Structural Analysis Report of
Anchorage Design for Propane Exchange Cage

Conducted at:
Various Locations
San Jose, CA

Prepared for:

21739 State Hwy 64
Canton, TX 75103

11/08/13

Expires 6/30/2015

November 8, 2013

Prepared by:

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October 31, 2013

Description of the project:

Structural calculations for the seismic check and anchorage design of new propane exchange cage

Design Codes:

2010 California Building Code and ASCE 7-05

References:

1. Drawings of propane exchange cage, CEC #20-18 & 12

Design Criteria:

Occupancy Category III; Soil site class D and Seismic Design Category E

Proposed Loading:
(N) (18) Propane Tank, 40 lbs each
(N) Propane Exchange Cage, 300 lbs

(N) Propane Exchange Case Structural Framing and Grade:
L2x2x3/16 (Steel Angle Beams: Fy = 36 ksi)
21GA steel sheets for covering.
14GA steel sheets for shelf.

Results:

As per provided structural calculations, the new propane exchange cage framing member stresses are calculated under vertical and lateral loads, and the member stresses are under the allowable values. Also, the proposed connections are adequate to support the proposed loads.

Conclusions:

Based on the results from the structural analysis, the new propane exchange case and connections are structurally adequate to support the proposed loads.

1. Lateral Loads Calculation

(2010 CBC & ASCE 7-05)

1.1 Earthquake Load

(by using Ground Motion Parameters Calculator Version 5.1.0)

Soil Site Class = **D**

Seismic Use Group = III

Seismic Parameters (Worst case in San Jose area) (from output of Seismic Design Parameters)

S_S = **2.277** g S_{MS} = **2.277** g S_{DS} = 2/3 S_{MS} = **1.518** g

S_1 = **1.285** g S_{M1} = **1.928** g S_{D1} = 2/3 S_{M1} = **1.285** g

Seismic Design Category = **E**

ρ = **1.0** (ASCE 7, 12.3.4.1)

Seismic Design Force : (for Nonstructural Components)

R = **2.5** a_p = **1.0** (ASCE 7, Table 13.5-1)

I_p = **1.25** z/h = **0.0**

For Propane Cage: W_p = **1,020** lbs ***(18 x 40 lb Tank + 300 lbs of Cage)***

$F_p = [0.4\ a_p\ S_{DS}\ W_p / (R_p/I_p)] \times (1+2(z/h))$ (ASCE 7, 13.3-1)

= **309.7** lbs

$F_{p,MAX} = 1.6\ S_{DS}\ I_p\ W_p$ = **3,096.7** lbs

$F_{p,MIN} = 0.3\ S_{DS}\ I_p\ W_p$ = **580.6** lbs

Therefore F_p = **580.6** lbs

Seismic Load Effects E :

For Propane Cage: $E = \rho F_p \pm 0.2\ S_{DS}\ D$ (ASCE 7, 12.4)

= **580.6** lbs (Lateral) ± **0.304** D lbs (Vertical)

= **0.569** W (lbs) (Lateral) ± **0.304** W (lbs) (Vertical)

0.7E = **406.4** lbs (Lateral) ± **0.213** D lbs (Vertical)

= **0.398** W (lbs) (Lateral) ± **0.213** W (lbs) (Vertical)

Output of Ground Motion Parameters Calculator Version 5.1.0

Conterminous 48 States
2005 ASCE 7 Standard
Latitude = 37.4
Longitude = -122.25
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0 ,Fv = 1.0
Data are based on a 0.01 deg grid spacing

Period (sec)	Sa (g)
0.2	2.277 (Ss, Site Class B)
1.0	1.285 (S1, Site Class B)

Conterminous 48 States
2005 ASCE 7 Standard
Latitude = 37.4
Longitude = -122.25
Spectral Response Accelerations SMs and SM1
SMs = Fa x Ss and SM1 = Fv x S1
Site Class D - Fa = 1.0 ,Fv = 1.5

Period (sec)	Sa (g)
0.2	2.277 (SMs, Site Class D)
1.0	1.928 (SM1, Site Class D)

Conterminous 48 States
2005 ASCE 7 Standard
Latitude = 37.4
Longitude = -122.25
Design Spectral Response Accelerations SDs and SD1
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.0 ,Fv = 1.5

Period (sec)	Sa (g)
0.2	1.518 (SDs, Site Class D)
1.0	1.285 (SD1, Site Class D)

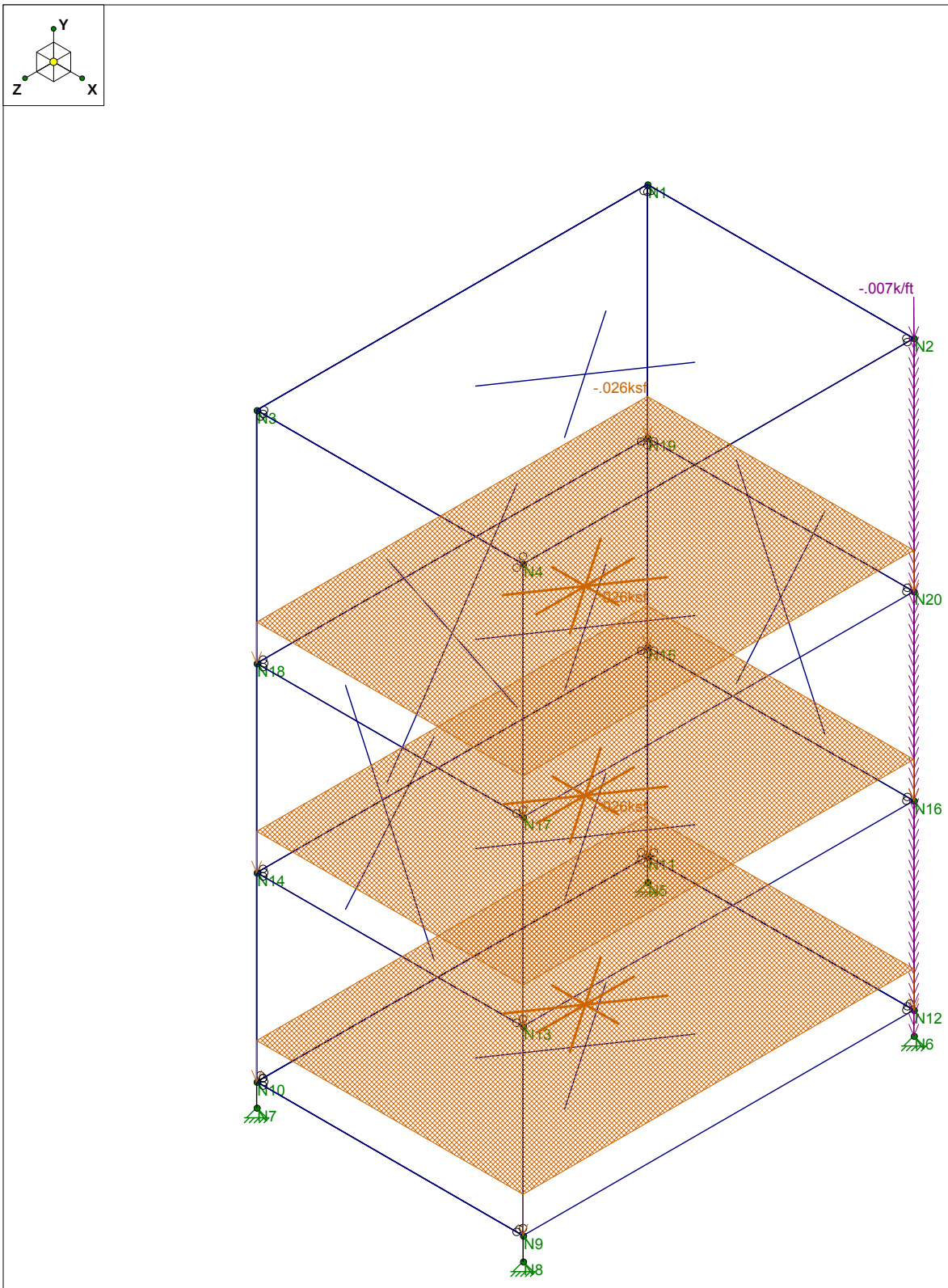
Load Calculation for RISA Analysis

Dead Loads:

Propane Tank = **40** lbs / each

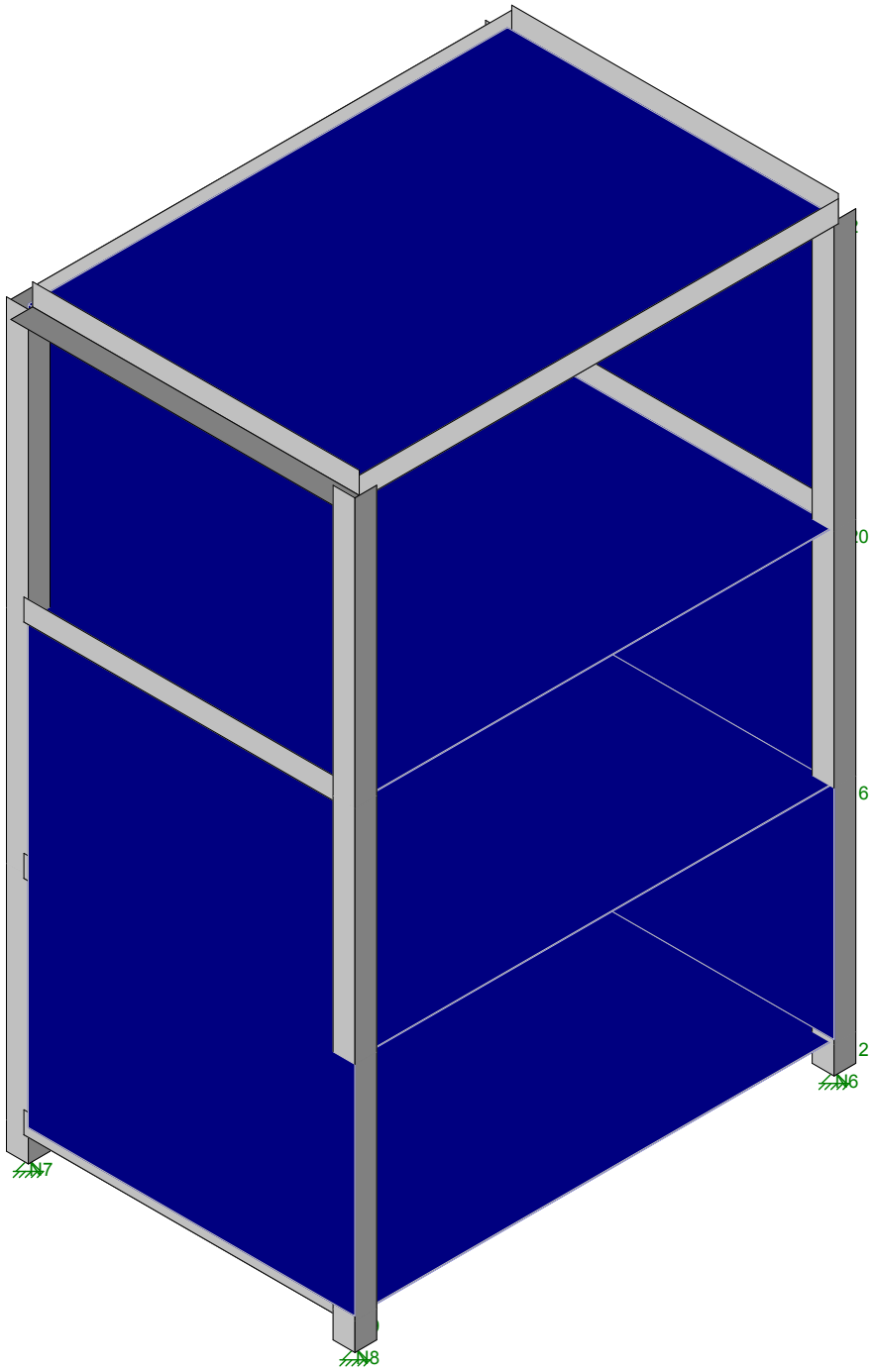
(6) Propane Tank per Shelf = **240** lbs Area = **9.1675** ft^2
= **26** psf / shelf

Sheet Cover Door = **7** lbs/ft (assumed)



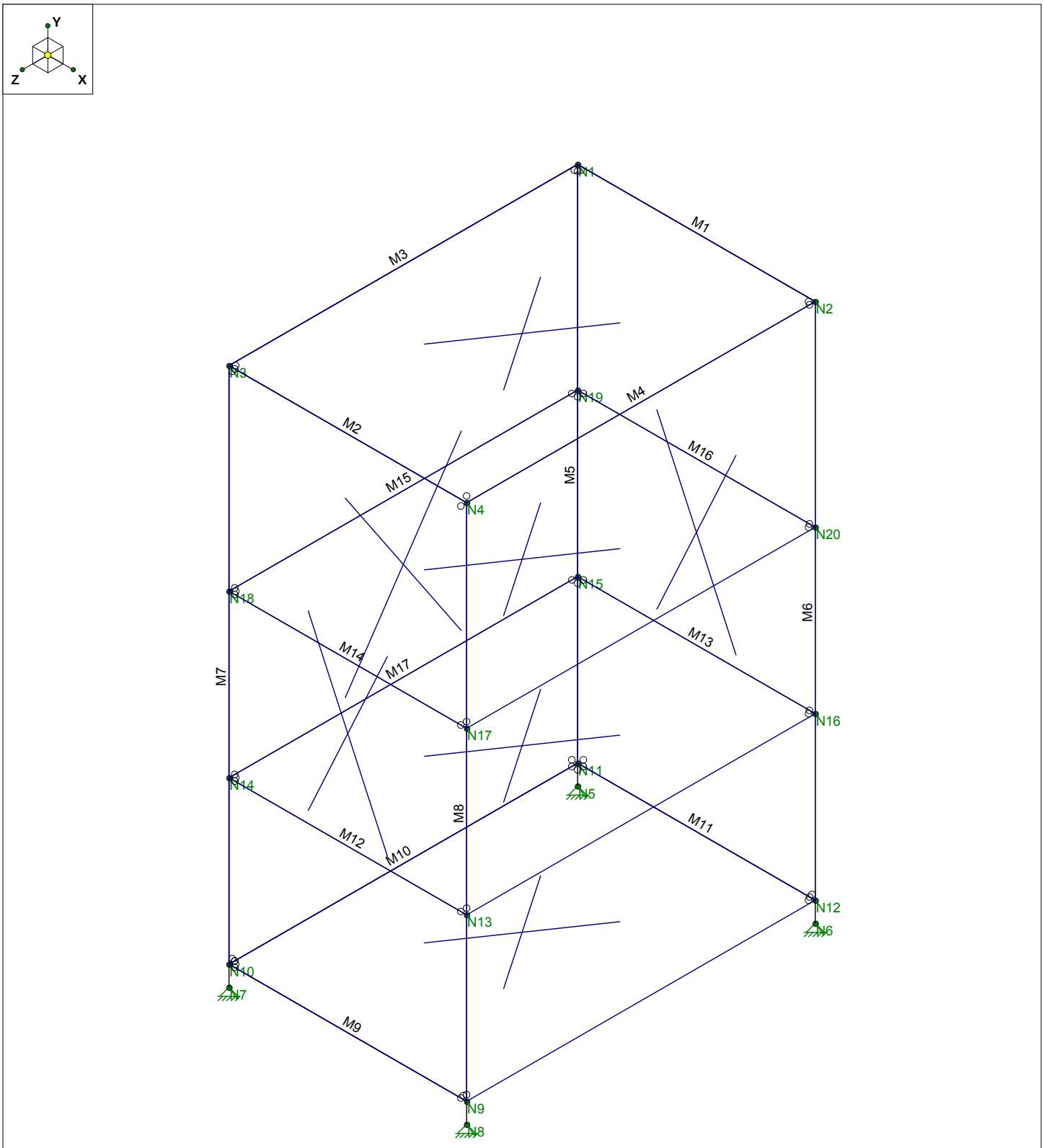
Loads: BLC 1, DL
Solution: Envelope

		SK - 1
YJK	CEC-20#-18	Nov 2, 2013 at 8:40 PM
	Dead Load	CEC-20#-18.r3d



Solution: Envelope

		SK - 2
YJK	CEC-20#-18	Nov 2, 2013 at 8:40 PM
	3D Model	CEC-20#-18.r3d



Solution: Envelope

		SK - 3
YJK	CEC-20#-18	Nov 2, 2013 at 8:41 PM
	Member and Node Numbers	CEC-20#-18.r3d

