

NONLINEAR ANALYSIS OF REINFORCED CONCRETE
FRAME-SHEARWALL STRUCTURES SUBJECT TO
EARTHQUAKE MOTION

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

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.

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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 simplified 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 degrees 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:

$$\begin{bmatrix} dv_1 \\ dv_2 \\ dv_3 \\ dv_4 \\ dv_5 \end{bmatrix} = \begin{bmatrix} 0 & -1 & B & 0 & 1 & -B \\ 0 & -1 & -B & 0 & 1 & B \\ 0 & -1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \\ -1 & 0 & 0 & 1 & 0 & H \end{bmatrix} \begin{bmatrix} dr_1 \\ dr_2 \\ dr_3 \\ dr_4 \\ dr_5 \\ dr_6 \end{bmatrix} \quad (2.1)$$

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

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

ELEMENT STIFFNESS

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

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

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

where $\left(\frac{EA}{H}\right)_L$ and $\left(\frac{EA}{H}\right)_R$ 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

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

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:

$$\begin{aligned} & \text{Slope of segment MF (or BG)} \\ &= \frac{\text{Initial slope in compression (slope of ABO)}}{\text{Initial slope in tension (slope of OC)}} \times \text{slope of segment MG (2.6)} \end{aligned}$$

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 condition 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 initial 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 (1015)-ONE CARD

Columns 5 Punch 7 (to indicate that group consists of shear-wall 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 (15,3F10.0)-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

RESPONSE OF SEVEN STORY FRAME-WALL STRUCTURE										A	
START	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						B2	
12		2300.0		375.0							
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							B3	
11	53	5	7								
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		
13		53130.0		53130.0		0.0	48	7	981.0	B6	
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	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			
12		0.0		-4849.2		0.0	54	7		C2	
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	1.51-0.103	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	2.98-0.090	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	
5.11	0.218	5.20	0.027	5.23	0.125	5.30	0.129	5.33	0.109	
5.45	0.172	5.51-0.102	5.61	0.014	5.69-0.195	5.77-0.024	5.80-0.005			
5.81-0.023	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				

C3

1.49										0.00094										C4												
4	4	50	7	0	0											D																
8	15	22	29	36	43	50																										
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	0.0																											
2	0.0	-250.0	0.0	0.0	0.0																											
3	250.0	0.0	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	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														
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	1.05	1.275																				

E2

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
4	144845.0	0.0218	0.0196

E7

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

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	
2	13	20	5	5	0	3	3	
			YIELD CODE					
			TOTAL FORCE/MOMENT					
			-0.5540E+04	-0.4344E+05	-0.1833E+06	-0.3901E+07	0.6117E+04	
			TOTAL DEFORMATION					
			0.5158E-01	-0.1136E+00	-0.3110E-01	-0.3307E-03	0.3723E-01	
			YIELD CODE					
			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	0.4500E-01	
			YIELD CODE					
			TOTAL FORCE/MOMENT					
			-0.4536E+05	-0.3057E+05	-0.1266E+06	-0.2206E+07	0.3771E+04	
			TOTAL DEFORMATION					
			-0.2039E-01	-0.1398E-01	-0.1719E-01	-0.5111E-03	0.8842E-02	
			YIELD CODE					
			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	
			YIELD CODE					
			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	-0.5000E-03	-0.1478E-01	
			YIELD CODE					
			TOTAL FORCE/MOMENT					
			-0.2363E+05	-0.2210E+05	-0.3417E+05	-0.1451E+07	-0.1010E+05	

7 48 55 TOTAL DEFORMATION -0.5965E-02 -0.3310E-02 -0.4637E-02 -0.5219E-03 -0.1010E-01
 YIELD CODE 3 3 0 3 0
 TOTAL FORCE/MOMENT -0.1475E+05 -0.1224E+05 -0.1280E+05 -0.1421E+07 -0.6032E+04
 TOTAL DEFORMATION -0.2368E-02 -0.1106E-02 -0.1737E-02 -0.5141E-03 -0.6032E-02
 INODAL DISPLACEMENT ENVELOPES, TIME = 10.100

NODE	X-DISPLACEMENT		Y-DISPLACEMENT		ROTATION		TIME	TYPE
	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE		
1	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
3	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
5	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
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	2.952	5.92	-3.034	-0.055	0.0671	2.74	-0.00807	5.92
9	2.952	5.92	-3.034	-0.080	0.00567	2.74	-0.00556	5.92
10	2.952	5.92	-3.034	-0.080	0.00537	2.74	-0.00583	5.92
11	2.952	5.92	-3.034	-0.057	0.00788	2.74	-0.00692	5.92
12	2.952	5.92	-3.034	-0.069	0.00664	2.74	-0.00817	5.92
13	2.952	5.92	-3.034	-0.056	0.00269	2.66	-0.00331	2.22
14	2.952	5.92	-4.924	-0.071	0.00805	2.74	-0.00675	5.92
15	5.082	5.92	-4.924	-0.093	0.00464	2.70	-0.00599	2.24
16	5.082	5.92	-4.924	-0.134	0.00433	2.70	-0.00452	2.24
17	5.082	5.92	-4.924	-0.135	0.00410	2.70	-0.00474	2.24
18	5.082	5.92	-4.924	-0.096	0.00544	2.70	-0.00520	2.24
19	5.082	5.92	-4.924	-0.115	0.00434	2.70	-0.00597	2.24
20	5.082	5.92	-4.924	-0.076	0.00304	2.68	-0.00372	2.22
21	5.082	5.92	-4.924	-0.120	0.00539	2.70	-0.00492	2.24
22	6.859	5.92	-6.405	-0.124	0.00361	2.64	-0.00525	2.24
23	6.859	5.92	-6.405	-0.179	0.00343	2.64	-0.00361	2.24
24	6.859	5.92	-6.405	-0.180	0.00318	2.64	-0.00405	2.24
25	6.859	5.92	-6.405	-0.127	0.00450	2.64	-0.00435	2.24
26	6.859	5.92	-6.405	-0.154	0.00323	2.64	-0.00513	2.24
27	6.859	5.92	-6.405	-0.091	0.00323	2.66	-0.00405	2.22
28	6.859	5.92	-6.405	-0.161	0.00439	2.64	-0.00396	2.24
29	8.302	5.92	-7.444	-0.148	0.00320	2.64	-0.00497	2.22
30	8.302	5.92	-7.444	-0.215	0.00311	2.64	-0.00360	2.22
31	8.302	5.92	-7.444	-0.217	0.00289	2.64	-0.00382	2.22
32	8.302	5.92	-7.444	-0.152	0.00406	2.64	-0.00410	2.22
33	8.302	5.92	-7.444	-0.186	0.00278	2.64	-0.00480	2.22
34	8.302	5.92	-7.444	-0.103	0.00341	2.64	-0.00425	2.22
35	8.302	5.92	-7.444	-0.193	0.00390	2.64	-0.00365	2.22
36	9.628	5.92	-8.441	-0.166	0.00332	2.64	-0.00466	2.20
37	9.628	5.92	-8.441	-0.242	0.00321	2.64	-0.00330	2.20
38	9.628	5.92	-8.441	-0.244	0.00296	2.64	-0.00355	2.20
39	9.628	5.92	-8.441	-0.171	0.00426	2.64	-0.00371	2.20
40	9.628	5.92	-8.441	-0.209	0.00280	2.64	-0.00445	2.20
41	9.628	5.92	-8.441	-0.111	0.00354	2.64	-0.00421	2.22
42	9.628	5.92	-8.441	-0.217	0.00409	2.64	-0.00322	2.20
43	10.864	2.22	-9.544	-0.178	0.00378	2.64	-0.00443	2.20
44	10.864	2.22	-9.544	-0.260	0.00306	2.64	-0.00334	2.20
45	10.864	2.22	-9.544	-0.262	0.00293	2.64	-0.00347	2.20

