BHB STRUCTURAL

Structural Calculations

BHB Project # 201247

Salt Lake Community College Remodel

4600 South Redwood Road
Taylorsville, UT 84123

Prepared For:

JRCA Architects, Inc.
577 South 200 East
Salt Lake City, Utah 84111

Prepared By:

AP

Rev 0
12/4/2020

These calculations were prepared solely for the client and project listed on the cover sheet. They shall not
be copied or used for the benefit of any other party or project.

	Width	Depth	in2	ft2	Weight	
Slab	60	5	300	2.083333	313	lbs
Beam	7	20	210	1.458333	219	lbs
					531	lbs
				/60	106	psf

Gravel	50	psf
Misc	15	psf

D	171	psf
L	100	psf

Wall D	112.5	psf
lt	11	ft
Wall D	50	psf
lt	11.5	ft
	1813	plf

Project:	Sheet:	2
	Job#:	
	Date:	12/4/20
	By:	AP

Steel Beam Design per AISC 360

File Name	
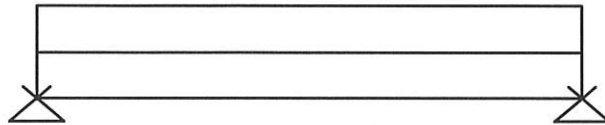
Section Input

Section Input		
Fy	50	ksi
E	29000	ksi
Beam	W16X26	
Enter Beam Size		

⦿ W Section
○ HSS Rectangle
○ HSS Square

Loads Input

Loads Input		
Trib	15	ft
DL	171	psf
LL	100	psf
Lr	0	psf

Design Aid	Distribute Loads	Clear Loads

Controlling Load Combination = 2

Beam Criteria

Span – L	Lb	SR max	LL Defl.	TL Defl.	Axis of Bending	Design Method	Ω	f_1
10.00 ft	1.00 ft	0.90	360	600	Strong Axis	ASD	1.67	0.5

Uniform and Trapezoidal Loads

	Location			Dead Loads			Live Loads			Roof Live Loads		
	X Start	X End		Start	End		Start	End		Start	End	
w1	0.00	10.00	ft	2.565	2.565	klf	1.500	1.500	klf	0.000	0.000	klf
w2	0.00	10.00	ft	2.000	2.000	klf	0.000	0.000	klf	0.000	0.000	klf
w3	0.00	0.00	ft	0.000	0.000	klf	0.000	0.000	klf	0.000	0.000	klf
w4	0.00	0.00	ft	0.000	0.000	klf	0.000	0.000	klf	0.000	0.000	klf

Concentrated Loads

	Location		DL		LL		Lr	
P1	0.00	ft	0.00	k	0.00	k	0.00	k
P2	0.00	ft	0.00	k	0.00	k	0.00	k
P3	0.00	ft	0.00	k	0.00	k	0.00	k
P4	0.00	ft	0.00	k	0.00	k	0.00	k

Fixed End Moments

	Left	Right	
DL	0.000	0.000	k-ft
LL	0.000	0.000	k-ft
Lr	0.000	0.000	k-ft
NOTE: Positive = CCW			

Output

SHAPE	NAME	Lp (ft)	Lr (ft)	Z provided (in3)	I provided (in4)
W	W16X26	3.96	11.21	44.20	301.00

Allowable Live Load Deflection	0.3333333	in	Actual Live Load Deflection	0.04	in	Pass
Allowable Total Load Deflection	0.20	in	Actual Total Load Deflection	0.16	in	Pass
Mn/Ω	110.3	k-ft	Ma	75.8	k-ft	Pass

Ma	75.8	k-ft
Va	30.33	k

Unfactored Reactions

	Left	Right	
Dead Loads	22.825	22.825	k
Live/Snow Loads	7.5	7.5	k
Total Loads	30.325	30.325	k

Loads are acceptable
Live load deflections are acceptable
Total load deflections are acceptable

Steel Beam

File = C:\Users\Alexp\Desktop\JRCA\SLCC\CALCUL~1\SLCC.ec6 .
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BHB CONSULTING ENGINEERS

