROOF	1
ST-3	1
ST-2	1
ST-1	1

LEVEL 1
ST-1 0
INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION IV
LEVEL 1
ROOF 0
ST-3 0
ST-2 0
ST-1 0

LEVEL 1
ST-1 0
ST-2 0
ST-3 0
ST-1 0

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL	1	II	III	IV
ROOF	72.89	3.95	0.00	0.00
ST-3	76.83	7.89	0.00	0.00
ST-2	76.83	7.89	0.00	0.00
ST-1	84.96	7.89	0.00	0.00

FRAME NO. 3
TIME .05

RAY WIDTHS
24.00 24.00

SILL DEPTHS
0.00 0.00

COLUMN SECTION PROPERTY DATA

10 1 .150 432000.0 .177E+01 .281E+00 1.47 1.33 1.33

BEAM SECTION PROPERTY DATA

10 1 .180 432000.0 .281E+00 4.00 .50 1.50 0.00 1.25 1.00

BEAM LOADING DATA . . . FIXED END FORCES

ID	1	2	3	4
VL	0.00	0.00	0.00	0.00
VR	0.00	0.00	0.00	0.00

BEAM LOADING DATA . . . UNIFORM AND COLUMN POINT LOS

ID	1	2	3	4
WL	1.100	1.160	1.250	1.320
FL	0.00	0.00	0.00	0.00

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LEVEL 1 2
ST-1 0 0

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION IV

LEVEL 1 2
ROOF 0 0
ST-1 0 0
ST-2 0 0
ST-3 0 0

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL-----VERTICAL LOAD COND-----/
10 1 11 111 1V
ROOF 72.42 7.89 0.00 0.00
ST-1 79.82 15.79 0.00 0.00
ST-2 79.82 15.79 0.00 0.00
ST-3 81.42 15.79 0.00 0.00

FRAME NO. 4
TIME .07

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FRAME LOCATION DATA

FRAME TYPE PRINT
NC TYPE CODE
1 1 C
2 1 0
3 2 C
4 3 C
5 3 C
6 4 C
7 4 0
8 4 C

X1 Y1 X2 Y2 /--FRAME LOCATION--/
-45.00 -24.00 45.00 -24.00 FRAME A
-45.00 24.00 45.00 24.00 FRAME B
-45.00 0.00 45.00 0.00 FRAME C
-48.00 -20.00 -48.00 -20.00 FRAME D
-48.00 20.00 -48.00 20.00 FRAME E
-24.00 -24.00 -24.00 -24.00 FRAME F
0.00 0.00 0.00 0.00 FRAME G
24.00 24.00 24.00 24.00 FRAME H

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INPUT/GENERATED COLUMN LOCATIONS

LEVEL 1 2 3
ROOF 1 1 1
ST-1 1 1 1
ST-2 1 1 1
ST-3 1 1 1

INPUT/GENERATED BEAM LOCATIONS

LEVEL 1 2
ROOF 1 1
ST-1 1 1
ST-2 1 1
ST-3 1 1

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION I

LEVEL 1 2
ROOF 1 1
ST-1 3 3
ST-2 2 3
ST-3 3 3

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION II

LEVEL 1 2
ROOF 2 2
ST-1 4 4
ST-2 4 4
ST-3 4 4

INPUT/GENERATED BEAM LOADS FOR LOAD CONDITION III

LEVEL 1 2
ROOF 0 0
ST-1 0 0
ST-2 0 0

MODAL PARTICIPATION FACTORS			
MODE NUMBER	MODE DIRECTION	P-FACTOR	P-FACTOR VALUE
1	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000
2	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000
3	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000
4	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000
5	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000
6	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000
7	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000
8	X	0.00000	0.00000
	Y	0.00000	0.00000
	ROT	0.00000	0.00000

MODE SHAPES			
MODE NUMBER	LEVEL	DIR	TIME PERIOD
1	1	X	-0027
2	2	Y	-0014
3	3	ROT	-1179
4	4	X	-0518
5	5	Y	-0517
6	6	ROT	-0300
7	7	X	-0268
8	8	Y	-0268
MODE SHAPES			
LEVEL	DIR	1	2
ROCF	X	0.000000	-153726
ROCF	Y	-153898	0.000000
ROCF	ROT	0.000000	0.000000
SI-3	X	0.000000	-110420
SI-3	Y	-110355	0.000000
SI-3	ROT	0.000000	0.000000
SI-2	X	0.000000	-046317
SI-2	Y	-046142	0.000000
SI-2	ROT	0.000000	0.000000
SI-1	X	0.000000	-027862
SI-1	Y	-027708	0.000000
SI-1	ROT	0.000000	0.000000
MODE SHAPES			
LEVEL	DIR	5	6
ROCF	X	-100447	0.000000
ROCF	Y	0.000000	-000000
ROCF	ROT	0.000000	-003425
SI-3	X	-005681	0.000000
SI-3	Y	-000000	-000000
SI-3	ROT	0.000000	-000000
SI-2	X	-123196	0.000000
SI-2	Y	0.000000	-000000
SI-2	ROT	0.000000	-000000
SI-1	X	-110592	0.000000
SI-1	Y	0.000000	-000000
SI-1	ROT	0.000000	-000000
MODE SHAPES			
LEVEL	DIR	7	8
ROCF	X	0.000000	0.000000
ROCF	Y	-090160	0.000000
ROCF	ROT	0.000000	0.000000
SI-3	X	0.000000	-113748
SI-3	Y	-113745	0.000000
SI-3	ROT	0.000000	0.000000
SI-2	X	0.000000	-013764
SI-2	Y	-013764	0.000000
SI-2	ROT	0.000000	0.000000
SI-1	X	0.000000	-136408
SI-1	Y	-136446	0.000000
SI-1	ROT	0.000000	0.000000

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STATIC SEISMIC LOAD CALCULATION DATA . . .
UNC 1976 (SEAD CODE)

UNC ZONE FACTOR (Z)-----
PREDOMINANT SOIL PERIOD (TS)-----
UNC IMPORTANCE FACTOR (I)-----
GRAVITATIONAL ACCELERATION-----

LOAD CONDITION A (X-DIRECTION) . . .

PJP LEVEL OF TRIANGULAR DISTRIBUTION-----
TOP LEVEL OF TRIANGULAR DISTRIBUTION-----
BOTOM LEVEL OF TRIANGULAR DISTRIBUTION-----
PERIOD OF PREDOMINANT X STRUCTURAL MODE-----
UNC STRUCTURAL SYSTEM FACTOR-----

LOAD CONDITION B (Y-DIRECTION) . . .

TJP LEVEL OF TRIANGULAR DISTRIBUTION-----
TOP LEVEL OF TRIANGULAR DISTRIBUTION-----
BOTOM LEVEL OF TRIANGULAR DISTRIBUTION-----
PERIOD OF PREDOMINANT Y STRUCTURAL MODE-----
UNC STRUCTURAL SYSTEM FACTOR-----

UNIFORM BUILDING CODE SEISMIC LOADS FOR DIRECTION X
V = Z SICK W SC=0.14 MAX

Z = 1.0000
S = 1.5000
I = 1.0000
C = -1486
K = 1.3300
W = 3263.6104
V = -18624
= 607.5725
FI= 0.0000

UNIFORM BUILDING CODE SEISMIC LOADS FOR DIRECTION Y
V = Z SICK W SC=0.14 MAX

Z = 1.0000
S = 1.5000
I = 1.0000
C = -1481
K = 1.3300
W = 3263.6104
V = -18624
= 607.5725
FI= 0.0000

STATIC LOAD CONDITION DISPLACEMENTS
DISPLACEMENTS ARE AT THE CENTERS OF MASS OF THE RESPECTIVE LEVELS

LEVEL	DIRN	LOAD CONDITIONS							
		I	II	III	IV	A	B	C	D
ROOF	X	-0.0004	-0.0001	0.0000	0.0000	-0.0000	-0.0000	-0.0000	0.0000
ROOF	Y	-0.0006	-0.0009	0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000
ROOF	ROT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ST-3	X	-0.0002	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ST-3	Y	-0.0003	-0.0006	0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000
ST-3	ROT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ST-2	X	-0.0001	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ST-2	Y	-0.0001	-0.0003	0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000
ST-2	ROT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ST-1	X	-0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ST-1	Y	-0.0005	-0.0001	0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000
ST-1	ROT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LOAD CASE DEFINITION DATA

NO	IC	I	II	III	IV	A	B	DYN-1	DYN-2	DYN-3	LOAD CASE 10
1	0	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	DEAD LOAD
2	0	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	LIVE LOAD
3	0	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	WIND-SEISMIC
4	0	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	WIND-SEISMIC

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD

DYNAMIC 1 . . . SASS MODAL COMBINATION
DYNAMIC 2 . . . ABS MODAL COMBINATION
DYNAMIC 3 . . . CDC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 . . . NOT USED
DYNAMIC 2 . . . NOT USED
DYNAMIC 3 . . . TIME HISTORY MODAL ANALYSIS

STRUCTURAL LATERAL LOAD CONDITIONS
AS ADJUSTED BY UBC SEISMIC REQUIREMENTS

STRUCTURAL LATERAL LOAD CONDITION A (X-DIRECTION). . .				
LEVEL	F _X	F _Y	X	Y
ROOF	219.55	0.00	4.20	4.80
51-3	188.13	0.00	4.20	4.80
51-2	129.34	0.00	4.20	4.80
51-1	70.55	0.00	4.20	4.80
STRUCTURAL LATERAL LOAD CONDITION B (Y-DIRECTION). . .				
LEVEL	F _X	F _Y	X	Y
ROOF	0.00	219.55	4.20	4.80
51-3	0.00	188.13	4.20	4.80
51-2	0.00	129.34	4.20	4.80
51-1	0.00	70.55	4.20	4.80

ATC-001 SHAPE DISPLACEMENTS IN FRAME 4

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

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COLUMN FORCES AT LEVEL ST-2 IN FRAME 4

STATSOO / SAMPLE EXAMPLE 1
STATIC ANALYSIS / VERTICAL AND UNC LATERAL
CORRES AT LEVEL ST-1 IN FRAME 4

[illegible]

2-10-66 4 10-66 11-1 IN FRAME 4

FLOOR	FORCES AT LEVEL 30-1										FORCES AT LEVEL 30-2									
	BEAM NO	IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	LEFT SHEAR	RIGHT SHEAR	BEAM NO	IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	LEFT SHEAR	RIGHT SHEAR								
30	1	/DEAD LOAD	-59.11	60.90	-16.15	-17.28	1	/DEAD LOAD	-58.37	60.34	-16.37	-16.98								
	1	/LIVE LOAD	-11.08	14.56	-3.75	-3.75	1	/LIVE LOAD	-12.69	13.99	-3.75	-3.68								
	1	/W-SEISMIC	-0.23	-0.21	-0.02	0.02	1	/W-SEISMIC	-0.28	-0.27	-0.02	0.02								
	1	/V-SEISMIC	5.81	-0.21	0.49	-0.49	1	/V-SEISMIC	7.16	6.80	0.62	-0.62								
29	1	/DEAD LOAD	-67.28	53.71	-17.12	-16.12	2	/DEAD LOAD	-65.03	57.64	-17.04	-16.39								
	2	/LIVE LOAD	-14.63	11.61	-3.76	-3.49	2	/LIVE LOAD	-14.09	12.58	-3.69	-3.56								
	2	/W-SEISMIC	-0.23	-0.21	-0.02	0.02	2	/W-SEISMIC	-0.27	-0.28	-0.02	0.02								
	2	/V-SEISMIC	5.40	-0.21	0.49	-0.49	2	/V-SEISMIC	6.80	7.16	0.62	-0.62								

FRAMES / SAMPLE EXAMPLE 1
/ STATIC ANALYSIS / VERTICAL AND UBC LATERAL

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COLUMN FORCES AT LEVEL ST-3 IN FRAME 4

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/DEAD LOAD	27.70	24.63	-39.42	-1.16
1	/LIVE LOAD	6.16	6.26	-5.98	-1.48
1	/X-SEISMIC	0.15	0.12	-0.05	-0.03
1	/Y-SEISMIC	-3.95	-3.08	1.19	0.03
2	/DEAD LOAD	0.43	0.30	-73.57	-0.09
2	/LIVE LOAD	0.07	0.05	-11.75	-0.01
2	/X-SEISMIC	0.27	0.23	0.00	-0.06
2	/Y-SEISMIC	-6.99	-5.88	0.00	1.51
3	/DEAD LOAD	-27.18	-24.36	-39.26	6.06
3	/LIVE LOAD	-6.28	-6.22	-5.95	1.47
3	/X-SEISMIC	0.15	0.12	0.05	-0.03
3	/Y-SEISMIC	-3.95	-3.08	-1.19	0.03

MEAN FORCES AT LEVEL ST-3 IN FRAME 4

MEAN FORCES AT LEVEL ROOF IN FRAME 4

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/DEAD LOAD	36.88	42.31	-14.54	-9.12
1	/LIVE LOAD	6.35	5.27	-1.99	-1.17
1	/X-SEISMIC	0.16	0.19	-0.02	-0.04
1	/Y-SEISMIC	-3.98	-4.90	0.51	1.04
2	/DEAD LOAD	0.56	0.60	-35.41	-0.14
2	/LIVE LOAD	0.09	0.10	-10.92	-0.02
2	/X-SEISMIC	0.30	0.35	0.00	-0.08
2	/Y-SEISMIC	-7.69	-8.82	0.00	1.94
3	/DEAD LOAD	-36.25	-41.64	-18.47	9.16
3	/LIVE LOAD	-6.25	-5.16	-1.98	1.34
3	/X-SEISMIC	0.16	0.19	0.02	-0.04
3	/Y-SEISMIC	-3.98	-4.90	-0.51	1.04

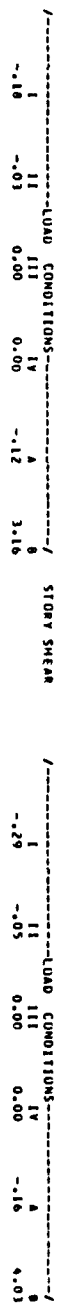
MEAN FORCES AT LEVEL ROOF IN FRAME 4

MEAN NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/DEAD LOAD	-59.73	63.95	33.42	-16.76	-16.86
1	/LIVE LOAD	-12.27	13.09	7.01	-1.76	-1.90
1	/X-SEISMIC	-0.31	0.29	-0.01	-0.03	0.03
1	/Y-SEISMIC	7.89	7.46	0.19	0.60	-0.60
2	/DEAD LOAD	-64.29	58.75	33.26	-16.96	-16.47
2	/LIVE LOAD	-14.19	12.31	7.32	-1.71	-1.54
2	/X-SEISMIC	-0.29	0.31	0.01	-0.03	0.03
2	/Y-SEISMIC	7.46	7.85	-0.19	0.60	-0.60

STORY SHEAR

STORY SHEAR

FRAME NO. = 1
STRESS TIME = .20



LATERAL FRAME DISPLACEMENTS IN FRAME A			
LEVEL	/DEAD LOAD	/LIVE LOAD	/X-SEISMIC
40CF	-.000007	-.000007	.000422
SI-3	-.000004	-.000004	.000303
SI-2	-.000002	-.000002	.000183
SI-1	-.000001	-.000001	.000078

FORCES AT LEVEL ST-1 IN FRAME A			
COLUMN	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT
1	/DEAD LOAD	16.84	28.88
1	/LIVE LOAD	5.01	6.97
1	/X-SEISMIC	-5.59	-1.72
1	/Y-SEISMIC	-.24	-.07
2	/DEAD LOAD	34.78	-37.18
2	/LIVE LOAD	6.73	-7.23
2	/X-SEISMIC	-8672.44	9454.67
2	/Y-SEISMIC	-370.49	243.34
3	/DEAD LOAD	1.31	2.23
3	/LIVE LOAD	1.32	1.54
3	/X-SEISMIC	-6.45	-3.20
3	/Y-SEISMIC	-.27	-.14
4	/DEAD LOAD	-17.26	-29.63
4	/LIVE LOAD	-4.10	-7.04
4	/X-SEISMIC	-5.25	-1.15
4	/Y-SEISMIC	-.22	-.05

AXIAL FORCES			
COLUMN	AXIAL FORCE	TOP MOMENT	BOTTOM MOMENT
1	-75.89	28.88	16.84
1	-13.31	6.97	5.01
1	3.27	-1.72	-5.59
1	.14	-.07	-.24
2	-416.47	-37.18	34.78
2	-56.89	-7.23	6.73
2	287.41	9454.67	-8672.44
2	12.11	243.34	-370.49
3	-34	2.23	1.31
3	-28.23	1.54	1.32
3	-.92	-3.20	-6.45
3	-.04	-.14	-.27
4	9.47	-29.63	-17.26
4	13.57	-7.04	-4.10
4	-2.01	-1.15	-5.25
4	-.09	-.05	-.22

FORCES AT LEVEL ST-1 IN FRAME A			
BEAM	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT
1	/DEAD LOAD	-70.04	91.35
1	/LIVE LOAD	-16.54	21.56
1	/X-SEISMIC	7.12	6.79
1	/Y-SEISMIC	.30	.29
2	/DEAD LOAD	-85.69	82.96
2	/LIVE LOAD	-20.16	19.66
2	/X-SEISMIC	6.49	6.48
2	/Y-SEISMIC	.28	.28
3	/DEAD LOAD	-88.46	72.23
3	/LIVE LOAD	-20.93	17.00
3	/X-SEISMIC	4.77	5.45
3	/Y-SEISMIC	.20	.22

SPIN MOMENTS			
BEAM	SPIN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	65.75	-16.61	-18.49
1	11.18	-3.78	-4.22
1	.17	.61	.61
1	-.01	.03	-.03
2	90.19	-17.57	-17.43
2	9.52	-4.02	-3.98
2	-.01	.57	.57
2	-.00	.02	-.02
3	45.27	-18.27	-16.83
3	11.07	-4.17	-3.83
3	-.24	.44	.44
3	-.01	.02	-.02

LOAD CONDITIONS			
STORY	1	2	3
1	.00	.00	.00
2	.00	.00	.00
3	.00	.00	.00
4	.00	.00	.00
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10	.00	.00	.00
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30	.00	.00	.00
31	.00	.00	.00
32	.00	.00	.00
33	.00	.00	.00
34	.00	.00	.00
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36	.00	.00	.00
37	.00	.00	.00
38	.00	.00	.00
39	.00	.00	.00
40	.00	.00	.00
41	.00	.00	.00
42	.00	.00	.00
43	.00	.00	.00
44	.00	.00	.00
45	.00	.00	.00
46	.00	.00	.00
47	.00	.00	.00
48	.00	.00	.00
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50	.00	.00	.00
51	.00	.00	.00
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67	.00	.00	.00
68	.00	.00	.00
69	.00	.00	.00
70	.00	.00	.00
71	.00	.00	.00
72	.00	.00	.00
73	.00	.00	.00
74	.00	.00	.00
75	.00	.00	.00
76	.00	.00	.00
77	.00	.00	.00
78	.00	.00	.00
79	.00	.00	.00
80	.00	.00	.00
81	.00	.00	.00
82	.00	.00	.00
83	.00	.00	.00
84	.00	.00	.00
85	.00	.00	.00
86	.00	.00	.00
87	.00	.00	.00
88	.00	.00	.00
89	.00	.00	.00
90	.00	.00	.00
91	.00	.00	.00
92	.00	.00	.00
93	.00	.00	.00
94	.00	.00	.00
95	.00	.00	.00
96	.00	.00	.00
97	.00	.00	.00
98	.00	.00	.00
99	.00	.00	.00
100	.00	.00	.00

COLUMN	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE	COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/DEAD LOAD	45.07	36.07	-56.09	-9.71	1	/DEAD LOAD	33.82	30.34	-36.57	-7.55
1	/LIVE LOAD	10.62	8.37	-9.53	-2.23	1	/LIVE LOAD	8.49	8.42	-5.68	-1.94
1	/W-SEISMIC	-4.76	-3.00	2.66	.98	1	/W-SEISMIC	-4.96	-3.95	1.82	1.05
1	/W-SEISMIC	-2.21	-2.15	-11	.04	1	/W-SEISMIC	-2.21	-2.17	.08	.05
2	/DEAD LOAD	21.47	-24.49	-304.71	.36	2	/DEAD LOAD	17.28	-17.07	-200.66	.08
2	/LIVE LOAD	3.49	-5.17	-60.65	27.17	2	/LIVE LOAD	2.53	-2.50	-24.83	.25
2	/W-SEISMIC	-5351.80	3112.13	-112	10.70	2	/W-SEISMIC	-2274.23	1145.42	189.24	.75
2	/W-SEISMIC	-226.39	137.91	-201	.01	2	/W-SEISMIC	-121.05	51.94	.00	0.13
3	/DEAD LOAD	3.32	2.47	-109.79	-.88	3	/DEAD LOAD	1.70	1.34	-71.91	-.37
3	/LIVE LOAD	.76	.50	-20.07	-.15	3	/LIVE LOAD	.47	.51	-12.04	-.12
3	/W-SEISMIC	-7.35	-5.90	-97	1.56	3	/W-SEISMIC	-7.51	-6.42	-.71	1.44
3	/W-SEISMIC	-.32	-.25	-.04	.07	3	/W-SEISMIC	-.32	-.28	-.03	.07
4	/DEAD LOAD	-47.10	-38.28	-57.18	10.04	4	/DEAD LOAD	-35.21	-31.50	-37.37	7.85
4	/LIVE LOAD	-10.92	-8.65	-9.74	2.30	4	/LIVE LOAD	-8.78	-8.68	-5.83	2.05
4	/W-SEISMIC	-3.48	-2.23	-1.57	.67	4	/W-SEISMIC	-3.55	-2.82	-1.02	.75
4	/W-SEISMIC	-.15	-.09	-.07	.03	4	/W-SEISMIC	-.15	-.12	-.04	.03

MEAN FORCES AT LEVEL ST-3 IN FRAME A

MEAN FORCES AT LEVEL ST-2 IN FRAME A

BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR	BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/DEAD LOAD	-17.44	21.05	93.70	-15.84	-18.24	1	/DEAD LOAD	-74.53	19.52	13.43	-16.86	-18.11
1	/LIVE LOAD	-17.44	21.05	10.59	-3.95	-4.15	1	/LIVE LOAD	-17.13	21.33	10.85	-3.81	-4.19
1	/W-SEISMIC	9.48	9.52	-.02	.84	-.84	1	/W-SEISMIC	10.78	10.47	-.04	.95	-.95
1	/W-SEISMIC	.41	.41	-.00	.04	-.04	1	/W-SEISMIC	.47	.47	-.04	.04	-.04
2	/DEAD LOAD	-97.21	81.19	40.44	-17.82	-17.29	2	/DEAD LOAD	-88.16	80.12	40.42	-17.91	-17.20
2	/LIVE LOAD	-20.49	19.25	9.69	-4.05	-3.95	2	/LIVE LOAD	-20.61	19.17	9.71	-4.04	-3.94
2	/W-SEISMIC	9.28	8.94	.17	.80	-.80	2	/W-SEISMIC	10.40	10.16	.22	.92	-.92
2	/W-SEISMIC	.40	.38	.01	.03	-.03	2	/W-SEISMIC	.46	.44	.01	.04	-.04
3	/DEAD LOAD	-86.03	77.15	43.23	-17.94	-17.16	3	/DEAD LOAD	-85.33	78.42	42.81	-17.86	-17.25
3	/LIVE LOAD	-20.34	18.28	10.39	-4.09	-3.91	3	/LIVE LOAD	-20.42	17.94	10.60	-4.11	-3.89
3	/W-SEISMIC	5.91	6.42	-.26	.54	-.54	3	/W-SEISMIC	6.53	7.02	-.24	.60	-.60
3	/W-SEISMIC	.25	.28	-.01	.02	-.02	3	/W-SEISMIC	.28	.30	-.01	.03	-.03

STORY SHEAR	LOAD CONDITIONS	STORY SHEAR	LOAD CONDITIONS
.01	11 111 1111	.01	11 111 1111
.00	0.00 0.00 0.00	.00	0.00 0.00 0.00
254.95	A 10.84	192.67	A 0.28

TABLED /SAMPLE EXAMPLE 1
/STATIC ANALYSIS /VERTICAL AND URC LATERAL
FORCES AT LEVEL ROOF IN FRAME A

SUPMARY OF STORY SHEAR DISTRIBUTION
STORY-BY-STORY / FRAME-BY-FRAME

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE	LOAD CONDITIONS				
						ST-1	ST-2	ST-3	ROOF	
1	DEAD LOAD	44.09	49.87	-17.03	-11.05	.00	.00	.00	.00	.00
1	LIVE LOAD	8.27	6.64	-1.87	-1.75	.00	.00	.00	.00	.00
1	W-SEISMIC	-5.59	-7.48	.86	1.57	.00	.00	.00	.00	.00
1	W-SEISMIC	-2.26	-1.32	.04	.07	.00	.00	.00	.00	.00
2	DEAD LOAD	12.86	-16.23	-96.55	.40	.00	.00	.00	.00	.00
2	LIVE LOAD	.78	-1.08	-8.20	.04	.00	.00	.00	.00	.00
2	W-SEISMIC	-926.93	101.72	-2.04	96.85	.00	.00	.00	.00	.00
2	W-SEISMIC	-61.69	4.73	-2.00	96.85	.00	.00	.00	.00	.00
3	DEAD LOAD	3.76	5.40	-34.71	-1.08	.00	.00	.00	.00	.00
3	LIVE LOAD	.68	.68	-3.99	.25	.00	.00	.00	.00	.00
3	W-SEISMIC	-8.83	-10.32	-2.19	2.25	.00	.00	.00	.00	.00
3	W-SEISMIC	-3.38	-2.45	-2.02	.10	.00	.00	.00	.00	.00
4	DEAD LOAD	-46.62	-53.28	-17.47	11.75	.00	.00	.00	.00	.00
4	LIVE LOAD	-8.76	-7.24	-1.94	1.88	.00	.00	.00	.00	.00
4	W-SEISMIC	-3.47	-6.22	-2.42	.90	.00	.00	.00	.00	.00
4	W-SEISMIC	-1.15	-2.16	-2.02	.04	.00	.00	.00	.00	.00
FORCES AT LEVEL ROOF IN FRAME A										
1	DEAD LOAD	.40	.44	-2.02	.04	.00	.00	.00	.00	.00
1	W-SEISMIC	.40	.44	-2.02	.04	.00	.00	.00	.00	.00
2	DEAD LOAD	-71.45	71.40	35.37	-15.83	.00	.00	.00	.00	.00
2	LIVE LOAD	-10.71	9.23	4.96	-2.07	.00	.00	.00	.00	.00
2	W-SEISMIC	9.98	8.55	.72	.42	.00	.00	.00	.00	.00
2	W-SEISMIC	.43	.37	.03	.04	.00	.00	.00	.00	.00
3	DEAD LOAD	-77.73	61.06	41.62	-16.29	.00	.00	.00	.00	.00
3	LIVE LOAD	-10.01	8.77	5.46	-2.04	.00	.00	.00	.00	.00
3	W-SEISMIC	6.32	5.24	.42	.02	.00	.00	.00	.00	.00
3	W-SEISMIC	.19	.23	-.02	-.02	.00	.00	.00	.00	.00

