



Structural Design Calculations

For

D-BATS
LEE'S SUMMIT, MO



05/19/2022

DAVIDSON ARCHITECTURE & ENGINEERING

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Design Loads

	MAX. EXTERIOR COLUMN REACTIONS, RIGID FRAME, 2A
	MAX. EXTERIOR COLUMN REACTIONS, RIGID FRAME, 2F
	MAX. EXTERIOR COLUMN REACTIONS, RIGID FRAME, END WALL
	MAX. INTERIOR COLUMN REACTIONS

[illegible][illegible]

Form	Endow-	Column:	Base-Point	Base-Point (in)	Base-Point
Code	ment	Label	Label	Label	Label
			Width	Length	Area
			Label	Label	Label
1	A	0.750	0.000	0.250	0.175
2	B	0.750	0.000	0.250	0.175
3	C	0.750	0.000	0.250	0.175
4	D	0.750	0.000	0.250	0.175
5	E	0.750	0.000	0.250	0.175
6	F	0.750	0.000	0.250	0.175
7	G	0.750	0.000	0.250	0.175
8	H	0.750	0.000	0.250	0.175
9	I	0.750	0.000	0.250	0.175
10	J	0.750	0.000	0.250	0.175
11	K	0.750	0.000	0.250	0.175
12	L	0.750	0.000	0.250	0.175
13	M	0.750	0.000	0.250	0.175
14	N	0.750	0.000	0.250	0.175
15	O	0.750	0.000	0.250	0.175
16	P	0.750	0.000	0.250	0.175
17	Q	0.750	0.000	0.250	0.175
18	R	0.750	0.000	0.250	0.175
19	S	0.750	0.000	0.250	0.175
20	T	0.750	0.000	0.250	0.175
21	U	0.750	0.000	0.250	0.175
22	V	0.750	0.000	0.250	0.175
23	W	0.750	0.000	0.250	0.175
24	X	0.750	0.000	0.250	0.175
25	Y	0.750	0.000	0.250	0.175
26	Z	0.750	0.000	0.250	0.175
27	AA	0.750	0.000	0.250	0.175
28	AB	0.750	0.000	0.250	0.175
29	AC	0.750	0.000	0.250	0.175
30	AD	0.750	0.000	0.250	0.175
31	AE	0.750	0.000	0.250	0.175
32	AF	0.750	0.000	0.250	0.175
33	AG	0.750	0.000	0.250	0.175
34	AH	0.750	0.000	0.250	0.175
35	AI	0.750	0.000	0.250	0.175
36	AJ	0.750	0.000	0.250	0.175
37	AK	0.750	0.000	0.250	0.175
38	AL	0.750	0.000	0.250	0.175
39	AM	0.750	0.000	0.250	0.175
40	AN	0.750	0.000	0.250	0.175
41	AO	0.750	0.000	0.250	0.175
42	AP	0.750	0.000	0.250	0.175
43	AQ	0.750	0.000	0.250	0.175
44	AR	0.750	0.000	0.250	0.175
45	AS	0.750	0.000	0.250	0.175
46	AT	0.750	0.000	0.250	0.175
47	AU	0.750	0.000	0.250	0.175
48	AV	0.750	0.000	0.250	0.175
49	AW	0.750	0.000	0.250	0.175
50	AX	0.750	0.000	0.250	0.175
51	AY	0.750	0.000	0.250	0.175
52	AZ	0.750	0.000	0.250	0.175
53	BA	0.750	0.000	0.250	0.175
54	BB	0.750	0.000	0.250	0.175
55	BC	0.750	0.000	0.250	0.175
56	BD	0.750	0.000	0.250	0.175
57	BE	0.750	0.000	0.250	0.175
58	BF	0.750	0.000	0.250	0.175
59	BG	0.750	0.000	0.250	0.175
60	BH	0.750	0.000	0.250	0.175
61	BI	0.750	0.000	0.250	0.175
62	BJ	0.750	0.000	0.250	0.175
63	BK	0.750	0.000	0.250	0.175
64	BL	0.750	0.000	0.250	0.175
65	BM	0.750	0.000	0.250	0.175
66	BN	0.750	0.000	0.250	0.175
67	BO	0.750	0.000	0.250	0.17

[illegible]

1. ALL LOADS INCLUDING WIND ARE DOWNWARD. THE HORIZONTAL (HORIZONTAL) AND VERTICAL (V) COMPONENTS OF THE WIND LOADS ARE DETERMINED BY THE WIND SPEED AND DIRECTION.
2. APPROPRIATE CODE FACTORS AND COMBINATIONS TO BE USED WITH OTHER WEATHER EFFECTS FOR ULTIMATE STRENGTH DESIGN. WIND LOADS ARE EIGHTH FOR PERMANENT WIND DIRECTION.
3. THE WIND LOADS ARE DETERMINED BY THE WIND SPEED AND DIRECTION. THE WIND LOADS ARE DETERMINED BY THE WIND SPEED AND DIRECTION. THE WIND LOADS ARE DETERMINED BY THE WIND SPEED AND DIRECTION.
4. THE WIND LOADS ARE DETERMINED BY THE WIND SPEED AND DIRECTION. THE WIND LOADS ARE DETERMINED BY THE WIND SPEED AND DIRECTION. THE WIND LOADS ARE DETERMINED BY THE WIND SPEED AND DIRECTION.
5. POSITIVE (+) REACTIONS ARE AS SHOWN ABOVE. FOUNDATION LOADS ARE IN POSITIVE DIRECTIONS.
6. FROM THE BACKED BY AND THE VERTICAL REACTION (V) ACTING DOWNWARD.

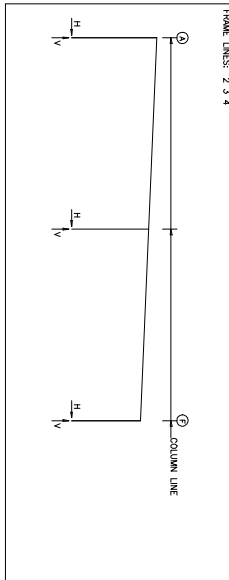
Well — Col		± Reactional —		Pore Shoa	
Loc	Line	Wind	Seismic	(b/1)	Wind
Line	Line	Horz	Vert	Horz	Vert
ESW 1	E 5	4.0	3.9	1.3	1.3
SW 2	E 2	4.0	4.4	2.4	1.6
R 5W 7	E 4	4.3	4.2	1.5	1.4
SW 6	E 6	4.4	5.5	2.4	2.1
SW 21	E 21	6.4	5.9	2.5	2.3

PROJECT NAME	
DBAT SINGLE SLOPE LEES SUMMIT, MO 64086	
CUSTOMER NAME	
MAR BUILDING SOLUTIONS LEES SUMMIT, MO 64081	
JOB NUMBER	SHEET TITLE
T21K0694A	

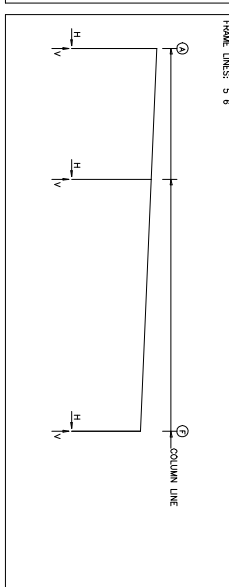
NUCOR
BUILDING SYSTEMS
305 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1006, 200 WHEATSTONE RD, SWANSEA, SC 2916
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 APACHE TRAIL, TERRELL, TX 75160
PHONE: (972) 524-5407 FAX: (972) 524-5417
1050 WATERY LANE, BRIGHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

ISSUE	OWN	DRG	ENG	PE	DATE
ANCHOR BOLTS	TDN	MBS	JSA		12/20/2021
PERMITS	TDN	MBS	JSA	KAP	12/24/2021
FINAL ERECTIONS	BDT	MBS	JSA	KAP	1/10/2022

	MAX. EXTERIOR COLUMN REACTIONS, RIGID FRAME, 2A
	MAX. EXTERIOR COLUMN REACTIONS, RIGID FRAME, 2F
	MAX. EXTERIOR COLUMN REACTIONS, RIGID FRAME, END WALL



FRAME LINES: 2 3 4



FRAME LINES: 3 6

RIGID FRAME: BASIC COLUMN REACTIONS (k)

Frame Column	-----Dood-----	-----Collateral-----	-----Live-----	-----Snow-----	-----Wind Left-----	-----Wind Right-----
Line	Horiz	Vert	Horiz	Vert	Horiz	Vert

[illegible]

RIGID FRAME: ANCHOR BOLTS & BASE PLATES

ENDWALL COLUMN: SQUEEZE COLUMN RECTIONS ()									
Line	Col	Beam	Line	Col	Beam	Line	Col	Beam	Line
From	Col	Dist	From	Col	Dist	From	Col	Dist	From
1	1	0.0	1	1	0.0	1	1	0.0	1
2	2	0.0	2	2	0.0	2	2	0.0	2
3	3	0.0	3	3	0.0	3	3	0.0	3
4	4	0.0	4	4	0.0	4	4	0.0	4
5	5	0.0	5	5	0.0	5	5	0.0	5
6	6	0.0	6	6	0.0	6	6	0.0	6
7	7	0.0	7	7	0.0	7	7	0.0	7
8	8	0.0	8	8	0.0	8	8	0.0	8
9	9	0.0	9	9	0.0	9	9	0.0	9
10	10	0.0	10	10	0.0	10	10	0.0	10
11	11	0.0	11	11	0.0	11	11	0.0	11
12	12	0.0	12	12	0.0	12	12	0.0	12
13	13	0.0	13	13	0.0	13	13	0.0	13
14	14	0.0	14	14	0.0	14	14	0.0	14
15	15	0.0	15	15	0.0	15	15	0.0	15
16	16	0.0	16	16	0.0	16	16	0.0	16
17	17	0.0	17	17	0.0	17	17	0.0	17
18	18	0.0	18	18	0.0	18	18	0.0	18
19	19	0.0	19	19	0.0	19	19	0.0	19
20	20	0.0	20	20	0.0	20	20	0.0	20
21	21	0.0	21	21	0.0	21	21	0.0	21
22	22	0.0	22	22	0.0	22	22	0.0	22
23	23	0.0	23	23	0.0	23	23	0.0	23
24	24	0.0	24	24	0.0	24	24	0.0	24
25	25	0.0	25	25	0.0	25	25	0.0	25
26	26	0.0	26	26	0.0	26	26	0.0	26
27	27	0.0	27	27	0.0	27	27	0.0	27
28	28	0.0	28	28	0.0	28	28	0.0	28
29	29	0.0	29	29	0.0	29	29	0.0	29
30	30	0.0	30	30	0.0	30	30	0.0	30
31	31	0.0	31	31	0.0	31	31	0.0	31
32	32	0.0	32	32	0.0	32	32	0.0	32
33	33	0.0	33	33	0.0	33	33	0.0	33
34	34	0.0	34	34	0.0	34	34	0.0	34
35	35	0.0	35	35	0.0	35	35	0.0	35
36	36	0.0	36	36	0.0	36	36	0.0	36
37	37	0.0	37	37	0.0	37	37	0.0	37
38	38	0.0	38	38	0.0	38	38	0.0	38
39	39	0.0	39	39	0.0	39	39	0.0	39
40	40	0.0	40	40	0.0	40	40	0.0	40
41	41	0.0	41	41	0.0	41	41	0.0	41
42	42	0.0	42	42	0.0	42	42	0.0	42
43	43	0.0	43	43	0.0	43	43	0.0	43
44	44	0.0	44	44	0.0	44	44	0.0	44

ENDWALL COLUMN:		ANCHOR BOLTS & BASE PLATES		
Frm	Col	Anchor-Bolt	Base-Plate (in)	Elev.

Line	Line	Qty	Weight	(in)
1	A	0.750	8.000	8.250
2	B	0.750	8.000	8.250
3	C	0.750	8.000	8.250
4	D	0.750	8.000	8.250
5	E	0.750	8.000	8.250
6	F	0.750	8.000	8.250
7	G	0.750	8.000	8.250
7	D	0.750	8.000	8.250
7	C	0.750	8.000	8.250
7	B	0.750	8.000	8.250
7	A	0.750	8.000	8.250

Firm	Col	Seis Left	Seis Right	-MIN_SNOW--EIPAT_
1	4	0.8	0.5	3.3
				2.6
				-2

[illegible]

GENERAL NOTES

1. ALL LOADING CONDITIONS ARE EXAMINED. THE MAXIMUM AND MINIMUM HORIZONTAL (H) AND VERTICAL (V)

1. REACTIONS AND THE CORRESPONDING VERTICAL (V) OR HORIZONTAL (H) ARE REPORTED.
2. REACTIONS ARE PROVIDED BY LOAD CASE IN SERIES AND THE FOUNDATION ENGINEER IS DETERMINING THE CORRESPONDING REACTION. REACTIONS ARE REPORTED FOR EACH MEMBER, INCLUDING STRUTTED DESIGN MEMBERS. REACTIONS ARE GIVEN FOR EACH PRIMARY AND SECONDARY MEMBER.
3. FOR ASSESS-10 AND LATER BASED BUILDING CODES, THE UNFACTORED LOAD CASE REACTIONS DUE TO DEAD AND LIVE LOADS ARE REPORTED USING THE ULTIMATE DESIGN AND SPEED VULN.
4. POSITIVE (+) REACTIONS ARE AS SHOWN ABOVE. FOUNDATION LOADS ARE IN OPPOSITE DIRECTIONS.
5. BRACING REACTIONS ARE IN THE PLANE OF THE BRACE WITH THE FOUNDATION REACTION (V) ACTING AWAY FROM THE BRACED END AND THE VERTICAL REACTION (V) ACTING DOWNWARD.