DESCRIPTION: Cantilevered steel beam

CODE REFERENCES

Calculations per AISC 360-10, IBC 2012, CBC 2013, ASCE 7-10
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design	Fy : Steel Yield : 50.0 ksi
Beam Bracing : Completely Unbraced	E: Modulus : 29,000.0 ksi
Bending Axis : Major Axis Bending	

Beam diagram: D(23) L(8); D(0.4); D(1.05) L(0.6); D(0.4); D(1.05) L(0.6); W16x31; W16x31; Span = 12.0 ft; Span = 3.0 ft

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load for Span Number 1
  Uniform Load : D = 0.1750, L = 0.10 ksf, Tributary Width = 6.0 ft, (Floor)

  Uniform Load : D = 0.40 k/ft, Tributary Width = 1.0 ft, (Wall)

Load for Span Number 2
  Uniform Load : D = 0.1750, L = 0.10 ksf, Tributary Width = 6.0 ft, (Floor)

  Point Load : D = 23.0, L = 8.0 k @ 3.0 ft, (Perp beam)

  Uniform Load : D = 0.40 k/ft, Tributary Width = 1.0 ft, (Wall)

DESIGN SUMMARY

Design N.G.

Maximum Bending Stress Ratio =	0.759 : 1	Maximum Shear Stress Ratio =	0.425 : 1
Section used for this span	W16x31	Section used for this span	W16x31
Ma : Applied	102.225 k-ft	Va : Applied	37.150 k
Mn / Omega : Allowable	134.731 k-ft	Vn/Omega : Allowable	87.450 k
Load Combination	+D+L+H, LL Comb Run (LL)	Load Combination	+D+L+H, LL Comb Run (*L)
Location of maximum on span	12.000 ft	Location of maximum on span	12.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection
Max Downward Transient Deflection	0.063 in	Ratio =	1,137 >=360
Max Upward Transient Deflection	-0.021 in	Ratio =	3,496 >=360
Max Downward Total Deflection	0.193 in	Ratio =	374 <600.0
Max Upward Total Deflection	-0.091 in	Ratio =	1578 >=600.

Good enough!

Maximum Forces & Stresses for Load Combinations

Load Combination	Span #	Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length		M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+L+H, LL Comb Run (*L)													
Dsgn. L = 12.00 ft	1	0.759	0.425	0.01	-102.23	102.23	225.00	134.73	2.34	1.00	37.15	131.18	87.45
Dsgn. L = 3.00 ft	2	0.759	0.425		-102.23	102.23	225.00	134.73	1.00	1.00	37.15	131.18	87.45
+D+L+H, LL Comb Run (L*)													
Dsgn. L = 12.00 ft	1	0.561	0.313	8.80	-75.53	75.53	225.00	134.73	3.00	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+L+H, LL Comb Run (LL)													

Title Block Line 1
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using the "Settings" menu item
and then using the "Printing &
Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

