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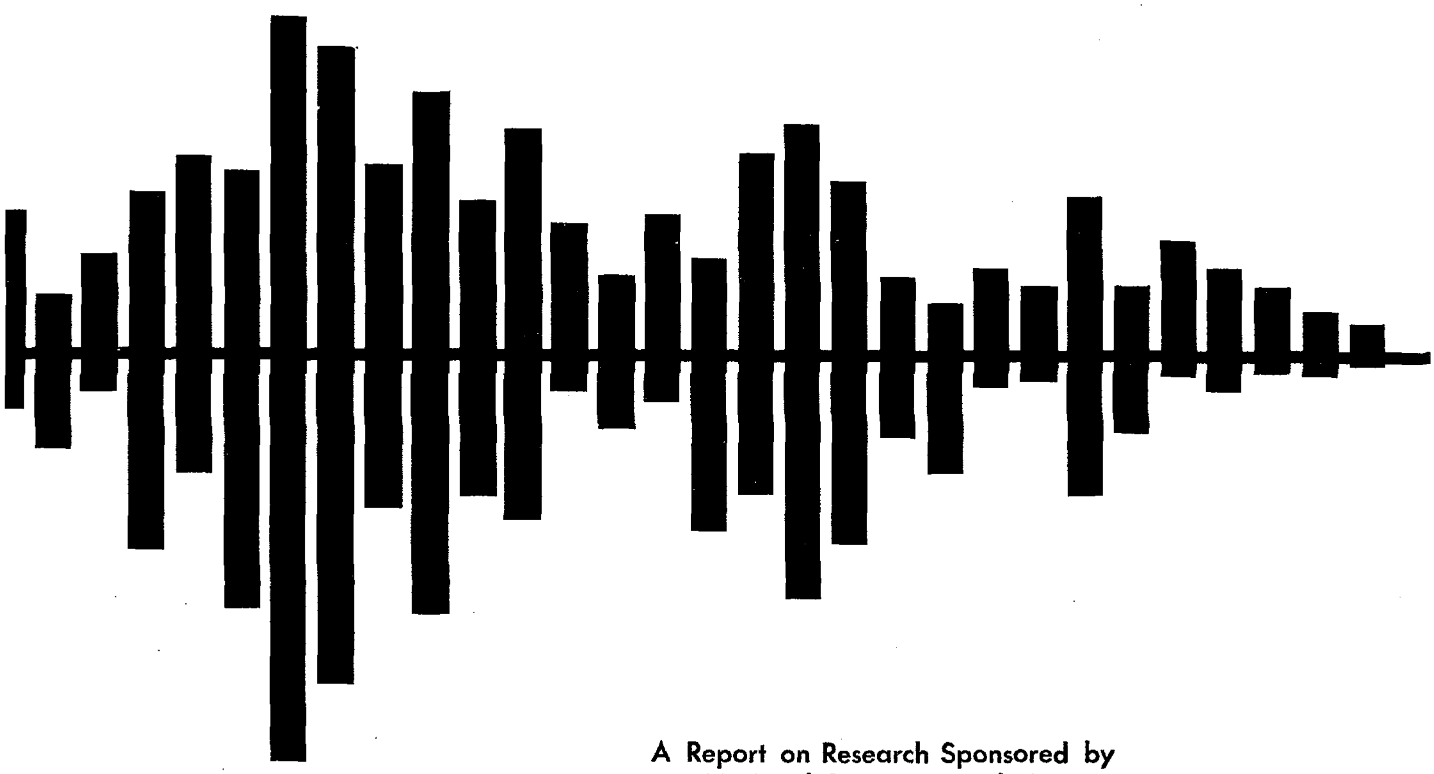
(USER'S GUIDE TO DRAIN–2D: EL7 FOR RC SHEARWALLS)

Anil Kumar

James K. Wight

The University of Michigan Department of Civil Engineering



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by

Anil Kumar
Scientist, Cement Research Institute of India
New Delhi-INDIA
Presently Visiting Scholar at the University of Michigan

J. K. Wight
Associate Professor of Civil Engineering

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ABSTRACT

Element EL7 is a general purpose element for reinforced concrete shearwalls under reversed cyclic loading. The element is developed for use in the DRAIN-2D computer program for calculating the nonlinear response of multistory structures subject to earthquake motion. This report describes the essential features of the element and includes the FORTRAN listing of the subroutines. Input data and sample computer output for a seven story reinforced concrete frame-wall structure are presented to illustrate the data preparation procedure and output format for the shearwall element. A discussion on the computer results will be reported separately. Stiffness and hysteresis modelling for the shearwall element are taken from available literature, with a few modifications.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

Reinforced concrete walls are often introduced into multistory structures to resist lateral loads, especially when the frame alone is insufficient for lateral resistance. Such a case occurs normally in tall structures when a frame alone does not provide an economical and structurally efficient system. The shearwalls, acting as predominant lateral resisting units, are assumed to behave linearly elastic in earthquake resistant design of frame-wall structures. This is because, until quite recently, reinforced concrete shearwalls have been thought to be brittle or semi-brittle elements. However, analytical and experimental investigations on shearwall systems (Refs. 8,10,12) and their satisfactory performance during several earthquakes have shown that walls are capable of showing ductile behavior, provided adequate care is taken in design and detailing.

A review of the available analytical investigations (Refs. 1,2,3,4) on the nonlinear seismic behavior of frame-wall structures shows that a shearwall is normally idealized as an equivalent column taking into account flexural deformation and sometimes shear deformation also. An extension of the equivalent column idealization is done by dividing the interstory shearwall element into a finite number of small segments (Ref. 2) to take into account a more general distribution of moments in shearwalls than in the case of beams and columns. The segment nodal points are condensed out of the element stiffness matrix before it is used in the analysis of the complete structure.

Experimental investigations on reinforced concrete walls (Refs. 5,8,12) have shown that bending deformation of a wall was caused primarily by the extension of the tension side boundary column. Also, a full scale test on a seven story frame-wall structure has indicated the possibility of shear yielding at the base of the wall under certain types of earthquake motions (Ref. 9). Kabeyasawa et.al.(Ref. 6) have proposed a simiplified model for a reinforced concrete wall taking into account the above features. The model was used (Ref. 6) for the psuedo-dynamic analysis of a seven story frame-wall structure. The writers of this report have developed the required subroutines for the above model to be used with the DRAIN-2D program for the nonlinear time history analysis of multistory frame-wall structures. Some additions and simplifictions have been introduced by the writers in the model proposed by Kabeyasawa (Ref. 6). A general description of the shearwall model and user's guide for the preparation of data for the shearwall element are given in this report.

DRAIN - 2D COMPUTER PROGRAM

Drain-2D is a general purpose computer program for the nonlinear response of plane structures subjected to earthquake motion, and was developed by Kanaan and Powell (Ref. 7). The program concepts and features are described in Reference 7. The user's guide (Ref. 11) describes the extensions made to the original program (Ref. 7) and presents input data procedures. This report supplements References 7 and 11 and has to be used in conjunction with them. The data preparation procedure presented in this report is kept the same as in References 7 and 11 in order to provide continuity. The procedure followed for adding the new shearwall element, hereafter referred to as EL7, to the DRAIN-2D conforms to Chapter 4 of Reference 7. The four main subroutines developed for the element EL7 are as follows. The number at the end of the subroutine names corresponds to the element type which is 7 in the present case. The other subroutines make a part of these four main subroutines.

1. INEL7: Input and initialization of element data.
2. STIF7: Calculation of element tangent stiffness matrix at different time steps.
3. RESP7: Determination of increments of element deformations and forces in each component, determination of yield status of each component, and output of time history results. This is also referred to as "state determination phase".
4. OUT7: Output of final envelop values for element deformations and forces.

The arrangement described above is used in the DRAIN-2D program and is adopted as such. The FORTRAN listing for the element EL7 is given in Appendix A-1. COMMENT statements are introduced at suitable places in the subroutines for understanding the underlying logic. The subroutine programs are developed for AMDAHL 470V/6 Computer at the University of Michigan using MTS. It is believed that these programs can easily be used on other systems.

CHAPTER 2

SHEARWALL ELEMENT EL7

STRUCTURAL IDEALIZATION OF THE ELEMENT

The shearwall member is idealized as three vertical line elements with infinitely rigid beams connecting the elements at the top and bottom floor levels (Fig. 1). The two outside truss elements represent the axial stiffness of the boundary columns. The axial stiffness varies with the sign and level of axial stress, and degraded with tensile history. The central vertical element which rigidly connects to the top rigid beam, is a one component model in which vertical, horizontal and rotational springs are concentrated at the base. The resistance of the wall section is lumped at the locations of the outer truss elements and the central vertical spring. The effect of strain gradient across the interior portion of the wall section is represented by the rotational spring in the central element, and the shear deformation is expressed by the deformation of the horizontal spring. Each of these components can have independent stiffness and hysteretic characteristics.

ELEMENT DEFORMATION

The shearwall element has six degress of freedom with reference to the global coordinate system. There are five deformations to be considered, i.e. axial extensions in the two truss members and the vertical spring, rotation of the rotational spring and extension in the horizontal spring (Fig. 2). The three deformations in the springs are sufficient to find the deformation pattern in the member. The five deformations are considered here for the sake of generality and could be useful for any future modifications.

The displacement transformation matrix relating increments of element deformation to the degrees of freedom in global coordinates, is as follows:

$$\begin{bmatrix} dv_1 \\ dv_2 \\ dv_3 \\ dv_4 \\ dv_5 \end{bmatrix} = \begin{bmatrix} 0 & -1 & B & 0 & 1 & -B \\ 0 & -1 & -B & 0 & 1 & B \\ 0 & -1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \\ -1 & 0 & 0 & 1 & 0 & H \end{bmatrix} \begin{bmatrix} dr_1 \\ dr_2 \\ dr3 \\ dr_4 \\ dr_5 \\ dr_6 \end{bmatrix} \qquad (2.1)$$

or $\{dv\} = [a] \{dr\}$ (2.2)

The effect of large deformations is not taken into account in the above fromulation. The parameters B and H, therefore, remain constant.

ELEMENT STIFFNESS

The tangent stiffness matrix relating the element deformations and element forces is as follows:

$$\begin{bmatrix} ds_1 \\ ds_2 \\ ds_3 \\ ds_4 \\ ds_5 \end{bmatrix} = \begin{bmatrix} (\frac{EA}{H})_L & 0 & 0 & 0 & 0 \\ 0 & (\frac{EA}{H})_R & 0 & 0 & 0 \\ 0 & 0 & K_V & 0 & 0 \\ 0 & 0 & 0 & K_R & 0 \\ 0 & 0 & 0 & 0 & K_H \end{bmatrix} \begin{bmatrix} dv_1 \\ dv_2 \\ dv_3 \\ dv_4 \\ dv_5 \end{bmatrix} \qquad (2.3)$$

or $\{ds\} = [k_T] \{dv\}$ (2.4)

where $(\frac{EA}{H})_L$ and $(\frac{EA}{H})_R$ represent the current axial stiffness of the left and the right hand columns respectively.

K_V represents the current axial stiffness of the vertical spring

K_R represents the current rotational stiffness of the rotational spring, and

K_H represents the current stiffness of the horizontal spring.

The tangent stiffness in terms of nodal displacements is

$$[K_T] = [a]^T[k_T][a] \qquad (2.5)$$

where [a] is given by equations 2.1 and 2.2. The matrix $[K_T]$ for the proposed shearwall element is given in Appendix A-2.

HYSTERESIS MODELS

Two types of hysteresis models are used in the formulation of the computer program. One is the axial-stiffness hysteresis model (Fig. 3) used for the axially loaded components of the shearwall element, such as the boundary columns and vertical spring. The other is the origin oriented hysteresis model (Fig. 4) used for the rotational and horizontal springs. The two models are described in the following. The boundary columns are assumed to have the same properties, that is, initial stiffness, yield load, yield displacement and strain hardening, and therefore have the same hysteretic properties. The other components possess individual hysteretic properties.

Axial Stiffness Hysteresis Model

Assuming that the member is initially loaded in compression, it follows segment ABO (computer print out code for this segment is 0) elastically as shown in Fig. 3(a). When the net axial load in the member changes sign from compression to tension, it follows segment OC (code=1) under increasing tensile load up to point C. The member yields at C and follows segment CM (code=2). If the displacement changes direction from a response point D on slope OC (code=1) the member unloads elastically along segment DE (code=3) parallel to the initial slope ABO (code=0). The member then follows a regular bilinear hysteresis rule between point D and point B. Point B is defined on the elastic slope in compression at a force equal to the tensile yield strength F_y. Point E is, therefore, determined with the condition that segment BE (code=4) is parallel to OC (code=0). If the response point reaches the previous tensile response point D, the response point moves further on slope OC (code=1) renewing the coordinates of D and E. If the response point reaches point B along the slopes DE and EB, under continued compression, it moves on slope BA (code=0), the elastic slope in compression. Coordinates of D and E are updated when there is a change in the direction of displacement for the response point on slope BE (code=4) or OC (code=1).

After the tensile yielding occurs along segment CM (code=2), the response point moves in accordance with the regular bilinear hysteresis rule between point B and previous maximum tensile response point M (Fig. 3b). The slope of segment MG (code=9) is the same as the slope of the line joining M and O. The segment BF (code=6) has the same slope as (code=9). The slope of parallel segments MF (code=5) and BG (code=8) is obtained from the following relationship:

Slope of segment MF (or BG)

$$= \frac{\text{Initial slope in compression (slope of ABO)}}{\text{Initial slope in tension (slope of OC)}} \times \text{Slope of segment MG} \quad (2.6)$$

Based on the information obtained for these slopes, the coordinates of points G and F are computed and stored.

When the response point reaches the previous maximum tensile response point M, the response point further moves on slope CM (code=2) under increasing displacement renewing the maximum response point M, point F and point G. If, under continued compression, the response point reaches point B along the slopes MF and FB, it moves on slope BA (code=7), i.e. the elastic slope in compression. A separate code number is assigned to slope BA because two slopes are originating from point B after tensile yielding has taken place. In case there is a change in the direction of displacement from slope BF, the response point follows a slope parallel to FM (code=5) until it strikes slope GM (code=9) and then it further moves on slope GM. Similarly, the response point moved along a slope parallel to FM (code=5) after it unloads from slope GM until it strikes FB (code=6). Thereafter, the response point shall move on slope FB (code=6)

It may be noted that the codes for slopes DE and OBA are kept different even though they are parallel to each other. The same is true for slopes BE and OG, BG and MF, and GM and MF. This has been done for the sake of simplicity in the development of the algorithm for the computer program.

Origin Oriented Hysteresis Model

The origin oriented hysteresis model (Fig. 4), which dissipates a small amount of hysteretic energy, is used for the rotational and horizontal springs at the base of the shearwall element. The response point moves along a line connecting the origin and the previous maximum response point (Fig. 4). Thus it will move either on slope AB (code=0) or CD (code=3). Initially, the point moves on slope AB (code=0) and then the slope BC (code=1) or slope AD (code=2) depending upon the direction of loading. When there is a change in the direction of displacement of the response point on slope AD or BC it will move elastically on CD (code=3). Once the response point reaches the previous maximum point it will follow slope BC or AD renewing the maximum response point, i.e. coordinates of points C and D. No hysteretic energy is dissipated when the response point oscillates within a region defined by the positive and negative maximum response points.

FIXED END AND INITIAL ELEMENT FORCES

The effects of static loads applied along the length of the element rather than those applied directly at nodes can be taken into account by specifying fixed end force patterns. Such a loading contiion does not normally occur in shearwalls. However, this provision has also been incorporated for shearwalls for the sake of consistency with other available DRAIN-2D elements.

Elements may be stressed under static load, but sometimes it may be incorrect or inconvenient to determine the element forces by applying static loads to the structure. To allow for such cases, provision is made for intial forces to be specified in the element. These forces will typically be the forces in the elements under static loading as calculated by a separate analysis. The gravity loads, transferred by the transverse beams directly to the boundary columns of the shearwall, can be covered by this provision. For consistency, these forces should be in equilibrium with the static load producing them, although this is not essential. The computer program, however, does not make any corrections for any equilibrium unbalance resulting from the specification of initial forces.

To satisfy the requirement stipulated in DRAIN-2D program (7) that the structure remains elastic under static loading, the initial element forces should be less than the yield strength of the element. If desired, additional static loads can be applied together with initial forces. The element forces will then be the sum of initial forces and those due to additional static loads.

OUTPUT RESULTS

The following results are printed for the static loading conditions (t=0) and at each output time if a time history is asked for.

1. Yield Code: 0 to 9 for boundary columns and central vertical spring as explained in Fig. 3.

: 0 to 3 for rotational and horizontal springs as explained in Fig. 4.

2. (a) Axial force in boundary columns and central vertical spring (tension positive).
   (b) Moment in rotational spring (anticlockwise moment positive).
   (c) Force in horizontal spring (tension positive).
3. (a) Axial extension in boundary columns and central vertical spring.
   (b) Rotation in rotational spring (anticlockwise rotation positive)
   (c) Extension in horizontal spring.

The maximum positive and negative values of axial forces and extensions in boundary columns and the central vertical spring, moment and rotation in the rotational spring, and force and extension in horizontal spring are printed at the specified time intervals.

