MURDOCH ENGINEERING
SIGN STRUCTURE PROFESSIONALS

STRUCTURAL DESIGN CALCULATIONS

PROLOGIS - GHM-75-VHWL
1501 W. Copans Rd
Pompano Beach, FL 33064

DESIGN SPECIFICATIONS		
	FL Building Code 2020 7th Edition	
ASCE	7-16	Minimum Design Loads for Buildings & Other Structures
ACI	318-14	Building Code Requirements for Structural Concrete
ANSI/AISC	360-16	Specification for Stuctural Steel Buildings

DESIGN LOADS		
Wind	V =	175 mph
Exposure	C	
Risk Cat.	II	

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2399 A-2 NJ-34
MANASQUAN, NJ 08736
(973) 570-8215 x0

5/11/2023

Jere Murdoch, PE
Professional Engineer
FL PE Lic. #73432
Exp. 2/28/2025

PN 2242570

DATE ISSUED: 5/11/2023
BY: JERE MURDOCH, PE
FL LIC. # 73432

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Digitally signed by Jere Murdoch, PE
Date: 2025.03.10 13:54:09 -04'00'

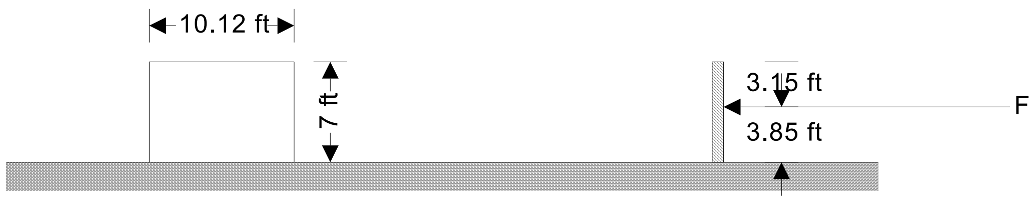
AAC
PZ25-30000001
03/03/2026

WIND LOADING

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.13



Wall/sign data

Length of wall/sign	B = **10.12** ft
Height of wall/sign	s = **7.00** ft
Height to top of sign	h = **7.00** ft

General wind load requirements

Basic wind speed	V = **175.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **1.00**
Exposure category (cl 26.7.3)	C
Gust effect factor	G_f = **0.85**
Minimum design wind loading (cl.27.1.5)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.85**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2$ = **56.6** psf
Area of sign	$A_f = B \times s$ = **70.84** ft^2
Ratio of solid area to gross area	ε = **1.00**

Wall/sign forces – Case A and B

Force coefficient (Figure 29.3-1)	C_{f_A} = **1.43**
Resultant force	$F_A = \max(16psf, q_h \times G_f \times C_{f\_A}) \times A_f$ = **4.9** kips

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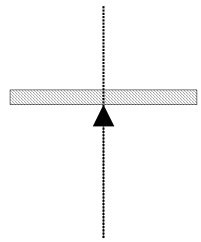
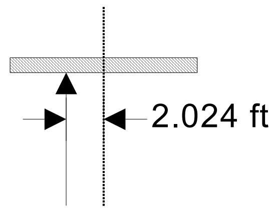
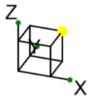
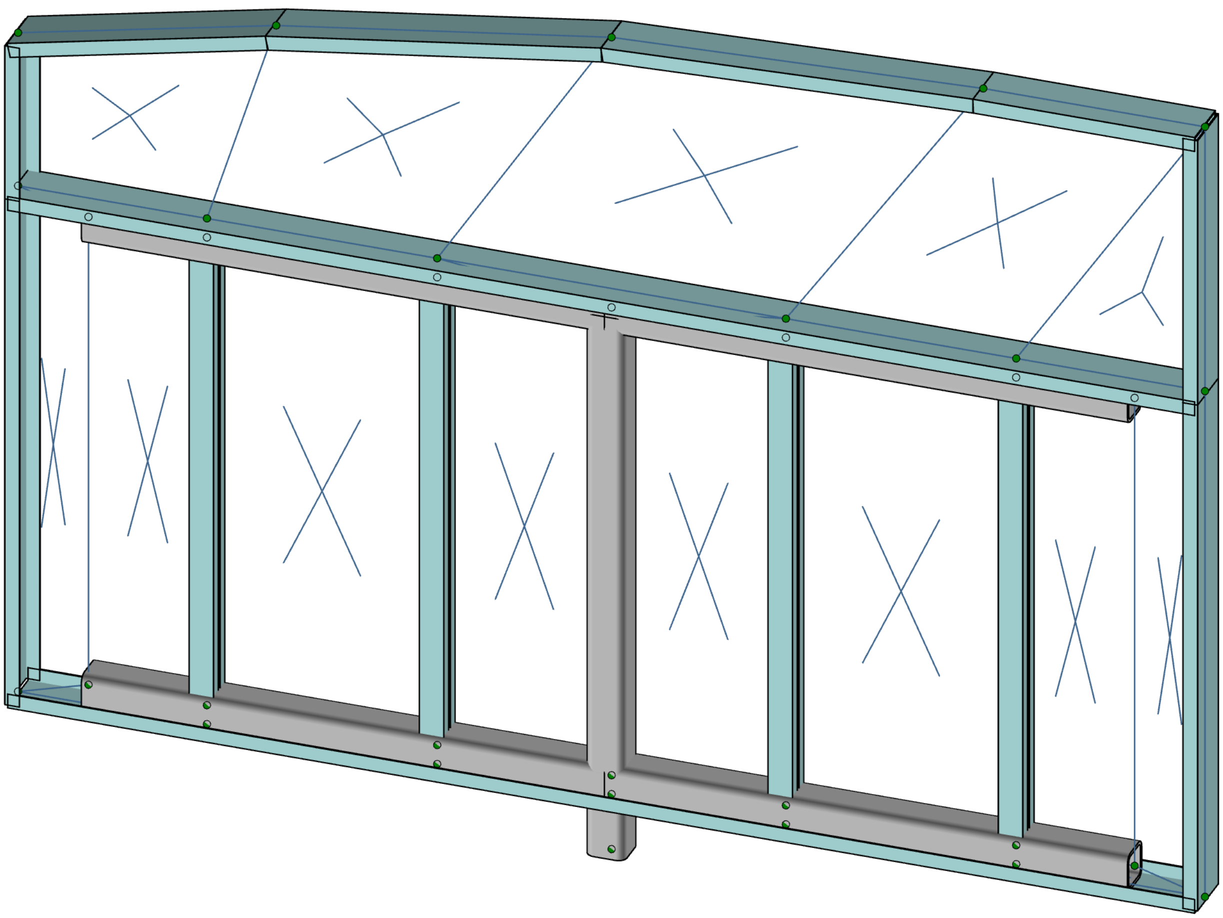


Plan - Case A



Plan - Case B





Murdoch Engineering	AAC	SK-1
Brian O	PZ25-30000001 03/03/2026	May 11, 2023
		wireframe to model.r3d

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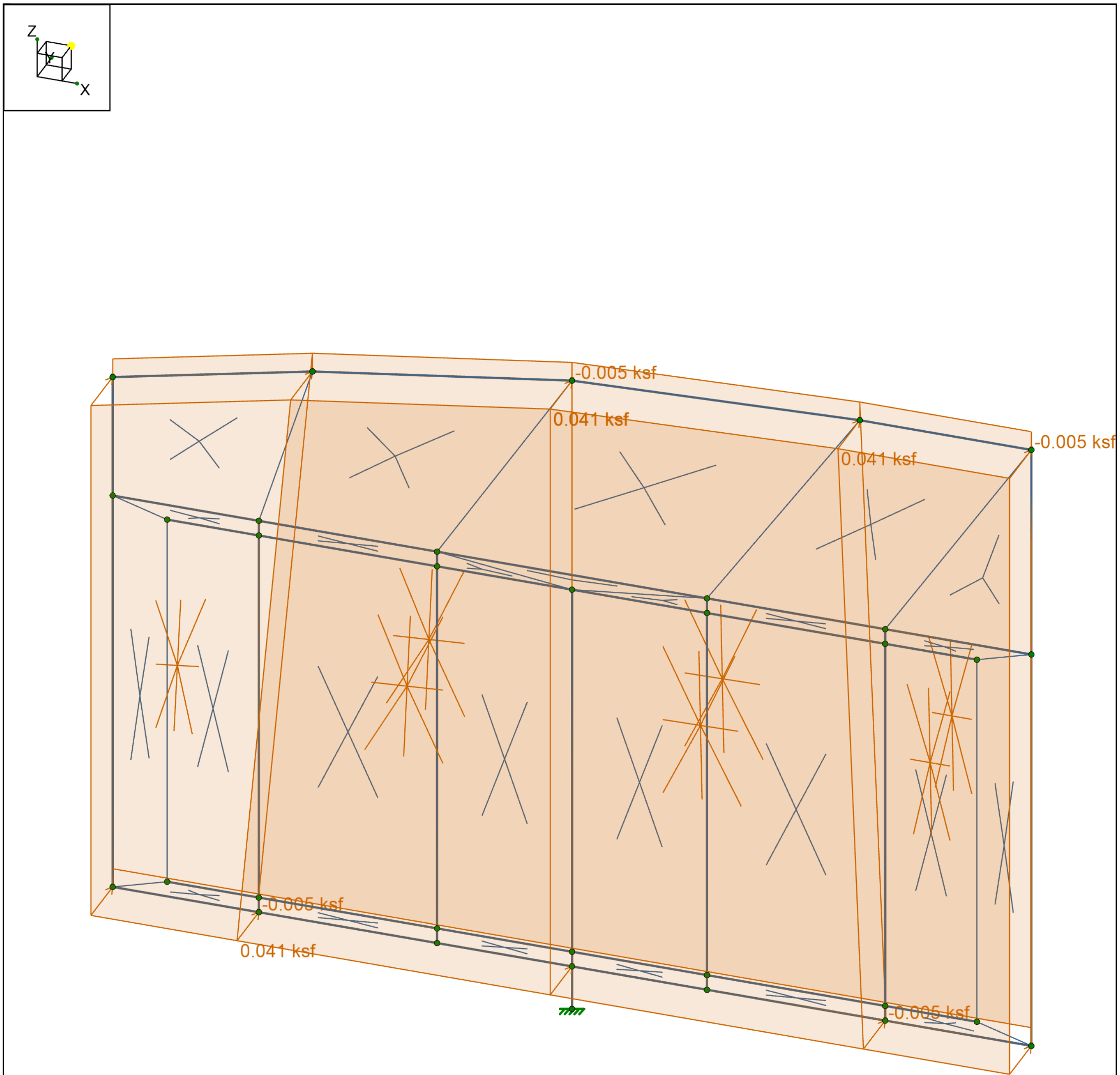

