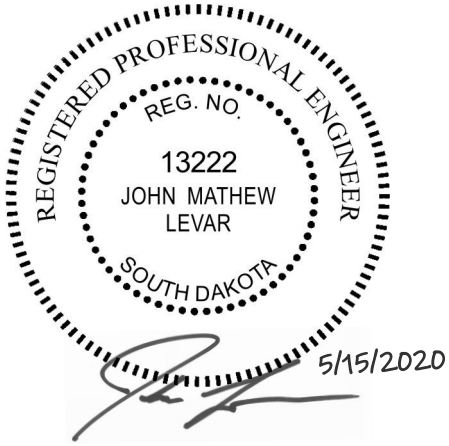
STRUCTURAL CALCULATIONS

RENOVATE OLD CHAPEL AND AUDITORIUM
SIOUX FALLS, SD

CONSTRUCTION DOCUMENTS

MAY 15, 2020



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SECTION A

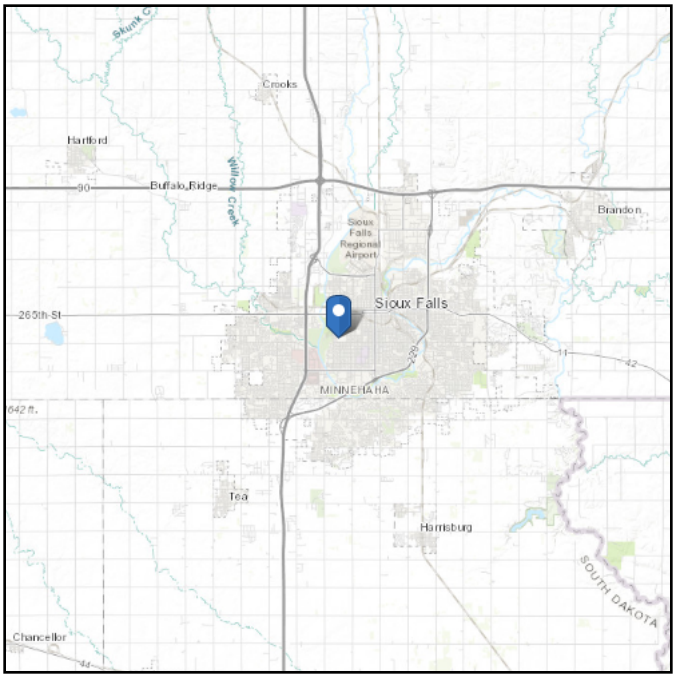
GENERAL DESIGN DATA AND LOADING

ASCE 7 Hazards Report

Address:
2501 W 22nd St
Sioux Falls, South Dakota
57105

Standard: ASCE/SEI 7-16
Risk Category: IV
Soil Class: D - Default (see Section 11.4.3)

Elevation: 1490.41 ft (NAVD 88)
Latitude: 43.531236
Longitude: -96.757623



Wind

Results:

Wind Speed:	125 Vmph
10-year MRI	77 Vmph
25-year MRI	85 Vmph
50-year MRI	90 Vmph
100-year MRI	96 Vmph
Data Source:	ASCE/SEI 7-16, Fig. 26.5-1D and Figs. CC.2-1–CC.2-4
Date Accessed:	Wed Oct 09 2019

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 1.6% probability of exceedance in 50 years (annual exceedance probability = 0.00033, MRI = 3,000 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Mountainous terrain, gorges, ocean promontories, and special wind regions should be examined for unusual wind conditions.

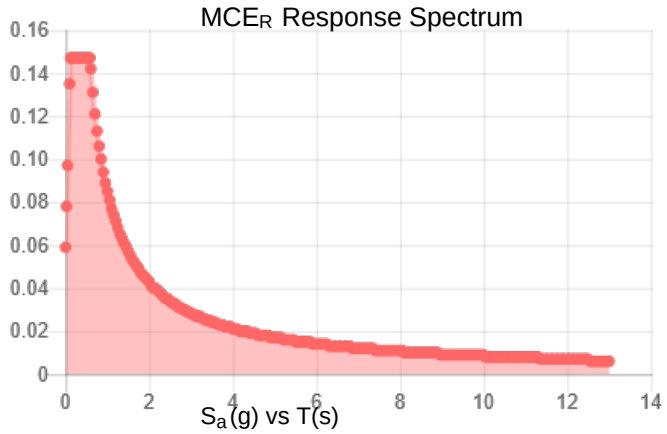
Seismic

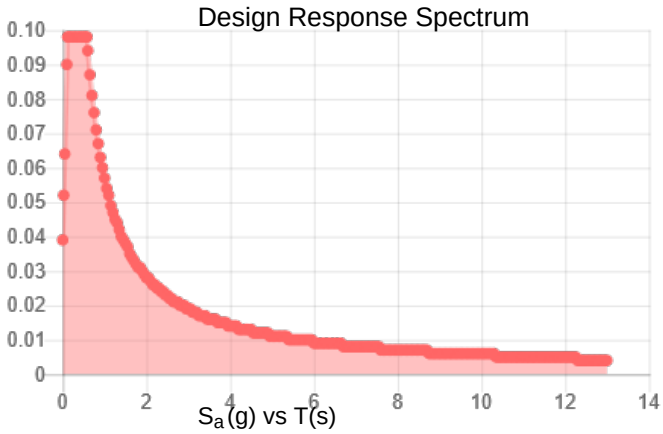
Site Soil Class: D - Default (see Section 11.4.3)

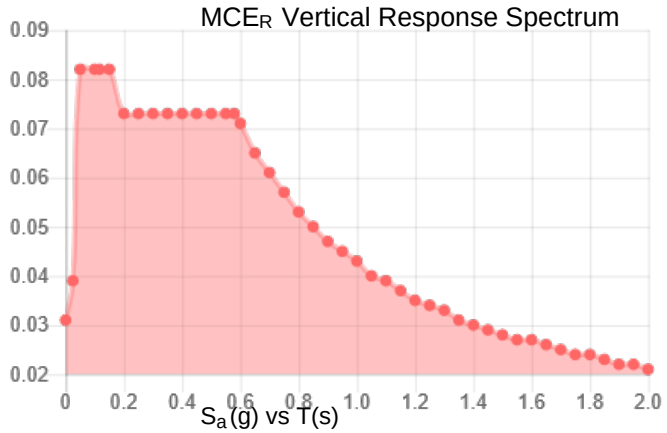
Results:

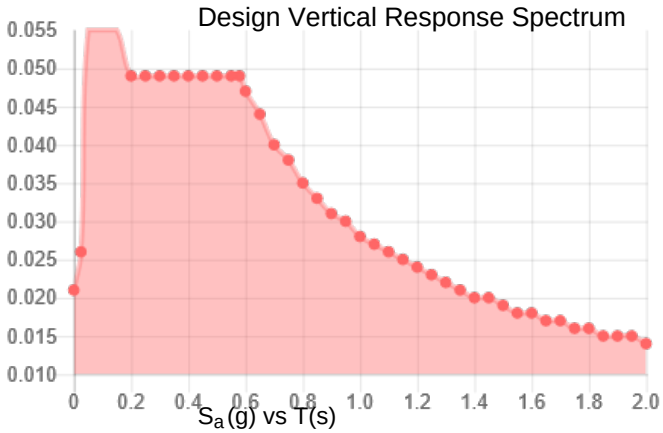
S_S :	0.092	S_{D1} :	0.057
S_1 :	0.035	T_L :	12
F_a :	1.6	PGA :	0.045
F_v :	2.4	PGA_M :	0.072
S_{MS} :	0.147	F_{PGA} :	1.6
S_{M1} :	0.085	I_e :	1.5
S_{DS} :	0.098	C_v :	0.7

Seismic Design Category A









Data Accessed: Wed Oct 09 2019

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

Snow

Results:

Ground Snow Load, p_g:	40 lb/ft^2
Elevation:	1490.4 ft
Data Source:	ASCE/SEI 7-16, Table 7.2-8
Date Accessed:	Wed Oct 09 2019

Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow loads at elevations not covered.

SECTION B

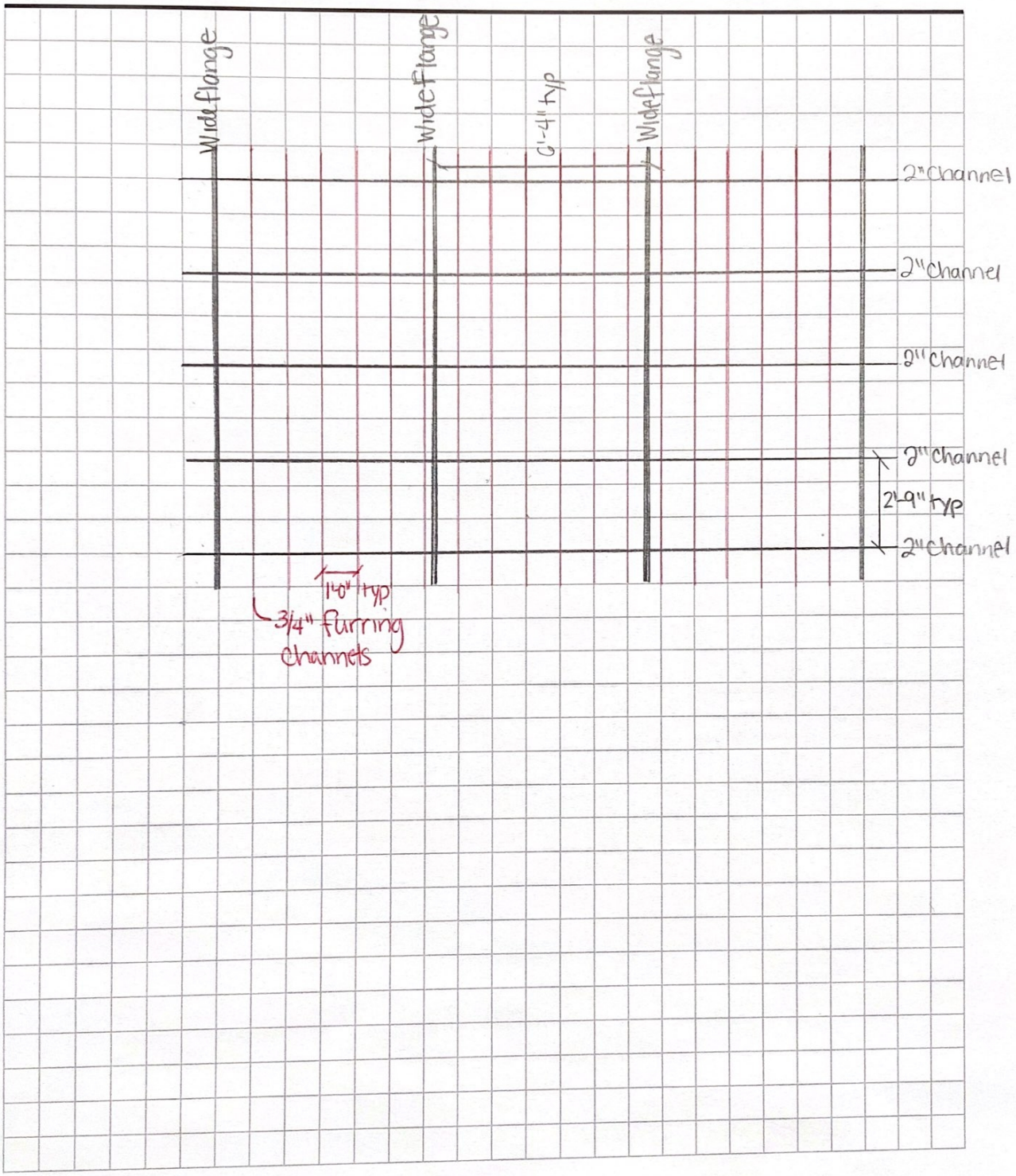
5TH FLOOR UNISTRUT DESIGN

Project SD 1007

Date

By

Sheet ____ of ____

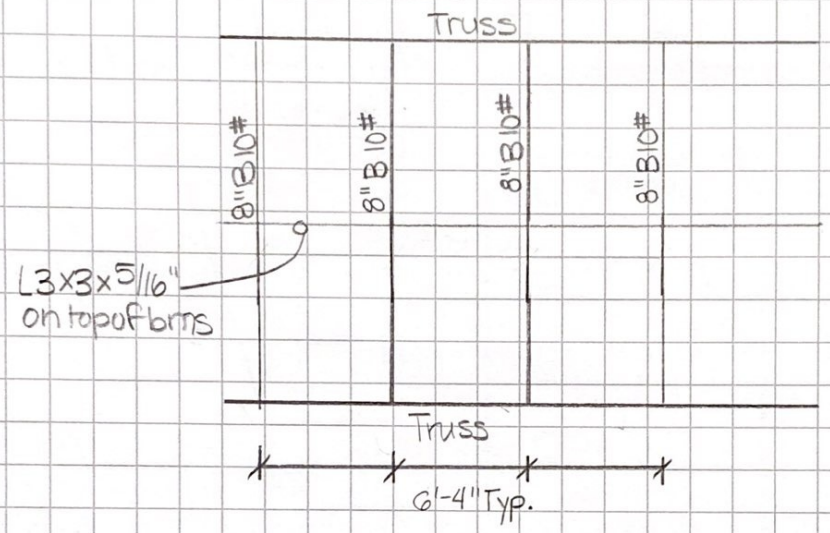


Project SD1007

Date

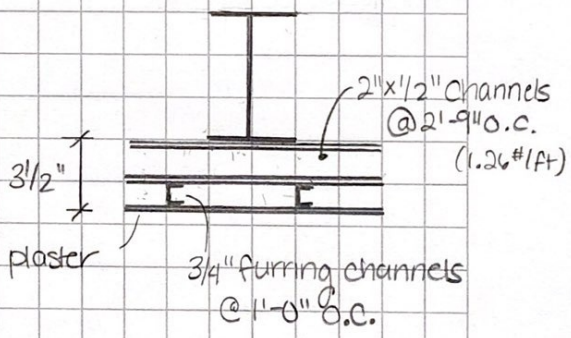
By

Sheet ____ of ____



Acoustical plaster ceiling = 2.25 lb/ft²
2" channels = 1.26 lb/ft / 2'-9" = 0.46 lb/ft²
3/4" channels = 0.5 lb/ft / 1' = 0.5 lb/ft²

Total ≈ 3.25 lb/ft²



3 1/2" − 2" − 3/4" = 3/4" plaster
≈ 2.25 lb/ft²

New suspended ceiling ≈ 2 psf

Project SD1007

Date

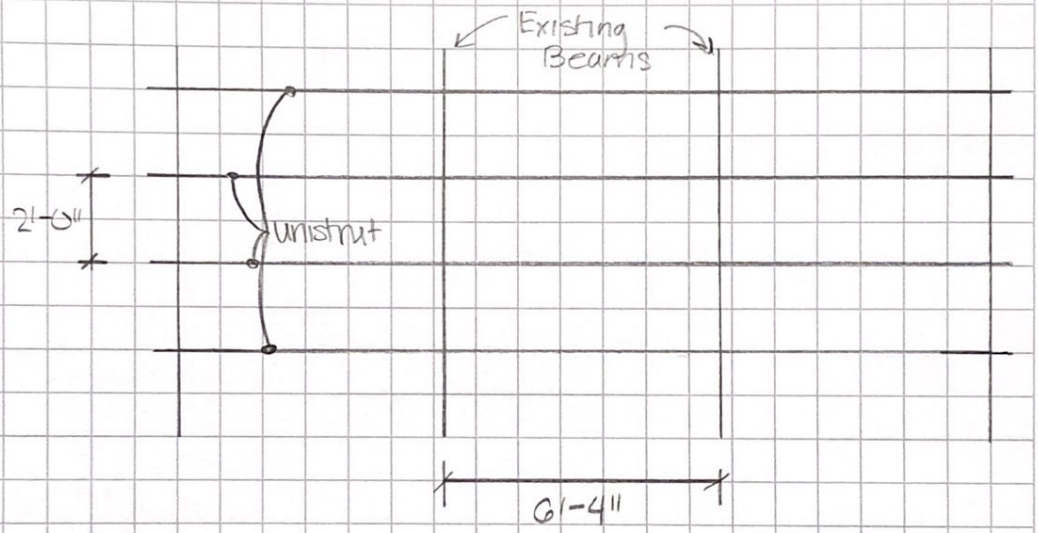
By

Sheet ____ of ____

Unistrut system

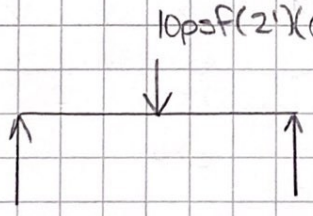
Existing W8x10 beams are spaced 6'-4" apart (6'-6" @ ends)

Add unistrut at 2'-0" supported by existing beams



Design for 10psf:

Hangers @ 2' o.c.



P1000: Allowed midspan point load (unbraced length factor) (concentrated load factor)

Max allowable uniform load = 5201b(.765) = 3981b(.5)(.85) = 1691b

$\Delta = 0.59"(.8) = 0.47" \Rightarrow L/165$ ← deflection too large

Project SD 1007

Date

By

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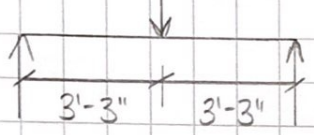
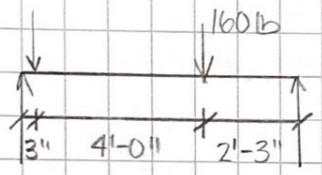
Hangers @ 4' o.c.

10psf (4')(6'-6") = 260lb



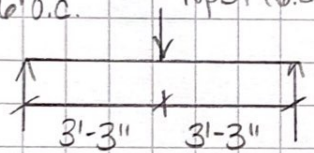
M = 423ft-lb * max loading



M = 248ft-lb

Hangers @ 6' o.c.