INPUT DATA PREPARATION

E7. SHEARWALL ELEMENTS

E7(a) CONTROL INFORMATION FOR GROUP (10I5)-ONE CARD

Columns	5	Punch 7 (to indicate that group consists of shearwall elements)
	6-10	Number of elements in group
	11-15	Number of different axial stiffness types for boundary columns and vertical spring
	16-20	Number of different rotational stiffness types for rotational spring
	21-25	Number of different horizontal stiffness types for horizontal springs
	26-30	Number of different yield patterns for boundary columns and vertical spring
	31-35	Number of different yield patterns for rotational spring
	36-40	Number of different yield patterns for horizontal spring
	41-45	Number of different fixed end force patterns
	46-50	Number of different initial element force patterns

E7(b) AXIAL STIFFNESS TYPES (I5,3F10.0)-ONE CARD FOR EACH STIFFNESS TYPE

Columns	1-5	Axial stiffness type number, in sequence beginning with 1
	6-15	Initial stiffness in compression
	16-25	Initial stiffness in tension
	26-35	Strain hardening in tension, as a proportion of the initial stiffness in tension

E7(c) STIFFNESS TYPES FOR ROTATIONAL SPRINGS (I5,E15.6,F10.0)-ONE CARD FOR EACH STIFFNESS TYPE

Columns	1-5	Rotational stiffness type number, in sequence beginning with 1
	6-20	Initial stiffness
	21-20	Strain hardening stiffness, as a proportion of the initial stiffness

E7(d) STIFFNESS TYPES FOR HORIZONTAL SPRINGS (I5,2F10.0)-ONE CARD FOR EACH STIFFNESS TYPE

Columns	1-5	Horizontal stiffness type number, in sequence beginning with 1
	6-15	Initial stiffness
	16-25	Strain hardening stiffness, as a ratio of the initial stiffness

E7(e) YIELD DATA FOR AXIAL COMPONENTS (I5,3F10.0)-ONE CARD FOR EACH TYPE

Columns	1-5	Yield data number, in sequence beginning with 1
	6-15	Tensile yield load
	16-25	Tensile yield displacement
	26-35	Compression displacement corresponding to tensile yield load

E7(f) YIELD DATA FOR ROTATIONAL SPRINGS (I5,2F10.0)-ONE CARD FOR EACH TYPE

Columns	1-5	Yield data number, in sequence beginning with 1.
	6-15	Moment in the spring at yield
	16-25	Rotation in the spring at yield

E7(g) YIELD DATA FOR HORIZONTAL SPRING (I5,2F10.0)-ONE CARD FOR EACH TYPE

Columns	1-5	Yield data number, in sequence beginning with 1
	6-15	Force at yield
	16-25	Displacement at yield

E7(h) FIXED END FORCE PATTERNS (I5,5F10.0)-ONE CARD FOR EACH PATTERN

Omit if there are no fixed end forces

Columns	1-5	Pattern number, in sequence beginning with 1
	6-15	Axial force in left boundary column
	16-25	Axial force in right boundary column
	26-35	Axial force in vertical spring
	36-45	Moment in rotational spring
	46-55	Force in horizontal spring

E7(i) INITIAL ELEMENT FORCE PATTERNS (I5,5F10.0)-ONE CARD FOR EACH INITIAL FORCE PATTERN

Omit if there are no initial forces

Columns	1-5	Pattern number, in sequence beginning with 1
	6-15	Axial force in left boundary column
	16-25	Axial force in right boundary column
	26-35	Axial force in vertical spring
	36-45	Moment in rotational spring
	46-55	Force in horizontal spring

E7(j) ELEMENT GENERATION COMMANDS (4I4,F6.0,11I3,2F5.0,I5,F5.0)-ONE CARD FOR EACH GENERATION COMMAND

Elements must be specified in increasing numerical order. Cards for the first and last elements must be included.

Columns	1-4	Element number, or number of first element in a sequentially numbered series of elements to be generated by this command
	5-8	Node number at element end i
	9-12	Node number at element end j
	13-16	Node number increment for element generation. If zero or blank, assumed to be equal to 1

17-22	Width of the shearwall
23-25	Stiffness type number for boundary columns
26-28	Stiffness type number for vertical spring
29-31	Stiffness type number for rotational spring
32-34	Stiffness type number for horizontal spring
35-37	Yield data number for boundary columns
38-40	Yield data number for vertical spring
41-43	Yield data number for rotational spring
44-46	Yield data number for horizontal spring
47-49	Time history output Code. If a time history of element results is not required for the element covered by the command, punch zero or leave blank. If a time history print out at the interval specified earlier (Ref. 11) is required, punch 1.
50-52	Fixed end force pattern number for static dead loads on element. Leave blank or punch zero if there are no dead loads.
53-55	Fixed end force pattern number for static live loads on the element. Leave blank or punch zero if there are no live loads.
55-60	Scale Factor to be applied to fixed end forces due to static dead loads.
61-65	Scale factor to be applied to fixed end forces due to static live loads.
66-70	Initial force pattern number. Leave blank or punch zero if there are no initial forces.
71-75	Scale factor to be applied to initial element forces.

CHAPTER THREE

INPUT DATA AND SAMPLE RESULTS FOR A SEVEN STORY STRUCTURE

The two dimensional frame wall structure shown in Fig. 5 is used to demonstrate the inclusion of shearwall element EL7 in the DRAIN-2D program. The data given in Table 1 is prepared for the time history response analysis of the structure for the first ten seconds of EL CENTRO 1940 N-S with maximum acceleration magnified to 0.42g. The sample results (Table 2) from the computer output give the yield code, force and deformation in each component of the shearwall in each story at the end of 10.08 seconds. The envelopes of deformations and forces in all the elements of the structure, at the end of 10.1 seconds of the chosen earthquake motion, are also given. A detailed analysis and discussion of the computer results will be reported separately.

The structure shown in Fig. 5 represents a seven story frame wall structure analyzed in References 1 and 6. The gravity load, nodal masses, damping coefficients, stiffness and yield properties of columns and beams are taken as such from Reference 1. The properties of the shearwall element are calculated separately according to the requirements of the proposed model of the shearwall. The material and cross-sectional properties (dimensions and area of reinforcement) are taken from References 6 and 13. The horizontal members indicated by dashed lines (Fig. 5) are the pin-ended link beams (i.e. beams having zero bending stiffness) transferring horizontal forces, but no moments. A zero value of bending stiffness indicates error in the execution of beam column element (EL2) subroutines. Therefore, the moment of inertia for these beams have been assigned a value of 0.25 which is negligible as compared to the stiffness of other members.

The input cards for the structure shown in Fig. 5 are listed in Table 1 and are identified by the corresponding sections in the User's Guide (Ref. 11). Both columns and beams are represented by element EL2 in group 1 and the shearwall elements are represented by element EL7 in group 2. Node numbers are shown near the nodes and the element numbers are shown in circles near the middle of the members. The units of force (load) and length are taken as kilograms and centimeters respectively for the preparation of data.