Loads: LC 1, case a

Murdoch Engineering		SK-2
Brian O		May 11, 2023
		wireframe to model.r3d

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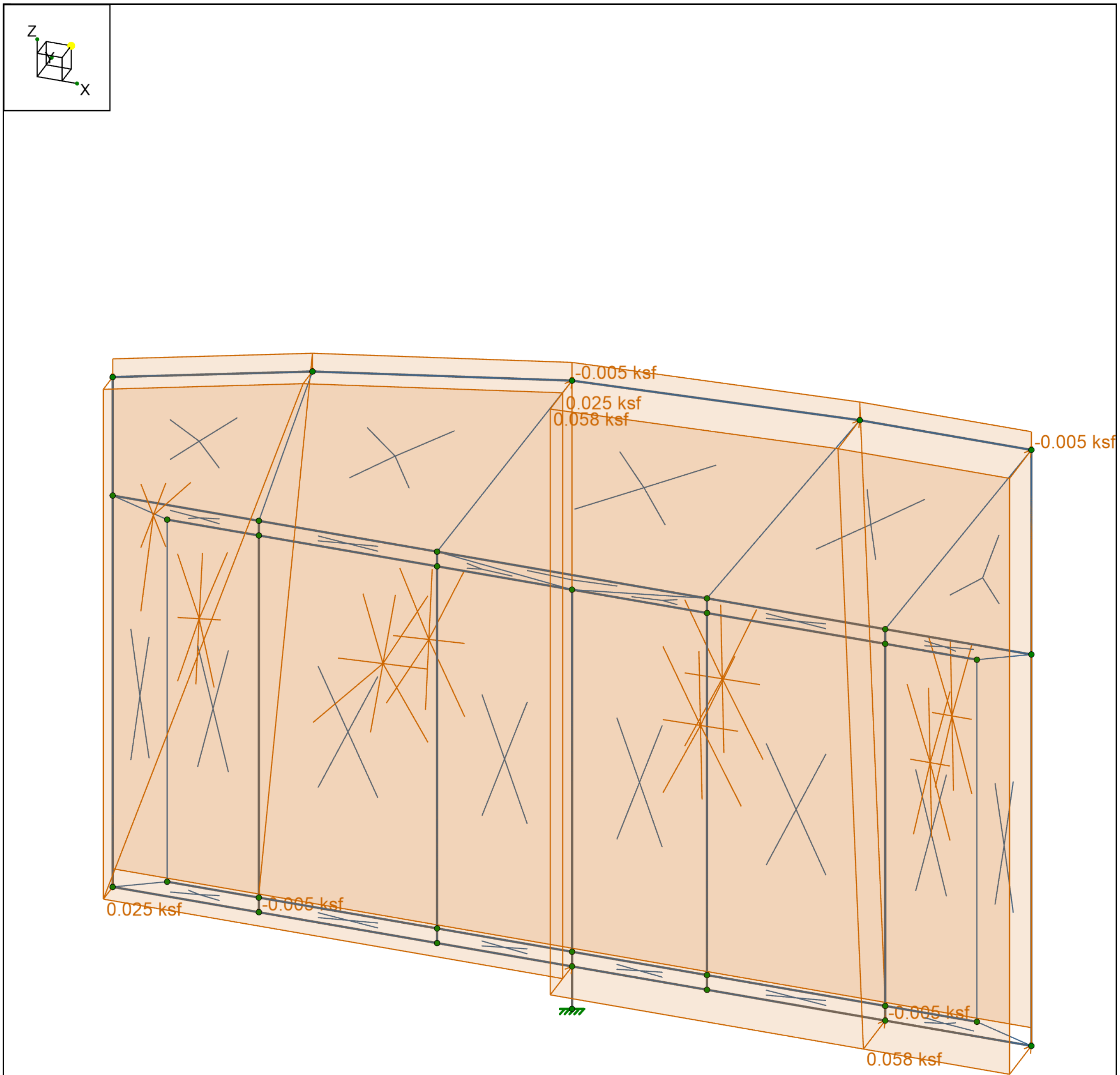

Loads: LC 2, case b

Murdoch Engineering		SK-3
Brian O		May 11, 2023
		wireframe to model.r3d

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Member Primary Data

	Label	I Node	J Node	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N2	N1	270	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
2	M2	N1	N17	180	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
3	M3	N18	N3	90	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
4	M4	N2	N20		AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
5	M5	N3	N4	90	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
6	M6	N4	N5	90	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
7	M7	N5	N19	90	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
8	M9	N8	N7		HSS4X4X6	Beam	Tube	A500 Gr.B Rect	Typical
9	M10	N8	N9		HSS4X4X6	Beam	Tube	A500 Gr.B Rect	Typical
10	M11	N11	N10		HSS4X4X6	Beam	Tube	A500 Gr.B Rect	Typical
11	M12	N11	N12		HSS4X4X6	Beam	Tube	A500 Gr.B Rect	Typical
12	M13	N13	N14	90	2-2.5X1.3125X0.090-FF	Beam	AA Channel	6061-T6 W	Typical
13	M14	N15	N16	90	2-2.5X1.3125X0.090-FF	Beam	AA Channel	6061-T6 W	Typical
14	M15	N20	N17	90	AGI513/16CHANNEL	Beam	AA Channel	6061-T6 W	Typical
15	M16	N17	N18	180	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
16	M17	N19	N20	180	AGI513/16CHANNEL	Beam	AA Channel	6061-T6	Typical
17	M18	N21	N22	90	2-2.5X1.3125X0.090-FF	Beam	AA Channel	6061-T6 W	Typical
18	M19	N23	N24	90	2-2.5X1.3125X0.090-FF	Beam	AA Channel	6061-T6 W	Typical
19	M20	N8	N34		HSS4X4X6	Beam	Tube	A500 Gr.B Rect	Typical

Basic Load Cases

	BLC Description	Category	Z Gravity	Distributed	Area(Member)
1	self weight	DL	-1		
2	D	DL			4
3	W(a)	WL			4
4	W(b)	WL			4
5	BLC 2 Transient Area Loads	None		141	
6	BLC 3 Transient Area Loads	None		141	
7	BLC 4 Transient Area Loads	None		140	

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor
1	case a	Yes	Y	1	1	2	1	3	0.6
2	case b	Yes	Y	1	1	2	1	4	0.6

Member Area Loads (BLC 2 : D)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [ksf]
1	N18	N3	N13	N1	Z	Two Way	-0.005
2	N13	N6	N4	N3	Z	Two Way	-0.005
3	N4	N5	N15	N6	Z	Two Way	-0.005
4	N15	N2	N19	N5	Z	Two Way	-0.005

Member Area Loads (BLC 3 : W(a))

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [ksf]
1	N3	N13	N1	N18	Y	Two Way	0.069
2	N4	N6	N13	N3	Y	Two Way	0.069
3	N4	N5	N15	N6	Y	Two Way	0.069
4	N15	N2	N19	N5	Y	Two Way	0.069

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Member Area Loads (BLC 4 : W(b))

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [ksf]
1	N4	N6	N13	N3	Y	Two Way	0.096
2	N13	N3	N18	N1	Y	Two Way	0.096
3	N4	N5	N2	N6	Y	Two Way	0.041
4	N2	N5	N19		Y	Two Way	0.041

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

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Z	4e-6	4e-6	7.073	7.68
2	M1	Z	4e-6	-0.000121	7.68	8.286
3	M1	Z	-0.000121	-0.000355	8.286	8.892
4	M1	Z	-0.000355	-0.000502	8.892	9.499
5	M1	Z	-0.000502	-0.000576	9.499	10.105
6	M2	Z	-0.001	-0.003	0	0.92
7	M2	Z	-0.003	-0.005	0.92	1.84
8	M2	Z	-0.005	-0.004	1.84	2.76
9	M2	Z	-0.004	-0.003	2.76	3.68
10	M2	Z	-0.003	-0.001	3.68	4.6
11	M3	Z	4.8e-5	-0.002	0	0.472
12	M3	Z	-0.002	-0.005	0.472	0.944
13	M3	Z	-0.005	-0.005	0.944	1.416
14	M3	Z	-0.005	-0.006	1.416	1.888
15	M9	Z	0.000151	3.9e-5	2.672	3.028
16	M9	Z	3.9e-5	-0.0006	3.028	3.384
17	M9	Z	-0.0006	-0.002	3.384	3.741
18	M9	Z	-0.002	-0.004	3.741	4.097
19	M9	Z	-0.004	-0.007	4.097	4.453
20	M11	Z	0.000106	0.000106	2.672	3.028
21	M11	Z	0.000106	-0.000535	3.028	3.384
22	M11	Z	-0.000535	-0.002	3.384	3.741
23	M11	Z	-0.002	-0.004	3.741	4.097
24	M11	Z	-0.004	-0.006	4.097	4.453
25	M13	Z	-0.000513	-0.006	0	0.92
26	M13	Z	-0.006	-0.009	0.92	1.84
27	M13	Z	-0.009	-0.009	1.84	2.76
28	M13	Z	-0.009	-0.007	2.76	3.68
29	M13	Z	-0.007	-0.000513	3.68	4.6
30	M15	Z	-0.00019	-0.00019	7.073	7.68
31	M15	Z	-0.00019	-0.003	7.68	8.286
32	M15	Z	-0.003	-0.006	8.286	8.892
33	M15	Z	-0.006	-0.004	8.892	9.499
34	M15	Z	-0.004	-0.00026	9.499	10.105
35	M16	Z	-0.001	-0.003	0	0.481
36	M16	Z	-0.003	-0.004	0.481	0.962
37	M16	Z	-0.004	-0.004	0.962	1.443
38	M16	Z	-0.004	-0.003	1.443	1.923
39	M16	Z	-0.003	-0.002	1.923	2.404
40	M1	Z	-0.000462	-0.00043	4.042	5.052
41	M1	Z	-0.00043	-0.000461	5.052	6.063
42	M1	Z	-0.000447	-0.000469	6.063	7.073
43	M1	Z	-0.000469	-0.000316	7.073	8.084
44	M1	Z	-0.000316	-2.6e-5	8.084	9.094
45	M5	Z	-0.006	-0.006	0	0.633
46	M5	Z	-0.006	-0.006	0.633	1.267
47	M5	Z	-0.006	-0.007	1.267	1.9

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

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
48	M5	Z	-0.007	-0.006	1.9	2.534
49	M5	Z	-0.006	-0.004	2.534	3.167
50	M9	Z	-0.002	-0.002	0	0.802
51	M9	Z	-0.002	-0.003	0.802	1.603
52	M9	Z	-0.003	-0.003	1.603	2.405
53	M9	Z	-0.003	-0.002	2.405	3.206
54	M9	Z	-0.002	-2.2e-5	3.206	4.008
55	M11	Z	-0.002	-0.002	0	0.802
56	M11	Z	-0.002	-0.003	0.802	1.603
57	M11	Z	-0.003	-0.003	1.603	2.405
58	M11	Z	-0.003	-0.002	2.405	3.206
59	M11	Z	-0.002	-3.8e-5	3.206	4.008
60	M15	Z	-0.006	-0.006	4.042	5.052
61	M15	Z	-0.006	-0.006	5.052	6.063
62	M15	Z	-0.006	-0.006	6.063	7.073
63	M15	Z	-0.006	-0.004	7.073	8.084
64	M15	Z	-0.004	-0.000152	8.084	9.094
65	M18	Z	-0.000554	-0.006	0	0.92
66	M18	Z	-0.006	-0.009	0.92	1.84
67	M18	Z	-0.009	-0.009	1.84	2.76
68	M18	Z	-0.009	-0.007	2.76	3.68
69	M18	Z	-0.007	-0.000554	3.68	4.6
70	M20	Z	-0.002	-0.007	0	0.986
71	M20	Z	-0.007	-0.008	0.986	1.971
72	M20	Z	-0.008	-0.006	1.971	2.957
73	M20	Z	-0.006	-0.004	2.957	3.942
74	M20	Z	-0.004	-0.00029	3.942	4.928
75	M1	Z	-2.4e-5	-0.000315	1.01	2.021
76	M1	Z	-0.000315	-0.00047	2.021	3.031
77	M1	Z	-0.00047	-0.000447	3.031	4.042
78	M6	Z	-0.006	-0.005	0	0.577
79	M6	Z	-0.005	-0.005	0.577	1.154
80	M6	Z	-0.005	-0.005	1.154	1.732
81	M6	Z	-0.005	-0.004	1.732	2.309
82	M6	Z	-0.004	-0.005	2.309	2.886
83	M7	Z	-0.000643	-0.000643	0	0.591
84	M10	Z	-0.003	-0.002	0	0.713
85	M10	Z	-0.002	-0.002	0.713	1.425
86	M10	Z	-0.002	-0.003	1.425	2.138
87	M10	Z	-0.003	-0.003	2.138	2.85
88	M10	Z	-0.003	-6.8e-5	2.85	3.563
89	M12	Z	-0.002	-0.002	0	0.802
90	M12	Z	-0.002	-0.003	0.802	1.603
91	M12	Z	-0.003	-0.003	1.603	2.405
92	M12	Z	-0.003	-0.002	2.405	3.206
93	M12	Z	-0.002	-3.8e-5	3.206	4.008
94	M14	Z	-0.001	-0.006	0	0.92
95	M14	Z	-0.006	-0.009	0.92	1.84
96	M14	Z	-0.009	-0.01	1.84	2.76
97	M14	Z	-0.01	-0.007	2.76	3.68
98	M14	Z	-0.007	-0.001	3.68	4.6
99	M15	Z	0	-0.003	1.01	2.021
100	M15	Z	-0.003	-0.005	2.021	3.031
101	M15	Z	-0.005	-0.006	3.031	4.042
102	M19	Z	-0.000513	-0.006	0	0.92

