Upgrade Piping Loads on Cleanroom Roof

Steve Sakla
August 28, 1995

D-Zero Engineering Note 3823.115-EN-428

Approved FOR REFERENCE Date _____
ONLY.

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The proposed piping layout for the D0 upgrade will run along the south wall of DAB. The cryogenic service pipe runs above the upper and lower cleanroom roofs and will need to be supported by the roofs' beams. Calculations were done to determine the stresses in the I-beams created by the existing and additional loads due to the upgrade. Refer to drawing no. 3823.115-ME-317283 for drawings of the piping layout. Figure 1 shows the "plan view" portion of this drawing.

The weight of the individual lines were calculated in figure 2 assuming a pipe density of 0.28 lbm/in^3 for stainless steel (0.12% C) and a fluid density (assuming LN2 @ 1 atm) of 0.03 lbm/in^3 . The weights of the corrugated steel flooring, assembly hall feed cans, support beams, and roof hatch were also included in the analysis. These loads are calculated on pgs. 5-6. A floor load of 50 lbf/ft^2 was also added in order to maintain the existing floor load limit in addition to the added piping loads. Measurements of the dimensions of the I-beams determined that the nominal sizes of the beams were W8x21 for the lower roof and W14x26 for the upper roof. Pipe lengths were determined from the drawing for each of the lines on pgs. 1-2 of the calculations (refer to all piping by line numbers according to figure 2). A total weight was calculated for lines 3-9 along the south wall and lines 1-2 running along the north wall of the lower cleanroom roof. To simplify the calculations these weights were assumed to be evenly distributed on the 5 I-beam supports of the lower cleanroom roof 2.5 feet in from the south wall. The stress analysis was done using FrameMac, a 2-D finite element program for the Macintosh. Beam 3 was not included in the analysis because it is structurally equivalent to beam 1. The program outputted maximum values for shear stress, bending stress, shear force, and moments in each of the beams analyzed. These values were then compared to the allowable stresses as per the specifications and codes stated in the AISC: Manual of Steel Construction.

The stresses on the roof beams needed to be determined in a number of different places. The first was in the beam itself which included the flange and web sections. The second place was at the ends of the beams where the flanges were removed to make the perpendicular connections to the other beams on the lower roof (refer to fig. 3). The final point was the framed beam connection which included the bolt analysis. FrameMac

calculated stresses only for the beams which included the sections where the flanges were removed to make the end connections. To analyze the connections, the allowable bending and shear stresses were solved for allowable shear and moments. This was done because FrameMac does not have the capability to analyze the dimensions for the bolts and angles used in the connections were known and the program outputted values for reaction forces and moments at the ends of the beams. Multiplying the allowable shear stress for the bolts and angle connections by their respective areas gave the allowable shear force. The allowable moment for the angle connection was calculated by multiplying the section modulus of the angle by the allowable bending stress. These allowable loads are calculated on pgs. 7-8. The allowable and maximum calculated stresses by FrameMac are summarized in the table below.

		ALLOWABLE	MAXIMUM CALCULATED
BOLTS	SHEAR FORCE	37.1 ksi	1,543 psi @ beam 1, node 1
	AXIAL FORCE	19.4 ksi	1,511 psi @ beam 1, node 3
ANGLE CONNECTION	SHEAR FORCE	33.7 ksi	1,487 psi @ beam 1, node 1
	BENDING STRESS	23.76 ksi	19.33 ksi @ beam 5, node 1
BEAMS	SHEAR STRESS	16,800 psi	1,400 psi @ beam 1, element 6-7
	BENDING STRESS	23,760 psi	16,356 psi @ beam 6, element 1-2

In conclusion, the cleanroom roofs will be able to safely support the weight of the upgrade cryogenic piping, feed cans, corrugated flooring and a 50 lbf/ft² floor load with the addition of diagonal braces at the ends of beams 1,2,3,4, and 8. The location and size of these diagonal braces are shown in fig. 4. Also, the piping supports and feed cans will all need to be placed directly above the I-beam supports. These supports will consist of unistrut structures that will be detailed and specified separate to this analysis. The output and input data from FrameMac and the drawings used in the analysis follow the calculation pages.

PLAN VIEW

NOTE: 1. (SEAL) SUPPORT (H) LOWER CLEANWOOD ROOF
(SEE: HYDROX CATALOG)