10psf (6.5')(6) = 390lb



M = 634 ft-lb

P5000: Allowed midspan point load

Unbraced length factor ↓

Max allowable uniform load = 1625lb (.41) = 666 lb (.5)(.85)

↑ = 283 lb concentrated load factor

$\Delta = 0.31" (.8) = 0.25" \Rightarrow 4/312$

For P5000 ⇒ if hangers are @ 6'-0" o.c.

Max allowable load = 283lb/(6.5)(6)

= 7.3 psf

Project SD 1007

Date

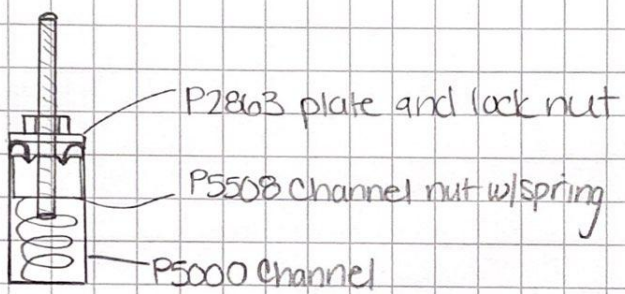
By

Sheet ____ of ____

P5000 Channels

use 3/8" ϕ threaded rods for hangers
Allowable tension load = 2,110 lb

P2863 plate and Lock nut
P5508 Channel nut w/spring



Project SD1007

Date

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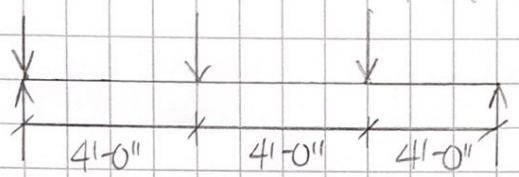
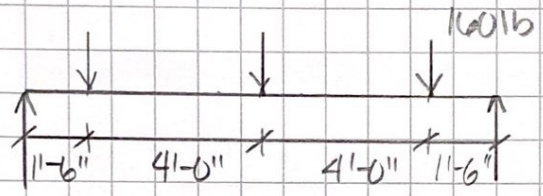
Hangers @ 4'-0" L=11'-0"

10psf (41)(41) = 1601b



M_{max} = 581.6k·ft



M_{max} = 680ft-lb * max loading

P5501: Allowed midspan point load

Max allowable uniform load = 17701b(.585) = 10351b(.85)
= 8801b

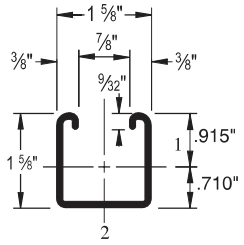
Δ = 0.48" ⇒ 4/275

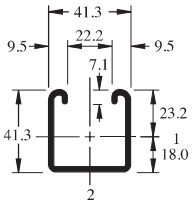
P5501: M_{allow} = 28,940in-lb = 2412 ft-lb

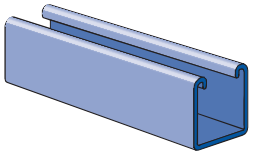
P5000: M_{allow} = 15,770in-lb = 1314.2 ft-lb

P1000®

DF GR HG PG PL



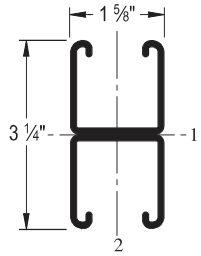


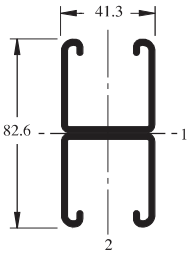


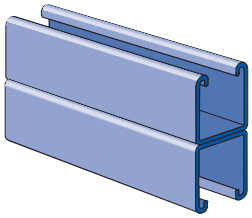
Wt/100 Ft:189 Lbs (281 kg/100 m)
Allowable Moment 5,070 In-Lbs (570 N•m)
12 Gauge Nominal Thickness .105" (2.7mm)

P1001

DF GR HG PG PL

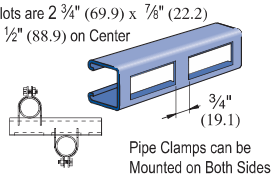






Wt/100 Ft: 378 Lbs (562 kg/100 m)
Allowable Moment 14,360 In-Lbs (1,620 N•m)
12 Gauge Nominal Thickness .105" (2.7mm)

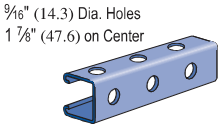
P1000 DS



Wt/100 Ft: 173 Lbs (257 kg/100 m)

P1000 H3

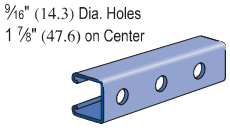
GR HG PG PL



Wt/100 Ft: 175 Lbs (260 kg/100 m)

P1000 HS

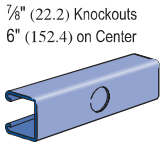
GR HG PG PL



Wt/100 Ft: 190 Lbs (283 kg/100 m)

P1000 KO

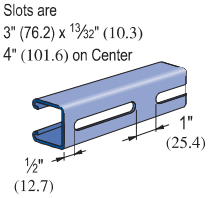
GR PG



Wt/100 Ft:185 Lbs (275 kg/100 m)

P1000 SL

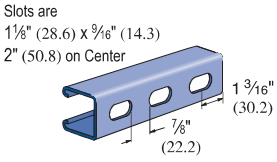
GR HG PG PL



Wt/100 Ft: 185 Lbs (275 kg/100 m)

P1000 T

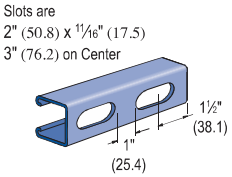
DF GR HG PG PL



Wt/100 Ft: 185 Lbs (275 kg/100 m)

P1000 WT

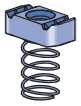
DF GR HG PG PL



Wt/100 Ft: 185 Lbs (275 kg/100 m)

Channel Nuts (Refer to Pages 73,74 for Details)

See Page 73, 74



P1006-0832
P1006-1024
P1006-1420
P1007
P1008
P1009
P1010

P1008T
P1006T1420
P1010T

P1024
P1012S
P1023S

P1012
P1023
P1024S

P3006-0832
P3006-1024
P3006-1420
P3007
P3008
P3009
P3010

P3016-0632
P3016-0832
P3016-1024
P3016-1420

Channel Finishes: DF, PL, GR, HG, PG, ZD; Standard Lengths: 10' & 20'

P1000 - Beam Loading

Span In	Max. Allowable Uniform Load Lbs	Defl. at Uniform Load In	Uniform Loading at Deflection Span/180 Lbs	Span/240 Lbs	Span/360 Lbs
24	1,690	0.06	1,690	1,690	1,690
36	1,130	0.13	1,130	1,130	900
48	850	0.22	850	760	500
60	680	0.35	650	480	320
72	560	0.50	450	340	220
84	480	0.68	330	250	160
96	420	0.89	250	190	130
108	380	1.14	200	150	100
120	340	1.40	160	120	80
144	280	2.00	110	80	60
168	240	2.72	80	60	40
192	210	3.55	60	50	NR
216	190	4.58	50	40	NR
240	170	5.62	40	NR	NR

P1001 - Beam Loading

Span In	Max. Allowable Uniform Load Lbs	Defl. at Uniform Load In	Uniform Loading at Deflection Span/180 Lbs	Span/240 Lbs	Span/360 Lbs
24	3,500*	0.02	3,500*	3,500*	3,500*
36	3,190	0.07	3,190	3,190	3,190
48	2,390	0.13	2,390	2,390	2,390
60	1,910	0.20	1,910	1,910	1,620
72	1,600	0.28	1,600	1,600	1,130
84	1,370	0.39	1,370	1,240	830
96	1,200	0.51	1,200	950	630
108	1,060	0.64	1,000	750	500
120	960	0.79	810	610	410
144	800	1.14	560	420	280
168	680	1.53	410	310	210
192	600	2.02	320	240	160
216	530	2.54	250	190	130
240	480	3.16	200	150	100

P1000 - Column Loading

Unbraced Height In	Max. Allowable Load at Slot Face Lbs	Maximum Column Load Applied at C.G. K = 0.65 Lbs	K = 0.80 Lbs	K =1.0 Lbs	K = 1.2 Lbs
24	3,550	10,740	9,890	8,770	7,740
36	3,190	8,910	7,740	6,390	5,310
48	2,770	7,260	6,010	4,690	3,800
60	2,380	5,910	4,690	3,630	2,960
72	2,080	4,840	3,800	2,960	2,400
84	1,860	4,040	3,200	2,480	1,980
96	1,670	3,480	2,750	2,110	1,660
108	1,510	3,050	2,400	1,810	**
120	1,380	2,700	2,110	**	**
144	1,150	2,180	1,660	**	**

P1001 - Column Loading

Unbraced Height In	Max. Allowable Load at Slot Face Lbs	Maximum Column Load Applied at C.G. K = 0.65 Lbs	K = 0.80 Lbs	K =1.0 Lbs	K = 1.2 Lbs
24	6,430	24,280	23,610	22,700	21,820
36	6,290	22,810	21,820	20,650	19,670
48	6,160	21,410	20,300	18,670	16,160
60	6,000	20,210	18,670	15,520	12,390
72	5,620	18,970	16,160	12,390	8,950
84	5,170	16,950	13,630	9,470	6,580
96	4,690	14,890	11,190	7,250	5,040
108	4,170	12,850	8,950	5,730	3,980
120	3,690	10,900	7,250	4,640	**
144	2,930	7,630	5,040	**	**

P1000/P1001 - Elements of Section

Parameter	P1000		P1001	
Area of Section	0.555	In^2	1.111	In^2
Axis 1-1				
Moment of Inertia (I)	0.185	In^4	0.928	In^4
Section Modulus (S)	0.202	In^3	0.571	In^3
Radius of Gyration (r)	0.577	In	0.914	In
Axis 2-2				
Moment of Inertia (I)	0.236	In^4	0.471	In^4
Section Modulus (S)	0.290	In^3	0.580	In^3
Radius of Gyration (r)	0.651	In	0.651	In

Notes:

* Load limited by spot weld shear.

** KL/r > 200

NR = Not Recommended.

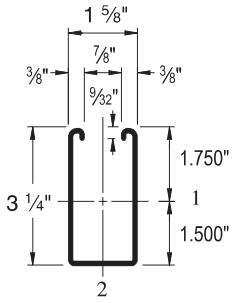
1. Beam loads are given in *total* uniform load (W Lbs) not uniform load (w lbs/ft or w lbs/in).
2. Beam loads are based on a simple span and assumed to be adequately laterally braced. Unbraced spans can reduce beam load carrying capacity. Refer to Page 62 for reduction factors for unbraced lengths.
3. For pierced channel, multiply beam loads by the following factor:

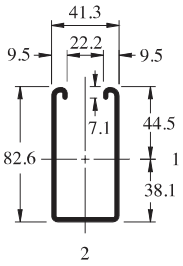
"KO" Series.....95%
"HS" Series.....90%
"H3" Series.....90%
"WT" Series.....85%
"T" Series.....85%
"SL" Series.....85%
"DS" Series.....70%

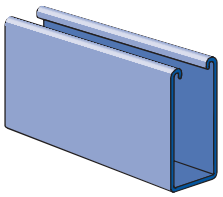
4. Deduct channel weight from the beam loads.
5. For concentrated midspan point loads, multiply beam loads by 50% and the corresponding deflection by 80%. For other load conditions refer to page 18.
6. All beam loads are for bending about Axis 1-1.

P5000

DF GR PL PG



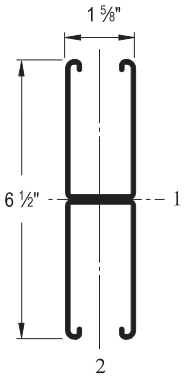


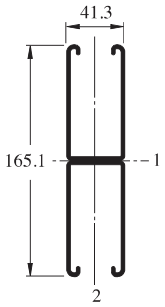


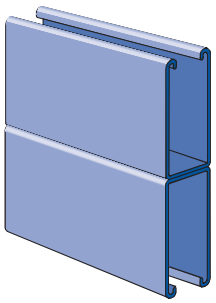
Wt/100 Ft: 305 Lbs (454 kg/100 m)
Allowable Moment 15,770 In-Lbs (1,780 N•m)
12 Gauge Nominal Thickness .105" (2.7mm)

P5001

DF GR PG



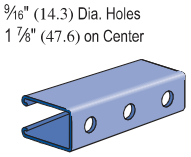




Wt/100 Ft: 610 Lbs (907 kg/100 m)
Allowable Moment 48,180 In-Lbs (5,440 N•m)
12 Gauge Nominal Thickness .105" (2.7mm)

P5000 HS

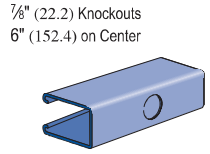
GR PG



Wt/100 Ft: 300 Lbs (446 kg/100 m)

P5000 KO

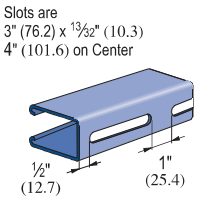
GR PG



Wt/100 Ft: 305 Lbs (454 kg/100 m)

P5000 SL

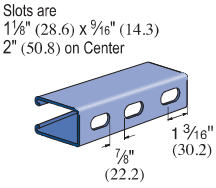
GR PG



Wt/100 Ft: 300 Lbs (446 kg/100 m)

P5000 T

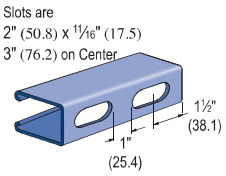
DF GR PG



Wt/100 Ft: 300 Lbs (446 kg/100 m)

P5000 WT

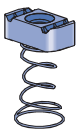
DF GR HG PG PL



Wt/100 Ft: 300 Lbs (446 kg/100 m)

Channel Nuts (Refer to Pages 73,74 for Details)

See Page 73, 74



P5506-0832
P5506-1024
P5506-1420
P5507
P5508
P5509
P5510

P1006T1420
P1008T
P1010T

P1012
P1023
P1024

P3006-0832
P3006-1024
P3006-1420
P3007
P3008
P3009
P3010

P3016-0632
P3016-0832
P3016-1024
P3016-1420

Channel Finishes: DF, PL, GR, HG, PG, ZD; Standard Lengths: 10' & 20'

P5000 - Beam Loading

Span In	Max Allowable Uniform Load Lbs	Defl. at Uniform Load In	Uniform Loading at Deflection Span/180 Lbs	Span/240 Lbs	Span/360 Lbs
24	5,260	0.03	5,260	5,260	5,260
36	3,500	0.07	3,500	3,500	3,500
48	2,630	0.12	2,630	2,630	2,630
60	2,100	0.18	2,100	2,100	1,920
72	1,750	0.26	1,750	1,750	1,330
84	1,500	0.36	1,500	1,470	980
96	1,310	0.47	1,310	1,120	750
108	1,170	0.59	1,170	890	590
120	1,050	0.73	960	720	480
144	880	1.06	670	500	330
168	750	1.43	490	370	240
192	660	1.88	370	280	190
216	580	2.35	300	220	150
240	530	2.95	240	180	120

P5001 - Beam Loading

Span In	Max Allowable Uniform Load Lbs	Defl. at Uniform Load In	Uniform Loading at Deflection Span/180 Lbs	Span/240 Lbs	Span/360 Lbs
24	6,890*	0.01	6,890*	6,890*	6,890*
36	6,890*	0.02	6,890*	6,890*	6,890*
48	6,890*	0.05	6,890*	6,890*	6,890*
60	6,420	0.10	6,420	6,420	6,420
72	5,350	0.14	5,350	5,350	5,350
84	4,590	0.19	4,590	4,590	4,590
96	4,020	0.25	4,020	4,020	4,020
108	3,570	0.32	3,570	3,570	3,360
120	3,210	0.39	3,210	3,210	2,720
144	2,680	0.57	2,680	2,680	1,890
168	2,290	0.77	2,290	2,080	1,390
192	2,010	1.01	2,010	1,590	1,060
216	1,780	1.27	1,680	1,260	840
240	1,610	1.58	1,360	1,020	680

P5000 - Column Loading

Unbraced Height In	Maximum Allowable Load at Slot Face Lbs	Maximum Column Load Applied at C.G. K = 0.65 Lbs	K = 0.80 Lbs	K =1.0 Lbs	K = 1.2 Lbs
24	5,650	16,870	15,180	12,850	10,600
36	4,690	13,140	10,600	7,650	5,660
48	3,560	9,550	6,860	4,790	3,660
60	2,730	6,680	4,790	3,450	2,710
72	2,160	4,980	3,660	2,710	2,170
84	1,760	3,950	2,960	2,240	1,820
96	1,500	3,270	2,500	1,930	1,580
108	1,310	2,800	2,170	1,690	1,390
120	1,170	2,450	1,930	1,510	**
144	980	1,980	1,580	**	**
168	850	1,670	1,340	**	**

P5001 - Column Loading

Unbraced Height In	Maximum Allowable Load at Slot Face Lbs	Maximum Column Load Applied at C.G. K = 0.65 Lbs	K = 0.80 Lbs	K =1.0 Lbs	K = 1.2 Lbs
24	10,670	39,230	38,030	36,210	34,240
36	10,350	36,450	34,240	31,200	28,260
48	9,940	33,220	30,200	26,430	23,190
60	9,290	29,950	26,430	22,470	19,380
72	8,560	26,880	23,190	19,380	16,450
84	7,860	24,140	20,520	17,040	12,090
96	7,220	21,790	18,370	13,330	9,250
108	6,600	19,790	16,450	10,530	7,310
120	5,760	18,130	13,330	8,530	**
144	4,390	14,020	9,250	**	**
168	3,420	10,300	6,800	**	**

P5000/P5001 - Elements of Section

Parameter		P5000		P5001	
Area of Section		0.897	In^2	1.793	In^2
Axis 1-1					
	Moment of Inertia (I)	1.098	In^4	6.227	In^4
	Section Modulus (S)	0.627	In^3	1.916	In^3
	Radius of Gyration (r)	1.107	In	1.864	In
Axis 2-2					
	Moment of Inertia (I)	0.433	In^4	0.866	In^4
	Section Modulus (S)	0.533	In^3	1.066	In^3
	Radius of Gyration (r)	0.695	In	0.695	In

Notes:

* Load limited by spot weld shear.