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

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
103	M19	Z	-0.006	-0.009	0.92	1.84
104	M19	Z	-0.009	-0.008	1.84	2.76
105	M19	Z	-0.008	-0.007	2.76	3.68
106	M19	Z	-0.007	-0.002	3.68	4.6
107	M1	Z	-0.001	-0.000689	0	0.606
108	M1	Z	-0.000689	-0.000337	0.606	1.213
109	M1	Z	-0.000337	-0.000108	1.213	1.819
110	M1	Z	-0.000108	2.6e-5	1.819	2.425
111	M1	Z	2.6e-5	2.6e-5	2.425	3.031
112	M4	Z	-0.001	-0.003	0	0.92
113	M4	Z	-0.003	-0.005	0.92	1.84
114	M4	Z	-0.005	-0.005	1.84	2.76
115	M4	Z	-0.005	-0.003	2.76	3.68
116	M4	Z	-0.003	-0.000937	3.68	4.6
117	M7	Z	-0.003	-0.003	0	0.449
118	M7	Z	-0.003	-0.005	0.449	0.899
119	M7	Z	-0.005	-0.004	0.899	1.348
120	M7	Z	-0.004	-0.002	1.348	1.798
121	M7	Z	-0.002	-0.000401	1.798	2.247
122	M10	Z	0.000163	6e-6	2.227	2.672
123	M10	Z	6e-6	-0.000489	2.672	3.117
124	M10	Z	-0.000489	-0.001	3.117	3.563
125	M10	Z	-0.001	-0.003	3.563	4.008
126	M10	Z	-0.003	-0.007	4.008	4.453
127	M12	Z	0.000187	0.000187	2.672	3.028
128	M12	Z	0.000187	-0.000217	3.028	3.384
129	M12	Z	-0.000217	-0.002	3.384	3.741
130	M12	Z	-0.002	-0.004	3.741	4.097
131	M12	Z	-0.004	-0.008	4.097	4.453
132	M15	Z	-0.001	-0.003	0	0.606
133	M15	Z	-0.003	-0.005	0.606	1.213
134	M15	Z	-0.005	-0.003	1.213	1.819
135	M15	Z	-0.003	-0.001	1.819	2.425
136	M15	Z	-0.001	-0.000113	2.425	3.031
137	M17	Z	-0.002	-0.002	0	0.278
138	M17	Z	-0.002	-0.003	0.278	0.557
139	M17	Z	-0.003	-0.003	0.557	0.835
140	M17	Z	-0.003	-0.002	0.835	1.114
141	M17	Z	-0.002	-0.000456	1.114	1.392

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

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M17	Y	0.033	0.027	0	0.278
2	M17	Y	0.027	0.039	0.278	0.557
3	M17	Y	0.039	0.044	0.557	0.835
4	M17	Y	0.044	0.024	0.835	1.114
5	M17	Y	0.024	0.006	1.114	1.392
6	M1	Y	-5.1e-5	-5.1e-5	7.073	7.68
7	M1	Y	-5.1e-5	0.002	7.68	8.286
8	M1	Y	0.002	0.005	8.286	8.892
9	M1	Y	0.005	0.007	8.892	9.499
10	M1	Y	0.007	0.008	9.499	10.105
11	M2	Y	0.017	0.047	0	0.92
12	M2	Y	0.047	0.064	0.92	1.84
13	M2	Y	0.064	0.061	1.84	2.76

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

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
14	M2	Y	0.061	0.042	2.76	3.68
15	M2	Y	0.042	0.014	3.68	4.6
16	M3	Y	-0.000657	0.032	0	0.472
17	M3	Y	0.032	0.067	0.472	0.944
18	M3	Y	0.067	0.074	0.944	1.416
19	M3	Y	0.074	0.084	1.416	1.888
20	M9	Y	-0.002	-0.000534	2.672	3.028
21	M9	Y	-0.000534	0.008	3.028	3.384
22	M9	Y	0.008	0.025	3.384	3.741
23	M9	Y	0.025	0.056	3.741	4.097
24	M9	Y	0.056	0.097	4.097	4.453
25	M11	Y	-0.001	-0.001	2.672	3.028
26	M11	Y	-0.001	0.007	3.028	3.384
27	M11	Y	0.007	0.027	3.384	3.741
28	M11	Y	0.027	0.051	3.741	4.097
29	M11	Y	0.051	0.081	4.097	4.453
30	M13	Y	0.007	0.088	0	0.92
31	M13	Y	0.088	0.128	0.92	1.84
32	M13	Y	0.128	0.128	1.84	2.76
33	M13	Y	0.128	0.09	2.76	3.68
34	M13	Y	0.09	0.007	3.68	4.6
35	M15	Y	0.003	0.003	7.073	7.68
36	M15	Y	0.003	0.042	7.68	8.286
37	M15	Y	0.042	0.081	8.286	8.892
38	M15	Y	0.081	0.056	8.892	9.499
39	M15	Y	0.056	0.004	9.499	10.105
40	M16	Y	0.018	0.036	0	0.481
41	M16	Y	0.036	0.06	0.481	0.962
42	M16	Y	0.06	0.058	0.962	1.443
43	M16	Y	0.058	0.038	1.443	1.923
44	M16	Y	0.038	0.033	1.923	2.404
45	M1	Y	0.006	0.006	4.042	5.052
46	M1	Y	0.006	0.006	5.052	6.063
47	M1	Y	0.006	0.006	6.063	7.073
48	M1	Y	0.006	0.004	7.073	8.084
49	M1	Y	0.004	0.000357	8.084	9.094
50	M5	Y	0.069	0.072	0	0.633
51	M5	Y	0.072	0.099	0.633	1.267
52	M5	Y	0.099	0.103	1.267	1.9
53	M5	Y	0.103	0.075	1.9	2.534
54	M5	Y	0.075	0.065	2.534	3.167
55	M9	Y	0.028	0.03	0	0.802
56	M9	Y	0.03	0.037	0.802	1.603
57	M9	Y	0.037	0.048	1.603	2.405
58	M9	Y	0.048	0.028	2.405	3.206
59	M9	Y	0.028	0.000344	3.206	4.008
60	M11	Y	0.029	0.03	0	0.802
61	M11	Y	0.03	0.039	0.802	1.603
62	M11	Y	0.039	0.045	1.603	2.405
63	M11	Y	0.045	0.024	2.405	3.206
64	M11	Y	0.024	0.000482	3.206	4.008
65	M15	Y	0.08	0.084	4.042	5.052
66	M15	Y	0.084	0.084	5.052	6.063
67	M15	Y	0.084	0.086	6.063	7.073
68	M15	Y	0.086	0.056	7.073	8.084

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

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
69	M15	Y	0.056	0.002	8.084	9.094
70	M18	Y	0.008	0.088	0	0.92
71	M18	Y	0.088	0.122	0.92	1.84
72	M18	Y	0.122	0.123	1.84	2.76
73	M18	Y	0.123	0.089	2.76	3.68
74	M18	Y	0.089	0.008	3.68	4.6
75	M20	Y	0.038	0.094	0	0.986
76	M20	Y	0.094	0.103	0.986	1.971
77	M20	Y	0.103	0.092	1.971	2.957
78	M20	Y	0.092	0.054	2.957	3.942
79	M20	Y	0.054	0.003	3.942	4.928
80	M1	Y	0.000337	0.004	1.01	2.021
81	M1	Y	0.004	0.006	2.021	3.031
82	M1	Y	0.006	0.006	3.031	4.042
83	M6	Y	0.083	0.071	0	0.577
84	M6	Y	0.071	0.073	0.577	1.154
85	M6	Y	0.073	0.07	1.154	1.732
86	M6	Y	0.07	0.062	1.732	2.309
87	M6	Y	0.062	0.066	2.309	2.886
88	M7	Y	0.009	0.009	0	0.591
89	M10	Y	0.035	0.033	0	0.713
90	M10	Y	0.033	0.032	0.713	1.425
91	M10	Y	0.032	0.046	1.425	2.138
92	M10	Y	0.046	0.035	2.138	2.85
93	M10	Y	0.035	0.000929	2.85	3.563
94	M12	Y	0.028	0.03	0	0.802
95	M12	Y	0.03	0.036	0.802	1.603
96	M12	Y	0.036	0.042	1.603	2.405
97	M12	Y	0.042	0.024	2.405	3.206
98	M12	Y	0.024	0.000524	3.206	4.008
99	M14	Y	0.017	0.087	0	0.92
100	M14	Y	0.087	0.122	0.92	1.84
101	M14	Y	0.122	0.132	1.84	2.76
102	M14	Y	0.132	0.093	2.76	3.68
103	M14	Y	0.093	0.014	3.68	4.6
104	M15	Y	0	0.035	1.01	2.021
105	M15	Y	0.035	0.073	2.021	3.031
106	M15	Y	0.073	0.078	3.031	4.042
107	M19	Y	0.007	0.088	0	0.92
108	M19	Y	0.088	0.119	0.92	1.84
109	M19	Y	0.119	0.115	1.84	2.76
110	M19	Y	0.115	0.09	2.76	3.68
111	M19	Y	0.09	0.029	3.68	4.6
112	M1	Y	0.017	0.009	0	0.606
113	M1	Y	0.009	0.005	0.606	1.213
114	M1	Y	0.005	0.001	1.213	1.819
115	M1	Y	0.001	-0.000355	1.819	2.425
116	M1	Y	-0.000355	-0.000355	2.425	3.031
117	M4	Y	0.019	0.041	0	0.92
118	M4	Y	0.041	0.065	0.92	1.84
119	M4	Y	0.065	0.066	1.84	2.76
120	M4	Y	0.066	0.04	2.76	3.68
121	M4	Y	0.04	0.013	3.68	4.6
122	M7	Y	0.042	0.043	0	0.449
123	M7	Y	0.043	0.064	0.449	0.899

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

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
124	M7	Y	0.064	0.059	0.899	1.348
125	M7	Y	0.059	0.024	1.348	1.798
126	M7	Y	0.024	0.006	1.798	2.247
127	M10	Y	-0.002	-8.7e-5	2.227	2.672
128	M10	Y	-8.7e-5	0.007	2.672	3.117
129	M10	Y	0.007	0.018	3.117	3.563
130	M10	Y	0.018	0.048	3.563	4.008
131	M10	Y	0.048	0.092	4.008	4.453
132	M12	Y	-0.003	-0.003	2.672	3.028
133	M12	Y	-0.003	0.003	3.028	3.384
134	M12	Y	0.003	0.021	3.384	3.741
135	M12	Y	0.021	0.059	3.741	4.097
136	M12	Y	0.059	0.11	4.097	4.453
137	M15	Y	0.017	0.048	0	0.606
138	M15	Y	0.048	0.063	0.606	1.213
139	M15	Y	0.063	0.046	1.213	1.819
140	M15	Y	0.046	0.016	1.819	2.425
141	M15	Y	0.016	0.002	2.425	3.031

Member Distributed Loads (BLC 7 : BLC 4 Transient Area Loads)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	0.000279	0.004	4.042	5.052
2	M1	Y	0.004	0.009	5.052	6.063
3	M1	Y	0.009	0.009	6.063	7.073
4	M1	Y	0.009	0.006	7.073	8.084
5	M1	Y	0.006	0.0005	8.084	9.094
6	M5	Y	0.096	0.1	0	0.633
7	M5	Y	0.1	0.139	0.633	1.267
8	M5	Y	0.139	0.144	1.267	1.9
9	M5	Y	0.144	0.105	1.9	2.534
10	M5	Y	0.105	0.091	2.534	3.167
11	M9	Y	0.04	0.042	0	0.802
12	M9	Y	0.042	0.052	0.802	1.603
13	M9	Y	0.052	0.068	1.603	2.405
14	M9	Y	0.068	0.039	2.405	3.206
15	M9	Y	0.039	0.000481	3.206	4.008
16	M11	Y	0.041	0.043	0	0.802
17	M11	Y	0.043	0.054	0.802	1.603
18	M11	Y	0.054	0.064	1.603	2.405
19	M11	Y	0.064	0.034	2.405	3.206
20	M11	Y	0.034	0.000674	3.206	4.008
21	M13	Y	0.01	0.124	0	0.92
22	M13	Y	0.124	0.179	0.92	1.84
23	M13	Y	0.179	0.174	1.84	2.76
24	M13	Y	0.174	0.124	2.76	3.68
25	M13	Y	0.124	0.029	3.68	4.6
26	M15	Y	0.054	0.089	4.042	5.052
27	M15	Y	0.089	0.118	5.052	6.063
28	M15	Y	0.117	0.121	6.063	7.073
29	M15	Y	0.121	0.079	7.073	8.084
30	M15	Y	0.079	0.003	8.084	9.094
31	M18	Y	0.011	0.123	0	0.92
32	M18	Y	0.123	0.171	0.92	1.84
33	M18	Y	0.171	0.172	1.84	2.76
34	M18	Y	0.172	0.124	2.76	3.68