9	9	NEGATIVE	-4959413.00	2.760	-30405.77	5.920	-260591.50	2.620	0.0	0.0	0.0
		POSITIVE	3300102.00	2.220	23038.12	2.200	222740.06	2.620	0.0	0.0	0.0
	16	NEGATIVE	-2464765.00	2.680	-17838.71	2.680	0.0	0.0	0.0	0.0	0.0
		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	-1546826.00	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	2063214.00	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	-1070577.00	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	2.660	-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

45	NEGATIVE	-1999379.00	2.640	-13378.53	2.640	0.0	0.0	0.0	0.0	0.0	0.0
	POSITIVE	1966479.00	2.200	13378.53	2.640	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-2014105.00	2.640	-13127.40	2.200	-73007.13	2.200	0.0	0.0	0.0	0.0
21	POSITIVE	1909599.00	2.180	14650.95	2.180	36479.90	2.200	0.0	0.0	0.0	0.0
	NEGATIVE	-2062513.00	2.620	-15798.79	2.620	0.0	0.0	0.0	0.0	0.0	0.0
52	POSITIVE	2437709.00	2.180	15748.79	2.620	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-2675953.00	2.620	-14650.95	2.180	-36479.90	2.200	0.0	0.0	0.0	0.0
22	POSITIVE	6271622.00	5.920	26505.85	5.920	107459.81	2.200	0.0	0.0	0.0	0.0
	NEGATIVE	-6166749.00	2.760	-25320.81	2.760	0.0	0.0	-0.000052	2.760	0.0	0.0
11	POSITIVE	3668090.00	5.920	25320.81	2.760	0.0	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	0.0
23	POSITIVE	2001456.00	2.260	14700.80	2.200	157396.69	2.200	0.0	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	0.0
18	POSITIVE	2529996.00	2.200	5504.60	1.940	0.0	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	0.0
24	POSITIVE	2062369.00	2.260	15110.68	2.260	129371.19	2.200	0.0	0.0	0.0	0.0
	NEGATIVE	-745619.25	2.640	-5650.99	2.700	0.0	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	0.0
	NEGATIVE	-1117689.00	2.700	-15110.68	2.260	-129371.19	2.200	0.0	0.0	0.0	0.0
25	POSITIVE	1830595.00	2.220	12515.57	2.220	102724.94	2.200	0.0	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	0.0
32	POSITIVE	1924106.00	2.220	1411.87	1.900	0.0	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	0.0
26	POSITIVE	1824913.00	2.180	12390.24	2.240	76468.50	2.180	0.0	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	0.0
39	POSITIVE	1936855.00	2.240	2968.96	2.660	0.0	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	0.0
39	POSITIVE	1653349.00	2.200	10917.52	2.200	50237.88	2.180	0.0	0.0	0.0	0.0
	NEGATIVE	-316272.50	2.640	-2647.65	2.640	0.0	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	0.0
	NEGATIVE	-475992.56	2.640	-10917.52	2.200	-50237.88	2.180	0.0	0.0	0.0	0.0
46	POSITIVE	1841710.00	2.180	14820.52	2.180	23910.18	2.180	0.0	0.0	0.0	0.0
	NEGATIVE	-146722.00	2.620	-1265.85	2.620	0.0	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	0.0
	NEGATIVE	-230933.30	2.620	-14820.52	2.180	-23910.18	2.180	0.0	0.0	0.0	0.0
29	POSITIVE	2684207.00	5.920	11317.25	5.920	112185.38	2.640	0.0	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	0.0
12	POSITIVE	1359740.00	5.920	14537.73	2.760	0.0	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	0.0
30	POSITIVE	237684.94	2.260	2738.66	2.200	96022.06	2.620	0.0	0.0	0.0	0.0
	NEGATIVE	-1117406.00	1.940	-8304.46	1.940	0.0	0.0	0.0	0.0	0.0	0.0
19	POSITIVE	633093.80	2.200	8304.46	1.940	0.0	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	0.0
19	POSITIVE	472455.38	2.260	3826.81	2.260	79980.63	2.620	0.0	0.0	0.0	0.0
	NEGATIVE	-1188085.00	2.640	-4558.39	2.700	0.0	0.0	0.0	0.0	0.0	0.0
26	POSITIVE	675578.19	2.260	8350.39	2.700	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-1404145.00	2.700	-3826.81	2.260	-79980.63	2.620	0.0	0.0	0.0	0.0

