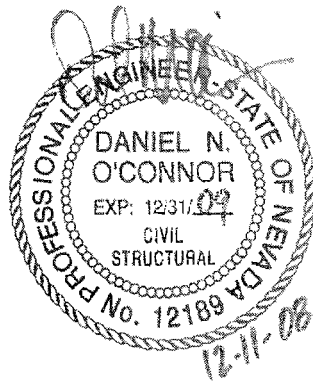
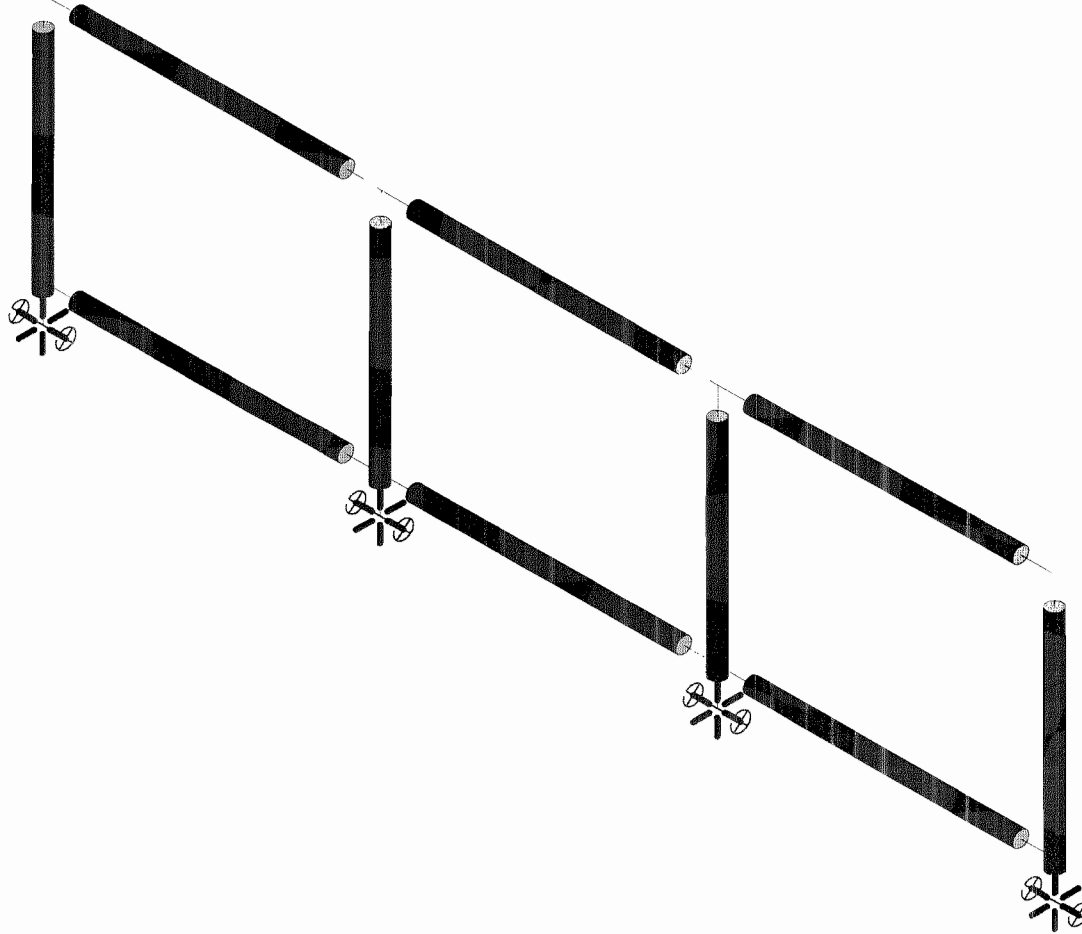
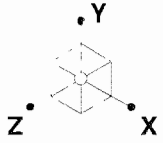


D21—1-1/2" PIPE x 36-1/2" HIGH RAIL WITH BOTTOM RAIL

Building Code:	2006 <i>International Building Code</i> 2007 <i>California Building Code</i> AISC <i>Steel Construction Manual</i>, 13th ed—ASD
Material:	Carbon Steel, A53, Grade B, Fy = 35 ksi Carbon Steel, A501, Grade B, Fy = 36 ksi Stainless Steel, A312, Grade TP-304 or TP-316, Fy = 30 ksi
Height:	36.5"
Anchor Post:	1.5" SCHD 80 (1.90" OD x 0.200") Pipe
Intermediate Posts:	1.5" SCHD 40 (1.90" OD x 0.145") Pipe
Top Rail:	1.5" SCHD 40 (1.90" OD x 0.145") Pipe
Bottom Rail:	1.5" SCHD 40 (1.90" OD x 0.145") Pipe
Number of Cables:	8
Cable Spacing:	3.24"



Disclaimer: Analysis and Structural Certification DOES NOT include base plates or anchorage to supporting structure. Where required by the Local Building Official, these shall be reviewed and designed by the project Structural Engineer of Record.