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Member Distributed Loads (BLC 7 : BLC 4 Transient Area Loads) (Continued)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
35	M18	Y	0.124	0.011	3.68	4.6
36	M20	Y	0.041	0.092	0	0.986
37	M20	Y	0.092	0.102	0.986	1.971
38	M20	Y	0.102	0.093	1.971	2.957
39	M20	Y	0.093	0.055	2.957	3.942
40	M20	Y	0.055	0.003	3.942	4.928
41	M1	Y	-7.1e-5	-7.1e-5	7.073	7.68
42	M1	Y	-7.1e-5	0.002	7.68	8.286
43	M1	Y	0.002	0.007	8.286	8.892
44	M1	Y	0.007	0.01	8.892	9.499
45	M1	Y	0.01	0.011	9.499	10.105
46	M2	Y	0.024	0.066	0	0.92
47	M2	Y	0.066	0.09	0.92	1.84
48	M2	Y	0.09	0.086	1.84	2.76
49	M2	Y	0.086	0.059	2.76	3.68
50	M2	Y	0.059	0.019	3.68	4.6
51	M3	Y	-0.000914	0.046	0	0.472
52	M3	Y	0.046	0.094	0.472	0.944
53	M3	Y	0.094	0.103	0.944	1.416
54	M3	Y	0.103	0.118	1.416	1.888
55	M9	Y	-0.003	-0.000717	2.672	3.028
56	M9	Y	-0.000717	0.012	3.028	3.384
57	M9	Y	0.012	0.035	3.384	3.741
58	M9	Y	0.035	0.078	3.741	4.097
59	M9	Y	0.078	0.135	4.097	4.453
60	M11	Y	-0.002	-0.002	2.672	3.028
61	M11	Y	-0.002	0.007	3.028	3.384
62	M11	Y	0.007	0.035	3.384	3.741
63	M11	Y	0.035	0.073	3.741	4.097
64	M11	Y	0.073	0.114	4.097	4.453
65	M15	Y	0.004	0.004	7.073	7.68
66	M15	Y	0.004	0.058	7.68	8.286
67	M15	Y	0.058	0.113	8.286	8.892
68	M15	Y	0.113	0.078	8.892	9.499
69	M15	Y	0.078	0.005	9.499	10.105
70	M16	Y	0.026	0.05	0	0.481
71	M16	Y	0.05	0.084	0.481	0.962
72	M16	Y	0.084	0.081	0.962	1.443
73	M16	Y	0.081	0.053	1.443	1.923
74	M16	Y	0.053	0.046	1.923	2.404
75	M1	Y	0.006	0.004	0	1.213
76	M1	Y	0.004	0.004	1.213	2.425
77	M1	Y	0.004	0.004	2.425	3.638
78	M1	Y	0.004	0.002	3.638	4.85
79	M1	Y	0.002	-3.8e-5	4.85	6.063
80	M4	Y	0.002	0.008	0	0.46
81	M4	Y	0.008	0.016	0.46	0.92
82	M4	Y	0.016	0.018	0.92	1.38
83	M4	Y	0.018	0.008	1.38	1.84
84	M4	Y	0.008	0.000316	1.84	2.3
85	M6	Y	0.034	0.043	0	0.577
86	M6	Y	0.043	0.038	0.577	1.154
87	M6	Y	0.038	0.038	1.154	1.732
88	M6	Y	0.038	0.044	1.732	2.309
89	M6	Y	0.044	0.034	2.309	2.886

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Member Distributed Loads (BLC 7 : BLC 4 Transient Area Loads) (Continued)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
90	M7	Y	0.032	0.035	0	0.449
91	M7	Y	0.035	0.031	0.449	0.899
92	M10	Y	0.024	0.017	0	0.891
93	M10	Y	0.017	0.023	0.891	1.781
94	M10	Y	0.023	0.026	1.781	2.672
95	M10	Y	0.026	0.009	2.672	3.563
96	M10	Y	0.009	-0.00037	3.563	4.453
97	M12	Y	0.028	0.016	0	0.891
98	M12	Y	0.016	0.019	0.891	1.781
99	M12	Y	0.019	0.022	1.781	2.672
100	M12	Y	0.022	0.023	2.672	3.563
101	M12	Y	0.023	0.037	3.563	4.453
102	M14	Y	0.011	0.049	0	0.92
103	M14	Y	0.049	0.074	0.92	1.84
104	M14	Y	0.074	0.074	1.84	2.76
105	M14	Y	0.074	0.045	2.76	3.68
106	M14	Y	0.045	0.004	3.68	4.6
107	M15	Y	0.001	0.03	1.01	2.021
108	M15	Y	0.03	0.046	2.021	3.031
109	M15	Y	0.046	0.051	3.031	4.042
110	M19	Y	0.006	0.052	0	0.92
111	M19	Y	0.052	0.077	0.92	1.84
112	M19	Y	0.077	0.074	1.84	2.76
113	M19	Y	0.074	0.049	2.76	3.68
114	M19	Y	0.049	0.009	3.68	4.6
115	M4	Y	0.001	0.014	0	0.92
116	M4	Y	0.014	0.026	0.92	1.84
117	M4	Y	0.026	0.034	1.84	2.76
118	M4	Y	0.034	0.027	2.76	3.68
119	M4	Y	0.027	0.01	3.68	4.6
120	M7	Y	0.033	0.035	0.899	1.348
121	M7	Y	0.035	0.026	1.348	1.798
122	M7	Y	0.026	0.002	1.798	2.247
123	M10	Y	-0.002	-0.002	2.672	3.028
124	M10	Y	-0.002	0.002	3.028	3.384
125	M10	Y	0.002	0.013	3.384	3.741
126	M10	Y	0.013	0.035	3.741	4.097
127	M10	Y	0.035	0.066	4.097	4.453
128	M14	Y	0.003	0.009	2.3	3.067
129	M14	Y	0.009	0.008	3.067	3.834
130	M14	Y	0.008	0.000979	3.834	4.6
131	M15	Y	0.007	0.028	0	0.606
132	M15	Y	0.028	0.033	0.606	1.213
133	M15	Y	0.033	0.014	1.213	1.819
134	M15	Y	0.014	0.001	1.819	2.425
135	M15	Y	0.001	0.001	2.425	3.031
136	M17	Y	0.019	0.016	0	0.278
137	M17	Y	0.016	0.023	0.278	0.557
138	M17	Y	0.023	0.025	0.557	0.835
139	M17	Y	0.025	0.013	0.835	1.114
140	M17	Y	0.013	0.002	1.114	1.392

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Node Reactions

	LC	Node Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N34	0	-2.804	0.891	10.9	-0.058	-0.336
2	1	Totals:	0	-2.804	0.891			
3	1	COG (ft):	X: 21.573	Y: 10.897	Z: 3.31			
4	2	N34	0	-2.845	0.891	11.194	-0.058	-3.182
5	2	Totals:	0	-2.845	0.891			
6	2	COG (ft):	X: 21.573	Y: 10.897	Z: 3.31			

AISC 15TH (360-16): ASD Member Steel Code Checks

	LC	Member	Shape	UC Max	Loc[ft]	Shear UC	Loc[ft]	Dir	Pnc/om [k]	Pnt/om [k]	Mnyy/om [k-ft]	Mnzz/om [k-ft]	Cb	Eqn
1	1	M9	HSS4X4X6	0.138	0	0.056	0	z	120.435	131.665	14.668	14.668	2.51	H1-1b
2	1	M10	HSS4X4X6	0.135	0	0.029	3.479	z	120.435	131.665	14.668	14.668	2.44	H1-1b
3	1	M11	HSS4X4X6	0.087	0	0.073	0	z	120.435	131.665	14.668	14.668	3	H1-1b
4	1	M12	HSS4X4X6	0.078	0	0.072	0	z	120.435	131.665	14.668	14.668	2.776	H1-1b
5	1	M20	HSS4X4X6	0.751	4.928	0.109	4.928	y	118.047	131.665	14.668	14.668	2.018	H1-1b
6	2	M9	HSS4X4X6	0.149	0	0.09	0	z	120.435	131.665	14.668	14.668	2.51	H1-1b
7	2	M10	HSS4X4X6	0.125	0	0.04	1.484	z	120.435	131.665	14.668	14.668	2.44	H1-1b
8	2	M11	HSS4X4X6	0.142	0	0.12	0	z	120.435	131.665	14.668	14.668	3	H1-1b
9	2	M12	HSS4X4X6	0.023	0	0.028	0	z	120.435	131.665	14.668	14.668	2.776	H1-1b
10	2	M20	HSS4X4X6	0.888	4.928	0.332	4.928	y	118.047	131.665	14.668	14.668	2.006	H3-6

AA ADM1-15: ASD - BUILDING Member Aluminum Code Checks

	LC	Member	Shape	UC Max	Loc[ft]	Shear UC	Loc[ft]	Dir	Pnc/Om[k]	Pnt/Om[k]	Mny/Om[k-ft]	Mnz/Om[k-ft]	Vny/Om[k]	Vnz/Om[k]	Cb	Eqn
1	1	M13	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
2	1	M14	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
3	1	M18	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
4	1	M19	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
5	1	M15	AGI513/16CHANNEL	0.758	3.579	0.058	10.105	y	0.651	9.73	0.158	0.485	3.963	2.045	1.611	H.1-1
6	1	M1	AGI513/16CHANNEL	0.359	6.526	0.013	10.105	y	0.651	20.856	0.349	0.475	8.53	4.615	1.582	H.1-1
7	1	M6	AGI513/16CHANNEL	0.271	1.353	0.025	2.886	y	7.979	20.856	0.413	2.013	8.53	4.615	1.012	H.1-1
8	1	M5	AGI513/16CHANNEL	0.228	1.749	0.028	0	y	6.625	20.856	0.413	1.827	8.53	4.615	1.028	H.1-1
9	1	M16	AGI513/16CHANNEL	0.163	2.404	0.017	2.404	y	11.497	20.856	0.324	2.278	8.53	4.615	1.043	H.1-1
10	1	M4	AGI513/16CHANNEL	0.139	4.6	0.011	4.6	y	3.14	20.856	0.324	1.607	8.53	4.615	1.715	H.1-1
11	1	M7	AGI513/16CHANNEL	0.117	0	0.048	2.247	y	12.889	20.856	0.324	2.388	8.53	4.615	1.119	H.1-1
12	1	M17	AGI513/16CHANNEL	0.097	1.392	0.046	1.392	y	15.53	20.856	0.349	2.388	8.53	4.615	1.348	H.1-1
13	1	M2	AGI513/16CHANNEL	0.075	4.6	0.01	4.6	y	3.14	20.856	0.324	2.026	8.53	4.615	2.307	H.1-1
14	1	M3	AGI513/16CHANNEL	0.066	0	0.043	0	y	14.479	20.856	0.324	2.388	8.53	4.615	1.324	H.1-1
15	2	M13	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
16	2	M14	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
17	2	M18	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
18	2	M19	2-2.5X1.3125X0.090-FF	- Aluminum code check not calculated -												
19	2	M15	AGI513/16CHANNEL	0.772	3.579	0.061	10.105	y	0.651	9.73	0.158	0.482	3.963	2.045	1.601	H.1-1
20	2	M1	AGI513/16CHANNEL	0.768	5.052	0.021	5.052	y	0.651	20.856	0.349	0.512	8.53	4.615	1.705	H.1-1
21	2	M6	AGI513/16CHANNEL	0.253	0	0.024	2.886	y	7.979	20.856	0.324	2.012	8.53	4.615	1.011	H.1-1
22	2	M5	AGI513/16CHANNEL	0.247	1.683	0.029	0	y	6.625	20.856	0.413	1.835	8.53	4.615	1.032	H.1-1
23	2	M16	AGI513/16CHANNEL	0.193	0	0.017	0	y	11.497	20.856	0.413	2.284	8.53	4.615	1.053	H.1-1
24	2	M4	AGI513/16CHANNEL	0.127	4.6	0.006	4.6	y	3.14	20.856	0.324	1.383	8.53	4.615	1.477	H.1-1
25	2	M2	AGI513/16CHANNEL	0.106	4.6	0.015	4.6	y	3.14	20.856	0.324	2.04	8.53	4.615	2.348	H.1-1
26	2	M7	AGI513/16CHANNEL	0.101	0	0.046	2.247	y	12.889	20.856	0.324	2.388	8.53	4.615	1.14	H.1-1
27	2	M17	AGI513/16CHANNEL	0.08	1.392	0.044	1.392	y	15.53	20.856	0.349	2.388	8.53	4.615	1.338	H.1-1
28	2	M3	AGI513/16CHANNEL	0.069	0	0.044	0	y	14.479	20.856	0.324	2.388	8.53	4.615	1.395	H.1-1