	OD [in]	ID [in]	QTY.	AREA [in ²]	V/L [in ²]	FLUID DENSITY [lbm/in ³]	PIPE DENSITY [lbm/in ³]	W/L [lb/ft]
① SOLENOID X-FER LINE:	6.63	6.40	1.00	2.35	32.15	0.03	0.28	19.48
	0.38	0.28	2.00	0.10	0.12	0.03	0.28	0.38
	0.63	0.53	1.00	0.09	0.22	0.03	0.28	0.38
	1.32	1.10	1.00	0.41	0.95	0.03	0.28	1.71
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	1170.47	0.03	0.28	21.95
② VLPC X-FER LINE:	6.63	6.40	1.00	2.35	32.15	0.03	0.28	19.48
	0.38	0.31	1.00	0.03	0.08	0.03	0.28	0.14
	0.50	0.40	3.00	0.21	0.38	0.03	0.28	0.85
	0.84	0.67	1.00	0.20	0.35	0.03	0.28	0.80
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	1153.54	0.03	0.28	21.28
③ LN2 SUPPLY:	1.90	1.68	1.00	0.61	2.22	0.03	0.28	2.86
	0.84	0.67	1.00	0.20	0.36	0.03	0.28	0.79
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	90.21	0.03	0.28	3.65
④ LN2 RETURN:	3.50	3.28	1.00	1.27	8.34	0.03	0.28	7.28
	1.90	1.68	1.00	0.61	2.22	0.03	0.28	2.86
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	369.72	0.03	0.28	10.14
⑤ GHE COOLDOWN RETURN:	1.90	1.68	1.00	0.61	2.22	0.03	0.28	2.86
	0.84	0.67	1.00	0.20	0.36	0.03	0.28	0.79
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	90.21	0.03	0.28	3.65
⑥ HE COOLDOWN SUPPLY:	1.90	1.68	1.00	0.61	2.22	0.03	0.28	2.86
	0.84	0.67	1.00	0.20	0.36	0.03	0.28	0.79
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	90.21	0.03	0.28	3.65
⑦ HIGH PRESSURE HE	2.38	2.16	1.00	0.77	3.66	0.03	0.28	3.89
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	128.19	0.03	0.28	3.89
⑧ STORAGE	1.32	1.10	1.00	0.41	0.95	0.03	0.28	1.71
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
TOTALS				0.00	33.24	0.03	0.28	1.71
⑨ INSTRUMENT AIR	1.32	1.10	1.00	0.41	0.95	0.03	0.28	1.71
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
				0.00	0.00	0.03	0.28	0.00
TOTALS					33.24	0.03		1.71

Figure 2

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UPGRADE PIPING LOADS ON CLEAN ROOM ROOF

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FRAMED BEAM CONNECTION

FIGURE 3

DIAGONAL BRACING LOCATIONS
*(BEAMS 1,2,3,4,8)

FIGURE 4

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PIPE LOADS ON CLEANROOM ROOF

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LINE LENGTHS

SOLENOID X-FEED LINE :

- Valve Box to Tee = 35 ft.
- Tee to Feed Can = 8 ft.
- Tee to South wall = 20 ft.

VLPC X-FEED LINE:

- Valve Box to Tee = 35 ft.
- Tee to Feed Can = 8 ft.
- Tee to South wall = 20 ft.

LN₂ SUPPLY :

- Along West wall = 38 ft.
- Along East wall = 18 ft.

LN₂ Return:

- Along West wall = 8 ft. (feeds into GN2 Vent Line)
- Along East wall = 18 ft.

HE COOLDOWN RETURN:

- Along East Wall = 18 ft.
- Along South wall = 38 ft.

HE COOLDOWN SUPPLY:

- Along East Wall = 18 ft.
- Along South Wall = 38 ft.

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PIPE LOADS ON CLEANROOM ROOF

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HIGH PRESSURE HELIUM:

- Along South Wall = 36 ft.

STORAGE:

- Along South Wall = 28 ft.

INSTRUMENT AIR:

- Along South Wall = 36 ft.

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PIPE LOADS ON CLEANROOM ROOF

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TOTAL WEIGHT ALONG SOUTH WALL:

$$W_3 = (3.65 \text{ }^{1bf}/ft)(38 ft) = 138.7 \text{ }^{1bf}$$

$$W_4 = (10.14 \text{ }^{1bf}/ft)(8 ft) = 81.1 \text{ }^{1bf}$$

$$W_5 = (3.65 \text{ }^{1bf}/ft)(38 ft) = 138.7 \text{ }^{1bf}$$

$$W_6 = (3.65 \text{ }^{1bf}/ft)(38 ft) = 138.7 \text{ }^{1bf}$$

$$W_7 = (3.89 \text{ }^{1bf}/ft)(36 ft) = 140 \text{ }^{1bf}$$

$$W_8 = (1.71 \text{ }^{1bf}/ft)(28 ft) = 47.9 \text{ }^{1bf}$$

$$W_9 = (1.71 \text{ }^{1bf}/ft)(36 ft) = 61.6 \text{ }^{1bf}$$

$$W_{\text{SOUTH}} = 3(138.7) + 81.1 + 140 + 47.9 + 61.6 = \boxed{746.7 \text{ }^{1bf}}$$

TOTAL WEIGHT ALONG NORTH WALL (LOWER ROOF)

$$W_1 = (21.95 \text{ }^{1bf}/ft)(35 ft) = 768 \text{ }^{1bf}$$

$$W_2 = (21.28 \text{ }^{1bf}/ft)(35 ft) = 745 \text{ }^{1bf}$$

$$W_{\text{NORTH}} = \boxed{1513 \text{ }^{1bf}}$$

TOTAL WEIGHT ALONG WEST WALL (LOWER ROOF)

$$W_1 = (21.95 \text{ }^{1bf}/ft)(20 ft) = 439 \text{ }^{1bf}$$

$$W_2 = (21.28 \text{ }^{1bf}/ft)(20 ft) = 426 \text{ }^{1bf}$$

$$W_{\text{WEST}} = \boxed{865 \text{ }^{1bf}}$$

* ALL WEIGHTS INCLUDE MASS OF PIPE &
FLUID WHICH WAS ASSUMED TO BE LN₂ @ 1 ATM

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PIPE LOADS ON LOWER CLEAN ROOM ROOF