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E..	Density[k/ft...	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A36 Gr.36	29000	11154	.3	.65	.49	36	1.5	58	1.2
2	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.1
3	A992	29000	11154	.3	.65	.49	50	1.1	65	1.1
4	A500 Gr.42	29000	11154	.3	.65	.49	42	1.4	58	1.3
5	A500 Gr.46	29000	11154	.3	.65	.49	46	1.4	58	1.3

General Material Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E5 F)	Density[k/ft^3]
1	gen_Conc3NW	3155	1372	.15	.6	.145
2	gen_Conc4NW	3644	1584	.15	.6	.145
3	gen_Conc3LW	2085	906	.15	.6	.11
4	gen_Conc4LW	2408	1047	.15	.6	.11
5	gen_Alum	10600	4077	.3	1.29	.173
6	gen_Steel	29000	11154	.3	.65	.49
7	RIGID	1e+6		.3	0	0

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rul...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Frame	L2x2x2	Beam	Single Angle	A36 Gr.36	Typical	.491	.189	.189	.003

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	5.667	0	0	
2	N2	2.5	5.667	0	0	
3	N3	0	5.667	3.667	0	
4	N4	2.5	5.667	3.667	0	
5	N5	0	0	0	0	
6	N6	2.5	0	0	0	
7	N7	0	0	3.667	0	
8	N8	2.5	0	3.667	0	
9	N9	2.5	.21	3.667	0	
10	N10	0	.21	3.667	0	
11	N11	0	.21	0	0	
12	N12	2.5	.21	0	0	
13	N13	2.5	1.91	3.667	0	
14	N14	0	1.91	3.667	0	
15	N15	0	1.91	0	0	
16	N16	2.5	1.91	0	0	
17	N17	2.5	3.61	3.667	0	
18	N18	0	3.61	3.667	0	
19	N19	0	3.61	0	0	
20	N20	2.5	3.61	0	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	N5	Reaction	Reaction	Reaction				
2	N7	Reaction	Reaction	Reaction				
3	N8	Reaction	Reaction	Reaction				
4	N6	Reaction	Reaction	Reaction				

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	N2			Frame	Beam	Single Angle	A36 Gr.36	Typical
2	M2	N3	N4			Frame	Beam	Single Angle	A36 Gr.36	Typical
3	M3	N1	N3			Frame	Beam	Single Angle	A36 Gr.36	Typical
4	M4	N2	N4			Frame	Beam	Single Angle	A36 Gr.36	Typical
5	M5	N1	N5			Frame	Beam	Single Angle	A36 Gr.36	Typical
6	M6	N2	N6			Frame	Beam	Single Angle	A36 Gr.36	Typical
7	M7	N3	N7			Frame	Beam	Single Angle	A36 Gr.36	Typical
8	M8	N4	N8			Frame	Beam	Single Angle	A36 Gr.36	Typical
9	M9	N9	N10			Frame	Beam	Single Angle	A36 Gr.36	Typical
10	M10	N10	N11			Frame	Beam	Single Angle	A36 Gr.36	Typical
11	M11	N11	N12			Frame	Beam	Single Angle	A36 Gr.36	Typical
12	M12	N13	N14			Frame	Beam	Single Angle	A36 Gr.36	Typical
13	M13	N15	N16			Frame	Beam	Single Angle	A36 Gr.36	Typical
14	M14	N17	N18			Frame	Beam	Single Angle	A36 Gr.36	Typical
15	M15	N18	N19			Frame	Beam	Single Angle	A36 Gr.36	Typical
16	M16	N19	N20			Frame	Beam	Single Angle	A36 Gr.36	Typical
17	M17	N15	N14			Frame	Beam	Single Angle	A36 Gr.36	Typical

Plate Primary Data

	Label	A Joint	B Joint	C Joint	D Joint	Material	Thickness[in]
1	P1	N19	N20	N17	N18	gen_Steel	.079
2	P2	N15	N16	N13	N14	gen_Steel	.079
3	P3	N12	N11	N10	N9	gen_Steel	.079
4	P4	N1	N2	N4	N3	gen_Steel	.037
5	P5	N1	N11	N10	N3	gen_Steel	.037
6	P6	N1	N2	N12	N11	gen_Steel	.037
7	P7	N3	N4	N9	N10	gen_Steel	.037

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M6	Y	-.007	-.007	0	0

Member Distributed Loads (BLC 2 : EQX)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M6	X	.007	.007	0	0

Member Distributed Loads (BLC 3 : EQZ)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M6	Z	.007	.007	0	0

Member Distributed Loads (BLC 4 : BLC 1 Transient Area Loads)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M14	Y	-.032	-.032	2.512e-15	2.25
2	M15	Y	-.026	-.026	0	3.667
3	M16	Y	-.032	-.032	.25	2.5
4	M12	Y	-.032	-.032	2.512e-15	2.25
5	M13	Y	-.032	-.032	.25	2.5
6	M17	Y	-.026	-.026	8.049e-16	3.667
7	M9	Y	-.032	-.032	2.512e-15	2.25
8	M10	Y	-.026	-.026	0	3.667
9	M11	Y	-.032	-.032	.25	2.5

Member Distributed Loads (BLC 5 : BLC 2 Transient Area Loads)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M14	X	.068	.068	2.512e-15	.25
2	M14	X	.068	.068	.25	.5
3	M14	X	.068	.063	.5	.75
4	M14	X	.063	.054	.75	1
5	M14	X	.054	.044	1	1.25
6	M14	X	.044	.034	1.25	1.5
7	M14	X	.034	.024	1.5	1.75
8	M14	X	.024	.015	1.75	2
9	M14	X	.015	.005	2	2.25
10	M15	X	.037	.037	0	3.667
11	M16	X	.005	.015	.25	.5
12	M16	X	.015	.024	.5	.75
13	M16	X	.024	.034	.75	1
14	M16	X	.034	.044	1	1.25
15	M16	X	.044	.054	1.25	1.5
16	M16	X	.054	.063	1.5	1.75
17	M16	X	.063	.068	1.75	2
18	M16	X	.068	.068	2	2.25
19	M16	X	.068	.068	2.25	2.5
20	M12	X	.068	.068	2.512e-15	.25
21	M12	X	.068	.068	.25	.5
22	M12	X	.068	.063	.5	.75
23	M12	X	.063	.054	.75	1
24	M12	X	.054	.044	1	1.25
25	M12	X	.044	.034	1.25	1.5
26	M12	X	.034	.024	1.5	1.75
27	M12	X	.024	.015	1.75	2
28	M12	X	.015	.005	2	2.25
29	M13	X	.005	.015	.25	.5
30	M13	X	.015	.024	.5	.75
31	M13	X	.024	.034	.75	1
32	M13	X	.034	.044	1	1.25
33	M13	X	.044	.054	1.25	1.5
34	M13	X	.054	.063	1.5	1.75
35	M13	X	.063	.068	1.75	2
36	M13	X	.068	.068	2	2.25
37	M13	X	.068	.068	2.25	2.5
38	M17	X	.037	.037	8.049e-16	3.667
39	M9	X	.068	.068	2.512e-15	.25
40	M9	X	.068	.068	.25	.5
41	M9	X	.068	.063	.5	.75
42	M9	X	.063	.054	.75	1
43	M9	X	.054	.044	1	1.25
44	M9	X	.044	.034	1.25	1.5
45	M9	X	.034	.024	1.5	1.75
46	M9	X	.024	.015	1.75	2
47	M9	X	.015	.005	2	2.25
48	M10	X	.037	.037	0	3.667
49	M11	X	.005	.015	.25	.5
50	M11	X	.015	.024	.5	.75
51	M11	X	.024	.034	.75	1
52	M11	X	.034	.044	1	1.25
53	M11	X	.044	.054	1.25	1.5
54	M11	X	.054	.063	1.5	1.75
55	M11	X	.063	.068	1.75	2
56	M11	X	.068	.068	2	2.25
57	M11	X	.068	.068	2.25	2.5