Series	Value
A	-0.5
B	4.1
C	3.5
D	2.9

- [illegible]

BUILDING BRACING REACTIONS	Panel, Shear
± Reactions(k)	

Loc	Wall Line	Col	Wind Horiz	Semic- (lb/ft)	Wind Sps
EW 1	EF 1	40	1.3	1.7	2.1
ESW F	F 1.2	39	2.4	1.6	2.1
ESW 7	FE 4	43	2.5	2.1	2.5
	54	64	5.9		
	2.1				

Foundation Design



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (2A,5A)

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

General Information

Material Properties

f'_c : Concrete 28 day strength	=	3.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : 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.	=	0.00180
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	=	2.0 ksf
Soil Density	=	110.0 pcf
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	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

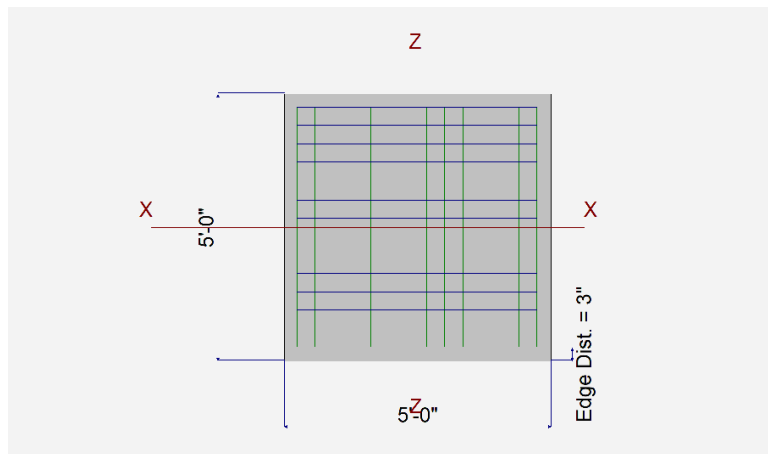
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
---	---	-----------

Dimensions

Width parallel to X-X Axis	=	5.0 ft
Length parallel to Z-Z Axis	=	5.0 ft
Footing Thickness	=	36.0 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

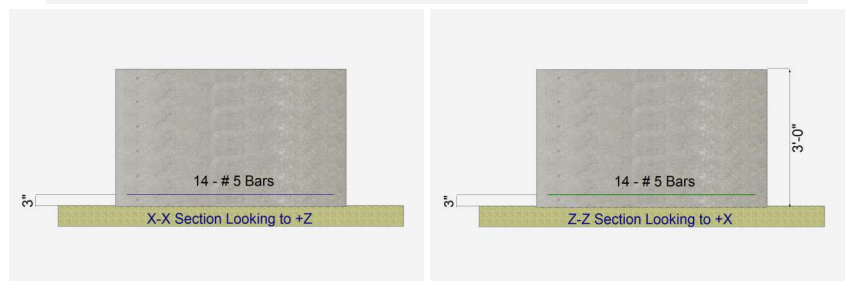
Bars parallel to X-X Axis	=	
Number of Bars	=	14.0
Reinforcing Bar Size	=	# 5

Bars parallel to Z-Z Axis	=	
Number of Bars	=	14.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	3.60	11.10	17.80	-14.30	-0.20	k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



Project Title: D-Bats
 Engineer: JMB
 Project ID: Lee's Summit, MO
 Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

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DESCRIPTION: Exterior Column Rigid Frame (2A,5A)

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6455	Soil Bearing	1.291 ksf	2.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	1.012	Uplift	-8.580 k	8.685 k	+0.60D+0.60W
PASS	0.03253	Z Flexure (+X)	4.10 k-ft/ft	126.049 k-ft/ft	+1.20D+1.60S
PASS	0.03253	Z Flexure (-X)	4.10 k-ft/ft	126.049 k-ft/ft	+1.20D+1.60S
PASS	0.03253	X Flexure (+Z)	4.10 k-ft/ft	126.049 k-ft/ft	+1.20D+1.60S
PASS	0.03253	X Flexure (-Z)	4.10 k-ft/ft	126.049 k-ft/ft	+1.20D+1.60S
PASS	n/a	1-way Shear (+X)	0.0 psi	88.741 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	88.741 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	88.741 psi	n/a
PASS	n/a	2-way Punching	5.334 psi	88.741 psi	+1.20D+1.60S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				(in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0			0.5790	0.5790	n/a	n/a	0.290
X-X, +D+Lr	2.0	n/a	0.0			1.023	1.023	n/a	n/a	0.512
X-X, +D+S	2.0	n/a	0.0			1.291	1.291	n/a	n/a	0.646
X-X, +D+0.750Lr	2.0	n/a	0.0			0.9120	0.9120	n/a	n/a	0.456
X-X, +D+0.750S	2.0	n/a	0.0			1.113	1.113	n/a	n/a	0.557
X-X, +D+0.60W	2.0	n/a	0.0			0.2358	0.2358	n/a	n/a	0.118
X-X, +D+0.70E	2.0	n/a	0.0			0.5734	0.5734	n/a	n/a	0.287
X-X, +D+0.750Lr+0.450W	2.0	n/a	0.0			0.6546	0.6546	n/a	n/a	0.327
X-X, +D+0.750S+0.450W	2.0	n/a	0.0			0.8556	0.8556	n/a	n/a	0.428
X-X, +D+0.750S+0.5250E	2.0	n/a	0.0			1.109	1.109	n/a	n/a	0.555
X-X, +0.60D+0.60W	2.0	n/a	0.0			0.00420	0.00420	n/a	n/a	0.002
X-X, +0.60D+0.70E	2.0	n/a	0.0			0.3418	0.3418	n/a	n/a	0.171
Z-Z, D Only	2.0	0.0	n/a			n/a	n/a	0.5790	0.5790	0.290
Z-Z, +D+Lr	2.0	0.0	n/a			n/a	n/a	1.023	1.023	0.512
Z-Z, +D+S	2.0	0.0	n/a			n/a	n/a	1.291	1.291	0.646
Z-Z, +D+0.750Lr	2.0	0.0	n/a			n/a	n/a	0.9120	0.9120	0.456
Z-Z, +D+0.750S	2.0	0.0	n/a			n/a	n/a	1.113	1.113	0.557
Z-Z, +D+0.60W	2.0	0.0	n/a			n/a	n/a	0.2358	0.2358	0.118
Z-Z, +D+0.70E	2.0	0.0	n/a			n/a	n/a	0.5734	0.5734	0.287
Z-Z, +D+0.750Lr+0.450W	2.0	0.0	n/a			n/a	n/a	0.6546	0.6546	0.327
Z-Z, +D+0.750S+0.450W	2.0	0.0	n/a			n/a	n/a	0.8556	0.8556	0.428
Z-Z, +D+0.750S+0.5250E	2.0	0.0	n/a			n/a	n/a	1.109	1.109	0.555
Z-Z, +0.60D+0.60W	2.0	0.0	n/a			n/a	n/a	0.00420	0.00420	0.002
Z-Z, +0.60D+0.70E	2.0	0.0	n/a			n/a	n/a	0.3418	0.3418	0.171

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

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	0.630	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (2A,5A)

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	0.630	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50Lr	1.234	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50Lr	1.234	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50S	1.653	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50S	1.653	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60Lr	2.760	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60Lr	2.760	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60Lr+0.50W	1.866	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60Lr+0.50W	1.866	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60S	4.10	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60S	4.10	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60S+0.50W	3.206	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+1.60S+0.50W	3.206	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50Lr+W	0.5538	+Z	Top	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50Lr+W	0.5538	-Z	Top	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50S+W	0.1350	+Z	Top	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.50S+W	0.1350	-Z	Top	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.70S+E	2.073	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +1.20D+0.70S+E	2.073	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +0.90D+W	1.383	+Z	Top	0.7776	AsMin	0.8680	126.049	OK
X-X, +0.90D+W	1.383	-Z	Top	0.7776	AsMin	0.8680	126.049	OK
X-X, +0.90D+E	0.380	+Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
X-X, +0.90D+E	0.380	-Z	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.40D	0.630	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.40D	0.630	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50Lr	1.234	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50Lr	1.234	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50S	1.653	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50S	1.653	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60Lr	2.760	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60Lr	2.760	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60Lr+0.50W	1.866	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60Lr+0.50W	1.866	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60S	4.10	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60S	4.10	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60S+0.50W	3.206	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+1.60S+0.50W	3.206	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50Lr+W	0.5538	-X	Top	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50Lr+W	0.5538	+X	Top	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50S+W	0.1350	-X	Top	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.50S+W	0.1350	+X	Top	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.70S+E	2.073	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +1.20D+0.70S+E	2.073	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +0.90D+W	1.383	-X	Top	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +0.90D+W	1.383	+X	Top	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +0.90D+E	0.380	-X	Bottom	0.7776	AsMin	0.8680	126.049	OK
Z-Z, +0.90D+E	0.380	+X	Bottom	0.7776	AsMin	0.8680	126.049	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50S	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60Lr+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60S	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60S+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50Lr+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50S+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.70S+E	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+0.90D+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+0.90D+E	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (2A,5A)

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.82 psi	177.48 psi	0.004618	OK
+1.20D+0.50Lr	1.61 psi	177.48 psi	0.009044	OK
+1.20D+0.50S	2.15 psi	177.48 psi	0.01211	OK
+1.20D+1.60Lr	3.59 psi	177.48 psi	0.02023	OK
+1.20D+1.60Lr+0.50W	2.43 psi	177.48 psi	0.01368	OK
+1.20D+1.60S	5.33 psi	177.48 psi	0.03005	OK
+1.20D+1.60S+0.50W	4.17 psi	177.48 psi	0.0235	OK
+1.20D+0.50Lr+W	0.72 psi	177.48 psi	0.004059	OK
+1.20D+0.50S+W	0.18 psi	177.48 psi	0.00099	OK
+1.20D+0.70S+E	2.70 psi	177.48 psi	0.01519	OK
+0.90D+W	1.80 psi	177.48 psi	0.01013	OK
+0.90D+E	0.49 psi	177.48 psi	0.002786	OK



Project Title: D-Bats
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Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (2F, 5F)

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

General Information

Material Properties

f'_c : Concrete 28 day strength	=	3.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : 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.	=	0.00180
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	=	2.0 ksf
Soil Density	=	110.0 pcf
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	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

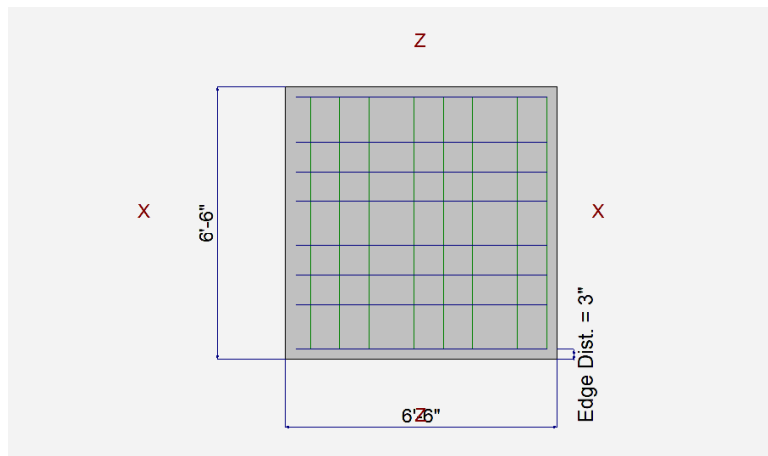
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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Dimensions

Width parallel to X-X Axis	=	6.50 ft
Length parallel to Z-Z Axis	=	6.50 ft
Footing Thickness	=	36.0 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

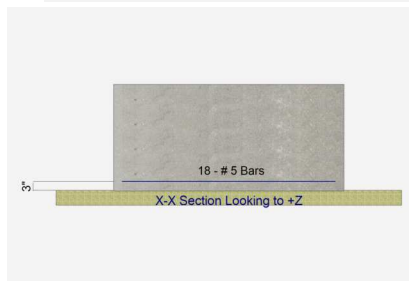
Bars parallel to X-X Axis	=	
Number of Bars	=	18.0
Reinforcing Bar Size	=	# 5

Bars parallel to Z-Z Axis	=	
Number of Bars	=	18.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	5.80	16.20	26.10	-23.50	-0.20	k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



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APEX ENGINEERS INC

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DESCRIPTION: Exterior Column Rigid Frame (2F, 5F)

