

LA-SUB--94-44



**REMEDIAL SHIELDING CONCEPTS FOR
LINE D AND LINE D FACILITIES
LOS ALAMOS MESON PHYSICS FACILITY
LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS NEW MEXICO**

Contract No. 9 - LQ3 - 2465J - 1

APPENDIX I

FINAL REPORT

Revision 0

MAY 28, 1992

MASTER

Prepared by

Pye Construction Technologies Inc.,

2690, Via Caballero D. N.

Santa Fe, New Mexico

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

**Portions of this document may be illegible
in electronic image products. Images are
produced from the best available original
document.**

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Appendix I

Preliminary Analyses of Line D Tunnel Structures

Computational Brief No.	Title
CB-1000-6 (T/21)	Preliminary Structural Assessment of Tunnel Section 6(T/21)
CB-1000-5(21/21)	Preliminary Structural Assessment of Tunnel Section 5(21/21)
CB-1000-3(21/21)	Preliminary Structural Assessment of Tunnel Section 3(21/21)
CB-1000-2(21/21)	Preliminary Structural Assessment of Tunnel Section 2(21/21)
CB-1000-1(21/21)	Preliminary Structural Assessment of Tunnel Section 1(21/21)
CB-1000-2(21/24)	Preliminary Structural Assessment of Tunnel Section 2(21/24)
CB-1000-1(21/24)	Preliminary Structural Assessment of Tunnel Section 1(21/24)
CB-1000-3(23/23)	Preliminary Structural Assessment of Tunnel Section 3(23/23)
CB-1000-5(21/21)S	Preliminary Structural Assessment of Tunnel Section 5(21/21)S
CB-1000-4(22/22)	Preliminary Structural Assessment of Tunnel Section 4(22/22)
CB-1000-5 (2/8)	Preliminary Structural Assessment of Tunnel Section 5 (2/8)



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-6(T/21)

TITLE: Preliminary Structural Assessment of Tunnel Section 6(T/21)

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 6(T/21) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY: _____

DATE: _____

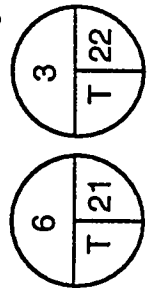
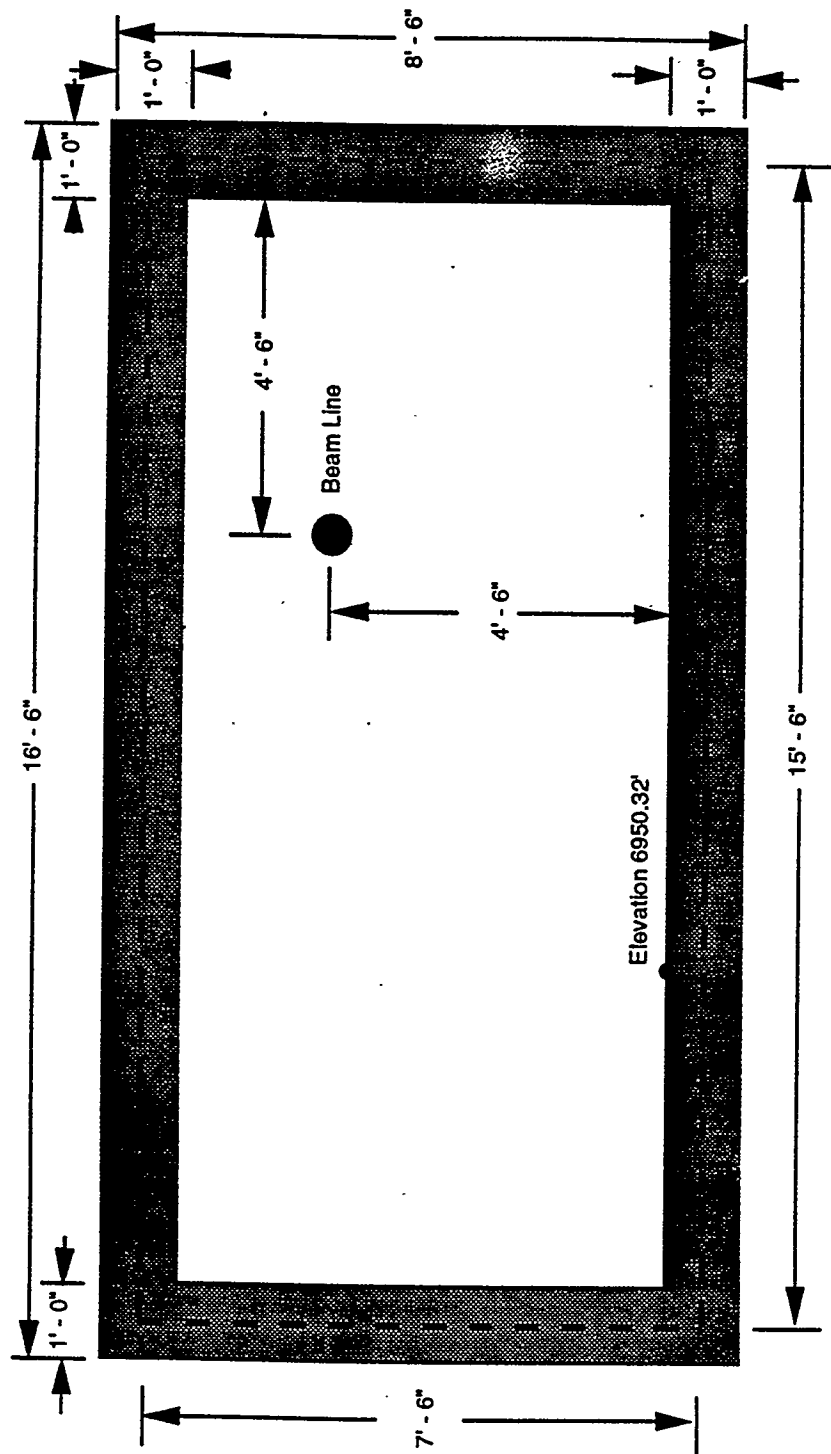


Figure () Section

TUNNEL SECTION 	TITLE OF ANALYSIS <u>P.L. MINOR 1</u> PAGE <u>1</u> OF <u>3</u>
ROOF ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = <u>$3.32 \cdot 10^6$</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.033</u> ft
FLOOR ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = <u>$3.32 \cdot 10^6$</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>12</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.033</u> ft
LEFTWALL ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = <u>$3.32 \cdot 10^6$</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.071</u> ft

RIGHTWALL ELEMENT PROPERTIES

Youngs Modulus $w 1.5 (33) \sqrt{f'c}$	E = <u>3.32 .10⁶</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{(Ic/A)}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.071</u> ft

SOIL ELEMENT PROPERTIES

Youngs Modulus	E = <u>300</u> psi
Area of Cross Section (b x d)	A = <u>154.32</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12.86</u> in
Weight per Unit Length	W = <u>123.25</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>1852.</u> in ⁴
Sectional Modulus Ic/C $\frac{bd^2}{b}$	S = <u>308.7</u> in ³
Radius of Gyration $\sqrt{(Ic/A)}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>0.083</u> ft 1"

SOILEND PROPERTIES

Youngs Modulus	E = <u>300</u> psi
Area of Cross Section (b x d)	A = <u>77.16</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>6.43</u> in
Weight per Unit Length	W = <u>61.23</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>925.9</u> in ⁴
Sectional Modulus Ic/C	S = <u>154.3</u> in ³
Radius of Gyration $\sqrt{(Ic/A)}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>0.083</u> ft 1"

TUNNEL SECTION 6 T 21	TITLE OF ANALYSIS <u>PRELIMINARY</u> PAGE <u>2</u> OF <u>3</u>
SUBSOIL ELEMENT PROPERTIES	
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft
SUBSOILEND ELEMENT PROPERTIES	
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft
ELEMENT PROPERTIES	
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

FRAME MAC file: 6(T/21) PRELIM; Last modified at 22:08:22 on Tue, Mar 2, 1993
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

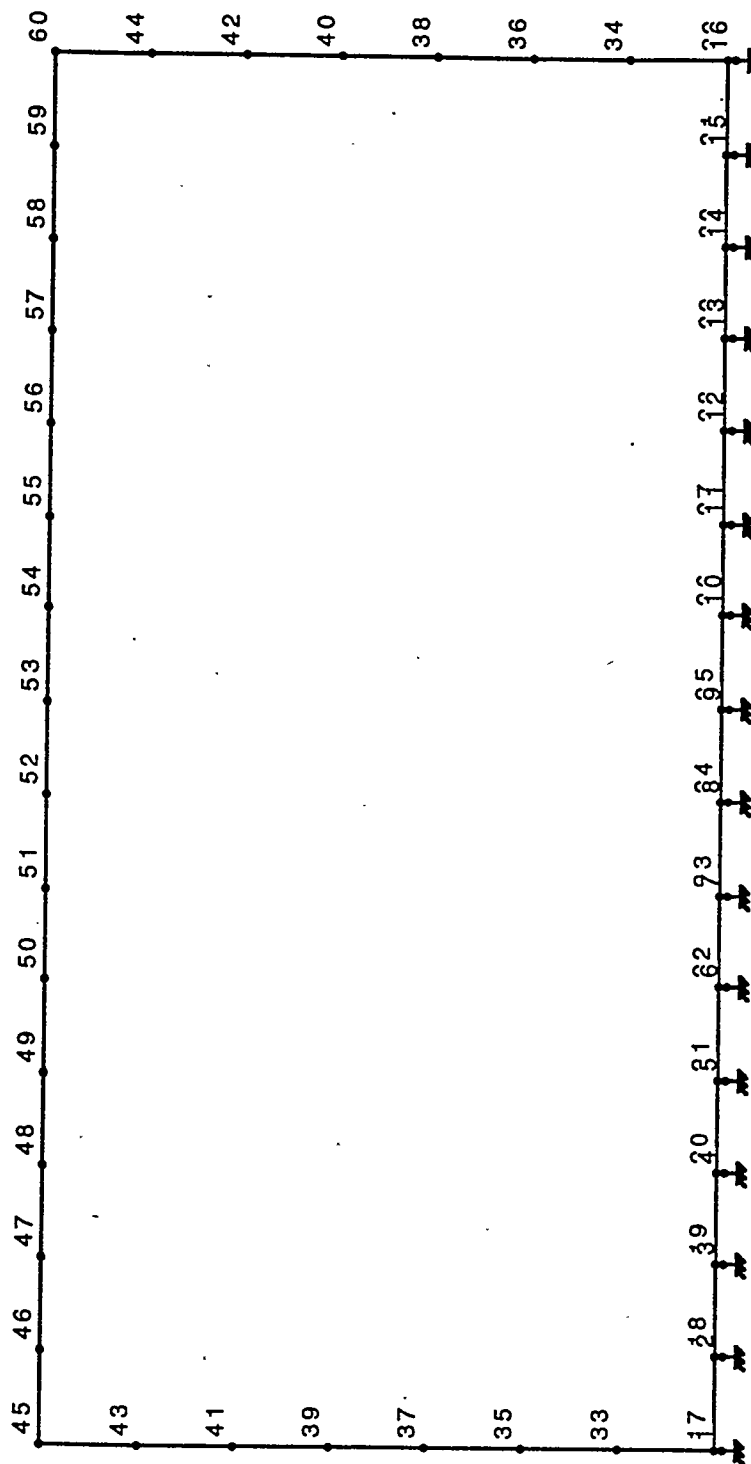
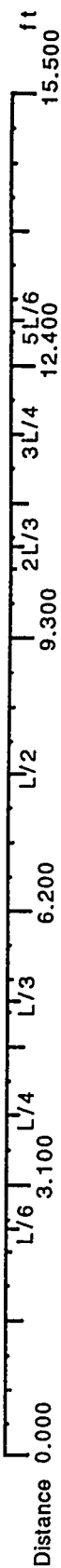
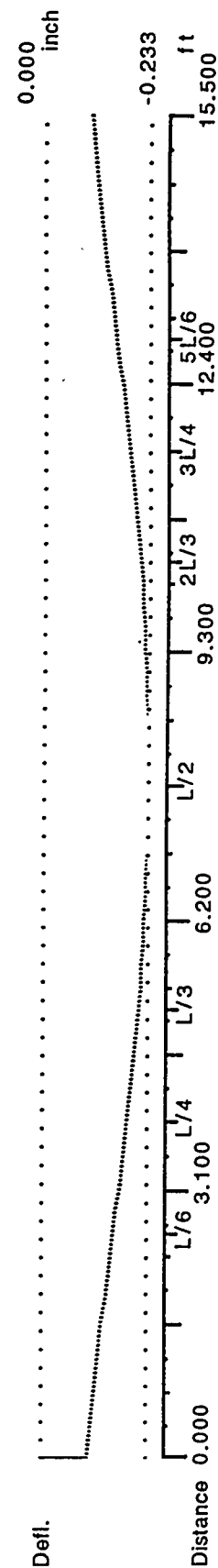
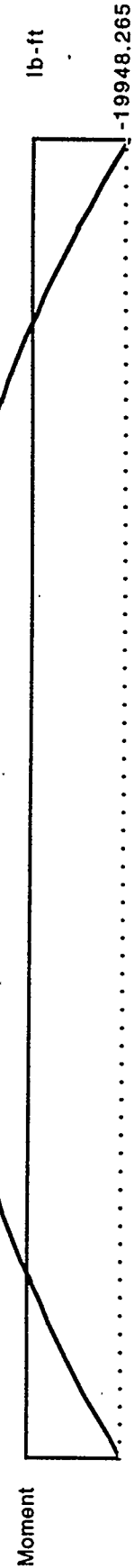
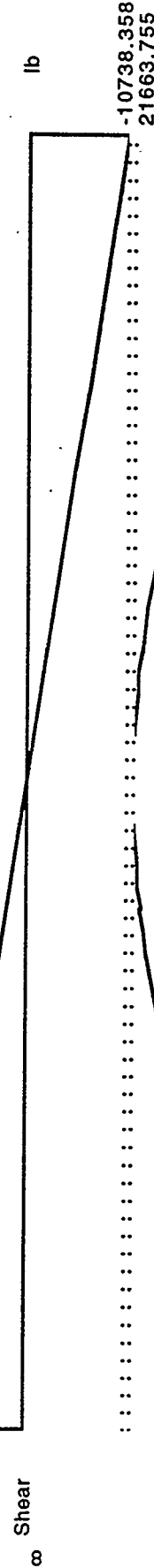
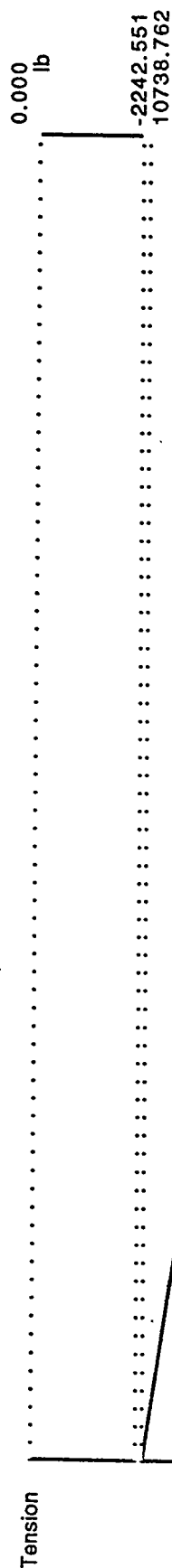
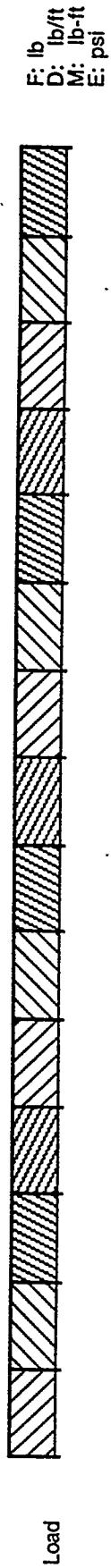


Figure 1 is a line graph showing the number of iterations required for convergence (Y-axis) versus the number of nodes N (X-axis). The X-axis ranges from 17 to 60, and the Y-axis ranges from 16 to 44. Two data series are plotted: one with solid circles and a solid line, and another with solid circles and a dotted line. Both series show a sharp increase in iterations as N increases, starting around $N=45$.

N	Iterations (Solid Line)	Iterations (Dotted Line)
17	17	17
18	17	17
19	17	17
20	17	17
21	17	17
22	17	17
23	17	17
24	17	17
25	17	17
26	17	17
27	17	17
28	17	17
29	17	17
30	17	17
31	17	17
32	17	17
33	17	17
34	17	17
35	17	17
36	17	17
37	17	17
38	17	17
39	17	17
40	17	17
41	17	17
42	17	17
43	17	17
44	17	17
45	17	17
46	17	17
47	17	17
48	17	17
49	17	17
50	17	17
51	17	17
52	17	17
53	17	17
54	17	17
55	17	17
56	17	17
57	17	17
58	17	17
59	17	17
60	17	17

FRAME MAC file: 6(T/21) PRELIMINARY; Last modified at 22:08:22 on Tue, Mar 2, 1993

Node 45	Node 46	Node 47	Node 48	Node 49	Node 50	Node 51	Node 52	Node 53	Node 54	Node 55	Node 56	Node 57	Node 58	Node 59	Node 60
0.000	1.033	2.067	3.100	4.133	5.167	6.200	7.233	8.267	9.300	10.333	11.367	12.400	13.433	14.467	15.500
7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500	7.500



Continuous Elements Output Data

FRAME MAC file: 6(T/21) PRELIM.

Last modified at 22:08:22 on Tue, Mar 2, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
45	0.000	-0.099	-0.002
46	0.000	-0.121	-0.002
47	0.000	-0.145	-0.002
48	0.000	-0.170	-0.002
49	0.000	-0.193	-0.002
50	0.000	-0.212	-0.001
51	0.000	-0.225	-0.001
52	0.000	-0.232	-0.000
53	-0.000	-0.232	0.000
54	-0.000	-0.225	0.001
55	-0.000	-0.212	0.001
56	-0.000	-0.193	0.002
57	-0.000	-0.170	0.002
58	-0.000	-0.145	0.002
59	-0.000	-0.121	0.002
60	-0.000	-0.099	0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,46	0.000	716.100	123.328	0.000	715.708	-123.328
46,47	0.000	716.100	123.328	0.000	715.708	-123.328
47,48	0.000	716.100	123.328	0.000	715.708	-123.328
48,49	0.000	716.100	123.328	0.000	715.708	-123.328
49,50	0.000	716.100	123.328	0.000	715.708	-123.328
50,51	0.000	716.100	123.328	0.000	715.708	-123.328
51,52	0.000	716.100	123.328	0.000	715.708	-123.328
52,53	0.000	716.100	123.328	0.000	715.708	-123.328
53,54	0.000	716.100	123.328	0.000	715.708	-123.328
54,55	0.000	716.100	123.328	0.000	715.708	-123.328
55,56	0.000	716.100	123.328	0.000	715.708	-123.328
56,57	0.000	716.100	123.328	0.000	715.708	-123.328
57,58	0.000	716.100	123.328	0.000	715.708	-123.328
58,59	0.000	716.100	123.328	0.000	715.708	-123.328
59,60	0.000	716.100	123.328	0.000	715.708	-123.328

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,46	2242.551	10738.762	19948.265	-2242.551	-9306.954	-9591.514
46,47	2242.551	9306.954	9591.514	-2242.551	-7875.146	-714.298
47,48	2242.551	7875.146	714.298	-2242.551	-6443.338	6683.383
48,49	2242.551	6443.338	-6683.383	-2242.551	-5011.530	12601.530
49,50	2242.551	5011.530	-12601.530	-2242.551	-3579.722	17040.141
50,51	2242.551	3579.722	-17040.141	-2242.551	-2147.914	19999.218
51,52	2242.551	2147.914	-19999.218	-2242.551	-716.106	21478.760
52,53	2242.551	716.106	-21478.760	-2242.551	715.702	21478.766
53,54	2242.551	-715.702	-21478.766	-2242.551	2147.510	19999.238
54,55	2242.551	-2147.510	-19999.238	-2242.551	3579.318	17040.175
55,56	2242.551	-3579.318	-17040.175	-2242.551	5011.126	12601.577
56,57	2242.551	-5011.126	-12601.577	-2242.551	6442.934	6683.444
57,58	2242.551	-6442.934	-6683.444	-2242.551	7874.742	-714.224
58,59	2242.551	-7874.742	714.224	-2242.551	9306.550	-9591.427
59,60	2242.551	-9306.550	9591.427	-2242.551	10738.358	-19948.165

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians

45,46	0.000	-0.099	-0.002	0.000	-0.121	-0.002
46,47	0.000	-0.121	-0.002	0.000	-0.145	-0.002
47,48	0.000	-0.145	-0.002	0.000	-0.170	-0.002
48,49	0.000	-0.170	-0.002	0.000	-0.193	-0.002
49,50	0.000	-0.193	-0.002	0.000	-0.212	-0.001
50,51	0.000	-0.212	-0.001	0.000	-0.225	-0.001
51,52	0.000	-0.225	-0.001	0.000	-0.232	-0.000
52,53	0.000	-0.232	-0.000	-0.000	-0.232	0.000
53,54	-0.000	-0.232	0.000	-0.000	-0.225	0.001
54,55	-0.000	-0.225	0.001	-0.000	-0.212	0.001
55,56	-0.000	-0.212	0.001	-0.000	-0.193	0.002
56,57	-0.000	-0.193	0.002	-0.000	-0.170	0.002
57,58	-0.000	-0.170	0.002	-0.000	-0.145	0.002
58,59	-0.000	-0.145	0.002	-0.000	-0.121	0.002
59,60	-0.000	-0.121	0.002	-0.000	-0.099	0.002

Maximum deformations:

Node 60 moved 0.000 inch to the left.
Node 45 moved 0.000 inch to the right.
Node 52 moved 0.232 inch downwards.
No nodes moved upwards.
Node 47 rotated 0.002 radian clockwise.
Node 58 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
45,46	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
46,47	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
47,48	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
48,49	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
49,50	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
50,51	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
51,52	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
52,53	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
53,54	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
54,55	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
55,56	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
56,57	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
57,58	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
58,59	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
59,60	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
45,46	10738.762	0.000	10738.762	74.575	0.000	74.575
46,47	9306.954	0.000	9306.954	64.632	0.000	64.632
47,48	7875.146	0.000	7875.146	54.689	0.000	54.689
48,49	6443.338	0.000	6443.338	44.745	0.000	44.745
49,50	5011.530	0.000	5011.530	34.802	0.000	34.802
50,51	3579.722	0.000	3579.722	24.859	0.000	24.859
51,52	2147.914	0.000	2147.914	14.916	0.000	14.916
52,53	716.106	-715.702	716.106	4.973	-4.970	4.973
53,54	0.000	-2147.510	-2147.510	0.000	-14.913	-14.913
54,55	0.000	-3579.318	-3579.318	0.000	-24.856	-24.856
55,56	0.000	-5011.126	-5011.126	0.000	-34.799	-34.799
56,57	0.000	-6442.934	-6442.934	0.000	-44.743	-44.743
57,58	0.000	-7874.742	-7874.742	0.000	-54.686	-54.686
58,59	0.000	-9306.550	-9306.550	0.000	-64.629	-64.629
59,60	0.000	-10738.358	-10738.358	0.000	-74.572	-74.572

Maximum moment and bending stress values:							
From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi	
45,46	0.000	-19948.265	-19948.265	0.000	-831.178	-831.178	
46,47	0.000	-9591.514	-9591.514	0.000	-399.646	-399.646	
47,48	6683.383	-714.298	6683.383	278.474	-29.762	278.474	
48,49	12601.530	0.000	12601.530	525.064	0.000	525.064	
49,50	17040.141	0.000	17040.141	710.006	0.000	710.006	
50,51	19999.218	0.000	19999.218	833.301	0.000	833.301	
51,52	21478.760	0.000	21478.760	894.948	0.000	894.948	
52,53	21663.755	0.000	21663.755	902.656	0.000	902.656	
53,54	21478.766	0.000	21478.766	894.949	0.000	894.949	
54,55	19999.238	0.000	19999.238	833.302	0.000	833.302	
55,56	17040.175	0.000	17040.175	710.007	0.000	710.007	
56,57	12601.577	0.000	12601.577	525.066	0.000	525.066	
57,58	6683.444	-714.224	6683.444	278.477	-29.759	278.477	
58,59	0.000	-9591.427	-9591.427	0.000	-399.643	-399.643	
59,60	0.000	-19948.165	-19948.165	0.000	-831.174	-831.174	

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
45,46	0.000	-0.121	-0.121
46,47	0.000	-0.145	-0.145
47,48	0.000	-0.170	-0.170
48,49	0.000	-0.193	-0.193
49,50	0.000	-0.212	-0.212
50,51	0.000	-0.225	-0.225
51,52	0.000	-0.232	-0.232
52,53	0.000	-0.233	-0.233
53,54	0.000	-0.232	-0.232
54,55	0.000	-0.225	-0.225
55,56	0.000	-0.212	-0.212
56,57	0.000	-0.193	-0.193
57,58	0.000	-0.170	-0.170
58,59	0.000	-0.145	-0.145
59,60	0.000	-0.121	-0.121

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
1.033	-0.002	-0.121
2.067	-0.002	-0.145
3.100	-0.002	-0.170
4.133	-0.002	-0.193
5.167	-0.001	-0.212
6.200	-0.001	-0.225
7.233	-0.000	-0.232
8.267	0.000	-0.232
9.300	0.001	-0.225
10.333	0.001	-0.212
11.367	0.002	-0.193
12.400	0.002	-0.170
13.433	0.002	-0.145
14.467	0.002	-0.121

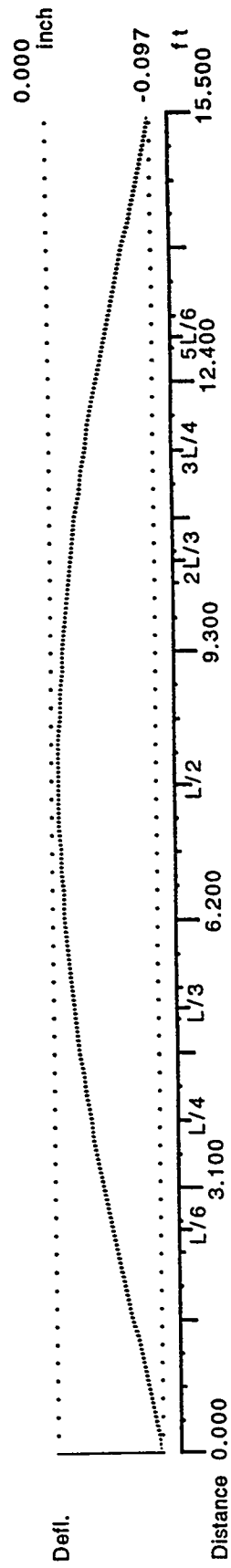
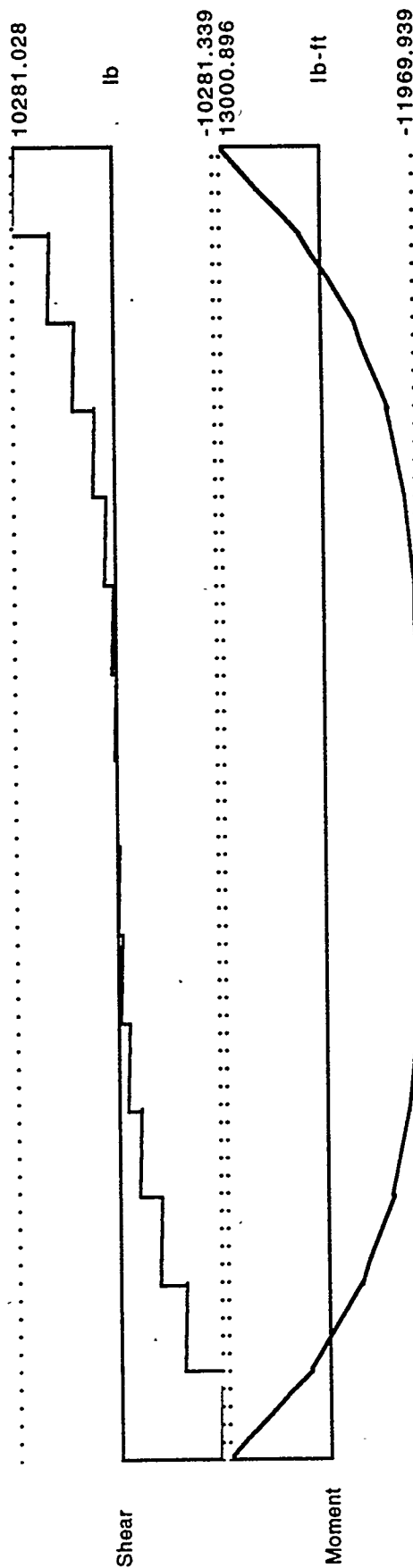
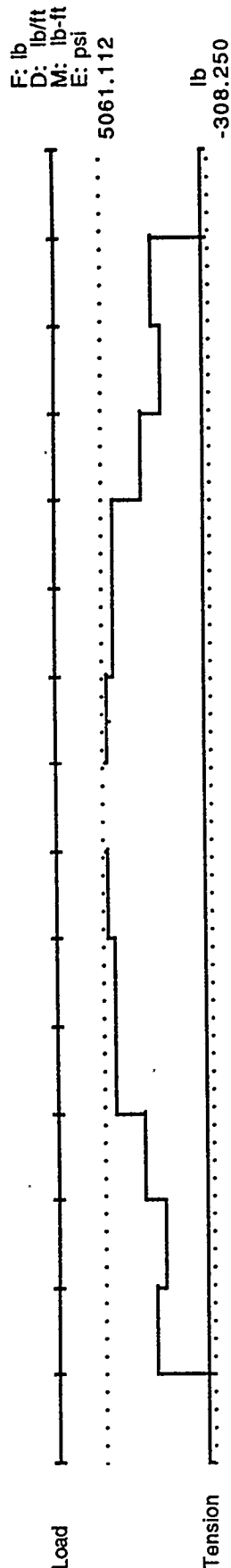
At evenly-spaced intervals:

0.000	-0.002	-0.099
1.550	-0.002	-0.133
3.100	-0.002	-0.170
4.650	-0.002	-0.203
6.200	-0.001	-0.225
7.750	0.000	-0.233
9.300	0.001	-0.225
10.850	0.002	-0.203
12.400	0.002	-0.170
13.950	0.002	-0.133

15.500 0.002 -0.099

FRAME MAC file: 6(T/21) PRELIMINARY; Last modified at 22:08:22 on Tue, Mar 2, 1993

Node 17	Node 18	Node 19	Node 20	Node 21	Node 22	Node 23	Node 24	Node 25	Node 26	Node 27	Node 28	Node 29	Node 30	Node 31	Node 32
0.000	1.033	2.067	3.100	4.133	5.167	6.200	7.233	8.267	9.300	10.333	11.367	12.400	13.433	14.467	15.500
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Continuous Elements Output Data

FRAME MAC file: 6(T/21) PRELIM.

Last modified at 22:08:22 on Tue, Mar 2, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

17	-0.001	-0.097	0.001
18	-0.001	-0.080	0.001
19	-0.001	-0.062	0.001
20	-0.001	-0.044	0.001
21	-0.000	-0.030	0.001
22	-0.000	-0.019	0.001
23	-0.000	-0.011	0.000
24	-0.000	-0.007	0.000
25	0.000	-0.007	-0.000
26	0.000	-0.011	-0.000
27	0.000	-0.019	-0.001
28	0.000	-0.030	-0.001
29	0.001	-0.044	-0.001
30	0.001	-0.062	-0.001
31	0.001	-0.080	-0.001
32	0.001	-0.097	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
17,18	0.000	108.500	18.686	0.000	108.500	-18.686
18,19	0.000	108.500	18.686	0.000	108.500	-18.686
19,20	0.000	108.500	18.686	0.000	108.500	-18.686
20,21	0.000	108.500	18.686	0.000	108.500	-18.686
21,22	0.000	108.500	18.686	0.000	108.500	-18.686
22,23	0.000	108.500	18.686	0.000	108.500	-18.686
23,24	0.000	108.500	18.686	0.000	108.500	-18.686
24,25	0.000	108.500	18.686	0.000	108.500	-18.686
25,26	0.000	108.500	18.686	0.000	108.500	-18.686
26,27	0.000	108.500	18.686	0.000	108.500	-18.686
27,28	0.000	108.500	18.686	0.000	108.500	-18.686
28,29	0.000	108.500	18.686	0.000	108.500	-18.686
29,30	0.000	108.500	18.686	0.000	108.500	-18.686
30,31	0.000	108.500	18.686	0.000	108.500	-18.686
31,32	0.000	108.500	18.686	0.000	108.500	-18.686

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
17,18	308.235	-10064.339	-13000.896	-308.235	10281.339	2488.963
18,19	-2565.150	-6572.286	-2677.639	2565.150	6789.286	-4225.840
19,20	-2080.389	-3939.014	4179.198	2080.389	4156.014	-8361.629
20,21	-3040.280	-2101.079	8261.771	3040.280	2318.079	-10545.003
21,22	-4502.092	-932.086	10435.245	4502.092	1149.086	-11510.518
22,23	-4517.761	-291.184	11474.582	4517.761	508.184	-11887.589
23,24	-4795.652	-3.148	11854.570	4795.652	220.148	-11969.939
24,25	-5061.112	108.568	11951.655	5061.112	108.432	-11951.585
25,26	-4795.615	220.278	11969.870	4795.615	-3.278	-11854.367
26,27	-4517.689	508.296	11887.386	4517.689	-291.296	-11474.263
27,28	-4501.978	1149.165	11510.199	4501.978	-932.165	-10434.845
28,29	-3040.183	2318.105	10544.600	3040.183	-2101.105	-8261.342
29,30	-2080.298	4155.962	8361.197	2080.298	-3938.962	-4178.820
30,31	-2565.022	6789.123	4225.461	2565.022	-6572.123	2677.850
31,32	308.250	10281.028	-2489.181	-308.250	-10064.028	13000.793

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians

17,18	-0.001	-0.097	0.001	-0.001	-0.080	0.001
18,19	-0.001	-0.080	0.001	-0.001	-0.062	0.001
19,20	-0.001	-0.062	0.001	-0.001	-0.044	0.001
20,21	-0.001	-0.044	0.001	-0.000	-0.030	0.001
21,22	-0.000	-0.030	0.001	-0.000	-0.019	0.001
22,23	-0.000	-0.019	0.001	-0.000	-0.011	0.000
23,24	-0.000	-0.011	0.000	-0.000	-0.007	0.000
24,25	-0.000	-0.007	0.000	0.000	-0.007	-0.000
25,26	0.000	-0.007	-0.000	0.000	-0.011	-0.000
26,27	0.000	-0.011	-0.000	0.000	-0.019	-0.001
27,28	0.000	-0.019	-0.001	0.000	-0.030	-0.001
28,29	0.000	-0.030	-0.001	0.001	-0.044	-0.001
29,30	0.001	-0.044	-0.001	0.001	-0.062	-0.001
30,31	0.001	-0.062	-0.001	0.001	-0.080	-0.001
31,32	0.001	-0.080	-0.001	0.001	-0.097	-0.001

Maximum deformations:

Node 18 moved 0.001 inch to the left.
Node 31 moved 0.001 inch to the right.
Node 17 moved 0.097 inch downwards.
No nodes moved upwards.
Node 31 rotated 0.001 radian clockwise.
Node 18 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
17,18	0.000	-308.235	-308.235	0.000	-2.141	-2.141
18,19	2565.150	0.000	2565.150	17.814	0.000	17.814
19,20	2080.389	0.000	2080.389	14.447	0.000	14.447
20,21	3040.280	0.000	3040.280	21.113	0.000	21.113
21,22	4502.092	0.000	4502.092	31.265	0.000	31.265
22,23	4517.761	0.000	4517.761	31.373	0.000	31.373
23,24	4795.652	0.000	4795.652	33.303	0.000	33.303
24,25	5061.112	0.000	5061.112	35.147	0.000	35.147
25,26	4795.615	0.000	4795.615	33.303	0.000	33.303
26,27	4517.689	0.000	4517.689	31.373	0.000	31.373
27,28	4501.978	0.000	4501.978	31.264	0.000	31.264
28,29	3040.183	0.000	3040.183	21.112	0.000	21.112
29,30	2080.298	0.000	2080.298	14.447	0.000	14.447
30,31	2565.022	0.000	2565.022	17.813	0.000	17.813
31,32	0.000	-308.250	-308.250	0.000	-2.141	-2.141

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
17,18	0.000	-10281.339	-10281.339	0.000	-71.398	-71.398
18,19	0.000	-6789.286	-6789.286	0.000	-47.148	-47.148
19,20	0.000	-4156.014	-4156.014	0.000	-28.861	-28.861
20,21	0.000	-2318.079	-2318.079	0.000	-16.098	-16.098
21,22	0.000	-1149.086	-1149.086	0.000	-7.980	-7.980
22,23	0.000	-508.184	-508.184	0.000	-3.529	-3.529
23,24	0.000	-220.148	-220.148	0.000	-1.529	-1.529
24,25	108.568	-108.432	108.568	0.754	-0.753	0.754
25,26	220.278	0.000	220.278	1.530	0.000	1.530
26,27	508.296	0.000	508.296	3.530	0.000	3.530
27,28	1149.165	0.000	1149.165	7.980	0.000	7.980
28,29	2318.105	0.000	2318.105	16.098	0.000	16.098
29,30	4155.962	0.000	4155.962	28.861	0.000	28.861
30,31	6789.123	0.000	6789.123	47.147	0.000	47.147
31,32	10281.028	0.000	10281.028	71.396	0.000	71.396

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
17,18	13000.896	0.000	13000.896	541.704	0.000	541.704
18,19	2677.639	-4225.840	-4225.840	111.568	-176.077	-176.077
19,20	0.000	-8361.629	-8361.629	0.000	-348.401	-348.401
20,21	0.000	-10545.003	-10545.003	0.000	-439.375	-439.375
21,22	0.000	-11510.518	-11510.518	0.000	-479.605	-479.605
22,23	0.000	-11887.589	-11887.589	0.000	-495.316	-495.316
23,24	0.000	-11969.939	-11969.939	0.000	-498.747	-498.747
24,25	0.000	-11951.655	-11951.655	0.000	-497.986	-497.986
25,26	0.000	-11969.870	-11969.870	0.000	-498.745	-498.745
26,27	0.000	-11887.386	-11887.386	0.000	-495.308	-495.308
27,28	0.000	-11510.199	-11510.199	0.000	-479.592	-479.592
28,29	0.000	-10544.600	-10544.600	0.000	-439.358	-439.358
29,30	0.000	-8361.197	-8361.197	0.000	-348.383	-348.383
30,31	2677.850	-4225.461	-4225.461	111.577	-176.061	-176.061
31,32	13000.793	0.000	13000.793	541.700	0.000	541.700

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
17,18	0.000	-0.097	-0.097
18,19	0.000	-0.080	-0.080
19,20	0.000	-0.062	-0.062
20,21	0.000	-0.044	-0.044
21,22	0.000	-0.030	-0.030
22,23	0.000	-0.019	-0.019
23,24	0.000	-0.011	-0.011
24,25	0.000	-0.007	-0.007
25,26	0.000	-0.011	-0.011
26,27	0.000	-0.019	-0.019
27,28	0.000	-0.030	-0.030
28,29	0.000	-0.044	-0.044
29,30	0.000	-0.062	-0.062
30,31	0.000	-0.080	-0.080
31,32	0.000	-0.097	-0.097

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch

At the intermediate nodes:

1.033	0.001	-0.080
2.067	0.001	-0.062
3.100	0.001	-0.044
4.133	0.001	-0.030
5.167	0.001	-0.019
6.200	0.000	-0.011
7.233	0.000	-0.007
8.267	-0.000	-0.007
9.300	-0.000	-0.011
10.333	-0.001	-0.019
11.367	-0.001	-0.030
12.400	-0.001	-0.044
13.433	-0.001	-0.062
14.467	-0.001	-0.080

At evenly-spaced intervals:

0.000	0.001	-0.097
1.550	0.001	-0.071
3.100	0.001	-0.044
4.650	0.001	-0.024
6.200	0.000	-0.011
7.750	0.000	-0.007
9.300	-0.000	-0.011
10.850	-0.001	-0.024
12.400	-0.001	-0.044
13.950	-0.001	-0.071

15.500

-0.001

-0.097

FRAME MAC file: 6(T/21) PRELIMINARY; Last modified at 22:08:22 on Tue, Mar 2, 1993

Node 17
0.000
0.000

Node 33
0.000
1.071

Node 35
0.000
2.143

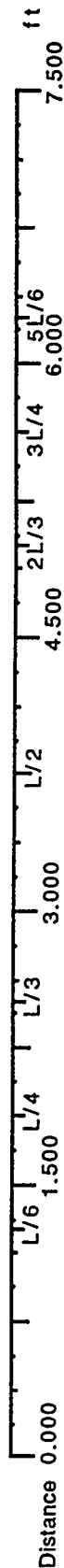
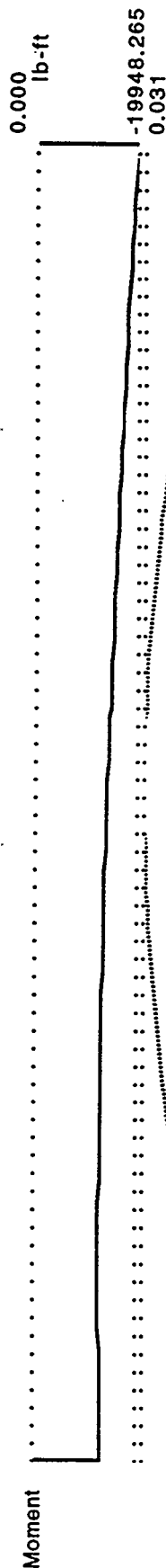
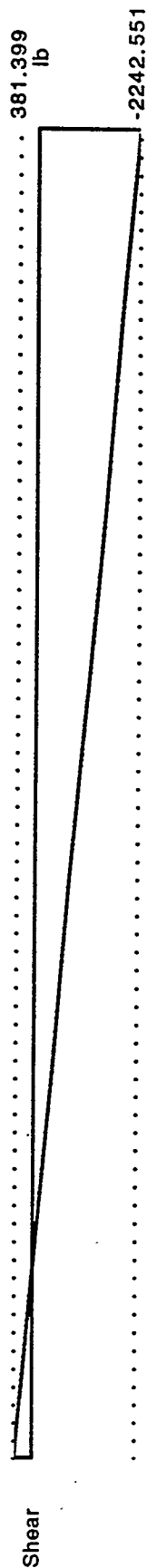
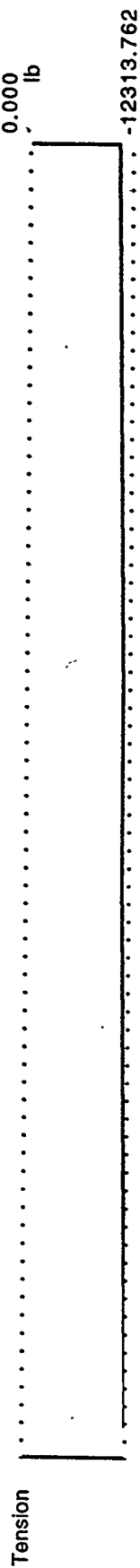
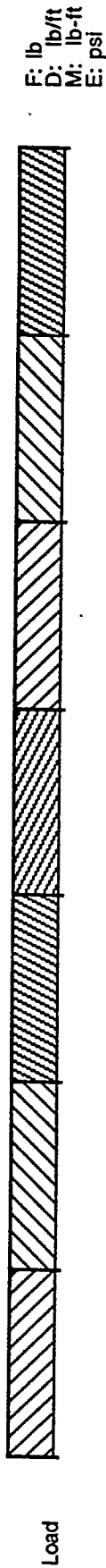
Node 37
0.000
3.214

Node 39
0.000
4.286

Node 41
0.000
5.357

Node 43
0.000
6.429

Node 45
0.000
7.500



Continuous Elements Output Data

FRAME MAC file: 6(T/21) PRELIM.

Last modified at 22:08:22 on Tue, Mar 2, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
45	0.000	-0.099	-0.002
46	0.000	-0.121	-0.002
47	0.000	-0.145	-0.002
48	0.000	-0.170	-0.002
49	0.000	-0.193	-0.002
50	0.000	-0.212	-0.001
51	0.000	-0.225	-0.001
52	0.000	-0.232	-0.000
53	-0.000	-0.232	0.000
54	-0.000	-0.225	0.001
55	-0.000	-0.212	0.001
56	-0.000	-0.193	0.002
57	-0.000	-0.170	0.002
58	-0.000	-0.145	0.002
59	-0.000	-0.121	0.002
60	-0.000	-0.099	0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,46	0.000	716.100	123.328	0.000	715.708	-123.328
46,47	0.000	716.100	123.328	0.000	715.708	-123.328
47,48	0.000	716.100	123.328	0.000	715.708	-123.328
48,49	0.000	716.100	123.328	0.000	715.708	-123.328
49,50	0.000	716.100	123.328	0.000	715.708	-123.328
50,51	0.000	716.100	123.328	0.000	715.708	-123.328
51,52	0.000	716.100	123.328	0.000	715.708	-123.328
52,53	0.000	716.100	123.328	0.000	715.708	-123.328
53,54	0.000	716.100	123.328	0.000	715.708	-123.328
54,55	0.000	716.100	123.328	0.000	715.708	-123.328
55,56	0.000	716.100	123.328	0.000	715.708	-123.328
56,57	0.000	716.100	123.328	0.000	715.708	-123.328
57,58	0.000	716.100	123.328	0.000	715.708	-123.328
58,59	0.000	716.100	123.328	0.000	715.708	-123.328
59,60	0.000	716.100	123.328	0.000	715.708	-123.328

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,46	2242.551	10738.762	19948.265	-2242.551	-9306.954	-9591.514
46,47	2242.551	9306.954	9591.514	-2242.551	-7875.146	-714.298
47,48	2242.551	7875.146	714.298	-2242.551	-6443.338	6683.383
48,49	2242.551	6443.338	-6683.383	-2242.551	-5011.530	12601.530
49,50	2242.551	5011.530	-12601.530	-2242.551	-3579.722	17040.141
50,51	2242.551	3579.722	-17040.141	-2242.551	-2147.914	19999.218
51,52	2242.551	2147.914	-19999.218	-2242.551	-716.106	21478.760
52,53	2242.551	716.106	-21478.760	-2242.551	715.702	21478.766
53,54	2242.551	-715.702	-21478.766	-2242.551	2147.510	19999.238
54,55	2242.551	-2147.510	-19999.238	-2242.551	3579.318	17040.175
55,56	2242.551	-3579.318	-17040.175	-2242.551	5011.126	12601.577
56,57	2242.551	-5011.126	-12601.577	-2242.551	6442.934	6683.444
57,58	2242.551	-6442.934	-6683.444	-2242.551	7874.742	-714.224
58,59	2242.551	-7874.742	714.224	-2242.551	9306.550	-9591.427
59,60	2242.551	-9306.550	9591.427	-2242.551	10738.358	-19948.165

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians

45,46	0.000	-0.099	-0.002	0.000	-0.121	-0.002
46,47	0.000	-0.121	-0.002	0.000	-0.145	-0.002
47,48	0.000	-0.145	-0.002	0.000	-0.170	-0.002
48,49	0.000	-0.170	-0.002	0.000	-0.193	-0.002
49,50	0.000	-0.193	-0.002	0.000	-0.212	-0.001
50,51	0.000	-0.212	-0.001	0.000	-0.225	-0.001
51,52	0.000	-0.225	-0.001	0.000	-0.232	-0.000
52,53	0.000	-0.232	-0.000	-0.000	-0.232	0.000
53,54	-0.000	-0.232	0.000	-0.000	-0.225	0.001
54,55	-0.000	-0.225	0.001	-0.000	-0.212	0.001
55,56	-0.000	-0.212	0.001	-0.000	-0.193	0.002
56,57	-0.000	-0.193	0.002	-0.000	-0.170	0.002
57,58	-0.000	-0.170	0.002	-0.000	-0.145	0.002
58,59	-0.000	-0.145	0.002	-0.000	-0.121	0.002
59,60	-0.000	-0.121	0.002	-0.000	-0.099	0.002

Maximum deformations:

Node 60 moved 0.000 inch to the left.
Node 45 moved 0.000 inch to the right.
Node 52 moved 0.232 inch downwards.
No nodes moved upwards.
Node 47 rotated 0.002 radian clockwise.
Node 58 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
45,46	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
46,47	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
47,48	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
48,49	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
49,50	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
50,51	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
51,52	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
52,53	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
53,54	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
54,55	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
55,56	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
56,57	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
57,58	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
58,59	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
59,60	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
45,46	10738.762	0.000	10738.762	74.575	0.000	74.575
46,47	9306.954	0.000	9306.954	64.632	0.000	64.632
47,48	7875.146	0.000	7875.146	54.689	0.000	54.689
48,49	6443.338	0.000	6443.338	44.745	0.000	44.745
49,50	5011.530	0.000	5011.530	34.802	0.000	34.802
50,51	3579.722	0.000	3579.722	24.859	0.000	24.859
51,52	2147.914	0.000	2147.914	14.916	0.000	14.916
52,53	716.106	-715.702	716.106	4.973	-4.970	4.973
53,54	0.000	-2147.510	-2147.510	0.000	-14.913	-14.913
54,55	0.000	-3579.318	-3579.318	0.000	-24.856	-24.856
55,56	0.000	-5011.126	-5011.126	0.000	-34.799	-34.799
56,57	0.000	-6442.934	-6442.934	0.000	-44.743	-44.743
57,58	0.000	-7874.742	-7874.742	0.000	-54.686	-54.686
58,59	0.000	-9306.550	-9306.550	0.000	-64.629	-64.629
59,60	0.000	-10738.358	-10738.358	0.000	-74.572	-74.572

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
45,46	0.000	-19948.265	-19948.265	0.000	-831.178	-831.178
46,47	0.000	-9591.514	-9591.514	0.000	-399.646	-399.646
47,48	6683.383	-714.298	6683.383	278.474	-29.762	278.474
48,49	12601.530	0.000	12601.530	525.064	0.000	525.064
49,50	17040.141	0.000	17040.141	710.006	0.000	710.006
50,51	19999.218	0.000	19999.218	833.301	0.000	833.301
51,52	21478.760	0.000	21478.760	894.948	0.000	894.948
52,53	21663.755	0.000	21663.755	902.656	0.000	902.656
53,54	21478.766	0.000	21478.766	894.949	0.000	894.949
54,55	19999.238	0.000	19999.238	833.302	0.000	833.302
55,56	17040.175	0.000	17040.175	710.007	0.000	710.007
56,57	12601.577	0.000	12601.577	525.066	0.000	525.066
57,58	6683.444	-714.224	6683.444	278.477	-29.759	278.477
58,59	0.000	-9591.427	-9591.427	0.000	-399.643	-399.643
59,60	0.000	-19948.165	-19948.165	0.000	-831.174	-831.174

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
45,46	0.000	-0.121	-0.121
46,47	0.000	-0.145	-0.145
47,48	0.000	-0.170	-0.170
48,49	0.000	-0.193	-0.193
49,50	0.000	-0.212	-0.212
50,51	0.000	-0.225	-0.225
51,52	0.000	-0.232	-0.232
52,53	0.000	-0.233	-0.233
53,54	0.000	-0.232	-0.232
54,55	0.000	-0.225	-0.225
55,56	0.000	-0.212	-0.212
56,57	0.000	-0.193	-0.193
57,58	0.000	-0.170	-0.170
58,59	0.000	-0.145	-0.145
59,60	0.000	-0.121	-0.121

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
1.033	-0.002	-0.121
2.067	-0.002	-0.145
3.100	-0.002	-0.170
4.133	-0.002	-0.193
5.167	-0.001	-0.212
6.200	-0.001	-0.225
7.233	-0.000	-0.232
8.267	0.000	-0.232
9.300	0.001	-0.225
10.333	0.001	-0.212
11.367	0.002	-0.193
12.400	0.002	-0.170
13.433	0.002	-0.145
14.467	0.002	-0.121

At evenly-spaced intervals:

0.000	-0.002	-0.099
1.550	-0.002	-0.133
3.100	-0.002	-0.170
4.650	-0.002	-0.203
6.200	-0.001	-0.225
7.750	0.000	-0.233
9.300	0.001	-0.225
10.850	0.002	-0.203
12.400	0.002	-0.170
13.950	0.002	-0.133

15.500

0.092

-0.099

Continuous Elements Output Data

FRAME MAC file: 6(T/21) PRELIM.

Last modified at 22:08:22 on Tue, Mar 2, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb' (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
17	-0.001	-0.097	0.001
33	-0.015	-0.098	0.001
35	-0.024	-0.098	0.001
37	-0.030	-0.098	0.000
39	-0.030	-0.099	-0.000
41	-0.026	-0.099	-0.001
43	-0.016	-0.099	-0.001
45	0.000	-0.099	-0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
17,33	112.500	187.500	33.482	112.500	187.350	-33.482
33,35	112.500	187.500	33.482	112.500	187.350	-33.482
35,37	112.500	187.500	33.482	112.500	187.350	-33.482
37,39	112.500	187.500	33.482	112.500	187.350	-33.482
39,41	112.500	187.500	33.482	112.500	187.350	-33.482
41,43	112.500	187.500	33.482	112.500	187.350	-33.482
43,45	112.500	187.500	33.482	112.500	187.350	-33.482

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
17,33	12313.762	381.399	12968.387	-12088.762	-6.549	-12760.637
33,35	12088.762	6.549	12760.637	-11863.762	368.301	-12954.513
35,37	11863.762	-368.301	12954.513	-11638.762	743.151	-13550.013
37,39	11638.762	-743.151	13550.013	-11413.762	1118.001	-14547.139
39,41	11413.762	-1118.001	14547.139	-11188.762	1492.851	-15945.889
41,43	11188.762	-1492.851	15945.889	-10963.762	1867.701	-17746.265
43,45	10963.762	-1867.701	17746.265	-10738.762	2242.551	-19948.265

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
17,33	-0.097	0.001	0.001	-0.098	0.015	0.001
33,35	-0.098	0.015	0.001	-0.098	0.024	0.001
35,37	-0.098	0.024	0.001	-0.098	0.030	0.000
37,39	-0.098	0.030	0.000	-0.099	0.030	-0.000
39,41	-0.099	0.030	-0.000	-0.099	0.026	-0.001
41,43	-0.099	0.026	-0.001	-0.099	0.016	-0.001
43,45	-0.099	0.016	-0.001	-0.099	-0.000	-0.002

Maximum deformations:

Node 39 moved 0.030 inch to the left.
Node 45 moved 0.000 inch to the right.
Node 45 moved 0.099 inch downwards.
No nodes moved upwards.
Node 45 rotated 0.002 radian clockwise.
Node 17 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
17,33	0.000	-12313.762	-12313.762	0.000	-85.512	-85.512
33,35	0.000	-12088.762	-12088.762	0.000	-83.950	-83.950
35,37	0.000	-11863.762	-11863.762	0.000	-82.387	-82.387
37,39	0.000	-11638.762	-11638.762	0.000	-80.825	-80.825
39,41	0.000	-11413.762	-11413.762	0.000	-79.262	-79.262
41,43	0.000	-11188.762	-11188.762	0.000	-77.700	-77.700
43,45	0.000	-10963.762	-10963.762	0.000	-76.137	-76.137

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
17,33	381.399	0.000	381.399	2.649	0.000	2.649
33,35	6.549	-368.301	-368.301	0.045	-2.558	-2.558
35,37	0.000	-743.151	-743.151	0.000	-5.161	-5.161
37,39	0.000	-1118.001	-1118.001	0.000	-7.764	-7.764
39,41	0.000	-1492.851	-1492.851	0.000	-10.367	-10.367
41,43	0.000	-1867.701	-1867.701	0.000	-12.970	-12.970
43,45	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
17,33	0.000	-12968.387	-12968.387	0.000	-540.349	-540.349
33,35	0.000	-12954.513	-12954.513	0.000	-539.771	-539.771
35,37	0.000	-13550.013	-13550.013	0.000	-564.584	-564.584
37,39	0.000	-14547.139	-14547.139	0.000	-606.131	-606.131
39,41	0.000	-15945.889	-15945.889	0.000	-664.412	-664.412
41,43	0.000	-17746.265	-17746.265	0.000	-739.428	-739.428
43,45	0.000	-19948.265	-19948.265	0.000	-831.178	-831.178

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
17,33	0.015	0.000	0.015
33,35	0.024	0.000	0.024
35,37	0.030	0.000	0.030
37,39	0.031	0.000	0.031
39,41	0.030	0.000	0.030
41,43	0.026	0.000	0.026
43,45	0.016	-0.000	0.016

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
1.071	0.001	0.015
2.143	0.001	0.024
3.214	0.000	0.030
4.286	-0.000	0.030
5.357	-0.001	0.026
6.429	-0.001	0.016

At evenly-spaced intervals:

Distance from left (bottom) ft	Rotation radian	Deflection inch
0.000	0.001	0.001
0.750	0.001	0.011
1.500	0.001	0.019
2.250	0.001	0.025
3.000	0.000	0.029
3.750	0.000	0.031

4.500	-0.000	0.030
5.250	-0.001	0.025
6.000	-0.001	0.020
6.750	-0.001	0.012
7.500	-0.002	-0.000

FRAME MAC file: 6(T/21) PRELIMINARY; Last modified at 22:08:22 on Tue, Mar 2, 1993

Node 32
15.500
0.000

Node 34
15.500
1.071

Node 36
15.500
2.143

Node 38
15.500
3.214

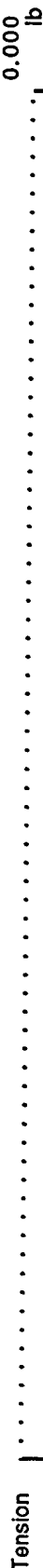
Node 40
15.500
4.286

Node 42
15.500
5.357

Node 44
15.500
6.429

Node 60
15.500
7.500

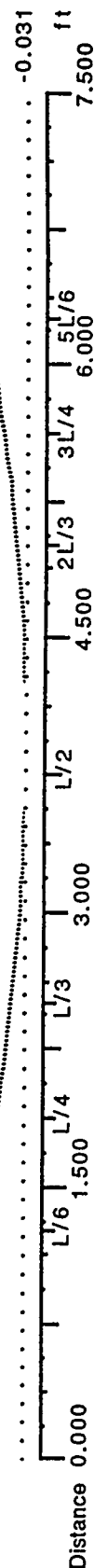
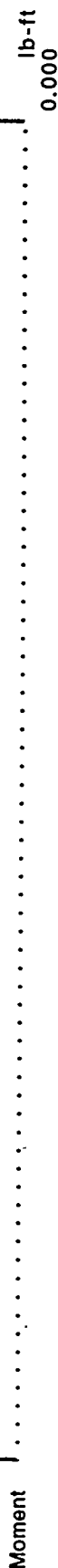
F: lb
D: lb/ft
M: lb-ft
E: psi



-12313.358
2242.551



19948.165



Continuous Elements Output Data

FRAME MAC file: 6(T/21) PRELIM.

Last modified at 22:08:22 on Tue, Mar 2, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)
16	73.149	2249.330	26.406

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
32	0.001	-0.097	-0.001
34	0.015	-0.098	-0.001
36	0.024	-0.098	-0.001
38	0.030	-0.098	-0.000
40	0.030	-0.099	0.000
42	0.026	-0.099	0.001
44	0.016	-0.099	0.001
60	-0.000	-0.099	0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
16,32	0.000	0.000	0.000	0.000	0.000	0.000
32,34	112.500	-187.500	-33.482	112.500	-187.350	33.482
34,36	112.500	-187.500	-33.482	112.500	-187.350	33.482
36,38	112.500	-187.500	-33.482	112.500	-187.350	33.482
38,40	112.500	-187.500	-33.482	112.500	-187.350	33.482
40,42	112.500	-187.500	-33.482	112.500	-187.350	33.482
42,44	112.500	-187.500	-33.482	112.500	-187.350	33.482
44,60	112.500	-187.500	-33.482	112.500	-187.350	33.482

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
16,32	2249.330	-73.149	26.406	-2249.330	73.149	-32.507
32,34	12313.358	-381.399	-12968.286	-12088.358	6.549	12760.537
34,36	12088.358	-6.549	-12760.537	-11863.358	-368.301	12954.412
36,38	11863.358	368.301	-12954.412	-11638.358	-743.151	13549.913
38,40	11638.358	743.151	-13549.913	-11413.358	-1118.001	14547.038
40,42	11413.358	1118.001	-14547.038	-11188.358	-1492.851	15945.789
42,44	11188.358	1492.851	-15945.789	-10963.358	-1867.701	17746.164
44,60	10963.358	1867.701	-17746.164	-10738.358	-2242.551	19948.165

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
16,32	0.000	0.000	0.000	-0.097	-0.001	-0.001
32,34	-0.097	-0.001	-0.001	-0.098	-0.015	-0.001
34,36	-0.098	-0.015	-0.001	-0.098	-0.024	-0.001
36,38	-0.098	-0.024	-0.001	-0.098	-0.030	-0.000
38,40	-0.098	-0.030	-0.000	-0.099	-0.030	0.000
40,42	-0.099	-0.030	0.000	-0.099	-0.026	0.001
42,44	-0.099	-0.026	0.001	-0.099	-0.016	0.001
44,60	-0.099	-0.016	0.001	-0.099	0.000	0.002

Maximum deformations:

Node 60 moved 0.000 inch to the left.

Node 40 moved 0.030 inch to the right.

Node 60 moved 0.099 inch downwards.

No nodes moved upwards.

Node 32 rotated 0.001 radian clockwise.

Node 60 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.

The reaction at node 16 was 73.149 lb to the right.

There were no downwards reactions.
The reaction at node 16 was 2249.330 lb upwards.
There were no clockwise reactions.
The reaction at node 16 was 26.406 lb-ft counter-clockwise.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
16,32	0.000	-2249.330	-2249.330	0.000	-29.152	-29.152
32,34	0.000	-12313.358	-12313.358	0.000	-85.509	-85.509
34,36	0.000	-12088.358	-12088.358	0.000	-83.947	-83.947
36,38	0.000	-11863.358	-11863.358	0.000	-82.384	-82.384
38,40	0.000	-11638.358	-11638.358	0.000	-80.822	-80.822
40,42	0.000	-11413.358	-11413.358	0.000	-79.259	-79.259
42,44	0.000	-11188.358	-11188.358	0.000	-77.697	-77.697
44,60	0.000	-10963.358	-10963.358	0.000	-76.134	-76.134

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
16,32	0.000	-73.149	-73.149	0.000	-0.948	-0.948
32,34	0.000	-381.399	-381.399	0.000	-2.649	-2.649
34,36	368.301	-6.549	368.301	2.558	-0.045	2.558
36,38	743.151	0.000	743.151	5.161	0.000	5.161
38,40	1118.001	0.000	1118.001	7.764	0.000	7.764
40,42	1492.851	0.000	1492.851	10.367	0.000	10.367
42,44	1867.701	0.000	1867.701	12.970	0.000	12.970
44,60	2242.551	0.000	2242.551	15.573	0.000	15.573

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
16,32	0.000	-32.507	-32.507	0.000	-2.528	-2.528
32,34	12968.286	0.000	12968.286	540.345	0.000	540.345
34,36	12954.412	0.000	12954.412	539.767	0.000	539.767
36,38	13549.913	0.000	13549.913	564.580	0.000	564.580
38,40	14547.038	0.000	14547.038	606.127	0.000	606.127
40,42	15945.789	0.000	15945.789	664.408	0.000	664.408
42,44	17746.164	0.000	17746.164	739.424	0.000	739.424
44,60	19948.165	0.000	19948.165	831.174	0.000	831.174

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
16,32	0.000	-0.001	-0.001
32,34	0.000	-0.015	-0.015
34,36	0.000	-0.024	-0.024
36,38	0.000	-0.030	-0.030
38,40	0.000	-0.031	-0.031
40,42	0.000	-0.030	-0.030
42,44	0.000	-0.026	-0.026
44,60	0.000	-0.016	-0.016

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
0.083	-0.001	-0.001
1.155	-0.001	-0.015
2.226	-0.001	-0.024
3.298	-0.000	-0.030
4.369	0.000	-0.030
5.441	0.001	-0.026

6.512	0.001	-0.016
At evenly-spaced intervals:		
0.000	0.000	0.000
0.758	-0.001	-0.010
1.517	-0.001	-0.019
2.275	-0.001	-0.025
3.033	-0.000	-0.029
3.792	-0.000	-0.031
4.550	0.000	-0.030
5.308	0.001	-0.027
6.067	0.001	-0.021
6.825	0.001	-0.012
7.583	0.002	0.000

Output Data

FRAME MAC file: 6(T/21) PRELIM.

Last modified at 22:08:22 on Tue, Mar 2, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

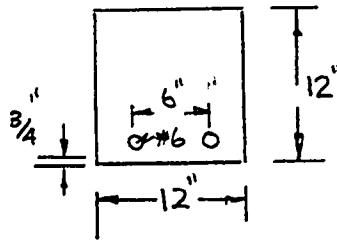
From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,17	0.000	-2249.424	-2249.424	0.000	-29.153	-29.153
2,18	0.000	-3697.539	-3697.539	0.000	-23.960	-23.960
3,19	0.000	-2848.311	-2848.311	0.000	-18.457	-18.457
4,20	0.000	-2054.935	-2054.935	0.000	-13.316	-13.316
5,21	0.000	-1380.140	-1380.140	0.000	-8.943	-8.943
6,22	0.000	-857.958	-857.958	0.000	-5.560	-5.560
7,23	0.000	-505.037	-505.037	0.000	-3.273	-3.273
8,24	0.000	-327.652	-327.652	0.000	-2.123	-2.123
9,25	0.000	-327.646	-327.646	0.000	-2.123	-2.123
10,26	0.000	-505.019	-505.019	0.000	-3.273	-3.273
11,27	0.000	-857.925	-857.925	0.000	-5.559	-5.559
12,28	0.000	-1380.087	-1380.087	0.000	-8.943	-8.943
13,29	0.000	-2054.857	-2054.857	0.000	-13.316	-13.316
14,30	0.000	-2848.201	-2848.201	0.000	-18.456	-18.456
15,31	0.000	-3697.392	-3697.392	0.000	-23.959	-23.959
16,32	0.000	-2249.330	-2249.330	0.000	-29.152	-29.152
17,33	0.000	-12313.762	-12313.762	0.000	-85.512	-85.512
17,18	0.000	-308.235	-308.235	0.000	-2.141	-2.141
18,19	2565.150	0.000	2565.150	17.814	0.000	17.814
19,20	2080.389	0.000	2080.389	14.447	0.000	14.447
20,21	3040.280	0.000	3040.280	21.113	0.000	21.113
21,22	4502.092	0.000	4502.092	31.265	0.000	31.265
22,23	4517.761	0.000	4517.761	31.373	0.000	31.373
23,24	4795.652	0.000	4795.652	33.303	0.000	33.303
24,25	5061.112	0.000	5061.112	35.147	0.000	35.147
25,26	4795.615	0.000	4795.615	33.303	0.000	33.303
26,27	4517.689	0.000	4517.689	31.373	0.000	31.373
27,28	4501.978	0.000	4501.978	31.264	0.000	31.264
28,29	3040.183	0.000	3040.183	21.112	0.000	21.112
29,30	2080.298	0.000	2080.298	14.447	0.000	14.447
30,31	2565.022	0.000	2565.022	17.813	0.000	17.813
31,32	0.000	-308.250	-308.250	0.000	-2.141	-2.141
32,34	0.000	-12313.358	-12313.358	0.000	-85.509	-85.509
33,35	0.000	-12088.762	-12088.762	0.000	-83.950	-83.950
34,36	0.000	-12088.358	-12088.358	0.000	-83.947	-83.947
35,37	0.000	-11863.762	-11863.762	0.000	-82.387	-82.387
36,38	0.000	-11863.358	-11863.358	0.000	-82.384	-82.384
37,39	0.000	-11638.762	-11638.762	0.000	-80.825	-80.825
38,40	0.000	-11638.358	-11638.358	0.000	-80.822	-80.822
39,41	0.000	-11413.762	-11413.762	0.000	-79.262	-79.262
40,42	0.000	-11413.358	-11413.358	0.000	-79.259	-79.259
41,43	0.000	-11188.762	-11188.762	0.000	-77.700	-77.700
42,44	0.000	-11188.358	-11188.358	0.000	-77.697	-77.697
43,45	0.000	-10963.762	-10963.762	0.000	-76.137	-76.137
44,60	0.000	-10963.358	-10963.358	0.000	-76.134	-76.134
45,46	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
46,47	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
47,48	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
48,49	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
49,50	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
50,51	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
51,52	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
52,53	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
53,54	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
54,55	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
55,56	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
56,57	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
57,58	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
58,59	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573
59,60	0.000	-2242.551	-2242.551	0.000	-15.573	-15.573

SOIL LOG 22

1.12 = 3.17 = 2
= 1.2 - 4.5

I. MOMENT CAPACITY - ROOF, WALL & FLOOR

ROOF & FLOOR

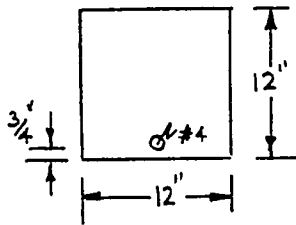


$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$\phi M_n = (0.9) \left[(0.8836)(60,000) \left(10.875 - \frac{1.732}{2} \right) \right]$$

$$\begin{aligned} \phi M_n &= 482,487 \text{ in-lbs} \\ &= \underline{40,207 \text{ ft-lbs}} \end{aligned}$$

LEFT & RIGHT WALL (INSIDE)



$$\phi M_n = (0.9) \left[(0.1963)(60,000) \left(11.25 - \frac{0.385}{2} \right) \right]$$

$$\begin{aligned} \phi M_n &= 117,212 \text{ in-lbs} \\ &= \underline{9768 \text{ ft-lbs}} \end{aligned}$$

$$A_{ST} = \frac{2(\pi)(0.75)^2}{4} = 0.8836$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in}$$

$$d = 12 - 0.75 - \frac{0.75}{2} = 10.875 \text{ in}$$

$$\phi = 0.9$$

$$a = \frac{A_{ST} f_y}{(0.85) f'_c b_w}$$

$$a = \frac{(0.8836)(60,000)}{(0.85)(3,000)(12)} = 1.732 \text{ in}$$

$$A_{ST} = \frac{(\pi)(0.5)^2}{4} = 0.1963 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in}$$

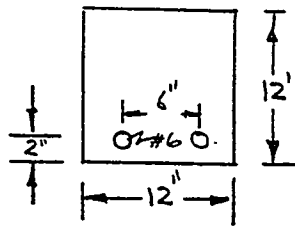
$$\phi = 0.9$$

$$a = \frac{A_{ST} f_y}{(0.85) f'_c b_w}$$

$$a = \frac{(0.1963)(60,000)}{(0.85)(3,000)(12)} = 0.385 \text{ in}$$

$$d = 12 - 0.5 - \frac{0.5}{2} = 11.25 \text{ in}$$

LEFT & RIGHT WALLS (OUTSIDE)



$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$A_{ST} = (2)(\pi)(0.75)^2 = 0.8836$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in}$$

$$\phi M_n = (0.9) \left[(0.8836)(60,000) \left(9.625 - \frac{1.732}{2} \right) \right]$$

$$d = 12 - 2 - \frac{0.75}{2} = 9.625$$

$$\phi = 0.9$$

$$\phi M_n = 464,367 \text{ in-lbs}$$

$$= \underline{38,697 \text{ ft-lbs}}$$

$$a = \frac{A_{ST} f_y}{0.85 f'_c b_w}$$

$$= \frac{(0.8836)(60,000)}{(0.85)(3,000)(12)} = 1.73$$

2. SHEAR CAPACITY

$$\phi V_c = \phi 2 \sqrt{f'_c} b_w d$$

$$\phi = 0.85$$

$$\phi V_c = (0.85)(2) \sqrt{3,000} (12)(10.875)$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in}$$

$$= \underline{12,152 \text{ lbs}}$$

$$d = 12 - 0.75 - \frac{0.75}{2} = 10.875$$

3. AXIAL CAPACITY

$$\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$\phi = 0.7$$

$$l_c = (6.5')(12") = 78 \text{ in}$$

$$h = 12 \text{ in}$$

$$= (0.55)(0.8)(3,000)(144) \left[1 - \left(\frac{(0.8)(78)}{(32)(12)} \right)^2 \right]$$

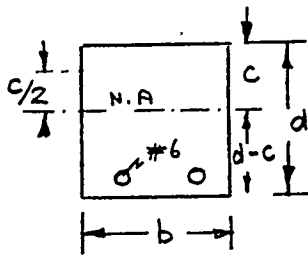
$$f'_c = 3,000 \text{ psi}$$

$$K = 0.8$$

$$\phi P_{nw} = \underline{185,060 \text{ lbs}}$$

$$A_g = (12')(12") = 144 \text{ in}^2$$

EFFECTIVE AREA



$$I_g = \frac{(12)(12)^3}{12} = 1,728 \text{ in}^4$$

$$f'_c = 3,000 \text{ psi}$$

$$A_{ST} = (2)(\pi) \frac{(0.75)^2}{4} = 0.8836 \text{ in}^2$$

$$n = \frac{E_s}{E_c} = \frac{2.9 \times 10^7}{3.32 \times 10^6}$$
$$n = 8.73$$

$$c = \frac{n A_{ST}}{b} \left[\sqrt{1 + \frac{2bd}{n A_{ST}}} - 1 \right]$$

$$c = \frac{(8.73)(0.8836)}{12} \left[\sqrt{1 + \frac{(2)(12)(12)}{(8.73)(0.8836)}} - 1 \right]$$

$$c = (0.6428)(5.19156)$$

$$\underline{c = 3.337 \text{ in}}$$

$$I_{cr} = \frac{bc^3}{3} + n A_{ST} (d-c)^2$$

$$= \frac{(12)(3.337)^3}{3} + (8.73)(0.8836)(12 - 3.337)$$

$$= 148.67 + 578.9 = 727.57 \text{ in}^4$$

$$\text{MODULUS OF RUPTURE } f_r = 7.5 \sqrt{f'_c} = (7.5) \sqrt{3,000} = 410 \text{ psi}$$

$$y_t = \frac{h}{2} ; y_t = \frac{12}{2} = 6 \text{ in}$$

$$M_{cr} = \frac{f_r I_g}{y_t} = \frac{(410)(1,728)}{(6)(12)} \text{ ft-lbs} = 9,859 \text{ ft-lbs}$$

$$\left(\frac{M_{cr}}{M_{max}} \right)^3 = \left(\frac{9,859}{28,851} \right)^3 = (0.3417)^3 = 0.0399$$

SERVICE MOMENT (M_w) (M_{max} IS MAX UNSERVICED)

$$M_w = f_{ST} A_{ST} \left(d - \frac{c}{3} \right) = (36,000)(0.8836) \left(\frac{12 - 3.337}{2} \right)$$

$$= 346,215 \text{ in-lbs}$$

$$\underline{= 28,851 \text{ ft-lbs}}$$

$$f_{ST} = 0.6 f_y = 0.6 (60,000)$$

$$= 36,000 \text{ psi}$$

$$A_{ST} = 0.8836 \text{ in}^2$$

$$c = 3.337 \text{ in}$$

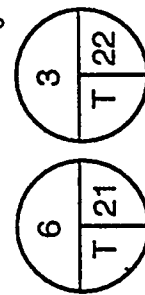
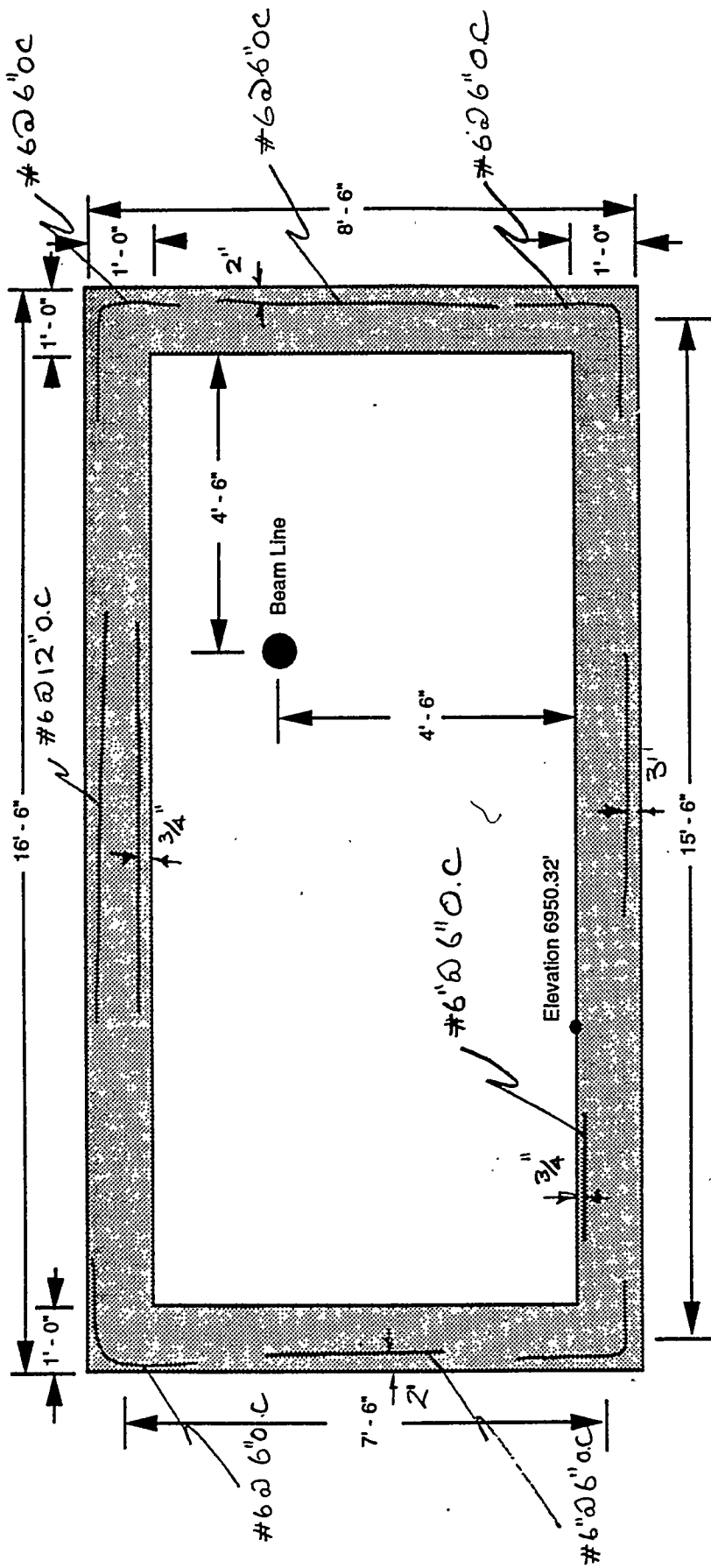
$$d = 12 \text{ in}$$

SECTION $\frac{6}{T121}$ PRELIMINARY.

$$I_e = \left(\frac{M_{cr}}{M_{MAX}} \right) I_g + \left[1 - \left(\frac{M_{cr}}{M_{MAX}} \right)^3 \right] I_{cr} \leq I_g$$

$$I_e = (0.3417)(1,728) + [0.96](728)$$

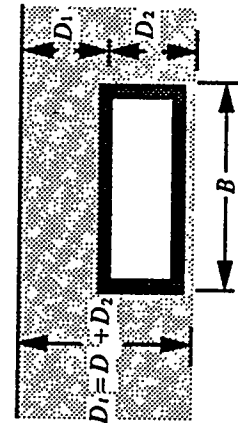
$$\underline{I_e = 1,289 \text{ m}^4} \approx 75\% I_g.$$



Figure(1.3) Tunnel Section

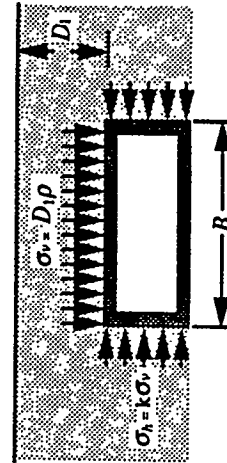
TUNNEL SECTION		STRUCTURAL ASSESSMENT		
PAGE 6 OF 21				
TUNNEL ELEMENT		ACI 318-89	VALUE FROM MODEL	COMPLIANCE
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$				
Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2 \sqrt{f'_c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2 \sqrt{f'_c} B_w d$				
Axial Capacity Design axial load ϕP_{nw} is computed by ACI 318-89 (14-1) $\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{k l_c}{32 h} \right)^2 \right]$ where $\phi = 0.7$				
ROOF STRUCTURE		40207 ft-lbs	19948 ft-lbs	
FLOOR STRUCTURE		40207 ft-lbs	13000 ft-lbs	
LEFT INSIDE WALL		9546 ft-lbs	ft-lbs	
LEFT OUTSIDE WALL		38697 ft-lbs	19848 ft-lbs	
RIGHT INSIDE WALL		9546 ft-lbs	ft-lbs	
RIGHT OUTSIDE WALL		38697 ft-lbs	19948 ft-lbs	
ROOF STRUCTURE		12151 lbs	10739 lbs	
FLOOR STRUCTURE		12151 lbs	10281 lbs	
LEFT WALL		12151 lbs	2242 lbs	
RIGHT WALL		12151 lbs	2242 lbs	
LEFT WALL		185060 lbs	12314 lbs	
RIGHT WALL		185060 lbs	12313 lbs	

Loading Conditions



$$B = 16.5 \text{ ft.} \quad D_2 = 8.5 \text{ ft.}$$

$$D_1 = 7.3 \text{ ft.} \quad D_1 = 15.8 \text{ ft.}$$



$$\text{where } k = \frac{1 - \sin \theta}{1 + \sin \theta}$$

$$k = 0.3$$

$$\sigma_v = D_1 \rho \quad 84.0 \text{ lbs/ft}^2$$

$$\sigma_h = k \sigma_v \quad 25.0 \text{ lbs/ft}^2$$

Figure() Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-5(21/21)

TITLE: Preliminary Structural Assessment of Tunnel Section 5(21/21)

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 5(21/21) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY:

DATE:

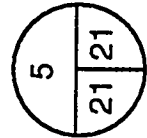
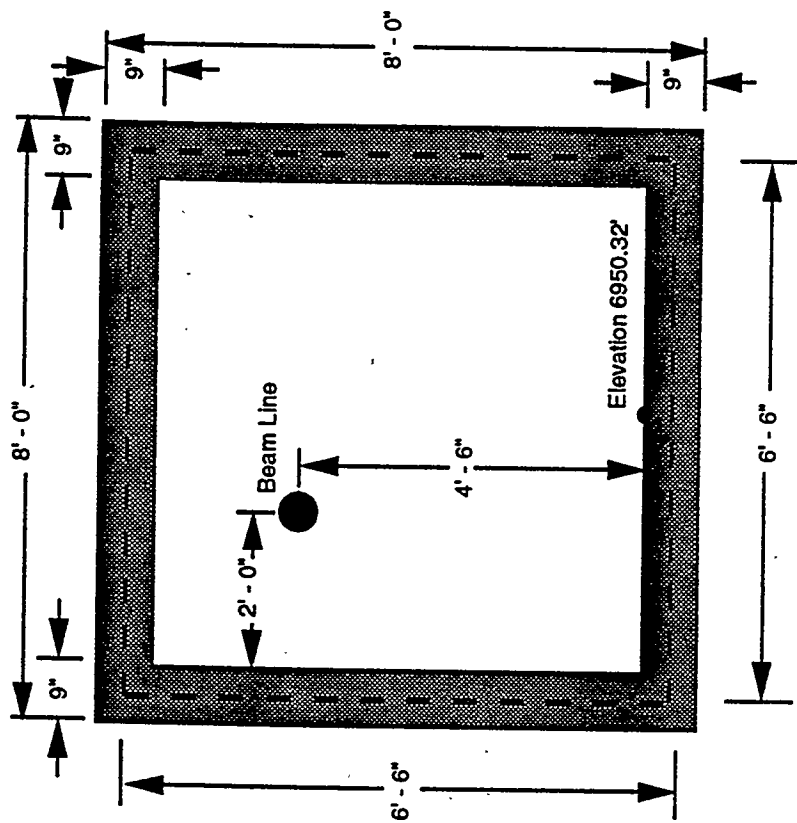
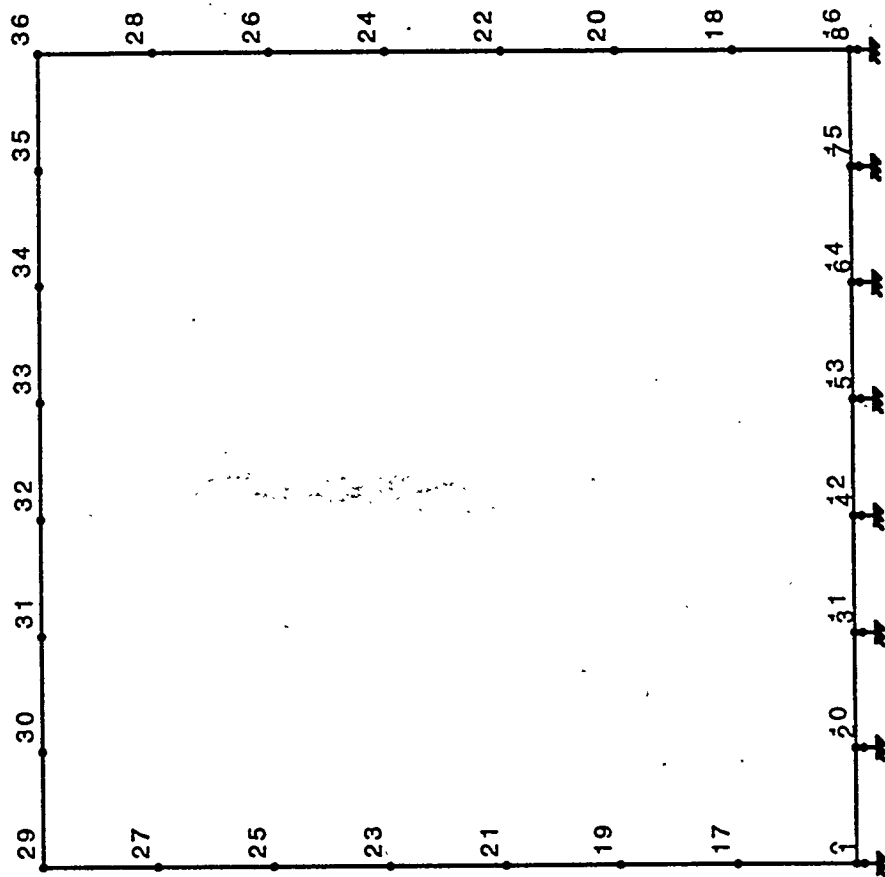
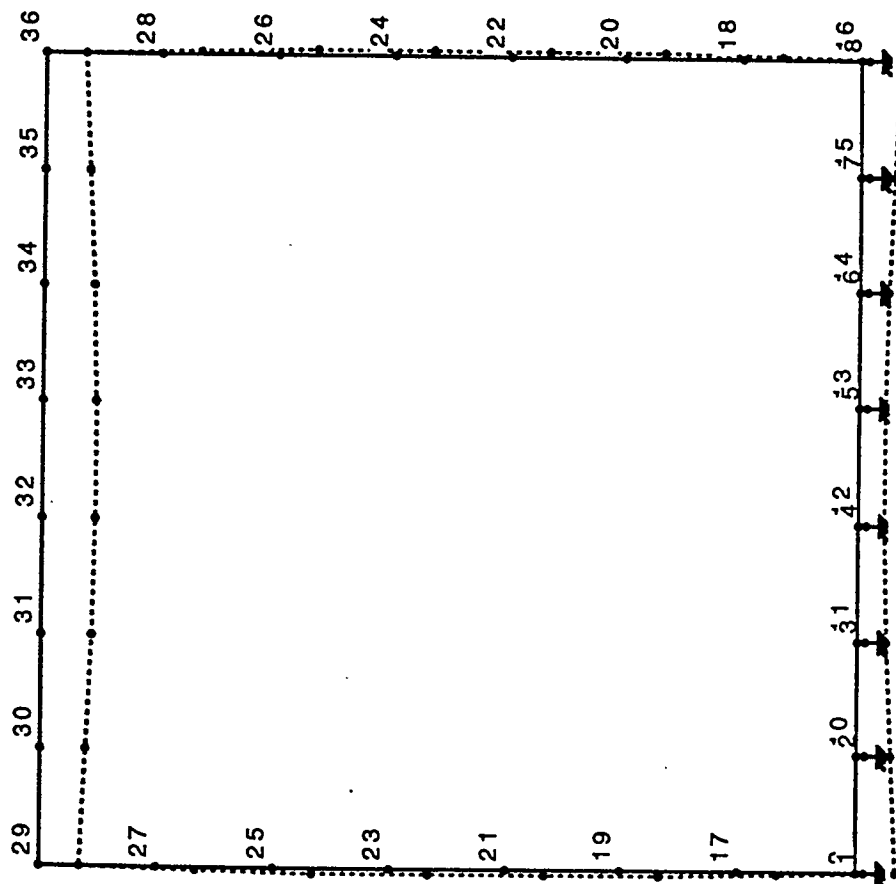


Figure () Section





TUNNEL SECTION 5 21 21	TITLE OF ANALYSIS <u>PRELIMINARY</u> PAGE <u>2</u> OF <u>3</u>

RIGHTWALL ELEMENT PROPERTIES	
Youngs Modulus w 1.5 (33)√f'c	E = <u>3.32×10⁶</u> psi
Area of Cross Section (b x d)	A = <u>108</u> in ²
Depth of Section	d = <u>9</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>112.5</u> lbs/ft
Moment of Inertia b.d ³ /12	Ic = <u>729</u> in ⁴
Sectional Modulus Ic/C	S = <u>162</u> in ³
Radius of Gyration √(Ic/A)	r = <u>2.6</u> in
Neutral Axis	NA = <u>4.5</u> in
Extreme Fiber	C = <u>4.5</u> in
Element Length	L = <u>1.036</u> ft

SOIL ELEMENT PROPERTIES	
Youngs Modulus	E = <u>300</u> psi (K)
Area of Cross Section (b x d)	A = <u>149.2</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12.432</u> in 12
Weight per Unit Length	W = <u>119.14</u> lbs/ft 12.432
Moment of Inertia b.d ³ /12	Ic = <u>1790</u> in ⁴
Sectional Modulus Ic/C	S = <u>298.4</u> in ³
Radius of Gyration √(Ic/A)	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>0.0833</u> ft (1')

SOILBED PROPERTIES	
Youngs Modulus	E = <u>200</u> psi K
Area of Cross Section (b x d)	A = <u>74.59</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>6.216</u> in 12
Weight per Unit Length	W = <u>59.59</u> lbs/ft 6.216
Moment of Inertia b.d ³ /12	Ic = <u>895.5</u> in ⁴
Sectional Modulus Ic/C	S = <u>149.2</u> in ³
Radius of Gyration √(Ic/A)	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>0.0833</u> ft (1')

TUNNEL SECTION

TITLE OF ANALYSIS PRELIMINARYPAGE 1 OF 3

ROOF ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f'c}$	$E = 3.32 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 108$ in ²
Depth of Section	$d = 9$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 112.5$ lbs/ft
Moment of Inertia $b.d^3 / 12$	$I_c = 729$ in ⁴
Sectional Modulus I_c/C	$S = 162$ in ³
Radius of Gyration $\sqrt{I_c/A}$	$r = 2.6$ in
Neutral Axis	$NA = 4.5$ in
Extreme Fiber	$C = 4.5$ in
Element Length	$L = 1.036$ ft

FLOOR ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f'c}$	$E = 3.32 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 108$ in ²
Depth of Section	$d = 9$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 112.5$ lbs/ft
Moment of Inertia $b.d^3 / 12$	$I_c = 729$ in ⁴
Sectional Modulus I_c/C	$S = 162$ in ³
Radius of Gyration $\sqrt{I_c/A}$	$r = 2.6$ in
Neutral Axis	$NA = 4.5$ in
Extreme Fiber	$C = 4.5$ in
Element Length	$L = 1.036$ ft

LEFTWALL ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f'c}$	$E = 3.32 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 108$ in ²
Depth of Section	$d = 9$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 112.5$ lbs/ft
Moment of Inertia $b.d^3 / 12$	$I_c = 729$ in ⁴
Sectional Modulus I_c/C	$S = 162$ in ³
Radius of Gyration $\sqrt{I_c/A}$	$r = 2.6$ in
Neutral Axis	$NA = 4.5$ in
Extreme Fiber	$C = 4.5$ in
Element Length	$L = 1.036$ ft

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

FRAME MAC file: 5(21/21)PRELIMINARY; Last modified at 13:24:37 on Tue, May 4, 1993

Node 29
0.000
7.250

Node 30
1.036
7.250

Node 31
2.071
7.250

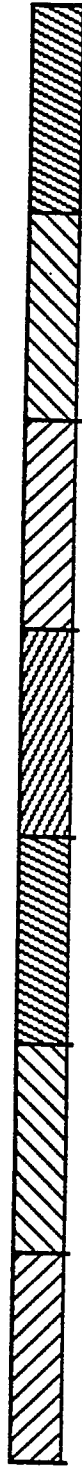
Node 32
3.107
7.250

Node 33
4.143
7.250

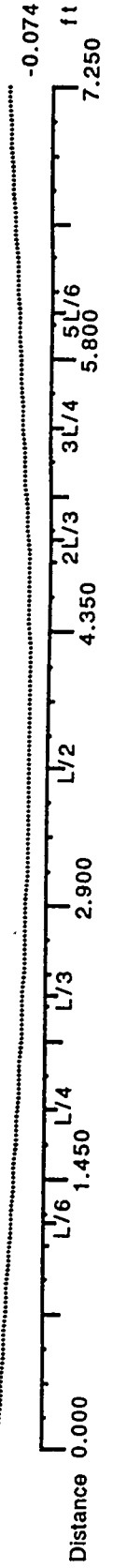
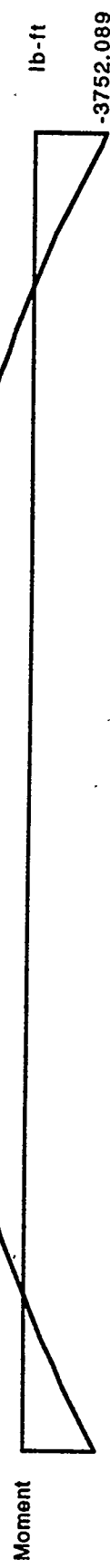
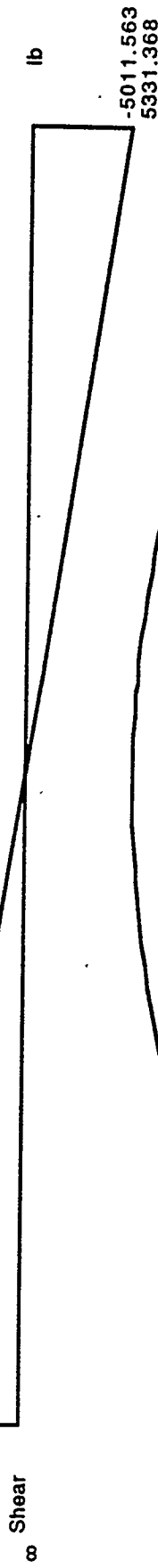
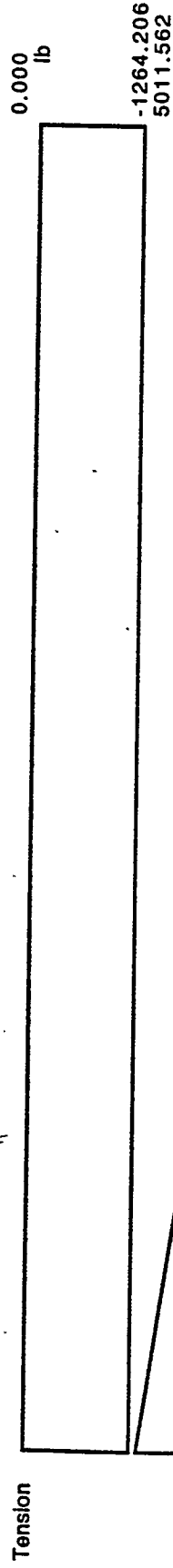
Node 34
5.179
7.250

Node 35
6.214
7.250

Node 36
7.250
7.250



F: lb
D: lb/ft
M: lb-ft
E: psi



Continuous Elements Output Data

FRAME MAC file: 5(21/21)PRELIMINARY.