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murdochengineering.com
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Plate Principal Stresses

	LC	Plate Label	Loc	Sigma1[ksi]	Sigma2[ksi]	Tau Max[ksi]	Angle[rad]	Von Mises[ksi]
1	1	P1	T	0.089	-0.28	0.184	0.507	0.333
2			B	0.308	-0.099	0.203	2.092	0.368
3	1	P2	T	-0.09	-0.514	0.212	-0.04	0.476
4			B	0.477	0.109	0.184	1.617	0.433
5	1	P3	T	-0.145	-0.537	0.196	0.014	0.481
6			B	0.5	0.165	0.167	1.554	0.441
7	1	P4	T	0.317	-0.053	0.185	1.97	0.346
8			B	0.038	-0.289	0.164	0.332	0.31
9	1	P5	T	0.09	-0.091	0.09	-0.783	0.156
10			B	0.1	-0.101	0.1	0.784	0.174
11	1	P6	T	0.27	0.002	0.134	1.59	0.269
12			B	0.002	-0.246	0.124	-0.02	0.247
13	1	P7	T	0.035	-0.009	0.022	2.231	0.04
14			B	0.035	-0.009	0.022	2.231	0.04
15	1	P8	T	0.039	0.017	0.011	1.68	0.034
16			B	0.039	0.017	0.011	1.68	0.034
17	1	P9	T	-0.062	-0.236	0.087	-0.012	0.212
18			B	-0.062	-0.236	0.087	-0.012	0.212
19	1	P10	T	0.033	0.016	0.009	1.515	0.029
20			B	0.033	0.016	0.009	1.515	0.029
21	1	P11	T	0.007	-0.203	0.105	0.102	0.206
22			B	0.232	0.003	0.115	1.477	0.231
23	1	P12	T	0.119	0.002	0.058	1.487	0.118
24			B	0.004	-0.099	0.052	0.095	0.101
25	1	P13	T	0.01	-0.009	0.009	2.325	0.016
26			B	0.01	-0.009	0.009	2.325	0.016
27	1	P14	T	0.015	-0.01	0.012	2.286	0.022
28			B	0.015	-0.01	0.012	2.286	0.022
29	1	P15	T	0.033	-0.035	0.034	2.346	0.059
30			B	0.033	-0.035	0.034	2.346	0.059
31	1	P16	T	0.081	-0.02	0.05	1.928	0.092
32			B	0.001	-0.13	0.066	-0.262	0.131
33	1	P17	T	0.021	-0.05	0.036	-0.681	0.064
34			B	0.021	-0.05	0.036	-0.681	0.064
35	1	P18	T	0.034	-0.029	0.032	0.828	0.055
36			B	0.034	-0.029	0.032	0.828	0.055
37	1	P19	T	0.015	-0.008	0.012	2.26	0.02
38			B	0.015	-0.008	0.012	2.26	0.02
39	1	P20	T	0.009	-0.008	0.009	2.284	0.015
40			B	0.009	-0.008	0.009	2.284	0.015
41	1	P21	T	0.295	-0.001	0.148	1.557	0.296
42			B	-0.001	-0.307	0.153	0.013	0.307
43	1	P22	T	0.007	0.001	0.003	1.639	0.006
44			B	0.007	0.001	0.003	1.639	0.006
45	1	P23	T	-0.016	-0.153	0.068	-0.17	0.145
46			B	0.081	-0.025	0.053	1.794	0.096
47	1	P24	T	-0.013	-0.169	0.078	0.33	0.163
48			B	0.092	-0.048	0.07	1.196	0.124
49	1	P25	T	0.009	-0.001	0.005	1.119	0.009
50			B	0.009	-0.001	0.005	1.119	0.009
51	1	P26	T	0.399	0.121	0.139	1.59	0.355
52			B	-0.123	-0.414	0.145	-0.018	0.368
53	2	P1	T	0.099	-0.28	0.19	0.531	0.341
54			B	0.309	-0.11	0.209	2.114	0.376
55	2	P2	T	-0.087	-0.508	0.21	-0.04	0.47

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Plate Principal Stresses (Continued)

	LC	Plate Label	Loc	Sigma1[ksi]	Sigma2[ksi]	Tau Max[ksi]	Angle[rad]	Von Mises[ksi]
56			B	0.471	0.107	0.182	1.617	0.428
57	2	P3	T	-0.146	-0.544	0.199	0.014	0.487
58			B	0.507	0.166	0.171	1.555	0.448
59	2	P4	T	0.341	0.034	0.154	2.055	0.326
60			B	-0.052	-0.31	0.129	0.416	0.288
61	2	P5	T	0.005	-0.005	0.005	0.751	0.009
62			B	0.005	-0.005	0.005	0.751	0.009
63	2	P6	T	0.313	0.002	0.155	1.587	0.312
64			B	0.002	-0.288	0.145	-0.017	0.289
65	2	P7	T	0.035	-0.009	0.022	2.231	0.04
66			B	0.035	-0.009	0.022	2.231	0.04
67	2	P8	T	0.039	0.017	0.011	1.68	0.034
68			B	0.039	0.017	0.011	1.68	0.034
69	2	P9	T	-0.062	-0.236	0.087	-0.012	0.212
70			B	-0.062	-0.236	0.087	-0.012	0.212
71	2	P10	T	0.033	0.016	0.009	1.515	0.029
72			B	0.033	0.016	0.009	1.515	0.029
73	2	P11	T	0.007	-0.228	0.117	0.092	0.231
74			B	0.257	0.003	0.127	1.486	0.255
75	2	P12	T	0.017	-0.004	0.01	0.956	0.019
76			B	0.017	-0.004	0.01	0.956	0.019
77	2	P13	T	0.01	-0.009	0.009	2.325	0.016
78			B	0.01	-0.009	0.009	2.325	0.016
79	2	P14	T	0.015	-0.01	0.012	2.286	0.022
80			B	0.015	-0.01	0.012	2.286	0.022
81	2	P15	T	0.033	-0.035	0.034	2.346	0.059
82			B	0.033	-0.035	0.034	2.346	0.059
83	2	P16	T	0.086	-0.019	0.052	1.91	0.097
84			B	0.001	-0.136	0.068	-0.252	0.136
85	2	P17	T	0.021	-0.05	0.036	-0.681	0.064
86			B	0.021	-0.05	0.036	-0.681	0.064
87	2	P18	T	0.034	-0.029	0.032	0.828	0.055
88			B	0.034	-0.029	0.032	0.828	0.055
89	2	P19	T	0.015	-0.008	0.012	2.26	0.02
90			B	0.015	-0.008	0.012	2.26	0.02
91	2	P20	T	0.009	-0.008	0.009	2.284	0.015
92			B	0.009	-0.008	0.009	2.284	0.015
93	2	P21	T	0.314	0.097	0.109	1.553	0.279
94			B	-0.099	-0.326	0.114	0.017	0.29
95	2	P22	T	0.007	0.001	0.003	1.639	0.006
96			B	0.007	0.001	0.003	1.639	0.006
97	2	P23	T	-0.016	-0.153	0.069	-0.17	0.146
98			B	0.081	-0.025	0.053	1.793	0.096
99	2	P24	T	-0.013	-0.174	0.08	0.319	0.168
100			B	0.097	-0.047	0.072	1.21	0.128
101	2	P25	T	0.009	-0.001	0.005	1.119	0.009
102			B	0.009	-0.001	0.005	1.119	0.009
103	2	P26	T	0.408	0.122	0.143	1.589	0.362
104			B	-0.124	-0.422	0.149	-0.018	0.376

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Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
Design:	Concrete - May 11, 2023	Date:	5/11/2023
Fastening point:			

Specifier's comments:

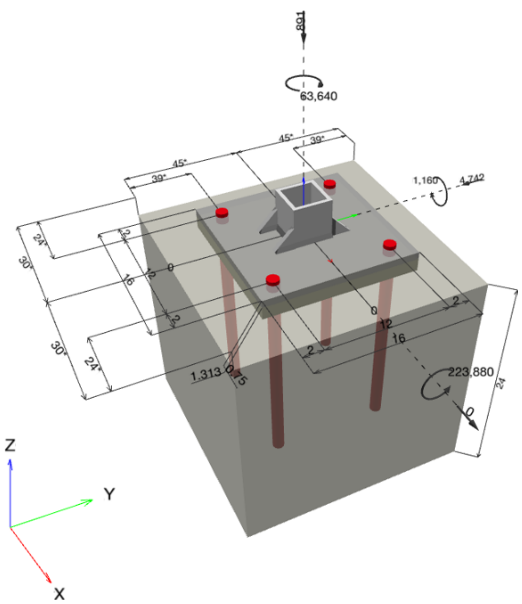
1 Anchor Design

1.1 Input data

Anchor type and diameter:	**Heavy Hex Head ASTM F 1554 GR. 105 1 1/4**
Item number:	not available
Effective embedment depth:	h_{ef} = 20.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-14 / CIP
Stand-off installation:	without clamping (anchor); restraint level (anchor plate): 2.00; e_b = 1.313 in.; t = 0.750 in.
	Hilti Grout: CB-G EG, epoxy, $f_{c,Grout}$ = 14,939 psi
Anchor plate[CBFEM] :	l_x x l_y x t = 16.000 in. x 16.000 in. x 0.750 in.;
Profile:	Square HSS (AISC), HSS4X4X.375; (L x W x T) = 4.000 in. x 4.000 in. x 0.375 in.
Base material:	cracked concrete, 3000, f_c' = 3,000 psi; h = 24.000 in.
Reinforcement:	tension: condition A, shear: condition A;
	edge reinforcement: > No. 4 bar with stirrups

[CBFEM] - The anchor calculation is based on a component-based Finite Element Method (CBFEM)

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



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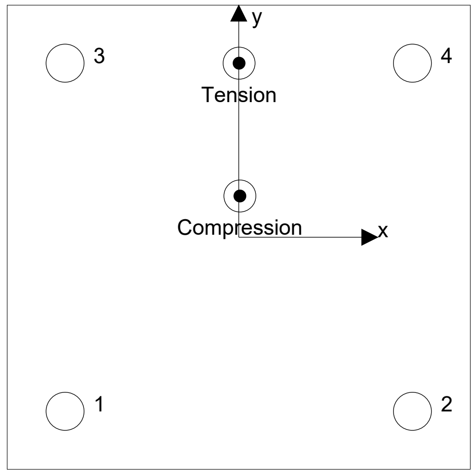
1.1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = -891$; $V_x = 0$; $V_y = -4{,}742$; $M_x = 223{,}880$; $M_y = 1{,}160$; $M_z = -63{,}640$;	no	46

1.2 Load case/Resulting anchor forces



Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	-0	1,403	-1,394	158
2	-0	2,811	-1,263	-2,511
3	17,214	1,526	1,522	117
4	17,280	2,751	1,135	-2,506

resulting tension force in (x/y)=(0.011/6.000): 34,493 [lb]
resulting compression force in (x/y)=(0.040/1.422): 37,150 [lb]

Anchor forces are calculated based on a component-based Finite Element Method (CBFEM)