Member Distributed Loads (BLC 6 : BLC 3 Transient Area Loads)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M14	Z	.068	.068	2.512e-15	.25
2	M14	Z	.068	.068	.25	.5
3	M14	Z	.068	.063	.5	.75
4	M14	Z	.063	.054	.75	1
5	M14	Z	.054	.044	1	1.25
6	M14	Z	.044	.034	1.25	1.5
7	M14	Z	.034	.024	1.5	1.75
8	M14	Z	.024	.015	1.75	2
9	M14	Z	.015	.005	2	2.25
10	M15	Z	.037	.037	0	3.667
11	M16	Z	.005	.015	.25	.5
12	M16	Z	.015	.024	.5	.75
13	M16	Z	.024	.034	.75	1
14	M16	Z	.034	.044	1	1.25
15	M16	Z	.044	.054	1.25	1.5
16	M16	Z	.054	.063	1.5	1.75
17	M16	Z	.063	.068	1.75	2
18	M16	Z	.068	.068	2	2.25
19	M16	Z	.068	.068	2.25	2.5
20	M12	Z	.068	.068	2.512e-15	.25
21	M12	Z	.068	.068	.25	.5
22	M12	Z	.068	.063	.5	.75
23	M12	Z	.063	.054	.75	1
24	M12	Z	.054	.044	1	1.25
25	M12	Z	.044	.034	1.25	1.5
26	M12	Z	.034	.024	1.5	1.75
27	M12	Z	.024	.015	1.75	2
28	M12	Z	.015	.005	2	2.25
29	M13	Z	.005	.015	.25	.5
30	M13	Z	.015	.024	.5	.75
31	M13	Z	.024	.034	.75	1
32	M13	Z	.034	.044	1	1.25
33	M13	Z	.044	.054	1.25	1.5
34	M13	Z	.054	.063	1.5	1.75
35	M13	Z	.063	.068	1.75	2
36	M13	Z	.068	.068	2	2.25
37	M13	Z	.068	.068	2.25	2.5
38	M17	Z	.037	.037	8.049e-16	3.667
39	M9	Z	.068	.068	2.512e-15	.25
40	M9	Z	.068	.068	.25	.5
41	M9	Z	.068	.063	.5	.75
42	M9	Z	.063	.054	.75	1
43	M9	Z	.054	.044	1	1.25
44	M9	Z	.044	.034	1.25	1.5
45	M9	Z	.034	.024	1.5	1.75
46	M9	Z	.024	.015	1.75	2
47	M9	Z	.015	.005	2	2.25
48	M10	Z	.037	.037	0	3.667
49	M11	Z	.005	.015	.25	.5
50	M11	Z	.015	.024	.5	.75
51	M11	Z	.024	.034	.75	1
52	M11	Z	.034	.044	1	1.25
53	M11	Z	.044	.054	1.25	1.5
54	M11	Z	.054	.063	1.5	1.75
55	M11	Z	.063	.068	1.75	2
56	M11	Z	.068	.068	2	2.25
57	M11	Z	.068	.068	2.25	2.5

Member Area Loads (BLC 1 : DL)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[ksf]
1	N19	N20	N17	N18	Y	Two Way	-.026
2	N15	N16	N13	N14	Y	Two Way	-.026
3	N11	N12	N9	N10	Y	Two Way	-.026

Member Area Loads (BLC 2 : EQX)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[ksf]
1	N19	N20	N17	N18	X	Two Way	.037
2	N15	N16	N13	N14	X	Two Way	.037
3	N11	N12	N9	N10	X	Two Way	.037

Member Area Loads (BLC 3 : EQZ)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[ksf]
1	N19	N20	N17	N18	Z	Two Way	.037
2	N15	N16	N13	N14	Z	Two Way	.037
3	N11	N12	N9	N10	Z	Two Way	.037

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu...	Area(M...	Surface...
1	DL	DL		-1				1	3	
2	EQX	ELX	1					1	3	
3	EQZ	ELZ			1			1	3	
4	BLC 1 Transient ...	None						9		
5	BLC 2 Transient ...	None						57		
6	BLC 3 Transient ...	None						57		

Load Combinations

	Description	Sol...	PD...	SR...	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	DL	Yes	Y		DL	1														
2	1.2DL+EQX	Yes	Y		DL	1.2	ELX	.569	DL	.304										
3	1.2DL-EQX	Yes	Y		DL	1.2	ELX	-.569	DL	.304										
4	1.2DL+EQZ	Yes	Y		DL	1.2	ELZ	.569	DL	.304										
5	1.2DL-EQZ	Yes	Y		DL	1.2	ELZ	-.569	DL	.304										
6	0.9DL+EQX	Yes	Y		DL	.9	ELX	.569	DL	-.304										
7	0.9DL-EQX	Yes	Y		DL	.9	ELX	-.569	DL	-.304										
8	0.9DL+EQZ	Yes	Y		DL	.9	ELZ	.569	DL	-.304										
9	0.9DL-EQZ	Yes	Y		DL	.9	ELZ	-.569	DL	-.304										

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N5	max	.193	7	1.206	5	.2	5	0	1	0	1	0	1
2		min	-.197	6	-.531	8	-.209	8	0	1	0	1	0	1
3	N7	max	.184	7	1.206	4	.209	9	0	1	0	1	0	1
4		min	-.187	6	-.531	9	-.2	4	0	1	0	1	0	1
5	N8	max	.188	3	.571	2	.175	5	0	1	0	1	0	1
6		min	-.185	2	-.203	7	-.177	8	0	1	0	1	0	1
7	N6	max	.194	3	.659	2	.174	9	0	1	0	1	0	1
8		min	-.19	2	-.208	7	-.172	4	0	1	0	1	0	1
9	Totals:	max	.758	7	1.548	3	.758	5						
10		min	-.758	2	.613	6	-.758	8						