TABLE 1 DATA FOR A SEVEN STORY STRUCTURE

START	RESPONSE OF SEVEN STORY FRAME-WALL STRUCTURE											A
56	21	7	1	7	12	2	0					B1
1		0.0		0.0								
2		600.0		0.0								
3		1100.0		0.0								
4		1700.0		0.0								
5		2300.0		0.0								
6		3150.0		0.0								
7		4000.0		0.0								
8		0.0		375.0								
9		600.0		375.0								
10		1100.0		375.0								
11		1700.0		375.0								
12		2300.0		375.0								B2
13		3150.0		375.0								
14		4000.0		375.0								
50		0.0		2175.0								
51		600.0		2175.0								
52		1100.0		2175.0								
53		1700.0		2175.0								
54		2300.0		2175.0								
55		3150.0		2175.0								
56		4000.0		2175.0								
8	50	5	7									
9	51	5	7									
10	52	5	7									
11	53	5	7									B3
12	54	5	7									
13	55	5	7									
14	56	5	7									
1	1	1	1	7	1							B4
1	7	8	9	10	11	12	13	14				
1	7	15	16	17	18	19	20	21				
1	7	22	23	24	25	26	27	28				B5
1	7	29	30	31	32	33	34	35				
1	7	36	37	38	39	40	41	42				
1	7	43	44	45	46	47	48	49				
1	7	50	51	52	53	54	55	56				
1		0.0		0.0		0.0	7	1	981.0			
8		14490.0		14490.0		0.0	43	7	981.0			
9		26565.0		26565.0		0.0	44	7	981.0			
10		26565.0		26565.0		0.0	45	7	981.0			
11		14490.0		14490.0		0.0	46	7	981.0			
12		14490.0		14490.0		0.0	47	7	981.0			B6
13		53130.0		53130.0		0.0	48	7	981.0			
14		14490.0		14490.0		0.0	49	7	981.0			
50		14250.0		14250.0		0.0	53	3	981.0			
51		26125.0		26125.0		0.0	52	1	981.0			
54		14250.0		14250.0		0.0	56	2	981.0			
55		52250.0		52250.0		0.0			981.0			
1	7	505		0.02		1300.0		1.0	1.0	1.0	200.0	C1
8		0.0		-8728.6		0.0	50	7				
11		0.0		-8728.6		0.0	53	7				
9		0.0		-15984.0		0.0	51	7				
10		0.0		-15984.0		0.0	52	7				C2
12		0.0		-4849.2		0.0	54	7				
14		0.0		-4849.2		0.0	56	7				
13		0.0		-8078.4		0.0	55	7				
185	0	1	1	ELCENTRO 1940 FIRST TEN SECONDS MAX ACC=0.42g								
0.0	0.0	0.01	0.011	0.04		0.001	0.10	0.016	0.16-0.000	0.22	0.019	

```
0.26 0.000   0.29 0.006   0.33-0.001   0.37 0.020   0.43-0.024   0.47 0.008
0.58 0.043   0.62 0.009   0.66 0.014   0.72-0.009   0.72-0.026   0.79-0.039
0.79-0.057   0.87-0.023   0.87-0.034   0.94-0.040   0.94-0.060   1.00-0.079
1.07-0.067   1.07-0.038   1.09-0.043   1.17 0.090   1.32-0.170   1.38-0.083
1.41-0.083   1.44-0.095   1.48-0.089   1.51-0.108   1.54-0.128   1.63 0.114
1.70 0.236   1.80 0.143   1.85 0.178   1.92-0.261   2.01-0.319   2.21 0.295
2.27 0.263   2.32-0.298   2.39 0.005   2.45 0.287   2.52-0.047   2.57 0.152
2.65 0.208   2.71 0.109   2.77-0.033   2.89 0.103   2.98-0.080   3.07 0.052
3.13-0.155   3.21 0.007   3.25-0.206   3.39 0.193   3.42-0.094   3.53 0.171
3.60-0.036   3.67 0.037   3.74-0.074   3.83 0.031   3.90-0.183   4.01 0.023
4.06-0.044   4.11 0.022   4.22-0.197   4.31-0.176   4.42 0.146   4.47-0.005
4.62 0.257   4.67-0.205   4.76 0.061   4.83-0.273   4.97 0.178   5.04 0.030      C3
5.11 0.218   5.20 0.027   5.23 0.125   5.30 0.129   5.33 0.109   5.34-0.024
5.45 0.172   5.51-0.102   5.61 0.014   5.69-0.195   5.77-0.024   5.80-0.005
5.81-0.028   5.87-0.057   5.88-0.033   5.92 0.022   5.98 0.011   6.01 0.024
6.09-0.067   6.13 0.001   6.17 0.049   6.19 0.015   6.19-0.020   6.23-0.038
6.28 0.021   6.33-0.006   6.37-0.060   6.38-0.016   6.41 0.020   6.46-0.018
6.48-0.003   6.52 0.004   6.53-0.004   6.56-0.010   6.58-0.002   6.60-0.017
6.64 0.037   6.69 0.046   6.71 0.039   6.73 0.001   6.77-0.029   6.77 0.002
6.81 0.011   6.85 0.002   6.91 0.009   6.99-0.100   7.07 0.036   7.12 0.008
7.14-0.028   7.15 0.003   7.17 0.027   7.23 0.058   7.30-0.049   7.37 0.030
7.41 0.011   7.43 0.019   7.46-0.025   7.53-0.035   7.57 0.004   7.60-0.063
7.64-0.028   7.67-0.020   7.69 0.007   7.75-0.005   7.79-0.060   7.84-0.036
7.88-0.072   7.96-0.014   7.99-0.006   8.00 0.022   8.07 0.047   8.13 0.026
8.13-0.034   8.20-0.013   8.22 0.066   8.28 0.031   8.33 0.025   8.40 0.035
8.46-0.037   8.53-0.034   8.60-0.010   8.64-0.026   8.73 0.153   8.82-0.003
8.86 0.023   8.88-0.026   8.91-0.002   8.96-0.185   9.05 0.126   9.09 0.032
9.12 0.096   9.15 0.125   9.25-0.033   9.29-0.045   9.43 0.130   9.44-0.166
9.51 0.042   9.63-0.094   9.70 0.082   9.81-0.088   9.90 0.006   9.94-0.001
9.99 0.059  10.02-0.071 10.05-0.045 10.05-0.022 10.11 0.009
----------------------------------------------------------------------------------
     1.49      0.00094                                                         C4
----------------------------------------------------------------------------------
  4    4    50    7     0     0
  8   15    22   29    36    43    50                                          D
----------------------------------------------------------------------------------
  2   84     5    3     4     7     0
  1  245625.0      0.900     5000.0   285035.0  4.0  4.0  2.0
  2  245625.0      0.900     2500.0   142517.5  4.0  4.0  2.0
  3  245625.0      0.627     3000.0   225680.7  4.0  4.0  2.0
  4  245625.0      0.627     1500.0   112840.3  4.0  4.0  2.0
  5  245625.0      0.627     4000.0       0.25  4.0  4.0  2.0
  1       0.0        0.0        0.0        0.0
  2       0.0     -250.0        0.0        0.0
  3     250.0        0.0        0.0        0.0
  1    1 2318327.3 4731327.3
  2    1 1159163.6 2365663.6
  3    3 4475018.2 4475018.2 1183636.4   261818.2  2.4 0.37  2.4 0.37
  4    3 2237509.1 2237509.1  591818.2   130909.1  2.4 0.37  2.4 0.37
  1    1       0.0       0.0       0.0        0.0       0.0       0.0        1.0
  2    1       0.0    8378.0 1032800.0        0.0    8378.0-1032800.0        1.0
  3    1       0.0    6980.0  716000.0        0.0    6980.0 -716000.0        1.0
  4    1       0.0    1344.0  164400.0        0.0    1344.0 -164400.0        1.0  E2
  5    1       0.0    1120.0  114200.0        0.0    1120.0 -114200.0        1.0
  6    1       0.0    5456.0  740100.0        0.0    5456.0 -740100.0        1.0
  7    1       0.0     846.0  114600.0        0.0     846.0 -114600.0        1.0
  1    1    8    7    1    1    3    3         1    1    1  1.0  1.0
  8    2    9    7    1    1    3    3         1    1    1  1.0  1.0
 15    3   10    7    1    1    3    3         1    1    1  1.0  1.0
 22    4   11    7    1    1    3    3         1    1    1  1.0  1.0
 29    5   12    7    2    1    4    4         1    1    1  1.0  1.0
 36    7   14    7    2    1    4    4         1    1    1  1.0  1.0
 43    8    9    7    3    1    1    1         1    2    4 1.051.275
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50    9   10    7    3    1    1    1         1    3    5 1.051.275
57   10   11    7    3    1    1    1         1    2    4 1.051.275
64   11   12    7    5    1    1    1         1    1    1  1.0  1.0
71   12   13    7    4    2    2    2         1    6    7 1.051.275
78   13   14    7    4    3    2    2         1    6    7 1.051.275
84   55   56    7    4    3    2    2         1    6    7 1.051.275
 7    7    4    7    2    4    7    2    0    7
  1 1637500.0 1473750.0        0.02
  2 2046875.0 1842187.5        0.02
  3 5895000.0 5305500.0        0.02
  4 7368750.0 6631875.0        0.02
  1    0.125450E 11        0.02
  2    0.150900E 11        0.02
  3    0.144800E 11        0.02
  4    0.138600E 11        0.02
  5    0.132290E 11        0.02
  6    0.125870E 11        0.02
  7    0.119340E 11        0.02
  1   800000.0        0.02
  2  1000000.0        0.02
  1   126676.8     0.0859     0.0773
  2   126676.8     0.0688     0.0619
  3   144845.0     0.0273     0.0246                                  E7
  4   144845.0     0.0218     0.0196
  139000000.0    0.00237
  236100000.0    0.00187
  333200000.0    0.00184
  430300000.0    0.00181
  527400000.0    0.00178
  624600000.0    0.00175
  721600000.0    0.00172
  1   333424.0     0.4167
  2   333424.0     0.3334
  1   -57610.0   -57610.0        0.0        0.0        0.0
  2   -49380.0   -49380.0        0.0        0.0        0.0
  3   -41150.0   -41150.0        0.0        0.0        0.0
  4   -32920.0   -32920.0        0.0        0.0        0.0
  5   -24690.0   -24690.0        0.0        0.0        0.0
  6   -16460.0   -16460.0        0.0        0.0        0.0
  7    -8230.0    -8230.0        0.0        0.0        0.0
 1    6   13      500.0  1  3  1  1  1  3  1  1  1  0  0  1.0  1.0    1 1.08
 2   13   20      500.0  2  4  2  2  2  4  2  2  1  0  0  1.0  1.0    2 1.08
 3   20   27      500.0  2  4  3  2  2  4  3  2  1  0  0  1.0  1.0    3 1.08
 4   27   34      500.0  2  4  4  2  2  4  4  2  1  0  0  1.0  1.0    4 1.08
 5   34   41      500.0  2  4  5  2  2  4  5  2  1  0  0  1.0  1.0    5 1.08
 6   41   48      500.0  2  4  6  2  2  4  7  2  1  0  0  1.0  1.0    6 1.08
 7   48   55      500.0  2  4  7  2  2  4  7  2  1  0  0  1.0  1.0    7 1.08
STOP                                                                    G
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TABLE 2 SAMPLE RESULTS

RESULTS FOR GROUP 2 SHEAR WALL ELEMENTS, TIME = 10.080

ELEM NO	NODE I	NODE J		LEFT AXIAL MEMBER	RIGHT AXIAL MEMBER	CENTRAL AXIAL SPRING	ROTATIONAL SPRING	HORIZONTAL SPRING
1	6	13	YIELD CODE	5	5	0	3	3
			TOTAL FORCE/MOMENT	-0.5540E+04	-0.4344E+05	-0.1833E+06	-0.3901E+07	0.6117E+04
			TOTAL DEFORMATION	0.5158E-01	-0.1138E+00	-0.3110E-01	-0.3307E-03	0.3723E-01
2	13	20	YIELD CODE	5	8	0	3	3
			TOTAL FORCE/MOMENT	-0.6471E+05	-0.5509E+05	-0.1220E+06	-0.3160E+07	0.1413E+05
			TOTAL DEFORMATION	-0.3375E-01	0.6375E-03	-0.1656E-01	-0.5927E-03	0.4508E-01
3	20	27	YIELD CODE	3	3	0	3	3
			TOTAL FORCE/MOMENT	-0.4536E+05	-0.3057E+05	-0.1266E+06	-0.2286E+07	0.3771E+04
			TOTAL DEFORMATION	-0.2039E-01	-0.1398E-01	-0.1719E-01	-0.5111E-03	0.8842E-02
4	27	34	YIELD CODE	4	3	0	3	3
			TOTAL FORCE/MOMENT	-0.3768E+05	-0.2847E+05	-0.9291E+05	-0.1906E+07	0.2553E+05
			TOTAL DEFORMATION	-0.1359E-01	-0.1163E-01	-0.1261E-01	-0.4944E-03	0.2971E-01
5	34	41	YIELD CODE	4	3	0	3	0
			TOTAL FORCE/MOMENT	-0.1913E+05	-0.2068E+05	-0.5978E+05	-0.1750E+07	-0.1478E+05
			TOTAL DEFORMATION	-0.3517E-02	-0.1271E-01	-0.8112E-02	-0.5008E-03	-0.1478E-01
6	41	48	YIELD CODE	4	1	0	3	0
			TOTAL FORCE/MOMENT	-0.2363E+05	-0.2210E+05	-0.3417E+05	-0.1451E+07	-0.1018E+05

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                  TOTAL DEFORMATION  -0.5965E-02  -0.3310E-02  -0.4637E-02  -0.5219E-03  -0.1018E-01
   7    48    55
                  YIELD CODE              3            3            0            3            0

                  TOTAL FORCE/MOMENT  -0.1475E+05  -0.1224E+05  -0.1280E+05  -0.1421E+07  -0.6832E+04

                  TOTAL DEFORMATION  -0.2368E-02  -0.1106E-02  -0.1737E-02  -0.5141E-03  -0.6832E-02
1NODAL DISPLACEMENT ENVELOPES, TIME =  10.100
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	X-DISPLACEMENT				Y-DISPLACEMENT				ROTATION			
NODE	POSITIVE	TIME	NEGATIVE	TIME	POSITIVE	TIME	NEGATIVE	TIME	POSITIVE	TIME	NEGATIVE	TIME
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	2.952	5.92	-3.034	2.76	0.0	0.0	-0.055	2.64	0.00671	2.74	-0.00807	5.92
9	2.952	5.92	-3.034	2.76	0.0	0.0	-0.080	2.62	0.00567	2.74	-0.00556	5.92
10	2.952	5.92	-3.034	2.76	0.0	0.0	-0.080	2.20	0.00537	2.74	-0.00583	5.92
11	2.952	5.92	-3.034	2.76	0.0	0.0	-0.057	2.20	0.00780	2.74	-0.00692	5.92
12	2.952	5.92	-3.034	2.76	0.0	0.0	-0.069	2.64	0.00664	2.74	-0.00817	5.92
13	2.952	5.92	-3.034	2.76	0.0	0.0	-0.056	2.10	0.00269	2.66	-0.00331	2.22
14	2.952	5.92	-3.034	2.76	0.0	0.0	-0.071	2.20	0.00805	2.74	-0.00675	5.92
15	5.082	5.92	-4.924	2.74	0.0	0.0	-0.093	2.64	0.00464	2.70	-0.00599	2.24
16	5.082	5.92	-4.924	2.74	0.0	0.0	-0.134	2.62	0.00433	2.70	-0.00452	2.24
17	5.082	5.92	-4.924	2.74	0.0	0.0	-0.135	2.20	0.00410	2.70	-0.00474	2.24
18	5.082	5.92	-4.924	2.74	0.0	0.0	-0.096	2.20	0.00544	2.70	-0.00520	2.24
19	5.082	5.92	-4.924	2.74	0.0	0.0	-0.115	2.64	0.00434	2.70	-0.00597	2.24
20	5.082	5.92	-4.924	2.74	0.0	0.0	-0.076	2.10	0.00304	2.68	-0.00372	2.22
21	5.082	5.92	-4.924	2.74	0.0	0.0	-0.120	2.20	0.00539	2.70	-0.00492	2.24
22	6.859	5.92	-6.405	2.72	0.0	0.0	-0.124	2.64	0.00361	2.64	-0.00525	2.24
23	6.859	5.92	-6.405	2.72	0.0	0.0	-0.179	2.62	0.00343	2.64	-0.00361	2.24
24	6.859	5.92	-6.405	2.72	0.0	0.0	-0.180	2.20	0.00318	2.64	-0.00405	2.24
25	6.859	5.92	-6.405	2.72	0.0	0.0	-0.127	2.20	0.00450	2.64	-0.00435	2.24
26	6.859	5.92	-6.405	2.72	0.0	0.0	-0.154	2.62	0.00323	2.64	-0.00513	2.24
27	6.859	5.92	-6.405	2.72	0.0	0.0	-0.091	2.12	0.00323	2.66	-0.00405	2.22
28	6.859	5.92	-6.405	2.72	0.0	0.0	-0.161	2.20	0.00439	2.64	-0.00396	2.24
29	8.302	5.92	-7.444	2.70	0.0	0.0	-0.148	2.64	0.00320	2.64	-0.00497	2.22
30	8.302	5.92	-7.444	2.70	0.0	0.0	-0.215	2.62	0.00311	2.64	-0.00360	2.22
31	8.302	5.92	-7.444	2.70	0.0	0.0	-0.217	2.20	0.00289	2.64	-0.00382	2.22
32	8.302	5.92	-7.444	2.70	0.0	0.0	-0.152	2.20	0.00406	2.64	-0.00410	2.22
33	8.302	5.92	-7.444	2.70	0.0	0.0	-0.166	2.62	0.00278	2.64	-0.00480	2.22
34	8.302	5.92	-7.444	2.70	0.0	0.0	-0.103	2.12	0.00341	2.64	-0.00425	2.22
35	8.302	5.92	-7.444	2.70	0.0	0.0	-0.193	2.20	0.00390	2.64	-0.00365	2.22
36	9.628	5.92	-8.441	2.68	0.0	0.0	-0.166	2.64	0.00332	2.64	-0.00466	2.20
37	9.628	5.92	-8.441	2.68	0.0	0.0	-0.242	2.62	0.00321	2.64	-0.00330	2.20
38	9.628	5.92	-8.441	2.68	0.0	0.0	-0.244	2.20	0.00296	2.64	-0.00355	2.20
39	9.628	5.92	-8.441	2.68	0.0	0.0	-0.171	2.20	0.00426	2.64	-0.00371	2.20
40	9.628	5.92	-8.441	2.68	0.0	0.0	-0.209	2.62	0.00280	2.64	-0.00445	2.20
41	9.628	5.92	-8.441	2.68	0.0	0.0	-0.111	2.12	0.00354	2.64	-0.00421	2.22
42	9.628	5.92	-8.441	2.68	0.0	0.0	-0.217	2.20	0.00409	2.64	-0.00322	2.20
43	10.884	2.22	-9.544	2.66	0.0	0.0	-0.178	2.64	0.00328	2.64	-0.00443	2.20
44	10.884	2.22	-9.544	2.66	0.0	0.0	-0.260	2.62	0.00306	2.64	-0.00334	2.20
45	10.884	2.22	-9.544	2.66	0.0	0.0	-0.262	2.20	0.00293	2.64	-0.00347	2.20

46	10.884	2.22	-9.544	2.66	0.0	0.0	-0.183	2.20	0.00393	2.64	-0.00378	2.20
47	10.884	2.22	-9.544	2.66	0.0	0.0	-0.224	2.62	0.00299	2.64	-0.00434	2.20
48	10.884	2.22	-9.544	2.66	0.0	0.0	-0.117	2.12	0.00358	2.64	-0.00420	2.20
49	10.884	2.22	-9.544	2.66	0.0	0.0	-0.233	2.20	0.00384	2.64	-0.00347	2.20
50	12.152	2.20	-10.625	2.66	0.0	0.0	-0.184	2.64	0.00170	2.62	-0.00412	2.18
51	12.152	2.20	-10.625	2.66	0.0	0.0	-0.269	2.62	0.00216	2.62	-0.00187	2.18
52	12.152	2.20	-10.625	2.66	0.0	0.0	-0.271	2.20	0.00156	2.62	-0.00245	2.18
53	12.152	2.20	-10.625	2.66	0.0	0.0	-0.189	2.20	0.00371	2.62	-0.00212	2.18
54	12.152	2.20	-10.625	2.66	0.0	0.0	-0.232	2.62	0.00070	2.62	-0.00342	2.18
55	12.152	2.20	-10.625	2.66	0.0	0.0	-0.119	2.12	0.00357	2.64	-0.00418	2.20
56	12.152	2.20	-10.625	2.66	0.0	0.0	-0.241	2.20	0.00314	2.62	-0.00099	2.18

1RESULTS ENVELOPES, ELEMENT GROUP 1 TIME = 10.100

BEAM COLUMN ELEMENTS (TYPE 2)

ELEM NO.	NODE NO.		BENDING MOMENT	TIME	SHEAR FORCE	TIME	AXIAL FORCE	TIME	PL HINGE ROTATION	TIME	ACCUM ROTATIONS
1	1	POSITIVE	5791036.00	5.920	22872.43	5.920	181307.69	2.640	0.00013	5.920	0.00013
		NEGATIVE	-6635738.00	2.760	-28918.70	2.760	0.0	0.0	0.0	0.0	0.0
	8	POSITIVE	2786118.00	5.920	28918.70	2.760	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-4208790.00	2.760	-22872.43	5.920	-181307.69	2.640	0.0	0.0	0.0
2	8	POSITIVE	561257.81	2.260	5635.31	2.200	153129.31	2.640	0.0	0.0	0.0
		NEGATIVE	-1936843.00	1.940	-14574.49	1.940	0.0	0.0	0.0	0.0	0.0
	15	POSITIVE	1250675.00	2.200	14574.49	1.940	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2435536.00	1.940	-5635.31	2.200	-153129.31	2.640	0.0	0.0	0.0
3	15	POSITIVE	899546.38	2.260	7210.64	2.260	126302.69	2.640	0.0	0.0	0.0
		NEGATIVE	-1908394.00	2.640	-13594.00	2.700	0.0	0.0	0.0	0.0	0.0
	22	POSITIVE	1263618.00	2.260	13594.00	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2325099.00	2.700	-7210.64	2.260	-126302.69	2.640	0.0	0.0	0.0
4	22	POSITIVE	590757.38	2.220	4209.92	2.220	100210.94	2.640	0.0	0.0	0.0
		NEGATIVE	-1437764.00	1.900	-9638.27	1.900	0.0	0.0	0.0	0.0	0.0
	29	POSITIVE	696180.94	2.220	9638.27	1.900	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1454689.00	1.920	-4209.92	2.220	-100210.94	2.640	0.0	0.0	0.0
5	29	POSITIVE	571394.63	2.180	3916.36	2.240	74714.81	2.640	0.0	0.0	0.0
		NEGATIVE	-1733150.00	2.640	-11450.89	2.660	0.0	0.0	0.0	0.0	0.0
	36	POSITIVE	645759.13	2.240	11450.89	2.660	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1722449.00	2.660	-3916.36	2.240	-74714.81	2.640	0.0	0.0	0.0
6	36	POSITIVE	466442.75	2.200	3477.39	2.200	48947.56	2.640	0.0	0.0	0.0
		NEGATIVE	-1505192.00	2.640	-10087.84	2.640	0.0	0.0	0.0	0.0	0.0
	43	POSITIVE	576758.50	2.200	10087.84	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1521100.00	2.640	-3477.39	2.200	-48947.56	2.640	0.0	0.0	0.0
7	43	POSITIVE	304053.50	2.180	2456.46	2.180	23309.26	2.640	0.0	0.0	0.0
		NEGATIVE	-1686380.00	2.620	-13629.76	2.620	0.0	0.0	0.0	0.0	0.0
	50	POSITIVE	432604.50	2.180	13629.76	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2402657.00	2.620	-2456.46	2.180	-23309.26	2.640	0.0	0.0	0.0
8	2	POSITIVE	6739860.00	5.920	30405.77	5.920	260591.50	2.620	0.0	0.0	0.0
		NEGATIVE	-7011049.00	2.760	-31921.25	2.760	0.0	0.0	0.0	0.0	0.0
	9	POSITIVE	4662323.00	5.920	31921.25	2.760	0.0	0.0	0.0	0.0	0.0

		NEGATIVE	-4959413.00	2.760	-30405.77	5.920	-260591.50	2.620	0.0	0.0	0.0
9	9	POSITIVE	3300102.00	2.220	23038.12	2.200	222740.06	2.620	0.0	0.0	0.0
		NEGATIVE	-2464765.00	2.680	-17838.71	2.680	0.0	0.0	0.0	0.0	0.0
	16	POSITIVE	3632522.00	2.200	17838.71	2.680	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2886841.00	2.680	-23038.12	2.200	-222740.06	2.620	0.0	0.0	0.0
10	16	POSITIVE	2952296.00	2.260	20812.47	2.260	185032.69	2.620	0.0	0.0	0.0
		NEGATIVE	-2193005.00	2.640	-15715.78	2.700	0.0	0.0	0.0	0.0	0.0
	23	POSITIVE	3291444.00	2.260	15715.78	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2604802.00	2.700	-20812.47	2.260	-185032.69	2.620	0.0	0.0	0.0
11	23	POSITIVE	2565044.00	2.220	17359.66	2.220	147708.44	2.620	0.0	0.0	0.0
		NEGATIVE	-1393828.00	2.640	-9782.81	2.620	0.0	0.0	0.0	0.0	0.0
	30	POSITIVE	2642853.00	2.220	9782.81	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1546828.00	2.620	-17359.66	2.220	-147708.44	2.620	0.0	0.0	0.0
12	30	POSITIVE	2369537.00	2.180	16203.11	2.240	110570.06	2.620	0.0	0.0	0.0
		NEGATIVE	-1859532.00	2.640	-12246.15	2.640	0.0	0.0	0.0	0.0	0.0
	37	POSITIVE	2494268.00	2.240	12246.15	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1825317.00	2.660	-16203.11	2.240	-110570.06	2.620	0.0	0.0	0.0
13	37	POSITIVE	2241189.00	2.200	14884.41	2.200	73446.25	2.620	0.0	0.0	0.0
		NEGATIVE	-1708038.00	2.640	-11621.93	2.640	0.0	0.0	0.0	0.0	0.0
	44	POSITIVE	2224127.00	2.200	11621.93	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1778539.00	2.640	-14884.41	2.200	-73446.25	2.620	0.0	0.0	0.0
14	44	POSITIVE	2360943.00	2.180	18004.66	2.180	36378.52	2.620	0.0	0.0	0.0
		NEGATIVE	-1671170.00	2.620	-12481.20	2.620	0.0	0.0	0.0	0.0	0.0
	51	POSITIVE	3040481.00	2.180	12481.20	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2073201.00	2.620	-18004.66	2.180	-36378.52	2.620	0.0	0.0	0.0
15	3	POSITIVE	6642216.00	5.920	29624.65	5.920	262444.56	2.200	0.0	0.0	0.0
		NEGATIVE	-7126182.00	2.760	-32842.26	2.760	0.0	0.0	0.0	0.0	0.0
	10	POSITIVE	4467039.00	5.920	32842.26	2.760	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-5189670.00	2.760	-29624.65	5.920	-262444.56	2.200	0.0	0.0	0.0
16	10	POSITIVE	2863214.00	2.220	20338.54	2.200	224369.06	2.200	0.0	0.0	0.0
		NEGATIVE	-2898602.00	2.680	-20533.88	2.680	0.0	0.0	0.0	0.0	0.0
	17	POSITIVE	3257471.00	2.200	20533.88	2.680	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3261562.00	2.680	-20338.54	2.200	-224369.06	2.200	0.0	0.0	0.0
17	17	POSITIVE	2626801.00	2.260	18610.96	2.260	186238.75	2.200	0.0	0.0	0.0
		NEGATIVE	-2518229.00	2.640	-17934.59	2.700	0.0	0.0	0.0	0.0	0.0
	24	POSITIVE	2956479.00	2.260	17934.59	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2941054.00	2.700	-18610.96	2.260	-186238.75	2.200	0.0	0.0	0.0
18	24	POSITIVE	2230791.00	2.220	15166.20	2.220	148658.88	2.200	0.0	0.0	0.0
		NEGATIVE	-1727955.00	2.640	-11975.68	2.620	0.0	0.0	0.0	0.0	0.0
	31	POSITIVE	2319058.00	2.220	11975.68	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1870577.00	2.620	-15166.20	2.220	-148658.88	2.200	0.0	0.0	0.0
19	31	POSITIVE	2045060.00	2.180	14001.87	2.240	111200.94	2.200	0.0	0.0	0.0
		NEGATIVE	-2184121.00	2.640	-14447.49	2.640	0.0	0.0	0.0	0.0	0.0
	38	POSITIVE	2158461.00	2.240	14447.49	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2161141.00	2.560	-14001.87	2.240	-111200.94	2.200	0.0	0.0	0.0
20	38	POSITIVE	1949850.00	2.200	13127.80	2.200	73807.13	2.200	0.0	0.0	0.0

		NEGATIVE	-1999379.00	2.640	-13378.53	2.640	0.0	0.0	0.0	0.0	0.0
	45	POSITIVE	1988479.00	2.200	13378.53	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2014185.00	2.640	-13127.80	2.200	-73007.13	2.200	0.0	0.0	0.0
21	45	POSITIVE	1969569.00	2.180	14690.95	2.180	36479.90	2.200	0.0	0.0	0.0
		NEGATIVE	-2062513.00	2.620	-15794.79	2.620	0.0	0.0	0.0	0.0	0.0
	52	POSITIVE	2437708.00	2.180	15794.79	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2675953.00	2.620	-14690.95	2.180	-36479.90	2.200	0.0	0.0	0.0
22	4	POSITIVE	6271622.00	5.920	26505.85	5.920	187459.81	2.200	0.0	0.0	0.0
		NEGATIVE	-6166749.00	2.760	-25320.81	2.760	0.0	0.0	-0.00052	2.760	-0.00052
	11	POSITIVE	3668090.00	5.920	25320.81	2.760	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3326552.00	2.760	-26505.85	5.920	-187459.81	2.200	0.0	0.0	0.0
23	11	POSITIVE	2001456.00	2.260	14700.80	2.200	157396.69	2.200	0.0	0.0	0.0
		NEGATIVE	-495282.13	1.940	-5504.60	1.940	0.0	0.0	0.0	0.0	0.0
	18	POSITIVE	2529996.00	2.200	5504.60	1.940	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1156056.00	1.940	-14700.80	2.200	-157396.69	2.200	0.0	0.0	0.0
24	18	POSITIVE	2062369.00	2.260	15110.68	2.260	129371.19	2.200	0.0	0.0	0.0
		NEGATIVE	-745619.25	2.640	-5690.99	2.700	0.0	0.0	0.0	0.0	0.0
	25	POSITIVE	2470857.00	2.260	5690.99	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1117689.00	2.700	-15110.68	2.260	-129371.19	2.200	0.0	0.0	0.0
25	25	POSITIVE	1830595.00	2.220	12515.57	2.220	102724.94	2.200	0.0	0.0	0.0
		NEGATIVE	-197763.69	1.900	-1411.87	1.900	0.0	0.0	0.0	0.0	0.0