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$$I_{NA} = \frac{1}{12} (0.25) (7.48)^3 + 2 \left[\frac{1}{12} (5.27) (0.40)^3 + (0.40) (5.27) (3.94)^2 \right] = 266.64 \text{ in}^4$$

$$\Rightarrow \underline{\underline{0.01286 \text{ ft}^4}}$$

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FLOOR LOADS ON CLEANROOM ROOFS

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LOWER CLEANROOM ROOF:

Dimensions: 27.5' x 14' (Since the floor is corrugated increase by 200%)

$$\text{Area} = (27.5 \text{ ft})(28 \text{ ft}) = 770 \text{ ft}^2$$

- Using a conservative thickness of $\frac{3}{16}$ " (0.188)

$$P_{\text{steel}} = 487 \text{ lb/ft}^3$$

$$W_{\text{floor}} = (770 \text{ ft}^2) \left(\frac{0.188}{12} \text{ ft} \right) (487 \text{ lb/ft}^3) = 5860 \text{ lbf}$$

$$W_{\text{floor}} \approx 6000 \text{ lbf}$$

$$\text{TOTAL LENGTH OF BEAMS} = 4 \times 14 + 22 + 5.25 + 0.5 = 83.75 \text{ ft}$$

$$\frac{W}{L} = \frac{6000 \text{ lbf}}{83.75 \text{ ft}} = \underline{\underline{71.6 \text{ lb/ft}}}$$

* Assuming a weight of 500 lbf for roof hatch, $\frac{W}{L} = \frac{500 \text{ lbf}}{38.5 \text{ ft}} = \underline{\underline{13 \text{ lb/ft}}}$

UPPER CLEANROOM ROOF

$$\text{AREA} = \left(\frac{400}{12} \text{ ft} \right) (32 \text{ ft}) = 1067 \text{ ft}^2$$

$$W_{\text{floor}} = (1067 \text{ ft}^2) \left(\frac{0.188}{12} \text{ ft} \right) (487 \text{ lb/ft}^3) = 8138 \text{ lbf}$$

$$\text{TOTAL LENGTH OF BEAMS} = 8 (32 \text{ ft}) = 256 \text{ ft}$$

$$\frac{W}{L} = \frac{8138 \text{ lbf}}{256 \text{ ft}} = \underline{\underline{31.8 \text{ lb/ft}}}$$

NOTE: BOTH FLOOR LOAD LIMITS ARE 50 lb/ft^2

$$\left(\frac{W}{L} \right)_L = (50 \text{ lb/ft}^2) (27.5 \text{ ft}) (4 \text{ ft}) \left(\frac{1}{83.75 \text{ ft}} \right) = \underline{\underline{230 \text{ lb/ft}}}$$

$$\left(\frac{W}{L} \right)_u = (50 \text{ lb/ft}^2) \left(\frac{400}{12} \text{ ft} \right) (32 \text{ ft}) \left(\frac{1}{256 \text{ ft}} \right) = \underline{\underline{208 \text{ lb/ft}}}$$

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FEED CAN LOADS

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$$\rho_{s.s.} = 484 \text{ lbm/ft}^3$$

$$\begin{aligned} \text{TOP PLATE: } V &= \left(\frac{5}{8} \text{ in}\right) \left(\frac{\pi \cdot 20^2}{4}\right) = 196.25 \text{ in}^3 = 0.114 \text{ ft}^3 \\ W &= (484 \text{ lbm/ft}^3) (0.114 \text{ ft}^3) = 55 \text{ lbf} \end{aligned}$$

SHELL: 20" sch SS PIPE (20" OD x 0.188" wall)

$$\frac{\pi}{4} (20^2 - (20 - 0.188)^2) (30) = 176 \text{ lbf}$$

$$\text{TOTAL WEIGHT OF FEED CAN} \equiv W_{FC} = 2(SS) + 176 + 114 = \underline{\underline{400 \text{ lbf}}}$$

Misc. ↑

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ALLOWABLE STRESSES

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BEAM:

$$\text{BENDING} \rightarrow F_B = 0.66 F_y = 0.66 (36 \text{ ksi}) = \underline{23.76 \text{ ksi}} \quad (\text{AISC 1.5.1.4.1})$$

$$\text{SHEAR} \rightarrow F_V = 0.30 F_u = (0.30) (56 \text{ ksi}) = \underline{16.8 \text{ ksi}} \quad (\text{AISC 1.5.1.2.2})$$

BOLT: $L = 5\frac{1}{2}$, $n = 2$, $\frac{3}{4}$ " A325-N BOLTS

$$F_{u, \text{bolt}} = \underline{37.1 \text{ ksi}} \quad (\text{AISC TABLE II-A, 7.4-25})$$