32	26	POSITIVE	400536.94	2.220	2865.62	2.220	63895.56	2.620	0.0	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	0.0
	33	POSITIVE	459137.50	2.220	6277.14	1.900	0.0	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-980242.61	2.620	-2865.62	2.220	-63895.56	2.620	0.0	0.0	0.0	0.0
	33	POSITIVE	413407.00	2.180	2835.12	2.240	47792.19	2.620	0.0	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	0.0
	40	POSITIVE	460842.44	2.240	7706.16	2.660	0.0	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	0.0
	34	POSITIVE	352670.56	2.200	2434.96	2.200	31590.09	2.620	0.0	0.0	0.0	0.0
		NEGATIVE	-1026460.44	2.640	-6759.05	2.640	0.0	0.0	0.0	0.0	0.0	0.0
	47	POSITIVE	377806.75	2.200	6759.05	2.640	0.0	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	0.0
	35	POSITIVE	354096.75	2.180	3060.02	2.180	15240.84	2.620	0.0	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	0.0
	54	POSITIVE	563891.69	2.180	9824.08	2.620	0.0	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	0.0
	36	POSITIVE	3155786.00	5.920	13462.54	5.920	116728.75	2.200	0.0	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	0.0
	14	POSITIVE	1892679.00	5.920	12418.31	2.760	0.0	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	0.0
	37	POSITIVE	1170002.00	2.260	8717.54	2.100	99838.31	2.200	0.0	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	0.0
	21	POSITIVE	147652.00	2.200	2293.12	1.940	0.0	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	0.0
	38	POSITIVE	1236610.00	2.260	9015.38	2.260	83089.75	2.200	0.0	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	0.0
	28	POSITIVE	1468014.00	2.260	3204.65	2.700	0.0	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	0.0
	39	POSITIVE	1233180.00	2.220	8370.03	2.220	66399.38	2.200	0.0	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	0.0
	35	POSITIVE	1280237.00	2.220	1075.18	1.900	0.0	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-186414.19	2.620	-8370.03	2.220	-66399.38	2.200	0.0	0.0	0.0	0.0
	40	POSITIVE	1225219.00	2.180	8336.39	2.240	49618.66	2.200	0.0	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	0.0
	42	POSITIVE	1291377.00	2.240	2256.20	2.660	0.0	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	0.0
	41	POSITIVE	1130864.00	2.200	7345.74	2.200	32806.83	2.200	0.0	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	0.0
	49	POSITIVE	1072064.00	2.200	1940.32	2.640	0.0	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	0.0
	42	POSITIVE	1325412.00	2.180	10749.03	2.180	15816.00	2.200	0.0	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	0.0
	56	POSITIVE	1902575.00	2.200	2159.02	2.620	0.0	0.0	0.0	0.0	0.0	0.0
		NEGATIVE	-400707.19	2.620	-10749.03	2.180	-15816.00	2.200	0.0	0.0	0.0	0.0
	43	POSITIVE	4802300.00	2.740	21918.88	2.740	0.0	0.0	0.00031	2.740	0.00031	0.00031
		NEGATIVE	-2541438.00	5.920	-1613.25	5.920	0.0	0.0	-0.00096	5.920	-0.00096	-0.00127

9	POSITIVE	2042646.00	2.740	22433.36	5.920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-4732507.00	5.920	-650.34	2.740	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	POSITIVE	3050065.00	2.700	18935.31	2.700	0.0	0.0	0.0	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	0.0	0.0	0.0
16	POSITIVE	1204926.00	2.700	19904.91	2.240	0.0	0.0	0.0	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	0.0	0.0	0.0
45	POSITIVE	3312407.00	2.640	17182.45	2.640	0.0	0.0	0.0	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	0.0	0.0	0.0
23	POSITIVE	690870.63	2.640	15560.50	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-3575561.00	2.240	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	POSITIVE	3111903.00	2.640	16544.76	2.640	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-1094901.00	2.220	0.0	0.0	0.0	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	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	0.0	0.0	0.0
47	POSITIVE	3182333.00	2.640	16772.32	2.640	0.0	0.0	0.0	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	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	0.0	0.0	0.0
	NEGATIVE	-324689.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	POSITIVE	3147233.00	2.640	16619.36	2.640	0.0	0.0	0.0	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	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	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	0.0	0.0	0.0
49	POSITIVE	2402756.00	2.620	14347.94	2.620	0.0	0.0	0.0	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	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	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	0.0	0.0	0.0
50	POSITIVE	4566877.00	2.740	23048.92	2.740	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-2651884.00	5.920	-5974.16	5.920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	POSITIVE	2577103.00	2.740	23487.34	5.920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-4713545.00	5.920	-5535.30	2.740	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	POSITIVE	3712096.00	2.700	19913.55	2.700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-2130734.00	2.240	-3487.40	2.240	0.0	0.0	0.0	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	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	0.0	0.0	0.0
52	POSITIVE	3099904.00	2.640	17457.89	2.640	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-1664632.00	2.240	-1601.11	2.240	0.0	0.0	0.0	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	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	0.0	0.0	0.0
53	POSITIVE	2891547.00	2.640	16634.32	2.640	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-1516137.00	2.220	-990.42	2.220	0.0	0.0	0.0	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	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	0.0	0.0	0.0
54	POSITIVE	2947763.00	2.640	16848.51	2.640	0.0	0.0	0.0	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	0.0	0.0	0.0
30	POSITIVE	1096090.00	2.640	17737.59	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NEGATIVE	-3170045.00	2.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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67	NEGATIVE	-1294049.00	0.0	-0.01	2.640	0.0	0.0	0.0	0.0	0.0	0.0
32	POSITIVE	2.35	2.640	0.01	2.640	0.0	0.0	0.0	0.0	0.0	0.0
33	NEGATIVE	-2.74	2.220	-0.01	2.220	0.0	0.0	0.0	0.0	0.0	0.0
	POSITIVE	2.08	2.640	0.01	2.220	0.0	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	0.0
66	POSITIVE	2.46	2.640	0.01	2.640	0.0	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	0.0
40	POSITIVE	2.18	2.640	0.01	2.200	0.0	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	0.0
69	POSITIVE	2.35	2.640	0.01	2.640	0.0	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	0.0
47	POSITIVE	2.16	2.640	0.01	2.200	0.0	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	0.0
70	POSITIVE	1.80	2.620	0.00	2.620	0.0	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	0.0
54	POSITIVE	1.18	2.620	0.01	2.180	0.0	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	0.0
71	POSITIVE	2526381.00	2.740	11697.54	2.720	0.0	0.0	0.00201	2.740	0.00201	0.00201
	NEGATIVE	-1199091.00	5.920	0.0	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	0.0
	NEGATIVE	-2513798.00	5.920	0.0	0.0	0.0	0.0	-0.00148	5.920	-0.00148	-0.00148
72	POSITIVE	2324022.00	2.680	11362.88	2.680	0.0	0.0	0.00016	2.680	0.00016	0.00016
	NEGATIVE	-859700.88	2.240	0.0	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	0.0
	NEGATIVE	-2485159.00	2.220	0.0	0.0	0.0	0.0	-0.00103	2.220	-0.00103	-0.00103
73	POSITIVE	2184321.00	2.640	11082.09	2.640	0.0	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	0.0
27	POSITIVE	380585.19	2.640	12327.04	2.220	0.0	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	-0.00126
74	POSITIVE	2139563.00	2.640	11042.84	2.640	0.0	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	0.0
34	POSITIVE	401774.50	2.640	12340.79	2.220	0.0	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	-0.00144
75	POSITIVE	2167610.00	2.640	11124.11	2.640	0.0	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	0.0
41	POSITIVE	422498.63	2.640	12160.93	2.200	0.0	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	-0.00117
76	POSITIVE	2190312.00	2.640	11187.52	2.640	0.0	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	0.0
48	POSITIVE	437847.19	2.640	12135.11	2.200	0.0	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	-0.00112
77	POSITIVE	1735701.00	2.620	10000.97	2.640	0.0	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	0.0
55	POSITIVE	180853.50	2.640	11770.41	2.180	0.0	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	-0.00062
78	POSITIVE	2391543.00	2.700	12596.55	2.720	0.0	0.0	0.00094	2.680	0.00094	0.00094