	32	POSITIVE	1924106.00	2.220	1411.87	1.900	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-226710.38	1.920	-12515.57	2.220	-102724.94	2.200	0.0	0.0	0.0
26	32	POSITIVE	1824913.00	2.180	12398.24	2.240	76468.50	2.180	0.0	0.0	0.0
		NEGATIVE	-479576.75	2.640	-2968.96	2.660	0.0	0.0	0.0	0.0	0.0
	39	POSITIVE	1936855.00	2.240	2968.96	2.660	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-431342.38	2.660	-12398.24	2.240	-76468.50	2.180	0.0	0.0	0.0
27	39	POSITIVE	1653349.00	2.200	10917.52	2.200	50237.88	2.180	0.0	0.0	0.0
		NEGATIVE	-318272.50	2.640	-2647.65	2.640	0.0	0.0	0.0	0.0	0.0
	46	POSITIVE	1621927.00	2.200	2647.65	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-475992.56	2.640	-10917.52	2.200	-50237.88	2.180	0.0	0.0	0.0
28	46	POSITIVE	1841710.00	2.180	14820.52	2.180	23910.18	2.180	0.0	0.0	0.0
		NEGATIVE	-148722.00	2.620	-1265.85	2.620	0.0	0.0	0.0	0.0	0.0
	53	POSITIVE	2604555.00	2.180	1265.85	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-230933.38	2.620	-14820.52	2.180	-23910.18	2.180	0.0	0.0	0.0
29	5	POSITIVE	2884207.00	5.920	11317.25	5.920	112185.38	2.640	0.0	0.0	0.0
		NEGATIVE	-3327668.00	2.760	-14537.73	2.760	0.0	0.0	0.0	0.0	0.0
	12	POSITIVE	1359740.00	5.920	14537.73	2.760	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2124001.00	2.760	-11317.25	5.920	-112185.38	2.640	0.0	0.0	0.0
30	12	POSITIVE	237684.94	2.260	2738.66	2.200	96022.06	2.620	0.0	0.0	0.0
		NEGATIVE	-1117408.00	1.940	-8304.46	1.940	0.0	0.0	0.0	0.0	0.0
	19	POSITIVE	633093.88	2.200	8304.46	1.940	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1373937.00	1.940	-2738.66	2.200	-96022.06	2.620	0.0	0.0	0.0
31	19	POSITIVE	472455.38	2.260	3826.81	2.260	79980.63	2.620	0.0	0.0	0.0
		NEGATIVE	-1188085.00	2.640	-8358.39	2.700	0.0	0.0	0.0	0.0	0.0
	26	POSITIVE	675578.19	2.260	8358.39	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1404185.00	2.700	-3826.81	2.260	-79980.63	2.620	0.0	0.0	0.0

32	26	POSITIVE	400538.94	2.220	2865.62	2.220	63895.56	2.620	0.0	0.0	0.0
		NEGATIVE	-939776.94	1.900	-6277.14	1.900	0.0	0.0	0.0	0.0	0.0
	33	POSITIVE	459137.50	2.220	6277.14	1.900	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-980292.81	2.620	-2865.62	2.220	-63895.56	2.620	0.0	0.0	0.0
33	33	POSITIVE	413407.00	2.180	2835.12	2.240	47792.19	2.620	0.0	0.0	0.0
		NEGATIVE	-1164841.00	2.640	-7706.16	2.660	0.0	0.0	0.0	0.0	0.0
	40	POSITIVE	460642.44	2.240	7706.16	2.660	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1160532.00	2.660	-2835.12	2.240	-47792.19	2.620	0.0	0.0	0.0
34	40	POSITIVE	352670.56	2.200	2434.96	2.200	31590.09	2.620	0.0	0.0	0.0
		NEGATIVE	-1026460.44	2.640	-6759.09	2.640	0.0	0.0	0.0	0.0	0.0
	47	POSITIVE	377806.75	2.200	6759.09	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1001277.38	2.640	-2434.96	2.200	-31590.09	2.620	0.0	0.0	0.0
35	47	POSITIVE	354096.75	2.180	3060.02	2.180	15240.84	2.620	0.0	0.0	0.0
		NEGATIVE	-1211507.00	2.620	-9824.08	2.620	0.0	0.0	0.0	0.0	0.0
	54	POSITIVE	563891.69	2.180	9824.08	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1735760.00	2.620	-3060.02	2.180	-15240.84	2.620	0.0	0.0	0.0
36	7	POSITIVE	3155786.00	5.920	13462.54	5.920	116728.75	2.200	0.0	0.0	0.0
		NEGATIVE	-3059350.00	2.760	-12418.31	2.760	0.0	0.0	-0.00018	2.760	-0.00018
	14	POSITIVE	1892679.00	5.920	12418.31	2.760	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1597519.00	2.760	-13462.54	5.920	-116728.75	2.200	0.0	0.0	0.0
37	14	POSITIVE	1170002.00	2.260	8717.54	2.180	99838.31	2.200	0.0	0.0	0.0
		NEGATIVE	-159909.38	1.940	-2293.12	1.940	0.0	0.0	0.0	0.0	0.0
	21	POSITIVE	1474652.00	2.200	2293.12	1.940	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-528018.69	1.940	-8717.54	2.180	-99838.31	2.200	0.0	0.0	0.0
38	21	POSITIVE	1236610.00	2.260	9015.38	2.260	83089.75	2.200	0.0	0.0	0.0
		NEGATIVE	-429734.25	2.640	-3204.65	2.700	0.0	0.0	0.0	0.0	0.0
	28	POSITIVE	1468014.00	2.260	3204.65	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-618060.25	2.700	-9015.38	2.260	-83089.75	2.200	0.0	0.0	0.0
39	28	POSITIVE	1233180.00	2.220	8378.03	2.220	66399.38	2.200	0.0	0.0	0.0
		NEGATIVE	-153945.44	1.900	-1075.18	1.900	0.0	0.0	0.0	0.0	0.0
	35	POSITIVE	1280237.00	2.220	1075.18	1.900	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-186414.19	2.620	-8378.03	2.220	-66399.38	2.200	0.0	0.0	0.0
40	35	POSITIVE	1225219.00	2.180	8336.39	2.240	49618.66	2.200	0.0	0.0	0.0
		NEGATIVE	-358202.00	2.640	-2256.20	2.660	0.0	0.0	0.0	0.0	0.0
	42	POSITIVE	1291377.00	2.240	2256.20	2.660	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-333082.50	2.660	-8336.39	2.240	-49618.66	2.200	0.0	0.0	0.0
41	42	POSITIVE	1130864.00	2.200	7345.74	2.200	32806.83	2.200	0.0	0.0	0.0
		NEGATIVE	-261346.25	2.640	-1940.32	2.640	0.0	0.0	0.0	0.0	0.0
	49	POSITIVE	1072864.00	2.200	1940.32	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-320738.19	2.640	-7345.74	2.200	-32806.83	2.200	0.0	0.0	0.0
42	49	POSITIVE	1325412.00	2.180	10749.03	2.180	15816.00	2.200	0.0	0.0	0.0
		NEGATIVE	-246893.56	2.620	-2159.02	2.620	0.0	0.0	0.0	0.0	0.0
	56	POSITIVE	1902575.00	2.200	2159.02	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-400787.19	2.620	-10749.03	2.180	-15816.00	2.200	0.0	0.0	0.0
43	8	POSITIVE	4802300.00	2.740	21918.88	2.740	0.0	0.0	0.00031	2.740	0.00031
		NEGATIVE	-2541438.00	5.920	-1613.25	5.920	0.0	0.0	-0.00096	5.920	-0.00127

	9	POSITIVE	2042646.00	2.740	22633.36	5.920	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-4732587.00	5.920	-698.34	2.740	0.0	0.0	0.0	0.0	0.0
44	15	POSITIVE	3850085.00	2.700	18935.31	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1684791.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	16	POSITIVE	1204926.00	2.700	19984.91	2.240	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3999999.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	22	POSITIVE	3312407.00	2.640	17182.45	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1254177.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	23	POSITIVE	690870.63	2.640	18560.50	2.240	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3575961.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	29	POSITIVE	3111903.00	2.640	16544.76	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1094801.00	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	30	POSITIVE	506777.44	2.640	18050.74	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3429487.00	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	36	POSITIVE	3182333.00	2.640	16772.32	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-911991.44	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	37	POSITIVE	574875.94	2.640	17445.08	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3248898.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	43	POSITIVE	3147233.00	2.640	16619.36	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-822169.69	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	44	POSITIVE	518211.13	2.640	17229.70	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3209489.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	50	POSITIVE	2402756.00	2.620	14347.94	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-432547.50	2.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	51	POSITIVE	0.0	0.0	15570.60	2.180	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2603655.00	2.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	9	POSITIVE	4568877.00	2.740	23048.92	2.740	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2651884.00	5.920	-5974.16	5.920	0.0	0.0	-0.00164	5.920	-0.00164
	10	POSITIVE	2577183.00	2.740	23487.34	5.920	0.0	0.0	0.00115	2.740	0.00115
		NEGATIVE	-4713545.00	5.920	-5535.38	2.740	0.0	0.0	0.0	0.0	-0.00026
51	16	POSITIVE	3712096.00	2.700	19913.55	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2138734.00	2.240	-3487.40	2.240	0.0	0.0	0.0	0.0	0.0
	17	POSITIVE	1866287.00	2.700	21001.00	2.240	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3983373.00	2.240	-2400.00	2.700	0.0	0.0	0.0	0.0	0.0
52	23	POSITIVE	3099904.00	2.640	17457.89	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1664832.00	2.240	-1601.11	2.240	0.0	0.0	0.0	0.0	0.0
	24	POSITIVE	1250631.00	2.640	19114.71	2.240	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3514142.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	30	POSITIVE	2891547.00	2.640	16634.32	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1516137.00	2.220	-996.42	2.220	0.0	0.0	0.0	0.0	0.0
	31	POSITIVE	1047202.44	2.640	18510.04	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3360496.00	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	37	POSITIVE	2947763.00	2.640	16848.51	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1320354.00	2.200	-223.97	2.200	0.0	0.0	0.0	0.0	0.0
	38	POSITIVE	1098090.00	2.640	17737.59	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3170046.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0

55	44	POSITIVE	2872054.00	2.640	16598.57	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1316183.00	2.200	-154.40	2.200	0.0	0.0	0.0	0.0	0.0
	45	POSITIVE	1048833.00	2.640	17667.99	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3139429.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	51	POSITIVE	2173556.00	2.620	13603.71	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-436491.06	2.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	52	POSITIVE	249901.75	2.620	14350.11	2.180	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2360174.00	2.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	10	POSITIVE	4646611.00	2.740	22380.52	2.740	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2118704.00	5.920	-1134.70	5.920	0.0	0.0	0.0	0.0	0.0
	11	POSITIVE	2475515.00	2.740	22154.83	5.920	0.0	0.0	0.00068	2.740	0.00068
		NEGATIVE	-4868201.00	5.920	-1359.96	2.740	0.0	0.0	-0.00059	5.920	-0.00127
58	17	POSITIVE	3747863.00	2.700	19102.63	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1455257.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	18	POSITIVE	1407535.00	2.700	19813.63	2.240	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-4126766.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	24	POSITIVE	3209063.00	2.640	17301.18	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1057772.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	25	POSITIVE	865458.56	2.640	18441.80	2.240	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3701159.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	31	POSITIVE	3001395.00	2.640	16563.56	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-936836.81	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	32	POSITIVE	630564.94	2.640	18031.95	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3576173.00	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	38	POSITIVE	3051620.00	2.640	16770.38	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-772126.50	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	39	POSITIVE	704427.19	2.640	17447.01	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3389928.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62	45	POSITIVE	2968326.00	2.640	16398.45	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-759349.31	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	46	POSITIVE	564566.06	2.640	17450.64	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3404876.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	52	POSITIVE	2426122.00	2.620	14938.81	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-77330.19	2.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	53	POSITIVE	230999.44	2.620	14979.70	2.180	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2604321.00	2.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64	11	POSITIVE	4.62	2.740	0.01	2.740	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-4.53	5.920	-0.02	5.920	0.0	0.0	0.0	0.0	0.0
	12	POSITIVE	4.37	2.740	0.02	5.920	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1294049.00	0.0	-0.01	2.740	0.0	0.0	0.0	0.0	0.0
65	18	POSITIVE	3.18	2.700	0.01	2.700	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-3.40	2.240	-0.01	2.240	0.0	0.0	0.0	0.0	0.0
	19	POSITIVE	2.95	2.700	0.01	2.240	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1294049.00	0.0	-0.01	2.700	0.0	0.0	0.0	0.0	0.0
66	25	POSITIVE	2.60	2.640	0.01	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2.89	2.240	-0.01	2.240	0.0	0.0	0.0	0.0	0.0
	26	POSITIVE	2.34	2.640	0.01	2.240	0.0	0.0	0.0	0.0	0.0

		NEGATIVE	-1294049.00	0.0	-0.01	2.640	0.0	0.0	0.0	0.0	0.0
67	32	POSITIVE	2.35	2.640	0.01	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2.74	2.220	-0.01	2.220	0.0	0.0	0.0	0.0	0.0
	33	POSITIVE	2.08	2.640	0.01	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1294049.00	0.0	-0.01	2.640	0.0	0.0	0.0	0.0	0.0
68	39	POSITIVE	2.46	2.640	0.01	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2.53	2.200	-0.01	2.200	0.0	0.0	0.0	0.0	0.0
	40	POSITIVE	2.18	2.640	0.01	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1294049.00	0.0	-0.01	2.640	0.0	0.0	0.0	0.0	0.0
69	46	POSITIVE	2.35	2.640	0.01	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2.54	2.200	-0.01	2.200	0.0	0.0	0.0	0.0	0.0
	47	POSITIVE	2.16	2.640	0.01	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1294049.00	0.0	-0.01	2.640	0.0	0.0	0.0	0.0	0.0
70	53	POSITIVE	1.80	2.620	0.00	2.620	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1.67	2.180	-0.01	2.180	0.0	0.0	0.0	0.0	0.0
	54	POSITIVE	1.18	2.620	0.01	2.180	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1294049.00	0.0	-0.00	2.620	0.0	0.0	0.0	0.0	0.0
71	12	POSITIVE	2526381.00	2.740	11697.54	2.720	0.0	0.0	0.00201	2.740	0.00201
		NEGATIVE	-1199091.00	5.920	0.0	0.0	0.0	0.0	0.0	0.0	-0.00161
	13	POSITIVE	427213.44	2.700	12995.03	5.920	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2513798.00	5.920	0.0	0.0	0.0	0.0	-0.00148	5.920	-0.00148
72	19	POSITIVE	2324022.00	2.680	11362.88	2.680	0.0	0.0	0.00016	2.680	0.00016
		NEGATIVE	-859700.88	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	20	POSITIVE	409352.75	2.680	12375.46	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2485159.00	2.220	0.0	0.0	0.0	0.0	-0.00103	2.220	-0.00103
73	26	POSITIVE	2184321.00	2.640	11082.09	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-800621.31	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	27	POSITIVE	380585.19	2.640	12327.04	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2511271.00	2.220	0.0	0.0	0.0	0.0	-0.00126	2.220	-0.00126
74	33	POSITIVE	2139563.00	2.640	11042.84	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-787506.81	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	34	POSITIVE	401774.50	2.640	12340.79	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2532642.00	2.220	0.0	0.0	0.0	0.0	-0.00144	2.220	-0.00144
75	40	POSITIVE	2167610.00	2.640	11124.11	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-715175.38	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	41	POSITIVE	422498.63	2.640	12160.93	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2500646.00	2.220	0.0	0.0	0.0	0.0	-0.00117	2.220	-0.00117
76	47	POSITIVE	2190312.00	2.640	11187.52	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-701066.69	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	48	POSITIVE	437847.19	2.640	12135.11	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2495665.00	2.200	0.0	0.0	0.0	0.0	-0.00112	2.200	-0.00112
77	54	POSITIVE	1735701.00	2.620	10000.97	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-543164.00	2.180	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	55	POSITIVE	180853.50	2.640	11770.41	2.180	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2437771.00	2.200	0.0	0.0	0.0	0.0	-0.00062	2.200	-0.00062
78	13	POSITIVE	2391543.00	2.700	12596.55	2.720	0.0	0.0	0.00094	2.680	0.00094

		NEGATIVE	-591832.56	5.920	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	14	POSITIVE	1101332.00	2.740	12198.08	5.920	0.0	0.0	0.0	0.0	0.00088
		NEGATIVE	-2642841.00	5.920	0.0	0.0	0.0	0.0	-0.00286	5.920	-0.00374
79	20	POSITIVE	2345583.00	2.680	11961.23	2.680	0.0	0.0	0.00027	2.680	0.00027
		NEGATIVE	-567903.25	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	21	POSITIVE	746805.44	2.680	11867.09	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2467993.00	2.220	0.0	0.0	0.0	0.0	-0.00088	2.220	-0.00088
80	27	POSITIVE	2314692.00	2.640	11649.85	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-599705.25	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	28	POSITIVE	590875.06	2.640	11828.43	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2413001.00	2.220	0.0	0.0	0.0	0.0	-0.00041	2.220	-0.00041
81	34	POSITIVE	2326054.00	2.640	11579.52	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-630772.31	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	35	POSITIVE	537318.88	2.640	11873.52	2.220	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2406982.00	2.220	0.0	0.0	0.0	0.0	-0.00037	2.220	-0.00037
82	41	POSITIVE	2368184.00	2.640	11710.29	2.640	0.0	0.0	0.00002	2.640	0.00002
		NEGATIVE	-578466.56	2.220	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	42	POSITIVE	573643.31	2.640	11654.95	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2333374.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
83	48	POSITIVE	2362357.00	2.640	11648.57	2.640	0.0	0.0	0.00001	2.640	0.00001
		NEGATIVE	-598487.13	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	49	POSITIVE	542439.00	2.640	11762.34	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-2374565.00	2.200	0.0	0.0	0.0	0.0	-0.00008	2.200	-0.00008
84	55	POSITIVE	2288120.00	2.640	11282.45	2.640	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-357829.31	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	56	POSITIVE	400817.81	2.620	10574.35	2.200	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-1902434.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1RESULTS ENVELOPES, ELEMENT GROUP 2 TIME = 10.100

SHEARWALL ELEMENTS (TYPE 7)///

ELEM NO	NODE I	NODE J		LEFT AXIAL MEMBER	RIGHT AXIAL MEMBER	CENTRAL AXIAL SPRING	ROTATIONAL SPRING	HORIZONTAL SPRING
1	6	13	POSITIVE FORCE	0.1471E+06	0.1436E+06	0.0	0.3172E+08	0.3405E+06
			TIME	2.2200	2.6600	0.0	2.6600	2.2000
			NEGATIVE FORCE	-0.3886E+06	-0.3567E+06	-0.3279E+06	-0.3905E+08	-0.3620E+06
			TIME	1.9000	1.5800	2.1000	2.2200	2.7600
			POSITIVE DISP	0.7803E+00	0.6604E+00	0.0	0.2689E-02	0.1785E+01
			TIME	2.2200	2.6600	0.0	2.6600	5.9200
			NEGATIVE DISP	-0.6840E+00	-0.8749E+00	-0.5562E-01	-0.3310E-02	-0.2203E+01
			TIME	2.6600	2.2200	2.1000	2.2200	2.7600
2	13	20	POSITIVE FORCE	0.1276E+06	0.1271E+06	0.0	0.3673E+08	0.3477E+06
			TIME	2.2600	2.6200	0.0	1.9000	2.2400

			NEGATIVE FORCE	-0.2195E+06	-0.2510E+06	-0.1832E+06	-0.3750E+08	-0.3495E+06
			TIME	1.9600	2.2400	2.5800	2.2200	2.7200
			POSITIVE DISP	0.9472E-01	0.8120E-01	0.0	0.5728E-02	0.1104E+01
			TIME	2.2600	2.6200	0.0	2.6600	5.9200
			NEGATIVE DISP	-0.1247E+00	-0.1226E+00	-0.2486E-01	-0.7033E-02	-0.1135E+01
			TIME	2.6000	2.2400	2.5800	2.2200	2.7200
3	20	27						
			POSITIVE FORCE	0.1022E+06	0.9827E+05	0.0	0.3397E+08	0.3428E+06
			TIME	2.2600	2.6200	0.0	1.9000	2.2600
			NEGATIVE FORCE	-0.1733E+06	-0.1999E+06	-0.1369E+06	-0.3479E+08	-0.3338E+06
			TIME	2.6200	2.2200	2.5600	2.2200	1.9400
			POSITIVE DISP	0.6956E-01	0.5333E-01	0.0	0.6269E-02	0.8038E+00
			TIME	2.2400	2.6200	0.0	2.6600	2.2600
			NEGATIVE DISP	-0.8465E-01	-0.9770E-01	-0.1857E-01	-0.7777E-02	-0.7370E+00
			TIME	2.6200	2.2200	2.5600	2.2200	2.7000
4	27	34						
			POSITIVE FORCE	0.7060E+05	0.6550E+05	0.0	0.3112E+08	0.3345E+06
			TIME	2.5200	2.6400	0.0	1.9000	2.2200
			NEGATIVE FORCE	-0.1464E+06	-0.1407E+06	-0.1060E+06	-0.3199E+08	-0.2740E+06
			TIME	2.0000	2.5000	2.6600	2.2200	1.9200
			POSITIVE DISP	0.4736E-01	0.4090E-01	0.0	0.6632E-02	0.3893E+00
			TIME	2.5000	2.0000	0.0	2.6400	2.2200
			NEGATIVE DISP	-0.6174E-01	-0.6877E-01	-0.1438E-01	-0.8300E-02	-0.2769E+00
			TIME	2.6400	2.5000	2.6600	2.2200	2.6200
5	34	41						
			POSITIVE FORCE	0.6772E+05	0.5092E+05	0.0	0.2822E+08	0.3057E+06
			TIME	2.7400	2.4200	0.0	1.9000	2.2400
			NEGATIVE FORCE	-0.1140E+06	-0.1269E+06	-0.7500E+05	-0.2909E+08	-0.2818E+06
			TIME	2.4200	2.7200	2.9200	2.2200	2.6600
			POSITIVE DISP	0.4703E-01	0.3738E-01	0.0	0.6951E-02	0.3057E+00
			TIME	2.7200	2.4000	0.0	2.6400	2.2400
			NEGATIVE DISP	-0.5426E-01	-0.6203E-01	-0.1018E-01	-0.8457E-02	-0.2818E+00
			TIME	2.4000	2.7200	2.9200	2.2200	2.6600
6	41	48						
			POSITIVE FORCE	0.6261E+05	0.5760E+05	0.0	0.2246E+08	0.2152E+06
			TIME	2.7400	2.4000	0.0	1.8800	2.2000
			NEGATIVE FORCE	-0.1066E+06	-0.1100E+06	-0.4603E+05	-0.2328E+08	-0.2390E+06
			TIME	2.4000	2.7400	2.3000	2.2000	2.6400

POSITIVE DISP	0.4267E-01	0.3995E-01	0.0	0.7121E-02	0.2152E+00
TIME	2.7400	2.4000	0.0	2.6400	2.2000
NEGATIVE DISP	-0.5100E-01	-0.5283E-01	-0.6247E-02	-0.8373E-02	-0.2390E+00
TIME	2.4000	2.7400	2.3000	2.2000	2.6400

7 48 55

POSITIVE FORCE	0.2890E+05	0.4785E+05	0.0	0.2237E+08	0.1177E+06
TIME	2.7400	2.4000	0.0	1.8800	2.1800
NEGATIVE FORCE	-0.7742E+05	-0.5692E+05	-0.1889E+05	-0.2317E+08	-0.1199E+06
TIME	2.4000	2.7400	2.3000	2.2000	2.6200
POSITIVE DISP	0.2003E-01	0.3032E-01	0.0	0.7153E-02	0.1177E+00
TIME	2.7400	2.4000	0.0	2.6400	2.1800
NEGATIVE DISP	-0.3516E-01	-0.2404E-01	-0.2564E-02	-0.8382E-02	-0.1199E+00
TIME	2.4000	2.7400	2.3000	2.2000	2.6200

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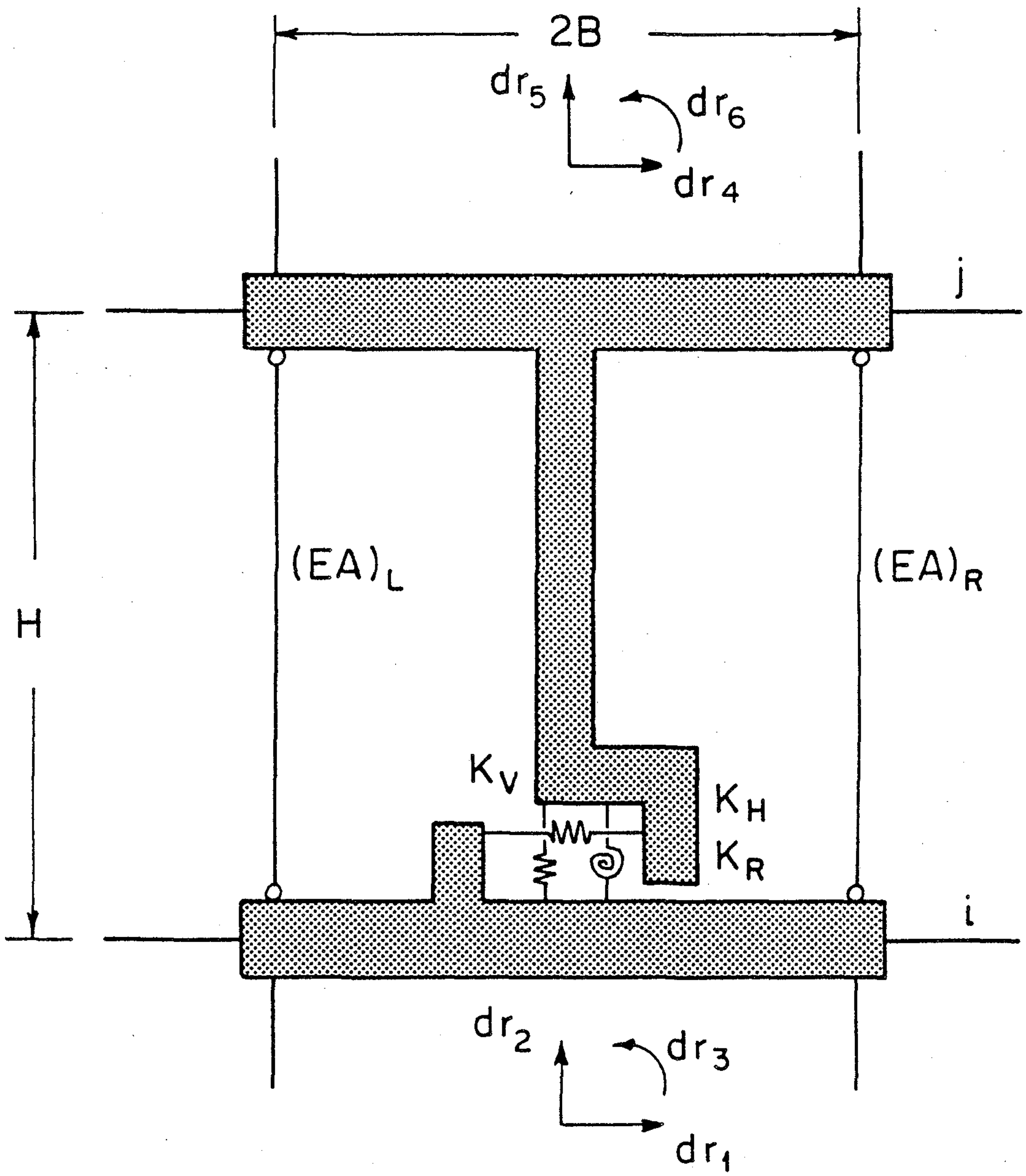


Fig. 1 Idealized Model of a Shearwall

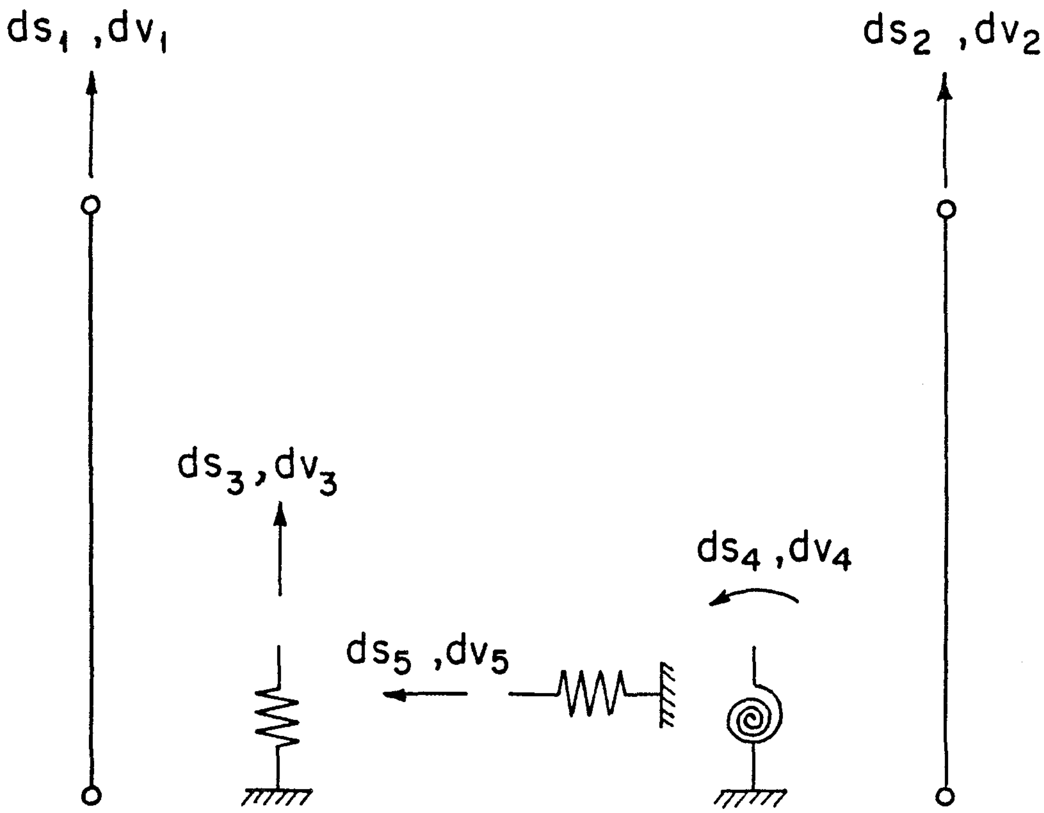
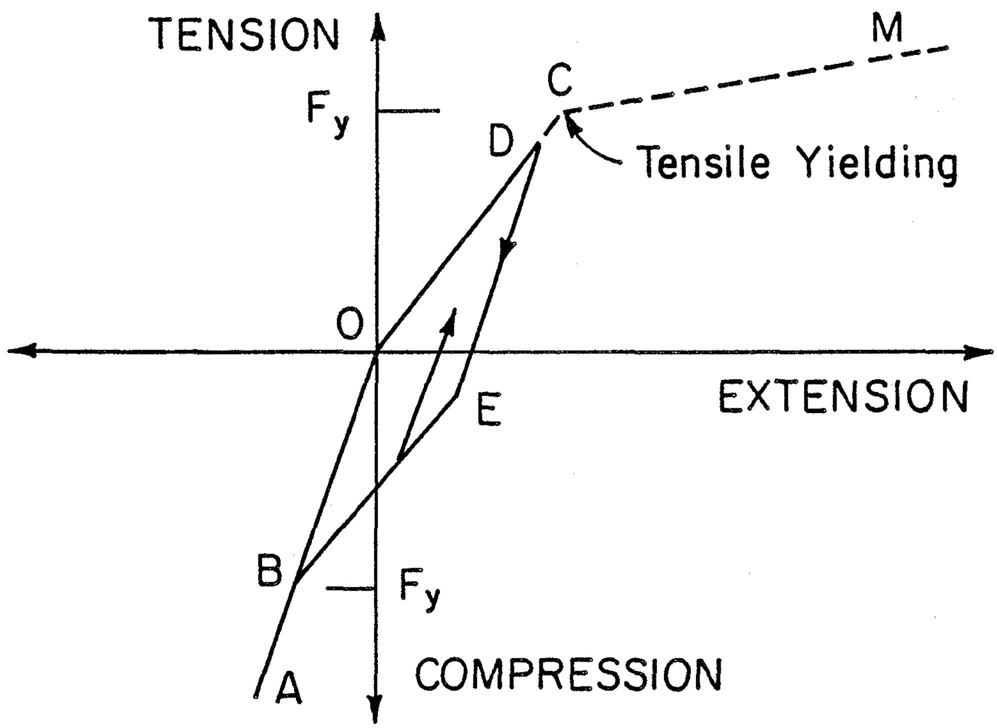
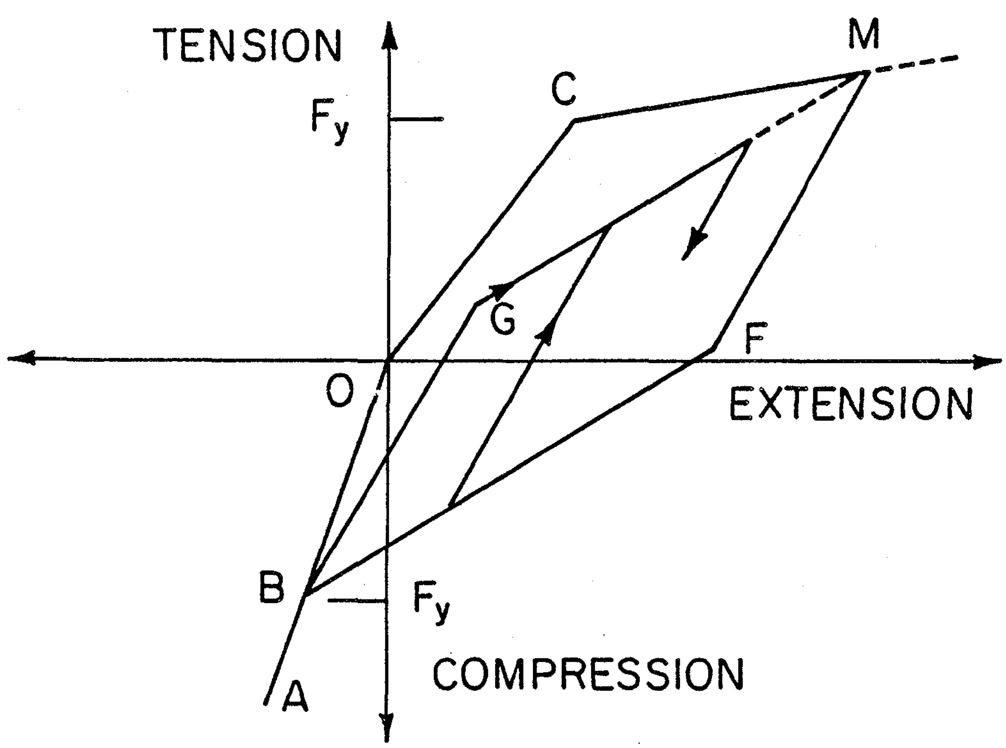


Fig. 2 Element Forces and Deformations



(a) Hysteresis Rule before Tensile Yielding (Bilinear Relation)



(b) Hysteresis Rule after Tensile Yielding
(Degrading Bilinear Relation)

Fig. 3 Axial Stiffness Hysteresis Model

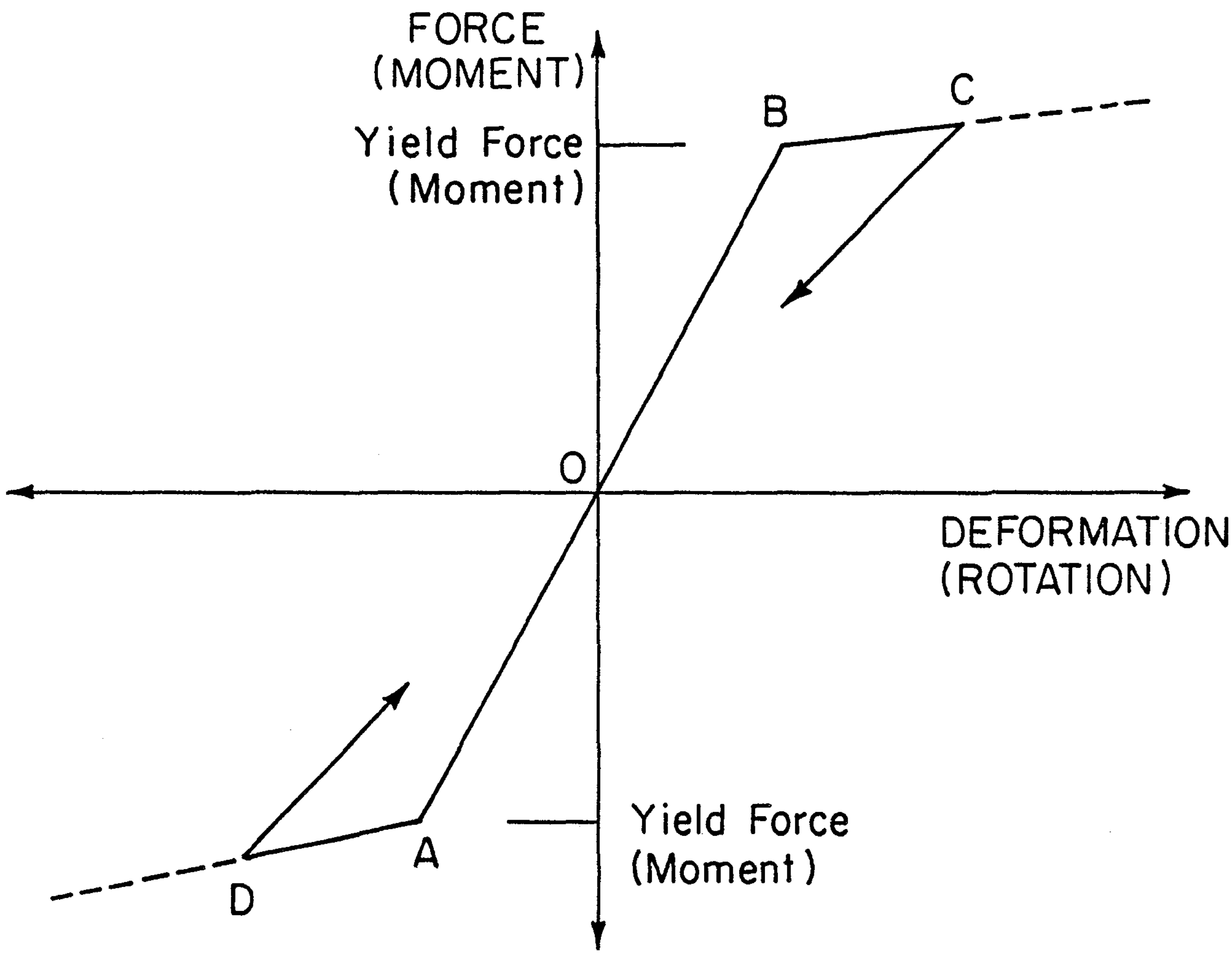


Fig. 4 Origin Oriented Hysteresis Model

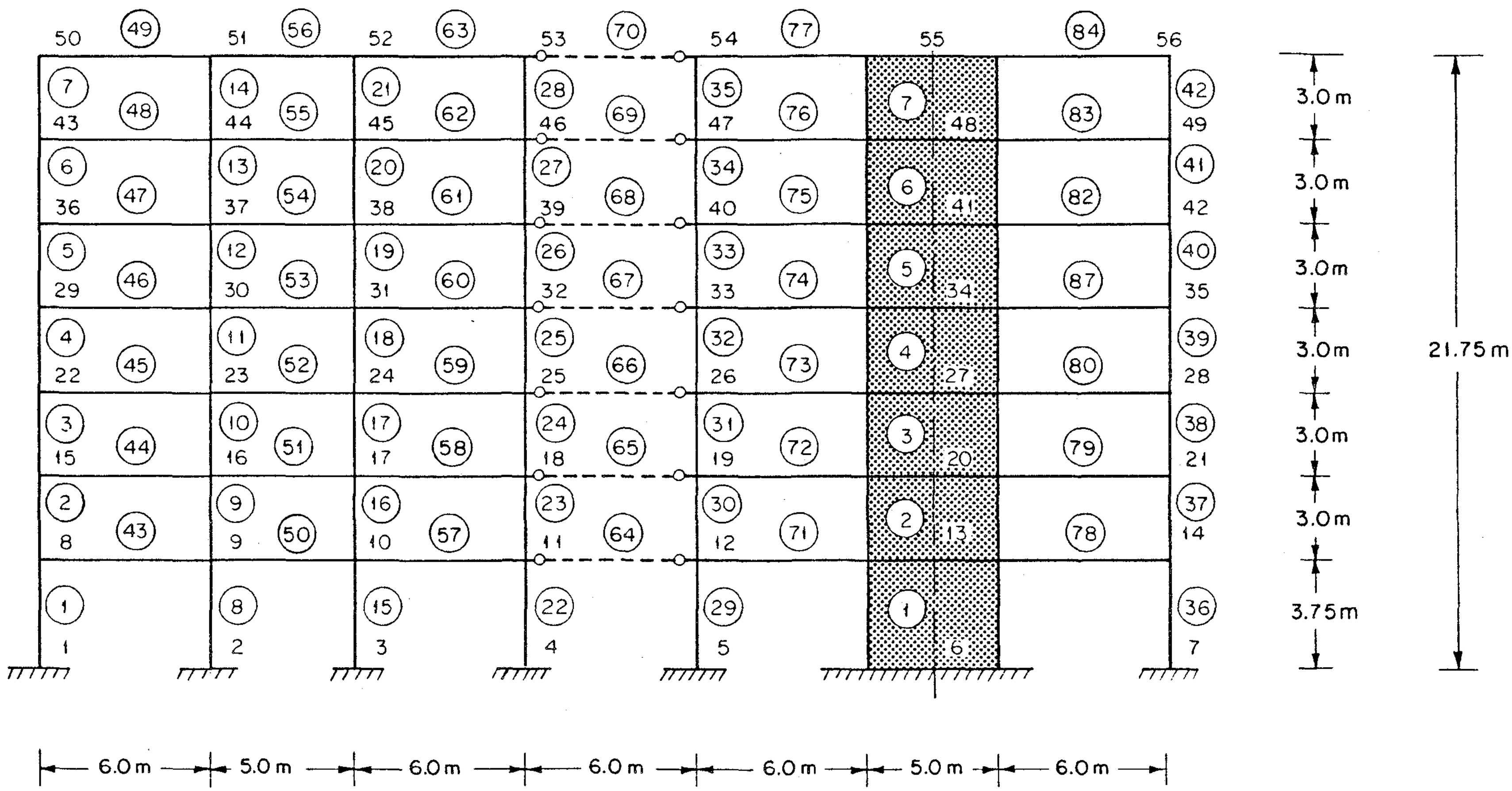


Fig. 5 Idealized Seven Story Frame-Wall Structure

APPENDIX A-1

FORTRAN LISTING OF THE SHEARWALL ELEMENT EL7