Last modified at 13:24:37 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
29	0.000	-0.056	-0.000
30	0.000	-0.063	-0.001
31	0.000	-0.069	-0.000
32	0.000	-0.073	-0.000
33	-0.000	-0.073	0.000
34	-0.000	-0.069	0.000
35	-0.000	-0.063	0.001
36	-0.000	-0.056	0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
29,30	0.000	715.938	123.584	0.000	715.938	-123.584
30,31	0.000	715.938	123.584	0.000	715.938	-123.584
31,32	0.000	715.938	123.584	0.000	715.938	-123.584
32,33	0.000	715.938	123.584	0.000	715.938	-123.584
33,34	0.000	715.937	123.584	0.000	715.937	-123.584
34,35	0.000	715.937	123.584	0.000	715.937	-123.584
35,36	0.000	715.938	123.584	0.000	715.938	-123.584

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
29,30	1264.206	5011.562	3752.089	-1264.206	-3579.688	696.952
30,31	1264.206	3579.687	-696.952	-1264.206	-2147.812	3662.978
31,32	1264.206	2147.813	-3662.978	-1264.206	-715.938	5145.992
32,33	1264.206	715.938	-5145.992	-1264.206	715.937	5145.992
33,34	1264.206	-715.938	-5145.992	-1264.206	2147.813	3662.978
34,35	1264.206	-2147.813	-3662.978	-1264.206	3579.688	696.952
35,36	1264.206	-3579.688	-696.952	-1264.206	5011.563	-3752.089

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
29,30	0.000	-0.056	-0.000	0.000	-0.063	-0.001
30,31	0.000	-0.063	-0.001	0.000	-0.069	-0.000
31,32	0.000	-0.069	-0.000	0.000	-0.073	-0.000
32,33	0.000	-0.073	-0.000	-0.000	-0.073	0.000
33,34	-0.000	-0.073	0.000	-0.000	-0.069	0.000
34,35	-0.000	-0.069	0.000	-0.000	-0.063	0.001
35,36	-0.000	-0.063	0.001	-0.000	-0.056	0.000

Maximum deformations:

Node 36 moved 0.000 inch to the left.
Node 29 moved 0.000 inch to the right.
Node 32 moved 0.073 inch downwards.
No nodes moved upwards.
Node 30 rotated 0.001 radian clockwise.
Node 35 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
29,30	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
30,31	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
31,32	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
32,33	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
33,34	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
34,35	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
35,36	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
29,30	5011.562	0.000	5011.562	46.403	0.000	46.403
30,31	3579.687	0.000	3579.687	33.145	0.000	33.145
31,32	2147.813	0.000	2147.813	19.887	0.000	19.887
32,33	715.938	-715.937	715.938	6.629	-6.629	6.629
33,34	0.000	-2147.813	-2147.813	0.000	-19.887	-19.887
34,35	0.000	-3579.688	-3579.688	0.000	-33.145	-33.145
35,36	0.000	-5011.563	-5011.563	0.000	-46.403	-46.403

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
29,30	696.952	-3752.089	-3752.089	51.626	-277.932	-277.932
30,31	3662.978	0.000	3662.978	271.332	0.000	271.332
31,32	5145.992	0.000	5145.992	381.185	0.000	381.185
32,33	5331.368	0.000	5331.368	394.916	0.000	394.916
33,34	5145.992	0.000	5145.992	381.185	0.000	381.185
34,35	3662.978	0.000	3662.978	271.332	0.000	271.332
35,36	696.952	-3752.089	-3752.089	51.626	-277.932	-277.932

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
29,30	0.000	-0.063	-0.063
30,31	0.000	-0.069	-0.069
31,32	0.000	-0.073	-0.073
32,33	0.000	-0.074	-0.074
33,34	0.000	-0.073	-0.073
34,35	0.000	-0.069	-0.069
35,36	0.000	-0.063	-0.063

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch

At the intermediate nodes:

1.036	-0.001	-0.063
2.071	-0.000	-0.069
3.107	-0.000	-0.073
4.143	0.000	-0.073
5.179	0.000	-0.069
6.214	0.001	-0.063

At evenly-spaced intervals:

0.000	-0.000	-0.056
0.725	-0.001	-0.061
1.450	-0.001	-0.066
2.175	-0.000	-0.070
2.900	-0.000	-0.073
3.625	0.000	-0.074

4.350	0.000	-0.073
5.075	0.000	-0.070
5.800	0.001	-0.066
6.525	0.001	-0.061
7.250	0.000	-0.056

FRAME MAC file: 5(21/21)PRELIMINARY; Last modified at 13:24:37 on Tue, May 4, 1993

Node 9
0.000
0.000

Node 10
1.036
0.000

Node 11
2.071
0.000

Node 12
3.107
0.000

Node 13
4.143
0.000

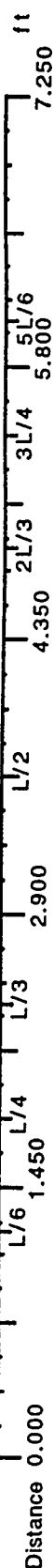
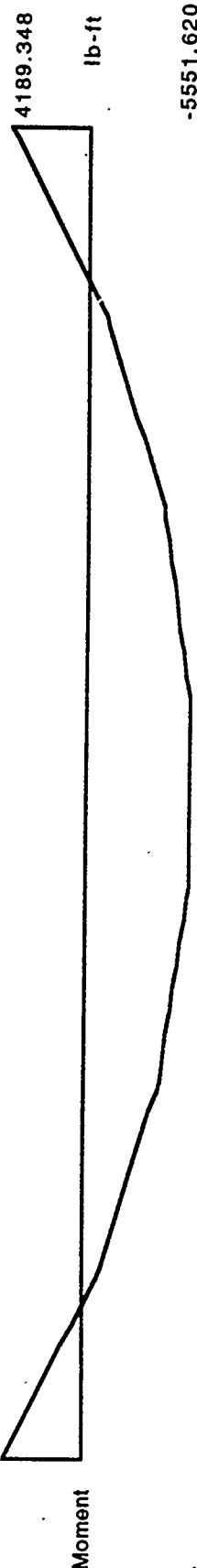
Node 14
5.179
0.000

Node 15
6.214
0.000

Node 16
7.250
0.000

F: lb
D: lb/ft
M: lb-ft
E: psi
1845.995

Load



Continuous Elements Output Data

FRAME MAC file: 5(21/21)PRELIMINARY.

Last modified at 13:24:37 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
9	-0.000	-0.054	0.001
10	-0.000	-0.047	0.001
11	-0.000	-0.040	0.000
12	-0.000	-0.036	0.000
13	0.000	-0.036	-0.000
14	0.000	-0.040	-0.000
15	0.000	-0.047	-0.001
16	0.000	-0.054	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
9,10	0.000	81.562	14.079	0.000	81.562	-14.079
10,11	0.000	81.562	14.079	0.000	81.562	-14.079
11,12	0.000	81.562	14.079	0.000	81.562	-14.079
12,13	0.000	81.562	14.079	0.000	81.562	-14.079
13,14	0.000	81.562	14.079	0.000	81.562	-14.079
14,15	0.000	81.562	14.079	0.000	81.562	-14.079
15,16	0.000	81.563	14.079	0.000	81.563	-14.079

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
9,10	781.383	-4936.148	-4189.348	-781.383	5099.273	-1007.566
10,11	-548.897	-2996.180	924.423	548.897	3159.305	-4112.085
11,12	-1504.636	-1366.874	4051.454	1504.636	1529.999	-5551.620
12,13	-1845.995	81.563	5529.792	1845.995	81.562	-5529.792
13,14	-1504.636	1529.999	5551.620	1504.636	-1366.874	-4051.454
14,15	-548.897	3159.305	4112.085	548.897	-2996.180	-924.423
15,16	781.383	5099.273	1007.566	-781.383	-4936.148	4189.348

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
9,10	-0.000	-0.054	0.001	-0.000	-0.047	0.001
10,11	-0.000	-0.047	0.001	-0.000	-0.040	0.000
11,12	-0.000	-0.040	0.000	-0.000	-0.036	0.000
12,13	-0.000	-0.036	0.000	0.000	-0.036	-0.000
13,14	0.000	-0.036	-0.000	0.000	-0.040	-0.000
14,15	0.000	-0.040	-0.000	0.000	-0.047	-0.001
15,16	0.000	-0.047	-0.001	0.000	-0.054	-0.001

Maximum deformations:

Node 10 moved 0.000 inch to the left.
Node 15 moved 0.000 inch to the right.
Node 9 moved 0.054 inch downwards.
No nodes moved upwards.
Node 15 rotated 0.001 radian clockwise.
Node 10 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative);						
From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
9,10	0.000	-781.383	-781.383	0.000	-7.235	-7.235
10,11	548.897	0.000	548.897	5.082	0.000	5.082
11,12	1504.636	0.000	1504.636	13.932	0.000	13.932
12,13	1845.995	0.000	1845.995	17.093	0.000	17.093
13,14	1504.636	0.000	1504.636	13.932	0.000	13.932
14,15	548.897	0.000	548.897	5.082	0.000	5.082
15,16	0.000	-781.383	-781.383	0.000	-7.235	-7.235

Maximum shear and shear stress values:						
From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
9,10	0.000	-5099.273	-5099.273	0.000	-47.215	-47.215
10,11	0.000	-3159.305	-3159.305	0.000	-29.253	-29.253
11,12	0.000	-1529.999	-1529.999	0.000	-14.167	-14.167
12,13	81.563	-81.562	81.563	0.755	-0.755	0.755
13,14	1529.999	0.000	1529.999	14.167	0.000	14.167
14,15	3159.305	0.000	3159.305	29.253	0.000	29.253
15,16	5099.273	0.000	5099.273	47.215	0.000	47.215

Maximum moment and bending stress values:						
From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
9,10	4189.348	-1007.566	4189.348	310.322	-74.635	310.322
10,11	0.000	-4112.085	-4112.085	0.000	-304.599	-304.599
11,12	0.000	-5551.620	-5551.620	0.000	-411.231	-411.231
12,13	0.000	-5529.792	-5529.792	0.000	-409.614	-409.614
13,14	0.000	-5551.620	-5551.620	0.000	-411.231	-411.231
14,15	0.000	-4112.085	-4112.085	0.000	-304.599	-304.599
15,16	4189.348	-1007.566	4189.348	310.322	-74.635	310.322

Maximum deflection values:			
From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
9,10	0.000	-0.054	-0.054
10,11	0.000	-0.047	-0.047
11,12	0.000	-0.040	-0.040
12,13	0.000	-0.036	-0.036
13,14	0.000	-0.040	-0.040
14,15	0.000	-0.047	-0.047
15,16	0.000	-0.054	-0.054

Deflections along the elements (positive is up or counter-clockwise):		
Distance from left (bottom) ft	Rotation radian	Deflection inch

At the intermediate nodes:		
1.036	0.001	-0.047
2.071	0.000	-0.040
3.107	0.000	-0.036
4.143	-0.000	-0.036
5.179	-0.000	-0.040
6.214	-0.001	-0.047

At evenly-spaced intervals:		
0.000	0.001	-0.054
0.725	0.001	-0.049
1.450	0.001	-0.044
2.175	0.000	-0.039
2.900	0.000	-0.037
3.625	0.000	-0.035

4.350	-0.000	-0.037
5.075	-0.000	-0.039
5.800	-0.001	-0.044
6.525	-0.001	-0.049
7.250	-0.001	-0.054

FRAME MAC file: 5(21/21)PRELIMINARY; Last modified at 13:24:37 on Tue, May 4, 1993

Node 9
0.000
0.000

Node 17
0.000
1.036

Node 19
0.000
2.071

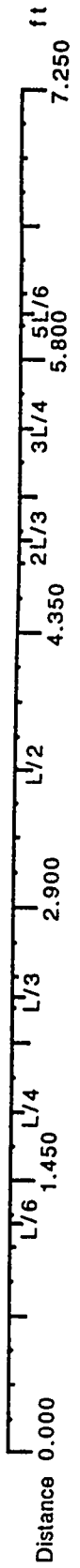
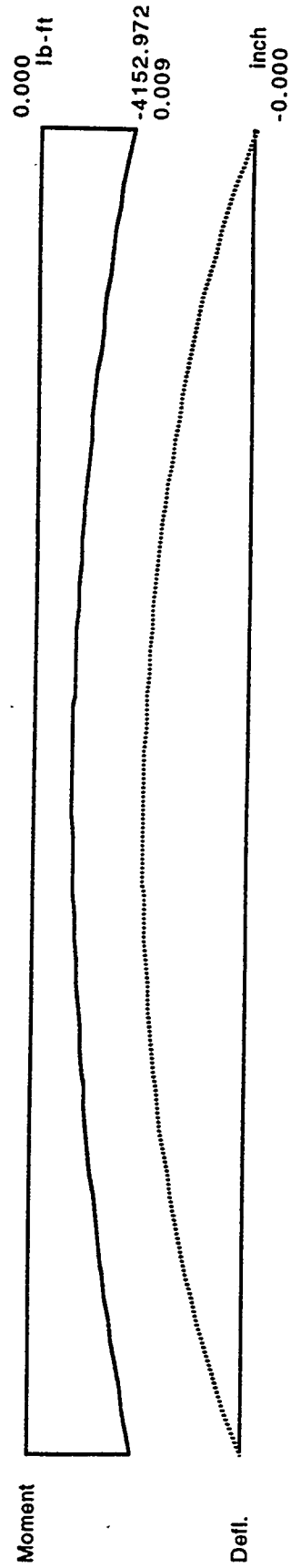
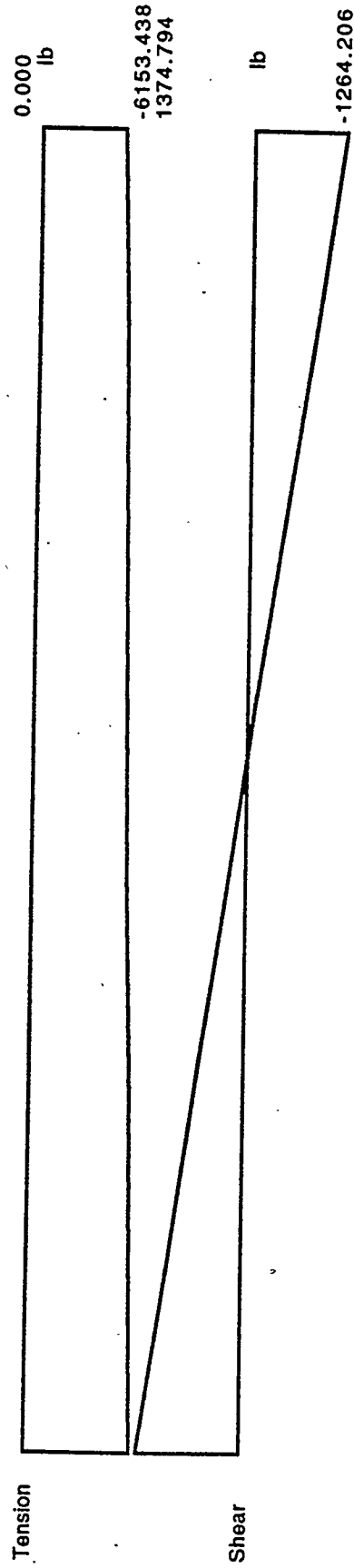
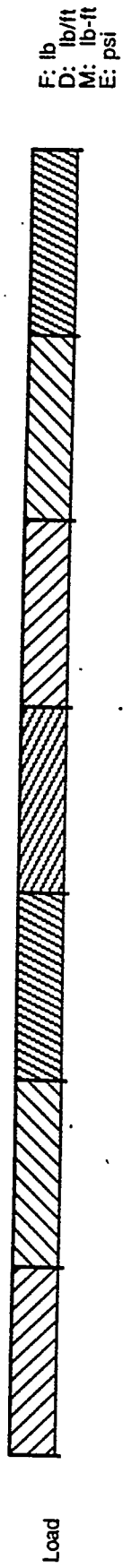
Node 21
0.000
3.107

Node 23
0.000
4.143

Node 25
0.000
5.179

Node 27
0.000
6.214

Node 29
0.000
7.250



Continuous Elements Output Data

FRAME MAC file: 5(21/21)PRELIMINARY.

Last modified at 13:24:37 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
9	-0.000	-0.054	0.001
17	-0.005	-0.055	0.000
19	-0.008	-0.055	0.000
21	-0.009	-0.055	0.000
23	-0.009	-0.055	-0.000
25	-0.008	-0.055	-0.000
27	-0.005	-0.056	-0.000
29	0.000	-0.056	-0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
9,17	81.562	188.500	32.539	81.562	188.500	-32.539
17,19	81.562	188.500	32.539	81.562	188.500	-32.539
19,21	81.562	188.500	32.539	81.562	188.500	-32.539
21,23	81.562	188.500	32.539	81.562	188.500	-32.539
23,25	81.562	188.500	32.539	81.562	188.500	-32.539
25,27	81.562	188.500	32.539	81.562	188.500	-32.539
27,29	81.563	188.500	32.539	81.563	188.500	-32.539

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
9,17	6153.438	1374.794	4152.972	-5990.313	-997.794	-2924.310
17,19	5990.313	997.794	2924.310	-5827.188	-620.794	-2086.113
19,21	5827.188	620.794	2086.113	-5664.063	-243.794	-1638.379
21,23	5664.063	243.794	1638.379	-5500.938	133.206	-1581.110
23,25	5500.938	-133.206	1581.110	-5337.813	510.206	-1914.305
25,27	5337.813	-510.206	1914.305	-5174.688	887.206	-2637.965
27,29	5174.688	-887.206	2637.965	-5011.563	1264.206	-3752.089

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
9,17	-0.054	0.000	0.001	-0.055	0.005	0.000
17,19	-0.055	0.005	0.000	-0.055	0.008	0.000
19,21	-0.055	0.008	0.000	-0.055	0.009	0.000
21,23	-0.055	0.009	0.000	-0.055	0.009	-0.000
23,25	-0.055	0.009	-0.000	-0.055	0.008	-0.000
25,27	-0.055	0.008	-0.000	-0.056	0.005	-0.000
27,29	-0.056	0.005	-0.000	-0.056	-0.000	-0.000

Maximum deformations:

Node 21 moved 0.009 inch to the left.
Node 29 moved 0.000 inch to the right.
Node 29 moved 0.056 inch downwards.
No nodes moved upwards.
Node 29 rotated 0.000 radian clockwise.
Node 9 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
9,17	0.000	-6153.438	-6153.438	0.000	-56.976	-56.976
17,19	0.000	-5990.313	-5990.313	0.000	-55.466	-55.466
19,21	0.000	-5827.188	-5827.188	0.000	-53.955	-53.955
21,23	0.000	-5664.063	-5664.063	0.000	-52.445	-52.445
23,25	0.000	-5500.938	-5500.938	0.000	-50.935	-50.935
25,27	0.000	-5337.813	-5337.813	0.000	-49.424	-49.424
27,29	0.000	-5174.688	-5174.688	0.000	-47.914	-47.914

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
9,17	1374.794	0.000	1374.794	12.730	0.000	12.730
17,19	997.794	0.000	997.794	9.239	0.000	9.239
19,21	620.794	0.000	620.794	5.748	0.000	5.748
21,23	243.794	-133.206	243.794	2.257	-1.233	2.257
23,25	0.000	-510.206	-510.206	0.000	-4.724	-4.724
25,27	0.000	-887.206	-887.206	0.000	-8.215	-8.215
27,29	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
9,17	0.000	-4152.972	-4152.972	0.000	-307.628	-307.628
17,19	0.000	-2924.310	-2924.310	0.000	-216.616	-216.616
19,21	0.000	-2086.113	-2086.113	0.000	-154.527	-154.527
21,23	0.000	-1638.379	-1638.379	0.000	-121.361	-121.361
23,25	0.000	-1914.305	-1914.305	0.000	-141.800	-141.800
25,27	0.000	-2637.965	-2637.965	0.000	-195.405	-195.405
27,29	0.000	-3752.089	-3752.089	0.000	-277.932	-277.932

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
9,17	0.005	0.000	0.005
17,19	0.008	0.000	0.008
19,21	0.009	0.000	0.009
21,23	0.009	0.000	0.009
23,25	0.009	0.000	0.009
25,27	0.008	0.000	0.008
27,29	0.005	-0.000	0.005

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch

At the intermediate nodes:

1.036	0.000	0.005
2.071	0.000	0.008
3.107	0.000	0.009
4.143	-0.000	0.009
5.179	-0.000	0.008
6.214	-0.000	0.005

At evenly-spaced intervals:

0.000	0.001	0.000
0.725	0.000	0.004
1.450	0.000	0.006
2.175	0.000	0.008
2.900	0.000	0.009
3.625	-0.000	0.009

4.350	-0.000	0.009
5.075	-0.000	0.008
5.800	-0.000	0.006
6.525	-0.000	0.004
7.250	-0.000	-0.000

FRAME MAC file: 5(21/21)PRELIMINARY; Last modified at 13:24:37 on Tue, May 4, 1993

Node 16
7.250
0.000

Node 18
7.250
1.036

Node 20
7.250
2.071

Node 22
7.250
3.107

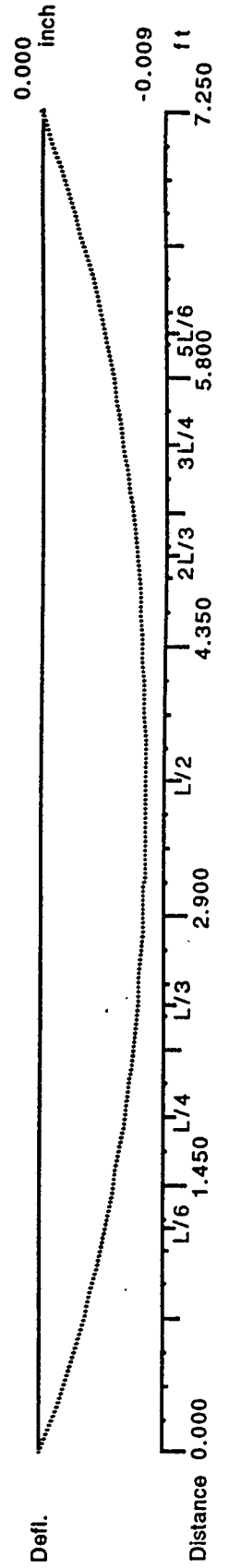
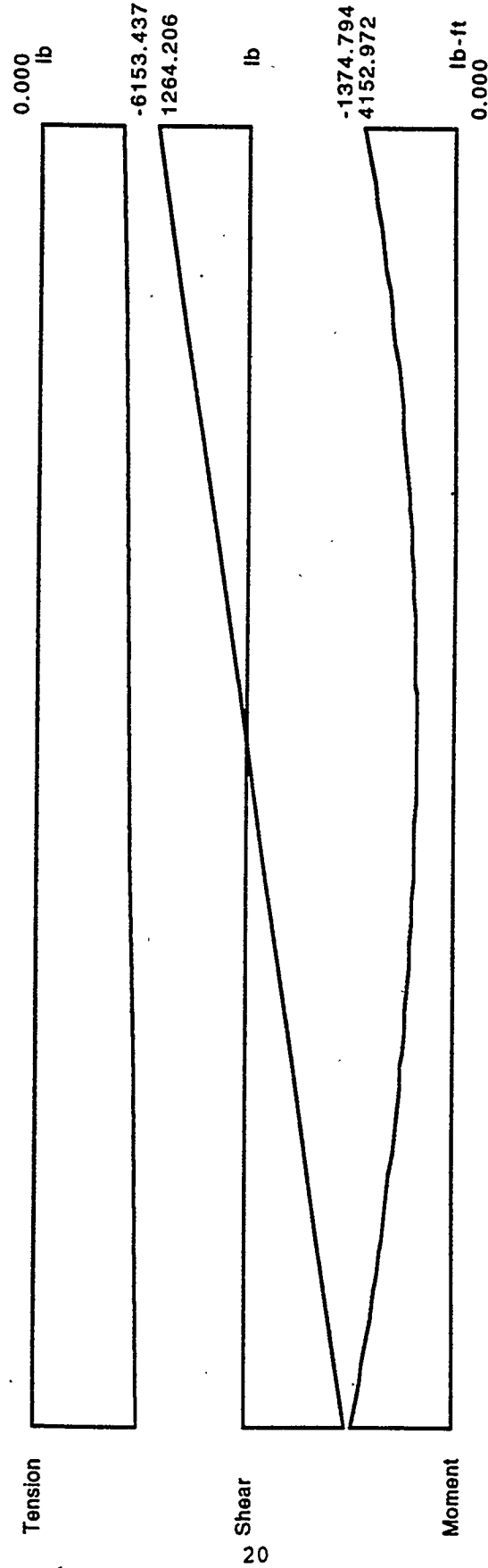
Node 24
7.250
4.143

Node 26
7.250
5.179

Node 28
7.250
6.214

Node 36
7.250
7.250

F: lb
D: lb/ft
M: lb-ft
E: psi



Continuous Elements Output Data

FRAME MAC file: 5(21/21)PRELIMINARY.

Last modified at 13:24:37 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
16	0.000	-0.054	-0.001
18	0.005	-0.055	-0.000
20	0.008	-0.055	-0.000
22	0.009	-0.055	-0.000
24	0.009	-0.055	0.000
26	0.008	-0.055	0.000
28	0.005	-0.056	0.000
36	-0.000	-0.056	0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
16,18	81.562	-188.500	-32.539	81.562	-188.500	32.539
18,20	81.562	-188.500	-32.539	81.562	-188.500	32.539
20,22	81.562	-188.500	-32.539	81.562	-188.500	32.539
22,24	81.562	-188.500	-32.539	81.562	-188.500	32.539
24,26	81.562	-188.500	-32.539	81.562	-188.500	32.539
26,28	81.562	-188.500	-32.539	81.562	-188.500	32.539
28,36	81.563	-188.500	-32.539	81.563	-188.500	32.539

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
16,18	6153.437	-1374.794	-4152.972	-5990.312	997.794	2924.310
18,20	5990.312	-997.794	-2924.310	-5827.187	620.794	2086.113
20,22	5827.187	-620.794	-2086.113	-5664.062	243.794	1638.379
22,24	5664.062	-243.794	-1638.379	-5500.937	-133.206	1581.110
24,26	5500.937	133.206	-1581.110	-5337.812	-510.206	1914.305
26,28	5337.812	510.206	-1914.305	-5174.687	-887.206	2637.965
28,36	5174.687	887.206	-2637.965	-5011.562	-1264.206	3752.089

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
16,18	-0.054	-0.000	-0.001	-0.055	-0.005	-0.000
18,20	-0.055	-0.005	-0.000	-0.055	-0.008	-0.000
20,22	-0.055	-0.008	-0.000	-0.055	-0.009	-0.000
22,24	-0.055	-0.009	-0.000	-0.055	-0.009	0.000
24,26	-0.055	-0.009	0.000	-0.055	-0.008	0.000
26,28	-0.055	-0.008	0.000	-0.056	-0.005	0.000
28,36	-0.056	-0.005	0.000	-0.056	0.000	0.000

Maximum deformations:

Node 36 moved 0.000 inch to the left.
Node 22 moved 0.009 inch to the right.
Node 36 moved 0.056 inch downwards.
No nodes moved upwards.
Node 16 rotated 0.001 radian clockwise.
Node 36 rotated 0.000 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative)

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	M ten

16,18	0.000	-6153.437	-6153.437	0.000	-
18,20	0.000	-5990.312	-5990.312	0.000	-
20,22	0.000	-5827.187	-5827.187	0.000	-
22,24	0.000	-5664.062	-5664.062	0.000	-
24,26	0.000	-5500.937	-5500.937	0.000	-
26,28	0.000	-5337.812	-5337.812	0.000	-
28,36	0.000	-5174.687	-5174.687	0.000	-

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	M shr

16,18	0.000	-1374.794	-1374.794	0.000	-
18,20	0.000	-997.794	-997.794	0.000	-
20,22	0.000	-620.794	-620.794	0.000	-
22,24	133.206	-243.794	-243.794	1.233	-
24,26	510.206	0.000	510.206	4.724	-
26,28	887.206	0.000	887.206	8.215	-
28,36	1264.206	0.000	1264.206	11.706	-

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	M ben

16,18	4152.972	0.000	4152.972	307.628	-
18,20	2924.310	0.000	2924.310	216.616	-
20,22	2086.113	0.000	2086.113	154.527	-
22,24	1638.379	0.000	1638.379	121.361	-
24,26	1914.305	0.000	1914.305	141.800	-
26,28	2637.965	0.000	2637.965	195.405	-
28,36	3752.089	0.000	3752.089	277.932	-

Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch

16,18	0.000	-0.005
18,20	0.000	-0.008
20,22	0.000	-0.009
22,24	0.000	-0.009
24,26	0.000	-0.009
26,28	0.000	-0.008
28,36	0.000	-0.005

Deflections along the elements (positive is up or counter-cl.
Distance from left (bottom) ft Rotation ---
radian

At the intermediate nodes:

1.036	-0.000
2.071	-0.000
3.107	-0.000
4.143	0.000
5.179	0.000
6.214	0.000

At evenly-spaced intervals:

0.000	-0.001
0.725	-0.000
1.450	-0.000
2.175	-0.000
2.900	-0.000
3.625	0.000

4.350	0.000	-0.009
5.075	0.000	-0.008
5.800	0.000	-0.006
6.525	0.000	-0.004
7.250	0.000	0.000

Output Data

FRAME MAC file: 5(21/21)PRELIMINARY.

Last modified at 13:24:37 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

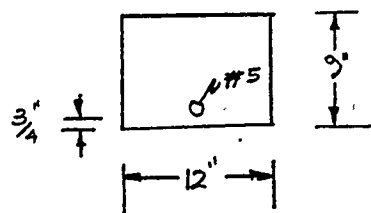
Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,9	0.000	-1217.289	-1217.289	0.000	-16.320	-16.320
2,10	0.000	-2103.093	-2103.093	0.000	-14.096	-14.096
3,11	0.000	-1792.432	-1792.432	0.000	-12.014	-12.014
4,12	0.000	-1611.561	-1611.561	0.000	-10.801	-10.801
5,13	0.000	-1611.561	-1611.561	0.000	-10.801	-10.801
6,14	0.000	-1792.432	-1792.432	0.000	-12.014	-12.014
7,15	0.000	-2103.093	-2103.093	0.000	-14.096	-14.096
8,16	0.000	-1217.289	-1217.289	0.000	-16.320	-16.320
9,10	0.000	-781.383	-781.383	0.000	-7.235	-7.235
9,17	0.000	-6153.438	-6153.438	0.000	-56.976	-56.976
10,11	548.897	0.000	548.897	5.082	0.000	5.082
11,12	1504.636	0.000	1504.636	13.932	0.000	13.932
12,13	1845.995	0.000	1845.995	17.093	0.000	17.093
13,14	1504.636	0.000	1504.636	13.932	0.000	13.932
14,15	548.897	0.000	548.897	5.082	0.000	5.082
15,16	0.000	-781.383	-781.383	0.000	-7.235	-7.235
16,18	0.000	-6153.437	-6153.437	0.000	-56.976	-56.976
17,19	0.000	-5990.313	-5990.313	0.000	-55.466	-55.466
18,20	0.000	-5990.312	-5990.312	0.000	-55.466	-55.466
19,21	0.000	-5827.188	-5827.188	0.000	-53.955	-53.955
20,22	0.000	-5827.187	-5827.187	0.000	-53.955	-53.955
21,23	0.000	-5664.063	-5664.063	0.000	-52.445	-52.445
22,24	0.000	-5664.062	-5664.062	0.000	-52.445	-52.445
23,25	0.000	-5500.938	-5500.938	0.000	-50.935	-50.935
24,26	0.000	-5500.937	-5500.937	0.000	-50.935	-50.935
25,27	0.000	-5337.813	-5337.813	0.000	-49.424	-49.424
26,28	0.000	-5337.812	-5337.812	0.000	-49.424	-49.424
27,29	0.000	-5174.688	-5174.688	0.000	-47.914	-47.914
28,36	0.000	-5174.687	-5174.687	0.000	-47.914	-47.914
29,30	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
30,31	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
31,32	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
32,33	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
33,34	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
34,35	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706
35,36	0.000	-1264.206	-1264.206	0.000	-11.706	-11.706

SOIL ELEMENTS

= -

1. MOMENT CAPACITY - ROOF, FLOOR WALLS



$$A_{ST} = (1)(\pi) \frac{(0.625)^2}{4} = 0.31 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12''$$

$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.31)(60,000)}{(0.85)(3,000)(12)} = 0.609 \text{ in} \quad d = 9 - 0.75 - 0.625/2 = 7.94 \text{ in}$$

$$\phi = 0.9$$

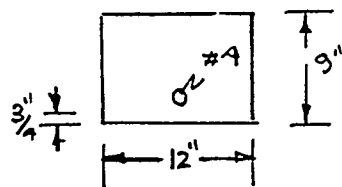
$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$= 0.9 \left[(0.31)(60,000) \left(7.94 - \frac{0.609}{2} \right) \right]$$

$$= 12,408 \text{ in-lbs}$$

$$= 1033 \text{ ft-lbs}$$

LEFT & RIGHT WALLS.
INSIDE.



$$A_{ST} = (1)(\pi) \frac{(0.5)^2}{4} = 0.196 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12''$$

$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.196)(60,000)}{(0.85)(3,000)(12)} = 0.384 \text{ in} \quad d = 9 - 0.75 - 0.5/2 = 8 \text{ in}$$

$$\phi = 0.9$$

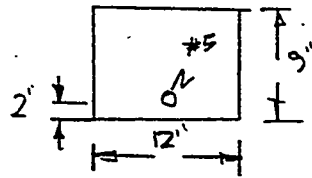
$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$= 0.9 \left[(0.196)(60,000) \left(8 - \frac{0.384}{2} \right) \right]$$

$$= 8276 \text{ in-lbs}$$

$$= 689 \text{ ft-lbs}$$

LEFT & RIGHT WALLS cont'd



$$A_{st} = \frac{(1)(T)(0.625)^2}{4} = 0.31 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$d = 9 - 2 - \frac{0.625}{2} = 6.70 \text{ in}$$

$$a = \frac{A_{st} f_y}{0.85 f'_c b} = \frac{(0.31)(60,000)}{(0.85)(3,000)(12)} = 0.61 \text{ in}^2$$

$$\phi M_n = \phi \left[A_{st} f_y \left(d - \frac{a}{2} \right) \right]$$

$$= 0.9 \left[(0.31)(60,000) \left(6.70 - \frac{0.61}{2} \right) \right]$$

$$= 103,734 \text{ in-lbs}$$

$$= \underline{8644 \text{ ft-lbs}}$$

2. SHEAR CAPACITY

$$\phi V_c = (0.85) 2 \sqrt{f'_c} \cdot b_w d$$

$$= (0.85)(2) \sqrt{3,000} \cdot (12)(7.94)$$

$$\phi V_c = \underline{8,872 \text{ lb}}$$

$$\phi = 0.85$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12''$$

$$d = 9 - 0.75 - \frac{0.625}{2} = 7$$

3. AXIAL CAPACITY

$$\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$= (0.55)(0.7)(3000)(108) \left[1 - \left(\frac{(0.8)(89)}{(32)(9)} \right)^2 \right]$$

$$\phi P_{nw} = \underline{117,116 \text{ lb}}$$

$$\phi = 0.7$$

$$l_c = 7.5 \times = 89'$$

$$h = 9''$$

$$K = 0.8$$

$$A_g = 12'' \times 9'' = 108''$$

$$f'_c = 3,000 \text{ psi}$$

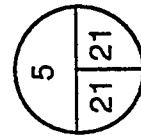
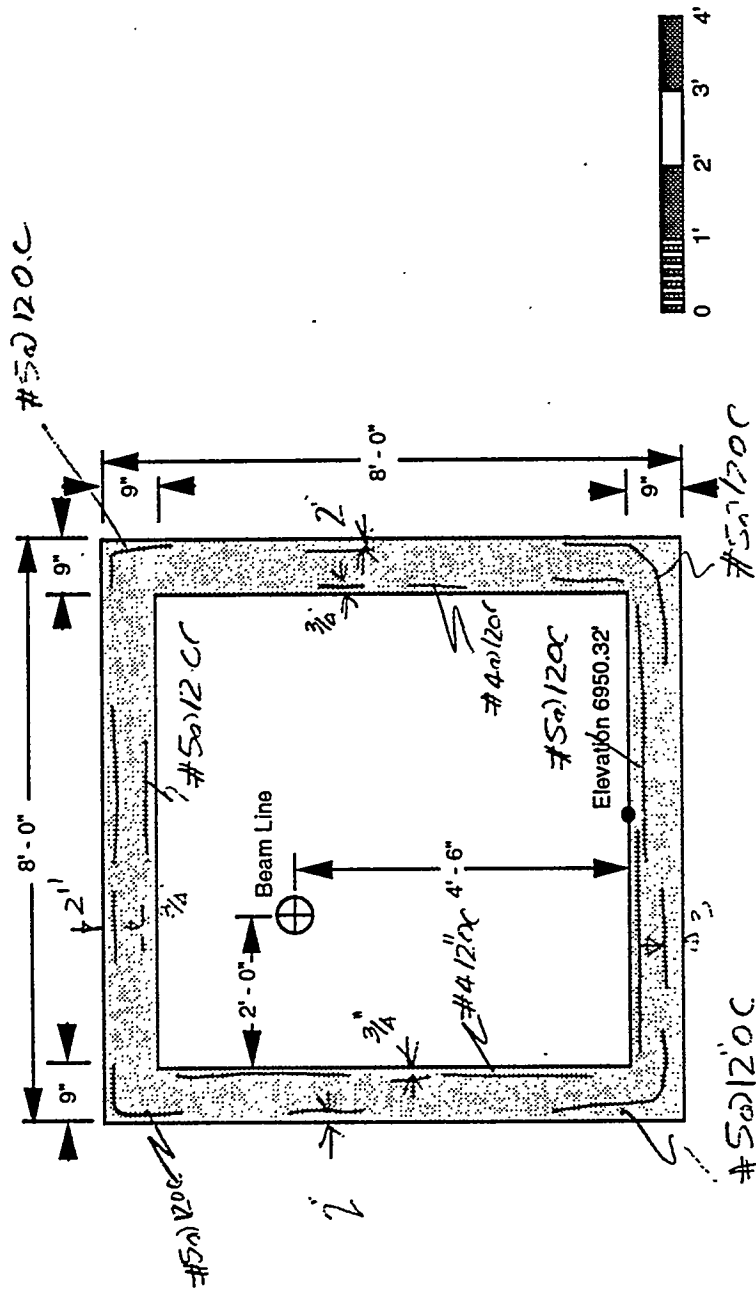
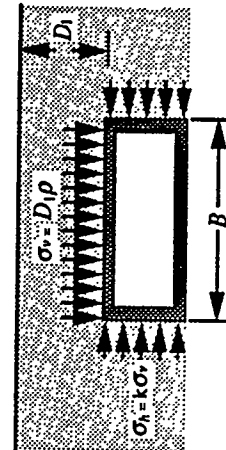
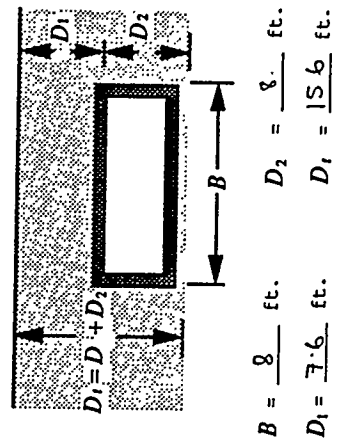


FIGURE () Section

TUNNEL SECTION		PRELIMINARY				STRUCTURAL ASSESSMENT	
PAGE ____ OF ____		TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE		
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$		ROOF STRUCTURE	<u>10336</u> ft-lbs	<u>5331</u> ft-lbs			
		FLOOR STRUCTURE	<u>10336</u> ft-lbs	<u>5551</u> ft-lbs			
		LEFT INSIDE WALL	<u>6897</u> ft-lbs	ft-lbs			
		LEFT OUTSIDE WALL	<u>8672</u> ft-lbs	<u>4153</u> ft-lbs			
		RIGHT INSIDE WALL	<u>6897</u> ft-lbs	ft-lbs			
		RIGHT OUTSIDE WALL	<u>8672</u> ft-lbs	<u>4153</u> ft-lbs			
		ROOF STRUCTURE	<u>8872</u> lbs	<u>5011</u> lbs			
		FLOOR STRUCTURE	<u>8872</u> lbs	<u>5092</u> lbs			
		LEFT WALL	<u>8872</u> lbs	<u>1374</u> lbs			
		RIGHT WALL	<u>8872</u> lbs	<u>1374</u> lbs			
Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2\sqrt{f'c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2\sqrt{f'c} B_w d$		LEFT WALL	<u>117116</u> lbs	<u>6153</u> lbs			
		RIGHT WALL	<u>117116</u> lbs	<u>6153</u> lbs			
Axial Capacity Design axial load ϕP_{nw} is computed by ACI 318-89 (14-1) $\phi P_{nw} = 0.55 \phi f'c A_g \left[1 - \left(\frac{kl_c}{32h} \right)^2 \right]$ where $\phi = 0.7$							

Loading Conditions



where $k = \frac{1 - \sin \theta}{1 + \sin \theta}$
 $k = 0.3$

Figure() Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-3 (21/21)

TITLE: Preliminary Structural Assessment of Tunnel Section 3 (21/21)

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 3(21/21)) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY:

DATE:

ROOF ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f \cdot c}$	$E = 332 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c / C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c / A}$	$r = 3.464$ in
Neutral Axis	$NA = 60$ in
Extreme Fiber	$C = 60$ in
Element Length	$L = 1.0$ ft

FLOOR ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f \cdot c}$	$E = 332 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c / C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c / A}$	$r = 3.46$ in
Neutral Axis	$NA = 60$ in
Extreme Fiber	$C = 60$ in
Element Length	$L = 1.0$ ft

LEFTWALL ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f \cdot c}$	$E = 332 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c / C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c / A}$	$r = 3.46$ in
Neutral Axis	$NA = 60$ in
Extreme Fiber	$C = 60$ in
Element Length	$L = 1.76$ ft

RIGHTWALL ELEMENT PROPERTIES

Youngs Modulus $w 1.5 (33) \sqrt{f \cdot c}$ $E = 332.10^6$ psi
 Area of Cross Section (b x d) $A = 144$ in²
 Depth of Section $d = 12$ in
 Thickness of Web $b = 12$ in
 Weight per Unit Length $W = 150$ lbs/ft
 Moment of Inertia $b \cdot d^3 / 12$ $I_c = 1728$ in⁴
 Sectional Modulus I_c / C $S = 288$ in³
 Radius of Gyration $\sqrt{I_c / A}$ $r = 34.64$ in
 Neutral Axis $NA = 60$ in
 Extreme Fiber $C = 60$ in
 Element Length $L = 1066$ ft

SOIL ELEMENT PROPERTIES

Youngs Modulus $E = 300$ psi (r)
 Area of Cross Section (b x d) $A = 144$ in²
 Depth of Section $d = 12$ in
 Thickness of Web $b = 12$ in
 Weight per Unit Length $W = 115$ lbs/ft
 Moment of Inertia $b \cdot d^3 / 12$ $I_c = 1728$ in⁴
 Sectional Modulus I_c / C $S = 288$ in³
 Radius of Gyration $\sqrt{I_c / A}$ $r = 34.64$ in
 Neutral Axis $NA = 60$ in
 Extreme Fiber $C = 60$ in
 Element Length $L = 0.083$ ft

SOILEND PROPERTIES

Youngs Modulus $E = 300$ psi (r)
 Area of Cross Section (b x d) $A = 72$ in²
 Depth of Section $d = 12$ in
 Thickness of Web $b = 6$ in
 Weight per Unit Length $W = 57.5$ lbs/ft
 Moment of Inertia $b \cdot d^3 / 12$ $I_c = 864$ in⁴
 Sectional Modulus I_c / C $S = 144$ in³
 Radius of Gyration $\sqrt{I_c / A}$ $r = 34.64$ in
 Neutral Axis $NA = 60$ in
 Extreme Fiber $C = 60$ in
 Element Length $L = 0.083$ ft



ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

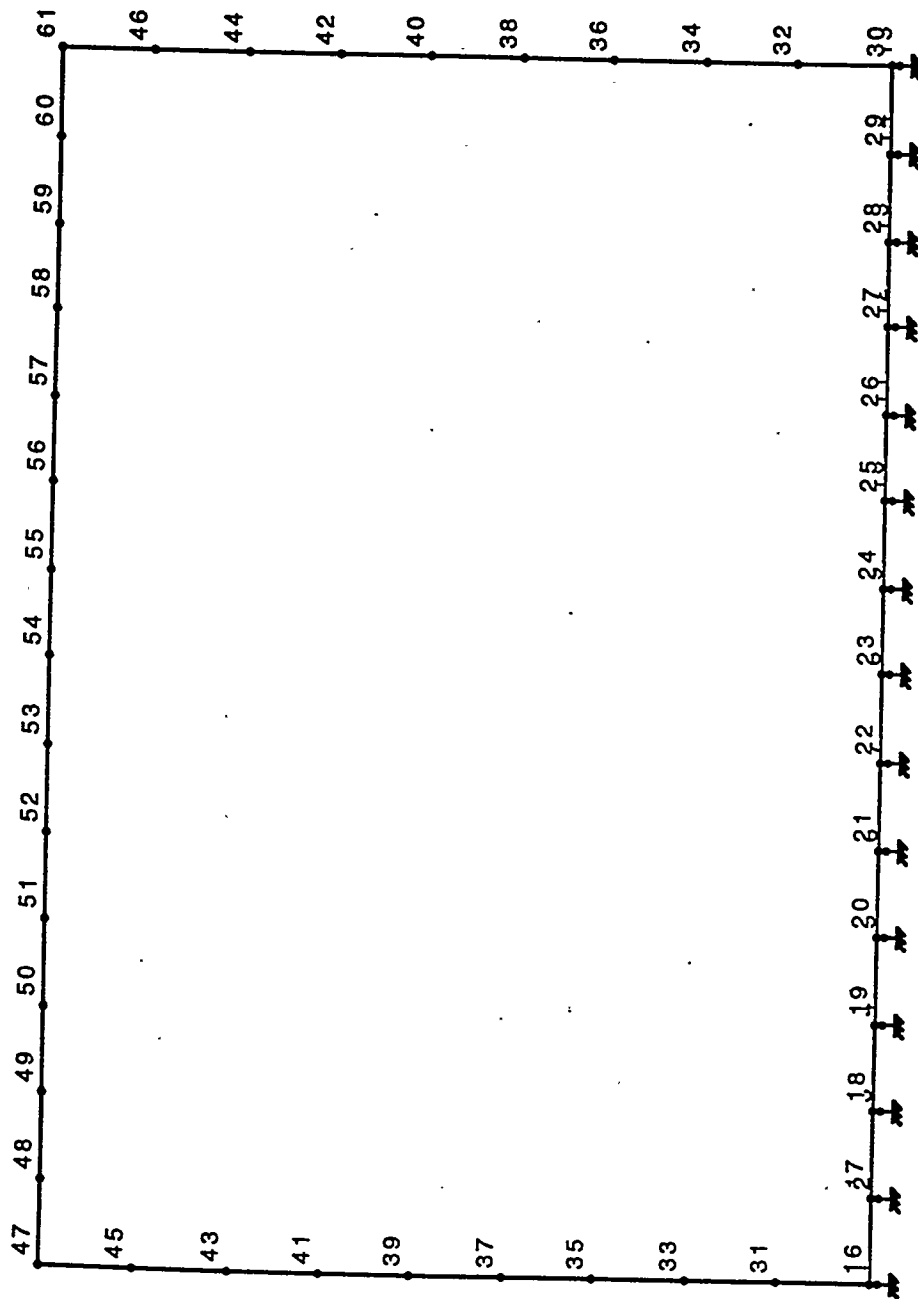
ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

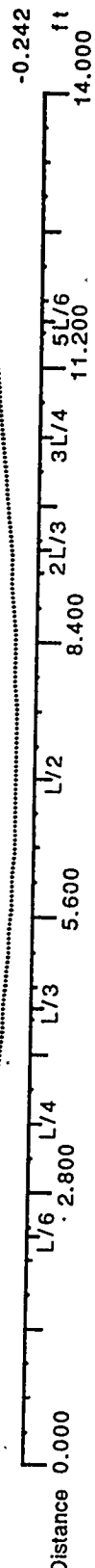
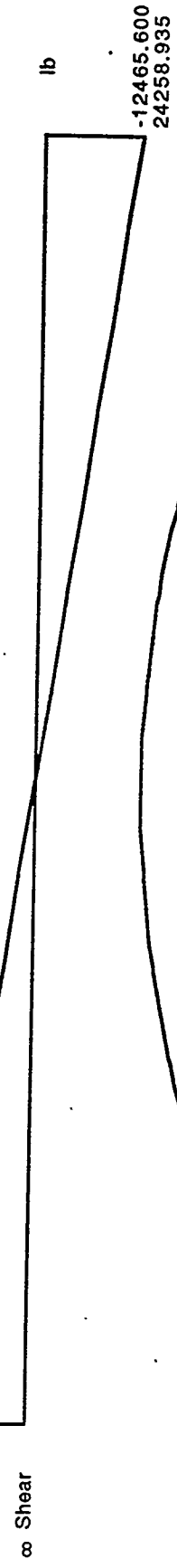
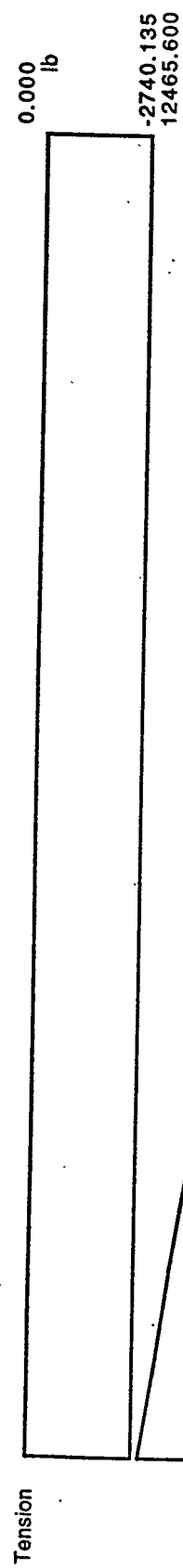
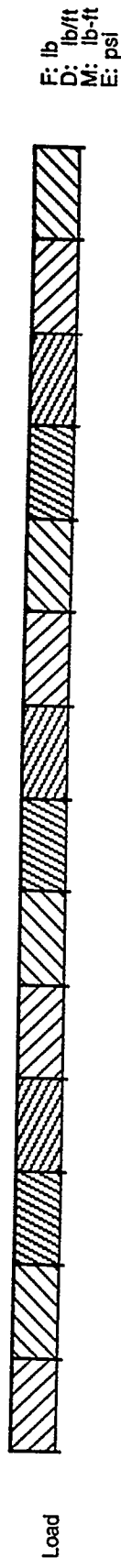
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

FRAME MAC file: 3(21/21) PRELIMINARY: Last modified at 15:41:25 on Tue, May 4, 1993
 Above each load are the magnitudes in lb, lb/ft, and lb-ft.



FRAME MAC file: 3(21/21) PRELIMINARY; Last modified at 15:41:25 on Tue, May 4, 1993

Node 47	Node 48	Node 49	Node 50	Node 51	Node 52	Node 53	Node 54	Node 55	Node 56	Node 57	Node 58	Node 59	Node 60	Node 61
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	11.000	12.000	13.000	14.000
11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000



Continuous Elements Output Data

FRAME MAC file: 3(21/21) PRELIMINARY.

Last modified at 15:41:25 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
47	0.000	-0.117	-0.002
48	0.000	-0.139	-0.002
49	0.000	-0.165	-0.002
50	0.000	-0.189	-0.002
51	0.000	-0.211	-0.002
52	0.000	-0.228	-0.001
53	0.000	-0.238	-0.001
54	0.000	-0.242	0.000
55	-0.000	-0.238	0.001
56	-0.000	-0.228	0.001
57	-0.000	-0.211	0.002
58	-0.000	-0.189	0.002
59	-0.000	-0.165	0.002
60	-0.000	-0.139	0.002
61	-0.000	-0.117	0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
47,48	0.000	890.400	148.400	0.000	890.400	-148.400
48,49	0.000	890.400	148.400	0.000	890.400	-148.400
49,50	0.000	890.400	148.400	0.000	890.400	-148.400
50,51	0.000	890.400	148.400	0.000	890.400	-148.400
51,52	0.000	890.400	148.400	0.000	890.400	-148.400
52,53	0.000	890.400	148.400	0.000	890.400	-148.400
53,54	0.000	890.400	148.400	0.000	890.400	-148.400
54,55	0.000	890.400	148.400	0.000	890.400	-148.400
55,56	0.000	890.400	148.400	0.000	890.400	-148.400
56,57	0.000	890.400	148.400	0.000	890.400	-148.400
57,58	0.000	890.400	148.400	0.000	890.400	-148.400
58,59	0.000	890.400	148.400	0.000	890.400	-148.400
59,60	0.000	890.400	148.400	0.000	890.400	-148.400
60,61	0.000	890.400	148.400	0.000	890.400	-148.400

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
47,48	2740.135	12465.600	19370.665	-2740.135	-10684.800	-7795.465
48,49	2740.135	10684.800	7795.465	-2740.135	-8904.000	1998.935
49,50	2740.135	8904.000	-1998.935	-2740.135	-7123.200	10012.535
50,51	2740.135	7123.200	-10012.535	-2740.135	-5342.400	16245.335
51,52	2740.135	5342.400	-16245.335	-2740.135	-3561.600	20697.335
52,53	2740.135	3561.600	-20697.335	-2740.135	-1780.800	23368.535
53,54	2740.135	1780.800	-23368.535	-2740.135	0.000	24258.935
54,55	2740.135	0.000	-24258.935	-2740.135	1780.800	23368.535
55,56	2740.135	-1780.800	-23368.535	-2740.135	3561.600	20697.335
56,57	2740.135	-3561.600	-20697.335	-2740.135	5342.400	16245.335
57,58	2740.135	-5342.400	-16245.335	-2740.135	7123.200	10012.535
58,59	2740.135	-7123.200	-10012.535	-2740.135	8904.000	1998.935
59,60	2740.135	-8904.000	-1998.935	-2740.135	10684.800	-7795.465
60,61	2740.135	-10684.800	7795.465	-2740.135	12465.600	-19370.665

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
47,48	0.000	-0.117	-0.002	0.000	-0.139	-0.002
48,49	0.000	-0.139	-0.002	0.000	-0.165	-0.002

49,50	0.000	-0.165	-0.002	0.000	-0.189	-0.002
50,51	0.000	-0.189	-0.002	0.000	-0.211	-0.002
51,52	0.000	-0.211	-0.002	0.000	-0.228	-0.001
52,53	0.000	-0.228	-0.001	0.000	-0.238	-0.001
53,54	0.000	-0.238	-0.001	0.000	-0.242	0.000
54,55	0.000	-0.242	0.000	-0.000	-0.238	0.001
55,56	-0.000	-0.238	0.001	-0.000	-0.228	0.001
56,57	-0.000	-0.228	0.001	-0.000	-0.211	0.002
57,58	-0.000	-0.211	0.002	-0.000	-0.189	0.002
58,59	-0.000	-0.189	0.002	-0.000	-0.165	0.002
59,60	-0.000	-0.165	0.002	-0.000	-0.139	0.002
60,61	-0.000	-0.139	0.002	-0.000	-0.117	0.002

Maximum deformations:

Node 61 moved 0.000 inch to the left.
Node 47 moved 0.000 inch to the right.
Node 54 moved 0.242 inch downwards.
No nodes moved upwards.
Node 49 rotated 0.002 radian clockwise.
Node 59 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
47,48	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
48,49	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
49,50	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
50,51	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
51,52	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
52,53	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
53,54	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
54,55	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
55,56	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
56,57	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
57,58	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
58,59	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
59,60	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
60,61	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
47,48	12465.600	0.000	12465.600	86.567	0.000	86.567
48,49	10684.800	0.000	10684.800	74.200	0.000	74.200
49,50	8904.000	0.000	8904.000	61.833	0.000	61.833
50,51	7123.200	0.000	7123.200	49.467	0.000	49.467
51,52	5342.400	0.000	5342.400	37.100	0.000	37.100
52,53	3561.600	0.000	3561.600	24.733	0.000	24.733
53,54	1780.800	0.000	1780.800	12.367	0.000	12.367
54,55	0.000	-1780.800	-1780.800	0.000	-12.367	-12.367
55,56	0.000	-3561.600	-3561.600	0.000	-24.733	-24.733
56,57	0.000	-5342.400	-5342.400	0.000	-37.100	-37.100
57,58	0.000	-7123.200	-7123.200	0.000	-49.467	-49.467
58,59	0.000	-8904.000	-8904.000	0.000	-61.833	-61.833
59,60	0.000	-10684.800	-10684.800	0.000	-74.200	-74.200
60,61	0.000	-12465.600	-12465.600	0.000	-86.567	-86.567

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi

47,48	0.000	-19370.665	-19370.665	0.000	-807.111	-807.111
48,49	1998.935	-7795.465	-7795.465	83.289	-324.811	-324.811
49,50	10012.535	0.000	10012.535	417.189	0.000	417.189
50,51	16245.335	0.000	16245.335	676.889	0.000	676.889
51,52	20697.335	0.000	20697.335	862.389	0.000	862.389
52,53	23368.535	0.000	23368.535	973.689	0.000	973.689
53,54	24258.935	0.000	24258.935	1010.789	0.000	1010.789
54,55	24258.935	0.000	24258.935	1010.789	0.000	1010.789
55,56	23368.535	0.000	23368.535	973.689	0.000	973.689
56,57	20697.335	0.000	20697.335	862.389	0.000	862.389
57,58	16245.335	0.000	16245.335	676.889	0.000	676.889
58,59	10012.535	0.000	10012.535	417.189	0.000	417.189
59,60	1998.935	-7795.465	-7795.465	83.289	-324.811	-324.811
60,61	0.000	-19370.665	-19370.665	0.000	-807.111	-807.111

Maximum deflection values:

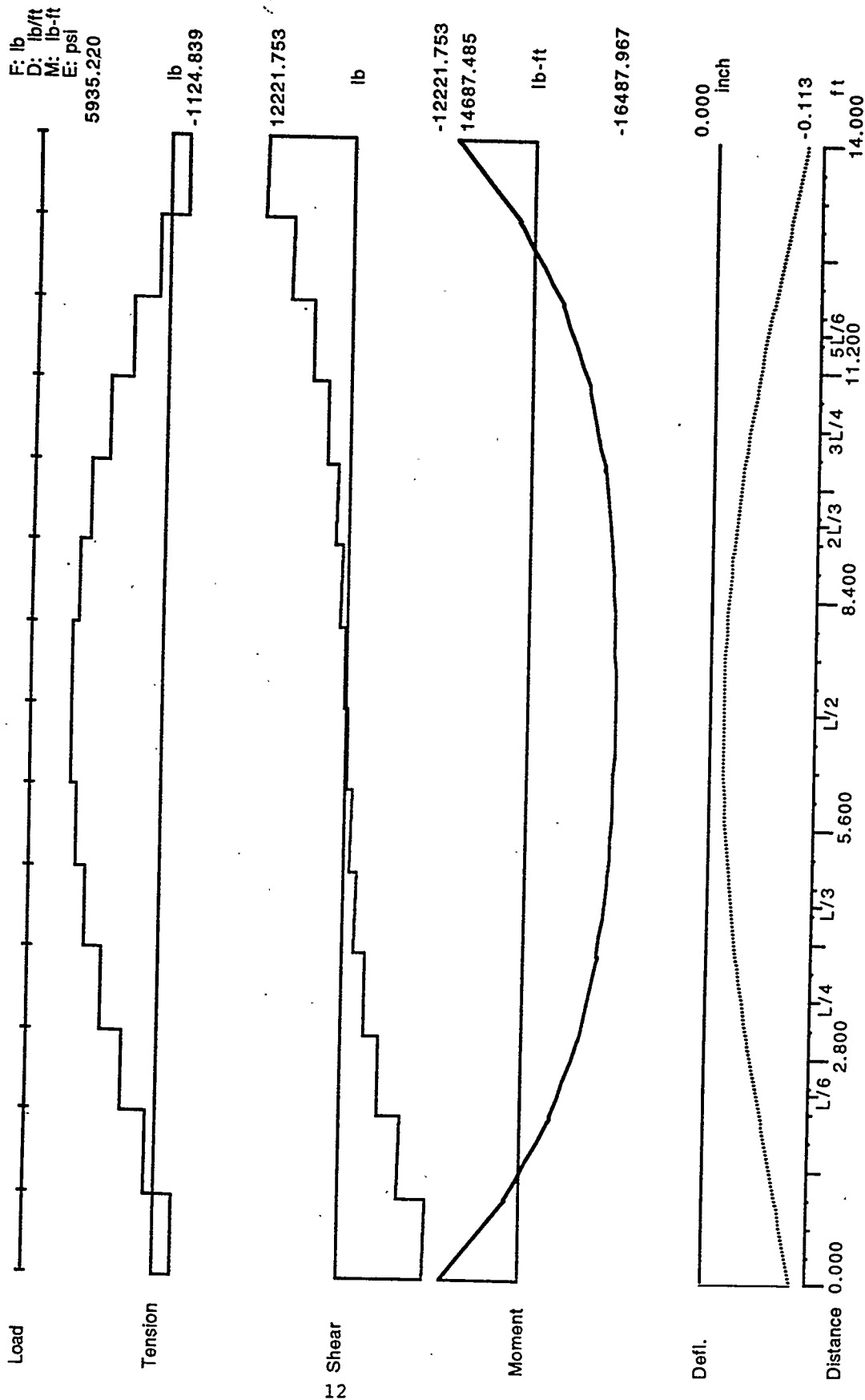
From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
47,48	0.000	-0.139	-0.139
48,49	0.000	-0.165	-0.165
49,50	0.000	-0.189	-0.189
50,51	0.000	-0.211	-0.211
51,52	0.000	-0.228	-0.228
52,53	0.000	-0.238	-0.238
53,54	0.000	-0.242	-0.242
54,55	0.000	-0.242	-0.242
55,56	0.000	-0.238	-0.238
56,57	0.000	-0.228	-0.228
57,58	0.000	-0.211	-0.211
58,59	0.000	-0.189	-0.189
59,60	0.000	-0.165	-0.165
60,61	0.000	-0.139	-0.139

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch
At the intermediate nodes:		
1.000	-0.002	-0.139
2.000	-0.002	-0.165
3.000	-0.002	-0.189
4.000	-0.002	-0.211
5.000	-0.001	-0.228
6.000	-0.001	-0.238
7.000	0.000	-0.242
8.000	0.001	-0.238
9.000	0.001	-0.228
10.000	0.002	-0.211
11.000	0.002	-0.189
12.000	0.002	-0.165
13.000	0.002	-0.139
At evenly-spaced intervals:		
0.000	-0.002	-0.117
1.400	-0.002	-0.149
2.800	-0.002	-0.184
4.200	-0.002	-0.215
5.600	-0.001	-0.235
7.000	0.000	-0.242
8.400	0.001	-0.235
9.800	0.002	-0.215
11.200	0.002	-0.184
12.600	0.002	-0.149
14.000	0.002	-0.117

FRAME MAC file: 3(21/21) PRELIMINARY: Last modified at 15:41:25 on Tue, May 4, 1993

Node 16	Node 17	Node 18	Node 19	Node 20	Node 21	Node 22	Node 23	Node 24	Node 25	Node 26	Node 27	Node 28	Node 29	Node 30
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000	14.000	15.000
1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500



Continuous Elements Output Data

FRAME MAC file: 3(21/21) PRELIMINARY.

Last modified at 15:41:25 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node	Reaction	Reaction	Reaction
No.	lb (FX)	lb (FY)	lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node	Deflection	Deflection	Rotation
No.	inch (FX)	inch (FY)	radians (MZ)

16	-0.001	-0.113	0.002
17	-0.001	-0.094	0.002
18	-0.001	-0.073	0.002
19	-0.001	-0.054	0.001
20	-0.000	-0.038	0.001
21	-0.000	-0.026	0.001
22	-0.000	-0.019	0.000
23	0.000	-0.016	0.000
24	0.000	-0.019	-0.000
25	0.000	-0.026	-0.001
26	0.000	-0.038	-0.001
27	0.001	-0.054	-0.001
28	0.001	-0.073	-0.002
29	0.001	-0.094	-0.002
30	0.001	-0.113	-0.002

Element fixed-end forces & moments: (local coordinate system)

From, To	FxL	FyL	MzL	FxR	FyR	MzR
Nodes	lb	lb	lb-ft	lb	lb	lb-ft

16,17	0.000	105.000	17.500	0.000	105.000	-17.500
17,18	0.000	105.000	17.500	0.000	105.000	-17.500
18,19	0.000	105.000	17.500	0.000	105.000	-17.500
19,20	0.000	105.000	17.500	0.000	105.000	-17.500
20,21	0.000	105.000	17.500	0.000	105.000	-17.500
21,22	0.000	105.000	17.500	0.000	105.000	-17.500
22,23	0.000	105.000	17.500	0.000	105.000	-17.500
23,24	0.000	105.000	17.500	0.000	105.000	-17.500
24,25	0.000	105.000	17.500	0.000	105.000	-17.500
25,26	0.000	105.000	17.500	0.000	105.000	-17.500
26,27	0.000	105.000	17.500	0.000	105.000	-17.500
27,28	0.000	105.000	17.500	0.000	105.000	-17.500
28,29	0.000	105.000	17.500	0.000	105.000	-17.500
29,30	0.000	105.000	17.500	0.000	105.000	-17.500

Actual element end forces & moments: (local coordinate system)

From, To	FxL	FyL	MzL	FxR	FyR	MzR
Nodes	lb	lb	lb-ft	lb	lb	lb-ft

16,17	1124.839	-12011.753	-14687.485	-1124.839	12221.753	2570.732
17,18	-608.770	-8171.256	-2717.164	608.770	8381.256	-5559.092
18,19	-2327.859	-5220.913	5414.786	2327.859	5430.913	-10740.699
19,20	-3781.163	-3095.958	10616.208	3781.163	3305.958	-13817.166
20,21	-4872.467	-1662.289	13720.987	4872.467	1872.289	-15488.276
21,22	-5585.729	-744.094	15423.666	5585.729	954.094	-16272.760
22,23	-5935.220	-142.494	16240.473	5935.220	352.494	-16487.967
23,24	-5935.220	352.494	16487.967	5935.220	-142.494	-16240.473
24,25	-5585.729	954.094	16272.760	5585.729	-744.094	-15423.666
25,26	-4872.467	1872.289	15488.276	4872.467	-1662.289	-13720.987
26,27	-3781.163	3305.958	13817.166	3781.163	-3095.958	-10616.208
27,28	-2327.859	5430.913	10740.699	2327.859	-5220.913	-5414.786
28,29	-608.770	8381.256	5559.092	608.770	-8171.256	2717.164
29,30	1124.839	12221.753	-2570.732	-1124.839	-12011.753	14687.485

Member end deformations: (local coordinate system)

From, To	dx at L	dy at L	rotZ at L	dx at R	dy at R	rotZ at R
Nodes	inch	inch	radians	inch	inch	radians

16,17	-0.001	-0.113	0.002	-0.001	-0.094	0.002
17,18	-0.001	-0.094	0.002	-0.001	-0.073	0.002

18,19	-0.001	-0.073	0.002	-0.001	-0.054	0.001
19,20	-0.001	-0.054	0.001	-0.000	-0.038	0.001
20,21	-0.000	-0.038	0.001	-0.000	-0.026	0.001
21,22	-0.000	-0.026	0.001	-0.000	-0.019	0.000
22,23	-0.000	-0.019	0.000	0.000	-0.016	0.000
23,24	0.000	-0.016	0.000	0.000	-0.019	-0.000
24,25	0.000	-0.019	-0.000	0.000	-0.026	-0.001
25,26	0.000	-0.026	-0.001	0.000	-0.038	-0.001
26,27	0.000	-0.038	-0.001	0.001	-0.054	-0.001
27,28	0.001	-0.054	-0.001	0.001	-0.073	-0.002
28,29	0.001	-0.073	-0.002	0.001	-0.094	-0.002
29,30	0.001	-0.094	-0.002	0.001	-0.113	-0.002

Maximum deformations:

Node 17 moved 0.001 inch to the left.
 Node 29 moved 0.001 inch to the right.
 Node 30 moved 0.113 inch downwards.
 No nodes moved upwards.
 Node 29 rotated 0.002 radian clockwise.
 Node 17 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
16,17	0.000	-1124.839	-1124.839	0.000	-7.811	-7.811
17,18	608.770	0.000	608.770	4.228	0.000	4.228
18,19	2327.859	0.000	2327.859	16.166	0.000	16.166
19,20	3781.163	0.000	3781.163	26.258	0.000	26.258
20,21	4872.467	0.000	4872.467	33.837	0.000	33.837
21,22	5585.729	0.000	5585.729	38.790	0.000	38.790
22,23	5935.220	0.000	5935.220	41.217	0.000	41.217
23,24	5935.220	0.000	5935.220	41.217	0.000	41.217
24,25	5585.729	0.000	5585.729	38.790	0.000	38.790
25,26	4872.467	0.000	4872.467	33.837	0.000	33.837
26,27	3781.163	0.000	3781.163	26.258	0.000	26.258
27,28	2327.859	0.000	2327.859	16.166	0.000	16.166
28,29	608.770	0.000	608.770	4.228	0.000	4.228
29,30	0.000	-1124.839	-1124.839	0.000	-7.811	-7.811

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
16,17	0.000	-12221.753	-12221.753	0.000	-84.873	-84.873
17,18	0.000	-8381.256	-8381.256	0.000	-58.203	-58.203
18,19	0.000	-5430.913	-5430.913	0.000	-37.715	-37.715
19,20	0.000	-3305.958	-3305.958	0.000	-22.958	-22.958
20,21	0.000	-1872.289	-1872.289	0.000	-13.002	-13.002
21,22	0.000	-954.094	-954.094	0.000	-6.626	-6.626
22,23	0.000	-352.494	-352.494	0.000	-2.448	-2.448
23,24	352.494	0.000	352.494	2.448	0.000	2.448
24,25	954.094	0.000	954.094	6.626	0.000	6.626
25,26	1872.289	0.000	1872.289	13.002	0.000	13.002
26,27	3305.958	0.000	3305.958	22.958	0.000	22.958
27,28	5430.913	0.000	5430.913	37.715	0.000	37.715
28,29	8381.256	0.000	8381.256	58.203	0.000	58.203
29,30	12221.753	0.000	12221.753	84.873	0.000	84.873

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi

16,17	14687.485	0.000	14687.485	611.979	0.000	611.979
17,18	2717.164	-5559.092	-5559.092	113.215	-231.629	-231.629
18,19	0.000	-10740.699	-10740.699	0.000	-447.529	-447.529
19,20	0.000	-13817.166	-13817.166	0.000	-575.715	-575.715
20,21	0.000	-15488.276	-15488.276	0.000	-645.345	-645.345
21,22	0.000	-16272.760	-16272.760	0.000	-678.032	-678.032
22,23	0.000	-16487.967	-16487.967	0.000	-686.999	-686.999
23,24	0.000	-16487.967	-16487.967	0.000	-686.999	-686.999
24,25	0.000	-16272.760	-16272.760	0.000	-678.032	-678.032
25,26	0.000	-15488.276	-15488.276	0.000	-645.345	-645.345
26,27	0.000	-13817.166	-13817.166	0.000	-575.715	-575.715
27,28	0.000	-10740.699	-10740.699	0.000	-447.529	-447.529
28,29	2717.164	-5559.092	-5559.092	113.215	-231.629	-231.629
29,30	14687.485	0.000	14687.485	611.979	0.000	611.979

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
16,17	0.000	-0.113	-0.113
17,18	0.000	-0.094	-0.094
18,19	0.000	-0.073	-0.073
19,20	0.000	-0.054	-0.054
20,21	0.000	-0.038	-0.038
21,22	0.000	-0.026	-0.026
22,23	0.000	-0.019	-0.019
23,24	0.000	-0.019	-0.019
24,25	0.000	-0.026	-0.026
25,26	0.000	-0.038	-0.038
26,27	0.000	-0.054	-0.054
27,28	0.000	-0.073	-0.073
28,29	0.000	-0.094	-0.094
29,30	0.000	-0.113	-0.113

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch
At the intermediate nodes:		
1.000	0.002	-0.094
2.000	0.002	-0.073
3.000	0.001	-0.054
4.000	0.001	-0.038
5.000	0.001	-0.026
6.000	0.000	-0.019
7.000	0.000	-0.016
8.000	-0.000	-0.019
9.000	-0.001	-0.026
10.000	-0.001	-0.038
11.000	-0.001	-0.054
12.000	-0.002	-0.073
13.000	-0.002	-0.094

At evenly-spaced intervals:

0.000	0.002	-0.113
1.400	0.002	-0.085
2.800	0.002	-0.058
4.200	0.001	-0.035
5.600	0.001	-0.021
7.000	0.000	-0.016
8.400	-0.001	-0.021
9.800	-0.001	-0.035
11.200	-0.002	-0.058
12.600	-0.002	-0.085
14.000	-0.002	-0.113

FRAME MAC file: 3(21/21) PRELIMINARY; Last modified at 15:41:25 on Tue, May 4, 1993

Node 16
1.000
1.500

Node 31
1.000
2.556

Node 33
1.000
3.611

Node 35
1.000
4.667

Node 37
1.000
5.722

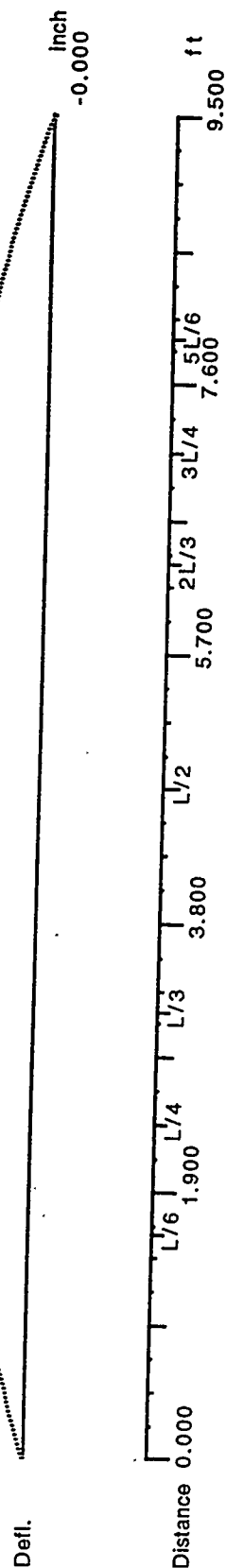
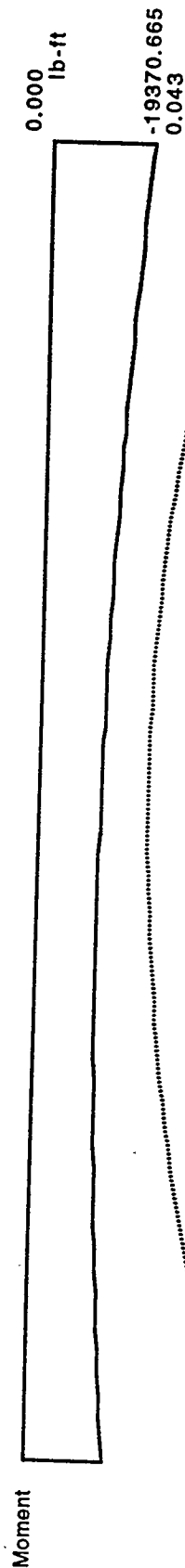
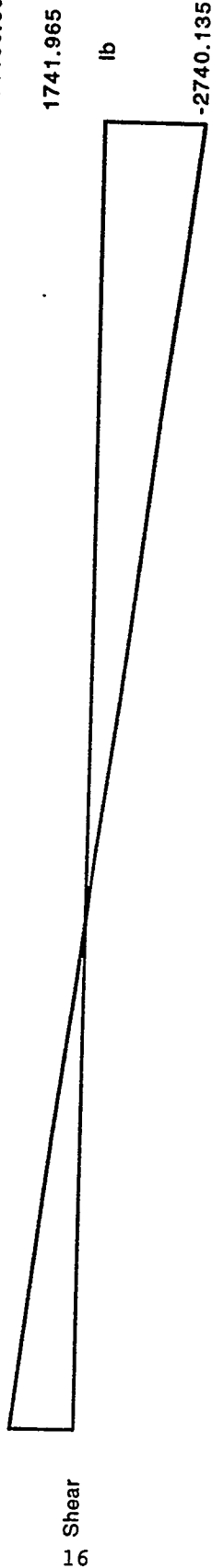
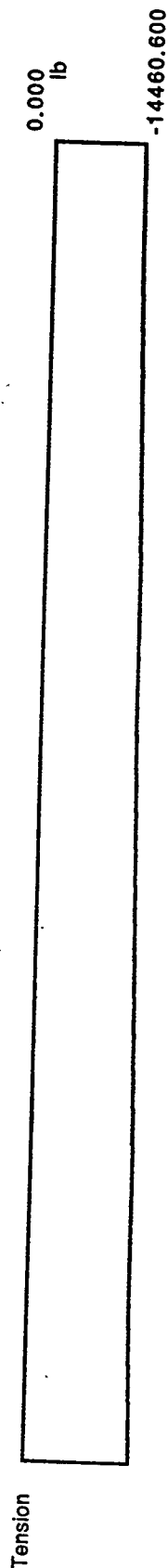
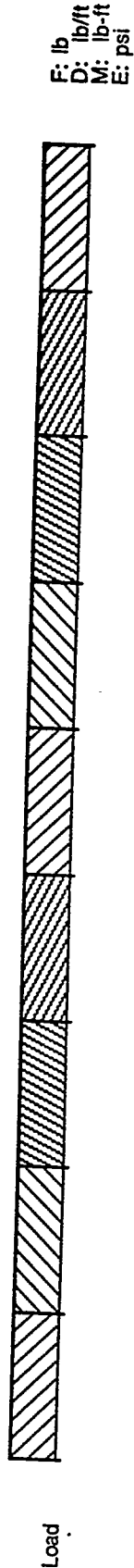
Node 39
1.000
6.778

Node 41
1.000
7.833

Node 43
1.000
8.889

Node 45
1.000
9.944

Node 47
1.000
11.000



Continuous Elements Output Data

FRAME MAC file: 3(21/21) PRELIMINARY.
Last modified at 15:41:25 on Tue, May 4, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)
16	-0.001	-0.113	0.002
31	-0.017	-0.114	0.001
33	-0.029	-0.114	0.001
35	-0.038	-0.115	0.000
37	-0.042	-0.115	0.000
39	-0.042	-0.115	-0.000
41	-0.039	-0.116	-0.000
43	-0.031	-0.116	-0.001
45	-0.018	-0.116	-0.001
47	0.000	-0.117	-0.002

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
16	-0.001	-0.113	0.002
31	-0.017	-0.114	0.001
33	-0.029	-0.114	0.001
35	-0.038	-0.115	0.000
37	-0.042	-0.115	0.000
39	-0.042	-0.115	-0.000
41	-0.039	-0.116	-0.000
43	-0.031	-0.116	-0.001
45	-0.018	-0.116	-0.001
47	0.000	-0.117	-0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
16,31	110.833	249.006	43.807	110.833	249.006	-43.807
31,33	110.833	249.006	43.807	110.833	249.006	-43.807
33,35	110.833	249.006	43.807	110.833	249.006	-43.807
35,37	110.833	249.006	43.807	110.833	249.006	-43.807
37,39	110.833	249.006	43.807	110.833	249.006	-43.807
39,41	110.833	249.006	43.807	110.833	249.006	-43.807
41,43	110.833	249.006	43.807	110.833	249.006	-43.807
43,45	110.833	249.006	43.807	110.833	249.006	-43.807
45,47	110.833	249.006	43.807	110.833	249.006	-43.807

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
16,31	14460.600	1741.965	14629.361	-14238.933	-1243.954	-13053.459
31,33	14238.933	1243.954	13053.459	-14017.267	-745.943	-12003.235
33,35	14017.267	745.943	12003.235	-13795.600	-247.932	-11478.690
35,37	13795.600	247.932	11478.690	-13573.933	250.079	-11479.823
37,39	13573.933	-250.079	11479.823	-13352.267	748.090	-12006.635
39,41	13352.267	-748.090	12006.635	-13130.600	1246.101	-13059.125
41,43	13130.600	-1246.101	13059.125	-12908.933	1744.112	-14637.293
43,45	12908.933	-1744.112	14637.293	-12687.267	2242.123	-16741.140
45,47	12687.267	-2242.123	16741.140	-12465.600	2740.135	-19370.665

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
16,31	-0.113	0.001	0.002	-0.114	0.017	0.001
31,33	-0.114	0.017	0.001	-0.114	0.029	0.001
33,35	-0.114	0.029	0.001	-0.115	0.038	0.000
35,37	-0.115	0.038	0.000	-0.115	0.042	0.000
37,39	-0.115	0.042	0.000	-0.115	0.042	-0.000
39,41	-0.115	0.042	-0.000	-0.116	0.039	-0.000
41,43	-0.116	0.039	-0.000	-0.116	0.031	-0.001
43,45	-0.116	0.031	-0.001	-0.116	0.018	-0.001
45,47	-0.116	0.018	-0.001	-0.117	-0.000	-0.002

Maximum deformations:
Node 39 moved 0.042 inch to the left.
Node 47 moved 0.000 inch to the right.
Node 47 moved 0.117 inch downwards.
No nodes moved upwards.
Node 47 rotated 0.002 radian clockwise.
Node 16 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
16,31	0.000	-14460.600	-14460.600	0.000	-100.421	-100.421
31,33	0.000	-14238.933	-14238.933	0.000	-98.881	-98.881
33,35	0.000	-14017.267	-14017.267	0.000	-97.342	-97.342
35,37	0.000	-13795.600	-13795.600	0.000	-95.803	-95.803
37,39	0.000	-13573.933	-13573.933	0.000	-94.263	-94.263
39,41	0.000	-13352.267	-13352.267	0.000	-92.724	-92.724
41,43	0.000	-13130.600	-13130.600	0.000	-91.185	-91.185
43,45	0.000	-12908.933	-12908.933	0.000	-89.645	-89.645
45,47	0.000	-12687.267	-12687.267	0.000	-88.106	-88.106

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
16,31	1741.965	0.000	1741.965	12.097	0.000	12.097
31,33	1243.954	0.000	1243.954	8.639	0.000	8.639
33,35	745.943	0.000	745.943	5.180	0.000	5.180
35,37	247.932	-250.079	-250.079	1.722	-1.737	-1.737
37,39	0.000	-748.090	-748.090	0.000	-5.195	-5.195
39,41	0.000	-1246.101	-1246.101	0.000	-8.653	-8.653
41,43	0.000	-1744.112	-1744.112	0.000	-12.112	-12.112
43,45	0.000	-2242.123	-2242.123	0.000	-15.570	-15.570
45,47	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
16,31	0.000	-14629.361	-14629.361	0.000	-609.557	-609.557
31,33	0.000	-13053.459	-13053.459	0.000	-543.894	-543.894
33,35	0.000	-12003.235	-12003.235	0.000	-500.135	-500.135
35,37	0.000	-11479.823	-11479.823	0.000	-478.326	-478.326
37,39	0.000	-12006.635	-12006.635	0.000	-500.276	-500.276
39,41	0.000	-13059.125	-13059.125	0.000	-544.130	-544.130
41,43	0.000	-14637.293	-14637.293	0.000	-609.887	-609.887
43,45	0.000	-16741.140	-16741.140	0.000	-697.547	-697.547
45,47	0.000	-19370.665	-19370.665	0.000	-807.111	-807.111

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
16,31	0.017	0.000	0.017
31,33	0.029	0.000	0.029
33,35	0.038	0.000	0.038
35,37	0.042	0.000	0.042
37,39	0.043	0.000	0.043
39,41	0.042	0.000	0.042
41,43	0.039	0.000	0.039
43,45	0.031	0.000	0.031
45,47	0.018	-0.000	0.018

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch

```

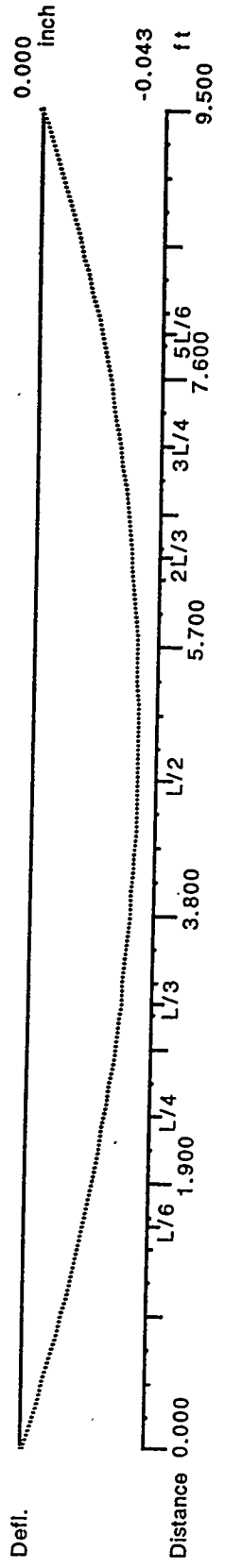
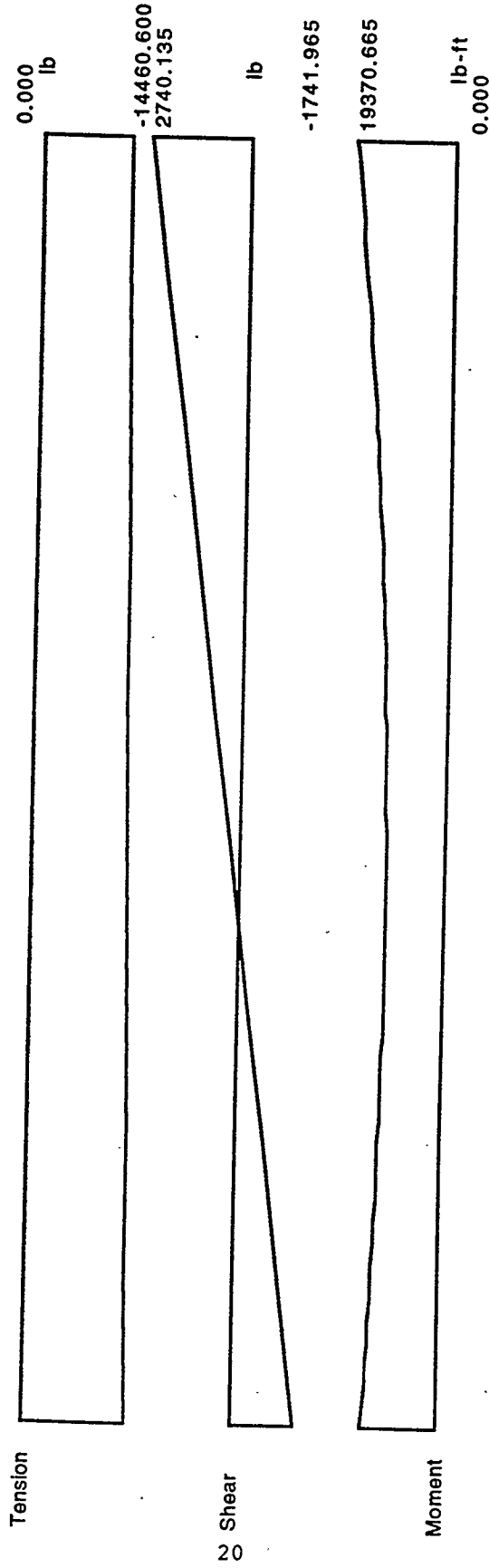
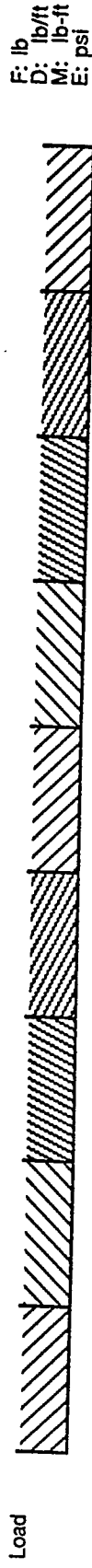
-----
At the intermediate nodes:
    1.056      0.001      0.017
    2.111      0.001      0.029
    3.167      0.000      0.038
    4.222      0.000      0.042
    5.278     -0.000      0.042
    6.333     -0.000      0.039
    7.389     -0.001      0.031
    8.444     -0.001      0.018

At evenly-spaced intervals:
    0.000      0.002      0.001
    0.950      0.001      0.016
    1.900      0.001      0.027
    2.850      0.001      0.036
    3.800      0.000      0.041
    4.750      0.000      0.043
    5.700     -0.000      0.042
    6.650     -0.001      0.037
    7.600     -0.001      0.029
    8.550     -0.001      0.016
    9.500     -0.002     -0.000
*****

```

FRAME MAC file: 3(21/21) PRELIMINARY: Last modified at 15:41:25 on Tue, May 4, 1993

Node 30	Node 32	Node 34	Node 36	Node 38	Node 40	Node 42	Node 44	Node 46	Node 61
15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
1.500	2.556	3.611	4.667	5.722	6.778	7.833	8.889	9.944	11.000



Continuous Elements Output Data

FRAME MAC file: 3(21/21) PRELIMINARY.

Last modified at 15:41:25 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)
30	0.001	-0.113	-0.002
32	0.017	-0.114	-0.001
34	0.029	-0.114	-0.001
36	0.038	-0.115	-0.000
38	0.042	-0.115	-0.000
40	0.042	-0.115	0.000
42	0.039	-0.116	0.000
44	0.031	-0.116	0.001
46	0.018	-0.116	0.001
61	-0.000	-0.117	0.002

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
30	0.001	-0.113	-0.002
32	0.017	-0.114	-0.001
34	0.029	-0.114	-0.001
36	0.038	-0.115	-0.000
38	0.042	-0.115	-0.000
40	0.042	-0.115	0.000
42	0.039	-0.116	0.000
44	0.031	-0.116	0.001
46	0.018	-0.116	0.001
61	-0.000	-0.117	0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
30,32	110.833	-249.006	-43.807	110.833	-249.006	43.807
32,34	110.833	-249.006	-43.807	110.833	-249.006	43.807
34,36	110.833	-249.006	-43.807	110.833	-249.006	43.807
36,38	110.833	-249.006	-43.807	110.833	-249.006	43.807
38,40	110.833	-249.006	-43.807	110.833	-249.006	43.807
40,42	110.833	-249.006	-43.807	110.833	-249.006	43.807
42,44	110.833	-249.006	-43.807	110.833	-249.006	43.807
44,46	110.833	-249.006	-43.807	110.833	-249.006	43.807
46,61	110.833	-249.006	-43.807	110.833	-249.006	43.807

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
30,32	14460.600	-1741.965	-14629.361	-14238.933	1243.954	13053.459
32,34	14238.933	-1243.954	-13053.459	-14017.267	745.943	12003.235
34,36	14017.267	-745.943	-12003.235	-13795.600	247.932	11478.690
36,38	13795.600	-247.932	-11478.690	-13573.933	-250.079	11479.823
38,40	13573.933	250.079	-11479.823	-13352.267	-748.090	12006.635
40,42	13352.267	748.090	-12006.635	-13130.600	-1246.101	13059.125
42,44	13130.600	1246.101	-13059.125	-12908.933	-1744.112	14637.293
44,46	12908.933	1744.112	-14637.293	-12687.267	-2242.123	16741.140
46,61	12687.267	2242.123	-16741.140	-12465.600	-2740.135	19370.665

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
30,32	-0.113	-0.001	-0.002	-0.114	-0.017	-0.001
32,34	-0.114	-0.017	-0.001	-0.114	-0.029	-0.001
34,36	-0.114	-0.029	-0.001	-0.115	-0.038	-0.000
36,38	-0.115	-0.038	-0.000	-0.115	-0.042	-0.000
38,40	-0.115	-0.042	-0.000	-0.115	-0.042	0.000
40,42	-0.115	-0.042	0.000	-0.116	-0.039	0.000
42,44	-0.116	-0.039	0.000	-0.116	-0.031	0.001
44,46	-0.116	-0.031	0.001	-0.116	-0.018	0.001
46,61	-0.116	-0.018	0.001	-0.117	0.000	0.002

Maximum deformations:

Node 61 moved 0.000 inch to the left.
Node 40 moved 0.042 inch to the right.
Node 61 moved 0.117 inch downwards.
No nodes moved upwards.
Node 30 rotated 0.002 radian clockwise.
Node 61 rotated 0.002 radian counter-clockwise.

Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):
From, To Maximum Minimum Max. abs. Maximum Minimum Max. abs.
Node tension tension tension ten. str. ten. str. stress
--- lb lb lb psi psi psi

30,32 0.000 -14460.600 -14460.600 0.000 -100.421 -100.421
32,34 0.000 -14238.933 -14238.933 0.000 -98.881 -98.881
34,36 0.000 -14017.267 -14017.267 0.000 -97.342 -97.342
36,38 0.000 -13795.600 -13795.600 0.000 -95.803 -95.803
38,40 0.000 -13573.933 -13573.933 0.000 -94.263 -94.263
40,42 0.000 -13352.267 -13352.267 0.000 -92.724 -92.724
42,44 0.000 -13130.600 -13130.600 0.000 -91.185 -91.185
44,46 0.000 -12908.933 -12908.933 0.000 -89.645 -89.645
46,61 0.000 -12687.267 -12687.267 0.000 -88.106 -88.106

Maximum shear and shear stress values:
From, To Maximum Minimum Max. abs. Maximum Minimum Max. abs.
Node shear shear shear shr. str. shr. str. stress
--- lb lb lb psi psi psi

30,32 0.000 -1741.965 -1741.965 0.000 -12.097 -12.097
32,34 0.000 -1243.954 -1243.954 0.000 -8.639 -8.639
34,36 0.000 -745.943 -745.943 0.000 -5.180 -5.180
36,38 250.079 -247.932 250.079 1.737 -1.722 1.737
38,40 748.090 0.000 748.090 5.195 0.000 5.195
40,42 1246.101 0.000 1246.101 8.653 0.000 8.653
42,44 1744.112 0.000 1744.112 12.112 0.000 12.112
44,46 2242.123 0.000 2242.123 15.570 0.000 15.570
46,61 2740.135 0.000 2740.135 19.029 0.000 19.029

Maximum moment and bending stress values:
From, To Maximum Minimum Max. abs. Maximum Minimum Max. abs.
Node moment moment moment ben. str. ben. str. stress
--- lb-ft lb-ft lb-ft psi psi psi

30,32 14629.361 0.000 14629.361 609.557 0.000 609.557
32,34 13053.459 0.000 13053.459 543.894 0.000 543.894
34,36 12003.235 0.000 12003.235 500.135 0.000 500.135
36,38 11479.823 0.000 11479.823 478.326 0.000 478.326
38,40 12006.635 0.000 12006.635 500.276 0.000 500.276
40,42 13059.125 0.000 13059.125 544.130 0.000 544.130
42,44 14637.293 0.000 14637.293 609.887 0.000 609.887
44,46 16741.140 0.000 16741.140 697.547 0.000 697.547
46,61 19370.665 0.000 19370.665 807.111 0.000 807.111

Maximum deflection values:
From, To Maximum defl. Maximum defl. Maximum defl.
Node up (left) down (rt.) absolute
--- inch inch inch

30,32 0.000 -0.017 -0.017
32,34 0.000 -0.029 -0.029
34,36 0.000 -0.038 -0.038
36,38 0.000 -0.042 -0.042
38,40 0.000 -0.043 -0.043
40,42 0.000 -0.042 -0.042
42,44 0.000 -0.039 -0.039
44,46 0.000 -0.031 -0.031
46,61 0.000 -0.018 -0.018

Deflections along the elements (positive is up or counter-clockwise):
Distance from Rotation Deflection
left (bottom) --- ---
ft radian inch

At the intermediate nodes:

1.056	-0.001	-0.017
2.111	-0.001	-0.029
3.167	-0.000	-0.038
4.222	-0.000	-0.042
5.278	0.000	-0.042
6.333	0.000	-0.039
7.389	0.001	-0.031
8.444	0.001	-0.018

At evenly-spaced intervals:

0.000	-0.002	-0.001
0.950	-0.001	-0.016
1.900	-0.001	-0.027
2.850	-0.001	-0.036
3.800	-0.000	-0.041
4.750	-0.000	-0.043
5.700	0.000	-0.042
6.650	0.001	-0.037
7.600	0.001	-0.029
8.550	0.001	-0.016
9.500	0.002	0.000

Output Data

FRAME MAC file: 3(21/21) PRELIMINARY.

Last modified at 15:41:25 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

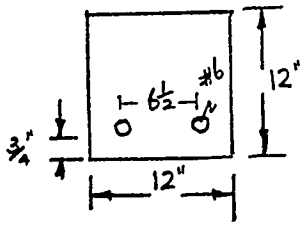
From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,16	0.000	-2448.847	-2448.847	0.000	-34.012	-34.012
2,17	0.000	-4050.497	-4050.497	0.000	-28.128	-28.128
3,18	0.000	-3160.343	-3160.343	0.000	-21.947	-21.947
4,19	0.000	-2334.955	-2334.955	0.000	-16.215	-16.215
5,20	0.000	-1643.668	-1643.668	0.000	-11.414	-11.414
6,21	0.000	-1128.195	-1128.195	0.000	-7.835	-7.835
7,22	0.000	-811.600	-811.600	0.000	-5.636	-5.636
8,23	0.000	-704.988	-704.988	0.000	-4.896	-4.896
9,24	0.000	-811.600	-811.600	0.000	-5.636	-5.636
10,25	0.000	-1128.195	-1128.195	0.000	-7.835	-7.835
11,26	0.000	-1643.668	-1643.668	0.000	-11.414	-11.414
12,27	0.000	-2334.955	-2334.955	0.000	-16.215	-16.215
13,28	0.000	-3160.343	-3160.343	0.000	-21.947	-21.947
14,29	0.000	-4050.497	-4050.497	0.000	-28.128	-28.128
15,30	0.000	-2448.847	-2448.847	0.000	-34.012	-34.012
16,17	0.000	-1124.839	-1124.839	0.000	-7.811	-7.811
16,31	0.000	-14460.600	-14460.600	0.000	-100.421	-100.421
17,18	608.770	0.000	608.770	4.228	0.000	4.228
18,19	2327.859	0.000	2327.859	16.166	0.000	16.166
19,20	3781.163	0.000	3781.163	26.258	0.000	26.258
20,21	4872.467	0.000	4872.467	33.837	0.000	33.837
21,22	5585.729	0.000	5585.729	38.790	0.000	38.790
22,23	5935.220	0.000	5935.220	41.217	0.000	41.217
23,24	5935.220	0.000	5935.220	41.217	0.000	41.217
24,25	5585.729	0.000	5585.729	38.790	0.000	38.790
25,26	4872.467	0.000	4872.467	33.837	0.000	33.837
26,27	3781.163	0.000	3781.163	26.258	0.000	26.258
27,28	2327.859	0.000	2327.859	16.166	0.000	16.166
28,29	608.770	0.000	608.770	4.228	0.000	4.228
29,30	0.000	-1124.839	-1124.839	0.000	-7.811	-7.811
30,32	0.000	-14460.600	-14460.600	0.000	-100.421	-100.421
31,33	0.000	-14238.933	-14238.933	0.000	-98.881	-98.881
32,34	0.000	-14238.933	-14238.933	0.000	-98.881	-98.881
33,35	0.000	-14017.267	-14017.267	0.000	-97.342	-97.342
34,36	0.000	-14017.267	-14017.267	0.000	-97.342	-97.342
35,37	0.000	-13795.600	-13795.600	0.000	-95.803	-95.803
36,38	0.000	-13795.600	-13795.600	0.000	-95.803	-95.803
37,39	0.000	-13573.933	-13573.933	0.000	-94.263	-94.263
38,40	0.000	-13573.933	-13573.933	0.000	-94.263	-94.263
39,41	0.000	-13352.267	-13352.267	0.000	-92.724	-92.724
40,42	0.000	-13352.267	-13352.267	0.000	-92.724	-92.724
41,43	0.000	-13130.600	-13130.600	0.000	-91.185	-91.185
42,44	0.000	-13130.600	-13130.600	0.000	-91.185	-91.185
43,45	0.000	-12908.933	-12908.933	0.000	-89.645	-89.645
44,46	0.000	-12908.933	-12908.933	0.000	-89.645	-89.645
45,47	0.000	-12687.267	-12687.267	0.000	-88.106	-88.106
46,61	0.000	-12687.267	-12687.267	0.000	-88.106	-88.106
47,48	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
48,49	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
49,50	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
50,51	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
51,52	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
52,53	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
53,54	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
54,55	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
55,56	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
56,57	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
57,58	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
58,59	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
59,60	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029
60,61	0.000	-2740.135	-2740.135	0.000	-19.029	-19.029

SOIL ELEMENTS

AVE FIB. 12.

7.7505

1. MOMENT CAPACITY - ROOF, FLOOR, WALLS



$$A_{ST} = (2)(\pi)(0.75)^2 = 0.8836 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12"$$

$$a = \frac{A_{ST} F_y}{0.85 f'_c b_w} = \frac{(0.8836)(60,000)}{(0.85)(3,000)(12)}$$

$$a = 1.599 \text{ in}$$

$$d = 12 - 0.75 - 0.75/2 = 10.875 \text{ in}$$

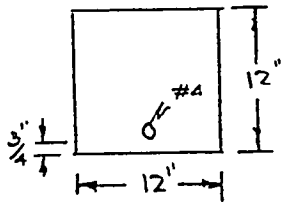
$$\phi = 0.9$$

$$\phi M_n = \phi \left[A_{ST} F_y \left(d - \frac{a}{2} \right) \right] = (0.9) \left[(0.8836)(60,000) \left(10.875 - \frac{1.599}{2} \right) \right]$$

$$\phi M_n = 480746 \text{ in-lbs}$$

$$= 40,062 \text{ Ft-lbs}$$

LEFT & RIGHT WALLS (INSIDE)



$$A_{ST} = (1)(\pi)(0.5)^2 = 0.1963 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12"$$

$$a = \frac{A_{ST} F_y}{0.85 f'_c b_w} = \frac{(0.1963)(60,000)}{(0.85)(3,000)(12)} = 0.3849 \text{ in}$$

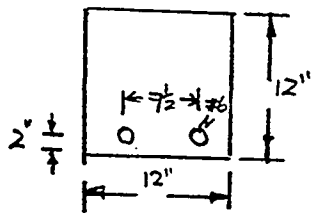
$$\phi = 0.9$$

$$\phi M_n = 0.9 \left[(0.1963)(60,000) \left(11 - \frac{0.3849}{2} \right) \right]$$

$$= 114562 \text{ in-lbs}$$

$$= 9547 \text{ Ft-lbs}$$

LEFT & RIGHT WALL (OUTSIDE)



$$a = \frac{A_{ST} F_y}{0.85 f'_c b_w} = \frac{(0.6136)(60,000)}{(0.85)(3000)(15)}$$

$$a = 0.9625 \text{ in}$$

$$A_{ST} = (2)(\pi)(0.625)^2 = 0.6136 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3000 \text{ psi}$$

$$b_w = 15"$$

$$d = 12 - 2 - \frac{0.625}{2} = 9.688 \text{ in}$$

$$\phi = 0.9$$

$$\phi M_n = 0.9 \left[(0.6136)(60,000) \left(9.688 - \frac{0.9625}{2} \right) \right]$$

$$= 305,060 \text{ in-lbs}$$

$$= 25,421 \text{ ft-lbs}$$

2. SHEAR

$$V_n = V_c = 2 \sqrt{f'_c} b_w d$$

$$\phi V_n = (0.85)(2) \sqrt{3000} (12)(10.875)$$

$$= 12,151 \text{ lbs}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12$$

$$d = 12 - 0.75 - \frac{0.75}{2} = 10$$

$$\phi = 0.85$$

3. AXIAL

$$\phi P_n = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$= (0.55)(0.7)(3000)(144) \left[1 - \left(\frac{(0.8)(101)}{(32)(12)} \right)^2 \right]$$

$$\phi P_n = 158,956 \text{ lb}$$

$$K = 0.8$$

$$l_c = 8.5 \times 12 = 101 \text{ in}$$

$$A_g = 12 \times 12 = 144 \text{ in}^2$$

$$f'_c = 3000$$

$$h = 12$$

$$\phi = 0.7$$

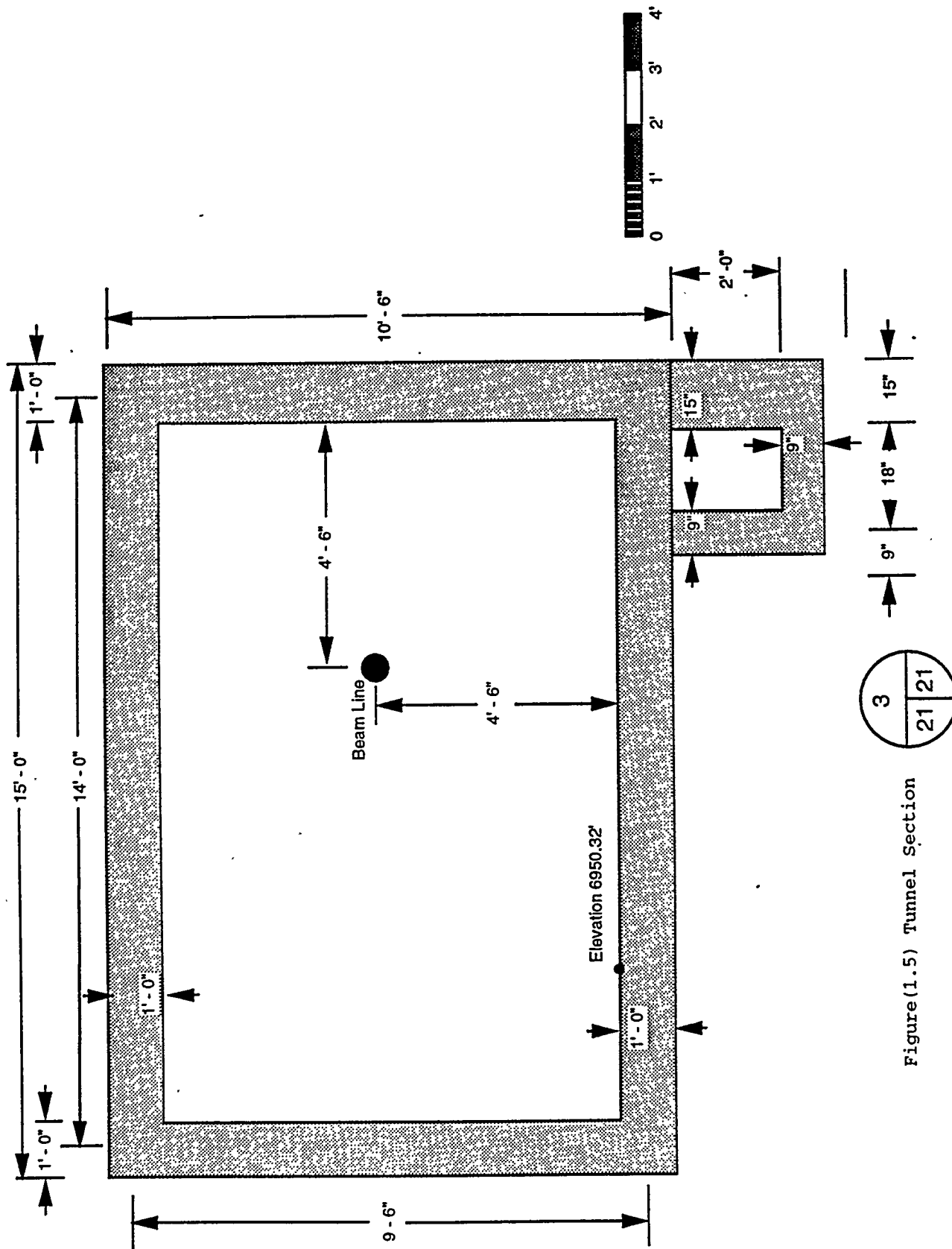
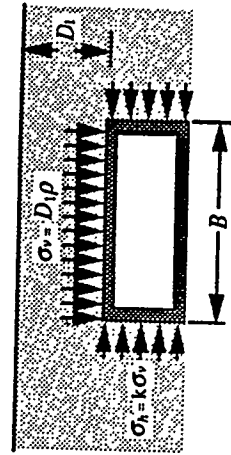
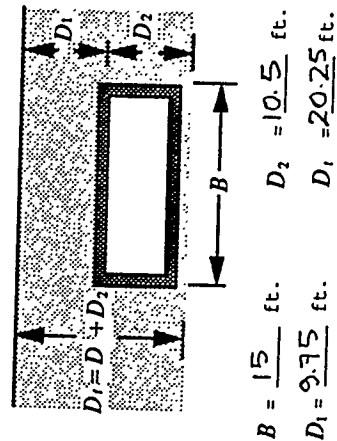


Figure (1.5) Tunnel Section

TUNNEL SECTION		PRELIMINARY				STRUCTURAL ASSESSMENT	
PAGE	OF	TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE		
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$		ROOF STRUCTURE	40,062 ft-lbs	24,252 ft-lbs			
		FLOOR STRUCTURE	40,062 ft-lbs	16,488 ft-lbs			
		LEFT INSIDE WALL	9,547 ft-lbs	— ft-lbs			
		LEFT OUTSIDE WALL	25,421 ft-lbs	19,370 ft-lbs			
		RIGHT INSIDE WALL	9,547 ft-lbs	— ft-lbs			
		RIGHT OUTSIDE WALL	25,421 ft-lbs	19,370 ft-lbs			
		ROOF STRUCTURE	12,151 lbs	12,465 (9,962) lbs	ad.		
		FLOOR STRUCTURE	12,151 lbs	12,221 (8,256) lbs	ad.		
		LEFT WALL	12,151 lbs	2,740 lbs			
		RIGHT WALL	12,151 lbs	2,740 lbs			
Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2\sqrt{f'_c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2\sqrt{f'_c} B_w d$		LEFT WALL	158,956 lbs	14,460 lbs			
		RIGHT WALL	158,956 lbs	14,460 lbs			
Axial Capacity Design axial load ϕP_{nw} is computed by ACI 318-89 (14-1) $\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{kl_c}{32h} \right)^2 \right]$ where $\phi = 0.7$		LEFT WALL					
		RIGHT WALL					

Loading Conditions



$$\text{where } k = \frac{1 - \sin \theta}{1 + \sin \theta}$$

$$k = 0.3$$

Figure () Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-2(21/21)

TITLE: Preliminary Structural Assessment of Tunnel Section 2(21/21)

PROJECT: Remedial Shielding Concepts for Line D and Line D

Facilities. Los Alamos Meson Physics Facility,

Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 2(21/21) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

5/3/93

DATE:

CHECKED BY:

DATE:

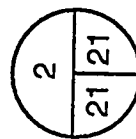
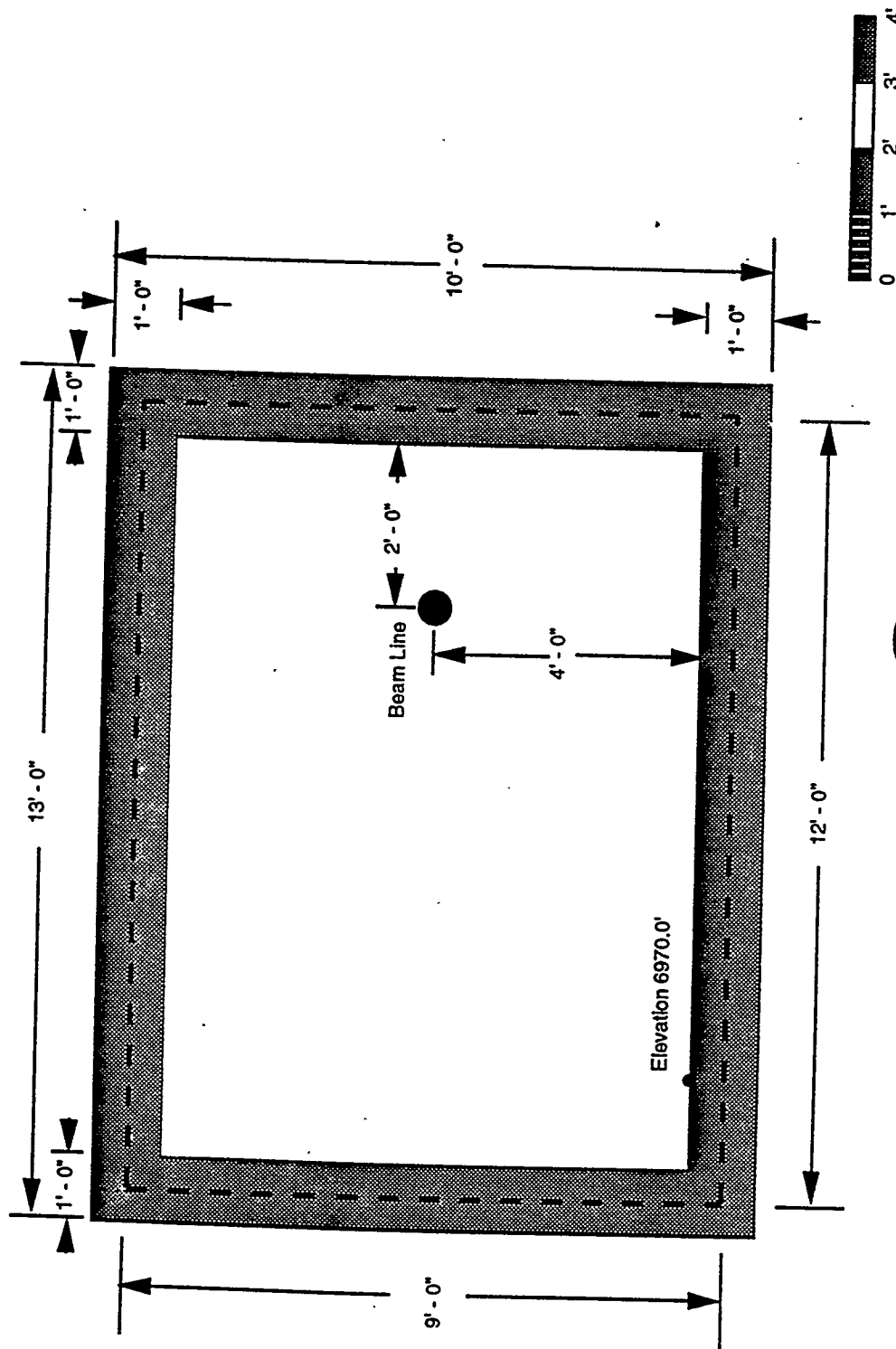


Figure () Section

ROOF ELEMENT PROPERTIES

Youngs Modulus w 1.5 (33)√f'c	E = 332×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia b.d ³ /12	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration √(Ic/A)	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.0</u> ft

FLOOR ELEMENT PROPERTIES

Youngs Modulus w 1.5 (33)√f'c	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia b.d ³ /12	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration √(Ic/A)	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.0</u> ft

LEFTWALL ELEMENT PROPERTIES

Youngs Modulus w 1.5 (33)√f'c	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia b.d ³ /12	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration √(Ic/A)	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.0</u> ft

RIGHTWALL ELEMENT PROPERTIES

Youngs Modulus $w 1.5 (33)\sqrt{f \cdot c}$ $E = 332 \times 10^6$ psi
 Area of Cross Section (b x d) $A = 144$ in²
 Depth of Section $d = 12$ in
 Thickness of Web $b = 12$ in
 Weight per Unit Length $W = 150$ lbs/ft
 Moment of Inertia $b \cdot d^3 / 12$ $I_c = 1728$ in⁴
 Sectional Modulus I_c / c $S = 288$ in³
 Radius of Gyration $\sqrt{(I_c / A)}$ $r = 3.464$ in
 Neutral Axis $NA = 6.0$ in
 Extreme Fiber $C = 6.0$ in
 Element Length $L = 10$ ft

SOIL ELEMENT PROPERTIES

Youngs Modulus $E = 300$ psi (K)
 Area of Cross Section (b x d) $A = 144$ in²
 Depth of Section $d = 12$ in
 Thickness of Web $b = 12$ in
 Weight per Unit Length $W = 115$ lbs/ft
 Moment of Inertia $b \cdot d^3 / 12$ $I_c = 1728$ in⁴
 Sectional Modulus I_c / C $S = 288$ in³
 Radius of Gyration $\sqrt{(I_c / A)}$ $r = 3.464$ in
 Neutral Axis $NA = 6.0$ in
 Extreme Fiber $C = 6.0$ in
 Element Length $L = 0.0833$ ft

SOILEND PROPERTIES

Youngs Modulus $E = 300$ psi (K)
 Area of Cross Section (b x d) $A = 72$ in²
 Depth of Section $d = 12$ in
 Thickness of Web $b = 6$ in
 Weight per Unit Length $W = 57.5$ lbs/ft
 Moment of Inertia $b \cdot d^3 / 12$ $I_c = 864$ in⁴
 Sectional Modulus I_c / C $S = 144$ in³
 Radius of Gyration $\sqrt{(I_c / A)}$ $r = 3.464$ in
 Neutral Axis $NA = 6.0$ in
 Extreme Fiber $C = 6.0$ in
 Element Length $L = 0.0833$ ft

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

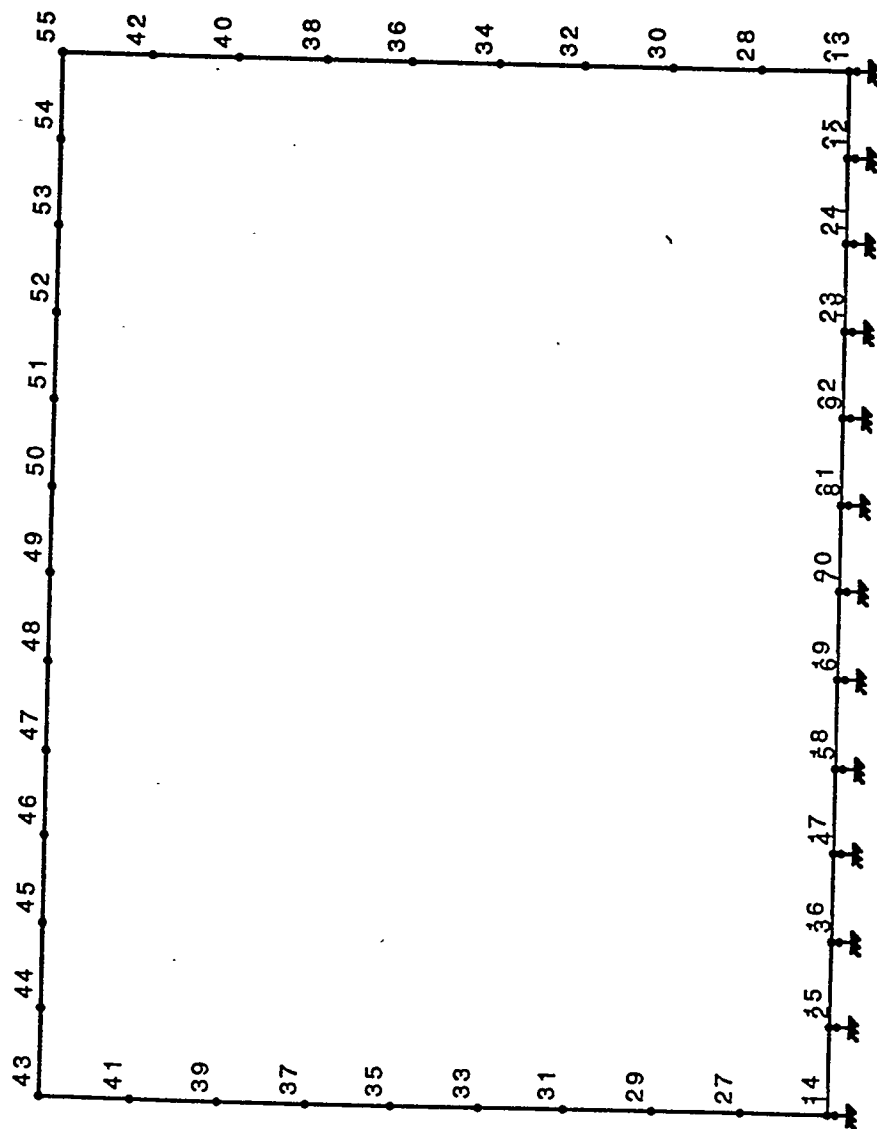
ELEMENT PROPERTIES

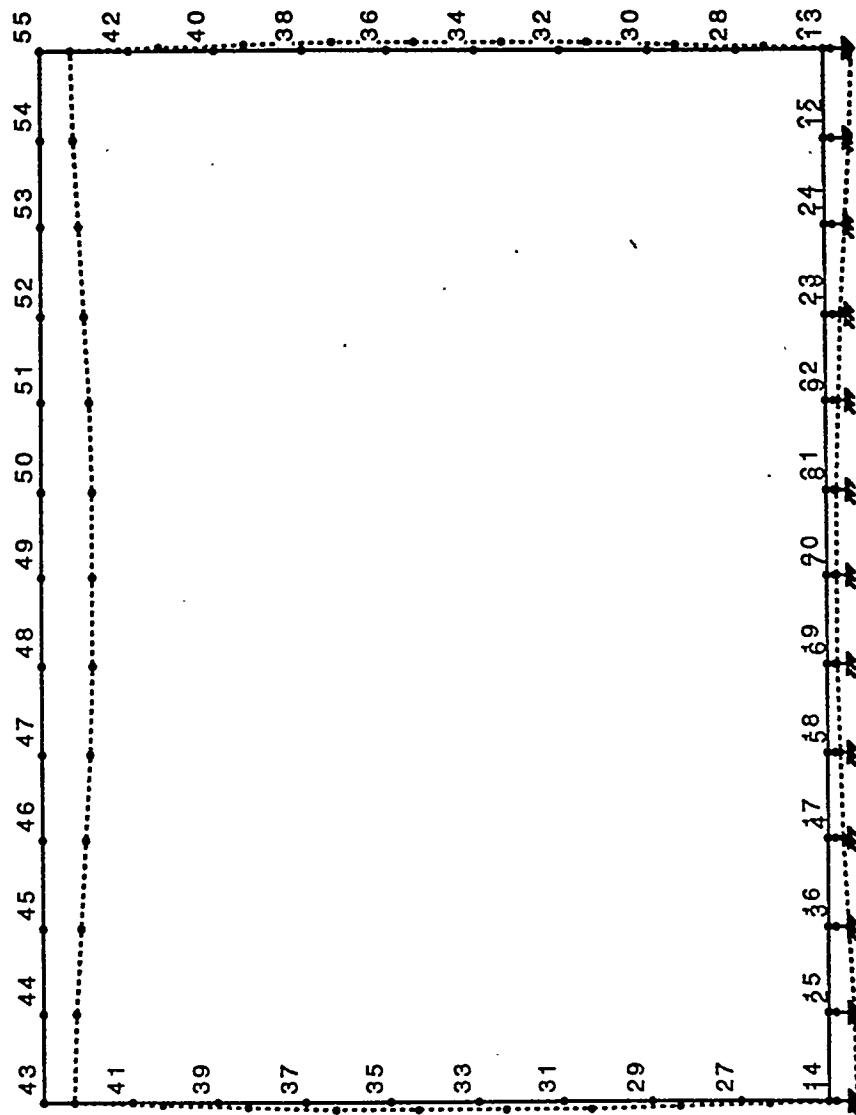
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

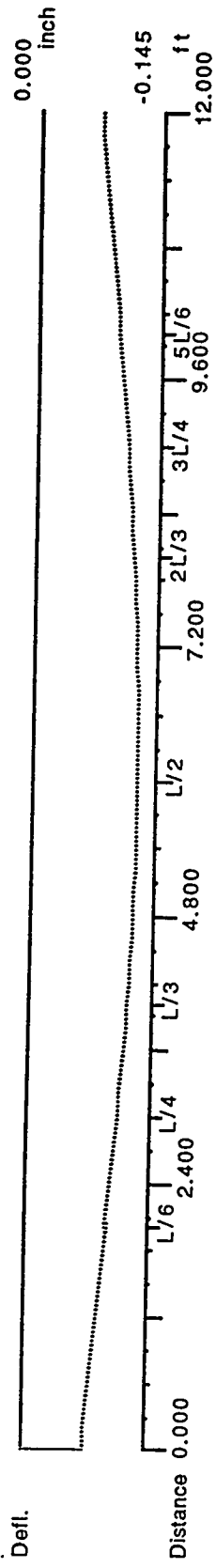
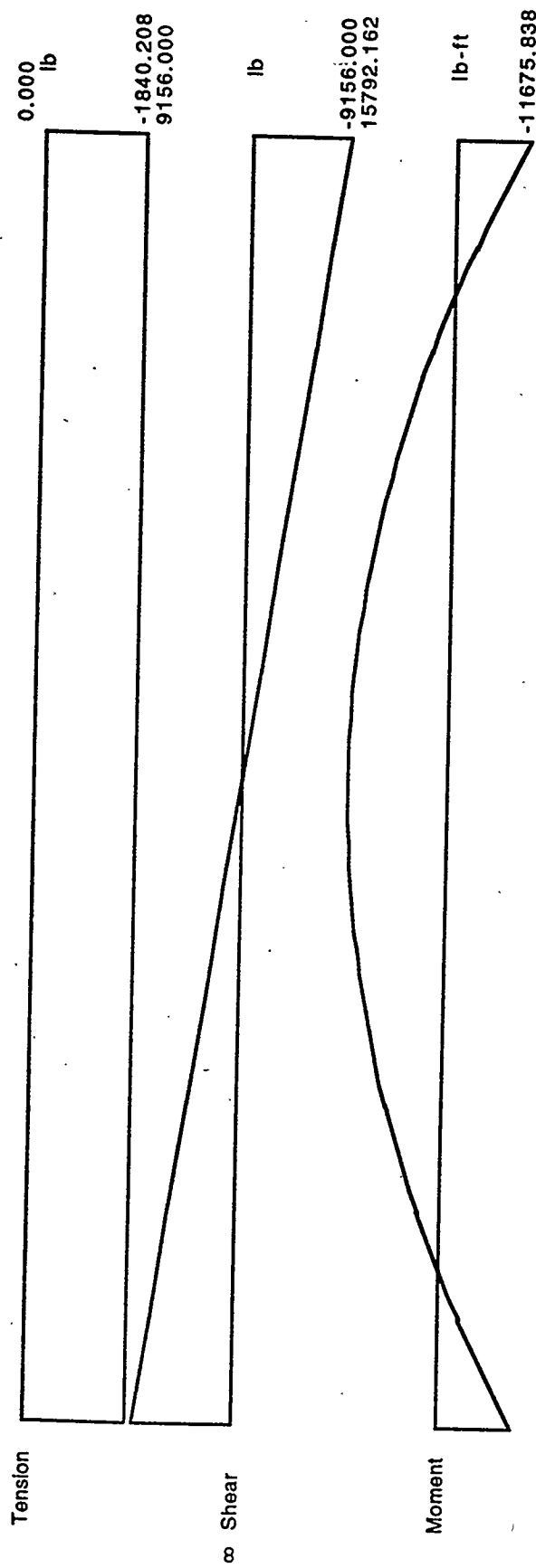
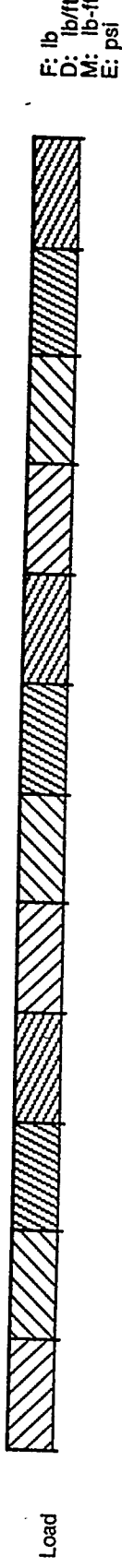
FRAME MAC file: 2(21/21)PRELIMINARY; Last modified at 17:45:40 on Tue, May 4, 1993





FRAME MAC file: 2(21/21)PRELIMINARY; Last modified at 17:45:40 on Tue, May 4, 1993

Node 43	Node 44	Node 45	Node 46	Node 47	Node 48	Node 49	Node 50	Node 51	Node 52	Node 53	Node 54	Node 55
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	10.000	12.000	13.000
10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	11.000	12.000	10.000



Continuous Elements Output Data

FRAME MAC file: 2(21/21)PRELIMINARY.

Last modified at 17:45:40 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
43	0.000	-0.084	-0.001
44	0.000	-0.097	-0.001
45	0.000	-0.112	-0.001
46	0.000	-0.125	-0.001
47	0.000	-0.136	-0.001
48	0.000	-0.143	-0.000
49	0.000	-0.145	0.000
50	-0.000	-0.143	0.000
51	-0.000	-0.136	0.001
52	-0.000	-0.125	0.001
53	-0.000	-0.112	0.001
54	-0.000	-0.097	0.001
55	-0.000	-0.084	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
43,44	0.000	763.000	127.167	0.000	763.000	-127.167
44,45	0.000	763.000	127.167	0.000	763.000	-127.167
45,46	0.000	763.000	127.167	0.000	763.000	-127.167
46,47	0.000	763.000	127.167	0.000	763.000	-127.167
47,48	0.000	763.000	127.167	0.000	763.000	-127.167
48,49	0.000	763.000	127.167	0.000	763.000	-127.167
49,50	0.000	763.000	127.167	0.000	763.000	-127.167
50,51	0.000	763.000	127.167	0.000	763.000	-127.167
51,52	0.000	763.000	127.167	0.000	763.000	-127.167
52,53	0.000	763.000	127.167	0.000	763.000	-127.167
53,54	0.000	763.000	127.167	0.000	763.000	-127.167
54,55	0.000	763.000	127.167	0.000	763.000	-127.167

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
43,44	1840.208	9156.000	11675.838	-1840.208	-7630.000	-3282.838
44,45	1840.208	7630.000	3282.838	-1840.208	-6104.000	3584.162
45,46	1840.208	6104.000	-3584.162	-1840.208	-4578.000	8925.162
46,47	1840.208	4578.000	-8925.162	-1840.208	-3052.000	12740.162
47,48	1840.208	3052.000	-12740.162	-1840.208	-1526.000	15029.162
48,49	1840.208	1526.000	-15029.162	-1840.208	0.000	15792.162
49,50	1840.208	0.000	-15792.162	-1840.208	1526.000	15029.162
50,51	1840.208	-1526.000	-15029.162	-1840.208	3052.000	12740.162
51,52	1840.208	-3052.000	-12740.162	-1840.208	4578.000	8925.162
52,53	1840.208	-4578.000	-8925.162	-1840.208	6104.000	3584.162
53,54	1840.208	-6104.000	-3584.162	-1840.208	7630.000	-3282.838
54,55	1840.208	-7630.000	3282.838	-1840.208	9156.000	-11675.838

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
43,44	0.000	-0.084	-0.001	0.000	-0.097	-0.001
44,45	0.000	-0.097	-0.001	0.000	-0.112	-0.001
45,46	0.000	-0.112	-0.001	0.000	-0.125	-0.001
46,47	0.000	-0.125	-0.001	0.000	-0.136	-0.001
47,48	0.000	-0.136	-0.001	0.000	-0.143	-0.000
48,49	0.000	-0.143	-0.000	0.000	-0.145	0.000
49,50	0.000	-0.145	0.000	-0.000	-0.143	0.000
50,51	-0.000	-0.143	0.000	-0.000	-0.136	0.001

51,52	-0.000	-0.136	0.001	-0.000	-0.125	0.001
52,53	-0.000	-0.125	0.001	-0.000	-0.112	0.001
53,54	-0.000	-0.112	0.001	-0.000	-0.097	0.001
54,55	-0.000	-0.097	0.001	-0.000	-0.084	0.001

Maximum deformations:

Node 55 moved 0.000 inch to the left.
Node 43 moved 0.000 inch to the right.
Node 49 moved 0.145 inch downwards.
No nodes moved upwards.
Node 44 rotated 0.001 radian clockwise.
Node 54 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
43,44	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
44,45	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
45,46	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
46,47	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
47,48	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
48,49	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
49,50	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
50,51	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
51,52	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
52,53	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
53,54	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
54,55	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
43,44	9156.000	0.000	9156.000	63.583	0.000	63.583
44,45	7630.000	0.000	7630.000	52.986	0.000	52.986
45,46	6104.000	0.000	6104.000	42.389	0.000	42.389
46,47	4578.000	0.000	4578.000	31.792	0.000	31.792
47,48	3052.000	0.000	3052.000	21.194	0.000	21.194
48,49	1526.000	0.000	1526.000	10.597	0.000	10.597
49,50	0.000	-1526.000	-1526.000	0.000	-10.597	-10.597
50,51	0.000	-3052.000	-3052.000	0.000	-21.194	-21.194
51,52	0.000	-4578.000	-4578.000	0.000	-31.792	-31.792
52,53	0.000	-6104.000	-6104.000	0.000	-42.389	-42.389
53,54	0.000	-7630.000	-7630.000	0.000	-52.986	-52.986
54,55	0.000	-9156.000	-9156.000	0.000	-63.583	-63.583

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
43,44	0.000	-11675.838	-11675.838	0.000	-486.493	-486.493
44,45	3584.162	-3282.838	3584.162	149.340	-136.785	149.340
45,46	8925.162	0.000	8925.162	371.882	0.000	371.882
46,47	12740.162	0.000	12740.162	530.840	0.000	530.840
47,48	15029.162	0.000	15029.162	626.215	0.000	626.215
48,49	15792.162	0.000	15792.162	658.007	0.000	658.007
49,50	15792.162	0.000	15792.162	658.007	0.000	658.007
50,51	15029.162	0.000	15029.162	626.215	0.000	626.215
51,52	12740.162	0.000	12740.162	530.840	0.000	530.840
52,53	8925.162	0.000	8925.162	371.882	0.000	371.882
53,54	3584.162	-3282.838	3584.162	149.340	-136.785	149.340
54,55	0.000	-11675.838	-11675.838	0.000	-486.493	-486.493

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
43,44	0.000	-0.097	-0.097
44,45	0.000	-0.112	-0.112
45,46	0.000	-0.125	-0.125
46,47	0.000	-0.136	-0.136
47,48	0.000	-0.143	-0.143
48,49	0.000	-0.145	-0.145
49,50	0.000	-0.145	-0.145
50,51	0.000	-0.143	-0.143
51,52	0.000	-0.136	-0.136
52,53	0.000	-0.125	-0.125
53,54	0.000	-0.112	-0.112
54,55	0.000	-0.097	-0.097

Deflections along the elements (positive is up or counter-clockwise):

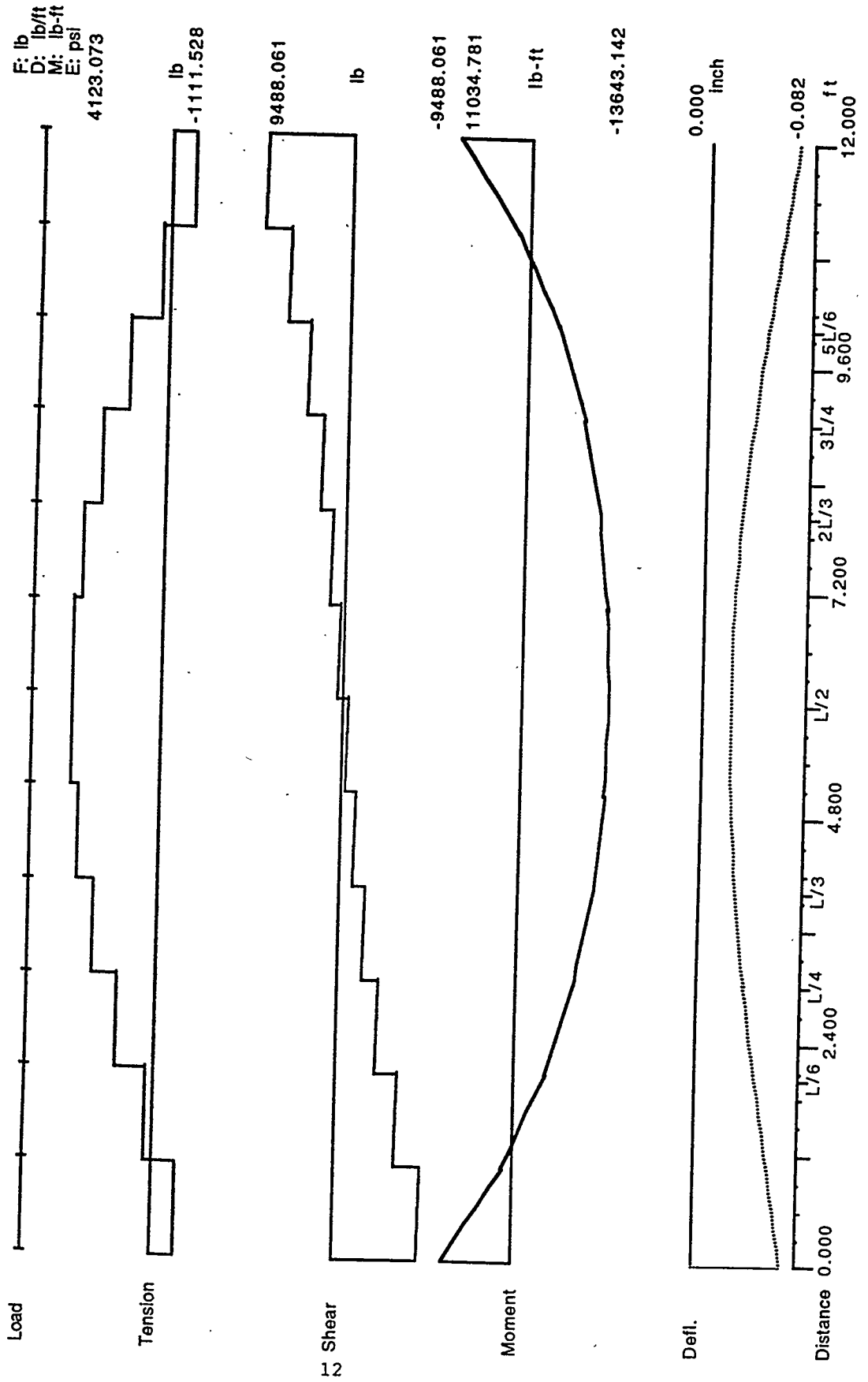
Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch
At the intermediate nodes:		
1.000	-0.001	-0.097
2.000	-0.001	-0.112
3.000	-0.001	-0.125
4.000	-0.001	-0.136
5.000	-0.000	-0.143
6.000	0.000	-0.145
7.000	0.000	-0.143
8.000	0.001	-0.136
9.000	0.001	-0.125
10.000	0.001	-0.112
11.000	0.001	-0.097

At evenly-spaced intervals:

0.000	-0.001	-0.084
1.200	-0.001	-0.100
2.400	-0.001	-0.117
3.600	-0.001	-0.132
4.800	-0.000	-0.142
6.000	0.000	-0.145
7.200	0.000	-0.142
8.400	0.001	-0.132
9.600	0.001	-0.117
10.800	0.001	-0.100
12.000	0.001	-0.084

FRAME MAC file: 2(21/21)PRELIMINARY; Last modified at 17:45:40 on Tue, May 4, 1993

Node 14	Node 15	Node 16	Node 17	Node 18	Node 19	Node 20	Node 21	Node 22	Node 23	Node 24	Node 25	Node 26
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000



Continuous Elements Output Data

FRAME MAC file: 2(21/21)PRELIMINARY.

Last modified at 17:45:40 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

14	-0.000	-0.082	0.001
15	-0.000	-0.069	0.001
16	-0.000	-0.056	0.001
17	-0.000	-0.044	0.001
18	-0.000	-0.034	0.001
19	-0.000	-0.028	0.000
20	0.000	-0.026	0.000
21	0.000	-0.028	-0.000
22	0.000	-0.034	-0.001
23	0.000	-0.044	-0.001
24	0.000	-0.056	-0.001
25	0.000	-0.069	-0.001
26	0.000	-0.082	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,15	0.000	105.000	17.500	0.000	105.000	-17.500
15,16	0.000	105.000	17.500	0.000	105.000	-17.500
16,17	0.000	105.000	17.500	0.000	105.000	-17.500
17,18	0.000	105.000	17.500	0.000	105.000	-17.500
18,19	0.000	105.000	17.500	0.000	105.000	-17.500
19,20	0.000	105.000	17.500	0.000	105.000	-17.500
20,21	0.000	105.000	17.500	0.000	105.000	-17.500
21,22	0.000	105.000	17.500	0.000	105.000	-17.500
22,23	0.000	105.000	17.500	0.000	105.000	-17.500
23,24	0.000	105.000	17.500	0.000	105.000	-17.500
24,25	0.000	105.000	17.500	0.000	105.000	-17.500
25,26	0.000	105.000	17.500	0.000	105.000	-17.500

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,15	1111.528	-9278.061	-11034.781	-1111.528	9488.061	1651.720
15,16	-364.035	-6502.946	-1761.700	364.035	6712.946	-4846.246
16,17	-1777.399	-4307.046	4740.511	1777.399	4517.046	-9152.558
17,18	-2927.330	-2632.982	9065.313	2927.330	2842.982	-11803.295
18,19	-3721.086	-1366.085	11742.185	3721.086	1576.085	-13213.271
19,20	-4123.073	-356.146	13181.997	4123.073	566.146	-13643.142
20,21	-4123.073	566.146	13643.142	4123.073	-356.146	-13181.997
21,22	-3721.086	1576.085	13213.271	3721.086	-1366.085	-11742.185
22,23	-2927.330	2842.982	11803.295	2927.330	-2632.982	-9065.313
23,24	-1777.399	4517.046	9152.558	1777.399	-4307.046	-4740.511
24,25	-364.035	6712.946	4846.246	364.035	-6502.946	1761.700
25,26	1111.528	9488.061	-1651.720	-1111.528	-9278.061	11034.781

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
14,15	-0.000	-0.082	0.001	-0.000	-0.069	0.001
15,16	-0.000	-0.069	0.001	-0.000	-0.056	0.001
16,17	-0.000	-0.056	0.001	-0.000	-0.044	0.001
17,18	-0.000	-0.044	0.001	-0.000	-0.034	0.001
18,19	-0.000	-0.034	0.001	-0.000	-0.028	0.000
19,20	-0.000	-0.028	0.000	0.000	-0.026	0.000
20,21	0.000	-0.026	0.000	0.000	-0.028	-0.000
21,22	0.000	-0.028	-0.000	0.000	-0.034	-0.001

22,23	0.000	-0.034	-0.001	0.000	-0.044	-0.001
23,24	0.000	-0.044	-0.001	0.000	-0.056	-0.001
24,25	0.000	-0.056	-0.001	0.000	-0.069	-0.001
25,26	0.000	-0.069	-0.001	0.000	-0.082	-0.001

Maximum deformations:

Node 15 moved 0.000 inch to the left.
Node 25 moved 0.000 inch to the right.
Node 14 moved 0.082 inch downwards.
No nodes moved upwards.
Node 25 rotated 0.001 radian clockwise.
Node 15 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
14,15	0.000	-1111.528	-1111.528	0.000	-7.719	-7.719
15,16	364.035	0.000	364.035	2.528	0.000	2.528
16,17	1777.399	0.000	1777.399	12.343	0.000	12.343
17,18	2927.330	0.000	2927.330	20.329	0.000	20.329
18,19	3721.086	0.000	3721.086	25.841	0.000	25.841
19,20	4123.073	0.000	4123.073	28.632	0.000	28.632
20,21	4123.073	0.000	4123.073	28.632	0.000	28.632
21,22	3721.086	0.000	3721.086	25.841	0.000	25.841
22,23	2927.330	0.000	2927.330	20.329	0.000	20.329
23,24	1777.399	0.000	1777.399	12.343	0.000	12.343
24,25	364.035	0.000	364.035	2.528	0.000	2.528
25,26	0.000	-1111.528	-1111.528	0.000	-7.719	-7.719

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
14,15	0.000	-9488.061	-9488.061	0.000	-65.889	-65.889
15,16	0.000	-6712.946	-6712.946	0.000	-46.618	-46.618
16,17	0.000	-4517.046	-4517.046	0.000	-31.368	-31.368
17,18	0.000	-2842.982	-2842.982	0.000	-19.743	-19.743
18,19	0.000	-1576.085	-1576.085	0.000	-10.945	-10.945
19,20	0.000	-566.146	-566.146	0.000	-3.932	-3.932
20,21	566.146	0.000	566.146	3.932	0.000	3.932
21,22	1576.085	0.000	1576.085	10.945	0.000	10.945
22,23	2842.982	0.000	2842.982	19.743	0.000	19.743
23,24	4517.046	0.000	4517.046	31.368	0.000	31.368
24,25	6712.946	0.000	6712.946	46.618	0.000	46.618
25,26	9488.061	0.000	9488.061	65.889	0.000	65.889

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
14,15	11034.781	0.000	11034.781	459.783	0.000	459.783
15,16	1761.700	-4846.246	-4846.246	73.404	-201.927	-201.927
16,17	0.000	-9152.558	-9152.558	0.000	-381.357	-381.357
17,18	0.000	-11803.295	-11803.295	0.000	-491.804	-491.804
18,19	0.000	-13213.271	-13213.271	0.000	-550.553	-550.553
19,20	0.000	-13643.142	-13643.142	0.000	-568.464	-568.464
20,21	0.000	-13643.142	-13643.142	0.000	-568.464	-568.464
21,22	0.000	-13213.271	-13213.271	0.000	-550.553	-550.553
22,23	0.000	-11803.295	-11803.295	0.000	-491.804	-491.804
23,24	0.000	-9152.558	-9152.558	0.000	-381.357	-381.357
24,25	1761.700	-4846.246	-4846.246	73.404	-201.927	-201.927
25,26	11034.781	0.000	11034.781	459.783	0.000	459.783

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
14,15	0.000	-0.082	-0.082
15,16	0.000	-0.069	-0.069
16,17	0.000	-0.056	-0.056
17,18	0.000	-0.044	-0.044
18,19	0.000	-0.034	-0.034
19,20	0.000	-0.028	-0.028
20,21	0.000	-0.028	-0.028
21,22	0.000	-0.034	-0.034
22,23	0.000	-0.044	-0.044
23,24	0.000	-0.056	-0.056
24,25	0.000	-0.069	-0.069
25,26	0.000	-0.082	-0.082

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch

At the intermediate nodes:

1.000	0.001	-0.069
2.000	0.001	-0.056
3.000	0.001	-0.044
4.000	0.001	-0.034
5.000	0.000	-0.028
6.000	0.000	-0.026
7.000	-0.000	-0.028
8.000	-0.001	-0.034
9.000	-0.001	-0.044
10.000	-0.001	-0.056
11.000	-0.001	-0.069

At evenly-spaced intervals:

0.000	0.001	-0.082
1.200	0.001	-0.066
2.400	0.001	-0.051
3.600	0.001	-0.038
4.800	0.000	-0.029
6.000	0.000	-0.026
7.200	-0.000	-0.029
8.400	-0.001	-0.038
9.600	-0.001	-0.051
10.800	-0.001	-0.066
12.000	-0.001	-0.082

FRAME MAC file: 2(21/21)PRELIMINARY; Last modified at 17:45:40 on Tue, May 4, 1993

Node 14
1.000
1.000

Node 27
1.000
2.000

Node 29
1.000
3.000

Node 31
1.000
4.000

Node 33
1.000
5.000

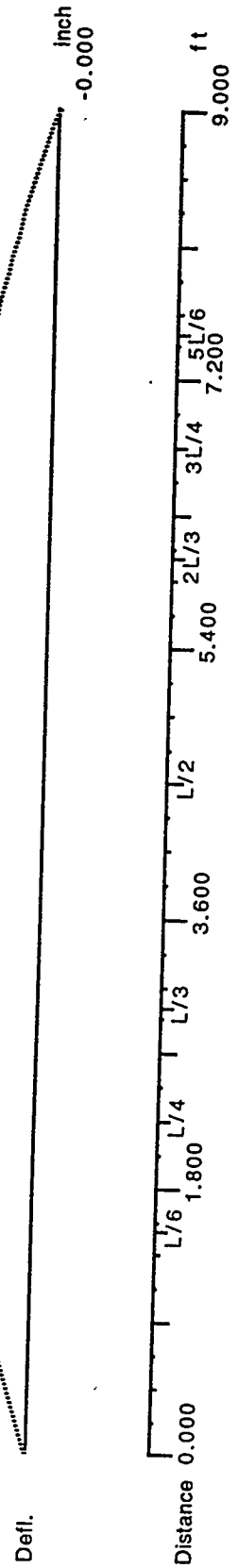
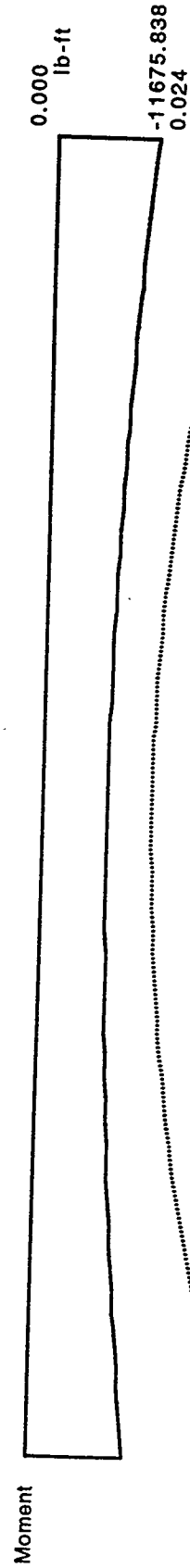
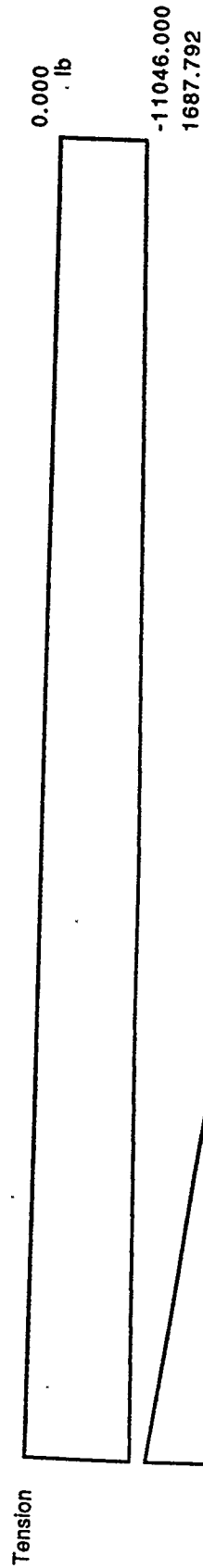
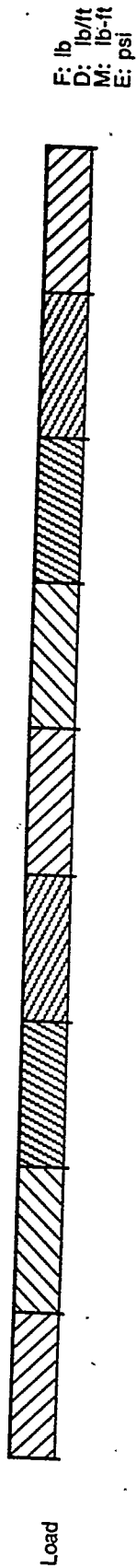
Node 35
1.000
6.000

Node 37
1.000
7.000

Node 39
1.000
8.000

Node 41
1.000
9.000

Node 43
1.000
10.000



Continuous Elements Output Data

FRAME MAC file: 2(21/21)PRELIMINARY.

Last modified at 17:45:40 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
14	-0.000	-0.082	0.001
27	-0.010	-0.082	0.001
29	-0.017	-0.082	0.000
31	-0.022	-0.083	0.000
33	-0.024	-0.083	0.000
35	-0.024	-0.083	-0.000
37	-0.022	-0.083	-0.000
39	-0.017	-0.084	-0.000
41	-0.010	-0.084	-0.001
43	0.000	-0.084	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,27	105.000	196.000	32.667	105.000	196.000	-32.667
27,29	105.000	196.000	32.667	105.000	196.000	-32.667
29,31	105.000	196.000	32.667	105.000	196.000	-32.667
31,33	105.000	196.000	32.667	105.000	196.000	-32.667
33,35	105.000	196.000	32.667	105.000	196.000	-32.667
35,37	105.000	196.000	32.667	105.000	196.000	-32.667
37,39	105.000	196.000	32.667	105.000	196.000	-32.667
39,41	105.000	196.000	32.667	105.000	196.000	-32.667
41,43	105.000	196.000	32.667	105.000	196.000	-32.667

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,27	11046.000	1687.792	10989.969	-10836.000	-1295.792	-9498.177
27,29	10836.000	1295.792	9498.177	-10626.000	-903.792	-8398.385
29,31	10626.000	903.792	8398.385	-10416.000	-511.792	-7690.592
31,33	10416.000	511.792	7690.592	-10206.000	-119.792	-7374.800
33,35	10206.000	119.792	7374.800	-9996.000	272.208	-7451.007
35,37	9996.000	-272.208	7451.007	-9786.000	664.208	-7919.215
37,39	9786.000	-664.208	7919.215	-9576.000	1056.208	-8779.423
39,41	9576.000	-1056.208	8779.423	-9366.000	1448.208	-10031.630
41,43	9366.000	-1448.208	10031.630	-9156.000	1840.208	-11675.838

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
14,27	-0.082	0.000	0.001	-0.082	0.010	0.001
27,29	-0.082	0.010	0.001	-0.082	0.017	0.000
29,31	-0.082	0.017	0.000	-0.083	0.022	0.000
31,33	-0.083	0.022	0.000	-0.083	0.024	0.000
33,35	-0.083	0.024	0.000	-0.083	0.024	-0.000
35,37	-0.083	0.024	-0.000	-0.083	0.022	-0.000
37,39	-0.083	0.022	-0.000	-0.084	0.017	-0.000
39,41	-0.084	0.017	-0.000	-0.084	0.010	-0.001
41,43	-0.084	0.010	-0.001	-0.084	-0.000	-0.001

Maximum deformations:

Node 35 moved 0.024 inch to the left.
Node 43 moved 0.000 inch to the right.
Node 43 moved 0.084 inch downwards.
No nodes moved upwards.
Node 43 rotated 0.001 radian clockwise.
Node 14 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
14,27	0.000	-11046.000	-11046.000	0.000	-76.708	-76.708
27,29	0.000	-10836.000	-10836.000	0.000	-75.250	-75.250
29,31	0.000	-10626.000	-10626.000	0.000	-73.792	-73.792
31,33	0.000	-10416.000	-10416.000	0.000	-72.333	-72.333
33,35	0.000	-10206.000	-10206.000	0.000	-70.875	-70.875
35,37	0.000	-9996.000	-9996.000	0.000	-69.417	-69.417
37,39	0.000	-9786.000	-9786.000	0.000	-67.958	-67.958
39,41	0.000	-9576.000	-9576.000	0.000	-66.500	-66.500
41,43	0.000	-9366.000	-9366.000	0.000	-65.042	-65.042

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
14,27	1687.792	0.000	1687.792	11.721	0.000	11.721
27,29	1295.792	0.000	1295.792	8.999	0.000	8.999
29,31	903.792	0.000	903.792	6.276	0.000	6.276
31,33	511.792	0.000	511.792	3.554	0.000	3.554
33,35	119.792	-272.208	-272.208	0.832	-1.890	-1.890
35,37	0.000	-664.208	-664.208	0.000	-4.613	-4.613
37,39	0.000	-1056.208	-1056.208	0.000	-7.335	-7.335
39,41	0.000	-1448.208	-1448.208	0.000	-10.057	-10.057
41,43	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
14,27	0.000	-10989.969	-10989.969	0.000	-457.915	-457.915
27,29	0.000	-9498.177	-9498.177	0.000	-395.757	-395.757
29,31	0.000	-8398.385	-8398.385	0.000	-349.933	-349.933
31,33	0.000	-7690.592	-7690.592	0.000	-320.441	-320.441
33,35	0.000	-7451.007	-7451.007	0.000	-310.459	-310.459
35,37	0.000	-7919.215	-7919.215	0.000	-329.967	-329.967
37,39	0.000	-8779.423	-8779.423	0.000	-365.809	-365.809
39,41	0.000	-10031.630	-10031.630	0.000	-417.985	-417.985
41,43	0.000	-11675.838	-11675.838	0.000	-486.493	-486.493

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
14,27	0.010	0.000	0.010
27,29	0.017	0.000	0.017
29,31	0.022	0.000	0.022
31,33	0.024	0.000	0.024
33,35	0.024	0.000	0.024
35,37	0.024	0.000	0.024
37,39	0.022	0.000	0.022
39,41	0.017	0.000	0.017
41,43	0.010	-0.000	0.010

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch

```

-----
At the intermediate nodes:
      1.000      0.001      0.010
      2.000      0.000      0.017
      3.000      0.000      0.022
      4.000      0.000      0.024
      5.000     -0.000      0.024
      6.000     -0.000      0.022
      7.000     -0.000      0.017
      8.000     -0.001      0.010

```

```

At evenly-spaced intervals:
      0.000      0.001      0.000
      0.900      0.001      0.009
      1.800      0.001      0.016
      2.700      0.000      0.021
      3.600      0.000      0.024
      4.500      0.000      0.024
      5.400     -0.000      0.024
      6.300     -0.000      0.021
      7.200     -0.001      0.016
      8.100     -0.001      0.009
      9.000     -0.001     -0.000

```

```

*****

```

FRAME MAC file: 2(21/21)PRELIMINARY; Last modified at 17:45:40 on Tue, May 4, 1993

Node 26
13.000
1.000

Node 28
13.000
2.000

Node 30
13.000
3.000

Node 32
13.000
4.000

Node 34
13.000
5.000

Node 36
13.000
6.000

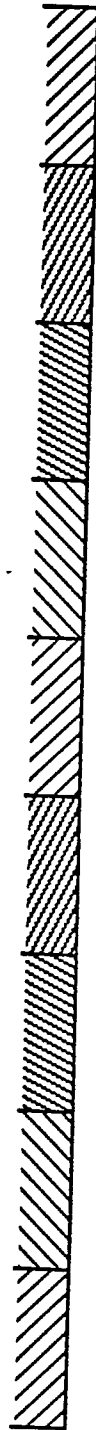
Node 38
13.000
7.000

Node 40
13.000
8.000

Node 42
13.000
9.000

Node 55
13.000
10.000

Load

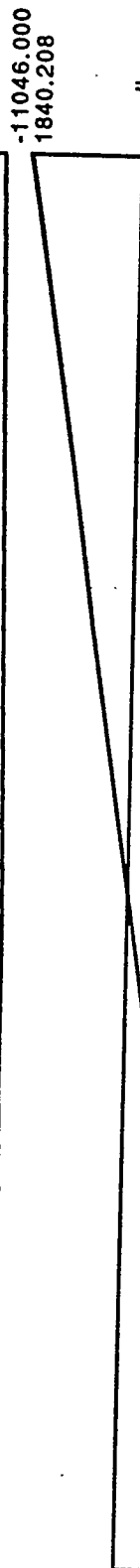


F: lb
D: lb/ft
M: lb-ft
E: psi

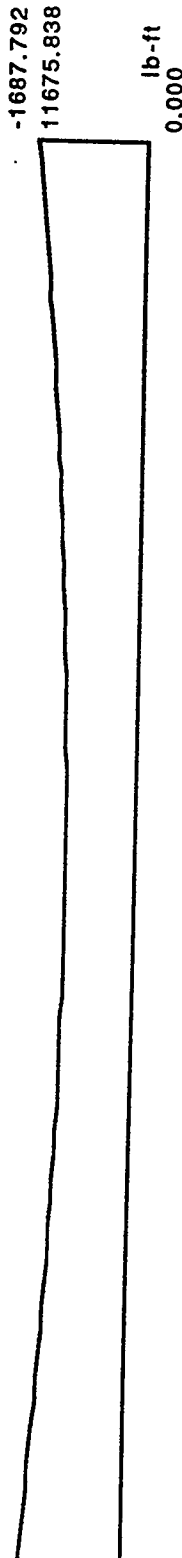
Tension



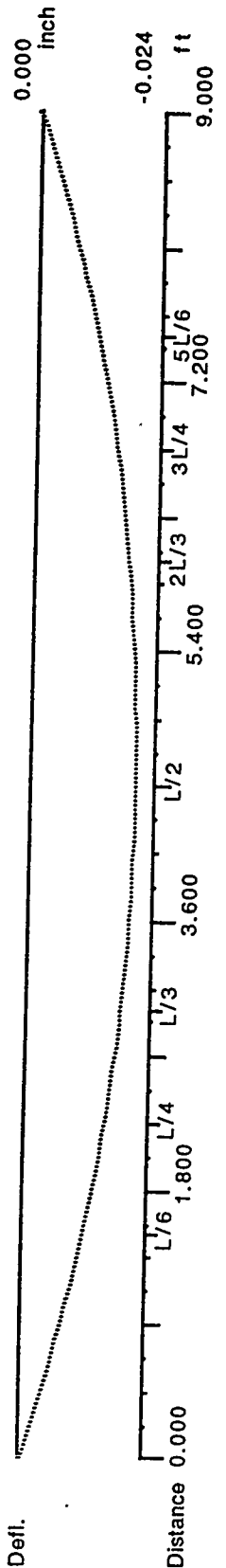
20 Shear



Moment



Defl.



Continuous Elements Output Data

FRAME MAC file: 2(21/21)PRELIMINARY.

Last modified at 17:45:40 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node	Reaction	Reaction	Reaction
No.	lb (FX)	lb (FY)	lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node	Deflection	Deflection	Rotation
No.	inch (FX)	inch (FY)	radians (MZ)

26	0.000	-0.082	-0.001
28	0.010	-0.082	-0.001
30	0.017	-0.082	-0.000
32	0.022	-0.083	-0.000
34	0.024	-0.083	-0.000
36	0.024	-0.083	0.000
38	0.022	-0.083	0.000
40	0.017	-0.084	0.000
42	0.010	-0.084	0.001
55	-0.000	-0.084	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To	FxL	FyL	MzL	FxR	FyR	MzR
Nodes	lb	lb	lb-ft	lb	lb	lb-ft

26,28	105.000	-196.000	-32.667	105.000	-196.000	32.667
28,30	105.000	-196.000	-32.667	105.000	-196.000	32.667
30,32	105.000	-196.000	-32.667	105.000	-196.000	32.667
32,34	105.000	-196.000	-32.667	105.000	-196.000	32.667
34,36	105.000	-196.000	-32.667	105.000	-196.000	32.667
36,38	105.000	-196.000	-32.667	105.000	-196.000	32.667
38,40	105.000	-196.000	-32.667	105.000	-196.000	32.667
40,42	105.000	-196.000	-32.667	105.000	-196.000	32.667
42,55	105.000	-196.000	-32.667	105.000	-196.000	32.667

Actual element end forces & moments: (local coordinate system)

From, To	FxL	FyL	MzL	FxR	FyR	MzR
Nodes	lb	lb	lb-ft	lb	lb	lb-ft

26,28	11046.000	-1687.792	-10989.969	-10836.000	1295.792	9498.177
28,30	10836.000	-1295.792	-9498.177	-10626.000	903.792	8398.385
30,32	10626.000	-903.792	-8398.385	-10416.000	511.792	7690.592
32,34	10416.000	-511.792	-7690.592	-10206.000	119.792	7374.800
34,36	10206.000	-119.792	-7374.800	-9996.000	-272.208	7451.007
36,38	9996.000	272.208	-7451.007	-9786.000	-664.208	7919.215
38,40	9786.000	664.208	-7919.215	-9576.000	-1056.208	8779.423
40,42	9576.000	1056.208	-8779.423	-9366.000	-1448.208	10031.630
42,55	9366.000	1448.208	-10031.630	-9156.000	-1840.208	11675.838

Member end deformations: (local coordinate system)

From, To	dx at L	dy at L	rotZ at L	dx at R	dy at R	rotZ at R
Nodes	inch	inch	radians	inch	inch	radians

26,28	-0.082	-0.000	-0.001	-0.082	-0.010	-0.001
28,30	-0.082	-0.010	-0.001	-0.082	-0.017	-0.000
30,32	-0.082	-0.017	-0.000	-0.083	-0.022	-0.000
32,34	-0.083	-0.022	-0.000	-0.083	-0.024	-0.000
34,36	-0.083	-0.024	-0.000	-0.083	-0.024	0.000
36,38	-0.083	-0.024	0.000	-0.083	-0.022	0.000
38,40	-0.083	-0.022	0.000	-0.084	-0.017	0.000
40,42	-0.084	-0.017	0.000	-0.084	-0.010	0.001
42,55	-0.084	-0.010	0.001	-0.084	0.000	0.001

Maximum deformations:

Node 55 moved 0.000 inch to the left.
Node 36 moved 0.024 inch to the right.
Node 55 moved 0.084 inch downwards.
No nodes moved upwards.
Node 26 rotated 0.001 radian clockwise.
Node 55 rotated 0.001 radian counter-clockwise.

 Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

 Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
26,28	0.000	-11046.000	-11046.000	0.000	-76.708	-76.708
28,30	0.000	-10836.000	-10836.000	0.000	-75.250	-75.250
30,32	0.000	-10626.000	-10626.000	0.000	-73.792	-73.792
32,34	0.000	-10416.000	-10416.000	0.000	-72.333	-72.333
34,36	0.000	-10206.000	-10206.000	0.000	-70.875	-70.875
36,38	0.000	-9996.000	-9996.000	0.000	-69.417	-69.417
38,40	0.000	-9786.000	-9786.000	0.000	-67.958	-67.958
40,42	0.000	-9576.000	-9576.000	0.000	-66.500	-66.500
42,55	0.000	-9366.000	-9366.000	0.000	-65.042	-65.042

 Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
26,28	0.000	-1687.792	-1687.792	0.000	-11.721	-11.721
28,30	0.000	-1295.792	-1295.792	0.000	-8.999	-8.999
30,32	0.000	-903.792	-903.792	0.000	-6.276	-6.276
32,34	0.000	-511.792	-511.792	0.000	-3.554	-3.554
34,36	272.208	-119.792	272.208	1.890	-0.832	1.890
36,38	664.208	0.000	664.208	4.613	0.000	4.613
38,40	1056.208	0.000	1056.208	7.335	0.000	7.335
40,42	1448.208	0.000	1448.208	10.057	0.000	10.057
42,55	1840.208	0.000	1840.208	12.779	0.000	12.779

 Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
26,28	10989.969	0.000	10989.969	457.915	0.000	457.915
28,30	9498.177	0.000	9498.177	395.757	0.000	395.757
30,32	8398.385	0.000	8398.385	349.933	0.000	349.933
32,34	7690.592	0.000	7690.592	320.441	0.000	320.441
34,36	7451.007	0.000	7451.007	310.459	0.000	310.459
36,38	7919.215	0.000	7919.215	329.967	0.000	329.967
38,40	8779.423	0.000	8779.423	365.809	0.000	365.809
40,42	10031.630	0.000	10031.630	417.985	0.000	417.985
42,55	11675.838	0.000	11675.838	486.493	0.000	486.493

 Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
26,28	0.000	-0.010	-0.010
28,30	0.000	-0.017	-0.017
30,32	0.000	-0.022	-0.022
32,34	0.000	-0.024	-0.024
34,36	0.000	-0.024	-0.024
36,38	0.000	-0.024	-0.024
38,40	0.000	-0.022	-0.022
40,42	0.000	-0.017	-0.017
42,55	0.000	-0.010	-0.010

 Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch

At the intermediate nodes:

1.000	-0.001	-0.010
2.000	-0.000	-0.017
3.000	-0.000	-0.022
4.000	-0.000	-0.024
5.000	0.000	-0.024
6.000	0.000	-0.022
7.000	0.000	-0.017
8.000	0.001	-0.010

At evenly-spaced intervals:

0.000	-0.001	-0.000
0.900	-0.001	-0.009
1.800	-0.001	-0.016
2.700	-0.000	-0.021
3.600	-0.000	-0.024
4.500	-0.000	-0.024
5.400	0.000	-0.024
6.300	0.000	-0.021
7.200	0.001	-0.016
8.100	0.001	-0.009
9.000	0.001	0.000

 ***** Output Data *****

FRAME MAC file: 2(21/21)PRELIMINARY.

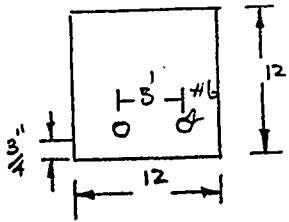
Last modified at 17:45:40 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,14	0.000	-1767.939	-1767.939	0.000	-24.555	-24.555
2,15	0.000	-2985.115	-2985.115	0.000	-20.730	-20.730
3,16	0.000	-2405.899	-2405.899	0.000	-16.708	-16.708
4,17	0.000	-1884.065	-1884.065	0.000	-13.084	-13.084
5,18	0.000	-1476.897	-1476.897	0.000	-10.256	-10.256
6,19	0.000	-1219.940	-1219.940	0.000	-8.472	-8.472
7,20	0.000	-1132.292	-1132.292	0.000	-7.863	-7.863
8,21	0.000	-1219.940	-1219.940	0.000	-8.472	-8.472
9,22	0.000	-1476.897	-1476.897	0.000	-10.256	-10.256
10,23	0.000	-1884.065	-1884.065	0.000	-13.084	-13.084
11,24	0.000	-2405.899	-2405.899	0.000	-16.708	-16.708
12,25	0.000	-2985.115	-2985.115	0.000	-20.730	-20.730
13,26	0.000	-1767.939	-1767.939	0.000	-24.555	-24.555
14,15	0.000	-1111.528	-1111.528	0.000	-7.719	-7.719
14,27	0.000	-11046.000	-11046.000	0.000	-76.708	-76.708
15,16	364.035	0.000	364.035	2.528	0.000	2.528
16,17	1777.399	0.000	1777.399	12.343	0.000	12.343
17,18	2927.330	0.000	2927.330	20.329	0.000	20.329
18,19	3721.086	0.000	3721.086	25.841	0.000	25.841
19,20	4123.073	0.000	4123.073	28.632	0.000	28.632
20,21	4123.073	0.000	4123.073	28.632	0.000	28.632
21,22	3721.086	0.000	3721.086	25.841	0.000	25.841
22,23	2927.330	0.000	2927.330	20.329	0.000	20.329
23,24	1777.399	0.000	1777.399	12.343	0.000	12.343
24,25	364.035	0.000	364.035	2.528	0.000	2.528
25,26	0.000	-1111.528	-1111.528	0.000	-7.719	-7.719
26,28	0.000	-11046.000	-11046.000	0.000	-76.708	-76.708
27,29	0.000	-10836.000	-10836.000	0.000	-75.250	-75.250
28,30	0.000	-10836.000	-10836.000	0.000	-75.250	-75.250
29,31	0.000	-10626.000	-10626.000	0.000	-73.792	-73.792
30,32	0.000	-10626.000	-10626.000	0.000	-73.792	-73.792
31,33	0.000	-10416.000	-10416.000	0.000	-72.333	-72.333
32,34	0.000	-10416.000	-10416.000	0.000	-72.333	-72.333
33,35	0.000	-10206.000	-10206.000	0.000	-70.875	-70.875
34,36	0.000	-10206.000	-10206.000	0.000	-70.875	-70.875
35,37	0.000	-9996.000	-9996.000	0.000	-69.417	-69.417
36,38	0.000	-9996.000	-9996.000	0.000	-69.417	-69.417
37,39	0.000	-9786.000	-9786.000	0.000	-67.958	-67.958
38,40	0.000	-9786.000	-9786.000	0.000	-67.958	-67.958
39,41	0.000	-9576.000	-9576.000	0.000	-66.500	-66.500
40,42	0.000	-9576.000	-9576.000	0.000	-66.500	-66.500
41,43	0.000	-9366.000	-9366.000	0.000	-65.042	-65.042
42,55	0.000	-9366.000	-9366.000	0.000	-65.042	-65.042
43,44	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
44,45	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
45,46	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
46,47	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
47,48	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
48,49	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
49,50	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
50,51	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
51,52	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
52,53	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
53,54	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779
54,55	0.000	-1840.208	-1840.208	0.000	-12.779	-12.779

1. MOMENT CAPACITY - ROOF, FLOOR & WALLS



$$a = \frac{A_{st} f_y}{0.85 f'_c b} = \frac{(0.8875)(60,000)}{(0.85)(3,000)(10)}$$

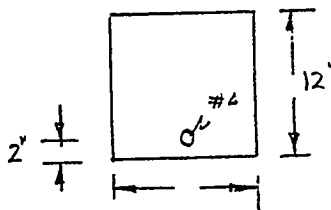
$$= 2.07 \text{ in}$$

$$\phi M_n = \phi \left[A_{st} f_y \left(d - \frac{a}{2} \right) \right] = 0.9 \left[(0.8875)(60,000) \left(10.875 - \frac{2.07}{2} \right) \right]$$

$$\phi M_n = 471,582 \text{ in-lbs}$$

$$= \underline{39,299 \text{ ft-lbs}}$$

LEFT & RIGHT WALL (INSIDE)



$$a = \frac{A_{st} f_y}{0.85 f'_c b} = \frac{(0.1963)(60,000)}{(0.85)(3,000)(12)}$$

$$= 0.3849$$

$$\phi M_n = 0.9 \left[(0.1963)(60,000) \left(11 - \frac{0.3849}{2} \right) \right]$$

$$= 114,562 \text{ in-lbs}$$

$$= \underline{9547 \text{ ft-lbs}}$$

$$A_{st} = (2)(\pi) \frac{(0.75)^2}{4} = 0.8875 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b = 10 \text{ in}$$

$$d = 12 - 0.75 - 0.75/2 = 10.875 \text{ in}$$

$$\phi = 0.9$$

$$A_{st} = (\pi) \frac{(0.5)^2}{4} = 0.1963 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

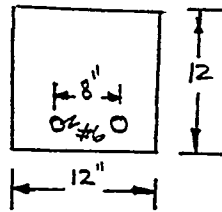
$$f'_c = 3,000 \text{ psi}$$

$$b = 12 \text{ in}$$

$$d = 12 - 0.75 - 0.5/2 = 9.75 \text{ in}$$

$$\phi = 0.9$$

LEFT & RIGHT WALL (OUTSIDE)



$$A_{ST} = \frac{2(\pi)(0.75)^2}{4} = 0.8836 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b = 16''$$

$$d = 12 - 2.00 - 0.75/2 = 9.625$$

$$\phi = 0.9$$

$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.8836)(60,000)}{(0.85)(3,000)(16)}$$

$$a = 1.299 \text{ in}$$

$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right] = 0.9 \left[(0.8836)(60,000) \left(9.625 - \frac{1.299}{2} \right) \right]$$

$$= 428,260 \text{ in-lbs}$$

$$= 35,688 \text{ ft-lbs}$$

2. SHEAR CAPACITY

$$V_n = V_c = 2 \sqrt{f'_c} \cdot b \cdot d$$

$$f'_c = 3,000$$

$$\phi V_n = (0.85)(2) \sqrt{3000} (10.875)(12)$$

$$b_w = 12$$

$$\phi V_n = 12,151 \text{ lbs}$$

$$d = 12 - 0.75 - 0.75/2 = 10.875$$

$$b = 12$$

$$\phi = 0.85$$

3. AXIAL CAPACITY

$$\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{k l_c}{32 h} \right)^2 \right]$$

$$k = 0.8$$

$$l_c = 8' \times 12' = 96 \text{ in}$$

$$\phi P_{nw} = (0.55)(0.7)(3000)(144) \left[1 - \left(\frac{(0.8)(96)}{(32)(12)} \right)^2 \right]$$

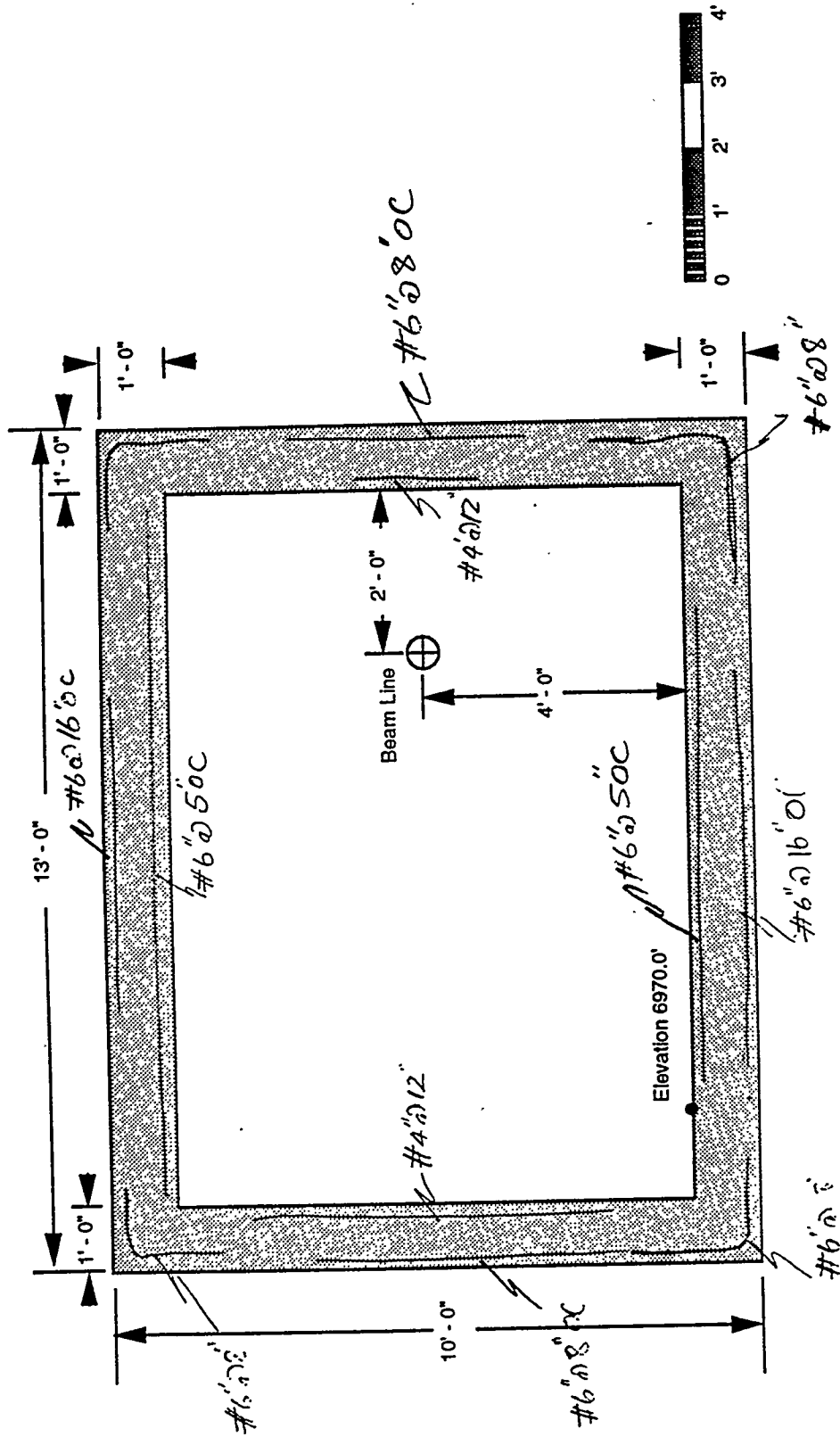
$$h = 12$$

$$f'_c = 3,000 \text{ psi}$$

$$\phi P_n = 159,667 \text{ lbs}$$

$$A_g = 12'' \times 12'' = 144 \text{ in}^2$$

$$\phi = 0.7$$



2
21 | 21

FIGURE () Section

TUNNEL SECTION		PRELIMINARY			STRUCTURAL ASSESSMENT	
PAGE	OF	TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE	
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$		ROOF STRUCTURE	39,299 ft-lbs	15,792 ft-lbs		
		FLOOR STRUCTURE	39,299 ft-lbs	13,643 ft-lbs		
		LEFT INSIDE WALL	9,547 ft-lbs			
		LEFT OUTSIDE WALL	35,688 ft-lbs	11,675 ft-lbs		
		RIGHT INSIDE WALL	9,547 ft-lbs			
		RIGHT OUTSIDE WALL	35,688 ft-lbs	11,675 ft-lbs		
Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2\sqrt{f'_c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2\sqrt{f'_c} B_w d$		ROOF STRUCTURE	12,151 lbs	9,156 lbs		
		FLOOR STRUCTURE	12,151 lbs	9,488 lbs		
		LEFT WALL	12,151 lbs	18,40 lbs		
		RIGHT WALL	12,151 lbs	18,40 lbs		
Axial Capacity Design axial load ϕP_{nw} is computed by ACI 318-89 (14-1) $\phi P_{nw} = 0.55\phi f'_c A_g \left[1 - \left(\frac{kl_c}{32h} \right)^2 \right]$ where $\phi = 0.7$		LEFT WALL	159,667 lbs	11,046 lbs		
		RIGHT WALL	159,667 lbs	11,046 lbs		

$B = \frac{13}{17}$ ft.
 $D_1 = \frac{8.17}{17}$ ft.