4

Printed: 2 DEC 2020, 8:31AM

Steel Beam

DESCRIPTION: Cantilevered steel beam

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Dsgn. L = 12.00 ft	1	0.759	0.425	3.49	-102.23	102.23	225.00	134.73	2.74	1.00	37.15	131.18	87.45
Dsgn. L = 3.00 ft	2	0.759	0.425		-102.23	102.23	225.00	134.73	1.00	1.00	37.15	131.18	87.45
+D+Lr+H, LL Comb Run (*L)													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+Lr+H, LL Comb Run (L*)													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+Lr+H, LL Comb Run (LL)													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+S+H													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750Lr+0.750L+H, LL Comb Run (*													
Dsgn. L = 12.00 ft	1	0.709	0.397	0.19	-95.55	95.55	225.00	134.73	2.41	1.00	34.70	131.18	87.45
Dsgn. L = 3.00 ft	2	0.709	0.397		-95.55	95.55	225.00	134.73	1.00	1.00	34.70	131.18	87.45
+D+0.750Lr+0.750L+H, LL Comb Run (L													
Dsgn. L = 12.00 ft	1	0.561	0.313	6.86	-75.53	75.53	225.00	134.73	2.98	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750Lr+0.750L+H, LL Comb Run (L													
Dsgn. L = 12.00 ft	1	0.709	0.397	3.11	-95.55	95.55	225.00	134.73	2.73	1.00	34.70	131.18	87.45
Dsgn. L = 3.00 ft	2	0.709	0.397		-95.55	95.55	225.00	134.73	1.00	1.00	34.70	131.18	87.45
+D+0.750L+0.750S+H, LL Comb Run (*L													
Dsgn. L = 12.00 ft	1	0.709	0.397	0.19	-95.55	95.55	225.00	134.73	2.41	1.00	34.70	131.18	87.45
Dsgn. L = 3.00 ft	2	0.709	0.397		-95.55	95.55	225.00	134.73	1.00	1.00	34.70	131.18	87.45
+D+0.750L+0.750S+H, LL Comb Run (L'													
Dsgn. L = 12.00 ft	1	0.561	0.313	6.86	-75.53	75.53	225.00	134.73	2.98	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750L+0.750S+H, LL Comb Run (LI													
Dsgn. L = 12.00 ft	1	0.709	0.397	3.11	-95.55	95.55	225.00	134.73	2.73	1.00	34.70	131.18	87.45
Dsgn. L = 3.00 ft	2	0.709	0.397		-95.55	95.55	225.00	134.73	1.00	1.00	34.70	131.18	87.45
+D+0.60W+H													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750Lr+0.450W+H, LL Comb Run ('													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750Lr+0.450W+H, LL Comb Run (I													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750Lr+0.450W+H, LL Comb Run (I													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750S+0.450W+H													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+0.60D+0.60W+0.60H													
Dsgn. L = 12.00 ft	1	0.336	0.188	1.20	-45.32	45.32	225.00	134.73	2.70	1.00	16.41	131.18	87.45
Dsgn. L = 3.00 ft	2	0.336	0.188		-45.32	45.32	225.00	134.73	1.00	1.00	16.41	131.18	87.45
+D+0.70E+0.60H													
Dsgn. L = 12.00 ft	1	0.561	0.313	2.00	-75.53	75.53	225.00	134.73	2.70	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750L+0.750S+0.5250E+H, LL Con													
Dsgn. L = 12.00 ft	1	0.709	0.397	0.19	-95.55	95.55	225.00	134.73	2.41	1.00	34.70	131.18	87.45
Dsgn. L = 3.00 ft	2	0.709	0.397		-95.55	95.55	225.00	134.73	1.00	1.00	34.70	131.18	87.45
+D+0.750L+0.750S+0.5250E+H, LL Con													
Dsgn. L = 12.00 ft	1	0.561	0.313	6.86	-75.53	75.53	225.00	134.73	2.98	1.00	27.35	131.18	87.45
Dsgn. L = 3.00 ft	2	0.561	0.313		-75.53	75.53	225.00	134.73	1.00	1.00	27.35	131.18	87.45
+D+0.750L+0.750S+0.5250E+H, LL Con													
Dsgn. L = 12.00 ft	1	0.709	0.397	3.11	-95.55	95.55	225.00	134.73	2.73	1.00	34.70	131.18	87.45
Dsgn. L = 3.00 ft	2	0.709	0.397		-95.55	95.55	225.00	134.73	1.00	1.00	34.70	131.18	87.45
+0.60D+0.70E+H													
Dsgn. L = 12.00 ft	1	0.336	0.188	1.20	-45.32	45.32	225.00	134.73	2.70	1.00	16.41	131.18	87.45
Dsgn. L = 3.00 ft	2	0.336	0.188		-45.32	45.32	225.00	134.73	1.00	1.00	16.41	131.18	87.45

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+L+H	-0.0913	7.584

Title Block Line 1
You can change this area
using the "Settings" menu item
and then using the "Printing &
Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

DESCRIPTION: Cantilevered steel beam

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	2	0.1926	3.000		0.0000	7.584