STORY SHEAR	LOAD CONDITIONS				
	I	II	III	IV	R
1	.02	.00	.00	.00	6.55
2	.02	.00	.00	.00	101.58
3	.02	.00	.00	.00	6.55

STRESSES AT LEVEL ST-1 IN FRAME 4

STRESSES AT LEVEL ST-1 IN FRAME 4

STRESSES AT LEVEL ST-1 IN FRAME 4

STRESSES AT LEVEL ST-2 IN FRAME 4

STRESSES AT LEVEL ST-2 IN FRAME 4

STRESSES AT LEVEL ST-2 IN FRAME 4

CONP	LOAD	IDENTIFICATION	STRESS	TOP-BEND	AXIAL	SHEAR	COLP	LOAD	IDENTIFICATION	STRESS	TOP-BEND	AXIAL	SHEAR
1	DEAD LOAD	1	238.69	405.34	-318.75	-18.32	1	DEAD LOAD	1	651.26	528.84	-238.75	-18.32
1	LIVE LOAD	1	52.16	98.41	-94.54	-3.97	1	LIVE LOAD	1	139.09	110.20	-39.09	-3.97
1	W-SEISMIC	1	3.95	-22.18	-9.03	-1.12	1	W-SEISMIC	1	2.69	-4.73	-1.14	-1.14
1	W-SEISMIC	1	-101.63	-22.18	9.03	3.14	1	W-SEISMIC	1	-68.91	-44.44	7.09	3.55
2	DEAD LOAD	2	2.67	-42	-594.21	-0.08	2	DEAD LOAD	2	6.21	3.40	-439.35	-0.31
2	LIVE LOAD	2	6.44	21.08	-107.55	-0.17	2	LIVE LOAD	2	1.02	-61	-76.77	-0.05
2	W-SEISMIC	2	6.44	21.08	-107.55	-0.17	2	W-SEISMIC	2	4.89	3.66	-60	-0.27
2	W-SEISMIC	2	-120.00	-53.71	-60	6.40	2	W-SEISMIC	2	-124.34	-94.09	-60	6.83
3	DEAD LOAD	3	-234.46	-406.40	-317.75	16.24	3	DEAD LOAD	3	-643.14	-526.26	-235.44	36.60
3	LIVE LOAD	3	-51.47	-88.98	-54.40	3.56	3	LIVE LOAD	3	-137.75	-109.74	-39.01	7.74
3	W-SEISMIC	3	3.95	-22.18	-9.03	-1.12	3	W-SEISMIC	3	2.69	1.73	-28	-1.14
3	W-SEISMIC	3	-101.63	-22.18	9.03	3.14	3	W-SEISMIC	3	-68.91	-44.44	-2.69	3.55

STRESSES AT LEVEL ST-1 IN FRAME 4

STRESSES AT LEVEL ST-1 IN FRAME 4

STRESSES AT LEVEL ST-1 IN FRAME 4

STRESSES AT LEVEL ST-2 IN FRAME 4

STRESSES AT LEVEL ST-2 IN FRAME 4

STRESSES AT LEVEL ST-2 IN FRAME 4

CONP	LOAD	IDENTIFICATION	STRESS	TOP-BEND	AXIAL	SHEAR	COLP	LOAD	IDENTIFICATION	STRESS	TOP-BEND	AXIAL	SHEAR
1	DEAD LOAD	1	238.69	405.34	-318.75	-18.32	1	DEAD LOAD	1	651.26	528.84	-238.75	-18.32
1	LIVE LOAD	1	52.16	98.41	-94.54	-3.97	1	LIVE LOAD	1	139.09	110.20	-39.09	-3.97
1	W-SEISMIC	1	3.95	-22.18	-9.03	-1.12	1	W-SEISMIC	1	2.69	-4.73	-1.14	-1.14
1	W-SEISMIC	1	-101.63	-22.18	9.03	3.14	1	W-SEISMIC	1	-68.91	-44.44	7.09	3.55
2	DEAD LOAD	2	2.67	-42	-594.21	-0.08	2	DEAD LOAD	2	6.21	3.40	-439.35	-0.31
2	LIVE LOAD	2	6.44	21.08	-107.55	-0.17	2	LIVE LOAD	2	1.02	-61	-76.77	-0.05
2	W-SEISMIC	2	6.44	21.08	-107.55	-0.17	2	W-SEISMIC	2	4.89	3.66	-60	-0.27
2	W-SEISMIC	2	-120.00	-53.71	-60	6.40	2	W-SEISMIC	2	-124.34	-94.09	-60	6.83
3	DEAD LOAD	3	-234.46	-406.40	-317.75	16.24	3	DEAD LOAD	3	-643.14	-526.26	-235.44	36.60
3	LIVE LOAD	3	-51.47	-88.98	-54.40	3.56	3	LIVE LOAD	3	-137.75	-109.74	-39.01	7.74
3	W-SEISMIC	3	3.95	-22.18	-9.03	-1.12	3	W-SEISMIC	3	2.69	1.73	-28	-1.14
3	W-SEISMIC	3	-101.63	-22.18	9.03	3.14	3	W-SEISMIC	3	-68.91	-44.44	-2.69	3.55

COLUMN STRESSES AT LEVEL 51-3 IN FRAME 4

COLUMN	LOAD IDENTIFICATION	BEAM-BEND STRESS	TOP-BEND STRESS	LT-BEND STRESS	RT-BEND STRESS	LT-SHEAR STRESS	RT-SHEAR STRESS
1	/DEAD LOAD	112.44	110.67	112.44	110.67	-19.00	-19.00
1	/LIVE LOAD	112.44	110.67	112.44	110.67	-19.00	-19.00
1	/W-SEISPIC	2.23	2.12	2.23	2.12	-1.15	-1.15
1	/T-SEISPIC	-69.95	-54.63	-69.95	-54.63	3.90	3.90
2	/DEAD LOAD	7.60	5.31	7.60	5.31	-0.90	-0.90
2	/LIVE LOAD	1.20	0.84	1.20	0.84	-0.06	-0.06
2	/W-SEISPIC	4.60	4.06	4.60	4.06	-0.28	-0.28
2	/T-SEISPIC	-122.68	-104.13	-122.68	-104.13	7.10	7.10
3	/DEAD LOAD	-481.35	-431.48	-481.35	-431.48	28.37	28.37
3	/LIVE LOAD	-111.23	-110.12	-111.23	-110.12	6.93	6.93
3	/W-SEISPIC	2.73	2.12	2.73	2.12	-0.15	-0.15
3	/T-SEISPIC	-69.95	-54.63	-69.95	-54.63	3.90	3.90

BEAM STRESSES AT LEVEL 51-3 IN FRAME 4

BEAM	LOAD IDENTIFICATION	LT-BEND STRESS	RT-BEND STRESS	LT-SHEAR STRESS	RT-SHEAR STRESS	SP-BEND STRESS	LT-SHEAR STRESS	RT-SHEAR STRESS
1	/DEAD LOAD	-990.05	1057.11	-990.05	1057.11	731.32	-990.05	1057.11
1	/LIVE LOAD	-205.72	234.77	-205.72	234.77	160.98	-205.72	234.77
1	/W-SEISPIC	-5.69	-5.41	-5.69	-5.41	3.60	-5.69	-5.41
1	/T-SEISPIC	145.44	138.23	145.44	138.23	3.60	145.44	138.23
2	/DEAD LOAD	-1074.43	571.84	-1074.43	571.84	731.98	-1074.43	571.84
2	/LIVE LOAD	-237.23	202.82	-237.23	202.82	160.71	-237.23	202.82
2	/W-SEISPIC	-5.41	-5.69	-5.41	-5.69	3.60	-5.41	-5.69
2	/T-SEISPIC	138.23	145.44	138.23	145.44	3.60	138.23	145.44

BEAM STRESSES AT LEVEL RCDF IN FRAME 4

BEAM	LOAD IDENTIFICATION	LT-BEND STRESS	RT-BEND STRESS	LT-SHEAR STRESS	RT-SHEAR STRESS	SP-BEND STRESS	LT-SHEAR STRESS	RT-SHEAR STRESS
1	/DEAD LOAD	-760.30	1008.98	-760.30	1008.98	694.10	-760.30	1008.98
1	/LIVE LOAD	-101.08	114.60	-101.08	114.60	82.07	-101.08	114.60
1	/W-SEISPIC	-4.45	-4.01	-4.45	-4.01	5.94	-4.45	-4.01
1	/T-SEISPIC	113.42	102.34	113.42	102.34	5.94	113.42	102.34
2	/DEAD LOAD	-1023.10	744.60	-1023.10	744.60	695.51	-1023.10	744.60
2	/LIVE LOAD	-117.86	98.57	-117.86	98.57	82.25	-117.86	98.57
2	/W-SEISPIC	-4.01	-4.45	-4.01	-4.45	5.94	-4.01	-4.45
2	/T-SEISPIC	102.34	113.42	102.34	113.42	5.94	102.34	113.42

STRESSES AT LEVEL ST-1 IN FRAPPE A									
COLUMN	LOAD IDENTIFICATION	BCI-BEND STRESS	TOP-BEND STRESS	AXIAL STRESS	SHEAR STRESS	COLUMN NO	LOAD IDENTIFICATION	BCI-BEND STRESS	TOP-BEND STRESS
1	/DEAD LOAD	290.31	211.91	-297.92	-20.92	1	/DEAD LOAD	800.97	632.94
1	/LIVE LOAD	70.95	121.08	-52.26	-4.28	1	/LIVE LOAD	18.44	10.43
1	/W-SEISMIC	-98.96	-30.50	12.63	3.28	1	/W-SEISMIC	-84.39	-43.61
1	/W-SEISMIC	-4.19	-1.28	.55	.16	1	/W-SEISMIC	-3.64	-2.73
2	/DEAD LOAD	2.26	-2.41	-114.18	.08	2	/DEAD LOAD	1.39	-1.59
2	/LIVE LOAD	.44	-.48	-15.60	.02	2	/LIVE LOAD	.23	-.27
2	/W-SEISMIC	-93.20	367.22	-.04	94.95	2	/W-SEISMIC	-341.06	202.10
2	/W-SEISMIC	-24.66	15.80	-.00	3.88	2	/W-SEISMIC	-14.70	8.79
3	/DEAD LOAD	23.22	39.55	-583.66	-1.59	3	/DEAD LOAD	58.79	43.79
3	/LIVE LOAD	4.24	6.24	-110.61	-.38	3	/LIVE LOAD	13.09	8.77
3	/W-SEISMIC	-114.27	-6.94	-4.33	4.33	3	/W-SEISMIC	-130.10	-104.48
3	/W-SEISMIC	-4.84	-2.39	-.19	.18	3	/W-SEISMIC	-5.59	-6.47
4	/DEAD LOAD	-305.72	-324.78	-303.66	21.04	4	/DEAD LOAD	-894.11	-678.02
4	/LIVE LOAD	-72.59	-124.60	-53.27	5.00	4	/LIVE LOAD	-193.36	-153.11
4	/W-SEISMIC	-93.04	-70.34	-7.88	2.87	4	/W-SEISMIC	-81.56	-59.49
4	/W-SEISMIC	-3.94	-.44	-.34	.12	4	/W-SEISMIC	-2.66	-1.88
STRESSES AT LEVEL ST-2 IN FRAPPE A									
BEAM	LOAD IDENTIFICATION	LT-BEND STRESS	RT-BEND STRESS	AXIAL STRESS	SHEAR STRESS	BEAM NO	LOAD IDENTIFICATION	LT-BEND STRESS	RT-BEND STRESS
1	/DEAD LOAD	-1175.08	1587.84	969.03	-92.28	1	/DEAD LOAD	-1249.28	1537.54
1	/LIVE LOAD	-178.44	371.51	234.81	-20.99	1	/LIVE LOAD	-299.18	362.03
1	/W-SEISMIC	131.91	124.71	3.10	3.41	1	/W-SEISMIC	175.59	176.22
1	/W-SEISMIC	5.64	5.38	.13	.15	1	/W-SEISMIC	7.54	7.57
2	/DEAD LOAD	-1464.91	1414.44	866.09	-98.17	2	/DEAD LOAD	-1493.03	1391.72
2	/LIVE LOAD	-345.58	316.29	204.64	-22.10	2	/LIVE LOAD	-351.83	328.76
2	/W-SEISMIC	120.45	120.06	.69	3.18	2	/W-SEISMIC	171.90	165.60
2	/W-SEISMIC	5.15	5.13	.01	.14	2	/W-SEISMIC	7.39	7.12
3	/DEAD LOAD	-1510.36	1215.74	960.22	-101.48	3	/DEAD LOAD	-1471.23	1306.77
3	/LIVE LOAD	-359.80	287.02	232.77	-23.19	3	/LIVE LOAD	-348.88	310.77
3	/W-SEISMIC	88.27	97.13	-4.43	2.45	3	/W-SEISMIC	109.37	118.94
3	/W-SEISMIC	3.76	4.14	-.19	.10	3	/W-SEISMIC	4.69	5.11
STRESSES AT LEVEL ST-2 IN FRAPPE A									
BEAM	LOAD IDENTIFICATION	LT-BEND STRESS	RT-BEND STRESS	AXIAL STRESS	SHEAR STRESS	BEAM NO	LOAD IDENTIFICATION	LT-BEND STRESS	RT-BEND STRESS
1	/DEAD LOAD	-1249.28	1537.54	931.17	-91.69	1	/DEAD LOAD	-1249.28	1537.54
1	/LIVE LOAD	-299.18	362.03	223.82	-21.39	1	/LIVE LOAD	-299.18	362.03
1	/W-SEISMIC	175.59	176.22	-.32	4.66	1	/W-SEISMIC	175.59	176.22
1	/W-SEISMIC	7.54	7.57	-.62	.20	1	/W-SEISMIC	7.54	7.57
2	/DEAD LOAD	-1493.03	1391.72	870.49	-98.98	2	/DEAD LOAD	-1493.03	1391.72
2	/LIVE LOAD	-351.83	328.76	207.17	-22.52	2	/LIVE LOAD	-351.83	328.76
2	/W-SEISMIC	171.90	165.60	3.15	4.97	2	/W-SEISMIC	171.90	165.60
2	/W-SEISMIC	7.39	7.12	.14	.19	2	/W-SEISMIC	7.39	7.12
3	/DEAD LOAD	-1471.23	1306.77	922.48	-99.68	3	/DEAD LOAD	-1471.23	1306.77
3	/LIVE LOAD	-348.88	310.77	220.23	-21.72	3	/LIVE LOAD	-348.88	310.77
3	/W-SEISMIC	109.37	118.94	-4.78	3.02	3	/W-SEISMIC	109.37	118.94
3	/W-SEISMIC	4.69	5.11	-.21	.13	3	/W-SEISMIC	4.69	5.11

STRESSES AT LEVEL ST-3 IN FRAME A									
COLUMN	LOAD	IDENTIFICATION	BCI-BEND	TOP-BEND	AXIAL	SHEAR	BCI-BEND	TOP-BEND	AXIAL
NO	IDENTIFICATION	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS
1	DEAD LOAD	599.06	537.38	143.59	-35.56	-93.87	790.87	883.24	-66.86
1	LIVE LOAD	150.43	149.05	-22.31	-9.37	-9.37	146.49	117.64	-7.34
1	SEISMIC	-87.84	-69.93	7.13	9.94	-21	-104.34	-132.45	3.39
1	SEISMIC	-3.79	-2.99	.31	.21	.21	-4.54	-5.73	.32
2	DEAD LOAD	1.12	-1.17	-55.01	.03	.03	.83	-1.06	-26.47
2	LIVE LOAD	.16	.19	-8.70	.02	.02	.05	-.07	-2.25
2	SEISMIC	-180.15	75.70	-.02	62.26	62.26	-60.20	6.74	-1.01
2	SEISMIC	-74.86	3.37	-.00	2.46	2.46	-2.71	.31	-1.43
3	DEAD LOAD	31.44	23.82	-282.31	-1.73	-1.73	66.59	95.62	-134.28
3	LIVE LOAD	8.32	9.03	-47.26	-.54	-.54	-12.12	12.06	-15.67
3	SEISMIC	-132.98	-113.62	-2.40	7.72	7.72	-156.71	-182.44	-1.55
3	SEISMIC	-5.73	-4.87	-.12	.33	.33	-6.79	-7.91	-.07
4	DEAD LOAD	-623.54	-557.80	-348.70	36.97	36.97	-825.64	-593.61	-68.58
4	LIVE LOAD	-155.56	-153.79	-22.50	9.68	9.68	-155.09	-128.27	-7.63
4	SEISMIC	-62.83	-49.96	-4.01	3.53	3.53	-61.47	-74.70	-1.66
4	SEISMIC	-2.71	-2.13	-.17	.15	.15	-2.69	-3.24	-.07

STRESSES AT LEVEL ST-3 IN FRAME A									
BEAM	LOAD	IDENTIFICATION	LT-BEND	RT-BEND	SP-BEND	LT-SHEAR	RT-SHEAR	SP-BEND	LT-SHEAR
NO	IDENTIFICATION	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS	STRESS
1	DEAD LOAD	-1288.22	1535.87	926.13	-93.83	-101.18	-665.54	1437.51	895.45
1	LIVE LOAD	-289.52	367.29	228.65	-21.19	-23.25	-134.84	190.09	118.55
1	SEISMIC	199.56	201.22	-.82	5.30	-5.30	171.56	190.56	-9.50
1	SEISMIC	8.61	8.66	-.03	.23	-.23	7.43	8.24	-.41
2	DEAD LOAD	-1510.74	1361.75	874.11	-99.47	-95.53	-1333.65	1214.17	762.52
2	LIVE LOAD	-353.84	321.14	207.54	-22.54	-21.87	-184.52	157.08	105.71
2	SEISMIC	196.38	186.19	6.09	5.09	-5.09	184.80	156.37	13.26
2	SEISMIC	8.47	8.12	.18	.22	-.22	7.99	8.65	.57
3	DEAD LOAD	-1458.35	1330.29	914.68	-99.20	-95.81	-1331.53	1022.59	878.67
3	LIVE LOAD	-350.31	304.36	224.10	-22.83	-21.61	-172.64	146.59	115.29
3	SEISMIC	120.92	129.96	-4.52	3.32	-3.32	79.98	98.01	-9.02
3	SEISMIC	5.22	5.61	-.20	.14	-.14	3.47	4.25	-.39

```

/STATISTICS /SAMPLE EXAMPLE 1
/ANALYSIS /VERTICAL ANAL AG UBC LATERAL

```

POUR FRAME STIFFNESSES.....	0.82
SOLVE STATIC LOAD CASES.....	0.03
SOLVE SCAPES AND FREQUENCIES.....	0.17
COMPUTE FRAME DISPLACEMENTS.....	0.00
MEMBER FORCES AND STRESSES.....	2.11
TOTAL TIME.....	3.13

B. Example 2

(i) Description

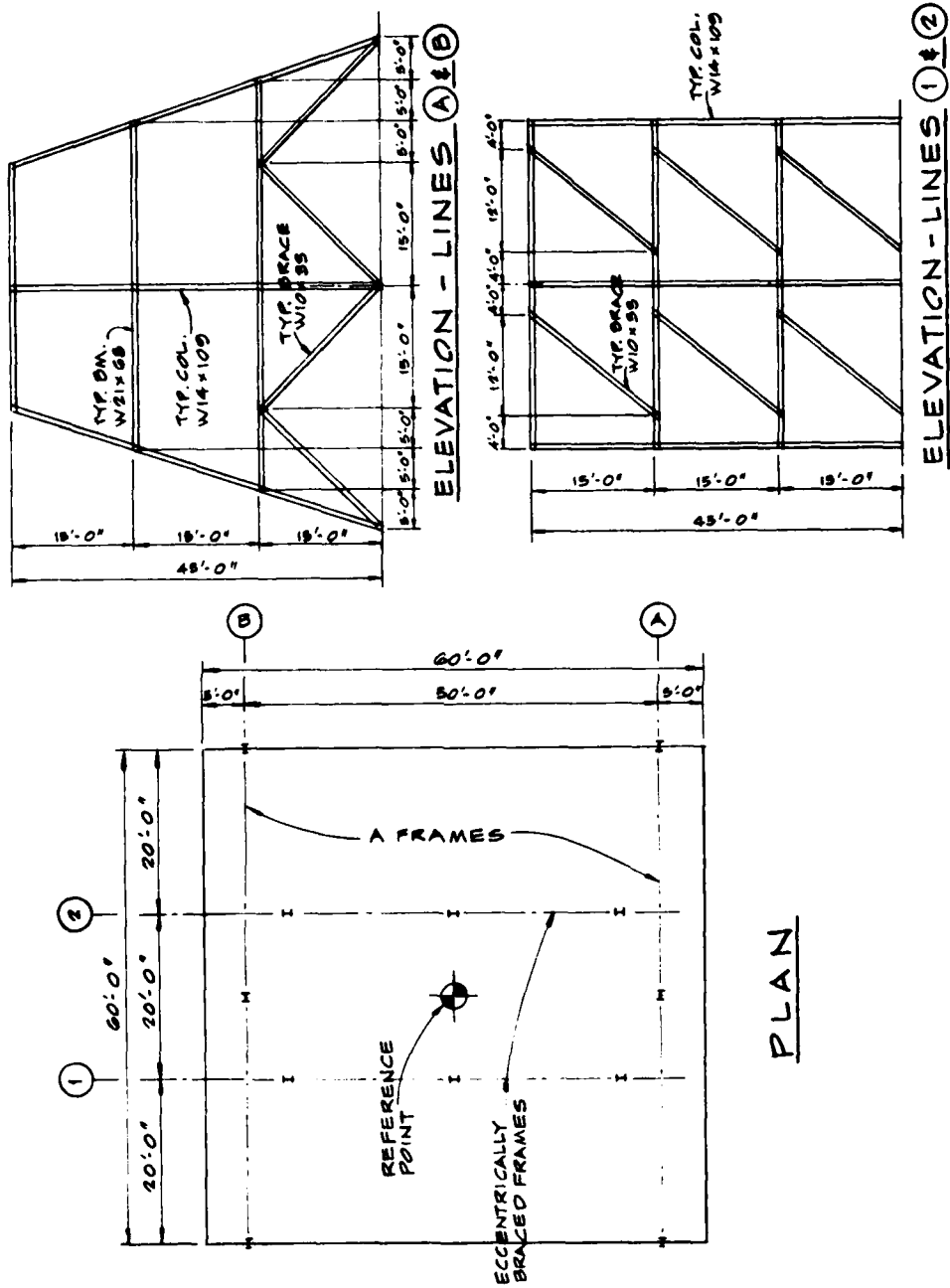
This is a three story structure laterally braced with eccentrically braced frames in one direction and A-frames in the other direction. A lateral static wind load analysis of wind acting in two directions independently is implemented.

(ii) Significant options of CTABS80 activated

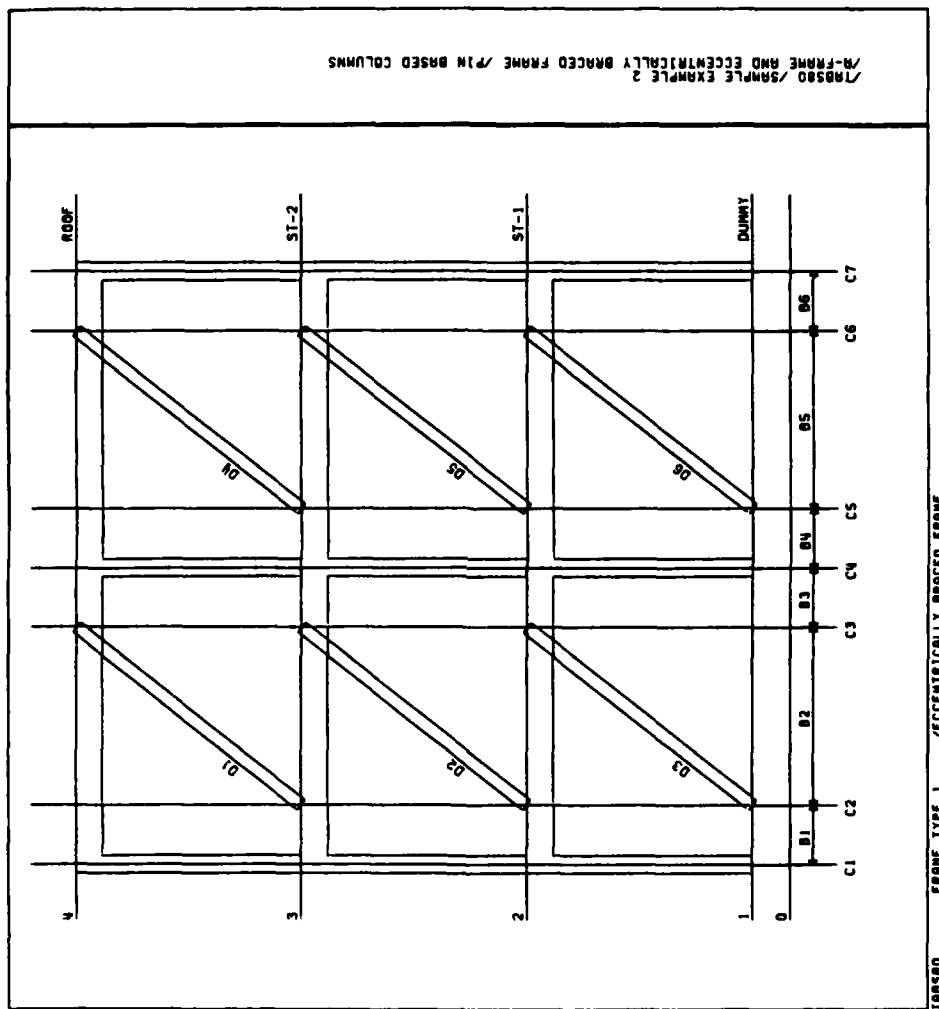
1. Bending diagonal element usage
2. Pin base modeling
3. Plotting
4. Static lateral load analysis

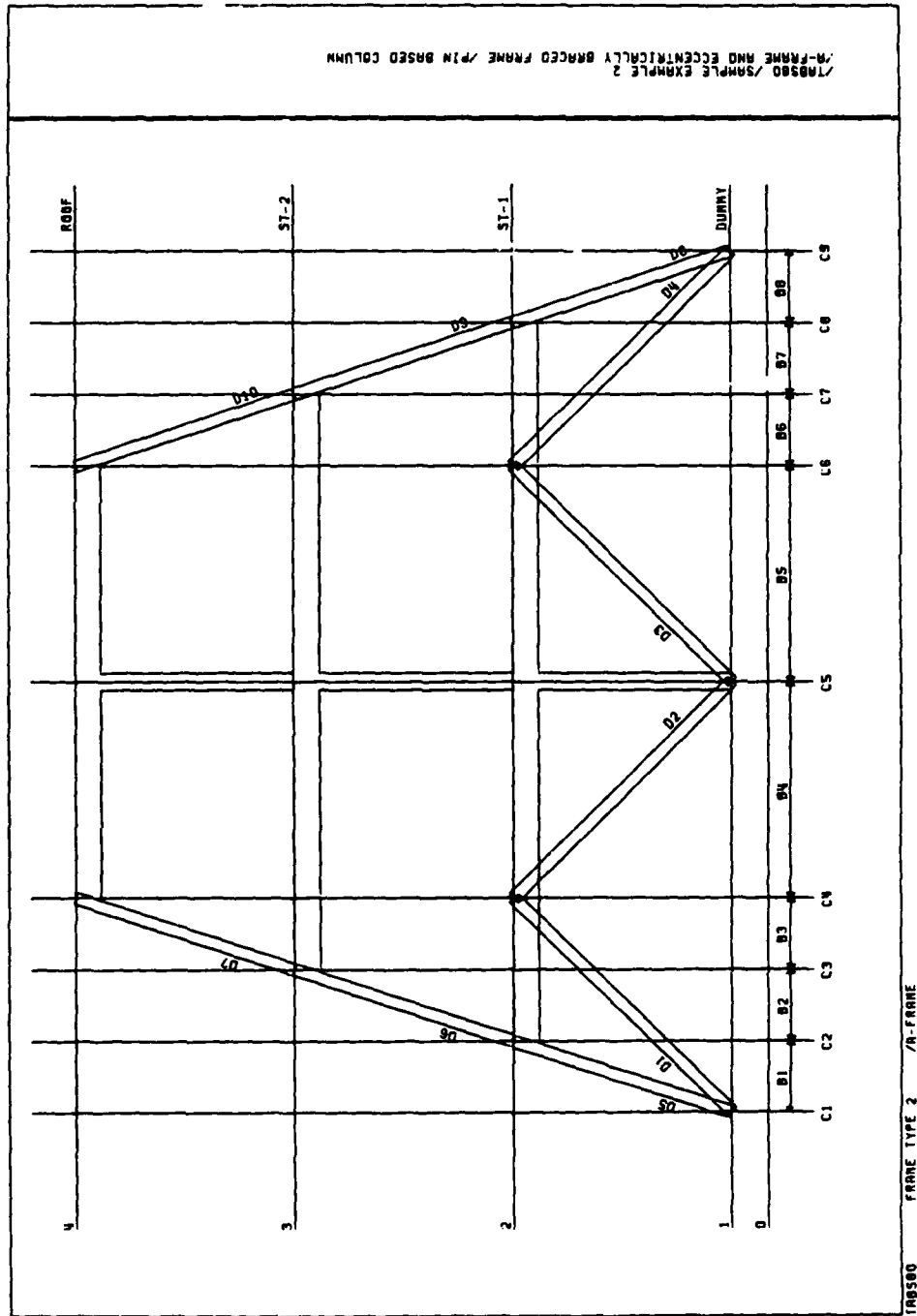
(iii) Comments

This example illustrates how the new diagonal element can be used to effectively model complex situations. Bending stiffness of the diagonal element allows inclined members to participate in the structural frame action.