$P_{y, \text{max}} = 4090 \text{ lbf}$ @ beam 1, node 1

$$\tau_{\text{BOLT, max}} = \frac{F_y}{A_T} = \frac{4090 \text{ lbf}}{\left[\frac{\pi (0.75 \text{ in})^2}{4} \times 6 \text{ BOLTS} \right]} = \underline{1543 \text{ psi}} < 37.1 \text{ ksi} \quad \checkmark$$

$P_{x, \text{max}} = 2670 \text{ lbf}$ @ Beam 1, node 3

$$F_T = \underline{19.4 \text{ ksi}} \quad (\text{AISC TABLE I-A})$$

$$\sigma_{\text{BOLT, MAX}} = \frac{F_x}{A_T} = \frac{2670 \text{ lbf}}{\left[\frac{\pi (0.75 \text{ in})^2}{4} \times 4 \text{ BOLTS} \right]} = \underline{1511 \text{ psi}} < 19.4 \text{ ksi} \quad \checkmark$$

```
*****
                                Input Data
*****
FRAME MAC file:  beam2.
Last modified at 11:09:36 AM on Mon, Aug 21, 1995.
All coord. and distances are in ft.
There are 6 nodes and 5 elements.
There are 9 degrees of freedom; the half-bandwidth is 6.
*****
Node loads (only those that are in applied groups are listed):
      Node      Force or      Group      Magnitude      Magnitude      Magnitude
      No.      moment                lb (FX)      lb (FY)      lb-ft (MZ)
-----
          4      Force      Dead 1      0.0000e+0      1.5000e+2
*****
Element loads (only those that are in applied groups are listed):
      From, To      Group      From 1st Dist.Len/      MagX,L      MagY,L      MagX,R      MagY,R
      Nodes                ft      lb-ft      lb (FX)      lb (FY)      lb (FX)      lb (FY)
-----
          3,4      Dead 1      0.0000e+0      2.2500e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          4,5      Dead 1      0.0000e+0      2.5000e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
*****
General load factor: 1.000
Load factors (suffix denotes whether the group is currently applied):
      Group      Dead      Live      Wind      Snow      Misc.
-----
          1      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          2      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          3      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          4      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          5      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
*****
```

Output Data

FRAME MAC file: beam2.

Last modified at 11:09:36 AM on Mon, Aug 21, 1995.

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	7.1460e+2	8.7389e+2	1.9255e+2
2	-3.7085e+2	4.0226e+2	1.6289e+2
6	-3.4376e+2	4.8834e+2	-1.9478e+2

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
1,4	1.1264e+2	0.0000e+0	1.1264e+2	5.4414e+1	0.0000e+0	5.4414e+1
2,3	4.0226e+2	0.0000e+0	4.0226e+2	2.4105e+2	0.0000e+0	2.4105e+2
3,4	3.9926e+2	-3.2749e+2	3.9926e+2	1.9288e+2	-1.5821e+2	1.9288e+2
4,5	3.2216e+2	-4.8534e+2	4.8534e+2	1.5563e+2	-2.3447e+2	2.3447e+2
5,6	0.0000e+0	-4.8834e+2	4.8834e+2	0.0000e+0	-2.9264e+2	2.9264e+2

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
1,4	1.1287e+2	-1.9255e+2	1.9255e+2	7.4423e+1	-1.2696e+2	1.2696e+2
2,3	0.0000e+0	-1.6289e+2	1.6289e+2	0.0000e+0	-1.0509e+3	1.0509e+3
3,4	1.8406e+2	-6.2701e+1	1.8406e+2	1.2136e+2	-4.1341e+1	1.2136e+2
4,5	2.9157e+2	-7.3071e+1	2.9157e+2	1.9224e+2	-4.8179e+1	1.9224e+2
5,6	0.0000e+0	-1.9478e+2	1.9478e+2	0.0000e+0	-1.2567e+3	1.2567e+3

FRAME MAC file: beam2; Last modified at 11:15:02 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

```
*****
                                Input Data
*****
FRAME MAC file:  beam4.
Last modified at 12:47:08 PM on Mon, Aug 21, 1995.
All coord. and distances are in ft.
There are 10 nodes and 9 elements.
There are 18 degrees of freedom; the half-bandwidth is 6.
*****
Node loads (only those that are in applied groups are listed):
      Node      Force or      Group      Magnitude      Magnitude      Magnitude
      No.      moment                lb (FX)      lb (FY)      lb-ft (MZ)
-----
          5      Force      Dead 1      0.0000e+0      1.5000e+2
          8      Force      Dead 1      0.0000e+0      3.0300e+2
*****
Element loads (only those that are in applied groups are listed):
      From, To      Group      From 1st Dist. Len/      MagX,L      MagY,L      MagX,R      MagY,R
      Nodes                ft      lb-ft      lb (FX)      lb (FY)      lb (FX)      lb (FY)
-----
          4,5      Dead 1      0.0000e+0      2.2500e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          5,6      Dead 1      0.0000e+0      5.0000e-1      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          6,7      Dead 1      0.0000e+0      8.0000e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          7,8      Dead 1      0.0000e+0      2.5000e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          8,9      Dead 1      0.0000e+0      2.5000e-1      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
*****
General load factor: 1.000
Load factors (suffix denotes whether the group is currently applied):
      Group      Dead      Live      Wind      Snow      Misc.
-----
          1      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          2      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          3      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          4      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          5      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
*****
```

Output Data

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FRAME MAC file: beam4.