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.5950	Soil Bearing	1.190 ksf	2.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	1.029	Uplift	-14.10 k	14.507 k	+0.60D+0.60W
PASS	0.04884	Z Flexure (+X)	6.090 k-ft/ft	124.695 k-ft/ft	+1.20D+1.60S
PASS	0.04884	Z Flexure (-X)	6.090 k-ft/ft	124.695 k-ft/ft	+1.20D+1.60S
PASS	0.04884	X Flexure (+Z)	6.090 k-ft/ft	124.695 k-ft/ft	+1.20D+1.60S
PASS	0.04884	X Flexure (-Z)	6.090 k-ft/ft	124.695 k-ft/ft	+1.20D+1.60S
PASS	0.01706	1-way Shear (+X)	1.514 psi	88.741 psi	+1.20D+1.60S
PASS	0.01706	1-way Shear (-X)	1.514 psi	88.741 psi	+1.20D+1.60S
PASS	0.01706	1-way Shear (+Z)	1.514 psi	88.741 psi	+1.20D+1.60S
PASS	0.01706	1-way Shear (-Z)	1.514 psi	88.741 psi	+1.20D+1.60S
PASS	0.05190	2-way Punching	9.212 psi	177.482 psi	+1.20D+1.60S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				(in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0			0.5723	0.5723	n/a	n/a	0.286
X-X, +D+Lr	2.0	n/a	0.0			0.9557	0.9557	n/a	n/a	0.478
X-X, +D+S	2.0	n/a	0.0			1.190	1.190	n/a	n/a	0.595
X-X, +D+0.750Lr	2.0	n/a	0.0			0.8599	0.8599	n/a	n/a	0.430
X-X, +D+0.750S	2.0	n/a	0.0			1.036	1.036	n/a	n/a	0.518
X-X, +D+0.60W	2.0	n/a	0.0			0.2386	0.2386	n/a	n/a	0.119
X-X, +D+0.70E	2.0	n/a	0.0			0.5690	0.5690	n/a	n/a	0.285
X-X, +D+0.750Lr+0.450W	2.0	n/a	0.0			0.6096	0.6096	n/a	n/a	0.305
X-X, +D+0.750S+0.450W	2.0	n/a	0.0			0.7853	0.7853	n/a	n/a	0.393
X-X, +D+0.750S+0.5250E	2.0	n/a	0.0			1.033	1.033	n/a	n/a	0.517
X-X, +0.60D+0.60W	2.0	n/a	0.0			0.009639	0.009639	n/a	n/a	0.005
X-X, +0.60D+0.70E	2.0	n/a	0.0			0.3401	0.3401	n/a	n/a	0.170
Z-Z, D Only	2.0	0.0	n/a			n/a	n/a	0.5723	0.5723	0.286
Z-Z, +D+Lr	2.0	0.0	n/a			n/a	n/a	0.9557	0.9557	0.478
Z-Z, +D+S	2.0	0.0	n/a			n/a	n/a	1.190	1.190	0.595
Z-Z, +D+0.750Lr	2.0	0.0	n/a			n/a	n/a	0.8599	0.8599	0.430
Z-Z, +D+0.750S	2.0	0.0	n/a			n/a	n/a	1.036	1.036	0.518
Z-Z, +D+0.60W	2.0	0.0	n/a			n/a	n/a	0.2386	0.2386	0.119
Z-Z, +D+0.70E	2.0	0.0	n/a			n/a	n/a	0.5690	0.5690	0.285
Z-Z, +D+0.750Lr+0.450W	2.0	0.0	n/a			n/a	n/a	0.6096	0.6096	0.305
Z-Z, +D+0.750S+0.450W	2.0	0.0	n/a			n/a	n/a	0.7853	0.7853	0.393
Z-Z, +D+0.750S+0.5250E	2.0	0.0	n/a			n/a	n/a	1.033	1.033	0.517
Z-Z, +0.60D+0.60W	2.0	0.0	n/a			n/a	n/a	0.009639	0.009639	0.005
Z-Z, +0.60D+0.70E	2.0	0.0	n/a			n/a	n/a	0.3401	0.3401	0.170

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

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	1.015	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK



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DESCRIPTION: Exterior Column Rigid Frame (2F, 5F)

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	1.015	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50Lr	1.883	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50Lr	1.883	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50S	2.501	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50S	2.501	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60Lr	4.110	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60Lr	4.110	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60Lr+0.50W	2.641	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60Lr+0.50W	2.641	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60S	6.090	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60S	6.090	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60S+0.50W	4.621	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+1.60S+0.50W	4.621	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50Lr+W	1.055	+Z	Top	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50Lr+W	1.055	-Z	Top	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50S+W	0.4363	+Z	Top	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.50S+W	0.4363	-Z	Top	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.70S+E	3.129	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +1.20D+0.70S+E	3.129	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +0.90D+W	2.285	+Z	Top	0.7776	AsMin	0.8585	124.695	OK
X-X, +0.90D+W	2.285	-Z	Top	0.7776	AsMin	0.8585	124.695	OK
X-X, +0.90D+E	0.6275	+Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
X-X, +0.90D+E	0.6275	-Z	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.40D	1.015	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.40D	1.015	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50Lr	1.883	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50Lr	1.883	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50S	2.501	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50S	2.501	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60Lr	4.110	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60Lr	4.110	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60Lr+0.50W	2.641	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60Lr+0.50W	2.641	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60S	6.090	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60S	6.090	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60S+0.50W	4.621	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+1.60S+0.50W	4.621	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50Lr+W	1.055	-X	Top	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50Lr+W	1.055	+X	Top	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50S+W	0.4363	-X	Top	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.50S+W	0.4363	+X	Top	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.70S+E	3.129	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +1.20D+0.70S+E	3.129	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +0.90D+W	2.285	-X	Top	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +0.90D+W	2.285	+X	Top	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +0.90D+E	0.6275	-X	Bottom	0.7776	AsMin	0.8585	124.695	OK
Z-Z, +0.90D+E	0.6275	+X	Bottom	0.7776	AsMin	0.8585	124.695	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.25 psi	0.25 psi	0.25 psi	0.25 psi	0.25 psi	88.74 psi	0.00	OK
+1.20D+0.50Lr	0.47 psi	0.47 psi	0.47 psi	0.47 psi	0.47 psi	88.74 psi	0.01	OK
+1.20D+0.50S	0.62 psi	0.62 psi	0.62 psi	0.62 psi	0.62 psi	88.74 psi	0.01	OK
+1.20D+1.60Lr	1.02 psi	1.02 psi	1.02 psi	1.02 psi	1.02 psi	88.74 psi	0.01	OK
+1.20D+1.60Lr+0.50W	0.66 psi	0.66 psi	0.66 psi	0.66 psi	0.66 psi	88.74 psi	0.01	OK
+1.20D+1.60S	1.51 psi	1.51 psi	1.51 psi	1.51 psi	1.51 psi	88.74 psi	0.02	OK
+1.20D+1.60S+0.50W	1.15 psi	1.15 psi	1.15 psi	1.15 psi	1.15 psi	88.74 psi	0.01	OK
+1.20D+0.50Lr+W	0.26 psi	0.26 psi	0.26 psi	0.26 psi	0.26 psi	88.74 psi	0.00	OK
+1.20D+0.50S+W	0.11 psi	0.11 psi	0.11 psi	0.11 psi	0.11 psi	88.74 psi	0.00	OK
+1.20D+0.70S+E	0.78 psi	0.78 psi	0.78 psi	0.78 psi	0.78 psi	88.74 psi	0.01	OK
+0.90D+W	0.57 psi	0.57 psi	0.57 psi	0.57 psi	0.57 psi	88.74 psi	0.01	OK
+0.90D+E	0.16 psi	0.16 psi	0.16 psi	0.16 psi	0.16 psi	88.74 psi	0.00	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (2F, 5F)

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	1.54 psi	177.48 psi	0.00865	OK
+1.20D+0.50Lr	2.85 psi	177.48 psi	0.01604	OK
+1.20D+0.50S	3.78 psi	177.48 psi	0.02132	OK
+1.20D+1.60Lr	6.22 psi	177.48 psi	0.03503	OK
+1.20D+1.60Lr+0.50W	4.00 psi	177.48 psi	0.02251	OK
+1.20D+1.60S	9.21 psi	177.48 psi	0.0519	OK
+1.20D+1.60S+0.50W	6.99 psi	177.48 psi	0.03938	OK
+1.20D+0.50Lr+W	1.60 psi	177.48 psi	0.008991	OK
+1.20D+0.50S+W	0.66 psi	177.48 psi	0.003718	OK
+1.20D+0.70S+E	4.73 psi	177.48 psi	0.02667	OK
+0.90D+W	3.46 psi	177.48 psi	0.01947	OK
+0.90D+E	0.95 psi	177.48 psi	0.005348	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (End Wall)

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

General Information

Material Properties

f'_c : Concrete 28 day strength	=	3.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : 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.	=	0.00180
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	=	2.0 ksf
Soil Density	=	110.0 pcf
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	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

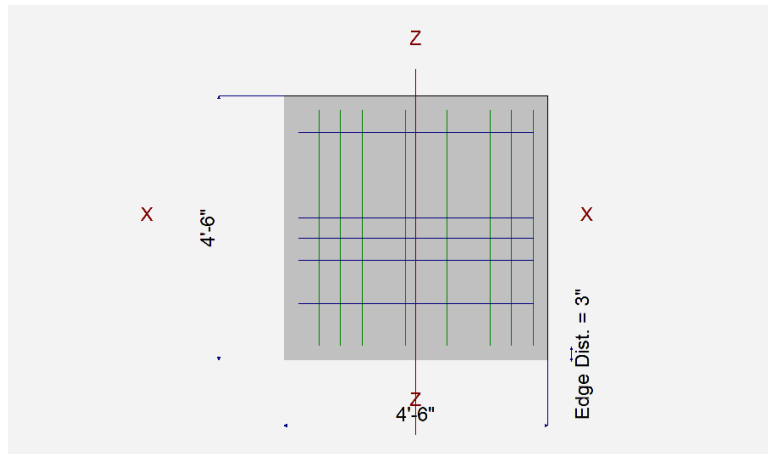
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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Dimensions

Width parallel to X-X Axis	=	4.50 ft
Length parallel to Z-Z Axis	=	4.50 ft
Footing Thickness	=	36.0 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



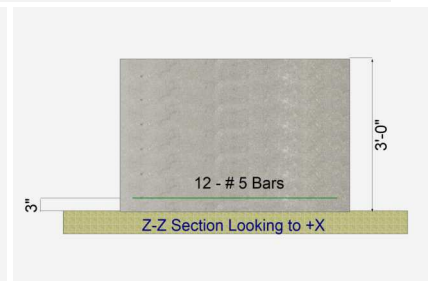
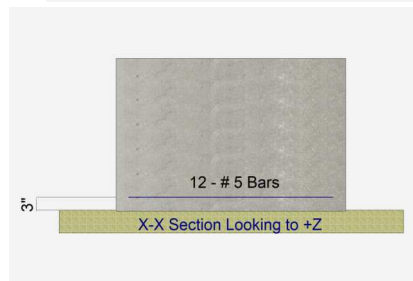
Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	12.0
Reinforcing Bar Size	=	# 5

Bars parallel to Z-Z Axis	=	
Number of Bars	=	12.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	1.80	7.40	8.90	-9.50	0.10	k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



Project Title: D-Bats
 Engineer: JMB
 Project ID: Lee's Summit, MO
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General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (End Wall)

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4817	Soil Bearing	0.9634 ksf	2.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	1.117	Uplift	-5.70 k	6.365 k	+0.60D+0.60W
PASS	0.01706	Z Flexure (+X)	2.050 k-ft/ft	120.176 k-ft/ft	+1.20D+1.60S
PASS	0.01706	Z Flexure (-X)	2.050 k-ft/ft	120.176 k-ft/ft	+1.20D+1.60S
PASS	0.01706	X Flexure (+Z)	2.050 k-ft/ft	120.176 k-ft/ft	+1.20D+1.60S
PASS	0.01706	X Flexure (-Z)	2.050 k-ft/ft	120.176 k-ft/ft	+1.20D+1.60S
PASS	n/a	1-way Shear (+X)	0.0 psi	88.741 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	88.741 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	88.741 psi	n/a
PASS	n/a	2-way Punching	2.318 psi	88.741 psi	+1.20D+1.60S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				(in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0			0.5239	0.5239	n/a	n/a	0.262
X-X, +D+Lr	2.0	n/a	0.0			0.8893	0.8893	n/a	n/a	0.445
X-X, +D+S	2.0	n/a	0.0			0.9634	0.9634	n/a	n/a	0.482
X-X, +D+0.750Lr	2.0	n/a	0.0			0.7980	0.7980	n/a	n/a	0.399
X-X, +D+0.750S	2.0	n/a	0.0			0.8535	0.8535	n/a	n/a	0.427
X-X, +D+0.60W	2.0	n/a	0.0			0.2424	0.2424	n/a	n/a	0.121
X-X, +D+0.70E	2.0	n/a	0.0			0.5273	0.5273	n/a	n/a	0.264
X-X, +D+0.750Lr+0.450W	2.0	n/a	0.0			0.5869	0.5869	n/a	n/a	0.294
X-X, +D+0.750S+0.450W	2.0	n/a	0.0			0.6424	0.6424	n/a	n/a	0.321
X-X, +D+0.750S+0.5250E	2.0	n/a	0.0			0.8561	0.8561	n/a	n/a	0.428
X-X, +0.60D+0.60W	2.0	n/a	0.0			0.03285	0.03285	n/a	n/a	0.016
X-X, +0.60D+0.70E	2.0	n/a	0.0			0.3178	0.3178	n/a	n/a	0.159
Z-Z, D Only	2.0	0.0	n/a			n/a	n/a	0.5239	0.5239	0.262
Z-Z, +D+Lr	2.0	0.0	n/a			n/a	n/a	0.8893	0.8893	0.445
Z-Z, +D+S	2.0	0.0	n/a			n/a	n/a	0.9634	0.9634	0.482
Z-Z, +D+0.750Lr	2.0	0.0	n/a			n/a	n/a	0.7980	0.7980	0.399
Z-Z, +D+0.750S	2.0	0.0	n/a			n/a	n/a	0.8535	0.8535	0.427
Z-Z, +D+0.60W	2.0	0.0	n/a			n/a	n/a	0.2424	0.2424	0.121
Z-Z, +D+0.70E	2.0	0.0	n/a			n/a	n/a	0.5273	0.5273	0.264
Z-Z, +D+0.750Lr+0.450W	2.0	0.0	n/a			n/a	n/a	0.5869	0.5869	0.294
Z-Z, +D+0.750S+0.450W	2.0	0.0	n/a			n/a	n/a	0.6424	0.6424	0.321
Z-Z, +D+0.750S+0.5250E	2.0	0.0	n/a			n/a	n/a	0.8561	0.8561	0.428
Z-Z, +0.60D+0.60W	2.0	0.0	n/a			n/a	n/a	0.03285	0.03285	0.016
Z-Z, +0.60D+0.70E	2.0	0.0	n/a			n/a	n/a	0.3178	0.3178	0.159