ELEM NO	TYPE	FORCE	MEMBER	RIGHT AXIAL MEMBER	CENTRAL AXIAL SPRING	ROTATIONAL SPRING	HORIZONTAL SPRING	
14	NEGATIVE	-591532.56	5.920	0.0	0.0	0.0	0.0	0.0
	POSITIVE	1101332.00	2.740	12198.08	0.0	0.0	0.0	0.00088
	NEGATIVE	-2642841.00	5.920	0.0	0.0	-0.00286	5.920	-0.00374
79	POSITIVE	2345583.00	2.680	11961.23	0.0	0.00027	2.680	0.00027
	NEGATIVE	-567903.25	2.220	0.0	0.0	0.0	0.0	0.0
21	POSITIVE	746005.44	2.680	11867.09	0.0	0.0	0.0	0.0
	NEGATIVE	-2467993.00	2.220	0.0	0.0	-0.00088	2.220	-0.00088
80	POSITIVE	2314692.00	2.640	11649.85	0.0	0.0	0.0	0.0
	NEGATIVE	-599705.25	2.220	0.0	0.0	0.0	0.0	0.0
28	POSITIVE	590875.06	2.640	11828.43	0.0	0.0	0.0	0.0
	NEGATIVE	-2413001.00	2.220	0.0	0.0	-0.00041	2.220	-0.00041
81	POSITIVE	2326054.00	2.640	11579.52	0.0	0.0	0.0	0.0
	NEGATIVE	-630772.31	2.220	0.0	0.0	0.0	0.0	0.0
35	POSITIVE	537318.88	2.640	11873.52	0.0	0.0	0.0	0.0
	NEGATIVE	-2406982.00	2.220	0.0	0.0	-0.00037	2.220	-0.00037
82	POSITIVE	2368184.00	2.640	11710.29	0.0	0.00002	2.640	0.00002
	NEGATIVE	-578466.56	2.220	0.0	0.0	0.0	0.0	0.0
42	POSITIVE	573643.31	2.640	11654.45	0.0	0.0	0.0	0.0
	NEGATIVE	-2333374.00	2.200	0.0	0.0	0.0	0.0	0.0
83	POSITIVE	2362357.00	2.640	11648.57	0.0	0.00001	2.640	0.00001
	NEGATIVE	-598487.13	2.200	0.0	0.0	0.0	0.0	0.0
49	POSITIVE	542439.00	2.640	11762.34	0.0	0.0	0.0	0.0
	NEGATIVE	-2374565.00	2.200	0.0	0.0	-0.00008	2.200	-0.00008
84	POSITIVE	2288120.00	2.640	11282.45	0.0	0.0	0.0	0.0
	NEGATIVE	-357829.31	2.200	0.0	0.0	0.0	0.0	0.0
56	POSITIVE	400817.81	2.620	10574.35	0.0	0.0	0.0	0.0
	NEGATIVE	-1902434.00	2.200	0.0	0.0	0.0	0.0	0.0

RESULTS ENVELOPES, ELEMENT GROUP 2 TIME = 10.100

SHEARWALL ELEMENTS (TYPE 7) ///

ELEM NO	TYPE	FORCE	MEMBER	RIGHT AXIAL MEMBER	CENTRAL AXIAL SPRING	ROTATIONAL SPRING	HORIZONTAL SPRING
1	6	13	POSITIVE	0.1471E+06 2.220	0.1436E+06 2.660	0.3172E+08 2.660	0.3405E+06 2.200
			NEGATIVE	-0.3885E+06 1.9000	-0.3279E+06 2.1000	-0.3905E+08 2.220	-0.3620E+06 2.760
			POSITIVE	0.7803E+00 2.220	0.6604E+00 2.660	0.2689E+02 2.660	0.1785E+01 5.920
			NEGATIVE	-0.6840E+00 2.660	-0.8749E+00 2.220	-0.3310E-02 2.220	-0.2203E+01 2.760
2	13	20	POSITIVE	0.1276E+06 2.2600	0.1271E+06 2.620	0.3673E+08 1.9000	0.3477E+06 2.2400

NEGATIVE FORCE
 TIME -0.2195E+04 -0.2510E+06 -0.1432E+06 -0.3750E+08 -0.3495E+06
 1.9600 2.2400 2.5800 2.2200 2.7200
 POSITIVE DISP
 TIME 0.4472E-01 0.0120E-01 0.0 0.5728E-02 0.1104E+01
 2.2600 2.6200 0.0 2.6600 5.9200
 NEGATIVE DISP
 TIME -0.1247E+00 -0.1226E+00 -0.2486E-01 -0.7033E-02 -0.1135E+01
 2.0000 2.2400 2.5000 2.2200 2.7200

3 20 27
 POSITIVE FORCE
 TIME 0.1022E+06 0.9827E+05 0.0 0.3397E+08 0.3428E+06
 2.2600 2.6200 0.0 1.9000 2.2600
 NEGATIVE FORCE
 TIME -0.1733E+06 -0.1999E+06 -0.1369E+06 -0.3479E+08 -0.3338E+06
 2.6200 2.2200 2.5600 2.2200 1.9400
 POSITIVE DISP
 TIME 0.6956E-01 0.5333E-01 0.0 0.6269E-02 0.8038E+00
 2.2400 2.6200 0.0 2.6600 2.2600
 NEGATIVE DISP
 TIME -0.8465E-01 -0.9770E-01 -0.1857E-01 -0.7777E-02 -0.7370E+00
 2.6200 2.2200 2.5600 2.2200 2.7000

4 27 34
 POSITIVE FORCE
 TIME 0.7060E+05 0.6550E+05 0.0 0.3112E+08 0.3345E+06
 2.5200 2.6400 0.0 1.9000 2.2200
 NEGATIVE FORCE
 TIME -0.1464E+06 -0.1407E+06 -0.1060E+06 -0.3199E+08 -0.2740E+06
 2.0000 2.5000 2.6600 2.2200 1.9200
 POSITIVE DISP
 TIME 0.4736E-01 0.4090E-01 0.0 0.6632E-02 0.3893E+00
 2.5000 2.0000 0.0 2.6400 2.2200
 NEGATIVE DISP
 TIME -0.6174E-01 -0.6877E-01 -0.1438E-01 -0.8300E-02 -0.2769E+00
 2.6400 2.5000 2.6600 2.2200 2.6200