Vertical Reactions

Support notation : Far left is #1   Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	6.006	57.969	
Overall MINimum	0.181	3.600	
+D+H	2.406	42.344	
+D+L+H, LL Comb Run (*L)	0.181	54.369	
+D+L+H, LL Comb Run (L*)	6.006	45.944	
+D+L+H, LL Comb Run (LL)	3.781	57.969	
+D+Lr+H, LL Comb Run (*L)	2.406	42.344	
+D+Lr+H, LL Comb Run (L*)	2.406	42.344	
+D+Lr+H, LL Comb Run (LL)	2.406	42.344	
+D+S+H	2.406	42.344	
+D+0.750Lr+0.750L+H, LL Comb Run (*	0.737	51.363	
+D+0.750Lr+0.750L+H, LL Comb Run (L	5.106	45.044	
+D+0.750Lr+0.750L+H, LL Comb Run (L	3.437	54.063	
+D+0.750L+0.750S+H, LL Comb Run (*L	0.737	51.363	
+D+0.750L+0.750S+H, LL Comb Run (L'	5.106	45.044	
+D+0.750L+0.750S+H, LL Comb Run (LI	3.437	54.063	
+D+0.60W+H	2.406	42.344	
+D+0.750Lr+0.450W+H, LL Comb Run ('	2.406	42.344	
+D+0.750Lr+0.450W+H, LL Comb Run (I	2.406	42.344	
+D+0.750Lr+0.450W+H, LL Comb Run (I	2.406	42.344	
+D+0.750S+0.450W+H	2.406	42.344	
+0.60D+0.60W+0.60H	1.444	25.406	
+D+0.70E+0.60H	2.406	42.344	
+D+0.750L+0.750S+0.5250E+H, LL Con	0.737	51.363	
+D+0.750L+0.750S+0.5250E+H, LL Con	5.106	45.044	
+D+0.750L+0.750S+0.5250E+H, LL Con	3.437	54.063	
+0.60D+0.70E+H	1.444	25.406	
D Only	2.406	42.344	
Lr Only, LL Comb Run (*L)			
Lr Only, LL Comb Run (L*)			
Lr Only, LL Comb Run (LL)			
L Only, LL Comb Run (*L)	-2.225	12.025	
L Only, LL Comb Run (L*)	3.600	3.600	
L Only, LL Comb Run (LL)	1.375	15.625	
S Only			
W Only			
E Only			
H Only			

Steel Column

File Name	
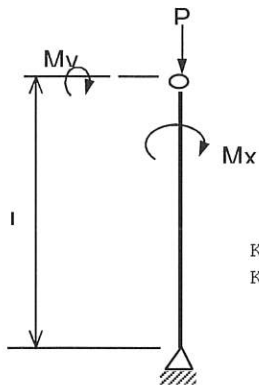
Kx 1.0
Ky 1.0

Column Loads

P_{DL}	0.00	k
P_{LL}	58.00	k
$P_{S/Lr}$	0.00	k
P_W	0.00	k
P_E	0.00	k
M_{DL-X}	0.00	k-ft
M_{DL-Y}	0.00	k-ft
M_{LL-X}	0.00	k-ft
M_{LL-Y}	0.00	k-ft
$M_{S/Lr-X}$	0.00	k-ft
$M_{S/Lr-Y}$	0.00	k-ft
M_{WIND-X}	0.00	k-ft
M_{WIND-Y}	0.00	k-ft
M_{SEIS-X}	0.00	k-ft
M_{SEIS-Y}	0.00	k-ft
f1	1	
f2	0.5	

Beam Geometry

Col. unbraced Lx =	12.0	ft
Col. unbraced Ly =	12.0	ft
Beam unbraced Lx =	12.0	ft
Beam unbraced Ly =	12.0	ft

Load Combinations per IBC 2018

1. D
2. D+L
3. D+(Lr or S)
4. D+0.75L+0.75(Lr or S)
5. D+(0.6W or 0.7E)
6. D+0.75(0.6W or 0.7E)+0.75L+0.75(Lr or S)
7. 0.6D+0.6W
8. 0.6D+0.7E

Controlling Load Combination	2

Member Properties

Section	HSS4x4x3/8	
Ag	4.78	in^2
Sx	5.13	in^3
Sy	5.13	in^3
rx	1.47	in
ry	1.47	in
wt	17.20	lbs/ft
Ix	10.3	in^4
Iy	0	in^4

Material Properties

Steel Type	A500 gr. C	
Fy	50	ksi
E	29000	ksi
S_{DS}	0.21	
Ω	2.5	

Design Controls

Code Year	2018
Design Criteria	ASD

☑ Pin Connection at Base Plate

Cross Section

$\Omega c/b =$ 1.67

Analysis

Nominal Compressive Strength (Pn = FcrAg)	118	k
Allowable Axial Compressive Strength (Pc = Pn/Ωc)	71	k
Nominal Flexural Strength (Mnx = FyZx)	27	k-ft
Nominal Flexural Strength (Mny = FyZy)	27	k-ft
Allowable Flexural Strength (Mcx = Mnx/Ωb)	16	k-ft
Allowable Flexural Strength (Mcy = Mny/Ωb)	16	k-ft