Envelope Member Section Forces

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Momen...	LC	z-z Momen...	LC
1	M1	1	max	0	7	.087	2	.001	9	0	5	.072	7	.075	2
2			min	-.011	2	-.082	7	-.001	4	0	4	-.074	2	-.074	7
3		2	max	0	7	.085	2	0	9	0	5	.037	3	.037	6
4			min	-.011	2	-.083	7	0	4	0	4	-.036	6	-.037	3
5		3	max	0	7	.084	2	0	7	0	5	.001	5	0	9
6			min	-.01	5	-.083	3	0	2	0	4	0	8	-.001	4
7		4	max	0	8	.083	6	0	7	0	5	.037	2	.037	7
8			min	-.01	5	-.085	3	0	2	0	4	-.036	7	-.038	2
9		5	max	0	8	.082	6	0	8	0	5	.073	6	.075	3
10			min	-.01	5	-.087	3	0	5	0	4	-.074	3	-.074	6
11	M2	1	max	0	7	.083	2	.001	5	0	5	.07	7	.07	2
12			min	-.009	2	-.078	7	-.001	8	0	4	-.071	2	-.069	7
13		2	max	0	7	.081	2	0	5	0	5	.036	3	.035	6
14			min	-.009	4	-.079	7	0	8	0	4	-.035	6	-.035	3
15		3	max	0	9	.08	2	0	2	0	5	.001	5	0	9
16			min	-.009	4	-.079	3	0	7	0	4	0	8	-.001	4
17		4	max	0	9	.079	6	0	2	0	5	.036	2	.035	7
18			min	-.009	4	-.081	3	0	7	0	4	-.035	7	-.035	2
19		5	max	0	9	.078	6	0	4	0	5	.07	6	.07	3
20			min	-.009	4	-.083	3	0	9	0	4	-.071	3	-.069	6
21	M3	1	max	.003	6	.058	4	.002	2	0	9	.069	9	.071	4
22			min	-.013	3	-.052	9	-.002	7	0	4	-.072	4	-.068	9
23		2	max	.003	6	.056	4	0	2	0	9	.036	5	.034	8
24			min	-.013	3	-.053	9	0	7	0	4	-.035	8	-.035	5
25		3	max	.003	6	.054	4	0	4	0	9	.002	2	0	6
26			min	-.013	3	-.054	5	0	5	0	4	0	7	-.002	3
27		4	max	.003	6	.053	8	0	3	0	9	.036	4	.034	9
28			min	-.013	3	-.056	5	0	6	0	4	-.035	9	-.035	4
29		5	max	.003	6	.052	8	.002	3	0	9	.069	8	.071	5
30			min	-.013	3	-.058	5	-.002	6	0	4	-.072	5	-.068	8
31	M4	1	max	.004	3	.053	4	.002	6	0	9	.062	9	.064	4
32			min	0	8	-.046	9	-.002	3	0	4	-.064	4	-.062	9
33		2	max	.004	3	.05	4	0	6	0	9	.032	5	.031	8
34			min	0	6	-.047	9	0	3	0	4	-.031	8	-.032	5
35		3	max	.004	4	.048	4	0	9	0	9	.002	2	0	6
36			min	0	9	-.048	5	0	8	0	4	0	7	-.002	3
37		4	max	.004	4	.047	8	0	7	0	9	.032	4	.031	9
38			min	0	9	-.05	5	0	2	0	4	-.031	9	-.032	4
39		5	max	.005	4	.046	8	.002	7	0	9	.061	8	.064	5
40			min	-.002	9	-.053	5	-.002	2	0	4	-.064	5	-.062	8
41	M5	1	max	.07	9	.084	2	.085	4	0	1	.072	7	.074	6
42			min	-.2	4	-.083	7	-.083	9	0	1	-.075	2	-.075	3
43		2	max	.071	9	.083	2	.084	4	0	1	.013	8	.014	8
44			min	-.197	4	-.082	7	-.082	9	0	1	-.014	5	-.015	5
45		3	max	.16	5	.023	2	.021	4	0	1	.06	4	.067	4
46			min	-.086	8	-.023	3	-.022	5	0	1	-.059	5	-.067	5
47		4	max	.303	5	.036	3	.038	5	0	1	.06	2	.068	4
48			min	-.029	8	-.037	2	-.038	4	0	1	-.06	3	-.068	5
49		5	max	1.206	5	.198	3	.208	5	0	1	0	1	0	1
50			min	-.531	8	-.197	2	-.207	4	0	1	0	1	0	1
51	M6	1	max	.063	8	.087	6	.081	4	0	1	.074	7	.072	6
52			min	-.128	5	-.087	3	-.079	9	0	1	-.076	2	-.075	3
53		2	max	.07	8	.08	6	.074	4	0	1	.013	8	.014	8
54			min	-.109	5	-.08	3	-.072	9	0	1	-.013	5	-.014	5
55		3	max	.145	4	.024	2	.02	4	0	1	.06	2	.062	4
56			min	-.056	9	-.023	3	-.021	5	0	1	-.06	3	-.062	5

Envelope Member Section Forces (Continued)

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Momen...	LC	z-z Momen...	LC
57		4	max	.237	4	.035	3	.035	5	0	1	.062	2	.062	4
58			min	-.019	9	-.035	2	-.035	4	0	1	-.062	3	-.063	5
59		5	max	.659	2	.193	3	.174	5	0	1	0	1	0	1
60			min	-.208	7	-.194	2	-.176	4	0	1	0	1	0	1
61	M7	1	max	.07	8	.08	2	.083	8	0	1	.075	5	.073	2
62			min	-.2	5	-.079	7	-.085	5	0	1	-.074	8	-.07	7
63		2	max	.072	8	.079	2	.082	8	0	1	.015	4	.014	4
64			min	-.197	5	-.078	7	-.084	5	0	1	-.014	9	-.013	9
65		3	max	.16	4	.022	2	.022	4	0	1	.067	4	.059	4
66			min	-.086	9	-.022	3	-.021	5	0	1	-.067	5	-.06	5
67		4	max	.303	4	.035	3	.038	5	0	1	.068	4	.06	4
68			min	-.029	9	-.035	2	-.038	4	0	1	-.068	5	-.06	5
69		5	max	1.206	4	.188	3	.207	5	0	1	0	1	0	1
70			min	-.531	9	-.188	2	-.208	4	0	1	0	1	0	1
71	M8	1	max	.069	9	.079	6	.075	8	0	1	.073	3	.07	2
72			min	-.113	4	-.08	3	-.077	5	0	1	-.07	6	-.069	7
73		2	max	.07	9	.078	6	.074	8	0	1	.014	4	.013	4
74			min	-.109	4	-.079	3	-.076	5	0	1	-.013	9	-.012	9
75		3	max	.131	5	.022	2	.021	4	0	1	.062	4	.055	3
76			min	-.062	8	-.022	3	-.02	5	0	1	-.062	5	-.056	2
77		4	max	.208	5	.035	3	.036	5	0	1	.062	4	.057	3
78			min	-.031	8	-.035	2	-.037	4	0	1	-.062	5	-.057	2
79		5	max	.571	2	.188	3	.179	5	0	1	0	1	0	1
80			min	-.203	7	-.188	2	-.177	4	0	1	0	1	0	1
81	M9	1	max	.039	6	.062	3	.04	4	0	4	0	1	0	1
82			min	-.045	3	.025	6	-.04	5	0	5	0	1	0	1
83		2	max	.014	6	.031	5	.015	4	0	4	.033	4	.004	8
84			min	-.02	3	.012	6	-.015	5	0	5	-.004	9	-.033	5
85		3	max	.003	7	0	7	.005	9	0	4	.041	4	.003	8
86			min	-.009	2	0	2	-.005	8	0	5	-.003	9	-.041	5
87		4	max	.015	7	-.013	7	.017	9	0	4	.029	4	0	8
88			min	-.021	2	-.032	2	-.017	8	0	5	0	9	-.029	5
89		5	max	.018	7	-.02	7	.02	9	0	4	0	1	0	1
90			min	-.024	2	-.052	2	-.02	8	0	5	0	1	0	1
91	M10	1	max	.037	8	.076	3	.04	3	0	4	0	1	0	1
92			min	-.047	5	.03	7	-.04	2	0	5	0	1	0	1
93		2	max	.017	8	.038	2	.02	7	0	4	.057	3	.005	7
94			min	-.026	5	.015	7	-.02	2	0	5	-.005	6	-.057	2
95		3	max	.002	6	0	1	0	1	0	4	.076	3	.007	7
96			min	-.009	3	0	1	0	1	0	5	-.007	6	-.076	2
97		4	max	.017	9	-.015	6	.02	2	0	4	.057	3	.005	7
98			min	-.027	4	-.038	2	-.02	7	0	5	-.005	6	-.057	2
99		5	max	.037	9	-.03	7	.04	2	0	4	0	1	0	1
100			min	-.047	4	-.076	2	-.04	7	0	5	0	1	0	1
101	M11	1	max	.019	7	.052	2	.02	5	0	4	0	1	0	1
102			min	-.026	2	.02	7	-.02	8	0	5	0	1	0	1
103		2	max	.015	7	.032	2	.017	5	0	4	.029	5	0	9
104			min	-.023	2	.013	7	-.017	8	0	5	0	8	-.029	4
105		3	max	.003	7	0	2	.005	5	0	4	.041	5	.003	9
106			min	-.011	2	0	7	-.005	8	0	5	-.003	8	-.041	4
107		4	max	.012	6	-.012	8	.015	4	0	4	.033	5	.004	9
108			min	-.02	3	-.031	3	-.015	9	0	5	-.004	8	-.033	4
109		5	max	.037	6	-.025	6	.04	4	0	4	0	1	0	1
110			min	-.045	3	-.062	3	-.04	9	0	5	0	1	0	1
111	M12	1	max	.042	2	.062	5	.04	4	0	8	0	1	0	1
112			min	-.043	3	.025	6	-.04	5	0	5	0	1	0	1
113		2	max	.018	2	.031	5	.015	4	0	8	.033	4	.004	8