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

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	0.3150	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (End Wall)

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	0.3150	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50Lr	0.7325	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50Lr	0.7325	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50S	0.8263	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50S	0.8263	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60Lr	1.750	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60Lr	1.750	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60Lr+0.50W	1.156	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60Lr+0.50W	1.156	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60S	2.050	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60S	2.050	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60S+0.50W	1.456	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+1.60S+0.50W	1.456	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50Lr+W	0.4550	+Z	Top	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50Lr+W	0.4550	-Z	Top	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50S+W	0.3613	+Z	Top	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.50S+W	0.3613	-Z	Top	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.70S+E	1.061	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +1.20D+0.70S+E	1.061	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +0.90D+W	0.9850	+Z	Top	0.7776	AsMin	0.8267	120.176	OK
X-X, +0.90D+W	0.9850	-Z	Top	0.7776	AsMin	0.8267	120.176	OK
X-X, +0.90D+E	0.2150	+Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
X-X, +0.90D+E	0.2150	-Z	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.40D	0.3150	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.40D	0.3150	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50Lr	0.7325	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50Lr	0.7325	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50S	0.8263	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50S	0.8263	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60Lr	1.750	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60Lr	1.750	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60Lr+0.50W	1.156	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60Lr+0.50W	1.156	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60S	2.050	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60S	2.050	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60S+0.50W	1.456	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+1.60S+0.50W	1.456	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50Lr+W	0.4550	-X	Top	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50Lr+W	0.4550	+X	Top	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50S+W	0.3613	-X	Top	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.50S+W	0.3613	+X	Top	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.70S+E	1.061	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +1.20D+0.70S+E	1.061	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +0.90D+W	0.9850	-X	Top	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +0.90D+W	0.9850	+X	Top	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +0.90D+E	0.2150	-X	Bottom	0.7776	AsMin	0.8267	120.176	OK
Z-Z, +0.90D+E	0.2150	+X	Bottom	0.7776	AsMin	0.8267	120.176	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50S	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60Lr+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60S	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60S+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50Lr+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50S+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.70S+E	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+0.90D+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+0.90D+E	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Exterior Column Rigid Frame (End Wall)

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.36 psi	177.48 psi	0.002007	OK
+1.20D+0.50Lr	0.83 psi	177.48 psi	0.004666	OK
+1.20D+0.50S	0.93 psi	177.48 psi	0.005263	OK
+1.20D+1.60Lr	1.98 psi	177.48 psi	0.01115	OK
+1.20D+1.60Lr+0.50W	1.31 psi	177.48 psi	0.007365	OK
+1.20D+1.60S	2.32 psi	177.48 psi	0.01306	OK
+1.20D+1.60S+0.50W	1.65 psi	177.48 psi	0.009276	OK
+1.20D+0.50Lr+W	0.51 psi	177.48 psi	0.002898	OK
+1.20D+0.50S+W	0.41 psi	177.48 psi	0.002301	OK
+1.20D+0.70S+E	1.20 psi	177.48 psi	0.00676	OK
+0.90D+W	1.11 psi	177.48 psi	0.006275	OK
+0.90D+E	0.24 psi	177.48 psi	0.00137	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Interior Column Rigid Frame (Middle 2 & 5)

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

General Information

Material Properties

f'_c : Concrete 28 day strength	=	3.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : 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.	=	0.00180
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	=	2.0 ksf
Soil Density	=	110.0 pcf
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	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

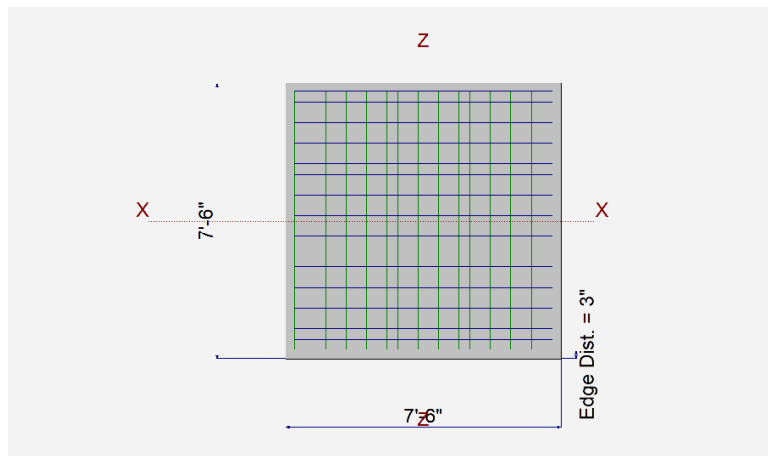
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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Dimensions

Width parallel to X-X Axis	=	7.50 ft
Length parallel to Z-Z Axis	=	7.50 ft
Footing Thickness	=	48.0 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

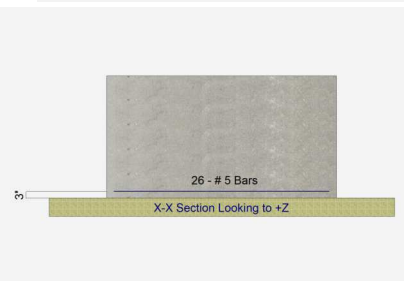
Bars parallel to X-X Axis	=	
Number of Bars	=	26.0
Reinforcing Bar Size	=	# 5

Bars parallel to Z-Z Axis	=	
Number of Bars	=	26.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	8.50	26.0	43.40	-37.60	-0.30	k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Interior Column Rigid Frame (Middle 2 & 5)

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.7515	Soil Bearing	1.503 ksf	2.0 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	1.094	Uplift	-22.560 k	24.675 k	+0.60D+0.60W
PASS	0.04668	Z Flexure (+X)	9.955 k-ft/ft	213.253 k-ft/ft	+1.20D+1.60S
PASS	0.04668	Z Flexure (-X)	9.955 k-ft/ft	213.253 k-ft/ft	+1.20D+1.60S
PASS	0.04668	X Flexure (+Z)	9.955 k-ft/ft	213.253 k-ft/ft	+1.20D+1.60S
PASS	0.04668	X Flexure (-Z)	9.955 k-ft/ft	213.253 k-ft/ft	+1.20D+1.60S
PASS	n/a	1-way Shear (+X)	0.0 psi	88.741 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	88.741 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	88.741 psi	n/a
PASS	n/a	2-way Punching	7.374 psi	88.741 psi	+1.20D+1.60S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				(in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.0	n/a	0.0	0.0	0.7311	0.7311	n/a	n/a	n/a	0.366
X-X, +D+Lr	2.0	n/a	0.0	0.0	1.193	1.193	n/a	n/a	n/a	0.597
X-X, +D+S	2.0	n/a	0.0	0.0	1.503	1.503	n/a	n/a	n/a	0.752
X-X, +D+0.750Lr	2.0	n/a	0.0	0.0	1.078	1.078	n/a	n/a	n/a	0.539
X-X, +D+0.750S	2.0	n/a	0.0	0.0	1.310	1.310	n/a	n/a	n/a	0.655
X-X, +D+0.60W	2.0	n/a	0.0	0.0	0.330	0.330	n/a	n/a	n/a	0.165
X-X, +D+0.70E	2.0	n/a	0.0	0.0	0.7274	0.7274	n/a	n/a	n/a	0.364
X-X, +D+0.750Lr+0.450W	2.0	n/a	0.0	0.0	0.7770	0.7770	n/a	n/a	n/a	0.389
X-X, +D+0.750S+0.450W	2.0	n/a	0.0	0.0	1.009	1.009	n/a	n/a	n/a	0.505
X-X, +D+0.750S+0.5250E	2.0	n/a	0.0	0.0	1.307	1.307	n/a	n/a	n/a	0.654
X-X, +0.60D+0.60W	2.0	n/a	0.0	0.0	0.03760	0.03760	n/a	n/a	n/a	0.019
X-X, +0.60D+0.70E	2.0	n/a	0.0	0.0	0.4349	0.4349	n/a	n/a	n/a	0.218
Z-Z, D Only	2.0	0.0	n/a	n/a	n/a	n/a	0.7311	0.7311	0.7311	0.366
Z-Z, +D+Lr	2.0	0.0	n/a	n/a	n/a	n/a	1.193	1.193	1.193	0.597
Z-Z, +D+S	2.0	0.0	n/a	n/a	n/a	n/a	1.503	1.503	1.503	0.752
Z-Z, +D+0.750Lr	2.0	0.0	n/a	n/a	n/a	n/a	1.078	1.078	1.078	0.539
Z-Z, +D+0.750S	2.0	0.0	n/a	n/a	n/a	n/a	1.310	1.310	1.310	0.655
Z-Z, +D+0.60W	2.0	0.0	n/a	n/a	n/a	n/a	0.330	0.330	0.330	0.165
Z-Z, +D+0.70E	2.0	0.0	n/a	n/a	n/a	n/a	0.7274	0.7274	0.7274	0.364
Z-Z, +D+0.750Lr+0.450W	2.0	0.0	n/a	n/a	n/a	n/a	0.7770	0.7770	0.7770	0.389
Z-Z, +D+0.750S+0.450W	2.0	0.0	n/a	n/a	n/a	n/a	1.009	1.009	1.009	0.505
Z-Z, +D+0.750S+0.5250E	2.0	0.0	n/a	n/a	n/a	n/a	1.307	1.307	1.307	0.654
Z-Z, +0.60D+0.60W	2.0	0.0	n/a	n/a	n/a	n/a	0.03760	0.03760	0.03760	0.019
Z-Z, +0.60D+0.70E	2.0	0.0	n/a	n/a	n/a	n/a	0.4349	0.4349	0.4349	0.218

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

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	1.488	+Z	Bottom	1.037	AsMin	1.075	213.253	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Interior Column Rigid Frame (Middle 2 & 5)

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	1.488	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50Lr	2.90	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50Lr	2.90	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50S	3.988	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50S	3.988	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60Lr	6.475	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60Lr	6.475	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60Lr+0.50W	4.125	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60Lr+0.50W	4.125	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60S	9.955	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60S	9.955	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60S+0.50W	7.605	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+1.60S+0.50W	7.605	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50Lr+W	1.80	+Z	Top	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50Lr+W	1.80	-Z	Top	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50S+W	0.7125	+Z	Top	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.50S+W	0.7125	-Z	Top	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.70S+E	5.035	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +1.20D+0.70S+E	5.035	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +0.90D+W	3.744	+Z	Top	1.037	AsMin	1.075	213.253	OK
X-X, +0.90D+W	3.744	-Z	Top	1.037	AsMin	1.075	213.253	OK
X-X, +0.90D+E	0.9188	+Z	Bottom	1.037	AsMin	1.075	213.253	OK
X-X, +0.90D+E	0.9188	-Z	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.40D	1.488	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.40D	1.488	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50Lr	2.90	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50Lr	2.90	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50S	3.988	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50S	3.988	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60Lr	6.475	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60Lr	6.475	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60Lr+0.50W	4.125	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60Lr+0.50W	4.125	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60S	9.955	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60S	9.955	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60S+0.50W	7.605	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+1.60S+0.50W	7.605	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50Lr+W	1.80	-X	Top	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50Lr+W	1.80	+X	Top	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50S+W	0.7125	-X	Top	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.50S+W	0.7125	+X	Top	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.70S+E	5.035	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +1.20D+0.70S+E	5.035	+X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +0.90D+W	3.744	-X	Top	1.037	AsMin	1.075	213.253	OK
Z-Z, +0.90D+W	3.744	+X	Top	1.037	AsMin	1.075	213.253	OK
Z-Z, +0.90D+E	0.9188	-X	Bottom	1.037	AsMin	1.075	213.253	OK
Z-Z, +0.90D+E	0.9188	+X	Bottom	1.037	AsMin	1.075	213.253	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50S	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60Lr+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60S	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+1.60S+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50Lr+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.50S+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+1.20D+0.70S+E	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+0.90D+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK
+0.90D+E	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	88.74 psi	0.00	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

General Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Interior Column Rigid Frame (Middle 2 & 5)

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	1.10 psi	177.48 psi	0.006208	OK
+1.20D+0.50Lr	2.15 psi	177.48 psi	0.0121	OK
+1.20D+0.50S	2.95 psi	177.48 psi	0.01664	OK
+1.20D+1.60Lr	4.80 psi	177.48 psi	0.02702	OK
+1.20D+1.60Lr+0.50W	3.06 psi	177.48 psi	0.01722	OK
+1.20D+1.60S	7.37 psi	177.48 psi	0.04155	OK
+1.20D+1.60S+0.50W	5.63 psi	177.48 psi	0.03174	OK
+1.20D+0.50Lr+W	1.33 psi	177.48 psi	0.007512	OK
+1.20D+0.50S+W	0.53 psi	177.48 psi	0.002974	OK
+1.20D+0.70S+E	3.73 psi	177.48 psi	0.02101	OK
+0.90D+W	2.77 psi	177.48 psi	0.01563	OK
+0.90D+E	0.68 psi	177.48 psi	0.003834	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