```
      SUBROUTINE INEL7(/KCONT/./FCONT/./NDOF/./NINFC/./ID/.
     1/X/./Y/./NN/)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      COMMON/WORK/KSHE,NMEM,NAXT,NROT,NHST,NYAX,NYRO,NYHS,NFEF,NINT,
     1FATYP(30,3),FRTYP(30,2),FHTYP(30,2),YAX(30,3),YRO(30,2),
     2YHS(30,2),FEF(30,5),FINIT(30,5),INEL,INODI,INODJ,INC,IINC,
     3IAXB,IAXBT,IAXC,IAXCT,IHS,IHST,IRO,IROT,IKDT,FINT,FFINIT,
     4IYAXB,IYAXBT,IYAXC,IYAXCT,IYRO,IYROT,IYHS,IYHST,KFDL,
     5IKFDL,KFLL,IKFLL,FDL,FFDL,FLLM,FFLL,FLLF,INIT,IINIT,
     6SFF(6),SSFF(6),DD(6),FFEF(5),W(1212)
      DIMENSION KCONT(1),ID(NN,1),X(1),Y(1),COM(1),YESNO(2),AST(2)
      EQUIVALENCE (IMEM,COM(1))
      DATA AST/2H  ,2H */
      DATA YESNO/4H YES,4H NO /
C
C
C      DATA INPUT SHEAR WALL ELEMENT
C
      NDOF=6
      NINFC=152
      KSHE=KCONT(1)
      NMEM=KCONT(2)
      NAXT=KCONT(3)
      NROT=KCONT(4)
      NHST=KCONT(5)
      NYAX=KCONT(6)
      NYRO=KCONT(7)
      NYHS=KCONT(8)
      NFEF=KCONT(9)
      NINT=KCONT(10)
C
      PRINT 10,(KCONT(I),I=2,10)
 10   FORMAT(29H SHEAR WALL ELEMENTS (TYPE 7)////
     1        40H NO. OF ELEMENTS                        =I4/
     2        40H NO. OF AXIAL STIFF TYPES               =I4/
     3        40H NO. OF ROT SPRING STIFF TYPES          =I4/
     4        40H NO. OF HOR SPRING STIFF TYPES          =I4/
     5        40H NO. OF AXIAL YIELD PATTERNS            =I4/
     6        40H NO. OF ROT SPRING YIELD PATTERNS       =I4/
     7        40H NO. OF HOR SPRING YIELD PATTERNS       =I4/
     8        40H NO. OF FIXED END FORCE PATTERNS        =I4/
     9        40H NO. OF INITIAL FORCE PATTERNS          =I4)
C
C      INPUT STIFFNESS PROPERTIES
C
      PRINT 20
 20   FORMAT(/////18H AXIAL STIFF TYPES//
     12X,5H TYPE,15H   COMP MODULUS,15H   TENS MODULUS,
     217H   TENS HARDENING)
      DO 30 N=1,NAXT
      READ 40,I,(FATYP(N,J),J=1,3)
 30   PRINT 50 ,N,(FATYP(N,J),J=1,3)
 40   FORMAT(I5,3F10.0)
 50   FORMAT(2X,I4,3X,E12.4,3X,E12.4,7X,F6.3)
      PRINT 22
```