Solution: Envelope

Ferrari Shields & Associates

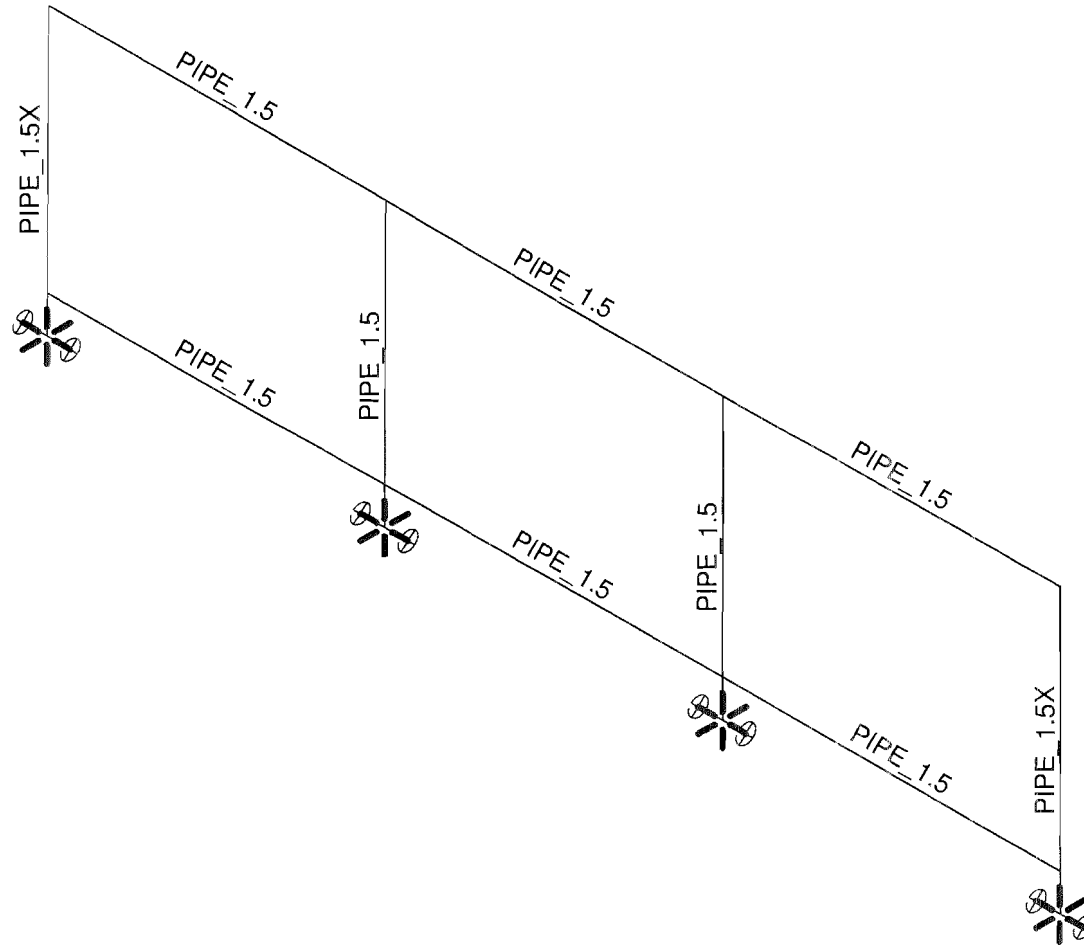
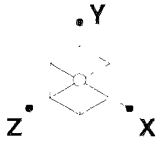
Dan O'Connor

08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL

Dec 8, 2008 at 2:31 PM

D21.r3d



Solution: Envelope

Ferrari Shields & Associates

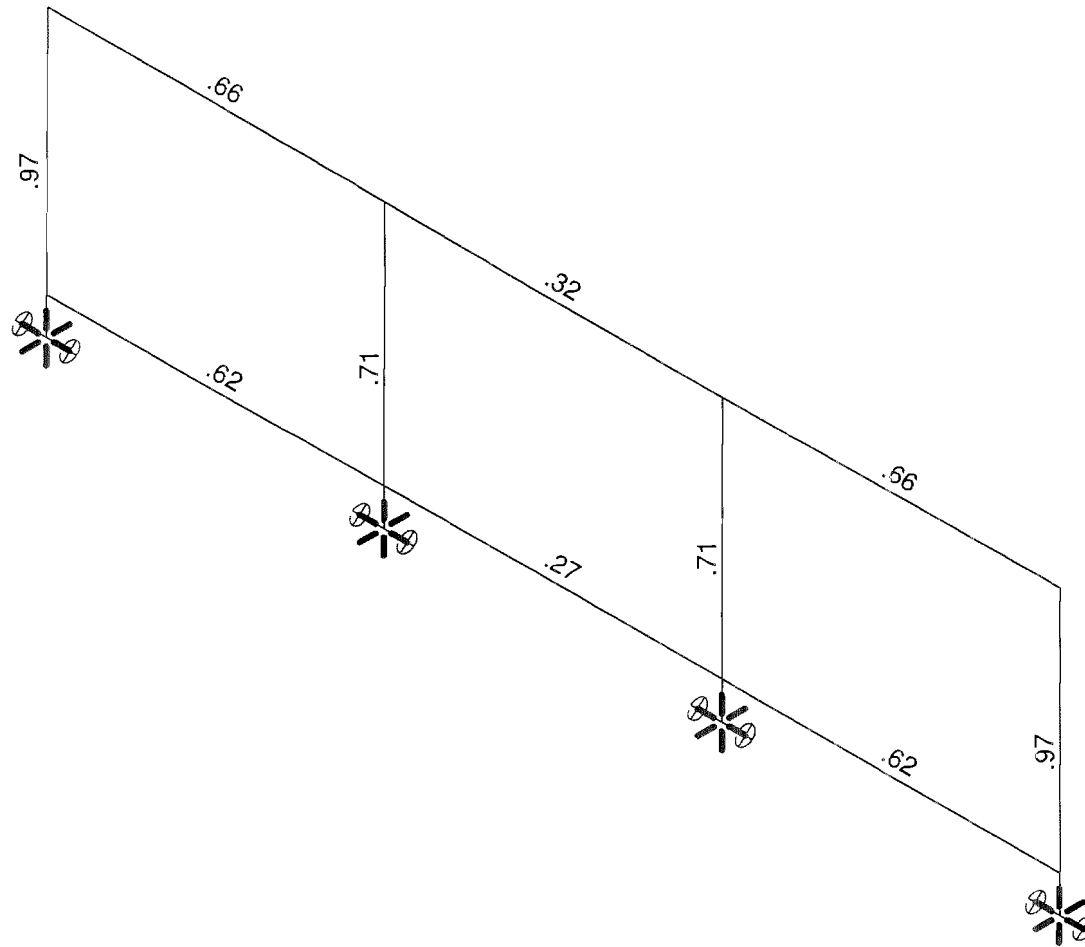
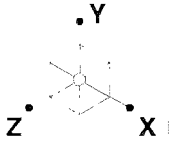
Dan O'Connor

