

Solution to HW # 1

LOADS

For Wind Loads: $\theta := .463648$ $\theta = 0.464$ rad

Point A

$$W_x := (0.9 - 0.8) \cdot \sin(\theta) \quad W_x = 0.045 \text{ kip}$$

$$W_y := (0.9 + 0.8) \cdot \cos(\theta) \quad W_y = 1.521 \text{ kip}$$

$$S := 3 \quad S = 3 \text{ kip}$$

$$D := 1.5 \quad D = 1.5 \text{ kip}$$

$$L := 0 \quad L = 0 \text{ kip}$$

Loading Combinations 1,2,3

$$L1 := 1.2D + 1.6L + 0.5S \quad L1 = 3.3 \text{ kip}$$

$$L2x := 1.3W_x \quad L2x = 0.058 \text{ kip} \quad L2x \text{ is } L3x$$

$$L2y := 0.9D - 1.3W_y \quad L2y = -0.627 \text{ kip}$$

$$L3 := 1.2D + 0.5L + 0.5S + -1.3W_y \quad L3 = 1.323 \text{ kip}$$

Point B

$$W_x := (-1.6) \cdot \sin(\theta) \quad W_x = -0.716$$

$$W_y := (1.6) \cdot \cos(\theta) \quad W_y = 1.431$$

$$S := 3 \quad S = 3 \text{ kip} \text{ kip}$$

$$D := 1.5 \quad D = 1.5 \text{ kip} \text{ kip}$$

$$L := 0 \quad L = 0 \text{ kip}$$

Loading Combinations 1,2,3

$$L1 := 1.2D + 1.6L + 0.5S \quad L1 = 3.3 \text{ kip}$$

$$L2x := 1.3W_x \quad L2x = -0.93 \text{ kip} \quad L2x \text{ is } L3x$$

$$L2y := 0.9D - 1.3W_y \quad L2y = -0.51 \text{ kip}$$

$$L3 := 1.2D + 0.5L + 0.5S + -1.3W_y \quad L3 = 1.44 \text{ kip}$$

Point C

$$W_x := (1.8) \cdot \sin(\theta) \quad W_x = 0.805 \text{ kip}$$

$$W_y := (1.8) \cdot \cos(\theta) \quad W_y = 1.61 \text{ kip}$$

$$S := 3 \quad S = 3 \text{ kip}$$

$$D := 1.5 \quad D = 1.5 \text{ kip}$$

$$L := 0 \quad L = 0 \text{ kip}$$

Loading Combinations 1,2,3

$$L1 := 1.2D + 1.6L + 0.5S \quad L1 = 3.3 \text{ kip}$$

$$L2x := 1.3W_x \quad L2x = 1.046 \text{ kip} \quad L2x \text{ is } L3x$$

$$L2y := 0.9D - 1.3W_y \quad L2y = -0.743 \text{ kip}$$

$$L3 := 1.2D + 0.5L + 0.5S + -1.3W_y \quad L3 = 1.207 \text{ kip}$$

Point D

$$\begin{aligned}W_x &:= (-.8) \cdot \sin(\theta) + 1.4 & W_x &= 1.042 \text{ kip} \\W_y &:= (.8) \cdot \cos(\theta) & W_y &= 0.716 \text{ kip} \\S &:= 1.5 & S &= 1.5 \text{ kip} \\D &:= .75 & D &= 0.75 \text{ kip} \\L &:= 0 & L &= 0 \text{ kip}\end{aligned}$$

Loading Combinations 1,2,3

$$\begin{aligned}L_1 &:= 1.2D + 1.6L + .5S & L_1 &= 1.65 \text{ kip} \\L_{2x} &:= 1.3 \cdot W_x & L_{2x} &= 1.355 \text{ kip} & L_{2x} \text{ is } L_{3x} \\L_{2y} &:= 0.9D - 1.3 \cdot W_y & L_{2y} &= -0.255 \text{ kip} \\L_3 &:= 1.2D + .5L + 0.5S - 1.3W_y & L_3 &= 0.72 \text{ kip}\end{aligned}$$

Point H

$$\begin{aligned}W_x &:= (.9) \cdot \sin(\theta) + .8 & W_x &= 1.202 \text{ kip} \\W_y &:= (.9) \cdot \cos(\theta) & W_y &= 0.805 \text{ kip} \\S &:= 1.5 & S &= 1.5 \text{ kip} \\D &:= .75 & D &= 0.75 \text{ kip} \\L &:= 0 & L &= 0 \text{ kip}\end{aligned}$$