```
 22   FORMAT(//23H ROT SPRING STIFF TYPES//
     12X,5H TYPE,15H    INIT MODULUS,17H    STRN HARDENING)
      DO 32 N=1,NROT
      READ 42,I,(FRTYP(N,J),J=1,2)
 32   PRINT 51,N,(FRTYP(N,J),J=1,2)
 42   FORMAT(I5,E15.6,F10.0)
 51   FORMAT(2X,I4,3X,E12.4,7X,F6.3)
      PRINT 21
 21   FORMAT(//23H HOR SPRING STIFF TYPES//
     12X,5H TYPE,15H    INIT MODULUS,17H    STRN HARDENING)
      DO 31 N=1,NHST
      READ 41,I,(FHTYP(N,J),J=1,2)
 31   PRINT 51,N,(FHTYP(N,J),J=1,2)
 41   FORMAT(I5,2F10.0)
C
C      YIELD PROPERTIES
C
      PRINT 110
110   FORMAT(////41H YIELD PROPERTIES OF THE AXIAL COMPONENTS//
     12X,5H TYPE,22H    TENS YIELD LOAD(PY),
     218H    TENS YIELD STRN,18H    COMP STRN AT PY)
      DO 200 N=1,NYAX
      READ 120,I,(YAX(N,J),J=1,3)
200   PRINT 130,N,(YAX(N,J),J=1,3)
120   FORMAT(I5,3F10.0)
130   FORMAT(2X,I4,6X,F12.2,4X,E13.4,4X,E13.4)
      PRINT 111
      DO 202 N=1,NYRO
      READ 122,I,(YRO(N,J),J=1,2)
202   PRINT 131,N,(YRO(N,J),J=1,2)
131   FORMAT(2X,I4,4X,E13.4,4X,E13.4)
122   FORMAT(I5,2F10.0)
111   FORMAT(////31H YIELD PROPERTIES OF ROT SPRING//
     12X,5H TYPE,17H     LOAD AT YIELD,
     217H     STRN AT YIELD)
      PRINT 112
      DO 201 N=1,NYHS
      READ 121 ,I,(YHS(N,J),J=1,2)
201   PRINT 131,N,(YHS(N,J),J=1,2)
112   FORMAT(////31H YIELD PROPERTIES OF HOR SPRING//
     12X,5H TYPE,17H     LOAD AT YIELD,17H     STRN AT YIELD)
121   FORMAT(I5,2F10.0)

      DO 140 N=1,NYAX
      YAX(N,1)=ABS(YAX(N,1))
      YAX(N,2)=ABS(YAX(N,2))
      YAX(N,3)=-ABS(YAX(N,3))
140   CONTINUE
      DO 150 N=NYHS
      YHS(N,1)=ABS(YHS(N,1))
      YHS(N,2)=ABS(YHS(N,2))
150   CONTINUE
      DO 160 N=1,NYRO
      YRO(N,1)=ABS(YRO(N,1))
      YRO(N,2)=ABS(YRO(N,2))
160   CONTINUE
C
C      FIXED END FORCE PATTERNS
C
      IF(NFEF.EQ.0)GO TO 250
```