Unity Check

Required Axial Compressive Strength (Pr)	58.0	k
Required Flexural Strength (Mcx)	0.0	k-ft
Required Flexural Strength (Mcy)	0.0	k-ft
Eq H1-1a: Pr/Pc≥0.2 Pr/Pc + 8/9(Mrx/Mcx+Mry/Mcy)	0.817	Pass
Eq H1-1b: Pr/Pc<0.2 Pr/(2Pc) + (Mrx/Mcx+Mry/Mcy)	NA	

Base Plate

◉ Type 1
○ Type 2
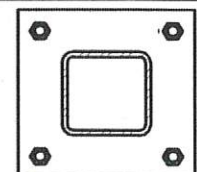
Use 7/8 Base Plate Type 1 Minimum

SIMPSON Anchor Designer™ Software Version 2.9.7376.1
Strong-Tie

Company:		Date:	12/2/2020
Engineer:		Page:	1/5
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E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 6.000
Effective Embedment depth, h_{ef} (inch): 4.640
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 9.58
c_{ac} (inch): 7.00
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 12.00
State: Cracked
Compressive strength, f'_c (psi): 4000
$\Psi_{c,v}$: 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: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 12.00 x 19.00 x 0.50
Yield stress: 24000 psi

Profile type/size: W16X31

Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:6" (152mm)
Code Report: ICC-ES ESR-2713

SIMPSON Anchor Designer™
Strong-Tie Software
Version 2.9.7376.1 ®

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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]: 0
V_{uax} [lb]: 0
V_{uay} [lb]: 16200
M_{ux} [ft-lb]: 4050
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0
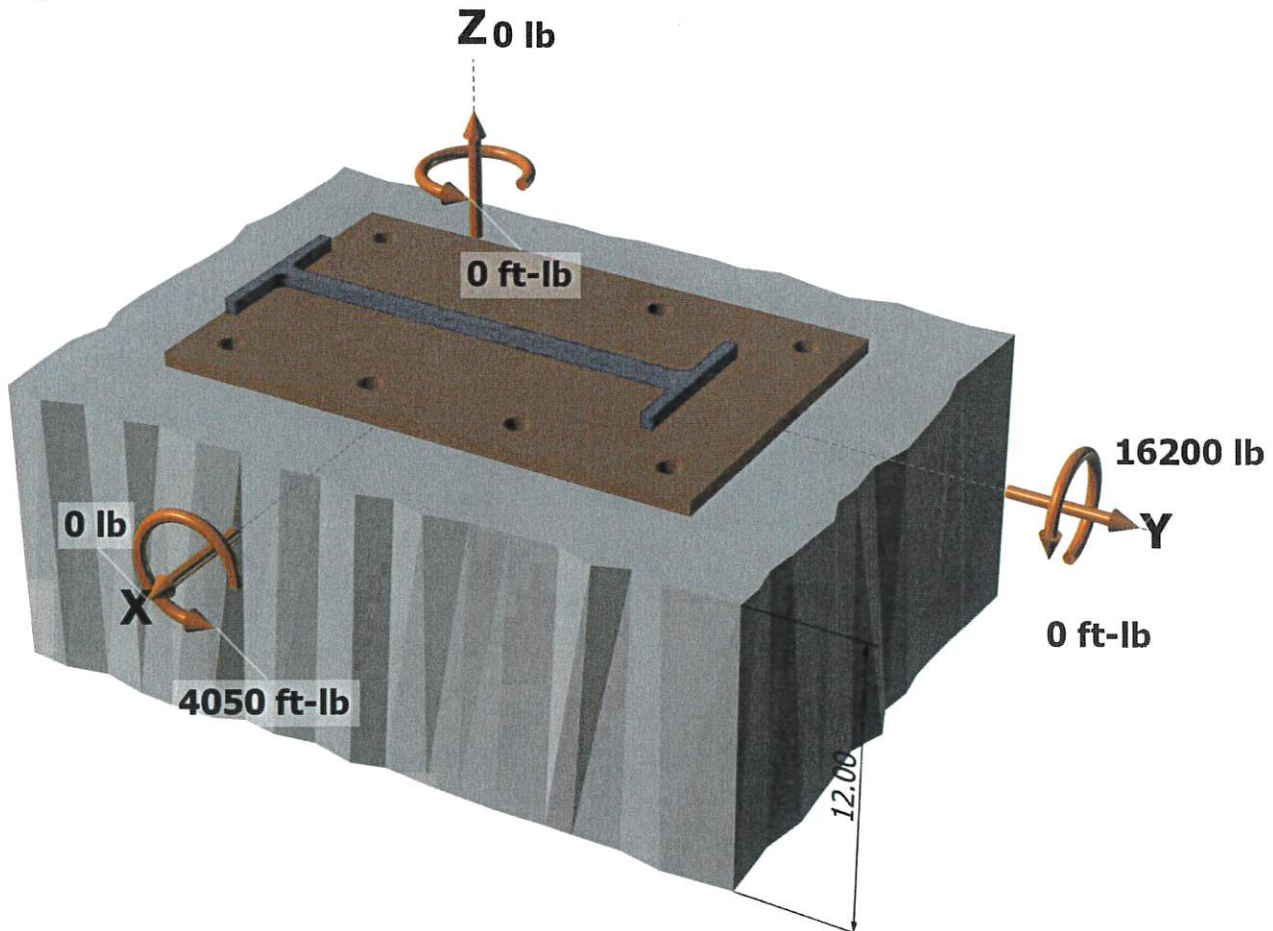
<Figure 1>