Loading Combinations 1,2,3

$$\begin{aligned}L_1 &:= 1.2D + 1.6L + .5S & L_1 &= 1.65 \text{ kip} \\L_{2x} &:= 1.3 \cdot W_x & L_{2x} &= 1.563 \text{ kip} & L_{2x} \text{ is } L_{3x} \\L_{2y} &:= 0.9D - 1.3W_y & L_{2y} &= -0.371 \text{ kip} \\L_3 &:= 1.2D + .5L + 0.5S + -1.3W_y & L_3 &= 0.604 \text{ kip}\end{aligned}$$

Points F,I,L

$$\begin{aligned}W_x &:= 2.5 & W_x &= 2.5 \text{ kip} \\W_y &:= 0 & W_y &= 0 \text{ kip} \\S &:= 0 & S &= 0 \text{ kip} \\D &:= 1.5 & D &= 1.5 \text{ kip} \\L &:= 5 & L &= 5 \text{ kip}\end{aligned}$$

Loading Combinations 1,2,3

$$\begin{aligned}L_1 &:= 1.2D + 1.6L + 0.5S & L_1 &= 9.8 \text{ kip} \\L_{2x} &:= 1.3 \cdot W_x & L_{2x} &= 3.25 \text{ kip} & L_{2x} \text{ is } L_{3x} \\L_{2y} &:= 0.9D + 1.3 \cdot W_y & L_{2y} &= 1.35 \text{ kip} \\L_3 &:= 1.2D + 0.5L + 0.5S + 1.3W_y & L_3 &= 4.3 \text{ kip}\end{aligned}$$

Points G,J,M

$W_x := 0$	$W_x = 0$	kip
$W_y := 0$	$W_y = 0$	kip
$S := 0$	$S = 0$	kip
$D := 3$	$D = 3$	kip
$L := 10$	$L = 10$	kip

Loading Combinations 1,2,3

$L1 := 1.2D + 1.6L + 0.5S$	$L1 = 19.6$	kip	
$L2x := 1.3 \cdot W_x$	$L2x = 0$	kip	$L2x$ is $L3x$
$L2y := 0.9D + 1.3 \cdot W_y$	$L2y = 2.7$	kip	
$L3 := 1.2D + 0.5L + 0.5S + 1.3W_y$	$L3 = 8.6$	kip	

Points H,K,N

$W_x := 1.6$	$W_x = 1.6$	kip
$W_y := 0$	$W_y = 0$	kip
$S := 0$	$S = 0$	kip
$D := 1.5$	$D = 1.5$	kip
$L := 5$	$L = 5$	kip