EXAMPLE 2





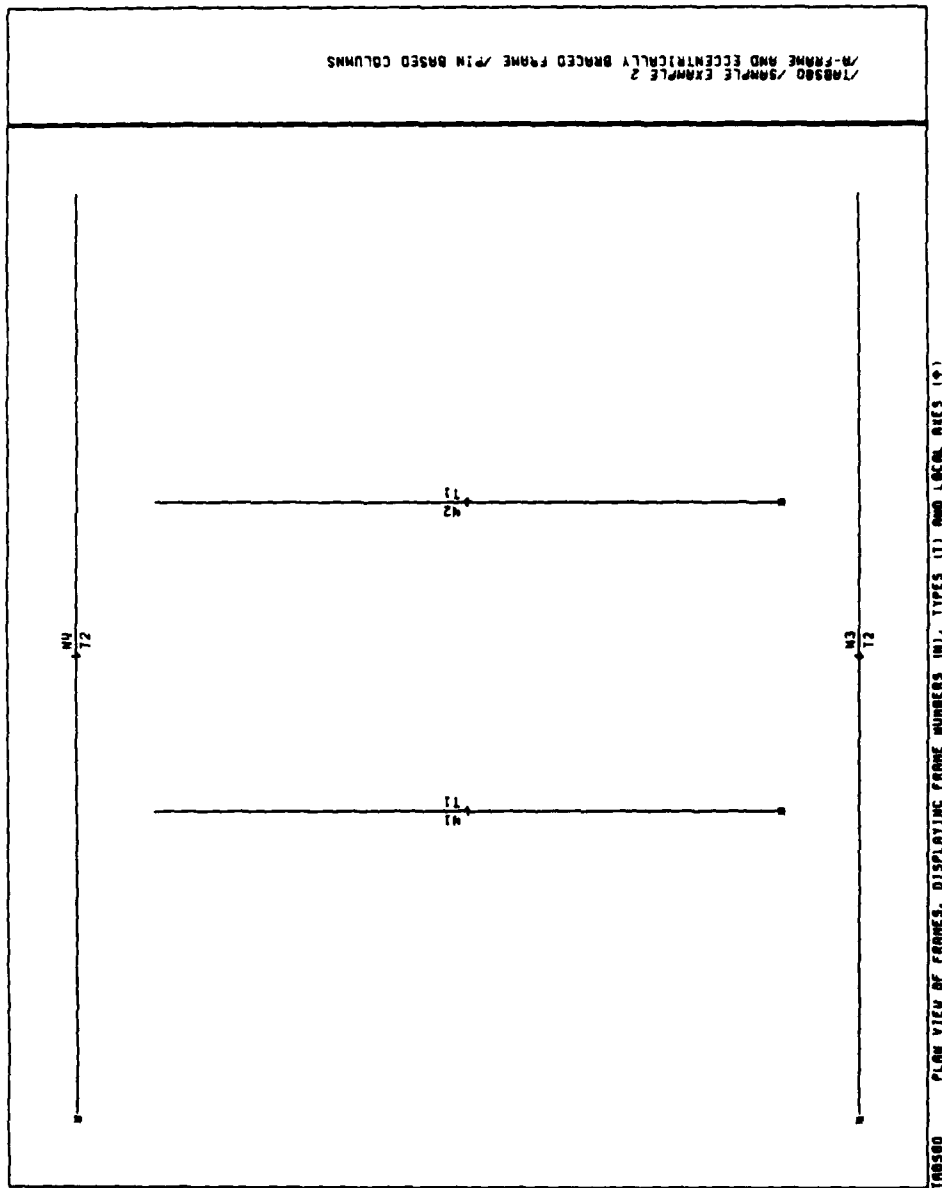


TABLE 2 / SAMPLE EXERCISE 2
M-FRAME AND ECCENTRICALLY BRACED FRAME / PIN BASED COLUMNS

/TABSD /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

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/TABSD /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

```

TOTAL NUMBER OF STORIES IN STRUCTURE----- 4
NUMBER OF DIFFERENT FRAMES IN STRUCTURE----- 2
TOTAL NUMBER OF FRAMES IN STRUCTURE----- 4
TOTAL NUMBER OF STRUCTURAL LOAD CASES----- 2
TYPE OF ANALYSIS----- C
NUMBER OF FORCES CONSIDERED----- 0
LATERAL STORY TRANSLATION CODE----- 0
EXECUTION CODE----- 0
FRAME JOINT RIGID ZONE MODIFICATION CODE----- C
FRAME JOINT DISPLACEMENT PRINT FLAG----- C
UNC LATERAL SEISMIC FORCE CODE----- C
NUMBER OF STORY PASS PATTERNS----- C
MASTER PEN PLOT FLAG----- 1

CONVERSION DATA FOR STRESSES
LENGTH CONVERSION FACTOR----- 1.000
FORCE CONVERSION FACTOR----- 1.000

STRUCTURAL STORY DATA . . .
LEVEL PASS TYPE HEIGHT E-1 E-2 E-3 E-ROIN
ROOF C 180.00 0.0 0.0 0.0
ST-2 C 180.00 0.0 0.0 0.0
ST-1 C 180.00 0.0 0.0 0.0
DUPPY C 30.00 1.0000E+10 1.0000E+10 1.0000E+10

STRUCTURAL MASS DATA . . .
LEVEL MASS PRI YH YP
ROOF 0.000 0.0 0.0 0.0
ST-2 0.000 0.0 0.0 0.0
ST-1 0.000 0.0 0.0 0.0
DUPPY 0.000 0.0 0.0 0.0

STRUCTURAL LATERAL LOAD CONDITION A . . .
LEVEL FX FY X Y
ROOF 30.00 0.00 0.00 0.00
ST-2 20.00 0.00 0.00 0.00
ST-1 20.00 0.00 0.00 0.00
DUPPY 0.00 0.00 0.00 0.00

STRUCTURAL LATERAL LOAD CONDITION B . . .
LEVEL FX FY X Y
ROOF 0.00 30.00 0.00 0.00
ST-2 0.00 20.00 0.00 0.00
ST-1 0.00 20.00 0.00 0.00
DUPPY 0.00 0.00 0.00 0.00

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/TAB500 /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

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/TAB500 /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

/ECCENTRICALLY BRACED FRAME

FRAME IDENTIFICATION NUMBER-----
NUMBER OF COLUMN LINES IN FRAME-----
NUMBER OF STORIES IN FRAME-----
NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
NUMBER OF BEAM SPAN LOADING PATTERNS-----
NUMBER OF BEAM SPAN LOADING PATTERNS-----
NUMBER OF POINT LOADS IN ANY SPAN LOADING-----
NUMBER OF PANEL ELEMENTS IN FRAME-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
FRAME PEN PLOT FLAG-----
STORY CONNECTIVITY CODE-----

BAY WIDTHS
48.00 144.00 48.00 48.00 144.00 48.00

SILL DEPTHS
0.00 0.00 0.00 0.00 0.00 0.00

COLUMN SECTION PROPERTY DATA

ID	U	E	A	I	AV	H	DA	AV	T
1	0.000	29500.0	-1.00E+07	0.171E+03	0.00	0.00	0.00	0.00	0.00
2	0.000	29500.0	-1.71E+03	2.72	9.98	0.00	0.00	0.00	0.00
3	0.000	29500.0	-3.20E+02	-1.24E+04	7.52	14.32	0.00	0.00	0.00

BEAM SECTION PROPERTY DATA

ID	U	E	I	K	C	DB	DA	AV	T
1	0.000	29500.0	-1.48E+04	4.00	-50	21.13	0.00	9.0%	0.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2	3	4	5	6	7
ROOF	3	0	0	3	0	0	3
ST-2	3	0	0	3	0	0	3
ST-1	3	0	0	3	0	0	3
DUPHY	1	1	1	1	1	1	1

INPUT/GENERATED BEAM LOCATIONS

LEVEL	1	2	3	4	5	6
ROOF	1	1	1	1	1	1

INPUT AND/OR GENERATED DIAGONAL DATA

DIAGONAL ID	LEVEL AT TOP	LOWER COLUMN	UPPER COLUMN	COLUMN PROP ID
1	4	2	3	2
2	3	2	3	2
3	2	2	3	2
4	4	5	6	2
5	3	5	6	2
6	2	5	6	2

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL	1	2	3	4	5	6	7
ROOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DUPHY	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FRAME MG. = 2
TIME = .14

7A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

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7A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

7A-FRAME

FRAME IDENTIFICATION NUMBER-----
NUMBER OF COLUMN LINES IN FRAME-----
NUMBER OF STORY LEVELS IN FRAME-----
NUMBER OF COLUMN/PARTIAL COLUMN PROPERTIES-----
NUMBER OF BEAM SPAN LOADING PATTERNS-----
NUMBER OF BEAM SPAN LOADING PATTERNS-----
MAXIMUM POINT LOADS IN ANY SPAN LOADING-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
FRAME PEA PLOT FLAG-----
STORY CONNECTIVITY CODE-----

INPUT/GENERATED BEAM LOCATIONS

LEVEL	1	2	3	4	5	6	7	8
ROOF	0	0	0	1	1	0	0	0
ST-2	0	0	1	1	1	1	0	0
ST-1	0	1	1	1	1	1	0	0
DUMMY	0	0	0	0	0	0	0	0

INPUT AND/OR GENERATED DIAGONAL DATA

DIAGONAL ID	LEVEL AT TOP	LOWER COLUMN	UPPER COLUMN	COLUMN PROP ID
1	2	1	4	2
2	2	1	4	2
3	2	5	4	2
4	2	9	6	2
5	2	1	2	2
6	3	2	3	2
7	4	3	4	2
8	2	9	8	2
9	3	8	7	2
10	4	7	6	2

COLUMN SECTION PROPERTY DATA

ID	U	E	A	I	AV	M	Z
1	0.000	29500.0	-100E+07	0.0	0.00	0.00	0.00
2	0.000	29500.0	-971E+01	-171E+03	2.82	9.98	0.00
3	0.000	29500.0	-320E+02	-124E+04	7.52	14.32	0.00

BEAM SECTION PROPERTY DATA

ID	U	E	I	K	C	DB	DA	AV	T
1	0.000	29500.0	-148E+04	4.00	-50	21.13	0.00	9.09	0.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2	3	4	5	6	7	8	9
ROOF	0	0	0	0	3	0	0	0	0
ST-2	0	0	0	0	3	0	0	0	0
ST-1	0	0	0	0	3	0	0	0	0
DUMMY	1	0	0	0	1	0	0	0	1

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL	1	2	3	4	5	6	7	8	9
ROOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DUMMY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FRAME NO. = 2
TIME = .16

/TAB500 /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

/TAB500 /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

LOAD CASE DEFINITION DATA

NO	1C	1	II	III	IV	A	B	DYN-1	DYN-2	DYN-3	LOAD CASE 10
1	0	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
2	0	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD

DYNAMIC 1 . . . SSSS MODAL COMBINATION
DYNAMIC 2 . . . ABS MODAL COMBINATION
DYNAMIC 3 . . . CQC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 . . . NOT USED
DYNAMIC 2 . . . NOT USED
DYNAMIC 3 . . . TIME HISTORY MODAL ANALYSIS

FRAME LOCATION DATA

FRAME TYPE	PRINT	AC	TYPE	CODE	X1	Y1	X2	Y2	/--FRAME LOCATION--/
1	1	1	1	120.00	-240.00	-120.00	240.00	240.00	/E-FRAME AT LINE 1
2	1	0	120.00	-240.00	120.00	240.00	240.00	240.00	/E-FRAME AT LINE 2
3	2	1	-300.00	-300.00	300.00	-300.00	300.00	300.00	/A-FRAME AT LINE A
4	2	0	-300.00	300.00	300.00	300.00	300.00	300.00	/A-FRAME AT LINE B

/TAB500 /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

STATIC LOAD CONDITION DISPLACEMENTS

DISPLACEMENTS ARE AT THE CENTERS OF MASS OF THE RESPECTIVE LEVELS

LEVEL	DIRN	1	II	III	IV	A	B
ROOF	X	0.00000	0.00000	0.00000	0.00000	-0.3658	0.00000
ROOF	Y	0.00000	0.00000	0.00000	0.00000	-0.1158	0.00000
ROOF	ROT	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
ST-2	X	0.00000	0.00000	0.00000	0.00000	-0.29208	0.00000
ST-2	Y	0.00000	0.00000	0.00000	0.00000	-0.0936	0.00000
ST-2	ROT	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
ST-1	X	0.00000	0.00000	0.00000	0.00000	-0.1341	0.00000
ST-1	Y	0.00000	0.00000	0.00000	0.00000	-0.0598	0.00000
ST-1	ROT	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DUMMY	X	0.00000	0.00000	0.00000	0.00000	-0.0000	0.00000
DUMMY	Y	0.00000	0.00000	0.00000	0.00000	-0.0000	0.00000
DUMMY	ROT	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

LATERAL FRAME DISPLACEMENTS IN /A-FRAME AT LINE 0

LEVEL	/WIND-X	/WIND-Y
ROOF	0.000000	0.000000
ST-1	0.000000	0.000000
DUPRY	0.000000	0.000000

/TABSD0 /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

COLUMNS FORCES AT LEVEL DUNRY IN /A-FRAME AT LINE 0

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/WIND-X	0.00	0.00	18.75	0.00
1	/WIND-Y	0.00	0.00	0.00	0.00
5	/WIND-X	0.00	0.00	0.00	0.00
5	/WIND-Y	0.00	0.00	0.00	0.00
9	/WIND-X	0.00	0.00	-18.75	0.00
9	/WIND-Y	0.00	0.00	0.00	0.00

COLUMNS FORCES AT LEVEL ST-1 IN /A-FRAME AT LINE 0

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
5	/WIND-X	132.22	318.29	0.00	-2.25
5	/WIND-Y	0.00	0.00	0.00	0.00

BEAM FORCES AT LEVEL ST-1 IN /A-FRAME AT LINE 0

BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
2	/WIND-X	205.25	-132.22	168.74	1.22	-1.22
2	/WIND-Y	0.00	0.00	0.00	0.00	0.00
3	/WIND-X	132.22	-59.19	95.70	1.22	-1.22
3	/WIND-Y	0.00	0.00	0.00	0.00	0.00
4	/WIND-X	90.40	383.52	-146.56	2.74	-2.74
4	/WIND-Y	0.00	0.00	0.00	0.00	0.00
5	/WIND-X	383.52	90.40	146.56	2.74	-2.74
5	/WIND-Y	0.00	0.00	0.00	0.00	0.00
6	/WIND-X	-59.19	132.22	-95.70	1.22	-1.22
6	/WIND-Y	0.00	0.00	0.00	0.00	0.00
7	/WIND-X	-132.22	205.25	-168.74	1.22	-1.22
7	/WIND-Y	0.00	0.00	0.00	0.00	0.00

STORY SHEAR /-----LOAD CONDITIONS-----/

I	II	III	IV	A	B
0.00	0.00	0.00	0.00	0.00	0.00

DIAGONAL FORCES AT LEVEL ST-1 IN /A-FRAME AT LINE 0

DIAG NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/WIND-X	-5.97	-12.06	11.71	0.07
1	/WIND-Y	0.00	0.00	0.00	0.00
2	/WIND-X	-19.56	-19.15	-9.63	-15
2	/WIND-Y	0.00	0.00	0.00	0.00
3	/WIND-X	-19.56	-19.15	9.63	-15
3	/WIND-Y	0.00	0.00	0.00	0.00
4	/WIND-X	-5.97	-12.06	-11.71	-07
4	/WIND-Y	0.00	0.00	0.00	0.00
5	/WIND-X	5.97	17.11	11.05	-12
5	/WIND-Y	0.00	0.00	0.00	0.00

DIAGONAL FORCES AT LEVEL ST-1 IN /A-FRAME AT LINE B

DIAG NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
8	/WIND-X	5.97	17.11	-11.05	-1.12
8	/WIND-Y	0.00	0.00	0.00	0.00

STORY SHEAR /-----LOAD COMPOSITIONS-----/

	I	II	III	IV	A	B
	0.00	0.00	0.00	0.00	35.00	0.00

BEAM FORCES AT LEVEL ST-2 IN /A-FRAME AT LINE B

BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN	LEFT SHEAR	RIGHT SHEAR
3	/WIND-X	435.29	-114.44	274.84	5.35	-5.35
3	/WIND-Y	0.00	0.00	0.00	0.00	0.00
4	/WIND-X	114.44	809.83	-347.70	5.35	-5.35
4	/WIND-Y	0.00	0.00	0.00	0.00	0.00
5	/WIND-X	809.83	114.44	347.70	5.35	-5.35
5	/WIND-Y	0.00	0.00	0.00	0.00	0.00
6	/WIND-X	-114.44	435.29	-274.84	5.35	-5.35
6	/WIND-Y	0.00	0.00	0.00	0.00	0.00

DIAGONAL FORCES AT LEVEL ST-2 IN /A-FRAME AT LINE B

DIAG NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
9	/WIND-X	-222.36	-249.83	-10.44	2.49
9	/WIND-Y	0.00	0.00	0.00	0.00

STORY SHEAR /-----LOAD COMPOSITIONS-----/

	I	II	III	IV	A	B
	0.00	0.00	0.00	0.00	25.00	0.00

ITABSD /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

ITABSD /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

LATERAL FRAME DISPLACEMENTS IN /E-FRAME AT LINE 2

LEVEL	/WIND-X	/WIND-Y
ROOF	0.00000	-115983
ST-2	0.00000	-089358
ST-1	0.00000	-053977
DUMMY	0.00000	-000000

BEAR FORCES AT LEVEL ROOF IN /A-FRAME AT LINE 8

BEAR NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
4	/WIND-X	209.57	474.48	-132.45	3.96	-3.96
4	/WIND-Y	0.00	0.00	0.00	0.00	0.00
5	/WIND-X	474.48	209.57	132.45	3.96	-3.96
5	/WIND-Y	0.00	0.00	0.00	0.00	0.00

DIAGONAL FORCES AT LEVEL ROOF IN /A-FRAME AT LINE 8

DIAG NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
7	/WIND-X	-185.46	-209.57	9.87	2.08
7	/WIND-Y	0.00	0.00	0.00	0.00
10	/WIND-X	-185.46	-209.57	-9.87	2.08
10	/WIND-Y	0.00	0.00	0.00	0.00

STORY SHEAR	I	II	III	IV	A	B
	0.00	0.00	0.00	0.00	15.00	0.00

FRAME NO. = 1
STRESS TYPE = .29

ITABSD /SAMPLE EXAMPLE 2
/A-FRAME AND ECCENTRICALLY BRACED FRAME /PIN BASED COLUMNS

COLUMN FORCES AT LEVEL DUMMY IN /E-FRAME AT LINE 2

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/WIND-X	0.00	0.00	0.00	0.00
1	/WIND-Y	0.00	0.00	13.06	0.00
2	/WIND-X	0.00	0.00	0.00	0.00
2	/WIND-Y	0.00	0.00	19.26	0.00
3	/WIND-X	0.00	0.00	0.00	0.00
3	/WIND-Y	0.00	0.00	0.00	0.00
4	/WIND-X	0.00	0.00	0.00	0.00
4	/WIND-Y	0.00	0.00	-20.16	0.00
5	/WIND-X	0.00	0.00	0.00	0.00
5	/WIND-Y	0.00	0.00	19.52	0.00
6	/WIND-X	0.00	0.00	0.00	0.00
6	/WIND-Y	0.00	0.00	0.00	0.00
7	/WIND-X	0.00	0.00	0.00	0.00
7	/WIND-Y	0.00	0.00	-31.68	0.00

STORY SHEAR	I	II	III	IV	A	B
	0.00	0.00	0.00	0.00	0.00	0.00

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BASED COLUMNS

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10/01/00
00/10/01

EXAMPLE 2 ECCENTRICALLY

FORCES AT LEVEL ST-1 IN /E-FRAME AT LINE 2						FORCES AT LEVEL ST-2 IN /E-FRAME AT LINE 2					
COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE	COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/WIND-X	0.00	-120.16	0.00	0.00	1	/WIND-X	0.00	0.00	0.00	0.00
1	/WIND-Y	-0.00	13.06	13.06	.76	1	/WIND-Y	-95.83	-100.28	4.82	1.23
4	/WIND-X	0.00	0.00	0.00	0.00	4	/WIND-X	0.00	0.00	0.00	0.00
4	/WIND-Y	0.00	-253.54	-20.16	1.60	4	/WIND-Y	-288.01	-237.81	-11.24	3.31
7	/WIND-X	0.00	0.00	0.00	0.00	7	/WIND-X	0.00	0.00	0.00	0.00
7	/WIND-Y	-0.00	-219.59	-31.88	1.38	7	/WIND-Y	-217.60	-162.16	-15.87	2.39

FORCES AT LEVEL ST-1 IN /E-FRAME AT LINE 2				FORCES AT LEVEL ST-2 IN /E-FRAME AT LINE 2			
BEAM	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR	BEAM NO
1	/WIND-Y	172.99	163.45	0.00	0.00	0.00	1
2	/WIND-X	-150.52	-288.61	0.00	0.00	0.00	2
3	/WIND-X	311.94	350.05	0.00	0.00	0.00	3
4	/WIND-Y	56.91	241.13	0.00	0.00	0.00	4
5	/WIND-X	-221.94	-282.07	0.00	0.00	0.00	5
6	/WIND-X	302.52	351.70	0.00	0.00	0.00	6
7	/WIND-Y	120.74	85.65	0.00	0.00	0.00	7
8	/WIND-Y	-75.01	-145.06	0.00	0.00	0.00	8
9	/WIND-X	104.76	233.64	0.00	0.00	0.00	9
10	/WIND-Y	116.12	110.20	0.00	0.00	0.00	10
11	/WIND-X	-92.98	-102.00	0.00	0.00	0.00	11
12	/WIND-Y	122.30	263.38	0.00	0.00	0.00	12
13	/WIND-X	-1.53	35.33	0.00	0.00	0.00	13
14	/WIND-X	9.76	-34.44	0.00	0.00	0.00	14
15	/WIND-Y	5.54	2.98	0.00	0.00	0.00	15
16	/WIND-X	-1.35	4.51	0.00	0.00	0.00	16
17	/WIND-Y	9.44	-70.54	0.00	0.00	0.00	17
18	/WIND-X	-5.05	-5.05	0.00	0.00	0.00	18
19	/WIND-X	-5.05	-5.05	0.00	0.00	0.00	19
20	/WIND-X	-5.05	-5.05	0.00	0.00	0.00	20

DIAGONAL FORCES AT LEVEL ST-1 IN E-FRAME AT LINE 2						DIAGONAL FORCES AT LEVEL ST-2 IN E-FRAME AT LINE 2					
UTAC NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE	DIAG NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
3	/MINO-X	0.00	0.00	0.00	0.00	1	/MINO-X	0.00	0.00	0.00	0.00
3	/MINO-Y	-0.00	-23.32	24.74	-1.0	2	/MINO-Y	-12.93	-19.10	0.00	-1.4
6	/MINO-X	0.00	0.00	0.00	0.00	5	/MINO-X	0.00	0.00	0.00	0.00
6	/MINO-Y	-0.00	-20.46	25.07	-0.9	6	/MINO-Y	-19.19	-20.30	13.96	-1.7

[illegible]

SUMMARY OF STORY SHEAR DISTRIBUTION
 STORY-BY-STORY / FRAME-BY-FRAME

LEVEL	TO	/A-FRAME LOCATION-/	LOAD CONDITIONS	I	II	III	IV	A	H
DURAY		/E-FRAME AT LINE 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		/A-FRAME AT LINE B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST-1		/E-FRAME AT LINE 2	0.00	0.00	0.00	0.00	0.00	0.00	35.00
		/A-FRAME AT LINE B	0.00	0.00	0.00	0.00	0.00	35.00	0.00
ST-2		/E-FRAME AT LINE 2	0.00	0.00	0.00	0.00	0.00	0.00	25.00
		/A-FRAME AT LINE B	0.00	0.00	0.00	0.00	0.00	25.00	0.00
ROOF		/E-FRAME AT LINE 2	0.00	0.00	0.00	0.00	0.00	0.00	15.00
		/A-FRAME AT LINE B	0.00	0.00	0.00	0.00	0.00	15.00	0.00

TIME LOG (SECONDS)

FORM FRAME STIFFNESSES..... -32
 SOLVE STATIC LOAD CASES..... -02
 MODE SHAPES AND FREQUENCIES..... -02
 COMPUTE FRAME DISPLACEMENTS..... -00
 MEMBER FORCES AND STRESSES..... -61
 TOTAL TIME..... -98

FORCES AT LEVEL ROOF IN /E-FRAME AT LINE 2

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/WIND-X	0.00	0.00	0.00	0.00
1	/WIND-Y	-10.56	-13.83	-2.23	-2.26
4	/WIND-X	0.00	0.00	0.00	0.00
4	/WIND-Y	-131.54	-141.11	-7.03	1.84
7	/WIND-X	0.00	0.00	0.00	0.00
7	/WIND-Y	-118.34	-158.30	-6.22	1.74

FORCES AT LEVEL ROOF IN /E-FRAME AT LINE 2

BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/WIND-X	0.00	0.00	0.00	0.00	0.00
1	/WIND-Y	21.38	-30.76	26.07	-2.23	-2.23
2	/WIND-X	0.00	0.00	0.00	0.00	0.00
2	/WIND-Y	30.76	-63.81	47.28	-2.23	-2.23
3	/WIND-X	0.00	0.00	0.00	0.00	0.00
3	/WIND-Y	79.49	180.12	-90.31	8.36	-8.36
4	/WIND-X	0.00	0.00	0.00	0.00	0.00
4	/WIND-Y	-40.77	13.26	-27.02	-1.67	-0.67
5	/WIND-X	0.00	0.00	0.00	0.00	0.00
5	/WIND-Y	-13.26	-63.77	35.26	-1.67	-0.67
6	/WIND-X	0.00	0.00	0.00	0.00	0.00
6	/WIND-Y	103.56	150.54	-23.49	6.22	-6.22

DIAGONAL FORCES AT LEVEL ROOF IN /E-FRAME AT LINE 2

DIAG NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/WIND-X	0.00	0.00	0.00	0.00
1	/WIND-Y	-10.84	-13.88	8.53	-1.11
4	/WIND-X	0.00	0.00	0.00	0.00
4	/WIND-Y	-17.22	-19.79	8.96	-1.16

STORY SHEAR	I	II	III	IV	A	H
	0.00	0.00	0.00	0.00	0.00	15.00