08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL

Dec 8, 2008 at 2:32 PM

D21.r3d



Member Code Checks Displayed
Solution: Envelope

Ferrari Shields & Associates

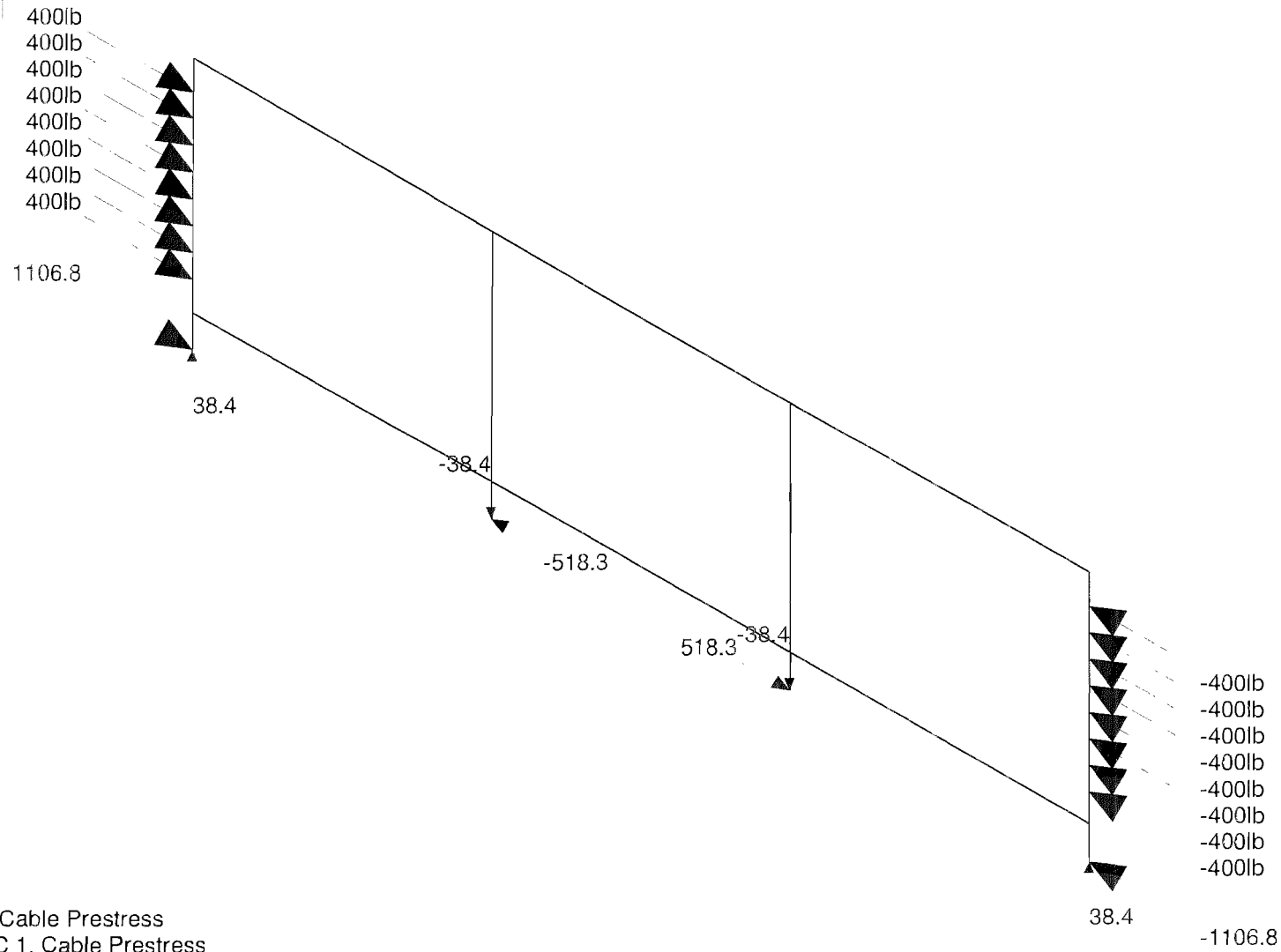
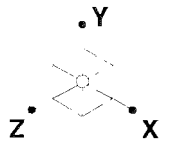
Dan O'Connor

08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL

Dec 8, 2008 at 2:32 PM

D21.r3d

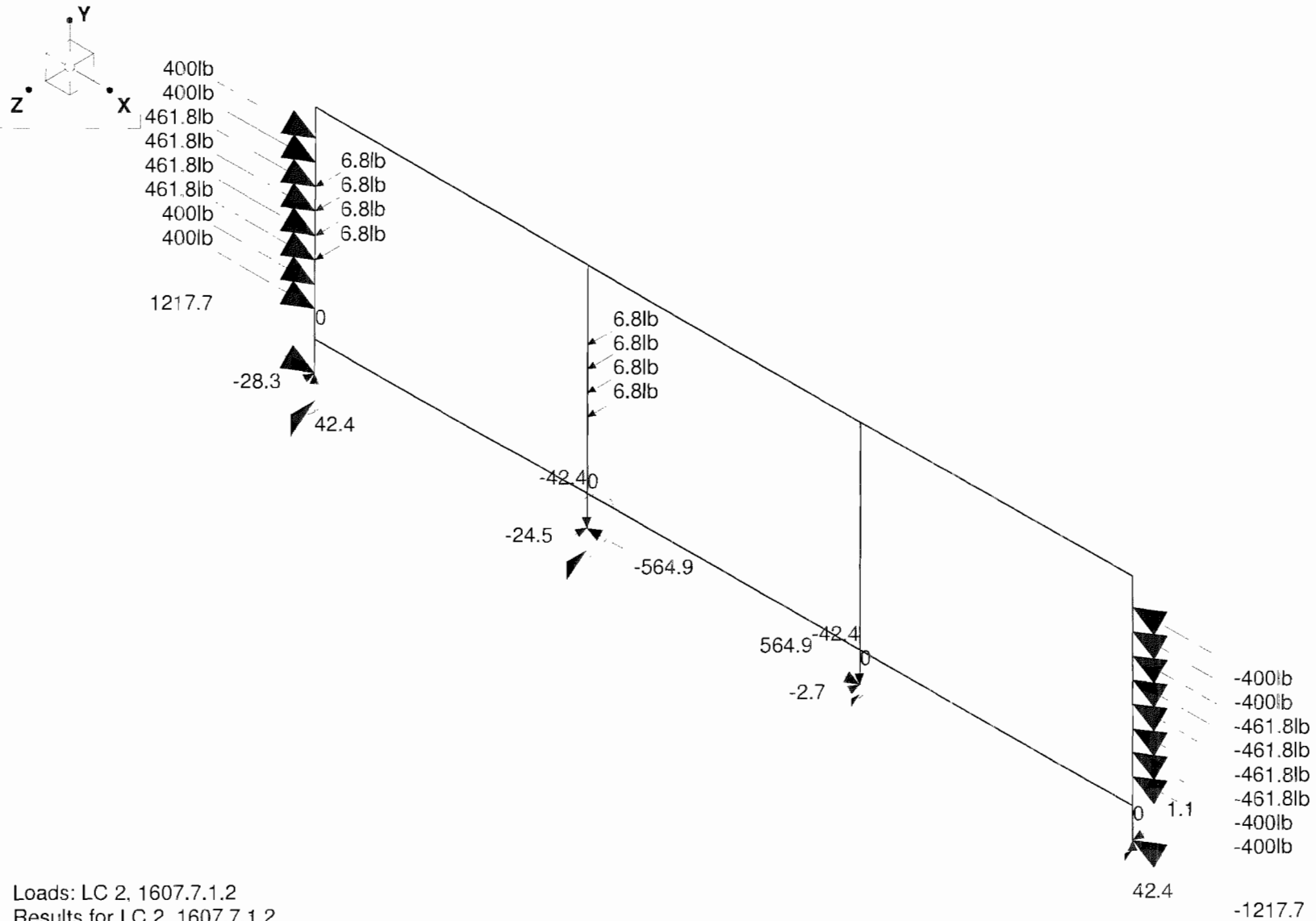


Loads: LC 1, Cable Prestress
 Results for LC 1, Cable Prestress
 Reaction units are lb and k-ft