5 34 41
 POSITIVE FORCE
 TIME 0.6772E+05 0.5092E+05 0.0 0.2822E+08 0.3057E+06
 2.7400 2.4200 0.0 1.9000 2.2400
 NEGATIVE FORCE
 TIME -0.1140E+06 -0.1269E+06 -0.7500E+05 -0.2909E+08 -0.2818E+06
 2.4200 2.7200 2.9200 2.2200 2.6600
 POSITIVE DISP
 TIME 0.4703E-01 0.3738E-01 0.0 0.6951E-02 0.3057E+00
 2.7200 2.4000 0.0 2.6400 2.2400
 NEGATIVE DISP
 TIME -0.5426E-01 -0.6203E-01 -0.1018E-01 -0.8457E-02 -0.2818E+00
 2.4000 2.7200 2.9200 2.2200 2.6600

6 41 48
 POSITIVE FORCE
 TIME 0.6261E+05 0.5760E+05 0.0 0.2246E+08 0.2152E+06
 2.7400 2.4000 0.0 1.8900 2.2000
 NEGATIVE FORCE
 TIME -0.1066E+06 -0.1100E+06 -0.4603E+05 -0.2328E+08 -0.2390E+06
 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
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

7 48 55

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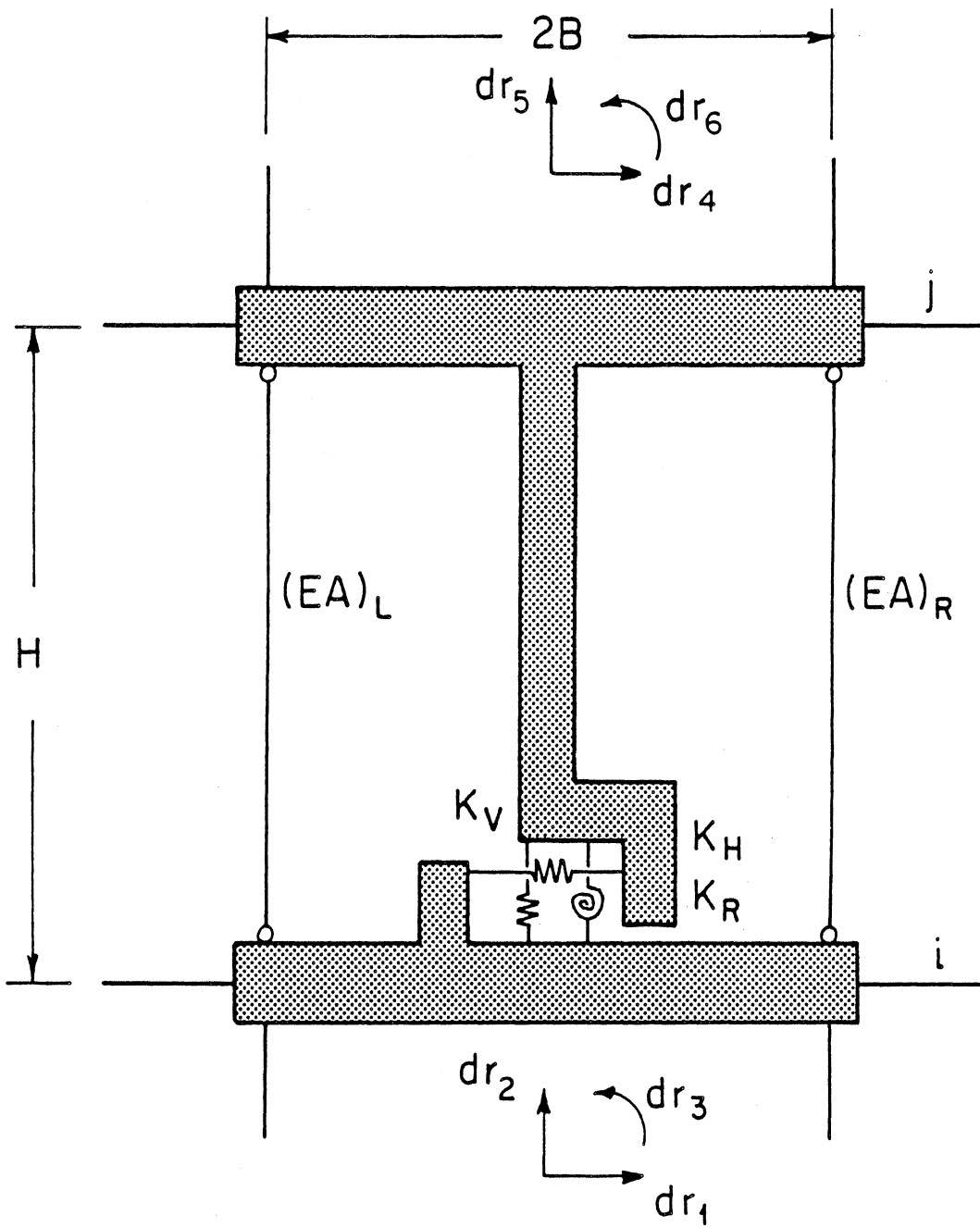