** KL/r > 200

NR = Not Recommended.

1. Beam loads are given in *total* uniform load (W Lbs) not uniform load (w lbs/ft or w lbs/in).
2. Beam loads are based on a simple span and assumed to be adequately laterally braced. Unbraced spans can reduce beam load carrying capacity. Refer to Page 62 for reduction factors for unbraced lengths.
3. For pierced channel, multiply beam loads by the following factor:

"KO" Series.....95% **"T" Series 85%**
"HS" Series .....90% **"SL" Series.....85%**
"WT" Series.....85%

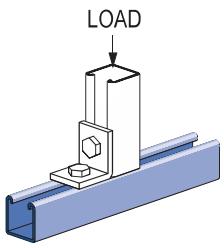
4. Deduct channel weight from the beam loads.
5. For concentrated midspan point loads, multiply beam loads by 50% and the corresponding deflection by 80%. For other load conditions refer to page 18.
6. All beam loads are for bending about Axis 1-1.

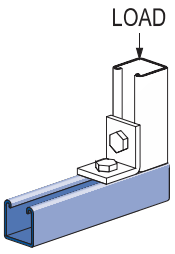
Lateral Bracing Load Reduction Charts

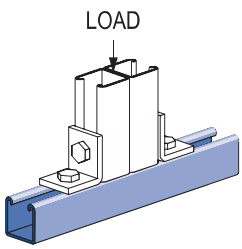
Span		Single Channel											Double Channel										
Ft. *(m)*	In. *(cm)*	P1000	P1100	P2000	P3000	P3300	P4000	P4100	P4400	P4520	P5000	P5500	P1001	P1101	P2001	P3001	P3301	P4001	P4101	P4401	P4521	P5001	P5501
2 *(0.61)*	24 *(61)*	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3 *(0.91)*	36 *(91)*	0.94	0.89	0.88	0.96	1.00	0.94	0.98	1.00	1.00	0.85	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4 *(1.22)*	48 *(122)*	0.88	0.78	0.75	0.91	1.00	0.88	0.94	0.98	1.00	0.70	0.77	1.00	0.98	0.98	1.00	1.00	0.98	1.00	1.00	1.00	0.97	0.98
5 *(1.52)*	60 *(152)*	0.82	0.68	0.61	0.88	0.98	0.83	0.91	0.96	1.00	0.55	0.67	0.97	0.93	0.92	0.98	1.00	0.93	0.96	1.00	1.00	0.90	0.93
6 *(1.83)*	72 *(183)*	0.78	0.59	0.48	0.84	0.97	0.79	0.89	0.94	0.98	0.44	0.58	0.93	0.87	0.85	0.95	0.97	0.88	0.92	0.97	0.97	0.83	0.87
6.5' 7 *(2.13)*	84 *(213)*	0.765 0.75	0.52	0.41	0.82	0.96	0.75	0.86	0.92	0.97	0.38	0.51	0.89	0.82	0.78	0.92	0.95	0.83	0.89	0.95	0.95	0.76	0.81
8 *(2.44)*	96 *(244)*	0.71	0.47	0.35	0.79	0.94	0.72	0.84	0.91	0.96	0.33	0.46	0.85	0.76	0.71	0.88	0.92	0.79	0.85	0.92	0.92	0.68	0.76
9 *(2.74)*	108 *(274)*	0.69	0.43	0.32	0.77	0.93	0.69	0.82	0.89	0.95	0.30	0.42	0.81	0.70	0.64	0.85	0.90	0.74	0.81	0.90	0.90	0.61	0.70
10 *(3.05)*	120 *(305)*	0.66	0.40	0.29	0.75	0.92	0.66	0.80	0.87	0.94	0.28	0.40	0.78	0.65	0.57	0.82	0.87	0.69	0.78	0.87	0.87	0.54	0.64
12 *(3.66)*	144 *(366)*	0.61	0.36	0.25	0.70	0.89	0.60	0.76	0.84	0.91	0.24	0.36	0.70	0.54	0.45	0.76	0.82	0.60	0.71	0.82	0.83	0.43	0.53
14 *(4.27)*	168 *(427)*	0.55	0.32	0.23	0.66	0.86	0.55	0.73	0.81	0.89	0.22	0.32	0.63	0.45	0.38	0.70	0.78	0.51	0.64	0.77	0.78	0.35	0.45
16 *(4.88)*	192 *(488)*	0.51	0.30	0.21	0.62	0.84	0.50	0.69	0.78	0.87	0.21	0.30	0.56	0.39	0.32	0.64	0.73	0.44	0.57	0.72	0.73	0.30	0.39
18 *(5.49)*	216 *(549)*	0.47	0.28	0.19	0.58	0.81	0.47	0.65	0.75	0.84	0.19	0.28	0.49	0.34	0.28	0.58	0.68	0.39	0.50	0.67	0.68	0.27	0.34
20 *(6.10)*	240 *(610)*	0.44	0.26	0.18	0.54	0.78	0.43	0.61	0.72	0.82	0.18	0.26	0.44	0.31	0.25	0.52	0.63	0.35	0.45	0.62	0.63	0.24	0.30

Bearing Loads on Unistrut Channel

Loads are calculated based on 2007 Specification For The Design Of Cold Formed Steel Structural Members published by AISI







Channel	Bearing Length 1⅝" (41 mm) Maximum Allowable Loads Lbs *(kN)*	Bearing Length 1⅝" (41 mm) Maximum Allowable Loads Lbs *(kN)*	Bearing Length 3¼" (82 mm) Maximum Allowable Loads Lbs *(kN)*
P1000	6,700 *29.80*	3,100 *13.79*	7,700 *34.25*
P1100	3,500 *15.57*	1,700 *7.56*	4,000 *17.79*
P2000	2,500 *11.12*	1,200 *5.34*	3,000 *13.34*
P3000	6,700 *29.80*	3,200 *14.23*	7,700 *34.25*
P3300	6,800 *30.25*	3,200 *14.23*	7,800 *34.70*
P4000	2,600 *11.57*	1,200 *5.34*	3,000 *13.34*
P4100	3,500 *15.57*	1,800 *8.01*	4,100 *18.24*
P4400	7,300 *32.47*	3,400 *15.12*	8,400 *37.37*
P4520	7,300 *32.47*	3,400 *15.12*	8,400 *37.37*
P5000	6,500 *28.91*	3,000 *13.34*	7,500 *33.36*
P5500	6,600 *29.36*	3,100 *13.79*	7,600 *33.81*

SECTION C
ELEVATOR DESIGN

Project SD 1007

Date

By

Sheet ____ of ____

5th floor elevator opening

Ribbed floor slab

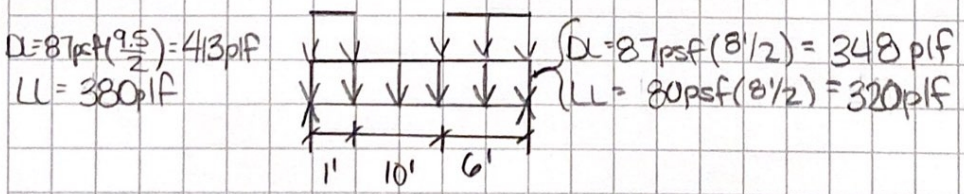
$150pcf\left(\frac{5''}{12}\right)\left(\frac{10''}{12}\right) = \frac{52.1\,lb/ft}{\frac{20''}{12}} = 31.25psf$

$150pcf\,(2\tfrac{1}{2}/12) =$ 31.25psf

Suspended plaster ceiling	15psf
Flooring (linoleum)	1psf
Misc	3psf
Mech/Elec/Sprinkler	5psf
	86.5psf ⇒ use 87psf

Beam length = 17'-0"

Live load = 80psf ← mechanical room



Project SD1007

Date

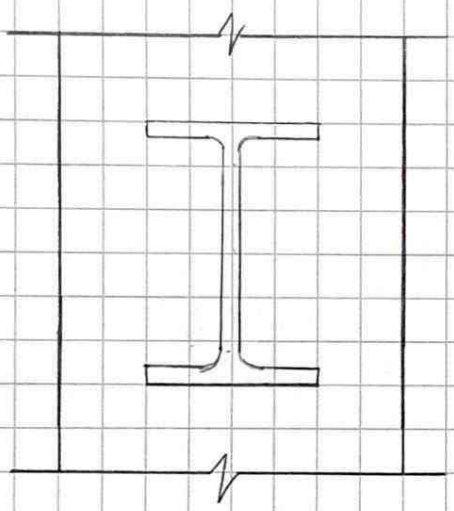
By

Sheet ____ of ____

16"x16" concrete column

Reaction = 4.16k DL
3.33k LL

W12x40 beam



Concrete Beam

Lic. # : KW-06005570 — ADVANCED STRUCTURAL TECHNOLOGY INC

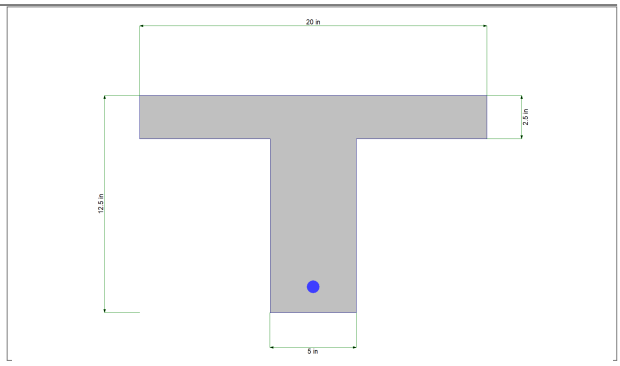
DESCRIPTION: Existing 5th floor joists - mechanical room

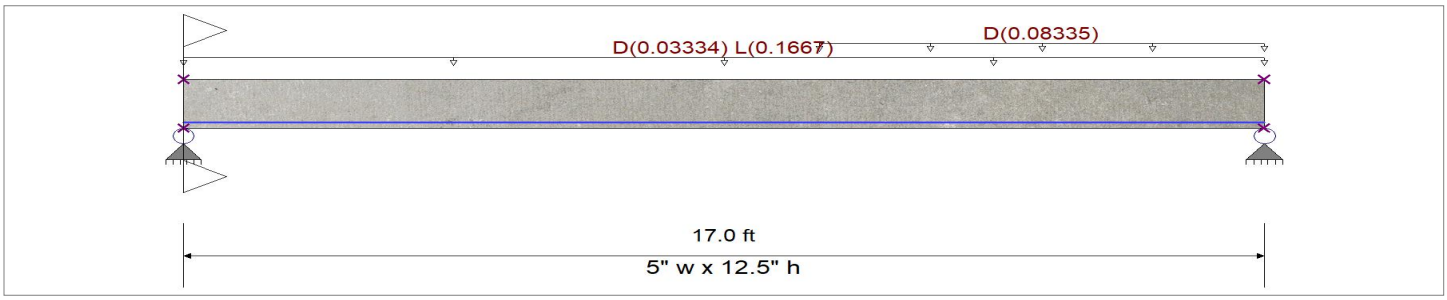
CODE REFERENCES

Calculations per ACI 318-08, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : ASCE 7-16

Material Properties

f'c	= 3.0 ksi		ϕ Phi Values	Flexure :	0.90
fr = f'c$^{1/2}$ * 7.50	= 410.792 psi			Shear :	0.750
ψ Density	= 145.0 pcf		β_1	=	0.850
λ LtWt Factor	= 1.0				
Elastic Modulus	= 3,122.0 ksi		Fy - Stirrups		40.0 ksi
fy - Main Rebar	= 60.0 ksi		E - Stirrups	=	29,000.0 ksi
E - Main Rebar	= 29,000.0 ksi		Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Tee Section, Stem Width = 5.0 in, Total Height = 12.50 in, Top Flange Width = 20.0 in, Flange Thickness = 2.50 in
Span #1 Reinforcing....
1-#6 at 1.50 in from Bottom, from 0.0 to 17.0 ft in this span

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.020, L = 0.10 ksf, Tributary Width = 1.667 ft
Uniform Load : D = 0.050 ksf, Extent = 10.0 -->> 17.0 ft, Tributary Width = 1.667 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.785** : 1		Maximum Deflection			
Section used for this span	**Typical Section**		Max Downward Transient Deflection	0.071 in	Ratio =	2878 >=360
Mu : Applied	16.695 k-ft		Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0
Mn * Phi : Allowable	21.268 k-ft		Max Downward Total Deflection	0.391 in	Ratio =	521 >=180
Location of maximum on span	8.825 ft		Max Upward Total Deflection	0.000 in	Ratio =	0 <180.0
Span # where maximum occurs	Span # 1					

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	2.676	3.020
Overall MINimum	0.756	0.962
+D+H	1.259	1.603
+D+L+H	2.676	3.020
+D+Lr+H	1.259	1.603
+D+S+H	1.259	1.603
+D+0.750Lr+0.750L+H	2.322	2.665
+D+0.750L+0.750S+H	2.322	2.665
+D+0.60W+H	1.259	1.603
+D+0.750Lr+0.750L+0.450W+H	2.322	2.665
+D+0.750L+0.750S+0.450W+H	2.322	2.665

Concrete Beam

DESCRIPTION: Existing 5th floor joists - mechanical room

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+0.60D+0.60W+0.60H	0.756	0.962
+D+0.70E+0.60H	1.259	1.603
+D+0.750L+0.750S+0.5250E+H	2.322	2.665
+0.60D+0.70E+H	0.756	0.962
D Only	1.259	1.603
Lr Only		
L Only	1.417	1.417
S Only		
W Only		
E Only		
H Only		

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+1.60L+0.50S+1.60H	1	0.00	11.00	3.78	3.78	0.00	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.19	11.00	3.70	3.70	0.69	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.37	11.00	3.62	3.62	1.37	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.56	11.00	3.54	3.54	2.04	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.74	11.00	3.46	3.46	2.69	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.93	11.00	3.38	3.38	3.33	0.93	5.06	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.11	11.00	3.30	3.30	3.95	0.77	4.93	PhiVc/2 < Vu <=	Min 11.4.6.1	19.4	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.30	11.00	3.22	3.22	4.55	0.65	4.83	PhiVc/2 < Vu <=	Min 11.4.6.1	19.3	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.49	11.00	3.14	3.14	5.14	0.56	4.75	PhiVc/2 < Vu <=	Min 11.4.6.1	19.3	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.67	11.00	3.06	3.06	5.72	0.49	4.70	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.86	11.00	2.98	2.98	6.28	0.44	4.65	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.04	11.00	2.90	2.90	6.83	0.39	4.61	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.23	11.00	2.83	2.83	7.36	0.35	4.58	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.42	11.00	2.75	2.75	7.88	0.32	4.56	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.60	11.00	2.67	2.67	8.38	0.29	4.53	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.79	11.00	2.59	2.59	8.87	0.27	4.51	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.97	11.00	2.51	2.51	9.34	0.25	4.50	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.16	11.00	2.43	2.43	9.80	0.23	4.48	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.34	11.00	2.35	2.35	10.25	0.21	4.47	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.53	11.00	2.27	2.27	10.67	0.19	4.45	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.72	11.00	2.19	2.19	11.09	0.18	4.44	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.90	11.00	2.11	2.11	11.49	0.17	4.43	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.09	11.00	2.03	2.03	11.87	0.16	4.42	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.27	11.00	1.95	1.95	12.24	0.15	4.41	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.46	11.00	1.87	1.87	12.60	0.14	4.41	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.64	11.00	1.79	1.79	12.94	0.13	4.40	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.83	11.00	1.71	1.71	13.26	0.12	4.39	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.02	11.00	1.63	1.63	13.57	0.11	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.20	11.00	1.55	1.55	13.87	0.10	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.39	11.00	1.47	1.47	14.15	0.10	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.57	11.00	1.40	1.40	14.42	0.09	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.76	11.00	1.32	1.32	14.67	0.08	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.95	11.00	1.24	1.24	14.91	0.08	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.13	11.00	1.16	1.16	15.13	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.32	11.00	1.08	1.08	15.34	0.06	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.50	11.00	1.00	1.00	15.53	0.06	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.69	11.00	0.92	0.92	15.71	0.05	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.87	11.00	0.84	0.84	15.87	0.05	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.06	11.00	0.76	0.76	16.02	0.04	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.25	11.00	0.68	0.68	16.15	0.04	4.32	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.43	11.00	0.60	0.60	16.27	0.03	4.32	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0