1.3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	17,280	90,844	20	OK
Pullout Strength*	17,280	37,582	46	OK
Concrete Breakout Failure**	34,494	91,010	38	OK
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

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Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
Design:	Concrete - May 11, 2023	Date:	5/11/2023
Fastening point:			

1.3.1 Steel Strength

$N_{sa} = A_{se,N} f_{uta}$ ACI 318-14 Eq. (17.4.1.2)

$\phi N_{sa} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.97	125,001

Calculations

N_{sa} [lb]
121,125

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
121,125	0.750	90,844	17,280

1.3.2 Pullout Strength

$N_{pN} = \psi_{c,p} N_p$ ACI 318-14 Eq. (17.4.3.1)

$N_p = 8 A_{brg} f'_c$ ACI 318-14 Eq. (17.4.3.4)

$\phi N_{pN} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$\psi_{c,p}$	A_{brg} [in.^{2}]	λ_a	f'_c [psi]
1.000	2.24	1.000	3,000

Calculations

N_p [lb]
53,688

Results

N_{pn} [lb]	$\phi_{concrete}$	ϕN_{pn} [lb]	N_{ua} [lb]
53,688	0.700	37,582	17,280

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Address:	Murdoch Engineering LLC, 2 Hummingbird Ct	Specifier:	Jere Murdoch, PE
Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
Design:	Concrete - May 11, 2023	Date:	5/11/2023
Fastening point:			

1.3.3 Concrete Breakout Failure

$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b$ ACI 318-14 Eq. (17.4.2.1b)

$\phi\ N_{cbg} \geq N_{ua}$ ACI 318-14 Table 17.3.1.1

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-14 Eq. (17.4.2.1c)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e'_N}{3\ h_{ef}}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.4)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.5b)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.7b)

$N_b = 16\ \lambda_a\ \sqrt{f'_c}\ h_{ef}^{5/3}$ ACI 318-14 Eq. (17.4.2.2b)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
20.000	0.011	0.000	24.000	1.000

c_{ac} [in.]	k_c	λ_a	f'_c [psi]
-	16	1.000	3,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
3,600.00	3,600.00	1.000	1.000	0.940	1.000	129,141

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi\ N_{cbg}$ [lb]	N_{ua} [lb]
121,346	0.750	91,010	34,494

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Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
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Fastening point:			

1.4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	2,811	37,791	8	OK
Steel failure (with lever arm)*	2,751	8,809	32	OK
Pryout Strength*	2,811	50,985	6	OK
Concrete edge failure in direction y-**	5,677	33,915	17	OK

* highest loaded anchor **anchor group (relevant anchors)

1.4.1 Steel Strength

$V_{sa} = 0.6\ A_{se,V}\ f_{uta}$ ACI 318-14 Eq. (17.5.1.2b)
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.97	125,001

Calculations

V_{sa} [lb]
72,675

Results

V_{sa} [lb]	ϕ_{steel}	ϕ_{eb}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
72,675	0.650	0.800	37,791	2,811

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Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
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Fastening point:			

1.4.2 Steel failure (with lever arm)

V_s^M	$= \frac{\alpha_M \cdot M_s}{L_b}$	bending equation for stand-off
M_s	$= M_s^0 \left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$	resultant flexural resistance of anchor
M_s^0	$= (1.2)(S)(f_{u,min})$	characteristic flexural resistance of anchor
$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$		reduction for tensile force acting simultaneously with a shear force on the anchor
S	$= \frac{\pi (d)^3}{32}$	elastic section modulus of anchor bolt at concrete surface
L_b	$= z + (n)(d_0)$	internal lever arm adjusted for spalling of the surface concrete
ϕV_s^M	$\geq V_{ua}$	ACI 318-14 Table 17.3.1.1

Variables

α_M	$f_{u,min}$ [psi]	N_{ua} [lb]	ϕN_{sa} [lb]	z [in.]	n	d_0 [in.]
2.00	125,001	17,280	90,844	1.688	0.500	1.250

Calculations

M_s^0 [in.lb]	$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$	M_s [in.lb]	L_b [in.]
19,356	0.810	15,674	2.313

Results

V_s^M [lb]	ϕ_{steel}	ϕV_s^M [lb]	V_{ua} [lb]
13,553	0.650	8,809	2,751

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1.4.3 Pryout Strength

$V_{cp} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b\right]$ ACI 318-14 Eq. (17.5.3.1a)

$\phi\ V_{cp} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-14 Eq. (17.4.2.1c)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e_N'}{3\ h_{ef}}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.4)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.5b)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.7b)

$N_b = 16\ \lambda_a\ \sqrt{f_c'}\ h_{ef}^{5/3}$ ACI 318-14 Eq. (17.4.2.2b)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	20.000	0.000	0.000	24.000

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f_c' [psi]
1.000	∞	16	1.000	3,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
1,080.00	3,600.00	1.000	1.000	0.940	1.000	129,141

Results

V_{cp} [lb]	$\phi_{concrete}$	$\phi\ V_{cp}$ [lb]	V_{ua} [lb]
72,835	0.700	50,985	2,811

1.4.4 Concrete edge failure in direction y-

$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ec,V}\ \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ — ACI 318-14 Eq. (17.5.2.1b)

$\phi\ V_{cbg} \geq V_{ua}$ — ACI 318-14 Table 17.3.1.1

A_{Vc} see ACI 318-14, Section 17.5.2.1, Fig. R 17.5.2.1(b)

$A_{Vc0} = 4.5\ c_{a1}^2$ — ACI 318-14 Eq. (17.5.2.1c)

$\psi_{ec,V} = \left(\frac{1}{1 + \frac{2e_V'}{3c_{a1}}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.5.2.5)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.5.2.6b)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ — ACI 318-14 Eq. (17.5.2.8)

$V_b = 9\ \lambda_a\ \sqrt{f_c'}\ c_{a1}^{1.5}$ — ACI 318-14 Eq. (17.5.2.2b)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
16.000	24.000	5.302	1.400	24.000

l_e [in.]	λ_a	d_a [in.]	f_c' [psi]	$\psi_{parallel,V}$
10.000	1.000	1.250	3,000	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ec,V}$	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
1,440.00	1,152.00	0.819	1.000	1.000	31,549

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi\ V_{cbg}$ [lb]	V_{ua} [lb]
45,220	0.750	33,915	5,677

1.5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.460	0.312	5/3	42	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

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1.6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates as per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Engineering calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- Attention! In case of compressive anchor forces a buckling check as well as the proof of the local load transfer into and within the base material (incl. punching) has to be done separately.
- The anchor design methods in PROFIS Engineering require rigid anchor plates, as per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means that the anchor plate should be sufficiently rigid to prevent load re-distribution to the anchors due to elastic/plastic displacements. The user accepts that the anchor plate is considered close to rigid by engineering judgment."

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1.7 Installation data

Profile: Square HSS (AISC), HSS4X4X.375; (L x W x T) = 4.000 in. x 4.000 in. x 0.375 in.

Hole diameter in the fixture: d_f = 1.312 in.

Plate thickness (input): 0.750 in.

Anchor type and diameter: Heavy Hex Head ASTM F 1554 GR. 105 1 1/4

Item number: not available

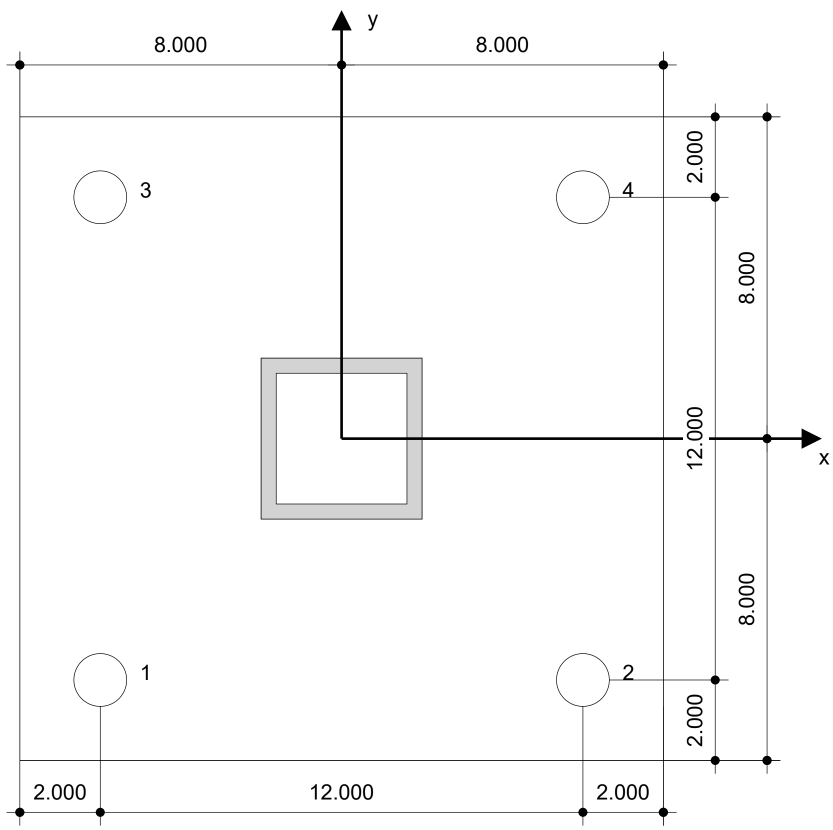
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 20.000 in.

Minimum thickness of the base material: 21.344 in.

Hilti Heavy Hex Head headed stud anchor with 20 in embedment, 1 1/4, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-6.000	-6.000	24.000	36.000	39.000	51.000
2	6.000	-6.000	36.000	24.000	39.000	51.000
3	-6.000	6.000	24.000	36.000	51.000	39.000
4	6.000	6.000	36.000	24.000	51.000	39.000

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2 Anchor plate design

2.1 Input data

Anchor plate:	Shape: Rectangular l_x x l_y x t = 16.000 in x 16.000 in x 0.750 in Calculation: CBFEM Material: ASTM A36; F_y = 36,000 psi; ε_{lim} = 5.00%
Anchor type and size:	Heavy Hex Head ASTM F 1554 GR. 105 1 1/4, h_{ef} = 20.000 in
Anchor stiffness:	The anchor is modeled considering stiffness values determined from load displacement curves tested in an independent laboratory. Please note that no simple replacement of the anchor is possible as the anchor stiffness has a major impact on the load distribution results.
Design method:	AISC and LRFD-based design using component-based FEM
Stand-off installation:	e_b = 1.313 in (Stand-off with grouting); t = 0.750 in
Profile:	HSS4X4X.375; (L x W x T x FT) = 4.000 in x 4.000 in x 0.375 in x - Material: ASTM A500 Gr.B Rect; F_y = 46,000 psi; ε_{lim} = 5.00% Eccentricity x: 0.000 in Eccentricity y: 0.000 in
Base material:	Cracked concrete; 3000; $f_{c,cyl}$ = 3,000 psi; h = 24.000 in
Welds (profile to anchor plate):	Type of redistribution: Plastic Material: E70xx
Stiffeners:	Geometry: Triangular; size = l_x x l_y x t = 2.000 in x 2.000 in x 0.500 in Material: ASTM A36; F_y = 36,000 psi; ε_{lim} = 5.00%
Welds (stiffeners to profile/anchor plate):	Type of redistribution: Plastic Material: E70xx
Mesh size:	Number of elements on edge: 8 Min. size of element: 0.394 in Max. size of element: 1.969 in

2.2 Summary

	Description	Profile		Stiffeners		Anchor plate			Welds [%]	Concrete [%]
		σ_{Ed} [psi]	ε_{Pl} [%]	σ_{Ed} [psi]	ε_{Pl} [%]	σ_{Ed} [psi]	ε_{Pl} [%]	Hole bearing [%]		
1	Combination 1	43,882	0.04	32,256	0.67	36,019	0.07	5	84	11

2.3 Anchor plate classification

Results below are displayed for the decisive load combinations: Combination 1

Anchor tension forces	Equivalent rigid anchor plate (CBFEM)	Component-based Finite Element Method (CBFEM) anchor plate design
Anchor 1	-1 lb	-0 lb
Anchor 2	-1 lb	-0 lb
Anchor 3	9,563 lb	17,214 lb
Anchor 4	9,471 lb	17,280 lb

User accepted to consider the selected anchor plate as rigid by his/her engineering judgement. This means the anchor design guidelines can be applied.