Wall Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.3.16

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Continuous Footing

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	No Uplift
Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.0	Soil Bearing	0.0 ksf	0.0
PASS	0.0	Z Flexure (+X)	0.0 k-ft	No Moment
PASS	0.0	Z Flexure (-X)	0.0 k-ft	No Moment
PASS	n/a	1-way Shear (+X)	0.0 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
-------------------------------------	-----------------	------	-------------------------------	-------------------------------	--------------------------

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
-------------------------------------	--------------------	------------------	-----------------	--------

Footing Has NO Overturning

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
--	---------------	-----------------	---------------------	--------

Footing Has NO Sliding

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
---------------------------------	---------	--------------	-------------------------	---------------	---------------	----------------	-------------	--------

One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
---------------------	---------	---------	--------	--------	-------------	--------



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

Wall Footing

Project File: d-bat.ec6

LIC# : KW-06014638, Build:20.22.4.26

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Continuous Footing (2" Gap Between E.O.S and Stone Wall)

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

General Information

Material Properties

f'_c : Concrete 28 day strength	=	3.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : 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.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
AutoCalc Footing Weight as DL :	=	Yes

Soil Design Values

Allowable Soil Bearing	=	2.0 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

Reference Depth below Surface	=	ft
Allow. Pressure Increase per foot of depth	=	ksf
when base footing is below	=	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

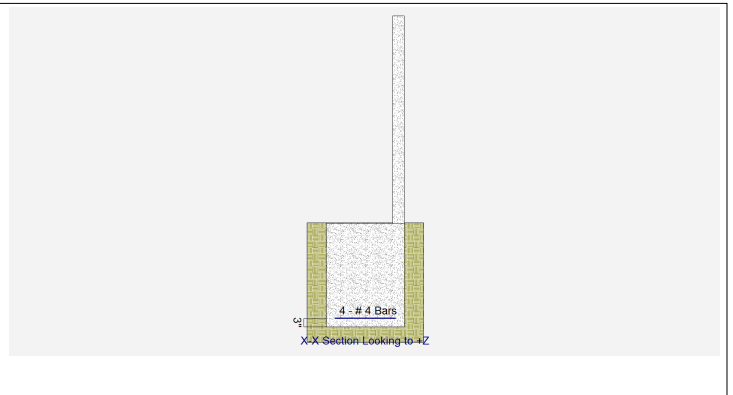
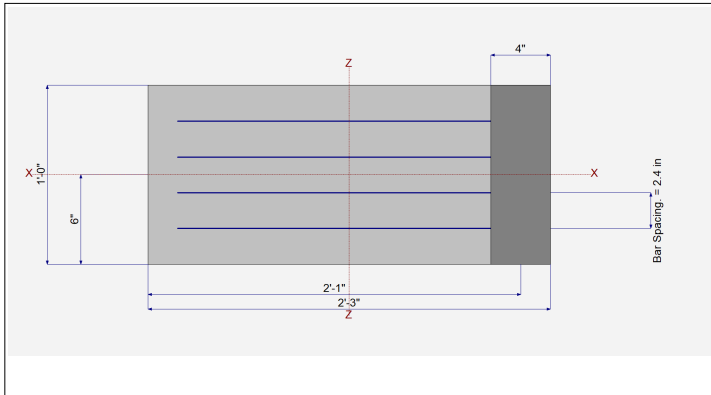
Adjusted Allowable Bearing Pressure

=	2.0 ksf
---	---------

Dimensions

Reinforcing

Footing Width	=	2.250 ft	Footing Thickness	=	36.0 in	Bars along X-X Axis	
Wall Thickness	=	4.0 in	Rebar Centerline to Edge of Concrete...			# of Bars in 12" Width	= 4
Wall center offset			at Bottom of footing =	3.0 in		Reinforcing Bar Size	= # 4
from center of footing	=	11.5 in					



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.5450	0.40	0.280			k
OB : Overburden	=						ksf
V-x	=						k
M-zz	=						k-ft
Vx applied	=						in above top of footing



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

Wall Footing

Project File: d-bat.ec6

LIC# : KW-06014638, Build:20.22.4.26

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Continuous Footing (2" Gap Between E.O.S and Stone Wall)

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	No Uplift
Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9727	Soil Bearing	1.945 ksf	+D+Lr
PASS	0.0	Z Flexure (+X)	0.0 k-ft	No Moment
PASS	0.005821	Z Flexure (-X)	0.6774 k-ft	+0.90D
PASS	n/a	1-way Shear (+X)	0.0 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress		Actual / Allowable Ratio
			-X	+X	
, D Only	2.0 ksf	4.113 in	0.06646 ksf	1.288 ksf	0.644
, +D+Lr	2.0 ksf	5.649 in	0.0 ksf	1.945 ksf	0.973
, +D+S	2.0 ksf	5.260 in	0.0 ksf	1.738 ksf	0.869
, +D+0.750Lr	2.0 ksf	5.328 in	0.0 ksf	1.772 ksf	0.886
, +D+0.750S	2.0 ksf	5.008 in	0.0 ksf	1.622 ksf	0.811
, +0.60D	2.0 ksf	4.113 in	0.03988 ksf	0.7728 ksf	0.386

Units : k-ft

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	1.054	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.40D	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50Lr	0.8864	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50Lr	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50S	0.8913	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50S	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60Lr	0.8523	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60Lr	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60S	0.8667	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60S	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.70S	0.8866	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.70S	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +0.90D	0.6774	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +0.90D	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK

Units : k

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.50Lr	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.50S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60Lr	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.70S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+0.90D	0 psi	0 psi	0 psi	88.741 psi	0	OK



Project Title: D-Bats
Engineer: JMB
Project ID: Lee's Summit, MO
Project Descr: PEMB Foundation

Wall Footing

Project File: D-BAT.ec6

LIC# : KW-06014638, Build:20.22.4.26

APEX ENGINEERS INC

(c) ENERCALC INC 1983-2022

DESCRIPTION: Continuous Footing (Stone at E.O.S.)

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	No Uplift
Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9727	Soil Bearing	1.945 ksf	+D+Lr
PASS	0.0	Z Flexure (+X)	0.0 k-ft	No Moment
PASS	0.005821	Z Flexure (-X)	0.6774 k-ft	+0.90D
PASS	n/a	1-way Shear (+X)	0.0 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress		Actual / Allowable Ratio
			-X	+X	
, D Only	2.0 ksf	4.113 in	0.06646 ksf	1.288 ksf	0.644
, +D+Lr	2.0 ksf	5.649 in	0.0 ksf	1.945 ksf	0.973
, +D+S	2.0 ksf	5.260 in	0.0 ksf	1.738 ksf	0.869
, +D+0.750Lr	2.0 ksf	5.328 in	0.0 ksf	1.772 ksf	0.886
, +D+0.750S	2.0 ksf	5.008 in	0.0 ksf	1.622 ksf	0.811
, +0.60D	2.0 ksf	4.113 in	0.03988 ksf	0.7728 ksf	0.386

Units : k-ft

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	1.054	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.40D	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50Lr	0.8864	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50Lr	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50S	0.8913	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.50S	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60Lr	0.8523	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60Lr	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60S	0.8667	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+1.60S	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.70S	0.8866	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +1.20D+0.70S	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +0.90D	0.6774	-X	Bottom	0.7776	Min Temp %	0.8	116.38	OK
, +0.90D	0	+X	Bottom	0.7776	Min Temp %	0.8	116.38	OK

Units : k

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.50Lr	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.50S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60Lr	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.70S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+0.90D	0 psi	0 psi	0 psi	88.741 psi	0	OK

Anchor Design

FRAME LINE 2 UPLIFT

FRAMELINE 2A						
D	L	Lr	S	R	W	E
3.6	0	11.1	17.8	0	-14.3	-0.2

LC (ASD)	LOAD (K)
1	3.6
2	3.6
3	21.4
4	16.95
5	-4.98
6	10.515
7	-6.42

FRAMELINE 2F						
D	L	Lr	S	R	W	E
3.4	0	11.1	17.7	0	-16.9	-0.4

LC (ASD)	LOAD (K)
1	3.4
2	3.4
3	21.1
4	16.675
5	-6.74
6	9.07
7	-8.1

FRAMELINE 2MID						
D	L	Lr	S	R	W	E
7.3	0	24.7	41.2	0	-34.6	-0.2

LC (ASD)	LOAD (K)
1	7.3
2	7.3
3	48.5
4	38.2
5	-13.46
6	22.63
7	-16.38

FRAME LINE 5 UPLIFT

FRAMELINE 5A

D	L	Lr	S	R	W	E
3.6	0	7.9	12.4	0	-10	-0.5

LC (ASD)	LOAD (K)
1	3.6
2	3.6
3	16
4	12.9
5	-2.4
6	8.4
7	-3.84

FRAMELINE 5F

D	L	Lr	S	R	W	E
5.8	0	16.2	26.1	0	-23.5	-0.2

LC (ASD)	LOAD (K)
1	5.8
2	5.8
3	31.9
4	25.375
5	-8.3
6	14.8
7	-10.62

FRAMELINE 5MID

D	L	Lr	S	R	W	E
8.5	0	26	43.4	0	-37.6	-0.3

LC (ASD)	LOAD (K)
1	8.5
2	8.5
3	51.9
4	41.05
5	-14.06
6	24.13
7	-17.46

FRAME LINE END WALL UPLIFT

FRAMELINE ENDWALL						
D	L	Lr	S	R	W	E
1.8	0	7.4	8.9	0	-9.5	0.1

LC (ASD)	LOAD (K)
1	1.8
2	1.8
3	10.7
4	8.475
5	-3.9
6	4.2
7	-4.62

FRAME LINE 2 SHEAR

FRAMELINE 2A

D	L	Lr	S	R	W	E
1	0	3.3	5.6	0	-7.7	-0.5

LC (ASD)	LOAD (K)
1	1
2	1
3	6.6
4	5.2
5	-3.62
6	1.735
7	-4.02

FRAMELINE 2F

D	L	Lr	S	R	W	E
-1	0	-3.3	-5.6	0	11.4	-0.4

LC (ASD)	LOAD (K)
1	-1
2	-1
3	-1
4	-1
5	5.84
6	4.13
7	6.24

FRAME LINE 5 SHEAR

FRAMELINE 5A						
D	L	Lr	S	R	W	E
1.5	0	4.6	7.6	0	-10	-0.8

LC (ASD)	LOAD (K)
1	1.5
2	1.5
3	9.1
4	7.2
5	-4.5
6	2.7
7	-5.1

FRAMELINE 5F						
D	L	Lr	S	R	W	E
-1.5	0	-4.6	-7.6	0	11.9	-0.8

LC (ASD)	LOAD (K)
1	-1.5
2	-1.5
3	-1.5
4	-1.5
5	5.64
6	3.855
7	6.24

FRAME LINE END WALL SHEAR

FRAMELINE ENDWALL						
D	L	Lr	S	R	W	E
0	0	0	0	0	5.2	0

LC (ASD)	LOAD (K)
1	0
2	0
3	0
4	0
5	3.12
6	2.34
7	3.12



Anchor Designer™
Software
Version 3.0.7947.0

Company:	Apex Engineers	Date:	3/29/2022
Engineer:	JMB	Page:	1/6
Project:	D-Bats		
Address:	Lee's Summit, MO		
Phone:			
E-mail:			

1. Project information

Customer company: Davidson Architecture & Engineering
Customer contact name:
Customer e-mail:
Comment:

Project description: Anchor Bolt Design for Detail (A.B.C)
Location:
Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-14
Units: Imperial units

Anchor Information:

Anchor type: Cast-in-place
Material: F1554 Grade 55
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 10.000
Anchor category: -
Anchor ductility: Yes
 h_{min} (inch): 11.50
 C_{min} (inch): 1.22
 S_{min} (inch): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 44.00
State: Cracked
Compressive strength, f'_c (psi): 3500
 $\Psi_{c,v}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Yes
Build-up grout pad: No

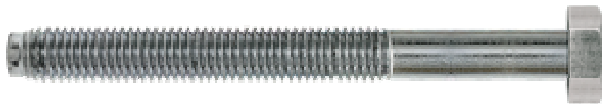
Base Plate

Length x Width x Thickness (inch): 8.25 x 8.00 x 0.38
Yield stress: 36000 psi

Profile type/size: W8X15

Recommended Anchor

Anchor Name: Heavy Hex Bolt - 3/4"Ø Heavy Hex Bolt, F1554 Gr. 55





Company:	Apex Engineers	Date:	3/29/2022
Engineer:	JMB	Page:	2/6
Project:	D-Bats		
Address:	Lee's Summit, MO		
Phone:			
E-mail:			