Last modified at 12:47:08 PM on Mon, Aug 21, 1995.

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	2.3381e+3	2.1947e+3	2.2120e+1
2	-2.2719e+3	2.1179e+3	-3.0315e+0
3	-1.2406e+3	2.2452e+2	1.9571e+2
10	1.1745e+3	4.5528e+2	-2.3154e+2

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
1,6	0.0000e+0	-1.6438e+2	-1.6438e+2	0.0000e+0	-7.9412e+1	-7.9412e+1
2,7	1.7189e+2	0.0000e+0	1.7189e+2	8.3038e+1	0.0000e+0	8.3038e+1
3,4	2.2452e+2	0.0000e+0	2.2452e+2	1.3454e+2	0.0000e+0	1.3454e+2
4,5	2.2152e+2	-5.0523e+2	-5.0523e+2	1.0701e+2	-2.4407e+2	-2.4407e+2
5,6	0.0000e+0	-8.1673e+2	-8.1673e+2	0.0000e+0	-3.9456e+2	-3.9456e+2
6,7	1.2889e+3	-1.2951e+3	-1.2951e+3	6.2264e+2	-6.2567e+2	-6.2567e+2
7,8	7.3372e+2	-7.3781e+1	7.3372e+2	3.5445e+2	-3.5643e+1	3.5445e+2
8,9	0.0000e+0	-4.5228e+2	-4.5228e+2	0.0000e+0	-1.2103e+2	-1.2103e+2
9,10	0.0000e+0	-4.5528e+2	-4.5528e+2	0.0000e+0	-2.7283e+2	-2.7283e+2

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
1,6	0.0000e+0	-5.8589e+2	-5.8589e+2	0.0000e+0	-3.8630e+2	-3.8630e+2
2,7	0.0000e+0	-5.9865e+2	-5.9865e+2	0.0000e+0	-3.9471e+2	-3.9471e+2
3,4	0.0000e+0	-1.9571e+2	-1.9571e+2	0.0000e+0	-1.2626e+3	-1.2626e+3
4,5	0.0000e+0	-4.5913e+2	-4.5913e+2	0.0000e+0	-3.0272e+2	-3.0272e+2
5,6	0.0000e+0	-8.2712e+2	-8.2712e+2	0.0000e+0	-5.4535e+2	-5.4535e+2
6,7	1.1585e+3	-1.4380e+3	-1.4380e+3	7.6384e+2	-9.4815e+2	-9.4815e+2
7,8	0.0000e+0	-8.3938e+2	-8.3938e+2	0.0000e+0	-5.5344e+2	-5.5344e+2
8,9	0.0000e+0	-1.1809e+2	-1.1809e+2	0.0000e+0	-3.3741e+1	-3.3741e+1
9,10	0.0000e+0	-2.3154e+2	-2.3154e+2	0.0000e+0	-1.4938e+3	-1.4938e+3

FRAME MAC file: beam4; Last modified at 11:15:43 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

Input Data

FRAME MAC file: beam5.

Last modified at 11:16:34 AM on Mon, Aug 21, 1995.

All coord. and distances are in ft.

There are 3 nodes and 2 elements.

There are 3 degrees of freedom; the half-bandwidth is 3.

Node loads (only those that are in applied groups are listed):

Node No.	Force or moment	Group	Magnitude lb (FX)	Magnitude lb (FY)	Magnitude lb-ft (MZ)
-------------	--------------------	-------	----------------------	----------------------	-------------------------

2	Force	Dead 1	0.0000e+0	4.8800e+2	
---	-------	--------	-----------	-----------	--

Element loads (only those that are in applied groups are listed):

From, To Nodes	Group	From 1st ft	Dist.Len/ lb-ft	MagX,L lb (FX)	MagY,L lb (FY)	MagX,R lb (FX)	MagY,R lb (FY)
-------------------	-------	----------------	--------------------	-------------------	-------------------	-------------------	-------------------

1,2	Dead 1	0.0000e+0	5.5000e+0	0.0000e+0	3.1500e+2	0.0000e+0	3.1500e+2
2,3	Dead 1	0.0000e+0	5.5000e+0	0.0000e+0	3.1500e+2	0.0000e+0	3.1500e+2

General load factor: 1.000

Load factors (suffix denotes whether the group is currently applied):

Group	Dead	Live	Wind	Snow	Misc.
1	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
2	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
3	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
4	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
5	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y

Output Data

20

FRAME MAC file: beam5.

Last modified at 11:16:34 AM on Mon, Aug 21, 1995.

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	0.0000e+0	2.0920e+3	4.0590e+3
3	0.0000e+0	2.0920e+3	-4.0590e+3

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
1,2	2.0920e+3	0.0000e+0	2.0920e+3	1.0106e+3	0.0000e+0	1.0106e+3
2,3	0.0000e+0	-2.0920e+3	-2.0920e+3	0.0000e+0	-1.0106e+3	-1.0106e+3

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
1,2	2.3650e+3	-4.0590e+3	-4.0590e+3	1.5593e+3	-2.6763e+3	-2.6763e+3
2,3	2.3650e+3	-4.0590e+3	-4.0590e+3	1.5593e+3	-2.6763e+3	-2.6763e+3

FRAME MAC file: beam5; Last modified at 11:16:24 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

Input Data

22

FRAME MAC file: beam6.