$\sigma_v = D_1 \rho$
 $\sigma_h = k \sigma_v$

where $k = \frac{1 - \sin \theta}{1 + \sin \theta}$
 $k = 0.3$

Figure () Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-1(21/21)

TITLE: Preliminary Structural Assessment of Tunnel Section 1(21/21)

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 1(21/21)) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

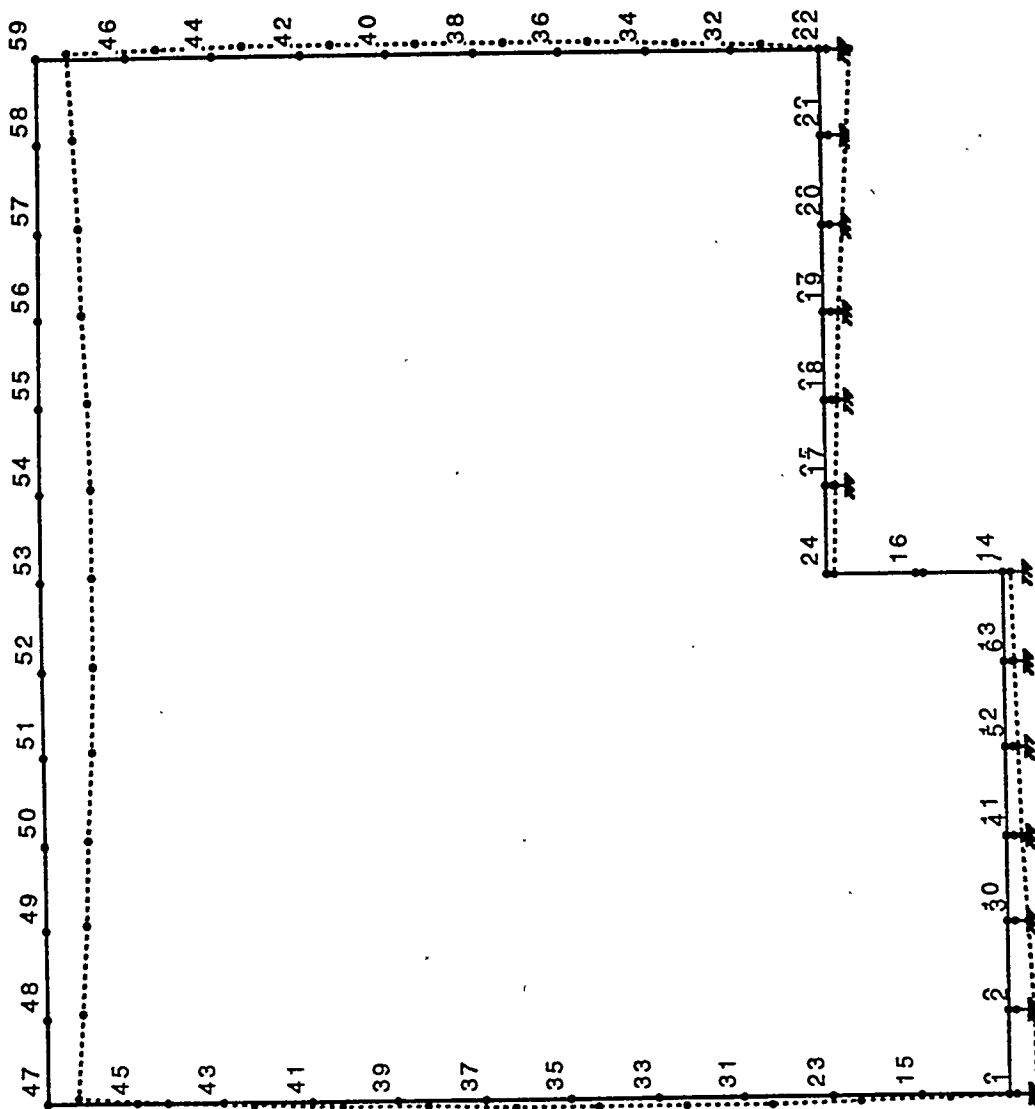
PREPARED BY: John H. Pye

DATE: 5/3/93

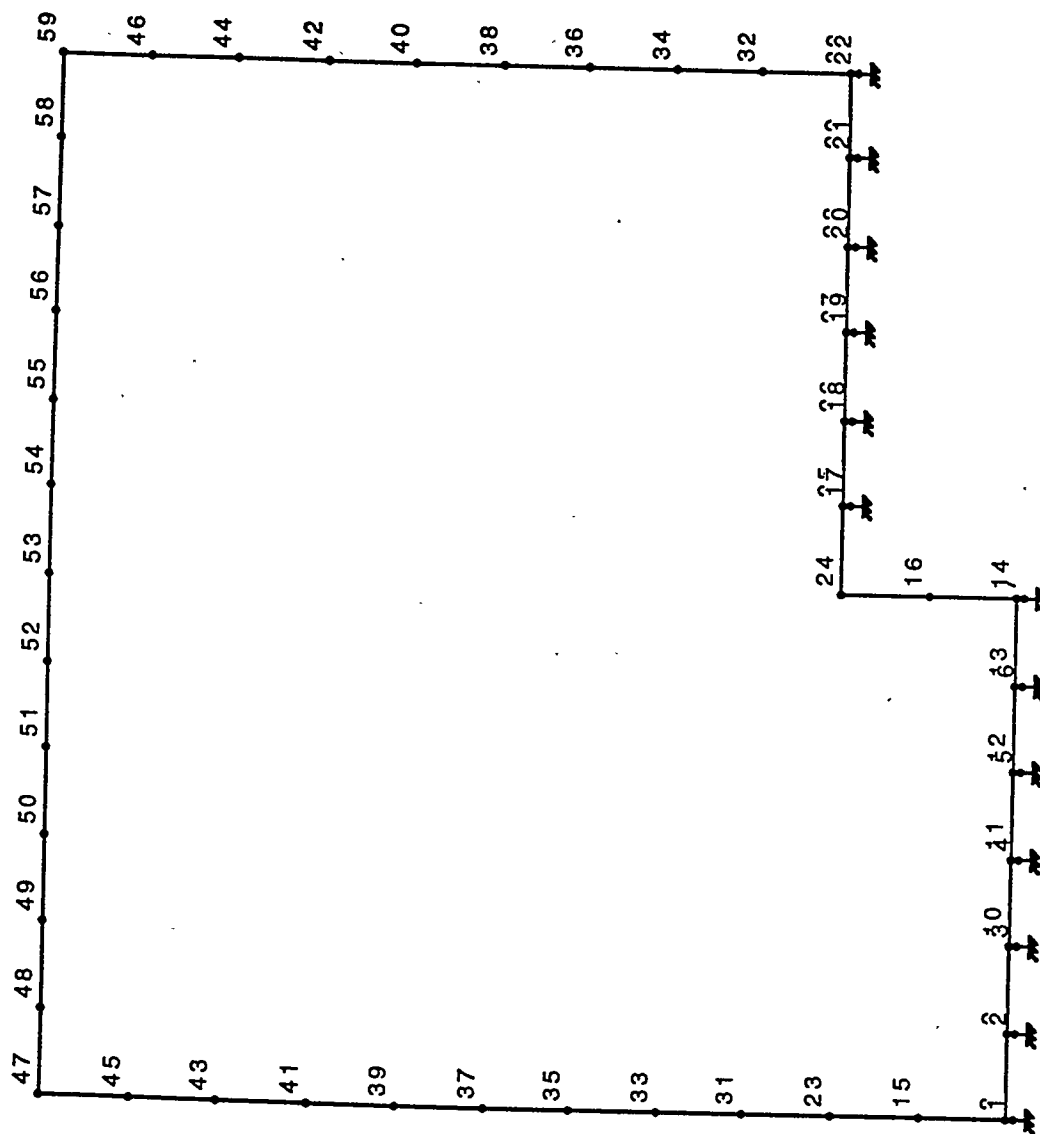
CHECKED BY: _____

DATE: _____

Number of Pages Including Title Page 27



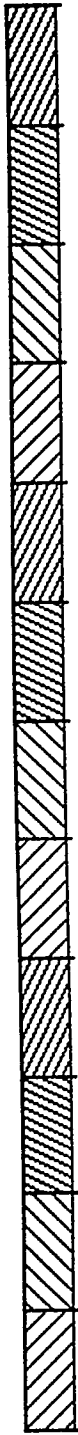
FRAME MAC file: 1(21/21)PRELIMINARY ; Last modified at 14:59:43 on Sun, Mar 7, 1993



FRAME MAC file: 1(21/21)PRELIMINARY ; Last modified at 14:59:43 on Sun, Mar 7, 1993

Node 47	Node 48	Node 49	Node 50	Node 51	Node 52	Node 53	Node 54	Node 55	Node 56	Node 57	Node 58	Node 59
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000
12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000

F: lb
D: lb/ft
M: lb-ft
E: psi



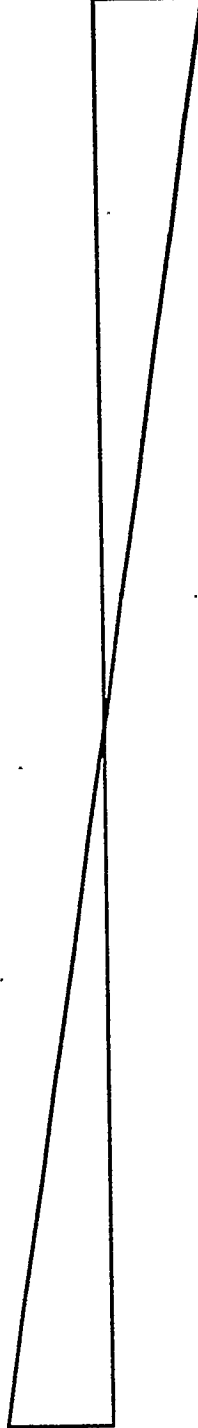
Load

0.000 lb
-1892.719
8641.300



Tension

lb
-8998.700
15355.581



Shear

lb-ft
-12187.482



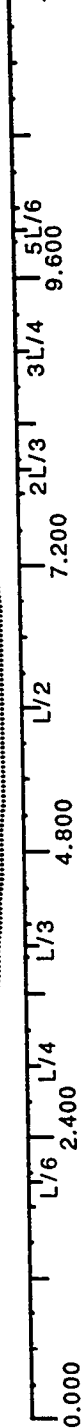
Moment

0.000 inch



Defl.

-0.148 ft



Distance 0.000

 Continuous Elements Output Data

FRAME MAC file: 1(21/21)PRELIMINARY .
 Last modified at 14:59:43 on Sun, Mar 7, 1993.
 All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)
 Node Reaction Reaction Reaction
 No. lb (FX) lb (FY) lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)
 Node Deflection Deflection Rotation
 No. inch (FX) inch (FY) radians (MZ)

47	0.015	-0.086	-0.001
48	0.014	-0.100	-0.001
49	0.014	-0.115	-0.001
50	0.014	-0.128	-0.001
51	0.014	-0.139	-0.001
52	0.014	-0.146	-0.000
53	0.014	-0.148	-0.000
54	0.014	-0.146	0.000
55	0.014	-0.139	0.001
56	0.014	-0.129	0.001
57	0.014	-0.116	0.001
58	0.014	-0.103	0.001
59	0.014	-0.091	0.001

Element fixed-end forces & moments: (local coordinate system)
 From, To FxL FyL MzL FxR FyR MzR
 Nodes lb lb lb-ft lb lb lb-ft

47,48	0.000	735.000	122.500	0.000	735.000	-122.500
48,49	0.000	735.000	122.500	0.000	735.000	-122.500
49,50	0.000	735.000	122.500	0.000	735.000	-122.500
50,51	0.000	735.000	122.500	0.000	735.000	-122.500
51,52	0.000	735.000	122.500	0.000	735.000	-122.500
52,53	0.000	735.000	122.500	0.000	735.000	-122.500
53,54	0.000	735.000	122.500	0.000	735.000	-122.500
54,55	0.000	735.000	122.500	0.000	735.000	-122.500
55,56	0.000	735.000	122.500	0.000	735.000	-122.500
56,57	0.000	735.000	122.500	0.000	735.000	-122.500
57,58	0.000	735.000	122.500	0.000	735.000	-122.500
58,59	0.000	735.000	122.500	0.000	735.000	-122.500

Actual element end forces & moments: (local coordinate system)
 From, To FxL FyL MzL FxR FyR MzR
 Nodes lb lb lb-ft lb lb lb-ft

47,48	1892.719	8641.300	10043.080	-1892.719	-7171.300	-2136.780
48,49	1892.719	7171.300	2136.780	-1892.719	-5701.300	4299.520
49,50	1892.719	5701.300	-4299.520	-1892.719	-4231.300	9265.819
50,51	1892.719	4231.300	-9265.819	-1892.719	-2761.300	12762.119
51,52	1892.719	2761.300	-12762.119	-1892.719	-1291.300	14788.419
52,53	1892.719	1291.300	-14788.419	-1892.719	178.700	15344.719
53,54	1892.719	-178.700	-15344.719	-1892.719	1648.700	14431.019
54,55	1892.719	-1648.700	-14431.019	-1892.719	3118.700	12047.318
55,56	1892.719	-3118.700	-12047.318	-1892.719	4588.700	8193.618
56,57	1892.719	-4588.700	-8193.618	-1892.719	6058.700	2869.918
57,58	1892.719	-6058.700	-2869.918	-1892.719	7528.700	-3923.782
58,59	1892.719	-7528.700	3923.782	-1892.719	8998.700	-12187.482

Member end deformations: (local coordinate system)
 From, To dx at L dy at L rotZ at L dx at R dy at R rotZ at R
 Nodes inch inch radians inch inch radians

47,48	0.015	-0.086	-0.001	0.014	-0.100	-0.001
48,49	0.014	-0.100	-0.001	0.014	-0.115	-0.001
49,50	0.014	-0.115	-0.001	0.014	-0.128	-0.001
50,51	0.014	-0.128	-0.001	0.014	-0.139	-0.001
51,52	0.014	-0.139	-0.001	0.014	-0.146	-0.000
52,53	0.014	-0.146	-0.000	0.014	-0.148	-0.000
53,54	0.014	-0.148	-0.000	0.014	-0.146	0.000
54,55	0.014	-0.146	0.000	0.014	-0.139	0.001

55,56	0.014	-0.139	0.001	0.014	-0.129	0.001
56,57	0.014	-0.129	0.001	0.014	-0.116	0.001
57,58	0.014	-0.116	0.001	0.014	-0.103	0.001
58,59	0.014	-0.103	0.001	0.014	-0.091	0.001

Maximum deformations:

No nodes moved to the left.
 Node 47 moved 0.015 inch to the right.
 Node 53 moved 0.148 inch downwards.
 No nodes moved upwards.
 Node 48 rotated 0.001 radian clockwise.
 Node 57 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
47,48	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
48,49	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
49,50	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
50,51	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
51,52	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
52,53	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
53,54	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
54,55	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
55,56	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
56,57	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
57,58	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
58,59	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
47,48	8641.300	0.000	8641.300	60.009	0.000	60.009
48,49	7171.300	0.000	7171.300	49.801	0.000	49.801
49,50	5701.300	0.000	5701.300	39.592	0.000	39.592
50,51	4231.300	0.000	4231.300	29.384	0.000	29.384
51,52	2761.300	0.000	2761.300	19.176	0.000	19.176
52,53	1291.300	-178.700	1291.300	8.967	-1.241	8.967
53,54	0.000	-1648.700	-1648.700	0.000	-11.449	-11.449
54,55	0.000	-3118.700	-3118.700	0.000	-21.658	-21.658
55,56	0.000	-4588.700	-4588.700	0.000	-31.866	-31.866
56,57	0.000	-6058.700	-6058.700	0.000	-42.074	-42.074
57,58	0.000	-7528.700	-7528.700	0.000	-52.283	-52.283
58,59	0.000	-8998.700	-8998.700	0.000	-62.491	-62.491

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
47,48	0.000	-10043.080	-10043.080	0.000	-418.462	-418.462
48,49	4299.520	-2136.780	4299.520	179.147	-89.033	179.147
49,50	9265.819	0.000	9265.819	386.076	0.000	386.076
50,51	12762.119	0.000	12762.119	531.755	0.000	531.755
51,52	14788.419	0.000	14788.419	616.184	0.000	616.184
52,53	15355.581	0.000	15355.581	639.816	0.000	639.816
53,54	15344.719	0.000	15344.719	639.363	0.000	639.363
54,55	14431.019	0.000	14431.019	601.292	0.000	601.292
55,56	12047.318	0.000	12047.318	501.972	0.000	501.972
56,57	8193.618	0.000	8193.618	341.401	0.000	341.401
57,58	2869.918	-3923.782	-3923.782	119.580	-163.491	-163.491
58,59	0.000	-12187.482	-12187.482	0.000	-507.812	-507.812

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
47,48	0.000	-0.100	-0.100
48,49	0.000	-0.115	-0.115
49,50	0.000	-0.128	-0.128
50,51	0.000	-0.139	-0.139
51,52	0.000	-0.146	-0.146
52,53	0.000	-0.148	-0.148
53,54	0.000	-0.148	-0.148
54,55	0.000	-0.146	-0.146
55,56	0.000	-0.139	-0.139
56,57	0.000	-0.129	-0.129
57,58	0.000	-0.116	-0.116
58,59	0.000	-0.103	-0.103

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch
At the intermediate nodes:		
1.000	-0.001	-0.100
2.000	-0.001	-0.115
3.000	-0.001	-0.128
4.000	-0.001	-0.139
5.000	-0.000	-0.146
6.000	-0.000	-0.148
7.000	0.000	-0.146
8.000	0.001	-0.139
9.000	0.001	-0.129
10.000	0.001	-0.116
11.000	0.001	-0.103

At evenly-spaced intervals:

0.000	-0.001	-0.086
1.200	-0.001	-0.103
2.400	-0.001	-0.121
3.600	-0.001	-0.135
4.800	-0.000	-0.145
6.000	-0.000	-0.148
7.200	0.000	-0.145
8.400	0.001	-0.135
9.600	0.001	-0.122
10.800	0.001	-0.106
12.000	0.001	-0.091

FRAME MAC file: 1(21/21)PRELIMINARY ; Last modified at 14:59:43 on Sun, Mar 7, 1993

Node 8
1.000
1.000

Node 9
2.000
1.000

Node 10
3.000
1.000

Node 11
4.000
1.000

Node 12
5.000
1.000

Node 13
6.000
1.000

Node 14
7.000
1.000

F: lb
D: lb/ft
M: lb-ft
E: psi

Load



1312.537

lb

Tension



-1829.108

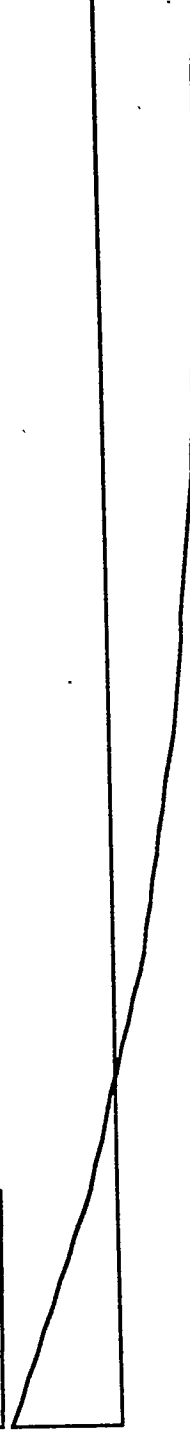
0.000
lb

Shear



-9352.491
12130.566

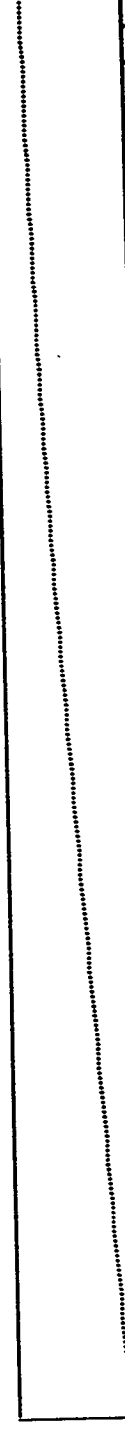
Moment



-10996.644

0.000
Inch

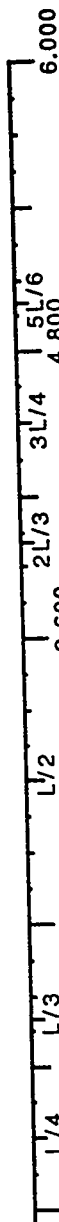
Defl.



-0.084

ft

Distance 0.000



6.000

5L/6
4.800

3L/4

2L/3

3.600

L/2

2.400

L/3

L/4

L/6

1.200

```

*****
Continuous Elements Output Data
*****
FRAME MAC file: 1(21/21)PRELIMINARY .
Last modified at 14:59:43 on Sun, Mar 7, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.
*****
Support reactions: (pos. force is to right or up; pos. moment is ccw.)
Node      Reaction      Reaction      Reaction
No.      lb (FX)      lb (FY)      lb-ft (MZ)
-----
Node deformations: (positive is to right, up, or counterclockwise.)
Node      Deflection      Deflection      Rotation
No.      inch (FX)      inch (FY)      radians (MZ)
-----
      8      -0.000      -0.084      0.001
      9      -0.000      -0.071      0.001
     10      -0.000      -0.058      0.001
     11      -0.000      -0.045      0.001
     12      -0.000      -0.034      0.001
     13      -0.000      -0.026      0.001
     14      -0.000      -0.022      0.000
*****
Element fixed-end forces & moments: (local coordinate system)
From, To  FxL      FyL      MzL      FxR      FyR      MzR
Nodes     lb      lb      lb-ft     lb      lb      lb-ft
-----
      8,9    0.000    105.000    17.500    0.000    105.000   -17.500
      9,10    0.000    105.000    17.500    0.000    105.000   -17.500
     10,11    0.000    105.000    17.500    0.000    105.000   -17.500
     11,12    0.000    105.000    17.500    0.000    105.000   -17.500
     12,13    0.000    105.000    17.500    0.000    105.000   -17.500
     13,14    0.000    105.000    17.500    0.000    105.000   -17.500
*****
Actual element end forces & moments: (local coordinate system)
From, To  FxL      FyL      MzL      FxR      FyR      MzR
Nodes     lb      lb      lb-ft     lb      lb      lb-ft
-----
      8,9  1829.108  -9142.491 -12130.566 -1829.108  9352.491  2883.075
      9,10  654.931  -6279.218  -2980.605  -654.931  6489.218 -3403.613
     10,11 -401.840  -4004.876  3311.185   401.840  4214.876  -7421.061
     11,12 -1103.781 -2280.937  7349.217  1103.781  2490.937  -9735.154
     12,13 -1312.537 -1015.275  9693.104  1312.537  1225.275 -10813.378
     13,14 -927.118   -84.460 10807.184   927.118  294.460 -10996.644
*****
Member end deformations: (local coordinate system)
From, To  dx at L  dy at L  rotZ at L  dx at R  dy at R  rotZ at R
Nodes     inch    inch    radians    inch    inch    radians
-----
      8,9    -0.000    -0.084    0.001    -0.000    -0.071    0.001
      9,10    -0.000    -0.071    0.001    -0.000    -0.058    0.001
     10,11    -0.000    -0.058    0.001    -0.000    -0.045    0.001
     11,12    -0.000    -0.045    0.001    -0.000    -0.034    0.001
     12,13    -0.000    -0.034    0.001    -0.000    -0.026    0.001
     13,14    -0.000    -0.026    0.001    -0.000    -0.022    0.000
*****
Maximum deformations:
Node 10 moved 0.000 inch to the left.
No nodes moved to the right.
Node 8 moved 0.084 inch downwards.
No nodes moved upwards.
No nodes rotated clockwise.
Node 9 rotated 0.001 radian counter-clockwise.
*****
Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.
*****
Maximum tension and tensile stress values (compression is negative):
From, To  Maximum  Minimum  Max. abs.  Maximum  Minimum  Max. abs.
Nodes     tension   tension   tension    ten. str.  ten. str.  stress

```

	lb	lb	lb	psi	psi	psi
8,9	0.000	-1829.108	-1829.108	0.000	-12.702	-12.702
9,10	0.000	-654.931	-654.931	0.000	-4.548	-4.548
10,11	401.840	0.000	401.840	2.791	0.000	2.791
11,12	1103.781	0.000	1103.781	7.665	0.000	7.665
12,13	1312.537	0.000	1312.537	9.115	0.000	9.115
13,14	927.118	0.000	927.118	6.438	0.000	6.438

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
8,9	0.000	-9352.491	-9352.491	0.000	-64.948	-64.948
9,10	0.000	-6489.218	-6489.218	0.000	-45.064	-45.064
10,11	0.000	-4214.876	-4214.876	0.000	-29.270	-29.270
11,12	0.000	-2490.937	-2490.937	0.000	-17.298	-17.298
12,13	0.000	-1225.275	-1225.275	0.000	-8.509	-8.509
13,14	0.000	-294.460	-294.460	0.000	-2.045	-2.045

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
8,9	12130.566	0.000	12130.566	505.440	0.000	505.440
9,10	2980.605	-3403.613	-3403.613	124.192	-141.817	-141.817
10,11	0.000	-7421.061	-7421.061	0.000	-309.211	-309.211
11,12	0.000	-9735.154	-9735.154	0.000	-405.631	-405.631
12,13	0.000	-10813.378	-10813.378	0.000	-450.557	-450.557
13,14	0.000	-10996.644	-10996.644	0.000	-458.194	-458.194

Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
8,9	0.000	-0.084	-0.084
9,10	0.000	-0.071	-0.071
10,11	0.000	-0.058	-0.058
11,12	0.000	-0.045	-0.045
12,13	0.000	-0.034	-0.034
13,14	0.000	-0.026	-0.026

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
1.000	0.001	-0.071
2.000	0.001	-0.058
3.000	0.001	-0.045
4.000	0.001	-0.034
5.000	0.001	-0.026
At evenly-spaced intervals:		
0.000	0.001	-0.084
0.600	0.001	-0.076
1.200	0.001	-0.068
1.800	0.001	-0.060
2.400	0.001	-0.052
3.000	0.001	-0.045
3.600	0.001	-0.038
4.200	0.001	-0.032
4.800	0.001	-0.028
5.400	0.000	-0.024
6.000	0.000	-0.022

FRAME MAC file: 1(21/21)PRELIMINARY ; Last modified at 14:59:43 on Sun, Mar 7, 1993

Node 24
7.000
3.000

Node 25
8.000
3.000

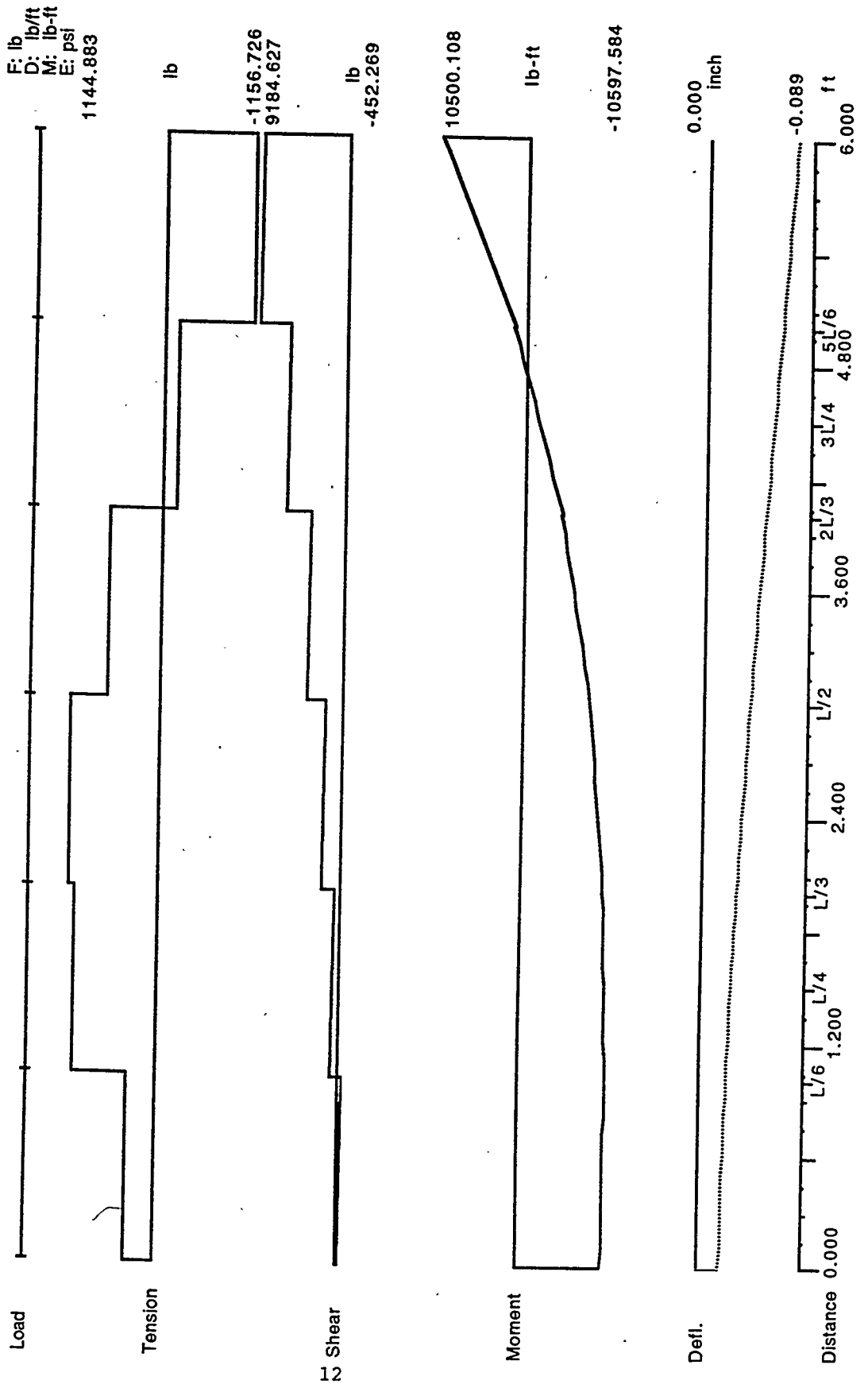
Node 26
9.000
3.000

Node 27
10.000
3.000

Node 28
11.000
3.000

Node 29
12.000
3.000

Node 30
13.000
3.000



Continuous Elements Output Data

FRAME MAC file: 1(21/21)PRELIMINARY .

Last modified at 14:59:43 on Sun, Mar 7, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node	Reaction	Reaction	Reaction
No.	lb (FX)	lb (FY)	lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node	Deflection	Deflection	Rotation
No.	inch (FX)	inch (FY)	radians (MZ)

24	0.000	-0.022	-0.000
25	0.000	-0.027	-0.001
26	0.000	-0.035	-0.001
27	0.000	-0.046	-0.001
28	0.000	-0.060	-0.001
29	0.000	-0.074	-0.001
30	0.000	-0.089	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To	FxL	FyL	MzL	FxR	FyR	MzR
Nodes	lb	lb	lb-ft	lb	lb	lb-ft

24,25	0.000	105.000	17.500	0.000	105.000	-17.500
25,26	0.000	105.000	17.500	0.000	105.000	-17.500
26,27	0.000	105.000	17.500	0.000	105.000	-17.500
27,28	0.000	105.000	17.500	0.000	105.000	-17.500
28,29	0.000	105.000	17.500	0.000	105.000	-17.500
29,30	0.000	105.000	17.500	0.000	105.000	-17.500

Actual element end forces & moments: (local coordinate system)

From, To	FxL	FyL	MzL	FxR	FyR	MzR
Nodes	lb	lb	lb-ft	lb	lb	lb-ft

24,25	-381.910	-242.269	10250.315	381.910	452.269	-10597.584
25,26	-1080.016	710.566	10592.383	1080.016	-500.566	-9986.817
26,27	-1144.883	2017.550	10019.140	1144.883	-1807.550	-8106.590
27,28	-682.394	3805.769	8170.696	682.394	-3595.769	-4469.927
28,29	165.565	6177.010	4556.929	-165.565	-5967.010	1515.081
29,30	1156.726	9184.627	-1420.481	-1156.726	-8974.627	10500.108

Member end deformations: (local coordinate system)

From, To	dx at L	dy at L	rotZ at L	dx at R	dy at R	rotZ at R
Nodes	inch	inch	radians	inch	inch	radians

24,25	0.000	-0.022	-0.000	0.000	-0.027	-0.001
25,26	0.000	-0.027	-0.001	0.000	-0.035	-0.001
26,27	0.000	-0.035	-0.001	0.000	-0.046	-0.001
27,28	0.000	-0.046	-0.001	0.000	-0.060	-0.001
28,29	0.000	-0.060	-0.001	0.000	-0.074	-0.001
29,30	0.000	-0.074	-0.001	0.000	-0.089	-0.001

Maximum deformations:

No nodes moved to the left.
Node 28 moved 0.000 inch to the right.
Node 30 moved 0.089 inch downwards.
No nodes moved upwards.
Node 29 rotated 0.001 radian clockwise.
No nodes rotated counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To	Maximum	Minimum	Max. abs.	Maximum	Minimum	Max. abs.
Node	tension	tension	tension	ten. str.	ten. str.	stress

---	lb	lb	lb	psi	psi	psi
24,25	381.910	0.000	381.910	2.652	0.000	2.652
25,26	1080.016	0.000	1080.016	7.500	0.000	7.500
26,27	1144.883	0.000	1144.883	7.951	0.000	7.951
27,28	682.394	0.000	682.394	4.739	0.000	4.739
28,29	0.000	-165.565	-165.565	0.000	-1.150	-1.150
29,30	0.000	-1156.726	-1156.726	0.000	-8.033	-8.033

Maximum shear and shear stress values:						
From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
24,25	0.000	-452.269	-452.269	0.000	-3.141	-3.141
25,26	710.566	0.000	710.566	4.934	0.000	4.934
26,27	2017.550	0.000	2017.550	14.011	0.000	14.011
27,28	3805.769	0.000	3805.769	26.429	0.000	26.429
28,29	6177.010	0.000	6177.010	42.896	0.000	42.896
29,30	9184.627	0.000	9184.627	63.782	0.000	63.782

Maximum moment and bending stress values:						
From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
24,25	0.000	-10597.584	-10597.584	0.000	-441.566	-441.566
25,26	0.000	-10592.383	-10592.383	0.000	-441.349	-441.349
26,27	0.000	-10019.140	-10019.140	0.000	-417.464	-417.464
27,28	0.000	-8170.696	-8170.696	0.000	-340.446	-340.446
28,29	1515.081	-4556.929	-4556.929	63.128	-189.872	-189.872
29,30	10500.108	0.000	10500.108	437.505	0.000	437.505

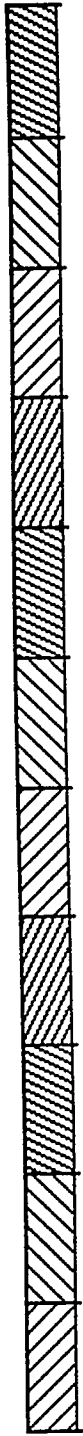
Maximum deflection values:						
From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch			
24,25	0.000	-0.027	-0.027			
25,26	0.000	-0.035	-0.035			
26,27	0.000	-0.046	-0.046			
27,28	0.000	-0.060	-0.060			
28,29	0.000	-0.074	-0.074			
29,30	0.000	-0.089	-0.089			

Deflections along the elements (positive is up or counter-clockwise):						
Distance from left (bottom) ft	Rotation radian	Deflection inch				
At the intermediate nodes:						
1.000	-0.001	-0.027				
2.000	-0.001	-0.035				
3.000	-0.001	-0.046				
4.000	-0.001	-0.060				
5.000	-0.001	-0.074				
At evenly-spaced intervals:						
0.000	-0.000	-0.022				
0.600	-0.000	-0.025				
1.200	-0.001	-0.028				
1.800	-0.001	-0.033				
2.400	-0.001	-0.039				
3.000	-0.001	-0.046				
3.600	-0.001	-0.054				
4.200	-0.001	-0.063				
4.800	-0.001	-0.072				
5.400	-0.001	-0.080				
6.000	-0.001	-0.089				

FRAME MAC file: 1(21/21)PRELIMINARY : Last modified at 14:59:43 on Sun, Mar 7, 1993

Node 8	Node 15	Node 23	Node 31	Node 33	Node 35	Node 37	Node 39	Node 41	Node 43	Node 45	Node 47
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000

F: lb
D: lb/ft
M: lb-ft
E: psi



Load

0.000 lb
-10951.300
2265.281

Tension

lb
-1892.719

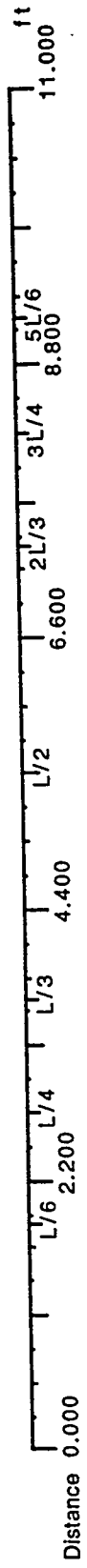
Shear

0.000 lb-ft
-12092.168
0.022

Moment

inches
-0.015

Defl.



 Continuous Elements Output Data

FRAME MAC file: 1(21/21)PRELIMINARY .
 Last modified at 14:59:43 on Sun, Mar 7, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

 Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

8	-0.000	-0.084	0.001
15	-0.010	-0.084	0.001
23	-0.016	-0.084	0.000
31	-0.020	-0.085	0.000
33	-0.022	-0.085	0.000
35	-0.022	-0.085	0.000
37	-0.021	-0.085	-0.000
39	-0.017	-0.086	-0.000
41	-0.012	-0.086	-0.000
43	-0.006	-0.086	-0.000
45	0.003	-0.086	-0.001
47	0.015	-0.086	-0.001

 Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
8,15	105.000	189.000	31.500	105.000	189.000	-31.500
15,23	105.000	189.000	31.500	105.000	189.000	-31.500
23,31	105.000	189.000	31.500	105.000	189.000	-31.500
31,33	105.000	189.000	31.500	105.000	189.000	-31.500
33,35	105.000	189.000	31.500	105.000	189.000	-31.500
35,37	105.000	189.000	31.500	105.000	189.000	-31.500
37,39	105.000	189.000	31.500	105.000	189.000	-31.500
39,41	105.000	189.000	31.500	105.000	189.000	-31.500
41,43	105.000	189.000	31.500	105.000	189.000	-31.500
43,45	105.000	189.000	31.500	105.000	189.000	-31.500
45,47	105.000	189.000	31.500	105.000	189.000	-31.500

 Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
8,15	10951.300	2265.281	12092.168	-10741.300	-1887.281	-10015.888
15,23	10741.300	1887.281	10015.888	-10531.300	-1509.281	-8317.607
23,31	10531.300	1509.281	8317.607	-10321.300	-1131.281	-6997.326
31,33	10321.300	1131.281	6997.326	-10111.300	-753.281	-6055.045
33,35	10111.300	753.281	6055.045	-9901.300	-375.281	-5490.765
35,37	9901.300	375.281	5490.765	-9691.300	2.719	-5304.484
37,39	9691.300	-2.719	5304.484	-9481.300	380.719	-5496.203
39,41	9481.300	-380.719	5496.203	-9271.300	758.719	-6065.922
41,43	9271.300	-758.719	6065.922	-9061.300	1136.719	-7013.642
43,45	9061.300	-1136.719	7013.642	-8851.300	1514.719	-8339.361
45,47	8851.300	-1514.719	8339.361	-8641.300	1892.719	-10043.080

 Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
8,15	-0.084	0.000	0.001	-0.084	0.010	0.001
15,23	-0.084	0.010	0.001	-0.084	0.016	0.000
23,31	-0.084	0.016	0.000	-0.085	0.020	0.000
31,33	-0.085	0.020	0.000	-0.085	0.022	0.000
33,35	-0.085	0.022	0.000	-0.085	0.022	-0.000
35,37	-0.085	0.022	-0.000	-0.085	0.021	-0.000
37,39	-0.085	0.021	-0.000	-0.086	0.017	-0.000
39,41	-0.086	0.017	-0.000	-0.086	0.012	-0.000
41,43	-0.086	0.012	-0.000	-0.086	0.006	-0.001
43,45	-0.086	0.006	-0.001	-0.086	-0.003	-0.001
45,47	-0.086	-0.003	-0.001	-0.086	-0.015	-0.001

Maximum deformations:
Node 35 moved 0.022 inch to the left.
Node 47 moved 0.015 inch to the right.
Node 47 moved 0.086 inch downwards.
No nodes moved upwards.
Node 47 rotated 0.001 radian clockwise.
Node 8 rotated 0.001 radian counter-clockwise.

Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
8,15	0.000	-10951.300	-10951.300	0.000	-76.051	-76.051
15,23	0.000	-10741.300	-10741.300	0.000	-74.592	-74.592
23,31	0.000	-10531.300	-10531.300	0.000	-73.134	-73.134
31,33	0.000	-10321.300	-10321.300	0.000	-71.676	-71.676
33,35	0.000	-10111.300	-10111.300	0.000	-70.217	-70.217
35,37	0.000	-9901.300	-9901.300	0.000	-68.759	-68.759
37,39	0.000	-9691.300	-9691.300	0.000	-67.301	-67.301
39,41	0.000	-9481.300	-9481.300	0.000	-65.842	-65.842
41,43	0.000	-9271.300	-9271.300	0.000	-64.384	-64.384
43,45	0.000	-9061.300	-9061.300	0.000	-62.926	-62.926
45,47	0.000	-8851.300	-8851.300	0.000	-61.467	-61.467

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
8,15	2265.281	0.000	2265.281	15.731	0.000	15.731
15,23	1887.281	0.000	1887.281	13.106	0.000	13.106
23,31	1509.281	0.000	1509.281	10.481	0.000	10.481
31,33	1131.281	0.000	1131.281	7.856	0.000	7.856
33,35	753.281	0.000	753.281	5.231	0.000	5.231
35,37	375.281	-2.719	375.281	2.606	-0.019	2.606
37,39	0.000	-380.719	-380.719	0.000	-2.644	-2.644
39,41	0.000	-758.719	-758.719	0.000	-5.269	-5.269
41,43	0.000	-1136.719	-1136.719	0.000	-7.894	-7.894
43,45	0.000	-1514.719	-1514.719	0.000	-10.519	-10.519
45,47	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
8,15	0.000	-12092.168	-12092.168	0.000	-503.840	-503.840
15,23	0.000	-10015.888	-10015.888	0.000	-417.329	-417.329
23,31	0.000	-8317.607	-8317.607	0.000	-346.567	-346.567
31,33	0.000	-6997.326	-6997.326	0.000	-291.555	-291.555
33,35	0.000	-6055.045	-6055.045	0.000	-252.294	-252.294
35,37	0.000	-5490.765	-5490.765	0.000	-228.782	-228.782
37,39	0.000	-5496.203	-5496.203	0.000	-229.008	-229.008
39,41	0.000	-6065.922	-6065.922	0.000	-252.747	-252.747
41,43	0.000	-7013.642	-7013.642	0.000	-292.235	-292.235
43,45	0.000	-8339.361	-8339.361	0.000	-347.473	-347.473
45,47	0.000	-10043.080	-10043.080	0.000	-418.462	-418.462

Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
---	---	---	---

8,15	0.010	0.000	0.010
15,23	0.016	0.000	0.016
23,31	0.020	0.000	0.020
31,33	0.022	0.000	0.022
33,35	0.022	0.000	0.022
35,37	0.022	0.000	0.022
37,39	0.021	0.000	0.021
39,41	0.017	0.000	0.017
41,43	0.012	0.000	0.012
43,45	0.006	-0.003	0.006
45,47	0.000	-0.015	-0.015

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom)	Rotation	Deflection
ft	radian	inch

At the intermediate nodes:		
1.000	0.001	0.010
2.000	0.000	0.016
3.000	0.000	0.020
4.000	0.000	0.022
5.000	-0.000	0.022
6.000	-0.000	0.021
7.000	-0.000	0.017
8.000	-0.000	0.012
9.000	-0.001	0.006
10.000	-0.001	-0.003

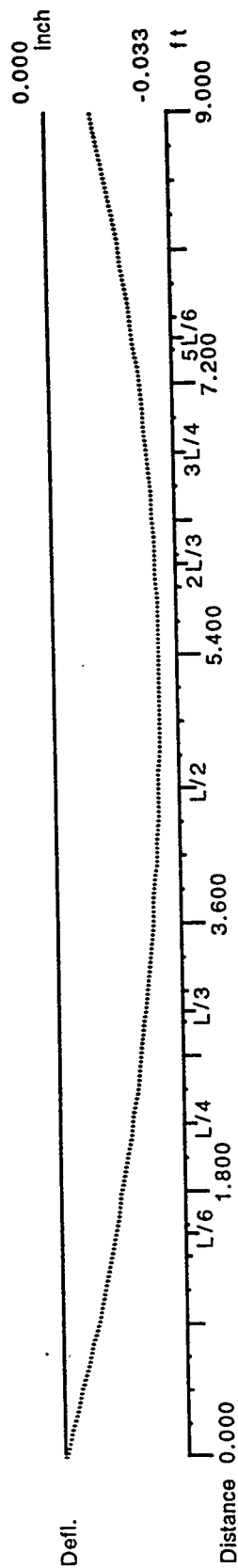
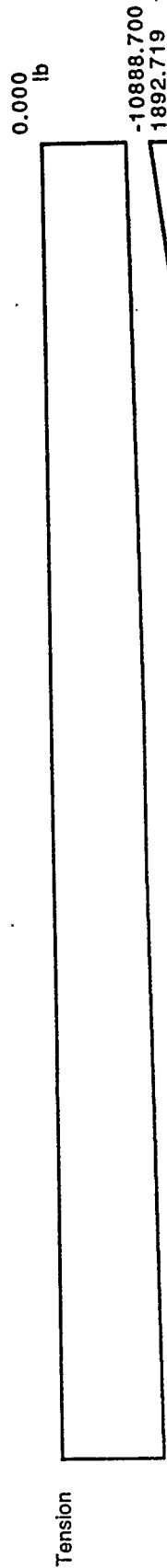
At evenly-spaced intervals:

0.000	0.001	0.000
1.100	0.001	0.011
2.200	0.000	0.017
3.300	0.000	0.021
4.400	0.000	0.022
5.500	-0.000	0.022
6.600	-0.000	0.019
7.700	-0.000	0.014
8.800	-0.001	0.007
9.900	-0.001	-0.002
11.000	-0.001	-0.015

FRAME MAC file: 1(21/21)PRELIMINARY ; Last modified at 14:59:43 on Sun, Mar 7, 1993

Node 30 13.000 3.000	Node 32 13.000 4.000	Node 34 13.000 5.000	Node 36 13.000 6.000	Node 38 13.000 7.000	Node 40 13.000 8.000	Node 42 13.000 9.000	Node 44 13.000 10.000	Node 46 13.000 11.000	Node 59 13.000 12.000

F: lb
D: lb/ft
M: lb-ft
E: psi



Distance 0.000

Continuous Elements Output Data

FRAME MAC file: 1(21/21)PRELIMINARY .
Last modified at 14:59:43 on Sun, Mar 7, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
30	0.000	-0.089	-0.001
32	0.012	-0.089	-0.001
34	0.021	-0.089	-0.001
36	0.027	-0.089	-0.001
38	0.031	-0.090	-0.000
40	0.033	-0.090	-0.000
42	0.032	-0.090	-0.000
44	0.029	-0.090	0.000
46	0.023	-0.091	0.000
59	0.014	-0.091	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
30,32	105.000	-189.000	-31.500	105.000	-189.000	31.500
32,34	105.000	-189.000	-31.500	105.000	-189.000	31.500
34,36	105.000	-189.000	-31.500	105.000	-189.000	31.500
36,38	105.000	-189.000	-31.500	105.000	-189.000	31.500
38,40	105.000	-189.000	-31.500	105.000	-189.000	31.500
40,42	105.000	-189.000	-31.500	105.000	-189.000	31.500
42,44	105.000	-189.000	-31.500	105.000	-189.000	31.500
44,46	105.000	-189.000	-31.500	105.000	-189.000	31.500
46,59	105.000	-189.000	-31.500	105.000	-189.000	31.500

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
30,32	10888.700	-1509.281	-10462.009	-10678.700	1131.281	9141.729
32,34	10678.700	-1131.281	-9141.729	-10468.700	753.281	8199.448
34,36	10468.700	-753.281	-8199.448	-10258.700	375.281	7635.167
36,38	10258.700	-375.281	-7635.167	-10048.700	-2.719	7448.886
38,40	10048.700	2.719	-7448.886	-9838.700	-380.719	7640.605
40,42	9838.700	380.719	-7640.605	-9628.700	-758.719	8210.325
42,44	9628.700	758.719	-8210.325	-9418.700	-1136.719	9158.044
44,46	9418.700	1136.719	-9158.044	-9208.700	-1514.719	10483.763
46,59	9208.700	1514.719	-10483.763	-8998.700	-1892.719	12187.482

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
30,32	-0.089	-0.000	-0.001	-0.089	-0.012	-0.001
32,34	-0.089	-0.012	-0.001	-0.089	-0.021	-0.001
34,36	-0.089	-0.021	-0.001	-0.089	-0.027	-0.000
36,38	-0.089	-0.027	-0.000	-0.090	-0.031	-0.000
38,40	-0.090	-0.031	-0.000	-0.090	-0.033	-0.000
40,42	-0.090	-0.033	-0.000	-0.090	-0.032	0.000
42,44	-0.090	-0.032	0.000	-0.090	-0.029	0.000
44,46	-0.090	-0.029	0.000	-0.091	-0.023	0.001
46,59	-0.091	-0.023	0.001	-0.091	-0.014	0.001

Maximum deformations:
No nodes moved to the left.
Node 40 moved 0.033 inch to the right.
Node 59 moved 0.091 inch downwards.
No nodes moved upwards.
Node 30 rotated 0.001 radian clockwise.
Node 59 rotated 0.001 radian counter-clockwise.

Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):
From, To Maximum Minimum Max. abs. Maximum Minimum Max. abs.
Node tension tension tension ten. str. ten. str. stress
--- lb lb lb psi psi psi

30,32 0.000 -10888.700 -10888.700 0.000 -75.616 -75.616
32,34 0.000 -10678.700 -10678.700 0.000 -74.158 -74.158
34,36 0.000 -10468.700 -10468.700 0.000 -72.699 -72.699
36,38 0.000 -10258.700 -10258.700 0.000 -71.241 -71.241
38,40 0.000 -10048.700 -10048.700 0.000 -69.783 -69.783
40,42 0.000 -9838.700 -9838.700 0.000 -68.324 -68.324
42,44 0.000 -9628.700 -9628.700 0.000 -66.866 -66.866
44,46 0.000 -9418.700 -9418.700 0.000 -65.408 -65.408
46,59 0.000 -9208.700 -9208.700 0.000 -63.949 -63.949

Maximum shear and shear stress values:
From, To Maximum Minimum Max. abs. Maximum Minimum Max. abs.
Node shear shear shear shr. str. shr. str. stress
--- lb lb lb psi psi psi

30,32 0.000 -1509.281 -1509.281 0.000 -10.481 -10.481
32,34 0.000 -1131.281 -1131.281 0.000 -7.856 -7.856
34,36 0.000 -753.281 -753.281 0.000 -5.231 -5.231
36,38 2.719 -375.281 -375.281 0.019 -2.606 -2.606
38,40 380.719 0.000 380.719 2.644 0.000 2.644
40,42 758.719 0.000 758.719 5.269 0.000 5.269
42,44 1136.719 0.000 1136.719 7.894 0.000 7.894
44,46 1514.719 0.000 1514.719 10.519 0.000 10.519
46,59 1892.719 0.000 1892.719 13.144 0.000 13.144

Maximum moment and bending stress values:
From, To Maximum Minimum Max. abs. Maximum Minimum Max. abs.
Node moment moment moment ben. str. ben. str. stress
--- lb-ft lb-ft lb-ft psi psi psi

30,32 10462.009 0.000 10462.009 435.917 0.000 435.917
32,34 9141.729 0.000 9141.729 380.905 0.000 380.905
34,36 8199.448 0.000 8199.448 341.644 0.000 341.644
36,38 7635.167 0.000 7635.167 318.132 0.000 318.132
38,40 7640.605 0.000 7640.605 318.359 0.000 318.359
40,42 8210.325 0.000 8210.325 342.097 0.000 342.097
42,44 9158.044 0.000 9158.044 381.585 0.000 381.585
44,46 10483.763 0.000 10483.763 436.823 0.000 436.823
46,59 12187.482 0.000 12187.482 507.812 0.000 507.812

Maximum deflection values:
From, To Maximum defl. Maximum defl. Maximum defl.
Node up (left) down (rt.) absolute
--- inch inch inch

30,32 0.000 -0.012 -0.012
32,34 0.000 -0.021 -0.021
34,36 0.000 -0.027 -0.027
36,38 0.000 -0.031 -0.031
38,40 0.000 -0.033 -0.033
40,42 0.000 -0.033 -0.033
42,44 0.000 -0.032 -0.032
44,46 0.000 -0.029 -0.029
46,59 0.000 -0.023 -0.023

Deflections along the elements (positive is up or counter-clockwise):
Distance from Rotation Deflection
left (bottom) --- ---
ft radian inch

At the intermediate nodes:

1.000	-0.001	-0.012
2.000	-0.001	-0.021
3.000	-0.000	-0.027
4.000	-0.000	-0.031
5.000	-0.000	-0.033
6.000	0.000	-0.032
7.000	0.000	-0.029
8.000	0.001	-0.023

At evenly-spaced intervals:

0.000	-0.001	-0.000
0.900	-0.001	-0.011
1.800	-0.001	-0.019
2.700	-0.000	-0.025
3.600	-0.000	-0.030
4.500	-0.000	-0.032
5.400	0.000	-0.033
6.300	0.000	-0.031
7.200	0.000	-0.028
8.100	0.001	-0.022
9.000	0.001	-0.014

Output Data

FRAME MAC file: 1(21/21)PRELIMINARY .

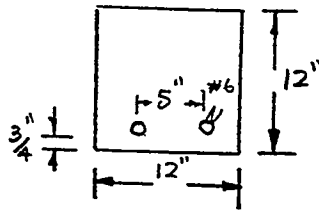
Last modified at 14:59:43 on Sun, Mar 7, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,8	0.000	-1808.809	-1808.809	0.000	-25.122	-25.122
2,9	0.000	-3073.273	-3073.273	0.000	-21.342	-21.342
3,10	0.000	-2484.342	-2484.342	0.000	-17.252	-17.252
4,11	0.000	-1933.938	-1933.938	0.000	-13.430	-13.430
5,12	0.000	-1475.663	-1475.663	0.000	-10.248	-10.248
6,13	0.000	-1140.814	-1140.814	0.000	-7.922	-7.922
7,14	0.000	-472.191	-472.191	0.000	-6.558	-6.558
8,9	0.000	-1829.108	-1829.108	0.000	-12.702	-12.702
8,15	0.000	-10951.300	-10951.300	0.000	-76.051	-76.051
9,10	0.000	-654.931	-654.931	0.000	-4.548	-4.548
10,11	401.840	0.000	401.840	2.791	0.000	2.791
11,12	1103.781	0.000	1103.781	7.665	0.000	7.665
12,13	1312.537	0.000	1312.537	9.115	0.000	9.115
13,14	927.118	0.000	927.118	6.438	0.000	6.438
14,16	32.269	-177.731	-177.731	0.224	-1.234	-1.234
15,23	0.000	-10741.300	-10741.300	0.000	-74.592	-74.592
16,24	242.269	0.000	242.269	1.682	0.000	1.682
17,25	0.000	-1162.835	-1162.835	0.000	-8.075	-8.075
18,26	0.000	-1516.984	-1516.984	0.000	-10.535	-10.535
19,27	0.000	-1998.219	-1998.219	0.000	-13.877	-13.877
20,28	0.000	-2581.241	-2581.241	0.000	-17.925	-17.925
21,29	0.000	-3217.617	-3217.617	0.000	-22.345	-22.345
22,30	0.000	-1914.073	-1914.073	0.000	-26.584	-26.584
23,31	0.000	-10531.300	-10531.300	0.000	-73.134	-73.134
24,25	381.910	0.000	381.910	2.652	0.000	2.652
25,26	1080.016	0.000	1080.016	7.500	0.000	7.500
26,27	1144.883	0.000	1144.883	7.951	0.000	7.951
27,28	682.394	0.000	682.394	4.739	0.000	4.739
28,29	0.000	-165.565	-165.565	0.000	-1.150	-1.150
29,30	0.000	-1156.726	-1156.726	0.000	-8.033	-8.033
30,32	0.000	-10888.700	-10888.700	0.000	-75.616	-75.616
31,33	0.000	-10321.300	-10321.300	0.000	-71.676	-71.676
32,34	0.000	-10678.700	-10678.700	0.000	-74.158	-74.158
33,35	0.000	-10111.300	-10111.300	0.000	-70.217	-70.217
34,36	0.000	-10468.700	-10468.700	0.000	-72.699	-72.699
35,37	0.000	-9901.300	-9901.300	0.000	-68.759	-68.759
36,38	0.000	-10258.700	-10258.700	0.000	-71.241	-71.241
37,39	0.000	-9691.300	-9691.300	0.000	-67.301	-67.301
38,40	0.000	-10048.700	-10048.700	0.000	-69.783	-69.783
39,41	0.000	-9481.300	-9481.300	0.000	-65.842	-65.842
40,42	0.000	-9838.700	-9838.700	0.000	-68.324	-68.324
41,43	0.000	-9271.300	-9271.300	0.000	-64.384	-64.384
42,44	0.000	-9628.700	-9628.700	0.000	-66.866	-66.866
43,45	0.000	-9061.300	-9061.300	0.000	-62.926	-62.926
44,46	0.000	-9418.700	-9418.700	0.000	-65.408	-65.408
45,47	0.000	-8851.300	-8851.300	0.000	-61.467	-61.467
46,59	0.000	-9208.700	-9208.700	0.000	-63.949	-63.949
47,48	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
48,49	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
49,50	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
50,51	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
51,52	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
52,53	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
53,54	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
54,55	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
55,56	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
56,57	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
57,58	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144
58,59	0.000	-1892.719	-1892.719	0.000	-13.144	-13.144

1. MOMENT CAPACITY - FLOORS, ROOF & WALLS



$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.8836)(60,000)}{(0.85)(3,000)(10)} = 2.079 \text{ in}$$

$$\phi M_n = \phi \left[A_{ST} \cdot f_y \left(d - \frac{a}{2} \right) \right]$$

$$\phi M_n = (0.9) \left[(0.8836)(60,000) \left(10.875 - \frac{2.079}{2} \right) \right]$$

$$\phi M_n = 469,295 \text{ in-lbs}$$

$$= \underline{39,108 \text{ ft-lbs}}$$

$$A_{ST} = \frac{(2)(\pi)(0.75)^2}{4} = 0.8836 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

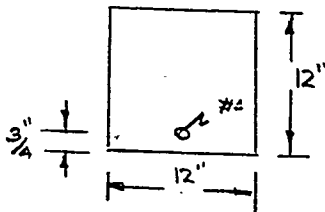
$$f'_c = 3,000 \text{ psi}$$

$$b = 10'$$

$$d = 12 - 0.75 - 0.75/2 = 10.87$$

$$\phi = 0.9$$

LEFT & RIGHT WALL (INSIDE)



$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.1963)(60,000)}{(0.85)(3,000)(12)} = 0.3849 \text{ in}$$

$$a = 0.3849 \text{ in}$$

$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$= (0.9) \left[(0.1963)(60,000) \left(11 - \frac{0.3849}{2} \right) \right]$$

$$\phi M_n = 114,562 \text{ in-lbs}$$

$$= \underline{9,547 \text{ ft-lbs}}$$

$$A_{ST} = \frac{(2)(\pi)(0.5)^2}{4} = 0.1963 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

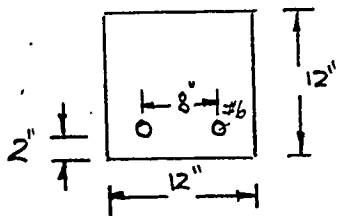
$$f'_c = 3,000 \text{ psi}$$

$$b = 12'$$

$$d = 12 - 0.75 - 0.5/2 = 11$$

$$\phi = 0.9$$

LEFT & RIGHT WALL (OUTSIDE)



$$a = \frac{A_{st} f_y}{0.85 f'_c b} = \frac{(0.8836)(60,000)}{(0.85)(3,000)(16)}$$

$$a = 1.299 \text{ in}$$

$$\phi M_n = \phi \left[A_{st} f_y \left(d - \frac{a}{2} \right) \right] = (0.9) \left[(0.8836)(60,000) \left(9.625 - \frac{1.299}{2} \right) \right]$$

$$= 428,250 \text{ in-lbs}$$

$$\phi M_n = 35,688 \text{ ft-lbs}$$

$$A_{st} = \frac{(2)(\pi)(0.75)^2}{2} = 0.8836 \text{ in}^2$$

$$f'_c = 3,000 \text{ psi}$$

$$f_y = 60,000 \text{ psi}$$

$$b = 16 \text{ in}$$

$$d = 12 - 2 - \frac{0.75}{2} = 9.625 \text{ in}$$

$$\phi = 0.9$$

2. SHEAR CAPACITY

$$V_n = V_c = 2 \sqrt{f'_c} \cdot b_w \cdot d$$

$$\phi V_n = \phi V_c = (0.85)(2) \sqrt{3,000} (12)(10.875)$$

$$\phi V_n = 12,151 \text{ lbs}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in}$$

$$d = 12 - 0.75 - \frac{0.75}{2} = 10.875 \text{ in}$$

$$\phi = 0.85$$

3. AXIAL CAPACITY

$$\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$\phi P_{nw} = (0.55)(0.7)(144)(3,000) \left[1 - \left(\frac{(0.8)(120)}{32(12)} \right)^2 \right]$$

$$\phi P_{nw} = 155,925 \text{ in-lbs}$$

$$K = 0.8$$

$$l_c = 10' \times 12" = 120 \text{ in}$$

$$h = 12 \text{ in}$$

$$A_g = 12' \times 12' = 144 \text{ in}^2$$

$$\phi = 0.7$$

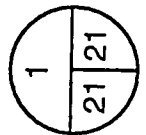
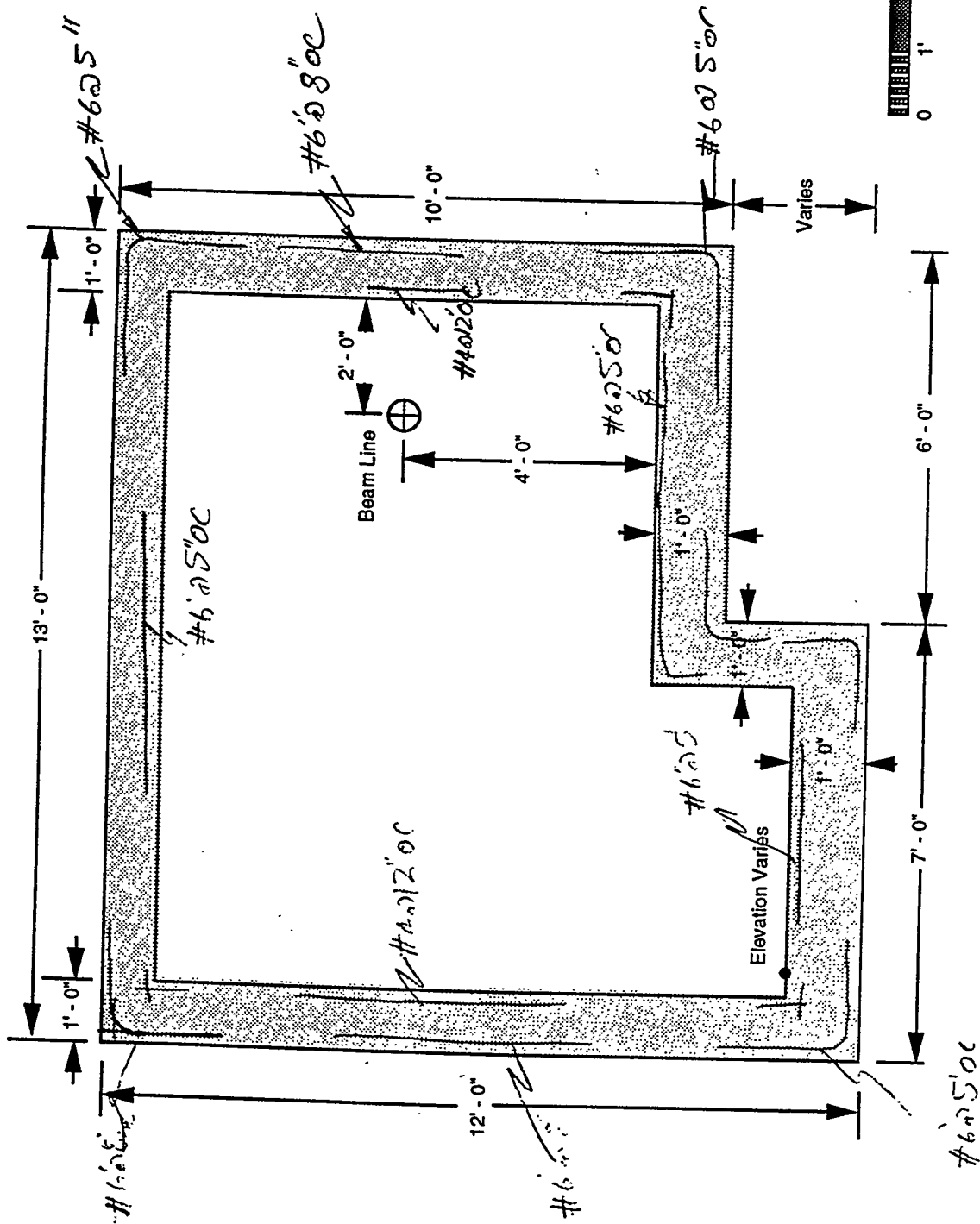


FIGURE () Section

5



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-2 (21/24)

TITLE: Preliminary Structural Assessment of Tunnel Section 2 (21/24)

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 2 (21/24) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY:

DATE:

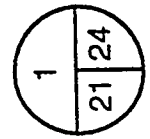
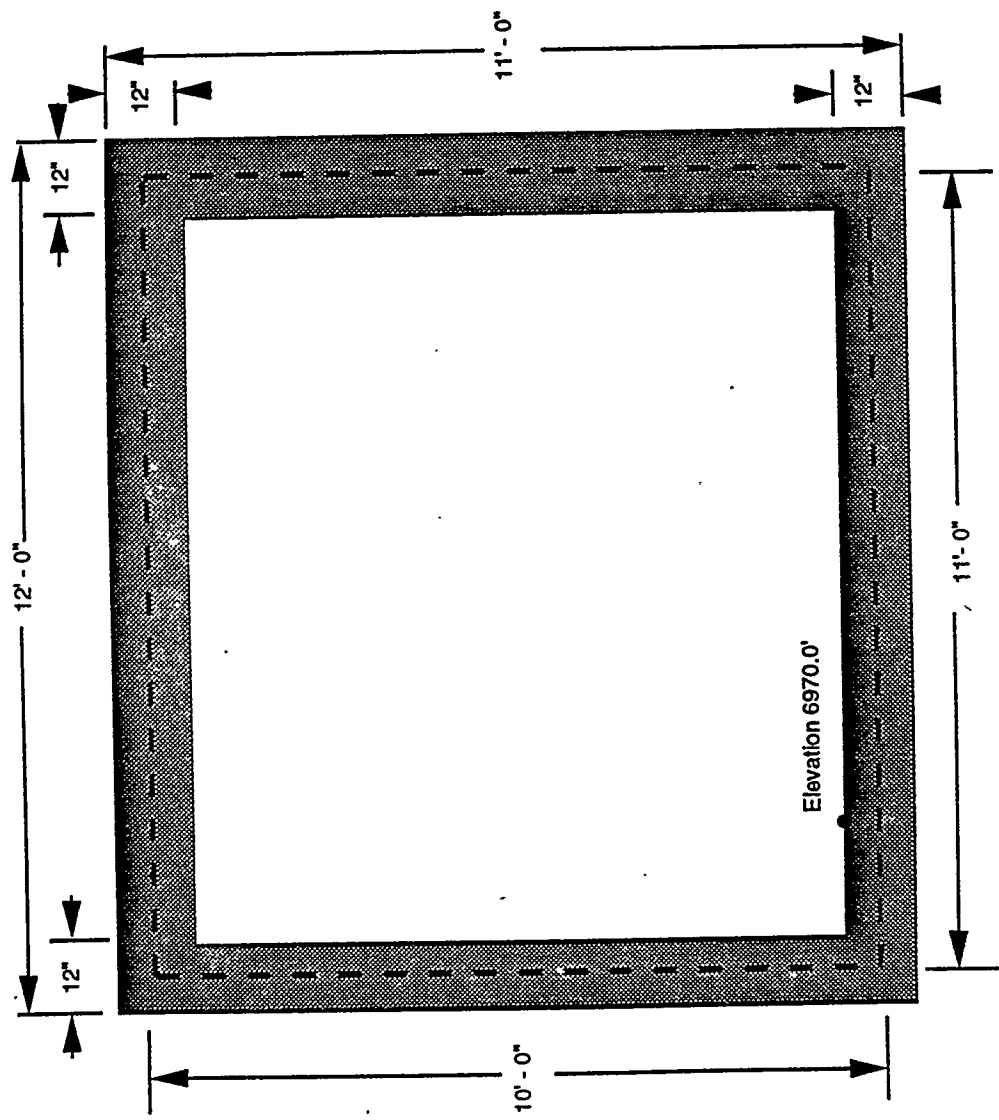


Figure () Section

ROOF ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f'c}$	$E = 3.32 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b.d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c/C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c/A}$	$r = 3.464$ in
Neutral Axis	$NA = 6.0$ in
Extreme Fiber	$C = 6.0$ in
Element Length	$L = 10$ ft

FLOOR ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f'c}$	$E = 3.32 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b.d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c/C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c/A}$	$r = 3.464$ in
Neutral Axis	$NA = 6.0$ in
Extreme Fiber	$C = 6.0$ in
Element Length	$L = 10$ ft

LEFTWALL ELEMENT PROPERTIES

Youngs Modulus $w^{1.5} (33)\sqrt{f'c}$	$E = 3.32 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b.d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c/C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c/A}$	$r = 3.464$ in
Neutral Axis	$NA = 6.0$ in
Extreme Fiber	$C = 6.0$ in
Element Length	$L = 10$ ft

TUNNEL SECTION

TITLE OF ANALYSIS 12-11-11PAGE 2 OF 3

RIGHTWALL ELEMENT PROPERTIES

Youngs Modulus w 1.5 (33) $\sqrt{f'c}$	E = <u>332 x 10</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>273</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>60</u> in
Extreme Fiber	C = <u>60</u> in
Element Length	L = <u>1.0</u> ft

SOIL ELEMENT PROPERTIES

Youngs Modulus	E = <u>300</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>115</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>60</u> in
Extreme Fiber	C = <u>60</u> in
Element Length	L = <u>0.083</u> ft

SOILEND PROPERTIES

Youngs Modulus	E = <u>300</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>60</u> in
Weight per Unit Length	W = <u>575</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>8000</u> in ⁴
Sectional Modulus Ic/C	S = <u>144</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>34.64</u> in
Neutral Axis	NA = <u>60</u> in
Extreme Fiber	C = <u>60</u> in
Element Length	L = <u>0.083</u> ft



ELEMENT PROPERTIES

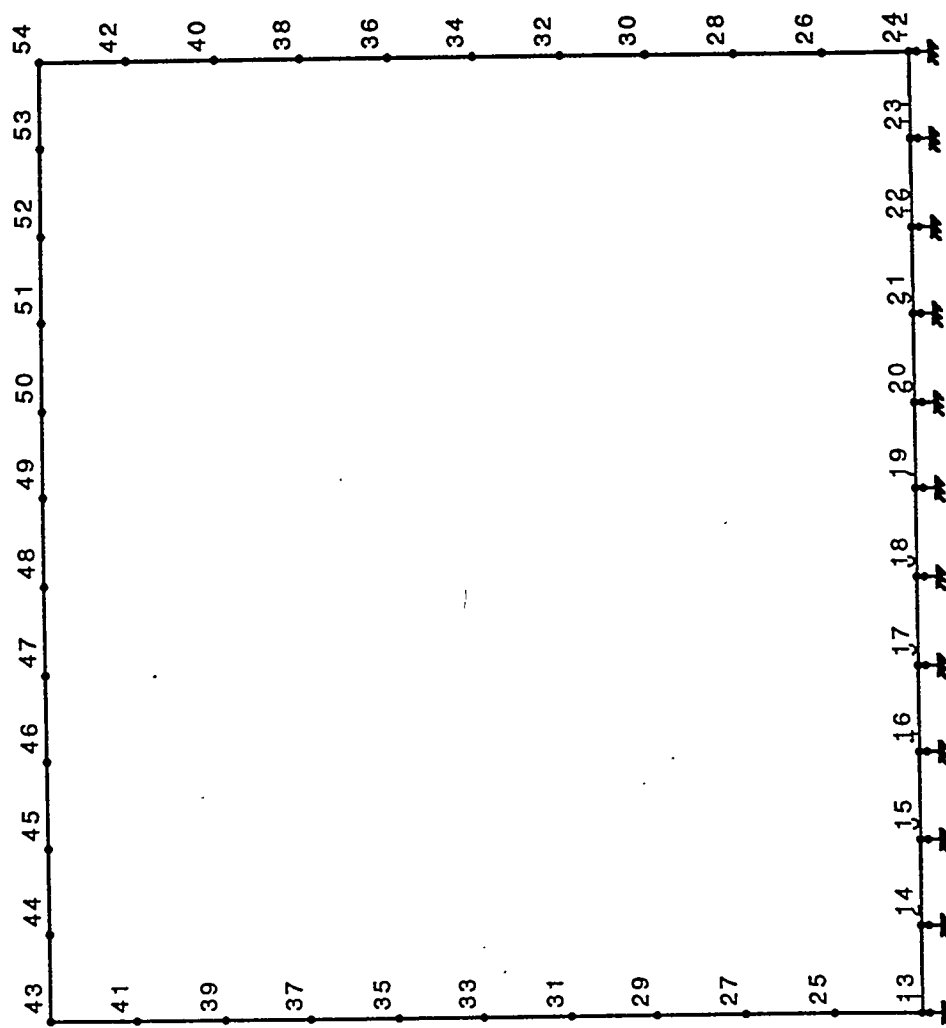
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{(Ic/A)}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

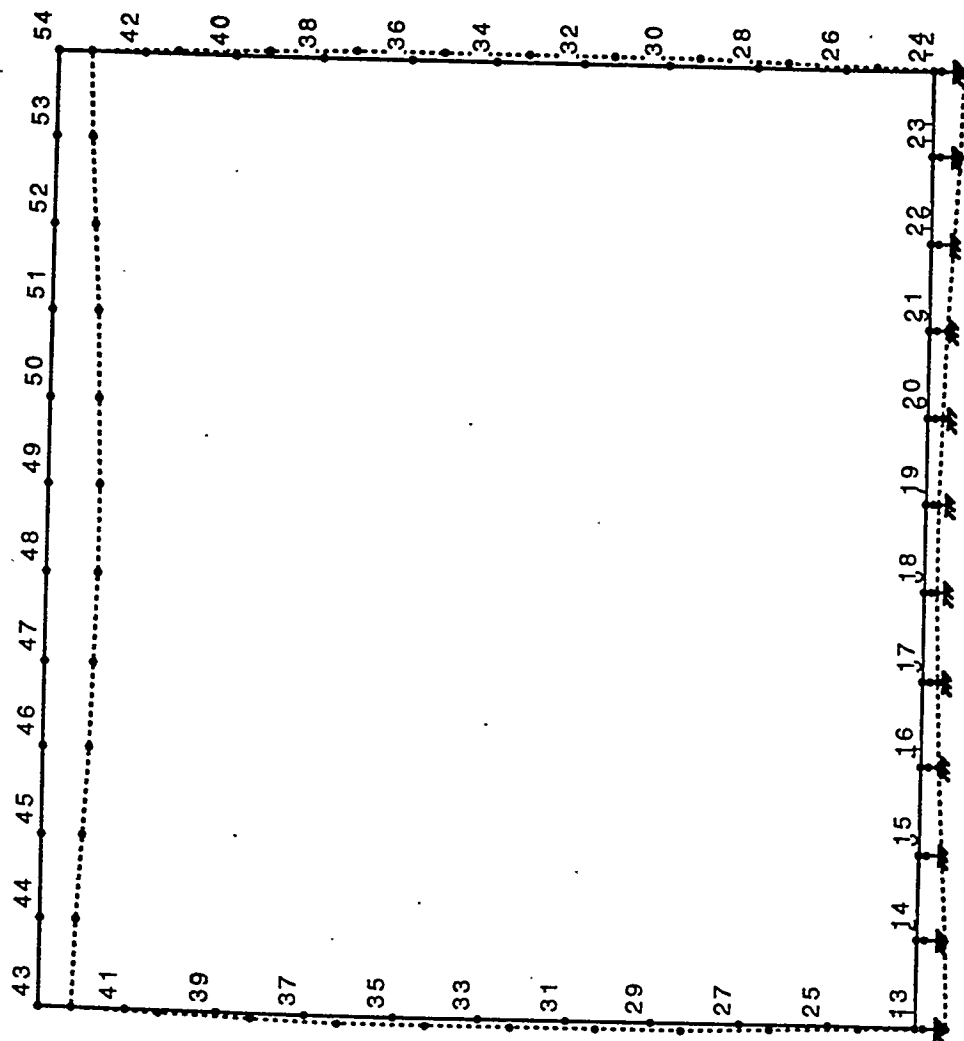
ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{(Ic/A)}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

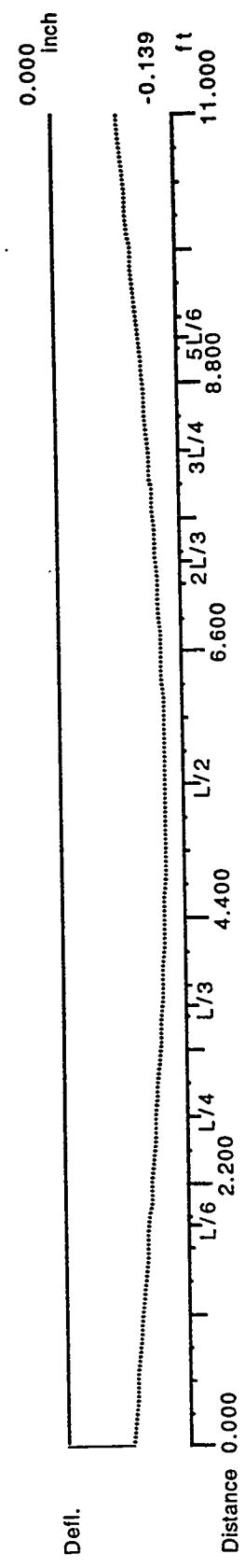
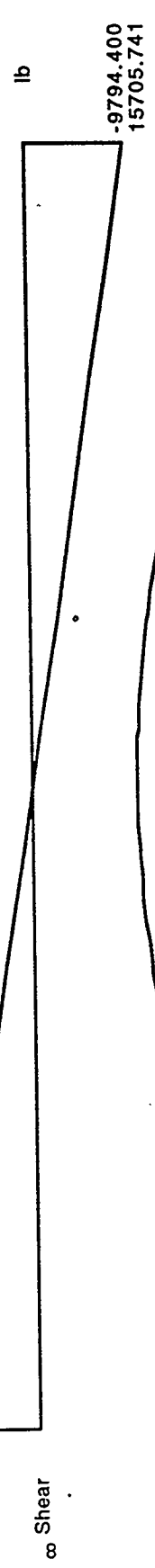
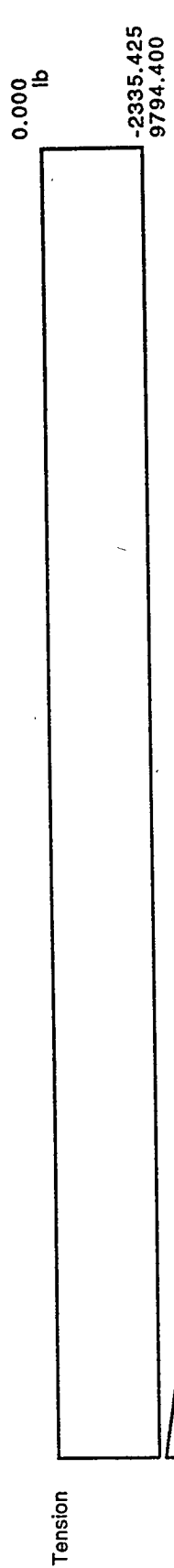
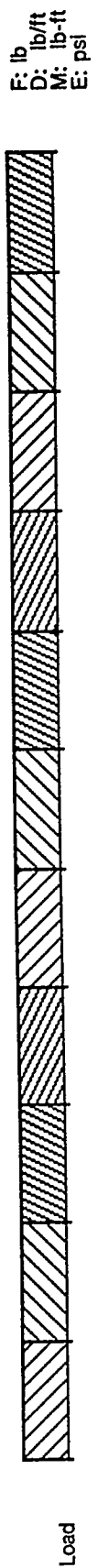
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{(Ic/A)}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft





FRAME MAC file: 1(21/24) PRELIMINARY ; Last modified at 9:25:41 on Wed, May 5, 1993

Node 43	Node 44	Node 45	Node 46	Node 47	Node 48	Node 49	Node 50	Node 51	Node 52	Node 53	Node 54
2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000
11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000



Continuous Elements Output Data

FRAME MAC file: 1(21/24) PRELIMINARY
Last modified at 9:25:41 on Wed, May 5, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)
43	0.000	-0.088	-0.001
44	0.000	-0.101	-0.001
45	0.000	-0.114	-0.001
46	0.000	-0.125	-0.001
47	0.000	-0.134	-0.001
48	0.000	-0.139	-0.001
49	-0.000	-0.139	-0.000
50	-0.000	-0.134	0.000
51	-0.000	-0.125	0.001
52	-0.000	-0.114	0.001
53	-0.000	-0.101	0.001
54	-0.000	-0.088	0.001

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
43	0.000	-0.088	-0.001
44	0.000	-0.101	-0.001
45	0.000	-0.114	-0.001
46	0.000	-0.125	-0.001
47	0.000	-0.134	-0.001
48	0.000	-0.139	-0.001
49	-0.000	-0.139	-0.000
50	-0.000	-0.134	0.000
51	-0.000	-0.125	0.001
52	-0.000	-0.114	0.001
53	-0.000	-0.101	0.001
54	-0.000	-0.088	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
43,44	0.000	890.400	148.400	0.000	890.400	-148.400
44,45	0.000	890.400	148.400	0.000	890.400	-148.400
45,46	0.000	890.400	148.400	0.000	890.400	-148.400
46,47	0.000	890.400	148.400	0.000	890.400	-148.400
47,48	0.000	890.400	148.400	0.000	890.400	-148.400
48,49	0.000	890.400	148.400	0.000	890.400	-148.400
49,50	0.000	890.400	148.400	0.000	890.400	-148.400
50,51	0.000	890.400	148.400	0.000	890.400	-148.400
51,52	0.000	890.400	148.400	0.000	890.400	-148.400
52,53	0.000	890.400	148.400	0.000	890.400	-148.400
53,54	0.000	890.400	148.400	0.000	890.400	-148.400

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
43,44	2335.425	9794.400	11228.859	-2335.425	-8013.600	-2324.859
44,45	2335.425	8013.600	2324.859	-2335.425	-6232.800	4798.341
45,46	2335.425	6232.800	-4798.341	-2335.425	-4452.000	10140.741
46,47	2335.425	4452.000	-10140.741	-2335.425	-2671.200	13702.341
47,48	2335.425	2671.200	-13702.341	-2335.425	-890.400	15483.141
48,49	2335.425	890.400	-15483.141	-2335.425	890.400	15483.141
49,50	2335.425	-890.400	-15483.141	-2335.425	2671.200	13702.341
50,51	2335.425	-2671.200	-13702.341	-2335.425	4452.000	10140.741
51,52	2335.425	-4452.000	-10140.741	-2335.425	6232.800	4798.341
52,53	2335.425	-6232.800	-4798.341	-2335.425	8013.600	-2324.859
53,54	2335.425	-8013.600	2324.859	-2335.425	9794.400	-11228.859

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
43,44	0.000	-0.088	-0.001	0.000	-0.101	-0.001
44,45	0.000	-0.101	-0.001	0.000	-0.114	-0.001
45,46	0.000	-0.114	-0.001	0.000	-0.125	-0.001
46,47	0.000	-0.125	-0.001	0.000	-0.134	-0.001
47,48	0.000	-0.134	-0.001	0.000	-0.139	-0.000
48,49	0.000	-0.139	-0.000	-0.000	-0.139	0.000
49,50	-0.000	-0.139	0.000	-0.000	-0.134	0.001
50,51	-0.000	-0.134	0.001	-0.000	-0.125	0.001
51,52	-0.000	-0.125	0.001	-0.000	-0.114	0.001
52,53	-0.000	-0.114	0.001	-0.000	-0.101	0.001
53,54	-0.000	-0.101	0.001	-0.000	-0.088	0.001

Maximum deformations:
Node 54 moved 0.000 inch to the left.
Node 43 moved 0.000 inch to the right.
Node 48 moved 0.139 inch downwards.
No nodes moved upwards.
Node 44 rotated 0.001 radian clockwise.
Node 53 rotated 0.001 radian counter-clockwise.

Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
43,44	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
44,45	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
45,46	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
46,47	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
47,48	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
48,49	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
49,50	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
50,51	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
51,52	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
52,53	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
53,54	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
43,44	9794.400	0.000	9794.400	68.017	0.000	68.017
44,45	8013.600	0.000	8013.600	55.650	0.000	55.650
45,46	6232.800	0.000	6232.800	43.283	0.000	43.283
46,47	4452.000	0.000	4452.000	30.917	0.000	30.917
47,48	2671.200	0.000	2671.200	18.550	0.000	18.550
48,49	890.400	-890.400	890.400	6.183	-6.183	6.183
49,50	0.000	-2671.200	2671.200	0.000	-18.550	18.550
50,51	0.000	-4452.000	4452.000	0.000	-30.917	30.917
51,52	0.000	-6232.800	6232.800	0.000	-43.283	43.283
52,53	0.000	-8013.600	8013.600	0.000	-55.650	55.650
53,54	0.000	-9794.400	9794.400	0.000	-68.017	68.017

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
43,44	0.000	-11228.859	11228.859	0.000	-467.869	467.869
44,45	4798.341	-2324.859	4798.341	199.931	-96.869	199.931
45,46	10140.741	0.000	10140.741	422.531	0.000	422.531
46,47	13702.341	0.000	13702.341	570.931	0.000	570.931
47,48	15483.141	0.000	15483.141	645.131	0.000	645.131
48,49	15705.741	0.000	15705.741	654.406	0.000	654.406
49,50	15483.141	0.000	15483.141	645.131	0.000	645.131
50,51	13702.341	0.000	13702.341	570.931	0.000	570.931
51,52	10140.741	0.000	10140.741	422.531	0.000	422.531
52,53	4798.341	-2324.859	4798.341	199.931	-96.869	199.931
53,54	0.000	-11228.859	11228.859	0.000	-467.869	467.869

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
43,44	0.000	0.000	0.000
44,45	0.000	0.000	0.000
45,46	0.000	0.000	0.000
46,47	0.000	0.000	0.000
47,48	0.000	0.000	0.000
48,49	0.000	0.000	0.000
49,50	0.000	0.000	0.000
50,51	0.000	0.000	0.000
51,52	0.000	0.000	0.000
52,53	0.000	0.000	0.000
53,54	0.000	0.000	0.000

43,44	0.000	-0.101	-0.101
44,45	0.000	-0.114	-0.114
45,46	0.000	-0.125	-0.125
46,47	0.000	-0.134	-0.134
47,48	0.000	-0.139	-0.139
48,49	0.000	-0.139	-0.139
49,50	0.000	-0.139	-0.139
50,51	0.000	-0.134	-0.134
51,52	0.000	-0.125	-0.125
52,53	0.000	-0.114	-0.114
53,54	0.000	-0.101	-0.101

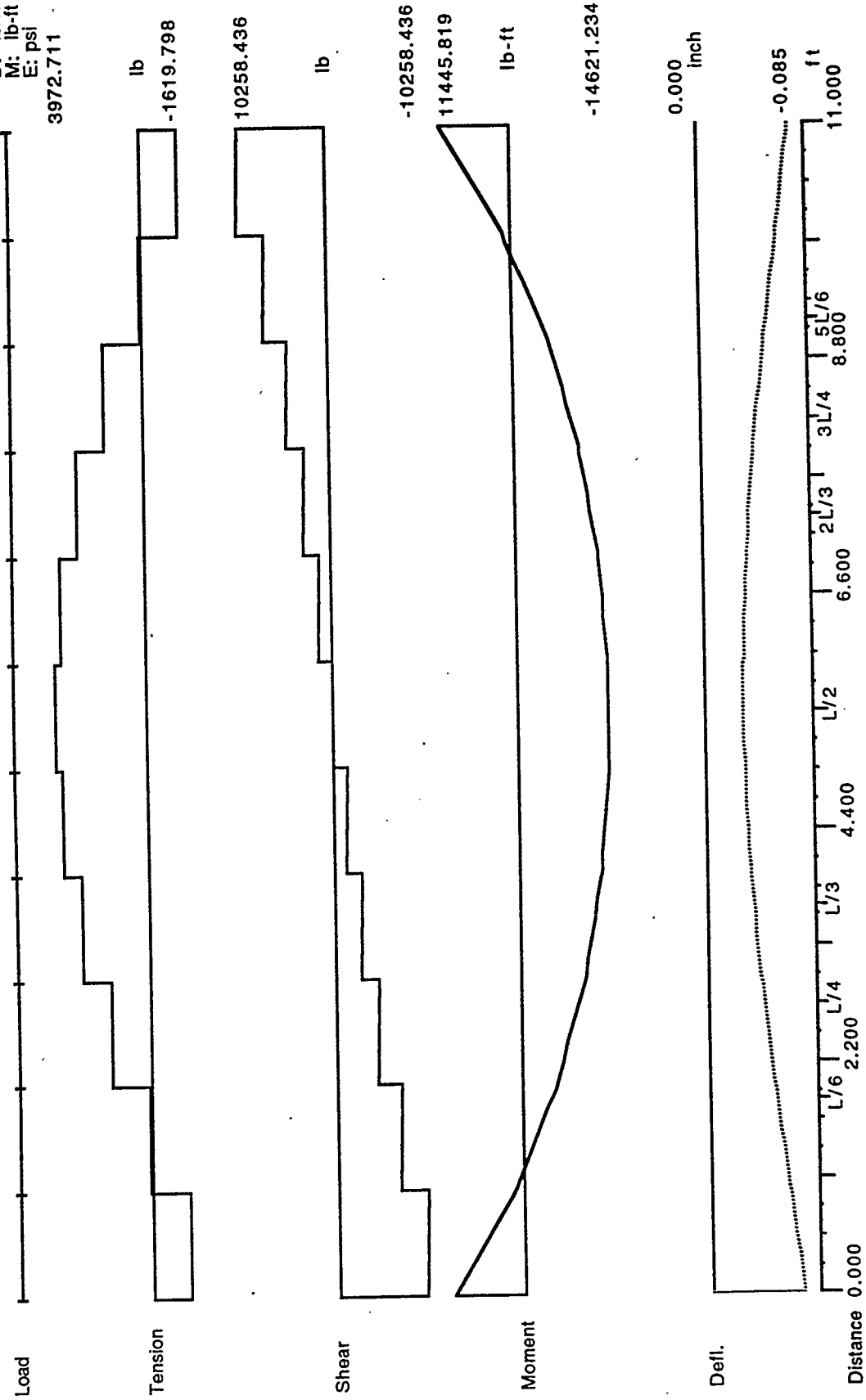
Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch
At the intermediate nodes:		
1.000	-0.001	-0.101
2.000	-0.001	-0.114
3.000	-0.001	-0.125
4.000	-0.001	-0.134
5.000	-0.000	-0.139
6.000	0.000	-0.139
7.000	0.001	-0.134
8.000	0.001	-0.125
9.000	0.001	-0.114
10.000	0.001	-0.101
At evenly-spaced intervals:		
0.000	-0.001	-0.088
1.100	-0.001	-0.102
2.200	-0.001	-0.116
3.300	-0.001	-0.128
4.400	-0.000	-0.136
5.500	0.000	-0.139
6.600	0.000	-0.136
7.700	0.001	-0.128
8.800	0.001	-0.116
9.900	0.001	-0.102
11.000	0.001	-0.088

FRAME MAC file: 1(21/24) PRELIMINARY ; Last modified at 9:25:41 on Wed, May 5, 1993

Node 13	Node 14	Node 15	Node 16	Node 17	Node 18	Node 19	Node 20	Node 21	Node 22	Node 23	Node 24
2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

F: lb
D: lb/ft
M: lb-ft
E: psi
3972.711



 Continuous Elements Output Data

FRAME MAC file: 1(21/24) PRELIMINARY .
 Last modified at 9:25:41 on Wed, May 5, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
13	-0.000	-0.085	0.001
14	-0.000	-0.073	0.001
15	-0.000	-0.060	0.001
16	-0.000	-0.049	0.001
17	-0.000	-0.041	0.001
18	-0.000	-0.036	0.000
19	0.000	-0.036	-0.000
20	0.000	-0.041	-0.001
21	0.000	-0.049	-0.001
22	0.000	-0.060	-0.001
23	0.000	-0.073	-0.001
24	0.000	-0.085	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
13,14	0.000	105.000	17.500	0.000	105.000	-17.500
14,15	0.000	105.000	17.500	0.000	105.000	-17.500
15,16	0.000	105.000	17.500	0.000	105.000	-17.500
16,17	0.000	105.000	17.500	0.000	105.000	-17.500
17,18	0.000	105.000	17.500	0.000	105.000	-17.500
18,19	0.000	105.000	17.500	0.000	105.000	-17.500
19,20	0.000	105.000	17.500	0.000	105.000	-17.500
20,21	0.000	105.000	17.500	0.000	105.000	-17.500
21,22	0.000	105.000	17.500	0.000	105.000	-17.500
22,23	0.000	105.000	17.500	0.000	105.000	-17.500
23,24	0.000	105.000	17.500	0.000	105.000	-17.500

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
13,14	1619.798	-10048.436	-11445.819	-1619.798	10258.436	1292.383
14,15	-123.446	-7099.417	-1411.973	123.446	7309.417	-5792.444
15,16	-1716.338	-4707.523	5681.475	1716.338	4917.523	-10493.998
16,17	-2947.168	-2803.520	10406.866	2947.168	3013.520	-13315.386
17,18	-3713.528	-1255.785	13260.449	3713.528	1465.785	-14621.234
18,19	-3972.711	105.000	14602.527	3972.711	105.000	-14602.527
19,20	-3713.528	1465.785	14621.234	3713.528	-1255.785	-13260.449
20,21	-2947.168	3013.520	13315.386	2947.168	-2803.520	-10406.866
21,22	-1716.338	4917.523	10493.998	1716.338	-4707.523	-5681.475
22,23	-123.446	7309.417	5792.444	123.446	-7099.417	1411.973
23,24	1619.798	10258.436	-1292.383	-1619.798	-10048.436	11445.819

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
13,14	-0.000	-0.085	0.001	-0.000	-0.073	0.001
14,15	-0.000	-0.073	0.001	-0.000	-0.060	0.001
15,16	-0.000	-0.060	0.001	-0.000	-0.049	0.001
16,17	-0.000	-0.049	0.001	-0.000	-0.041	0.001
17,18	-0.000	-0.041	0.001	-0.000	-0.036	0.000
18,19	-0.000	-0.036	0.000	0.000	-0.036	-0.000
19,20	0.000	-0.036	-0.000	0.000	-0.041	-0.001
20,21	0.000	-0.041	-0.001	0.000	-0.049	-0.001
21,22	0.000	-0.049	-0.001	0.000	-0.060	-0.001
22,23	0.000	-0.060	-0.001	0.000	-0.073	-0.001
23,24	0.000	-0.073	-0.001	0.000	-0.085	-0.001

Maximum deformations:
Node 14 moved 0.000 inch to the left.
Node 23 moved 0.000 inch to the right.
Node 24 moved 0.085 inch downwards.
No nodes moved upwards.
Node 23 rotated 0.001 radian clockwise.
Node 14 rotated 0.001 radian counter-clockwise.

Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
13,14	0.000	-1619.798	-1619.798	0.000	-11.249	-11.249
14,15	123.446	0.000	123.446	0.857	0.000	0.857
15,16	1716.338	0.000	1716.338	11.919	0.000	11.919
16,17	2947.168	0.000	2947.168	20.466	0.000	20.466
17,18	3713.528	0.000	3713.528	25.788	0.000	25.788
18,19	3972.711	0.000	3972.711	27.588	0.000	27.588
19,20	3713.528	0.000	3713.528	25.788	0.000	25.788
20,21	2947.168	0.000	2947.168	20.466	0.000	20.466
21,22	1716.338	0.000	1716.338	11.919	0.000	11.919
22,23	123.446	0.000	123.446	0.857	0.000	0.857
23,24	0.000	-1619.798	-1619.798	0.000	-11.249	-11.249

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
13,14	0.000	-10258.436	-10258.436	0.000	-71.239	-71.239
14,15	0.000	-7309.417	-7309.417	0.000	-50.760	-50.760
15,16	0.000	-4917.523	-4917.523	0.000	-34.149	-34.149
16,17	0.000	-3013.520	-3013.520	0.000	-20.927	-20.927
17,18	0.000	-1465.785	-1465.785	0.000	-10.179	-10.179
18,19	105.000	-105.000	105.000	0.729	-0.729	0.729
19,20	1465.785	0.000	1465.785	10.179	0.000	10.179
20,21	3013.520	0.000	3013.520	20.927	0.000	20.927
21,22	4917.523	0.000	4917.523	34.149	0.000	34.149
22,23	7309.417	0.000	7309.417	50.760	0.000	50.760
23,24	10258.436	0.000	10258.436	71.239	0.000	71.239

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
13,14	11445.819	0.000	11445.819	476.909	0.000	476.909
14,15	1411.973	-5792.444	-5792.444	58.832	-241.352	-241.352
15,16	0.000	-10493.998	-10493.998	0.000	-437.250	-437.250
16,17	0.000	-13315.386	-13315.386	0.000	-554.808	-554.808
17,18	0.000	-14621.234	-14621.234	0.000	-609.218	-609.218
18,19	0.000	-14602.527	-14602.527	0.000	-608.439	-608.439
19,20	0.000	-14621.234	-14621.234	0.000	-609.218	-609.218
20,21	0.000	-13315.386	-13315.386	0.000	-554.808	-554.808
21,22	0.000	-10493.998	-10493.998	0.000	-437.250	-437.250
22,23	1411.973	-5792.444	-5792.444	58.832	-241.352	-241.352
23,24	11445.819	0.000	11445.819	476.909	0.000	476.909

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch

13,14	0.000	-0.085	-0.085
14,15	0.000	-0.073	-0.073
15,16	0.000	-0.060	-0.060
16,17	0.000	-0.049	-0.049
17,18	0.000	-0.041	-0.041
18,19	0.000	-0.036	-0.036
19,20	0.000	-0.041	-0.041
20,21	0.000	-0.049	-0.049
21,22	0.000	-0.060	-0.060
22,23	0.000	-0.073	-0.073
23,24	0.000	-0.085	-0.085

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom)	Rotation	Deflection
ft	radian	inch

At the intermediate nodes:

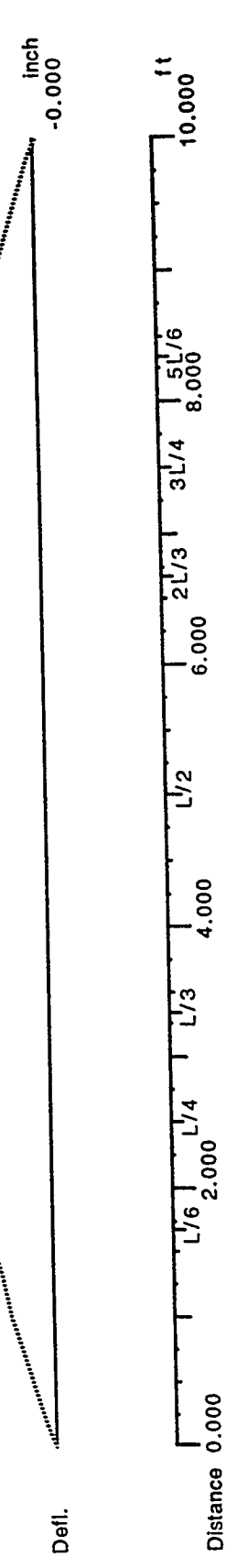
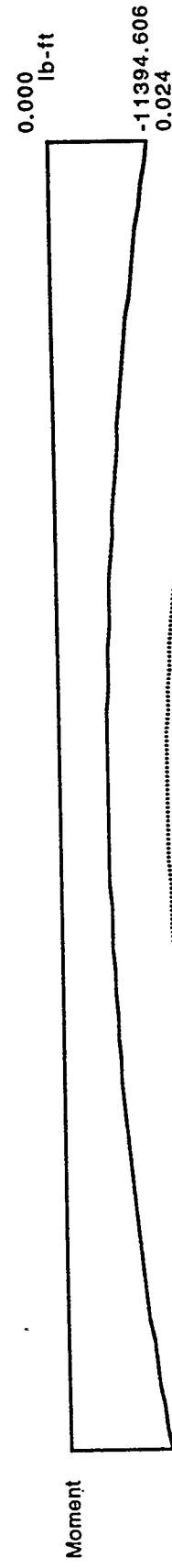
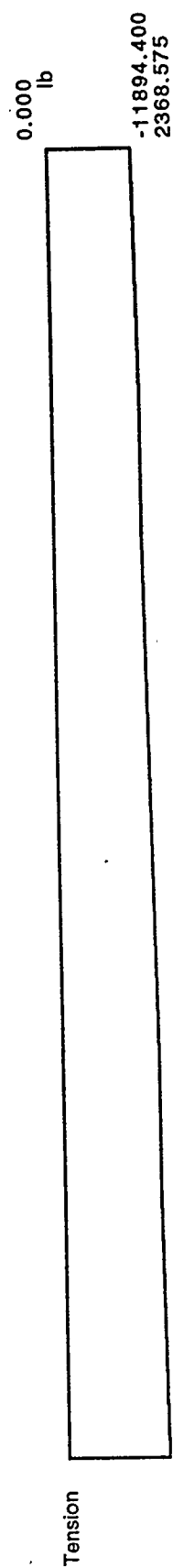
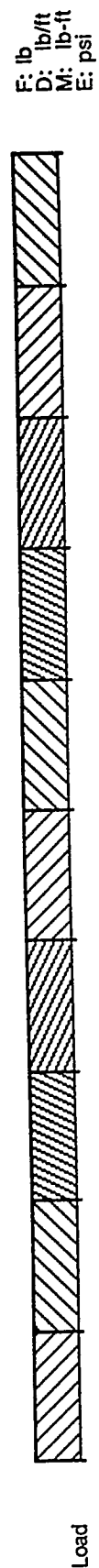
1.000	0.001	-0.073
2.000	0.001	-0.060
3.000	0.001	-0.049
4.000	0.001	-0.041
5.000	0.000	-0.036
6.000	-0.000	-0.036
7.000	-0.001	-0.041
8.000	-0.001	-0.049
9.000	-0.001	-0.060
10.000	-0.001	-0.073

At evenly-spaced intervals:

0.000	0.001	-0.085
1.100	0.001	-0.072
2.200	0.001	-0.058
3.300	0.001	-0.046
4.400	0.000	-0.038
5.500	0.000	-0.036
6.600	-0.000	-0.038
7.700	-0.001	-0.046
8.800	-0.001	-0.058
9.900	-0.001	-0.072
11.000	-0.001	-0.085

FRAME MAC file: 1(21/24) PRELIMINARY : Last modified at 9:25:41 on Wed, May 5, 1993

Node 13	Node 25	Node 27	Node 29	Node 31	Node 33	Node 35	Node 37	Node 39	Node 41	Node 43
2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000



Continuous Elements Output Data

FRAME MAC file: 1(21/24) PRELIMINARY .
Last modified at 9:25:41 on Wed, May 5, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
13	-0.000	-0.085	0.001
25	-0.010	-0.086	0.001
27	-0.016	-0.086	0.000
29	-0.021	-0.086	0.000
31	-0.023	-0.087	0.000
33	-0.024	-0.087	0.000
35	-0.023	-0.087	-0.000
37	-0.021	-0.087	-0.000
39	-0.016	-0.087	-0.000
41	-0.009	-0.088	-0.000
43	0.000	-0.088	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
13,25	105.000	235.200	39.200	105.000	235.200	-39.200
25,27	105.000	235.200	39.200	105.000	235.200	-39.200
27,29	105.000	235.200	39.200	105.000	235.200	-39.200
29,31	105.000	235.200	39.200	105.000	235.200	-39.200
31,33	105.000	235.200	39.200	105.000	235.200	-39.200
33,35	105.000	235.200	39.200	105.000	235.200	-39.200
35,37	105.000	235.200	39.200	105.000	235.200	-39.200
37,39	105.000	235.200	39.200	105.000	235.200	-39.200
39,41	105.000	235.200	39.200	105.000	235.200	-39.200
41,43	105.000	235.200	39.200	105.000	235.200	-39.200

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
13,25	11894.400	2368.575	11394.606	-11684.400	-1898.175	-9261.231
25,27	11684.400	1898.175	9261.231	-11474.400	-1427.775	-7598.256
27,29	11474.400	1427.775	7598.256	-11264.400	-957.375	-6405.682
29,31	11264.400	957.375	6405.682	-11054.400	-486.975	-5683.507
31,33	11054.400	486.975	5683.507	-10844.400	-16.575	-5431.733
33,35	10844.400	16.575	5431.733	-10634.400	453.825	-5650.358
35,37	10634.400	-453.825	5650.358	-10424.400	924.225	-6339.383
37,39	10424.400	-924.225	6339.383	-10214.400	1394.625	-7498.809
39,41	10214.400	-1394.625	7498.809	-10004.400	1865.025	-9128.634
41,43	10004.400	-1865.025	9128.634	-9794.400	2335.425	-11228.859

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
13,25	-0.085	0.000	0.001	-0.086	0.010	0.001
25,27	-0.086	0.010	0.001	-0.086	0.016	0.000
27,29	-0.086	0.016	0.000	-0.086	0.021	0.000
29,31	-0.086	0.021	0.000	-0.087	0.023	0.000
31,33	-0.087	0.023	0.000	-0.087	0.024	-0.000
33,35	-0.087	0.024	-0.000	-0.087	0.023	-0.000
35,37	-0.087	0.023	-0.000	-0.087	0.021	-0.000
37,39	-0.087	0.021	-0.000	-0.088	0.016	-0.000
39,41	-0.088	0.016	-0.000	-0.088	0.009	-0.001
41,43	-0.088	0.009	-0.001	-0.088	-0.000	-0.001

Maximum deformations:
Node 33 moved 0.024 inch to the left.
Node 43 moved 0.000 inch to the right.

Node 43 moved 0.088 inch downwards.
 No nodes moved upwards.
 Node 43 rotated 0.001 radian clockwise.
 Node 13 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
13,25	0.000	-11894.400	-11894.400	0.000	-82.600	-82.600
25,27	0.000	-11684.400	-11684.400	0.000	-81.142	-81.142
27,29	0.000	-11474.400	-11474.400	0.000	-79.683	-79.683
29,31	0.000	-11264.400	-11264.400	0.000	-78.225	-78.225
31,33	0.000	-11054.400	-11054.400	0.000	-76.767	-76.767
33,35	0.000	-10844.400	-10844.400	0.000	-75.308	-75.308
35,37	0.000	-10634.400	-10634.400	0.000	-73.850	-73.850
37,39	0.000	-10424.400	-10424.400	0.000	-72.392	-72.392
39,41	0.000	-10214.400	-10214.400	0.000	-70.933	-70.933
41,43	0.000	-10004.400	-10004.400	0.000	-69.475	-69.475

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
13,25	2368.575	0.000	2368.575	16.448	0.000	16.448
25,27	1898.175	0.000	1898.175	13.182	0.000	13.182
27,29	1427.775	0.000	1427.775	9.915	0.000	9.915
29,31	957.375	0.000	957.375	6.648	0.000	6.648
31,33	486.975	0.000	486.975	3.382	0.000	3.382
33,35	16.575	-453.825	-453.825	0.115	-3.152	-3.152
35,37	0.000	-924.225	-924.225	0.000	-6.418	-6.418
37,39	0.000	-1394.625	-1394.625	0.000	-9.685	-9.685
39,41	0.000	-1865.025	-1865.025	0.000	-12.952	-12.952
41,43	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
13,25	0.000	-11394.606	-11394.606	0.000	-474.775	-474.775
25,27	0.000	-9261.231	-9261.231	0.000	-385.885	-385.885
27,29	0.000	-7598.256	-7598.256	0.000	-316.594	-316.594
29,31	0.000	-6405.682	-6405.682	0.000	-266.903	-266.903
31,33	0.000	-5683.507	-5683.507	0.000	-236.813	-236.813
33,35	0.000	-5650.358	-5650.358	0.000	-235.432	-235.432
35,37	0.000	-6339.383	-6339.383	0.000	-264.141	-264.141
37,39	0.000	-7498.809	-7498.809	0.000	-312.450	-312.450
39,41	0.000	-9128.634	-9128.634	0.000	-380.360	-380.360
41,43	0.000	-11228.859	-11228.859	0.000	-467.869	-467.869

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
13,25	0.010	0.000	0.010
25,27	0.016	0.000	0.016
27,29	0.021	0.000	0.021
29,31	0.023	0.000	0.023
31,33	0.024	0.000	0.024
33,35	0.024	0.000	0.024
35,37	0.023	0.000	0.023

37,39	0.021	0.000	0.021
39,41	0.016	0.000	0.016
41,43	0.009	-0.000	0.009

Deflections along the elements (positive is up or counter-clockwise):			
Distance from	Rotation		Deflection
left (bottom)	---		---
ft	radian		inch

At the intermediate nodes:			
1.000	0.001		0.010
2.000	0.000		0.016
3.000	0.000		0.021
4.000	0.000		0.023
5.000	-0.000		0.024
6.000	-0.000		0.023
7.000	-0.000		0.021
8.000	-0.000		0.016
9.000	-0.001		0.009
At evenly-spaced intervals:			
0.000	0.001		0.000
1.000	0.001		0.010
2.000	0.000		0.016
3.000	0.000		0.021
4.000	0.000		0.023
5.000	-0.000		0.024
6.000	-0.000		0.023
7.000	-0.000		0.021
8.000	-0.000		0.016
9.000	-0.001		0.009
10.000	-0.001		-0.000

FRAME MAC file: 1(21/24) PRELIMINARY ; Last modified at 9:25:41 on Wed, May 5, 1993

Node 24	Node 26	Node 28	Node 30	Node 32	Node 34	Node 36	Node 38	Node 40	Node 42	Node 54
13.000	13.000	13.000	13.000	13.000	13.000	13.000	13.000	13.000	13.000	13.000
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000

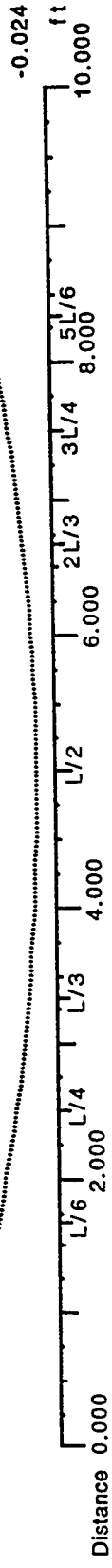
F: lb
D: lb/ft
M: lb-ft
E: psi



-11894.400
2335.425



-2368.575
11394.606



Continuous Elements Output Data

FRAME MAC file: 1(21/24) PRELIMINARY .

Last modified at 9:25:41 on Wed, May 5, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

24	0.000	-0.085	-0.001
26	0.010	-0.086	-0.001
28	0.016	-0.086	-0.000
30	0.021	-0.086	-0.000
32	0.023	-0.087	-0.000
34	0.024	-0.087	0.000
36	0.023	-0.087	0.000
38	0.021	-0.087	0.000
40	0.016	-0.088	0.000
42	0.009	-0.088	0.001
54	-0.000	-0.088	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
24,26	105.000	-235.200	-39.200	105.000	-235.200	39.200
26,28	105.000	-235.200	-39.200	105.000	-235.200	39.200
28,30	105.000	-235.200	-39.200	105.000	-235.200	39.200
30,32	105.000	-235.200	-39.200	105.000	-235.200	39.200
32,34	105.000	-235.200	-39.200	105.000	-235.200	39.200
34,36	105.000	-235.200	-39.200	105.000	-235.200	39.200
36,38	105.000	-235.200	-39.200	105.000	-235.200	39.200
38,40	105.000	-235.200	-39.200	105.000	-235.200	39.200
40,42	105.000	-235.200	-39.200	105.000	-235.200	39.200
42,54	105.000	-235.200	-39.200	105.000	-235.200	39.200

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
24,26	11894.400	-2368.575	-11394.606	-11684.400	1898.175	9261.231
26,28	11684.400	-1898.175	-9261.231	-11474.400	1427.775	7598.256
28,30	11474.400	-1427.775	-7598.256	-11264.400	957.375	6405.682
30,32	11264.400	-957.375	-6405.682	-11054.400	486.975	5683.507
32,34	11054.400	-486.975	-5683.507	-10844.400	16.575	5431.733
34,36	10844.400	-16.575	-5431.733	-10634.400	-453.825	5650.358
36,38	10634.400	453.825	-5650.358	-10424.400	-924.225	6339.383
38,40	10424.400	924.225	-6339.383	-10214.400	-1394.625	7498.809
40,42	10214.400	1394.625	-7498.809	-10004.400	-1865.025	9128.634
42,54	10004.400	1865.025	-9128.634	-9794.400	-2335.425	11228.859

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
24,26	-0.085	-0.000	-0.001	-0.086	-0.010	-0.001
26,28	-0.086	-0.010	-0.001	-0.086	-0.016	-0.000
28,30	-0.086	-0.016	-0.000	-0.086	-0.021	-0.000
30,32	-0.086	-0.021	-0.000	-0.087	-0.023	-0.000
32,34	-0.087	-0.023	-0.000	-0.087	-0.024	0.000
34,36	-0.087	-0.024	0.000	-0.087	-0.023	0.000
36,38	-0.087	-0.023	0.000	-0.087	-0.021	0.000
38,40	-0.087	-0.021	0.000	-0.088	-0.016	0.000
40,42	-0.088	-0.016	0.000	-0.088	-0.009	0.001
42,54	-0.088	-0.009	0.001	-0.088	0.000	0.001

Maximum deformations:

Node 54 moved 0.000 inch to the left.
Node 34 moved 0.024 inch to the right.

Node 54 moved 0.088 inch downwards.
 No nodes moved upwards.
 Node 24 rotated 0.001 radian clockwise.
 Node 54 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
24,26	0.000	-11894.400	-11894.400	0.000	-82.600	-82.600
26,28	0.000	-11684.400	-11684.400	0.000	-81.142	-81.142
28,30	0.000	-11474.400	-11474.400	0.000	-79.683	-79.683
30,32	0.000	-11264.400	-11264.400	0.000	-78.225	-78.225
32,34	0.000	-11054.400	-11054.400	0.000	-76.767	-76.767
34,36	0.000	-10844.400	-10844.400	0.000	-75.308	-75.308
36,38	0.000	-10634.400	-10634.400	0.000	-73.850	-73.850
38,40	0.000	-10424.400	-10424.400	0.000	-72.392	-72.392
40,42	0.000	-10214.400	-10214.400	0.000	-70.933	-70.933
42,54	0.000	-10004.400	-10004.400	0.000	-69.475	-69.475

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
24,26	0.000	-2368.575	-2368.575	0.000	-16.448	-16.448
26,28	0.000	-1898.175	-1898.175	0.000	-13.182	-13.182
28,30	0.000	-1427.775	-1427.775	0.000	-9.915	-9.915
30,32	0.000	-957.375	-957.375	0.000	-6.648	-6.648
32,34	0.000	-486.975	-486.975	0.000	-3.382	-3.382
34,36	453.825	-16.575	453.825	3.152	-0.115	3.152
36,38	924.225	0.000	924.225	6.418	0.000	6.418
38,40	1394.625	0.000	1394.625	9.685	0.000	9.685
40,42	1865.025	0.000	1865.025	12.952	0.000	12.952
42,54	2335.425	0.000	2335.425	16.218	0.000	16.218

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
24,26	11394.606	0.000	11394.606	474.775	0.000	474.775
26,28	9261.231	0.000	9261.231	385.885	0.000	385.885
28,30	7598.256	0.000	7598.256	316.594	0.000	316.594
30,32	6405.682	0.000	6405.682	266.903	0.000	266.903
32,34	5683.507	0.000	5683.507	236.813	0.000	236.813
34,36	5650.358	0.000	5650.358	235.432	0.000	235.432
36,38	6339.383	0.000	6339.383	264.141	0.000	264.141
38,40	7498.809	0.000	7498.809	312.450	0.000	312.450
40,42	9128.634	0.000	9128.634	380.360	0.000	380.360
42,54	11228.859	0.000	11228.859	467.869	0.000	467.869

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
24,26	0.000	-0.010	-0.010
26,28	0.000	-0.016	-0.016
28,30	0.000	-0.021	-0.021
30,32	0.000	-0.023	-0.023
32,34	0.000	-0.024	-0.024
34,36	0.000	-0.024	-0.024
36,38	0.000	-0.023	-0.023

38,40	0.000	-0.021	-0.021
40,42	0.000	-0.016	-0.016
42,54	0.000	-0.009	-0.009

Deflections along the elements (positive is up or counter-clockwise):			
Distance from	Rotation		Deflection
left (bottom)			
ft	radian		inch

At the intermediate nodes:			
1.000	-0.001		-0.010
2.000	-0.000		-0.016
3.000	-0.000		-0.021
4.000	-0.000		-0.023
5.000	0.000		-0.024
6.000	0.000		-0.023
7.000	0.000		-0.021
8.000	0.000		-0.016
9.000	0.001		-0.009
At evenly-spaced intervals:			
0.000	-0.001		-0.000
1.000	-0.001		-0.010
2.000	-0.000		-0.016
3.000	-0.000		-0.021
4.000	-0.000		-0.023
5.000	0.000		-0.024
6.000	0.000		-0.023
7.000	0.000		-0.021
8.000	0.000		-0.016
9.000	0.001		-0.009
10.000	0.001		0.000

Output Data

FRAME MAC file: 1(21/24) PRELIMINARY .

Last modified at 9:25:41 on Wed, May 5, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,13	0.000	-1845.964	-1845.964	0.000	-25.638	-25.638
2,14	0.000	-3159.019	-3159.019	0.000	-21.938	-21.938
3,15	0.000	-2601.894	-2601.894	0.000	-18.069	-18.069
4,16	0.000	-2114.003	-2114.003	0.000	-14.681	-14.681
5,17	0.000	-1757.735	-1757.735	0.000	-12.206	-12.206
6,18	0.000	-1570.785	-1570.785	0.000	-10.908	-10.908
7,19	0.000	-1570.785	-1570.785	0.000	-10.908	-10.908
8,20	0.000	-1757.735	-1757.735	0.000	-12.206	-12.206
9,21	0.000	-2114.003	-2114.003	0.000	-14.681	-14.681
10,22	0.000	-2601.894	-2601.894	0.000	-18.069	-18.069
11,23	0.000	-3159.019	-3159.019	0.000	-21.938	-21.938
12,24	0.000	-1845.964	-1845.964	0.000	-25.638	-25.638
13,14	0.000	-1619.798	-1619.798	0.000	-11.249	-11.249
13,25	0.000	-11894.400	-11894.400	0.000	-82.600	-82.600
14,15	123.446	0.000	123.446	0.857	0.000	0.857
15,16	1716.338	0.000	1716.338	11.919	0.000	11.919
16,17	2947.168	0.000	2947.168	20.466	0.000	20.466
17,18	3713.528	0.000	3713.528	25.788	0.000	25.788
18,19	3972.711	0.000	3972.711	27.588	0.000	27.588
19,20	3713.528	0.000	3713.528	25.788	0.000	25.788
20,21	2947.168	0.000	2947.168	20.466	0.000	20.466
21,22	1716.338	0.000	1716.338	11.919	0.000	11.919
22,23	123.446	0.000	123.446	0.857	0.000	0.857
23,24	0.000	-1619.798	-1619.798	0.000	-11.249	-11.249
24,26	0.000	-11894.400	-11894.400	0.000	-82.600	-82.600
25,27	0.000	-11684.400	-11684.400	0.000	-81.142	-81.142
26,28	0.000	-11684.400	-11684.400	0.000	-81.142	-81.142
27,29	0.000	-11474.400	-11474.400	0.000	-79.683	-79.683
28,30	0.000	-11474.400	-11474.400	0.000	-79.683	-79.683
29,31	0.000	-11264.400	-11264.400	0.000	-78.225	-78.225
30,32	0.000	-11264.400	-11264.400	0.000	-78.225	-78.225
31,33	0.000	-11054.400	-11054.400	0.000	-76.767	-76.767
32,34	0.000	-11054.400	-11054.400	0.000	-76.767	-76.767
33,35	0.000	-10844.400	-10844.400	0.000	-75.308	-75.308
34,36	0.000	-10844.400	-10844.400	0.000	-75.308	-75.308
35,37	0.000	-10634.400	-10634.400	0.000	-73.850	-73.850
36,38	0.000	-10634.400	-10634.400	0.000	-73.850	-73.850
37,39	0.000	-10424.400	-10424.400	0.000	-72.392	-72.392
38,40	0.000	-10424.400	-10424.400	0.000	-72.392	-72.392
39,41	0.000	-10214.400	-10214.400	0.000	-70.933	-70.933
40,42	0.000	-10214.400	-10214.400	0.000	-70.933	-70.933
41,43	0.000	-10004.400	-10004.400	0.000	-69.475	-69.475
42,54	0.000	-10004.400	-10004.400	0.000	-69.475	-69.475
43,44	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
44,45	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
45,46	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
46,47	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
47,48	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
48,49	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
49,50	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
50,51	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
51,52	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
52,53	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218
53,54	0.000	-2335.425	-2335.425	0.000	-16.218	-16.218

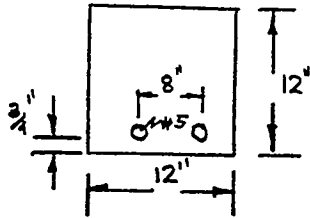
SOIL ELEMENTS

RVE = 17.24/14 = 123.1

= 1775 in ft

SECTION $\frac{2}{21|24}$ PRELIMINARY

I. MOMENT CAPACITY ROOF, FLOOR & WALLS



$$A_{ST} = (2)(\pi) \left(\frac{0.625}{4} \right)^2 = 0.6136 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$\phi = 0.9$$

$$d = 12 - 0.75 - \frac{0.625}{2} = 10.938'$$

$$b = 16''$$

$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.6136)(60,000)}{(0.85)(3,000)(16)}$$

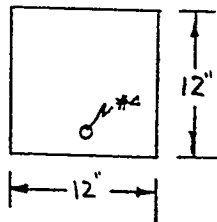
$$a = 0.9014$$

$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right] = 0.9 \left[(0.9024)(60,000) \left(10.938 - \frac{0.9024}{2} \right) \right]$$

$$\phi M_n = 511,018 \text{ in-lbs}$$

$$\phi M_n = 42,585 \text{ ft-lbs}$$

LEFT & RIGHT WALL (INSIDE)



$$A_{ST} = (\pi) \left(\frac{0.5}{2} \right)^2 = 0.1963 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b = 12 \text{ in}$$

$$d = 12 - 0.75 - \frac{0.5}{2} = 11''$$

$$\phi = 0.9$$

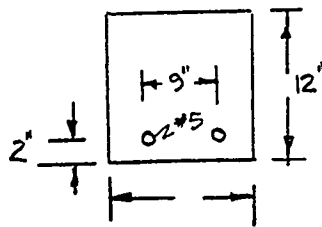
$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.1963)(60,000)}{(0.85)(3,000)(12)}$$

$$a = 0.3849$$

$$\phi M_n = (0.9) \left[(0.1963)(60,000) \left(11 - \frac{0.3849}{2} \right) \right]$$

$$\phi M_n = 114,562 \text{ in-lbs}$$

$$= 9,547 \text{ ft-lbs}$$



$$A_{ST} = (2)(\pi)(0.625)^2 = 0.6136 \text{ in}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$\phi = 0.9$$

$$d = 12 - 2 - 0.625/2 = 9.6875$$

$$b_w = 12 \text{ inches}$$

$$a = \frac{A_{ST} f_y}{0.85 f'_c b_w} = \frac{(0.6136)(60,000)}{(0.85)(3,000)(12)} = 0.8021$$

$$\phi M_n = (0.9) \left[(0.6136)(60,000) \left(9.6875 - \frac{0.8021}{2} \right) \right]$$

$$= 307,701 \text{ in-lbs}$$

$$= \underline{25,642 \text{ ft-lbs}}$$

2. SHEAR CAPACITY

$$\phi V_n = \phi V_c = \phi 2 \sqrt{f'_c} b_w d$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in}$$

$$\phi V_n = (0.85)(2) \sqrt{3,000}(12)$$

$$\phi V_n = 13,291 \text{ lbs}$$

$$d_r = 12 - 0.75 - 0.5/2 = 11$$

$$d_w = 12 - 0.75 - 0.625/2 = 10.938$$

3. AXIAL CAPACITY

$$\phi P_n = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$f'_c = 3,000 \text{ psi}$$

$$\phi = 0.7$$

$$= (0.55)(0.85)(3,000)(144) \left[1 - \left(\frac{(0.8)(108)}{(32)(12)} \right)^2 \right] K = 0.8$$

$$h = 12 \text{ inches}$$

$$= \underline{157,900 \text{ lbs}}$$

$$l_c = (9')(12) = 108'$$

$$A_g = (12')(12') = 144 \text{ in}^2$$

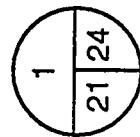
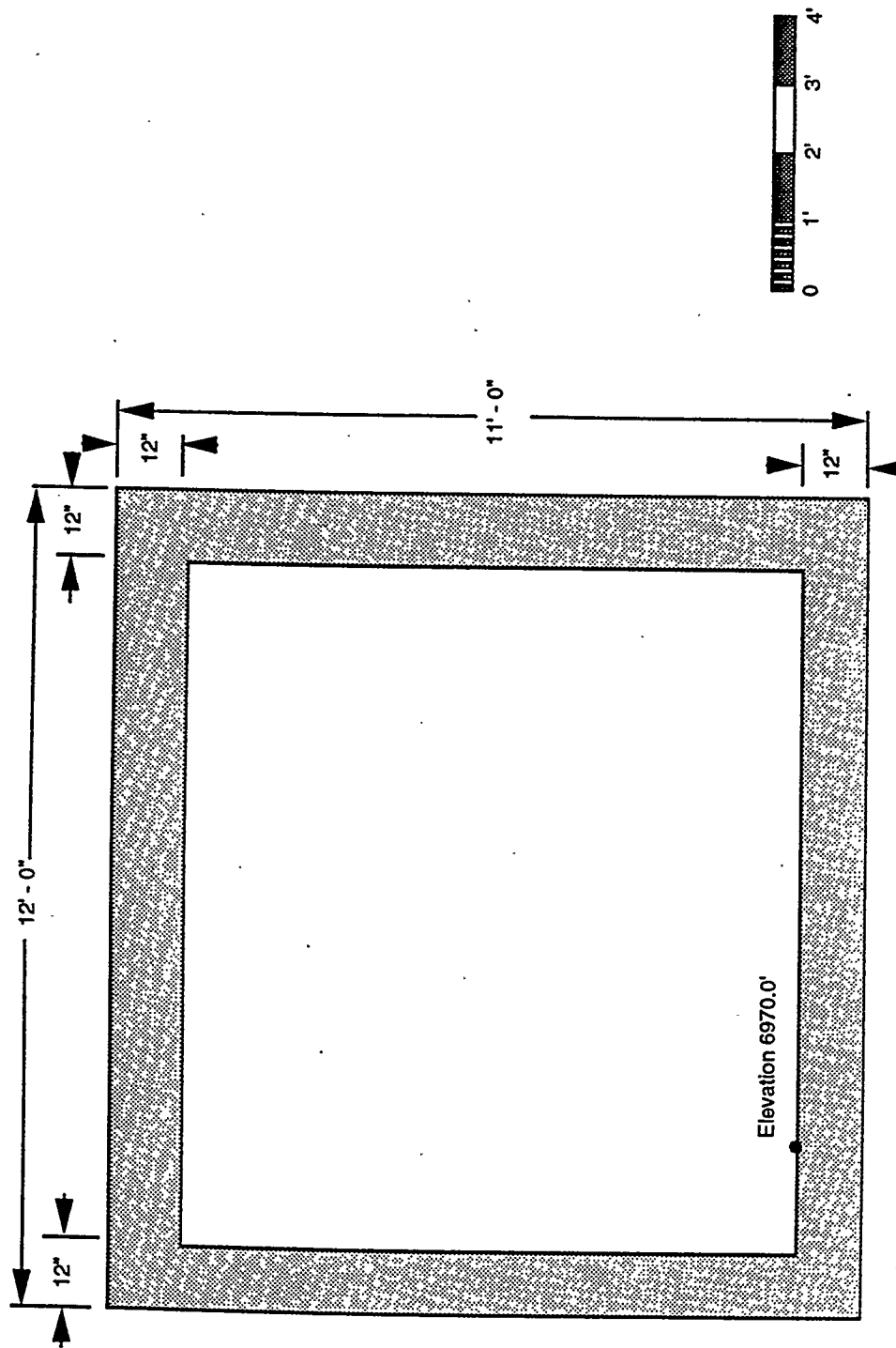
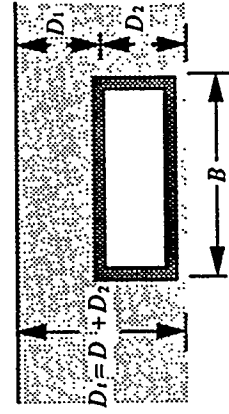


Figure () Section

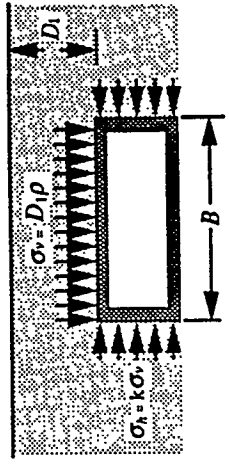
(7)

STRUCTURAL ASSESSMENT					
TUNNEL SECTION		TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE
PAGE 2 OF 24		ROOF STRUCTURE	42,585 ft-lbs	18,521 ft-lbs	
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$		FLOOR STRUCTURE	42,585 ft-lbs	15,856 ft-lbs	
		LEFT INSIDE WALL	9,547 ft-lbs	- ft-lbs	
		LEFT OUTSIDE WALL	25,642 ft-lbs	13,608 ft-lbs	
		RIGHT INSIDE WALL	9,547 ft-lbs	- ft-lbs	
		RIGHT OUTSIDE WALL	25,642 ft-lbs	13,608 ft-lbs	
Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2\sqrt{f'c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2\sqrt{f'c} B_w d$		ROOF STRUCTURE	122,711 lbs	10,710 lbs	
		FLOOR STRUCTURE	122,711 lbs	10,982 lbs	
		LEFT WALL	12,271 lbs	2475 lbs	
		RIGHT WALL	12,271 lbs	2475 lbs	
Axial Capacity Design axial load ϕP_{nw} is computed by ACI 318-89 (14-1) $\phi P_{nw} = 0.55 \phi f'c A_g \left[1 - \left(\frac{kl_c}{32h} \right)^2 \right]$ where $\phi = 0.7$		LEFT WALL	157,900 lbs	12,810 lbs	
		RIGHT WALL	157,900 lbs	12,810 lbs	

Loading Conditions



$B = 13 \text{ ft.}$ $D_2 = 11 \text{ ft.}$
 $D_1 = 9.78 \text{ ft.}$ $D_1 = 20.78 \text{ ft.}$



$\sigma_v = D_1 \rho$ 1125 lbs/ft^2
 $\sigma_h = k \sigma_v$ 340 lbs/ft^2

where $k = \frac{1 - \sin \theta}{1 + \sin \theta}$
 $k = 0.3$

Figure () Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-1(21/24)

TITLE: Preliminary Structural Assessment of Tunnel Section 1(21/24))

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 1(21/24) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY:

DATE:

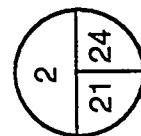
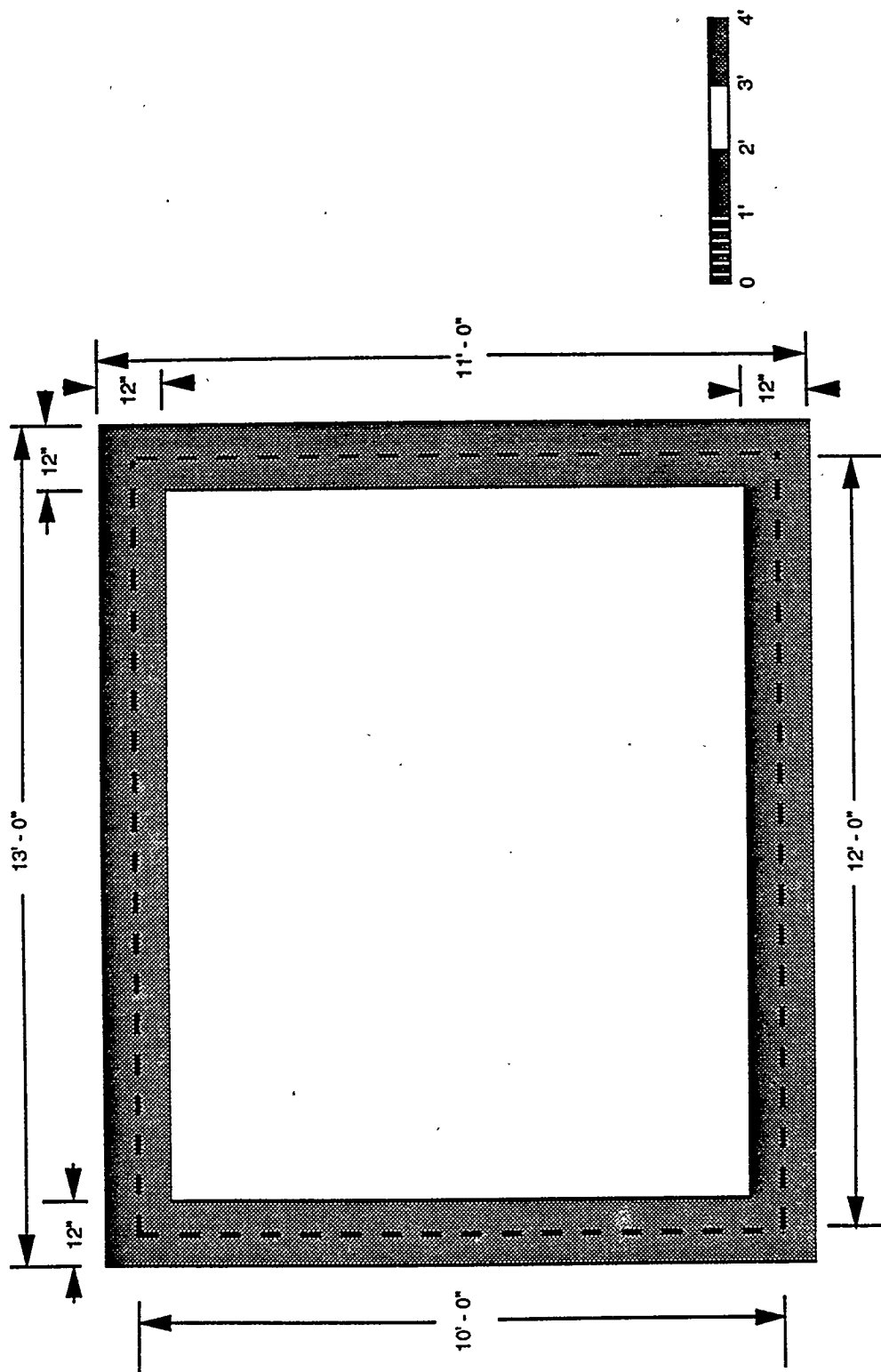


Figure () Section

ROOF ELEMENT PROPERTIES

Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>10</u> ft

FLOOR ELEMENT PROPERTIES

Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>10</u> ft

LEFTWALL ELEMENT PROPERTIES

Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>10</u> ft

RIGHTWALL ELEMENT PROPERTIES

Youngs Modulus $w 1.5 (33)\sqrt{f \cdot c}$	$E = 332 \times 10^6$ psi
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c / C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c / A}$	$r = 3.464$ in
Neutral Axis	$NA = 6.0$ in
Extreme Fiber	$C = 6.0$ in
Element Length	$L = 1.0$ ft

SOIL ELEMENT PROPERTIES

Youngs Modulus	$E = 300$ psi (r)
Area of Cross Section (b x d)	$A = 144$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 12$ in
Weight per Unit Length	$W = 150$ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	$I_c = 1728$ in ⁴
Sectional Modulus I_c / C	$S = 288$ in ³
Radius of Gyration $\sqrt{I_c / A}$	$r = 3.464$ in
Neutral Axis	$NA = 6.0$ in
Extreme Fiber	$C = 6.0$ in
Element Length	$L = 0.083$ ft 1"

SOILEND PROPERTIES

Youngs Modulus	$E = 300$ psi (K)
Area of Cross Section (b x d)	$A = 72$ in ²
Depth of Section	$d = 12$ in
Thickness of Web	$b = 6$ in
Weight per Unit Length	$W = 57.5$ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	$I_c = 864$ in ⁴
Sectional Modulus I_c / C	$S = 144$ in ³
Radius of Gyration $\sqrt{I_c / A}$	$r = 3.464$ in
Neutral Axis	$NA = 6.0$ in
Extreme Fiber	$C = 6.0$ in
Element Length	$L = 0.083$ ft 1"

ELEMENT PROPERTIES

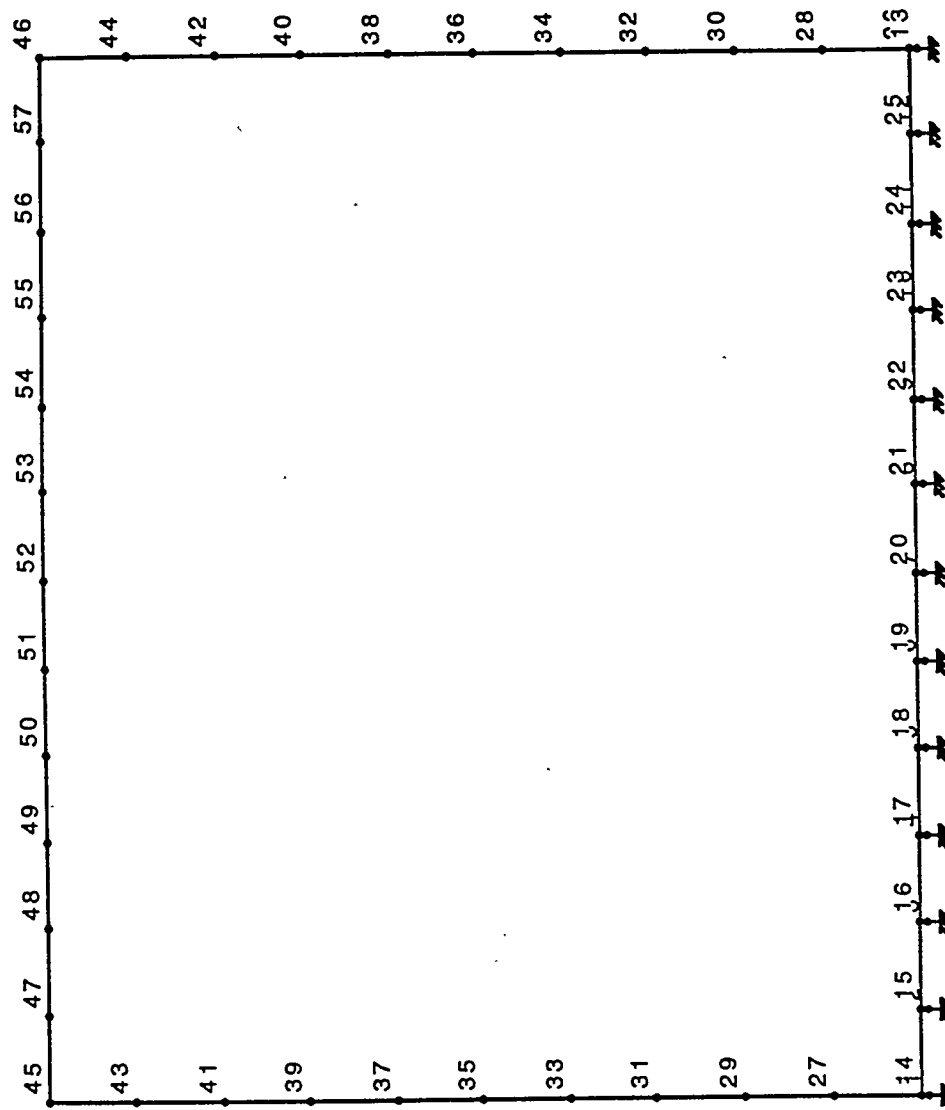
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

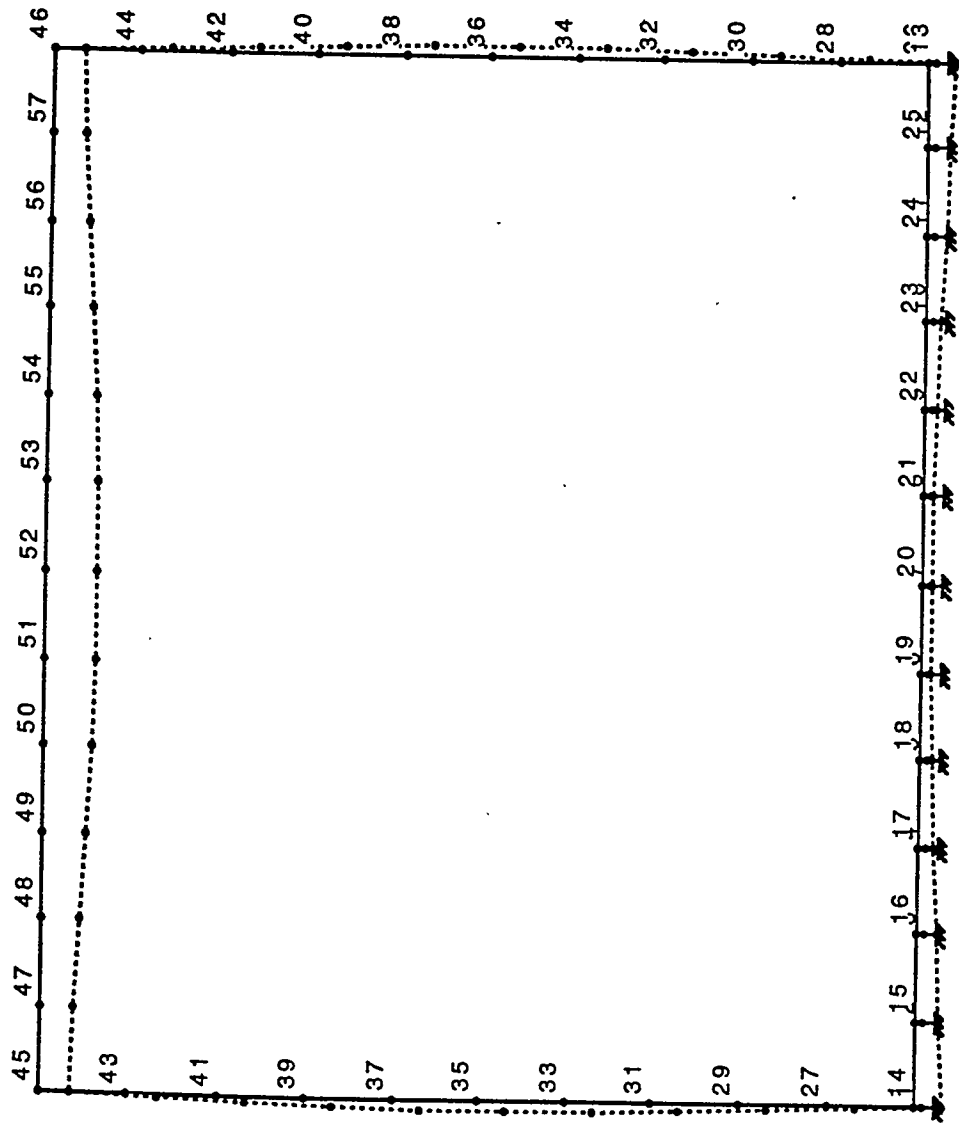
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft



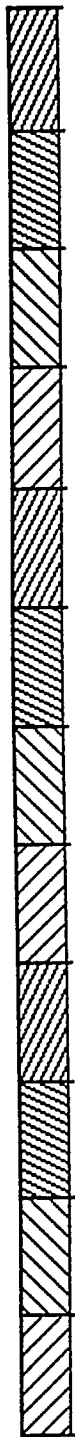
FRAME MAC file: 2(21/24) PRELIMINARY ; Last modified at 22:17:18 on Tue, May 4, 1993



FRAME MAC file: 2(21/24) PRELIMINARY ; Last modified at 22:17:18 on Tue, May 4, 1993

Node 45	Node 47	Node 48	Node 49	Node 50	Node 51	Node 52	Node 53	Node 54	Node 55	Node 56	Node 57	Node 46
11.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000
11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000

F: lb
D: lb/ft
M: lb-ft
E: psi



Load

0.000
lb



Tension

-2474.517
10710.000

lb



∞ Shear

-10710.000
18521.204

lb-ft



Moment

0.000
Inch

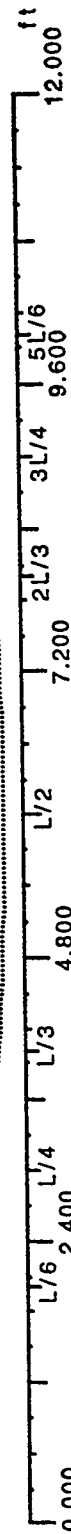


Defl.

-0.169

ft

Distance 0.000



 Continuous Elements Output Data

FRAME MAC file: 2(21/24) PRELIMINARY .
 Last modified at 22:17:18 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

45.	0.000	-0.097	-0.001
47	0.000	-0.113	-0.001
48	0.000	-0.130	-0.001
49	0.000	-0.145	-0.001
50	0.000	-0.158	-0.001
51	0.000	-0.166	-0.000
52	0.000	-0.169	0.000
53	-0.000	-0.166	0.000
54	-0.000	-0.158	0.001
55	-0.000	-0.145	0.001
56	-0.000	-0.130	0.001
57	-0.000	-0.113	-0.001
46	-0.000	-0.097	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,47	0.000	892.500	148.750	0.000	892.500	-148.750
47,48	0.000	892.500	148.750	0.000	892.500	-148.750
48,49	0.000	892.500	148.750	0.000	892.500	-148.750
49,50	0.000	892.500	148.750	0.000	892.500	-148.750
50,51	0.000	892.500	148.750	0.000	892.500	-148.750
51,52	0.000	892.500	148.750	0.000	892.500	-148.750
52,53	0.000	892.500	148.750	0.000	892.500	-148.750
53,54	0.000	892.500	148.750	0.000	892.500	-148.750
54,55	0.000	892.500	148.750	0.000	892.500	-148.750
55,56	0.000	892.500	148.750	0.000	892.500	-148.750
56,57	0.000	892.500	148.750	0.000	892.500	-148.750
57,46	0.000	892.500	148.750	0.000	892.500	-148.750

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,47	2474.517	10710.000	13608.796	-2474.517	-8925.000	-3791.296
47,48	2474.517	8925.000	3791.296	-2474.517	-7140.000	4241.204
48,49	2474.517	7140.000	-4241.204	-2474.517	-5355.000	10488.704
49,50	2474.517	5355.000	-10488.704	-2474.517	-3570.000	14951.204
50,51	2474.517	3570.000	-14951.204	-2474.517	-1785.000	17628.704
51,52	2474.517	1785.000	-17628.704	-2474.517	0.000	18521.204
52,53	2474.517	0.000	-18521.204	-2474.517	1785.000	17628.704
53,54	2474.517	-1785.000	-17628.704	-2474.517	3570.000	14951.204
54,55	2474.517	-3570.000	-14951.204	-2474.517	5355.000	10488.704
55,56	2474.517	-5355.000	-10488.704	-2474.517	7140.000	4241.204
56,57	2474.517	-7140.000	-4241.204	-2474.517	8925.000	-3791.296
57,46	2474.517	-8925.000	3791.296	-2474.517	10710.000	-13608.796

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
45,47	0.000	-0.097	-0.001	0.000	-0.113	-0.001
47,48	0.000	-0.113	-0.001	0.000	-0.130	-0.001
48,49	0.000	-0.130	-0.001	0.000	-0.145	-0.001
49,50	0.000	-0.145	-0.001	0.000	-0.158	-0.001
50,51	0.000	-0.158	-0.001	0.000	-0.166	-0.000
51,52	0.000	-0.166	-0.000	0.000	-0.169	0.000
52,53	0.000	-0.169	0.000	-0.000	-0.166	0.000
53,54	-0.000	-0.166	0.000	-0.000	-0.158	0.001

54,55	-0.000	-0.158	0.001	-0.000	-0.145	0.001
55,56	-0.000	-0.145	0.001	-0.000	-0.130	0.001
56,57	-0.000	-0.130	0.001	-0.000	-0.113	0.001
57,46	-0.000	-0.113	0.001	-0.000	-0.097	0.001

Maximum deformations:

Node 46 moved 0.000 inch to the left.
 Node 45 moved 0.000 inch to the right.
 Node 52 moved 0.169 inch downwards.
 No nodes moved upwards.
 Node 47 rotated 0.001 radian clockwise.
 Node 57 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
45,47	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
47,48	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
48,49	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
49,50	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
50,51	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
51,52	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
52,53	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
53,54	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
54,55	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
55,56	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
56,57	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
57,46	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
45,47	10710.000	0.000	10710.000	74.375	0.000	74.375
47,48	8925.000	0.000	8925.000	61.979	0.000	61.979
48,49	7140.000	0.000	7140.000	49.583	0.000	49.583
49,50	5355.000	0.000	5355.000	37.188	0.000	37.188
50,51	3570.000	0.000	3570.000	24.792	0.000	24.792
51,52	1785.000	0.000	1785.000	12.396	0.000	12.396
52,53	0.000	-1785.000	-1785.000	0.000	-12.396	-12.396
53,54	0.000	-3570.000	-3570.000	0.000	-24.792	-24.792
54,55	0.000	-5355.000	-5355.000	0.000	-37.188	-37.188
55,56	0.000	-7140.000	-7140.000	0.000	-49.583	-49.583
56,57	0.000	-8925.000	-8925.000	0.000	-61.979	-61.979
57,46	0.000	-10710.000	-10710.000	0.000	-74.375	-74.375

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
45,47	0.000	-13608.796	-13608.796	0.000	-567.033	-567.033
47,48	4241.204	-3791.296	4241.204	176.717	-157.971	176.717
48,49	10488.704	0.000	10488.704	437.029	0.000	437.029
49,50	14951.204	0.000	14951.204	622.967	0.000	622.967
50,51	17628.704	0.000	17628.704	734.529	0.000	734.529
51,52	18521.204	0.000	18521.204	771.717	0.000	771.717
52,53	18521.204	0.000	18521.204	771.717	0.000	771.717
53,54	17628.704	0.000	17628.704	734.529	0.000	734.529
54,55	14951.204	0.000	14951.204	622.967	0.000	622.967
55,56	10488.704	0.000	10488.704	437.029	0.000	437.029
56,57	4241.204	-3791.296	4241.204	176.717	-157.971	176.717
57,46	0.000	-13608.796	-13608.796	0.000	-567.033	-567.033

```

*****
*****
Maximum deflection values:

```

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
45,47	0.000	-0.113	-0.113
47,48	0.000	-0.130	-0.130
48,49	0.000	-0.145	-0.145
49,50	0.000	-0.158	-0.158
50,51	0.000	-0.166	-0.166
51,52	0.000	-0.169	-0.169
52,53	0.000	-0.169	-0.169
53,54	0.000	-0.166	-0.166
54,55	0.000	-0.158	-0.158
55,56	0.000	-0.145	-0.145
56,57	0.000	-0.130	-0.130
57,46	0.000	-0.113	-0.113

```

*****
Deflections along the elements (positive is up or counter-clockwise):

```

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch
At the intermediate nodes:		
1.000	-0.001	-0.113
2.000	-0.001	-0.130
3.000	-0.001	-0.145
4.000	-0.001	-0.158
5.000	-0.000	-0.166
6.000	0.000	-0.169
7.000	0.000	-0.166
8.000	0.001	-0.158
9.000	0.001	-0.145
10.000	0.001	-0.130
11.000	0.001	-0.113
At evenly-spaced intervals:		
0.000	-0.001	-0.097
1.200	-0.001	-0.116
2.400	-0.001	-0.136
3.600	-0.001	-0.153
4.800	-0.001	-0.165
6.000	0.000	-0.169
7.200	0.001	-0.165
8.400	0.001	-0.153
9.600	0.001	-0.136
10.800	0.001	-0.116
12.000	0.001	-0.097

```

*****

```

FRAME MAC file: 2(21/24) PRELIMINARY ; Last modified at 22:17:18 on Tue, May 4, 1993

Node 14	Node 15	Node 16	Node 17	Node 18	Node 19	Node 20	Node 21	Node 22	Node 23	Node 24	Node 25	Node 26
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

F: lb
D: lb/ft
M: lb-ft
E: psi

Load

4738.341

Tension

lb
-1548.651

10982.663

lb

Shear

-10982.663

12718.630

lb-ft

Moment

-15856.269

0.000
inch

Defl.

-0.094

ft

Distance 0.000

12.000
9.600
5L/6
3L/4
2L/3
7.200
L/2
4.800
L/3
2.400
L/4
L/6

***** Continuous Elements Output Data *****

FRAME MAC file: 2(21/24) PRELIMINARY .

Last modified at 22:17:18 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

***** Support reactions: (pos. force is to right or up; pos. moment is ccw.) *****

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

***** Node deformations: (positive is to right, up, or counterclockwise.) *****

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
14	-0.000	-0.094	0.001
15	-0.000	-0.079	0.001
16	-0.000	-0.064	0.001
17	-0.000	-0.050	0.001
18	-0.000	-0.039	0.001
19	-0.000	-0.032	0.000
20	0.000	-0.030	0.000
21	0.000	-0.032	-0.000
22	0.000	-0.039	-0.001
23	0.000	-0.050	-0.001
24	0.000	-0.064	-0.001
25	0.000	-0.079	-0.001
26	0.000	-0.094	-0.001

***** Element fixed-end forces & moments: (local coordinate system) *****

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,15	0.000	105.000	17.500	0.000	105.000	-17.500
15,16	0.000	105.000	17.500	0.000	105.000	-17.500
16,17	0.000	105.000	17.500	0.000	105.000	-17.500
17,18	0.000	105.000	17.500	0.000	105.000	-17.500
18,19	0.000	105.000	17.500	0.000	105.000	-17.500
19,20	0.000	105.000	17.500	0.000	105.000	-17.500
20,21	0.000	105.000	17.500	0.000	105.000	-17.500
21,22	0.000	105.000	17.500	0.000	105.000	-17.500
22,23	0.000	105.000	17.500	0.000	105.000	-17.500
23,24	0.000	105.000	17.500	0.000	105.000	-17.500
24,25	0.000	105.000	17.500	0.000	105.000	-17.500
25,26	0.000	105.000	17.500	0.000	105.000	-17.500

***** Actual element end forces & moments: (local coordinate system) *****

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,15	1548.651	-10772.663	-12718.630	-1548.651	10982.663	1840.967
15,16	-252.913	-7550.562	-1972.554	252.913	7760.562	-5683.007
16,17	-1950.494	-5003.060	5557.746	1950.494	5213.060	-10665.805
17,18	-3320.698	-3062.777	10562.961	3320.698	3272.777	-13730.738
18,19	-4262.448	-1596.036	13658.899	4262.448	1806.036	-15359.935
19,20	-4738.341	-428.048	15323.220	4738.341	638.048	-15856.269
20,21	-4738.341	638.048	15856.269	4738.341	-428.048	-15323.220
21,22	-4262.448	1806.036	15359.935	4262.448	-1596.036	-13658.899
22,23	-3320.698	3272.777	13730.738	3320.698	-3062.777	-10562.961
23,24	-1950.494	5213.060	10665.805	1950.494	-5003.060	-5557.746
24,25	-252.913	7760.562	5683.007	252.913	-7550.562	1972.554
25,26	1548.651	10982.663	-1840.967	-1548.651	-10772.663	12718.630

***** Member end deformations: (local coordinate system) *****

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
14,15	-0.000	-0.094	0.001	-0.000	-0.079	0.001
15,16	-0.000	-0.079	0.001	-0.000	-0.064	0.001
16,17	-0.000	-0.064	0.001	-0.000	-0.050	0.001
17,18	-0.000	-0.050	0.001	-0.000	-0.039	0.001
18,19	-0.000	-0.039	0.001	-0.000	-0.032	0.000
19,20	-0.000	-0.032	0.000	0.000	-0.030	0.000
20,21	0.000	-0.030	0.000	0.000	-0.032	-0.000
21,22	0.000	-0.032	-0.000	0.000	-0.039	-0.001

22,23	0.000	-0.039	-0.001	0.000	-0.050	-0.001
23,24	0.000	-0.050	-0.001	0.000	-0.064	-0.001
24,25	0.000	-0.064	-0.001	0.000	-0.079	-0.001
25,26	0.000	-0.079	-0.001	0.000	-0.094	-0.001

Maximum deformations:

Node 15 moved 0.000 inch to the left.
 Node 25 moved 0.000 inch to the right.
 Node 26 moved 0.094 inch downwards.
 No nodes moved upwards.
 Node 25 rotated 0.001 radian clockwise.
 Node 15 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
14,15	0.000	-1548.651	-1548.651	0.000	-10.755	-10.755
15,16	252.913	0.000	252.913	1.756	0.000	1.756
16,17	1950.494	0.000	1950.494	13.545	0.000	13.545
17,18	3320.698	0.000	3320.698	23.060	0.000	23.060
18,19	4262.448	0.000	4262.448	29.600	0.000	29.600
19,20	4738.341	0.000	4738.341	32.905	0.000	32.905
20,21	4738.341	0.000	4738.341	32.905	0.000	32.905
21,22	4262.448	0.000	4262.448	29.600	0.000	29.600
22,23	3320.698	0.000	3320.698	23.060	0.000	23.060
23,24	1950.494	0.000	1950.494	13.545	0.000	13.545
24,25	252.913	0.000	252.913	1.756	0.000	1.756
25,26	0.000	-1548.651	-1548.651	0.000	-10.755	-10.755

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
14,15	0.000	-10982.663	-10982.663	0.000	-76.268	-76.268
15,16	0.000	-7760.562	-7760.562	0.000	-53.893	-53.893
16,17	0.000	-5213.060	-5213.060	0.000	-36.202	-36.202
17,18	0.000	-3272.777	-3272.777	0.000	-22.728	-22.728
18,19	0.000	-1806.036	-1806.036	0.000	-12.542	-12.542
19,20	0.000	-638.048	-638.048	0.000	-4.431	-4.431
20,21	638.048	0.000	638.048	4.431	0.000	4.431
21,22	1806.036	0.000	1806.036	12.542	0.000	12.542
22,23	3272.777	0.000	3272.777	22.728	0.000	22.728
23,24	5213.060	0.000	5213.060	36.202	0.000	36.202
24,25	7760.562	0.000	7760.562	53.893	0.000	53.893
25,26	10982.663	0.000	10982.663	76.268	0.000	76.268

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
14,15	12718.630	0.000	12718.630	529.943	0.000	529.943
15,16	1972.554	-5683.007	-5683.007	82.190	-236.792	-236.792
16,17	0.000	-10665.805	-10665.805	0.000	-444.409	-444.409
17,18	0.000	-13730.738	-13730.738	0.000	-572.114	-572.114
18,19	0.000	-15359.935	-15359.935	0.000	-639.997	-639.997
19,20	0.000	-15856.269	-15856.269	0.000	-660.678	-660.678
20,21	0.000	-15856.269	-15856.269	0.000	-660.678	-660.678
21,22	0.000	-15359.935	-15359.935	0.000	-639.997	-639.997
22,23	0.000	-13730.738	-13730.738	0.000	-572.114	-572.114
23,24	0.000	-10665.805	-10665.805	0.000	-444.409	-444.409
24,25	1972.554	-5683.007	-5683.007	82.190	-236.792	-236.792
25,26	12718.630	0.000	12718.630	529.943	0.000	529.943

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
14,15	0.000	-0.094	-0.094
15,16	0.000	-0.079	-0.079
16,17	0.000	-0.064	-0.064
17,18	0.000	-0.050	-0.050
18,19	0.000	-0.039	-0.039
19,20	0.000	-0.032	-0.032
20,21	0.000	-0.032	-0.032
21,22	0.000	-0.039	-0.039
22,23	0.000	-0.050	-0.050
23,24	0.000	-0.064	-0.064
24,25	0.000	-0.079	-0.079
25,26	0.000	-0.094	-0.094

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch
At the intermediate nodes:		
1.000	0.001	-0.079
2.000	0.001	-0.064
3.000	0.001	-0.050
4.000	0.001	-0.039
5.000	0.000	-0.032
6.000	0.000	-0.030
7.000	-0.000	-0.032
8.000	-0.001	-0.039
9.000	-0.001	-0.050
10.000	-0.001	-0.064
11.000	-0.001	-0.079

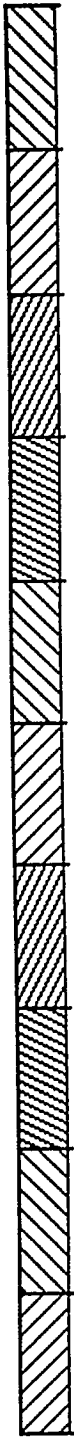
At evenly-spaced intervals:

0.000	0.001	-0.094
1.200	0.001	-0.076
2.400	0.001	-0.058
3.600	0.001	-0.043
4.800	0.000	-0.033
6.000	0.000	-0.030
7.200	-0.000	-0.033
8.400	-0.001	-0.043
9.600	-0.001	-0.058
10.800	-0.001	-0.076
12.000	-0.001	-0.094

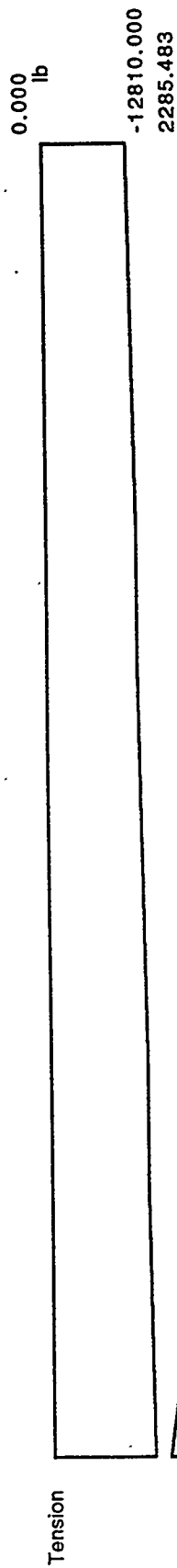
FRAME MAC file: 2(21/24) PRELIMINARY : Last modified at 22:17:18 on Tue, May 4, 1993

Node 14	Node 27	Node 29	Node 31	Node 33	Node 35	Node 37	Node 39	Node 41	Node 43	Node 45
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000

F: lb
D: lb/ft
M: lb-ft
E: psi



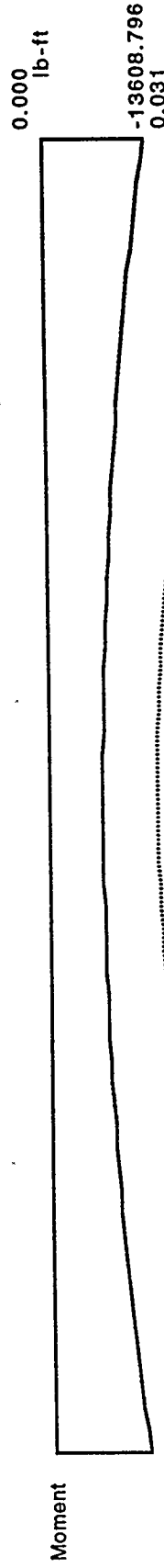
Load



Tension



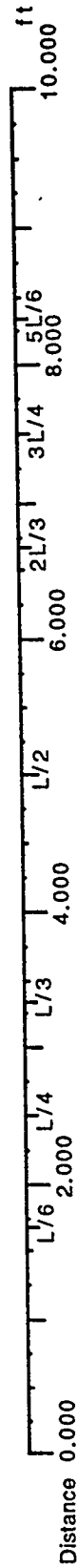
Shear



Moment



Defl.



Distance

Continuous Elements Output Data

FRAME MAC file: 2(21/24) PRELIMINARY .

Last modified at 22:17:18 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

14	-0.000	-0.094	0.001
27	-0.012	-0.095	0.001
29	-0.021	-0.095	0.001
31	-0.026	-0.095	0.000
33	-0.030	-0.096	0.000
35	-0.031	-0.096	0.000
37	-0.030	-0.096	-0.000
39	-0.026	-0.096	-0.000
41	-0.021	-0.097	-0.001
43	-0.012	-0.097	-0.001
45	0.000	-0.097	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,27	105.000	238.000	39.667	105.000	238.000	-39.667
27,29	105.000	238.000	39.667	105.000	238.000	-39.667
29,31	105.000	238.000	39.667	105.000	238.000	-39.667
31,33	105.000	238.000	39.667	105.000	238.000	-39.667
33,35	105.000	238.000	39.667	105.000	238.000	-39.667
35,37	105.000	238.000	39.667	105.000	238.000	-39.667
37,39	105.000	238.000	39.667	105.000	238.000	-39.667
39,41	105.000	238.000	39.667	105.000	238.000	-39.667
41,43	105.000	238.000	39.667	105.000	238.000	-39.667
43,45	105.000	238.000	39.667	105.000	238.000	-39.667

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,27	12810.000	2285.483	12663.624	-12600.000	-1809.483	-10616.142
27,29	12600.000	1809.483	10616.142	-12390.000	-1333.483	-9044.659
29,31	12390.000	1333.483	9044.659	-12180.000	-857.483	-7949.176
31,33	12180.000	857.483	7949.176	-11970.000	-381.483	-7329.693
33,35	11970.000	381.483	7329.693	-11760.000	94.517	-7186.210
35,37	11760.000	-94.517	7186.210	-11550.000	570.517	-7518.728
37,39	11550.000	-570.517	7518.728	-11340.000	1046.517	-8327.245
39,41	11340.000	-1046.517	8327.245	-11130.000	1522.517	-9611.762
41,43	11130.000	-1522.517	9611.762	-10920.000	1998.517	-11372.279
43,45	10920.000	-1998.517	11372.279	-10710.000	2474.517	-13608.796

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
14,27	-0.094	0.000	0.001	-0.095	0.012	0.001
27,29	-0.095	0.012	0.001	-0.095	0.021	0.001
29,31	-0.095	0.021	0.001	-0.095	0.026	0.000
31,33	-0.095	0.026	0.000	-0.096	0.030	0.000
33,35	-0.096	0.030	0.000	-0.096	0.031	0.000
35,37	-0.096	0.031	0.000	-0.096	0.030	-0.000
37,39	-0.096	0.030	-0.000	-0.096	0.026	-0.000
39,41	-0.096	0.026	-0.000	-0.097	0.021	-0.001
41,43	-0.097	0.021	-0.001	-0.097	0.012	-0.001
43,45	-0.097	0.012	-0.001	-0.097	-0.000	-0.001

Maximum deformations:

Node 35 moved 0.031 inch to the left.

Node 45 moved 0.000 inch to the right.

Node 45 moved 0.097 inch downwards.
 No nodes moved upwards.
 Node 45 rotated 0.001 radian clockwise.
 Node 14 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
14,27	0.000	-12810.000	-12810.000	0.000	-88.958	-88.958
27,29	0.000	-12600.000	-12600.000	0.000	-87.500	-87.500
29,31	0.000	-12390.000	-12390.000	0.000	-86.042	-86.042
31,33	0.000	-12180.000	-12180.000	0.000	-84.583	-84.583
33,35	0.000	-11970.000	-11970.000	0.000	-83.125	-83.125
35,37	0.000	-11760.000	-11760.000	0.000	-81.667	-81.667
37,39	0.000	-11550.000	-11550.000	0.000	-80.208	-80.208
39,41	0.000	-11340.000	-11340.000	0.000	-78.750	-78.750
41,43	0.000	-11130.000	-11130.000	0.000	-77.292	-77.292
43,45	0.000	-10920.000	-10920.000	0.000	-75.833	-75.833

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
14,27	2285.483	0.000	2285.483	15.871	0.000	15.871
27,29	1809.483	0.000	1809.483	12.566	0.000	12.566
29,31	1333.483	0.000	1333.483	9.260	0.000	9.260
31,33	857.483	0.000	857.483	5.955	0.000	5.955
33,35	381.483	-94.517	381.483	2.649	-0.656	2.649
35,37	0.000	-570.517	-570.517	0.000	-3.962	-3.962
37,39	0.000	-1046.517	-1046.517	0.000	-7.267	-7.267
39,41	0.000	-1522.517	-1522.517	0.000	-10.573	-10.573
41,43	0.000	-1998.517	-1998.517	0.000	-13.879	-13.879
43,45	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
14,27	0.000	-12663.624	-12663.624	0.000	-527.651	-527.651
27,29	0.000	-10616.142	-10616.142	0.000	-442.339	-442.339
29,31	0.000	-9044.659	-9044.659	0.000	-376.861	-376.861
31,33	0.000	-7949.176	-7949.176	0.000	-331.216	-331.216
33,35	0.000	-7329.693	-7329.693	0.000	-305.404	-305.404
35,37	0.000	-7518.728	-7518.728	0.000	-313.280	-313.280
37,39	0.000	-8327.245	-8327.245	0.000	-346.969	-346.969
39,41	0.000	-9611.762	-9611.762	0.000	-400.490	-400.490
41,43	0.000	-11372.279	-11372.279	0.000	-473.845	-473.845
43,45	0.000	-13608.796	-13608.796	0.000	-567.033	-567.033

Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
14,27	0.012	0.000	0.012
27,29	0.021	0.000	0.021
29,31	0.026	0.000	0.026
31,33	0.030	0.000	0.030
33,35	0.031	0.000	0.031
35,37	0.031	0.000	0.031
37,39	0.030	0.000	0.030

39,41	0.026	0.000	0.026
41,43	0.021	0.000	0.021
43,45	0.012	-0.000	0.012

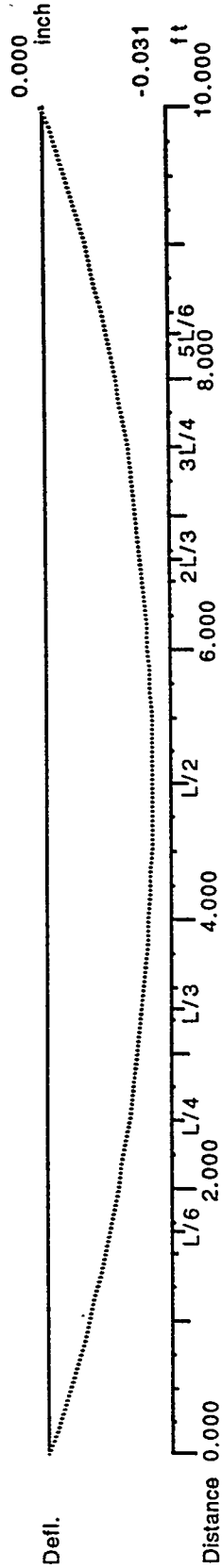
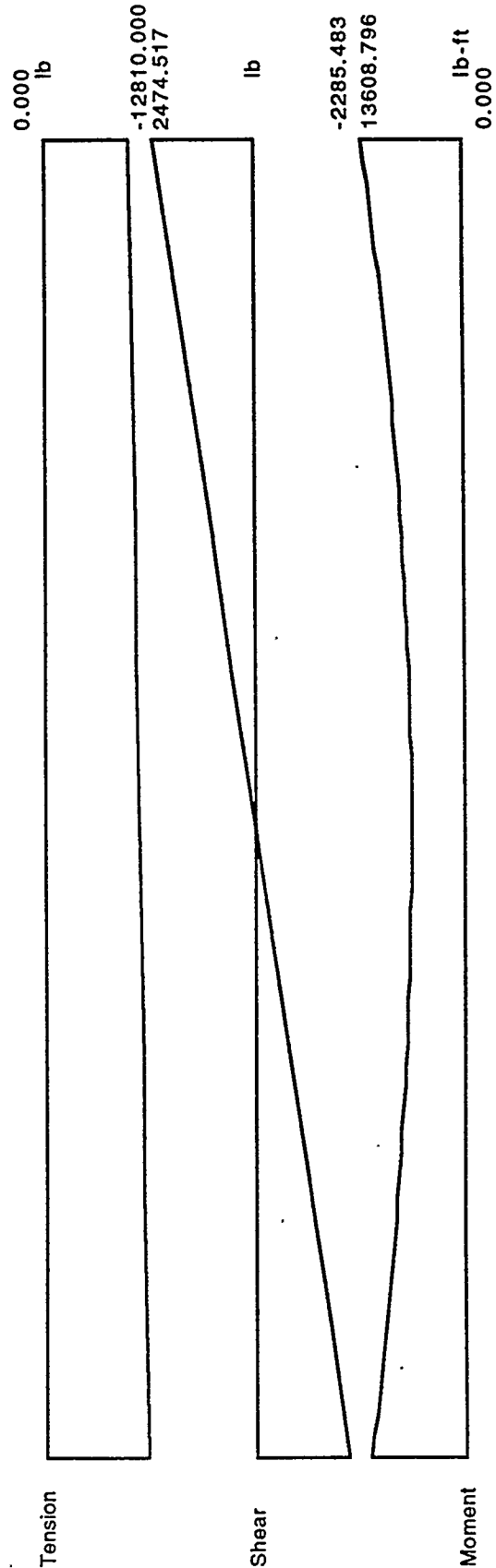
Deflections along the elements (positive is up or counter-clockwise):			
Distance from	Rotation		Deflection
left (bottom)	---		---
ft	radian		inch

At the intermediate nodes:			
1.000	0.001		0.012
2.000	0.001		0.021
3.000	0.000		0.026
4.000	0.000		0.030
5.000	0.000		0.031
6.000	-0.000		0.030
7.000	-0.000		0.026
8.000	-0.001		0.021
9.000	-0.001		0.012
At evenly-spaced intervals:			
0.000	0.001		0.000
1.000	0.001		0.012
2.000	0.001		0.021
3.000	0.000		0.026
4.000	0.000		0.030
5.000	0.000		0.031
6.000	-0.000		0.030
7.000	-0.000		0.026
8.000	-0.001		0.021
9.000	-0.001		0.012
10.000	-0.001		-0.000

FRAME MAC file: 2(21/24) PRELIMINARY ; Last modified at 22:17:18 on Tue, May 4, 1993

Node 26 13.000 1.000	Node 28 13.000 2.000	Node 30 13.000 3.000	Node 32 13.000 4.000	Node 34 13.000 5.000	Node 36 13.000 6.000	Node 38 13.000 7.000	Node 40 13.000 8.000	Node 42 13.000 9.000	Node 44 13.000 10.000	Node 46 13.000 11.000

F: lb
D: lb/ft
M: lb-ft
E: psi



```

*****
Continuous Elements Output Data
*****
FRAME MAC file: 2(21/24) PRELIMINARY
Last modified at 22:17:18 on Tue, May 4, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.
*****
Support reactions: (pos. force is to right or up; pos. moment is ccw.)
*****

```

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)
26	0.000	-0.094	-0.001
28	0.012	-0.095	-0.001
30	0.021	-0.095	-0.001
32	0.026	-0.095	-0.000
34	0.030	-0.096	-0.000
36	0.031	-0.096	-0.000
38	0.030	-0.096	0.000
40	0.026	-0.096	0.000
42	0.021	-0.097	0.001
44	0.012	-0.097	0.001
46	-0.000	-0.097	0.001

```

*****
Node deformations: (positive is to right, up, or counterclockwise.)
*****

```

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
26	0.000	-0.094	-0.001
28	0.012	-0.095	-0.001
30	0.021	-0.095	-0.001
32	0.026	-0.095	-0.000
34	0.030	-0.096	-0.000
36	0.031	-0.096	-0.000
38	0.030	-0.096	0.000
40	0.026	-0.096	0.000
42	0.021	-0.097	0.001
44	0.012	-0.097	0.001
46	-0.000	-0.097	0.001

```

*****
Element fixed-end forces & moments: (local coordinate system)
*****

```

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
26,28	105.000	-238.000	-39.667	105.000	-238.000	39.667
28,30	105.000	-238.000	-39.667	105.000	-238.000	39.667
30,32	105.000	-238.000	-39.667	105.000	-238.000	39.667
32,34	105.000	-238.000	-39.667	105.000	-238.000	39.667
34,36	105.000	-238.000	-39.667	105.000	-238.000	39.667
36,38	105.000	-238.000	-39.667	105.000	-238.000	39.667
38,40	105.000	-238.000	-39.667	105.000	-238.000	39.667
40,42	105.000	-238.000	-39.667	105.000	-238.000	39.667
42,44	105.000	-238.000	-39.667	105.000	-238.000	39.667
44,46	105.000	-238.000	-39.667	105.000	-238.000	39.667

```

*****
Actual element end forces & moments: (local coordinate system)
*****

```

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
26,28	12810.000	-2285.483	-12663.624	-12600.000	1809.483	10616.142
28,30	12600.000	-1809.483	-10616.142	-12390.000	1333.483	9044.659
30,32	12390.000	-1333.483	-9044.659	-12180.000	857.483	7949.176
32,34	12180.000	-857.483	-7949.176	-11970.000	381.483	7329.693
34,36	11970.000	-381.483	-7329.693	-11760.000	-94.517	7186.210
36,38	11760.000	94.517	-7186.210	-11550.000	-570.517	7518.728
38,40	11550.000	570.517	-7518.728	-11340.000	-1046.517	8327.245
40,42	11340.000	1046.517	-8327.245	-11130.000	-1522.517	9611.762
42,44	11130.000	1522.517	-9611.762	-10920.000	-1998.517	11372.279
44,46	10920.000	1998.517	-11372.279	-10710.000	-2474.517	13608.796

```

*****
Member end deformations: (local coordinate system)
*****

```

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
26,28	-0.094	-0.000	-0.001	-0.095	-0.012	-0.001
28,30	-0.095	-0.012	-0.001	-0.095	-0.021	-0.001
30,32	-0.095	-0.021	-0.001	-0.095	-0.026	-0.000
32,34	-0.095	-0.026	-0.000	-0.096	-0.030	-0.000
34,36	-0.096	-0.030	-0.000	-0.096	-0.031	-0.000
36,38	-0.096	-0.031	-0.000	-0.096	-0.030	0.000
38,40	-0.096	-0.030	0.000	-0.096	-0.026	0.000
40,42	-0.096	-0.026	0.000	-0.097	-0.021	0.001
42,44	-0.097	-0.021	0.001	-0.097	-0.012	0.001
44,46	-0.097	-0.012	0.001	-0.097	0.000	0.001

```

*****
Maximum deformations:
Node 46 moved 0.000 inch to the left.
Node 36 moved 0.031 inch to the right.

```

Node 46 moved 0.097 inch downwards.
 No nodes moved upwards.
 Node 26 rotated 0.001 radian clockwise.
 Node 46 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
26,28	0.000	-12810.000	-12810.000	0.000	-88.958	-88.958
28,30	0.000	-12600.000	-12600.000	0.000	-87.500	-87.500
30,32	0.000	-12390.000	-12390.000	0.000	-86.042	-86.042
32,34	0.000	-12180.000	-12180.000	0.000	-84.583	-84.583
34,36	0.000	-11970.000	-11970.000	0.000	-83.125	-83.125
36,38	0.000	-11760.000	-11760.000	0.000	-81.667	-81.667
38,40	0.000	-11550.000	-11550.000	0.000	-80.208	-80.208
40,42	0.000	-11340.000	-11340.000	0.000	-78.750	-78.750
42,44	0.000	-11130.000	-11130.000	0.000	-77.292	-77.292
44,46	0.000	-10920.000	-10920.000	0.000	-75.833	-75.833

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
26,28	0.000	-2285.483	-2285.483	0.000	-15.871	-15.871
28,30	0.000	-1809.483	-1809.483	0.000	-12.566	-12.566
30,32	0.000	-1333.483	-1333.483	0.000	-9.260	-9.260
32,34	0.000	-857.483	-857.483	0.000	-5.955	-5.955
34,36	94.517	-381.483	-381.483	0.656	-2.649	-2.649
36,38	570.517	0.000	570.517	3.962	0.000	3.962
38,40	1046.517	0.000	1046.517	7.267	0.000	7.267
40,42	1522.517	0.000	1522.517	10.573	0.000	10.573
42,44	1998.517	0.000	1998.517	13.879	0.000	13.879
44,46	2474.517	0.000	2474.517	17.184	0.000	17.184

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
26,28	12663.624	0.000	12663.624	527.651	0.000	527.651
28,30	10616.142	0.000	10616.142	442.339	0.000	442.339
30,32	9044.659	0.000	9044.659	376.861	0.000	376.861
32,34	7949.176	0.000	7949.176	331.216	0.000	331.216
34,36	7329.693	0.000	7329.693	305.404	0.000	305.404
36,38	7518.728	0.000	7518.728	313.280	0.000	313.280
38,40	8327.245	0.000	8327.245	346.969	0.000	346.969
40,42	9611.762	0.000	9611.762	400.490	0.000	400.490
42,44	11372.279	0.000	11372.279	473.845	0.000	473.845
44,46	13608.796	0.000	13608.796	567.033	0.000	567.033

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
26,28	0.000	-0.012	-0.012
28,30	0.000	-0.021	-0.021
30,32	0.000	-0.026	-0.026
32,34	0.000	-0.030	-0.030
34,36	0.000	-0.031	-0.031
36,38	0.000	-0.031	-0.031
38,40	0.000	-0.030	-0.030

40,42	0.000	-0.026	-0.026
42,44	0.000	-0.021	-0.021
44,46	0.000	-0.012	-0.012

Deflections along the elements (positive is up or counter-clockwise):			
Distance from	Rotation		Deflection
left (bottom)			
ft	radian		inch

At the intermediate nodes:			
1.000	-0.001		-0.012
2.000	-0.001		-0.021
3.000	-0.000		-0.026
4.000	-0.000		-0.030
5.000	-0.000		-0.031
6.000	0.000		-0.030
7.000	0.000		-0.026
8.000	0.001		-0.021
9.000	0.001		-0.012
At evenly-spaced intervals:			
0.000	-0.001		-0.000
1.000	-0.001		-0.012
2.000	-0.001		-0.021
3.000	-0.000		-0.026
4.000	-0.000		-0.030
5.000	-0.000		-0.031
6.000	0.000		-0.030
7.000	0.000		-0.026
8.000	0.001		-0.021
9.000	0.001		-0.012
10.000	0.001		0.000

Output Data

FRAME MAC file: 2(21/24) PRELIMINARY .

Last modified at 22:17:18 on Tue, May 4, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

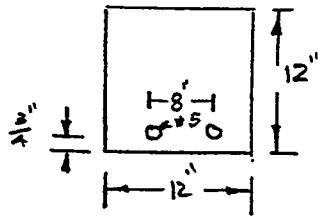
Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,14	0.000	-2037.337	-2037.337	0.000	-28.296	-28.296
2,15	0.000	-3432.101	-3432.101	0.000	-23.834	-23.834
3,16	0.000	-2757.502	-2757.502	0.000	-19.149	-19.149
4,17	0.000	-2150.282	-2150.282	0.000	-14.933	-14.933
5,18	0.000	-1676.741	-1676.741	0.000	-11.644	-11.644
6,19	0.000	-1377.987	-1377.987	0.000	-9.569	-9.569
7,20	0.000	-1276.097	-1276.097	0.000	-8.862	-8.862
8,21	0.000	-1377.987	-1377.987	0.000	-9.569	-9.569
9,22	0.000	-1676.741	-1676.741	0.000	-11.644	-11.644
10,23	0.000	-2150.282	-2150.282	0.000	-14.933	-14.933
11,24	0.000	-2757.502	-2757.502	0.000	-19.149	-19.149
12,25	0.000	-3432.101	-3432.101	0.000	-23.834	-23.834
13,26	0.000	-2037.337	-2037.337	0.000	-28.296	-28.296
14,15	0.000	-1548.651	-1548.651	0.000	-10.755	-10.755
14,27	0.000	-12810.000	-12810.000	0.000	-88.958	-88.958
15,16	252.913	0.000	252.913	1.756	0.000	1.756
16,17	1950.494	0.000	1950.494	13.545	0.000	13.545
17,18	3320.698	0.000	3320.698	23.060	0.000	23.060
18,19	4262.448	0.000	4262.448	29.600	0.000	29.600
19,20	4738.341	0.000	4738.341	32.905	0.000	32.905
20,21	4738.341	0.000	4738.341	32.905	0.000	32.905
21,22	4262.448	0.000	4262.448	29.600	0.000	29.600
22,23	3320.698	0.000	3320.698	23.060	0.000	23.060
23,24	1950.494	0.000	1950.494	13.545	0.000	13.545
24,25	252.913	0.000	252.913	1.756	0.000	1.756
25,26	0.000	-1548.651	-1548.651	0.000	-10.755	-10.755
26,28	0.000	-12810.000	-12810.000	0.000	-88.958	-88.958
27,29	0.000	-12600.000	-12600.000	0.000	-87.500	-87.500
28,30	0.000	-12600.000	-12600.000	0.000	-87.500	-87.500
29,31	0.000	-12390.000	-12390.000	0.000	-86.042	-86.042
30,32	0.000	-12390.000	-12390.000	0.000	-86.042	-86.042
31,33	0.000	-12180.000	-12180.000	0.000	-84.583	-84.583
32,34	0.000	-12180.000	-12180.000	0.000	-84.583	-84.583
33,35	0.000	-11970.000	-11970.000	0.000	-83.125	-83.125
34,36	0.000	-11970.000	-11970.000	0.000	-83.125	-83.125
35,37	0.000	-11760.000	-11760.000	0.000	-81.667	-81.667
36,38	0.000	-11760.000	-11760.000	0.000	-81.667	-81.667
37,39	0.000	-11550.000	-11550.000	0.000	-80.208	-80.208
38,40	0.000	-11550.000	-11550.000	0.000	-80.208	-80.208
39,41	0.000	-11340.000	-11340.000	0.000	-78.750	-78.750
40,42	0.000	-11340.000	-11340.000	0.000	-78.750	-78.750
41,43	0.000	-11130.000	-11130.000	0.000	-77.292	-77.292
42,44	0.000	-11130.000	-11130.000	0.000	-77.292	-77.292
43,45	0.000	-10920.000	-10920.000	0.000	-75.833	-75.833
44,46	0.000	-10920.000	-10920.000	0.000	-75.833	-75.833
45,47	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
46,57	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
47,48	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
48,49	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
49,50	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
50,51	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
51,52	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
52,53	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
53,54	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
54,55	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
55,56	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184
56,57	0.000	-2474.517	-2474.517	0.000	-17.184	-17.184

Soil E-11-11
P: 172 / 122
= 1770 17

SECTION $\frac{1}{21/24}$. PRELIMINARY.