Load and Geometry

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: Not applicable

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 4700

V_{uax} [lb]: 3200

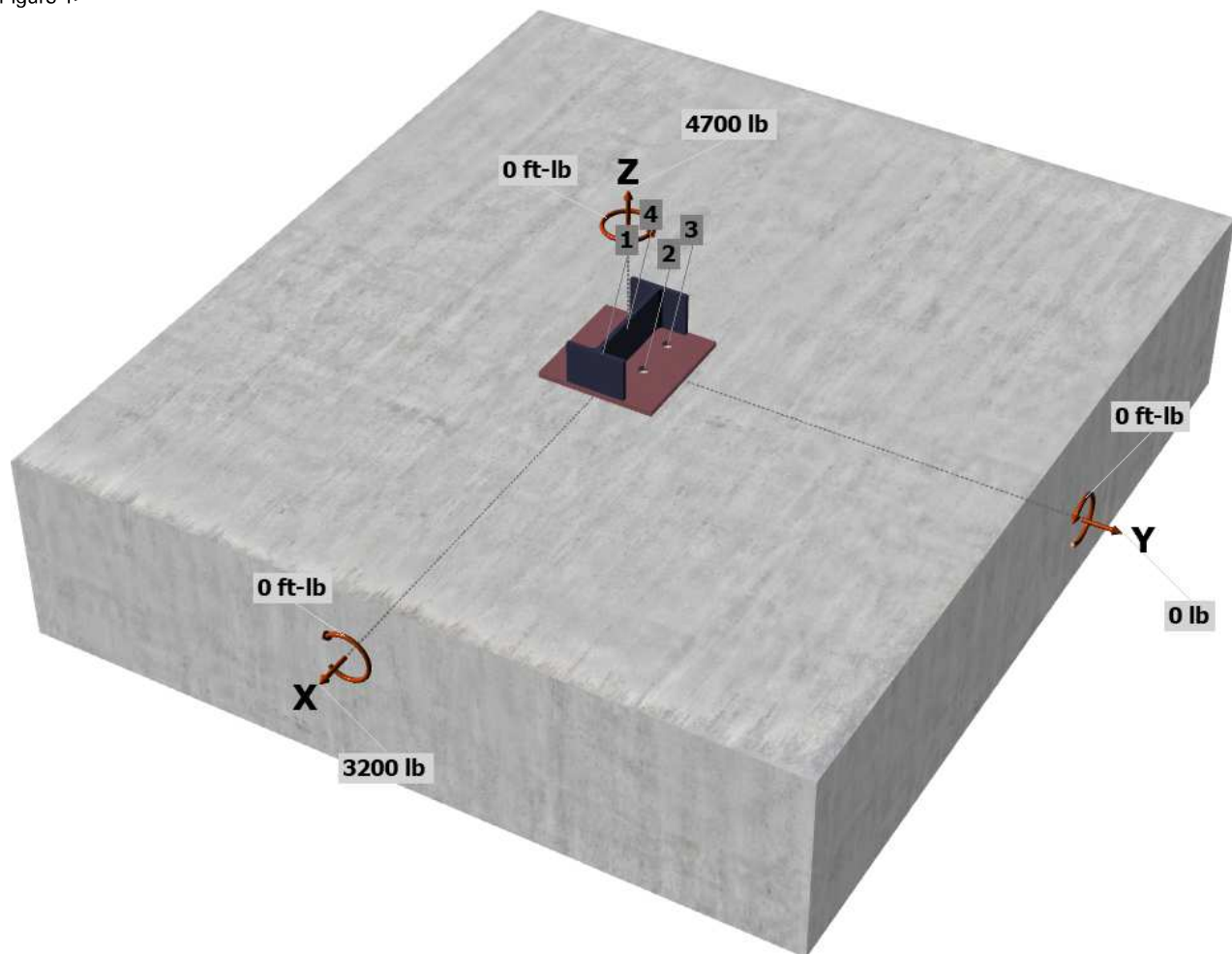
V_{uay} [lb]: 0

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

<Figure 1>





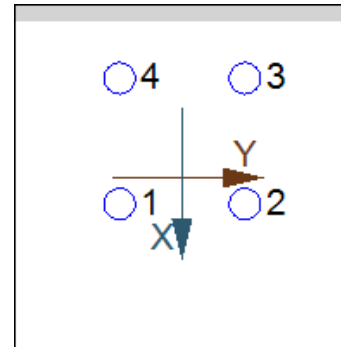
Company:	Apex Engineers	Date:	3/29/2022
Engineer:	JMB	Page:	4/6
Project:	D-Bats		
Address:	Lee's Summit, MO		
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	1833.3	800.0	0.0	800.0
2	1833.3	800.0	0.0	800.0
3	566.1	800.0	0.0	800.0
4	566.1	800.0	0.0	800.0
Sum	4798.8	3200.0	0.0	3200.0

Maximum concrete compression strain (‰): 0.01
Maximum concrete compression stress (psi): 60
Resultant tension force (lb): 4799
Resultant compression force (lb): 99
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.79
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N _{sa} (lb)	φ	φN _{sa} (lb)
25050	0.75	18788

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k _c	λ _a	f' _c (psi)	h _{ef} (in)	N _b (lb)
24.0	1.00	3500	10.000	44900

$$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.3.1 & Eq. 17.4.2.1b)}$$

A _{Nc} (in ²)	A _{Nco} (in ²)	C _{a,min} (in)	Ψ _{ec,N}	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
1089.00	900.00	25.50	0.950	1.000	1.00	1.000	44900	0.70	36122

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$$\phi N_{pn} = \phi \Psi_{c,P} N_p = \phi \Psi_{c,P} 8 A_{brg} f'_c \text{ (Sec. 17.3.1, Eq. 17.4.3.1 & 17.4.3.4)}$$

Ψ _{c,P}	A _{brg} (in ²)	f' _c (psi)	φ	φN _{pn} (lb)
1.0	0.91	3500	0.70	17856



Anchor Designer™
Software
Version 3.0.7947.0

Company:	Apex Engineers	Date:	3/29/2022
Engineer:	JMB	Page:	5/6
Project:	D-Bats		
Address:	Lee's Summit, MO		
Phone:			
E-mail:			

8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
15030	1.0	0.65	9770

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$$V_{bx} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}C_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}C_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f'_c (psi)	C_{a1} (in)	V_{bx} (lb)
6.00	0.750	1.00	3500	29.33	84590

$$\phi V_{cbgx} = \phi (A_{Vc}/A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
2376.00	3872.00	1.000	0.874	1.000	1.000	84590	0.70	31752

Shear parallel to edge in y-direction:

$$V_{by} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}C_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}C_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f'_c (psi)	C_{a1} (in)	V_{by} (lb)
6.00	0.750	1.00	3500	25.50	68563

$$\phi V_{cbgy} = \phi (2)(A_{Vc}/A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
2328.28	2926.13	1.000	1.000	1.000	1.000	68563	0.70	76376

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$$\phi V_{cp} = \phi K_{cp}N_{cbg} = \phi K_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b \text{ (Sec. 17.3.1 \& Eq. 17.5.3.1b)}$$

K_{cp}	A_{Nc} (in ²)	A_{Nco} (in ²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cp} (lb)
2.0	1089.00	900.00	1.000	1.000	1.000	1.000	44900	0.70	76060

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status	
Steel	1833	18788	0.10	Pass	
Concrete breakout	4799	36122	0.13	Pass (Governs)	
Pullout	1833	17856	0.10	Pass	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	800	9770	0.08	Pass	
T Concrete breakout x+	3200	31752	0.10	Pass (Governs)	
 Concrete breakout y+	1600	76376	0.02	Pass (Governs)	
Pryout	3200	76060	0.04	Pass	
Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.13	0.00	13.3%	1.0	Pass

3/4"Ø Heavy Hex Bolt, F1554 Gr. 55 with hef = 10.000 inch meets the selected design criteria.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

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12. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Sections 17.7.1 and 17.7.2 for torqued cast-in-place anchor is waived per designer option.
- Designer must exercise own judgement to determine if this design is suitable.



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Phone:			
E-mail:			

1. Project information

Customer company: Davidson Architecture & Engineering
Customer contact name:
Customer e-mail:
Comment:

Project description: Anchor Bolt Design for Detail (D)
Location:
Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-14
Units: Imperial units

Anchor Information:

Anchor type: Cast-in-place
Material: F1554 Grade 55
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 10.000
Anchor category: -
Anchor ductility: Yes
 h_{min} (inch): 11.50
 C_{min} (inch): 1.22
 S_{min} (inch): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 44.00
State: Cracked
Compressive strength, f'_c (psi): 3500
 $\Psi_{c,v}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Yes
Build-up grout pad: No

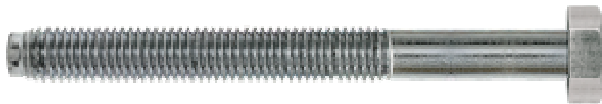
Base Plate

Length x Width x Thickness (inch): 12.56 x 8.00 x 0.38
Yield stress: 36000 psi

Profile type/size: W12X30

Recommended Anchor

Anchor Name: Heavy Hex Bolt - 3/4"Ø Heavy Hex Bolt, F1554 Gr. 55





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Load and Geometry

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: Not applicable

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 8100

V_{uax} [lb]: 6600

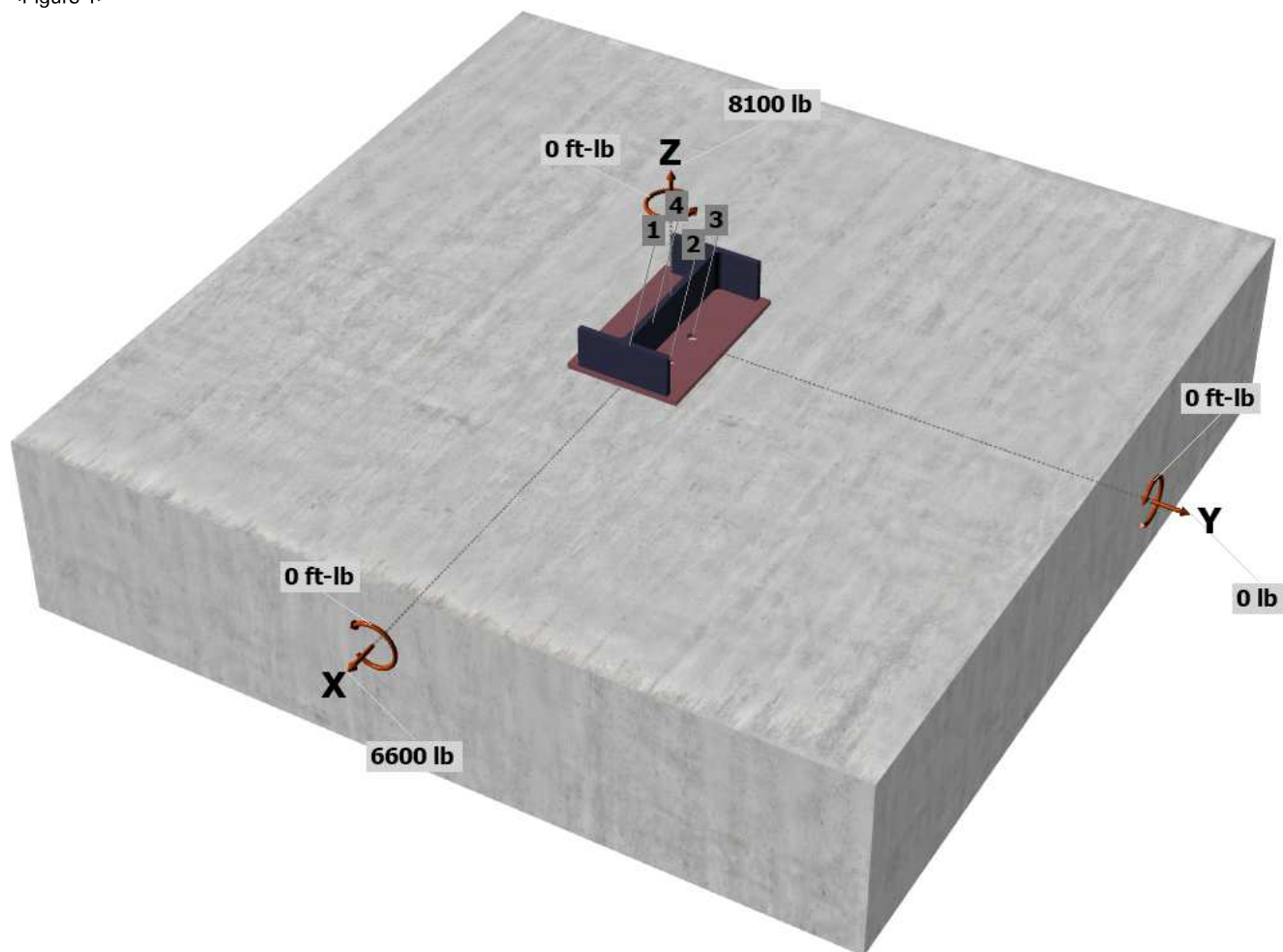
V_{uay} [lb]: 0

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

<Figure 1>

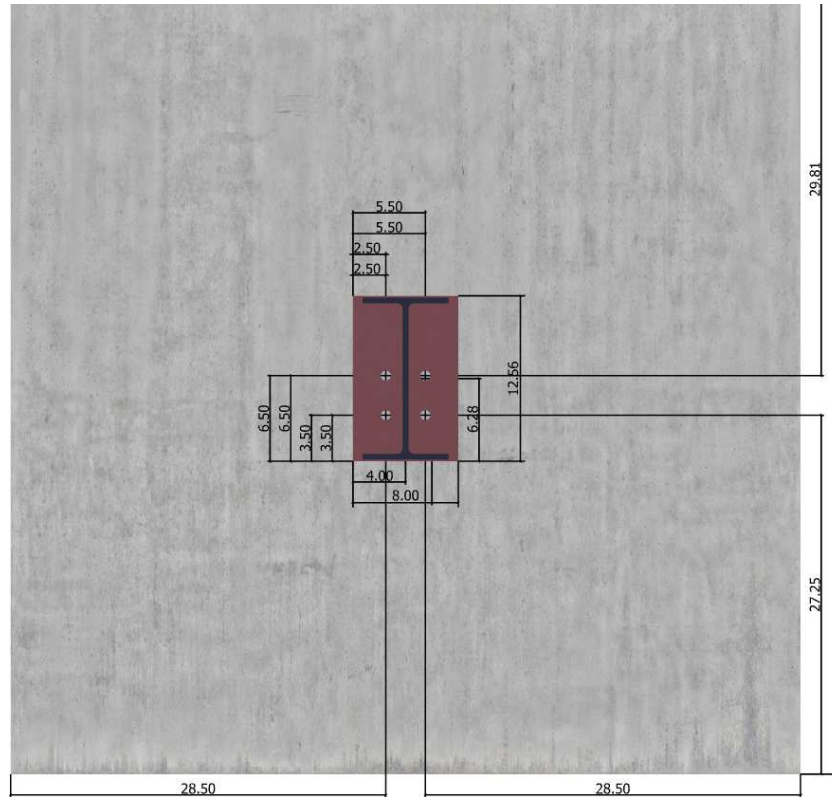




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<Figure 2>





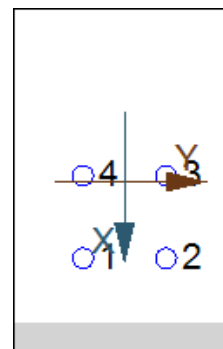
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3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	1402.9	1650.0	0.0	1650.0
2	1402.9	1650.0	0.0	1650.0
3	3188.5	1650.0	0.0	1650.0
4	3188.5	1650.0	0.0	1650.0
Sum	9182.9	6600.0	0.0	6600.0