FRAME NO. = 3
 STRESS TIME = .29

C. Example 3

(i) Description

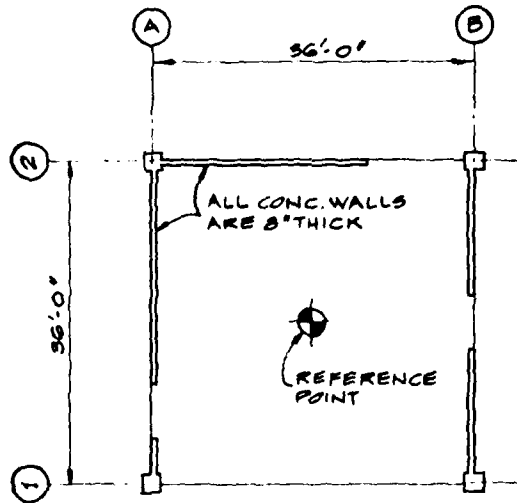
This three story building has complex shear wall framing on three of the four sides of the structure. The fourth side is open. The structure is analyzed for lateral seismic loads in two directions. Time periods and mode shapes are evaluated.

(ii) Significant options of CTABS80 activated

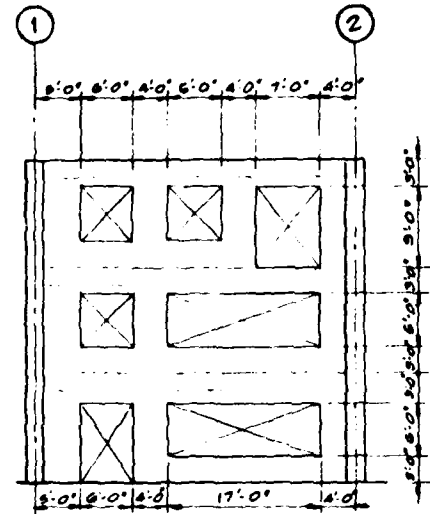
1. Mass properties calculated automatically
2. Section properties calculated automatically
3. Shear panel usage
4. UBC loads calculated automatically
5. Plotting
6. Static lateral load analysis

(iii) Comments

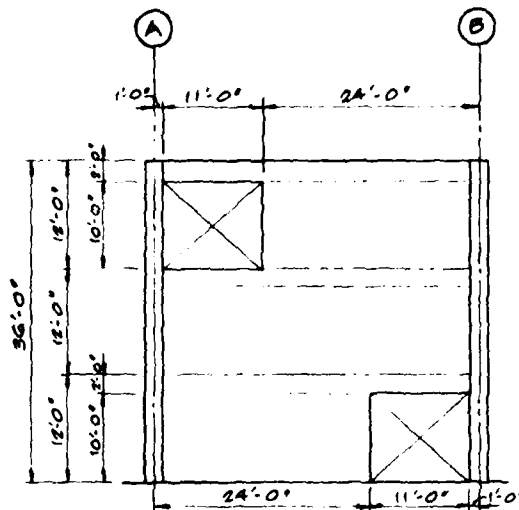
This example demonstrates modeling of complex shear wall systems. Discontinuous shear walls and shear walls with arbitrarily located openings can very effectively be modeled as shown in this example.



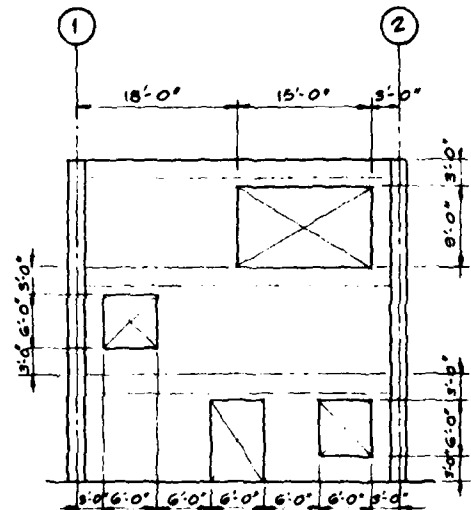
PLAN



ELEVATION - LINE A

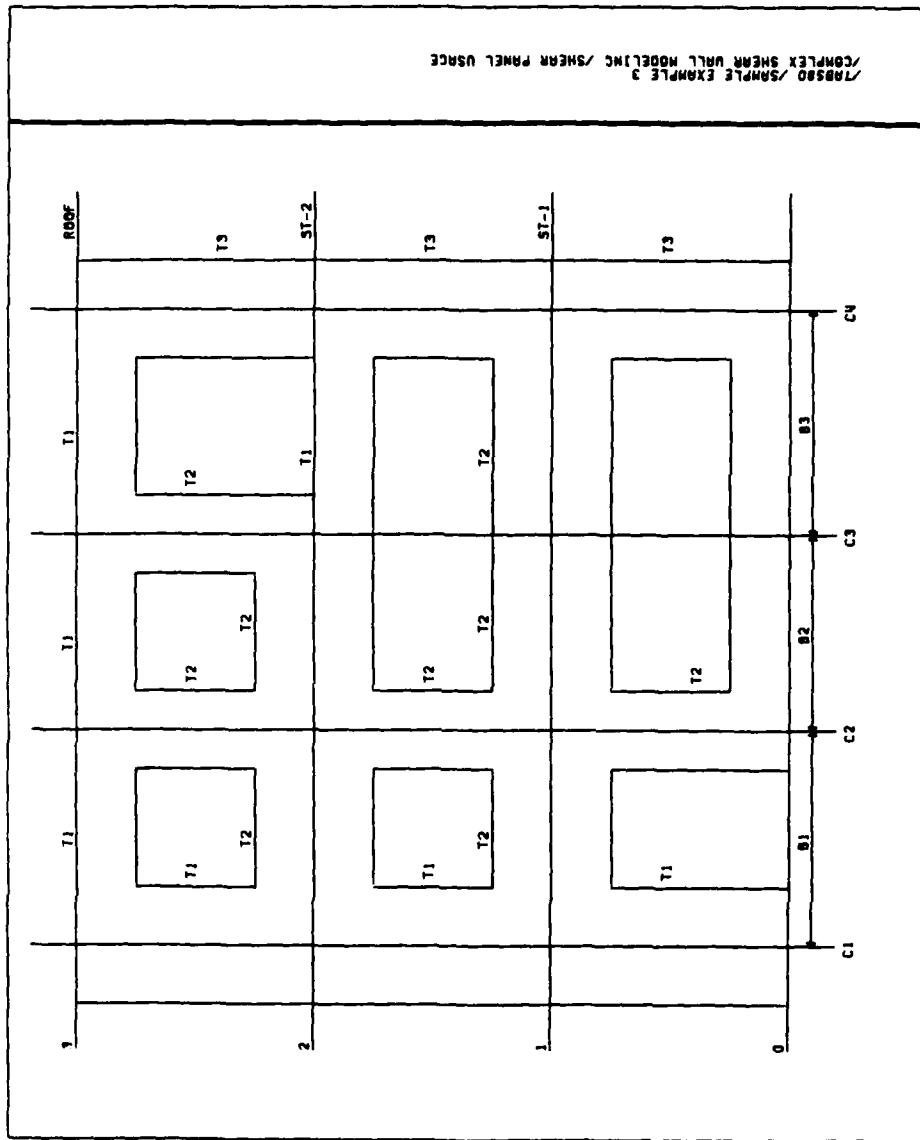


ELEVATION - LINE 2

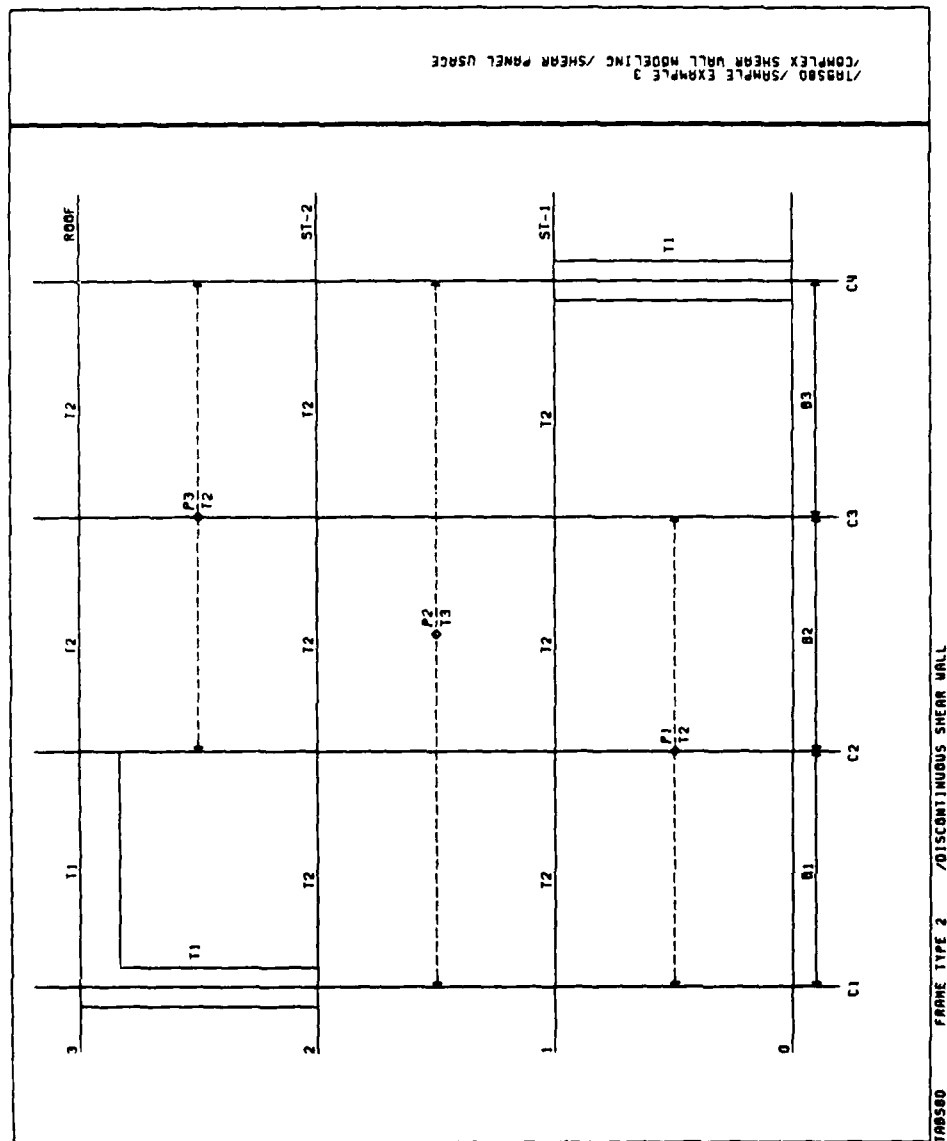


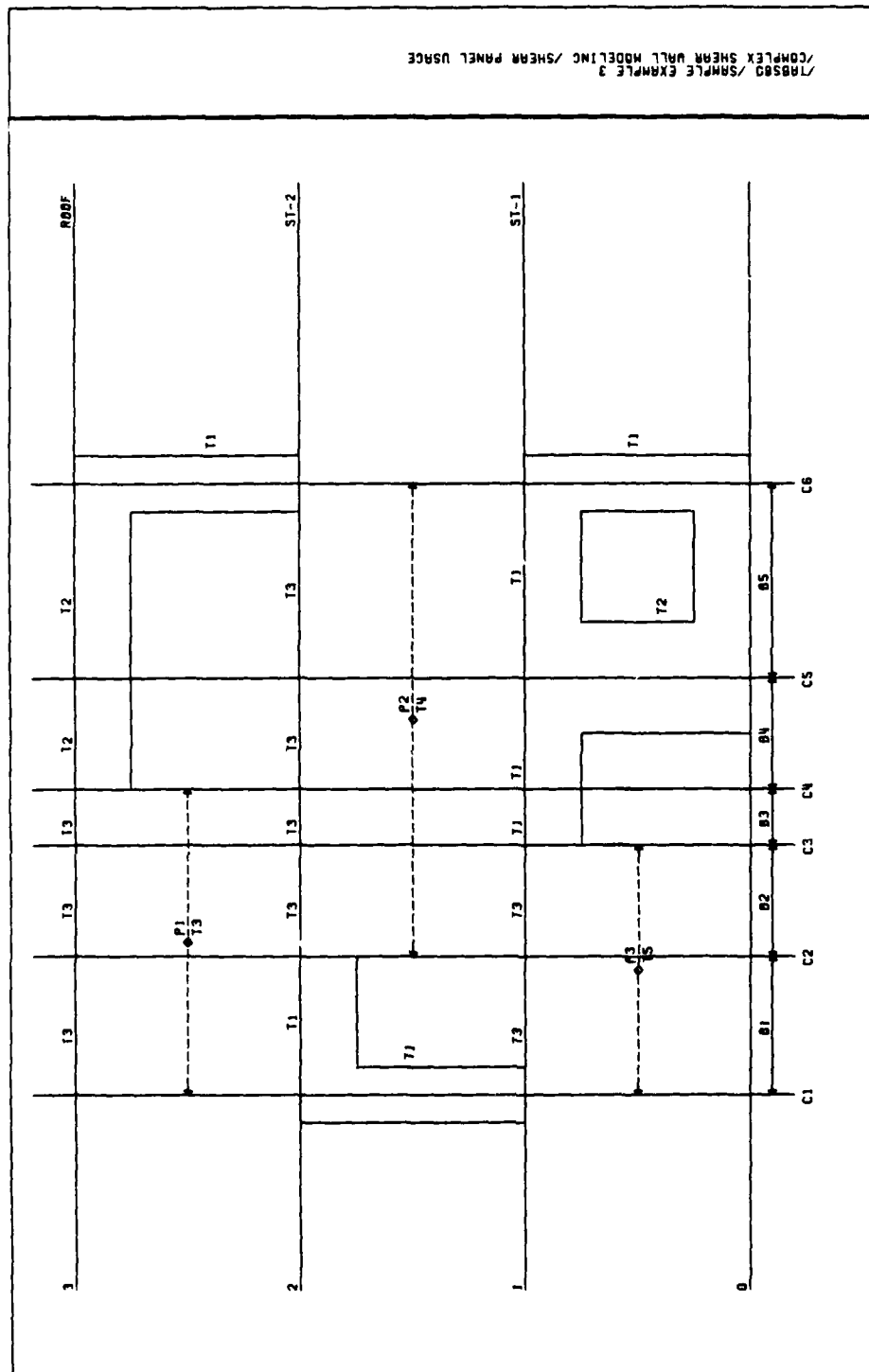
ELEVATION - LINE B

EXAMPLE 3



708580 FRAME TYPE 1 /PIER SPANDEL SYSTEM





PAGE 1 /TAB50 /SAMPLE EXAMPLE 3
06/09/80 /COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE
PAGE 2
06/09/80

STORY MASS TYPE NUMBER-----1		DIMENSIONS OF SEGMENT	
NUMBER OF MASS SEGMENTS-----1		X	Y
MASS SCALE FACTOR-----.311E-01		36.00	36.00
SEGMENT	COORDINATES OF CENTER		
NUMBER	MASS	X	Y
1	260.00	0.00	0.00
CALCULATED STORY MASS PROPERTIES			
STORY MASS-----			
MASS MOMENT OF INERTIA-----			
X-COORDINATE OF CENTER OF MASS-----			
Y-COORDINATE OF CENTER OF MASS-----			
0.07			
1784.1			
0.00			
0.00			

/TABSUO /SAMPLE EXAMPLE 3
 /SMOOTH /SUGAR WALL MODELING /SMEAR PANEL USAGE

PAGE 3
 06/09/80

STRUCTURAL STORY DATA . . .					K-X	K-Y	K-ROTN
LEVEL	MASS	TYPE	WEIGHT				
ROOF			12.00	0.	0.	0.	0.
SY-2	1		12.00	0.	0.	0.	0.
SY-2	1		12.00	0.	0.	0.	0.

STRUCTURAL MASS DATA . . .				
LEVEL	MASS	MRI	IN	VM
ROOF	6.075	1744.1	0.00	0.00
51-2	6.075	1744.1	0.00	0.00
51-1	6.075	1744.1	0.00	0.00

STRUCTURAL LATERAL LOAD CONDITION A . . .					
LEVEL	FX	FY	X	Y	
MOOF	0.00	0.00	0.00	0.00	
ST-2	0.00	0.00	0.00	0.00	
ST-1	0.00	0.00	0.00	0.00	

STRUCTURAL LATERAL LOAD COMPOSITION . . .					
LEVEL	FX	FY	K	Y	
ROOF	0.00	0.00	0.00	0.00	
ST-2	0.00	0.00	0.00	0.00	
ST-1	0.00	0.00	0.00	0.00	

VTAS80 / SAMPLE EXAMPLE 3
/ COMPLEX SHEAR WALL MODELING / SHEAR PANEL USAGE

3	TOTAL NUMBER OF STORIES IN STRUCTURE-----
3	NUMBER OF DIFFERENT FRAMES IN STRUCTURE-----
3	TOTAL NUMBER OF FRAMES IN STRUCTURE-----
2	TOTAL NUMBER OF STRUCTURAL LOAD CASES-----
2	TYPE OF ANALYSIS-----
0	NUMBER OF MODES CONSIDERED-----
0	LATERAL STORY TRANSLATION CODE-----
0	EXECUTION MODE-----
0	FRAME JOINT RIGID ZONE MODIFICATION CODE-----
0	FRAME JOINT DISPLACEMENT PRINT FLAG-----
1	UBC LATERAL SEISMIC FORCE CODE-----
1	NUMBER OF STORY MASS PATTERNS-----
2	MASTER PEN PLOT FLAG-----

CONVERSION DATA FOR STRESSES	
LENGTH CONVERSION FACTOR	12.000
FORCE CONVERSION FACTOR	1000.000

/IABSD /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

/PIER SPANDREL SYSTEM

FRAME IDENTIFICATION NUMBER-----
NUMBER OF COLUMN LINES IN FRAME-----
NUMBER OF STORY LEVELS IN FRAME-----
NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
NUMBER OF BEAM PROPERTIES-----
NUMBER OF BEAM SPAN LOADING PATTERNS-----
MAXIMUM POINT LOADS IN ANY SPAN LOADING-----
NUMBER OF PANEL ELEMENTS IN FRAME-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
FRAME PER COLUMN-----
STORY CONNECTIVITY CODE-----

BAY WIDTHS 11.00 10.00 11.50
SILL DEPTHS 0.00 3.00 3.00

COLUMN SECTION PROPERTY DATA

ID	U	E	A	I	AV	H	T
1	0.000	432000.0	.402E+01	.122E+02	3.35	6.00	.67
2	0.000	432000.0	.268E+01	.157E+01	2.23	4.00	.67
3	0.000	432000.0	.335E+01	.698E+01	2.79	5.00	.67

BEAM SECTION PROPERTY DATA

ID	U	E	I	K	C	OA	AV	T
1	0.000	432000.0	.151E+01	4.00	.50	3.00	1.68	.67
2	0.000	432000.0	0.	4.00	.50	3.00	0.00	0.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2	3	4
ROOF	1	2	3	
ST-2	1	2	0	3
ST-1	1	2	0	3

INPUT/GENERATED BEAM LOCATIONS

LEVEL	1	2	3
ROOF	1	1	1

/IABSD /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

LEVEL	1	2	3
ST-2	2	2	1
ST-1	2	2	2

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL	1	11	111	1V
ROOF	0.00	0.00	0.00	0.00
ST-2	0.00	0.00	0.00	0.00
ST-1	0.00	0.00	0.00	0.00

FRAME NO. = 1
TIME = .06

/TABSD0 /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELLING /SHEAR PANEL USAGE

LEVEL	1	2	3
ST-2	2	2	2
ST-1	2	2	2

INPUT ANG/UR GENERATED SHEAR PANEL DATA

PANEL	LEVEL	FIRST	LAST	COLUMN
ID	AT TOP	BAY	BAY	PROP ID
1	1	1	2	2
2	2	1	3	2
3	3	2	3	2

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL/	1	11	111	1V
ROOF	0.00	0.00	0.00	0.00
ST-2	0.00	0.00	0.00	0.00
ST-1	0.00	0.00	0.00	0.00

FRAME NO. = 2
TIME = .06

/TABSD0 /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELLING /SHEAR PANEL USAGE

/DISCONTINUOUS SHEAR #ALL

FRAME IDENTIFICATION NUMBER-----
2
NUMBER OF COLUMN LINES IN FRAME-----
3
NUMBER OF STORY LEVELS IN FRAME-----
3
NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
2
NUMBER OF BEAM PROPERTIES-----
0
NUMBER OF BEAM SPAN CONNECTING PATTERNS-----
0
MAXIMUM POINT LOADS IN ANY SPAN LOADING-----
3
NUMBER OF PANEL ELEMENTS IN FRAME-----
0
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
0
FRAME BEAM PLAT FLAG-----
0
STORY CONNECTIVITY CODE-----
0

BAY WIDTH'S	12.00	12.00	12.00
SILL DEPTHS	0.00	0.00	0.00

COLUMN SECTION PROPERTY DATA

ID	U	E	A	I	AV	D	I
1	0.000	432000.0	.400E+01	.133E+01	3.33	2.00	2.00
2	0.000	432000.0	.161E+02	.772E+03	13.40	24.00	.87
3	0.000	432000.0	.241E+02	.260E+04	20.10	36.00	.87

BEAM SECTION PROPERTY DATA

ID	U	E	I	K	C	D8	DA	AV	I
1	0.000	432000.0	.667E+00	4.00	.50	2.00	0.00	1.67	1.00
2	0.000	432000.0	.100E+07	4.00	.50	0.00	0.00	0.00	0.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2	3	4
ROOF	1	0	0	0
ST-2	0	0	0	0
ST-1	0	0	0	1

INPUT/GENERATED BEAM LOCATIONS

LEVEL	1	2	3
ROOF	1	2	2

141

MODE SHAPES

MODE NUMBER	LEVEL	DIRM	9
1	ROOF	X	.072759
2	ROOF	Y	-.011693
3	ROOF	ROTM	.004791
4	ST-2	X	-.100942
5	ST-2	Y	-.045685
6	ST-2	ROTM	-.014823
7	ST-1	X	-.096343
8	ST-1	Y	-.045176
9	ST-1	ROTM	-.014692

MODAL PARTICIPATION FACTORS

MODE NUMBER	P-DIRECTION	P-FACTOR	VALUE
1	X	X	-3.01918
	Y	Y	2.52386
	ROTM	ROTM	32.21217
2	X	X	2.80623
	Y	Y	3.51375
	ROTM	ROTM	-2.90106
3	X	X	1.43075
	Y	Y	-6.6203
	ROTM	ROTM	-11.95605
4	X	X	-1.89889
	Y	Y	1.22767
	ROTM	ROTM	-37.24576
5	X	X	-.86495
	Y	Y	-1.82025
	ROTM	ROTM	3.25990
6	X	X	-.40315
	Y	Y	-.61288
	ROTM	ROTM	9.51509
7	X	X	-.50119
	Y	Y	-.47256
	ROTM	ROTM	10.45003
8	X	X	-.60574
	Y	Y	-.50630
	ROTM	ROTM	-22.12508
9	X	X	-.22738
	Y	Y	-.09031
	ROTM	ROTM	8.12753

MODE SHAPES

MODE NUMBER	LEVEL	DIRM	1	2	3	4
1	ROOF	X	-.186496	.185136	-.146814	-.116754
2	ROOF	Y	.153014	-.220915	-.089545	-.08724
3	ROOF	ROTM	.004186	-.001216	-.006059	-.016837
4	ST-2	X	-.133879	.101589	.140234	-.065112
5	ST-2	Y	-.114047	.148436	-.072230	-.034155
6	ST-2	ROTM	.006689	.000041	-.005638	-.011190
7	ST-1	X	-.053538	.060814	.183793	-.053303
8	ST-1	Y	.043508	.065791	-.096628	.029162
9	ST-1	ROTM	.002594	-.000468	-.007276	-.004796

MODE SHAPES

MODE NUMBER	LEVEL	DIRM	5	6	7	8
1	ROOF	X	.087174	-.061165	-.000825	.084754
2	ROOF	Y	.168215	-.028917	-.080019	-.010504
3	ROOF	ROTM	.000731	.004214	-.003634	.010687
4	ST-2	X	-.068782	.203080	-.065090	-.106293
5	ST-2	Y	-.184208	-.062517	-.216479	-.040032
6	ST-2	ROTM	.000249	-.006404	.003999	-.007739
7	ST-1	X	-.125513	-.191843	.126336	-.053480
8	ST-1	Y	-.199648	.109415	.194985	.124410
9	ST-1	ROTM	.000912	.007645	.004427	-.013634

STARSDO /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

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STARSDO /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

UNIFORM BUILDING CODE SEISMIC LOADS FOR DIRECTION X

V = Z SICK M SC=0.14 MAX

Z = 1.0000
S = 1.5000
I = 1.0000
C = -1.140
R = 1.3300
M = 780.0025
V = -18624
= 145.2365
PT= 0.0000

UNIFORM BUILDING CODE SEISMIC LOADS FOR DIRECTION Y

V = Z SICK M SC=0.14 MAX

Z = 1.0000
S = 1.5000
I = 1.0000
C = -1.140
R = 1.3300
M = 780.0025
V = -18624
= 145.2365
PT= 0.0000

STATIC SEISMIC LOAD CALCULATION DATA . . .

UNC 1976 (SEADOC CODE)
UNC ZONE FACTOR (Z)----- 1.00
PREDOMINANT SOIL PERIOD (TS)----- 0.00
UNC IMPORTANCE FACTOR (I)----- 1.00
GRAVITATIONAL ACCELERATION----- 32.20

LOAD CONDITION A (X-DIRECTION) . . .

TOP LEVEL OF TRIANGULAR DISTRIBUTION----- 3
BOTTOM LEVEL OF TRIANGULAR DISTRIBUTION----- 0
PERIOD OF PREDOMINANT X STRUCTURAL MODE----- .342
UNC STRUCTURAL SYSTEM FACTOR----- 1.330

LOAD CONDITION B (Y-DIRECTION) . . .

TOP LEVEL OF TRIANGULAR DISTRIBUTION----- 3
BOTTOM LEVEL OF TRIANGULAR DISTRIBUTION----- 0
PERIOD OF PREDOMINANT Y STRUCTURAL MODE----- .119
UNC STRUCTURAL SYSTEM FACTOR----- 1.330

/TABSD /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

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/TABSD /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

LOAD CASE DEFINITION DATA
NO 1C 1 11 111 1V A 0 DYM-1 DYM-2 DYM-3 LOAD CASE 10
1 0 0.00 0.00 0.00 0.00 1.00 0.00 0.00 0.00 /SEISMIC-X
2 0 0.00 0.00 0.00 0.00 0.00 1.00 0.00 0.00 /SEISMIC-Y

OR DYNAMICS BY THE RESPONSE SPECTRUM METHOD
DYNAMIC 1 . . . SRSS MODAL COMBINATION
DYNAMIC 2 . . . ABS MODAL COMBINATION
DYNAMIC 3 . . . CQC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD
DYNAMIC 1 . . . NOT USED
DYNAMIC 2 . . . NOT USED
DYNAMIC 3 . . . TIME HISTORY AQUAL ANALYSIS

STRUCTURAL LATERAL LOAD COMBINATIONS
AS ADJUSTED BY UBC SEISMIC REQUIREMENTS
STRUCTURAL LATERAL LOAD COMBINATION A (X-DIRECTION) . . .
LEVEL FX FY X Y
ROOF 72.62 0.00 0.00 0.00
ST-2 48.41 0.00 0.00 0.00
ST-1 24.21 0.00 0.00 0.00

STRUCTURAL LATERAL LOAD COMBINATION B (Y-DIRECTION) . . .
LEVEL FX FY X Y
ROOF 0.00 72.62 0.00 0.00
ST-2 0.00 48.41 0.00 0.00
ST-1 0.00 24.21 0.00 0.00

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/TABSD /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

STATIC LOAD CONDITION DISPLACEMENTS
DISPLACEMENTS ARE AT THE CENTERS OF MASS OF THE RESPECTIVE LEVELS

LEVEL	DIRN	LOAD CONDITIONS			
		I	II	IV	A
ROOF	X	0.00000	0.00000	0.00000	.01322
ROOF	Y	0.00000	0.00000	0.00000	-.00430
ROOF	ROT	0.00000	0.00000	0.00000	.01023
ST-2	X	0.00000	0.00000	0.00000	-.00057
ST-2	Y	0.00000	0.00000	0.00000	.00046
ST-2	ROT	0.00000	0.00000	0.00000	-.00419
ST-1	X	0.00000	0.00000	0.00000	-.00737
ST-1	Y	0.00000	0.00000	0.00000	-.00419
ST-1	ROT	0.00000	0.00000	0.00000	.00034
ST-1	X	0.00000	0.00000	0.00000	-.00232
ST-1	Y	0.00000	0.00000	0.00000	-.00291
ST-1	ROT	0.00000	0.00000	0.00000	-.00016

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/TAB500 /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

LATERAL FRAME DISPLACEMENTS IN /ARBITRARY OPENINGS

LEVEL /SEISMIC-X /SEISMIC-Y
NODE .001929 .001929
ST-2 .001184 .001184
ST-1 .000597 .000597

COLUMN FORCES AT LEVEL ST-1 IN /ARBITRARY OPENINGS

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
5	/SEISMIC-X	-65.04	-41.93	-25.75	17.83
5	/SEISMIC-Y	-65.04	-41.93	-25.75	17.83
6	/SEISMIC-X	-19.79	-16.32	-39.72	6.02
6	/SEISMIC-Y	-19.79	-16.32	-39.72	6.02

BEAM FORCES AT LEVEL ST-1 IN /ARBITRARY OPENINGS

BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/SEISMIC-X	9.31	16.81	-3.75	3.48	-3.48
1	/SEISMIC-Y	9.31	16.81	-3.75	3.48	-3.48
2	/SEISMIC-X	-16.81	-96.39	39.79	-18.87	18.87
2	/SEISMIC-Y	-16.81	-96.39	39.79	-18.87	18.87
3	/SEISMIC-X	96.39	-19.99	58.19	25.47	-25.47
3	/SEISMIC-Y	96.39	-19.99	58.19	25.47	-25.47
4	/SEISMIC-X	19.99	56.40	-18.20	25.47	-25.47
4	/SEISMIC-Y	19.99	56.40	-18.20	25.47	-25.47
5	/SEISMIC-X	-36.52	34.80	-35.66	-2.29	2.29
5	/SEISMIC-Y	-36.52	34.80	-35.66	-2.29	2.29

PANEL FORCES AT LEVEL ST-1 IN /ARBITRARY OPENINGS

PANEL NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
3	/SEISMIC-X	-428.71	-156.55	65.47	48.77
3	/SEISMIC-Y	-428.71	-156.55	65.47	48.77

STORY SHEAR /-----LOAD CONDITIONS-----/

	I	II	III	IV	A	B
0.00	0.00	0.00	0.00	0.00	72.62	72.62

STORY SHEAR						
/	I	II	III	IV	A	B
	0.00	0.00	0.00	0.00	60.52	60.52
STORY SHEAR						
/	I	II	III	IV	A	B
	0.00	0.00	0.00	0.00	36.31	36.31

FRAME NO. = 1
STRESS TYPE = -19

/TAB580 /SAMPLE EXAMPLE 3
 /COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE
 FORCES AT LEVEL ST-1 IN /DISCONTINUOUS WALL

COLUMN	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
NO 4	/SEISMIC-X	-16.74	-19.48	-93.81	2.85
4	/SEISMIC-Y	-1.00	.00	-9.00	.00

BEAM FORCES AT LEVEL ST-1 IN /DISCONTINUOUS WALL

BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/SEISMIC-X	.00	-167.85	83.92	-13.99	13.99
1	/SEISMIC-Y	.00	-1.00	.00	.00	.00
2	/SEISMIC-X	167.85	-335.70	251.77	-13.99	13.99
2	/SEISMIC-Y	.00	-1.00	.00	.00	.00
3	/SEISMIC-X	335.70	-13.78	174.74	29.26	-29.26
3	/SEISMIC-Y	.00	-1.00	.00	.00	.00

PANEL FORCES AT LEVEL ST-1 IN /DISCONTINUOUS WALL

PANEL NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/SEISMIC-X	-1796.34	87.72	93.81	142.36
1	/SEISMIC-Y	-1.00	.00	.00	.00

STORY SHEAR /-----LOAD CONDITIONS-----
 0.00 0.00 0.00 0.00 0.00 145.24 .00

/TAB580 /SAMPLE EXAMPLE 3
 /COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

LATERAL FRAME DISPLACEMENTS IN /DISCONTINUOUS WALL
 LEVEL /SEISMIC-X /SEISMIC-Y
 ROOF .002985 .000000
 ST-2 .001899 .000000
 ST-1 .000973 .000000

STARS80 /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

FORCES AT LEVEL ST-2 IN /DISCONTINUOUS WALL

BEAM	COL/M	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	1	/SEISMIC-X	-8.06	-11.15	.99	1.28
1	1	/SEISMIC-Y	-.00	-.00	.00	.00

FORCES AT LEVEL ROOF IN /DISCONTINUOUS WALL

BEAM	COL/M	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	1	/SEISMIC-X	5.72	5.20	.26	.99	.99
1	1	/SEISMIC-Y	-.00	-.00	.00	.00	.00
2	2	/SEISMIC-X	-5.20	2.60	-3.90	-.22	.22
2	2	/SEISMIC-Y	-.00	-.00	.00	.00	.00
3	3	/SEISMIC-X	-2.60	0.00	-1.30	-.22	.22
3	3	/SEISMIC-Y	-.00	-.00	.00	.00	.00

FORCES AT LEVEL ROOF IN /DISCONTINUOUS WALL

PANEL	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/SEISMIC-X	-818.94	-17.11	-.99	71.34
1	/SEISMIC-Y	-.00	-.00	.00	.00
2	/SEISMIC-X	-.00	-.00	.00	.00
2	/SEISMIC-Y	-.00	-.00	.00	.00

STORY SHEAR

STORY	1	2	3	4	5	6	7	8
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.00

FRAME NO. 2
STRESS TIME= .12

STARS80 /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

FORCES AT LEVEL ST-2 IN /DISCONTINUOUS WALL

BEAM	COL/M	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	1	/SEISMIC-X	8.06	269.91	-130.63	23.21	-23.21
1	1	/SEISMIC-Y	.00	.00	.00	.00	.00
2	2	/SEISMIC-X	-269.91	134.95	-202.63	-11.25	11.25
2	2	/SEISMIC-Y	-.00	.00	.00	.00	.00
3	3	/SEISMIC-X	-134.95	.00	-67.48	-11.25	11.25
3	3	/SEISMIC-Y	-.00	.00	.00	.00	.00

FORCES AT LEVEL ST-2 IN /DISCONTINUOUS WALL

PANEL	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/SEISMIC-X	-2323.78	871.42	-.00	121.03
1	/SEISMIC-Y	-.00	.00	.00	.00
2	/SEISMIC-X	-.00	.00	.00	.00
2	/SEISMIC-Y	-.00	.00	.00	.00

STORY SHEAR

STORY	1	2	3	4	5	6	7	8
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.00

/TABS80 /SAMPLE EXAMPLE 3
 /COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

LATERAL FRAME DISPLACEMENTS IN /PIER-SPANDEL

LEVEL /SEISMIC-X /SEISMIC-Y
 MODR -.010534 -.010538
 ST-2 -.013557 -.013557
 ST-1 -.0095220 -.0095220

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/TABS80 /SAMPLE EXAMPLE 3
 /COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

COLUMN FORCES AT LEVEL ST-1 IN /PIER-SPANDEL