```
      PRINT 210
210   FORMAT(////25H FIXED END FORCE PATTERNS//
     12X,8H PATTERN,15H  AXL FORCE LFT,15H  AXL FORCE RHT,
     219H  AXL FORCE CENTRAL,22H  MOMENT IN ROT SPRING,
     321H  FORCE IN HOR SPRING,5X,10HLL RED FAC/)
      DO 220 N=1,NFEF
      READ 230,I,(FEF(N,J),J=1,5)
220   PRINT 240,N,(FEF(N,J),J=1,5)
230   FORMAT(I5,5F10.0)
240   FORMAT(2X,I6,3X,F12.2,3X,F12.2,5X,F12.2,8X,F12.2,7X,F12.2)
C       INITIAL FORCE PATTERNS
C
250   IF(NINT.EQ.O)GO TO 300
      PRINT 260
260   FORMAT(////28H INITIAL END FORCE PATTERNS//
     12X,8H PATTERN,15H  AXL FORCE LFT,15H  AXL FORCE RHT,
     219H  AXL FORCE CENTRAL,22H  MOMENT IN ROT SPRING,
     321H  FORCE IN HOR SPRING)
      DO 270 N=1,NINT
      READ 280 ,I,(FINIT(N,J),J=1,5)
270   PRINT 240,N,(FINIT(N,J),J=1,5)
280   FORMAT(I5,5F10.0)
C
C       ELEMENT SPECIFICATION
C
300   PRINT 310
310   FORMAT(////22H ELEMENT SPECIFICATION//
     13X,4HELEM,2X,4HNODE,5H NODE,5H NODE,6H WIDTH,5H BAXS,5H CAXS,
     25H ROTS,5H HORS,5H BAXY,5H CAXY,5H ROTY,5H HORY,6H TIME ,
     313HFEF PATTERNS ,18HFEF SCALE FACTORS ,14HINITIAL FORCES/
     44X,2HNO,6H      I,5H    J,6H  DIFF,7X,5HTYPE ,5HTYPE ,5HTYPE ,
     55HTYPE ,5HTYPE ,5HTYPE ,5HTYPE ,5HTYPE ,5HHIST ,12H  DL    LL
     613H    DL       LL    ,17H NO.    SCALE FAC./)
C
      DO 319 J=1,5
      KODY(J)=0
      KODYX(J)=0
319   CONTINUE
      KST=0
      DO 320 J=98,152
320   COM(J)=0.
      IMEM=1
330   READ 340,INEL,INODI,INODJ,IINC,DSW,IAXBT,IAXCT,IROT,IHST,
     1IYAXBT,IYAXCT,IYROT,IYHST,IKDT,IKFDL,IKFLL,FFDL,FFLL,
     2IINIT,FFINIT
340   FORMAT(4I4,F6.0,11I3,2F5.0,I5,F5.0)
      IF(INEL.GT.IMEM)GO TO 380
350   NODI=INODI
      NODJ=INODJ
      INC=IINC
      IF(INC.EQ.O)INC=1
      IAXB=IAXBT
      IAXC=IAXCT
      KOUTDT=IKDT
      WID=DSW/2.
      IHS=IHST
      IRO=IROT
      IYAXB=IYAXBT
      IYAXC=IYAXCT
```

```
      IYHS=IYHST
      IYRO=IYROT
      YNT=YESNO(2)
      IF(KOUTDT.NE.O)YNT=YESNO(1)
      KFDL=IKFDL
      KFLL=IKFLL
      FDL=FFDL
      FLLM=FFLL
      FLLF=1.0
      IF(KFLL.EQ.O)GO TO 360
      FLLF=FEF(IKFLL,6)
      IF(FLLF.EQ.O)FLLF=1.E-6
360   INIT=IINIT
      FINT=FFINIT
      ASTT=AST(1)
      IF(INEL-NMEM)330,380,330
C
370   NODI=NODI+INC
      NODJ=NODJ+INC
      ASTT=AST(2)
C
380   PRINT 390,ASTT,IMEM,NODI,NODJ,INC,DSW,IAXB,IAXC,IRO,IHS,
     1IYAXB,IYAXC,IYRO,IYHS,YNT,KFDL,KFLL,FDL,FLLM,INIT,FINT
390   FORMAT(A2,I4,I6,2I5,F5.1,I4,7I5,3X,A3,I6,I5,3X,F8.2,
     1F9.2,I7,F11.2)
C
C       LOCATION MATRIX
C
      DO 400 I=1,3
      LM(I)=ID(NODI,I)
400   LM(I+3)=ID(NODJ,I)
      CALL BAND
C
C       ELEMENT PROPERTIES
C
      FL=ABS(Y(NODJ)-Y(NODI))
      STO(1)=FATYP(IAXB,1)
      ST1(1)=FATYP(IAXB,2)
      ST2(1)=FATYP(IAXB,3)*ST1(1)
      STO(2)=STO(1)
      ST1(2)=ST1(1)
      ST2(2)=ST2(1)
      STO(3)=FATYP(IAXC,1)
      ST1(3)=FATYP(IAXC,2)
      ST2(3)=FATYP(IAXC,3)*ST1(3)
      STSO(1)=FRTYP(IRO,1)
      STS1(1)=FRTYP(IRO,2)*STSO(1)
      STSO(2)=FHTYP(IHS,1)
      STS1(2)=FHTYP(IHS,2)*STSO(2)
      PY(1)=YAX(IAXB,1)
      PY(2)=PY(1)
      DELY(1)=YAX(IAXB,2)
      DELY(2)=DELY(1)
      DELC(1)=-ABS(YAX(IAXB,3))
      DELC(2)=DELC(1)
      PY(3)=YAX(IAXC,1)
      DELY(3)=YAX(IAXC,2)
      DELC(3)=-ABS(YAX(IYAXC,3))
      PY(4)=YRO(IYRO,1)
      DELY(4)=YRO(IYRO,2)
```

```
      PY(5)=YHS(IYHS,1)
      DELY(5)=YHS(IYHS,2)
C     LOADS DUE TO FIXED END FORCES
C
      DO 480 I=1,6
480   SFF(I)=0.0
      IF(KFDL+KFLL.EQ.0)GO TO 610
      IF(KFDL.EQ.0)GO TO 530
      DO 500 I=1,5
500   FFEF(I)=FEF(KFDL,I)*FDL
      CALL TRANS(SFF,FFEF)
530   IF(KFLL.EQ.0)GO TO 570
      DO 529 I=1,5
529   FFEF(I)=FEF(KFLL,I)
      CALL TRANS(SSFF,FFEF)
      DO 540 I=1,6
      FLL=FLLF*FLLM
      IF(I.EQ.3.OR.I.EQ.6)FLL=FLLM
540   SSFF(I)=SSFF(I)*FLL
570   DO 580 I=1,6
580   DD(I)=SFF(I)+SSFF(I)
      CALL SFORCE(DD)
C
C      MODIFY TO GET INITIAL FORCES
      IF(KFDL.EQ.0)GO TO 531
      DO 501 I=1,5
501   SFF(I)=FEF(KFDL,I)*FDL
531   IF(KFLL.EQ.0)GO TO 610
      DO 583 I=1,5
      SSFF(I)=FEF(KFLL,I)*FLLM
583   SFF(I)=SFF(I)+SSFF(I)
C
C      INITIAL FORCES
C
610   IF(INIT.EQ.0)GO TO 630
      DO 620 I=1,5
620   SFF(I)=SFF(I)+FINIT(INIT,I)*FINT
C
C      INITIALISE ELEMENT FORCES
C
630   DO 631 I=1,5
631   FTOT(I)=SFF(I)
      DO 650 I=1,5
      SS=FTOT(I)
      IF(SS.LT.0.)GO TO 640
      SENP(I)=SS
      GO TO 650
640   SENN(I)=SS
650   CONTINUE
      CALL FINISH
C
C      GENERATE MISSING ELEMENTS
      IF(IMEM.EQ.NMEM)RETURN
      IMEM=IMEM+1
      IF(IMEM.EQ.INEL)GO TO 350
      GO TO 370
      END
      SUBROUTINE STIF7(/MSTEP/,/NDOF/,/NINFC/,/COMS/,/FK/,/DFAC/)

      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
```

```
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      COMMON/WORK/ST(5),STT(5)
C
      DIMENSION COM(1),COMS(1),FK(6,6)
      EQUIVALENCE(IMEM,COM(1))
C
C      STIFFNESS FORMULATION
C
      DO 10 J=3,57
10    COM(J)=COMS(J)
C
C      CURRENT STIFFNESS OF EACH COMPONENT
      CALL FSTF7( ST , KODY )
C
C      PREVIOUS STIFFNESS
      IF(MSTEP.LT.2)GO TO 30
      CALL FSTF7( STT , KODYX )
C
C      STIFFNESS DIFFERNCE
      DO 20 I=1,5
20    ST(I)=ST(I)-STT(I)
30    DO 31 I=1,6
      DO 31 J=1,6
31    FK(I,J)=0.0
      PARS=WID*WID*(ST(1)+ST(2))
      FK(1,1)=ST(5)
      FK(1,4)=-ST(5)
      FK(1,6)=-FL*ST(5)
      FK(2,2)=ST(1)+ST(2)+ST(3)
      FK(2,3)=WID*(ST(2)-ST(1))
      FK(2,5)=-FK(2,2)
      FK(2,6)=-FK(2,3)
      FK(3,3)=PARS+ST(4)
      FK(3,5)=FK(2,6)
      FK(3,6)=-PARS+ST(4)
      FK(4,4)=ST(5)
      FK(4,6)=-FK(1,6)
      FK(5,5)=FK(2,2)
      FK(5,6)=FK(2,3)
      FK(6,6)=PARS+FL*FL*ST(5)+ST(4)
      DO 60 I=1,6
      DO 60 J=1,6
60    FK(J,I)=FK(I,J)
      IF(MSTEP.GT.1)GO TO 80
C
C      INITIAL STIFFNESS FOR STEPO,BETA_O CORRECTION FOR STEP 1
C
      CC=1.0
      IF(MSTEP.EQ.1)CC=DFAC
      DO 40 I=1,36
40    FK(I,1)=FK(I,1)*CC
80    RETURN
      END
      SUBROUTINE TRANS(/SF/,/FE/)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
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```
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      DIMENSION SF(6),FE(5)
      SF(1)=-FE(5)
      SF(2)=-FE(1)-FE(2)-FE(3)
      SF(3)=WID*(FE(1)-FE(2))+FE(4)
      SF(4)=FE(5)
      SF(5)=-SF(2)
      SF(6)=WID*(FE(2)-FE(1))+FL*FE(5)+FE(4)
      RETURN
      END
      SUBROUTINE FSTF7(/STIF/,/KOD/)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      DIMENSION STIF(5),KOD(5)
      DO 25 I=1,3
      KYY=KOD(I)+1
      GO TO (30,35,40,30,35,55,60,30,55,60),KYY
30    STIF(I)=STO(I)
      GO TO 25
35    STIF(I)=ST1(I)
      GO TO 25
40    STIF(I)=ST2(I)
      GO TO 25
55    STIF(I)=ST5(I)
      GO TO 25
60    STIF(I)=ST6(I)
25    CONTINUE
      DO 80 I=1,2
      N=I+3
       KYY=KOD(N)+1
      GO TO (85,90,90,95),KYY
85    STIF(N)=STSO(I)
      GO TO 80
90    STIF(N)=STS1(I)
      GO TO 80
95    STIF(N)=STS3(I)
80    CONTINUE
      RETURN
      END
      SUBROUTINE RESP7(/NDOF/,/NINFC/,/KBAL/,/KPR/,/COMS/,/DDISM/,
     1/DD/,/TIME/,/VELM/,/DFAC/,/DELTA/)
C
C       STATE DETERMINATION ,SHEAR WALL ELEMENTS
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FDUM(5),DSUB(5),DELV(5),
     1FACAC,FAC,FACTOR,DELI,DTOT,STOT, DSO,DS ,DS2,DS3,DS4,DS5,DS6,
     2DS7,DS8,DS9,KODO,REM(1148)
      DIMENSION COM(1),COMS(1),DDISM(1),DD(1),VELM(1)
```