Last modified at 11:36:47 AM on Mon, Aug 21, 1995.

All coord. and distances are in ft.

There are 5 nodes and 4 elements.

There are 9 degrees of freedom; the half-bandwidth is 6.

Node loads (only those that are in applied groups are listed):

Node No.	Force or moment	Group	Magnitude 1b (FX)	Magnitude 1b (FY)	Magnitude 1b-ft (MZ)
3	Force	Dead 1	0.0000e+0	2.3500e+2	

Element loads (only those that are in applied groups are listed):

From, To Nodes	Group	From 1st ft	Dist. Len/ 1b-ft	MagX,L 1b (FX)	MagY,L 1b (FY)	MagX,R 1b (FX)	MagY,R 1b (FY)
2,3	Dead 1	0.0000e+0	5.2500e+0	0.0000e+0	3.1500e+2	0.0000e+0	3.1500e+2
3,4	Dead 1	0.0000e+0	5.2500e+0	0.0000e+0	3.1500e+2	0.0000e+0	3.1500e+2

General load factor: 1.000

Load factors (suffix denotes whether the group is currently applied):

Group	Dead	Live	Wind	Snow	Misc.
1	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
2	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
3	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
4	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
5	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y

Output Data

23

FRAME MAC file: beam6.

Last modified at 11:36:47 AM on Mon, Aug 21, 1995.

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	0.0000e+0	1.8845e+3	2.5353e+3
5	0.0000e+0	1.8845e+3	-2.5353e+3

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
1,2	1.8845e+3	0.0000e+0	1.8845e+3	1.1293e+3	0.0000e+0	1.1293e+3
2,3	1.8815e+3	0.0000e+0	1.8815e+3	9.0894e+2	0.0000e+0	9.0894e+2
3,4	0.0000e+0	-1.8815e+3	-1.8815e+3	0.0000e+0	-9.0894e+2	-9.0894e+2
4,5	0.0000e+0	-1.8845e+3	-1.8845e+3	0.0000e+0	-1.1293e+3	-1.1293e+3

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
1,2	0.0000e+0	-2.5353e+3	-2.5353e+3	0.0000e+0	-1.6356e+4	-1.6356e+4
2,3	3.1829e+3	-2.0645e+3	3.1829e+3	2.0986e+3	-1.3612e+3	2.0986e+3
3,4	3.1829e+3	-2.0645e+3	3.1829e+3	2.0986e+3	-1.3612e+3	2.0986e+3
4,5	0.0000e+0	-2.5353e+3	-2.5353e+3	0.0000e+0	-1.6356e+4	-1.6356e+4

)))
FRAME MAC file: beam6; Last modified at 11:17:12 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

```
*****
                          Input Data
*****
FRAME MAC file:  beam7.
Last modified at 11:35:41 AM on Mon, Aug 21, 1995.
All coord. and distances are in ft.
There are 4 nodes and 3 elements.
There are 6 degrees of freedom; the half-bandwidth is 6.
*****
Node loads (only those that are in applied groups are listed):
      Node      Force or      Group      Magnitude      Magnitude      Magnitude
      No.      moment                      lb (FX)      lb (FY)      lb-ft (MZ)
-----
*****
Element loads (only those that are in applied groups are listed):
      From, To      Group      From 1st Dist. Len/      MagX,L      MagY,L      MagX,R      MagY,R
      Nodes                      ft      lb-ft      lb (FX)      lb (FY)      lb (FX)      lb (FY)
-----
      2,3      Dead 1 2.5000e-1                      0.0000e+0 3.0300e+2
      2,3      Dead 1 0.0000e+0 5.0000e-1 0.0000e+0 3.0200e+2 0.0000e+0 3.0200e+2
*****
General load factor: 1.000
Load factors (suffix denotes whether the group is currently applied):
      Group      Dead      Live      Wind      Snow      Misc.
-----
      1      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
      2      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
      3      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
      4      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
      5      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
*****
```

Output Data

FRAME MAC file: beam7.

Last modified at 11:35:41 AM on Mon, Aug 21, 1995.