1. MOMENT. CAPACITY ROOF, FLOOR & WALLS.



$$A_{ST} = \frac{(2)(\pi)(0.625)^2}{4} = 0.6136 \text{ m}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b = 16"$$

$$a = \frac{A_{ST} f_y}{(0.85) f'_c (b)} = \frac{(0.6136)(60,000)}{(0.85)(3,000)(16)}$$

$$\phi = 0.9$$

$$d = 12 - 0.75 - 0.625/2 = 10.938$$

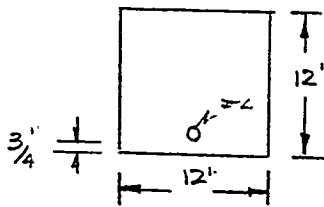
$$a = 0.9024$$

$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right] = 0.9 \left[(0.9024)(60,000) \left(10.938 - \frac{0.9024}{2} \right) \right]$$

$$\phi M_n = 511,018 \text{ m-lbs}$$

$$\phi M_n = 42,585 \text{ ft-lbs}$$

LEFT & RIGHT WALL (INSIDE)



$$A_{ST} = \frac{(1)(\pi)(0.5)^2}{2} = 0.1963 \text{ m}^2$$

$$f'_c = 3,000 \text{ psi}$$

$$f_y = 60,000 \text{ psi}$$

$$b = 12$$

$$d = 12 - 0.75 - 0.5/2 = 11$$

$$\phi = 0.9$$

$$a = \frac{A_{ST} f_y}{(0.85) f'_c (b)} = \frac{(0.1963)(60,000)}{(0.85)(3,000)(12)}$$

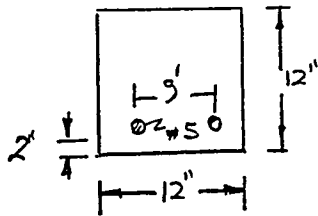
$$a = 0.3849$$

$$\phi M_n = (0.9) \left[(0.1963)(60,000) \left(\frac{11 - 0.3849}{2} \right) \right]$$

$$\phi M_n = 114,562 \text{ m-lbs}$$

$$= 9547 \text{ ft-lbs}$$

LEFT & RIGHT WALL (OUTSIDE)



$$A_{ST} = (2)(\pi) \frac{(0.625)^2}{2} = 0.6136 \text{ m}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b = 18"$$

$$\frac{a = A_{ST} f_y}{0.85 f'_c b} = \frac{(0.6136)(60,000)}{(0.85)(3,000)(18)} = 0.8021 \text{ m}$$

$$\phi = 0.9$$

$$d = 12 - 2 - \frac{0.625}{2} = 9.6875$$

$$\phi M_n = 0.9 \left[(0.6136)(60,000) \left(9.6875 - \frac{0.8021}{2} \right) \right]$$

$$= 307,701 \text{ m-lbs}$$

$$= 25,642 \text{ ft-lbs.}$$

2. SHEAR CAPACITY

$$V_n = V_c = 2 \sqrt{f'_c} \cdot b_w \cdot d$$

$$f'_c = 3,000 \text{ psi}$$

$$\phi V_n = (2)(0.35) \sqrt{3,000} (12)(10.938)$$

$$b_w = 12$$

ROOF
FLOOR

$$\phi V_n = 12,222 \text{ lbs}$$

$$d_s = 12 - 0.75 - \frac{0.5}{2} = 11$$

WALLS

$$\phi V_n = 12,291 \text{ lbs}$$

$$d_s = 12 - 0.75 - \frac{0.625}{2} = 10.938$$

$$\phi = 0.85$$

3. AXIAL CAPACITY

$$\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$f'_c = 3,000 \text{ psi}$$

$$\phi = 0.7$$

$$= (0.55)(0.7)(3,000)(144) \left[1 - \left(\frac{(0.8)(108)}{(32)(12)} \right)^2 \right]$$

$$K = 0.8$$

$$h = 12"$$

$$\phi P_{nw} = 157,900 \text{ lbs}$$

$$l_c = 9' \times 12 = 108'$$

$$A_g = 12' \times 12' = 144 \text{ m}^2$$

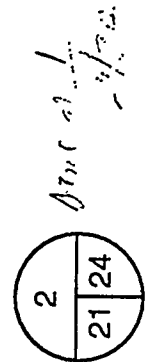
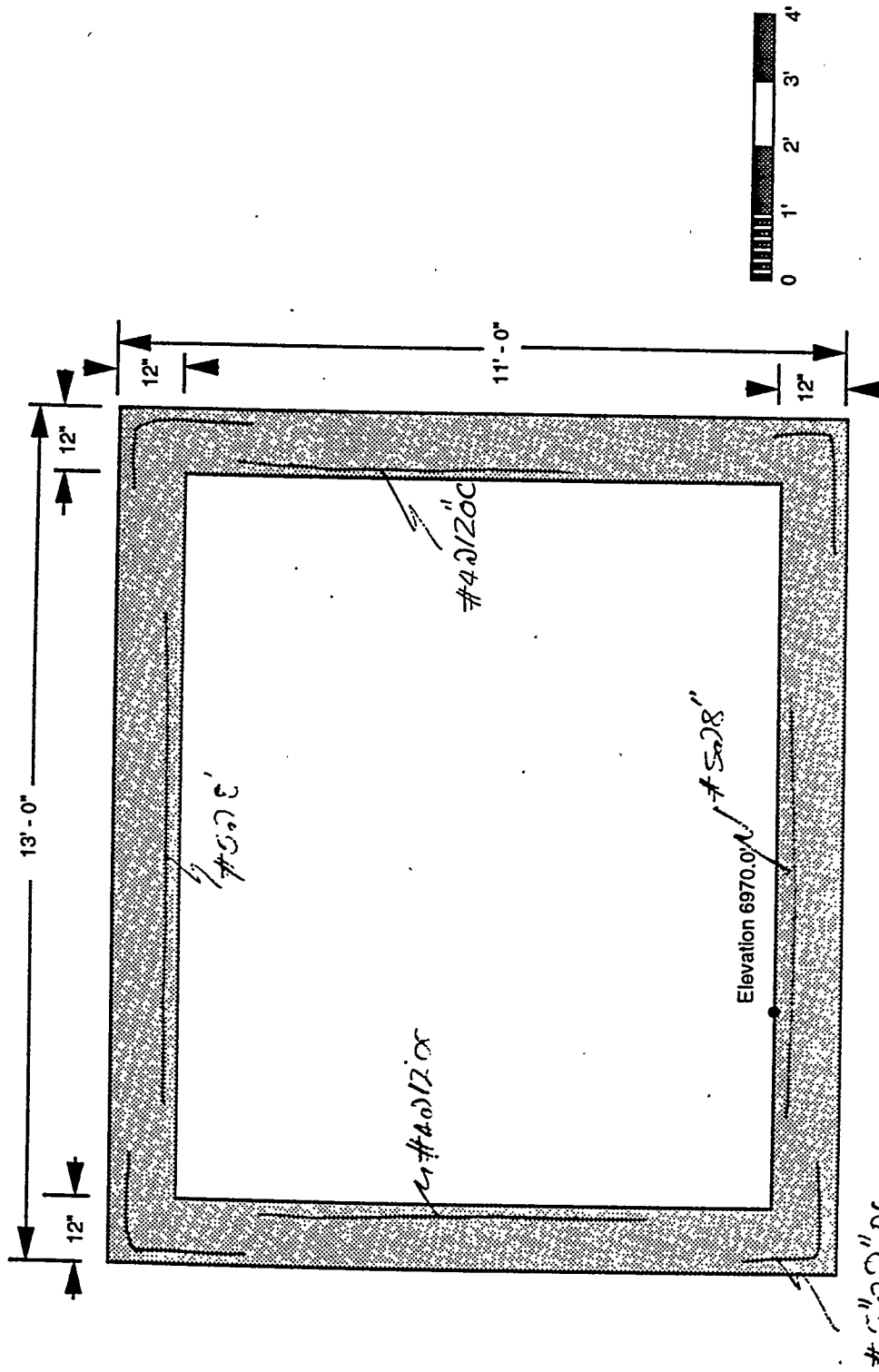
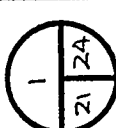


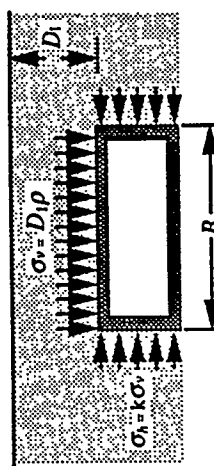
Figure () Section

(6)

TUNNEL SECTION		PRELIMINARY				STRUCTURAL ASSESSMENT	
PAGE ____ OF ____		TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE		
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2 \sqrt{f'_c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2 \sqrt{f'_c} B_w d$ Axial Capacity Design axial load ϕP_{nw} is computed by ACI 318-89 (14-1) $\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{k l_c}{32 h} \right)^2 \right]$ where $\phi = 0.7$		ROOF STRUCTURE	42,585 ft-lbs	15,706 ft-lbs			
		FLOOR STRUCTURE	42,585 ft-lbs	14,621 ft-lbs			
		LEFT INSIDE WALL	9,547 ft-lbs	ft-lbs			
		LEFT OUTSIDE WALL	25,642 ft-lbs	11,395 ft-lbs			
		RIGHT INSIDE WALL	9,547 ft-lbs	ft-lbs			
		RIGHT OUTSIDE WALL	25,642 ft-lbs	11,395 ft-lbs			
		ROOF STRUCTURE	12,791 lbs	9,794 lbs			
		FLOOR STRUCTURE	12,791 lbs	10,258 lbs			
		LEFT WALL	12,791 lbs	2368 lbs			
		RIGHT WALL	12,791 lbs	2368 lbs			
Loading Conditions		LEFT WALL	157,900 lbs	11,894 lbs			
		RIGHT WALL	157,900 lbs	11,894 lbs			



$B = 12 \text{ ft.}$
 $D_2 = 11 \text{ ft.}$
 $D_1 = 9.765 \text{ ft.}$



$\sigma_v = D_1 \phi$
 $\sigma_h = k \sigma_v$

$$k = \frac{1 - \sin \theta}{1 + \sin \theta}$$
$$k = 0.3$$

$\sigma_v = D_1 \phi$
 $\sigma_h = k \sigma_v$

Figure () Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-3(23/23)

TITLE: Preliminary Structural Assessment of Tunnel Section 3(23/23)

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 3(23/23) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY: _____

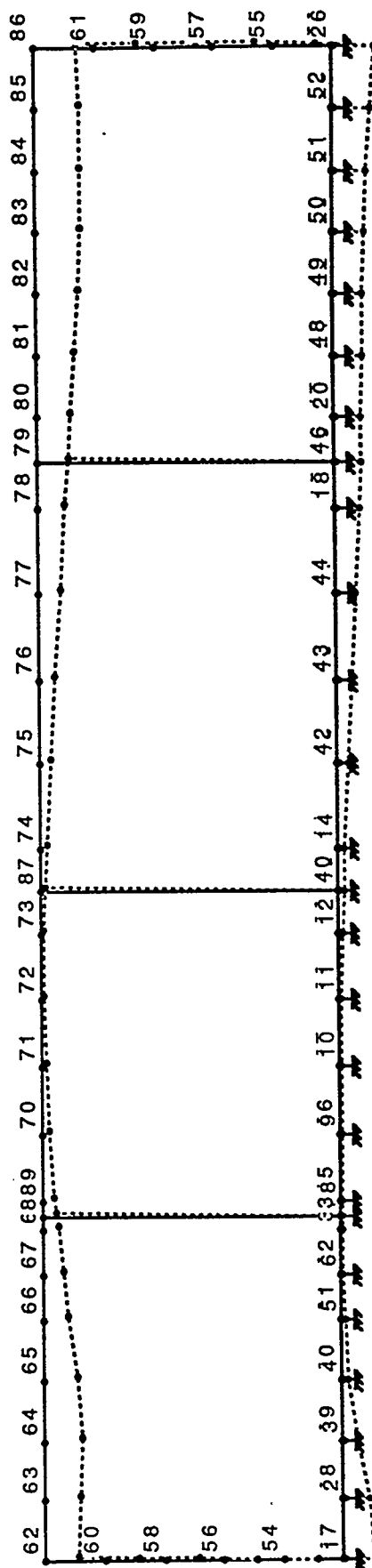
DATE: _____

Number of Pages Including Title Page 35

Figure 1 is a line graph showing the relationship between the number of iterations ω (x-axis) and the number of nodes n (y-axis). The x-axis ranges from 62 to 86, and the y-axis ranges from 17 to 61. The graph consists of a series of points connected by lines, with a vertical line at $\omega = 78$. The data points are as follows:

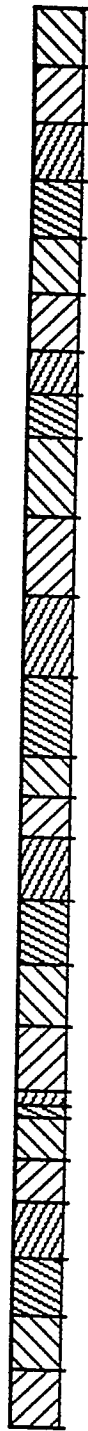
ω	n
62	17
63	28
64	39
65	40
66	51
67	62
68	85
69	96
70	10
71	11
72	12
73	40
74	14
75	42
76	43
77	44
78	18
79	46
80	20
81	48
82	49
83	50
84	51
85	52
86	26

FRAME MAC file: 3(23/23) PRELIMINARY; Last modified at 12:57:00 on Thu, Mar 25, 1993
 Above each load are the magnitudes in lb, lb/ft, and lb-ft.



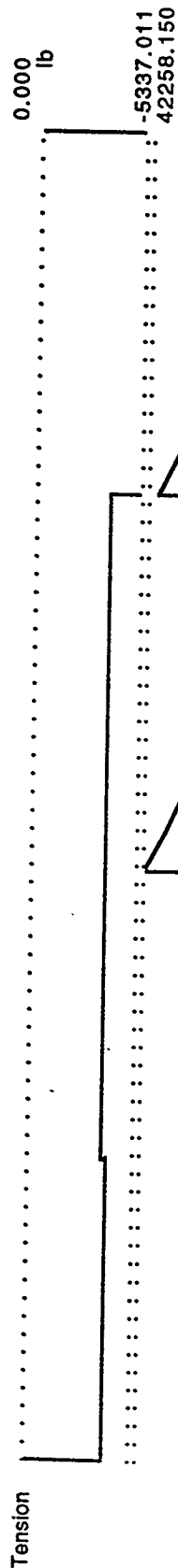
FRAME MAC file: 3(23/23) PRELIMINARY; Last modified at 12:57:00 on Thu, Mar 25, 1993

Node	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
0.000	2.000	4.000	6.000	8.000	9.500	11.000	11.500	12.000	14.250	16.500	18.750	21.000	22.417	23.833	26.666	29.500	32.333
18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000

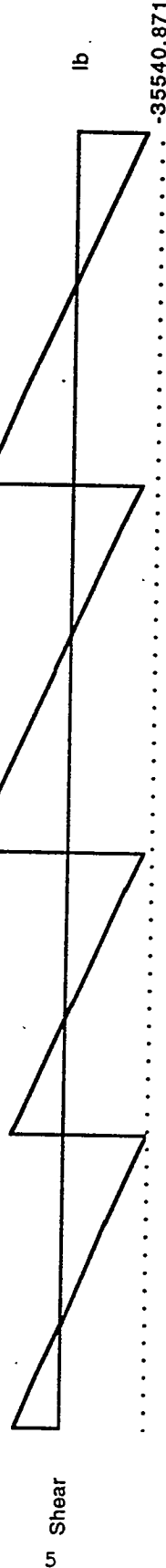


Load

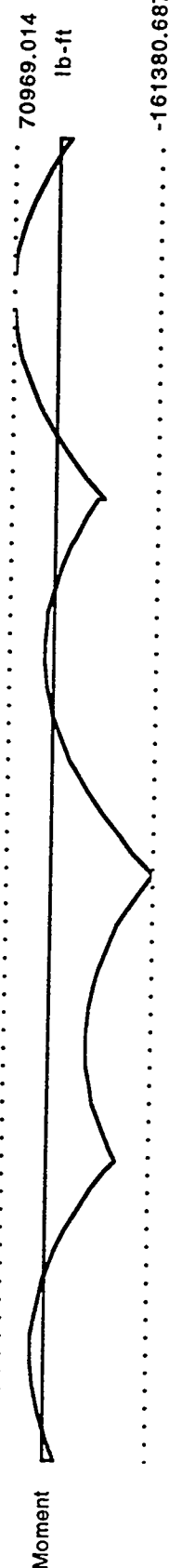
F: lb
D: lb/ft
M: lb-ft
E: psi



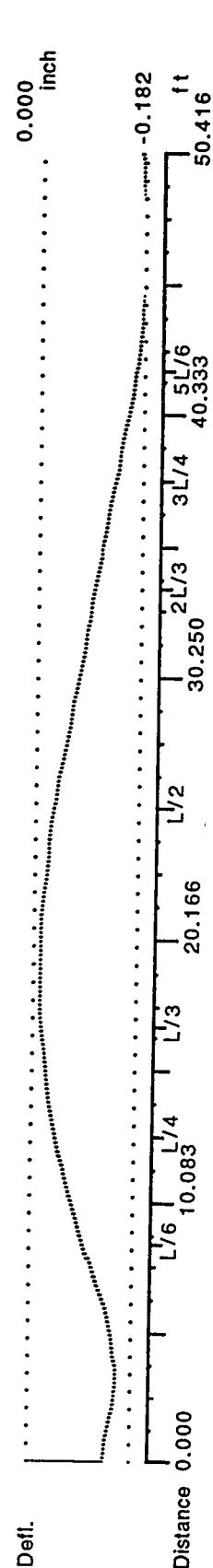
Tension



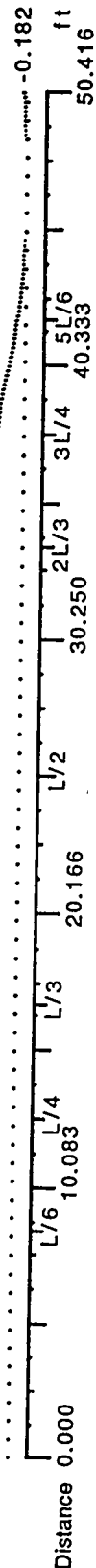
Shear



Moment



Defl.



Distance

Continuous Elements Output Data

FRAME MAC file: 3(23/23) PRELIMINARY.

Last modified at 12:57:00 on Thu, Mar 25, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
62	0.021	-0.134	-0.000
63	0.020	-0.149	-0.001
64	0.020	-0.152	0.000
65	0.020	-0.133	0.001
66	0.020	-0.100	0.001
67	0.020	-0.079	0.001
68	0.020	-0.060	0.001
88	0.020	-0.054	0.001
69	0.020	-0.049	0.001
70	0.019	-0.029	0.001
71	0.019	-0.016	0.000
72	0.019	-0.011	0.000
73	0.019	-0.014	-0.000
87	0.019	-0.019	-0.000
74	0.019	-0.025	-0.000
75	0.019	-0.043	-0.001
76	0.019	-0.067	-0.001
77	0.019	-0.090	-0.001
78	0.019	-0.112	-0.001
79	0.019	-0.124	-0.001
80	0.018	-0.137	-0.001
81	0.018	-0.154	-0.001
82	0.018	-0.169	-0.001
83	0.018	-0.178	-0.000
84	0.018	-0.182	-0.000
85	0.018	-0.180	0.000
86	0.018	-0.175	0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
62,63	0.000	4680.200	1560.067	0.000	4680.200	-1560.067
63,64	0.000	4680.200	1560.067	0.000	4680.200	-1560.067
64,65	0.000	4680.200	1560.067	0.000	4680.200	-1560.067
65,66	0.000	4680.200	1560.067	0.000	4680.200	-1560.067
66,67	0.000	3667.650	916.912	0.000	3667.650	-916.912
67,68	0.000	3667.650	916.912	0.000	3667.650	-916.912
68,88	0.000	1261.925	105.160	0.000	1261.925	-105.160
88,69	0.000	1261.925	105.160	0.000	1261.925	-105.160
69,70	0.000	5501.475	2063.053	0.000	5501.475	-2063.053
70,71	0.000	5501.475	2063.053	0.000	5501.475	-2063.053
71,72	0.000	5501.475	2063.053	0.000	5501.475	-2063.053
72,73	0.000	5501.475	2063.053	0.000	5501.475	-2063.053
73,87	0.000	3909.958	923.141	0.000	3909.958	-923.141
87,74	0.000	3909.958	923.141	0.000	3909.958	-923.141
74,75	0.000	6927.457	3271.145	0.000	6913.153	-3271.122
75,76	0.000	6927.457	3271.145	0.000	6913.153	-3271.122
76,77	0.000	6927.457	3271.145	0.000	6913.153	-3271.122
77,78	0.000	6927.457	3271.145	0.000	6913.153	-3271.122
78,79	0.000	4140.150	1035.037	0.000	4140.150	-1035.037
79,80	0.000	4140.150	1035.037	0.000	4140.150	-1035.037
80,81	0.000	4992.079	1698.694	0.000	4992.079	-1698.694
81,82	0.000	4992.079	1698.694	0.000	4992.079	-1698.694
82,83	0.000	4992.079	1698.694	0.000	4992.079	-1698.694
83,84	0.000	4992.079	1698.694	0.000	4992.079	-1698.694
84,85	0.000	4992.079	1698.694	0.000	4992.079	-1698.694
85,86	0.000	4992.079	1698.694	0.000	4992.079	-1698.694

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
62,63	3891.043	19095.179	18219.583	-3891.043	-9734.779	10610.375
63,64	3891.043	9734.779	-10610.375	-3891.043	-374.379	20719.534
64,65	3891.043	374.379	-20719.534	-3891.043	8986.021	12107.892
65,66	3891.043	-8986.021	-12107.892	-3891.043	18346.421	-15224.549
66,67	3891.043	-18346.421	15224.549	-3891.043	25681.721	-48245.656
67,68	3891.043	-25681.721	48245.656	-3891.043	33017.021	-92269.712
68,88	3891.043	-33017.021	92269.712	-3891.043	35540.871	-109409.185
88,69	3674.423	22076.167	108046.793	-3674.423	-19552.317	-97639.672
69,70	3674.423	19552.317	97639.672	-3674.423	-8549.367	-66025.277
70,71	3674.423	8549.367	66025.277	-3674.423	2453.583	-59167.520
71,72	3674.423	-2453.583	59167.520	-3674.423	13456.533	-77066.400
72,73	3674.423	-13456.533	77066.400	-3674.423	24459.483	-119721.918
73,87	3674.423	-24459.483	119721.918	-3674.423	32279.398	-159910.068
87,74	3704.480	42258.150	161380.687	-3704.480	-34438.234	-107056.638
74,75	3704.480	34438.234	107056.638	-3704.480	-20597.624	-29113.082
75,76	3704.480	20597.624	29113.082	-3704.480	-6757.014	9617.259
76,77	3704.480	6757.014	-9617.259	-3704.480	7083.596	9134.383
77,78	3704.480	-7083.596	-9134.383	-3704.480	20924.206	-30561.709
78,79	3704.480	-20924.206	30561.709	-3704.480	29204.506	-68158.243
79,80	5337.011	39002.741	77830.989	-5337.011	-30722.441	-25537.101
80,81	5337.011	30722.441	25537.101	-5337.011	-20738.283	26995.722
81,82	5337.011	20738.283	26995.722	-5337.011	-10754.125	59144.221
82,83	5337.011	10754.125	59144.221	-5337.011	-769.966	70908.398
83,84	5337.011	769.966	70908.398	-5337.011	9214.192	62288.251
84,85	5337.011	-9214.192	62288.251	-5337.011	19198.350	33283.781
85,86	5337.011	-19198.350	33283.781	-5337.011	29182.509	-16105.013

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
62,63	0.021	-0.134	-0.000	0.020	-0.149	-0.001
63,64	0.020	-0.149	-0.001	0.020	-0.152	0.000
64,65	0.020	-0.152	0.000	0.020	-0.133	0.001
65,66	0.020	-0.133	0.001	0.020	-0.100	0.001
66,67	0.020	-0.100	0.001	0.020	-0.079	0.001
67,68	0.020	-0.079	0.001	0.020	-0.060	0.001
68,88	0.020	-0.060	0.001	0.020	-0.054	0.001
88,69	0.020	-0.054	0.001	0.020	-0.049	0.001
69,70	0.020	-0.049	0.001	0.019	-0.029	0.001
70,71	0.019	-0.029	0.001	0.019	-0.016	0.000
71,72	0.019	-0.016	0.000	0.019	-0.011	0.000
72,73	0.019	-0.011	0.000	0.019	-0.014	-0.000
73,87	0.019	-0.014	-0.000	0.019	-0.019	-0.000
87,74	0.019	-0.019	-0.000	0.019	-0.025	-0.000
74,75	0.019	-0.025	-0.000	0.019	-0.043	-0.001
75,76	0.019	-0.043	-0.001	0.019	-0.067	-0.001
76,77	0.019	-0.067	-0.001	0.019	-0.090	-0.001
77,78	0.019	-0.090	-0.001	0.019	-0.112	-0.001
78,79	0.019	-0.112	-0.001	0.019	-0.124	-0.001
79,80	0.019	-0.124	-0.001	0.018	-0.137	-0.001
80,81	0.018	-0.137	-0.001	0.018	-0.154	-0.001
81,82	0.018	-0.154	-0.001	0.018	-0.169	-0.001
82,83	0.018	-0.169	-0.001	0.018	-0.178	-0.000
83,84	0.018	-0.178	-0.000	0.018	-0.182	-0.000
84,85	0.018	-0.182	-0.000	0.018	-0.180	0.000
85,86	0.018	-0.180	0.000	0.018	-0.175	0.000

Maximum deformations:

No nodes moved to the left.
Node 62 moved 0.021 inch to the right.
Node 84 moved 0.182 inch downwards.
No nodes moved upwards.
Node 76 rotated 0.001 radian clockwise.
Node 66 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):						
From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
62,63	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
63,64	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
64,65	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
65,66	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
66,67	0.000	-3891.043	-3891.043	0.000	-13.511	-13.511
67,68	0.000	-3891.043	-3891.043	0.000	-13.511	-13.511
68,88	0.000	-3891.043	-3891.043	0.000	-9.826	-9.826
88,69	0.000	-3674.423	-3674.423	0.000	-9.279	-9.279
69,70	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
70,71	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
71,72	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
72,73	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
73,87	0.000	-3674.423	-3674.423	0.000	-5.103	-5.103
87,74	0.000	-3704.480	-3704.480	0.000	-5.145	-5.145
74,75	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
75,76	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
76,77	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
77,78	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
78,79	0.000	-3704.480	-3704.480	0.000	-5.145	-5.145
79,80	0.000	-5337.011	-5337.011	0.000	-7.413	-7.413
80,81	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
81,82	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
82,83	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
83,84	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
84,85	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
85,86	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
62,63	19095.179	0.000	19095.179	132.605	0.000	132.605
63,64	9734.779	0.000	9734.779	67.603	0.000	67.603
64,65	374.379	-8986.021	-8986.021	2.600	-62.403	-62.403
65,66	0.000	-18346.421	-18346.421	0.000	-127.406	-127.406
66,67	0.000	-25681.721	-25681.721	0.000	-89.173	-89.173
67,68	0.000	-33017.021	-33017.021	0.000	-114.642	-114.642
68,88	0.000	-35540.871	-35540.871	0.000	-89.750	-89.750
88,69	22076.167	0.000	22076.167	55.748	0.000	55.748
69,70	19552.317	0.000	19552.317	67.890	0.000	67.890
70,71	8549.367	-2453.583	8549.367	29.685	-8.519	29.685
71,72	0.000	-13456.533	-13456.533	0.000	-46.724	-46.724
72,73	0.000	-24459.483	-24459.483	0.000	-84.929	-84.929
73,87	0.000	-32279.398	-32279.398	0.000	-44.832	-44.832
87,74	42258.150	0.000	42258.150	58.692	0.000	58.692
74,75	34438.234	0.000	34438.234	119.577	0.000	119.577
75,76	20597.624	0.000	20597.624	71.520	0.000	71.520
76,77	6757.014	-7083.596	-7083.596	23.462	-24.596	-24.596
77,78	0.000	-20924.206	-20924.206	0.000	-72.653	-72.653
78,79	0.000	-29204.506	-29204.506	0.000	-40.562	-40.562
79,80	39002.741	0.000	39002.741	54.170	0.000	54.170
80,81	30722.441	0.000	30722.441	106.675	0.000	106.675
81,82	20738.283	0.000	20738.283	72.008	0.000	72.008
82,83	10754.125	0.000	10754.125	37.341	0.000	37.341
83,84	769.966	-9214.192	-9214.192	2.673	-31.994	-31.994
84,85	0.000	-19198.350	-19198.350	0.000	-66.661	-66.661
85,86	0.000	-29182.509	-29182.509	0.000	-101.328	-101.328

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
62,63	10610.375	-18219.583	-18219.583	442.099	-759.149	-759.149
63,64	20719.534	0.000	20719.534	863.314	0.000	863.314
64,65	20734.508	0.000	20734.508	863.938	0.000	863.938
65,66	12107.892	-15224.549	-15224.549	504.496	-634.356	-634.356

66,67	0.000	-48245.656	-48245.656	0.000	-430.765	-430.765
67,68	0.000	-92269.712	-92269.712	0.000	-823.837	-823.837
68,88	0.000	-109409.185	-109409.185	0.000	-445.356	-445.356
88,69	0.000	-108046.793	-108046.793	0.000	-439.811	-439.811
69,70	0.000	-97639.672	-97639.672	0.000	-871.783	-871.783
70,71	0.000	-66025.277	-66025.277	0.000	-589.511	-589.511
71,72	0.000	-77066.400	-77066.400	0.000	-688.093	-688.093
72,73	0.000	-119721.918	-119721.918	0.000	-1068.946	-1068.946
73,87	0.000	-159910.068	-159910.068	0.000	-167.343	-167.343
87,74	0.000	-161380.687	-161380.687	0.000	-168.882	-168.882
74,75	0.000	-107056.638	-107056.638	0.000	-955.863	-955.863
75,76	9617.259	-29113.082	-29113.082	85.868	-259.938	-259.938
76,77	14285.498	0.000	14285.498	127.549	0.000	127.549
77,78	9134.383	-30561.709	-30561.709	81.557	-272.872	-272.872
78,79	0.000	-68158.243	-68158.243	0.000	-71.326	-71.326
79,80	0.000	-77830.989	-77830.989	0.000	-81.449	-81.449
80,81	26995.722	-25537.101	26995.722	241.033	-228.010	241.033
81,82	59144.221	0.000	59144.221	528.073	0.000	528.073
82,83	70908.398	0.000	70908.398	633.111	0.000	633.111
83,84	70969.014	0.000	70969.014	633.652	0.000	633.652
84,85	62288.251	0.000	62288.251	556.145	0.000	556.145
85,86	33283.781	-16105.013	33283.781	297.177	-143.795	297.177

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
62,63	0.000	-0.149	-0.149
63,64	0.000	-0.153	-0.153
64,65	0.000	-0.152	-0.152
65,66	0.000	-0.133	-0.133
66,67	0.000	-0.100	-0.100
67,68	0.000	-0.079	-0.079
68,88	0.000	-0.060	-0.060
88,69	0.000	-0.054	-0.054
69,70	0.000	-0.049	-0.049
70,71	0.000	-0.029	-0.029
71,72	0.000	-0.016	-0.016
72,73	0.000	-0.014	-0.014
73,87	0.000	-0.019	-0.019
87,74	0.000	-0.025	-0.025
74,75	0.000	-0.043	-0.043
75,76	0.000	-0.067	-0.067
76,77	0.000	-0.090	-0.090
77,78	0.000	-0.112	-0.112
78,79	0.000	-0.124	-0.124
79,80	0.000	-0.137	-0.137
80,81	0.000	-0.154	-0.154
81,82	0.000	-0.169	-0.169
82,83	0.000	-0.178	-0.178
83,84	0.000	-0.182	-0.182
84,85	0.000	-0.182	-0.182
85,86	0.000	-0.180	-0.180

Deflections along the elements (positive is up or counter-clockwise):

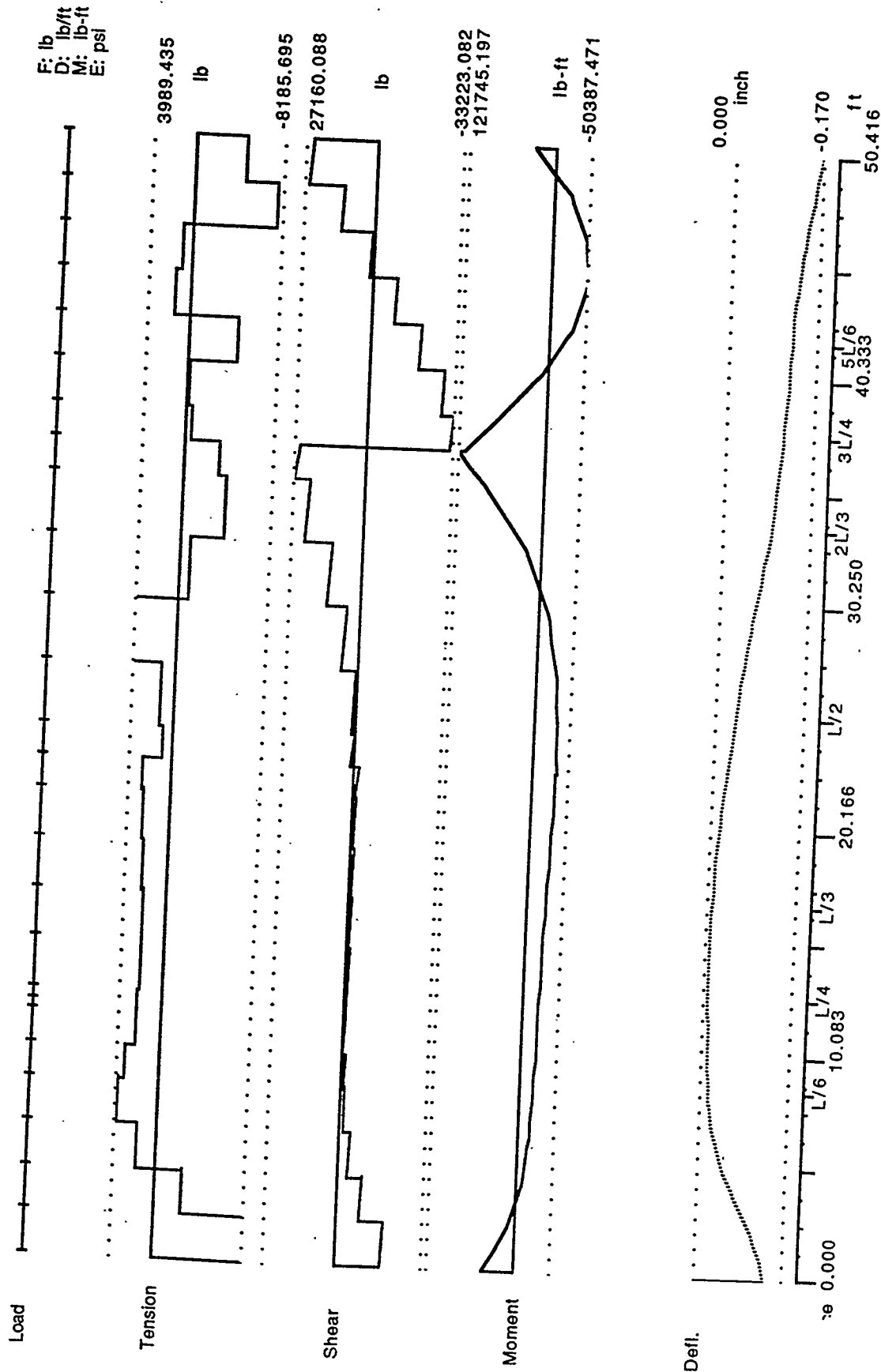
Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
2.000	-0.001	-0.149
4.000	0.000	-0.152
6.000	0.001	-0.133
8.000	0.001	-0.100
9.500	0.001	-0.079
11.000	0.001	-0.060
11.500	0.001	-0.054
12.000	0.001	-0.049
14.250	0.001	-0.029
16.500	0.000	-0.016
18.750	0.000	-0.011
21.000	-0.000	-0.014
22.417	-0.000	-0.019
23.833	-0.000	-0.025

26.666	-0.001	-0.043
29.500	-0.001	-0.067
32.333	-0.001	-0.090
35.166	-0.001	-0.112
36.666	-0.001	-0.124
38.166	-0.001	-0.137
40.208	-0.001	-0.154
42.249	-0.001	-0.169
44.291	-0.000	-0.178
46.333	-0.000	-0.182
48.374	0.000	-0.180

At evenly-spaced intervals:

0.000	-0.000	-0.134
5.042	0.001	-0.145
10.083	0.001	-0.071
15.125	0.000	-0.023
20.166	-0.000	-0.011
25.208	-0.001	-0.032
30.250	-0.001	-0.073
35.291	-0.001	-0.113
40.333	-0.001	-0.155
45.374	-0.000	-0.181
50.416	0.000	-0.175

FRAME MAC file: 3(23/23) PRELIMINARY: Last modified at 12:57:00 on Thu, Mar 25, 1993
 Node 27 Node 28 Node 29 Node 30 Node 31 Node 32 Node 33 Node 34 Node 35 Node 36 Node 37 Node 38 Node 39 Node 40 Node 41 Node 42 Node 43 Node 44 Node 45 N
 0.000 2.000 4.000 6.000 8.000 9.500 11.000 11.500 12.000 14.250 16.500 18.750 21.000 22.417 23.833 26.666 29.500 32.333 35.166 3
 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000 8.000



Continuous Elements Output Data

FRAME MAC file: 3(23/23) PRELIMINARY.

Last modified at 12:57:00 on Thu, Mar 25, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

27	0.000	-0.132	0.000
28	-0.000	-0.106	0.002
29	-0.000	-0.065	0.002
30	-0.000	-0.032	0.001
31	-0.000	-0.016	0.000
32	-0.000	-0.013	0.000
33	-0.000	-0.010	0.000
34	-0.000	-0.009	0.000
35	-0.000	-0.009	0.000
36	-0.000	-0.008	0.000
37	0.000	-0.009	-0.000
38	0.000	-0.013	-0.000
39	0.000	-0.020	-0.000
40	0.000	-0.026	-0.000
41	0.000	-0.032	-0.000
42	0.000	-0.046	-0.000
43	0.000	-0.065	-0.001
44	0.000	-0.085	-0.001
45	0.000	-0.101	-0.000
46	0.000	-0.107	-0.000
47	0.000	-0.112	-0.000
48	0.000	-0.117	-0.000
49	0.000	-0.121	-0.000
50	0.000	-0.128	-0.000
51	0.000	-0.139	-0.001
52	-0.000	-0.154	-0.001
53	-0.000	-0.170	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
27,28	0.000	210.000	70.000	0.000	210.000	-70.000
28,29	0.000	210.000	70.000	0.000	210.000	-70.000
29,30	0.000	210.000	70.000	0.000	210.000	-70.000
30,31	0.000	210.000	70.000	0.000	210.000	-70.000
31,32	0.000	315.000	78.750	0.000	315.000	-78.750
32,33	0.000	315.000	78.750	0.000	315.000	-78.750
33,34	0.000	144.375	12.031	0.000	144.375	-12.031
34,35	0.000	144.375	12.031	0.000	144.375	-12.031
35,36	0.000	472.500	177.188	0.000	472.500	-177.188
36,37	0.000	472.500	177.188	0.000	472.500	-177.188
37,38	0.000	472.500	177.188	0.000	472.500	-177.188
38,39	0.000	472.500	177.188	0.000	472.500	-177.188
39,40	0.000	743.663	175.566	0.000	743.663	-175.566
40,41	0.000	743.663	175.566	0.000	743.663	-175.566
41,42	0.000	594.983	280.956	0.000	594.983	-280.956
42,43	0.000	594.983	280.956	0.000	594.983	-280.956
43,44	0.000	594.983	280.956	0.000	594.983	-280.956
44,45	0.000	594.982	280.956	0.000	594.982	-280.956
45,46	0.000	787.500	196.875	0.000	787.500	-196.875
46,47	0.000	787.500	196.875	0.000	787.500	-196.875
47,48	0.000	428.750	145.894	0.000	428.750	-145.894
48,49	0.000	428.750	145.894	0.000	428.750	-145.894
49,50	0.000	428.750	145.894	0.000	428.750	-145.894
50,51	0.000	428.750	145.894	0.000	428.750	-145.894
51,52	0.000	428.750	145.894	0.000	428.750	-145.894
52,53	0.000	428.750	145.894	0.000	428.750	-145.894

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
27,28	8185.695	-17611.663	-45234.604	-8185.695	18031.663	9591.279
28,29	2521.301	-8870.922	-9965.957	-2521.301	9290.922	-8195.886
29,30	-1866.920	-3664.865	7870.243	1866.920	4084.865	-15619.974
30,31	-3775.473	-1345.263	15448.294	3775.473	1765.263	-18558.821
31,32	-3264.845	-1074.114	18570.744	3264.845	1704.114	-20654.415
32,33	-2389.594	-75.647	20669.630	2389.594	705.647	-21255.600
33,34	-2389.594	-705.647	21255.600	2389.594	994.397	-21680.611
34,35	-2252.599	-584.585	21681.912	2252.599	873.335	-22046.392
35,36	-2149.576	-441.178	22046.017	2149.576	1386.178	-24101.791
36,37	-2146.623	-654.587	24101.555	2146.623	1599.587	-26637.499
37,38	-2280.796	-746.607	26641.426	2280.796	1691.607	-29384.417
38,39	-2530.498	-436.746	29394.443	2530.498	1381.746	-31440.247
39,40	-2728.513	-399.370	31448.140	2728.513	1886.695	-33067.245
40,41	-823.757	1293.296	33188.451	823.757	194.029	-32409.895
41,42	-1267.898	1740.665	32412.102	1267.898	-550.700	-29166.096
42,43	-3989.435	6164.841	29112.384	3989.435	-4974.876	-13331.582
43,44	914.696	12913.093	13611.336	-914.696	-11723.128	21288.950
44,45	3894.047	22154.789	-21092.643	-3894.047	-20964.824	82176.963
45,46	3206.727	27160.088	-82186.315	-3206.727	-25585.088	121745.197
46,47	532.203	-31648.082	-115098.764	-532.203	33223.082	66445.390
47,48	152.432	-28274.799	-66448.194	-152.432	29132.299	7845.115
48,49	4493.492	-18766.458	-7648.492	-4493.492	19623.958	-31541.723
49,50	-1472.687	-8887.813	31309.136	1472.687	9745.313	-50330.453
50,51	-846.931	1551.805	50387.471	846.931	-694.305	-48094.568
51,52	7649.861	12979.135	48497.469	-7649.861	-12121.635	-22873.766
52,53	4704.815	25688.065	22807.051	-4704.815	-24830.565	28764.051

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
27,28	0.000	-0.132	0.000	-0.000	-0.106	0.002
28,29	-0.000	-0.106	0.002	-0.000	-0.065	0.002
29,30	-0.000	-0.065	0.002	-0.000	-0.032	0.001
30,31	-0.000	-0.032	0.001	-0.000	-0.016	0.000
31,32	-0.000	-0.016	0.000	-0.000	-0.013	0.000
32,33	-0.000	-0.013	0.000	-0.000	-0.010	0.000
33,34	-0.000	-0.010	0.000	-0.000	-0.009	0.000
34,35	-0.000	-0.009	0.000	-0.000	-0.009	0.000
35,36	-0.000	-0.009	0.000	-0.000	-0.008	0.000
36,37	-0.000	-0.008	0.000	-0.000	-0.009	-0.000
37,38	0.000	-0.009	-0.000	0.000	-0.013	-0.000
38,39	0.000	-0.013	-0.000	0.000	-0.020	-0.000
39,40	0.000	-0.020	-0.000	0.000	-0.026	-0.000
40,41	0.000	-0.026	-0.000	0.000	-0.032	-0.000
41,42	0.000	-0.032	-0.000	0.000	-0.046	-0.000
42,43	0.000	-0.046	-0.000	0.000	-0.065	-0.001
43,44	0.000	-0.065	-0.001	0.000	-0.085	-0.001
44,45	0.000	-0.085	-0.001	0.000	-0.101	-0.000
45,46	0.000	-0.101	-0.000	0.000	-0.107	-0.000
46,47	0.000	-0.107	-0.000	0.000	-0.112	-0.000
47,48	0.000	-0.112	-0.000	0.000	-0.117	-0.000
48,49	0.000	-0.117	-0.000	0.000	-0.121	-0.000
49,50	0.000	-0.121	-0.000	0.000	-0.128	-0.000
50,51	0.000	-0.128	-0.000	0.000	-0.139	-0.001
51,52	0.000	-0.139	-0.001	-0.000	-0.154	-0.001
52,53	-0.000	-0.154	-0.001	-0.000	-0.170	-0.001

Maximum deformations:

Node 29 moved 0.000 inch to the left.
Node 43 moved 0.000 inch to the right.
Node 53 moved 0.170 inch downwards.
No nodes moved upwards.
Node 52 rotated 0.001 radian clockwise.
Node 29 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):						
From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
27,28	0.000	-8185.695	-8185.695	0.000	-56.845	-56.845
28,29	0.000	-2521.301	-2521.301	0.000	-17.509	-17.509
29,30	1866.920	0.000	1866.920	12.965	0.000	12.965
30,31	3775.473	0.000	3775.473	26.219	0.000	26.219
31,32	3264.845	0.000	3264.845	11.336	0.000	11.336
32,33	2389.594	0.000	2389.594	8.297	0.000	8.297
33,34	2389.594	0.000	2389.594	6.034	0.000	6.034
34,35	2252.599	0.000	2252.599	5.688	0.000	5.688
35,36	2149.576	0.000	2149.576	7.464	0.000	7.464
36,37	2146.623	0.000	2146.623	7.454	0.000	7.454
37,38	2280.796	0.000	2280.796	7.919	0.000	7.919
38,39	2530.498	0.000	2530.498	8.786	0.000	8.786
39,40	2728.513	0.000	2728.513	3.790	0.000	3.790
40,41	823.757	0.000	823.757	1.144	0.000	1.144
41,42	1267.898	0.000	1267.898	4.402	0.000	4.402
42,43	3989.435	0.000	3989.435	13.852	0.000	13.852
43,44	0.000	-914.696	-914.696	0.000	-3.176	-3.176
44,45	0.000	-3894.047	-3894.047	0.000	-13.521	-13.521
45,46	0.000	-3206.727	-3206.727	0.000	-4.454	-4.454
46,47	0.000	-532.203	-532.203	0.000	-0.739	-0.739
47,48	0.000	-152.432	-152.432	0.000	-0.529	-0.529
48,49	0.000	-4493.492	-4493.492	0.000	-15.602	-15.602
49,50	1472.687	0.000	1472.687	5.113	0.000	5.113
50,51	846.931	0.000	846.931	2.941	0.000	2.941
51,52	0.000	-7649.861	-7649.861	0.000	-26.562	-26.562
52,53	0.000	-4704.815	-4704.815	0.000	-16.336	-16.336

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
27,28	0.000	-18031.663	-18031.663	0.000	-125.220	-125.220
28,29	0.000	-9290.922	-9290.922	0.000	-64.520	-64.520
29,30	0.000	-4084.865	-4084.865	0.000	-28.367	-28.367
30,31	0.000	-1765.263	-1765.263	0.000	-12.259	-12.259
31,32	0.000	-1704.114	-1704.114	0.000	-5.917	-5.917
32,33	0.000	-705.647	-705.647	0.000	-2.450	-2.450
33,34	0.000	-994.397	-994.397	0.000	-2.511	-2.511
34,35	0.000	-873.335	-873.335	0.000	-2.205	-2.205
35,36	0.000	-1386.178	-1386.178	0.000	-4.813	-4.813
36,37	0.000	-1599.587	-1599.587	0.000	-5.554	-5.554
37,38	0.000	-1691.607	-1691.607	0.000	-5.874	-5.874
38,39	0.000	-1381.746	-1381.746	0.000	-4.798	-4.798
39,40	0.000	-1886.695	-1886.695	0.000	-2.620	-2.620
40,41	1293.296	-194.029	1293.296	1.796	-0.269	1.796
41,42	1740.665	0.000	1740.665	6.044	0.000	6.044
42,43	6164.841	0.000	6164.841	21.406	0.000	21.406
43,44	12913.093	0.000	12913.093	44.837	0.000	44.837
44,45	22154.789	0.000	22154.789	76.926	0.000	76.926
45,46	27160.088	0.000	27160.088	37.722	0.000	37.722
46,47	0.000	-33223.082	-33223.082	0.000	-46.143	-46.143
47,48	0.000	-29132.299	-29132.299	0.000	-101.154	-101.154
48,49	0.000	-19623.958	-19623.958	0.000	-68.139	-68.139
49,50	0.000	-9745.313	-9745.313	0.000	-33.838	-33.838
50,51	1551.805	0.000	1551.805	5.388	0.000	5.388
51,52	12979.135	0.000	12979.135	45.066	0.000	45.066
52,53	25688.065	0.000	25688.065	89.195	0.000	89.195

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
27,28	45234.604	0.000	45234.604	1884.775	0.000	1884.775
28,29	9965.957	-8195.886	9965.957	415.248	-341.495	415.248
29,30	0.000	-15619.974	-15619.974	0.000	-650.832	-650.832
30,31	0.000	-18558.821	-18558.821	0.000	-773.284	-773.284

31,32	0.000	-20654.415	-20654.415	0.000	-184.414	-184.414
32,33	0.000	-21255.600	-21255.600	0.000	-189.782	-189.782
33,34	0.000	-21680.611	-21680.611	0.000	-88.252	-88.252
34,35	0.000	-22046.392	-22046.392	0.000	-89.741	-89.741
35,36	0.000	-24101.791	-24101.791	0.000	-215.195	-215.195
36,37	0.000	-26637.499	-26637.499	0.000	-237.835	-237.835
37,38	0.000	-29384.417	-29384.417	0.000	-262.361	-262.361
38,39	0.000	-31440.247	-31440.247	0.000	-280.716	-280.716
39,40	0.000	-33067.245	-33067.245	0.000	-34.604	-34.604
40,41	0.000	-33188.451	-33188.451	0.000	-34.731	-34.731
41,42	0.000	-32412.102	-32412.102	0.000	-289.394	-289.394
42,43	0.000	-29112.384	-29112.384	0.000	-259.932	-259.932
43,44	21288.950	-13611.336	21288.950	190.080	-121.530	190.080
44,45	82176.963	0.000	82176.963	733.723	0.000	733.723
45,46	121745.197	0.000	121745.197	127.404	0.000	127.404
46,47	115098.764	0.000	115098.764	120.449	0.000	120.449
47,48	66448.194	0.000	66448.194	593.287	0.000	593.287
48,49	7648.492	-31541.723	-31541.723	68.290	-281.623	-281.623
49,50	0.000	-50330.453	-50330.453	0.000	-449.379	-449.379
50,51	0.000	-50387.471	-50387.471	0.000	-449.888	-449.888
51,52	0.000	-48497.469	-48497.469	0.000	-433.013	-433.013
52,53	28764.051	-22807.051	28764.051	256.822	-203.634	256.822

 Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
27,28	0.000	-0.132	-0.132
28,29	0.000	-0.106	-0.106
29,30	0.000	-0.065	-0.065
30,31	0.000	-0.032	-0.032
31,32	0.000	-0.016	-0.016
32,33	0.000	-0.013	-0.013
33,34	0.000	-0.010	-0.010
34,35	0.000	-0.009	-0.009
35,36	0.000	-0.009	-0.009
36,37	0.000	-0.009	-0.009
37,38	0.000	-0.013	-0.013
38,39	0.000	-0.020	-0.020
39,40	0.000	-0.026	-0.026
40,41	0.000	-0.032	-0.032
41,42	0.000	-0.046	-0.046
42,43	0.000	-0.065	-0.065
43,44	0.000	-0.085	-0.085
44,45	0.000	-0.101	-0.101
45,46	0.000	-0.107	-0.107
46,47	0.000	-0.112	-0.112
47,48	0.000	-0.117	-0.117
48,49	0.000	-0.121	-0.121
49,50	0.000	-0.128	-0.128
50,51	0.000	-0.139	-0.139
51,52	0.000	-0.154	-0.154
52,53	0.000	-0.170	-0.170

 Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
2.000	0.002	-0.106
4.000	0.002	-0.065
6.000	0.001	-0.032
8.000	0.000	-0.016
9.500	0.000	-0.013
11.000	0.000	-0.010
11.500	0.000	-0.009
12.000	0.000	-0.009
14.250	0.000	-0.008
16.500	-0.000	-0.009
18.750	-0.000	-0.013
21.000	-0.000	-0.020
22.417	-0.000	-0.026
23.833	-0.000	-0.032

26.666	-0.000	-0.046
29.500	-0.001	-0.065
32.333	-0.001	-0.085
35.166	-0.000	-0.101
36.666	-0.000	-0.107
38.166	-0.000	-0.112
40.208	-0.000	-0.117
42.249	-0.000	-0.121
44.291	-0.000	-0.128
46.333	-0.001	-0.139
48.374	-0.001	-0.154

At evenly-spaced intervals:

0.000	0.000	-0.132
5.042	0.001	-0.046
10.083	0.000	-0.011
15.125	-0.000	-0.008
20.166	-0.000	-0.017
25.208	-0.000	-0.038
30.250	-0.001	-0.070
35.291	-0.000	-0.102
40.333	-0.000	-0.118
45.374	-0.000	-0.133
50.416	-0.001	-0.170

FRAME MAC file: 3(23/23) PRELIMINARY; Last modified at 12:57:00 on Thu, Mar 25, 1993

Node 27
0.000
8.000

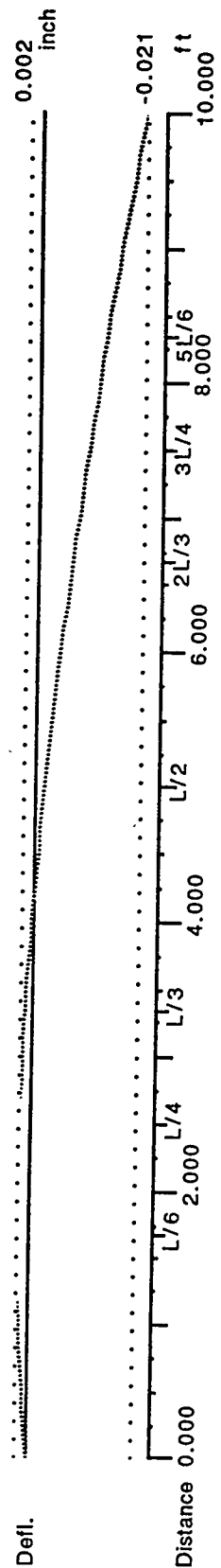
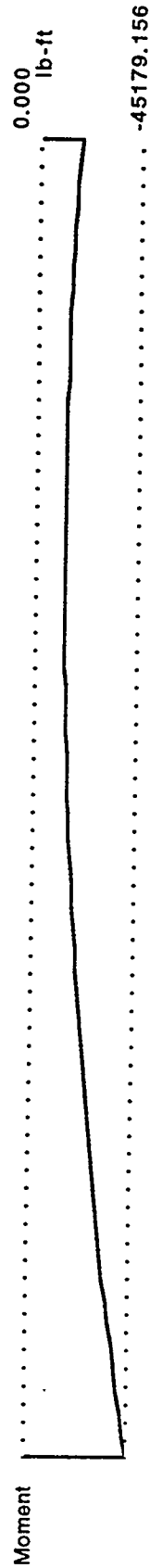
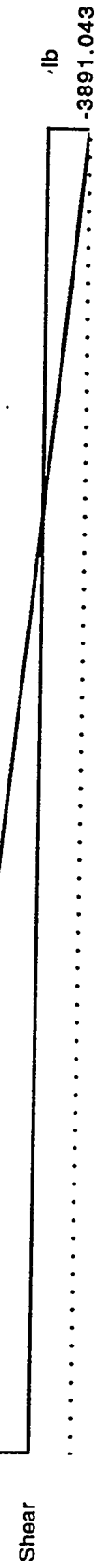
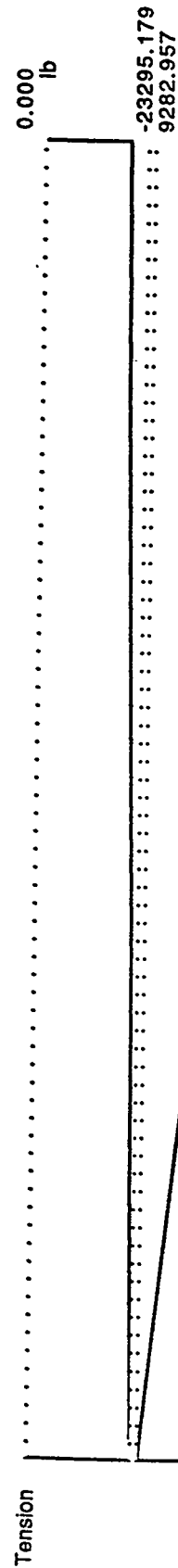
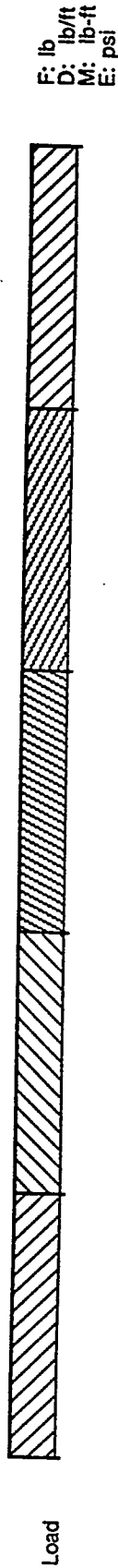
Node 54
0.000
10.000

Node 56
0.000
12.000

Node 58
0.000
14.000

Node 60
0.000
16.000

Node 62
0.000
18.000



Continuous Elements Output Data

FRAME MAC file: 3(23/23) PRELIMINARY.

Last modified at 12:57:00 on Thu, Mar 25, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)
1	-1097.262	5683.517	35.998

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
27	0.000	-0.132	0.000
54	-0.002	-0.132	-0.000
56	-0.000	-0.133	-0.000
58	0.005	-0.133	-0.000
60	0.012	-0.134	-0.000
62	0.021	-0.134	-0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
1,27	0.000	0.000	0.000	0.000	0.000	0.000
27,54	420.000	1317.400	439.133	420.000	1317.400	-439.133
54,56	420.000	1317.400	439.133	420.000	1317.400	-439.133
56,58	420.000	1317.400	439.133	420.000	1317.400	-439.133
58,60	420.000	1317.400	439.133	420.000	1317.400	-439.133
60,62	420.000	1317.400	439.133	420.000	1317.400	-439.133

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
1,27	5683.517	1097.262	35.998	-5683.517	-1097.262	55.448
27,54	23295.179	9282.957	45179.156	-22455.179	-6648.157	-29248.041
54,56	22455.179	6648.157	29248.041	-21615.179	-4013.357	-18586.527
56,58	21615.179	4013.357	18586.527	-20775.179	-1378.557	-13194.612
58,60	20775.179	1378.557	13194.612	-19935.179	1256.243	-13072.297
60,62	19935.179	-1256.243	13072.297	-19095.179	3891.043	-18219.583

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
1,27	0.000	0.000	0.000	-0.132	-0.000	0.000
27,54	-0.132	-0.000	0.000	-0.132	0.002	-0.000
54,56	-0.132	0.002	-0.000	-0.133	0.000	-0.000
56,58	-0.133	0.000	-0.000	-0.133	-0.005	-0.000
58,60	-0.133	-0.005	-0.000	-0.134	-0.012	-0.000
60,62	-0.134	-0.012	-0.000	-0.134	-0.021	-0.000

Maximum deformations:

Node 54 moved 0.002 inch to the left.

Node 62 moved 0.021 inch to the right.

Node 62 moved 0.134 inch downwards.

No nodes moved upwards.

Node 62 rotated 0.000 radian clockwise.

Node 27 rotated 0.000 radian counter-clockwise.

Maximum reactions:

The reaction at node 1 was 1097.262 lb to the left.

There were no reactions to the right.

There were no downwards reactions.

The reaction at node 1 was 5683.517 lb upwards.

There were no clockwise reactions.

The reaction at node 1 was 35.998 lb-ft counter-clockwise.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension	Minimum tension	Max. abs. tension	Maximum ten. str.	Minimum ten. str.	Max. abs. stress

---	lb	lb	lb	psi	psi	psi
1,27	0.000	-5683.517	-5683.517	0.000	-39.469	-39.469
27,54	0.000	-23295.179	-23295.179	0.000	-80.886	-80.886
54,56	0.000	-22455.179	-22455.179	0.000	-77.969	-77.969
56,58	0.000	-21615.179	-21615.179	0.000	-75.053	-75.053
58,60	0.000	-20775.179	-20775.179	0.000	-72.136	-72.136
60,62	0.000	-19935.179	-19935.179	0.000	-69.219	-69.219

Maximum shear and shear stress values:						
From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
1,27	1097.262	0.000	1097.262	7.620	0.000	7.620
27,54	9282.957	0.000	9282.957	32.232	0.000	32.232
54,56	6648.157	0.000	6648.157	23.084	0.000	23.084
56,58	4013.357	0.000	4013.357	13.935	0.000	13.935
58,60	1378.557	-1256.243	1378.557	4.787	-4.362	4.787
60,62	0.000	-3891.043	-3891.043	0.000	-13.511	-13.511

Maximum moment and bending stress values:						
From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
1,27	55.448	-35.998	55.448	2.310	-1.500	2.310
27,54	0.000	-45179.156	-45179.156	0.000	-470.616	-470.616
54,56	0.000	-29248.041	-29248.041	0.000	-304.667	-304.667
56,58	0.000	-18586.527	-18586.527	0.000	-193.610	-193.610
58,60	0.000	-13194.612	-13194.612	0.000	-137.444	-137.444
60,62	0.000	-18219.583	-18219.583	0.000	-189.787	-189.787

Maximum deflection values:						
From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch			
1,27	0.000	-0.000	-0.000			
27,54	0.002	-0.000	0.002			
54,56	0.002	0.000	0.002			
56,58	0.000	-0.005	-0.005			
58,60	0.000	-0.012	-0.012			
60,62	0.000	-0.021	-0.021			

Deflections along the elements (positive is up or counter-clockwise):						
Distance from left (bottom) ft	Rotation radian	Deflection inch				
At the intermediate nodes:						
0.083	0.000	-0.000				
2.083	-0.000	0.002				
4.083	-0.000	0.000				
6.083	-0.000	-0.005				
8.083	-0.000	-0.012				
At evenly-spaced intervals:						
0.000	0.000	0.000				
1.008	0.000	0.002				
2.017	0.000	0.002				
3.025	-0.000	0.002				
4.033	-0.000	0.000				
5.042	-0.000	-0.002				
6.050	-0.000	-0.004				
7.058	-0.000	-0.008				
8.067	-0.000	-0.011				
9.075	-0.000	-0.016				
10.083	-0.000	-0.021				

FRAME MAC file: 3(23/23) PRELIMINARY; Last modified at 12:57:00 on Thu, Mar 25, 1993

Node 53
50.416
8.000

Node 55
50.416
10.000

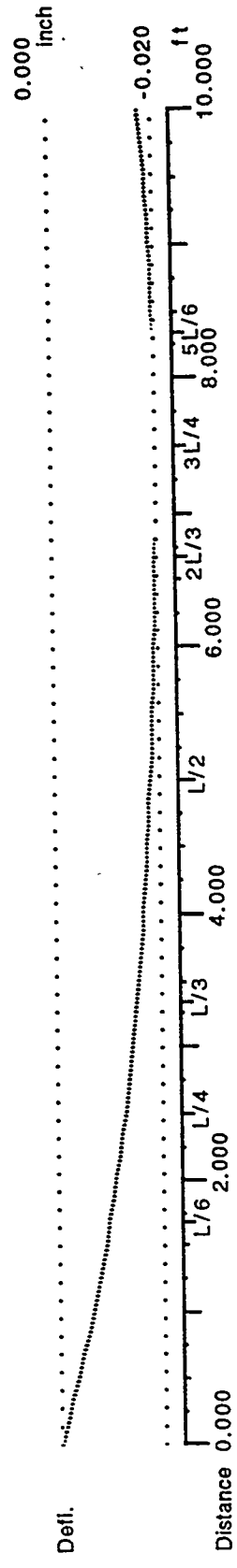
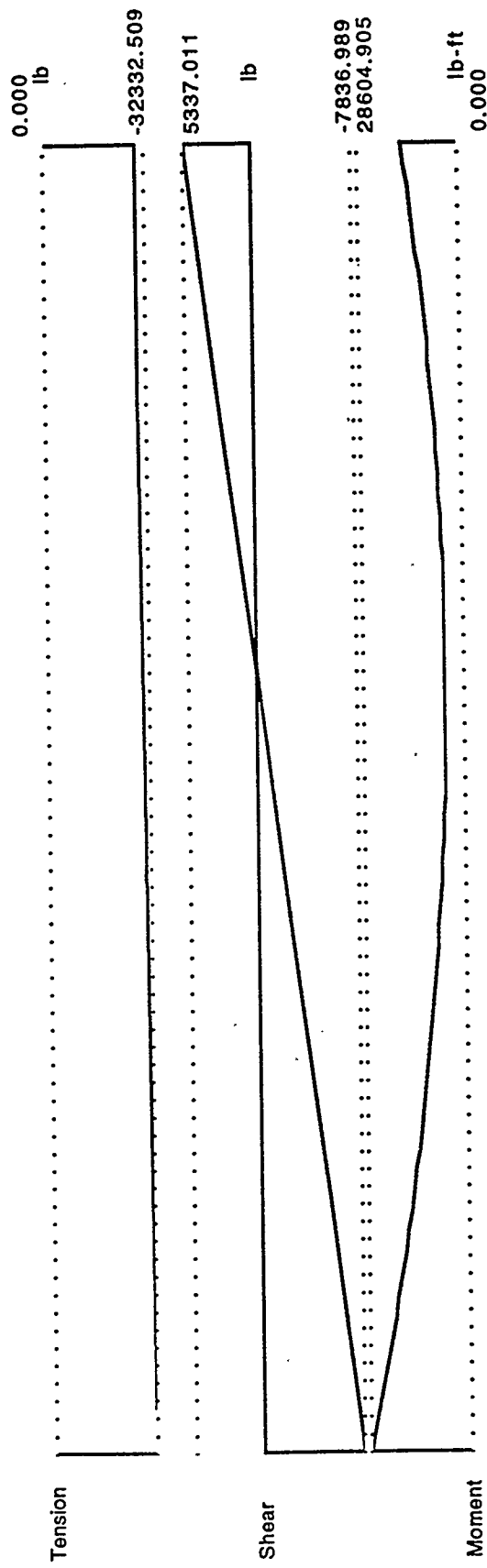
Node 57
50.416
12.000

Node 59
50.416
14.000

Node 61
50.416
16.000

Node 86
50.416
18.000

F: lb
D: lb/ft
M: lb-ft
E: psi



```

*****
Continuous Elements Output Data
*****
FRAME MAC file: 3(23/23) PRELIMINARY.
Last modified at 12:57:00 on Thu, Mar 25, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.
*****
Support reactions: (pos. force is to right or up; pos. moment is ccw.)
*****

```

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)
53	-0.000	-0.170	-0.001
55	0.011	-0.171	-0.000
57	0.017	-0.172	-0.000
59	0.019	-0.173	-0.000
61	0.020	-0.174	0.000
86	0.018	-0.175	0.000

```

*****
Node deformations: (positive is to right, up, or counterclockwise.)
*****

```

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
53	-0.000	-0.170	-0.001
55	0.011	-0.171	-0.000
57	0.017	-0.172	-0.000
59	0.019	-0.173	-0.000
61	0.020	-0.174	0.000
86	0.018	-0.175	0.000

```

*****
Element fixed-end forces & moments: (local coordinate system)
*****

```

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
53,55	315.000	-1317.400	-439.133	315.000	-1317.400	439.133
55,57	315.000	-1317.400	-439.133	315.000	-1317.400	439.133
57,59	315.000	-1317.400	-439.133	315.000	-1317.400	439.133
59,61	315.000	-1317.400	-439.133	315.000	-1317.400	439.133
61,86	315.000	-1317.400	-439.133	315.000	-1317.400	439.133

```

*****
Actual element end forces & moments: (local coordinate system)
*****

```

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
53,55	32332.509	-7836.989	-28604.905	-31702.509	5202.189	15565.726
55,57	31702.509	-5202.189	-15565.726	-31072.509	2567.389	7796.148
57,59	31072.509	-2567.389	-7796.148	-30442.509	-67.411	5296.170
59,61	30442.509	67.411	-5296.170	-29812.509	-2702.211	8065.791
61,86	29812.509	2702.211	-8065.791	-29182.509	-5337.011	16105.013

```

*****
Member end deformations: (local coordinate system)
*****

```

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
53,55	-0.170	0.000	-0.001	-0.171	-0.011	-0.000
55,57	-0.171	-0.011	-0.000	-0.172	-0.017	-0.000
57,59	-0.172	-0.017	-0.000	-0.173	-0.019	-0.000
59,61	-0.173	-0.019	-0.000	-0.174	-0.020	0.000
61,86	-0.174	-0.020	0.000	-0.175	-0.018	0.000

```

*****
Maximum deformations:
Node 53 moved 0.000 inch to the left.
Node 61 moved 0.020 inch to the right.
Node 86 moved 0.175 inch downwards.
No nodes moved upwards.
Node 53 rotated 0.001 radian clockwise.
Node 86 rotated 0.000 radian counter-clockwise.
*****
Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.
*****
Maximum tension and tensile stress values (compression is negative):
*****

```

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
53,55	0.000	-32332.509	-32332.509	0.000	-149.688	-149.688
55,57	0.000	-31702.509	-31702.509	0.000	-146.771	-146.771

57,59	0.000	-31072.509	-31072.509	0.000	-143.854	-143.854
59,61	0.000	-30442.509	-30442.509	0.000	-140.938	-140.938
61,86	0.000	-29812.509	-29812.509	0.000	-138.021	-138.021

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
53,55	0.000	-7836.989	-7836.989	0.000	-36.282	-36.282
55,57	0.000	-5202.189	-5202.189	0.000	-24.084	-24.084
57,59	67.411	-2567.389	-2567.389	0.312	-11.886	-11.886
59,61	2702.211	0.000	2702.211	12.510	0.000	12.510
61,86	5337.011	0.000	5337.011	24.708	0.000	24.708

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
53,55	28604.905	0.000	28604.905	529.720	0.000	529.720
55,57	15565.726	0.000	15565.726	288.254	0.000	288.254
57,59	7796.148	0.000	7796.148	144.373	0.000	144.373
59,61	8065.791	0.000	8065.791	149.367	0.000	149.367
61,86	16105.013	0.000	16105.013	298.241	0.000	298.241

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
53,55	0.000	-0.011	-0.011
55,57	0.000	-0.017	-0.017
57,59	0.000	-0.019	-0.019
59,61	0.000	-0.020	-0.020
61,86	0.000	-0.020	-0.020

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
2.000	-0.000	-0.011
4.000	-0.000	-0.017
6.000	-0.000	-0.019
8.000	0.000	-0.020
At evenly-spaced intervals:		
0.000	-0.001	0.000
1.000	-0.000	-0.006
2.000	-0.000	-0.011
3.000	-0.000	-0.014
4.000	-0.000	-0.017
5.000	-0.000	-0.018
6.000	-0.000	-0.019
7.000	-0.000	-0.020
8.000	0.000	-0.020
9.000	0.000	-0.019
10.000	0.000	-0.018

Output Data

FRAME MAC file: 3(23/23) PRELIMINARY.

Last modified at 12:57:00 on Thu, Mar 25, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,27	0.000	-5683.517	-5683.517	0.000	-39.469	-39.469
2,28	0.000	-9160.741	-9160.741	0.000	-31.808	-31.808
3,29	0.000	-5626.056	-5626.056	0.000	-19.535	-19.535
4,30	0.000	-2739.602	-2739.602	0.000	-9.513	-9.513
5,31	0.000	-691.149	-691.149	0.000	-4.800	-4.800
6,32	0.000	-1628.467	-1628.467	0.000	-3.770	-3.770
7,34	0.000	-409.812	-409.812	0.000	-2.846	-2.846
7,88	0.000	-58190.528	-58190.528	0.000	-1492.065	-1492.065
8,35	0.000	-432.157	-432.157	0.000	-2.668	-2.668
9,36	0.000	-731.591	-731.591	0.000	-2.258	-2.258
10,37	0.000	-852.979	-852.979	0.000	-2.633	-2.633
11,38	0.000	-1254.861	-1254.861	0.000	-3.873	-3.873
12,39	0.000	-982.377	-982.377	0.000	-6.064	-6.064
13,40	0.000	-3168.506	-3168.506	0.000	-7.766	-7.766
13,87	0.000	-76655.048	-76655.048	0.000	-532.327	-532.327
14,41	0.000	-1934.695	-1934.695	0.000	-9.484	-9.484
15,42	0.000	-5605.952	-5605.952	0.000	-13.740	-13.740
16,43	0.000	-7908.652	-7908.652	0.000	-19.384	-19.384
17,44	0.000	-10422.677	-10422.677	0.000	-25.546	-25.546
18,45	0.000	-6195.264	-6195.264	0.000	-30.369	-30.369
19,46	0.000	-13074.077	-13074.077	0.000	-32.044	-32.044
20,47	0.000	-4948.283	-4948.283	0.000	-33.662	-33.662
21,48	0.000	-10348.396	-10348.396	0.000	-35.199	-35.199
22,49	0.000	-10712.196	-10712.196	0.000	-36.436	-36.436
23,50	0.000	-11297.118	-11297.118	0.000	-38.426	-38.426
24,51	0.000	-12250.747	-12250.747	0.000	-41.669	-41.669
25,52	0.000	-13554.543	-13554.543	0.000	-46.104	-46.104
26,53	0.000	-7501.944	-7501.944	0.000	-51.034	-51.034
27,54	0.000	-23295.179	-23295.179	0.000	-80.886	-80.886
27,28	0.000	-8185.695	-8185.695	0.000	-56.845	-56.845
28,29	0.000	-2521.301	-2521.301	0.000	-17.509	-17.509
29,30	1866.920	0.000	1866.920	12.965	0.000	12.965
30,31	3775.473	0.000	3775.473	26.219	0.000	26.219
31,32	3264.845	0.000	3264.845	11.336	0.000	11.336
32,33	2389.594	0.000	2389.594	8.297	0.000	8.297
33,34	2389.594	0.000	2389.594	6.034	0.000	6.034
34,35	2252.599	0.000	2252.599	5.688	0.000	5.688
35,36	2149.576	0.000	2149.576	7.464	0.000	7.464
36,37	2146.623	0.000	2146.623	7.454	0.000	7.454
37,38	2280.796	0.000	2280.796	7.919	0.000	7.919
38,39	2530.498	0.000	2530.498	8.786	0.000	8.786
39,40	2728.513	0.000	2728.513	3.790	0.000	3.790
40,41	823.757	0.000	823.757	1.144	0.000	1.144
41,42	1267.898	0.000	1267.898	4.402	0.000	4.402
42,43	3989.435	0.000	3989.435	13.852	0.000	13.852
43,44	0.000	-914.696	-914.696	0.000	-3.176	-3.176
44,45	0.000	-3894.047	-3894.047	0.000	-13.521	-13.521
45,46	0.000	-3206.727	-3206.727	0.000	-4.454	-4.454
46,47	0.000	-532.203	-532.203	0.000	-0.739	-0.739
46,79	0.000	-70307.247	-70307.247	0.000	-488.245	-488.245
47,48	0.000	-152.432	-152.432	0.000	-0.529	-0.529
48,49	0.000	-4493.492	-4493.492	0.000	-15.602	-15.602
49,50	1472.687	0.000	1472.687	5.113	0.000	5.113
50,51	846.931	0.000	846.931	2.941	0.000	2.941
51,52	0.000	-7649.861	-7649.861	0.000	-26.562	-26.562
52,53	0.000	-4704.815	-4704.815	0.000	-16.336	-16.336
53,55	0.000	-32332.509	-32332.509	0.000	-149.688	-149.688
54,56	0.000	-22455.179	-22455.179	0.000	-77.969	-77.969
55,57	0.000	-31702.509	-31702.509	0.000	-146.771	-146.771
56,58	0.000	-21615.179	-21615.179	0.000	-75.053	-75.053
57,59	0.000	-31072.509	-31072.509	0.000	-143.854	-143.854
58,60	0.000	-20775.179	-20775.179	0.000	-72.136	-72.136
59,61	0.000	-30442.509	-30442.509	0.000	-140.938	-140.938
60,62	0.000	-19935.179	-19935.179	0.000	-69.219	-69.219

SOIL ELEMENT 2

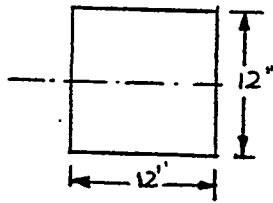
AVE = 25.2

= 18.12

= 2.1

61,86	0.000	-29812.509	-29812.509	0.000	-138.021	-138.021
62,63	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
63,64	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
64,65	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
65,66	0.000	-3891.043	-3891.043	0.000	-27.021	-27.021
66,67	0.000	-3891.043	-3891.043	0.000	-13.511	-13.511
67,68	0.000	-3891.043	-3891.043	0.000	-13.511	-13.511
68,88	0.000	-3891.043	-3891.043	0.000	-9.826	-9.826
69,70	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
69,88	0.000	-3674.423	-3674.423	0.000	-9.279	-9.279
70,71	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
71,72	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
72,73	0.000	-3674.423	-3674.423	0.000	-12.758	-12.758
73,87	0.000	-3674.423	-3674.423	0.000	-5.103	-5.103
74,75	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
74,87	0.000	-3704.480	-3704.480	0.000	-5.145	-5.145
75,76	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
76,77	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
77,78	0.000	-3704.480	-3704.480	0.000	-12.863	-12.863
78,79	0.000	-3704.480	-3704.480	0.000	-5.145	-5.145
79,80	0.000	-5337.011	-5337.011	0.000	-7.413	-7.413
80,81	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
81,82	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
82,83	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
83,84	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
84,85	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531
85,86	0.000	-5337.011	-5337.011	0.000	-18.531	-18.531

SECTION ①



$$I = \frac{bd^3}{12} = 1728 \text{ in}^4$$

$$S = \frac{bd^2}{6} = 288 \text{ in}^3$$

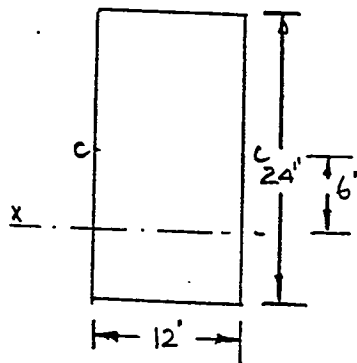
$$R = \sqrt{\frac{I}{A}} = 3.464 \text{ in}$$

$$N.A = 6.00 \text{ in}$$

$$W = 150 \text{ lbs/ft}$$

$$A = 144 \text{ in}^2$$

SECTION ②



$$I_c = \frac{bd^3}{12} = \frac{12(24)^3}{12} \quad I_x = I_c + Ad^2$$

$$I_x = 13824 + (12)(24)(6)^2 = 24192 \text{ in}^4$$

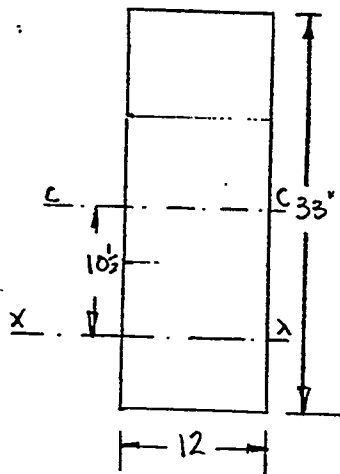
$$S = \frac{I}{C} = \frac{24192}{18} = 1344 \text{ in}^3$$

$$R = \sqrt{\frac{I}{A}} = \sqrt{\frac{(24192)}{(12)(24)}} = 9.165 \text{ in}$$

$$C = 18 \text{ in}$$

$$W = 300 \text{ lbs/ft} \quad A = 288$$

SECTION ③



$$I_c = \frac{bd^3}{12} = \frac{(12)(33)^3}{12} = 35937 \text{ in}^4$$

$$I_x = I_c + Ad^2 = 35937 + (12)(33)(10.5)^2$$

$$I_x = 79596 \text{ in}^4$$

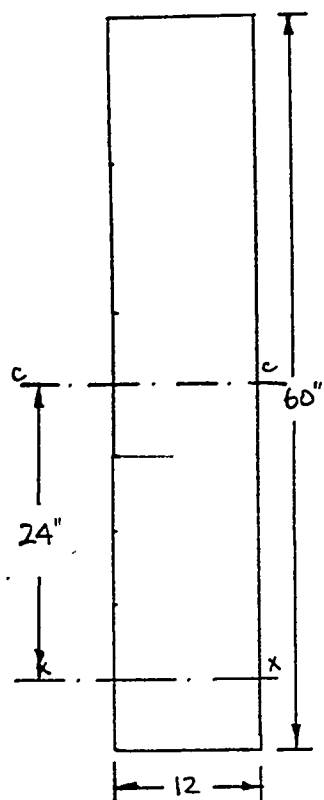
$$S = \frac{I}{C} = \frac{79596}{27} = 2948 \text{ in}^3$$

$$R = \sqrt{\frac{I}{A}} = \sqrt{(79596)/(12)(33)} = 14.17 \text{ in}$$

$$C = 27 \text{ in}$$

$$W = 412.5 \text{ lbs/ft}^2 \quad A = 396 \text{ in}^2$$

SECTION (4)



$$I_c = \frac{bd^3}{12} = \frac{12(60)^3}{12} = 216,000 \text{ in}^4$$

$$I_x = I_c + Ad^2 = 216,000 + (12)(60)(24)^2$$

$$I_x = 630,720 \text{ in}^4$$

$$S = \frac{I}{c} = \frac{630,720}{55} = 11,467 \text{ in}^3$$

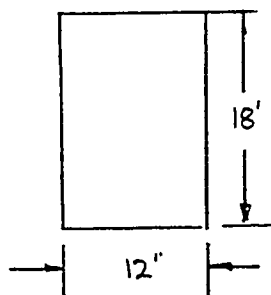
$$R = \sqrt{\frac{I}{A}} = \sqrt{\frac{630,720}{(12)(60)}} = 29.597 \text{ in}$$

$$c = 55"$$

$$W = 750 \text{ lb/ft}$$

$$A = 720 \text{ in}^2$$

SECTION (5)



$$I_c = \frac{bd^3}{12} = \frac{12(18)^3}{12} = 5832 \text{ in}^4$$

$$S = \frac{bd^2}{6} = \frac{12(18)^2}{6} = 648 \text{ in}^3$$

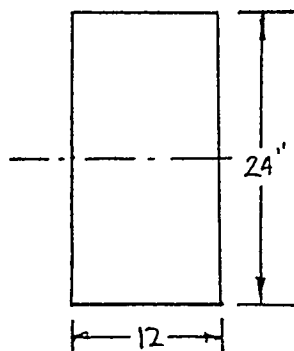
$$R = \sqrt{\frac{I}{A}} = \sqrt{\frac{5832}{(12)(18)}} = 5.196 \text{ in}$$

$$NA = 9.0$$

$$A = 216 \text{ in}^2$$

$$W = 225 \text{ lbs/ft}$$

SECTION 6.



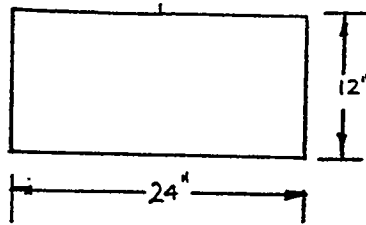
$$I_c = \frac{bd^3}{12} = \frac{12(24)^3}{12} = 13,824 \text{ in}^4$$

$$S = \frac{bd^2}{6} = \frac{12(24)^2}{6} = 1152.0 \text{ in}^3$$

$$R = \sqrt{\frac{I}{A}} = \sqrt{\frac{13,824}{(12)(24)}} = 6.928 \text{ in}$$

$$W = 300 \text{ lbs/ft} \quad A = 288 \text{ in}^2$$

(SOIL-1) FOR SECTION 1



$$I = \frac{bd^3}{12} = \frac{24(12)^3}{12} = 3456 \text{ in}^4$$

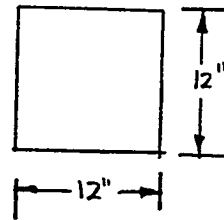
$$S = \frac{bd^2}{6} = \frac{24(12)^2}{6} = 576 \text{ in}^3$$

$$R = 3.464$$

$$W = 230 \text{ lb/ft}$$

$$A = 288 \text{ in}^2$$

SOIL-1(END)



$$I = \frac{bd^3}{12} = 1728$$

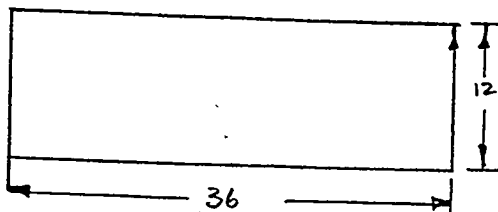
$$S = \frac{bd^2}{6} = 288$$

$$R = 3.464$$

$$W = 115 \text{ lb/ft}$$

$$A = 144 \text{ in}^2$$

(SOIL-2A) FOR SECTION 2A.



$$I = \frac{bd^3}{12} = \frac{36(12)^3}{12} = 5184 \text{ in}^4$$

$$S = \frac{bd^2}{6} = \frac{36(12)^2}{6} = 864 \text{ in}^3$$

$$R = 3.464$$

$$W = 345 \text{ lb/ft}$$

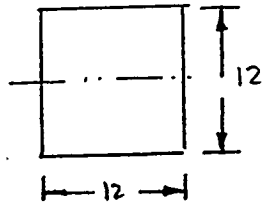
$$A = 432 \text{ in}^2$$

SOIL-2(END A

NA.

SOIL-3

SOIL-3(END)



$$I = 1728 \text{ in}^4$$

N.A

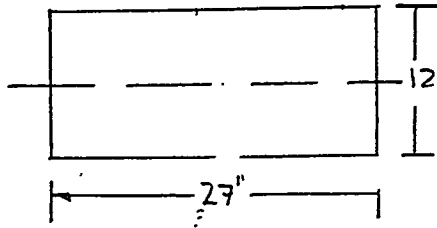
$$S = 288 \text{ in}^3$$

$$R = 3.464 \text{ in}$$

$$W = 115 \text{ lb/ft}$$

$$A = 144 \text{ in}^2$$

SOIL-2B



$$I = \frac{bd^3}{12} = \frac{27(12)^3}{12} = 3888 \text{ in}^4$$

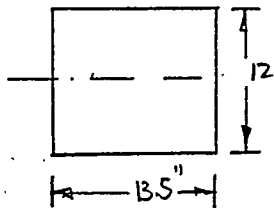
$$S = \frac{bd^2}{6} = \frac{27(12)^2}{6} = 648 \text{ in}^3$$

$$R = 3.464 \text{ in}$$

$$W = 258.8 \text{ lb/ft}$$

$$A = 324 \text{ in}^2$$

SOIL-2B(END)



$$I = \frac{bd^3}{12} = 1944 \text{ in}^4$$

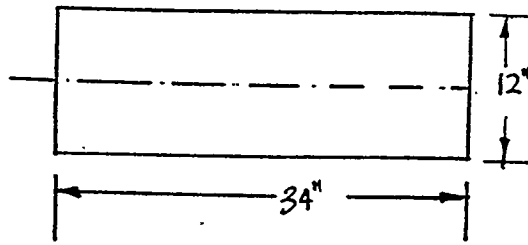
$$S = \frac{bd^2}{6} = 324 \text{ in}^3$$

$$R = 3.464 \text{ in}$$

$$W = 129.38 \text{ lb/ft}$$

$$A = 162 \text{ in}^2$$

SOIL-4A/4B



$$I = \frac{bd^3}{12} = \frac{(34)(12)^3}{12} = 4896 \text{ in}^4$$

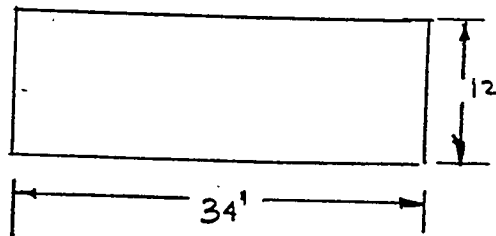
$$S = \frac{bd^2}{6} = \frac{34(12)^2}{6} = 816 \text{ in}^3$$

$$R = 3.464$$

$$W = 325.9 \text{ lb/ft}$$

$$A = 408 \text{ in}^2$$

SOIL-2C



$$I = 4896 \text{ in}^4$$

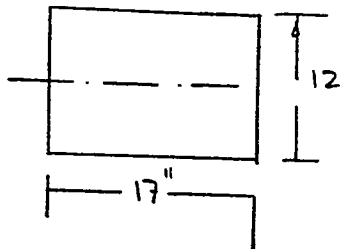
$$S = 816 \text{ in}^3$$

$$R = 3.464 \text{ in}$$

$$W = 325.9 \text{ lb/ft}$$

$$A = 408 \text{ in}^2$$

SOIL-2C(END)



$$I = \frac{bd^3}{12} = 2448$$

$$S = \frac{bd^2}{6} = 408$$

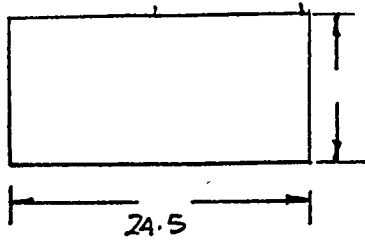
$$R = 3.464$$

$$W = 162.95 \text{ lb/ft}$$

$$A = 204 \text{ in}^2$$

SOIL-2D

SOIL-2D(END)



$$I = \frac{bd^3}{12} = 3528 \text{ m}^4$$

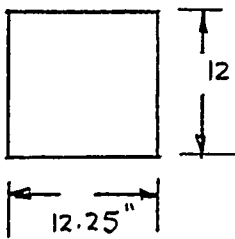
$$S = \frac{bd^2}{6} = 588 \text{ m}^3$$

$$R = 3464$$

$$W = 234.83 \text{ lb/ft}$$

$$A = 294 \text{ m}^2$$

SOIL-2D(END)



$$I = \frac{bd^3}{12} = 1764 \text{ m}^4$$

$$S = \frac{bd^2}{6} = 294 \text{ m}^3$$

$$R = 3464 \text{ m}$$

$$W = 117.40 \text{ lb/ft}$$

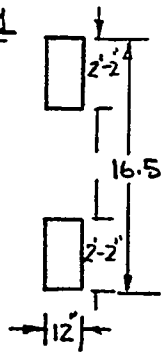
$$A = 147 \text{ m}^2$$

50 SHEETS 3 SQUARE
47 SHEETS 18 SQUARE
42 SHEETS 200 SQUARE
42 SHEETS 200 SQUARE

NATIONAL

END SUPPORTS. ON EXTERNAL BEAMS.

COLUMN 1



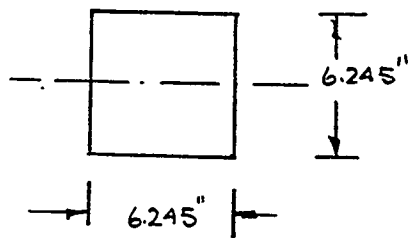
$$\text{AREA OF COLUMN} = 12" \times 26" \times 2ea = 644"$$

DISTRIBUTING AREA OVER SPAN DISTANCE

$$= \frac{644}{16.5'} = 39 \text{ in}^2/\text{ft}$$

RESOLVING TO SQUARE COLUMN EQUIVALENT OF SIDE D

$$D = \sqrt{39} = 6.245 \text{ in}$$



$$I = \frac{bd^3}{12} = \frac{(6.245)(6.245)^3}{12} = 126.75 \text{ in}^4$$

$$S = \frac{bd^2}{6} = \frac{(6.245)(6.245)^2}{6} = 40.59 \text{ in}^3$$

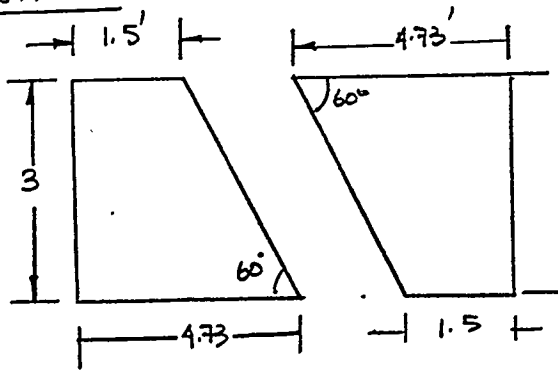
$$A = (6.245)^2 = 39 \text{ in}^2$$

$$R = \sqrt{\frac{I}{A}} = \sqrt{\frac{126.75}{39}} = 1.80 \text{ in}$$

$$W = \frac{(6.245)^2 \times 1.150}{144} = 40.625 \text{ lb/ft}$$

$$N.A = \frac{6.245}{2} = 3.1225 \text{ in}$$

COLUMN 2



$$\text{AREA OF SINGLE COLUMN} = \frac{(1.5 + 4.73)(3)}{2}$$

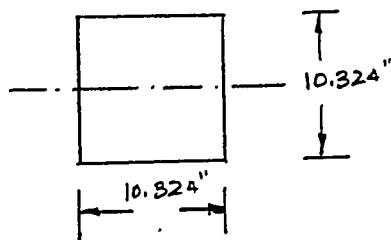
$$\text{COMBINED AREA - (2) COLUMNS} = \frac{(1.5 + 4.73)(3)(2)}{2} = 18.69 \text{ ft}^2$$

DISTRIBUTING THE AREA OF THE COLUMN OVER THE SPAN DISTANCE $D = 25.25'$

$$\frac{(18.69)(144)}{25.25} = 106.59 \text{ m}^2/\text{ft}$$

RESOLVING TO SQUARE COLUMN EQUIV.

$$d^2 = 106.59 ; d = \sqrt{106.59} = 10.324 \text{ m}$$



$$I = \frac{bd^3}{12} = \frac{(10.324)(10.324)^3}{12} = 946.69 \text{ m}^4$$

$$S = \frac{bd^2}{6} = \frac{(10.324)(10.324)^2}{6} = 183.39 \text{ m}^3$$

$$A = (10.324)^2 = 106.58 \text{ m}^2$$

$$W = (10.324)^2 / 144 (150) = 110 \text{ lb/ft}$$

$$R = \sqrt{\frac{I}{A}} = 2.980 \text{ m}$$

$$N.A = 10324 / 2 = 5162 \text{ m}$$

COLUMN 3

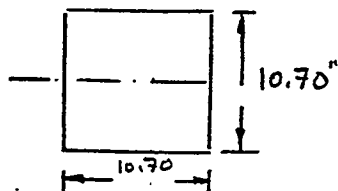
USING SAME AREAS AS COLUMN 2. AREA = 18.69 ft^2 .

DISTRIBUTING THIS AREA OVER THE SPAN OF 23.5 ft

$$\frac{(18.69)(144)}{23.5} = 114.53 \text{ m}^2/\text{ft}$$

RESOLVING TO SQUARE COLUMN EQUIV.

$$d^2 = 114.53 ; d = \sqrt{(114.53)} = 10.70 \text{ m}$$



$$I = \frac{bd^3}{12} = \frac{(10.70)(10.70)^3}{12} = 1092.33 \text{ m}^4$$

$$S = \frac{bd^2}{6} = \frac{(10.70)(10.70)^2}{6} = 204.17 \text{ m}^3$$

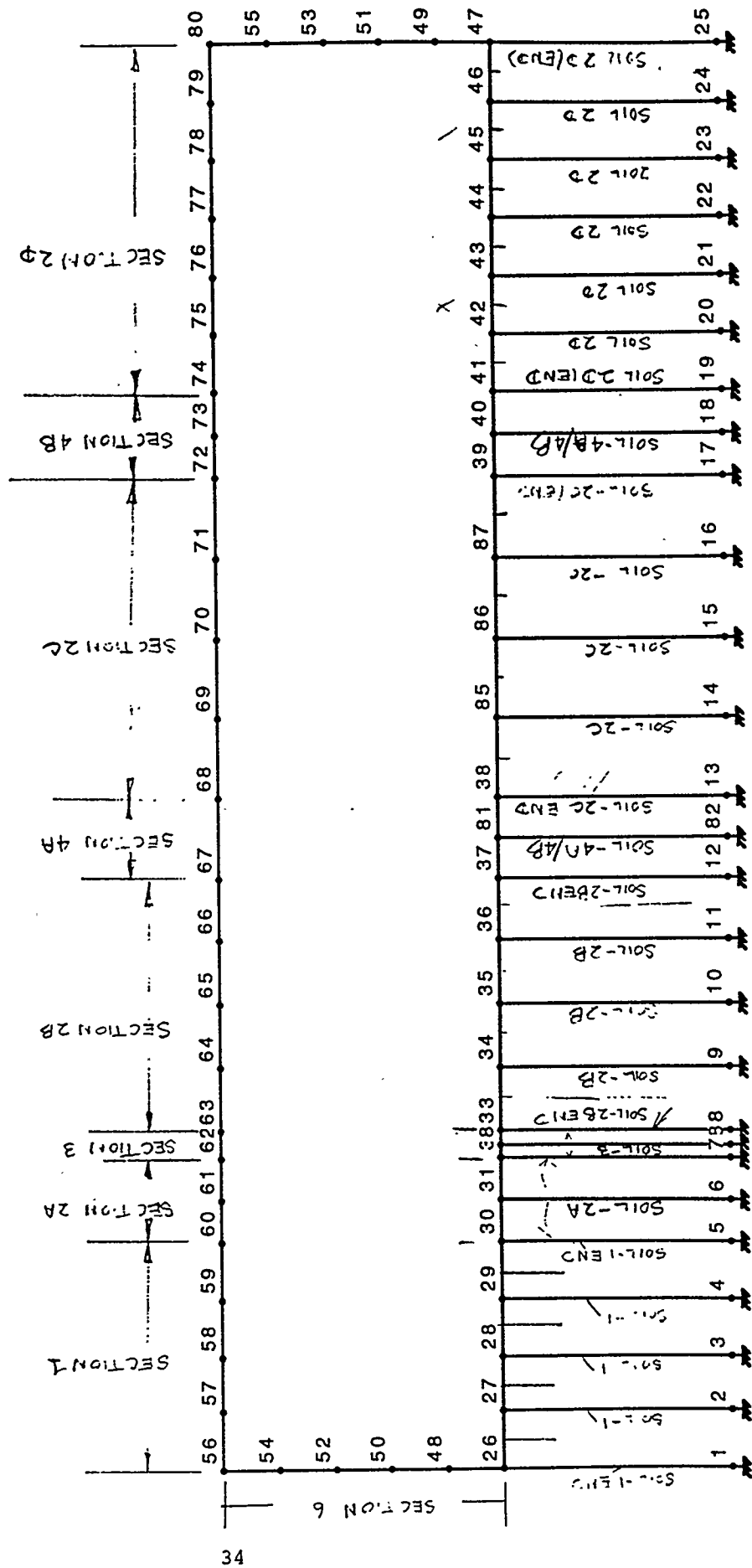
$$A = (10.70)^2 = 114.49 \text{ m}^2$$

$$W = (10.70)^2 / 144 (150) = 119.20 \text{ lb/ft}$$

$$R = \sqrt{\frac{I}{A}} = 3.089 \text{ m}$$

$$N.A = 5.35 \text{ m}$$

FRAME MAC file: 3(23/23) PRELIMINARY: Last modified at 11:04:12 on Wed, Mar 10, 1993
 Above each load are the magnitudes in lb, lb/ft, and lb-ft.