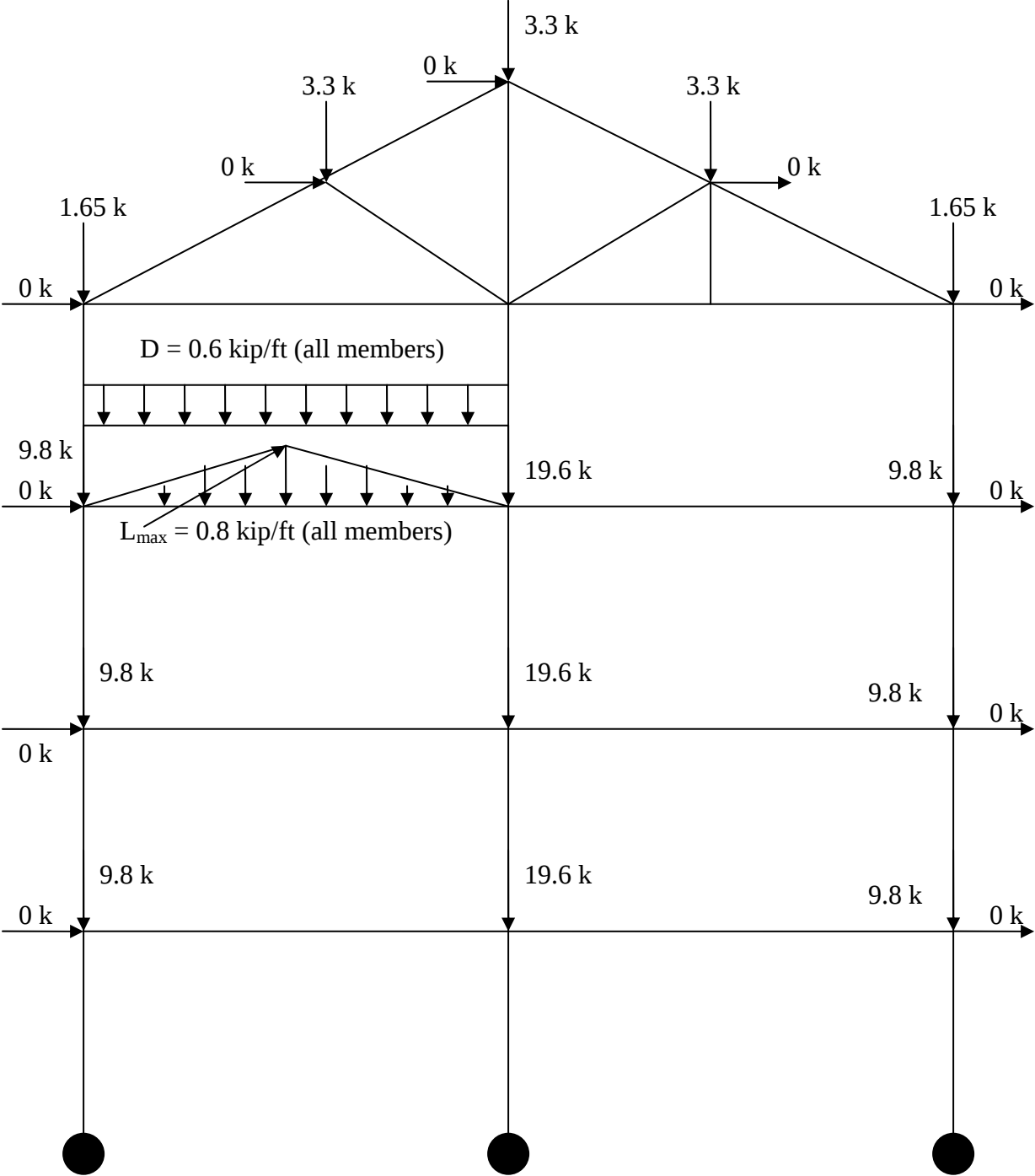
Loading Combinations 1,2,3

$L1 := 1.2D + 1.6L + 0.5S$	$L1 = 9.8$	kip	
$L2x := 1.3 \cdot W_x$	$L2x = 2.08$	kip	$L2x$ is $L3x$ Node N=2.34 kip
$L2y := 0.9D + 1.3 \cdot W_y$	$L2y = 1.35$	kip	
$L3 := 1.2D + 0.5L + 0.5S + 1.3W_y$	$L3 = 4.3$	kip	