COLUMN NO	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/SEISMIC-X	-442.59	-234.41	-20.70	-23.46
1	/SEISMIC-Y	-442.59	234.41	20.70	23.46
2	/SEISMIC-X	199.59	-71.40	-10.75	-21.37
2	/SEISMIC-Y	199.59	71.40	10.75	21.37
4	/SEISMIC-X	336.82	-170.08	31.45	-27.79
4	/SEISMIC-Y	336.82	170.08	-31.45	27.79

BEAM FORCES AT LEVEL ST-1 IN /PIER-SPANDEL

BEAM NO	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/SEISMIC-X	0.00	0.00	0.00	0.00	0.00
1	/SEISMIC-Y	0.00	0.00	0.00	0.00	0.00
2	/SEISMIC-X	0.00	0.00	0.00	0.00	0.00
2	/SEISMIC-Y	0.00	0.00	0.00	0.00	0.00
3	/SEISMIC-X	0.00	0.00	0.00	0.00	0.00
3	/SEISMIC-Y	0.00	0.00	0.00	0.00	0.00

STORY SHEAR

/-----LOAD CONDITIONS-----
 I II IV
 0.00 0.00 0.00 0.00
 A
 -72.62 72.62

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STARSDO /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE
FORCES AT LEVEL ST-2 IN /PIER-SPANDREL

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STARSDO /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE
FORCES AT LEVEL ST-2 IN /PIER-SPANDREL

COLUMN	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/SEISMIC-X	65.52	131.49	-20.70	-32.84
1	/SEISMIC-Y	-65.52	-131.49	20.70	32.84
2	/SEISMIC-X	2.28	13.76	-10.75	-2.34
2	/SEISMIC-Y	-2.28	-13.76	10.75	2.34
4	/SEISMIC-X	10.70	141.34	31.45	-25.34
4	/SEISMIC-Y	-10.70	-141.34	-31.45	25.34

BEAM FORCES AT LEVEL ST-2 IN /PIER-SPANDREL

BEAM	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/SEISMIC-X	0.00	0.00	0.00	0.00
1	/SEISMIC-Y	0.00	0.00	0.00	0.00
2	/SEISMIC-X	0.00	0.00	0.00	0.00
2	/SEISMIC-Y	0.00	0.00	0.00	0.00
3	/SEISMIC-X	-106.50	-101.18	-23.08	23.08
3	/SEISMIC-Y	106.50	101.18	23.08	-23.08

STARSDO /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE
FORCES AT LEVEL ROOF IN /PIER-SPANDREL

COLUMN	LOAD IDENTIFICATION	BOTTOM MOMENT	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	/SEISMIC-X	-208.79	166.36	-20.70	-7.07
1	/SEISMIC-Y	208.79	-166.36	20.70	7.07
2	/SEISMIC-X	-72.14	174.86	-10.75	-17.12
2	/SEISMIC-Y	72.14	-174.86	10.75	17.12
3	/SEISMIC-X	28.42	127.74	23.08	-26.03
3	/SEISMIC-Y	-28.42	-127.74	-23.08	26.03
4	/SEISMIC-X	-98.49	60.59	8.37	-7.37
4	/SEISMIC-Y	98.49	-60.59	-8.37	7.37

BEAM FORCES AT LEVEL ROOF IN /PIER-SPANDREL

BEAM	LOAD IDENTIFICATION	LEFT MOMENT	RIGHT MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/SEISMIC-X	-83.06	-41.12	-20.97	20.70
1	/SEISMIC-Y	83.06	41.12	20.97	-20.70
2	/SEISMIC-X	-80.80	-107.90	13.55	-11.45
2	/SEISMIC-Y	80.80	107.90	-13.55	11.45
3	/SEISMIC-X	-18.27	-40.35	11.04	-8.37
3	/SEISMIC-Y	18.27	40.35	-11.04	8.37

STORY SHEAR	1	11	111	A	B
	0.00	0.00	0.00	-60.52	60.52

STORY SHEAR	1	11	111	A	B
	0.00	0.00	0.00	-36.31	36.31

FRAME NO. = 3
STRESS TIME = .13

/TABSR0 /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

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/TABSR0 /SAMPLE EXAMPLE 3
/COMPLEX SHEAR WALL MODELING /SHEAR PANEL USAGE

SUMMARY OF STORY SHEAR DISTRIBUTION
STORY-9Y-STORY / FRAME-BY-FRAME

LEVEL	ID	FRAME LOCATION	1	II	III	IV	A	B
ST-1		/PIER-SPANDREL	0.00	0.00	0.00	0.00	-72.62	72.62
		/DISCONTINUOUS WALL	0.00	0.00	0.00	0.00	145.24	.00
		/ARBITRARY OPENINGS	0.00	0.00	0.00	0.00	72.62	72.62
ST-2		/PIER-SPANDREL	0.00	0.00	0.00	0.00	-60.52	60.52
		/DISCONTINUOUS WALL	0.00	0.00	0.00	0.00	121.03	.00
		/ARBITRARY OPENINGS	0.00	0.00	0.00	0.00	60.52	60.52
RUOF		/PIER-SPANDREL	0.00	0.00	0.00	0.00	-36.31	36.31
		/DISCONTINUOUS WALL	0.00	0.00	0.00	0.00	72.62	.00
		/ARBITRARY OPENINGS	0.00	0.00	0.00	0.00	36.31	36.31

TIME LOG (SECONDS)

FORM FRAME STIFFNESSES..... = .24
SOLVE STATIC LOAD CASES..... = .02
NODE SHAPES AND DISPLACEMENTS..... = .09
COMPUTE FRAME DISPLACEMENTS..... = .01
MEMBER FORCES AND STRESSES..... = .47
TOTAL TIME..... = .83

D. Example 4 (a and b)

(i) Description

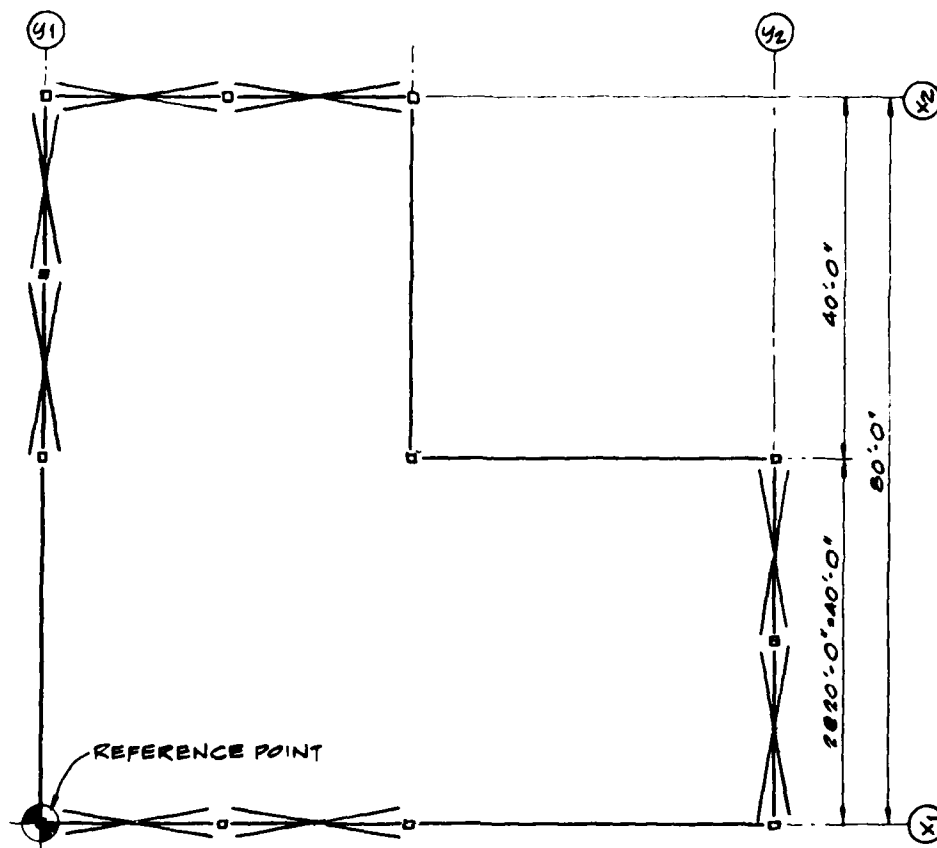
This three story L-shaped braced frame structure is subjected to dynamic loads. Example 4a is response spectrum dynamics and Example 4b is time history dynamics. In both examples the dynamic ground excitation is in the X direction.

(ii) Significant options of CTABS80 activated

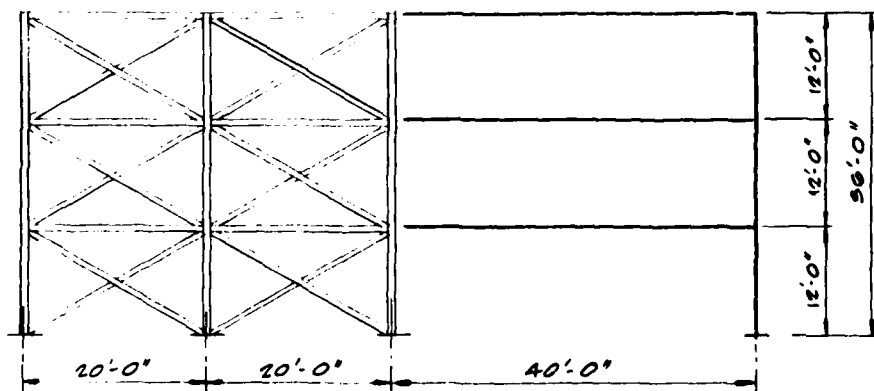
1. Mass properties calculated by program
2. Non-bending (axial only) diagonal element usage
3. Dynamic analysis, response spectrum, and time history
4. SRSS, ABS, and CQC modal combination techniques
5. Uncombined modal output

(iii) Comments

Only two modes of the structure were included in the analysis. Comparison of the response spectrum and the time history results indicate that the SRSS and the ABS combinations highly overestimate the time history results in the frames normal to the direction of excitation. Where as the SRSS combination underestimates the time history results in the frames parallel to the direction of the excitation, the ABS combination comes very close. However, the CQC combination estimates the time history results accurately for all frames, due to the fact that this method performs an algebraic modal summation on closely spaced modes and the effects are dramatic in situations like these where high modal cross coupling exists.



PLAN



ELEVATION

EXAMPLE 4

Computers/Structures International
4009 Webster Street
OAKLAND, CALIFORNIA 94609
(415) 656-9151

JOB CTABS80/Example 4

SHEET NO. _____ OF _____

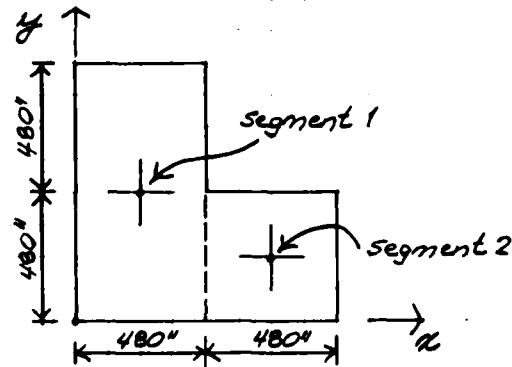
CALCULATED BY FH DATE 5/20/80

CHECKED BY _____ DATE _____

SCALE _____

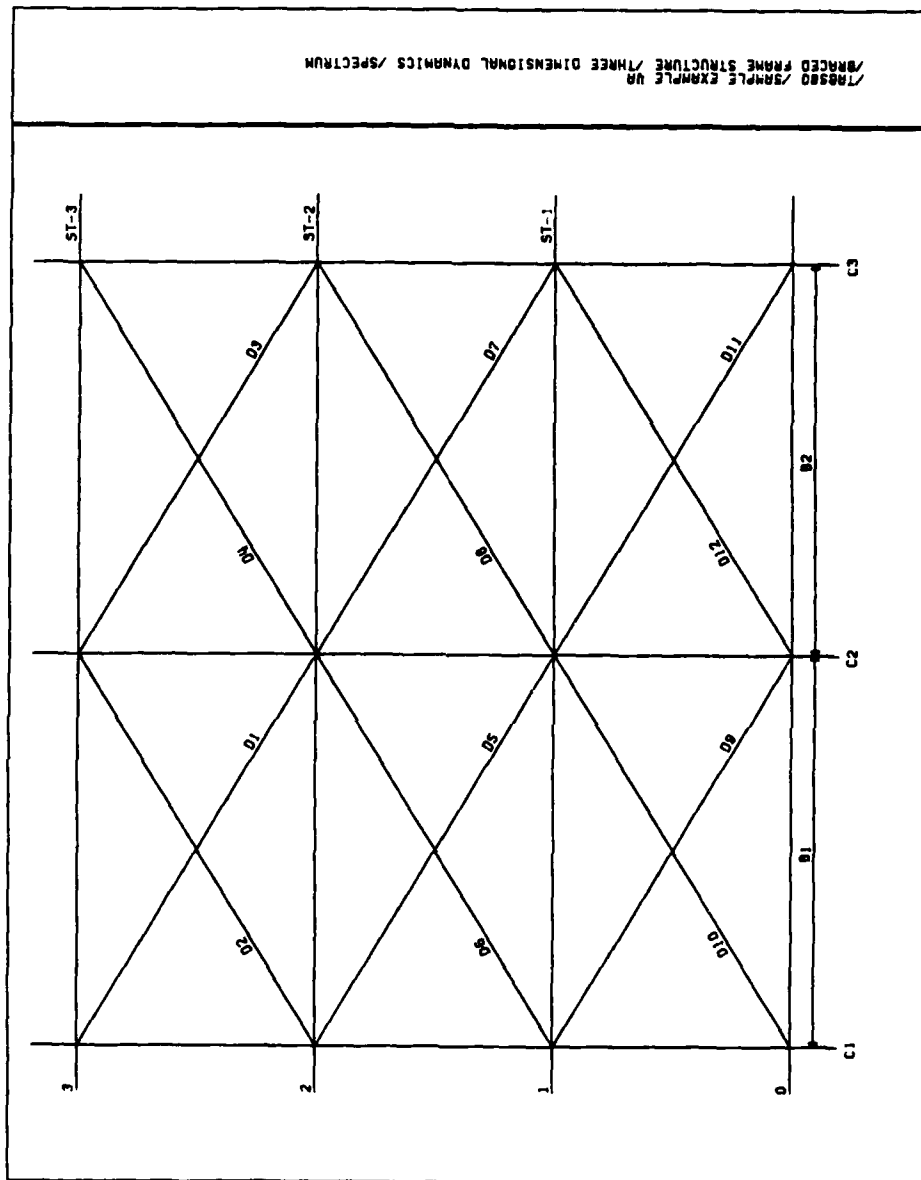
Average diaphragm
weight assumed
100 psf

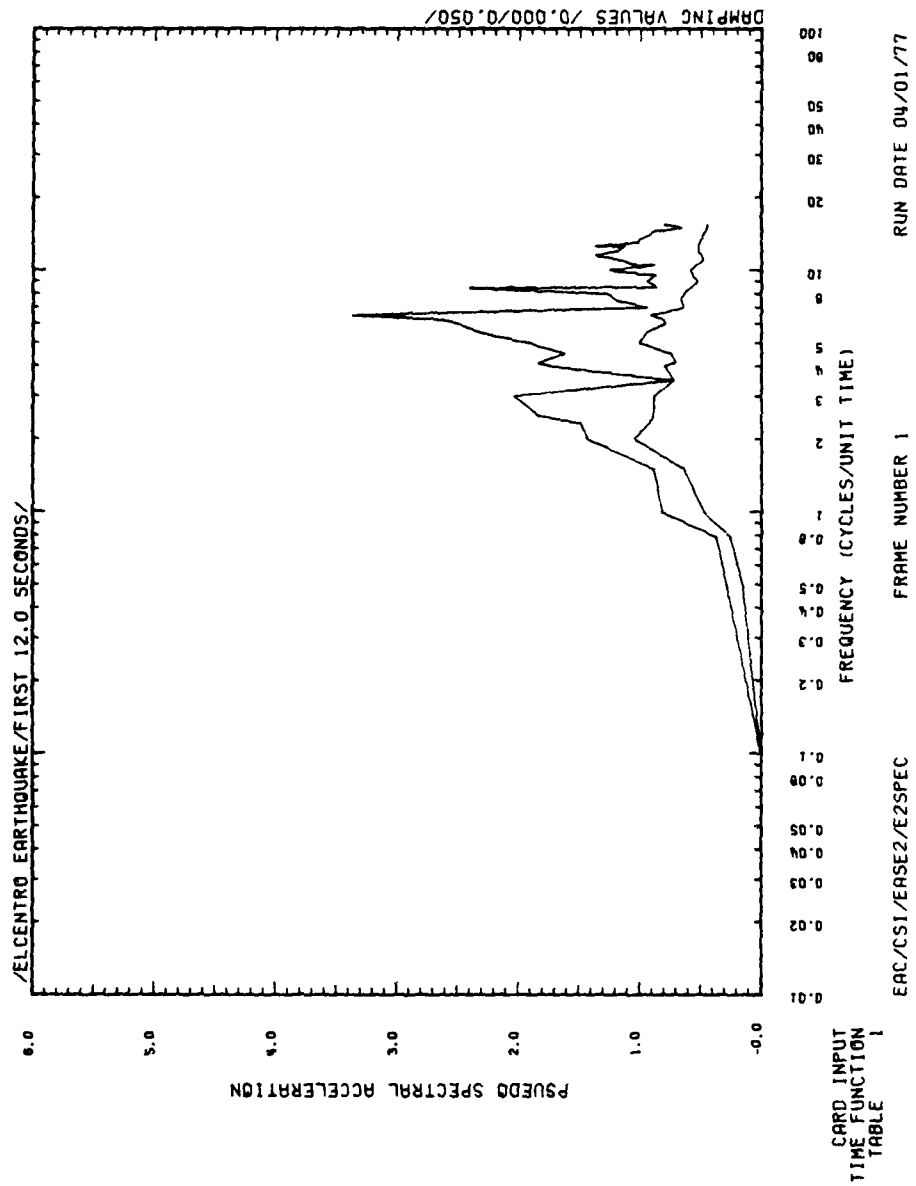
Each level is
discretized into
two rectangular
segments, for
program input
purposes to use
the program dynamic
property calculation
option



Seg #	Weight ^k	XM	YM	B	D
1	320.	240.	480.	480.	960.
2	160.	720.	240.	480.	480

Using a scale factor of $1/386.4 = .00259$
to convert weight to mass





/TAB500 /SAMPLE EXAMPLE 4A
 /BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /SPECTRUM

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TOTAL NUMBER OF STORIES IN STRUCTURE----- 3
 NUMBER OF DIFFERENT FRAMES IN STRUCTURE----- 1
 TOTAL NUMBER OF FRAMES IN STRUCTURE----- 4
 TOTAL NUMBER OF STRUCTURAL LOAD CASES----- 3
 TYPE OF ANALYSIS----- 3
 NUMBER OF MODES CONSIDERED----- 2
 LATERAL STORY TRANSLATION CODE----- 0
 EXECUTION CODE----- C
 FRAME JOINT RIGID ZONE MODIFICATION CODE----- C
 FRAME JOINT DISPLACEMENT PRINT FLAG----- 0
 UMC LATERAL SEISMIC FORCE CODE----- C
 NUMBER OF STORY PASS PATTERNS----- 1
 MASTER PEN PLOT FLAG----- 2

CONVERSION DATA FOR STRESSES
 LENGTH CONVERSION FACTOR----- 1.000
 FORCE CONVERSION FACTOR----- 1.000

STORY PASS TYPE NUMBER----- 1
 NUMBER OF MASS SEGMENTS----- 2
 MASS SCALE FACTOR----- .259E+02

SEGMENT COORDINATES OF CENTER OF MASS
 NUMBER 1 320.00 240.00 480.00
 2 160.00 720.00 240.00

DIMENSIONS OF SEGMENT
 X 480.00
 Y 480.00
 Z 480.00

CALCULATED STORY PASS PROPERTIES
 STORY PASS----- 1-24
 MASS MOMENT OF INERTIA----- 174907.4
 X-COORDINATE OF CENTER OF MASS----- 400.00
 Y-COORDINATE OF CENTER OF MASS----- 400.00

/TAB500 /SAMPLE EXAMPLE 4A
 /BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /SPECTRUM

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STRUCTURAL STORY DATA . . .
 LEVEL PASS TYPE HEIGHT K-X K-Y K-RUIN
 ST-3 1 144.00 0. 0. 0.
 ST-2 1 144.00 0. 0. 0.
 ST-1 1 144.00 0. 0. 0.

STRUCTURAL MASS DATA . . .
 LEVEL MASS PNI HW YP
 ST-3 1-242 174907.4 400.00 400.00
 ST-2 1-242 174907.4 400.00 400.00
 ST-1 1-242 174907.4 400.00 400.00

STRUCTURAL LATERAL LOAD CONDITION A . . .
 LEVEL FX FY X Y
 ST-3 0.00 0.00 0.00 0.00
 ST-2 0.00 0.00 0.00 0.00
 ST-1 0.00 0.00 0.00 0.00

STRUCTURAL LATERAL LOAD CONDITION B . . .
 LEVEL FX FY X Y
 ST-3 0.00 0.00 0.00 0.00
 ST-2 0.00 0.00 0.00 0.00
 ST-1 0.00 0.00 0.00 0.00

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/TAB580 /SAMPLE EXAMPLE 4A
/BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /SPECTRUM

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/TAB580 /SAMPLE EXAMPLE 4A
/BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /SPECTRUM

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LOAD CASE DEFINITION DATA

NO	IC	I	II	III	IV	A	0	DYN-1	DYN-2	DYN-3	LOAD CASE 10
1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
3	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD

DYNAMIC 1 : : : SRS MODAL COMBINATION
DYNAMIC 2 : : : ABS MODAL COMBINATION
DYNAMIC 3 : : : CQC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 : : : NOT USED
DYNAMIC 2 : : : NOT USED
DYNAMIC 3 : : : TIME HISTORY MODAL ANALYSIS

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/TAB580 /SAMPLE EXAMPLE 4A
/BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /SPECTRUM

MAXIMUM MODAL STORY SHEARS AT EACH LEVEL

LEVEL	DIRN	1	2
ST-3	X	244.27	243.30
ST-3	Y	-244.27	243.30
ST-2	X	411.09	409.46
ST-2	Y	-411.09	409.46
ST-1	X	488.43	486.49
ST-1	Y	-488.43	486.49

LATERAL FRAME DISPLACEMENTS IN FRAME Y1			
LEVEL	/SRSS	/ABS	/CC
ST-3	-812896	1.141018	-145763
ST-2	-553120	-780628	-131683
ST-1	-253375	-361697	-861975
LATERAL FRAME DISPLACEMENTS IN FRAME Y2			
LEVEL	MODE 2		
ST-3	-510049		
ST-2	-348340		
ST-1	-161489		

LATERAL FRAME DISPLACEMENTS IN FRAME Y1			
LEVEL	MODE 1	MODE 2	MODE 3
ST-3	-612949		
ST-2	-412288		
ST-1	-200408		
LATERAL FRAME DISPLACEMENTS IN FRAME Y2			
LEVEL	MODE 1	MODE 2	MODE 3
ST-3	-612949		
ST-2	-412288		
ST-1	-200408		

DIAGONAL FORCES AT LEVEL ST-1 IN FRAME Y1

DIAG	LOAD	IDENTIFICATION	BOTTOM	TOP	AXIAL	SHEAR
			MOMENT	MOMENT	FORCE	FORCE
9	/SRSS	/ABS	0.00	0.00	66.48	0.00
9	/SRSS	/ABS	0.00	0.00	121.60	0.00
9	/CC	/CC	0.00	0.00	20.82	0.00
9	MODE 1	MODE 1	0.00	0.00	67.34	0.00
9	MODE 2	MODE 2	0.00	0.00	-54.26	0.00
10	/SRSS	/SRSS	0.00	0.00	139.57	0.00
10	/SRSS	/ABS	0.00	0.00	196.25	0.00
10	/CC	/CC	0.00	0.00	33.61	0.00
10	MODE 1	MODE 1	0.00	0.00	108.68	0.00
10	MODE 2	MODE 2	0.00	0.00	-87.57	0.00
11	/SRSS	/SRSS	0.00	0.00	139.57	0.00
11	/SRSS	/ABS	0.00	0.00	196.25	0.00
11	/CC	/CC	0.00	0.00	33.61	0.00
11	MODE 1	MODE 1	0.00	0.00	108.68	0.00
11	MODE 2	MODE 2	0.00	0.00	-87.57	0.00
12	/SRSS	/SRSS	0.00	0.00	86.48	0.00
12	/SRSS	/ABS	0.00	0.00	121.60	0.00
12	/CC	/CC	0.00	0.00	20.82	0.00
12	MODE 1	MODE 1	0.00	0.00	67.34	0.00
12	MODE 2	MODE 2	0.00	0.00	-54.26	0.00

FORCES AT LEVEL ST-3 IN FRAME Y1

FORCES AT LEVEL ST-2 IN FRAME Y1

FORCES AT LEVEL ST-2 IN FRAME Y1

COL	NO	LOAD IDENTIFICATION	TOP MOMENT	TOP AXIAL FORCE	SHEAR FORCE	COL	NO	LOAD IDENTIFICATION	TOP MOMENT	TOP AXIAL FORCE	SHEAR FORCE
1	1	/SRSS	0.00	100.28	0.00	1	1	/SRSS	0.00	100.28	0.00
1	1	/FABS	0.00	141.00	0.00	1	1	/FABS	0.00	141.00	0.00
1	1	/CBC	0.00	24.15	0.00	1	1	/CBC	0.00	24.15	0.00
1	1	MODE 1	0.00	-78.08	0.00	1	1	MODE 1	0.00	-78.08	0.00
1	1	MODE 2	0.00	62.92	0.00	1	1	MODE 2	0.00	62.92	0.00
2	2	/SRSS	0.00	0.00	0.00	2	2	/SRSS	0.00	0.00	0.00
2	2	/FABS	0.00	0.00	0.00	2	2	/FABS	0.00	0.00	0.00
2	2	/CBC	0.00	0.00	0.00	2	2	/CBC	0.00	0.00	0.00
2	2	MODE 1	0.00	0.00	0.00	2	2	MODE 1	0.00	0.00	0.00
2	2	MODE 2	0.00	0.00	0.00	2	2	MODE 2	0.00	0.00	0.00
3	3	/SRSS	0.00	100.28	0.00	3	3	/SRSS	0.00	100.28	0.00
3	3	/FABS	0.00	141.00	0.00	3	3	/FABS	0.00	141.00	0.00
3	3	/CBC	0.00	24.15	0.00	3	3	/CBC	0.00	24.15	0.00
3	3	MODE 1	0.00	-78.08	0.00	3	3	MODE 1	0.00	-78.08	0.00
3	3	MODE 2	0.00	62.92	0.00	3	3	MODE 2	0.00	62.92	0.00

DIAGONAL FORCES AT LEVEL ST-3 IN FRAME Y1

DIAGONAL FORCES AT LEVEL ST-2 IN FRAME Y1

DIAGONAL FORCES AT LEVEL ST-2 IN FRAME Y1

DIAG	NO	LOAD IDENTIFICATION	TOP MOMENT	TOP AXIAL FORCE	SHEAR FORCE	DIAG	NO	LOAD IDENTIFICATION	TOP MOMENT	TOP AXIAL FORCE	SHEAR FORCE
1	1	/SRSS	0.00	81.86	0.00	1	1	/SRSS	0.00	81.86	0.00
1	1	/FABS	0.00	115.10	0.00	1	1	/FABS	0.00	115.10	0.00
1	1	/CBC	0.00	19.71	0.00	1	1	/CBC	0.00	19.71	0.00
1	1	MODE 1	0.00	63.74	0.00	1	1	MODE 1	0.00	63.74	0.00
1	1	MODE 2	0.00	-51.36	0.00	1	1	MODE 2	0.00	-51.36	0.00
2	2	/SRSS	0.00	108.40	0.00	2	2	/SRSS	0.00	108.40	0.00
2	2	/FABS	0.00	152.42	0.00	2	2	/FABS	0.00	152.42	0.00
2	2	/CBC	0.00	26.10	0.00	2	2	/CBC	0.00	26.10	0.00
2	2	MODE 1	0.00	-84.41	0.00	2	2	MODE 1	0.00	-84.41	0.00
2	2	MODE 2	0.00	68.02	0.00	2	2	MODE 2	0.00	68.02	0.00
3	3	/SRSS	0.00	108.40	0.00	3	3	/SRSS	0.00	108.40	0.00
3	3	/FABS	0.00	152.42	0.00	3	3	/FABS	0.00	152.42	0.00
3	3	/CBC	0.00	26.10	0.00	3	3	/CBC	0.00	26.10	0.00
3	3	MODE 1	0.00	94.41	0.00	3	3	MODE 1	0.00	94.41	0.00
3	3	MODE 2	0.00	-68.02	0.00	3	3	MODE 2	0.00	-68.02	0.00
4	4	/SRSS	0.00	81.86	0.00	4	4	/SRSS	0.00	81.86	0.00
4	4	/FABS	0.00	115.10	0.00	4	4	/FABS	0.00	115.10	0.00
4	4	/CBC	0.00	19.71	0.00	4	4	/CBC	0.00	19.71	0.00
4	4	MODE 1	0.00	-63.74	0.00	4	4	MODE 1	0.00	-63.74	0.00
4	4	MODE 2	0.00	51.36	0.00	4	4	MODE 2	0.00	51.36	0.00

LATERAL FRAME DISPLACEMENTS IN FRAME X1			
LEVEL	/SRSS	/ABS	/CQC
ST-3	-812896	1-143018	1-132821
ST-2	-55170	-780628	-773664
ST-1	-257375	-261897	-358669
LATERAL FRAME DISPLACEMENTS IN FRAME X1			
LEVEL	MODE	2	
ST-3	-510049		
ST-2	-348340		
ST-1	-161489		

DIAGONAL FORCES AT LEVEL ST-1 IN FRAME X1

DIAG	NO	LOAD IDENTIFICATION	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
9	9	/SRSS	0.00	260.55	0.00
9	9	/ABS	0.00	281.59	0.00
9	9	/CQC	0.00	279.47	0.00
9	9	MODE 1	0.00	-156.16	0.00
9	9	MODE 2	0.00	-125.83	0.00
10	10	/SRSS	0.00	139.57	0.00
10	10	/ABS	0.00	194.25	0.00
10	10	/CQC	0.00	194.50	0.00
10	10	MODE 1	0.00	198.68	0.00
10	10	MODE 2	0.00	87.57	0.00
11	11	/SRSS	0.00	139.57	0.00
11	11	/ABS	0.00	194.25	0.00
11	11	/CQC	0.00	194.50	0.00
11	11	MODE 1	0.00	-108.68	0.00
11	11	MODE 2	0.00	-87.57	0.00
12	12	/SRSS	0.00	86.48	0.00
12	12	/ABS	0.00	121.60	0.00
12	12	/CQC	0.00	120.52	0.00
12	12	MODE 1	0.00	87.34	0.00
12	12	MODE 2	0.00	54.26	0.00

FORCES AT LEVEL ST-2 IN FRAME XI									
COLUMN	LOAD	IDENTIFICATION	BOTTOM	TOP	AXIAL	SHEAR	COLUMN	LOAD	IDENTIFICATION
NO			PODMNT	PODMNT	FORCE	FORCE	NO		
1	/SRSS	1	0.00	0.00	100.28	0.00	1	/SRSS	1
1	/ABS	1	0.00	0.00	191.00	0.00	1	/ABS	1
1	/COC	1	0.00	0.00	135.75	0.00	1	/COC	1
1	MODE	1	0.00	0.00	78.08	0.00	1	MODE	1
1	MODE	2	0.00	0.00	62.92	0.00	1	MODE	2
2	/SRSS	2	0.00	0.00	0.00	0.00	2	/SRSS	2
2	/ABS	2	0.00	0.00	0.00	0.00	2	/ABS	2
2	/COC	2	0.00	0.00	0.00	0.00	2	/COC	2
2	MODE	1	0.00	0.00	0.00	0.00	2	MODE	1
2	MODE	2	0.00	0.00	0.00	0.00	2	MODE	2
3	/SRSS	3	0.00	0.00	100.28	0.00	3	/SRSS	3
3	/ABS	3	0.00	0.00	191.00	0.00	3	/ABS	3
3	/COC	3	0.00	0.00	135.75	0.00	3	/COC	3
3	MODE	1	0.00	0.00	78.08	0.00	3	MODE	1
3	MODE	2	0.00	0.00	62.92	0.00	3	MODE	2

DIAGONAL FORCES AT LEVEL ST-2 IN FRAME XI

DIAGONAL FORCES AT LEVEL ST-2 IN FRAME XI									
DIAG	LOAD	IDENTIFICATION	BOTTOM	TOP	AXIAL	SHEAR	DIAG	LOAD	IDENTIFICATION
NO			PODMNT	PODMNT	FORCE	FORCE	NO		
5	/SRSS	5	0.00	0.00	81.86	0.00	5	/SRSS	5
5	/ABS	5	0.00	0.00	115.10	0.00	5	/ABS	5
5	/COC	5	0.00	0.00	114.07	0.00	5	/COC	5
5	MODE	1	0.00	0.00	63.74	0.00	5	MODE	1
5	MODE	2	0.00	0.00	51.36	0.00	5	MODE	2
6	/SRSS	6	0.00	0.00	100.40	0.00	6	/SRSS	6
6	/ABS	6	0.00	0.00	192.42	0.00	6	/ABS	6
6	/COC	6	0.00	0.00	151.06	0.00	6	/COC	6
6	MODE	1	0.00	0.00	84.91	0.00	6	MODE	1
6	MODE	2	0.00	0.00	68.02	0.00	6	MODE	2
7	/SRSS	7	0.00	0.00	109.40	0.00	7	/SRSS	7
7	/ABS	7	0.00	0.00	192.42	0.00	7	/ABS	7
7	/COC	7	0.00	0.00	151.06	0.00	7	/COC	7
7	MODE	1	0.00	0.00	84.91	0.00	7	MODE	1
7	MODE	2	0.00	0.00	68.02	0.00	7	MODE	2
8	/SRSS	8	0.00	0.00	109.40	0.00	8	/SRSS	8
8	/ABS	8	0.00	0.00	192.42	0.00	8	/ABS	8
8	/COC	8	0.00	0.00	151.06	0.00	8	/COC	8
8	MODE	1	0.00	0.00	84.91	0.00	8	MODE	1
8	MODE	2	0.00	0.00	68.02	0.00	8	MODE	2

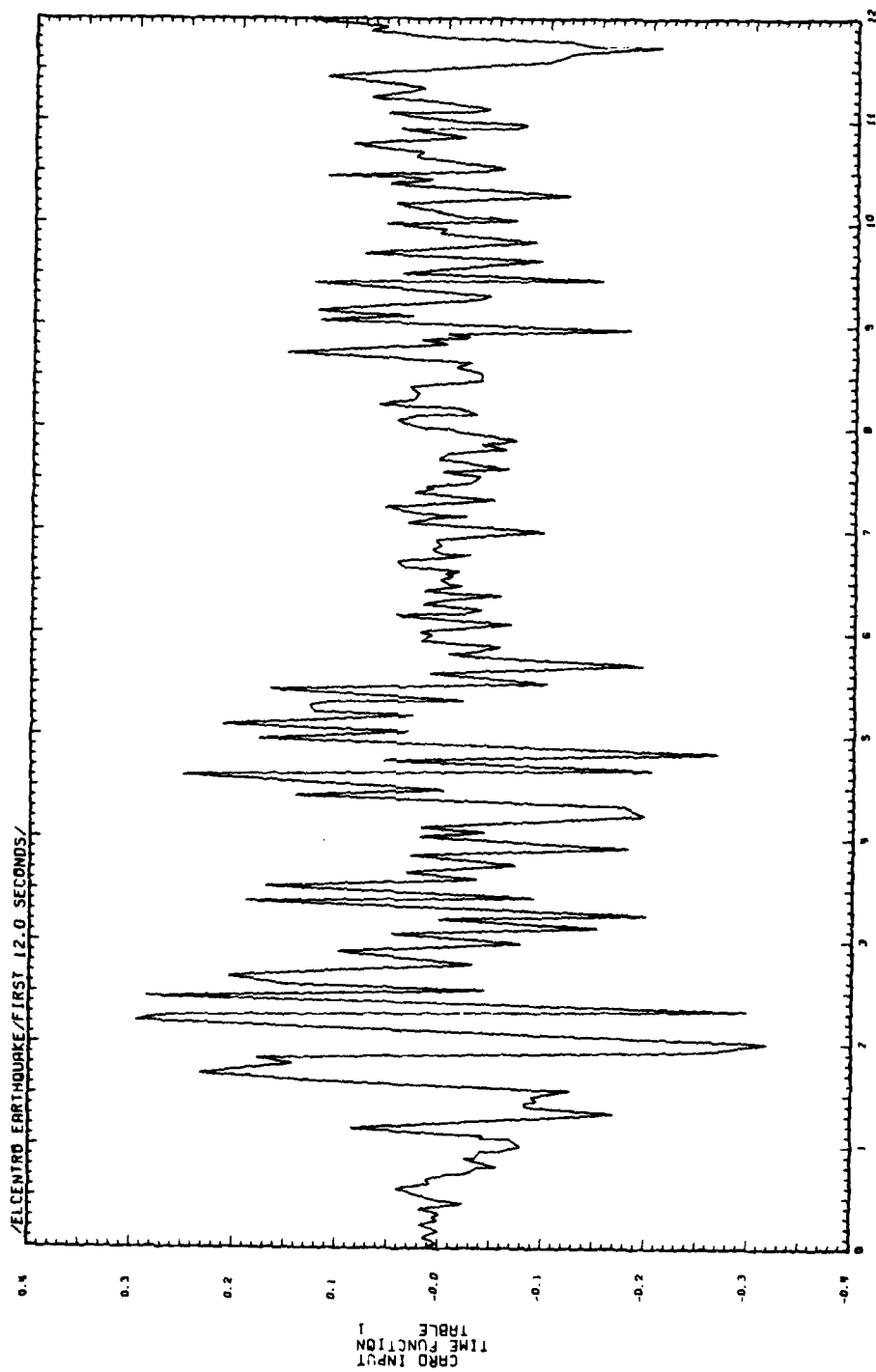
DIAGONAL FORCES AT LEVEL ST-3 IN FRAME XI

DIAGONAL FORCES AT LEVEL ST-3 IN FRAME XI									