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	0.0000e+0	2.3525e+2	3.3449e+1
4	0.0000e+0	2.3525e+2	-3.3449e+1

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
1,2	2.3525e+2	0.0000e+0	2.3525e+2	1.4097e+2	0.0000e+0	1.4097e+2
2,3	2.3225e+2	-2.3225e+2	-2.3225e+2	1.1220e+2	-1.1220e+2	-1.1220e+2
3,4	0.0000e+0	-2.3525e+2	-2.3525e+2	0.0000e+0	-1.4097e+2	-1.4097e+2

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
1,2	2.4988e+1	-3.3449e+1	-3.3449e+1	1.6121e+2	-2.1580e+2	-2.1580e+2
2,3	7.2957e+1	0.0000e+0	7.2957e+1	4.8103e+1	0.0000e+0	4.8103e+1
3,4	2.4988e+1	-3.3449e+1	-3.3449e+1	1.6121e+2	-2.1580e+2	-2.1580e+2

FRAME MAC file: beam7; Last modified at 11:18:42 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

```
*****
                          Input Data
*****
FRAME MAC file:  beam8.
Last modified at 12:58:05 PM on Mon, Aug 21, 1995.
All coord. and distances are in ft.
There are 12 nodes and 11 elements.
There are 24 degrees of freedom; the half-bandwidth is 18.
*****
Node loads (only those that are in applied groups are listed):
      Node      Force or      Group      Magnitude      Magnitude      Magnitude
      No.      moment                      lb (FX)      lb (FY)      lb-ft (MZ)
-----
          3      Force      Dead 1      0.0000e+0      1.5000e+2
          5      Force      Dead 1      0.0000e+0      4.3300e+2
          6      Force      Dead 1      0.0000e+0      4.3300e+2
          9      Force      Dead 1      0.0000e+0      3.0300e+2
*****
Element loads (only those that are in applied groups are listed):
      From, To      Group      From 1st Dist.Len/      MagX,L      MagY,L      MagX,R      MagY,R
      Nodes                      ft      lb-ft      lb (FX)      lb (FY)      lb (FX)      lb (FY)
-----
          2,3      Dead 1      0.0000e+0      2.2500e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          3,4      Dead 1      0.0000e+0      5.0000e-1      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          4,5      Dead 1      0.0000e+0      2.5000e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          5,6      Dead 1      0.0000e+0      4.2500e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          6,7      Dead 1      0.0000e+0      1.2500e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          7,8      Dead 1      0.0000e+0      7.5000e-1      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
          8,9      Dead 1      0.0000e+0      2.0000e+0      0.0000e+0      3.0200e+2      0.0000e+0      3.0200e+2
*****
General load factor: 1.000
Load factors (suffix denotes whether the group is currently applied):
      Group      Dead      Live      Wind      Snow      Misc.
-----
          1      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          2      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          3      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          4      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          5      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
*****
```

Output Data

29

FRAME MAC file: beam8.

Last modified at 12:58:05 PM on Mon, Aug 21, 1995.

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	-1.4678e+3	2.8928e+2	2.0680e+2
10	1.5014e+3	5.6350e+2	-2.4523e+2
11	2.8307e+3	2.5346e+3	3.5353e+2
12	-2.8643e+3	2.5526e+3	-3.4818e+2

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
1,2	2.8928e+2	0.0000e+0	2.8928e+2	1.7335e+2	0.0000e+0	1.7335e+2
2,3	2.8628e+2	-4.4047e+2	-4.4047e+2	1.3830e+2	-2.1279e+2	-2.1279e+2
3,4	0.0000e+0	-7.5197e+2	-7.5197e+2	0.0000e+0	-3.6327e+2	-3.6327e+2
4,5	1.6554e+3	0.0000e+0	1.6554e+3	7.9971e+2	0.0000e+0	7.9971e+2
4,11	0.0000e+0	-2.9933e+2	-2.9933e+2	0.0000e+0	-8.0103e+1	-8.0103e+1
5,6	4.1490e+2	-9.5785e+2	-9.5785e+2	2.0043e+2	-4.6273e+2	-4.6273e+2
6,7	0.0000e+0	-1.7946e+3	-1.7946e+3	0.0000e+0	-8.6696e+2	-8.6696e+2
7,8	6.3075e+2	0.0000e+0	6.3075e+2	3.0471e+2	0.0000e+0	3.0471e+2
7,12	3.1038e+2	0.0000e+0	3.1038e+2	8.3061e+1	0.0000e+0	8.3061e+1
8,9	3.8850e+2	-2.5750e+2	3.8850e+2	1.8768e+2	-1.2440e+2	1.8768e+2
9,10	0.0000e+0	-5.6350e+2	-5.6350e+2	0.0000e+0	-3.3768e+2	-3.3768e+2

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
1,2	0.0000e+0	-2.0680e+2	-2.0680e+2	0.0000e+0	-1.3342e+3	-1.3342e+3
2,3	0.0000e+0	-3.0832e+2	-3.0832e+2	0.0000e+0	-2.0329e+2	-2.0329e+2
3,4	0.0000e+0	-6.4393e+2	-6.4393e+2	0.0000e+0	-4.2457e+2	-4.2457e+2
4,5	1.0526e+3	-2.0765e+3	-2.0765e+3	6.9405e+2	-1.3691e+3	-1.3691e+3
4,11	0.0000e+0	-1.4325e+3	-1.4325e+3	0.0000e+0	-4.0930e+2	-4.0930e+2
5,6	1.3191e+3	-1.0114e+2	1.3191e+3	8.6974e+2	-6.6687e+1	8.6974e+2
6,7	0.0000e+0	-2.0921e+3	-2.0921e+3	0.0000e+0	-1.3794e+3	-1.3794e+3
7,8	0.0000e+0	-6.1795e+2	-6.1795e+2	0.0000e+0	-4.0744e+2	-4.0744e+2
7,12	0.0000e+0	-1.4741e+3	-1.4741e+3	0.0000e+0	-4.2117e+2	-4.2117e+2
8,9	0.0000e+0	-2.3573e+2	-2.3573e+2	0.0000e+0	-1.5543e+2	-1.5543e+2
9,10	0.0000e+0	-2.4523e+2	-2.4523e+2	0.0000e+0	-1.5822e+3	-1.5822e+3

FRAME MAC file: beam8; Last modified at 11:19:26 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

Input Data

FRAME MAC file: beam9.