Fig. 1 Idealized Model of a Shearwall

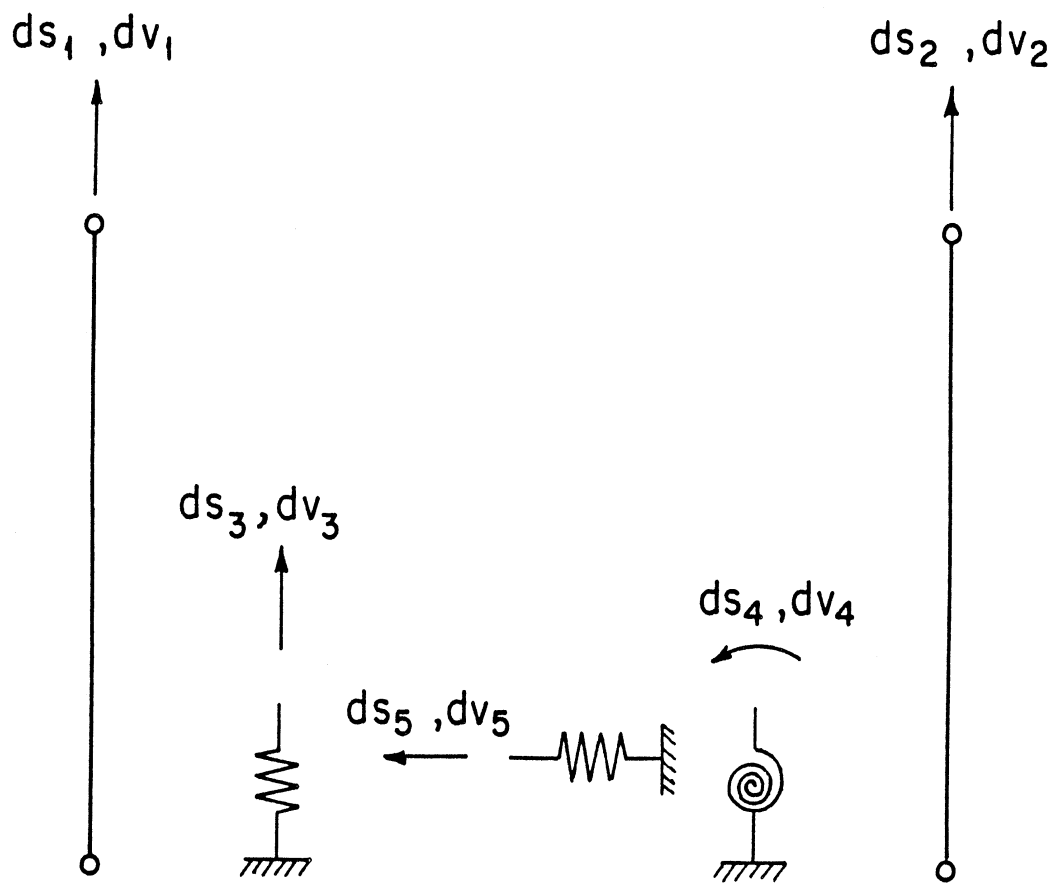
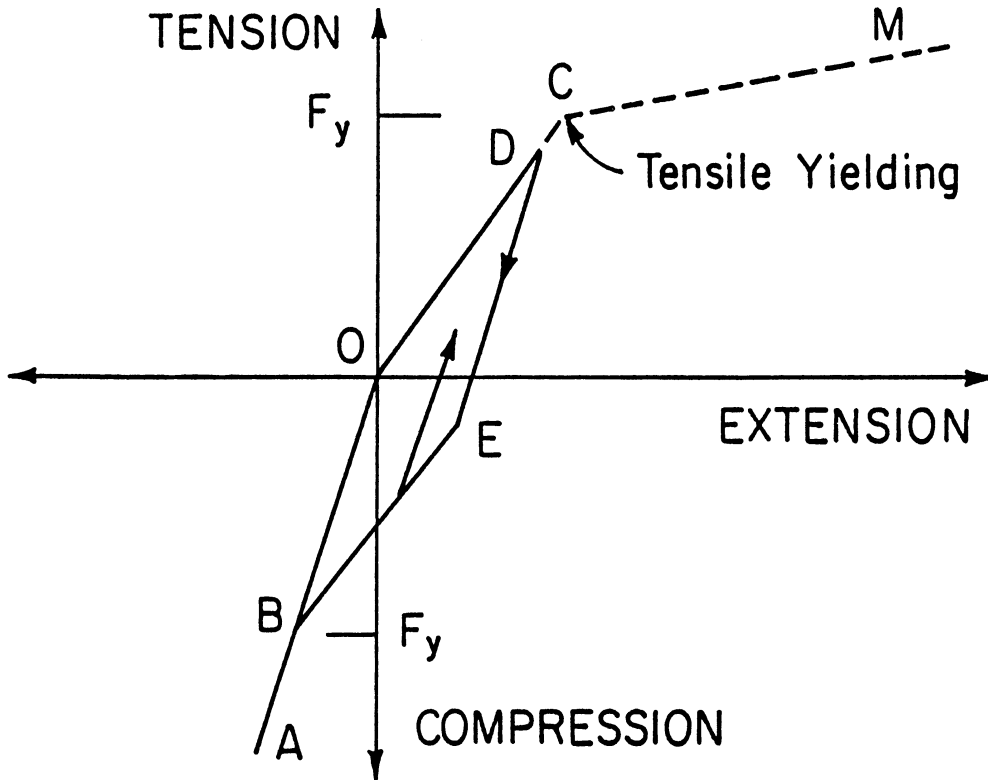
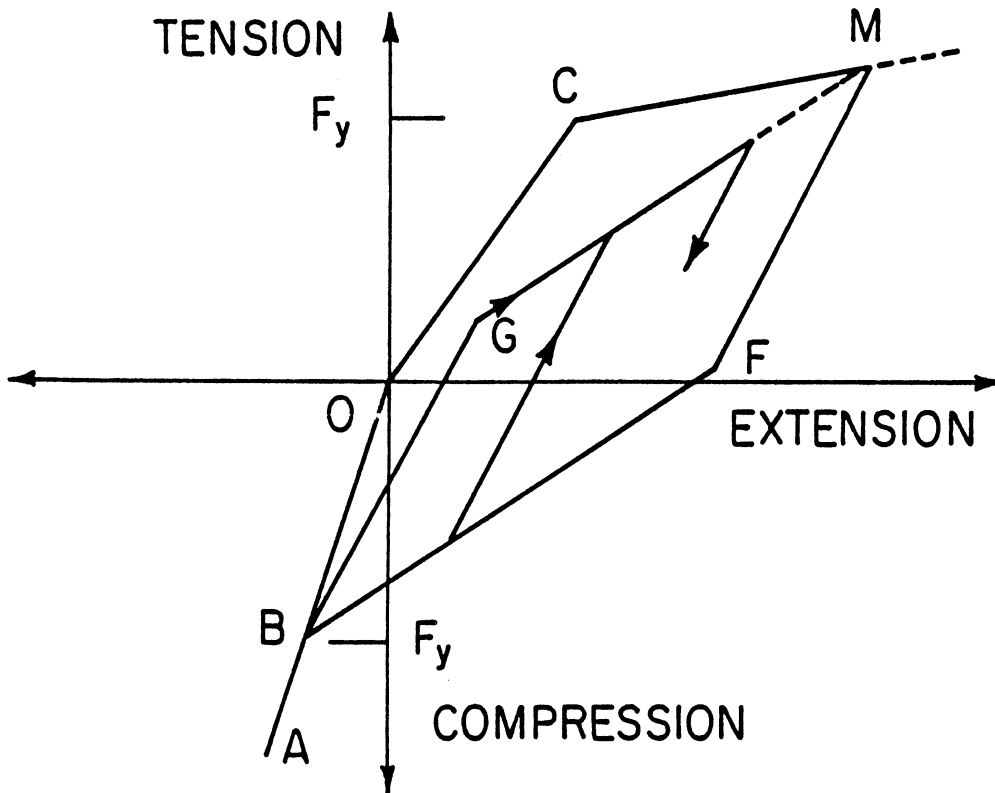