Envelope Member Section Forces (Continued)

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Momen...	LC	z-z Momen...	LC
114			min	-.018	3	.012	6	-.015	5	0	5	-.004	9	-.033	5
115		3	max	.003	7	0	7	.005	9	0	8	.041	4	.003	8
116			min	-.003	6	0	4	-.005	8	0	5	-.003	9	-.041	5
117		4	max	.015	7	-.013	8	.017	9	0	8	.029	4	0	8
118			min	-.015	6	-.032	4	-.017	8	0	5	0	9	-.029	5
119		5	max	.018	7	-.02	7	.02	9	0	8	0	1	0	1
120			min	-.018	6	-.052	2	-.02	8	0	5	0	1	0	1
121	M13	1	max	.019	7	.052	2	.02	5	0	4	0	1	0	1
122			min	-.019	2	.02	7	-.02	8	0	5	0	1	0	1
123		2	max	.016	7	.032	2	.017	5	0	4	.029	5	0	9
124			min	-.016	2	.013	7	-.017	8	0	5	0	8	-.029	4
125		3	max	.004	7	0	4	.005	5	0	4	.041	5	.003	9
126			min	-.004	2	0	9	-.005	8	0	5	-.003	8	-.041	4
127		4	max	.016	6	-.012	8	.015	4	0	4	.033	5	.004	9
128			min	-.016	3	-.031	2	-.015	9	0	5	-.004	8	-.033	4
129		5	max	.041	6	-.025	8	.04	4	0	4	0	1	0	1
130			min	-.041	3	-.062	5	-.04	9	0	5	0	1	0	1
131	M14	1	max	.042	6	.062	5	.04	4	0	5	0	1	0	1
132			min	-.043	7	.025	7	-.04	5	0	4	0	1	0	1
133		2	max	.018	6	.031	5	.015	4	0	5	.033	4	.004	8
134			min	-.018	7	.012	7	-.015	5	0	4	-.004	9	-.033	5
135		3	max	.003	3	0	6	.005	9	0	5	.041	4	.003	8
136			min	-.003	2	0	3	-.005	8	0	4	-.003	9	-.041	5
137		4	max	.015	3	-.013	6	.017	9	0	5	.029	4	0	8
138			min	-.015	2	-.032	3	-.017	8	0	4	0	9	-.029	5
139		5	max	.018	3	-.02	6	.02	9	0	5	0	1	0	1
140			min	-.018	2	-.052	3	-.02	8	0	4	0	1	0	1
141	M15	1	max	.04	8	.076	3	.04	3	0	5	0	1	0	1
142			min	-.041	5	.03	7	-.04	2	0	4	0	1	0	1
143		2	max	.02	8	.038	2	.02	7	0	5	.057	3	.005	7
144			min	-.02	5	.015	7	-.02	2	0	4	-.005	6	-.057	2
145		3	max	0	7	0	1	0	1	0	5	.076	3	.007	7
146			min	0	4	0	1	0	1	0	4	-.007	6	-.076	2
147		4	max	.02	9	-.015	6	.02	2	0	5	.057	3	.005	7
148			min	-.021	4	-.038	2	-.02	7	0	4	-.005	6	-.057	2
149		5	max	.04	9	-.03	7	.04	2	0	5	0	1	0	1
150			min	-.041	4	-.076	2	-.04	7	0	4	0	1	0	1
151	M16	1	max	.019	3	.052	3	.02	5	0	5	0	1	0	1
152			min	-.02	2	.02	6	-.02	8	0	4	0	1	0	1
153		2	max	.016	3	.032	3	.017	5	0	5	.029	5	0	9
154			min	-.016	2	.013	6	-.017	8	0	4	0	8	-.029	4
155		3	max	.004	3	0	4	.005	5	0	5	.041	5	.003	9
156			min	-.004	2	0	9	-.005	8	0	4	-.003	8	-.041	4
157		4	max	.016	6	-.012	8	.015	4	0	5	.033	5	.004	9
158			min	-.016	7	-.031	2	-.015	9	0	4	-.004	8	-.033	4
159		5	max	.041	6	-.025	8	.04	4	0	5	0	1	0	1
160			min	-.041	7	-.062	5	-.04	9	0	4	0	1	0	1
161	M17	1	max	.04	5	.076	2	.04	6	0	8	0	1	0	1
162			min	-.041	8	.03	6	-.04	3	0	5	0	1	0	1
163		2	max	.02	5	.038	2	.02	2	0	8	.057	2	.005	6
164			min	-.021	8	.015	6	-.02	3	0	5	-.005	7	-.057	3
165		3	max	0	3	0	1	0	1	0	8	.076	2	.007	6
166			min	0	8	0	1	0	1	0	5	-.007	7	-.076	3
167		4	max	.02	4	-.015	7	.02	3	0	8	.057	2	.005	6
168			min	-.02	9	-.038	4	-.02	6	0	5	-.005	7	-.057	3
169		5	max	.04	4	-.03	8	.04	3	0	8	0	1	0	1
170			min	-.04	9	-.076	2	-.04	2	0	5	0	1	0	1

Envelope AISC 13th(360-05): LRFD Steel Code Checks

	Member	Shape	Code ...	Loc[ft]	LC	Shear ...	Loc[ft]	Dir	LC	phi*Pnc [k]	phi*Pnt [k]	phi*Mn y...	phi*Mn z...	Cb	Eqn
1	M1	L2x2x2	.272	2.5	6	.018	0	y	2	10.933	15.908	.396	.844	2....	H2-1
2	M2	L2x2x2	.260	2.5	6	.017	0	y	2	10.933	15.908	.396	.844	2....	H2-1
3	M3	L2x2x2	.264	0	4	.012	0	y	4	7.897	15.908	.403	.823	2....	H2-1
4	M4	L2x2x2	.237	0	4	.011	3.667	y	5	7.897	15.908	.403	.824	2....	H2-1
5	M5	L2x2x2	.308	3.778	4	.043	5.667	z	5	12.726	15.908	.403	.66	1....	H2-1
6	M6	L2x2x2	.298	0	6	.040	5.667	y	2	11.977	15.908	.403	.665	1....	H2-1
7	M7	L2x2x2	.336	3.778	4	.043	5.667	z	4	12.726	15.908	.403	.658	1....	H2-1
8	M8	L2x2x2	.290	3.778	4	.039	5.667	y	2	12.726	15.908	.403	.658	1....	H2-1
9	M9	L2x2x2	.122	1.198	4	.014	0	y	4	10.933	15.908	.396	.779	1....	H2-1
10	M10	L2x2x2	.225	1.833	3	.017	0	y	5	7.897	15.908	.396	.705	1....	H2-1
11	M11	L2x2x2	.122	1.302	5	.014	2.5	y	5	10.933	15.908	.396	.779	1....	H2-1
12	M12	L2x2x2	.121	1.198	4	.013	0	y	5	10.933	15.908	.396	.779	1....	H2-1
13	M13	L2x2x2	.121	1.302	5	.013	2.5	y	4	10.933	15.908	.396	.779	1....	H2-1
14	M14	L2x2x2	.121	1.198	4	.013	0	y	4	10.933	15.908	.396	.779	1....	H2-1
15	M15	L2x2x2	.224	1.833	3	.016	0	y	4	7.897	15.908	.396	.705	1....	H2-1
16	M16	L2x2x2	.121	1.302	5	.013	2.5	y	4	10.933	15.908	.396	.779	1....	H2-1
17	M17	L2x2x2	.224	1.833	2	.016	0	y	5	7.897	15.908	.396	.705	1....	H2-1