DESCRIPTION: Existing 5th floor joists - mechanical room

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+1.60L+0.50S+1.60H	1	7.62	11.00	0.52	0.52	16.38	0.03	4.32	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.80	11.00	0.44	0.44	16.47	0.02	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.99	11.00	0.36	0.36	16.54	0.02	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.17	11.00	0.28	0.28	16.60	0.02	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.36	11.00	0.20	0.20	16.65	0.01	4.30	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.40D+1.60H	1	8.55	11.00	0.16	0.16	8.22	0.02	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.40D+1.60H	1	8.73	11.00	0.12	0.12	8.24	0.01	4.30	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.40D+1.60H	1	8.92	11.00	0.09	0.09	8.26	0.01	4.30	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.10	11.00	-0.11	0.11	16.68	0.01	4.30	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.29	11.00	-0.19	0.19	16.65	0.01	4.30	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.48	11.00	-0.27	0.27	16.61	0.02	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.66	11.00	-0.35	0.35	16.55	0.02	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.85	11.00	-0.43	0.43	16.48	0.02	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.03	11.00	-0.51	0.51	16.39	0.03	4.32	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.22	11.00	-0.61	0.61	16.28	0.03	4.32	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.40	11.00	-0.71	0.71	16.16	0.04	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.59	11.00	-0.81	0.81	16.02	0.05	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.78	11.00	-0.91	0.91	15.86	0.05	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.96	11.00	-1.00	1.00	15.68	0.06	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.15	11.00	-1.10	1.10	15.49	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.33	11.00	-1.20	1.20	15.27	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.52	11.00	-1.30	1.30	15.04	0.08	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.70	11.00	-1.40	1.40	14.79	0.09	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.89	11.00	-1.49	1.49	14.52	0.09	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.08	11.00	-1.59	1.59	14.24	0.10	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.26	11.00	-1.69	1.69	13.93	0.11	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.45	11.00	-1.79	1.79	13.61	0.12	4.39	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.63	11.00	-1.89	1.89	13.27	0.13	4.40	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.82	11.00	-1.98	1.98	12.91	0.14	4.41	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	13.01	11.00	-2.08	2.08	12.53	0.15	4.42	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	13.19	11.00	-2.18	2.18	12.13	0.16	4.43	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	13.38	11.00	-2.28	2.28	11.72	0.18	4.44	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	13.56	11.00	-2.38	2.38	11.29	0.19	4.45	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	13.75	11.00	-2.47	2.47	10.84	0.21	4.47	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	13.93	11.00	-2.57	2.57	10.37	0.23	4.48	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.12	11.00	-2.67	2.67	9.88	0.25	4.50	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.31	11.00	-2.77	2.77	9.37	0.27	4.52	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.49	11.00	-2.87	2.87	8.85	0.30	4.54	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.68	11.00	-2.97	2.97	8.31	0.33	4.56	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.86	11.00	-3.06	3.06	7.75	0.36	4.59	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.05	11.00	-3.16	3.16	7.17	0.40	4.63	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.23	11.00	-3.26	3.26	6.57	0.45	4.67	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.42	11.00	-3.36	3.36	5.96	0.52	4.72	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.61	11.00	-3.46	3.46	5.33	0.59	4.78	PhiVc/2 < Vu <=	Min 11.4.6.1	19.3	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.79	11.00	-3.55	3.55	4.68	0.70	4.87	PhiVc/2 < Vu <=	Min 11.4.6.1	19.4	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.98	11.00	-3.65	3.65	4.01	0.84	4.98	PhiVc/2 < Vu <=	Min 11.4.6.1	19.5	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.16	11.00	-3.75	3.75	3.32	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.35	11.00	-3.85	3.85	2.61	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.54	11.00	-3.95	3.95	1.89	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.72	11.00	-4.04	4.04	1.15	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.91	11.00	-4.14	4.14	0.39	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio

Concrete Beam

DESCRIPTION: Existing 5th floor joists - mechanical room

MAXimum BENDING Envelope					
Span # 1	1	17.000	16.70	21.27	0.79
+1.40D+1.60H					
Span # 1	1	17.000	8.28	21.27	0.39
+1.20D+0.50Lr+1.60L+1.60H					
Span # 1	1	17.000	16.70	21.27	0.79
+1.20D+1.60L+0.50S+1.60H					
Span # 1	1	17.000	16.70	21.27	0.79
+1.20D+1.60Lr+L+1.60H					
Span # 1	1	17.000	13.09	21.27	0.62
+1.20D+1.60Lr+0.50W+1.60H					
Span # 1	1	17.000	7.10	21.27	0.33
+1.20D+L+1.60S+1.60H					
Span # 1	1	17.000	13.09	21.27	0.62
+1.20D+1.60S+0.50W+1.60H					
Span # 1	1	17.000	7.10	21.27	0.33
+1.20D+0.50Lr+L+W+1.60H					
Span # 1	1	17.000	13.09	21.27	0.62
+1.20D+L+0.50S+W+1.60H					
Span # 1	1	17.000	13.09	21.27	0.62
+0.90D+W+1.60H					
Span # 1	1	17.000	5.33	21.27	0.25
+1.20D+L+0.20S+E+1.60H					
Span # 1	1	17.000	13.09	21.27	0.62
+0.90D+E+0.90H					
Span # 1	1	17.000	5.33	21.27	0.25

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L+H	1	0.3914	8.500		0.0000	0.000

Concrete Beam

Lic. # : KW-06005570 — ADVANCED STRUCTURAL TECHNOLOGY INC

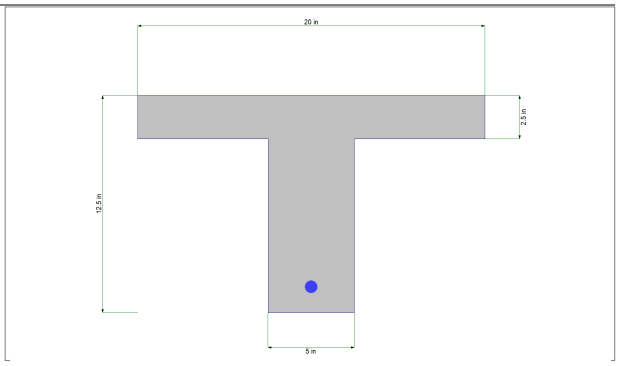
DESCRIPTION: Existing 5th floor joists - Projection room

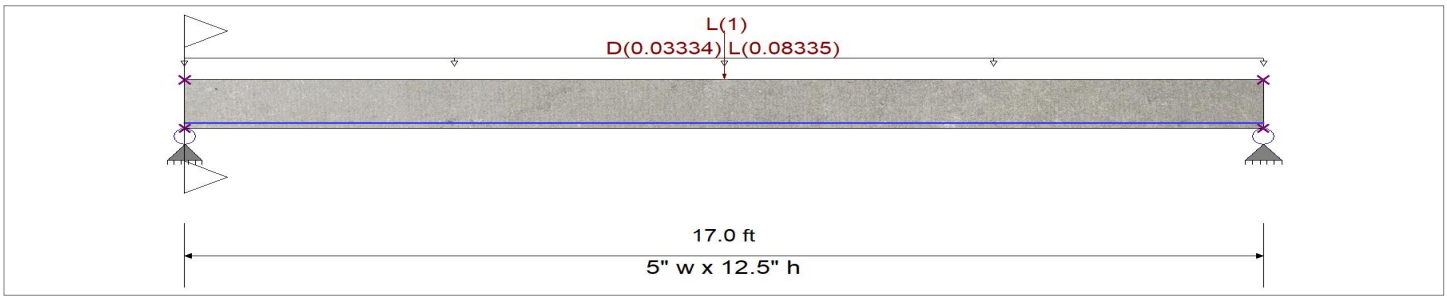
CODE REFERENCES

Calculations per ACI 318-08, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : ASCE 7-16

Material Properties

f'c	= 3.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c^1/2 * 7.50	= 410.792 psi		Shear :	0.750
ψ Density	= 145.0 pcf	β 1	=	0.850
λ LtWt Factor	= 1.0			
Elastic Modulus	= 3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	= 60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	= 29,000.0 ksi	Stirrup Bar Size #		3
		Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Tee Section, Stem Width = 5.0 in, Total Height = 12.50 in, Top Flange Width = 20.0 in, Flange Thickness = 2.50 in
Span #1 Reinforcing....
1-#6 at 1.50 in from Bottom, from 0.0 to 17.0 ft in this span

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.020, L = 0.050 ksf, Tributary Width = 1.667 ft
Point Load : L = 1.0 k @ 8.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.819** : 1	Maximum Deflection			
Section used for this span	**Typical Section**	Max Downward Transient Deflection	0.090 in	Ratio =	2254 >=360
Mu : Applied	17.416 k-ft	Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0
Mn * Phi : Allowable	21.268 k-ft	Max Downward Total Deflection	0.351 in	Ratio =	580 >=180
Location of maximum on span	8.515 ft	Max Upward Total Deflection	0.000 in	Ratio =	0 <180.0
Span # where maximum occurs	Span # 1				

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	2.348	2.348
Overall MINimum	0.684	0.684
+D+H	1.139	1.139
+D+L+H	2.348	2.348
+D+Lr+H	1.139	1.139
+D+S+H	1.139	1.139
+D+0.750Lr+0.750L+H	2.046	2.046
+D+0.750L+0.750S+H	2.046	2.046
+D+0.60W+H	1.139	1.139
+D+0.750Lr+0.750L+0.450W+H	2.046	2.046
+D+0.750L+0.750S+0.450W+H	2.046	2.046

Concrete Beam

DESCRIPTION: Existing 5th floor joists - Projection room

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+0.60D+0.60W+0.60H	0.684	0.684
+D+0.70E+0.60H	1.139	1.139
+D+0.750L+0.750S+0.5250E+H	2.046	2.046
+0.60D+0.70E+H	0.684	0.684
D Only	1.139	1.139
Lr Only		
L Only	1.208	1.208
S Only		
W Only		
E Only		
H Only		

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+1.60L+0.50S+1.60H	1	0.00	11.00	3.30	3.30	0.00	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.19	11.00	3.25	3.25	0.61	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.37	11.00	3.19	3.19	1.21	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.56	11.00	3.14	3.14	1.79	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.74	11.00	3.08	3.08	2.37	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	0.93	11.00	3.03	3.03	2.94	0.94	5.07	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.11	11.00	2.97	2.97	3.50	0.78	4.94	PhiVc/2 < Vu <=	Min 11.4.6.1	19.5	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.30	11.00	2.92	2.92	4.04	0.66	4.84	PhiVc/2 < Vu <=	Min 11.4.6.1	19.4	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.49	11.00	2.86	2.86	4.58	0.57	4.77	PhiVc/2 < Vu <=	Min 11.4.6.1	19.3	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.67	11.00	2.81	2.81	5.11	0.50	4.71	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	1.86	11.00	2.75	2.75	5.62	0.45	4.66	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.04	11.00	2.70	2.70	6.13	0.40	4.63	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.23	11.00	2.64	2.64	6.63	0.37	4.59	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.42	11.00	2.59	2.59	7.11	0.33	4.57	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.60	11.00	2.54	2.54	7.59	0.31	4.55	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.79	11.00	2.48	2.48	8.06	0.28	4.53	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	2.97	11.00	2.43	2.43	8.51	0.26	4.51	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.16	11.00	2.37	2.37	8.96	0.24	4.49	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.34	11.00	2.32	2.32	9.39	0.23	4.48	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.53	11.00	2.26	2.26	9.82	0.21	4.47	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	3.72	11.00	2.21	2.21	10.23	0.20	4.46	Vu < PhiVc/2	lot Reqd 11.4	4.5	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.90	11.00	2.15	2.15	10.64	0.19	4.45	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.09	11.00	2.10	2.10	11.03	0.17	4.44	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.27	11.00	2.04	2.04	11.42	0.16	4.43	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.46	11.00	1.99	1.99	11.79	0.15	4.42	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.64	11.00	1.93	1.93	12.16	0.15	4.41	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.83	11.00	1.88	1.88	12.51	0.14	4.41	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.02	11.00	1.82	1.82	12.86	0.13	4.40	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.20	11.00	1.77	1.77	13.19	0.12	4.39	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.39	11.00	1.72	1.72	13.51	0.12	4.39	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.57	11.00	1.66	1.66	13.83	0.11	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.76	11.00	1.61	1.61	14.13	0.10	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.95	11.00	1.55	1.55	14.42	0.10	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.13	11.00	1.50	1.50	14.71	0.09	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.32	11.00	1.44	1.44	14.98	0.09	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.50	11.00	1.39	1.39	15.24	0.08	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.69	11.00	1.33	1.33	15.50	0.08	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.87	11.00	1.28	1.28	15.74	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.06	11.00	1.22	1.22	15.97	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.25	11.00	1.17	1.17	16.19	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.43	11.00	1.11	1.11	16.41	0.06	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0

DESCRIPTION: Existing 5th floor joists - Projection room

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+1.60L+0.50S+1.60H	1	7.62	11.00	1.06	1.06	16.61	0.06	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.80	11.00	1.00	1.00	16.80	0.05	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.99	11.00	0.95	0.95	16.98	0.05	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.17	11.00	0.90	0.90	17.15	0.05	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.36	11.00	0.84	0.84	17.31	0.04	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.55	11.00	-0.81	0.81	17.39	0.04	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.73	11.00	-0.87	0.87	17.23	0.05	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.92	11.00	-0.92	0.92	17.07	0.05	4.33	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.10	11.00	-0.98	0.98	16.89	0.05	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.29	11.00	-1.03	1.03	16.70	0.06	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.48	11.00	-1.09	1.09	16.51	0.06	4.34	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.66	11.00	-1.14	1.14	16.30	0.06	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.85	11.00	-1.20	1.20	16.08	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.03	11.00	-1.25	1.25	15.86	0.07	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.22	11.00	-1.31	1.31	15.62	0.08	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.40	11.00	-1.36	1.36	15.37	0.08	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.59	11.00	-1.41	1.41	15.11	0.09	4.36	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.78	11.00	-1.47	1.47	14.85	0.09	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	10.96	11.00	-1.52	1.52	14.57	0.10	4.37	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.15	11.00	-1.58	1.58	14.28	0.10	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.33	11.00	-1.63	1.63	13.98	0.11	4.38	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.52	11.00	-1.69	1.69	13.67	0.11	4.39	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.70	11.00	-1.74	1.74	13.35	0.12	4.39	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	11.89	11.00	-1.80	1.80	13.02	0.13	4.40	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.08	11.00	-1.85	1.85	12.69	0.13	4.40	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.26	11.00	-1.91	1.91	12.34	0.14	4.41	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.45	11.00	-1.96	1.96	11.98	0.15	4.42	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.63	11.00	-2.02	2.02	11.61	0.16	4.42	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	12.82	11.00	-2.07	2.07	11.23	0.17	4.43	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	13.01	11.00	-2.13	2.13	10.84	0.18	4.44	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	13.19	11.00	-2.18	2.18	10.44	0.19	4.45	Vu < PhiVc/2	lot Reqd 11.4	4.5	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	13.38	11.00	-2.23	2.23	10.03	0.20	4.46	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	13.56	11.00	-2.29	2.29	9.61	0.22	4.47	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	13.75	11.00	-2.34	2.34	9.18	0.23	4.49	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	13.93	11.00	-2.40	2.40	8.74	0.25	4.50	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.12	11.00	-2.45	2.45	8.29	0.27	4.52	PhiVc/2 < Vu <=	Min 11.4.6.1	19.0	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.31	11.00	-2.51	2.51	7.82	0.29	4.54	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.49	11.00	-2.56	2.56	7.35	0.32	4.56	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.68	11.00	-2.62	2.62	6.87	0.35	4.58	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	14.86	11.00	-2.67	2.67	6.38	0.38	4.61	PhiVc/2 < Vu <=	Min 11.4.6.1	19.1	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.05	11.00	-2.73	2.73	5.88	0.43	4.64	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.23	11.00	-2.78	2.78	5.37	0.48	4.68	PhiVc/2 < Vu <=	Min 11.4.6.1	19.2	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.42	11.00	-2.84	2.84	4.85	0.54	4.74	PhiVc/2 < Vu <=	Min 11.4.6.1	19.3	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.61	11.00	-2.89	2.89	4.31	0.61	4.80	PhiVc/2 < Vu <=	Min 11.4.6.1	19.3	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.79	11.00	-2.95	2.95	3.77	0.72	4.88	PhiVc/2 < Vu <=	Min 11.4.6.1	19.4	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	15.98	11.00	-3.00	3.00	3.22	0.85	5.00	PhiVc/2 < Vu <=	Min 11.4.6.1	19.5	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.16	11.00	-3.05	3.05	2.66	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.35	11.00	-3.11	3.11	2.08	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.54	11.00	-3.16	3.16	1.50	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.72	11.00	-3.22	3.22	0.91	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0
+1.20D+1.60L+0.50S+1.60H	1	16.91	11.00	-3.27	3.27	0.31	1.00	5.12	PhiVc/2 < Vu <=	Min 11.4.6.1	19.6	5.5	5.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio

Concrete Beam

DESCRIPTION: Existing 5th floor joists - Projection room

MAXimum BENDING Envelope					
Span # 1	1	17.000	17.42	21.27	0.82
+1.40D+1.60H					
Span # 1	1	17.000	6.78	21.27	0.32
+1.20D+0.50Lr+1.60L+1.60H					
Span # 1	1	17.000	17.42	21.27	0.82
+1.20D+1.60L+0.50S+1.60H					
Span # 1	1	17.000	17.42	21.27	0.82
+1.20D+1.60Lr+L+1.60H					
Span # 1	1	17.000	13.06	21.27	0.61
+1.20D+1.60Lr+0.50W+1.60H					
Span # 1	1	17.000	5.81	21.27	0.27
+1.20D+L+1.60S+1.60H					
Span # 1	1	17.000	13.06	21.27	0.61
+1.20D+1.60S+0.50W+1.60H					
Span # 1	1	17.000	5.81	21.27	0.27
+1.20D+0.50Lr+L+W+1.60H					
Span # 1	1	17.000	13.06	21.27	0.61
+1.20D+L+0.50S+W+1.60H					
Span # 1	1	17.000	13.06	21.27	0.61
+0.90D+W+1.60H					
Span # 1	1	17.000	4.36	21.27	0.20
+1.20D+L+0.20S+E+1.60H					
Span # 1	1	17.000	13.06	21.27	0.61
+0.90D+E+0.90H					
Span # 1	1	17.000	4.36	21.27	0.20

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L+H	1	0.3512	8.500		0.0000	0.000