Maximum concrete compression strain (‰): 0.05
Maximum concrete compression stress (psi): 237
Resultant tension force (lb): 9183
Resultant compression force (lb): 1083
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.58
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N _{sa} (lb)	φ	φN _{sa} (lb)
25050	0.75	18788

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k _c	λ _a	f' _c (psi)	h _{ef} (in)	N _b (lb)
24.0	1.00	3500	10.000	44900

$$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.3.1 \& Eq. 17.4.2.1b)}$$

A _{Nc} (in ²)	A _{Nco} (in ²)	C _{a,min} (in)	Ψ _{ec,N}	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
1089.00	900.00	27.25	0.963	1.000	1.00	1.000	44900	0.70	36607

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$$\phi N_{pn} = \phi \Psi_{c,P} N_p = \phi \Psi_{c,P} 8 A_{brg} f'_c \text{ (Sec. 17.3.1, Eq. 17.4.3.1 \& 17.4.3.4)}$$

Ψ _{c,P}	A _{brg} (in ²)	f' _c (psi)	φ	φN _{pn} (lb)
1.0	0.91	3500	0.70	17856



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8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
15030	1.0	0.65	9770

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$$V_{bx} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}C_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}C_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f'_c (psi)	C_{a1} (in)	V_{bx} (lb)
6.00	0.750	1.00	3500	29.33	84590

$$\phi V_{cbgx} = \phi (A_{Vc}/A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
2640.00	3872.00	1.000	0.894	1.000	1.000	84590	0.70	36106

Shear parallel to edge in y-direction:

$$V_{by} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}C_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}C_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f'_c (psi)	C_{a1} (in)	V_{by} (lb)
6.00	0.750	1.00	3500	28.50	81011

$$\phi V_{cbgy} = \phi (2)(A_{Vc}/A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
2567.57	3655.13	1.000	1.000	1.000	1.000	81011	0.70	79669

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$$\phi V_{cp} = \phi K_{cp}N_{cbg} = \phi K_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b \text{ (Sec. 17.3.1 \& Eq. 17.5.3.1b)}$$

K_{cp}	A_{Nc} (in ²)	A_{Nco} (in ²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cp} (lb)
2.0	1089.00	900.00	1.000	1.000	1.000	1.000	44900	0.70	76060

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status	
Steel	3189	18788	0.17	Pass	
Concrete breakout	9183	36607	0.25	Pass (Governs)	
Pullout	3189	17856	0.18	Pass	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	1650	9770	0.17	Pass	
T Concrete breakout x+	6600	36106	0.18	Pass (Governs)	
 Concrete breakout y+	3300	79669	0.04	Pass (Governs)	
Pryout	6600	76060	0.09	Pass	
Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.25	0.00	25.1%	1.0	Pass

3/4"Ø Heavy Hex Bolt, F1554 Gr. 55 with hef = 10.000 inch meets the selected design criteria.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

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12. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Sections 17.7.1 and 17.7.2 for torqued cast-in-place anchor is waived per designer option.
- Designer must exercise own judgement to determine if this design is suitable.



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Address:	Lee's Summit, MO		
Phone:			
E-mail:			

1. Project information

Customer company: Davidson Architecture & Engineering
Customer contact name:
Customer e-mail:
Comment:

Project description: Anchor Bolt Design for Detail (E)
Location:
Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-14
Units: Imperial units

Anchor Information:

Anchor type: Cast-in-place
Material: F1554 Grade 55
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 10.000
Anchor category: -
Anchor ductility: Yes
 h_{min} (inch): 11.50
 C_{min} (inch): 1.22
 S_{min} (inch): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 44.00
State: Cracked
Compressive strength, f'_c (psi): 3500
 $\Psi_{c,v}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Yes
Build-up grout pad: No

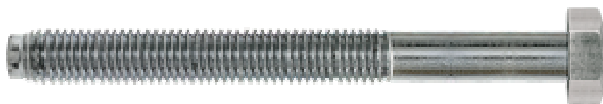
Base Plate

Length x Width x Thickness (inch): 12.75 x 12.00 x 0.38
Yield stress: 36000 psi

Profile type/size: W12X35

Recommended Anchor

Anchor Name: Heavy Hex Bolt - 3/4"Ø Heavy Hex Bolt, F1554 Gr. 55





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Load and Geometry

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: Not applicable

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 10700

V_{uax} [lb]: 9100

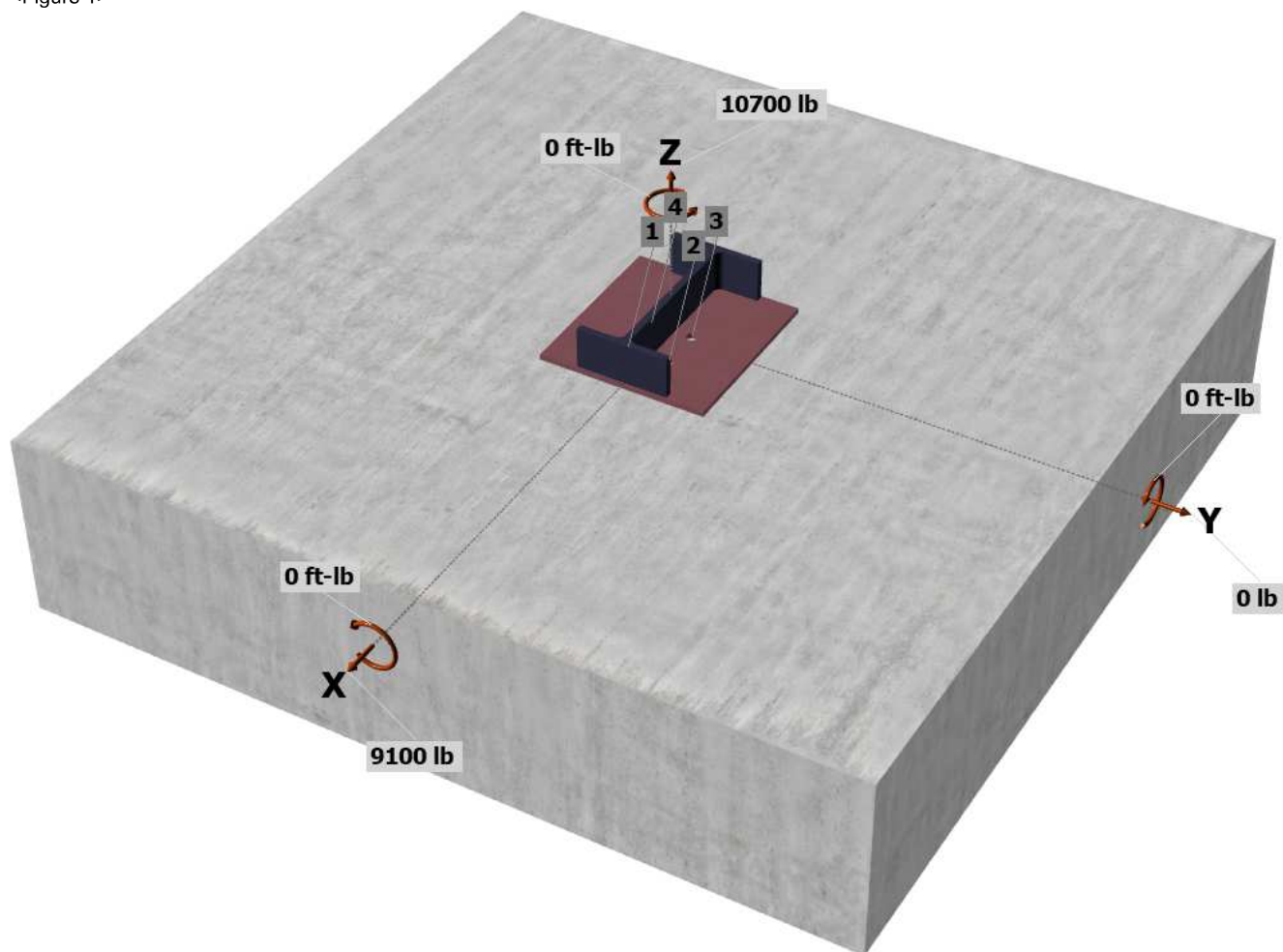
V_{uay} [lb]: 0

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

<Figure 1>

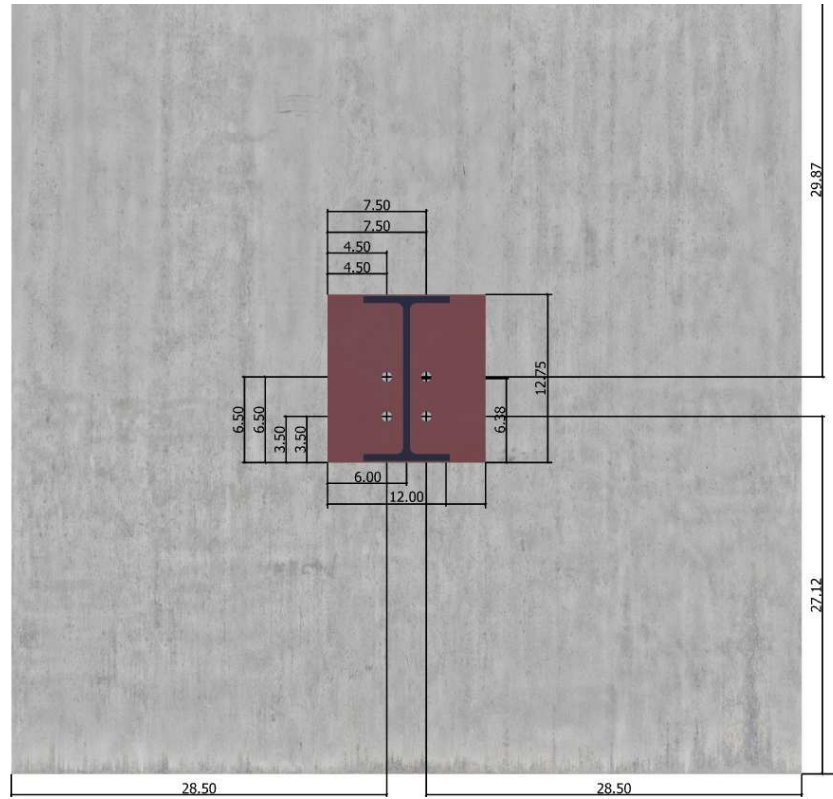




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<Figure 2>



Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

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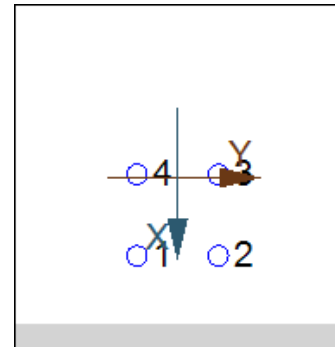
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3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	1927.5	2275.0	0.0	2275.0
2	1927.5	2275.0	0.0	2275.0
3	4252.3	2275.0	0.0	2275.0
4	4252.3	2275.0	0.0	2275.0
Sum	12359.7	9100.0	0.0	9100.0

Maximum concrete compression strain (‰): 0.06
Maximum concrete compression stress (psi): 273
Resultant tension force (lb): 12360
Resultant compression force (lb): 1660
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.56
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N _{sa} (lb)	φ	φN _{sa} (lb)
25050	0.75	18788

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k _c	λ _a	f' _c (psi)	h _{ef} (in)	N _b (lb)
24.0	1.00	3500	10.000	44900

$$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.3.1 \& Eq. 17.4.2.1b)}$$

A _{Nc} (in ²)	A _{Nco} (in ²)	C _{a,min} (in)	Ψ _{ec,N}	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
1089.00	900.00	27.12	0.964	1.000	1.00	1.000	44900	0.70	36651