Ferrari Shields & Associates
 Dan O'Connor
 08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL

Dec 8, 2008 at 2:01 PM
 D21.r3d



Loads: LC 2, 1607.7.1.2
Results for LC 2, 1607.7.1.2
Reaction units are lb and k-ft

Ferrari Shields & Associates

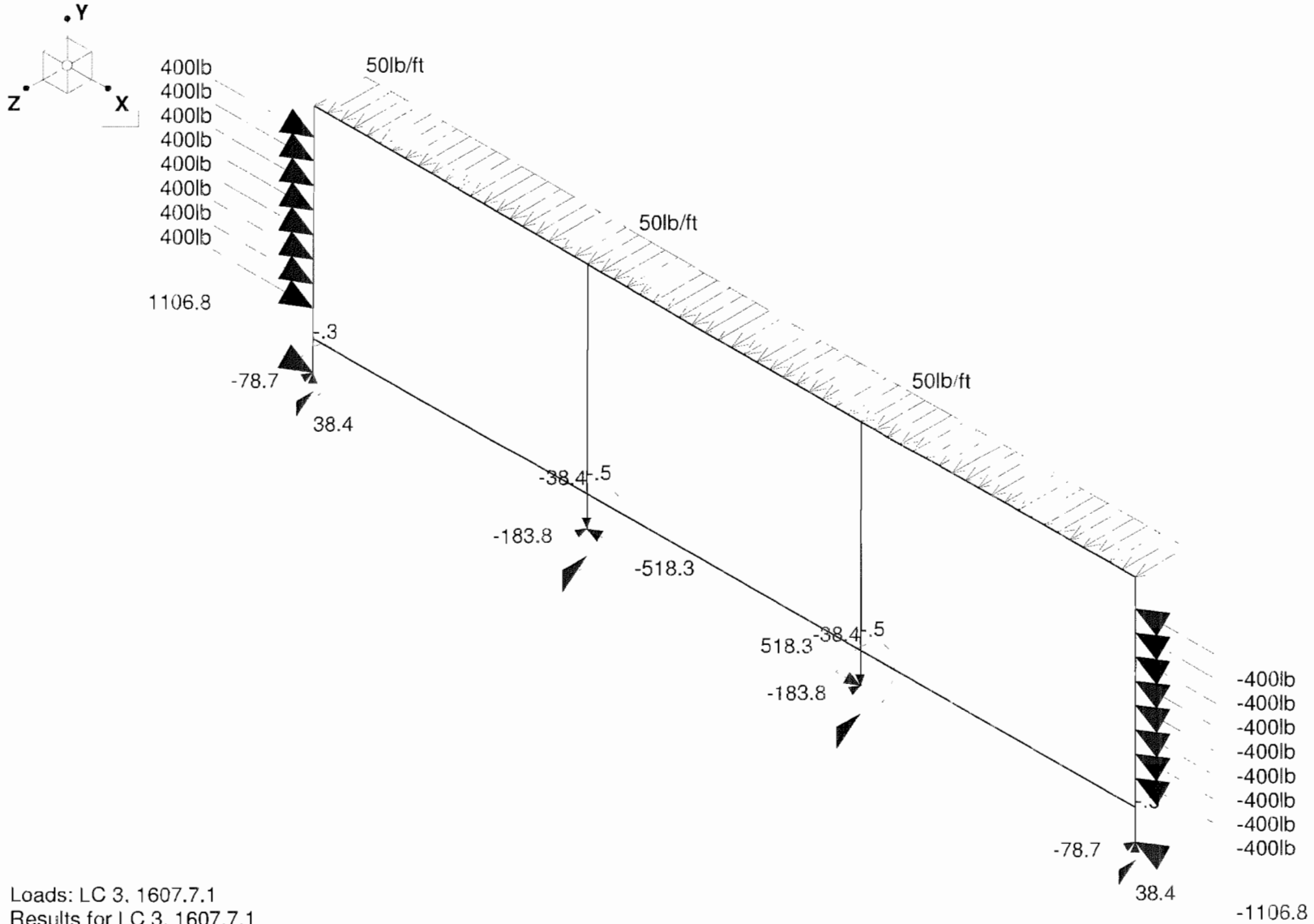
Dan O'Connor

08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL

Dec 8, 2008 at 2:02 PM

D21.r3d



Loads: LC 3, 1607.7.1
 Results for LC 3, 1607.7.1
 Reaction units are lb and k-ft