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<Figure 2>
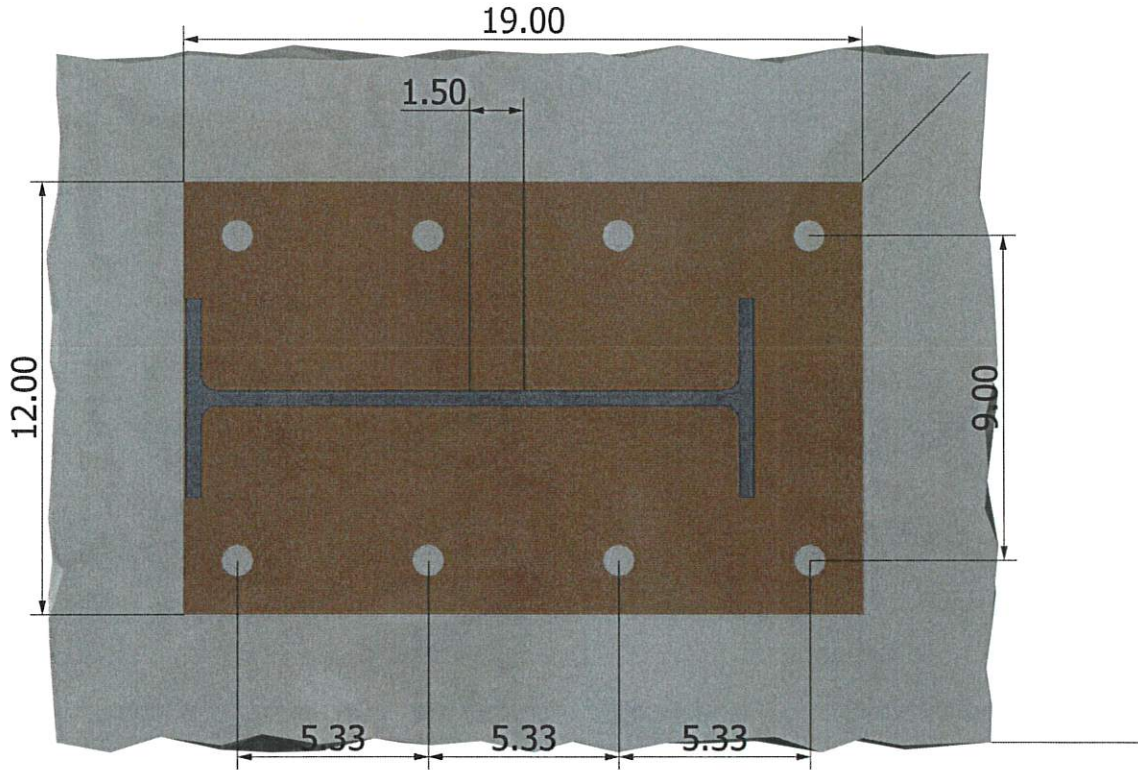
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SIMPSON **Strong-Tie** ®	Anchor Designer™ Software Version 2.9.7376.1	Engineer:		Page:	4/5
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3. Resulting Anchor Forces