Fig. 2 Element Forces and Deformations



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



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

Fig. 3 Axial Stiffness Hysteresis Model

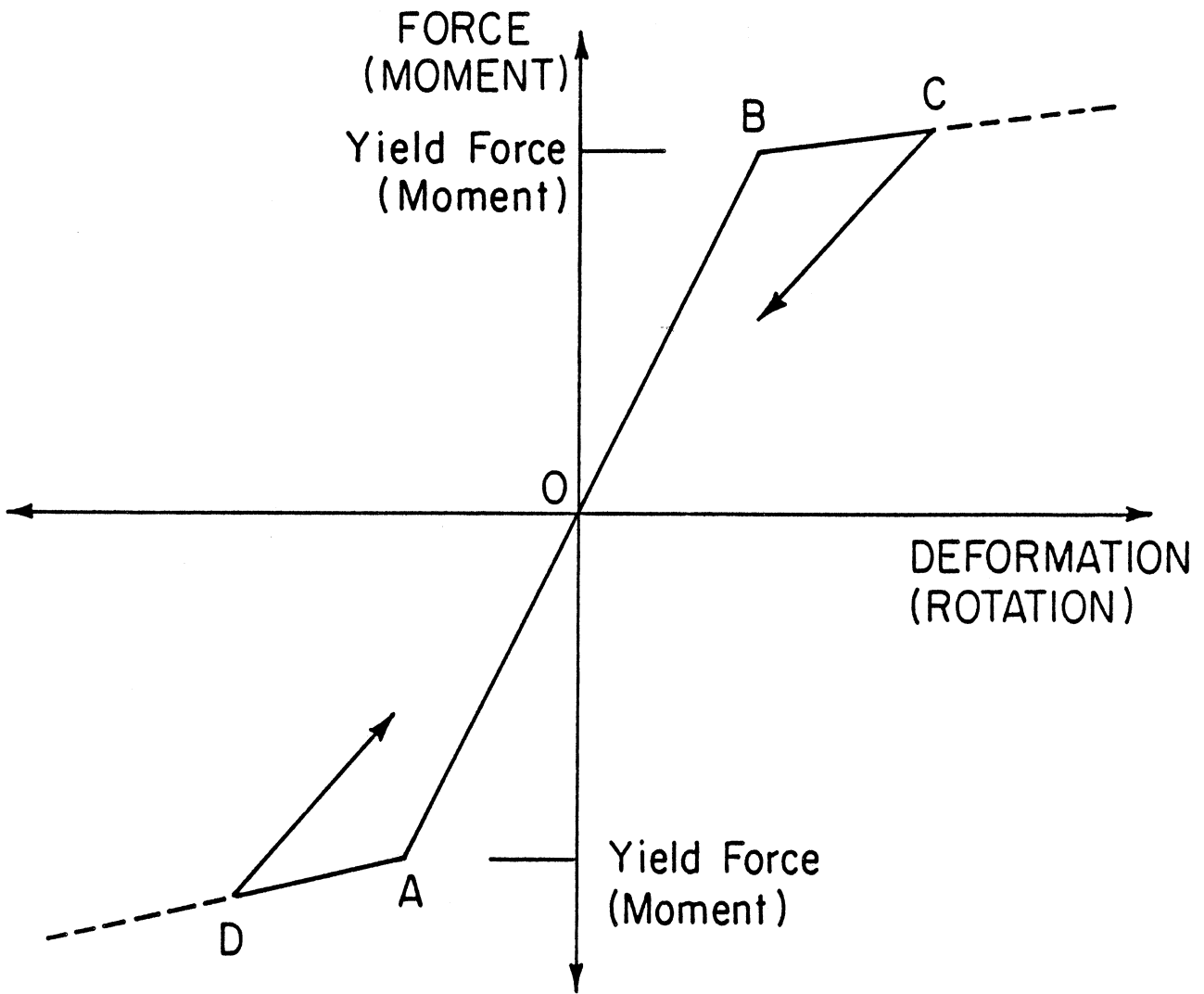


Fig. 4 Origin Oriented Hysteresis Model

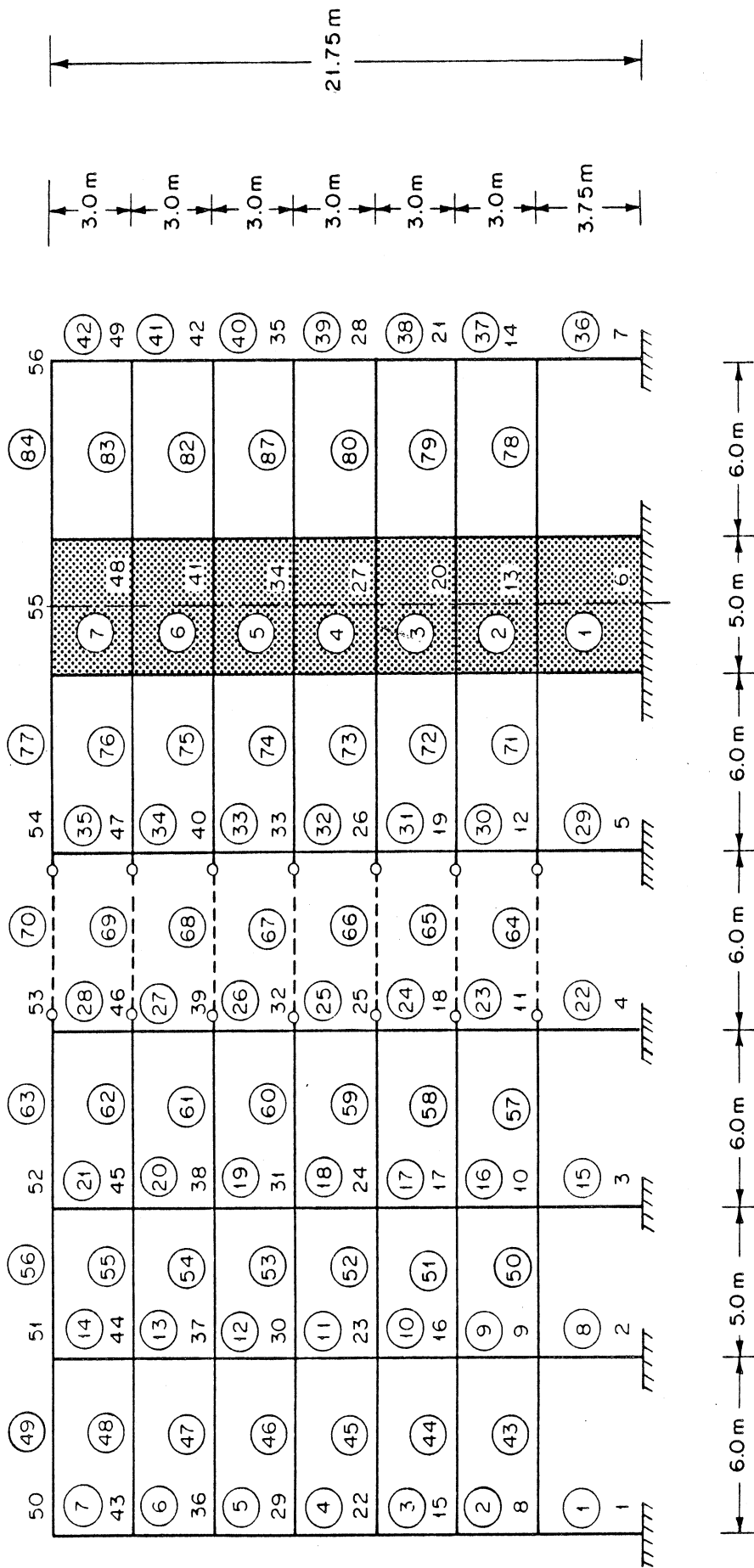


Fig. 5 Idealized Seven Story Frame-Wall Structure

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),DELG(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),SDF0(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),FRYP(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,FINI,FFINIT,
4IYAXB,IYAXBT,IYAXC,IYAXCT,IYRO,IYROT,IYHS,IYHST,KFDL,
5IKFDL,KFLL,IKFLL,FDL,FFDL,FLLM,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                =14/
2      40H NO. OF AXIAL STIFF TYPES        =14/
3      40H NO. OF ROT SPRING STIFF TYPES   =14/
4      40H NO. OF HOR SPRING STIFF TYPES   =14/
5      40H NO. OF AXIAL YIELD PATTERNS     =14/
6      40H NO. OF ROT SPRING YIELD PATTERNS =14/
7      40H NO. OF HOR SPRING YIELD PATTERNS =14/
8      40H NO. OF FIXED END FORCE PATTERNS  =14/
9      40H NO. OF INITIAL FORCE PATTERNS    =14/

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(15,3F10.0)
50  FORMAT(2X,14,3X,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(15,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(15,2F10.0)
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(15,3F10.0)
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(15,2F10.0)
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(15,2F10.0)

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(15,5F10.0)
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.0)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(15,5F10.0)
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 ROT5,5H HORS,5H BAXY,5H CAXY,5H ROTY,5H HORY,6H TIME ,
        313HFEF PATTERNS ,18HFEF SCALE FACTORS ,14HINITIAL FORCES/
        44X,2HNO,6H (,5H J,6H DIFF,7X,5HTYPE ,5HTYPE ,5HTYPE ,
        55HTYPE ,5HTYPE ,5HTYPE ,5HTYPE ,5HTYPE ,5HHIST ,12H DL LL
        618H 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,IAXB,IAXCT,IROT,IHST,
        IYAXB,IYAXCT,IYROT,IYHST,IKDT,IKFDL,IKFLL,FFDL,FLL,
        2IINIT,FFINIT
340  FORMAT(4I4,F6.0,11I3,2F5.0,15,F5.0)
      IF(INEL.GT.IMEM)GO TO 380
350  NODI=INODI
      NODJ=INODJ
      INC=IINC
      IF(INC.EQ.0)INC=1
      IAXB=IAXB
      IAXC=IAXCT
      KOUFDI=IKDT
      WID=DSW/2.
      IHS=IHS
      IRO=IRO
      IYAXB=IYAXB
      IYAXC=IYAXC
```



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      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,
      IYAXB,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,
      IF9.2,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+KFLLEQ.0)GO TO 610
          IF(KFDLEQ.0)GO TO 530
          DO 500 I=1,5
500     FFEF(I)=FEF(KFDL,I)*FDL
          CALL TRANS(SFF,FFEF)
530     IF(KFLLEQ.0)GO TO 570
          DO 529 I=1,5
529     FFEF(I)=FEF(KFLLE,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(KFDLEQ.0)GO TO 531
      DO 501 I=1,5
501     SFF(I)=FEF(KFDL,I)*FDL
531     IF(KFLLEQ.0)GO TO 610
          DO 583 I=1,5
          SSFF(I)=FEF(KFLLE,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),SDF0(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
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.LI.2)GO TO 30