STRUCTURAL ASSESSMENT

TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE
Moment Capacity			
Design of beam for flexural loads is based on:			
$\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$			
$\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$			
ROOF STRUCTURE	_____ ft-lbs	161380 ft-lbs	
FLOOR STRUCTURE	_____ ft-lbs	121745 ft-lbs	
LEFT INSIDE WALL	_____ ft-lbs	45179 ft-lbs	
LEFT OUTSIDE WALL	_____ ft-lbs	_____ ft-lbs	
RIGHT INSIDE WALL	_____ ft-lbs	_____ ft-lbs	
RIGHT OUTSIDE WALL	_____ ft-lbs	32333 ft-lbs	
Shear Capacity			
Design shear load is computed by ACI 318-89 (11-3)			
$V_c = 2 \sqrt{f'_c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$			
$\phi V_n = (0.85) 2 \sqrt{f'_c} B_w d$			
ROOF STRUCTURE	_____ lbs	42,258 lbs	
FLOOR STRUCTURE	_____ lbs	32,223 lbs	
LEFT WALL	_____ lbs	9283 lbs	
RIGHT WALL	_____ lbs	7837 lbs	
Axial Capacity			
Design axial load ϕP_n is computed by ACI 318-89 (14-1)			
$\phi P_n = 0.55 \phi f'_c A_g \left[1 - \left(\frac{M_u}{32 P_u} \right)^2 \right]$ where $\phi = 0.7$			
LEFT WALL	_____ lbs	23,295 lbs	
RIGHT WALL	_____ lbs	28604 lbs	

Loading Conditions

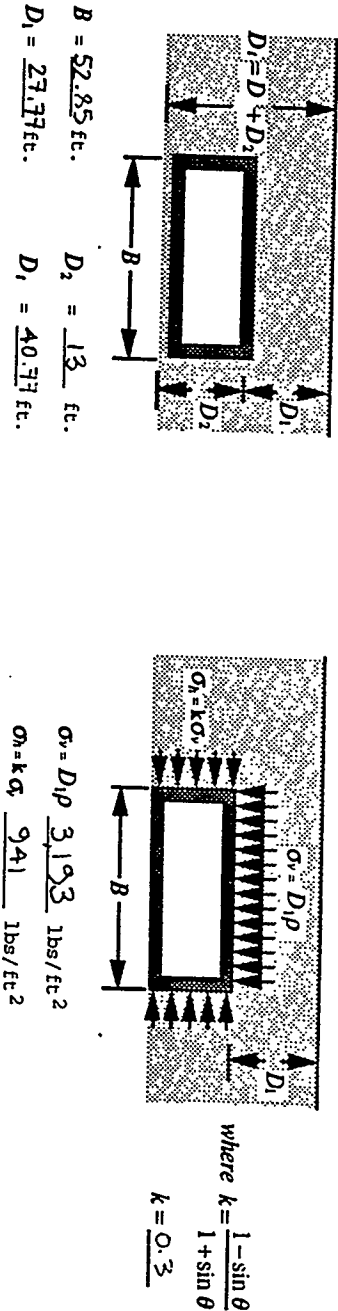


Figure () Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-5(21/21)S

TITLE: Preliminary Structural Assessment of Tunnel Section 5(21/21)

South

PROJECT: Remedial Shielding Concepts for Line D and Line D

Facilities. Los Alamos Meson Physics Facility,

Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 5(21/21)S subjected to vertical and horizontal loads

estimated as 115 lbs/ft² for each 1 ft of soil covering the structure

and a horizontal load equivalent to 0.3 of the estimated cover load.

Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY:

DATE:

TUNNEL SECTION 5 21 21 S	TITLE OF ANALYSIS <u>PRELIMINARY</u>
PAGE <u>1</u> OF <u>3</u>	
ROOF ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = <u>332×10^6</u> psi
Area of Cross Section (b x d)	A = <u>108</u> in ²
Depth of Section	d = <u>9</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>112.5</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>729</u> in ⁴
Sectional Modulus Ic/C	S = <u>162</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>2.6</u> in
Neutral Axis	NA = <u>4.5</u> in
Extreme Fiber	C = <u>4.5</u> in
Element Length	L = <u>1.083</u> ft
FLOOR ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = <u>332×10^6</u> psi
Area of Cross Section (b x d)	A = <u>108</u> in ²
Depth of Section	d = <u>9</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>112.5</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>729</u> in ⁴
Sectional Modulus Ic/C	S = <u>162</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>2.6</u> in
Neutral Axis	NA = <u>4.5</u> in
Extreme Fiber	C = <u>4.5</u> in
Element Length	L = <u>1.083</u> ft
LEFTWALL ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = <u>332×10^6</u> psi
Area of Cross Section (b x d)	A = <u>108</u> in ²
Depth of Section	d = <u>9</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>112.5</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>729</u> in ⁴
Sectional Modulus Ic/C	S = <u>162</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>2.6</u> in
Neutral Axis	NA = <u>4.5</u> in
Extreme Fiber	C = <u>4.5</u> in
Element Length	L = <u>1.083</u> ft

TUNNEL SECTION 5 212 S	TITLE OF ANALYSIS <u>PRELIMINARY</u> PAGE <u>2</u> OF <u>3</u>

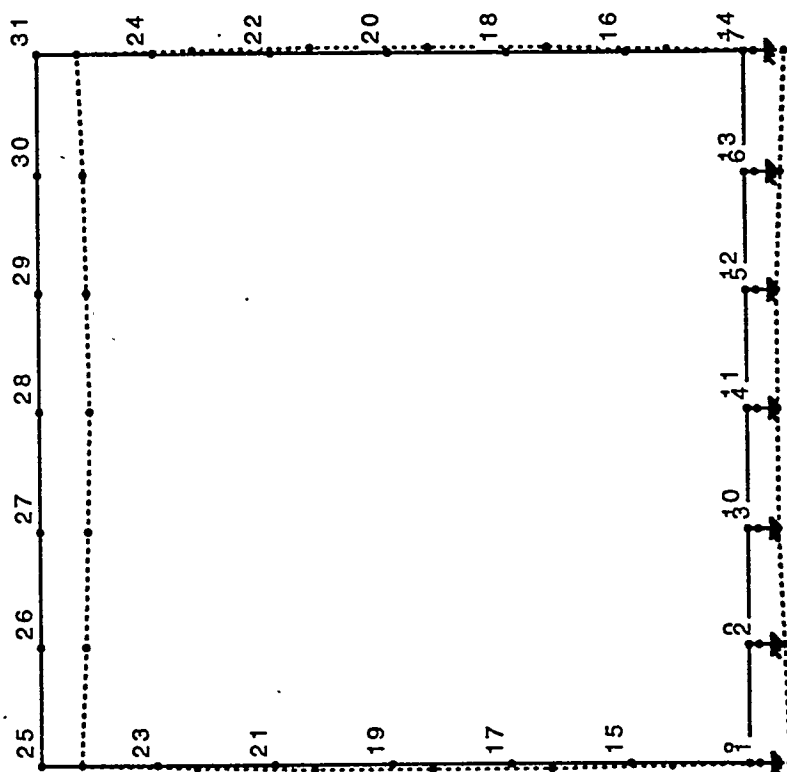
RIGHTWALL ELEMENT PROPERTIES	
Youngs Modulus w 1.5 (33)√f'c	E = <u>332x10⁶</u> psi
Area of Cross Section (b x d)	A = <u>108</u> in ²
Depth of Section	d = <u>9</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>112.5</u> lbs/ft
Moment of Inertia b.d ³ /12	Ic = <u>729</u> in ⁴
Sectional Modulus Ic/C	S = <u>162</u> in ³
Radius of Gyration √(Ic/A)	r = <u>26</u> in
Neutral Axis	NA = <u>45</u> in
Extreme Fiber	C = <u>45</u> in
Element Length	L = <u>1.083</u> ft

SOIL ELEMENT PROPERTIES	
Youngs Modulus	E = <u>300</u> psi (K)
Area of Cross Section (b x d)	A = <u>149.2</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12.437</u> in
Weight per Unit Length	W = <u>119.14</u> lbs/ft
Moment of Inertia b.d ³ /12	Ic = <u>1790</u> in ⁴
Sectional Modulus Ic/C	S = <u>298.4</u> in ³
Radius of Gyration √(Ic/A)	r = <u>34.64</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>0.0833</u> ft (1")

SOILEND PROPERTIES	
Youngs Modulus	E = <u>300</u> psi (K)
Area of Cross Section (b x d)	A = <u>74.5</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>6.216</u> in
Weight per Unit Length	W = <u>59.59</u> lbs/ft
Moment of Inertia b.d ³ /12	Ic = <u>895.5</u> in ⁴
Sectional Modulus Ic/C	S = <u>149.2</u> in ³
Radius of Gyration √(Ic/A)	r = <u>34.1</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>0.0833</u> ft (1")

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
84





FRAME MAC file: 5(21/21)S PRELIMINARY; Last modified at 17:53:11 on Thu, May 6, 1993

Node 25
1.000
6.500

Node 26
2.083
6.500

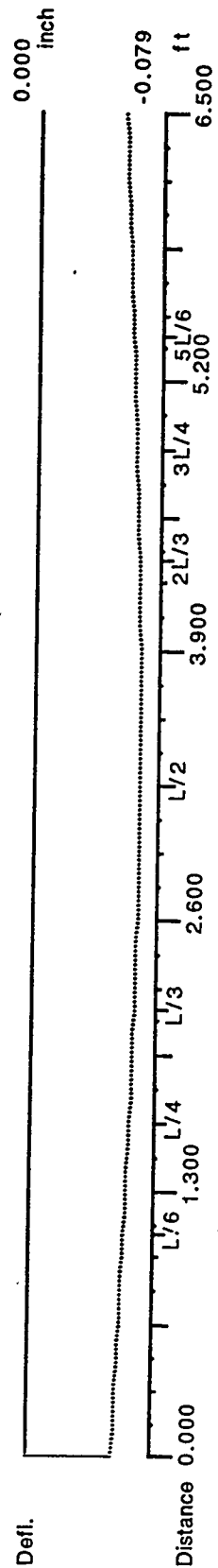
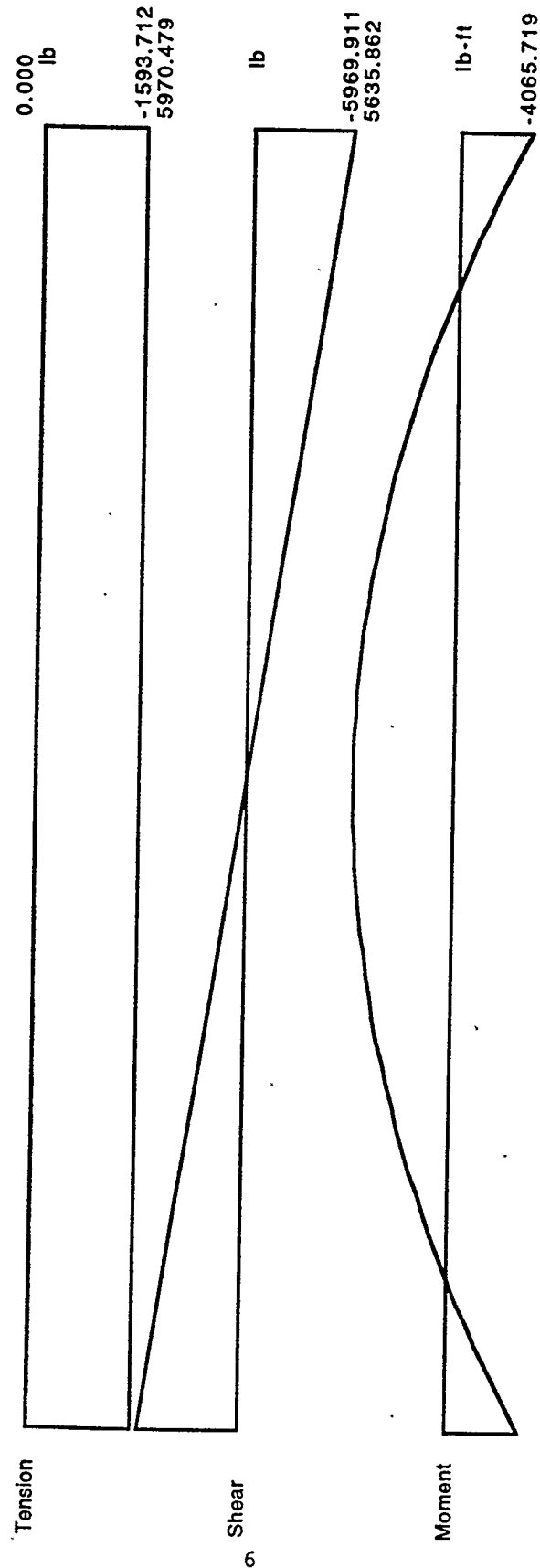
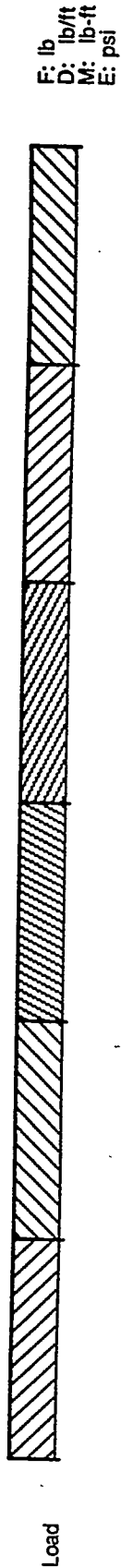
Node 27
3.167
6.500

Node 28
4.250
6.500

Node 29
5.333
6.500

Node 30
6.417
6.500

Node 31
7.500
6.500



Continuous Elements Output Data

FRAME MAC file: 5(21/21)S PRELIMINARY.

Last modified at 17:53:11 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
25	0.000	-0.064	-0.000
26	0.000	-0.071	-0.001
27	0.000	-0.077	-0.000
28	-0.000	-0.079	0.000
29	-0.000	-0.077	0.000
30	-0.000	-0.071	0.001
31	-0.000	-0.064	0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
25,26	0.000	995.312	179.709	0.000	994.753	-179.709
26,27	0.000	995.312	179.709	0.000	994.753	-179.709
27,28	0.000	995.312	179.709	0.000	994.753	-179.709
28,29	0.000	995.312	179.709	0.000	994.753	-179.709
29,30	0.000	995.312	179.709	0.000	994.753	-179.709
30,31	0.000	995.312	179.709	0.000	994.753	-179.709

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
25,26	1593.712	5970.479	4065.719	-1593.712	-3980.414	1324.045
26,27	1593.712	3980.414	-1324.045	-1593.712	-1990.349	4557.906
27,28	1593.712	1990.349	-4557.906	-1593.712	-0.284	5635.862
28,29	1593.712	0.284	-5635.862	-1593.712	1989.781	4557.915
29,30	1593.712	-1989.781	-4557.915	-1593.712	3979.846	1324.065
30,31	1593.712	-3979.846	-1324.065	-1593.712	5969.911	-4065.690

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
25,26	0.000	-0.064	-0.000	0.000	-0.071	-0.001
26,27	0.000	-0.071	-0.001	0.000	-0.077	-0.000
27,28	0.000	-0.077	-0.000	-0.000	-0.079	0.000
28,29	-0.000	-0.079	0.000	-0.000	-0.077	0.000
29,30	-0.000	-0.077	0.000	-0.000	-0.071	0.001
30,31	-0.000	-0.071	0.001	-0.000	-0.064	0.000

Maximum deformations:

Node 31 moved 0.000 inch to the left.
Node 25 moved 0.000 inch to the right.
Node 28 moved 0.079 inch downwards.
No nodes moved upwards.
Node 26 rotated 0.001 radian clockwise.
Node 30 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension	Minimum tension	Max. abs. tension	Maximum ten. str.	Minimum ten. str.	Max. abs. stress

---	lb	lb	lb	psi	psi	psi
25,26	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
26,27	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
27,28	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
28,29	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
29,30	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
30,31	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
25,26	5970.479	0.000	5970.479	55.282	0.000	55.282
26,27	3980.414	0.000	3980.414	36.856	0.000	36.856
27,28	1990.349	0.000	1990.349	18.429	0.000	18.429
28,29	0.284	-1989.781	-1989.781	0.003	-18.424	-18.424
29,30	0.000	-3979.846	-3979.846	0.000	-36.850	-36.850
30,31	0.000	-5969.911	-5969.911	0.000	-55.277	-55.277

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
25,26	1324.045	-4065.719	-4065.719	98.077	-301.164	-301.164
26,27	4557.906	0.000	4557.906	337.623	0.000	337.623
27,28	5635.862	0.000	5635.862	417.471	0.000	417.471
28,29	5635.862	0.000	5635.862	417.471	0.000	417.471
29,30	4557.915	0.000	4557.915	337.623	0.000	337.623
30,31	1324.065	-4065.690	-4065.690	98.079	-301.162	-301.162

Maximum deflection values:

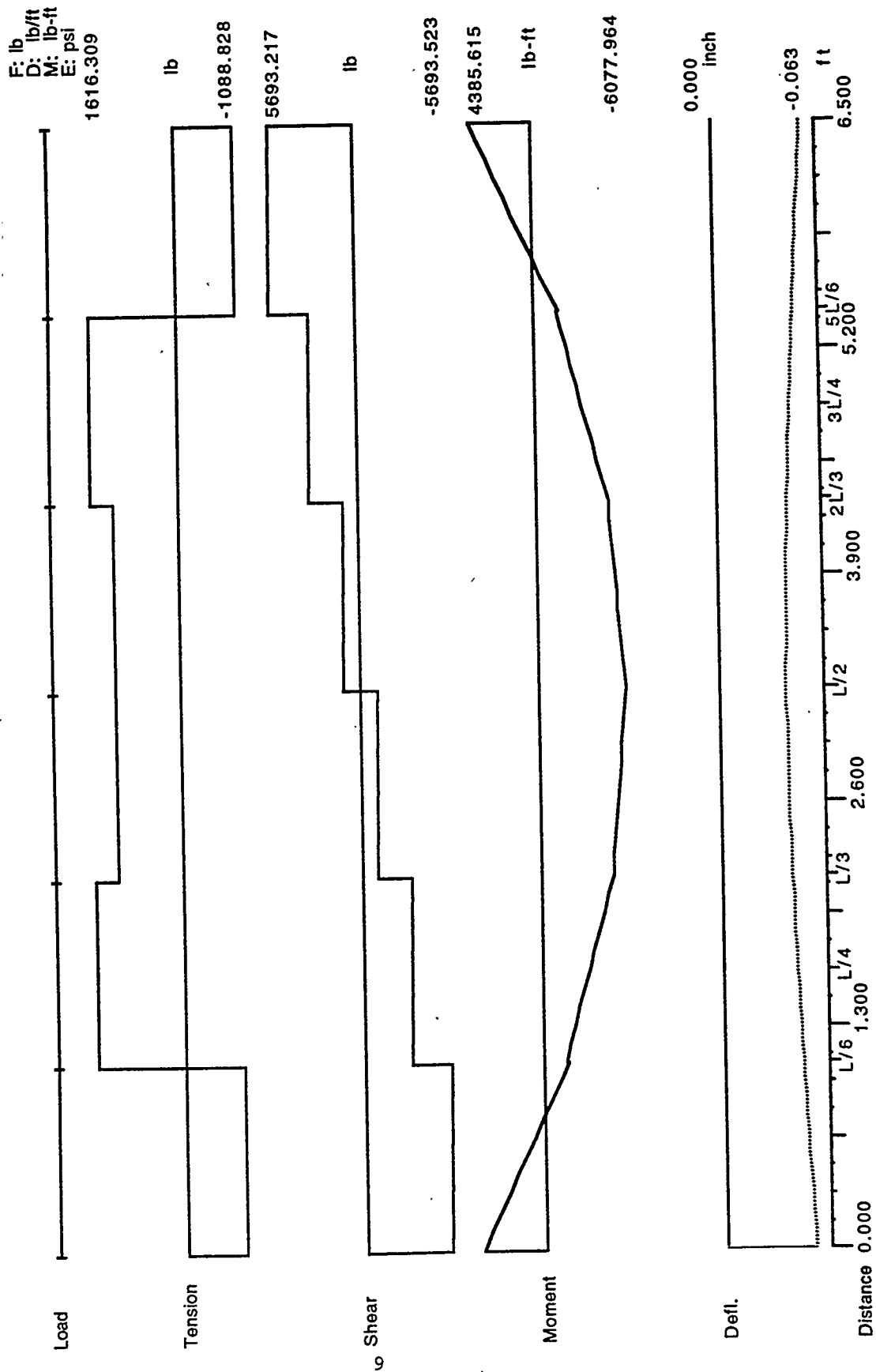
From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
25,26	0.000	-0.071	-0.071
26,27	0.000	-0.077	-0.077
27,28	0.000	-0.079	-0.079
28,29	0.000	-0.079	-0.079
29,30	0.000	-0.077	-0.077
30,31	0.000	-0.071	-0.071

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
1.083	-0.001	-0.071
2.167	-0.000	-0.077
3.250	0.000	-0.079
4.333	0.000	-0.077
5.417	0.001	-0.071
At evenly-spaced intervals:		
0.000	-0.000	-0.064
0.650	-0.001	-0.068
1.300	-0.001	-0.073
1.950	-0.000	-0.076
2.600	-0.000	-0.079
3.250	0.000	-0.079
3.900	0.000	-0.079
4.550	0.000	-0.076
5.200	0.001	-0.073
5.850	0.001	-0.068
6.500	0.000	-0.064

FRAME MAC file: 5(21/21)S PRELIMINARY; Last modified at 17:53:11 on Thu, May 6, 1993

Node 8	Node 9	Node 10	Node 11	Node 12	Node 13	Node 14
1.000	2.083	3.167	4.250	5.333	6.417	7.500
0.000	0.000	0.000	0.000	0.000	0.000	0.000



Continuous Elements Output Data

FRAME MAC file: 5(21/21)S PRELIMINARY.

Last modified at 17:53:11 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
8	-0.000	-0.063	0.000
9	-0.000	-0.056	0.001
10	-0.000	-0.049	0.000
11	-0.000	-0.047	0.000
12	0.000	-0.049	-0.000
13	0.000	-0.056	-0.001
14	0.000	-0.063	-0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
8,9	0.000	85.313	15.404	0.000	85.313	-15.404
9,10	0.000	85.312	15.404	0.000	85.312	-15.404
10,11	0.000	85.312	15.404	0.000	85.312	-15.404
11,12	0.000	85.313	15.404	0.000	85.313	-15.404
12,13	0.000	85.313	15.404	0.000	85.313	-15.404
13,14	0.000	85.312	15.404	0.000	85.312	-15.404

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
8,9	1088.827	-5522.898	-4385.615	-1088.827	5693.523	-1689.946
9,10	-1616.309	-3076.738	1550.359	1616.309	3247.363	-4975.914
10,11	-1197.086	-930.836	4977.136	1197.086	1101.461	-6077.964
11,12	-1197.056	1101.666	6077.959	1197.056	-931.041	-4976.909
12,13	-1616.141	3247.400	4975.679	1616.141	-3076.775	-1550.084
13,14	1088.828	5693.217	1689.651	-1088.828	-5522.592	4385.579

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
8,9	-0.000	-0.063	0.000	-0.000	-0.056	0.001
9,10	-0.000	-0.056	0.001	-0.000	-0.049	0.000
10,11	-0.000	-0.049	0.000	-0.000	-0.047	0.000
11,12	-0.000	-0.047	0.000	0.000	-0.049	-0.000
12,13	0.000	-0.049	-0.000	0.000	-0.056	-0.001
13,14	0.000	-0.056	-0.001	0.000	-0.063	-0.000

Maximum deformations:

Node 9 moved 0.000 inch to the left.
Node 13 moved 0.000 inch to the right.
Node 8 moved 0.063 inch downwards.
No nodes moved upwards.
Node 13 rotated 0.001 radian clockwise.
Node 9 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension	Minimum tension	Max. abs. tension	Maximum stress	Minimum stress	Max. abs. stress

---	lb	lb	lb	psi	psi	psi
8,9	0.000	-1088.827	-1088.827	0.000	-10.082	-10.082
9,10	1616.309	0.000	1616.309	14.966	0.000	14.966
10,11	1197.086	0.000	1197.086	11.084	0.000	11.084
11,12	1197.056	0.000	1197.056	11.084	0.000	11.084
12,13	1616.141	0.000	1616.141	14.964	0.000	14.964
13,14	0.000	-1088.828	-1088.828	0.000	-10.082	-10.082

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
8,9	0.000	-5693.523	-5693.523	0.000	-52.718	-52.718
9,10	0.000	-3247.363	-3247.363	0.000	-30.068	-30.068
10,11	0.000	-1101.461	-1101.461	0.000	-10.199	-10.199
11,12	1101.666	0.000	1101.666	10.201	0.000	10.201
12,13	3247.400	0.000	3247.400	30.069	0.000	30.069
13,14	5693.217	0.000	5693.217	52.715	0.000	52.715

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
8,9	4385.615	-1689.946	4385.615	324.860	-125.181	324.860
9,10	0.000	-4975.914	-4975.914	0.000	-368.586	-368.586
10,11	0.000	-6077.964	-6077.964	0.000	-450.220	-450.220
11,12	0.000	-6077.959	-6077.959	0.000	-450.219	-450.219
12,13	0.000	-4975.679	-4975.679	0.000	-368.569	-368.569
13,14	4385.579	-1689.651	4385.579	324.858	-125.159	324.858

Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
8,9	0.000	-0.063	-0.063
9,10	0.000	-0.056	-0.056
10,11	0.000	-0.049	-0.049
11,12	0.000	-0.049	-0.049
12,13	0.000	-0.056	-0.056
13,14	0.000	-0.063	-0.063

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
At the intermediate nodes:		
1.083	0.001	-0.056
2.167	0.000	-0.049
3.250	0.000	-0.047
4.333	-0.000	-0.049
5.417	-0.001	-0.056
At evenly-spaced intervals:		
0.000	0.000	-0.063
0.650	0.001	-0.059
1.300	0.001	-0.054
1.950	0.000	-0.050
2.600	0.000	-0.048
3.250	0.000	-0.047
3.900	-0.000	-0.048
4.550	-0.000	-0.050
5.200	-0.001	-0.054
5.850	-0.001	-0.059
6.500	-0.000	-0.063

FRAME MAC file: 5(21/21)S PRELIMINARY; Last modified at 17:53:11 on Thu, May 6, 1993

Node 8
1.000
0.000

Node 15
1.000
1.083

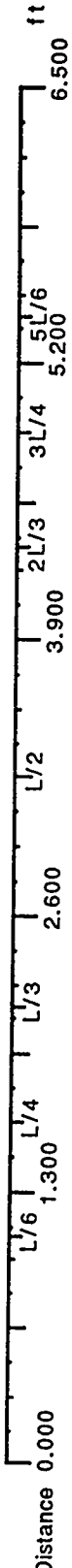
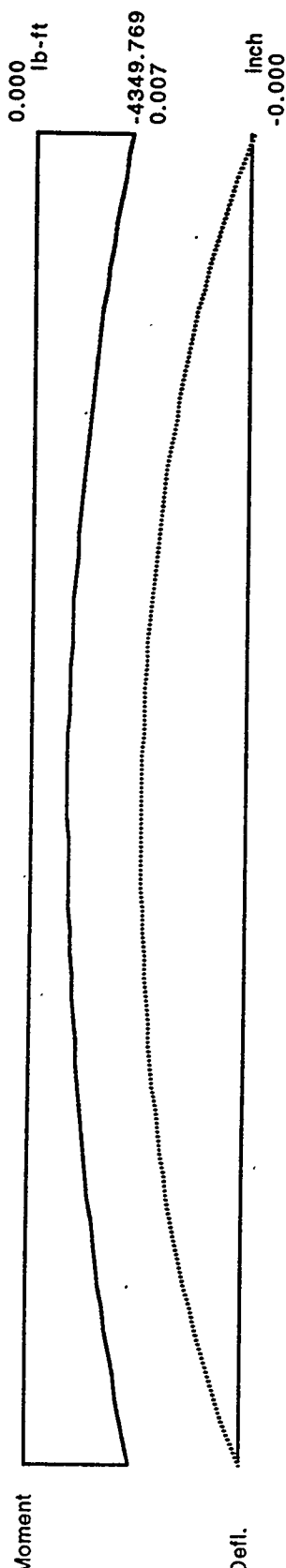
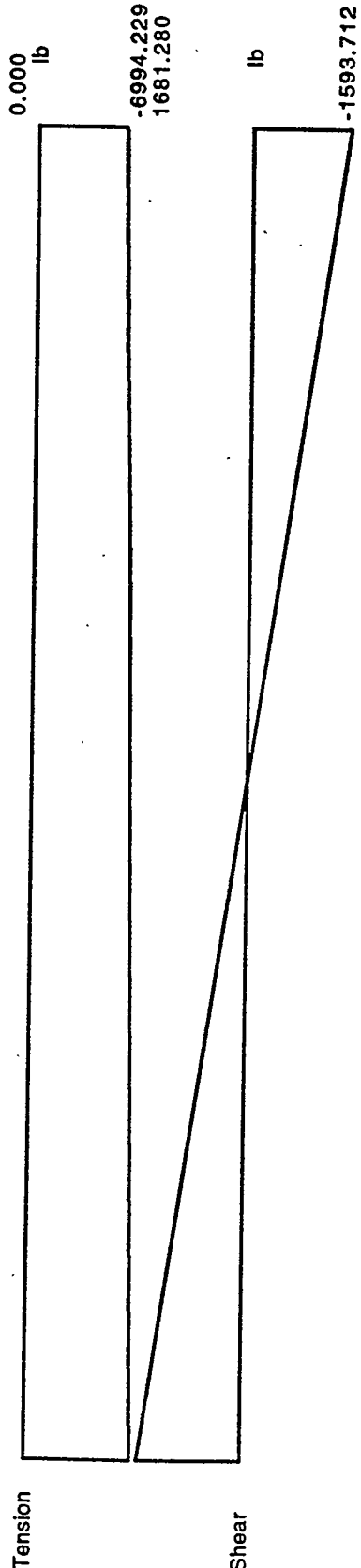
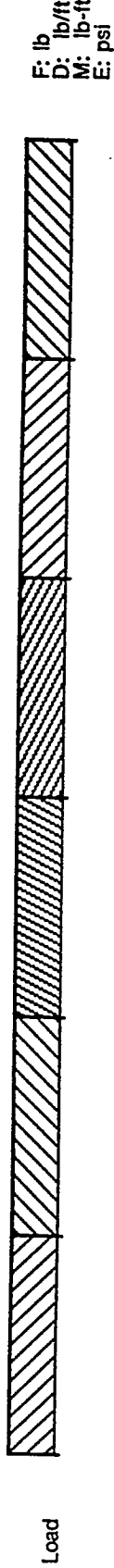
Node 17
1.000
2.167

Node 19
1.000
3.250

Node 21
1.000
4.333

Node 23
1.000
5.417

Node 25
1.000
6.500



Continuous Elements Output Data

FRAME MAC file: 5(21/21)S PRELIMINARY.

Last modified at 17:53:11 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

8	-0.000	-0.063	0.000
15	-0.005	-0.063	0.000
17	-0.007	-0.063	0.000
19	-0.007	-0.064	-0.000
21	-0.007	-0.064	-0.000
23	-0.004	-0.064	-0.000
25	0.000	-0.064	-0.000

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft

8,15	85.313	273.000	49.292	85.313	272.832	-49.292
15,17	85.312	273.000	49.292	85.312	272.832	-49.292
17,19	85.312	273.000	49.292	85.312	272.832	-49.292
19,21	85.313	273.000	49.292	85.313	272.832	-49.292
21,23	85.313	273.000	49.292	85.313	272.832	-49.292
23,25	85.312	273.000	49.292	85.312	272.832	-49.292

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft

8,15	6994.229	1681.280	4349.769	-6823.604	-1135.448	-2824.133
15,17	6823.604	1135.448	2824.133	-6652.979	-589.616	-1889.814
17,19	6652.979	589.616	1889.814	-6482.354	-43.784	-1546.813
19,21	6482.354	43.784	1546.813	-6311.729	502.048	-1795.130
21,23	6311.729	-502.048	1795.130	-6141.104	1047.880	-2634.766
23,25	6141.104	-1047.880	2634.766	-5970.479	1593.712	-4065.719

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians

8,15	-0.063	0.000	0.000	-0.063	0.005	0.000
15,17	-0.063	0.005	0.000	-0.063	0.007	0.000
17,19	-0.063	0.007	0.000	-0.064	0.007	-0.000
19,21	-0.064	0.007	-0.000	-0.064	0.007	-0.000
21,23	-0.064	0.007	-0.000	-0.064	0.004	-0.000
23,25	-0.064	0.004	-0.000	-0.064	-0.000	-0.000

Maximum deformations:

Node 19 moved 0.007 inch to the left.
Node 25 moved 0.000 inch to the right.
Node 25 moved 0.064 inch downwards.
No nodes moved upwards.
Node 25 rotated 0.000 radian clockwise.
Node 8 rotated 0.000 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension	Minimum tension	Max. abs. tension	Maximum ten. str.	Minimum ten. str.	Max. abs. stress

---	lb	lb	lb	psi	psi	psi
8,15	0.000	-6994.229	-6994.229	0.000	-64.761	-64.761
15,17	0.000	-6823.604	-6823.604	0.000	-63.182	-63.182
17,19	0.000	-6652.979	-6652.979	0.000	-61.602	-61.602
19,21	0.000	-6482.354	-6482.354	0.000	-60.022	-60.022
21,23	0.000	-6311.729	-6311.729	0.000	-58.442	-58.442
23,25	0.000	-6141.104	-6141.104	0.000	-56.862	-56.862

Maximum shear and shear stress values:						
From, To	Maximum	Minimum	Max. abs.	Maximum	Minimum	Max. abs.
Node	shear	shear	shear	shr. str.	shr. str.	stress
---	lb	lb	lb	psi	psi	psi
8,15	1681.280	0.000	1681.280	15.567	0.000	15.567
15,17	1135.448	0.000	1135.448	10.513	0.000	10.513
17,19	589.616	0.000	589.616	5.459	0.000	5.459
19,21	43.784	-502.048	-502.048	0.405	-4.649	-4.649
21,23	0.000	-1047.880	-1047.880	0.000	-9.703	-9.703
23,25	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757

Maximum moment and bending stress values:						
From, To	Maximum	Minimum	Max. abs.	Maximum	Minimum	Max. abs.
Node	moment	moment	moment	ben. str.	ben. str.	stress
---	lb-ft	lb-ft	lb-ft	psi	psi	psi
8,15	0.000	-4349.769	-4349.769	0.000	-322.205	-322.205
15,17	0.000	-2824.133	-2824.133	0.000	-209.195	-209.195
17,19	0.000	-1889.814	-1889.814	0.000	-139.986	-139.986
19,21	0.000	-1795.130	-1795.130	0.000	-132.973	-132.973
21,23	0.000	-2634.766	-2634.766	0.000	-195.168	-195.168
23,25	0.000	-4065.719	-4065.719	0.000	-301.164	-301.164

Maximum deflection values:						
From, To	Maximum defl.		Maximum defl.	Maximum defl.		
Node	up (left)		down (rt.)	absolute		
---	inch		inch	inch		
8,15	0.005		0.000	0.005		
15,17	0.007		0.000	0.007		
17,19	0.007		0.000	0.007		
19,21	0.007		0.000	0.007		
21,23	0.007		0.000	0.007		
23,25	0.004		-0.000	0.004		

Deflections along the elements (positive is up or counter-clockwise):						
Distance from	Rotation		Deflection			
left (bottom)	---		---			
ft	radian		inch			

At the intermediate nodes:						
1.083	0.000		0.005			
2.167	0.000		0.007			
3.250	-0.000		0.007			
4.333	-0.000		0.007			
5.417	-0.000		0.004			
At evenly-spaced intervals:						
0.000	0.000		0.000			
0.650	0.000		0.003			
1.300	0.000		0.005			
1.950	0.000		0.007			
2.600	0.000		0.007			
3.250	-0.000		0.007			
3.900	-0.000		0.007			
4.550	-0.000		0.006			
5.200	-0.000		0.005			
5.850	-0.000		0.003			
6.500	-0.000		-0.000			

FRAME MAC file: 5(21/21)S PRELIMINARY; Last modified at 17:53:11 on Thu, May 6, 1993

Node 14
7.500
0.000

Node 16
7.500
1.083

Node 18
7.500
2.167

Node 20
7.500
3.250

Node 22
7.500
4.333

Node 24
7.500
5.417

Node 31
7.500
6.500

F: lb
D: lb/ft
M: lb-ft
E: psi



Load

0.000
lb



Tension

-6993.661
1593.712



Shear

lb

-1681.280
4349.740



Moment

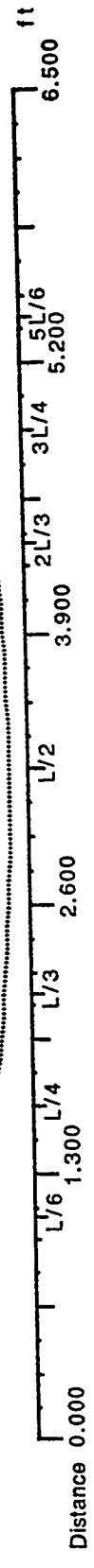
lb-ft
0.000

0.000
Inch



Defl.

-0.007



Distance 0.000

```

*****
Continuous Elements Output Data
*****
FRAME MAC file: 5(21/21)S PRELIMINARY.
Last modified at 17:53:11 on Thu, May 6, 1993.
All coord. and distances are in ft from the left (bot.) end of the element.
*****
Support reactions: (pos. force is to right or up; pos. moment is ccw.)
*****
Node      Reaction      Reaction      Reaction
No.      1b (FX)      1b (FY)      1b-ft (MZ)
-----
Node deformations: (positive is to right, up, or counterclockwise.)
Node      Deflection      Deflection      Rotation
No.      inch (FX)      inch (FY)      radians (MZ)
-----
14      0.000      -0.063      -0.000
16      0.005      -0.063      -0.000
18      0.007      -0.063      -0.000
20      0.007      -0.064      0.000
22      0.007      -0.064      0.000
24      0.004      -0.064      0.000
31      -0.000      -0.064      0.000
*****
Element fixed-end forces & moments: (local coordinate system)
From, To  FxL      FyL      MzL      FxR      FyR      MzR
Nodes      lb      lb      lb-ft      lb      lb      lb-ft
-----
14,16      85.313    -273.000   -49.292    85.313    -272.832   49.292
16,18      85.312    -273.000   -49.292    85.312    -272.832   49.292
18,20      85.312    -273.000   -49.292    85.312    -272.832   49.292
20,22      85.313    -273.000   -49.292    85.313    -272.832   49.292
22,24      85.313    -273.000   -49.292    85.313    -272.832   49.292
24,31      85.312    -273.000   -49.292    85.312    -272.832   49.292
*****
Actual element end forces & moments: (local coordinate system)
From, To  FxL      FyL      MzL      FxR      FyR      MzR
Nodes      lb      lb      lb-ft      lb      lb      lb-ft
-----
14,16      6993.661  -1681.280  -4349.740  -6823.036  1135.448  2824.104
16,18      6823.036  -1135.448  -2824.104  -6652.411  589.616  1889.785
18,20      6652.411  -589.616  -1889.785  -6481.786  43.784  1546.784
20,22      6481.786  -43.784  -1546.784  -6311.161  -502.048  1795.101
22,24      6311.161  502.048  -1795.101  -6140.536  -1047.880  2634.737
24,31      6140.536  1047.880  -2634.737  -5969.911  -1593.712  4065.690
*****
Member end deformations: (local coordinate system)
From, To  dx at L  dy at L  rotZ at L  dx at R  dy at R  rotZ at R
Nodes      inch      inch      radians      inch      inch      radians
-----
14,16      -0.063    -0.000    -0.000    -0.063    -0.005    -0.000
16,18      -0.063    -0.005    -0.000    -0.063    -0.007    -0.000
18,20      -0.063    -0.007    -0.000    -0.064    -0.007    0.000
20,22      -0.064    -0.007    0.000    -0.064    -0.007    0.000
22,24      -0.064    -0.007    0.000    -0.064    -0.004    0.000
24,31      -0.064    -0.004    0.000    -0.064    0.000    0.000
*****
Maximum deformations:
Node 31 moved 0.000 inch to the left.
Node 20 moved 0.007 inch to the right.
Node 31 moved 0.064 inch downwards.
No nodes moved upwards.
Node 14 rotated 0.000 radian clockwise.
Node 31 rotated 0.000 radian counter-clockwise.
*****
Maximum reactions:
There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.
*****
Maximum tension and tensile stress values (compression is negative):
From, To  Maximum  Minimum  Max. abs.  Maximum  Minimum  Max. abs.
Node      tension  tension  tension  ten. str.  ten. str.  stress

```

---	lb	lb	lb	psi	psi	psi
14,16	0.000	-6993.661	-6993.661	0.000	-64.756	-64.756
16,18	0.000	-6823.036	-6823.036	0.000	-63.176	-63.176
18,20	0.000	-6652.411	-6652.411	0.000	-61.596	-61.596
20,22	0.000	-6481.786	-6481.786	0.000	-60.017	-60.017
22,24	0.000	-6311.161	-6311.161	0.000	-58.437	-58.437
24,31	0.000	-6140.536	-6140.536	0.000	-56.857	-56.857

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
---	---	---	---	---	---	---
14,16	0.000	-1681.280	-1681.280	0.000	-15.567	-15.567
16,18	0.000	-1135.448	-1135.448	0.000	-10.513	-10.513
18,20	0.000	-589.616	-589.616	0.000	-5.459	-5.459
20,22	502.048	-43.784	502.048	4.649	-0.405	4.649
22,24	1047.880	0.000	1047.880	9.703	0.000	9.703
24,31	1593.712	0.000	1593.712	14.757	0.000	14.757

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
---	---	---	---	---	---	---
14,16	4349.740	0.000	4349.740	322.203	0.000	322.203
16,18	2824.104	0.000	2824.104	209.193	0.000	209.193
18,20	1889.785	0.000	1889.785	139.984	0.000	139.984
20,22	1795.101	0.000	1795.101	132.970	0.000	132.970
22,24	2634.737	0.000	2634.737	195.166	0.000	195.166
24,31	4065.690	0.000	4065.690	301.162	0.000	301.162

Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
---	---	---	---
14,16	0.000	-0.005	-0.005
16,18	0.000	-0.007	-0.007
18,20	0.000	-0.007	-0.007
20,22	0.000	-0.007	-0.007
22,24	0.000	-0.007	-0.007
24,31	0.000	-0.004	-0.004

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch
---	---	---
At the intermediate nodes:		
1.083	-0.000	-0.005
2.167	-0.000	-0.007
3.250	0.000	-0.007
4.333	0.000	-0.007
5.417	0.000	-0.004

At evenly-spaced intervals:

Distance from left (bottom) ft	Rotation radian	Deflection inch
---	---	---
0.000	-0.000	-0.000
0.650	-0.000	-0.003
1.300	-0.000	-0.005
1.950	-0.000	-0.007
2.600	-0.000	-0.007
3.250	0.000	-0.007
3.900	0.000	-0.007
4.550	0.000	-0.006
5.200	0.000	-0.005
5.850	0.000	-0.003
6.500	0.000	0.000

Output Data

FRAME MAC file: 5(21/21)S PRELIMINARY.

Last modified at 17:53:11 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,8	0.000	-1471.331	-1471.331	0.000	-18.863	-18.863
2,9	0.000	-2605.944	-2605.944	0.000	-16.705	-16.705
3,10	0.000	-2314.832	-2314.832	0.000	-14.839	-14.839
4,11	0.000	-2203.127	-2203.127	0.000	-14.123	-14.123
5,12	0.000	-2314.665	-2314.665	0.000	-14.838	-14.838
6,13	0.000	-2605.602	-2605.602	0.000	-16.703	-16.703
7,14	0.000	-1471.069	-1471.069	0.000	-18.860	-18.860
8,9	0.000	-1088.827	-1088.827	0.000	-10.082	-10.082
8,15	0.000	-6994.229	-6994.229	0.000	-64.761	-64.761
9,10	1616.309	0.000	1616.309	14.966	0.000	14.966
10,11	1197.086	0.000	1197.086	11.084	0.000	11.084
11,12	1197.056	0.000	1197.056	11.084	0.000	11.084
12,13	1616.141	0.000	1616.141	14.964	0.000	14.964
13,14	0.000	-1088.828	-1088.828	0.000	-10.082	-10.082
14,16	0.000	-6993.661	-6993.661	0.000	-64.756	-64.756
15,17	0.000	-6823.604	-6823.604	0.000	-63.182	-63.182
16,18	0.000	-6823.036	-6823.036	0.000	-63.176	-63.176
17,19	0.000	-6652.979	-6652.979	0.000	-61.602	-61.602
18,20	0.000	-6652.411	-6652.411	0.000	-61.596	-61.596
19,21	0.000	-6482.354	-6482.354	0.000	-60.022	-60.022
20,22	0.000	-6481.786	-6481.786	0.000	-60.017	-60.017
21,23	0.000	-6311.729	-6311.729	0.000	-58.442	-58.442
22,24	0.000	-6311.161	-6311.161	0.000	-58.437	-58.437
23,25	0.000	-6141.104	-6141.104	0.000	-56.862	-56.862
24,31	0.000	-6140.536	-6140.536	0.000	-56.857	-56.857
25,26	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
26,27	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
27,28	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
28,29	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
29,30	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
30,31	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757

Output Data

FRAME MAC file: 5(21/21)S PRELIMINARY.

Last modified at 17:53:11 on Thu, May 6, 1993.

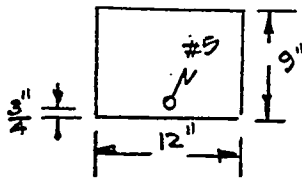
All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,8	0.000	-1471.331	-1471.331	0.000	-18.863	-18.863
2,9	0.000	-2605.944	-2605.944	0.000	-16.705	-16.705
3,10	0.000	-2314.832	-2314.832	0.000	-14.839	-14.839
4,11	0.000	-2203.127	-2203.127	0.000	-14.123	-14.123
5,12	0.000	-2314.665	-2314.665	0.000	-14.838	-14.838
6,13	0.000	-2605.602	-2605.602	0.000	-16.703	-16.703
7,14	0.000	-1471.069	-1471.069	0.000	-18.860	-18.860
8,9	0.000	-1088.827	-1088.827	0.000	-10.082	-10.082
8,15	0.000	-6994.229	-6994.229	0.000	-64.761	-64.761
9,10	1616.309	0.000	1616.309	14.966	0.000	14.966
10,11	1197.086	0.000	1197.086	11.084	0.000	11.084
11,12	1197.056	0.000	1197.056	11.084	0.000	11.084
12,13	1616.141	0.000	1616.141	14.964	0.000	14.964
13,14	0.000	-1088.828	-1088.828	0.000	-10.082	-10.082
14,16	0.000	-6993.661	-6993.661	0.000	-64.756	-64.756
15,17	0.000	-6823.604	-6823.604	0.000	-63.182	-63.182
16,18	0.000	-6823.036	-6823.036	0.000	-63.176	-63.176
17,19	0.000	-6652.979	-6652.979	0.000	-61.602	-61.602
18,20	0.000	-6652.411	-6652.411	0.000	-61.596	-61.596
19,21	0.000	-6482.354	-6482.354	0.000	-60.022	-60.022
20,22	0.000	-6481.786	-6481.786	0.000	-60.017	-60.017
21,23	0.000	-6311.729	-6311.729	0.000	-58.442	-58.442
22,24	0.000	-6311.161	-6311.161	0.000	-58.437	-58.437
23,25	0.000	-6141.104	-6141.104	0.000	-56.862	-56.862
24,31	0.000	-6140.536	-6140.536	0.000	-56.857	-56.857
25,26	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
26,27	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
27,28	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
28,29	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
29,30	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757
30,31	0.000	-1593.712	-1593.712	0.000	-14.757	-14.757

SOUTH ELEVATION
N/E 10.42 ft = 11.7
16.5

1. MOMENT CAPACITY - ROOF, FLOOR WALLS



$$a = \frac{A_{ST} f_y}{0.85 f'_c b} = \frac{(0.31)(60,000)}{(0.85)(3,000)(12)} = 0.609 \text{ in.}$$

$$A_{ST} = (1)(\pi) \frac{(0.625)^2}{4} = 0.31 \text{ in.}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in.}$$

$$d = 9 - 0.75 - 0.625/2 = 7.94 \text{ in.}$$

$$\phi = 0.9$$

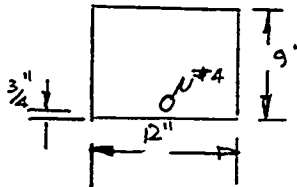
$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$= 0.9 \left[(0.31)(60,000) \left(7.94 - \frac{0.60}{2} \right) \right]$$

$$= 124,036 \text{ in.-lbs.}$$

$$= 10,336 \text{ ft.-lbs.}$$

LEFT & RIGHT WALL.



$$a = \frac{A_{ST} f_y}{(0.85) f'_c (b_w)} = \frac{(0.1936)(60,000)}{(0.85)(3,000)(12)} = 0.3849$$

$$A_{ST} = (1)(\pi) \frac{(0.5)^2}{4} = 0.1963 \text{ in.}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12 \text{ in.}$$

$$d = 9 - 0.75 - 0.5/2 = 8 \text{ in.}$$

$$\phi = 0.9$$

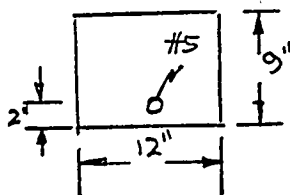
$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$= 0.9 \left[(0.1963)(60,000) \left(8 - \frac{0.3849}{2} \right) \right]$$

$$= 82,761 \text{ in.-lbs.}$$

$$= 6,897 \text{ ft.-lbs.}$$

SECTION $\frac{S}{21|21}$ PRELIMINARY
LEFT & RIGHT WALLS.



$$a = \frac{A_{ST} f_y}{(0.85) f'_c b_w} = \frac{(0.31)(60,000)}{(0.85)(3,000)(12)} = 0.61$$

$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right]$$

$$= (0.9) \left[(0.31)(60,000) \left(6.70 - \frac{0.61}{2} \right) \right]$$

$$= 103,734 \text{ in-lbs}$$

$$= \underline{8,644 \text{ ft-lbs}}$$

2.0 SHEAR CAPACITY.

$$\phi V_c = (0.85)(2) \sqrt{f'_c} \cdot b_w \cdot d$$

$$\phi V_c = (0.85)(2) \sqrt{3,000} (12)(7.94)$$

$$\phi V_c = \underline{8,872 \text{ lb}}$$

$$\phi = 0.85$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12"$$

$$d = 9 - 0.75 - \frac{0.625}{2} = 7.94"$$

3 AXIAL CAPACITY.

$$\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$= (0.55)(0.7)(3,000)(108) \left[1 - \left(\frac{(0.8)(89)}{(32)(9)} \right)^2 \right]$$

$$\phi P_{nw} = \underline{117,116 \text{ lb}}$$

$$\phi = 0.7$$

$$l_c = 7.5 \times 12 = 89"$$

$$h = 9"$$

$$K = 0.8$$

$$A_g = 12" \times 9" = 108"$$

$$f'_c = 3,000 \text{ psi}$$



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-4 (22/22)

TITLE: Preliminary Structural Assessment of Tunnel Section 4(22/22)

PROJECT: Remedial Shielding Concepts for Line D and Line D

Facilities. Los Alamos Meson Physics Facility,

Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 4(22/22) subjected to vertical and horizontal loads

estimated as 115 lbs/ft² for each 1 ft of soil covering the structure

and a horizontal load equivalent to 0.3 of the estimated cover load.

Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY: _____

DATE: _____

Number of Pages Including Title Page 27

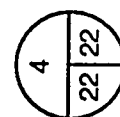
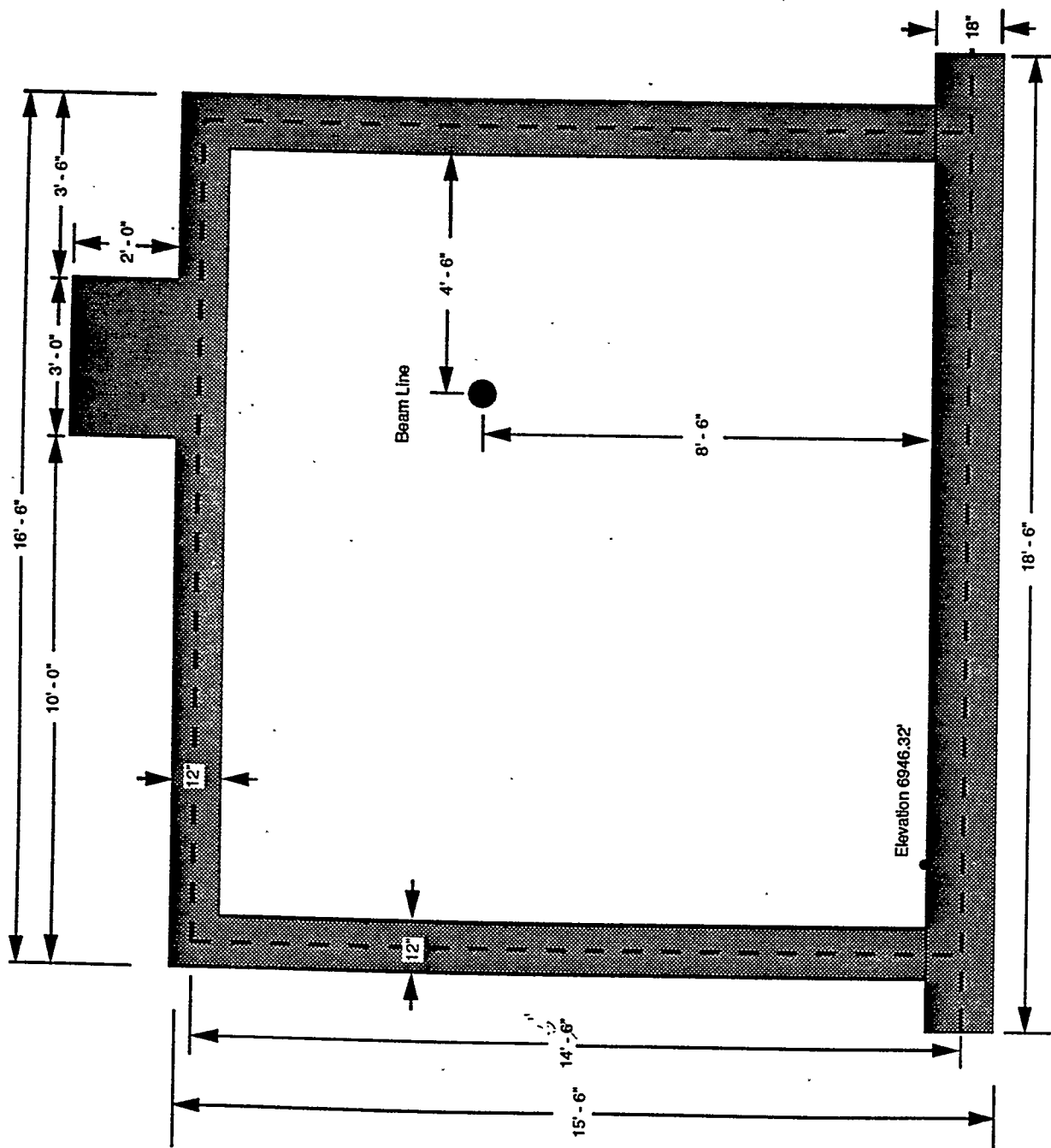


Figure () Section

TUNNEL SECTION 4 22/27	TITLE OF ANALYSIS <u>PRELIMINARY</u> PAGE <u>1</u> OF <u>3</u>

ROOF ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.550</u> ft

FLOOR ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>18</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>5832</u> in ⁴
Sectional Modulus Ic/C	S = <u>972</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>5.196</u> in
Neutral Axis	NA = <u>9.0</u> in
Extreme Fiber	C = <u>9.0</u> in
Element Length	L = <u>1.550</u> ft

LEFTWALL ELEMENT PROPERTIES	
Youngs Modulus w $1.5 (33)\sqrt{f \cdot c}$	E = 3.32×10^6 psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.425</u> ft

TUNNEL SECTION 4 2232	TITLE OF ANALYSIS <u>PRELIMINARY</u> PAGE <u>2</u> OF <u>3</u>
RIGHTWALL ELEMENT PROPERTIES	
Youngs Modulus $w 1.5 (33)\sqrt{f'c}$	E = <u>3.32×10^6</u> psi
Area of Cross Section (b x d)	A = <u>144</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>12</u> in
Weight per Unit Length	W = <u>150</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>1728</u> in ⁴
Sectional Modulus Ic/C	S = <u>288</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>1.425</u> ft
SOIL ELEMENT PROPERTIES	
Youngs Modulus	E = <u>300</u> psi
Area of Cross Section (b x d)	A = <u>223</u> in ²
Depth of Section	d = <u>12.0</u> in
Thickness of Web	b = <u>1.550</u> in
Weight per Unit Length	W = <u>115</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>2678.4</u> in ⁴
Sectional Modulus Ic/C	S = <u>446.4</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>12</u> in
Extreme Fiber	C = <u>12</u> in
Element Length	L = <u>0.083</u> ft 1"
SOILEND PROPERTIES	
Youngs Modulus	E = <u>300</u> psi
Area of Cross Section (b x d)	A = <u>87</u> in ²
Depth of Section	d = <u>12</u> in
Thickness of Web	b = <u>7.25</u> in
Weight per Unit Length	W = <u>69.48</u> lbs/ft
Moment of Inertia $b.d^3 / 12$	Ic = <u>1044</u> in ⁴
Sectional Modulus Ic/C	S = <u>174</u> in ³
Radius of Gyration $\sqrt{Ic/A}$	r = <u>3.464</u> in
Neutral Axis	NA = <u>6.0</u> in
Extreme Fiber	C = <u>6.0</u> in
Element Length	L = <u>0.083</u> ft 1"

TUNNEL SECTION 4 22 27	TITLE OF ANALYSIS <u>PRELIMINARY</u> PAGE <u>3</u> OF <u>3</u>

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

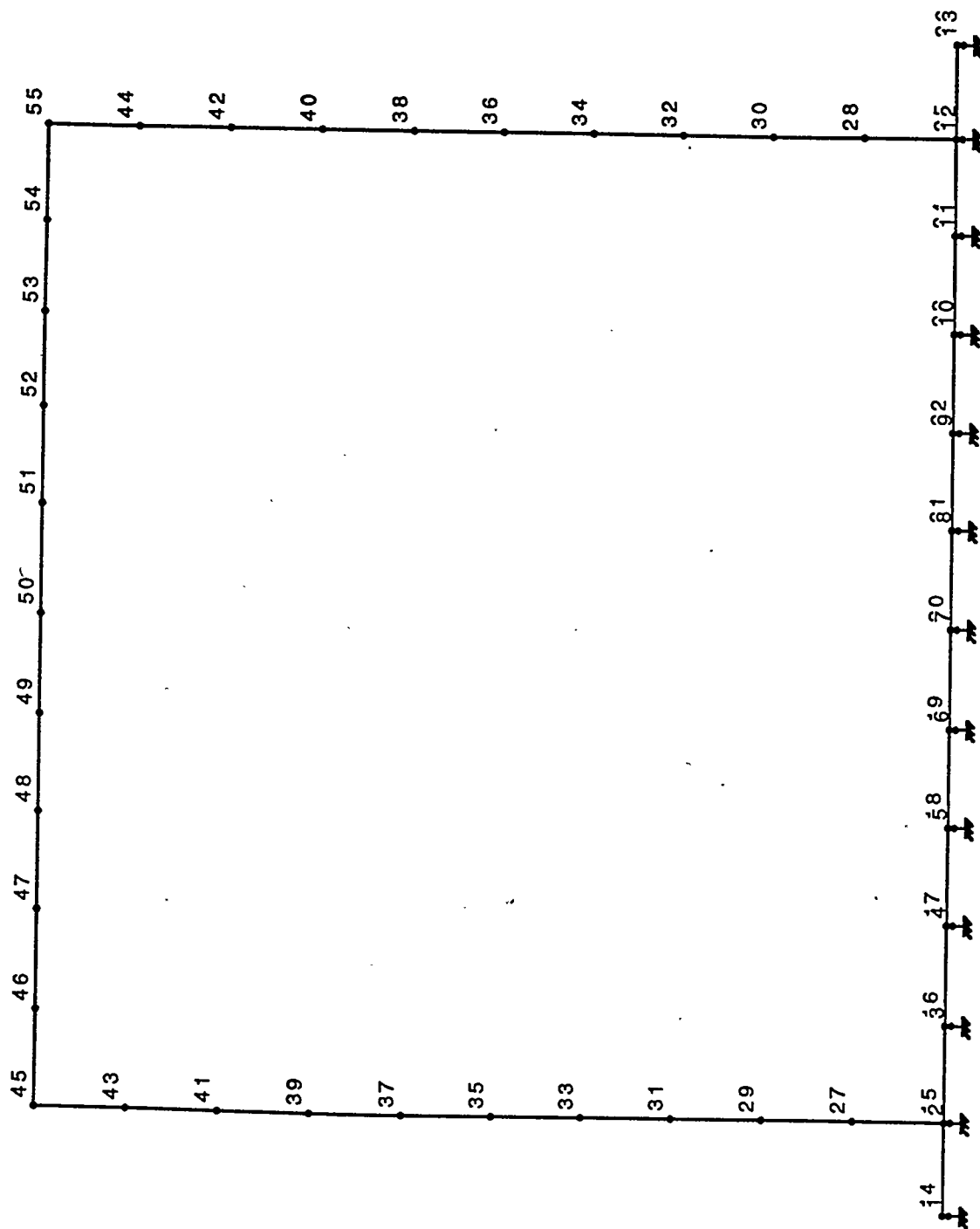
ELEMENT PROPERTIES

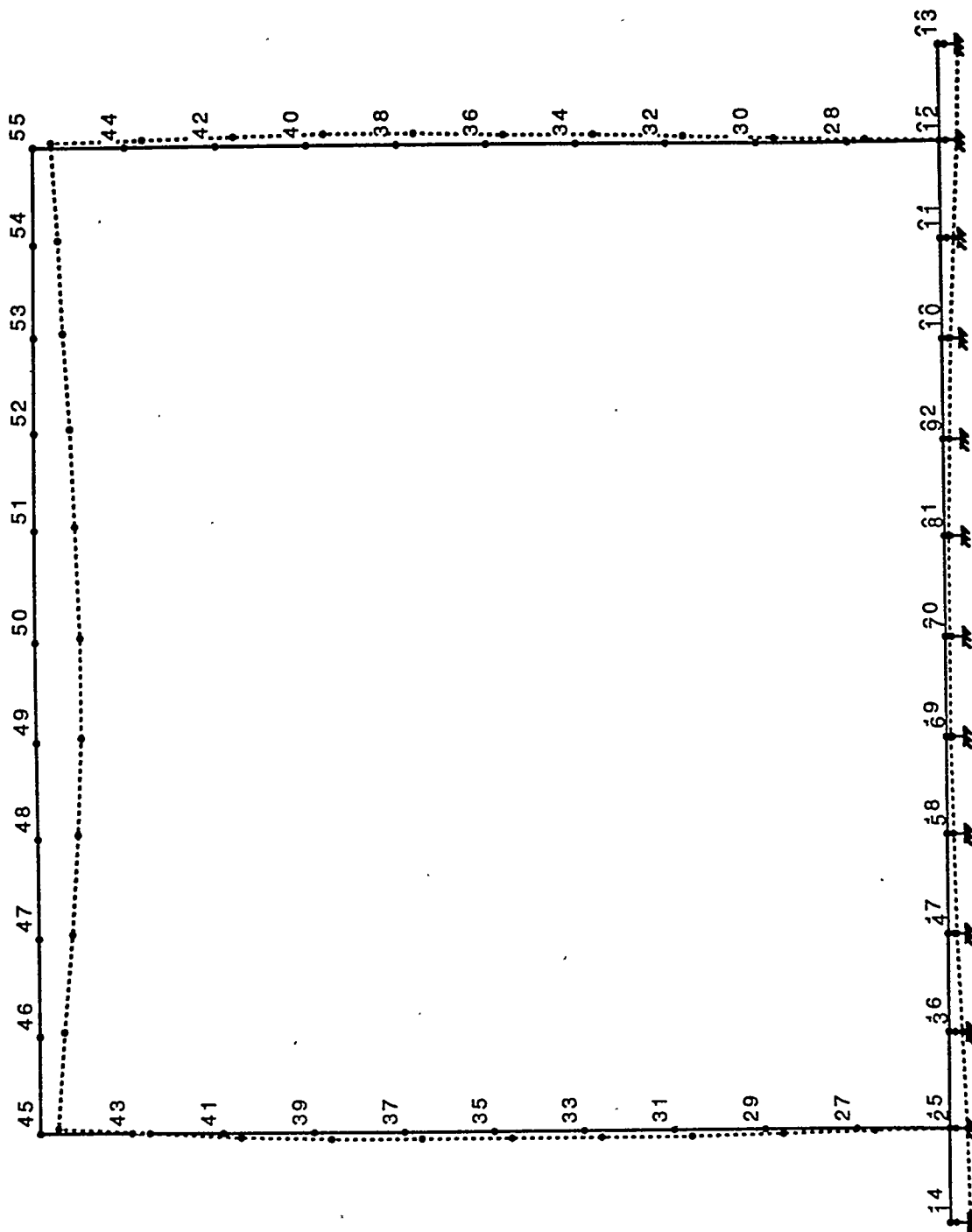
Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

ELEMENT PROPERTIES

Youngs Modulus	E = _____ psi
Area of Cross Section (b x d)	A = _____ in ²
Depth of Section	d = _____ in
Thickness of Web	b = _____ in
Weight per Unit Length	W = _____ lbs/ft
Moment of Inertia $b \cdot d^3 / 12$	Ic = _____ in ⁴
Sectional Modulus Ic/C	S = _____ in ³
Radius of Gyration $\sqrt{Ic/A}$	r = _____ in
Neutral Axis	NA = _____ in
Extreme Fiber	C = _____ in
Element Length	L = _____ ft

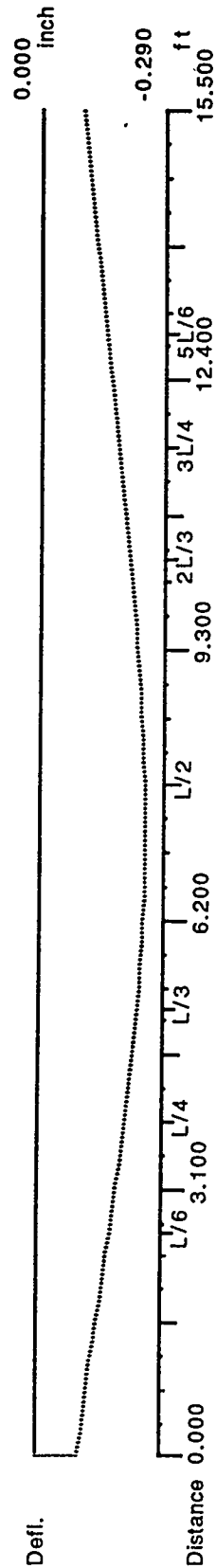
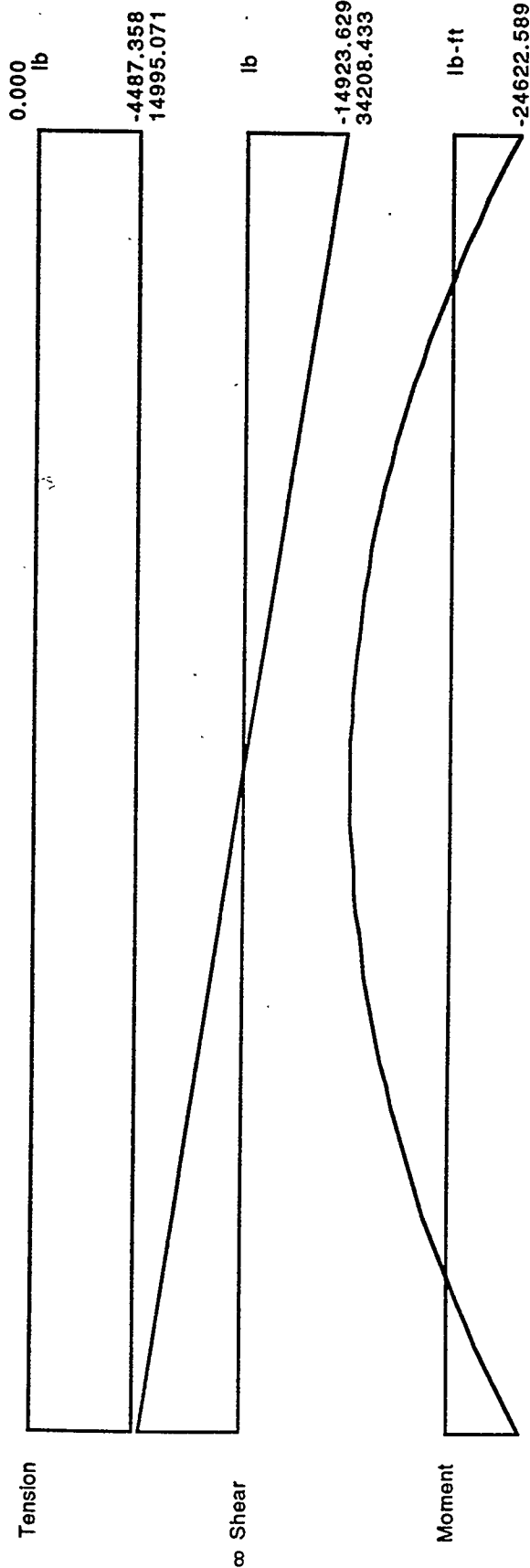
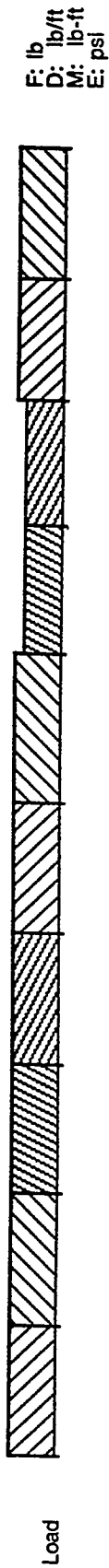
FRAME MAC file: 4(22/22) PRELIMINARY; Last modified at 11:45:35 on Thu, Mar 11, 1993





FRAME MAC file: 4(22/22) PRELIMINARY; Last modified at 11:45:35 on Thu, Mar 11, 1993

Node 45	Node 46	Node 47	Node 48	Node 49	Node 50	Node 51	Node 52	Node 53	Node 54	Node 55
1.500	3.050	4.600	6.150	7.700	9.250	11.000	12.500	14.000	15.450	17.000
14.250	14.250	14.250	14.250	14.250	14.250	14.250	14.250	14.250	14.250	14.250



Continuous Elements Output Data

FRAME MAC file: 4(22/22) PRELIMINARY.

Last modified at 11:45:35 on Thu, Mar 11, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

45	0.027	-0.115	-0.002
46	0.027	-0.165	-0.003
47	0.027	-0.216	-0.003
48	0.027	-0.260	-0.002
49	0.027	-0.285	-0.001
50	0.026	-0.288	0.000
51	0.026	-0.262	0.002
52	0.026	-0.227	0.002
53	0.026	-0.191	0.002
54	0.026	-0.154	0.002
55	0.026	-0.116	0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,46	0.000	1481.025	382.598	0.000	1481.025	-382.598
46,47	0.000	1481.025	382.598	0.000	1481.025	-382.598
47,48	0.000	1481.025	382.598	0.000	1481.025	-382.598
48,49	0.000	1481.025	382.598	0.000	1481.025	-382.598
49,50	0.000	1481.025	382.598	0.000	1481.025	-382.598
50,51	0.000	1672.125	487.703	0.000	1672.125	-487.703
51,52	0.000	1507.800	376.950	0.000	1507.800	-376.950
52,53	0.000	1507.800	376.950	0.000	1507.800	-376.950
53,54	0.000	1385.475	334.823	0.000	1385.475	-334.823
54,55	0.000	1481.025	382.598	0.000	1481.025	-382.598

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
45,46	4487.358	14995.071	24622.589	-4487.358	-12033.021	-3675.817
46,47	4487.358	12033.021	3675.817	-4487.358	-9070.971	12679.777
47,48	4487.358	9070.971	-12679.777	-4487.358	-6108.921	24444.194
48,49	4487.358	6108.921	-24444.194	-4487.358	-3146.871	31617.434
49,50	4487.358	3146.871	-31617.434	-4487.358	-184.821	34199.496
50,51	4487.358	184.821	-34199.496	-4487.358	3159.429	31596.714
51,52	4487.358	-3159.429	-31596.714	-4487.358	6175.029	24595.872
52,53	4487.358	-6175.029	-24595.872	-4487.358	9190.629	13071.629
53,54	4487.358	-9190.629	-13071.629	-4487.358	11961.579	-2263.721
54,55	4487.358	-11961.579	2263.721	-4487.358	14923.629	-23099.757

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
45,46	0.027	-0.115	-0.002	0.027	-0.165	-0.003
46,47	0.027	-0.165	-0.003	0.027	-0.216	-0.003
47,48	0.027	-0.216	-0.003	0.027	-0.260	-0.002
48,49	0.027	-0.260	-0.002	0.027	-0.285	-0.001
49,50	0.027	-0.285	-0.001	0.026	-0.288	0.000
50,51	0.026	-0.288	0.000	0.026	-0.262	0.002
51,52	0.026	-0.262	0.002	0.026	-0.227	0.002
52,53	0.026	-0.227	0.002	0.026	-0.191	0.002
53,54	0.026	-0.191	0.002	0.026	-0.154	0.002
54,55	0.026	-0.154	0.002	0.026	-0.116	0.002

Maximum deformations:

No nodes moved to the left.

Node 45 moved 0.027 inch to the right.

Node 50 moved 0.288 inch downwards.
 No nodes moved upwards.
 Node 46 rotated 0.003 radian clockwise.
 Node 54 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
45,46	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
46,47	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
47,48	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
48,49	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
49,50	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
50,51	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
51,52	0.000	-4487.358	-4487.358	0.000	-10.387	-10.387
52,53	0.000	-4487.358	-4487.358	0.000	-10.387	-10.387
53,54	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
54,55	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
45,46	14995.071	0.000	14995.071	104.132	0.000	104.132
46,47	12033.021	0.000	12033.021	83.563	0.000	83.563
47,48	9070.971	0.000	9070.971	62.993	0.000	62.993
48,49	6108.921	0.000	6108.921	42.423	0.000	42.423
49,50	3146.871	0.000	3146.871	21.853	0.000	21.853
50,51	184.821	-3159.429	-3159.429	1.283	-21.940	-21.940
51,52	0.000	-6175.029	-6175.029	0.000	-14.294	-14.294
52,53	0.000	-9190.629	-9190.629	0.000	-21.275	-21.275
53,54	0.000	-11961.579	-11961.579	0.000	-83.067	-83.067
54,55	0.000	-14923.629	-14923.629	0.000	-103.636	-103.636

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
45,46	0.000	-24622.589	-24622.589	0.000	-1025.941	-1025.941
46,47	12679.777	-3675.817	12679.777	528.324	-153.159	528.324
47,48	24444.194	0.000	24444.194	1018.508	0.000	1018.508
48,49	31617.434	0.000	31617.434	1317.393	0.000	1317.393
49,50	34199.496	0.000	34199.496	1424.979	0.000	1424.979
50,51	34208.433	0.000	34208.433	1425.351	0.000	1425.351
51,52	31596.714	0.000	31596.714	104.486	0.000	104.486
52,53	24595.872	0.000	24595.872	81.336	0.000	81.336
53,54	13071.629	-2263.721	13071.629	544.651	-94.322	544.651
54,55	0.000	-23099.757	-23099.757	0.000	-962.490	-962.490

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
45,46	0.000	-0.165	-0.165
46,47	0.000	-0.216	-0.216
47,48	0.000	-0.260	-0.260
48,49	0.000	-0.285	-0.285
49,50	0.000	-0.290	-0.290
50,51	0.000	-0.288	-0.288
51,52	0.000	-0.262	-0.262

52,53	0.000	-0.227	-0.227
53,54	0.000	-0.191	-0.191
54,55	0.000	-0.154	-0.154

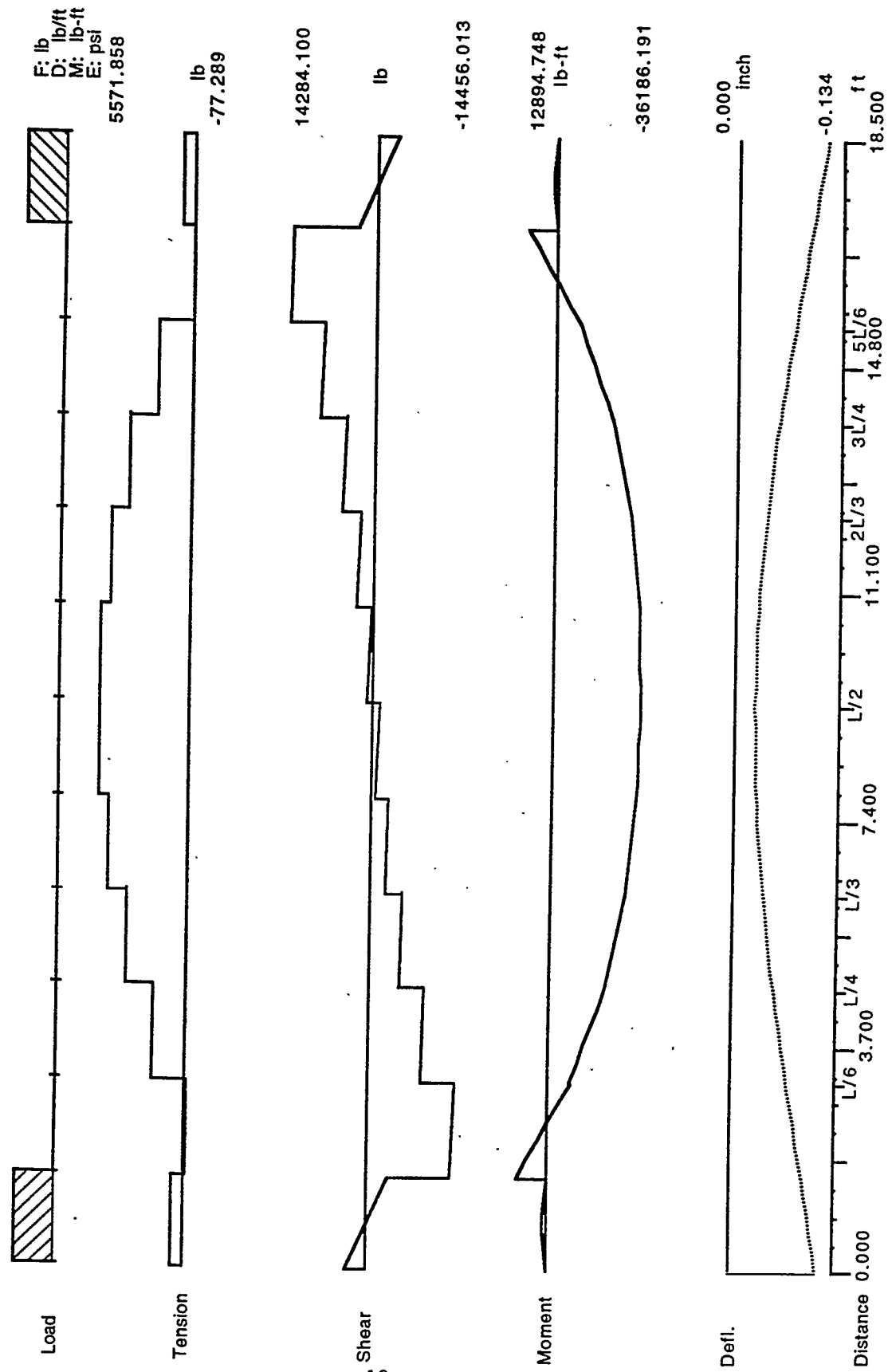
Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom)	Rotation ---	Deflection ---
ft	radian	inch

At the intermediate nodes:		
1.550	-0.003	-0.165
3.100	-0.003	-0.216
4.650	-0.002	-0.260
6.200	-0.001	-0.285
7.750	0.000	-0.288
9.500	0.002	-0.262
11.000	0.002	-0.227
12.500	0.002	-0.191
13.950	0.002	-0.154
At evenly-spaced intervals:		
0.000	-0.002	-0.115
1.550	-0.003	-0.165
3.100	-0.003	-0.216
4.650	-0.002	-0.260
6.200	-0.001	-0.285
7.750	0.000	-0.288
9.300	0.002	-0.267
10.850	0.002	-0.230
12.400	0.002	-0.194
13.950	0.002	-0.154
15.500	0.002	-0.116

FRAME MAC file: 4(22/22) PRELIMINARY; Last modified at 11:45:35 on Thu, Mar 11, 1993

Node 14	Node 15	Node 16	Node 17	Node 18	Node 19	Node 20	Node 21	Node 22	Node 23	Node 24	Node 25	Node 28
0.000	1.500	3.050	4.600	6.150	7.700	9.250	10.800	12.350	13.900	15.450	17.000	18.500
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Continuous Elements Output Data

FRAME MAC file: 4(22/22) PRELIMINARY.

Last modified at 11:45:35 on Thu, Mar 11, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

14	-0.000	-0.132	0.001
15	-0.000	-0.110	0.001
16	-0.000	-0.086	0.001
17	-0.000	-0.063	0.001
18	-0.000	-0.046	0.001
19	-0.000	-0.034	0.000
20	0.000	-0.030	0.000
21	0.000	-0.034	-0.000
22	0.000	-0.046	-0.001
23	0.000	-0.063	-0.001
24	0.000	-0.086	-0.001
25	0.000	-0.110	-0.001
26	0.000	-0.134	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,15	0.000	3375.750	843.938	0.000	3375.750	-843.938
15,16	0.000	244.125	63.066	0.000	244.125	-63.066
16,17	0.000	244.125	63.066	0.000	244.125	-63.066
17,18	0.000	244.125	63.066	0.000	244.125	-63.066
18,19	0.000	244.125	63.066	0.000	244.125	-63.066
19,20	0.000	244.125	63.066	0.000	244.125	-63.066
20,21	0.000	244.125	63.066	0.000	244.125	-63.066
21,22	0.000	244.125	63.066	0.000	244.125	-63.066
22,23	0.000	244.125	63.066	0.000	244.125	-63.066
23,24	0.000	244.125	63.066	0.000	244.125	-63.066
24,25	0.000	244.125	63.066	0.000	244.125	-63.066
25,26	0.000	3375.750	843.938	0.000	3375.750	-843.938

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
14,15	-700.208	3445.511	-61.699	700.208	3305.989	166.341
15,16	77.289	-13967.763	-12894.748	-77.289	14456.013	-9133.679
16,17	-2028.168	-8733.215	8960.288	2028.168	9221.465	-22875.164
17,18	-3759.908	-4992.282	22729.585	3759.908	5480.532	-30846.016
18,19	-4946.838	-2432.898	30743.768	4946.838	2921.148	-34893.154
19,20	-5550.465	-624.068	34840.492	5550.465	1112.318	-36186.191
20,21	-5571.858	926.346	36185.151	5571.858	-438.096	-35127.708
21,22	-5008.414	2730.340	35178.507	5008.414	-2242.090	-31324.874
22,23	-3852.990	5284.173	31425.956	3852.990	-4795.923	-23613.881
23,24	-2135.357	9027.182	23759.584	2135.357	-8538.932	-10145.845
24,25	-13.322	14284.100	10321.439	13.322	-13795.850	11440.523
25,26	-723.549	3265.107	-229.613	723.549	3486.393	63.649

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
14,15	-0.000	-0.132	0.001	-0.000	-0.110	0.001
15,16	-0.000	-0.110	0.001	-0.000	-0.086	0.001
16,17	-0.000	-0.086	0.001	-0.000	-0.063	0.001
17,18	-0.000	-0.063	0.001	-0.000	-0.046	0.001
18,19	-0.000	-0.046	0.001	-0.000	-0.034	0.000
19,20	-0.000	-0.034	0.000	0.000	-0.030	0.000
20,21	0.000	-0.030	0.000	0.000	-0.034	-0.000
21,22	0.000	-0.034	-0.000	0.000	-0.046	-0.001

22,23	0.000	-0.046	-0.001	0.000	-0.063	-0.001
23,24	0.000	-0.063	-0.001	0.000	-0.086	-0.001
24,25	0.000	-0.086	-0.001	0.000	-0.110	-0.001
25,26	0.000	-0.110	-0.001	0.000	-0.134	-0.001

Maximum deformations:

Node 14 moved 0.000 inch to the left.
Node 26 moved 0.000 inch to the right.
Node 26 moved 0.134 inch downwards.
No nodes moved upwards.
Node 24 rotated 0.001 radian clockwise.
Node 16 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
14,15	700.208	0.000	700.208	3.242	0.000	3.242
15,16	0.000	-77.289	-77.289	0.000	-0.358	-0.358
16,17	2028.168	0.000	2028.168	9.390	0.000	9.390
17,18	3759.908	0.000	3759.908	17.407	0.000	17.407
18,19	4946.838	0.000	4946.838	22.902	0.000	22.902
19,20	5550.465	0.000	5550.465	25.697	0.000	25.697
20,21	5571.858	0.000	5571.858	25.796	0.000	25.796
21,22	5008.414	0.000	5008.414	23.187	0.000	23.187
22,23	3852.990	0.000	3852.990	17.838	0.000	17.838
23,24	2135.357	0.000	2135.357	9.886	0.000	9.886
24,25	13.322	0.000	13.322	0.062	0.000	0.062
25,26	723.549	0.000	723.549	3.350	0.000	3.350

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
14,15	3445.511	-3305.989	3445.511	15.951	-15.306	15.951
15,16	0.000	-14456.013	-14456.013	0.000	-66.926	-66.926
16,17	0.000	-9221.465	-9221.465	0.000	-42.692	-42.692
17,18	0.000	-5480.532	-5480.532	0.000	-25.373	-25.373
18,19	0.000	-2921.148	-2921.148	0.000	-13.524	-13.524
19,20	0.000	-1112.318	-1112.318	0.000	-5.150	-5.150
20,21	926.346	0.000	926.346	4.289	0.000	4.289
21,22	2730.340	0.000	2730.340	12.640	0.000	12.640
22,23	5284.173	0.000	5284.173	24.464	0.000	24.464
23,24	9027.182	0.000	9027.182	41.793	0.000	41.793
24,25	14284.100	0.000	14284.100	66.130	0.000	66.130
25,26	3265.107	-3486.393	-3486.393	15.116	-16.141	-16.141

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
14,15	1380.467	0.000	1380.467	17.043	0.000	17.043
15,16	12894.748	-9133.679	12894.748	159.194	-112.761	159.194
16,17	0.000	-22875.164	-22875.164	0.000	-282.409	-282.409
17,18	0.000	-30846.016	-30846.016	0.000	-380.815	-380.815
18,19	0.000	-34893.154	-34893.154	0.000	-430.780	-430.780
19,20	0.000	-36186.191	-36186.191	0.000	-446.743	-446.743
20,21	0.000	-36185.151	-36185.151	0.000	-446.730	-446.730
21,22	0.000	-35178.507	-35178.507	0.000	-434.303	-434.303
22,23	0.000	-31425.956	-31425.956	0.000	-387.975	-387.975
23,24	0.000	-23759.584	-23759.584	0.000	-293.328	-293.328
24,25	11440.523	-10321.439	11440.523	141.241	-127.425	141.241
25,26	1413.897	0.000	1413.897	17.456	0.000	17.456

```

*****
*****
Maximum deflection values:
      From, To      Maximum defl.      Maximum defl.      Maximum defl.
      Node          up (left)         down (rt.)         absolute
      ---          inch              inch              inch
-----
      14,15          0.000             -0.132             -0.132
      15,16          0.000             -0.110             -0.110
      16,17          0.000             -0.086             -0.086
      17,18          0.000             -0.063             -0.063
      18,19          0.000             -0.046             -0.046
      19,20          0.000             -0.034             -0.034
      20,21          0.000             -0.034             -0.034
      21,22          0.000             -0.046             -0.046
      22,23          0.000             -0.063             -0.063
      23,24          0.000             -0.086             -0.086
      24,25          0.000             -0.110             -0.110
      25,26          0.000             -0.134             -0.134
*****

```

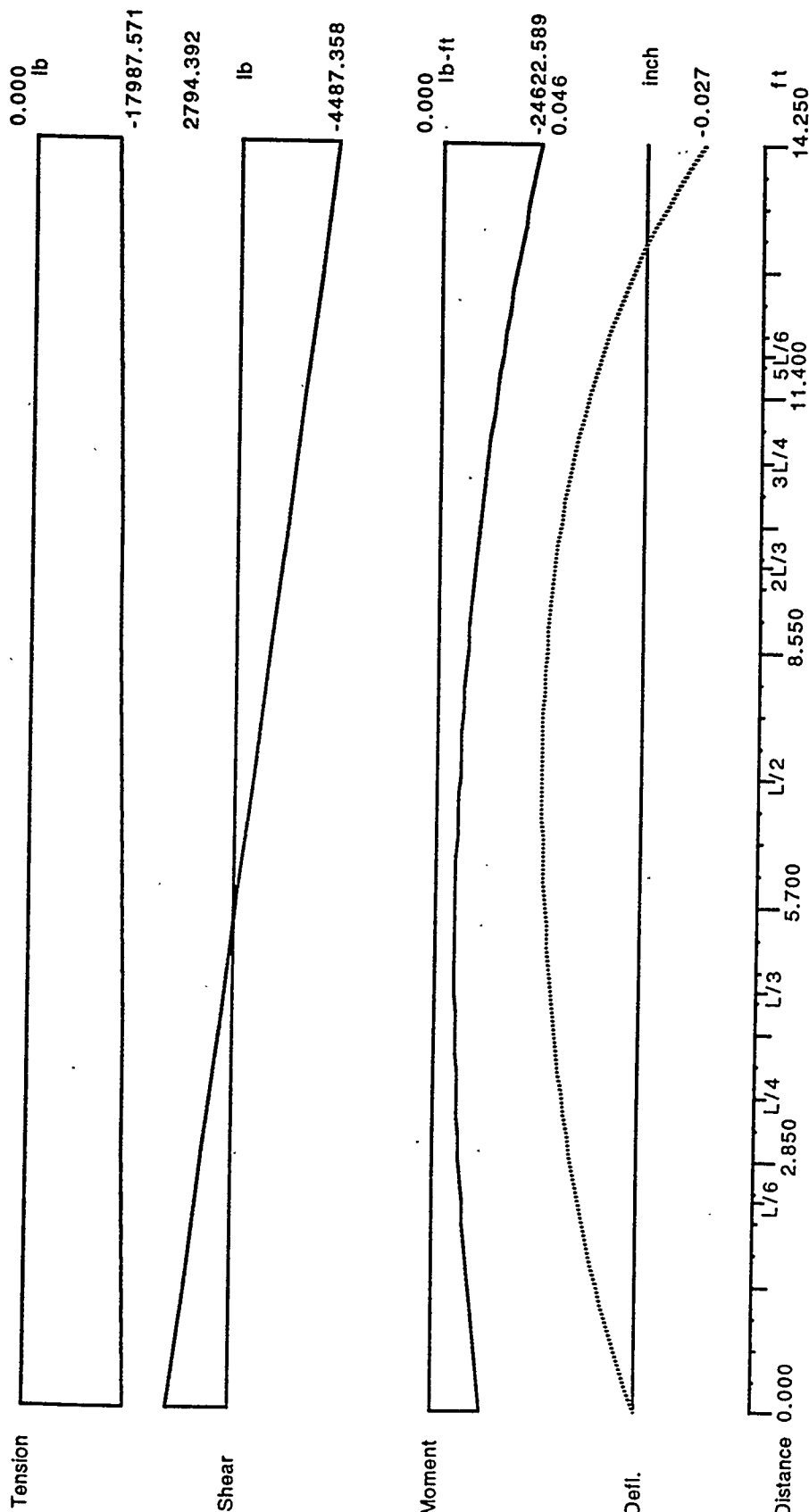
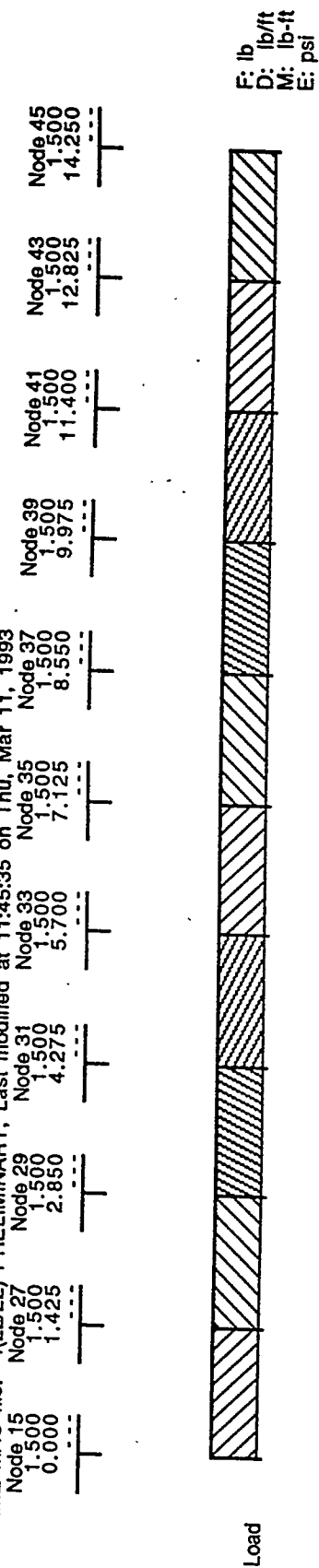
```

*****
Deflections along the elements (positive is up or counter-clockwise):
      Distance from      Rotation      Deflection
      left (bottom)      ---
      ft                radian        inch
-----
At the intermediate nodes:
      1.500              0.001             -0.110
      3.050              0.001             -0.086
      4.600              0.001             -0.063
      6.150              0.001             -0.046
      7.700              0.000             -0.034
      9.250              0.000             -0.030
      10.800             -0.000             -0.034
      12.350             -0.001             -0.046
      13.900             -0.001             -0.063
      15.450             -0.001             -0.086
      17.000             -0.001             -0.110

At evenly-spaced intervals:
      0.000              0.001             -0.132
      1.850              0.001             -0.104
      3.700              0.001             -0.076
      5.550              0.001             -0.052
      7.400              0.000             -0.036
      9.250              0.000             -0.030
      11.100             -0.000             -0.036
      12.950             -0.001             -0.052
      14.800             -0.001             -0.076
      16.650             -0.001             -0.105
      18.500             -0.001             -0.134
*****

```

FRAME MAC file: 4(22/22) PRELIMINARY; Last modified at 11:45:35 on Thu, Mar 11, 1993



Continuous Elements Output Data

FRAME MAC file: 4(22/22) PRELIMINARY.