2.4 Profile/Stiffeners/Plate

Profile and stiffeners are verified at the level of the steel to concrete connection. The connection design does not replace the steel design for critical cross sections, which should be performed outside of PROFIS Engineering.

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Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
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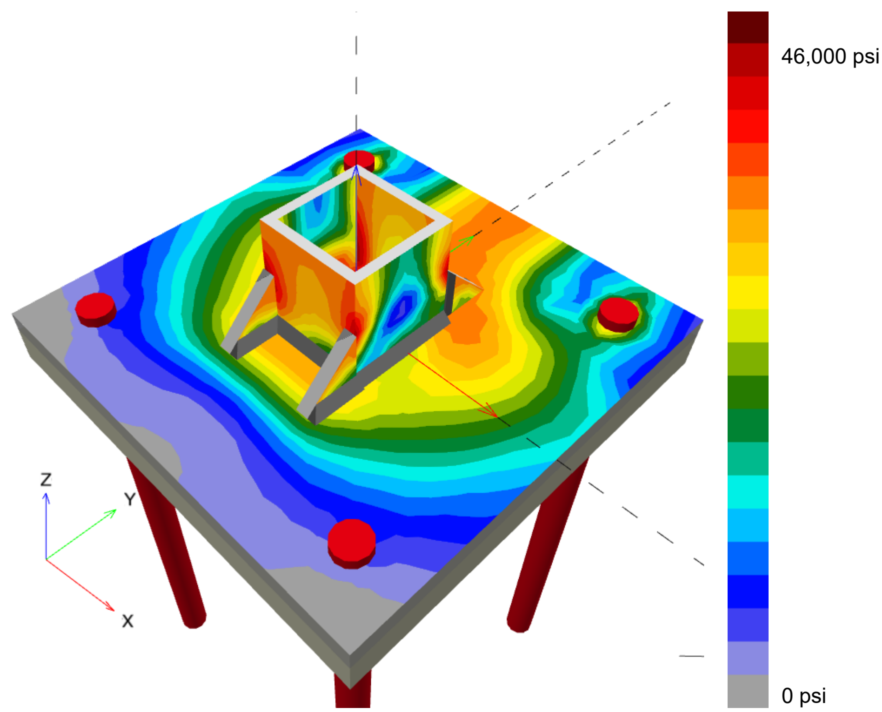
2.4.1 Equivalent stress and plastic strain

Part	Load combination	Material	f_y [psi]	ε_{lim} [%]	σ_{Ed} [psi]	ε_{Pl} [%]	Status
Plate	Combination 1	ASTM A36	36,000	5.00	36,019	0.07	OK
Profile	Combination 1	ASTM A500 Gr.B Rect	46,000	5.00	38,568	0.01	OK
Profile	Combination 1	ASTM A500 Gr.B Rect	46,000	5.00	43,882	0.04	OK
Profile	Combination 1	ASTM A500 Gr.B Rect	46,000	5.00	45,000	0.01	OK
Profile	Combination 1	ASTM A500 Gr.B Rect	46,000	5.00	46,011	0.04	OK
Stiffener	Combination 1	ASTM A36	36,000	5.00	32,256	0.67	OK

2.4.1.1 Equivalent stress

Results below are displayed for the decisive load combination: 1 - Combination 1



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murdochengineering.com
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Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
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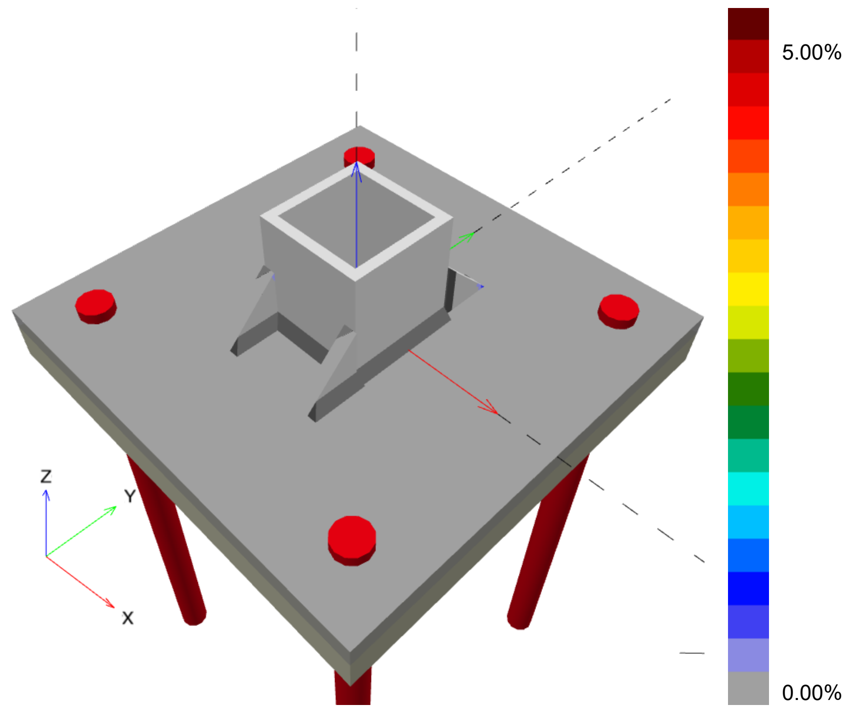
2.4.1.2 Plastic strain

Results below are displayed for the decisive load combination: 1 - Combination 1



2.4.2 Plate hole bearing resistance, AISC 360-16 Section J3

Decisive load combination: 1 - Combination 1

Equations

$R_n = \min(1.2\, l_c\, t\, F_u\, ,\, 2.4\, d\, t\, F_u)$ (AISC 360-16 J3-6a, c)

$\Phi R_n = 0.75\, R_n$

$V \leq \Phi R_n$

Variables

	l_c [in]	t [in]	F_u [psi]	d [in]	R_n [lb]
Anchor 1	13.433	0.750	58,000	1.250	130,500
Anchor 2	3.796	0.750	58,000	1.250	130,500
Anchor 3	1.350	0.750	58,000	1.250	70,454
Anchor 4	1.539	0.750	58,000	1.250	80,360

Results

	V [lb]	ΦR_n [lb]	Utilization [%]	Status
Anchor 1	1,403	97,875	2	OK
Anchor 2	2,811	97,875	3	OK
Anchor 3	1,526	52,840	3	OK

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Phone I Fax: 9735708215 |
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	V [lb]	ΦRn [lb]	Utilization [%]	Status
Anchor 4	2,751	60,270	5	OK

2.5 Welds

Profiles are modeled without taking the corner radius into account. Special rules for welding (e.g. for cold-formed profiles ...) are not taken into account by the software.

2.5.1 Anchor plate to profile

Decisive load combination: 1 - Combination 1

Equations

$F_{nw} = 0.6\, F_{EXX}\, (1.0 + 0.5 \sin^{1.5} \Theta)$

$\Phi R_n = \Phi\, F_{nw}\, A_w$

$\text{Utilization} = \dfrac{F_n}{\Phi\, R_n}$

Variables

Edge	Xu	Th [in]	Ls [in]	L [in]	Lc [in]	FEXX [psi]	Θ [°]	Aw [in²]
Member 1-tfl 1	E70xx	◢0.250	0.354	3.984	0.498	70,000	66.2	0.12
Member 1-bfl 1	E70xx	0.250◣	0.354	3.984	0.498	70,000	89.4	0.12
Member 1-w 1	E70xx	◢0.250	0.354	3.238	0.540	70,000	70.1	0.13
Member 1-w 2	E70xx	0.250◣	0.354	3.238	0.540	70,000	46.0	0.13

Results

Edge	Fn [lb]	ΦRn [lb]	Utilization [%]	Status
Member 1-tfl 1	4,325	5,638	77	OK
Member 1-bfl 1	4,441	5,883	76	OK
Member 1-w 1	4,644	6,188	76	OK
Member 1-w 2	4,172	5,545	76	OK

2.5.2 Stiffeners to profile/anchor plate

Decisive load combination: 1 - Combination 1

Equations

$F_{nw} = 0.6\, F_{EXX}\, (1.0 + 0.5 \sin^{1.5} \Theta)$

$\Phi R_n = \Phi\, F_{nw}\, A_w$

$\text{Utilization} = \dfrac{F_n}{\Phi\, R_n}$

Variables

Edge	Xu	Th [in]	Ls [in]	L [in]	Lc [in]	FEXX [psi]	Θ [°]	Aw [in²]
Stiffenera	E70xx	0.250◣	0.354	1.980	0.396	70,000	54.4	0.10
Stiffenerb	E70xx	0.250◣	0.354	1.980	0.396	70,000	56.4	0.10
Stiffenerc	E70xx	0.250◣	0.354	1.980	0.396	70,000	56.7	0.10
Stiffenerd	E70xx	0.250◣	0.354	1.980	0.396	70,000	57.7	0.10

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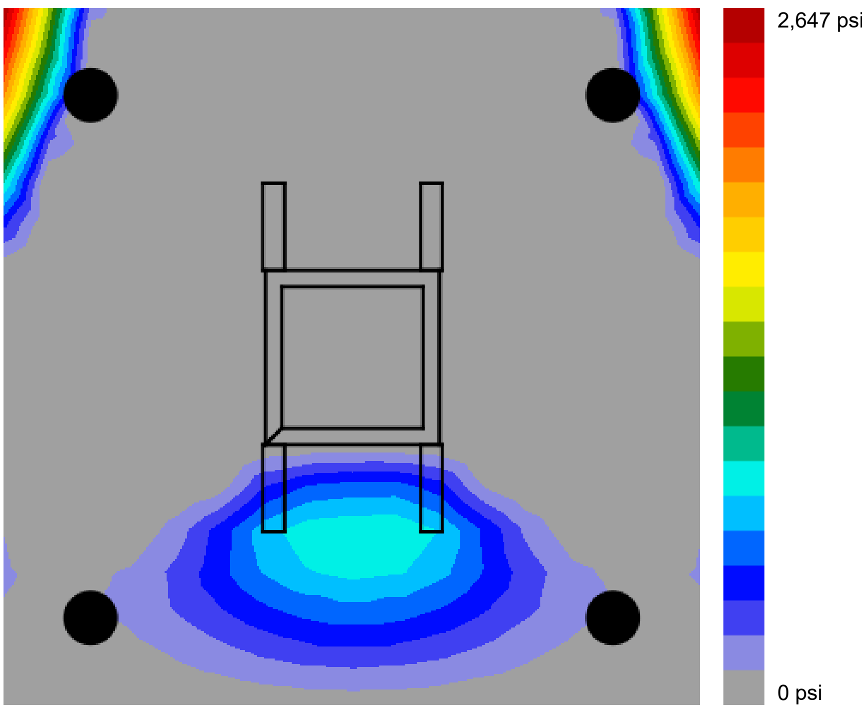
Results

Edge	F_n [lb]	ΦR_n [lb]	Utilization [%]	Status
Stiffenera	3,392	4,262	80	OK
Stiffenerb	3,500	4,305	82	OK
Stiffenerc	3,548	4,311	83	OK
Stiffenerd	3,625	4,331	84	OK

2.6 Concrete

Decisive load combination: 1 - Combination 1

2.6.1 Compression in concrete under the anchor plate



2.6.2 Concrete block compressive strength resistance check, AISC 360-16 Section J8

Equations

$$F_p = \Phi f_{p,max}$$

$$f_{p,max} = 0.85 f_c' \sqrt{\left(\frac{A_2}{A_1}\right)} \leq 1.7 f_c; \quad \sqrt{\left(\frac{A_2}{A_1}\right)} \leq 2$$

$$\sigma = \frac{N}{A_1}$$

$$\text{Utilization} = \frac{\sigma}{F_p}$$

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Phone I Fax: 9735708215 |
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Variables

N [lb]	f_c' [psi]	Φ	A_1 [in²]	A_2 [in²]
37,150	3,000	0.65	108.09	3,273.58

Results

Load combination	F_p [psi]	σ [psi]	Utilization [%]	Status
Combination 1	3,315	344	11	OK

2.7 Symbol explanation

A_1	Loaded area of concrete
A_2	Supporting area
A_w	Effective area of weld critical element
d	Nominal diameter of the bolt
ε_{lim}	Limit plastic strain
ε_{Pl}	Plastic strain from CBFEM results
f_c	Concrete compressive strength
f_c'	Concrete compressive strength
F_{EXX}	Electrode classification number, i.e. minimum specified tensile strength
F_u	Specified minimum tensile strength of the connected material
F_n	Force in weld critical element
F_{nw}	Nominal stress of the weld material
F_p	Concrete block design bearing strength
$f_{p,max}$	Concrete block design bearing strength maximum
f_y	Yield strength
l_c	Clear distance, in the direction of the force, between the edge of the hole and the edge of the adjacent hole or edge of the material
L	Length of weld
L_c	Length of weld critical element
L_s	Leg size of weld
N	Resulting compression force
σ	Average stress in concrete
σ_{Ed}	Equivalent stress
Φ	Resistance factor
ΦR_n	Factored resistance
R_n	Resistance
t	Thickness of the anchor plate
Θ	Angle of loading measured from the weld longitudinal axis
T_h	Throat thickness of weld
V	Resultant of shear forces Vy, Vz in bolt.
X_u	Filler metal tensile strength

2.8 Warnings

- By using the CBFEM calculation functionality of PROFIS Engineering you may act outside the applicable design codes and your specified anchor plate may not behave rigid. Please, validate the results with a professional designer and/or structural engineer to ensure suitability and adequacy for your specific jurisdiction and project requirements.
- The anchor is modeled considering stiffness values determined from load displacement curves tested in an independent laboratory. Please note that no simple replacement of the anchor is possible as the anchor stiffness has a major impact on the load distribution results.