CALL FSTF7( STT , KODYX )
C
C   STIFFNESS DIFFERENCE
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.GI.1)GO TO 80
C
C   INITIAL STIFFNESS FOR STEPO,BETA_O CORRECTION FOR STEP 1
C
CC=1.0
IF(MSTEP.EO.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),
3P5G(3),D5G(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDF0(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),
3P5G(3),D5G(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDF0(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(/NOOF/,/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),
3P5G(3),D5G(3),P89(3),D89(3),P9(3),D9(3),PS1(2),DS1(2),SDF0(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)
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
```

```
830 IF(DELTA.EQ.0.)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.0)GO TO 737
    CALL TRANS( DD , DSUB )
C
C EXTRACT ENVELOPES
737 DO 743 I=1,5
    IF(SENPI).GE.FDUM(I))GO TO 738
    SENPI=FDUM(I)
    TSENPI=TIME
    GO TO 741
738 IF(SENNI).LE.FDUM(I))GO TO 741
    SENNI=FDUM(I)
    TSENNI=TIME
741 IF(VENPI).GE.VTOT(I)) GO TO 742
    VENPI=VTOT(I)
    TVENPI=TIME
    GO TO 743
742 IF(VENNI).LE.VTOT(I))GO TO 743
    VENNI=VTOT(I)
    TVENNI=TIME
743 CONTINUE
C
C PRINT TIME HISTORY
C
    IF(KPRI.LT.0)GO TO 200
    IF(KPRI.EQ.0.OR.KOUTDT.EQ.0) GO TO 240
200 IF(IHED.NE.0)GO TO 220
    KKPRI=IABS(KPRI)
    PRINT 210, KKPRI, 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(19,2I6/23X,11H YIELD CODE,10X,16,6X,16,9X,16,7X,16,6X,16//
    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)
```

```
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),SDF0(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 IO 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,10HRIGHT 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),SDF0(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
```

```
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*ST7(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
```

```

      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.O.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),
3P5G(3),D5G(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),
      IFACAC,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)))
      I/(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),
```

```
2ST5(3),STG(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),SDF0(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,DELT,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
STG(I)=STOT/DTOT
ST5(I)=STG(I)*STO(I)/ST1(I)
P56(I)=(ST5(I)*STG(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)*STG(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),STG(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),SDF0(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,DELT,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),STG(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),SDF0(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,DELT,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 VRTX9(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
KODDI=KODD+1

```

C

C ON SLOPE 0 ,GET FACTOR FOR STATUS CHANGE

```
GO TO(113,114,115,303),KODDI
```

```
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

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

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