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	0.0	0.0	2025.0	2025.0
2	163.3	0.0	2025.0	2025.0
3	616.5	0.0	2025.0	2025.0
4	1069.7	0.0	2025.0	2025.0
5	1069.7	0.0	2025.0	2025.0
6	616.5	0.0	2025.0	2025.0
7	163.3	0.0	2025.0	2025.0
8	0.0	0.0	2025.0	2025.0
Sum	3698.9	0.0	16200.0	16200.0

Maximum concrete compression strain (‰): 0.03
Maximum concrete compression stress (psi): 125
Resultant tension force (lb): 3699
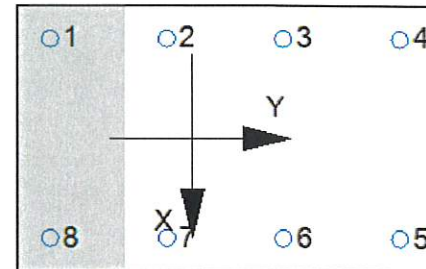Resultant compression force (lb): 3699
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 2.61
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, 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)
45540	0.65	29601

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

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

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	4000	4.640	10746

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

A_{Nc} (in²)	A_{Nco} (in²)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
563.37	193.77	-	0.727	1.000	1.00	1.000	10746	0.65	14767

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

$\phi N_{pn} = \phi \Psi_{c,P} \lambda_a N_p (f'_c/2,500)^n$ (Sec. 17.3.1, Eq. 17.4.3.1 & Code Report)

$\Psi_{c,P}$	λ_a	N_p (lb)	f'_c (psi)	n	ϕ	ϕN_{pn} (lb)
1.0	1.00	6820	4000	0.50	0.65	5607

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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)
16840	1.0	0.60	10104

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

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (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_{cpg} (lb)
2.0	685.54	193.77	1.000	1.000	1.000	1.000	10746	0.70	53228

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	1070	29601	0.04	Pass
Concrete breakout	**3699**	**14767**	**0.25**	**Pass (Governs)**
Pullout	1070	5607	0.19	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	2025	10104	0.20	Pass
Pryout	**16200**	**53228**	**0.30**	**Pass (Governs)**

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..2	0.00	0.30	30.4%	1.0	Pass

3/4"Ø Titen HD, hnom:6" (152mm) meets the selected design criteria.

Base Plate Thickness

Required base plate thickness: 0.350 inch

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.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

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General Footing

Lic. # : KW-06005009

BHB CONSULTING ENGINEERS

DESCRIPTION: Spot footing

Code References

Calculations per ACI 318-11, IBC 2012, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
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	=	1.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	0.0 ft
Allow press. increase per foot of depth	=	0.0 ksf
when footing base is below	=	0.0 ft

Increases based on footing plan dimension
Allowable pressure increase per foot of depth

when max. length or width is greater than	=	0.0 ksf
	=	0.0 ft

Dimensions

Width parallel to X-X Axis	=	7.0 ft
Length parallel to Z-Z Axis	=	7.0 ft
Footing Thickness	=	13.0 in

Pedestal dimensions...		
px : parallel to X-X Axis	=	10.0 in
pz : parallel to Z-Z Axis	=	10.0 in
Height	=	0.0 in
Rebar Centerline to Edge of Concrete...		
at Bottom of footing	=	3.0 in
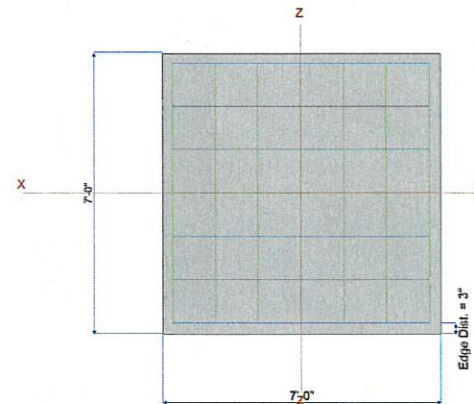
Reinforcing