Envelope Plate Forces

	Plate		Qx [k]	LC	Qy [k]	LC	Mx [k-ft]	LC	My [k-ft]	LC	Mxy [k-ft]	LC	Fx [k]	LC	Fy [k]	LC	Fxy [k]	LC
1	P1	max	0	1	0	1	0	1	0	1	0	1	.004	3	.003	5	.003	8
2		min	0	1	0	1	0	1	0	1	0	1	-.003	6	-.001	8	-.003	9
3	P2	max	0	1	0	1	0	1	0	1	0	1	.004	7	.001	9	.004	4
4		min	0	1	0	1	0	1	0	1	0	1	-.004	2	-.002	4	-.004	5
5	P3	max	0	1	0	1	0	1	0	1	0	1	.012	3	.009	3	.048	5
6		min	0	1	0	1	0	1	0	1	0	1	.003	6	-.001	6	-.048	4
7	P4	max	0	1	0	1	0	1	0	1	0	1	.009	2	.006	3	.047	5
8		min	0	1	0	1	0	1	0	1	0	1	.002	7	0	6	-.047	4
9	P5	max	0	1	0	1	0	1	0	1	0	1	.014	6	.002	6	.099	4
10		min	0	1	0	1	0	1	0	1	0	1	-.07	3	-.011	3	-.099	5
11	P6	max	0	1	0	1	0	1	0	1	0	1	0	7	-.007	7	.077	2
12		min	0	1	0	1	0	1	0	1	0	1	-.011	2	-.059	2	-.077	3
13	P7	max	0	1	0	1	0	1	0	1	0	1	0	7	-.004	9	.071	2
14		min	0	1	0	1	0	1	0	1	0	1	-.011	2	-.053	4	-.071	3

1.2 Anchor Bolt Design

(When EQ governs)

Anchor Bolts

Bolt Number =	1		
T (Tension on Bolt) =	531	lbs.	(From RISA Results)
V (Shear on Bolt) =	209	lbs.	(From RISA Results)

Try Min. (1) 1/2 ϕ **Hilti KWIK HUS Carbon Steel Screw Anchor System with Min. 2.25" Embedment** (ESR 3027)

f'_c = 2,500 psi Conservatively assumed

$\beta_N = N_u/\phi N_n$	$\beta_V = V_u/\phi V_n$	ζ	$\beta_{N,V}$ (%)	
0.684	0.25	1.67	63.0	**(See attached calculation)**

$\beta_{N,V} = \beta_N^{\zeta} + \beta_V^{\zeta} =$ **0.6302** < **1.0** (O.K.)

Use Min. (1) 1/2 ϕ **Hilti KWIK HUS Carbon Steel Screw Anchor System with Min. 2.25" Embedment** (ESR 3027)

See attached calculations for Strength Check

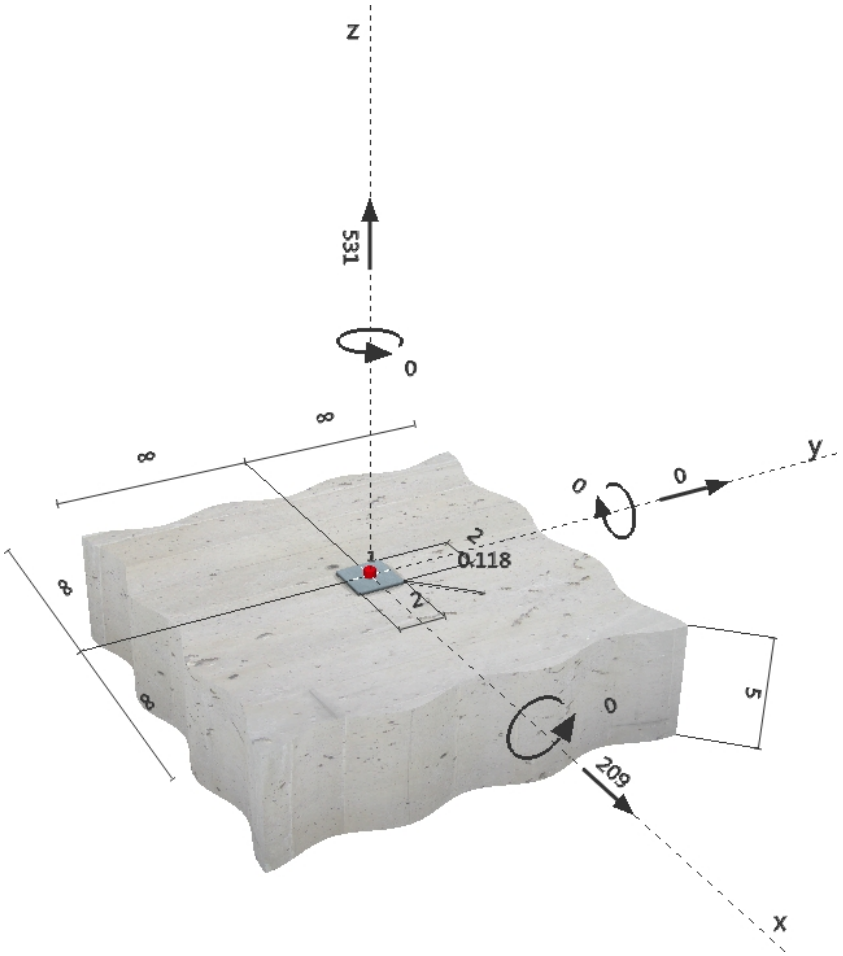
Company:	Abn Engineering	Page:	1
Specifier:	Sandeep A Mane	Project:	Propane Cage - SBI
Address:		Sub-Project I Pos. No.:	sites in San Jose, CA
Phone I Fax:	480-213-8524 |	Date:	11/10/2013
E-Mail:	smane@abneng.com		

Specifier's comments:

1 Input data

Anchor type and diameter:	**KWIK HUS-EZ (KH-EZ) 1/2 (2 1/4)**
Effective embedment depth:	h_{ef} = 1.520 in., h_{nom} = 2.250 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-3027
Issued I Valid:	8/1/2012 | 12/1/2013
Proof:	design method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.118 in.
Anchor plate:	l_x x l_y x t = 2.000 in. x 2.000 in. x 0.118 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 5.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	yes (D.3.3.5)

Geometry [in.] & Loading [lb, in.lb]



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2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Concrete Breakout Strength	531	777	69 / -	OK
Shear	Pryout Strength	209	836	- / 25	OK

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	0.684	0.250	5/3	63	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