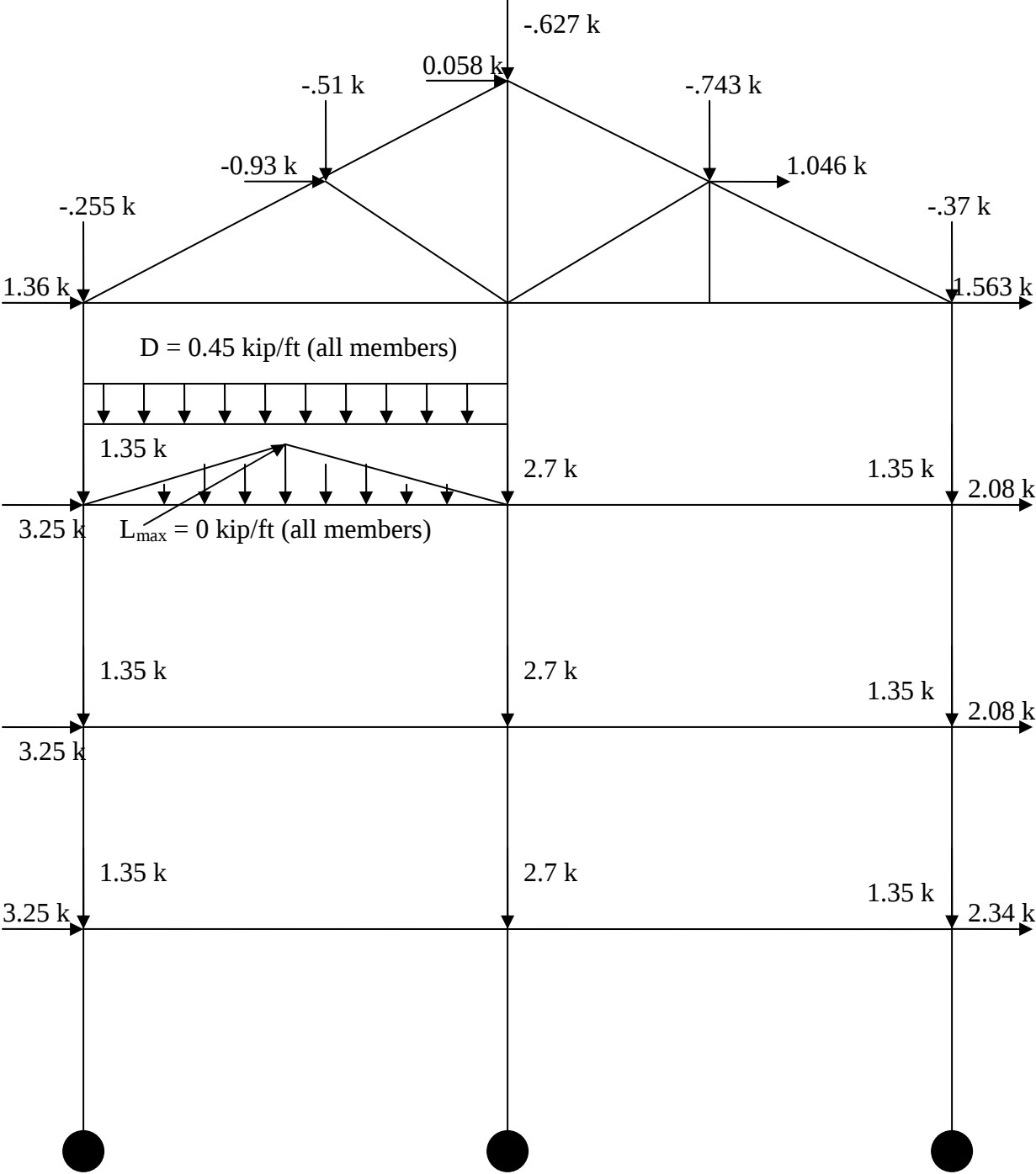
Beam Members

Peak Live Load	$L := 0.5$	$\frac{\text{kip}}{\text{ft}}$	$W_x := 0$	$W_y := 0$	$S := 0$
Dead Load	$D := 0.5$	$\frac{\text{kip}}{\text{ft}}$			
$0.9D = 0.45$					
$1.2D = 0.6$		$\frac{\text{kip}}{\text{ft}}$			
$1.6L = 0.8$					
$0.5L = 0.25$					

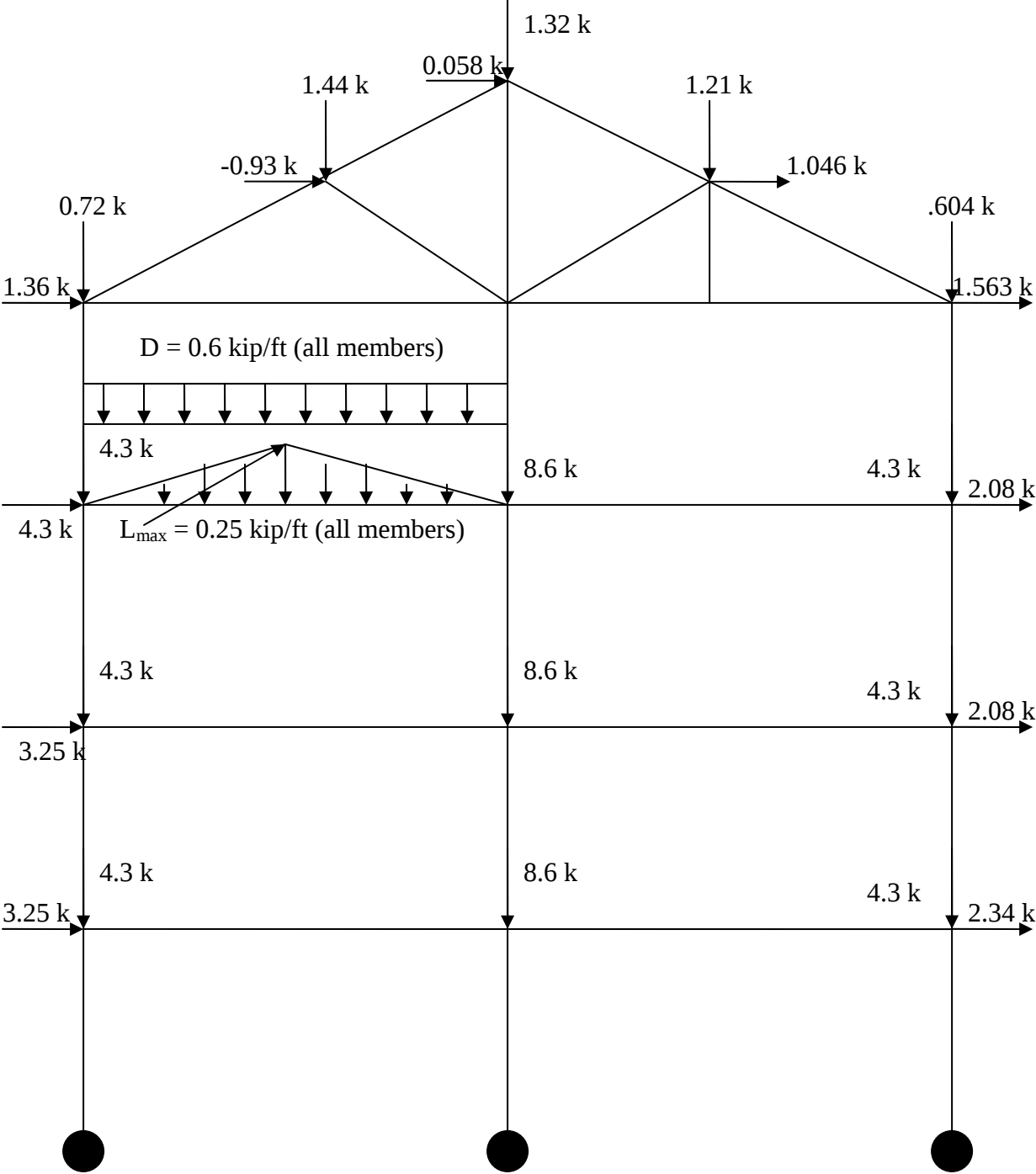
Loading Combination 1:



Loading Combination 2:



Loading Combination 3:



MEMBER DESIGN FORCES

Load Combo 1: 1.2D+1.6L+0.5(Lr or S)

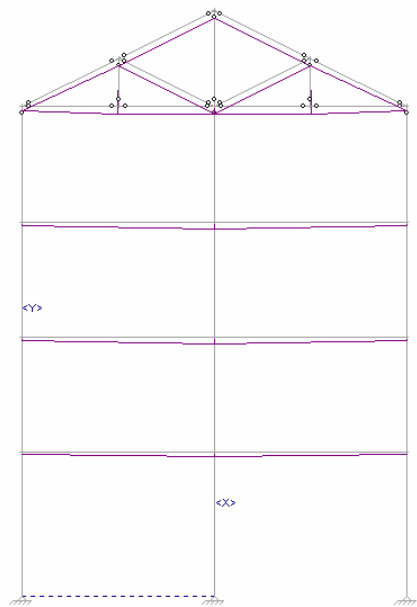
Load Combo 2: 0.9D+1.3W

Load Combo 3: 0.9D-1.3W

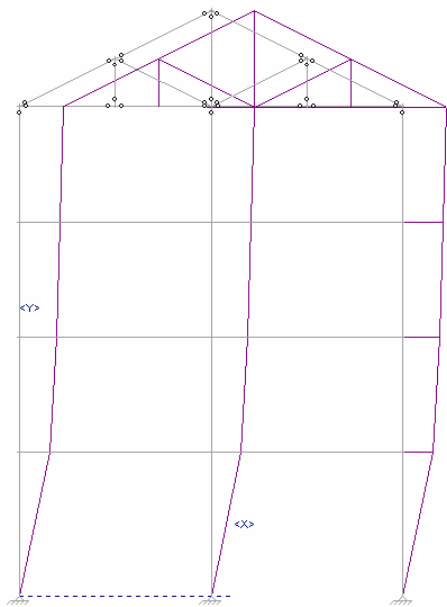
Load Combo 4: 1.2D+0.5L0.5(Lr or S)+1.3W