Steel Beam

Lic. # : KW-06005570 — ADVANCED STRUCTURAL TECHNOLOGY INC

DESCRIPTION: 4th floor framing around elevator opening

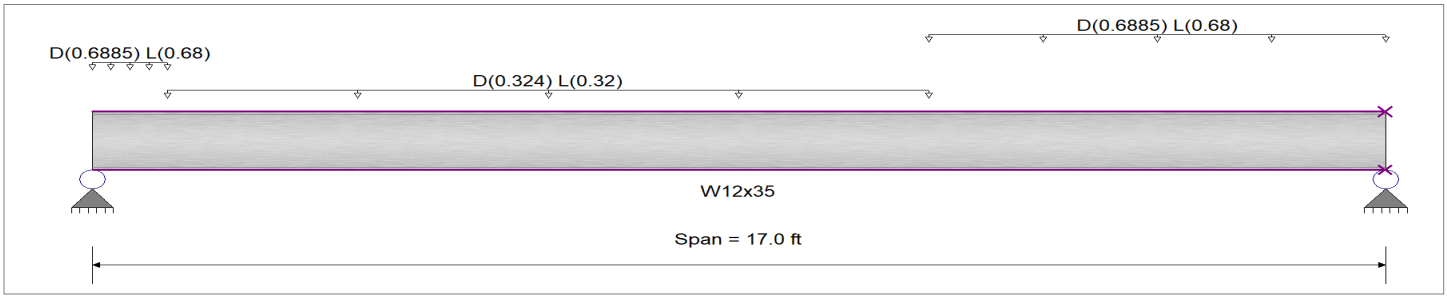
CODE REFERENCES

Calculations per AISC 360-05, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : IBC 2018

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.0810, L = 0.080 ksf, Extent = 1.0 -->> 11.0 ft, Tributary Width = 4.0 ft

Uniform Load : D = 0.0810, L = 0.080 ksf, Extent = 0.0 -->> 1.0 ft, Tributary Width = 8.50 ft

Uniform Load : D = 0.0810, L = 0.080 ksf, Extent = 11.0 -->> 17.0 ft, Tributary Width = 8.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.248 : 1	Maximum Shear Stress Ratio =	0.125 : 1
Section used for this span	W12x35	Section used for this span	W12x35
Ma : Applied	31.642 k-ft	Va : Applied	9.373 k
Mn / Omega : Allowable	127.745 k-ft	Vn/Omega : Allowable	75.0 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	9.617 ft	Location of maximum on span	17.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.096 in	Ratio =	2,116 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.202 in	Ratio =	1010 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 17.00 ft	1	0.129	0.065	16.54		16.54	213.33	127.74	1.00	1.00	4.86	112.50	75.00
+D+L+H													
Dsgn. L = 17.00 ft	1	0.248	0.125	31.64		31.64	213.33	127.74	1.00	1.00	9.37	112.50	75.00
+D+Lr+H													
Dsgn. L = 17.00 ft	1	0.129	0.065	16.54		16.54	213.33	127.74	1.00	1.00	4.86	112.50	75.00
+D+S+H													
Dsgn. L = 17.00 ft	1	0.129	0.065	16.54		16.54	213.33	127.74	1.00	1.00	4.86	112.50	75.00
+D+0.750Lr+0.750L+H													
Dsgn. L = 17.00 ft	1	0.218	0.110	27.87		27.87	213.33	127.74	1.00	1.00	8.25	112.50	75.00
+D+0.750L+0.750S+H													
Dsgn. L = 17.00 ft	1	0.218	0.110	27.87		27.87	213.33	127.74	1.00	1.00	8.25	112.50	75.00
+D+0.60W+H													
Dsgn. L = 17.00 ft	1	0.129	0.065	16.54		16.54	213.33	127.74	1.00	1.00	4.86	112.50	75.00
+D+0.70E+H													
Dsgn. L = 17.00 ft	1	0.129	0.065	16.54	C11	16.54	213.33	127.74	1.00	1.00	4.86	112.50	75.00
+D+0.750Lr+0.750L+0.450W+H													

Steel Beam

DESCRIPTION: 4th floor framing around elevator opening

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 17.00 ft +D+0.750L+0.750S+0.450W+H	1	0.218	0.110	27.87		27.87	213.33	127.74	1.00	1.00	8.25	112.50	75.00
Dsgn. L = 17.00 ft +D+0.750L+0.750S+0.5250E+H	1	0.218	0.110	27.87		27.87	213.33	127.74	1.00	1.00	8.25	112.50	75.00
Dsgn. L = 17.00 ft +0.60D+0.60W+0.60H	1	0.218	0.110	27.87		27.87	213.33	127.74	1.00	1.00	8.25	112.50	75.00
Dsgn. L = 17.00 ft +0.60D+0.70E+0.60H	1	0.078	0.039	9.92		9.92	213.33	127.74	1.00	1.00	2.92	112.50	75.00
Dsgn. L = 17.00 ft	1	0.078	0.039	9.92		9.92	213.33	127.74	1.00	1.00	2.92	112.50	75.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.2020	8.743		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.242	9.373
Overall MINimum	2.275	2.918
+D+H	3.792	4.864
+D+L+H	7.242	9.373
+D+Lr+H	3.792	4.864
+D+S+H	3.792	4.864
+D+0.750Lr+0.750L+H	6.380	8.246
+D+0.750L+0.750S+H	6.380	8.246
+D+0.60W+H	3.792	4.864
+D+0.70E+H	3.792	4.864
+D+0.750Lr+0.750L+0.450W+H	6.380	8.246
+D+0.750L+0.750S+0.450W+H	6.380	8.246
+D+0.750L+0.750S+0.5250E+H	6.380	8.246
+0.60D+0.60W+0.60H	2.275	2.918
+0.60D+0.70E+0.60H	2.275	2.918
D Only	3.792	4.864
Lr Only		
L Only	3.451	4.509
S Only		
W Only		
E Only		
H Only		

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Project Title:
Engineer:
Project ID:
Project Descr:

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Steel Beam

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Lic. # : KW-06005570 ADVANCED STRUCTURAL TECHNOLOGY INC

DESCRIPTION: 4th floor framing around elevator opening

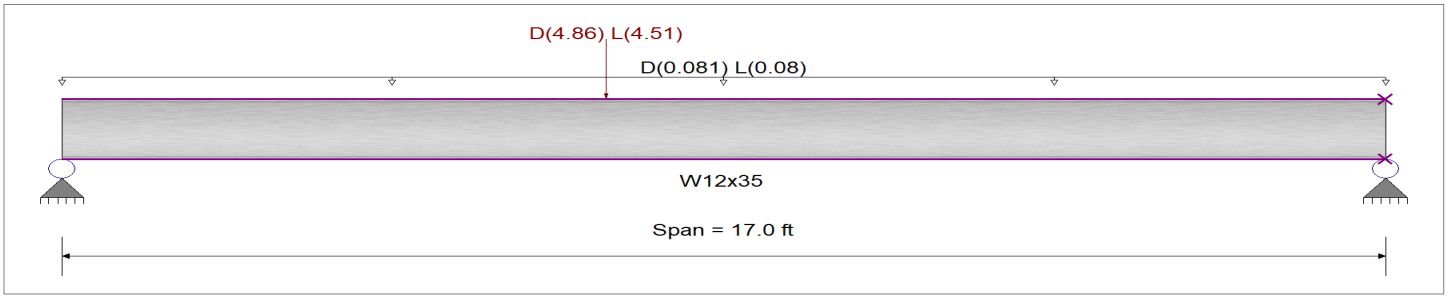
CODE REFERENCES

Calculations per AISC 360-05, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : IBC 2018

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading
Uniform Load : D = 0.0810, L = 0.080 ksf, Tributary Width = 1.0 ft

Point Load : D = 4.860, L = 4.510 k @ 7.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.355 : 1	Maximum Shear Stress Ratio =	0.096 : 1
Section used for this span	W12x35	Section used for this span	W12x35
Ma : Applied	45.409 k-ft	Va : Applied	7.178 k
Mn / Omega : Allowable	127.745 k-ft	Vn/Omega : Allowable	75.0 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	6.994 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.111 in	Ratio =	1,833 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.238 in	Ratio =	857 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 17.00 ft	1	0.188	0.051	24.05		24.05	213.33	127.74	1.00	1.00	3.84	112.50	75.00
+D+L+H													
Dsgn. L = 17.00 ft	1	0.355	0.096	45.41		45.41	213.33	127.74	1.00	1.00	7.18	112.50	75.00
+D+Lr+H													
Dsgn. L = 17.00 ft	1	0.188	0.051	24.05		24.05	213.33	127.74	1.00	1.00	3.84	112.50	75.00
+D+S+H													
Dsgn. L = 17.00 ft	1	0.188	0.051	24.05		24.05	213.33	127.74	1.00	1.00	3.84	112.50	75.00
+D+0.750Lr+0.750L+H													
Dsgn. L = 17.00 ft	1	0.314	0.085	40.07		40.07	213.33	127.74	1.00	1.00	6.34	112.50	75.00
+D+0.750L+0.750S+H													
Dsgn. L = 17.00 ft	1	0.314	0.085	40.07		40.07	213.33	127.74	1.00	1.00	6.34	112.50	75.00
+D+0.60W+H													
Dsgn. L = 17.00 ft	1	0.188	0.051	24.05		24.05	213.33	127.74	1.00	1.00	3.84	112.50	75.00
+D+0.70E+H													
Dsgn. L = 17.00 ft	1	0.188	0.051	24.05		24.05	213.33	127.74	1.00	1.00	3.84	112.50	75.00
+D+0.750Lr+0.750L+0.450W+H													
Dsgn. L = 17.00 ft	1	0.314	0.085	40.07		40.07	213.33	127.74	1.00	1.00	6.34	112.50	75.00
+D+0.750L+0.750S+0.450W+H													
Dsgn. L = 17.00 ft	1	0.314	0.085	40.07	C13	40.07	213.33	127.74	1.00	1.00	6.34	112.50	75.00
+D+0.750L+0.750S+0.5250E+H													

Steel Beam

DESCRIPTION: 4th floor framing around elevator opening

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 17.00 ft	1	0.314	0.085	40.07		40.07	213.33	127.74	1.00	1.00	6.34	112.50	75.00
+0.60D+0.60W+0.60H													
Dsgn. L = 17.00 ft	1	0.113	0.031	14.43		14.43	213.33	127.74	1.00	1.00	2.31	112.50	75.00
+0.60D+0.70E+0.60H													
Dsgn. L = 17.00 ft	1	0.113	0.031	14.43		14.43	213.33	127.74	1.00	1.00	2.31	112.50	75.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.2379	8.160		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.178	5.524
Overall MINimum	2.307	1.792
+D+H	3.845	2.987
+D+L+H	7.178	5.524
+D+Lr+H	3.845	2.987
+D+S+H	3.845	2.987
+D+0.750Lr+0.750L+H	6.345	4.890
+D+0.750L+0.750S+H	6.345	4.890
+D+0.60W+H	3.845	2.987
+D+0.70E+H	3.845	2.987
+D+0.750Lr+0.750L+0.450W+H	6.345	4.890
+D+0.750L+0.750S+0.450W+H	6.345	4.890
+D+0.750L+0.750S+0.5250E+H	6.345	4.890
+0.60D+0.60W+0.60H	2.307	1.792
+0.60D+0.70E+0.60H	2.307	1.792
D Only	3.845	2.987
Lr Only		
L Only	3.333	2.537
S Only		
W Only		
E Only		
H Only		

Steel Beam

Lic. # : KW-06005570 — ADVANCED STRUCTURAL TECHNOLOGY INC

DESCRIPTION: 5th floor framing around elevator opening

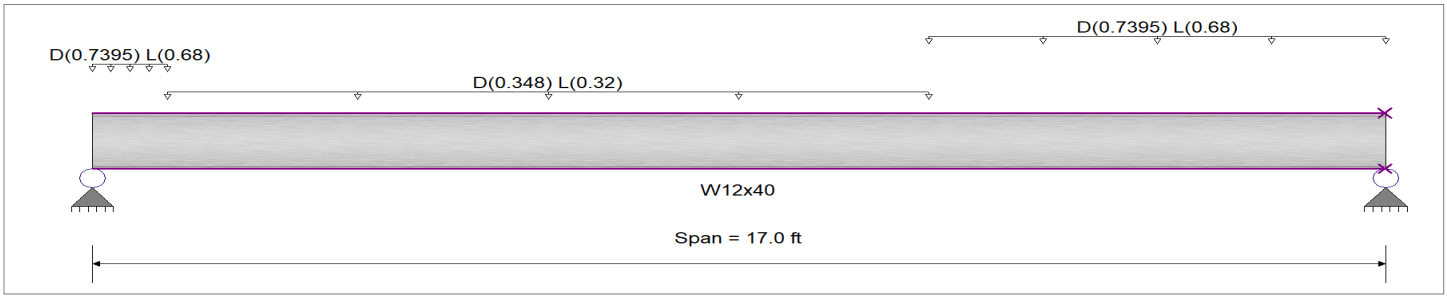
CODE REFERENCES

Calculations per AISC 360-05, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : IBC 2018

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.0870, L = 0.080 ksf, Extent = 1.0 -->> 11.0 ft, Tributary Width = 4.0 ft

Uniform Load : D = 0.0870, L = 0.080 ksf, Extent = 0.0 -->> 1.0 ft, Tributary Width = 8.50 ft

Uniform Load : D = 0.0870, L = 0.080 ksf, Extent = 11.0 -->> 17.0 ft, Tributary Width = 8.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.232 : 1	Maximum Shear Stress Ratio =	0.139 : 1
Section used for this span	W12x40	Section used for this span	W12x40
Ma : Applied	32.950 k-ft	Va : Applied	9.753 k
Mn / Omega : Allowable	142.216 k-ft	Vn/Omega : Allowable	70.210 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	9.569 ft	Location of maximum on span	17.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.089 in	Ratio =	2,280 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.195 in	Ratio =	1045 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 17.00 ft	1	0.125	0.075	17.85		17.85	237.50	142.22	1.00	1.00	5.24	105.32	70.21
+D+L+H													
Dsgn. L = 17.00 ft	1	0.232	0.139	32.95		32.95	237.50	142.22	1.00	1.00	9.75	105.32	70.21
+D+Lr+H													
Dsgn. L = 17.00 ft	1	0.125	0.075	17.85		17.85	237.50	142.22	1.00	1.00	5.24	105.32	70.21
+D+S+H													
Dsgn. L = 17.00 ft	1	0.125	0.075	17.85		17.85	237.50	142.22	1.00	1.00	5.24	105.32	70.21
+D+0.750Lr+0.750L+H													
Dsgn. L = 17.00 ft	1	0.205	0.123	29.17		29.17	237.50	142.22	1.00	1.00	8.63	105.32	70.21
+D+0.750L+0.750S+H													
Dsgn. L = 17.00 ft	1	0.205	0.123	29.17		29.17	237.50	142.22	1.00	1.00	8.63	105.32	70.21
+D+0.60W+H													
Dsgn. L = 17.00 ft	1	0.125	0.075	17.85		17.85	237.50	142.22	1.00	1.00	5.24	105.32	70.21
+D+0.70E+H													
Dsgn. L = 17.00 ft	1	0.125	0.075	17.85	C15	17.85	237.50	142.22	1.00	1.00	5.24	105.32	70.21
+D+0.750Lr+0.750L+0.450W+H													

Steel Beam

DESCRIPTION: 5th floor framing around elevator opening

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 17.00 ft +D+0.750L+0.750S+0.450W+H	1	0.205	0.123	29.17		29.17	237.50	142.22	1.00	1.00	8.63	105.32	70.21
Dsgn. L = 17.00 ft +D+0.750L+0.750S+0.5250E+H	1	0.205	0.123	29.17		29.17	237.50	142.22	1.00	1.00	8.63	105.32	70.21
Dsgn. L = 17.00 ft +0.60D+0.60W+0.60H	1	0.205	0.123	29.17		29.17	237.50	142.22	1.00	1.00	8.63	105.32	70.21
Dsgn. L = 17.00 ft +0.60D+0.70E+0.60H	1	0.075	0.045	10.71		10.71	237.50	142.22	1.00	1.00	3.15	105.32	70.21
Dsgn. L = 17.00 ft	1	0.075	0.045	10.71		10.71	237.50	142.22	1.00	1.00	3.15	105.32	70.21

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.1952	8.743		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.543	9.753
Overall MINimum	2.456	3.146
+D+H	4.093	5.244
+D+L+H	7.543	9.753
+D+Lr+H	4.093	5.244
+D+S+H	4.093	5.244
+D+0.750Lr+0.750L+H	6.680	8.626
+D+0.750L+0.750S+H	6.680	8.626
+D+0.60W+H	4.093	5.244
+D+0.70E+H	4.093	5.244
+D+0.750Lr+0.750L+0.450W+H	6.680	8.626
+D+0.750L+0.750S+0.450W+H	6.680	8.626
+D+0.750L+0.750S+0.5250E+H	6.680	8.626
+0.60D+0.60W+0.60H	2.456	3.146
+0.60D+0.70E+0.60H	2.456	3.146
D Only	4.093	5.244
Lr Only		
L Only	3.451	4.509
S Only		
W Only		
E Only		
H Only		