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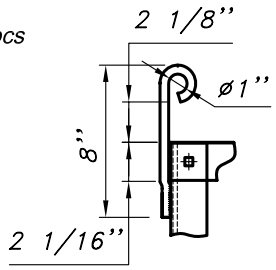
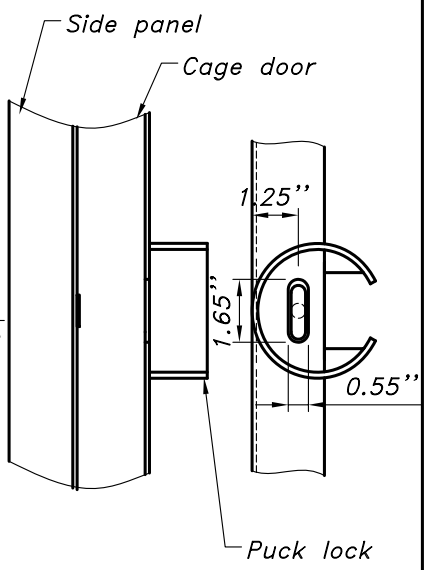
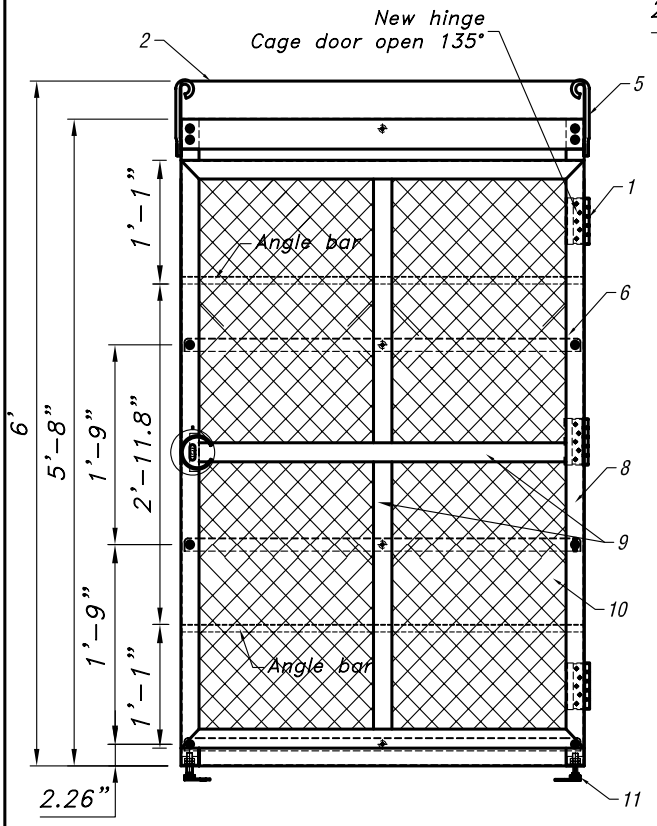
CEC - 20# - 18
Model: LB18302LS
Capacity: 18
Dimensins: 44w x 30d x 68h

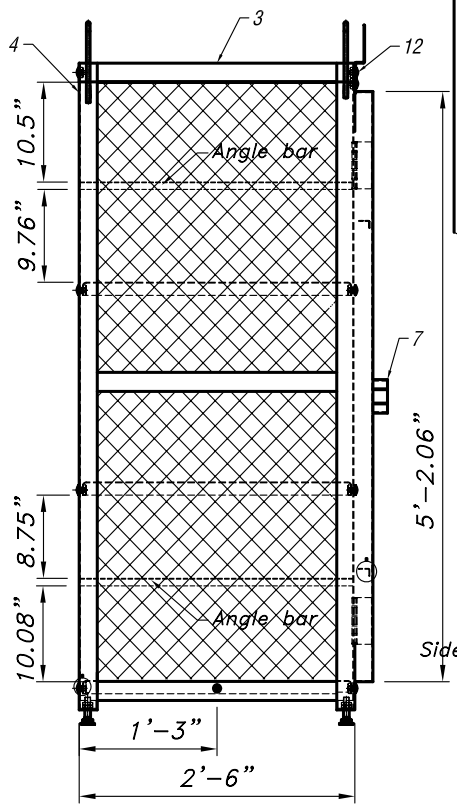
Hook
Quantity: 04 pcs

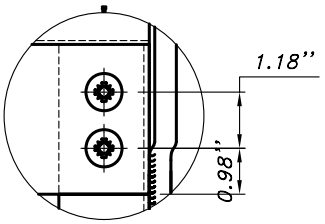


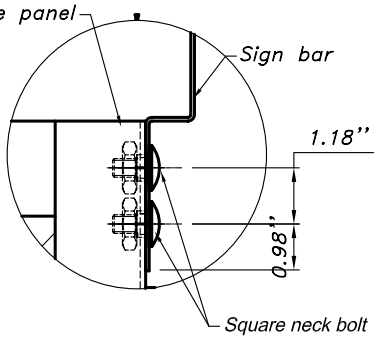
Puck Lock
Quantity: 01 pc

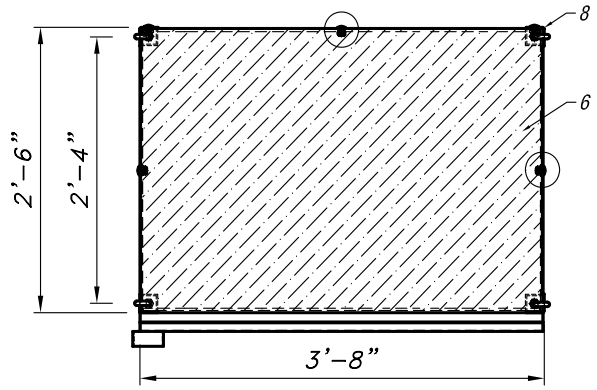


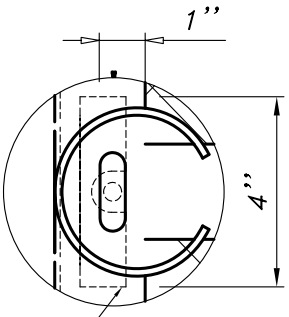




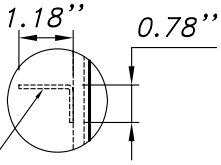






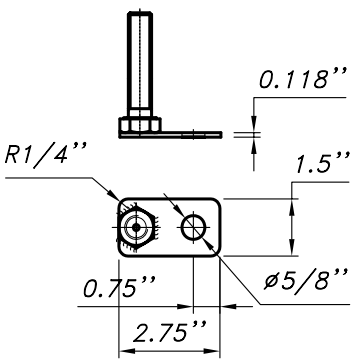


Protect the lock
Plate 1''x4''-3ga



Bracing strut cage
L1.18''x0.78''-14Ga

Plate Base Leveller
Quantity: 04 pcs



ITEM	DESCRIPTION	PART No.	QTY	MATERIAL
12	Square neck bolt		24	Steel
11	Leveller		4	Steel
10	Trellis			Steel thickness 13 Ga
9	Backing			Steel sheet thickness 11 Ga
8	Framed stile - angle bar 2"x2"		4	Steel sheet thickness 11 Ga
7	Puck lock		1	Steel sheet thickness 11 Ga
6	Solid shelf 40w x 26 d		3	Steel galvanned sheet thickness 14 Ga
5	Hook		4	Round bar, Ø0.472"
4	Back panel 40w x 66 13/32 h		1	Steel sheet thickness 21 Ga
3	Top panel 40w x 26 d		1	Steel sheet thickness 21 Ga
2	Sign bar 40w		1	Steel sheet thickness 13 Ga
1	Sheet hinge		3	Steel

SBI-Imports Product List - 5-15-2013

	Part Number	Description	Weight
Galv PC White	CEC-20#-18	Exchange Cylinder 18 Count for 20# - White Powder Coat	300
	CEC-20#12	Exchange Cylinder 12 Count for 20# - White Powder Coat	260
	CEC-20#-4	Exchange Cylinder 4 Count for 20# - White Powder Coat	110
	CEC-30#-8	Exchange Cylinder 12 Count for 30# - White Powder Coat	160
	CEC-30#-12	Exchange Cylinder 12 Count for 30# - White Powder Coat	340
	FCC-33#-18	Forklift Cylinder 18 Count for 33# - White Powder Coat	420
	FCC-33#-16	Forklift Cylinder 16 Count for 33# - White Powder Coat	340
	FCC-33#-12	Forklift Cylinder 12 Count for 33# - White Powder Coat	300
	FCC-33#-12HS	Forklift Cylinder 12 Count for 33# High Security - White PC	300
	FCC-33#-9	Forklift Cylinder 9 Count for 33# - White Powder Coat	190
	FCC-33#-8	Forklift Cylinder 8 Count for 33# - White Powder Coat	160
	FCC-33#-6	Forklift Cylinder 6 Count for 33# - White Powder Coat	160
	FCC-33#-4	Forklift Cylinder 4 Count for 33# - White Powder Coat	110

Aluminimum Cages	CEC-20#-18-ALM	Exchange Cylinder 18 Count for 20# - Aluminum	170
	CEC-20#12-ALM	Exchange Cylinder 12 Count for 20# - Aluminum	150

20# Propane bottles weigh approximately 37 lbs.
33# Propane bottles weigh approximately 53 lbs.

Weights can vary slightly +/- 2 or 3 pounds depending on manufacturer of bottles.