DIAG	LOAD	IDENTIFICATION	BOTTOM	TOP	AXIAL	SHEAR	DIAG	LOAD	IDENTIFICATION
NO			PODMNT	PODMNT	FORCE	FORCE	NO		
1	/SRSS	1	0.00	0.00	52.92	0.00	1	/SRSS	1
1	/ABS	1	0.00	0.00	74.41	0.00	1	/ABS	1
1	/COC	1	0.00	0.00	73.75	0.00	1	/COC	1
1	MODE	1	0.00	0.00	41.21	0.00	1	MODE	1
1	MODE	2	0.00	0.00	33.21	0.00	1	MODE	2
2	/SRSS	2	0.00	0.00	60.13	0.00	2	/SRSS	2
2	/ABS	2	0.00	0.00	84.95	0.00	2	/ABS	2
2	/COC	2	0.00	0.00	83.79	0.00	2	/COC	2
2	MODE	1	0.00	0.00	46.82	0.00	2	MODE	1
2	MODE	2	0.00	0.00	37.73	0.00	2	MODE	2
3	/SRSS	3	0.00	0.00	60.13	0.00	3	/SRSS	3
3	/ABS	3	0.00	0.00	84.95	0.00	3	/ABS	3
3	/COC	3	0.00	0.00	83.79	0.00	3	/COC	3
3	MODE	1	0.00	0.00	46.82	0.00	3	MODE	1
3	MODE	2	0.00	0.00	37.73	0.00	3	MODE	2
4	/SRSS	4	0.00	0.00	52.92	0.00	4	/SRSS	4
4	/ABS	4	0.00	0.00	74.41	0.00	4	/ABS	4
4	/COC	4	0.00	0.00	73.75	0.00	4	/COC	4
4	MODE	1	0.00	0.00	41.21	0.00	4	MODE	1
4	MODE	2	0.00	0.00	33.21	0.00	4	MODE	2

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STAR800 /SAMPLE EXAMPLE 4A
/SPACECRAFT STRUCTURE /THREE DIMENSIONAL DYNAMICS /SPECTRUM

TYPE LCG (SECONDS)	
FORP FRAME STIFFNESSES.....	.14
SOLVE STATIC LOAD CASES.....	.02
MODE SHAPES AND FREQUENCIES.....	.12
COMPUTE FRAME DISPLACEMENTS.....	.00
MEMBER FORCES AND STRESSES.....	.53
TOTAL TIME.....	.82



/TAB500 /SAMPLE EXAMPLE 40
 /BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY
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4-RESPONSE ANALYSIS DATA
 ACCELERATION HISTORY HEADING.../CENTRIC EARTHQUAKE (112 SECS)
 ACCELERATION INPUT FORMAT 16510.01
 NUMBER OF JOINTS IN HISTORY 222
 NUMBER OF OUTPUT TIMES 300
 ACCELERATION SCALE FACTOR 386.4000
 ANGLE OF I.C. INCIDENCE 90.0000
 TYPE INCREMENT PER OUTPUT -.0400
 TIME HISTORY TYPE L
 TIME STEP IF L-TYPE HISTORY 0.0000

LOAD CASE DEFINITION DATA

NO	IC	I	J1	J31	IV	A	B	DYN-1	DYN-2	DYN-3	LOAD CASE ID
1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	/HISTORY

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD

DYNAMIC 1 . . . 3855 MODAL COMBINATION

DYNAMIC 2 . . . ABS MODAL COMBINATION

DYNAMIC 3 . . . COC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 . . . NOT USED

DYNAMIC 2 . . . NOT USED

DYNAMIC 3 . . . TIME HISTORY MODAL ANALYSIS

/TAB500 /SAMPLE EXAMPLE 40
 /BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY
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*MODE DAPPING
 1 .050
 2 .050

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/TAB500 /SAMPLE EXAMPLE 40
 /BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY
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GROUND ACCELERATION CARDS

TYPE	ACCELERATION
C-0000	.C11
-0420	.001
-0970	.C16
-1610	-.000
-2210	.015
-2630	.000
-2910	.000
-3320	-.001
-3740	.020
-4290	-.024
-4710	.000
-5110	.043
-5530	.014
-5950	.040
-6370	.005
-6790	-.026
-7201	-.015
-7690	.057
-8191	-.057
-8720	.023
-9221	-.034
-9610	-.040

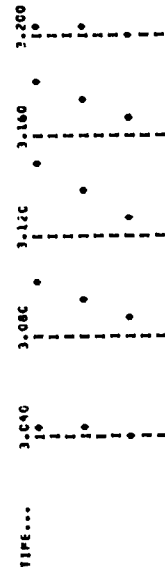
LATERAL FRAME DISPLACEMENTS IN FRAME 11

LEVEL	/HISTORY
ST-3	-.161007
ST-2	-.111736
ST-1	-.051800

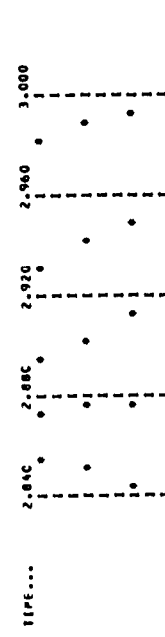
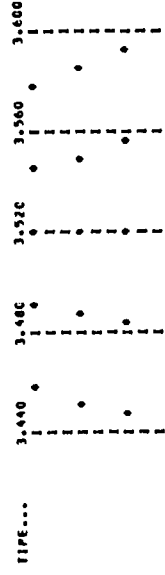
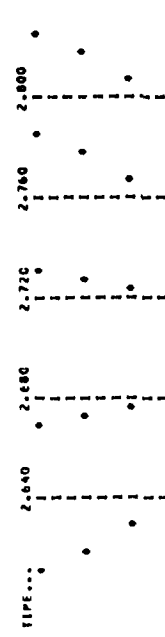
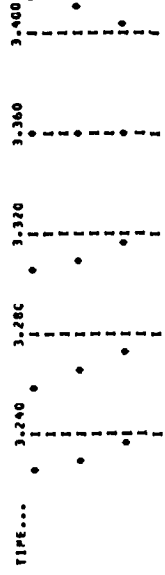
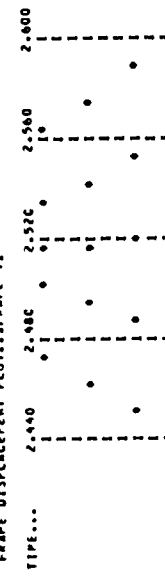
/TABSCC /SAMPLE EXAMPLE 4B
/BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

/TABSCC /SAMPLE EXAMPLE 4B
/BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

FRAME DISPLACEMENT PLOT...FRAME VI



FRAME DISPLACEMENT PLOT...FRAME VI



/TABSCC /SAMPLE EXAMPLE 4B
/BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

/TABSCC /SAMPLE EXAMPLE 4B
/BRACED FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

SCALE - CME ENCM = -163607E+00 MAXIMUM AT T= .26000E+01

NOTE..PLOT IS OF DYNAMIC DISPLACEMENTS ONLY AND DOES NOT
INCLUDE ANY SCALING BY LOAD CASE DEFINITION CARDS

TABLE 39 /SAMPLE EXAMPLE 48
/BRACE FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

FORCES AT LEVEL ST-1 IN FRAME Y1

COLUMN	LOAD IDENTIFICATION	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	1	0.00	40.36	0.00
2	2	0.00	0.00	0.00
3	3	0.00	40.36	0.00

DIAGONAL FORCES AT LEVEL ST-1 IN FRAME Y1

DIAG NO	LOAD IDENTIFICATION	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
9	1	0.00	17.41	0.00
10	2	0.00	28.09	0.00
11	3	0.00	28.09	0.00
12	4	0.00	17.41	0.00

TABLE 40 /SAMPLE EXAMPLE 48
/BRACE FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

FORCES AT LEVEL ST-2 IN FRAME Y1

COLUMN	LOAD IDENTIFICATION	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
1	1	0.00	20.18	0.00
2	2	0.00	0.00	0.00
3	3	0.00	20.18	0.00

DIAGONAL FORCES AT LEVEL ST-2 IN FRAME Y1

DIAG NO	LOAD IDENTIFICATION	TOP MOMENT	AXIAL FORCE	SHEAR FORCE
5	1	0.00	16.47	0.00
6	2	0.00	21.82	0.00
7	3	0.00	21.82	0.00
8	4	0.00	16.47	0.00

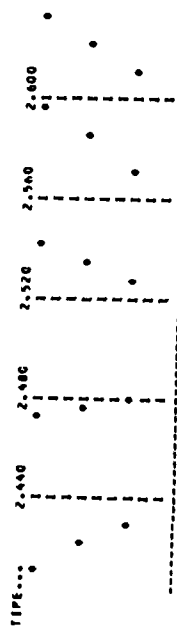
/TAB5BC /SAMPLE EXAMPLE AB
/BRACEC FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

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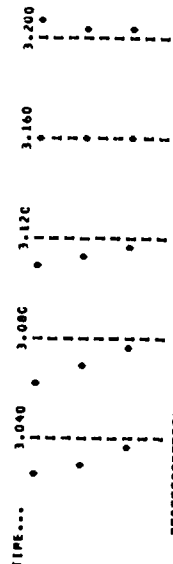
/TAB5BC /SAMPLE EXAMPLE AB
/BRACEC FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

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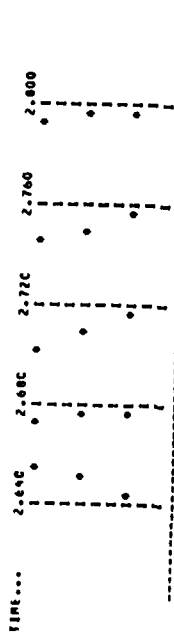
FRAME DISPLACEMENT PLOT...FRAME XI



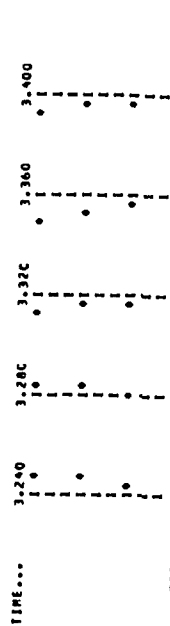
FRAME DISPLACEMENT PLOT...FRAME XI



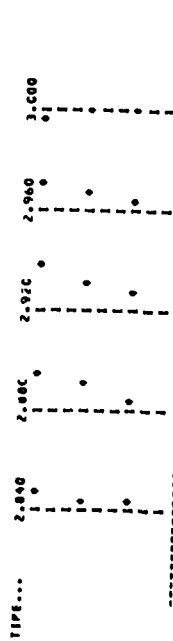
TIME... 2.640 2.680 2.720 2.760 2.800



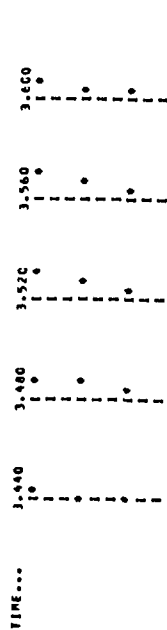
TIME... 3.240 3.280 3.320 3.360 3.400



TIME... 2.840 2.880 2.920 2.960 3.000



TIME... 3.440 3.480 3.520 3.560 3.600



/TAB5BC /SAMPLE EXAMPLE AB
/BRACEC FRAME STRUCTURE /THREE DIMENSIONAL DYNAMICS /HISTORY

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SCALE - CKE INCM - .12191DE+01 MAXIMUM AT T= .29400E+01

NOTE...PLOT IS OF DYNAMIC DISPLACEMENTS ONLY AND DOES NOT
INCLUDE ANY SCALING BY LOAD CASE DEFINITION CARDS

COLPN FORCES AT LEVEL ST-1 IN FRAME XI

COLPN	LOAD	IDENTIFICATION	TOP	BOTTOM	AXIAL	SHEAR
AC	IDENTIFICATION	IDENTIFICATION	POMENT	POMENT	FORCE	FORCE
1	/HISTORY	/HISTORY	0.00	0.00	300.76	0.00
2	/HISTORY	/HISTORY	0.00	0.00	.60	0.00
3	/HISTORY	/HISTORY	0.00	0.00	300.76	0.00

DIAGONAL FORCES AT LEVEL ST-1 IN FRAME XI

DIAG	LOAD	IDENTIFICATION	TOP	BOTTOM	AXIAL	SHEAR
AC	IDENTIFICATION	IDENTIFICATION	POMENT	POMENT	FORCE	FORCE
9	/HISTORY	/HISTORY	0.00	0.00	129.70	0.00
10	/HISTORY	/HISTORY	0.00	0.00	269.31	0.00
11	/HISTORY	/HISTORY	0.00	0.00	269.31	0.00
12	/HISTORY	/HISTORY	0.00	0.00	129.70	0.00

COLPN FORCES AT LEVEL ST-2 IN FRAME XI

COLPN	LOAD	IDENTIFICATION	TOP	BOTTOM	AXIAL	SHEAR
AC	IDENTIFICATION	IDENTIFICATION	POMENT	POMENT	FORCE	FORCE
1	/HISTORY	/HISTORY	0.00	0.00	150.39	0.00
2	/HISTORY	/HISTORY	0.00	0.00	.00	0.00
3	/HISTORY	/HISTORY	0.00	0.00	150.39	0.00

DIAGONAL FORCES AT LEVEL ST-2 IN FRAME XI

DIAG	LOAD	IDENTIFICATION	TOP	BOTTOM	AXIAL	SHEAR
AC	IDENTIFICATION	IDENTIFICATION	POMENT	POMENT	FORCE	FORCE
5	/HISTORY	/HISTORY	0.00	0.00	122.76	0.00
6	/HISTORY	/HISTORY	0.00	0.00	162.57	0.00
7	/HISTORY	/HISTORY	0.00	0.00	162.57	0.00
8	/HISTORY	/HISTORY	0.00	0.00	122.76	0.00

TIME LOG (SECONDS)
FORM FRAME STIFFNESSES..... = .C9
SOLVE STATIC LOAD CASES..... = .C1
MODE SHAPES AND FREQUENCIES..... = .29
COMPUTE FRAME DISPLACEMENTS..... = .C9
MEMBER FORCES AND STRESSES..... = 4.C8
TOTAL TIME..... = 4.56

E. Example 5 (a and b)

(i) Description

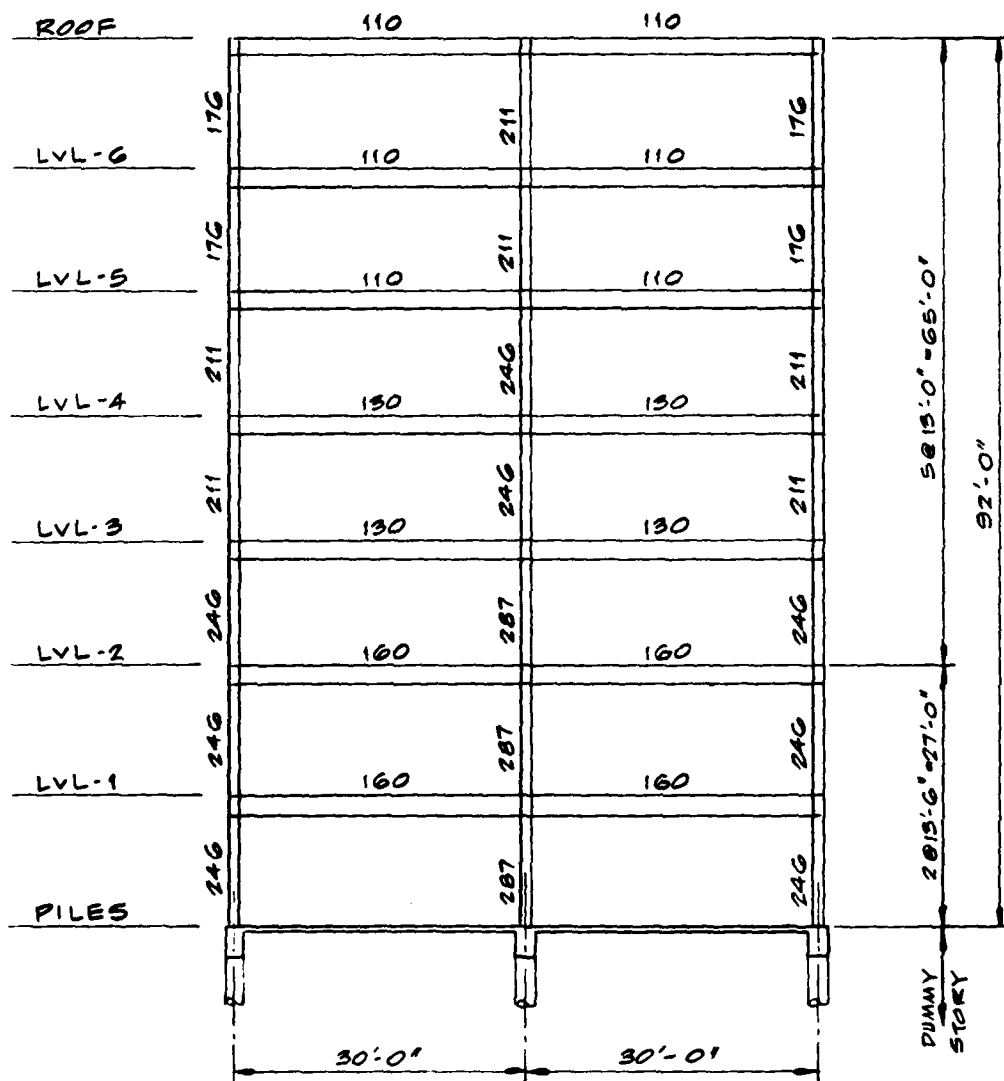
This seven story structure is a moment resisting frame subjected to dynamic response spectrum (5a) and time history (5b) loads.

(ii) Significant options of CTABS80 activated

1. Soil stiffness modeling with dummy story (PILES)
2. Response spectrum dynamics
3. Time history dynamics

(iii) Comments

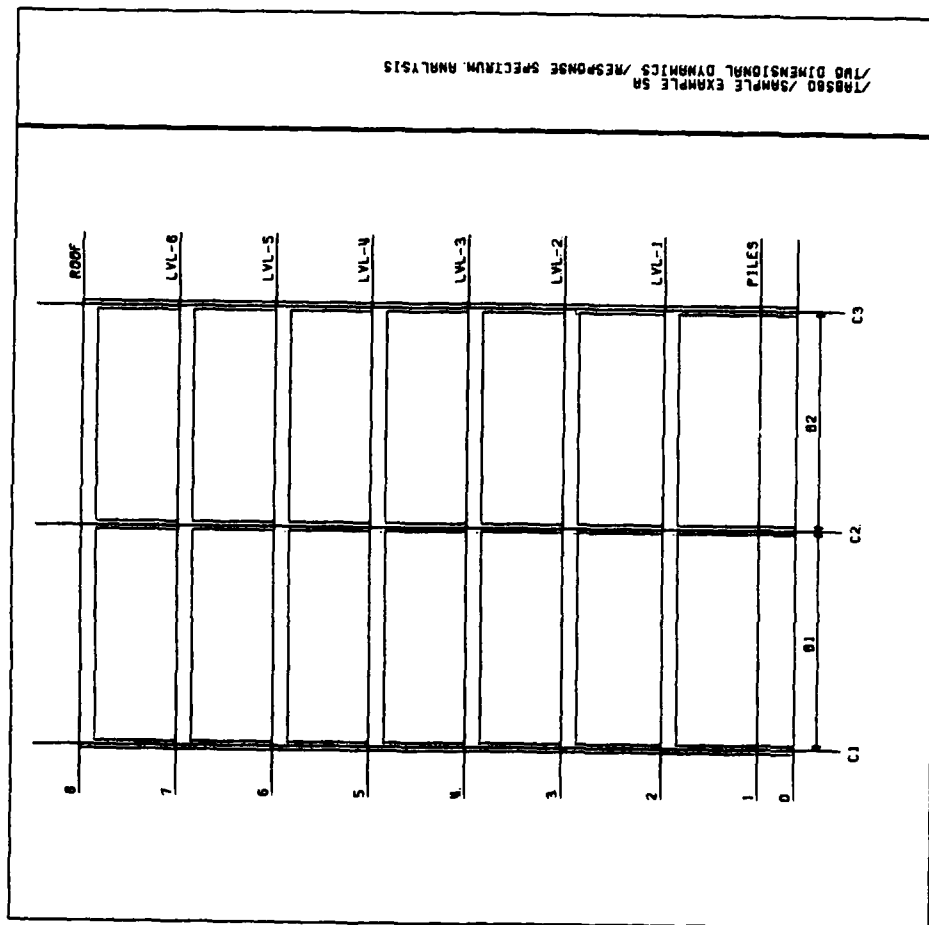
The time periods of this structure are well spread apart. In such situations the modal cross correlation matrix deflates to an identity matrix so that the CQC and SRSS techniques give virtually identical results as illustrated by the output of example 5a.



NOTE: MEMBER WEIGHTS ARE AS SHOWN
 COLUMNS ARE W14'S
 BEAMS ARE W24'S

FRAME ELEVATION

EXAMPLE 5



1. TOTAL NUMBER OF STUDIES IN STRUCTURE-----
2. NUMBER OF DIFFERENT FRAMES IN STRUCTURE-----
3. TOTAL NUMBER OF FRAMES IN STRUCTURE-----
4. TOTAL NUMBER OF STRUCTURAL LOAD CASES-----
5. TYPE OF ANALYSIS-----
6. NUMBER OF MODES CONSIDERED-----
7. LATERAL STORY TRANSLATION CODE-----
8. EXECUTION CODE-----
9. FRAME JOINT RIGID ZONE MODIFICATION CODE-----
10. FRAME JOINT DISPLACEMENT PRINT FLAG-----
11. UBC LATERAL SEISMIC FORCE CODE-----
12. NUMBER OF STORY MASS PATTERNS-----
13. MASTER PER PLOT FLAG-----

STRUCTURAL STORY DATA
LEVEL PASS TYPE HEIGHT R-X R-Y R-ROTH
ROOF 0 156.00 0. 0. 0.
LVL-4 0 156.00 0. 0. 0.
LVL-5 0 156.00 0. 0. 0.
LVL-4 0 156.00 0. 0. 0.
LVL-3 0 156.00 0. 0. 0.
LVL-2 0 162.00 0. 0. 0.
LVL-1 0 156.00 0. 0. 0.
PILES 0 60.00 0. 0. 0.

STRUCTURAL MASS DATA
LEVEL MASS PWT PY
ROOF -473 0.0 0.00 0.00
LVL-4 -487 0.0 0.00 0.00
LVL-5 -487 0.0 0.00 0.00
LVL-4 -487 0.0 0.00 0.00
LVL-3 -487 0.0 0.00 0.00
LVL-2 -487 0.0 0.00 0.00
LVL-1 -515 0.0 0.00 0.00
PILES 1250 0.0 0.00 0.00

STRUCTURAL LATERAL LOAD CONDITION A
LEVEL FX FY X Y
ROOF 0.00 0.00 0.00 0.00
LVL-4 0.00 0.00 0.00 0.00
LVL-5 0.00 0.00 0.00 0.00
LVL-4 0.00 0.00 0.00 0.00
LVL-3 0.00 0.00 0.00 0.00
LVL-2 0.00 0.00 0.00 0.00
LVL-1 0.00 0.00 0.00 0.00
PILES 0.00 0.00 0.00 0.00

STRUCTURAL LATERAL LOAD CONDITION B
LEVEL FX FY X Y
ROOF 0.00 0.00 0.00 0.00
LVL-4 0.00 0.00 0.00 0.00
LVL-5 0.00 0.00 0.00 0.00
LVL-4 0.00 0.00 0.00 0.00
LVL-3 0.00 0.00 0.00 0.00
LVL-2 0.00 0.00 0.00 0.00
LVL-1 0.00 0.00 0.00 0.00
PILES 0.00 0.00 0.00 0.00

CONVERSION DATA FOR STRESSES
LENGTH CONVERSION FACTOR-----
FORCE CONVERSION FACTOR-----

12-0 FRAME

FRAME IDENTIFICATION NUMBER-----
NUMBER OF COLUMN LINES IN FRAME-----
NUMBER OF STORY LEVELS IN FRAME-----
NUMBER OF COLUMNS/PANEL/DIAGONAL PROPERTIES-----
NUMBER OF BEAM PROPERTIES-----
NUMBER OF BEAM SPAN LOADING PATTERNS-----
MAXIMUM POINT LOADS IN ANY SPAN LOADING-----
NUMBER OF PANEL ELEMENTS IN FRAME-----
NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
FRAME PEN PLOT FLAG-----
STORY CONNECTIVITY CODE-----

RAY WIDTHS 360.00 360.00

SILL DEPTHS 0.00 0.00

COLUMN SECTION PROPERTY DATA

ID	U	E	A	I	AV	M	T
1	0.000	29000.0	-512E+02	-215E+04	12.50	14.00	0.00
2	0.000	29000.0	-512E+02	-247E+04	15.50	14.00	0.00
3	0.000	29000.0	-723E+02	-323E+04	18.30	14.00	0.00
4	0.000	29000.0	-844E+02	-391E+04	22.00	14.00	0.00
5	0.000	29000.0	-600E+04	-1.00E+07	20.00	14.00	0.00

BEAM SECTION PROPERTY DATA

ID	U	E	I	K	C	DB	AV	T
1	0.000	29000.0	-333E+04	4.00	-50	24.00	0.00	0.00
2	0.000	29000.0	-402E+04	4.00	-50	24.00	0.00	0.00
3	0.000	29000.0	-512E+04	4.00	-50	24.00	0.00	0.00
4	0.000	29000.0	-220E+05	4.00	-50	0.00	0.00	0.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1	2	3
ROOF	1	2	1
LVL-6	1	2	1
LVL-5	2	3	2
LVL-4	2	3	2
LVL-3	3	4	3
LVL-2	3	4	3
LVL-1	3	4	3

FRAME LOCATION DATA

FRAME PRINT NO	TYPE	CODE	X1	Y1	X2	Y2	FRAME LOCATION
1	1	0	0.00	0.00	10.00	0.00	FRAME OF EXAMPLE 5A

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-RY-LEVEL

LEVEL	1	2	3	4
ROOF	0.00	0.00	0.00	0.00
LVL-6	0.00	0.00	0.00	0.00
LVL-5	0.00	0.00	0.00	0.00
LVL-4	0.00	0.00	0.00	0.00
LVL-3	0.00	0.00	0.00	0.00
LVL-2	0.00	0.00	0.00	0.00
LVL-1	0.00	0.00	0.00	0.00
PILES	0.00	0.00	0.00	0.00

7150 DIMENSIONAL DYNAMICS /RESPONSE SPECTRUM ANALYSIS

MODE NUMBER	PCOE	TIME PERIOD	MODAL PARTICIPATION FACTORS			
			MODE NUMBER DIRECTION	P-FACTOR	P-FACTOR VALUE	
1	1	1.2332	1 X	1.05310		
2	2	.4166	2 X			
3	3	.2333	3 X			
4	4	.1544	4 X			
5	5	.1140	5 X			
6	6	.0905	6 X			
7	7	.0754	7 X			
8	8	.0613	8 X			

MODE SHAPES			
LEVEL	DIRN	1	2
ROCF	X	.797675	.758007
LVL-6	X	.746440	.364981
LVL-5	X	.642019	-.168703
LVL-4	X	.518404	-.582198
LVL-3	X	.376794	-.733651
LVL-2	X	.234770	-.609970
LVL-1	X	.092699	-.281831
PILES	X	.003670	-.012518

MODE SHAPES			
LEVEL	DIRN	3	4
ROCF	X	-.657640	.536085
LVL-6	X	.179644	-.632502
LVL-5	X	.737670	-.414161
LVL-4	X	.449826	.588259
LVL-3	X	-.362041	.476922
LVL-2	X	-.722184	-.437085
LVL-1	X	-.476430	-.639380
PILES	X	-.026057	-.047884

MODE NUMBER	PCOE	TIME PERIOD	MODAL PARTICIPATION FACTORS			
			MODE NUMBER DIRECTION	P-FACTOR	P-FACTOR VALUE	
1	1	1.2332	1 X	1.05310		
2	2	.4166	2 X			
3	3	.2333	3 X			
4	4	.1544	4 X			
5	5	.1140	5 X			
6	6	.0905	6 X			
7	7	.0754	7 X			
8	8	.0613	8 X			

MODE SHAPES			
LEVEL	DIRN	5	6
ROCF	X	.347439	.210667
LVL-6	X	-.745873	-.582195
LVL-5	X	.366650	.768331
LVL-4	X	.443266	-.543843
LVL-3	X	-.648027	-.647089
LVL-2	X	-.114129	.588205
LVL-1	X	.742878	-.625638
PILES	X	.081717	-.112398

MODE SHAPES			
LEVEL	DIRN	7	8
ROCF	X	.662672	-.001547
LVL-6	X	-.210421	.006355
LVL-5	X	.414545	-.017137
LVL-4	X	-.635173	.040655
LVL-3	X	.789640	-.085540
LVL-2	X	-.732050	.165402
LVL-1	X	.435980	-.286026
PILES	X	.159805	.867196

ACCELERATION SPECTRUM /E/CENTRO EARTHQUAKE
NO OF PERIOD CARDS = 51
NO OF SEPARATE PAGES = 0
SCALE FACTOR = 100.000
ANGLE OF EG INCIDENCE = 50.000
STRUCTURAL DAMPING = .050

PERIOD ACCELERATION
G.000 .328
.026 .330
.027 .330
.028 .343
.029 .354
.029 .363
.030 .368
.031 .368
.032 .363
.033 .360
.035 .364
.036 .363
.037 .361
.037 .359
.040 .352
.042 .346
.044 .344
.046 .347
.046 .343
.046 .344
.050 .354
.053 .354
.054 .355
.059 .362
.063 .431
.067 .446
.071 .476
.077 .505
.083 .518
.091 .478
.097 .553
.100 .582
.102 .585
.107 .555
.113 .529
.120 .595
.127 .637
.136 .662
.146 .689
.156 .811
.171 .817
.187 .948
.204 .976

GENERATED MODAL SPECTRAL ACCELERATION VALUES

MODE SPECTRAL
NUMBER ACCELERATION
1 103.879
2 349.456
3 277.671
4 317.300
5 288.201
6 185.379
7 192.381
8 267.439

MAXIMUM POOL STORY SHEARS AT EACH LEVEL

LEVEL	DIRN	1	2	3	4
ROOF	X	64.79	-80.76	36.45	-27.29
LVL-6	X	126.72	-120.79	26.20	5.86
LVL-5	X	180.41	-102.29	-15.90	27.57
LVL-4	X	223.77	-38.42	-41.57	-3.26
LVL-3	X	255.28	42.05	-24.33	-28.26
LVL-2	X	274.92	108.96	16.88	-5.35
LVL-1	X	283.11	141.65	45.63	30.09
PILES	X	283.90	145.18	49.45	36.50

MAXIMUM POOL STORY SHEARS AT EACH LEVEL

LEVEL	DIRN	5	6	7	8
ROOF	X	11.51	-5.12	1.56	-1.12
LVL-6	X	-12.55	9.43	-3.84	-38
LVL-5	X	-71	-9.77	6.81	-96
LVL-4	X	13.59	3.82	-9.51	2.16
LVL-3	X	-7.35	5.00	10.78	-6.65
LVL-2	X	-11.03	-9.52	-8.83	8.37
LVL-1	X	14.31	7.00	3.93	-15.15
PILES	X	21.08	14.21	14.47	157.96

MAXIMUM POOL INERTIA LOADS/TORSIONS
GENERATED IN EACH LEVEL (AT CENTER OF MASS)

LEVEL	DIRN	1	2	3	4
ROOF	X	64.79	-80.76	36.45	-27.29
LVL-6	X	61.93	-40.04	-10.25	33.15
LVL-5	X	53.69	18.51	-42.09	21.71
LVL-4	X	43.36	63.86	-25.67	-30.83
LVL-3	X	31.51	80.48	17.24	-25.00
LVL-2	X	15.63	66.91	41.21	22.91
LVL-1	X	8.20	32.69	28.75	35.44
PILES	X	.79	3.52	3.82	6.41

MAXIMUM POOL INERTIA LOADS/TORSIONS
GENERATED IN EACH LEVEL (AT CENTER OF MASS)

LEVEL	DIRN	5	6	7	8
ROOF	X	11.51	-5.12	1.56	-1.12
LVL-6	X	-24.86	14.55	-5.41	.45
LVL-5	X	11.84	-19.21	10.65	-1.33
LVL-4	X	14.30	13.59	-16.32	3.11
LVL-3	X	-26.94	1.18	20.29	-6.65
LVL-2	X	-3.48	-14.52	-18.81	12.86
LVL-1	X	25.35	16.52	11.95	-23.52
PILES	X	6.77	7.21	10.54	173.09

/TABSD0 /SAMPLE EXAMPLE 5A
/TND DIMENSIONAL DYNAMICS /RESPONSE SPECTRUM ANALYSIS
FORCES AT LEVEL LVL-1 IN /FRAME OF EXAMPLE 5A

COLN	LOAD IDENTIFICATION	BCITOP	PGRENT	TCP	AXIAL FORCE	SHEAR FORCE
1	/SRSS	5209.97	2806.14	270.72	90.75	90.75
2	/ABS	14867.24	5481.15	306.02	154.15	154.15
3	/COC	5266.40	2837.32	270.53	91.35	91.35
4	/SRSS	14538.40	6629.32	.00	140.55	140.55
5	/ABS	26071.76	10627.38	.00	232.37	232.37
6	/COC	12605.42	6675.30	.00	141.40	141.40