Ferrari Shields & Associates

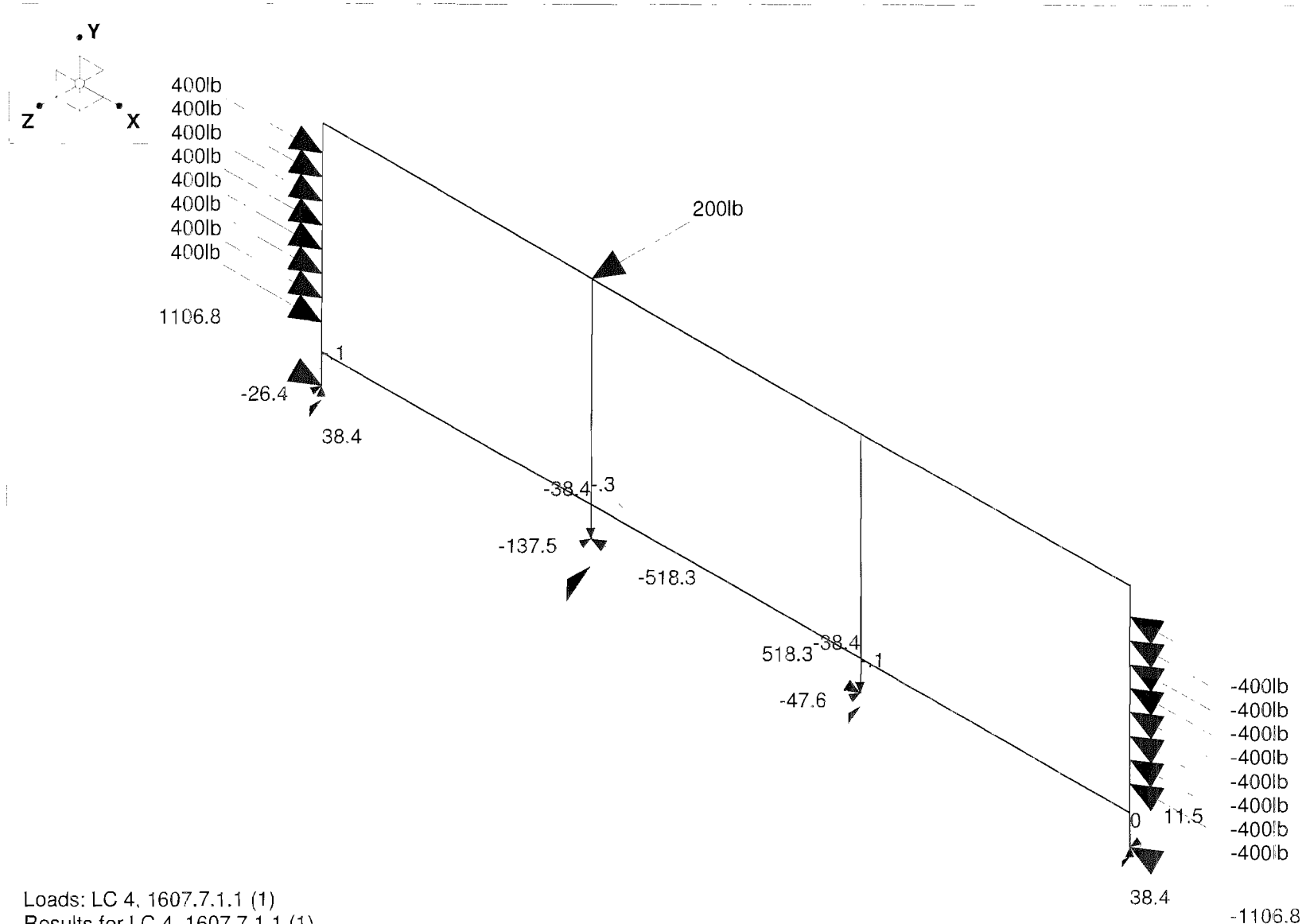
Dan O'Connor

08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL

Dec 8, 2008 at 2:02 PM

D21.r3d



Loads: LC 4, 1607.7.1.1 (1)
 Results for LC 4, 1607.7.1.1 (1)
 Reaction units are lb and k-ft

Ferrari Shields & Associates

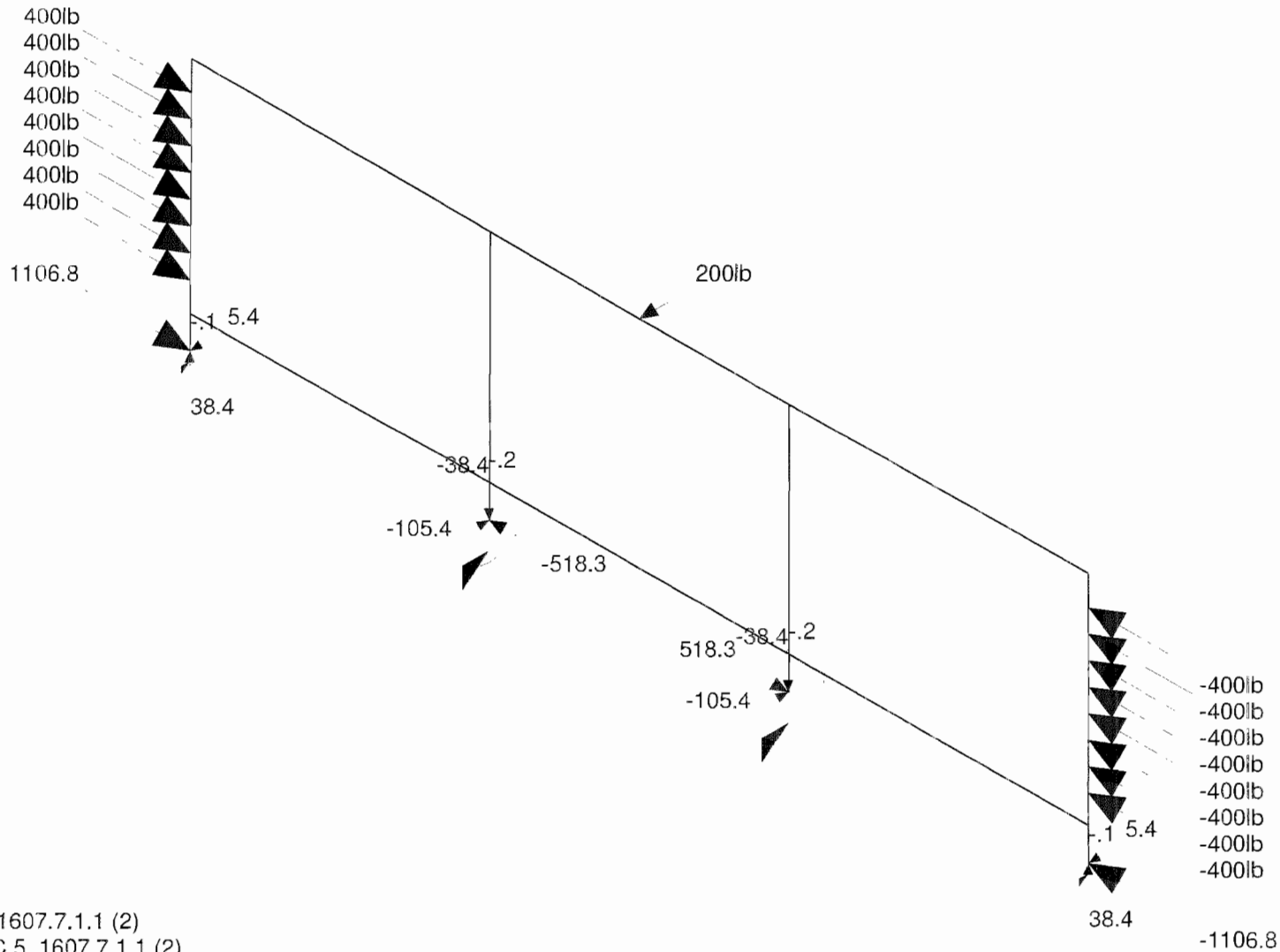
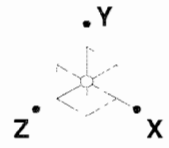
Dan O'Connor

08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL.