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$$\phi N_{pn} = \phi \Psi_{c,P} N_p = \phi \Psi_{c,P} 8 A_{brg} f'_c \text{ (Sec. 17.3.1, Eq. 17.4.3.1 \& 17.4.3.4)}$$

Ψ _{c,P}	A _{brg} (in ²)	f' _c (psi)	φ	φN _{pn} (lb)
1.0	0.91	3500	0.70	17856



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8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
15030	1.0	0.65	9770

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$$V_{bx} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}C_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}C_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f'_c (psi)	C_{a1} (in)	V_{bx} (lb)
6.00	0.750	1.00	3500	29.33	84590

$$\phi V_{cbgx} = \phi (A_{Vc}/A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
2640.00	3872.00	1.000	0.894	1.000	1.000	84590	0.70	36106

Shear parallel to edge in y-direction:

$$V_{by} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}C_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}C_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f'_c (psi)	C_{a1} (in)	V_{by} (lb)
6.00	0.750	1.00	3500	28.50	81011

$$\phi V_{cbgy} = \phi (2)(A_{Vc}/A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1b)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
2564.57	3655.13	1.000	1.000	1.000	1.000	81011	0.70	79576

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$$\phi V_{cp} = \phi K_{cp}N_{cbg} = \phi K_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b \text{ (Sec. 17.3.1 \& Eq. 17.5.3.1b)}$$

K_{cp}	A_{Nc} (in ²)	A_{Nco} (in ²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cp} (lb)
2.0	1089.00	900.00	1.000	1.000	1.000	1.000	44900	0.70	76060

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status	
Steel	4252	18788	0.23	Pass	
Concrete breakout	12360	36651	0.34	Pass (Governs)	
Pullout	4252	17856	0.24	Pass	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	2275	9770	0.23	Pass	
T Concrete breakout x+	9100	36106	0.25	Pass (Governs)	
 Concrete breakout y+	4550	79576	0.06	Pass (Governs)	
Pryout	9100	76060	0.12	Pass	
Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.34	0.00	33.7%	1.0	Pass

3/4"Ø Heavy Hex Bolt, F1554 Gr. 55 with hef = 10.000 inch meets the selected design criteria.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

Simpson Strong-Tie Company Inc. 5956 W. Las Positas Boulevard Pleasanton, CA 94588 Phone: 925.560.9000 Fax: 925.847.3871 www.strongtie.com



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Phone:			
E-mail:			

12. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Sections 17.7.1 and 17.7.2 for torqued cast-in-place anchor is waived per designer option.
- Designer must exercise own judgement to determine if this design is suitable.



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Project:	D-Bats		
Address:	Lee's Summit, MO		
Phone:			
E-mail:			

1. Project information

Customer company: Davidson Architecture & Engineering
Customer contact name:
Customer e-mail:
Comment:

Project description: Anchor Bolt Design for Detail (F)
Location:
Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-14
Units: Imperial units

Anchor Information:

Anchor type: Cast-in-place
Material: F1554 Grade 55
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 10.000
Anchor category: -
Anchor ductility: Yes
 h_{min} (inch): 11.50
 C_{min} (inch): 1.22
 S_{min} (inch): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 44.00
State: Cracked
Compressive strength, f'_c (psi): 3500
 $\Psi_{c,v}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Yes
Build-up grout pad: No

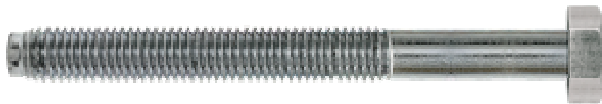
Base Plate

Length x Width x Thickness (inch): 16.00 x 10.00 x 0.25
Yield stress: 36000 psi

Profile type/size: HSS7X0.375

Recommended Anchor

Anchor Name: Heavy Hex Bolt - 3/4"Ø Heavy Hex Bolt, F1554 Gr. 55





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Load and Geometry

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: Not applicable

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 17500

V_{uax} [lb]: 0

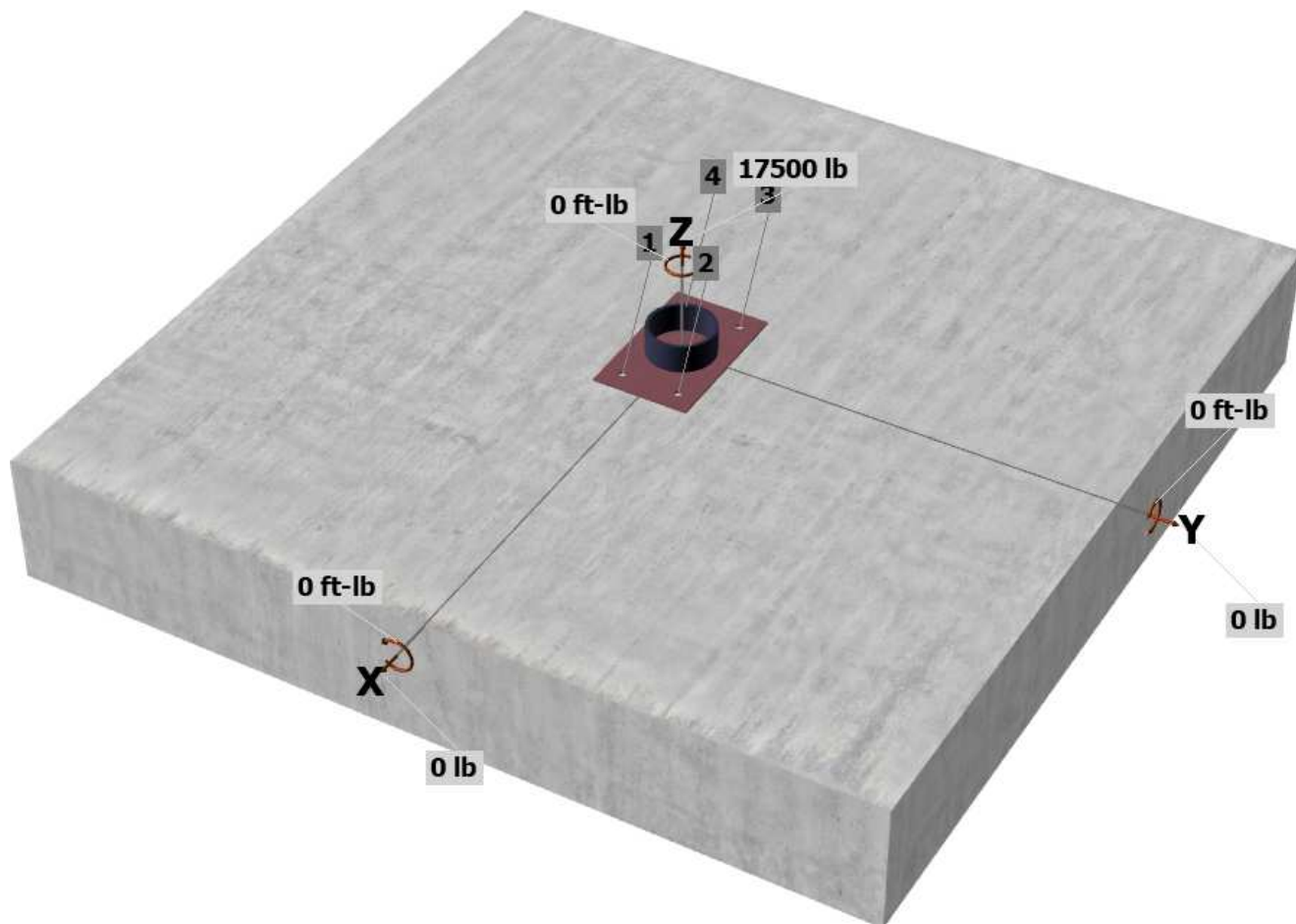
V_{uay} [lb]: 0

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

<Figure 1>

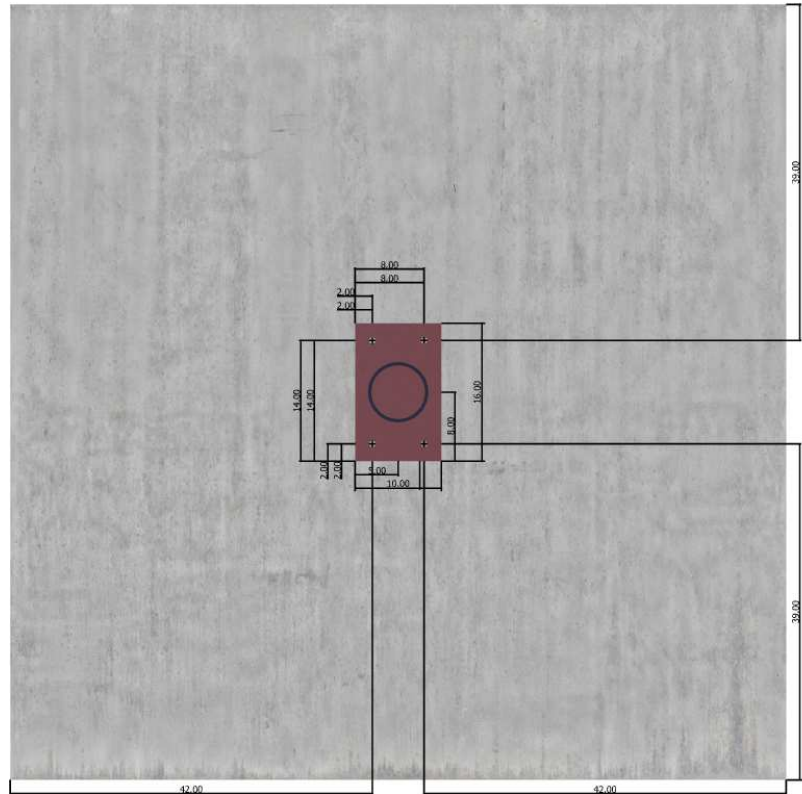




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<Figure 2>





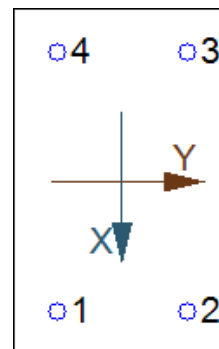
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3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	4375.0	0.0	0.0	0.0
2	4375.0	0.0	0.0	0.0
3	4375.0	0.0	0.0	0.0
4	4375.0	0.0	0.0	0.0
Sum	17500.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 17500
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N _{sa} (lb)	φ	φN _{sa} (lb)
25050	0.75	18788

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k _c	λ _a	f' _c (psi)	h _{ef} (in)	N _b (lb)
24.0	1.00	3500	10.000	44900

$$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.3.1 \& Eq. 17.4.2.1b)}$$

A _{Nc} (in ²)	A _{Nco} (in ²)	C _{a,min} (in)	Ψ _{ec,N}	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
1512.00	900.00	39.00	1.000	1.000	1.00	1.000	44900	0.70	52802

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$$\phi N_{pn} = \phi \Psi_{c,P} N_p = \phi \Psi_{c,P} 8 A_{brg} f'_c \text{ (Sec. 17.3.1, Eq. 17.4.3.1 \& 17.4.3.4)}$$

Ψ _{c,P}	A _{brg} (in ²)	f' _c (psi)	φ	φN _{pn} (lb)
1.0	0.91	3500	0.70	17856



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11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	4375	18788	0.23	Pass
Concrete breakout	17500	52802	0.33	Pass (Governs)
Pullout	4375	17856	0.25	Pass

3/4"Ø Heavy Hex Bolt, F1554 Gr. 55 with hef = 10.000 inch meets the selected design criteria.

12. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Sections 17.7.1 and 17.7.2 for torqued cast-in-place anchor is waived per designer option.
- Designer must exercise own judgement to determine if this design is suitable.

Miscellaneous

Hair Pin Design

- Required hair Pin area of steel

$$A_{hair} = \frac{T \sqrt{z}}{z (f_t)}$$

$$T = 7.4 \text{ K (ASD load governing combination)}$$

$$f_t = 24 \text{ Ksi (Tension stress)}$$

$$= \frac{(7.4 \text{ K}) \sqrt{z}}{z (24 \text{ Ksi})}$$

#5 recommended for corrosion resistance

$$= 0.22 \text{ in}^2$$

$$\text{USE \#6 hair Pin} = 0.44 \text{ in}^2$$

- Required length of hair Pin

$$A_w = 0.058 \text{ in}^2 \text{ area of } 6 \times 6 \text{ W2.9} \times 2.9 \text{ WWF}$$

$$\overline{f_t}$$

- Reinforced slab service load resistance

$$A_w \times f_t = 0.058 \text{ in}^2 / \overline{f_t} \times 24 \text{ Ksi} = 1.39 \text{ K}/\overline{f_t} \text{ of slab width}$$

- Total width of slab to be engaged

$$\frac{7.4 \text{ K}}{1.39 \text{ K}/\overline{f_t}} = 5.32 \text{ ft}$$

- Development length (ACI Table 25.4.2.2, 318-11)

$$\left(\frac{3 f_y \psi_t \psi_e}{50 \lambda \sqrt{f'_c}} \right) d_b$$

$$f_y = 60,000 \text{ Psi}$$

$$\psi_t = 1.0$$

$$\psi_e = 1.0$$

$$\lambda = 1.0$$

$$f'_c = 3,500 \text{ Psi}$$

$$d_b = 3/8"$$

$$= \frac{3(60,000)(1)(1)}{50(1)\sqrt{3,500}} \left(\frac{3}{8} \right)$$

$$= 22.8"$$

$$A_b > A_{hair} \therefore \text{OK}$$

$$L > l_d \therefore \text{OK}$$

USE 8'-0", #6 hair Pin