Last modified at 11:19:58 AM on Tue, Aug 22, 1995.

All coord. and distances are in ft.

There are 3 nodes and 2 elements.

There are 3 degrees of freedom; the half-bandwidth is 3.

Node loads (only those that are in applied groups are listed):

Node No.	Force or moment	Group	Magnitude lb (FX)	Magnitude lb (FY)	Magnitude lb-ft (MZ)
2	Force	Dead 1	0.0000e+0	4.0000e+2	

Element loads (only those that are in applied groups are listed):

From, To Nodes	Group	From 1st ft	Dist.Len/ lb-ft	MagX,L lb (FX)	MagY,L lb (FY)	MagX,R lb (FX)	MagY,R lb (FY)
1,2	Dead 1	0.0000e+0	1.0000e+0	0.0000e+0	3.1800e+1	0.0000e+0	3.1800e+1
2,3	Dead 1	0.0000e+0	3.1000e+1	0.0000e+0	3.1800e+1	0.0000e+0	3.1800e+1

General load factor: 1.000

Load factors (suffix denotes whether the group is currently applied):

Group	Dead	Live	Wind	Snow	Misc.
1	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
2	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
3	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
4	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y
5	1.000Y	1.000Y	1.000Y	1.000Y	1.000Y

Output Data

FRAME MAC file: beam9.
Last modified at 11:19:58 AM on Tue, Aug 22, 1995.
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	0.0000e+0	1.3237e+3	5.3077e+3
3	0.0000e+0	9.2595e+2	-4.9444e+3

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
1,2	1.3237e+3	0.0000e+0	1.3237e+3	3.7317e+2	0.0000e+0	3.7317e+2
2,3	8.6585e+2	-9.2595e+2	-9.2595e+2	2.4410e+2	-2.6105e+2	-2.6105e+2

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
1,2	0.0000e+0	-5.3077e+3	-5.3077e+3	0.0000e+0	-1.8043e+3	-1.8043e+3
2,3	2.4724e+3	-4.9444e+3	-4.9444e+3	8.4047e+2	-1.6808e+3	-1.6808e+3

)

FRAME MAC file: beam9; Last modified at 11:19:58 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.

```

*****
                                Input Data
*****
FRAME MAC file:  beam10.
Last modified at 11:20:29 AM on Tue, Aug 22, 1995.
All coord. and distances are in ft.
There are 3 nodes and 2 elements.
There are 3 degrees of freedom; the half-bandwidth is 3.
*****
Node loads (only those that are in applied groups are listed):
      Node      Force or      Group      Magnitude      Magnitude      Magnitude
      No.      moment                lb (FX)      lb (FY)      lb-ft (MZ)
-----
          2      Force      Dead 1      0.0000e+0      4.0000e+2
*****
Element loads (only those that are in applied groups are listed):
      From, To      Group      From 1st Dist.Len/      MagX,L      MagY,L      MagX,R      MagY,R
      Nodes                ft      lb-ft      lb (FX)      lb (FY)      lb (FX)      lb (FY)
-----
      1,2      Dead 1 0.0000e+0 2.0000e+0 0.0000e+0 2.4000e+2 0.0000e+0 2.4000e+2
      2,3      Dead 1 0.0000e+0 3.0000e+1 0.0000e+0 2.4000e+2 0.0000e+0 2.4000e+2
*****
General load factor: 1.000
Load factors (suffix denotes whether the group is currently applied):
      Group      Dead      Live      Wind      Snow      Misc.
-----
          1      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          2      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          3      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          4      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
          5      1.000Y      1.000Y      1.000Y      1.000Y      1.000Y
*****

```

```

*****
                        Output Data
*****
FRAME MAC file:  beam10.
Last modified at 11:20:29 AM on Tue, Aug 22, 1995.
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	0.0000e+0	4.6515e+3	2.3402e+4
3	0.0000e+0	4.2605e+3	-2.2746e+4

```

*****
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
1,2	4.6515e+3	0.0000e+0	4.6515e+3	1.3114e+3	0.0000e+0	1.3114e+3
2,3	3.7195e+3	-4.2605e+3	-4.2605e+3	1.0486e+3	-1.2011e+3	-1.2011e+3

```

*****
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
1,2	0.0000e+0	-2.3402e+4	-2.3402e+4	0.0000e+0	-7.9553e+3	-7.9553e+3
2,3	1.1374e+4	-2.2746e+4	-2.2746e+4	3.8666e+3	-7.7322e+3	-7.7322e+3

```

*****

```

FRAME MAC file: beam10; Last modified at 11:20:29 AM on Tue, Aug 22, 1995
Above each load are the magnitudes in lb, lb/ft, and lb-ft.