Bars parallel to X-X Axis		
Number of Bars	=	7.0
Reinforcing Bar Size	=	# 5
Bars parallel to Z-Z Axis		
Number of Bars	=	7.0
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	=	60.0	0.0	0.0	0.0	0.0	0.0	0.0 k
OB : Overburden	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 ksf
M-xx	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 k-ft
M-zz	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 k-ft
V-x	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 k
V-z	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 k

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General Footing

Lic. # : KW-06005009

BHB CONSULTING ENGINEERS

DESCRIPTION: Spot footing

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9213	Soil Bearing	1.382 ksf	1.50 ksf	D Only 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	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.6063	Z Flexure (+X)	8.149 k-ft/ft	13.441 k-ft/ft	+1.40D
PASS	0.6063	Z Flexure (-X)	8.149 k-ft/ft	13.441 k-ft/ft	+1.40D
PASS	0.6063	X Flexure (+Z)	8.149 k-ft/ft	13.441 k-ft/ft	+1.40D
PASS	0.6063	X Flexure (-Z)	8.149 k-ft/ft	13.441 k-ft/ft	+1.40D
PASS	0.4267	1-way Shear (+X)	32.0 psi	75.0 psi	+1.40D
PASS	0.4267	1-way Shear (-X)	32.0 psi	75.0 psi	+1.40D
PASS	0.4267	1-way Shear (+Z)	32.0 psi	75.0 psi	+1.40D
PASS	0.4267	1-way Shear (-Z)	32.0 psi	75.0 psi	+1.40D
PASS	0.6597	2-way Punching	98.952 psi	150.0 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.50	n/a	0.0	1.382	1.382	n/a	n/a	0.921
X-X, +0.60D	1.50	n/a	0.0	0.8289	0.8289	n/a	n/a	0.553
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	1.382	1.382	0.921
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.8289	0.8289	0.553

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	8.149	+Z	Bottom	0.2808	Min Temp %	0.310	13.441	OK
X-X, +1.40D	8.149	-Z	Bottom	0.2808	Min Temp %	0.310	13.441	OK
X-X, +1.20D	6.985	+Z	Bottom	0.2808	Min Temp %	0.310	13.441	OK
X-X, +1.20D	6.985	-Z	Bottom	0.2808	Min Temp %	0.310	13.441	OK
X-X, +0.90D	5.239	+Z	Bottom	0.2808	Min Temp %	0.310	13.441	OK
X-X, +0.90D	5.239	-Z	Bottom	0.2808	Min Temp %	0.310	13.441	OK
Z-Z, +1.40D	8.149	-X	Bottom	0.2808	Min Temp %	0.310	13.441	OK
Z-Z, +1.40D	8.149	+X	Bottom	0.2808	Min Temp %	0.310	13.441	OK
Z-Z, +1.20D	6.985	-X	Bottom	0.2808	Min Temp %	0.310	13.441	OK
Z-Z, +1.20D	6.985	+X	Bottom	0.2808	Min Temp %	0.310	13.441	OK
Z-Z, +0.90D	5.239	-X	Bottom	0.2808	Min Temp %	0.310	13.441	OK
Z-Z, +0.90D	5.239	+X	Bottom	0.2808	Min Temp %	0.310	13.441	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	32.00 psi	32.00 psi	32.00 psi	32.00 psi	32.00 psi	75.00 psi	0.43	OK
+1.20D	27.43 psi	27.43 psi	27.43 psi	27.43 psi	27.43 psi	75.00 psi	0.37	OK
+0.90D	20.57 psi	20.57 psi	20.57 psi	20.57 psi	20.57 psi	75.00 psi	0.27	OK

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General Footing

Lic. # : KW-06005009

DESCRIPTION: Spot footing

Two-Way "Punching" Shear

All units ^{k}

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	98.95 psi	150.00 psi	0.6597	OK
+1.20D	84.82 psi	150.00 psi	0.5654	OK
+0.90D	63.61 psi	150.00 psi	0.4241	OK