Dec 8, 2008 at 2:02 PM

D21.r3d



Loads: LC 5, 1607.7.1.1 (2)
 Results for LC 5, 1607.7.1.1 (2)
 Reaction units are lb and k-ft

Ferrari Shields & Associates

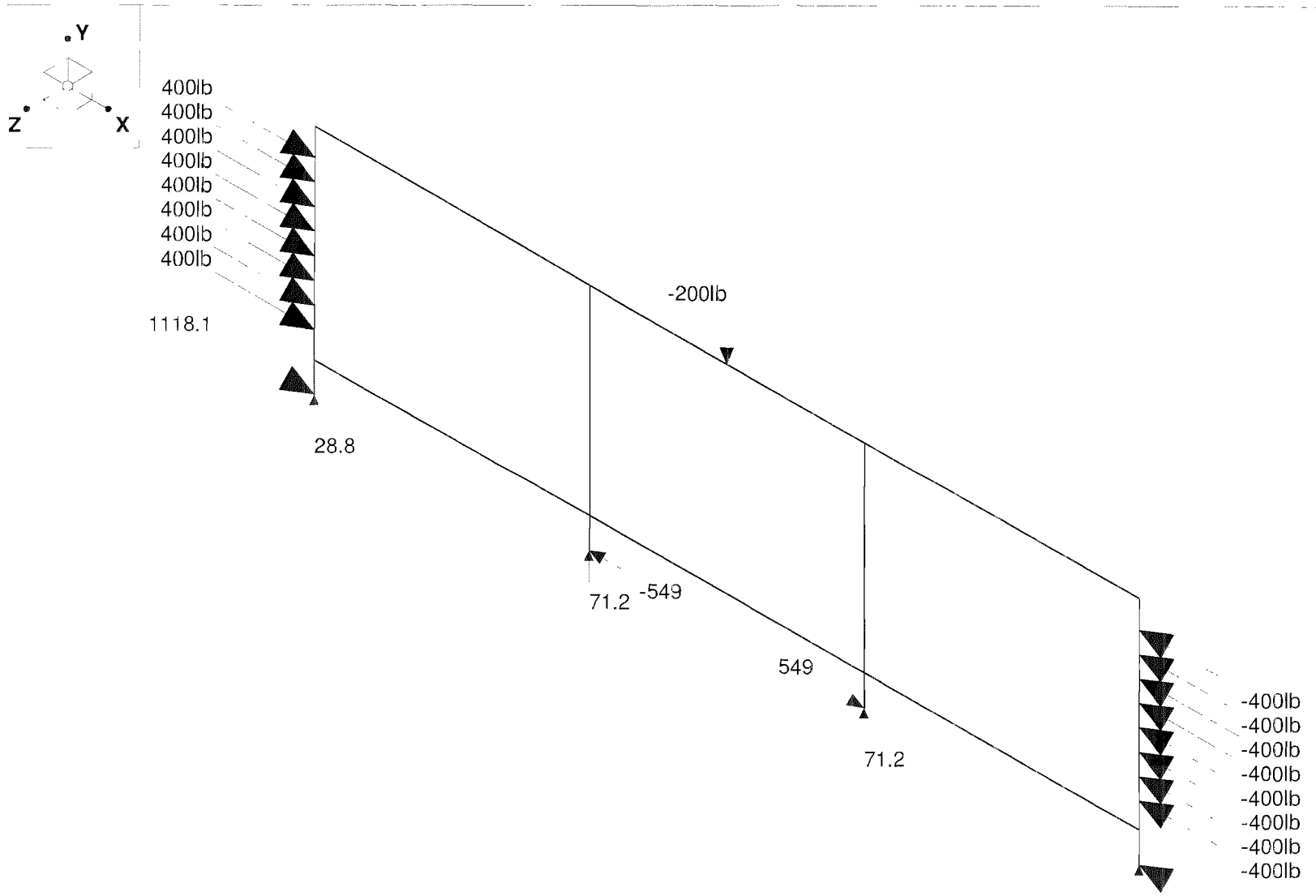
Dan O'Connor

08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL.

Dec 8, 2008 at 2:02 PM

D21.r3d



Loads: LC 6, 1607.7.1.1 (3)
 Results for LC 6, 1607.7.1.1 (3)
 Reaction units are lb and k-ft

Ferrari Shields & Associates
 Dan O'Connor
 08196

D21 - 1.5" PIPE x 36.5" HIGH RAIL W/ BTM RAIL

Dec 8, 2008 at 2:03 PM
 D21.r3d

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation	Yes
Include Warping	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Vertical Axis	Y
Hot Rolled Steel Code	AISC : ASD 13th
Cold Formed Steel Code	AISI 01: ASD
Wood Code	NDS 2005: ASD
Wood Temperature	< 100F
Concrete Code	ACI 2005
Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	PCA Load Contour
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections	Yes
Bad Framing Warnings	No
Unused Force Warnings	Yes

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (1/E5 F)	Density[k/ft^3]	Yield[ksi]
1	A53GrB/A501/SS316	29000	11154	.3	.65	.49	30

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rules	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	RAIL	PIPE 1.5	Beam	Pipe	A53GrB/A501...	Typical	.75	.293	.293	.586
2	IPOST	PIPE 1.5	Column	Pipe	A53GrB/A501...	Typical	.75	.293	.293	.586
3	EPOST	PIPE_1.5X	Column	Pipe	A53GrB/A501...	Typical	1	.372	.372	.744

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area (Mem...	Surface (Pl...
1	Cable Prestress	None					16			
2	1607.7.1.2	None					16			
3	1607.7.1	None						3		
4	1607.7.1.1 (1)	None				1				
5	1607.7.1.1 (2)	None					1			
6	1607.7.1.1 (3)	None					1			

Load Combinations

	Description	Solve PDelta	SR...	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor
1	Cable Prestress	Yes	C	1	1						
2	1607.7.1.2	Yes	C	1	1	2	1				

Load Combinations (Continued)

	Description	Solve	PDelta	SR...	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor	BLC Factor
3	1607.7.1	Yes	C		1	1	3	1				
4	1607.7.1.1 (1)	Yes	C		1	1	4	1				
5	1607.7.1.1 (2)	Yes	C		1	1	5	1				
6	1607.7.1.1 (3)	Yes	C		1	1	6	1				

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	N2			EPOST	Column	Pipe	A53GrB/A...	Typical
2	M2	N3	N4			IPOST	Column	Pipe	A53GrB/A...	Typical
3	M3	N2	N4			RAIL	Beam	Pipe	A53GrB/A...	Typical
4	M4	N4	N8			RAIL	Beam	Pipe	A53GrB/A...	Typical
5	M5	N5	N6			EPOST	Column	Pipe	A53GrB/A...	Typical
6	M6	N7	N8			IPOST	Column	Pipe	A53GrB/A...	Typical
7	M7	N8	N6			RAIL	Beam	Pipe	A53GrB/A...	Typical
8	M8	N9	N10			RAIL	Beam	Pipe	A53GrB/A...	Typical
9	M9	N10	N12			RAIL	Beam	Pipe	A53GrB/A...	Typical
10	M10	N12	N11			RAIL	Beam	Pipe	A53GrB/A...	Typical