Steel Beam

Lic. # : KW-06005570 — ADVANCED STRUCTURAL TECHNOLOGY INC

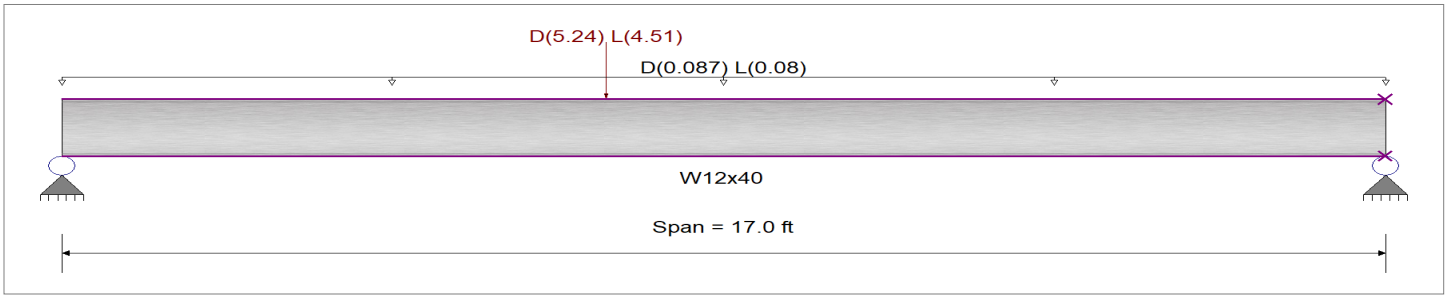
DESCRIPTION: 5th floor framing around elevator opening

CODE REFERENCES

Calculations per AISC 360-05, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : IBC 2018

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading
Uniform Load : D = 0.0870, L = 0.080 ksf, Tributary Width = 1.0 ft

Point Load : D = 5.240, L = 4.510 k @ 7.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.333 : 1	Maximum Shear Stress Ratio =	0.107 : 1
Section used for this span	W12x40	Section used for this span	W12x40
Ma : Applied	47.358 k-ft	Va : Applied	7.495 k
Mn / Omega : Allowable	142.216 k-ft	Vn/Omega : Allowable	70.210 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	6.994 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.103 in	Ratio =	1,975 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.230 in	Ratio =	885 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 17.00 ft	1	0.183	0.059	26.00		26.00	237.50	142.22	1.00	1.00	4.16	105.32	70.21
+D+L+H													
Dsgn. L = 17.00 ft	1	0.333	0.107	47.36		47.36	237.50	142.22	1.00	1.00	7.49	105.32	70.21
+D+Lr+H													
Dsgn. L = 17.00 ft	1	0.183	0.059	26.00		26.00	237.50	142.22	1.00	1.00	4.16	105.32	70.21
+D+S+H													
Dsgn. L = 17.00 ft	1	0.183	0.059	26.00		26.00	237.50	142.22	1.00	1.00	4.16	105.32	70.21
+D+0.750Lr+0.750L+H													
Dsgn. L = 17.00 ft	1	0.295	0.095	42.02		42.02	237.50	142.22	1.00	1.00	6.66	105.32	70.21
+D+0.750L+0.750S+H													
Dsgn. L = 17.00 ft	1	0.295	0.095	42.02		42.02	237.50	142.22	1.00	1.00	6.66	105.32	70.21
+D+0.60W+H													
Dsgn. L = 17.00 ft	1	0.183	0.059	26.00		26.00	237.50	142.22	1.00	1.00	4.16	105.32	70.21
+D+0.70E+H													
Dsgn. L = 17.00 ft	1	0.183	0.059	26.00		26.00	237.50	142.22	1.00	1.00	4.16	105.32	70.21
+D+0.750Lr+0.750L+0.450W+H													
Dsgn. L = 17.00 ft	1	0.295	0.095	42.02		42.02	237.50	142.22	1.00	1.00	6.66	105.32	70.21
+D+0.750L+0.750S+0.450W+H													
Dsgn. L = 17.00 ft	1	0.295	0.095	42.02	C17	42.02	237.50	142.22	1.00	1.00	6.66	105.32	70.21
+D+0.750L+0.750S+0.5250E+H													

Steel Beam

DESCRIPTION: 5th floor framing around elevator opening

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 17.00 ft +0.60D+0.60W+0.60H	1	0.295	0.095	42.02		42.02	237.50	142.22	1.00	1.00	6.66	105.32	70.21
Dsgn. L = 17.00 ft +0.60D+0.70E+0.60H	1	0.110	0.036	15.60		15.60	237.50	142.22	1.00	1.00	2.50	105.32	70.21
Dsgn. L = 17.00 ft	1	0.110	0.036	15.60		15.60	237.50	142.22	1.00	1.00	2.50	105.32	70.21

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.2305	8.160		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.495	5.774
Overall MINimum	2.497	1.942
+D+H	4.162	3.237
+D+L+H	7.495	5.774
+D+Lr+H	4.162	3.237
+D+S+H	4.162	3.237
+D+0.750Lr+0.750L+H	6.662	5.140
+D+0.750L+0.750S+H	6.662	5.140
+D+0.60W+H	4.162	3.237
+D+0.70E+H	4.162	3.237
+D+0.750Lr+0.750L+0.450W+H	6.662	5.140
+D+0.750L+0.750S+0.450W+H	6.662	5.140
+D+0.750L+0.750S+0.5250E+H	6.662	5.140
+0.60D+0.60W+0.60H	2.497	1.942
+0.60D+0.70E+0.60H	2.497	1.942
D Only	4.162	3.237
Lr Only		
L Only	3.333	2.537
S Only		
W Only		
E Only		
H Only		

Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

4.3 Concrete edge failure in direction y+

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

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

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

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

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

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

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

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right) \lambda_a \sqrt{f'_c}\, c_{a1}^{1.5}$ ACI 318-14 Eq. (17.5.2.2a)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
5.500	15.000	0.000	1.400	16.000

l_e [in.]	λ_a	d_a [in.]	f'_c [psi]	$\psi_{parallel,V}$
4.000	1.000	0.625	3,000	2.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ec,V}$	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
193.88	136.13	1.000	1.000	1.000	5,667

Results

V_{cbg} [lb]	$\phi_{concrete}$	ϕV_{cbg} [lb]	V_{ua} [lb]
22,601	0.700	15,820	10,320

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.444	0.652	5/3	75	OK

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

6 Warnings

- The anchor design methods in PROFIS Anchor require rigid anchor plates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies when supplementary reinforcement is used. The Φ factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-14, Section 17.8.1.

Fastening meets the design criteria!

Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

7 Installation data

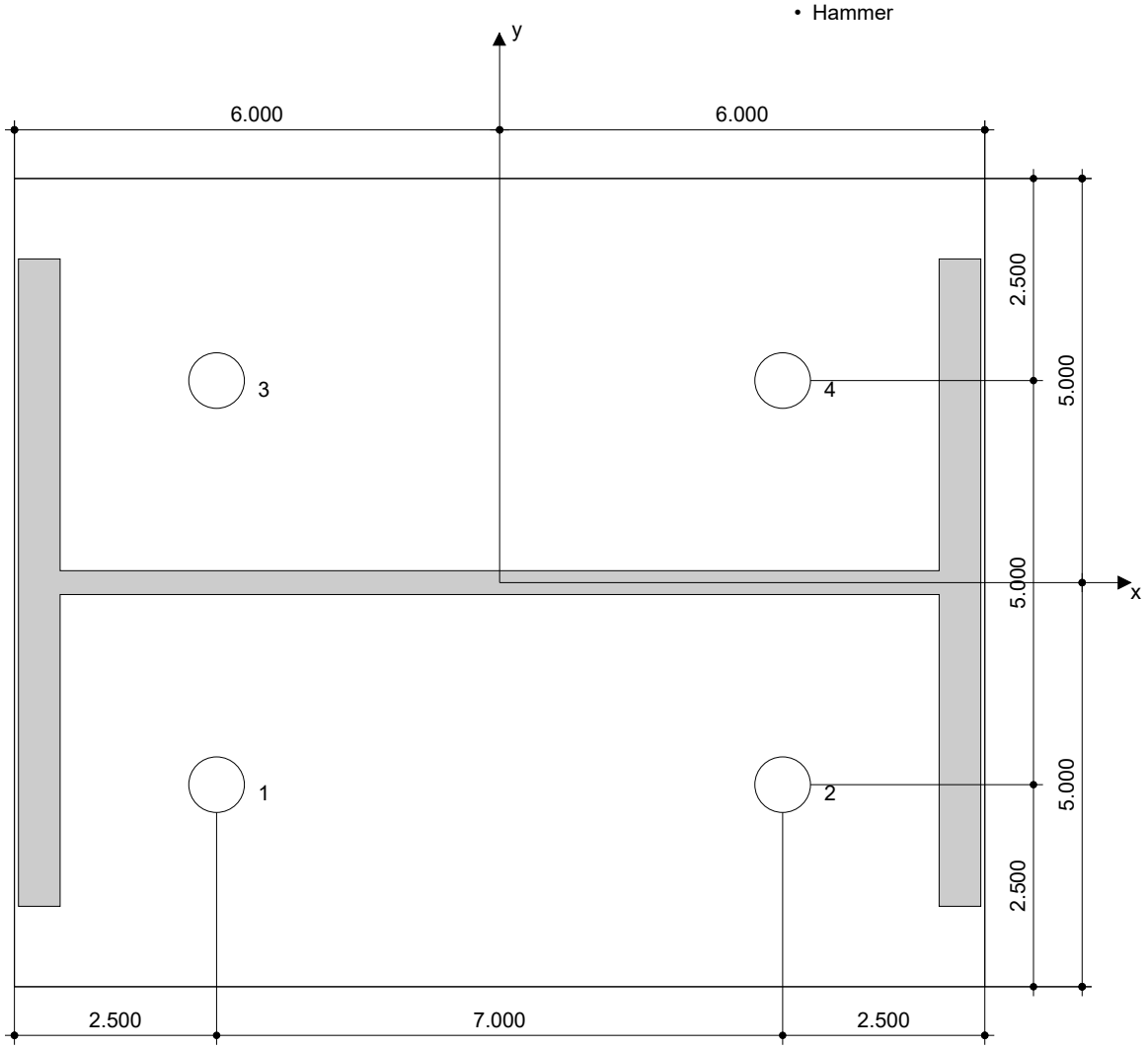
Anchor plate, steel: -
Profile: W shape (AISC), W12X40; (L x W x T x FT) = 11.900 in. x 8.010 in. x 0.295 in. x 0.515 in.
Hole diameter in the fixture: d_f = 0.688 in.
Plate thickness (input): 0.500 in.
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: Kwik Bolt TZ - CS 5/8 (4)
Installation torque: 720.001 in.lb

Hole diameter in the base material: 0.625 in.
Hole depth in the base material: 4.750 in.
Minimum thickness of the base material: 8.000 in.

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Manual blow-out pump	• Torque controlled cordless impact tool (Hilti Safeset System) • Torque wrench • Hammer



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-3.500	-2.500	15.000	-	5.500	10.500
2	3.500	-2.500	22.000	-	5.500	10.500
3	-3.500	2.500	15.000	-	10.500	5.500
4	3.500	2.500	22.000	-	10.500	5.500

Company:		Page:	7
Specifier:		Project:	
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	5/13/2020
E-Mail:			

8 Remarks; Your Cooperation Duties

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Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 13 MAY 2020, 10:43AM

Steel Beam

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Lic. # : KW-06005570 ADVANCED STRUCTURAL TECHNOLOGY INC

DESCRIPTION: Elevator hoist beam

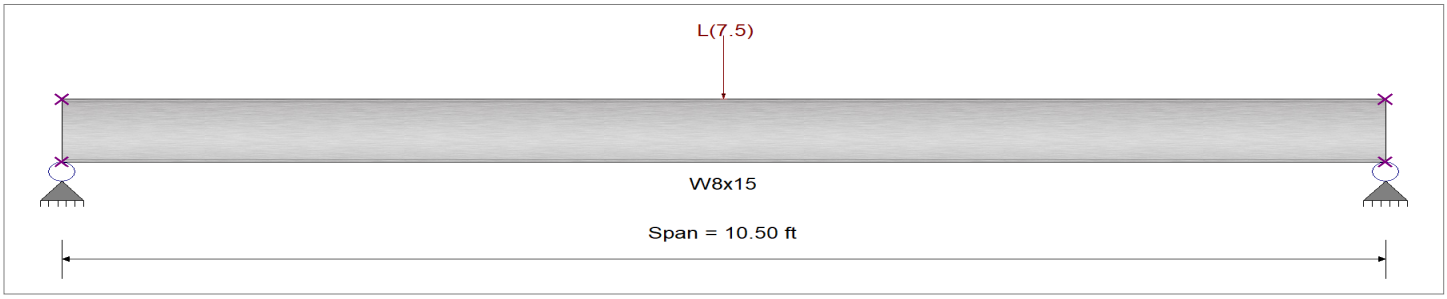
CODE REFERENCES

Calculations per AISC 360-05, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : L = 7.50 k @ 5.250 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.770 : 1	Maximum Shear Stress Ratio =	0.094 : 1
Section used for this span	W8x15	Section used for this span	W8x15
Ma : Applied	19.688 k-ft	Va : Applied	3.750 k
Mn / Omega : Allowable	25.554 k-ft	Vn/Omega : Allowable	39.739 k
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span	5.250 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.225 in	Ratio =	558 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.225 in	Ratio =	559 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 10.50 ft	1		0.000				32.43	19.42	1.00	1.00	-0.00	59.61	39.74
+D+L+H													
Dsgn. L = 10.50 ft	1	0.770	0.094	19.69		19.69	42.68	25.55	1.32	1.00	3.75	59.61	39.74
+D+Lr+H													
Dsgn. L = 10.50 ft	1		0.000				32.43	19.42	1.00	1.00	-0.00	59.61	39.74
+D+S+H													
Dsgn. L = 10.50 ft	1		0.000				32.43	19.42	1.00	1.00	-0.00	59.61	39.74
+D+0.750Lr+0.750L+H													
Dsgn. L = 10.50 ft	1	0.578	0.071	14.77		14.77	42.68	25.55	1.32	1.00	2.81	59.61	39.74
+D+0.750L+0.750S+H													
Dsgn. L = 10.50 ft	1	0.578	0.071	14.77		14.77	42.68	25.55	1.32	1.00	2.81	59.61	39.74
+D+0.60W+H													
Dsgn. L = 10.50 ft	1		0.000				32.43	19.42	1.00	1.00	-0.00	59.61	39.74
+D+0.750Lr+0.750L+0.450W+H													
Dsgn. L = 10.50 ft	1	0.578	0.071	14.77		14.77	42.68	25.55	1.32	1.00	2.81	59.61	39.74
+D+0.750L+0.750S+0.450W+H													
Dsgn. L = 10.50 ft	1	0.578	0.071	14.77		14.77	42.68	25.55	1.32	1.00	2.81	59.61	39.74
+0.60D+0.60W+0.60H													
Dsgn. L = 10.50 ft	1		0.000				32.43	19.42	1.00	1.00	-0.00	59.61	39.74
+D+0.70E+0.60H													
Dsgn. L = 10.50 ft	1		0.000				32.43	19.42	1.00	1.00	-0.00	59.61	39.74
+D+0.750L+0.750S+0.5250E+H													

Steel Column

DESCRIPTION: Elevator Rail

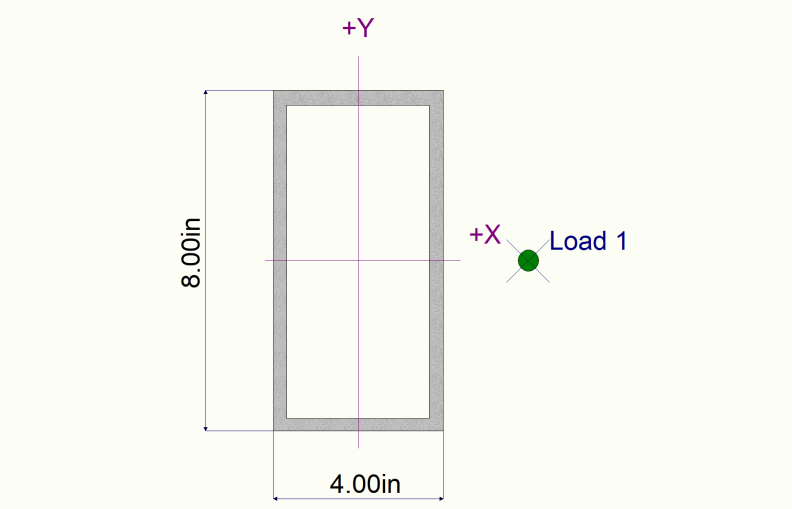
Maximum Deflections for Load Combinations

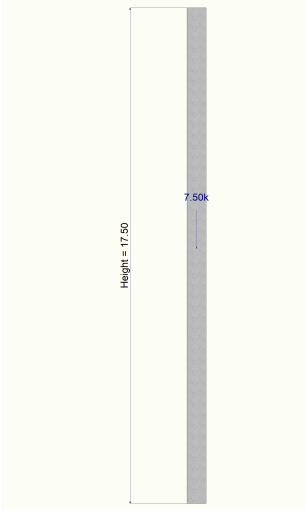
Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
W Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
E Only	0.0000	in	0.000	ft	0.000	in	0.000	ft
H Only	0.0000	in	0.000	ft	0.000	in	0.000	ft

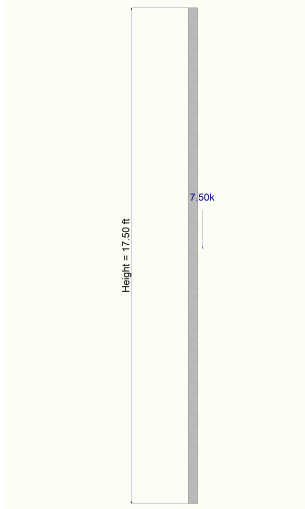
Steel Section Properties : HSS8x4x5/16

Depth	=	8.000	in	I xx	=	51.00	in^4	J	=	42.600	in^4
Design Thick	=	0.291	in	S xx	=	12.80	in^3	Cw	=	16.50	in^6
Width	=	4.000	in	R xx	=	2.820	in				
Wall Thick	=	0.313	in	Zx	=	16.100	in^3				
Area	=	6.430	in^2	I yy	=	17.200	in^4	C	=	16.500	in^3
Weight	=	23.318	plf	S yy	=	8.580	in^3				
				R yy	=	1.630	in				
				Zy	=	9.910	in^3				
Ycg	=	0.000	in								

Sketches







Project SD 1007

Date

By

Sheet ____ of ____

Lift: Capable of lifting 625 lbs

Lift wt = 23.5 lbs

- Lifting strap tested to hold 3000 lbs
- Slings rated to 1000 lbs

Based on spec info from a past project, apply a 1.65 factor to the service level load.