7	/SRSS	9209.97	2806.14	270.72	90.75	90.75
8	/ABS	14867.24	5481.15	306.02	154.15	154.15
9	/COC	5266.40	2837.32	270.53	91.35	91.35

BEAP FORCES AT LEVEL LVL-1 IN /FRAME OF EXAMPLE 5A

BEAP	LOAD IDENTIFICATION	LEFT	RIGHT	SPAN	LEFT SHEAR	RIGHT SHEAR
1	/SRSS	10073.43	9349.41	342.23	56.25	56.25
2	/ABS	14590.54	13570.44	514.11	81.41	81.41
3	/COC	10111.34	9424.34	343.73	56.46	56.46
4	/SRSS	9389.42	26073.43	342.23	56.25	56.25
5	/ABS	13570.44	14590.54	514.11	81.41	81.41
6	/COC	9424.34	10111.34	343.73	56.46	56.46

STORY SNEAR /-----LOAD CONDITIONS-----/

I	II	III	IV	A	B
0.00	0.00	0.00	0.00	0.00	0.00

/TABSD0 /SAMPLE EXAMPLE 5A
/TND DIMENSIONAL DYNAMICS /RESPONSE SPECTRUM ANALYSIS

NO	IC	I	II	III	IV	A	B	DYN-1	DYN-2	DYN-3	LOAD CASE ID
1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD

DYNAMIC 1 . . . SRSS MODAL COMBINATION
DYNAMIC 2 . . . ABS MODAL COMBINATION
DYNAMIC 3 . . . COC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 . . . NOT USED
DYNAMIC 2 . . . NOT USED
DYNAMIC 3 . . . TIME HISTORY MODAL ANALYSIS

/TABSD0 /SAMPLE EXAMPLE 5A
/TND DIMENSIONAL DYNAMICS /RESPONSE SPECTRUM ANALYSIS

LATERAL FRAME DISPLACEMENTS IN /FRAME OF EXAMPLE 5A

LEVEL	/SRSS	/ABS	/COC
ROOF	5.330844	6.170876	5.325689
LVL-6	4.811598	5.353577	4.908147
LVL-5	4.251945	4.579614	4.252694
LVL-4	3.478305	4.137399	3.481554
LVL-3	2.594836	3.320556	2.601785
LVL-2	1.870621	2.318719	1.875695
LVL-1	.875599	1.641274	.882915
PILES	.038022	.061346	.031210

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/TABS80 /SAMPLE EXAMPLE 5A
/TNC DIMENSIONAL DYNAMICS /RESPONSE SPECTRUM ANALYSIS

COLUMN FORCES AT LEVEL LVL-2 IN /FRAME OF EXAMPLE 5A

COLUMN NO	LOAD IDENTIFICATION	TOP PCMENT	TOP PCMENT	AXIAL FORCE	SHEAR FORCE
1	/SRSS	5695.99	5644.41	223.35	77.59
1	/ABS	631.32	6050.41	274.57	117.57
1	/COC	5708.92	5660.97	223.64	77.59
2	/SRSS	16360.47	1588.29	-50	192.14
2	/ABS	14918.57	13901.32	-50	207.92
2	/COC	16384.41	1571.13	-50	192.54
3	/SRSS	5495.99	5044.41	223.35	77.36
3	/ABS	631.32	6050.41	274.57	117.57
3	/COC	5708.92	5660.97	223.64	77.59

BEAP FORCES AT LEVEL LVL-2 IN /FRAME OF EXAMPLE 5A

BEAP NO	LOAD IDENTIFICATION	LEFT PCMENT	RIGHT PCMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/SRSS	16311.35	16176.76	317.38	60.46	60.46
1	/ABS	14169.49	13307.94	431.46	79.41	79.41
1	/COC	16828.33	16192.71	317.41	60.75	60.75
2	/SRSS	16176.76	16112.35	317.38	60.46	60.46
2	/ABS	13307.94	14169.49	431.46	79.41	79.41
2	/COC	16192.71	16828.33	317.41	60.75	60.75

STORY SHEAR	1	11	111	IV	A	8
	0.00	0.00	0.00	0.00	0.00	0.00

FRAME NO. = 1
STRESS TIME = .53

/TABS80 /SAMPLE EXAMPLE 5A
/TNC DIMENSIONAL DYNAMICS /RESPONSE SPECTRUM ANALYSIS

TYPE LOG (SECONDS)
FORM FRAME STIFFNESSES.....
SOLVE STATIC LOAD CASES.....
MODE SHAPES AND FREQUENCIES.....
COMPUTE FRAME DISPLACEMENTS.....
MEMBER FORCES AND STRESSES.....
TOTAL TIME.....

PAGE 22
06/06/80
/TABS80 /SAMPLE EXAMPLE 5A
/TNC DIMENSIONAL DYNAMICS /RESPONSE SPECTRUM ANALYSIS

COLUMN FORCES AT LEVEL RC0F IN /FRAME OF EXAMPLE 5A

COLUMN NO	LOAD IDENTIFICATION	TOP PCMENT	TOP PCMENT	AXIAL FORCE	SHEAR FORCE
1	/SRSS	1375.45	2473.04	16.61	24.48
1	/ABS	313.45	4936.63	31.60	50.10
1	/COC	1375.45	2449.01	16.63	20.04
2	/SRSS	3118.29	4442.60	-50	56.94
2	/ABS	6491.73	2213.94	-50	111.40
2	/COC	3064.38	4398.16	-50	56.21
3	/SRSS	1395.53	2473.04	16.61	24.48
3	/ABS	3132.65	4936.63	31.60	50.10
3	/COC	1395.45	2449.01	16.63	20.04

BEAP FORCES AT LEVEL RC0F IN /FRAME OF EXAMPLE 5A

BEAP NO	LOAD IDENTIFICATION	LEFT PCMENT	RIGHT PCMENT	SPAN MOMENT	LEFT SHEAR	RIGHT SHEAR
1	/SRSS	3030.49	2789.49	123.22	16.81	16.81
1	/ABS	2789.49	3030.49	243.72	31.60	31.60
1	/COC	2997.08	2755.22	121.62	16.63	16.63
2	/SRSS	2789.49	3030.49	123.22	16.81	16.81
2	/ABS	3030.49	2789.49	243.72	31.60	31.60
2	/COC	2755.22	2997.08	121.62	16.63	16.63

STORY SHEAR	1	11	111	IV	A	8
	0.00	0.00	0.00	0.00	0.00	0.00

/TAB500 /SAMPLE EXAMPLE 5B
/TND DIMENSIONAL DYNAMICS /TYPE HISTORY ANALYSIS

PAGE 1
06/06/80

/TAB500 /SAMPLE EXAMPLE 5B
/TND DIMENSIONAL DYNAMICS /TYPE HISTORY ANALYSIS

TOTAL NUMBER OF STORIES IN STRUCTURE-----
NUMBER OF DIFFERENT FRAMES IN STRUCTURE-----
TOTAL NUMBER OF FRAMES IN STRUCTURE-----
TOTAL NUMBER OF STRUCTURAL LOAD CASES-----
TYPE OF ANALYSIS-----
NUMBER OF MODES CONSIDERED-----
LATERAL STORY TRANSLATION CODE-----
EXECUTION CODE-----
FRAME JOINT RIGID ZONE MODIFICATION CODE-----
FRAME JOINT DISPLACEMENT PRINT FLAG-----
UBC LATERAL SEISMIC FORCE CODE-----
NUMBER OF STORY PASS PATTERNS-----
MASTER PER PLOT FLAG-----

CONVERSION DATA FOR STRESSES

LENGTH CONVERSION FACTOR-----
FORCE CONVERSION FACTOR-----

RESPONSE ANALYSIS DATA

ACCELERATION HISTORY HEADING../ELCENTRG EARTHQUAKE (112 SECS)
ACCELERATION INPUT FORMAT (6610.0)
NUMBER OF POINTS IN HISTORY 222
NUMBER OF OUTPUT TIMES 15C
ACCELERATION SCALE FACTOR 386.400C
ANGLE OF EQ INCIDENCE 9C.000C
TIME INCREMENT FOR OUTPUT .080C
TIME HISTORY TYPE U
TIME STEP IF E-TYPE HISTORY 0.000C

/TAB500 /SAMPLE EXAMPLE 5B
/TND DIMENSIONAL DYNAMICS /TYPE HISTORY ANALYSIS

MODE CAPPING
1 .050
2 .050
3 .050
4 .050
5 .050
6 .050
7 .050
8 .050

/TABS50 /SAMPLE EXAMPLE 50
 /TBC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
 PAGE 11 06/06/80

/TABS50 /SAMPLE EXAMPLE 50
 /TBC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
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/TABS50 /SAMPLE EXAMPLE 50
 /TBC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
 PAGE 17 06/06/80

GROUND ACCELERATION CARDS

TYPE	ACCELERATION
C-0000	-011
C-0050	-001
C-0100	-006
C-0150	-002
C-0200	-019
C-0250	-009
C-0300	-006
C-0350	-004
C-0400	-001
C-0450	-020
C-0500	-024
C-0550	-008
C-0600	-043
C-0650	-005
C-0700	-014
C-0750	-005
C-0800	-026
C-0850	-039
C-0900	-053
C-0950	-023
C-1000	-034
C-1050	-040
C-1100	-041
C-1150	-075
C-1200	-066
C-1250	-067
C-1300	-036
C-1350	-042
C-1400	-070
C-1450	-045
C-1500	-043
C-1550	-095
C-1600	-108
C-1650	-128
C-1700	-114
C-1750	-234
C-1800	-143
C-1850	-178
C-1900	-261
C-1950	-315
C-2000	-295
C-2050	-263
C-2100	-2700
C-2150	-2990
C-2200	-005
C-2250	-287
C-2300	-047
C-2350	-152
C-2400	-208

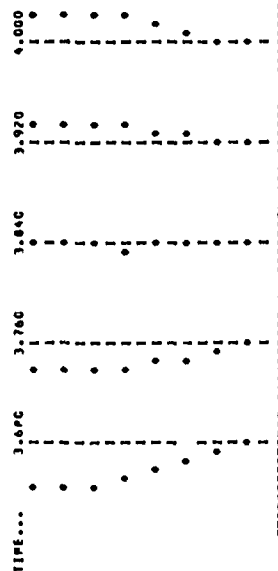
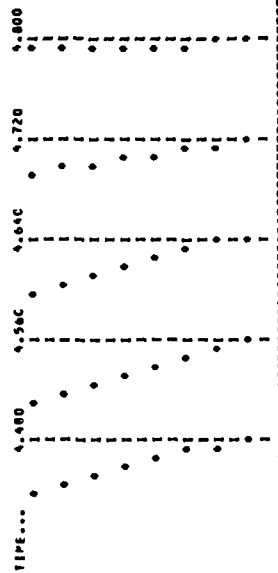
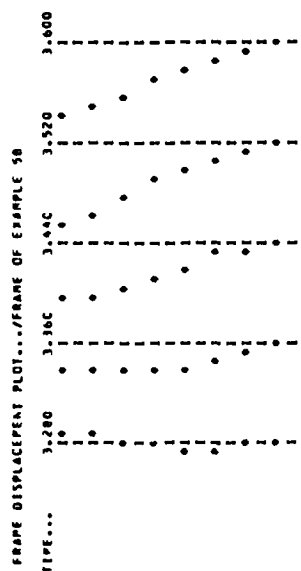
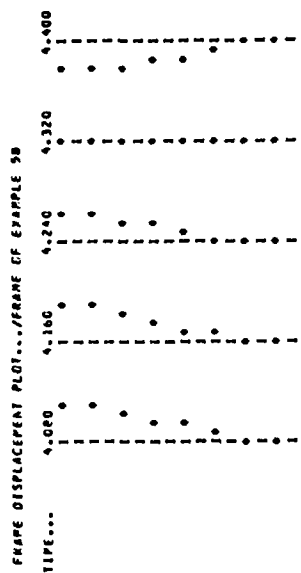
LOAD CASE DEFINITION DATA
 NO IC I II III IV A B DYN-1 DYN-2 DYN-3 LOAD CASE ID
 1 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 /HISTORY

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD
 DYNAMIC 1 . . . SRS MODAL COMBINATION
 DYNAMIC 2 . . . ABS MODAL COMBINATION
 DYNAMIC 3 . . . CQC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD
 DYNAMIC 1 . . . NOT USED
 DYNAMIC 2 . . . NOT USED
 DYNAMIC 3 . . . TIME HISTORY MODAL ANALYSIS

/TABS50 /SAMPLE EXAMPLE 50
 /TBC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
 LATERAL FRAME DISPLACEMENTS IN /FRAME OF EXAMPLE 50

LEVEL	/HISTORY
ROOF	5.483591
LVL-6	4.962946
LVL-5	4.185683
LVL-4	3.721915
LVL-3	2.425519
LVL-2	1.511921
LVL-1	.606925
PILES	.028064



SCALE - GNF INCH = .54035E+01

PARIMUR AT 1=

NOTE...PLOT IS OF DYNAMIC DISPLACEMENTS ONLY AND DOES NOT

INCLUDE ANY SCALING BY LOAD CASE DEFINITION CARDS

/TABS80 /SAMPLE EXAMPLE 58 /TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS

/TABS80 /SAMPLE EXAMPLE 58 /TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS

/TABS80 /SAMPLE EXAMPLE 58 /TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS

FORCES AT LEVEL LVL-1 IN /FRAME OF EXAMPLE 58									
COLUMN	LOAD	IDENTIFICATION	BOTTOM	TOP	AXIAL	FORCE	AXIAL	FORCE	AXIAL
NO	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3

/TABS80 /SAMPLE EXAMPLE 58 /TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS

FORCES AT LEVEL ROOF IN /FRAME OF EXAMPLE 58									
COLUMN	LOAD	IDENTIFICATION	BOTTOM	TOP	AXIAL	FORCE	AXIAL	FORCE	AXIAL
NO	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3

/TABS80 /SAMPLE EXAMPLE 58 /TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS

FORCES AT LEVEL ROOF IN /FRAME OF EXAMPLE 58									
COLUMN	LOAD	IDENTIFICATION	BOTTOM	TOP	AXIAL	FORCE	AXIAL	FORCE	AXIAL
NO	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION	IDENTIFICATION
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3

/TABS80 /SAMPLE EXAMPLE 58 /TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS

/TABS80 /SAMPLE EXAMPLE 58 /TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS
/TNC DIMENSIONAL DYNAMICS /TIME HISTORY ANALYSIS

F. Example 6

(i) Description

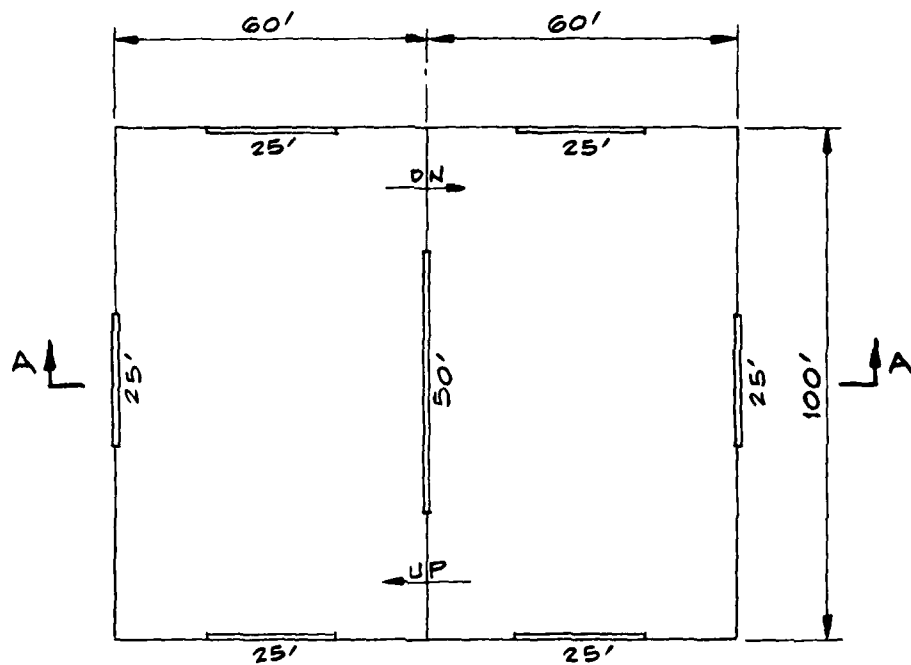
This structure is a 4-story concrete block shear wall parking garage with partial diaphragms. Wall type 3 engages all diaphragms, where all other walls connect only to the two levels associated with the corresponding segment of the structure.

(ii) Significant option of CTABS80 activated

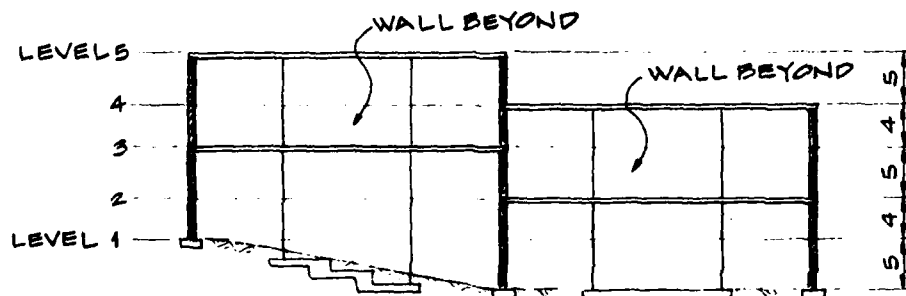
1. Frame/story special connectivity
2. Partial diaphragm modeling
3. Modeling of walls having bases at different elevations.

(iii) Comments

Level 1 is a dummy level for base fixity of higher walls. Wall types 1 and 3 do not connect to this level. A zero story height in the story data will model a condition where two diaphragms exist separately at the same level. In other words if the story height of level 4 is input as 0 (instead of 4) it will be established at the same elevation as level 3.



PLAN



SECTION A-A

ALL WALLS ARE 8" CONCRETE

EXAMPLE 6

STRUCTURAL STORY DATA . . .									
LEVEL	MASS	TYPE	HEIGHT	R-X	R-Y	R-MTM			
LEV 5	0	5.00	0.	0.	0.	0.			
LEV 4	0	4.00	0.	0.	0.	0.			
LEV 3	0	5.00	0.	0.	0.	0.			
LEV 2	0	4.00	0.	0.	0.	0.			
LEV 1	0	5.00	0.	0.	0.	0.			
STRUCTURAL MASS DATA . . .									
LEVEL	MASS	MMI		RM		YM			
LEV 5	0.000	0.0		0.00		0.00			
LEV 4	0.000	0.0		0.00		0.00			
LEV 3	0.000	0.0		0.00		0.00			
LEV 2	0.000	0.0		0.00		0.00			
LEV 1	0.000	0.0		0.00		0.00			
STRUCTURAL LATERAL LOAD CONDITION A . . .									
LEVEL	FX	FY		X		Y			
LEV 5	320.00	0.00		-30.00		0.00			
LEV 4	320.00	0.00		30.00		0.00			
LEV 3	160.00	0.00		-30.00		0.00			
LEV 2	160.00	0.00		30.00		0.00			
LEV 1	0.00	0.00		0.00		0.00			
STRUCTURAL LATERAL LOAD CONDITION B . . .									
LEVEL	FX	FY		X		Y			
LEV 5	0.00	320.00		-30.00		0.00			
LEV 4	0.00	320.00		30.00		0.00			
LEV 3	0.00	160.00		-30.00		0.00			
LEV 2	0.00	160.00		30.00		0.00			
LEV 1	0.00	0.00		0.00		0.00			

AD-A105 513

COMPUTERS/STRUCTURES INTERNATIONAL OAKLAND CA
USER'S GUIDE: COMPUTER PROGRAM FOR THREE-DIMENSIONAL ANALYSIS 0--ETC(U)
AUG 81 E L WILSON, H H DOVEY, A HABIBULLAH

F/6 13/13

UNCLASSIFIED

WES-IR-K-81-9

NL

3 - 5
2 - 1
1 - 12



END
DATE
FILMED
81
DTIC

725 FOOT WALL CONNECTING TO LEVELS 3 AND 5 AND DUPRY LEVEL 1

FRAME IDENTIFICATION NUMBER-----
 NUMBER OF COLUMN LINES IN FRAME-----
 NUMBER OF STORY LEVELS IN FRAME-----
 NUMBER OF COLUMN/PANEL/DIAGONAL PROPERTIES-----
 NUMBER OF BEAM PROPERTIES-----
 NUMBER OF BEAM SPAN LOADING PATTERNS-----
 MAXIMUM POINT LOADS IN ANY SPAN LOADING-----
 NUMBER OF PANEL ELEMENTS IN FRAME-----
 NUMBER OF DIAGONAL ELEMENTS IN FRAME-----
 FRAME PER PLOT FLAG-----
 STORY CONNECTIVITY CODE-----

2
1
2
1
0
0
0
0
0
0
0
1

STRUCTURE LEVELS CONNECTING TO FRAME
4 2

COLUMN SECTION PROPERTY DATA

10	U	E	A	1	AV	M	1
-	1	0.000	432000.0	-1.67E+02	-8.88E+03	13.89	25.00 .67

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1
LEV 4	1
LEV 2	1

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL/-----	VERTICAL LOAD COND-----
10	1 11 III IV
LEV 4	0.00 0.00 0.00 0.00
LEV 2	0.00 0.00 0.00 0.00
FRAME NO. =	2
TIME	.01

STRUCTURE LEVELS CONNECTING TO FRAME
5 3 1

COLUMN SECTION PROPERTY DATA

10	U	E	A	1	AV	4	1
-	1	0.000	432000.0	-1.67E+02	-8.88E+03	13.89	25.00 .67
2	0.000	432000.0	-1.00E+07	-1.00E+07	0.00	0.00	0.00

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1
LEV 5	1
LEV 3	1
LEV 1	2

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL-BY-LEVEL

LEVEL/-----	VERTICAL LOAD COND-----
10	1 11 III IV
LEV 5	0.00 0.00 0.00 0.00
LEV 3	0.00 0.00 0.00 0.00
LEV 1	0.00 0.00 0.00 0.00
FRAME NO. =	1
TIME	.02

/50 FOOT WALL CONNECTING TO LEVELS 2,3,4, AND 5

FRAME IDENTIFICATION NUMBER	3	4	5
NUMBER OF COLUMN LINES IN FRAME	1	1	1
NUMBER OF STORY LEVELS IN FRAME	4	4	4
NUMBER OF SPAN/PANEL/DIAGONAL PROPERTIES	1	1	1
NUMBER OF BEAM PROPERTIES	0	0	0
NUMBER OF BEAM SPAN LOADING PATTERNS	0	0	0
NUMBER OF POINT LOADS IN ANY SPAN LOADING	0	0	0
NUMBER OF PANEL ELEMENTS IN FRAME	0	0	0
NUMBER OF DIAGONAL ELEMENTS IN FRAME	0	0	0
FRAME PEN PLOT FLAG	0	0	0
STORY CONNECTIVITY CODE	1	1	1

STRUCTURE LEVELS CONNECTING TO FRAME

5 4 3 2

COLUMN SECTION PROPERTY DATA

ID	U	E	A	I	AV	M	T
1	0.000	432000.0	-333E+02	699E+04	27.78	50.00	.67

INPUT/GENERATED COLUMN LOCATIONS

LEVEL	1
LEV 5	1
LEV 4	1
LEV 3	1
LEV 2	1

TOTAL VERTICAL LOAD APPLIED ON FRAME LEVEL--BY-LEVEL

LEVEL	I	II	III	IV
LEV 5	0.00	0.00	0.00	0.00
LEV 4	0.00	0.00	0.00	0.00
LEV 3	0.00	0.00	0.00	0.00
LEV 2	0.00	0.00	0.00	0.00

FRAME NO. 3
TIME .02

FRAME LOCATION DATA	Y1	X2	Y2	/--FRAME LOCATION--/
FRAME FRAME PRINT				
NO TYPE CODE				
1 1 0	50.00	10.00	50.00	/LINE A (TYPE 1)
2 1 0	-50.00	10.00	-50.00	/LINE B (TYPE 1)
3 1 0	0.00	-60.00	10.00	/LINE 1 (TYPE 2)
4 2 0	50.00	10.00	50.00	/LINE A (TYPE 2)
5 2 0	-50.00	10.00	-50.00	/LINE B (TYPE 2)
6 2 0	0.00	60.00	10.00	/LINE 2 (TYPE 2)
7 3 0	0.00	0.00	10.00	/LINE 2 (TYPE 3)

TABLE 6 /SAMPLE EXAMPLE 6 /DISCONTINUOUS FLOOR DIAPHRAGMS /SPECIAL STORY LEVEL CONNECTIVITY

LOAD CASE DEFINITION DATA

NO	IC	I	II	III	IV	A	B	DYN-1	DYN-2	DYN-3	LOAD CASE 10
1	0	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	/SEISMIC-X
2	0	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	/SEISMIC-Y

FOR DYNAMICS BY TIME RESPONSE SPECTRUM METHOD

DYNAMIC 1 . . . SASS MODAL COMBINATION
DYNAMIC 2 . . . SASS MODAL COMBINATION
DYNAMIC 3 . . . CGC MODAL COMBINATION

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 . . . NOT USED
DYNAMIC 2 . . . NOT USED
DYNAMIC 3 . . . TIME HISTORY MODAL ANALYSIS

TABLE 7 /SAMPLE EXAMPLE 6 /DISCONTINUOUS FLOOR DIAPHRAGMS /SPECIAL STORY LEVEL CONNECTIVITY

STATIC LOAD CONDITION DISPLACEMENTS

DISPLACEMENTS ARE AT THE CENTERS OF MASS OF THE RESPECTIVE LEVELS

LOAD CONDITIONS: I II III IV A

LEVEL	DYN	I	II	III	IV	A
LEV 5 X	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 5 Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 5 ROTN	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 4 X	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 4 Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 4 ROTN	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 3 X	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 3 Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 3 ROTN	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 2 X	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 2 Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 2 ROTN	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 1 X	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 1 Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LEV 1 ROTN	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

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APPENDIX A: CONTROL CARDS FOR USING CTABS80

Cynernet Scope 3.4, CDC Sunnyvale, California

1. The following set of control cards will create a tape from a card deck of the CTABS80 program. These control cards will store the program in absolute form on the tape. The program can be recalled from the tape and used when needed, as shown below.