Envelope Joint Reactions

	Joint		X [lb]	Ic	Y [lb]	Ic	Z [lb]	Ic	MX [k-ft]	Ic	MY [k-ft]	Ic	MZ [k-ft]	Ic
1	N1	max	1506.774	2	48.676	2	7.607	5	0	1	0	1	0	1
2		min	1371.72	1	34.169	6	-77.7	3	-.334	3	0	1	0	1
3	N3	max	-417.598	1	65.831	6	0	1	0	1	0	1	0	1
4		min	-455.335	2	-48.676	2	-184.8	3	-.446	3	0	1	0	1
5	N5	max	-1371.72	1	48.676	2	13.226	4	0	1	0	1	0	1
6		min	-1506.774	2	34.169	6	-77.7	3	-.334	3	0	1	0	1
7	N7	max	455.335	2	65.831	6	0	1	0	1	0	1	0	1
8		min	417.598	1	-48.676	2	-184.8	3	-.446	3	0	1	0	1
9	Totals:	max	0	1	200	6	0	1						
10		min	0	4	0	2	-525	3						

Envelope Member Section Forces

	Member	Sec		Axial[lb]	Ic	y Shear[lb]	Ic	z Shear[lb]	Ic	Torque[k-ft]	Ic	y-y Moment[...]	Ic	z-z Moment[...]	Ic
1	M1	1	max	48.676	2	-1371.589	4	7.594	5	0	1	.334	3	0	1
2			min	34.169	6	-1506.618	2	-77.761	3	0	1	0	1	0	1
3		2	max	145.145	2	1509.144	2	0	1	.046	3	.256	3	.151	2
4			min	121.556	6	1369.187	4	-97.615	3	0	2	0	1	.128	4
5		3	max	145.145	2	647.344	2	0	1	.046	3	.184	3	-.601	1
6			min	121.556	6	569.187	4	-97.615	3	0	2	0	1	-.668	2
7		4	max	145.145	2	-625.522	6	0	1	.046	3	.111	3	-.516	1
8			min	121.556	6	-738.056	2	-97.615	3	0	2	0	2	-.563	2
9		5	max	145.145	2	-1425.522	6	0	1	.046	3	.039	3	.374	2
10			min	121.556	6	-1538.056	2	-97.615	3	0	2	-.002	2	-.332	6
11	M2	1	max	65.831	6	455.335	2	0	1	0	1	.446	3	0	1
12			min	-48.676	2	417.598	1	-184.8	3	0	1	0	1	0	1
13		2	max	-21.556	6	-56.698	1	0	1	.032	5	.33	3	-.034	1
14			min	-145.145	2	-79.737	6	-165.994	3	-.002	2	0	1	-.044	6
15		3	max	-21.556	6	-56.698	1	0	1	.032	5	.207	3	.015	6

Envelope Member Section Forces (Continued)

Member	Sec		Axial[lb]	lc	y Shear[lb]	lc	z Shear[lb]	lc	Torque[k-ft]	lc	y-y Moment[...]	lc	z-z Moment[...]	lc	
16		min	-145.145	2	-79.737	6	-165.994	3	-.002	2	0	1	.008	4	
17	4	max	-21.556	6	-56.698	1	2.989	2	.032	5	.084	3	.075	6	
18		min	-145.145	2	-79.737	6	-165.994	3	-.002	2	-.003	2	.05	1	
19	5	max	-21.556	6	-56.698	1	2.989	2	.032	5	0	1	.134	6	
20		min	-145.145	2	-79.737	6	-165.994	3	-.002	2	-.061	4	.092	1	
21	M3	1	max	1538.019	2	145.117	2	0	.002	2	.046	3	.374	2	
22		min	1425.494	6	121.546	6	-101.49	3	-.039	3	0	2	.332	6	
23	2	max	1538.019	2	145.117	2	0	1	.002	2	.018	5	.247	2	
24		min	1425.494	6	121.546	6	-57.74	3	-.039	3	-.024	3	.226	1	
25	3	max	1538.019	2	145.117	2	0	1	.002	2	.007	5	.12	2	
26		min	1425.494	6	121.546	6	-42.581	4	-.039	3	-.055	3	.11	1	
27	4	max	1538.019	2	145.117	2	29.76	3	.002	2	0	1	.013	6	
28		min	1425.494	6	121.546	6	-42.581	4	-.039	3	-.076	4	-.007	2	
29	5	max	1538.019	2	145.117	2	73.51	3	.002	2	0	1	-.093	6	
30		min	1425.494	6	121.546	6	-42.581	4	-.039	3	-.113	4	-.134	2	
31	M4	1	max	1599.986	2	100	6	45.339	4	.031	4	.017	5	.04	6
32		min	1487.48	4	0	1	-100	5	0	1	-.112	4	-.034	2	
33	2	max	1599.986	2	100	6	45.339	4	.031	4	0	1	-.031	4	
34		min	1487.48	4	0	1	-100	5	0	1	-.072	4	-.047	6	
35	3	max	1599.986	2	0	1	100	5	.031	4	0	1	-.031	4	
36		min	1487.48	4	-100	6	0	1	0	1	-.158	5	-.135	6	
37	4	max	1599.986	2	0	1	100	5	.031	4	.007	4	-.031	4	
38		min	1487.48	4	-100	6	0	1	0	1	-.07	5	-.047	6	
39	5	max	1599.986	2	0	1	100	5	.031	4	.047	4	.04	6	
40		min	1487.48	4	-100	6	0	1	0	1	0	1	-.034	2	
41	M5	1	max	48.676	2	1506.618	2	13.221	4	0	1	.334	3	0	1
42		min	34.169	6	1371.589	4	-77.761	3	0	1	0	1	0	1	
43	2	max	145.145	2	-1369.187	4	2.95	4	0	1	.256	3	-.128	4	
44		min	121.556	6	-1509.144	2	-97.615	3	-.046	3	0	1	-.151	2	
45	3	max	145.145	2	-569.187	4	2.95	4	0	1	.184	3	.668	2	
46		min	121.556	6	-647.344	2	-97.615	3	-.046	3	0	1	.601	1	
47	4	max	145.145	2	738.056	2	2.95	4	0	1	.111	3	.563	2	
48		min	121.556	6	625.522	6	-97.615	3	-.046	3	0	1	.516	1	
49	5	max	145.145	2	1538.056	2	2.95	4	0	1	.039	3	-.332	6	
50		min	121.556	6	1425.522	6	-97.615	3	-.046	3	0	1	-.374	2	
51	M6	1	max	65.831	6	-417.598	1	0	1	0	1	.446	3	0	1
52		min	-48.676	2	-455.335	2	-184.8	3	0	1	0	1	0	1	
53	2	max	-21.556	6	79.737	6	0	1	0	1	.33	3	.044	6	
54		min	-145.145	2	56.698	1	-165.994	3	-.032	5	0	1	.034	1	
55	3	max	-21.556	6	79.737	6	0	1	0	1	.207	3	-.008	4	
56		min	-145.145	2	56.698	1	-165.994	3	-.032	5	0	1	-.015	6	
57	4	max	-21.556	6	79.737	6	0	1	0	1	.084	3	-.05	1	
58		min	-145.145	2	56.698	1	-165.994	3	-.032	5	0	1	-.075	6	
59	5	max	-21.556	6	79.737	6	0	1	0	1	.001	4	-.092	1	
60		min	-145.145	2	56.698	1	-165.994	3	-.032	5	-.039	3	-.134	6	
61	M7	1	max	1538.019	2	-121.546	6	12.544	5	.039	3	.016	4	-.093	6
62		min	1425.494	6	-145.117	2	-73.51	3	0	1	-.015	5	-.134	2	
63	2	max	1538.019	2	-121.546	6	12.544	5	.039	3	.016	4	.013	6	
64		min	1425.494	6	-145.117	2	-29.76	3	0	1	-.048	3	-.007	2	
65	3	max	1538.019	2	-121.546	6	13.99	3	.039	3	.017	4	.12	2	
66		min	1425.494	6	-145.117	2	-.217	2	0	1	-.055	3	.11	1	
67	4	max	1538.019	2	-121.546	6	57.74	3	.039	3	.018	5	.247	2	
68		min	1425.494	6	-145.117	2	-.217	2	0	1	-.024	3	.226	1	