1.5 (load factor) x 1.1 (impact load factor) = 1.65

L/200 deflection limit

1000 lb (1.65) = 1,650 lb ← design load

SECTION D

PATIENT LIFT DESIGN

Project SD 1007

Date

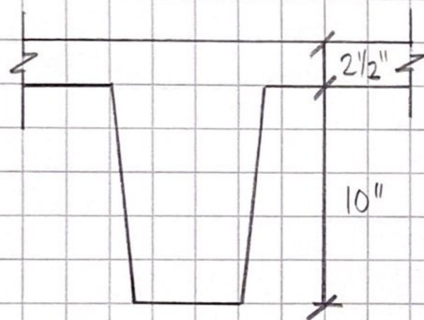
By

Sheet ___ of ___

Patient lift system

Lift system capacity ≅ 1000 lb

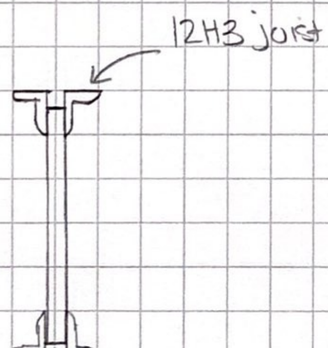
Two existing conditions to attach to:



spaced @ ~20" o.c.

L = 17'-0"

Joists are sufficient (Enercalc)



spaced @ 24" o.c.

L = 17'-0"

$\omega_{Allow} = 323\text{plf}$

Existing DL = 49 psf
LL = 50 psf (office)
} = 100 psf

$$M = \frac{wl^2}{8} + \frac{Pl}{4} = \frac{200\text{plf}(17')^2}{8} + \frac{1100(17')}{4} = 11{,}900 \text{ ft-lb}$$

$$M = \frac{323\text{plf}(17')^2}{8} = 11{,}668 \text{ ft-lb} \not> 11{,}900 \text{ ft-lb}$$

But within 2% overage ✓ ok

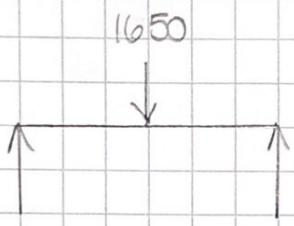
Project SD 1007

Date

By

Sheet ____ of ____

L = 24"



$M = \frac{1650(21)}{4} = 825\ ft\text{-}lb$

P1000

Max allowable uniform load = 1,690 lb (1.0) = 1690 lb (.5) = 845 lb

P1001

Max allowable uniform load = 3,500 lb (1.0) = 3500 lb (.5) = 1750 lb ✓ok

P1001 works for both the concrete joists and steel joists

Bent Plate: ϕM_n $\phi = 0.9$

$(0.9)36ksi\ S = M$

$S = \frac{1}{6}bd^2$

$M = 1.65k(6") = 9.9\ k\cdot in$

$99\ k\cdot in = 36\ ksi\left(\frac{1}{6}(6")(d^2)\right) \Rightarrow d = 0.524"$

Per profis, (2) Kwik Hus-EZ 3/8" ∅ w/ 4" edge distance is acceptable for 1650 lb w/ 2 1/2" embed

Allowable tension load for 1/2" ∅ threaded rod = 3,750 lb

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Specifier:		Project:	
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	5/13/2020
E-Mail:			

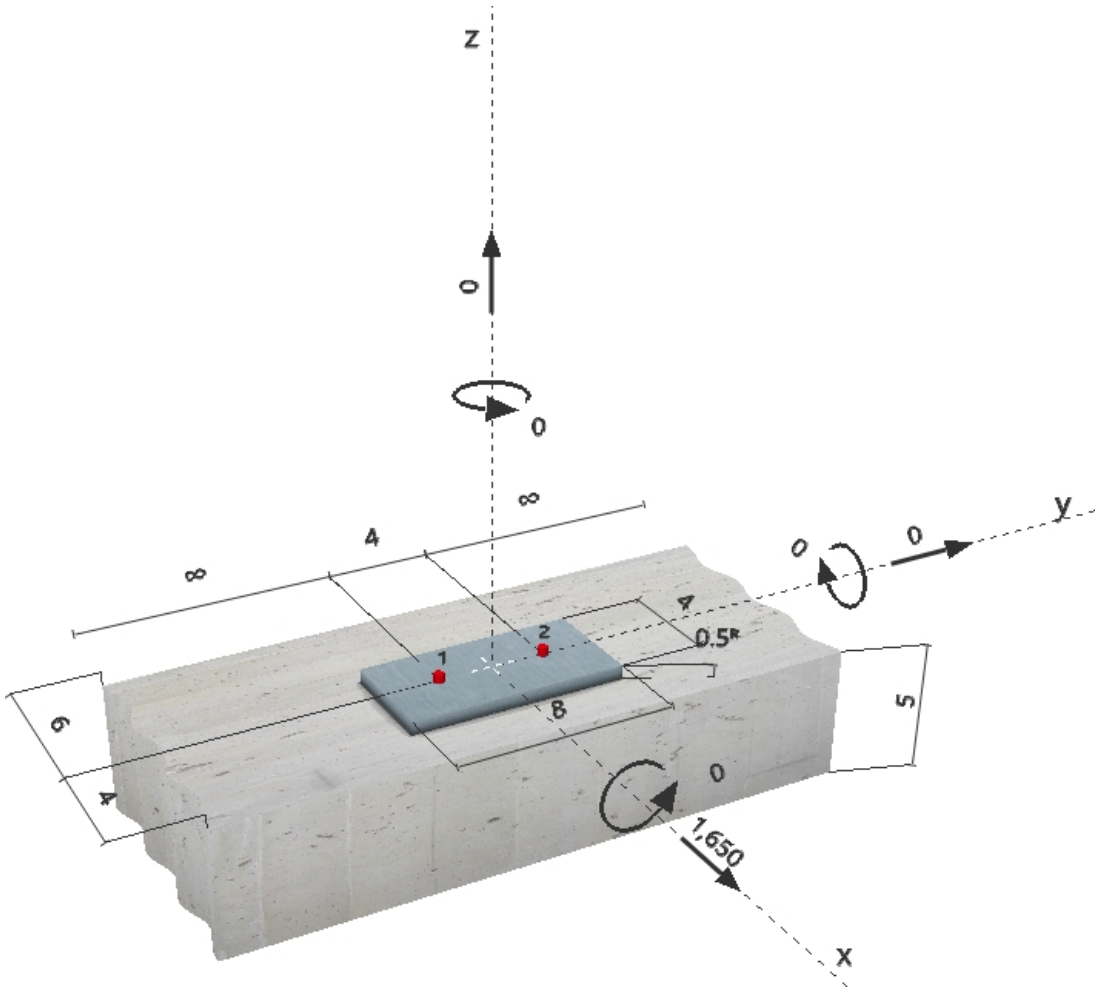
Specifier's comments:

1 Input data

Anchor type and diameter:	**KWIK HUS-EZ (KH-EZ) 3/8 (3 1/4)**
Effective embedment depth:	h_{ef} = 2.500 in., h_{nom} = 3.250 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-3027
Issued I Valid:	12/1/2017 | 12/1/2019
Proof:	Design method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate:	l_x x l_y x t = 4.000 in. x 8.000 in. x 0.500 in.; (Recommended plate thickness: not calculated
Profile:	no profile
Base material:	uncracked concrete, 3000, f_c' = 3,000 psi; h = 5.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

R - user is responsible to ensure a rigid base plate for the entered thickness with appropriate solutions (stiffeners,...)

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



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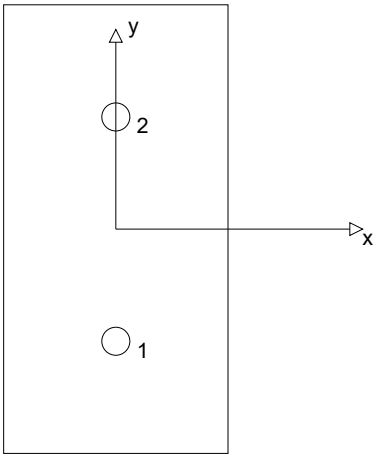
2 Load case/Resulting anchor forces



Load case: Design loads

Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0	825	825	0
2	0	825	825	0

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]

Anchor forces based on a rigid base plate assumption!

3 Tension load

	Load N_{ua} [lb]	Capacity ϕN_n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Strength**	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (anchors in tension)

Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	825	3,111	27	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	1,650	11,154	15	OK
Concrete edge failure in direction x+**	1,650	3,274	51	OK

* anchor having the highest loading **anchor group (relevant anchors)

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-3027
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.09	120,300

Calculations

V_{sa} [lb]
5,185

Results

V_{sa} [lb]	ϕ steel	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
5,185	0.600	3,111	825

4.2 Pryout Strength

$V_{cpg} = k_{cp}\left[\left(\frac{A_{Nc}}{A_{Nc0}}\right)\psi_{ec,N}\,\psi_{ed,N}\,\psi_{c,N}\,\psi_{cp,N}\,N_b\right]$ ACI 318-08 Eq. (D-31)

$\phi\ V_{cpg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9\,h_{ef}^2$ ACI 318-08 Eq. (D-6)

$\psi_{ec,N} = \left(\frac{1}{1+\frac{2\,e'_N}{3\,h_{ef}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-9)

$\psi_{ed,N} = 0.7 + 0.3\left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-08 Eq. (D-11)

$\psi_{cp,N} = \mathrm{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-08 Eq. (D-13)

$N_b = k_c\,\lambda\,\sqrt{f'_c}\,h_{ef}^{1.5}$ ACI 318-08 Eq. (D-7)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	2.500	0.000	0.000	4.000

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ	f'_c [psi]
1.000	3.750	24	1	3,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
86.25	56.25	1.000	1.000	1.000	1.000	5,196

Results

V_{cpg} [lb]	ϕ concrete	$\phi\ V_{cpg}$ [lb]	V_{ua} [lb]
15,935	0.700	11,154	1,650

Company:
Specifier:
Address:
Phone I Fax: |
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4.3 Concrete edge failure in direction x+

$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ec,V} \psi_{ed,V} \psi_{c,V} \psi_{h,V} \psi_{parallel,V} V_b$ ACI 318-08 Eq. (D-22)

$\phi V_{cbg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

A_{Vc} see ACI 318-08, Part D.6.2.1, Fig. RD.6.2.1(b)

$A_{Vc0} = 4.5 c_{a1}^2$ ACI 318-08 Eq. (D-23)

$\psi_{ec,V} = \left(\frac{1}{1 + \frac{2e'_v}{3c_{a1}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-26)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-08 Eq. (D-28)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-08 Eq. (D-29)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right) \lambda \sqrt{f'_c}\, c_{a1}^{1.5}$ ACI 318-08 Eq. (D-24)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
4.000	-	0.000	1.400	5.000

l_e [in.]	λ	d_a [in.]	f'_c [psi]	$\psi_{parallel,V}$
2.500	1.000	0.375	3,000	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ec,V}$	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
80.00	72.00	1.000	1.000	1.095	2,745

Results

V_{cbg} [lb]	$\phi_{concrete}$	ϕV_{cbg} [lb]	V_{ua} [lb]
4,678	0.700	3,274	1,650

5 Warnings

- The anchor design methods in PROFIS Anchor require rigid anchor plates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies when supplementary reinforcement is used. The Φ factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!

Fastening meets the design criteria!

Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

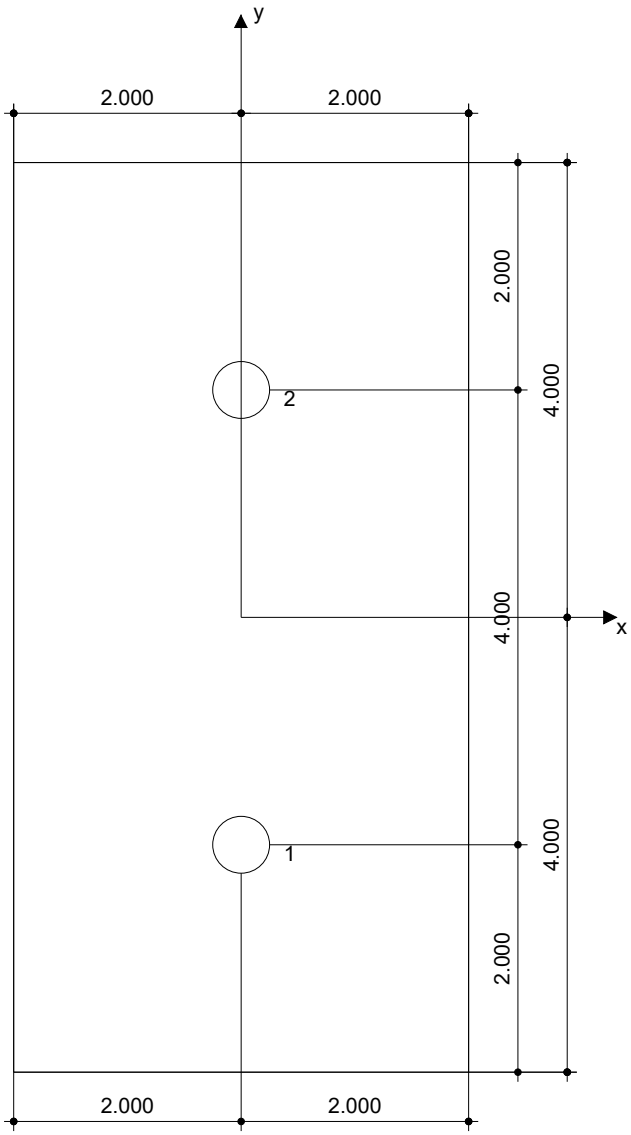
6 Installation data

Anchor plate, steel: -
Profile: no profile
Hole diameter in the fixture: d_f = 0.500 in.
Plate thickness (input): 0.500 in.
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Anchor type and diameter: KWIK HUS-EZ (KH-EZ) 3/8 (3 1/4)
Installation torque: 480.001 in.lb
Hole diameter in the base material: 0.375 in.
Hole depth in the base material: 3.500 in.
Minimum thickness of the base material: 4.750 in.
Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

[R] - user is responsible to ensure a rigid base plate for the entered thickness with appropriate solutions (stiffeners,...)

6.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer	• Manual blow-out pump	• Torque wrench
• Properly sized drill bit		



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.000	-2.000	6.000	4.000	-	-
2	0.000	2.000	6.000	4.000	-	-

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Phone I Fax:	|	Date:	5/13/2020
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7 Remarks; Your Cooperation Duties

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SECTION E

RETAINING WALL AND EXTERIOR MECHANICAL PAD DESIGN

This Wall in File: N:\SD 1007 - SFVA Auditorium and Chapel Reno\Structural Analysis - Calculations\s

RetainPro (c) 1987-2017, Build 11.17.11.03
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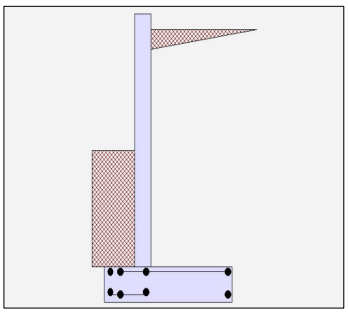
Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	7.83 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	46.00 in
Water height over heel	=	0.0 ft



Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	1,500.0 psf	Soil Density, Heel	=	125.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	0.00 pcf
At-Rest Heel Pressure	=	35.0 psf/ft	Footing||Soil Friction	=	0.450
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	440.0 psf/ft			

Surcharge Loads

Surcharge Over Heel	=	40.0 psf	Surcharge Over Toe	=	0.0
Used To Resist Sliding & Overturning			Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs	Axial Load Eccentricity	=	0.0 in
Axial Live Load	=	0.0 lbs			

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)

Wind on Exposed Stem

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs	Footing Type	Line Load	
Footing Width	=	0.00 ft	Base Above/Below Soil		
Eccentricity	=	0.00 in	at Back of Wall	=	0.0 ft
Wall to Ftg CL Dist	=	0.00 ft	Poisson's Ratio	=	0.300

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Wall Design Summary

Stability Ratios

Overturning	=	3.42 OK
Sliding	=	1.54 OK

Soil Bearing

Total Bearing Load	=	5,149 lbs
...resultant ecc.	=	5.26 in
Soil Pressure @ Toe	=	1,472 psf OK
Soil Pressure @ Heel	=	489 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,061 psf
ACI Factored @ Heel	=	685 psf
Footing Shear @ Toe	=	2.7 psi OK
Footing Shear @ Heel	=	7.6 psi OK
Allowable	=	82.2 psi

Sliding

Resisting Forces

Vertical Forces	Force
Soil Over Heel	3,263.8 lbs
Sloped Soil Over Heel	0.0
Surcharge Over Heel	133.3
Adjacent Footing Load	0.0
Axial Dead Load on Stem	0.0
Axial Live Load on Stem *	Omit
Soil Over Toe	0.0
Surcharge Over Toe	0.0
Stem Weight(s)	833.3
Earth @ Stem Transitions	0.0
Footing Weight	918.8
Key Weight	0.0
Vert. Component **	0.0
Total Vertical Loads	5,149.1 lbs

Sliding Forces

Lateral Forces	Force
* Heel Active Pressure	1,417.4 lbs
Surcharge over Heel	87.5
Adjacent Footing	0.0
Surcharge Over Toe	0.0
Load @ Stem Above Soil	0.0
Added Lateral Load	0.0
Seismic Load	0.0
Seismic-Self-weight	0.0
Lateral on Key	0.0
Totals =	1,504.9 lbs

*Includes water table effect

* Axial live load NOT included in total displayed , or used for overturning or sliding resistance, but is included for soil pressure calculations.