Member	Load Combination	Design Forces				
		Tension (k)	Compression (k)	Shear (k)	Pos. Moment (kip-in)	Neg. Moment (kip-in)
1	1		63.71	-0.57	102.39 ✓	
2	1	2.21		10.70	287.81	475.12
3	1		123.60			
4	1		82.60			
5	1	0.00		-10.22	276.85	429.05
6	1		44.58	-2.78	210.07	190.07
7	1		24.96	-2.78	210.11	190.35
8	1		1.80	10.38	287.67	436.55
9	1		42.55 ✓			
10	1		2.21			
11	1		5.50	-0.98	141.20	
12	1	6.71 ✓				
13	1		4.91			
14	1	1.09				
15	1		3.69 ✓			
1	2		2.42 ✓	5.76		1035.92
2	2	0.60		13.47 ✓	1033.06 ✓	1119.60
3	2		33.34	-7.39		1330.00
4	2		21.00	-7.78	509.23	610.51
5	2	1.30		8.17	257.04	631.02
6	2		17.75	-4.07	161.85	424.86
7	2		3.68	1.15	59.35	105.55
8	2		2.51	7.11	224.37	447.32
9	2		8.98 ✓	-3.99	257.91 ✓	316.05 ✓
10	2	3.20		-1.37	196.84	
11	2		0.26	-1.22	176.22	
12	2	0.53 ✓				
13	2		1.59			
14	2	2.08				
15	2	1.42 ✓				
1	3		31.93 ✓	-6.20 ✓	1116.54	
2	3	0.21		-12.83	719.64	1278.39
3	3		33.34	7.39	1330.00	
4	3		21.00	7.78	610.51	509.23
5	3		2.48	-8.48	336.76	619.18
6	3		5.54	1.91	277.41	
7	3		8.24	-3.29	268.01	208.16
8	3	0.01		-6.53	140.66	444.23
9	3		8.98 ✓	3.99	316.51 ✓	257.91 ✓
10	3	3.20		1.37		196.84
11	3		0.43	0.51		72.91
12	3	0.53 ✓				
13	3		1.66			
14	3	2.08				
15	3	1.09 ✓				
1	4		20.65 ✓	5.92 ✓		1065.22
2	4	1.30		16.92	1014.90	1305.10
3	4		71.04	-7.79		1402.96
4	4		46.94	-8.34	548.00	653.03
5	4	1.35		11.20	269.55	779.95
6	4		31.98	-5.10	232.73	501.99
7	4		11.57	0.66	24.22	71.52
8	4		3.84	10.11	272.76	584.41
9	4		23.52	-4.44	287.88	351.51 ✓
10	4	0.28		-1.38	200.29	
11	4		2.70	-1.50	216.29	
12	4	3.15 ✓				
13	4		2.68			
14	4	1.11				
15	4		0.77 ✓			

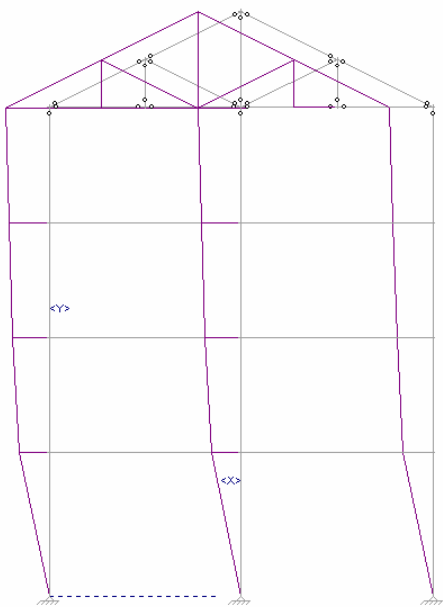
DEFLECTED SHAPES



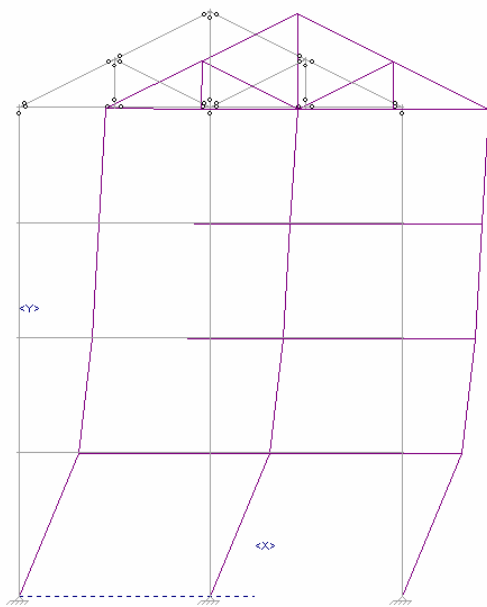
$1.2D + 1.6L + 0.5S$



$0.9D + 1.3W$



$0.9D - 1.3W$



$1.2D + 0.5L + 0.5S + 1.3W$