```
TABS80,NT1.  
USER,CSINTWC,ASHRAF. }  
PROJECT,*USA*.      }    User accounting information  
FTN,OPT=2.  
LOAD,LGO.  
NOGO,TABS80.  
REQUEST,TT,NT,SV,RING.  
REWIND,TT,TABS80.  
COPYBF,TABS80,TT.  
789 - Eor Card  
Source deck of TABS 80  
6789 - Eof Card
```

2. The following set of control cards will recall the program from the tape created above and execute it with data provided by the user.

```
TABS80,NT1.  
USER,CSINTWC,ASHRAF. }  
PROJECT,*USA*.      }    User accounting information  
REQUEST,TT,NT,VSN=iiiiii.  iiii is a six character identification  
                           of the tape created in the run above  
REWIND,TT,TABS80.  
COPYBF,TT,TABS80.  
UNLOAD,TT.  
REWIND,TABS80.  
TABS80.  
REWIND,TAPE9.  
COPY,TAPE9,OUTPUT.  
789 - Eor Card  
TABS 80 Data  
6789 - Eof Card
```

APPENDIX B: CARD IMAGE LISTING OF EXAMPLE PROBLEMS

B2

1	3	TAB580 101	1	3	TAB580 151
1	3	TAB580 102	1	3	TAB580 152
1	3	TAB580 103	1	3	TAB580 153
1	3	TAB580 104	1	3	TAB580 154
1	3	TAB580 105	1	3	TAB580 155
1	3	TAB580 106	1	3	TAB580 156
1	3	TAB580 107	1	3	TAB580 157
1	3	TAB580 108	1	3	TAB580 158
1	3	TAB580 109	1	3	TAB580 159
1	3	TAB580 110	1	3	TAB580 160
1	3	TAB580 111	1	3	TAB580 161
1	3	TAB580 112	1	3	TAB580 162
1	3	TAB580 113	1	3	TAB580 163
1	3	TAB580 114	1	3	TAB580 164
1	3	TAB580 115	1	3	TAB580 165
1	3	TAB580 116	1	3	TAB580 166
1	3	TAB580 117	1	3	TAB580 167
1	3	TAB580 118	1	3	TAB580 168
1	3	TAB580 119	1	3	TAB580 169
1	3	TAB580 120	1	3	TAB580 170
1	3	TAB580 121	1	3	TAB580 171
1	3	TAB580 122	1	3	TAB580 172
1	3	TAB580 123	1	3	TAB580 173
1	3	TAB580 124	1	3	TAB580 174
1	3	TAB580 125	1	3	TAB580 175
1	3	TAB580 126	1	3	TAB580 176
1	3	TAB580 127	1	3	TAB580 177
1	3	TAB580 128	1	3	TAB580 178
1	3	TAB580 129	1	3	TAB580 179
1	3	TAB580 130	1	3	TAB580 180
1	3	TAB580 131	1	3	TAB580 181
1	3	TAB580 132	1	3	TAB580 182
1	3	TAB580 133	1	3	TAB580 183
1	3	TAB580 134	1	3	TAB580 184
1	3	TAB580 135	1	3	TAB580 185
1	3	TAB580 136	1	3	TAB580 186
1	3	TAB580 137	1	3	TAB580 187
1	3	TAB580 138	1	3	TAB580 188
1	3	TAB580 139	1	3	TAB580 189
1	3	TAB580 140	1	3	TAB580 190
1	3	TAB580 141	1	3	TAB580 191
1	3	TAB580 142	1	3	TAB580 192
1	3	TAB580 143	1	3	TAB580 193
1	3	TAB580 144	1	3	TAB580 194
1	3	TAB580 145	1	3	TAB580 195
1	3	TAB580 146	1	3	TAB580 196
1	3	TAB580 147	1	3	TAB580 197
1	3	TAB580 148	1	3	TAB580 198
1	3	TAB580 149	1	3	TAB580 199
1	3	TAB580 150	1	3	TAB580 200

B5

89

9.89600 .00650 9.93900 -.00060 9.99500 -.05840
 10.62200 -.07130 10.05000 -.04480 10.05010 -.02210
 10.10500 .00930 10.10510 .00240 10.10800 .09100
 10.77200 -.12430 10.30200 .05870 10.42400 .01330
 10.45200 .03860 10.46500 .11640 10.50700 .07340
 10.71900 .05150 10.77000 .09310 10.81900 .07140
 10.92200 .04710 10.92210 .06770 10.94400 .07940
 10.99100 .01200 11.07400 .06080 11.08600 .02690
 11.11600 .04160 11.20700 .02930 11.20710 .05520
 11.22700 .07560 11.24800 .04310 11.32400 .02080
 11.93400 .11800 11.57300 .09990 11.65600 .12470
 11.72400 .20940 11.72510 .15180 11.70800 .11630
 11.80800 0.00000 11.87700 .07620 11.91900 .05700
 11.40000 .13540 12.04300 .06730 12.11300 .08650 /HISTORY
 1 0 1.
 5 SAMPLE PROBLEM 6
 5
 /TAB580 /SAMPLE EXAMPLE 6
 /015 CONTINUOUS FLOOR DIAPHRAGMS /SPECIAL STORY LEVEL CONNECTIVITY
 1. 5 3 7 0 0 0 0 0 0 0 0
 LEV 5 1.
 320. 320. -30. 0. -30. 0.
 LEV 4 4. -30. 0.
 320. 320. 30. 0. 30. 0.
 LEV 3 5. -30. 0.
 160. 160. -30. 0. -30. 0.
 LEV 2 4. 30. 0. 30. 0.
 160. 160. 30. 0. 30. 0.
 LEV 1 5. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0.
 /75 FOOT WALL CONNECTING TO LEVELS 3 AND 5 AND BUNNY LEVEL 1
 1 3 1 2 0 0 0 0 0 0 1
 -1 432000. 999999. 999999. 25. .000007
 2 432000.
 1 1

TAB580 901 /75 FOOT WALL CONNECTING TO LEVELS 2 AND 4 1
 TAB580 902 2 1 2 1 0 0 0 0 0
 TAB580 903 4 2 432000. 25. .000007
 TAB580 904 -1 1
 TAB580 905 /50 FOOT WALL CONNECTING TO LEVELS 2,3,4, AND 5 1
 TAB580 906 3 1 4 3 2 0 0 0 0 0
 TAB580 907 3 1 4 3 2 0 0 0 0 0
 TAB580 908 3 1 4 3 2 0 0 0 0 0
 TAB580 909 -1 432000. 50. .000007
 TAB580 910 1 3
 TAB580 911 1 0. 50. 10. 50.
 TAB580 912 1 0. -50. 10. -50.
 TAB580 913 1 0. 0. -60. 10. -60.
 TAB580 914 2 0. 30. 10. 30.
 TAB580 915 2 0. 30. 10. 30.
 TAB580 916 3 0. 60. 10. 60.
 TAB580 917 3 0. 0. 0. 10. 10.
 TAB580 918 1 0. 1.0 1.0
 TAB580 919 2 0
 TAB580 920 END
 TAB580 921
 TAB580 922
 TAB580 923
 TAB580 924
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 TAB580 998
 TAB580 999
 TAB580 1000

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User's guide, computer program for three-dimensional analysis of building systems (CTABS80) : final report / by Edward L. Wilson, H.H. Dovey, Ashraf Habibullah (Computers/Structures International). -- Vicksburg, Miss. : U.S. Army Engineer Waterways Experiment Station ; Springfield, Va. : available from NTIS, [1981].

208 p. in various pagings : ill. ; 27 cm. -- (Instruction report / U.S. Army Engineer Waterways Experiment Station ; K-81-9)

Cover title.

"August 1981."

"Prepared for Office, Chief of Engineers, U.S. Army, Washington, D.C."

"Monitored by Automatic Data Processing Center, U.S. Army Engineer Waterways Experiment Station."

"A report under the Computer-Aided Structural Engineering (CASE) Project."

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TA7.W34i no.K-81-9

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	Title	Date
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Technical Report K-80-1	Survey of Bridge-Oriented Design Software	Jan 1980
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Instruction Report K-80-7	User's Reference Manual: Computer Program for Design and Analysis of Inverted-T Retaining Walls and Floodwalls (TWDA)	Dec 1980
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