Envelope Member Section Forces (Continued)

Member	Sec		Axial[lb]	lc	y Shear[lb]	lc	z Shear[lb]	lc	Torque[k-ft]	lc	y-y Moment[lb-ft]	lc	z-z Moment[lb-ft]	lc
69		5 max	1538.019	2	-121.546	6	101.49	3	.039	3	.046	3	.374	2
70		min	1425.494	6	-145.117	2	-.217	2	0	1	0	1	.332	6
71	M8	1 max	3415.954	2	-87.385	6	18.48	3	0	2	0	2	-.203	6
72		min	3140.937	1	-96.472	2	-.423	2	-.014	3	-.046	3	-.222	2
73		2 max	3415.954	2	-87.385	6	18.48	3	0	2	0	2	-.126	1
74		min	3140.937	1	-96.472	2	-.423	2	-.014	3	-.03	3	-.138	2
75		3 max	3415.954	2	-87.385	6	18.48	3	0	2	0	1	-.049	1
76		min	3140.937	1	-96.472	2	-.423	2	-.014	3	-.013	3	-.054	2
77		4 max	3415.954	2	-87.385	6	18.48	3	0	2	.011	5	.031	2
78		min	3140.937	1	-96.472	2	-.423	2	-.014	3	-.001	4	.027	6
79		5 max	3415.954	2	-87.385	6	18.48	3	0	2	.024	5	.115	2
80		min	3140.937	1	-96.472	2	-.423	2	-.014	3	-.001	2	.103	6
81	M9	1 max	2898.653	2	0	1	0	1	.011	4	.009	4	-.002	6
82		min	2627.634	6	0	1	-6.191	4	0	1	-.009	5	-.003	2
83		2 max	2898.653	2	0	1	0	1	.011	4	.003	4	-.002	6
84		min	2627.634	6	0	1	-6.191	4	0	1	-.009	5	-.003	2
85		3 max	2898.653	2	0	1	0	1	.011	4	0	3	-.002	6
86		min	2627.634	6	0	1	-6.191	4	0	1	-.009	5	-.003	2
87		4 max	2898.653	2	0	1	0	1	.011	4	0	3	-.002	6
88		min	2627.634	6	0	1	-6.191	4	0	1	-.009	5	-.003	2
89		5 max	2898.653	2	0	1	0	1	.011	4	0	3	-.002	6
90		min	2627.634	6	0	1	-6.191	4	0	1	-.013	4	-.003	2
91	M10	1 max	3415.954	2	96.472	2	0	1	.014	3	.024	5	.115	2
92		min	3140.937	1	87.385	6	-18.48	3	0	1	0	1	.103	6
93		2 max	3415.954	2	96.472	2	0	1	.014	3	.011	5	.031	2
94		min	3140.937	1	87.385	6	-18.48	3	0	1	0	1	.027	6
95		3 max	3415.954	2	96.472	2	0	1	.014	3	0	4	-.049	1
96		min	3140.937	1	87.385	6	-18.48	3	0	1	-.013	3	-.054	2
97		4 max	3415.954	2	96.472	2	0	1	.014	3	0	1	-.126	1
98		min	3140.937	1	87.385	6	-18.48	3	0	1	-.03	3	-.138	2
99		5 max	3415.954	2	96.472	2	0	1	.014	3	0	1	-.203	6
100		min	3140.937	1	87.385	6	-18.48	3	0	1	-.046	3	-.222	2

Envelope AISC 13th ASD Steel Code Checks

Member	Shape	Code Check	Loc[in]	lc	Shear ...	Loc[in]	Dir	lc	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [k-ft]	Mnzz/om ...	Cb	LRFD E...
1	M1	PIPE 1.5X	.968	4.814	2	.394	4.814	3	15476.321	17964.072	.822	.822	1...	H1-1b
2	M2	PIPE 1.5	.710	0	3	.113	0	3	11690.208	13473.054	.63	.63	2...	H1-1b
3	M3	PIPE 1.5	.663	0	2	.112	0	3	11051.888	13473.054	.63	.63	2...	H1-1b
4	M4	PIPE 1.5	.322	21	5	.068	0	4	11051.888	13473.054	.63	.63	1	H1-1b
5	M5	PIPE 1.5X	.967	4.814	2	.394	4.814	3	15476.321	17964.072	.822	.822	1...	H1-1b
6	M6	PIPE 1.5	.710	0	3	.113	0	3	11690.208	13473.054	.63	.63	2...	H1-1b
7	M7	PIPE 1.5	.663	42	2	.112	42	3	11051.888	13473.054	.63	.63	2...	H1-1b
8	M8	PIPE 1.5	.623	0	2	.047	0	3	11051.888	13473.054	.63	.63	2...	H1-1a
9	M9	PIPE 1.5	.267	42	2	.021	0	4	11051.888	13473.054	.63	.63	1	H1-1a
10	M10	PIPE 1.5	.623	42	2	.047	0	3	11051.888	13473.054	.63	.63	2...	H1-1a

*** End of Calculations ***