Sliding Calcs

Lateral Sliding Force	=	1,504.9 lbs	
less 0 % Passive Force	=	- 0.0 lbs	
less 100% Friction Force	=	- 2,317.1 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment	
Soil Over Heel	3,263.8	lbs	3.58	ft	11,695.1	ft-#
Sloped Soil Over Heel	0.0					
Surcharge Over Heel	133.3		3.58		477.8	
Adjacent Footing Load	0.0					
Axial Dead Load on Stem	0.0					
Axial Live Load on Stem *	0.0					
Soil Over Toe	0.0		0.63			
Surcharge Over Toe	0.0					
Stem Weight(s)	833.3		1.58		1,319.4	
Earth @ Stem Transitions	0.0					
Footing Weight	918.8		2.63		2,411.7	
Key Weight	0.0					
Vert. Component	0.0					
Total Vertical Loads	5,149.1	lbs				
Resisting Moment					**15,904.0**	ft-#
Eccentricity					**5.3**	in

* Axial live load NOT included in total displayed, or used for overturning or sliding resistance, but is included for soil pressure calculations.

Overturning

Overturning Moments

Overturning Moments	Force		Distance		Moment	
Heel Active Pressure	1,417.4	lbs	3.00	ft	4,252.0	ft-#
Surcharge over Heel	87.5		4.50		393.7	
Adjacent Footing	0.0					
Surcharge Over Toe	0.0					
Load @ Stem Above Soil	0.0					
Added Lateral Load	0.0					
Seismic Load	0.0					
Seismic-Self-weight	0.0					
Totals =	1,504.9	lbs				
Overturning Moment					4,645.7	ft-#

Stem Design Summary

			Bottom
			Stem OK
Design Height Above Ftg	ft	=	0.00
Wall Material Above "Ht"		=	Concrete
Design Method		=	LRFD
Thickness		=	8.00
Rebar Size		=	# 6
Rebar Spacing		=	16.00
Rebar Placed at		=	Edge
Design Data			
fb/FB + fa/Fa		=	**0.630**
Total Force @ Section			
Service Level	lbs	=	
Strength Level	lbs	=	1,858.3
Moment....Actual			
Service Level	ft-#	=	
Strength Level	ft-#	=	5,035.4
Moment.....Allowable		=	7,991.7
Shear.....Actual			
Service Level	psi	=	
Strength Level	psi	=	27.5
Shear.....Allowable	psi	=	94.9
Anet	in2	=	
Rebar Depth 'd'	in	=	5.63
Masonry Data			
f'm	psi	=	
Fs	psi	=	
Solid Grouting		=	
Modular Ratio 'n'		=	
Wall Weight	psf	=	100.0
Short Term Factor		=	
Equiv. Solid Thick.		=	
Masonry Block Type		=	Medium Weight
Masonry Design Method		=	ASD
Concrete Data			
f'c	psi	=	4,000.0
Fy	psi	=	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2109 in2/ft		
(4/3) * As :	0.2812 in2/ft	Min Stem T&S Reinf Area 1.600 in2	
200bd/fy : 200(12)(5.625)/60000 :	0.225 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.225 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.33 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.2192 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.25 ft	f'c		=	3,000	psi
Heel Width	=	4.00	Fy		=	60,000	psi
Total Footing Width	=	5.25 ft	Footing Concrete Density		=	150.00	pcf
Footing Thickness	=	14.00 in	Min. As %		=	0.0018	
Key Width	=	0.00 in	Rebar Cover	@ Top	=	2.00	in
Key Depth	=	0.00 in		@ Bottom	=	3.00	in
Key Distance from Toe	=	0.00 ft					

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,061	685	psf
Mu' : Upward	=	1,525	5,423	ft-#
Mu' : Downward	=	613	8,050	ft-#
Mu: Design	=	912	2,626	ft-#
Actual 1-Way Shear	=	2.70	7.57	psi
Allow 1-Way Shear	=	43.82	43.82	psi

Toe Reinforcing	=	# 6 @ 16.00 in
Heel Reinforcing	=	# 6 @ 18.00 in
Key Reinforcing	=	None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm

Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm

Key: No key defined

Min footing T&S reinf Area	1.59	in2
Min footing T&S reinf Area per fc	0.30	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.065	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Concrete Beam

Lic. # : KW-06005570 — ADVANCED STRUCTURAL TECHNOLOGY INC

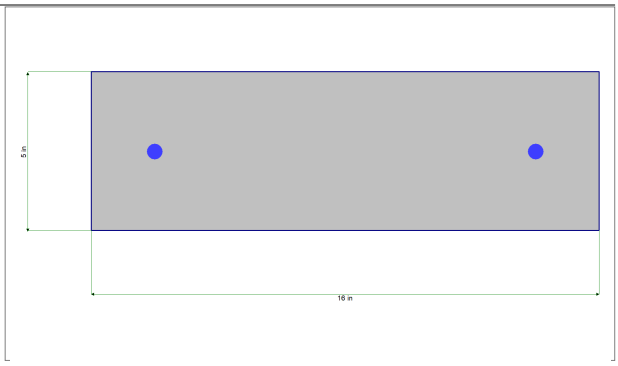
DESCRIPTION: Mechanical slab

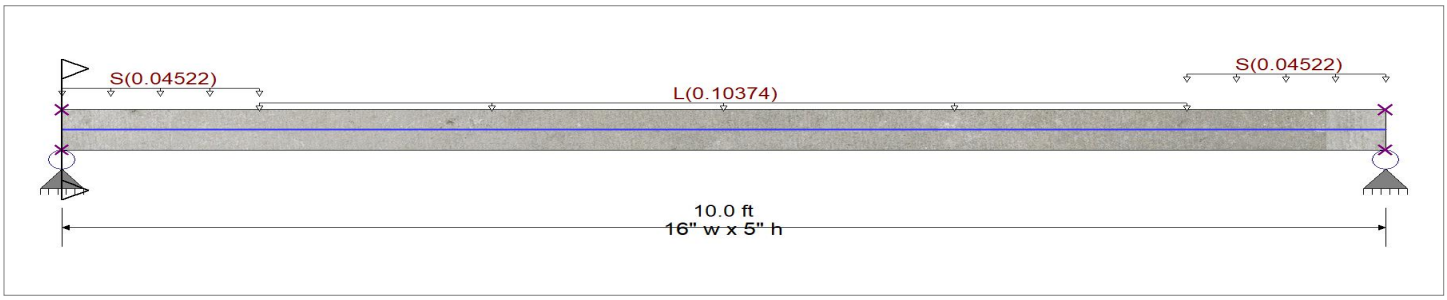
CODE REFERENCES

Calculations per ACI 318-08, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set : ASCE 7-16

Material Properties

f'c	= 4.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c^1/2 * 7.50	= 474.342 psi		Shear :	0.750
ψ Density	= 145.0 pcf	β 1	=	0.850
λ LtWt Factor	= 1.0			
Elastic Modulus	= 3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	= 60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	= 29,000.0 ksi	Stirrup Bar Size #		3
		Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 16.0 in, Height = 5.0 in
Span #1 Reinforcing....
2-#4 at 2.50 in from Top, from 0.0 to 10.0 ft in this span

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : L = 0.0780 ksf, Extent = 1.50 -->> 8.50 ft, Tributary Width = 1.330 ft
Uniform Load : S = 0.0340 ksf, Extent = 0.0 -->> 1.50 ft, Tributary Width = 1.330 ft
Uniform Load : S = 0.0340 ksf, Extent = 8.50 -->> 10.0 ft, Tributary Width = 1.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.761** : 1	Maximum Deflection				
Section used for this span	**Typical Section**	Max Downward Transient Deflection	0.040 in	Ratio =	2994	>=360
Mu : Applied	3.122 k-ft	Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0
Mn * Phi : Allowable	4.103 k-ft	Max Downward Total Deflection	0.075 in	Ratio =	1602	>=180
Location of maximum on span	5.009 ft	Max Upward Total Deflection	0.000 in	Ratio =	0	<180.0
Span # where maximum occurs	Span # 1					

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	0.766	0.766
Overall MINimum	0.068	0.068
+D+H	0.403	0.403
+D+L+H	0.766	0.766
+D+Lr+H	0.403	0.403
+D+S+H	0.471	0.471
+D+0.750Lr+0.750L+H	0.675	0.675
+D+0.750L+0.750S+H	0.726	0.726
+D+0.60W+H	0.403	0.403
+D+0.750Lr+0.750L+0.450W+H	0.675	0.675

Concrete Beam

DESCRIPTION: Mechanical slab

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	0.726	0.726
+0.60D+0.60W+0.60H	0.242	0.242
+D+0.70E+0.60H	0.403	0.403
+D+0.750L+0.750S+0.5250E+H	0.726	0.726
+0.60D+0.70E+H	0.242	0.242
D Only	0.403	0.403
Lr Only		
L Only	0.363	0.363
S Only	0.068	0.068
W Only		
E Only		
H Only		

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+1.60L+0.50S+1.60H	1	0.00	2.50	1.10	1.10	0.00	1.00	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.11	2.50	1.09	1.09	0.12	1.00	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.22	2.50	1.07	1.07	0.24	0.94	4.31	Vu < PhiVc/2	lot Reqd 11.4	4.3	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.33	2.50	1.06	1.06	0.35	0.62	4.07	Vu < PhiVc/2	lot Reqd 11.4	4.1	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.44	2.50	1.05	1.05	0.47	0.46	3.95	Vu < PhiVc/2	lot Reqd 11.4	4.0	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.55	2.50	1.03	1.03	0.58	0.37	3.88	Vu < PhiVc/2	lot Reqd 11.4	3.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.66	2.50	1.02	1.02	0.69	0.31	3.83	Vu < PhiVc/2	lot Reqd 11.4	3.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.77	2.50	1.01	1.01	0.81	0.26	3.80	Vu < PhiVc/2	lot Reqd 11.4	3.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.87	2.50	0.99	0.99	0.91	0.23	3.77	Vu < PhiVc/2	lot Reqd 11.4	3.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.98	2.50	0.98	0.98	1.02	0.20	3.75	Vu < PhiVc/2	lot Reqd 11.4	3.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.09	2.50	0.97	0.97	1.13	0.18	3.74	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.20	2.50	0.95	0.95	1.23	0.16	3.73	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.31	2.50	0.94	0.94	1.34	0.15	3.72	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.42	2.50	0.93	0.93	1.44	0.13	3.71	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.53	2.50	0.91	0.91	1.54	0.12	3.70	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.64	2.50	0.88	0.88	1.64	0.11	3.69	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.75	2.50	0.85	0.85	1.73	0.10	3.68	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	1.86	2.50	0.83	0.83	1.80	0.10	3.68	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.97	2.50	0.80	0.80	1.91	0.09	3.67	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.08	2.50	0.77	0.77	2.00	0.08	3.67	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.19	2.50	0.74	0.74	2.08	0.07	3.66	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.30	2.50	0.71	0.71	2.16	0.07	3.66	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.40	2.50	0.68	0.68	2.24	0.06	3.65	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	2.51	2.50	0.65	0.65	2.28	0.06	3.65	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	2.62	2.50	0.62	0.62	2.35	0.06	3.65	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	2.73	2.50	0.60	0.60	2.42	0.05	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.84	2.50	0.57	0.57	2.51	0.05	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	2.95	2.50	0.54	0.54	2.54	0.04	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	3.06	2.50	0.51	0.51	2.60	0.04	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	3.17	2.50	0.48	0.48	2.66	0.04	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.28	2.50	0.45	0.45	2.73	0.03	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.39	2.50	0.42	0.42	2.78	0.03	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.50	2.50	0.39	0.39	2.83	0.03	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	3.61	2.50	0.37	0.37	2.84	0.03	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	3.72	2.50	0.34	0.34	2.88	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	3.83	2.50	0.31	0.31	2.92	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	3.93	2.50	0.28	0.28	2.95	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	4.04	2.50	0.25	0.25	2.98	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.15	2.50	0.22	0.22	3.03	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	4.26	2.50	0.19	0.19	3.02	0.01	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0

Concrete Beam

DESCRIPTION: Mechanical slab

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+0.50Lr+1.60L+1.60H	1	4.37	2.50	0.17	0.17	3.04	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	4.48	2.50	0.14	0.14	3.06	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.59	2.50	0.11	0.11	3.10	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.70	2.50	0.08	0.08	3.11	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.81	2.50	0.05	0.05	3.12	0.00	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	4.92	2.50	0.02	0.02	3.10	0.00	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.03	2.50	-0.01	0.01	3.12	0.00	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.14	2.50	-0.04	0.04	3.12	0.00	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	5.25	2.50	-0.06	0.06	3.09	0.00	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	5.36	2.50	-0.09	0.09	3.08	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	5.46	2.50	-0.12	0.12	3.07	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	5.57	2.50	-0.15	0.15	3.05	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	5.68	2.50	-0.18	0.18	3.04	0.01	3.61	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.79	2.50	-0.21	0.21	3.04	0.01	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	5.90	2.50	-0.24	0.24	3.02	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.01	2.50	-0.27	0.27	2.99	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.12	2.50	-0.29	0.29	2.96	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	6.23	2.50	-0.32	0.32	2.90	0.02	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	6.34	2.50	-0.35	0.35	2.86	0.03	3.62	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.45	2.50	-0.38	0.38	2.85	0.03	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	6.56	2.50	-0.41	0.41	2.78	0.03	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	6.67	2.50	-0.44	0.44	2.73	0.03	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	6.78	2.50	-0.47	0.47	2.68	0.04	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.89	2.50	-0.50	0.50	2.66	0.04	3.63	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	6.99	2.50	-0.52	0.52	2.60	0.04	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	7.10	2.50	-0.55	0.55	2.52	0.05	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	7.21	2.50	-0.58	0.58	2.45	0.05	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	7.32	2.50	-0.61	0.61	2.39	0.05	3.64	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.43	2.50	-0.64	0.64	2.35	0.06	3.65	Vu < PhiVc/2	lot Reqd 11.4	3.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.54	2.50	-0.67	0.67	2.27	0.06	3.65	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	7.65	2.50	-0.70	0.70	2.20	0.07	3.65	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	7.76	2.50	-0.72	0.72	2.10	0.07	3.66	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	7.87	2.50	-0.75	0.75	2.02	0.08	3.66	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	7.98	2.50	-0.78	0.78	1.93	0.08	3.67	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	8.09	2.50	-0.81	0.81	1.84	0.09	3.67	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.20	2.50	-0.84	0.84	1.78	0.10	3.68	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.31	2.50	-0.87	0.87	1.69	0.11	3.69	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+0.50Lr+1.60L+1.60H	1	8.42	2.50	-0.90	0.90	1.56	0.12	3.69	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.52	2.50	-0.92	0.92	1.49	0.13	3.70	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.63	2.50	-0.94	0.94	1.39	0.14	3.71	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.74	2.50	-0.95	0.95	1.29	0.15	3.72	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.85	2.50	-0.96	0.96	1.18	0.17	3.73	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	8.96	2.50	-0.97	0.97	1.08	0.19	3.75	Vu < PhiVc/2	lot Reqd 11.4	3.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.07	2.50	-0.99	0.99	0.97	0.21	3.76	Vu < PhiVc/2	lot Reqd 11.4	3.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.18	2.50	-1.00	1.00	0.86	0.24	3.79	Vu < PhiVc/2	lot Reqd 11.4	3.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.29	2.50	-1.01	1.01	0.75	0.28	3.82	Vu < PhiVc/2	lot Reqd 11.4	3.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.40	2.50	-1.03	1.03	0.64	0.33	3.86	Vu < PhiVc/2	lot Reqd 11.4	3.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.51	2.50	-1.04	1.04	0.53	0.41	3.91	Vu < PhiVc/2	lot Reqd 11.4	3.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.62	2.50	-1.05	1.05	0.41	0.53	4.00	Vu < PhiVc/2	lot Reqd 11.4	4.0	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.73	2.50	-1.07	1.07	0.30	0.75	4.17	Vu < PhiVc/2	lot Reqd 11.4	4.2	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.84	2.50	-1.08	1.08	0.18	1.00	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	9.95	2.50	-1.09	1.09	0.06	1.00	4.35	Vu < PhiVc/2	lot Reqd 11.4	4.4	0.0	0.0

Maximum Forces & Stresses for Load Combinations

Concrete Beam

DESCRIPTION: Mechanical slab

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	10.000	3.12	4.10	0.76
+1.40D+1.60H					
Span # 1	1	10.000	1.41	4.10	0.34
+1.20D+0.50Lr+1.60L+1.60H					
Span # 1	1	10.000	3.10	4.10	0.75
+1.20D+1.60L+0.50S+1.60H					
Span # 1	1	10.000	3.12	4.10	0.76
+1.20D+1.60Lr+L+1.60H					
Span # 1	1	10.000	2.39	4.10	0.58
+1.20D+1.60Lr+0.50W+1.60H					
Span # 1	1	10.000	1.21	4.10	0.29
+1.20D+L+1.60S+1.60H					
Span # 1	1	10.000	2.47	4.10	0.60
+1.20D+1.60S+0.50W+1.60H					
Span # 1	1	10.000	1.29	4.10	0.31
+1.20D+0.50Lr+L+W+1.60H					
Span # 1	1	10.000	2.39	4.10	0.58
+1.20D+L+0.50S+W+1.60H					
Span # 1	1	10.000	2.41	4.10	0.59
+0.90D+W+1.60H					
Span # 1	1	10.000	0.91	4.10	0.22
+1.20D+L+0.20S+E+1.60H					
Span # 1	1	10.000	2.40	4.10	0.58
+0.90D+E+0.90H					
Span # 1	1	10.000	0.91	4.10	0.22

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L+H	1	0.0749	5.000		0.0000	0.000