Last modified at 11:45:35 on Thu, Mar 11, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
15	-0.000	-0.110	0.001
27	-0.018	-0.110	0.001
29	-0.031	-0.111	0.001
31	-0.039	-0.111	0.000
33	-0.044	-0.112	0.000
35	-0.046	-0.113	0.000
37	-0.045	-0.113	-0.000
39	-0.038	-0.114	-0.001
41	-0.026	-0.114	-0.001
43	-0.005	-0.115	-0.002
45	0.027	-0.115	-0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
15,27	149.625	364.087	86.471	149.625	364.087	-86.471
27,29	149.625	364.087	86.471	149.625	364.087	-86.471
29,31	149.625	364.087	86.471	149.625	364.087	-86.471
31,33	149.625	364.088	86.471	149.625	364.087	-86.471
33,35	149.625	364.088	86.471	149.625	364.087	-86.471
35,37	149.625	364.088	86.471	149.625	364.087	-86.471
37,39	149.625	364.088	86.471	149.625	364.087	-86.471
39,41	149.625	364.088	86.471	149.625	364.087	-86.471
41,43	149.625	364.088	86.471	149.625	364.087	-86.471
43,45	149.625	364.087	86.471	149.625	364.087	-86.471

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
15,27	17987.571	2794.392	12560.208	-17688.321	-2066.217	-9097.024
27,29	17688.321	2066.217	9097.024	-17389.071	-1338.042	-6671.489
29,31	17389.071	1338.042	6671.489	-17089.821	-609.867	-5283.604
31,33	17089.821	609.867	5283.604	-16790.571	118.308	-4933.368
33,35	16790.571	-118.308	4933.368	-16491.321	846.483	-5620.782
35,37	16491.321	-846.483	5620.782	-16192.071	1574.658	-7345.844
37,39	16192.071	-1574.658	7345.844	-15892.821	2302.833	-10108.557
39,41	15892.821	-2302.833	10108.557	-15593.571	3031.008	-13908.918
41,43	15593.571	-3031.008	13908.918	-15294.321	3759.183	-18746.929
43,45	15294.321	-3759.183	18746.929	-14995.071	4487.358	-24622.589

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
15,27	-0.110	0.000	0.001	-0.110	0.018	0.001
27,29	-0.110	0.018	0.001	-0.111	0.031	0.001
29,31	-0.111	0.031	0.001	-0.111	0.039	0.000
31,33	-0.111	0.039	0.000	-0.112	0.044	0.000
33,35	-0.112	0.044	0.000	-0.113	0.046	0.000
35,37	-0.113	0.046	0.000	-0.113	0.045	-0.000
37,39	-0.113	0.045	-0.000	-0.114	0.038	-0.001
39,41	-0.114	0.038	-0.001	-0.114	0.026	-0.001
41,43	-0.114	0.026	-0.001	-0.115	0.005	-0.002
43,45	-0.115	0.005	-0.002	-0.115	-0.027	-0.002

Maximum deformations:

Node 35 moved 0.046 inch to the left.

Node 45 moved 0.027 inch to the right.

Node 45 moved 0.115 inch downwards.
 No nodes moved upwards.
 Node 45 rotated 0.002 radian clockwise.
 Node 15 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
15,27	0.000	-17987.571	-17987.571	0.000	-124.914	-124.914
27,29	0.000	-17688.321	-17688.321	0.000	-122.836	-122.836
29,31	0.000	-17389.071	-17389.071	0.000	-120.757	-120.757
31,33	0.000	-17089.821	-17089.821	0.000	-118.679	-118.679
33,35	0.000	-16790.571	-16790.571	0.000	-116.601	-116.601
35,37	0.000	-16491.321	-16491.321	0.000	-114.523	-114.523
37,39	0.000	-16192.071	-16192.071	0.000	-112.445	-112.445
39,41	0.000	-15892.821	-15892.821	0.000	-110.367	-110.367
41,43	0.000	-15593.571	-15593.571	0.000	-108.289	-108.289
43,45	0.000	-15294.321	-15294.321	0.000	-106.211	-106.211

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
15,27	2794.392	0.000	2794.392	19.406	0.000	19.406
27,29	2066.217	0.000	2066.217	14.349	0.000	14.349
29,31	1338.042	0.000	1338.042	9.292	0.000	9.292
31,33	609.867	-118.308	609.867	4.235	-0.822	4.235
33,35	0.000	-846.483	-846.483	0.000	-5.878	-5.878
35,37	0.000	-1574.658	-1574.658	0.000	-10.935	-10.935
37,39	0.000	-2302.833	-2302.833	0.000	-15.992	-15.992
39,41	0.000	-3031.008	-3031.008	0.000	-21.049	-21.049
41,43	0.000	-3759.183	-3759.183	0.000	-26.105	-26.105
43,45	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
15,27	0.000	-12560.208	-12560.208	0.000	-523.342	-523.342
27,29	0.000	-9097.024	-9097.024	0.000	-379.043	-379.043
29,31	0.000	-6671.489	-6671.489	0.000	-277.979	-277.979
31,33	0.000	-5283.604	-5283.604	0.000	-220.150	-220.150
33,35	0.000	-5620.782	-5620.782	0.000	-234.199	-234.199
35,37	0.000	-7345.844	-7345.844	0.000	-306.077	-306.077
37,39	0.000	-10108.557	-10108.557	0.000	-421.190	-421.190
39,41	0.000	-13908.918	-13908.918	0.000	-579.538	-579.538
41,43	0.000	-18746.929	-18746.929	0.000	-781.122	-781.122
43,45	0.000	-24622.589	-24622.589	0.000	-1025.941	-1025.941

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
15,27	0.018	0.000	0.018
27,29	0.031	0.000	0.031
29,31	0.039	0.000	0.039
31,33	0.044	0.000	0.044
33,35	0.046	0.000	0.046
35,37	0.046	0.000	0.046
37,39	0.045	0.000	0.045

39,41	0.038	0.000	0.038
41,43	0.026	0.000	0.026
43,45	0.005	-0.027	-0.027

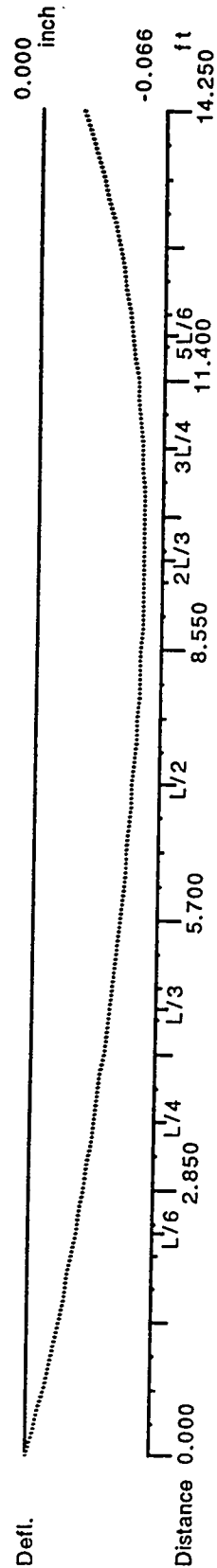
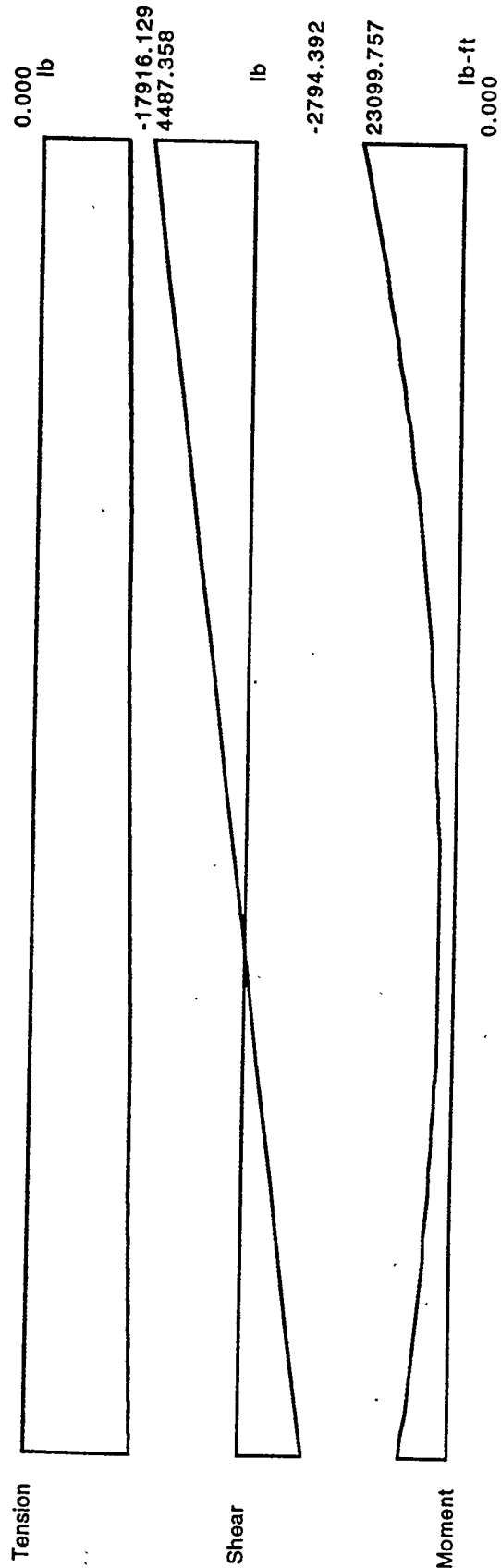
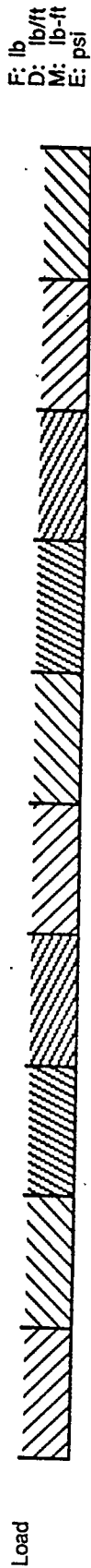
Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch

At the intermediate nodes:		
1.425	0.001	0.018
2.850	0.001	0.031
4.275	0.000	0.039
5.700	0.000	0.044
7.125	0.000	0.046
8.550	-0.000	0.045
9.975	-0.001	0.038
11.400	-0.001	0.026
12.825	-0.002	0.005
At evenly-spaced intervals:		
0.000	0.001	0.000
1.425	0.001	0.018
2.850	0.001	0.031
4.275	0.000	0.039
5.700	0.000	0.044
7.125	0.000	0.046
8.550	-0.000	0.045
9.975	-0.001	0.038
11.400	-0.001	0.026
12.825	-0.002	0.005
14.250	-0.002	-0.027

FRAME MAC file: 4(22/22) PRELIMINARY; Last modified at 11:45:35 on Thu, Mar 11, 1993

Node 25	Node 28	Node 30	Node 32	Node 34	Node 36	Node 38	Node 40	Node 42	Node 44	Node 55
17.000	17.000	17.000	17.000	17.000	17.000	17.000	17.000	17.000	17.000	17.000
0.000	1.425	2.850	4.275	5.700	7.125	8.550	9.975	11.400	12.825	14.250



Continuous Elements Output Data

FRAME MAC file: 4(22/22) PRELIMINARY.

Last modified at 11:45:35 on Thu, Mar 11, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

25	0.000	-0.110	-0.001
28	0.020	-0.111	-0.001
30	0.034	-0.112	-0.001
32	0.045	-0.112	-0.001
34	0.054	-0.113	-0.000
36	0.061	-0.114	-0.000
38	0.065	-0.114	-0.000
40	0.066	-0.115	0.000
42	0.061	-0.115	0.000
44	0.049	-0.116	0.001
55	0.026	-0.116	0.002

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
25,28	149.625	-364.087	-86.471	149.625	-364.087	86.471
28,30	149.625	-364.087	-86.471	149.625	-364.087	86.471
30,32	149.625	-364.087	-86.471	149.625	-364.087	86.471
32,34	149.625	-364.088	-86.471	149.625	-364.087	86.471
34,36	149.625	-364.088	-86.471	149.625	-364.087	86.471
36,38	149.625	-364.088	-86.471	149.625	-364.087	86.471
38,40	149.625	-364.088	-86.471	149.625	-364.087	86.471
40,42	149.625	-364.088	-86.471	149.625	-364.087	86.471
42,44	149.625	-364.088	-86.471	149.625	-364.087	86.471
44,55	149.625	-364.087	-86.471	149.625	-364.087	86.471

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
25,28	17916.129	-2794.392	-11037.376	-17616.879	2066.217	7574.191
28,30	17616.879	-2066.217	-7574.191	-17317.629	1338.042	5148.657
30,32	17317.629	-1338.042	-5148.657	-17018.379	609.867	3760.771
32,34	17018.379	-609.867	-3760.771	-16719.129	-118.308	3410.536
34,36	16719.129	118.308	-3410.536	-16419.879	-846.483	4097.949
36,38	16419.879	846.483	-4097.949	-16120.629	-1574.658	5823.012
38,40	16120.629	1574.658	-5823.012	-15821.379	-2302.833	8585.724
40,42	15821.379	2302.833	-8585.724	-15522.129	-3031.008	12386.086
42,44	15522.129	3031.008	-12386.086	-15222.879	-3759.183	17224.096
44,55	15222.879	3759.183	-17224.096	-14923.629	-4487.358	23099.757

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
25,28	-0.110	-0.000	-0.001	-0.111	-0.020	-0.001
28,30	-0.111	-0.020	-0.001	-0.112	-0.034	-0.001
30,32	-0.112	-0.034	-0.001	-0.112	-0.045	-0.001
32,34	-0.112	-0.045	-0.001	-0.113	-0.054	-0.000
34,36	-0.113	-0.054	-0.000	-0.114	-0.061	-0.000
36,38	-0.114	-0.061	-0.000	-0.114	-0.065	-0.000
38,40	-0.114	-0.065	-0.000	-0.115	-0.066	0.000
40,42	-0.115	-0.066	0.000	-0.115	-0.061	0.000
42,44	-0.115	-0.061	0.000	-0.116	-0.049	0.001
44,55	-0.116	-0.049	0.001	-0.116	-0.026	0.002

Maximum deformations:

No nodes moved to the left.

Node 40 moved 0.066 inch to the right.

Node 55 moved 0.116 inch downwards.
 No nodes moved upwards.
 Node 25 rotated 0.001 radian clockwise.
 Node 55 rotated 0.002 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
25,28	0.000	-17916.129	-17916.129	0.000	-124.418	-124.418
28,30	0.000	-17616.879	-17616.879	0.000	-122.339	-122.339
30,32	0.000	-17317.629	-17317.629	0.000	-120.261	-120.261
32,34	0.000	-17018.379	-17018.379	0.000	-118.183	-118.183
34,36	0.000	-16719.129	-16719.129	0.000	-116.105	-116.105
36,38	0.000	-16419.879	-16419.879	0.000	-114.027	-114.027
38,40	0.000	-16120.629	-16120.629	0.000	-111.949	-111.949
40,42	0.000	-15821.379	-15821.379	0.000	-109.871	-109.871
42,44	0.000	-15522.129	-15522.129	0.000	-107.793	-107.793
44,55	0.000	-15222.879	-15222.879	0.000	-105.714	-105.714

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
25,28	0.000	-2794.392	-2794.392	0.000	-19.406	-19.406
28,30	0.000	-2066.217	-2066.217	0.000	-14.349	-14.349
30,32	0.000	-1338.042	-1338.042	0.000	-9.292	-9.292
32,34	118.308	-609.867	-609.867	0.822	-4.235	-4.235
34,36	846.483	0.000	846.483	5.878	0.000	5.878
36,38	1574.658	0.000	1574.658	10.935	0.000	10.935
38,40	2302.833	0.000	2302.833	15.992	0.000	15.992
40,42	3031.008	0.000	3031.008	21.049	0.000	21.049
42,44	3759.183	0.000	3759.183	26.105	0.000	26.105
44,55	4487.358	0.000	4487.358	31.162	0.000	31.162

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
25,28	11037.376	0.000	11037.376	459.891	0.000	459.891
28,30	7574.191	0.000	7574.191	315.591	0.000	315.591
30,32	5148.657	0.000	5148.657	214.527	0.000	214.527
32,34	3760.771	0.000	3760.771	156.699	0.000	156.699
34,36	4097.949	0.000	4097.949	170.748	0.000	170.748
36,38	5823.012	0.000	5823.012	242.625	0.000	242.625
38,40	8585.724	0.000	8585.724	357.738	0.000	357.738
40,42	12386.086	0.000	12386.086	516.087	0.000	516.087
42,44	17224.096	0.000	17224.096	717.671	0.000	717.671
44,55	23099.757	0.000	23099.757	962.490	0.000	962.490

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
25,28	0.000	-0.020	-0.020
28,30	0.000	-0.034	-0.034
30,32	0.000	-0.045	-0.045
32,34	0.000	-0.054	-0.054
34,36	0.000	-0.061	-0.061
36,38	0.000	-0.065	-0.065
38,40	0.000	-0.066	-0.066

40,42	0.000	-0.066	-0.066
42,44	0.000	-0.061	-0.061
44,55	0.000	-0.049	-0.049

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch

At the intermediate nodes:

1.425	-0.001	-0.020
2.850	-0.001	-0.034
4.275	-0.001	-0.045
5.700	-0.000	-0.054
7.125	-0.000	-0.061
8.550	-0.000	-0.065
9.975	0.000	-0.066
11.400	0.000	-0.061
12.825	0.001	-0.049

At evenly-spaced intervals:

0.000	-0.001	-0.000
1.425	-0.001	-0.020
2.850	-0.001	-0.034
4.275	-0.001	-0.045
5.700	-0.000	-0.054
7.125	-0.000	-0.061
8.550	-0.000	-0.065
9.975	0.000	-0.066
11.400	0.000	-0.061
12.825	0.001	-0.049
14.250	0.002	-0.026

Output Data

FRAME MAC file: 4(22/22) PRELIMINARY.

Last modified at 11:45:35 on Thu, Mar 11, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,14	0.000	-3445.511	-3445.511	0.000	-39.604	-39.604
2,15	0.000	-7325.797	-7325.797	0.000	-32.851	-32.851
3,16	0.000	-5722.798	-5722.798	0.000	-25.663	-25.663
4,17	0.000	-4229.183	-4229.183	0.000	-18.965	-18.965
5,18	0.000	-3047.634	-3047.634	0.000	-13.667	-13.667
6,19	0.000	-2297.080	-2297.080	0.000	-10.301	-10.301
7,20	0.000	-2038.664	-2038.664	0.000	-9.142	-9.142
8,21	0.000	-2292.244	-2292.244	0.000	-10.279	-10.279
9,22	0.000	-3042.083	-3042.083	0.000	-13.642	-13.642
10,23	0.000	-4231.259	-4231.259	0.000	-18.974	-18.974
11,24	0.000	-5745.168	-5745.168	0.000	-25.763	-25.763
12,25	0.000	-7385.385	-7385.385	0.000	-33.118	-33.118
13,26	0.000	-3486.393	-3486.393	0.000	-40.073	-40.073
14,15	700.208	0.000	700.208	3.242	0.000	3.242
15,16	0.000	-77.289	-77.289	0.000	-0.358	-0.358
15,27	0.000	-17987.571	-17987.571	0.000	-124.914	-124.914
16,17	2028.168	0.000	2028.168	9.390	0.000	9.390
17,18	3759.908	0.000	3759.908	17.407	0.000	17.407
18,19	4946.838	0.000	4946.838	22.902	0.000	22.902
19,20	5550.465	0.000	5550.465	25.697	0.000	25.697
20,21	5571.858	0.000	5571.858	25.796	0.000	25.796
21,22	5008.414	0.000	5008.414	23.187	0.000	23.187
22,23	3852.990	0.000	3852.990	17.838	0.000	17.838
23,24	2135.357	0.000	2135.357	9.886	0.000	9.886
24,25	13.322	0.000	13.322	0.062	0.000	0.062
25,26	723.549	0.000	723.549	3.350	0.000	3.350
25,28	0.000	-17916.129	-17916.129	0.000	-124.418	-124.418
27,29	0.000	-17688.321	-17688.321	0.000	-122.836	-122.836
28,30	0.000	-17616.879	-17616.879	0.000	-122.339	-122.339
29,31	0.000	-17389.071	-17389.071	0.000	-120.757	-120.757
30,32	0.000	-17317.629	-17317.629	0.000	-120.261	-120.261
31,33	0.000	-17089.821	-17089.821	0.000	-118.679	-118.679
32,34	0.000	-17018.379	-17018.379	0.000	-118.183	-118.183
33,35	0.000	-16790.571	-16790.571	0.000	-116.601	-116.601
34,36	0.000	-16719.129	-16719.129	0.000	-116.105	-116.105
35,37	0.000	-16491.321	-16491.321	0.000	-114.523	-114.523
36,38	0.000	-16419.879	-16419.879	0.000	-114.027	-114.027
37,39	0.000	-16192.071	-16192.071	0.000	-112.445	-112.445
38,40	0.000	-16120.629	-16120.629	0.000	-111.949	-111.949
39,41	0.000	-15892.821	-15892.821	0.000	-110.367	-110.367
40,42	0.000	-15821.379	-15821.379	0.000	-109.871	-109.871
41,43	0.000	-15593.571	-15593.571	0.000	-108.289	-108.289
42,44	0.000	-15522.129	-15522.129	0.000	-107.793	-107.793
43,45	0.000	-15294.321	-15294.321	0.000	-106.211	-106.211
44,55	0.000	-15222.879	-15222.879	0.000	-105.714	-105.714
45,46	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
46,47	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
47,48	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
48,49	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
49,50	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
50,51	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
51,52	0.000	-4487.358	-4487.358	0.000	-10.387	-10.387
52,53	0.000	-4487.358	-4487.358	0.000	-10.387	-10.387
53,54	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162
54,55	0.000	-4487.358	-4487.358	0.000	-31.162	-31.162

SOIL ELEMENT

RUE = 22.46' 4" 15

= 22.46'

$$P_a = \frac{B}{F} \left[\frac{1}{2} \rho N_8 + \rho (N_4 - 1) \frac{D_f}{B} \right]$$

$$3.246m = 10.57'$$

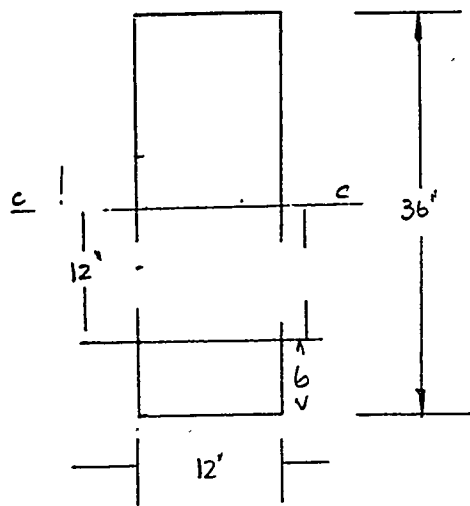
$$= \frac{18.5}{2} \left[\frac{1}{2} (115)(35) + 115(36.5 - 1) \frac{26.0}{18.5} \right]$$

$$= \frac{18.5}{2} [2012 + 5737.6] = 71,688 \text{ lb} \div 16.5 = 3875 \text{ lb/ft}^2 = 26.9 \text{ psi}$$

$$115 \times 10.57' = \sqrt{v} = 1215 \text{ psi} \approx 3$$

$$\sqrt{H} = 0.3 \sqrt{v} = 365 \sim$$

$$26 \times 115$$



$$I_{cc} = \frac{bd^3}{12} = \frac{12(36)^3}{12} = 46656$$

$$I_{xx} = I_{cc} + Ad^2$$

$$= 46656 + (12 \times 36)(12)^2$$

$$I_{xx} = 108,864 \text{ in}^4$$

$$c = 30''$$

$$S = \frac{I}{c} = \frac{108,864}{30}$$

$$S = 3628.8$$

$$R = \sqrt{\frac{I}{A}} = \sqrt{\frac{108,864}{(12)(36)}}$$

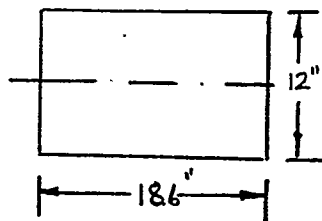
$$R = 15.87$$

$$W = 450 \text{ lbs/ft}$$

$$A = 432 \text{ in}^2$$

SECTION $\frac{4}{27|22}$

SOIL



$$I = \frac{bd^3}{12} = \frac{(18.6)(12)^3}{12} = 2678.4 \text{ in}^4$$

$$S = \frac{bd^2}{6} = \frac{(18.6)(12)^2}{6} = 446.4 \text{ in}^3$$

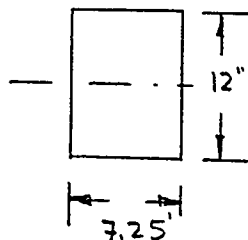
$$R = 3.464 \text{ in}$$

$$NA = 6.0 \text{ in}$$

$$W = 178.25 \text{ lb/ft}$$

$$A = 223 \text{ in}^2$$

SOIL END



$$I = \frac{(7.25)(12)^3}{12} = 1044$$

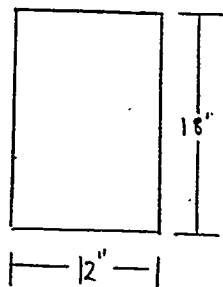
$$S = \frac{(7.25)(12)^2}{6} = 174$$

$$R = 3.464$$

$$W = 69.48 \text{ lb/ft}$$

$$A = 87 \text{ in}^2$$

$$NA = 6.0$$



$$I = \frac{12(18)^3}{12} = 5832 \text{ in}^4$$

$$S = \frac{12(18)^2}{6} = 972 \text{ in}^3$$

$$R = \sqrt{\frac{I}{A}} = 5.196 \text{ in}$$

$$A = 12 \times 18 = 216 \text{ in}^2$$

$$W = \frac{225 \text{ lb/ft}}{27}$$

TUNNEL SECTION		STRUCTURAL ASSESSMENT			
PAGE	OF	TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE
4 22/22		PRELIMINARY			
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$		ROOF STRUCTURE	ft-lbs	34,208 ft-lbs	
		FLOOR STRUCTURE	ft-lbs	36,186 ft-lbs	
		LEFT INSIDE WALL	ft-lbs	—	
		LEFT OUTSIDE WALL	ft-lbs	24,623 ft-lbs	
		RIGHT INSIDE WALL	ft-lbs	—	
Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2\sqrt{f'_c} B_w d$ when factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2\sqrt{f'_c} B_w d$		ROOF STRUCTURE	lbs	14,995 lbs	
		FLOOR STRUCTURE	lbs	14,456 lbs	
		LEFT WALL	lbs	44,877 lbs	
		RIGHT WALL	lbs	44,877 lbs	
		LEFT WALL	lbs	17,916 lbs	
Axial Capacity Design axial load ϕP_n is computed by ACI 318-89 (14-1) $\phi P_n = 0.55 \phi f'_c A_g \left[1 - \left(\frac{kl_c}{32h} \right)^2 \right]$ where $\phi = 0.7$		RIGHT WALL	lbs	17,916 lbs	
		LEFT WALL	lbs	—	
		RIGHT WALL	lbs	—	
		LEFT WALL	lbs	—	
		RIGHT WALL	lbs	—	

where $k = \frac{1 - \sin \theta}{1 + \sin \theta}$
 $k = 0.3$

$B = 18.5$ ft. $D_2 = 15.5$ ft.
 $D_1 = 10.57$ ft. $D_1 = 26.0$ ft.

Figure () Structural Assessment Summary



Pye Construction Technologies, Inc.

COMPUTATIONAL BRIEF

No: CB-1000-5(2/8)

TITLE: Preliminary Structural Assessment of Tunnel Section 5(2/8)

PROJECT: Remedial Shielding Concepts for Line D and Line D
Facilities. Los Alamos Meson Physics Facility,
Los Alamos National Laboratory, Los Alamos N.M.

TECHNICAL SUMMARY OF COMPUTATIONAL BRIEF

Tunnel Section 5(2/8) subjected to vertical and horizontal loads
estimated as 115 lbs/ft² for each 1 ft of soil covering the structure
and a horizontal load equivalent to 0.3 of the estimated cover load.
Determination of shear, axial and bending stresses and associated
deformations

PREPARED BY: John H. Pye

DATE: 5/3/93

CHECKED BY: _____

DATE: _____

Number of Pages Including Title Page 26

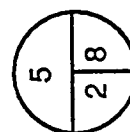
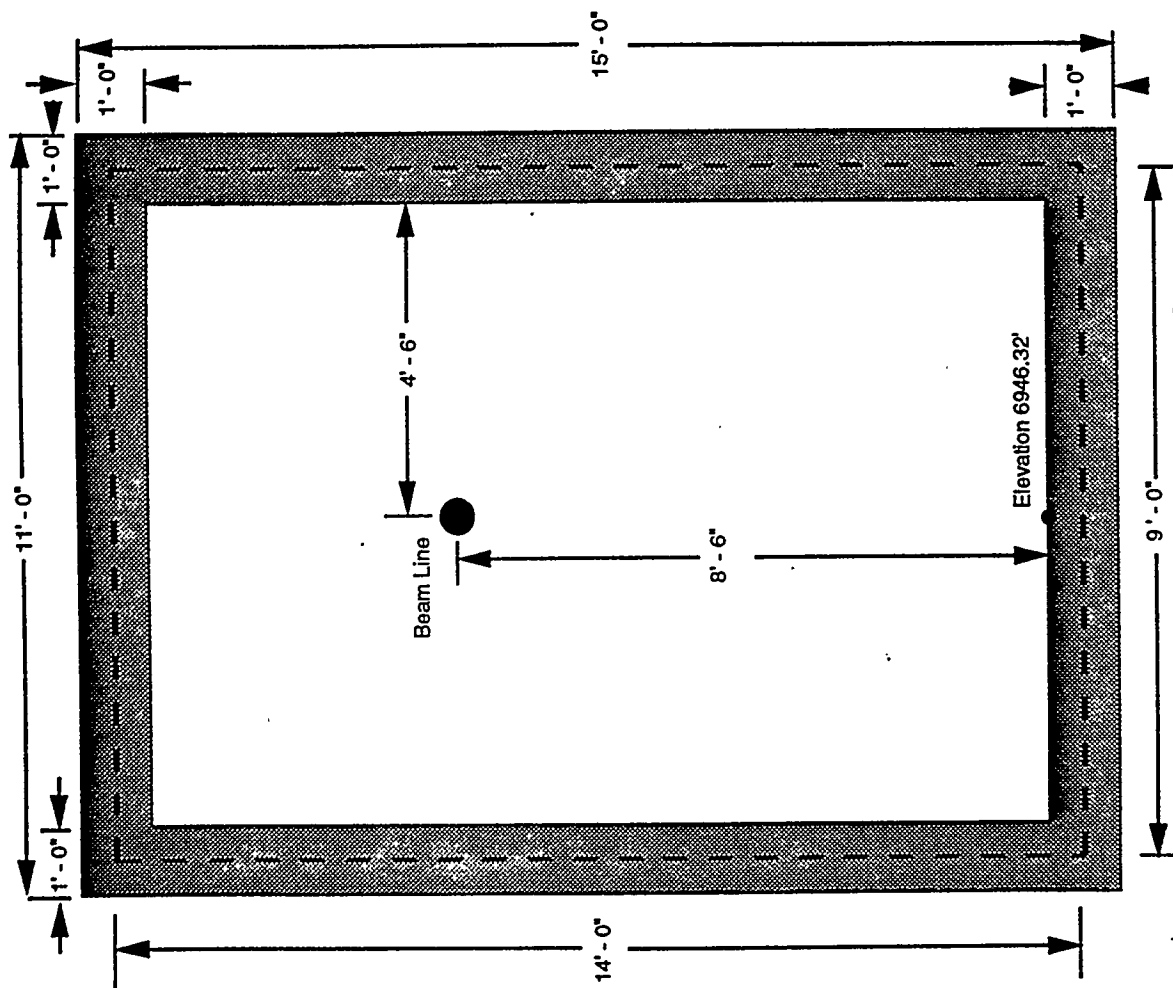
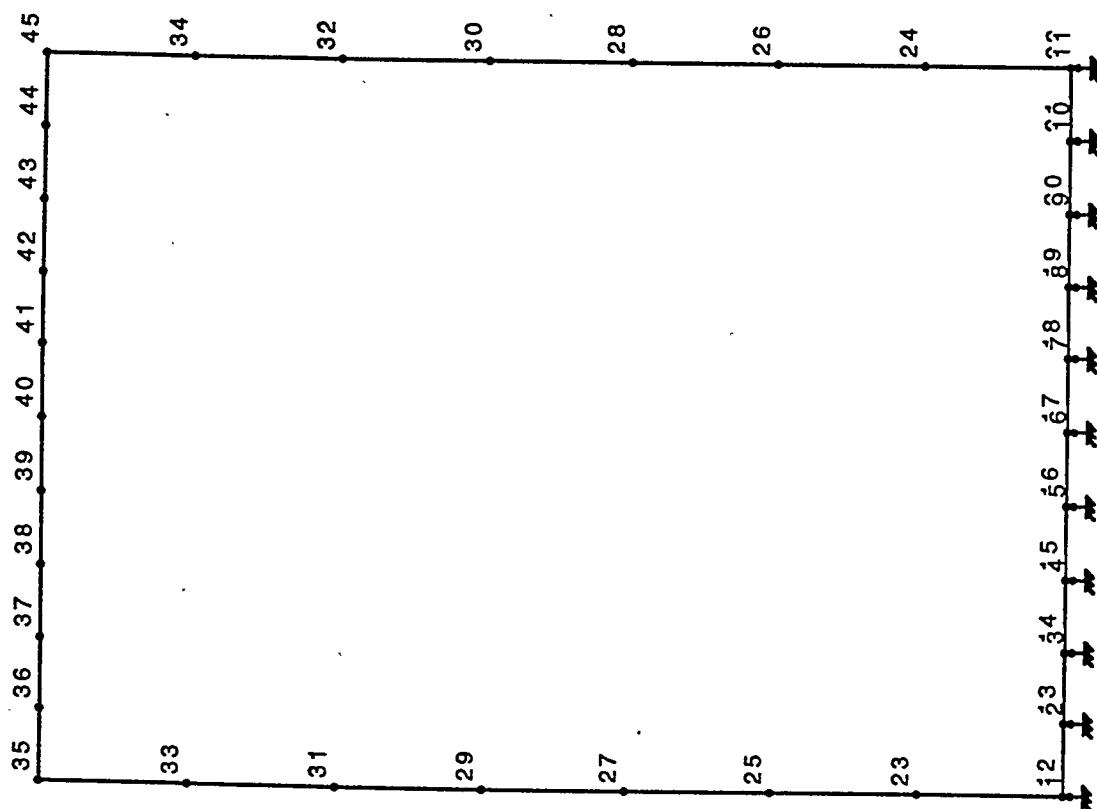
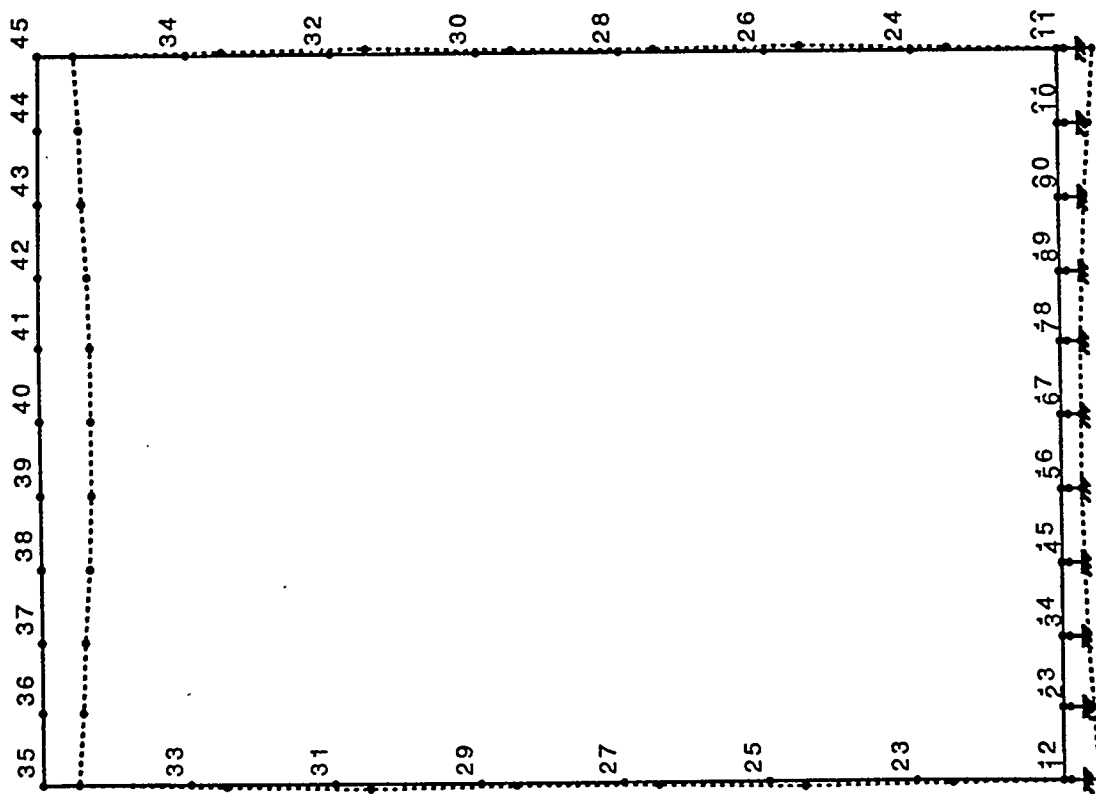


Figure () Section

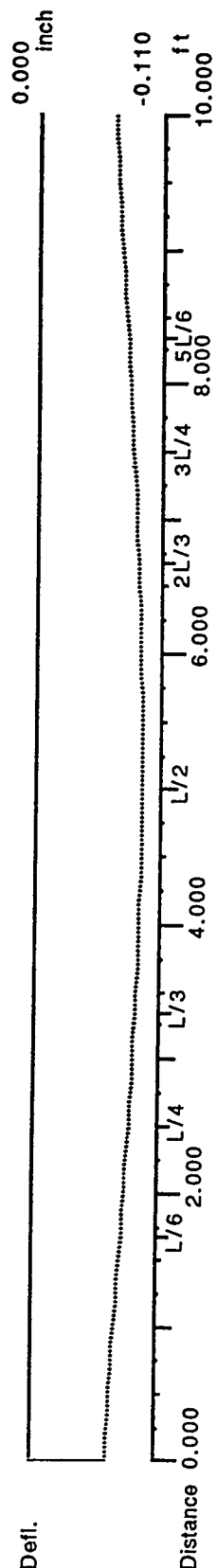
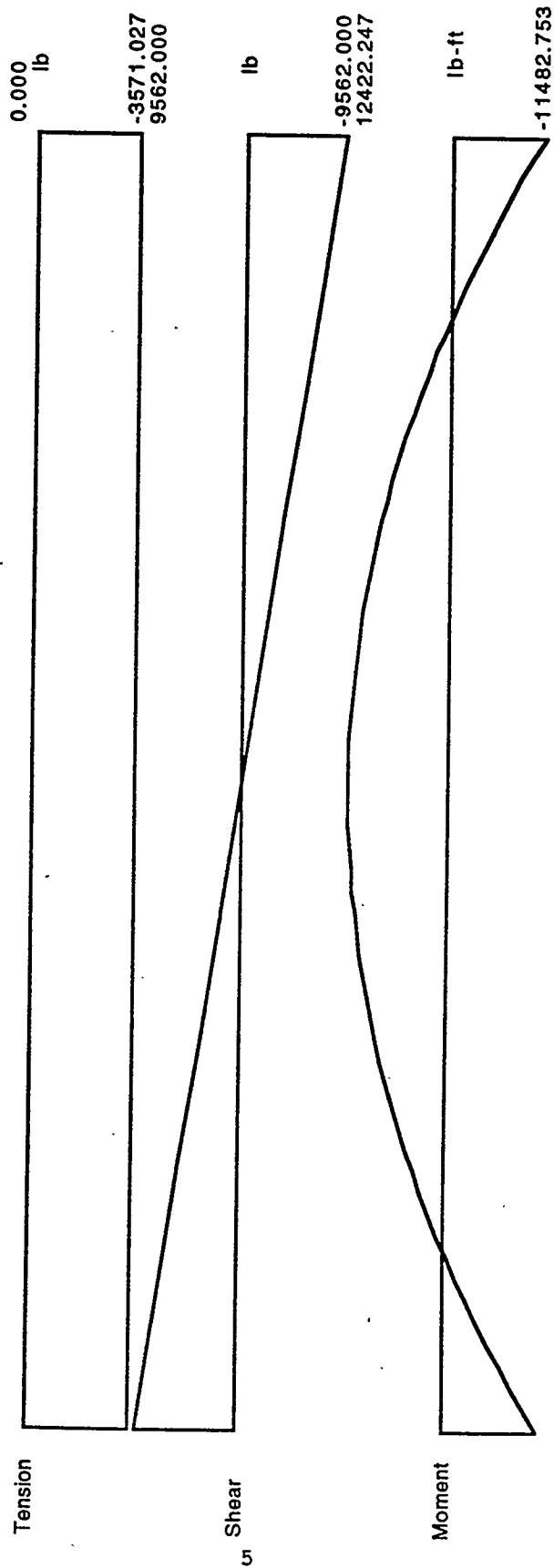
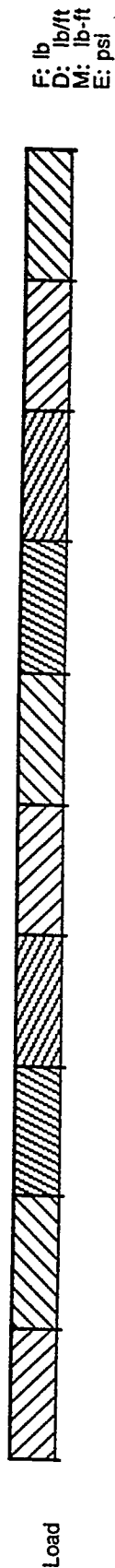
FRAME MAC file: 5(2/8) PRELIMINARY; Last modified at 21:10:37 on Thu, May 6, 1993





FRAME MAC file: 5(2/8) PRELIMINARY; Last modified at 21:10:37 on Thu, May 6, 1993

Node 35	Node 36	Node 37	Node 38	Node 39	Node 40	Node 41	Node 42	Node 43	Node 44	Node 45
4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000	14.000
14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000



Continuous Elements Output Data

FRAME MAC file: 5(2/8) PRELIMINARY.

Last modified at 21:10:37 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)

35	0.000	-0.078	-0.001
36	0.000	-0.086	-0.001
37	0.000	-0.095	-0.001
38	0.000	-0.103	-0.001
39	0.000	-0.108	-0.000
40	0.000	-0.110	0.000
41	-0.000	-0.108	0.000
42	-0.000	-0.103	0.001
43	-0.000	-0.095	0.001
44	-0.000	-0.086	0.001
45	-0.000	-0.078	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft

35,36	0.000	956.200	159.367	0.000	956.200	-159.367
36,37	0.000	956.200	159.367	0.000	956.200	-159.367
37,38	0.000	956.200	159.367	0.000	956.200	-159.367
38,39	0.000	956.200	159.367	0.000	956.200	-159.367
39,40	0.000	956.200	159.367	0.000	956.200	-159.367
40,41	0.000	956.200	159.367	0.000	956.200	-159.367
41,42	0.000	956.200	159.367	0.000	956.200	-159.367
42,43	0.000	956.200	159.367	0.000	956.200	-159.367
43,44	0.000	956.200	159.367	0.000	956.200	-159.367
44,45	0.000	956.200	159.367	0.000	956.200	-159.367

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft

35,36	3571.027	9562.000	11482.753	-3571.027	-7649.600	-2876.953
36,37	3571.027	7649.600	2876.953	-3571.027	-5737.200	3816.447
37,38	3571.027	5737.200	-3816.447	-3571.027	-3824.800	8597.447
38,39	3571.027	3824.800	-8597.447	-3571.027	-1912.400	11466.047
39,40	3571.027	1912.400	-11466.047	-3571.027	0.000	12422.247
40,41	3571.027	0.000	-12422.247	-3571.027	1912.400	11466.047
41,42	3571.027	-1912.400	-11466.047	-3571.027	3824.800	8597.447
42,43	3571.027	-3824.800	-8597.447	-3571.027	5737.200	3816.447
43,44	3571.027	-5737.200	-3816.447	-3571.027	7649.600	-2876.953
44,45	3571.027	-7649.600	2876.953	-3571.027	9562.000	-11482.753

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians

35,36	0.000	-0.078	-0.001	0.000	-0.086	-0.001
36,37	0.000	-0.086	-0.001	0.000	-0.095	-0.001
37,38	0.000	-0.095	-0.001	0.000	-0.103	-0.001
38,39	0.000	-0.103	-0.001	0.000	-0.108	-0.000
39,40	0.000	-0.108	-0.000	0.000	-0.110	0.000
40,41	0.000	-0.110	0.000	-0.000	-0.108	0.000
41,42	-0.000	-0.108	0.000	-0.000	-0.103	0.001
42,43	-0.000	-0.103	0.001	-0.000	-0.095	0.001
43,44	-0.000	-0.095	0.001	-0.000	-0.086	0.001
44,45	-0.000	-0.086	0.001	-0.000	-0.078	0.001

Maximum deformations:

Node 45 moved 0.000 inch to the left.

Node 35 moved 0.000 inch to the right.

Node 40 moved 0.110 inch downwards.
 No nodes moved upwards.
 Node 36 rotated 0.001 radian clockwise.
 Node 44 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
35,36	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
36,37	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
37,38	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
38,39	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
39,40	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
40,41	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
41,42	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
42,43	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
43,44	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
44,45	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
35,36	9562.000	0.000	9562.000	66.403	0.000	66.403
36,37	7649.600	0.000	7649.600	53.122	0.000	53.122
37,38	5737.200	0.000	5737.200	39.842	0.000	39.842
38,39	3824.800	0.000	3824.800	26.561	0.000	26.561
39,40	1912.400	0.000	1912.400	13.281	0.000	13.281
40,41	0.000	-1912.400	-1912.400	0.000	-13.281	-13.281
41,42	0.000	-3824.800	-3824.800	0.000	-26.561	-26.561
42,43	0.000	-5737.200	-5737.200	0.000	-39.842	-39.842
43,44	0.000	-7649.600	-7649.600	0.000	-53.122	-53.122
44,45	0.000	-9562.000	-9562.000	0.000	-66.403	-66.403

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
35,36	0.000	-11482.753	-11482.753	0.000	-478.448	-478.448
36,37	3816.447	-2876.953	3816.447	159.019	-119.873	159.019
37,38	8597.447	0.000	8597.447	358.227	0.000	358.227
38,39	11466.047	0.000	11466.047	477.752	0.000	477.752
39,40	12422.247	0.000	12422.247	517.594	0.000	517.594
40,41	12422.247	0.000	12422.247	517.594	0.000	517.594
41,42	11466.047	0.000	11466.047	477.752	0.000	477.752
42,43	8597.447	0.000	8597.447	358.227	0.000	358.227
43,44	3816.447	-2876.953	3816.447	159.019	-119.873	159.019
44,45	0.000	-11482.753	-11482.753	0.000	-478.448	-478.448

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
35,36	0.000	-0.086	-0.086
36,37	0.000	-0.095	-0.095
37,38	0.000	-0.103	-0.103
38,39	0.000	-0.108	-0.108
39,40	0.000	-0.110	-0.110
40,41	0.000	-0.110	-0.110
41,42	0.000	-0.108	-0.108

42,43	0.000	-0.103	-0.103
43,44	0.000	-0.095	-0.095
44,45	0.000	-0.086	-0.086

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation radian	Deflection inch

At the intermediate nodes:

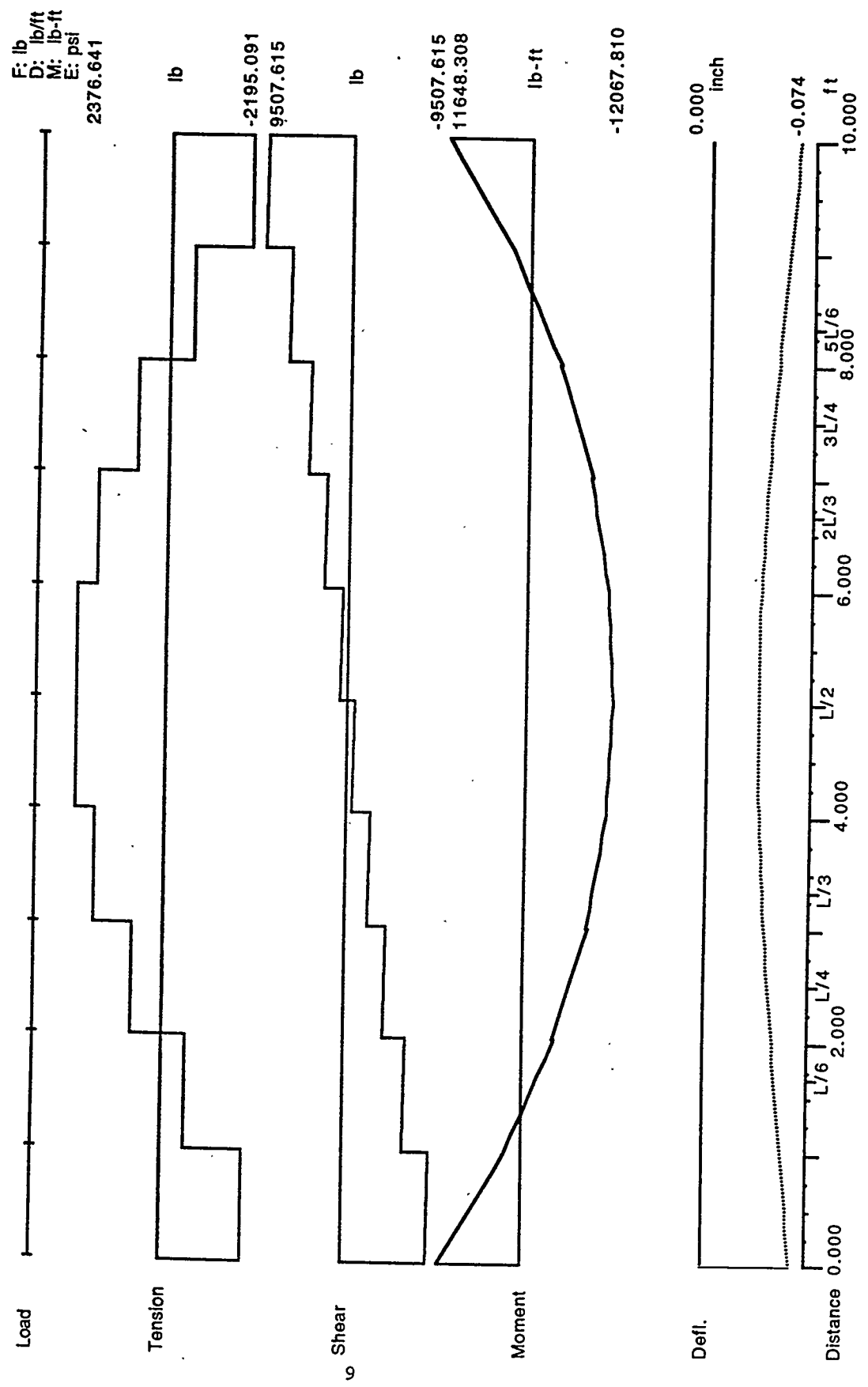
1.000	-0.001	-0.086
2.000	-0.001	-0.095
3.000	-0.001	-0.103
4.000	-0.000	-0.108
5.000	0.000	-0.110
6.000	0.000	-0.108
7.000	0.001	-0.103
8.000	0.001	-0.095
9.000	0.001	-0.086

At evenly-spaced intervals:

0.000	-0.001	-0.078
1.000	-0.001	-0.086
2.000	-0.001	-0.095
3.000	-0.001	-0.103
4.000	-0.000	-0.108
5.000	0.000	-0.110
6.000	0.000	-0.108
7.000	0.001	-0.103
8.000	0.001	-0.095
9.000	0.001	-0.086
10.000	0.001	-0.078

FRAME MAC file: 5(28) PRELIMINARY; Last modified at 21:10:37 on Thu, May 6, 1993

Node 12	Node 13	Node 14	Node 15	Node 16	Node 17	Node 18	Node 19	Node 20	Node 21	Node 22
4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000	13.000	14.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Continuous Elements Output Data

FRAME MAC file: 5(2/8) PRELIMINARY.

Last modified at 21:10:37 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
12	-0.000	-0.074	0.001
13	-0.000	-0.066	0.001
14	-0.000	-0.057	0.001
15	-0.000	-0.050	0.001
16	-0.000	-0.045	0.000
17	0.000	-0.043	0.000
18	0.000	-0.045	-0.000
19	0.000	-0.050	-0.001
20	0.000	-0.057	-0.001
21	0.000	-0.066	-0.001
22	0.000	-0.074	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
12,13	0.000	105.000	17.500	0.000	105.000	-17.500
13,14	0.000	105.000	17.500	0.000	105.000	-17.500
14,15	0.000	105.000	17.500	0.000	105.000	-17.500
15,16	0.000	105.000	17.500	0.000	105.000	-17.500
16,17	0.000	105.000	17.500	0.000	105.000	-17.500
17,18	0.000	105.000	17.500	0.000	105.000	-17.500
18,19	0.000	105.000	17.500	0.000	105.000	-17.500
19,20	0.000	105.000	17.500	0.000	105.000	-17.500
20,21	0.000	105.000	17.500	0.000	105.000	-17.500
21,22	0.000	105.000	17.500	0.000	105.000	-17.500

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
12,13	2195.091	-9297.615	-11648.308	-2195.091	9507.615	2245.693
13,14	606.231	-6647.910	-2343.550	-606.231	6857.910	-4409.360
14,15	-808.730	-4378.716	4319.850	808.730	4588.716	-8803.566
15,16	-1839.099	-2438.391	8737.178	1839.099	2648.391	-11280.569
16,17	-2376.641	-717.260	11245.549	2376.641	927.260	-12067.810
17,18	-2376.641	927.260	12067.810	2376.641	-717.260	-11245.549
18,19	-1839.099	2648.391	11280.569	1839.099	-2438.391	-8737.178
19,20	-808.730	4588.716	8803.566	808.730	-4378.716	-4319.850
20,21	606.231	6857.910	4409.360	-606.231	-6647.910	2343.550
21,22	2195.091	9507.615	-2245.693	-2195.091	-9297.615	11648.308

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
12,13	-0.000	-0.074	0.001	-0.000	-0.066	0.001
13,14	-0.000	-0.066	0.001	-0.000	-0.057	0.001
14,15	-0.000	-0.057	0.001	-0.000	-0.050	0.001
15,16	-0.000	-0.050	0.001	-0.000	-0.045	0.000
16,17	-0.000	-0.045	0.000	0.000	-0.043	0.000
17,18	0.000	-0.043	0.000	0.000	-0.045	-0.000
18,19	0.000	-0.045	-0.000	0.000	-0.050	-0.001
19,20	0.000	-0.050	-0.001	0.000	-0.057	-0.001
20,21	0.000	-0.057	-0.001	0.000	-0.066	-0.001
21,22	0.000	-0.066	-0.001	0.000	-0.074	-0.001

Maximum deformations:

Node 14 moved 0.000 inch to the left.

Node 20 moved 0.000 inch to the right.

Node 12 moved 0.074 inch downwards.
 No nodes moved upwards.
 Node 21 rotated 0.001 radian clockwise.
 Node 13 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
 There were no reactions to the right.
 There were no downwards reactions.
 There were no upwards reactions.
 There were no clockwise reactions.
 There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
12,13	0.000	-2195.091	-2195.091	0.000	-15.244	-15.244
13,14	0.000	-606.231	-606.231	0.000	-4.210	-4.210
14,15	808.730	0.000	808.730	5.616	0.000	5.616
15,16	1839.099	0.000	1839.099	12.772	0.000	12.772
16,17	2376.641	0.000	2376.641	16.504	0.000	16.504
17,18	2376.641	0.000	2376.641	16.504	0.000	16.504
18,19	1839.099	0.000	1839.099	12.772	0.000	12.772
19,20	808.730	0.000	808.730	5.616	0.000	5.616
20,21	0.000	-606.231	-606.231	0.000	-4.210	-4.210
21,22	0.000	-2195.091	-2195.091	0.000	-15.244	-15.244

Maximum shear and shear stress values:

From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
12,13	0.000	-9507.615	-9507.615	0.000	-66.025	-66.025
13,14	0.000	-6857.910	-6857.910	0.000	-47.624	-47.624
14,15	0.000	-4588.716	-4588.716	0.000	-31.866	-31.866
15,16	0.000	-2648.391	-2648.391	0.000	-18.392	-18.392
16,17	0.000	-927.260	-927.260	0.000	-6.439	-6.439
17,18	927.260	0.000	927.260	6.439	0.000	6.439
18,19	2648.391	0.000	2648.391	18.392	0.000	18.392
19,20	4588.716	0.000	4588.716	31.866	0.000	31.866
20,21	6857.910	0.000	6857.910	47.624	0.000	47.624
21,22	9507.615	0.000	9507.615	66.025	0.000	66.025

Maximum moment and bending stress values:

From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
12,13	11648.308	0.000	11648.308	485.346	0.000	485.346
13,14	2343.550	-4409.360	-4409.360	97.648	-183.723	-183.723
14,15	0.000	-8803.566	-8803.566	0.000	-366.815	-366.815
15,16	0.000	-11280.569	-11280.569	0.000	-470.024	-470.024
16,17	0.000	-12067.810	-12067.810	0.000	-502.825	-502.825
17,18	0.000	-12067.810	-12067.810	0.000	-502.825	-502.825
18,19	0.000	-11280.569	-11280.569	0.000	-470.024	-470.024
19,20	0.000	-8803.566	-8803.566	0.000	-366.815	-366.815
20,21	2343.550	-4409.360	-4409.360	97.648	-183.723	-183.723
21,22	11648.308	0.000	11648.308	485.346	0.000	485.346

Maximum deflection values:

From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
12,13	0.000	-0.074	-0.074
13,14	0.000	-0.066	-0.066
14,15	0.000	-0.057	-0.057
15,16	0.000	-0.050	-0.050
16,17	0.000	-0.045	-0.045
17,18	0.000	-0.045	-0.045
18,19	0.000	-0.050	-0.050

19,20	0.000	-0.057	-0.057
20,21	0.000	-0.066	-0.066
21,22	0.000	-0.074	-0.074

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom)	Rotation radian	Deflection inch

At the intermediate nodes:		
1.000	0.001	-0.066
2.000	0.001	-0.057
3.000	0.001	-0.050
4.000	0.000	-0.045
5.000	0.000	-0.043
6.000	-0.000	-0.045
7.000	-0.001	-0.050
8.000	-0.001	-0.057
9.000	-0.001	-0.066
At evenly-spaced intervals:		
0.000	0.001	-0.074
1.000	0.001	-0.066
2.000	0.001	-0.057
3.000	0.001	-0.050
4.000	0.000	-0.045
5.000	0.000	-0.043
6.000	-0.000	-0.045
7.000	-0.001	-0.050
8.000	-0.001	-0.057
9.000	-0.001	-0.066
10.000	-0.001	-0.074

FRAME MAC file: 5(2/8) PRELIMINARY; Last modified at 21:10:37 on Thu, May 6, 1993

Node 12
4.000
0.000

Node 23
4.000
2.000

Node 25
4.000
4.000

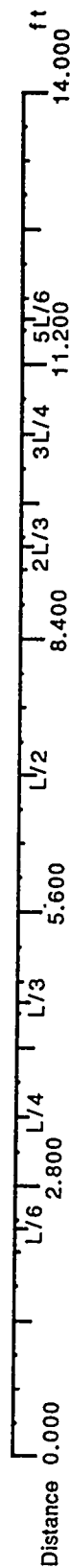
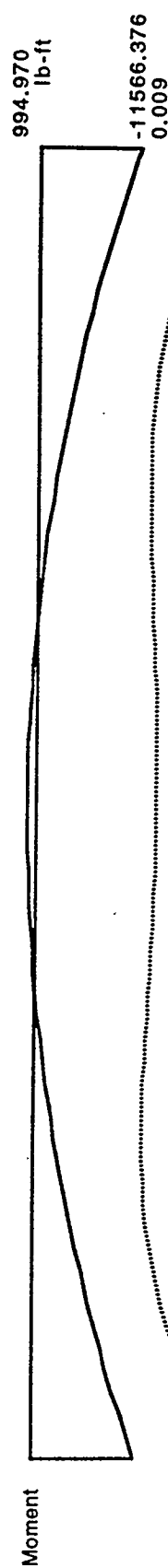
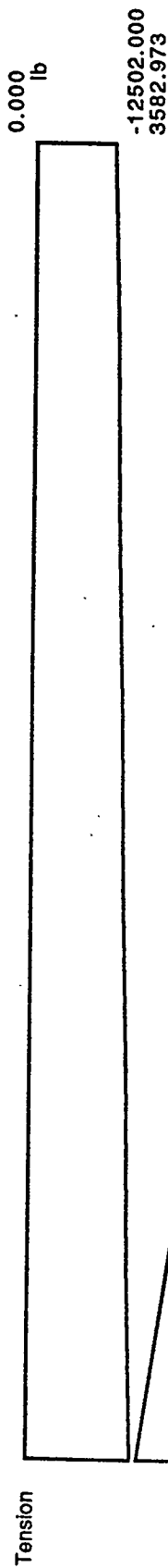
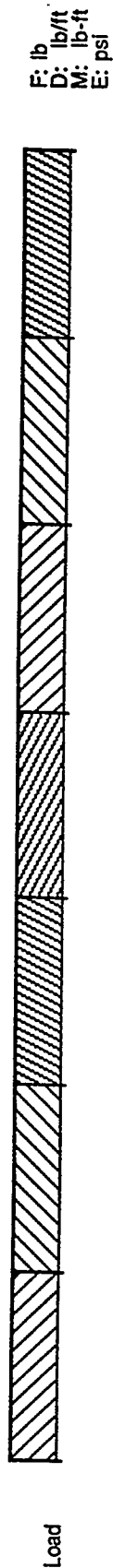
Node 27
4.000
6.000

Node 29
4.000
8.000

Node 31
4.000
10.000

Node 33
4.000
12.000

Node 35
4.000
14.000



Continuous Elements Output Data

FRAME MAC file: 5(2/8) PRELIMINARY.

Last modified at 21:10:37 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
12	-0.000	-0.074	0.001
23	-0.008	-0.075	0.000
25	-0.009	-0.075	-0.000
27	-0.008	-0.076	-0.000
29	-0.008	-0.077	0.000
31	-0.009	-0.077	0.000
33	-0.007	-0.078	-0.000
35	0.000	-0.078	-0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
12,23	210.000	511.000	170.333	210.000	511.000	-170.333
23,25	210.000	511.000	170.333	210.000	511.000	-170.333
25,27	210.000	511.000	170.333	210.000	511.000	-170.333
27,29	210.000	511.000	170.333	210.000	511.000	-170.333
29,31	210.000	511.000	170.333	210.000	511.000	-170.333
31,33	210.000	511.000	170.333	210.000	511.000	-170.333
33,35	210.000	511.000	170.333	210.000	511.000	-170.333

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
12,23	12502.000	3582.973	11566.376	-12082.000	-2560.973	-5422.430
23,25	12082.000	2560.973	5422.430	-11662.000	-1538.973	-1322.484
25,27	11662.000	1538.973	1322.484	-11242.000	-516.973	733.462
27,29	11242.000	516.973	-733.462	-10822.000	505.027	745.409
29,31	10822.000	-505.027	-745.409	-10402.000	1527.027	-1286.645
31,33	10402.000	-1527.027	1286.645	-9982.000	2549.027	-5362.699
33,35	9982.000	-2549.027	5362.699	-9562.000	3571.027	-11482.753

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
12,23	-0.074	0.000	0.001	-0.075	0.008	0.000
23,25	-0.075	0.008	0.000	-0.075	0.009	-0.000
25,27	-0.075	0.009	-0.000	-0.076	0.008	-0.000
27,29	-0.076	0.008	-0.000	-0.077	0.008	0.000
29,31	-0.077	0.008	0.000	-0.077	0.009	0.000
31,33	-0.077	0.009	0.000	-0.078	0.007	-0.000
33,35	-0.078	0.007	-0.000	-0.078	-0.000	-0.001

Maximum deformations:

Node 25 moved 0.009 inch to the left.
Node 35 moved 0.000 inch to the right.
Node 35 moved 0.078 inch downwards.
No nodes moved upwards.
Node 35 rotated 0.001 radian clockwise.
Node 12 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):						
From, To Node	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi

12,23	0.000	-12502.000	-12502.000	0.000	-86.819	-86.819
23,25	0.000	-12082.000	-12082.000	0.000	-83.903	-83.903
25,27	0.000	-11662.000	-11662.000	0.000	-80.986	-80.986
27,29	0.000	-11242.000	-11242.000	0.000	-78.069	-78.069
29,31	0.000	-10822.000	-10822.000	0.000	-75.153	-75.153
31,33	0.000	-10402.000	-10402.000	0.000	-72.236	-72.236
33,35	0.000	-9982.000	-9982.000	0.000	-69.319	-69.319

Maximum shear and shear stress values:						
From, To Node	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi

12,23	3582.973	0.000	3582.973	24.882	0.000	24.882
23,25	2560.973	0.000	2560.973	17.785	0.000	17.785
25,27	1538.973	0.000	1538.973	10.687	0.000	10.687
27,29	516.973	-505.027	516.973	3.590	-3.507	3.590
29,31	0.000	-1527.027	-1527.027	0.000	-10.604	-10.604
31,33	0.000	-2549.027	-2549.027	0.000	-17.702	-17.702
33,35	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799

Maximum moment and bending stress values:						
From, To Node	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi

12,23	0.000	-11566.376	-11566.376	0.000	-481.932	-481.932
23,25	0.000	-5422.430	-5422.430	0.000	-225.935	-225.935
25,27	733.462	-1322.484	-1322.484	30.561	-55.103	-55.103
27,29	994.970	0.000	994.970	41.457	0.000	41.457
29,31	745.409	-1286.645	-1286.645	31.059	-53.610	-53.610
31,33	0.000	-5362.699	-5362.699	0.000	-223.446	-223.446
33,35	0.000	-11482.753	-11482.753	0.000	-478.448	-478.448

Maximum deflection values:						
From, To Node	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch			

12,23	0.008	0.000	0.008			
23,25	0.009	0.000	0.009			
25,27	0.009	0.000	0.009			
27,29	0.008	0.000	0.008			
29,31	0.009	0.000	0.009			
31,33	0.009	0.000	0.009			
33,35	0.007	-0.000	0.007			

Deflections along the elements (positive is up or counter-clockwise):						
Distance from left (bottom) ft	Rotation radian	Deflection inch				

At the intermediate nodes:						
2.000	0.000	0.008				
4.000	-0.000	0.009				
6.000	-0.000	0.008				
8.000	0.000	0.008				
10.000	0.000	0.009				
12.000	-0.000	0.007				

At evenly-spaced intervals:						
0.000	0.001	0.000				
1.400	0.000	0.006				
2.800	0.000	0.009				
4.200	-0.000	0.009				
5.600	-0.000	0.008				
7.000	-0.000	0.008				

8.400	0.000	0.008
9.800	0.000	0.009
11.200	-0.000	0.008
12.600	-0.000	0.006
14.000	-0.001	-0.000

FRAME MAC file: 5(2/8) PRELIMINARY; Last modified at 21:10:37 on Thu, May 6, 1993

Node 22
14.000
0.000

Node 24
14.000
2.000

Node 26
14.000
4.000

Node 28
14.000
6.000

Node 30
14.000
8.000

Node 32
14.000
10.000

Node 34
14.000
12.000

Node 45
14.000
14.000

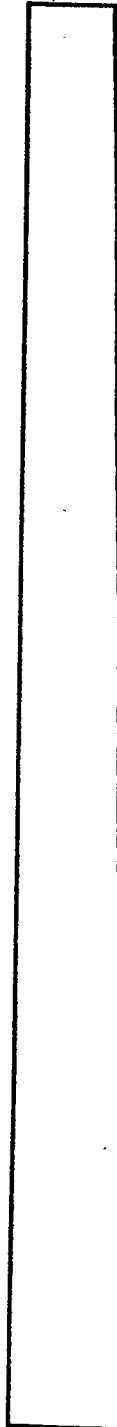
F: lb
D: lb/ft
M: lb-ft
E: psi



Load

0.000
lb

Tension



-12502.000
3571.027

lb

Shear



-3582.973
11566.376

lb-ft
-994.970

Moment



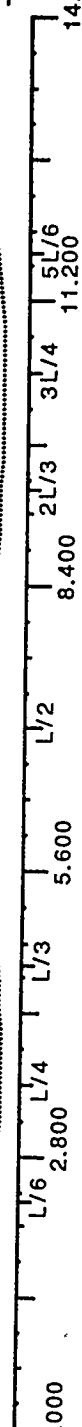
0.000
Inch

Defl.



-0.009
ft

Distance 0.000



Continuous Elements Output Data

FRAME MAC file: 5(2/8) PRELIMINARY.

Last modified at 21:10:37 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Support reactions: (pos. force is to right or up; pos. moment is ccw.)

Node No.	Reaction lb (FX)	Reaction lb (FY)	Reaction lb-ft (MZ)

Node deformations: (positive is to right, up, or counterclockwise.)

Node No.	Deflection inch (FX)	Deflection inch (FY)	Rotation radians (MZ)
22	0.000	-0.074	-0.001
24	0.008	-0.075	-0.000
26	0.009	-0.075	0.000
28	0.008	-0.076	0.000
30	0.008	-0.077	-0.000
32	0.009	-0.077	-0.000
34	0.007	-0.078	0.000
45	-0.000	-0.078	0.001

Element fixed-end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
22,24	210.000	-511.000	-170.333	210.000	-511.000	170.333
24,26	210.000	-511.000	-170.333	210.000	-511.000	170.333
26,28	210.000	-511.000	-170.333	210.000	-511.000	170.333
28,30	210.000	-511.000	-170.333	210.000	-511.000	170.333
30,32	210.000	-511.000	-170.333	210.000	-511.000	170.333
32,34	210.000	-511.000	-170.333	210.000	-511.000	170.333
34,45	210.000	-511.000	-170.333	210.000	-511.000	170.333

Actual element end forces & moments: (local coordinate system)

From, To Nodes	FxL lb	FyL lb	MzL lb-ft	FxR lb	FyR lb	MzR lb-ft
22,24	12502.000	-3582.973	-11566.376	-12082.000	2560.973	5422.430
24,26	12082.000	-2560.973	-5422.430	-11662.000	1538.973	1322.484
26,28	11662.000	-1538.973	-1322.484	-11242.000	516.973	-733.462
28,30	11242.000	-516.973	733.462	-10822.000	-505.027	-745.409
30,32	10822.000	505.027	745.409	-10402.000	-1527.027	1286.645
32,34	10402.000	1527.027	-1286.645	-9982.000	-2549.027	5362.699
34,45	9982.000	2549.027	-5362.699	-9562.000	-3571.027	11482.753

Member end deformations: (local coordinate system)

From, To Nodes	dx at L inch	dy at L inch	rotZ at L radians	dx at R inch	dy at R inch	rotZ at R radians
22,24	-0.074	-0.000	-0.001	-0.075	-0.008	-0.000
24,26	-0.075	-0.008	-0.000	-0.075	-0.009	0.000
26,28	-0.075	-0.009	0.000	-0.076	-0.008	0.000
28,30	-0.076	-0.008	0.000	-0.077	-0.008	-0.000
30,32	-0.077	-0.008	-0.000	-0.077	-0.009	-0.000
32,34	-0.077	-0.009	-0.000	-0.078	-0.007	0.000
34,45	-0.078	-0.007	0.000	-0.078	0.000	0.001

Maximum deformations:

Node 45 moved 0.000 inch to the left.
Node 26 moved 0.009 inch to the right.
Node 45 moved 0.078 inch downwards.
No nodes moved upwards.
Node 22 rotated 0.001 radian clockwise.
Node 45 rotated 0.001 radian counter-clockwise.

Maximum reactions:

There were no reactions to the left.
There were no reactions to the right.
There were no downwards reactions.
There were no upwards reactions.
There were no clockwise reactions.
There were no counter-clockwise reactions.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
22,24	0.000	-12502.000	-12502.000	0.000	-86.819	-86.819
24,26	0.000	-12082.000	-12082.000	0.000	-83.903	-83.903
26,28	0.000	-11662.000	-11662.000	0.000	-80.986	-80.986
28,30	0.000	-11242.000	-11242.000	0.000	-78.069	-78.069
30,32	0.000	-10822.000	-10822.000	0.000	-75.153	-75.153
32,34	0.000	-10402.000	-10402.000	0.000	-72.236	-72.236
34,45	0.000	-9982.000	-9982.000	0.000	-69.319	-69.319

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
22,24	0.000	-3582.973	-3582.973	0.000	-24.882	-24.882
24,26	0.000	-2560.973	-2560.973	0.000	-17.785	-17.785
26,28	0.000	-1538.973	-1538.973	0.000	-10.687	-10.687
28,30	505.027	-516.973	-516.973	3.507	-3.590	-3.590
30,32	1527.027	0.000	1527.027	10.604	0.000	10.604
32,34	2549.027	0.000	2549.027	17.702	0.000	17.702
34,45	3571.027	0.000	3571.027	24.799	0.000	24.799

Maximum moment and bending stress values:

From, To Node ---	Maximum moment lb-ft	Minimum moment lb-ft	Max. abs. moment lb-ft	Maximum ben. str. psi	Minimum ben. str. psi	Max. abs. stress psi
22,24	11566.376	0.000	11566.376	481.932	0.000	481.932
24,26	5422.430	0.000	5422.430	225.935	0.000	225.935
26,28	1322.484	-733.462	1322.484	55.103	-30.561	55.103
28,30	0.000	-994.970	-994.970	0.000	-41.457	-41.457
30,32	1286.645	-745.409	1286.645	53.610	-31.059	53.610
32,34	5362.699	0.000	5362.699	223.446	0.000	223.446
34,45	11482.753	0.000	11482.753	478.448	0.000	478.448

Maximum deflection values:

From, To Node ---	Maximum defl. up (left) inch	Maximum defl. down (rt.) inch	Maximum defl. absolute inch
22,24	0.000	-0.008	-0.008
24,26	0.000	-0.009	-0.009
26,28	0.000	-0.009	-0.009
28,30	0.000	-0.008	-0.008
30,32	0.000	-0.009	-0.009
32,34	0.000	-0.009	-0.009
34,45	0.000	-0.007	-0.007

Deflections along the elements (positive is up or counter-clockwise):

Distance from left (bottom) ft	Rotation --- radian	Deflection --- inch

At the intermediate nodes:

2.000	-0.000	-0.008
4.000	0.000	-0.009
6.000	0.000	-0.008
8.000	-0.000	-0.008
10.000	-0.000	-0.009
12.000	0.000	-0.007

At evenly-spaced intervals:

0.000		
1.400	-0.001	-0.000
2.800	-0.000	-0.006
4.200	-0.000	-0.009
5.600	0.000	-0.009
7.000	0.000	-0.008

8.400	-0.000	-0.008
9.800	-0.000	-0.009
11.200	0.000	-0.008
12.600	0.000	-0.006
14.000	0.001	0.000

Output Data

FRAME MAC file: 5(2/8) PRELIMINARY.

Last modified at 21:10:37 on Thu, May 6, 1993.

All coord. and distances are in ft from the left (bot.) end of the element.

Maximum tension and tensile stress values (compression is negative):

From, To Node ---	Maximum tension lb	Minimum tension lb	Max. abs. tension lb	Maximum ten. str. psi	Minimum ten. str. psi	Max. abs. stress psi
1,12	0.000	-3204.385	-3204.385	0.000	-22.253	-22.253
2,13	0.000	-2859.704	-2859.704	0.000	-19.859	-19.859
3,14	0.000	-2479.195	-2479.195	0.000	-17.217	-17.217
4,15	0.000	-2150.325	-2150.325	0.000	-14.933	-14.933
5,16	0.000	-1931.131	-1931.131	0.000	-13.411	-13.411
6,17	0.000	-1854.520	-1854.520	0.000	-12.879	-12.879
7,18	0.000	-1931.131	-1931.131	0.000	-13.411	-13.411
8,19	0.000	-2150.325	-2150.325	0.000	-14.933	-14.933
9,20	0.000	-2479.195	-2479.195	0.000	-17.217	-17.217
10,21	0.000	-2859.704	-2859.704	0.000	-19.859	-19.859
11,22	0.000	-3204.385	-3204.385	0.000	-22.253	-22.253
12,13	0.000	-2195.091	-2195.091	0.000	-15.244	-15.244
12,23	0.000	-12502.000	-12502.000	0.000	-86.819	-86.819
13,14	0.000	-606.231	-606.231	0.000	-4.210	-4.210
14,15	808.730	0.000	808.730	5.616	0.000	5.616
15,16	1839.099	0.000	1839.099	12.772	0.000	12.772
16,17	2376.641	0.000	2376.641	16.504	0.000	16.504
17,18	2376.641	0.000	2376.641	16.504	0.000	16.504
18,19	1839.099	0.000	1839.099	12.772	0.000	12.772
19,20	808.730	0.000	808.730	5.616	0.000	5.616
20,21	0.000	-606.231	-606.231	0.000	-4.210	-4.210
21,22	0.000	-2195.091	-2195.091	0.000	-15.244	-15.244
22,24	0.000	-12502.000	-12502.000	0.000	-86.819	-86.819
23,25	0.000	-12082.000	-12082.000	0.000	-83.903	-83.903
24,26	0.000	-12082.000	-12082.000	0.000	-83.903	-83.903
25,27	0.000	-11662.000	-11662.000	0.000	-80.986	-80.986
26,28	0.000	-11662.000	-11662.000	0.000	-80.986	-80.986
27,29	0.000	-11242.000	-11242.000	0.000	-78.069	-78.069
28,30	0.000	-11242.000	-11242.000	0.000	-78.069	-78.069
29,31	0.000	-10822.000	-10822.000	0.000	-75.153	-75.153
30,32	0.000	-10822.000	-10822.000	0.000	-75.153	-75.153
31,33	0.000	-10402.000	-10402.000	0.000	-72.236	-72.236
32,34	0.000	-10402.000	-10402.000	0.000	-72.236	-72.236
33,35	0.000	-9982.000	-9982.000	0.000	-69.319	-69.319
34,45	0.000	-9982.000	-9982.000	0.000	-69.319	-69.319
35,36	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
36,37	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
37,38	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
38,39	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
39,40	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
40,41	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
41,42	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
42,43	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
43,44	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
44,45	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799

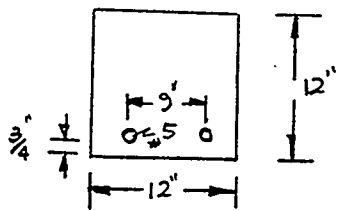
SOIL LAYER 11
AGE 17.12.2
1760 P25

Maximum shear and shear stress values:

From, To Node ---	Maximum shear lb	Minimum shear lb	Max. abs. shear lb	Maximum shr. str. psi	Minimum shr. str. psi	Max. abs. stress psi
1,12	1387.882	0.000	1387.882	9.638	0.000	9.638
2,13	1588.860	0.000	1588.860	11.034	0.000	11.034
3,14	1414.961	0.000	1414.961	9.826	0.000	9.826
4,15	1030.370	0.000	1030.370	7.155	0.000	7.155
5,16	537.542	0.000	537.542	3.733	0.000	3.733
6,17	0.000	0.000	0.000	0.000	0.000	0.000
7,18	0.000	-537.542	-537.542	0.000	-3.733	-3.733
8,19	0.000	-1030.370	-1030.370	0.000	-7.155	-7.155
9,20	0.000	-1414.961	-1414.961	0.000	-9.826	-9.826
10,21	0.000	-1588.860	-1588.860	0.000	-11.034	-11.034
11,22	0.000	-1387.882	-1387.882	0.000	-9.638	-9.638
12,13	0.000	-9507.615	-9507.615	0.000	-66.025	-66.025
12,23	3582.973	0.000	3582.973	24.882	0.000	24.882

13,14	0.000	-6857.910	-6857.910	0.000	-47.624	-47.624
14,15	0.000	-4588.716	-4588.716	0.000	-31.866	-31.866
15,16	0.000	-2648.391	-2648.391	0.000	-18.392	-18.392
16,17	0.000	-927.260	-927.260	0.000	-6.439	-6.439
17,18	927.260	0.000	927.260	6.439	0.000	6.439
18,19	2648.391	0.000	2648.391	18.392	0.000	18.392
19,20	4588.716	0.000	4588.716	31.866	0.000	31.866
20,21	6857.910	0.000	6857.910	47.624	0.000	47.624
21,22	9507.615	0.000	9507.615	66.025	0.000	66.025
22,24	0.000	-3582.973	-3582.973	0.000	-24.882	-24.882
23,25	2560.973	0.000	2560.973	17.785	0.000	17.785
24,26	0.000	-2560.973	-2560.973	0.000	-17.785	-17.785
25,27	1538.973	0.000	1538.973	10.687	0.000	10.687
26,28	0.000	-1538.973	-1538.973	0.000	-10.687	-10.687
27,29	516.973	-505.027	516.973	3.590	-3.507	3.590
28,30	505.027	-516.973	-516.973	3.507	-3.590	-3.590
29,31	0.000	-1527.027	-1527.027	0.000	-10.604	-10.604
30,32	1527.027	0.000	1527.027	10.604	0.000	10.604
31,33	0.000	-2549.027	-2549.027	0.000	-17.702	-17.702
32,34	2549.027	0.000	2549.027	17.702	0.000	17.702
33,35	0.000	-3571.027	-3571.027	0.000	-24.799	-24.799
34,45	3571.027	0.000	3571.027	24.799	0.000	24.799
35,36	9562.000	0.000	9562.000	66.403	0.000	66.403
36,37	7649.600	0.000	7649.600	53.122	0.000	53.122
37,38	5737.200	0.000	5737.200	39.842	0.000	39.842
38,39	3824.800	0.000	3824.800	26.561	0.000	26.561
39,40	1912.400	0.000	1912.400	13.281	0.000	13.281
40,41	0.000	-1912.400	-1912.400	0.000	-13.281	-13.281
41,42	0.000	-3824.800	-3824.800	0.000	-26.561	-26.561
42,43	0.000	-5737.200	-5737.200	0.000	-39.842	-39.842
43,44	0.000	-7649.600	-7649.600	0.000	-53.122	-53.122
44,45	0.000	-9562.000	-9562.000	0.000	-66.403	-66.403

1. MOMENT CAPACITY - ROOF, FLOOR & WALLS



$$A_{ST} = \frac{(2)(\pi)(0.625)}{2} = 0.1136 \text{ m}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$b = 12"$$

$$a = \frac{A_{ST} f_y}{(0.85) f'_c b} = \frac{(0.1136)(60,000)}{(0.85)(3,000)(12)}$$

$$d = 12 - 0.75 - 0.625/2 = 10.938 \text{ in}$$

$$\phi = 0.9$$

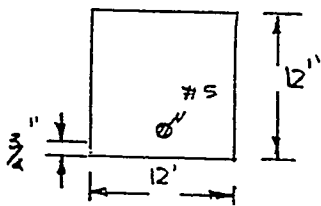
$$a = 0.8021$$

$$\phi M_n = \phi \left[A_{ST} f_y \left(d - \frac{a}{2} \right) \right] = 0.9 \left[(0.1136)(60,000) \left(10.938 - \frac{0.8021}{2} \right) \right]$$

$$\phi M_n = 349,136 \text{ in-lbs}$$

$$= 29,094 \text{ ft-lbs}$$

LEFT & RIGHT WALL (INSIDE)



$$A_{ST} = \frac{(1)(\pi)(0.625)}{2} = 0.3068 \text{ m}^2$$

$$f_y = 60,000 \text{ psi}$$

$$f'_c = 3,000 \text{ psi}$$

$$d = 12 - 0.75 - 0.625/2 = 10.938 \text{ in}$$

$$\phi = 0.9$$

$$a = \frac{(0.3068)(60,000)}{(0.85)(3,000)(12)}$$

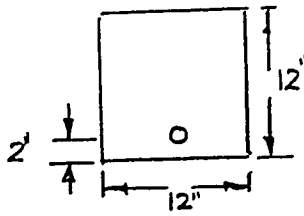
$$= 0.6016 \text{ in}$$

$$\phi M_n = 0.9 \left[(0.3068)(60,000) \left(10.938 - \frac{0.6016}{2} \right) \right]$$

$$\phi M_n = 176,229 \text{ in-lbs}$$

$$= 14,686 \text{ ft-lbs}$$

LEFT & RIGHT WALL (OUTSIDE)



$$a = \frac{(0.3068)(60,000)}{(0.85)(3,000)(12)}$$

$$= 0.8021$$

$$\phi M_n = 0.9 \left[(0.3068)(60,000) \left(9.6875 - \frac{0.8021}{2} \right) \right]$$

$$= 153,850 \text{ in-lbs}$$

$$\phi M_n = 12,820 \text{ ft-lbs}$$

2. SHEAR CAPACITY

$$V_n = V_c = 2 \sqrt{f'_c} b_w d$$

$$\phi V_n = \phi V_c = (0.85)(2)(\sqrt{3000})(12)(10.938)$$

$$= 12,222 \text{ lbs}$$

$$f'_c = 3,000 \text{ psi}$$

$$b_w = 12"$$

$$d = 12 - 0.75 - \frac{0.625}{2} = 10.938$$

$$\phi = 0.85$$

3 AXIAL CAPACITY

$$\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{K l_c}{32 h} \right)^2 \right]$$

$$= (0.55)(0.7)(3,000)(144) \left[1 - \left(\frac{(0.8)(156)}{(32)(12)} \right)^2 \right]$$

$$= 148,752 \text{ lb}$$

$$K = 0.8$$

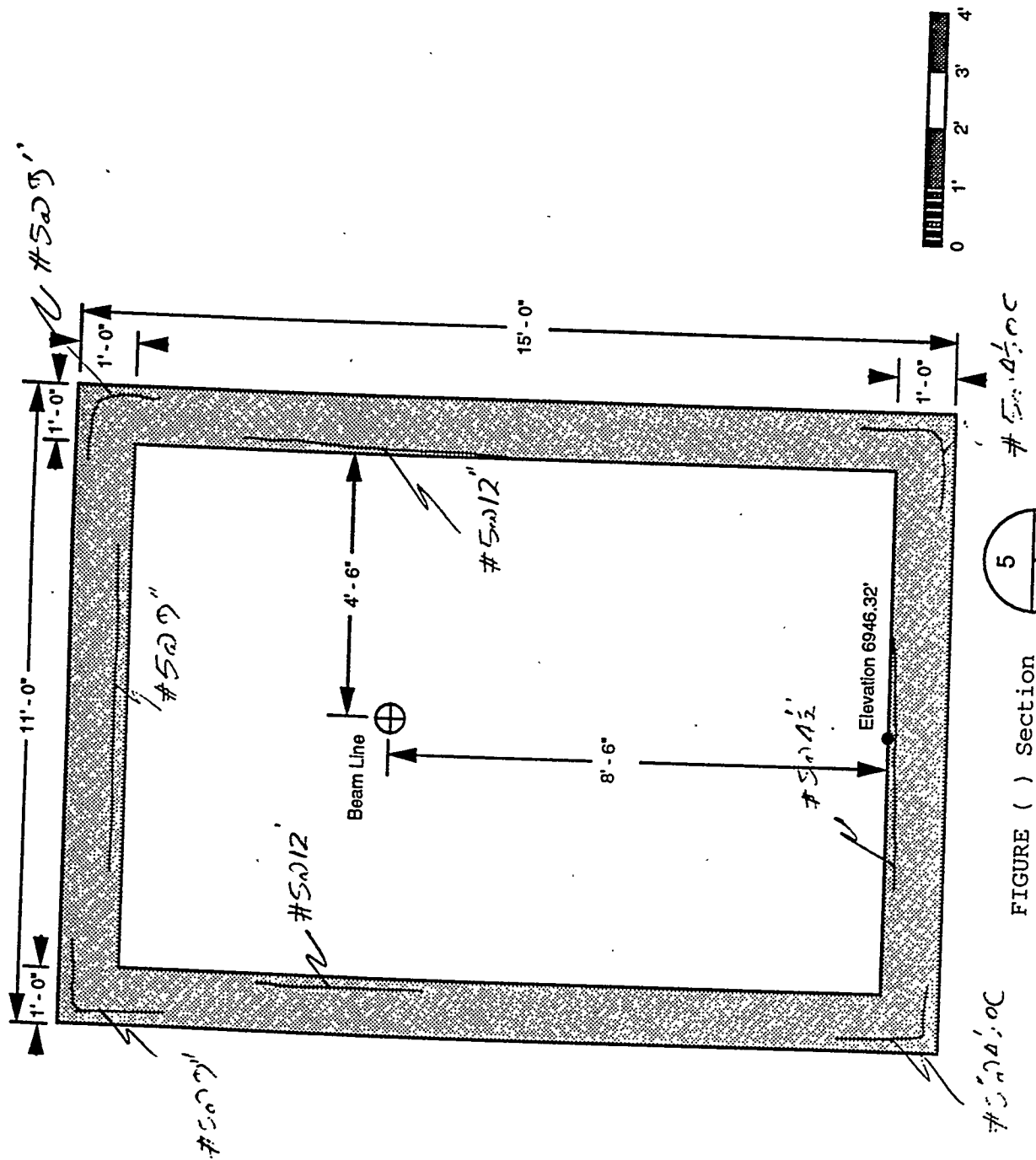
$$h = 12$$

$$l_c = 13' \times 12" = 156$$

$$f'_c = 3,000 \text{ psi}$$

$$A_g = 12" \times 12" = 144 \text{ in}^2$$

$$\phi = 0.7$$



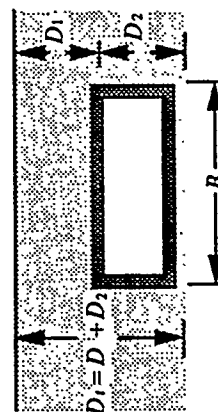
TUNNEL SECTION PAGE ____ OF ____	PRELIMINARY	STRUCTURAL ASSESSMENT		
	TUNNEL ELEMENT	ACI 318-89	VALUE FROM MODEL	COMPLIANCE
Moment Capacity Design of beam for flexural loads is based on: $\phi M_n = \phi \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$ for nominal beam strength and where $\phi = 0.9$ $\phi M_n = 0.9 \left[A_s f_y \left(d - \frac{a}{2} \right) \right]$	ROOF STRUCTURE	29094 ft-lbs	12422 ft-lbs	
	FLOOR STRUCTURE	29094 ft-lbs	12068 ft-lbs	
	LEFT INSIDE WALL	14686 ft-lbs	— ft-lbs	
	LEFT OUTSIDE WALL	12820 ft-lbs	11566 ft-lbs	
	RIGHT INSIDE WALL	14686 ft-lbs	— ft-lbs	
	RIGHT OUTSIDE WALL	12820 ft-lbs	11566 ft-lbs	
Shear Capacity Design shear load is computed by ACI 318-89 (11-3) $V_c = 2\sqrt{f'_c} B_w d$ When factored $\phi V_n = \phi V_c$ where $\phi = 0.85$ $\phi V_c = (0.85) 2\sqrt{f'_c} B_w d$	ROOF STRUCTURE	12,227 lbs	9562 lbs	
	FLOOR STRUCTURE	12,222 lbs	9507 lbs	
	LEFT WALL	12,222 lbs	3582 lbs	
	RIGHT WALL	12,222 lbs	3582 lbs	
Axial Capacity Design axial load ϕP_{nw} is computed by ACI 318-89 (14-1) $\phi P_{nw} = 0.55 \phi f'_c A_g \left[1 - \left(\frac{k l_c}{32h} \right)^2 \right]$ where $\phi = 0.7$	LEFT WALL	148,757 lbs	12502 lbs	
	RIGHT WALL	148,757 lbs	12502 lbs	

where $k = \frac{1 - \sin \theta}{1 + \sin \theta}$
 $k = 0.3$

$\sigma_v = D_1 \rho$ 1216 lbs/ft²
 $\sigma_h = k \sigma_v$ 365 lbs/ft²

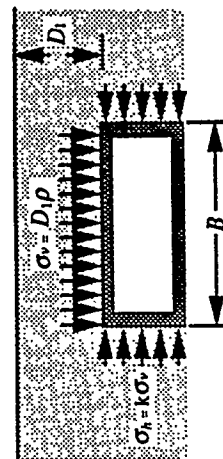
$B = 10$ ft. $D_2 = 15$ ft.
 $D_1 = 10.57$ ft. $D_1 = 25.57$ ft.

Loading Conditions



$$B = 10 \text{ ft.} \quad D_2 = 15 \text{ ft.}$$

$$D_1 = 10.57 \text{ ft.} \quad D_1 = 25.57 \text{ ft.}$$



$$\text{where } k = \frac{1 - \sin \theta}{1 + \sin \theta}$$

$$k = 0.3$$

$$\sigma_v = D_1 \rho \quad 1216 \text{ lbs/ft}^2$$

$$\sigma_h = k \sigma_v \quad 365 \text{ lbs/ft}^2$$

Figure() Structural Assessment Summary