```
      EQUIVALENCE(IMEM,COM(1))
C
      DO 10 J=1,NINFC
10    COM(J)=COMS(J)
      DO 11 J=1,5
11    KODYX(J)=KODY(J)
      IF(IMEM.EQ.1)IHED=0
C
C      DEFORMATION INCREMENTS
C
      DV(1)=-DDISM(2)+WID*DDISM(3)+DDISM(5)-WID*DDISM(6)
      DV(2)=-DDISM(2)-WID*DDISM(3)+DDISM(5)+WID*DDISM(6)
      DV(3)=-DDISM(2)+DDISM(5)
      DV(4)=DDISM(3)+DDISM(6)
      DV(5)=-DDISM(1)+DDISM(4)+FL*DDISM(6)
C
C      FORCE INCREMENTS IN VARIOUS COMPONENTS
C
      CALL FSTF7( STRS , KODY )
      DO 12 I=1,5
      DF(I)=STRS(I)*DV(I)
      VTOT(I)=VTOT(I) +DV(I)
12    FLIN(I)=FTOT(I)+DF(I)
      CALL RSPAX(1)
      CALL RSPAX(2)
      CALL RSPAX(3)
      CALL RSPSP(1)
      CALL RSPSP(2)
C
C      NEW FORCE,UNBALANCED FORCE DUE TO CHANGE OF SLOPE
C
      DO 790 I=1,5
      FDUM(I)=FTOT(I)
      DSUB(I)=FLIN(I)-FTOT(I)
      IF(ABS(DSUB(I)).GT.1.E-8)KBAL=1
790   CONTINUE
C
C      DEFORMATION RATE FOR DAMPING
      IF(DFAC.EQ.0.0.AND.DELTA.EQ.0.0)GO TO 800
      IF(TIME.EQ.0.)GO TO 737
      KBAL=1
      DELV(1)=-VELM(2)+WID*VELM(3)+VELM(5)-WID*VELM(6)
      DELV(2)=-VELM(2)-WID*VELM(3)+VELM(5)+WID*VELM(6)
      DELV(3)=-VELM(2)+VELM(5)
      DELV(4)=VELM(3)+VELM(6)
      DELV(5)=-VELM(1)+VELM(4)+FL*VELM(6)
C
C      BETA-O DAMPING FORCE
C
      IF(DFAC.EQ.0.)GO TO 830
      DO 835 I=1,5
      IF(I.GT.3)GO TO 840
      DSUB(I)=DSUB(I)+DFAC*STO(I)*DELV(I)
      GO TO 835
840   N=I-3
      DSUB(I)=DSUB(I)+DFAC*STSO(N)*DELV(I)
835   CONTINUE
C
C      STRUCTURAL DAMPING FORCE
C
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```
830  IF(DELTA.EQ.O.)GO TO 800
     DO 865 I=1,5
     DSL=DELTA*SIGN(ABS(FDUM(I)),DELV(I))
     DSUB(I)=DSUB(I)-DSL+SDFO(I)
     SDFO(I)=DSL
865  CONTINUE
C
C     UNBALANCED LOAD VECTORS
C
800  IF(KBAL.EQ.O)GO TO 737
     CALL TRANS( DD , DSUB )
C
C     EXTRACT ENVELOPES
737  DO 743 I=1,5
     IF(SENP(I).GE.FDUM(I))GO TO 738
     SENP(I)=FDUM(I)
     TSENP(I)=TIME
     GO TO 741
738  IF(SENN(I).LE.FDUM(I))GO TO 741
     SENN(I)=FDUM(I)
     TSENN(I)=TIME
741  IF(VENP(I).GE.VTOT(I)) GO TO 742
     VENP(I)=VTOT(I)
     TVENP(I)=TIME
     GO TO 743
742  IF(VENN(I).LE.VTOT(I))GO TO 743
     VENN(I)=VTOT(I)
     TVENN(I)=TIME
743  CONTINUE
C
C     PRINT TIME HISTORY
C
     IF(KPR.LT.O)GO TO 200
     IF(KPR.EQ.O.OR.KOUTOT.EQ.O) GO TO 240
200  IF(IHED.NE.O)GO TO 220
     KKPR=IABS(KPR)
     PRINT 210,KKPR,TIME
210  FORMAT(///18H RESULTS FOR GROUP,I3,
    128H SHEAR WALL ELEMENTS, TIME =F8.3//
    25X,5H ELEM,2X,4HNODE,2X,4HNODE,22X,10HLEFT AXIAL,
    32X,11HRIGHT AXIAL,2X,13HCENTRAL AXIAL,2X,10HROTATIONAL,
    42X,10HHORIZONTAL/7X,2HNO,5H     I,6H      J,26X,6HMEMBER,
    56X,6HMEMBER,9X,6HSPRING,9X,6HSPRING,6X,6HSPRING)
     IHED=1
220  PRINT 230,IMEM,NODI,NODJ,(KODY(I),I=1,5),(FTOT(I),I=1,5),
    1(VTOT(I),I=1,5)
230  FORMAT(I9,2I6/23X,11H YIELD CODE,10X,I6,6X,I6,9X,I6,7X,I6,6X,I6//
    123X,18HTOTAL FORCE/MOMENT,5E13.4//23X,17HTOTAL DEFORMATION,
    25E13.4)
C
C     SET INDICATOR FOR STATUS CHANGE
240  KST=0
     DO 245 I=1,5
     IF(KODYX(I).NE.KODY(I))KST=1
245  CONTINUE
C
C     UPDATE INFORMATION IN COMS ARRAY
C
     DO 250 J=40,152
250  COMS(J)=COM(J)
```

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      COMS(2)=COM(2)
      RETURN
      END
      SUBROUTINE OUT7(/COMS/,/NINFC/)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      DIMENSION COM(1),COMS(1)
      EQUIVALENCE(IMEM,COM(1))
C
C      ENVELOPE OUTPUT ,SHEARWALL ELEMENTS
C
      DO 10 J=1,NINFC
10    COM(J)=COMS(J)
      IF(IMEM.EQ.1)PRINT 20
20    FORMAT(32H  SHEARWALL ELEMENTS (TYPE 7)////
     15X,5H ELEM,2X,4HNODE,2X,4HNODE,22X,10HLEFT AXIAL,
     22X,11HRIGHT AXIAL,2X,13HCENTRAL AXIAL,2X,10HROTATIONAL,
     32X,10HHORIZONTAL/7X,2HNO,5H    I,6H     J,26X,6HMEMBER,
     46X,6HMEMBER,9X,6HSPRING,9X,6HSPRING,6X,6HSPRING)
C
      PRINT 30,IMEM,NODI,NODJ,(SENP(I),I=1,5),(TSENP(I),I=1,5),
     1    (SENN(I),I=1,5),(TSENN(I),I=1,5),(VENP(I),I=1,5),
     2(TVENP(I),I=1,5),(VENN(I),I=1,5),(TVENN(I),I=1,5)
30    FORMAT(I9,2I6/23X,14HPOSITIVE FORCE,6X,5E12.4/23X,
     114H            TIME,6X,5F12.4//23X,14HNEGATIVE FORCE,6X,
     25E12.4/23X,14H            TIME,6X,5F12.4//23X,13HPOSITIVE DISP
     3      ,6X,5E12.4/23X,13H            TIME,6X,5F12.4//
     423X,13HNEGATIVE DISP,6X,5E12.4/23X,13H            TIME,
     56X,5F12.4//)
      RETURN
      END
C
C      STATE DETERMINATION OF AXIAL COMPONENTS
C
      SUBROUTINE RSPAX(I)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FDUM(5),DSUB(5),DELV(5),
     1FACAC,FAC,FACTOR,DELI,DTOT,STOT,DSO,DS ,DS2,DS3,DS4,DS5,DS6,
     2DS7,DS8,DS9,KODD,REM(1148)
      KODD=KODY(I)
      DELI=DV(I)
      STOT=FTOT(I)
      DTOT=VTOT(I)
      FACAC=0.
20    FACTOR=1.-FACAC
      KODYI=KODD+1
      GO TO(701,702,703,300,705,500,707,708,709,710),KODYI

C
C      ON SLOPE 0 <GET FACTOR FOR STATUS CHANGE
701   DSO=STO(I)*DELI
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```
      IF(DSO)32,110,31
31    FAC=-STOT/DSO
      IF(FAC.GE.FACTOR) GO TO 32
      FACTOR=FAC
      STOT=0.0
      KODD=1
      GO TO 110
32    STOT=STOT+FACTOR*DSO
      GO TO 110
C
C      ON SLOPE 1 .GET FACTOR FOR STATUS CHANGE
C
702   DS =ST1(I)*DELI
      IF(DS )33,110,35
33    KODD=3
      GO TO 300
35    FAC=(PY(I)-STOT)/DS
      IF(FAC.GE.FACTOR)GO TO 38
      FACTOR=FAC
      STOT=PY(I)
      KODD=2
      GO TO 110
38    STOT=STOT+FACTOR*DS
      GO TO 110
C
C      ON SLOPE 2.GET FACTOR FOR STATUS CHANGE
C
703   DS2=DELI*ST2(I)
      IF(DS2)40,110,45
40    KODD=5
      GO TO 500
45    STOT=STOT+DS2*FACTOR
      KODD=2
      GO TO 110
C
C      ON SLOPE 3<GET FACTOR FOR STATUS CHANGE
C
300   DS3=STO(I)*DELI
      IF(DS3)50,110,55
50    FAC=(P34(I)-STOT)/DS3
      IF(FAC.GE.FACTOR)GO TO 60
      FACTOR=FAC
      STOT=P34(I)
      KODD=4
      GO TO 110
55    FAC=(P1(I)-STOT)/DS3
      IF(FAC.GE.FACTOR)GO TO 60
      FACTOR=FAC
      STOT=P1(I)
      KODD=1
      GO TO 110
60    STOT=STOT+FACTOR*DS3
      GO TO 110
C
C      ON SLOPE 4.GET FACTOR FOR STATUS CHANGE
C
705   DS4=ST1(I)*DELI
      IF(DS4)65,110,70
65    FAC=(-PY(I)-STOT)/DS4
      IF(FAC.GE.FACTOR)GO TO 75
```

```
      FACTOR=FAC
      STOT=-PY(I)
      KODD=0
      GO TO 110
70    KODD=3
      GO TO 300
75    STOT=STOT+FACTOR*DS4
      GO TO 110
C
C      ON SLOPE 5.GET FACTOR FOR STATUS CHANGE
500   DS5=DELI*ST5(I)
      IF(DS5)80,110,85
80    FAC=(P56(I)-STOT)/DS5
      IF(FAC.GE.FACTOR)GO TO 90
      FACTOR=FAC
      STOT=P56(I)
      KODD=6
      GO TO 110
85    FAC=(P9(I)-STOT)/DS5
      IF(FAC.GE.FACTOR)GO TO 90
      FACTOR=FAC
      STOT=P9(I)
      KODD=9
      GO TO 110
90    STOT=STOT+FACTOR*DS5
      GO TO 110
C
C      ON SLOPE 6.GET FACTOR FOR STATUS CHANGE
707   DS6=DELI*ST6(I)
      IF(DS6)120,110,125
120   FAC=(-PY(I)-STOT)/DS6
      IF(FAC.GE.FACTOR)GO TO 130
      FACTOR=FAC
      KODD=7
      GO TO 110
125   KODD=5
      GO TO 500
130   STOT=STOT+FACTOR*DS6
      GO TO 110
C      ON SLOPE 7.GET FACTOR FOR STATUS CHANGE
708   DS7=DELI*STO(I)
      IF(DS7)140,110,145
140   KODD=7
      GO TO 150
145   FAC=(-PY(I)-STOT)/DS7
      IF(FAC.GE.FACTOR)GO TO 150
      FACTOR=FAC
      STOT=-PY(I)
      KODD=8
      GO TO 110
150   STOT=STOT+FACTOR*DS7
      GO TO 110
C
C      ON SLOPE 8.GET FACTOR FOR STATUS CHANGE
709   DS8=ST5(I)*DELI
      IF(DS8)160,110,165
160   FAC=(-PY(I)-STOT)/DS8

      IF(FAC.GE.FACTOR)GO TO 170
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      FACTOR=FAC
      STOT=-PY(I)
      KODD=7
      GO TO 110
165   FAC=(P89(I)-STOT)/DS8
      IF(FAC.GE.FACTOR)GO TO 170
      FACTOR=FAC
      STOT=P89(I)
      KODD=9
      GO TO 110
170   STOT=STOT+FACTOR*DS8
      GO TO 110
C C
C       ON SLOPE 9,GET FACTOR FOR STATUS CHANGE
710   DS9=ST6(I)*DELI
      IF(DS9)175,110,180
175   KODD=5
      GO TO 500
180   FAC=(P2(I)-STOT)/DS9
      IF(FAC.GE.FACTOR)GO TO 185
      FACTOR=FAC
      STOT=P2(I)
      KODD=2
      GO TO 110
185   STOT=STOT+FACTOR*DS9
C
C       CHECK COMPLETION OF CYCLE
110   FACAC=FACAC+FACTOR
      IF(FACAC.LT.0.9999999)GO TO 20
      IF(KODD.EQ.1)CALL VRTX1(I)
      IF(KODD.EQ.2)CALL VRTX2(I)
      IF(KODD.EQ.4)CALL VRTX4(I)
      IF(KODD.EQ.6)CALL VRTX6(I)
      IF(KODD.EQ.9)CALL VRTX9(I)
      KODY(I)=KODD
      FTOT(I)=STOT
      VTOT(I)=DTOT
      RETURN
      END
      SUBROUTINE VRTX1(I)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FOUM(5),DSUB(5),DELV(5),
     1FACAC,FAC,FACTOR,DELI,DTOT,STOT,DSO,DS ,DS2,DS3,DS4,DS5,DS6,
     2DS7,DS8,DS9,KODD,REM(1148)
      P1(I)=STOT
      D1(I)=DTOT
      D34(I)=(-PY(I)-STOT+STO(I)*DTOT-ST1(I)*DELC(I))/(STO(I)-ST1(I))
      P34(I)=(-STO(I)*PY(I)-ST1(I)*STOT+STO(I)*ST1(I)*(DTOT-DELC(I)))
     1/(STO(I)-ST1(I))
      RETURN
      END
      SUBROUTINE VRTX2(I)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
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2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
5TSENN(5),TVENP(5),TVENN(5),REST(48)
 COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FDUM(5),DSUB(5),DELV(5),
1FACAC,FAC,FACTOR,DELI,DTOT,STOT,DSO,DS ,DS2,DS3,DS4,DS5,DS6,
2DS7,DS8,DS9,KODD,REM(1148)
 P2(I)=STOT
 P9(I)=STOT
 D2(I)=DTOT
 D9(I)=DTOT
 ST6(I)=STOT/DTOT
 ST5(I)=ST6(I)*STO(I)/ST1(I)
 P56(I)=(ST5(I)*ST6(I)*(DTOT-DELC(I))-ST5(I)*PY(I)-ST6(I)*STOT)
1/(ST5(I)-ST6(I))
 D56(I)=(-PY(I)-STOT+ST5(I)*DTOT-ST6(I)*DELC(I))/
1(ST5(I)-ST6(I))
 P89(I)=(ST5(I)*ST6(I)*(DELC(I)-DTOT)+ST5(I)*STOT+
1ST6(I)*PY(I))/(ST5(I)-ST6(I))
 D89(I)=(STOT+PY(I)+ST5(I)*DELC(I)-ST6(I)*DTOT)/
1(ST5(I)-ST6(I))
 RETURN
 END
 SUBROUTINE VRTX4(I)
 COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
5TSENN(5),TVENP(5),TVENN(5),REST(48)
 COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FDUM(5),DSUB(5),DELV(5),
1FACAC,FAC,FACTOR,DELI,DTOT,STOT,DSO,DS ,DS2,DS3,DS4,DS5,DS6,
2DS7,DS8,DS9,KODD,REM(1148)
 SDIFF=P34(I)-STOT
 VDIFF=D34(I)-DTOT
 P34(I)=STOT
 D34(I)=DTOT
 P1(I)=P1(I)-SDIFF
 D1(I)=D1(I)-VDIFF
 RETURN
 END

 SUBROUTINE VRTX6(I)
 COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
5TSENN(5),TVENP(5),TVENN(5),REST(48)
 COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FDUM(5),DSUB(5),DELV(5),
1FACAC,FAC,FACTOR,DELI,DTOT,STOT,DSO,DS ,DS2,DS3,DS4,DS5,DS6,
2DS7,DS8,DS9,KODD,REM(1148)
 SDIFF=P56(I)-STOT
 VDIFF=D56(I)-DTOT
 P56(I)=STOT
 D56(I)=DTOT
 P9(I)=P9(I)-SDIFF
 D9(I)=D9(I)-VDIFF
 RETURN
 END
```

```
      SUBROUTINE VRFX9(I)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FDUM(5),DSUB(5),DELV(5),
     1FACAC,FAC,FACTOR,DELI,DTOT,STOT,DSO,DS ,DS2,DS3,DS4,DS5,DS6,
     2DS7,DS8,DS9,KODD,REM(1148)
      SDIFF=P9(I)-STOT
      VDIFF=D9(I)-DTOT
      P9(I)=STOT
      D9(I)=DTOT
      P56(I)=P56(I)-SDIFF
      D56(I)=D56(I)-VDIFF
      RETURN
      END
C       STATE DETERMINATION OF SPRING COMPONENTS
      SUBROUTINE RSPSP(I)
      COMMON/INFEL/IMEM,KST,LM(6),NODI,NODJ,KOUTDT,FL,WID,STO(3),ST1(3),
     1ST2(3),STSO(2),STS1(2),PY(5),DELY(5),DELC(3),KODY(5),KODYX(5),
     2ST5(3),ST6(3),STS3(2),P1(3),D1(3),P2(3),D2(3),P34(3),D34(3),
     3P56(3),D56(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDFO(5),
     4FTOT(5),VTOT(5),SENP(5),SENN(5),VENP(5),VENN(5),TSENP(5),
     5TSENN(5),TVENP(5),TVENN(5),REST(48)
      COMMON/WORK/DV(5),DF(5),FLIN(5),STRS(5),FDUM(5),DSUB(5),DELV(5),
     1FACAC,FAC,FACTOR,DELI,DTOT,STOT,DSO,DS ,DS2,DS3,DS4,DS5,DS6,
     2DS7,DS8,DS9,KODD,REM(1148)
      N=I+3
      KODD=KODY(N)
      DELI=DV(N)
      STOT=FTOT(N)
      DTOT=VTOT(N)
      FACAC=0.0
 177  FACTOR=1.-FACAC
      KODYI=KODD+1
C
C      ON SLOPE 0 ,GET FACTOR FOR STATUS CHANGE
      GO TO(113,114,115,303),KODYI
 113  DSO=STSO(I)*DELI
      IF(DSO)31,41,51
 31   FAC=(-PY(N)-STOT)/DSO
      IF(FAC.GE.FACTOR)GO TO 61
      FACTOR=FAC
      KODD=2
      STOT=-PY(N)
      GO TO 41
 51   FAC=(PY(N)-STOT)/DSO
      IF(FAC.GE.FACTOR)GO TO 61
      FACTOR=FAC
      KODD=1
      STOT=PY(N)
      GO TO 41
 61   STOT=STOT+FACTOR*DSO
      GO TO 41
C      ON SLOPE 1,GET FACTOR FOR STATUS CHANGE
 114  DS =STS1(I)*DELI
      IF(DS )71,41,81
 71   KODD=3
```

```
      GO TO 303
81    STOT=STOT+FACTOR*DS
      GO TO 41
C      ON SLOPE 2,GET FACTOR FOR STATUS CHANGE
115   DS2=STS1(I)*DELI
      IF(DS2)91,41,101
91    STOT=STOT+FACTOR*DS2
      GO TO 41
101   KODD=3
      GO TO 303
C C
C      ON SLOPE 3,GET FACTOR FOR STATUS CHANGE
303   DS3=STS3(I)*DELI
      IF(DS3)111,41,121
111   FAC=(-PS1(I)-STOT)/DS3
      IF(FAC.GE.FACTOR)GO TO 131
      FACTOR=FAC
      KODD=2
      STOT=-PS1(I)
      GO TO 41
121   FAC=(PS1(I)-STOT)/DS3
      IF(FAC.GE.FACTOR)GO TO 131
      FACTOR=FAC
      KODD=1
      STOT=PS1(I)
      GO TO 41
131   STOT=STOT+FACTOR*DS3
41    FACAC=FACAC+FACTOR
      IF(FACAC.LT.0.9999999)GO TO  177
      IF(KODD.EQ.1)GO TO 750
      IF(KODD.EQ.2)GO TO 760
      GO TO 770
750   PS1(I)=STOT
      DS1(I)=DTOT
      STS3(I)=STOT/DTOT
      GO TO 770
760   PS1(I)=-STOT
      DS1(I)=-DTOT
      STS3(I)=STOT/DTOT
770   KODY(N)=KODD
      FTOT(N)=STOT
      VTOT(N)=DTOT
      RETURN
      END
```

APPENDIX A-2

TANGENT STIFFNESS MATRIX OF THE SHEARWALL ELEMENT

$$
\begin{bmatrix}
K_H & 0 & 0 & -K_H & 0 & -HK_H \\
0 & \begin{matrix}(\frac{EA}{H})_L+K_V+ \\ (\frac{EA}{H})_R\end{matrix} & \begin{matrix}-B(\frac{EA}{H})_L+ \\ B(\frac{EA}{H})_R\end{matrix} & 0 & \begin{matrix}-(\frac{EA}{H})_L-K_V \\ -(\frac{EA}{H})_R\end{matrix} & \begin{matrix}B(\frac{EA}{H})_L- \\ B(\frac{EA}{H})_R\end{matrix} \\
0 & \begin{matrix}-B(\frac{EA}{H})_L+ \\ B(\frac{EA}{H})_R\end{matrix} & \begin{matrix}B^2(\frac{EA}{H})_L+K_R \\ +B^2(\frac{EA}{H})_R\end{matrix} & 0 & \begin{matrix}B(\frac{EA}{H})_L- \\ B(\frac{EA}{H})_R\end{matrix} & \begin{matrix}-B^2(\frac{EA}{H})_L+K_R{}^{\delta} \\ -B^2(\frac{EA}{H})_R\end{matrix} \\
-K_H & 0 & 0 & K_H & 0 & HK_H \\
0 & \begin{matrix}-(\frac{EA}{H})_L-K_V- \\ (\frac{EA}{H})_R\end{matrix} & \begin{matrix}B(\frac{EA}{H})_L- \\ B(\frac{EA}{H})_R\end{matrix} & 0 & \begin{matrix}(\frac{EA}{H})_L+K_V \\ +(\frac{EA}{H})_R\end{matrix} & \begin{matrix}-B(\frac{EA}{H})_L \\ +B(\frac{EA}{H})_R\end{matrix} \\
-HK_H & \begin{matrix}B(\frac{EA}{H})_L- \\ B(\frac{EA}{H})_R\end{matrix} & \begin{matrix}-B^2(\frac{EA}{H})_L+K_R \\ -B^2(\frac{EA}{H})_R\end{matrix} & HK_H & \begin{matrix}-B(\frac{EA}{H})_L+ \\ B(\frac{EA}{H})_R\end{matrix} & \begin{matrix}B^2(\frac{EA}{H})_L+H^2K_H \\ +K_R+B^2(\frac{EA}{H})_R\end{matrix}
\end{bmatrix}
$$