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Phone I Fax:	9735708215 |	E-Mail:	jerem@murdochengineering.com
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3 Summary of results

Design of the anchor plate, anchors, welds and other elements are based on CBFEM (component based finite element method) and AISC.

	Load combination	Max. utilization	Status
Anchors	Combination 1	46%	OK
Anchor plate	Combination 1	100%	OK
Welds	Combination 1	84%	OK
Stiffeners	Combination 1	90%	OK
Concrete	Combination 1	11%	OK
Profile	Combination 1	96%	OK

Fastening meets the design criteria!

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4 Remarks; Your Cooperation Duties

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# Footings=	1		Moment/Per/Footing, M=	11194	lb-ft
Pass lat soil res, q=	150	psf	Composite Centroid, h=	3.93	ft
			Equiv Concentrated Load, P= M/h=	2,845	lb

Rectangular Pier

Width, W= 4.0 ft, parallel to sign face

Length, L= 1.5 ft, perpendicular to sign face

Depth, D= (A/2)(1+ SQR(1 + (4.36h)/A))= 5.3 ft — 5.5 ft design

1.17 **Yards Concrete**

S1= (2)(q)(D/3)= 536 psf

b= Sqrt(W^2 + L^2)= 4.3 ft

A= (2.34)(P) / (S1)(b)= 2.9

Calc Depth

Augur (Round Pier)

Diameter, b= 2.00 ft, round augured hole

Depth, D= (A/2)(1+ SQR(1 + (4.36h)/A))= 7.24 ft — 7.25 ft design

0.84 **Yard Concrete**

S1= (q)(2)(D/3)= 732 psf

A= (2.34 P) / (S1)(b)= 4.55

Calc Depth

Foundation Bearing Check

Allowable Soil Bearing Pressure= 1,500 psf

Square			*Round*		
Sign Wt=	891	lb	Sign Wt=	891	lb
Base Wt=	4,950	lb	Base Wt=	3,416	lb
Area=	6.0	sq ft	Area=	3.1	sq ft
q max=	974	psf, soil	**q max=**	1,371	psf,soil
OK, with depth increase			OK, with depth increase		

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General Footing

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DESCRIPTION: --None--

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00090	
Min. Overturning Safety Factor	=	1.0	: 1
Min. Sliding Safety Factor	=	1.0	: 1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	No	
Use Pedestal wt for stability, mom & shear	:	No	

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

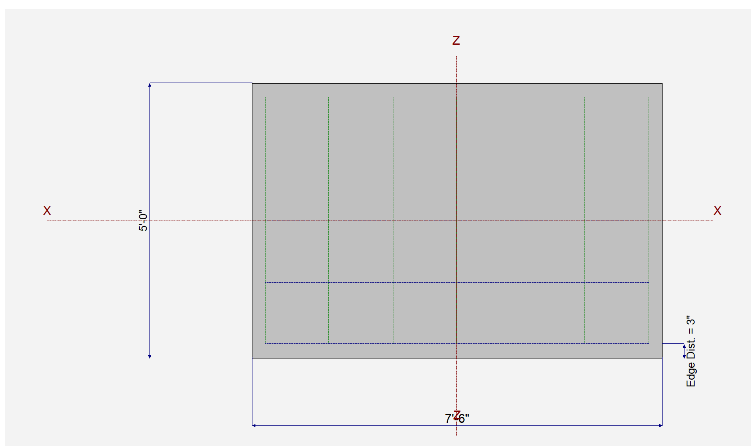
Footing base depth below soil surface	=	2.50	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

Width parallel to X-X Axis	=	7.50	ft
Length parallel to Z-Z Axis	=	5.0	ft
Footing Thickness	=	24	in



Pedestal dimensions...

px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0	in

Reinforcing

Bars parallel to X-X Axis

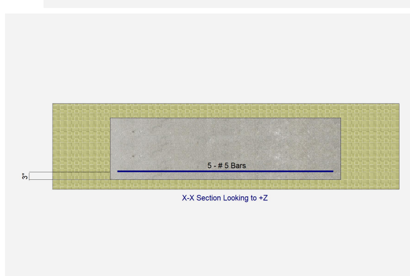
Number of Bars	=		5
Reinforcing Bar Size	=	#	5

Bars parallel to Z-Z Axis

Number of Bars	=		7
Reinforcing Bar Size	=	#	5

Bandwidth Distribution Check (ACI 15.4.4.2)
Direction Requiring Closer Separation

	Bars along Z-Z Axis
# Bars required within zone	80.0 %
# Bars required on each side of zone	20.0 %



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	0.8910							k
OB : Overburden	=								ksf
M-xx	=					0.0970			k-ft
M-zz	=					18.657			k-ft
V-x	=					4.742			k
V-z	=								k

973-570-8215
murdochengineering.com
New Projects
projects@murdochengineering.com

General Footing

DESCRIPTION: --None--

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4848	Soil Bearing	0.7272 ksf	1.50 ksf	+D+0.60W
PASS	356.405	Overturning - X-X	0.05820 k-ft	20.743 k-ft	+0.60D+0.60W
PASS	1.843	Overturning - Z-Z	16.885 k-ft	31.114 k-ft	+0.60D+0.60W
PASS	2.193	Sliding - X-X	2.845 k	6.239 k	+0.60D+0.60W
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.2199	Z Flexure (+X)	6.349 k-ft/ft	28.871 k-ft/ft	+1.20D+W
PASS	0.1308	Z Flexure (-X)	3.775 k-ft/ft	28.871 k-ft/ft	+1.40D
PASS	0.1105	X Flexure (+Z)	2.982 k-ft/ft	26.973 k-ft/ft	+1.20D+W
PASS	0.06221	X Flexure (-Z)	1.678 k-ft/ft	26.973 k-ft/ft	+1.40D
PASS	0.09266	1-way Shear (+X)	7.613 psi	82.158 psi	+1.20D+W
PASS	0.05251	1-way Shear (-X)	4.314 psi	82.158 psi	+1.40D
PASS	0.03458	1-way Shear (+Z)	2.841 psi	82.158 psi	+1.20D+W
PASS	0.03445	1-way Shear (-Z)	2.831 psi	82.158 psi	+1.20D+W
PASS	0.06118	2-way Punching	10.053 psi	164.317 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom Left	Top Left	Top Right	Bottom Right	Actual / Allow Ratio
, D Only								0.000
, 0.0 deg CCW	1.50	0.0	0.0	0.3688	0.3688	0.3688	0.3688	0.246
, +D+0.60W								0.000
, 0.2 deg CCW	1.50	14.652	0.05050	0.0140	0.01031	0.7235	0.7272	0.485
, +D+0.450W								0.000
, 0.2 deg CCW	1.50	10.989	0.03788	0.1027	0.09993	0.6348	0.6376	0.425
, +0.60D+0.60W								0.000
, 0.8 deg CCW	1.50	24.420	0.08417	0.0	0.0	0.6527	0.6612	0.441
, +0.60D								0.000
, 0.0 deg CCW	1.50	0.0	0.0	0.2213	0.2213	0.2213	0.2213	0.148

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	0.05820 k-ft	34.571 k-ft	594.01	OK
X-X, +D+0.450W	0.04365 k-ft	34.571 k-ft	792.01	OK
X-X, +0.60D+0.60W	0.05820 k-ft	20.743 k-ft	356.405	OK
X-X, +0.60D	None	0.0 k-ft	Infinity	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W	16.885 k-ft	51.857 k-ft	3.071	OK
Z-Z, +D+0.450W	12.663 k-ft	51.857 k-ft	4.095	OK
Z-Z, +0.60D+0.60W	16.885 k-ft	31.114 k-ft	1.843	OK
Z-Z, +0.60D	None	0.0 k-ft	Infinity	OK

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	7.899 k	No Sliding	OK
X-X, +D+0.60W	2.845 k	7.899 k	2.776	OK
X-X, +D+0.450W	2.134 k	7.899 k	3.701	OK
X-X, +0.60D+0.60W	2.845 k	6.239 k	2.193	OK
X-X, +0.60D	0.0 k	6.239 k	No Sliding	OK
Z-Z, D Only	0.0 k	9.774 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	9.774 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	9.774 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	8.114 k	No Sliding	OK
Z-Z, +0.60D	0.0 k	8.114 k	No Sliding	OK

General Footing

DESCRIPTION: --None--

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	1.678	+Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +1.40D	1.678	-Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +1.20D	1.438	+Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +1.20D	1.438	-Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +1.20D+0.50W	2.163	+Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +1.20D+0.50W	0.7916	-Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +1.20D+W	2.982	+Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +1.20D+W	0.1775	-Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +0.90D+W	2.897	+Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +0.90D+W	0.005253	-Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +0.90D	1.079	+Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
X-X, +0.90D	1.079	-Z	Bottom	0.2592	Min Temp %	0.2893	26.973	OK
Z-Z, +1.40D	3.775	-X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +1.40D	3.775	+X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +1.20D	3.236	-X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +1.20D	3.236	+X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +1.20D+0.50W	1.781	-X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +1.20D+0.50W	4.707	+X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +1.20D+W	0.3994	-X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +1.20D+W	6.349	+X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +0.90D+W	0.01182	-X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +0.90D+W	5.997	+X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +0.90D	2.427	-X	Bottom	0.2592	Min Temp %	0.310	28.871	OK
Z-Z, +0.90D	2.427	+X	Bottom	0.2592	Min Temp %	0.310	28.871	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	4.31 psi	4.31 psi	1.60 psi	1.60 psi	4.31 psi	82.16 psi	0.05	OK
+1.20D	3.70 psi	3.70 psi	1.37 psi	1.37 psi	3.70 psi	82.16 psi	0.05	OK
+1.20D+0.50W	1.88 psi	5.54 psi	2.05 psi	2.06 psi	5.54 psi	82.16 psi	0.07	OK
+1.20D+W	0.14 psi	7.61 psi	2.83 psi	2.84 psi	7.61 psi	82.16 psi	0.09	OK
+0.90D+W	0.00 psi	7.37 psi	2.72 psi	2.76 psi	7.37 psi	82.16 psi	0.09	OK
+0.90D	2.77 psi	2.77 psi	1.03 psi	1.03 psi	2.77 psi	82.16 psi	0.03	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	10.05 psi	164.32 psi	0.06118	OK
+1.20D	8.62 psi	164.32 psi	0.05244	OK
+1.20D+0.50W	8.62 psi	164.32 psi	0.05244	OK
+1.20D+W	8.66 psi	164.32 psi	0.0527	OK
+0.90D+W	6.76 psi	164.32 psi	0.04113	OK
+0.90D	6.46 psi	164.32 psi	0.03933	OK