

CASE

Engineering Inc.

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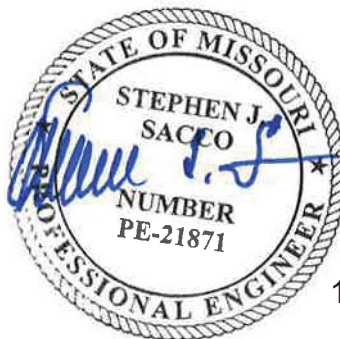
Structural Calculations

Client:
Verve Design Studio

Project:
DAP Polyol Storage
307 Intergram Drive
Pacific, MO 63069

Project #: VDS-MO-02-20

Date: November 18, 2020



11/18/20

Case Engineering, Inc.

796 Merus Ct.
Fenton, MO 63026
636-349-1600

JOB TITLE VerveDAP Polyol StorageJOB NO. VDS-MO-02-20

SHEET NO. _____

CALCULATED BY CLSDATE 11/5/20CHECKED BY SJS

DATE _____

www.struware.com

Code Search

Code: International Building Code 2009**Occupancy:**

Occupancy Group = S Storage

Occupancy Category & Importance Factors:

Occupancy Category = II

Wind factor = 1.00

Snow factor = 1.00

Seismic factor = 1.00

Type of Construction:

Fire Rating:

Roof = 0.0 hr

Floor = 0.0 hr

Building Geometry:Roof angle (θ) 0.38 / 12 1.8 deg

Building length (L) 120.0 ft

Least width (B) 80.0 ft

Mean Roof Ht (h) 22.0 ft

Parapet ht above grd 24.8 ft

Minimum parapet ht 2.7 ft

Live Loads:**Roof** 0 to 200 sf: 20 psf

200 to 600 sf: 24 - 0.02Area, but not less than 12 psf

over 600 sf: 12 psf

Floor:

Typical Floor 250 psf

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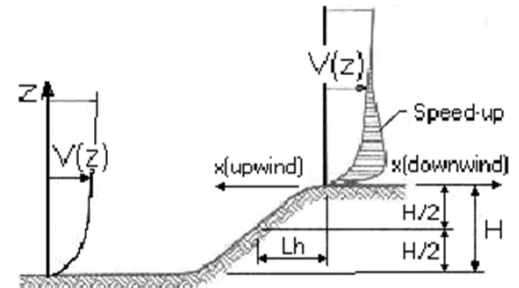
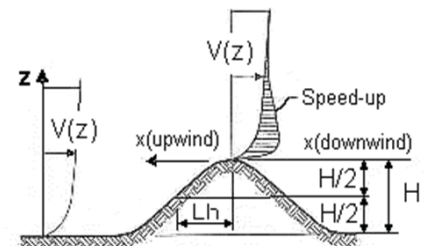
Wind Loads :

ASCE 7 - 05

Basic Wind Speed	90 mph
Importance Factor	1.00
Occupancy Category	II
Exposure Category	C
Enclosure Classif.	Enclosed Building
Internal pressure	+/-0.18
Directionality (Kd)	0.85
Kh case 1	0.920
Kh case 2	0.920
Type of roof	Monoslope

Topographic Factor (Kzt)

Topography	Flat
Hill Height (H)	80.0 ft
Half Hill Length (Lh)	100.0 ft
Actual H/Lh =	0.80
Use H/Lh =	0.50
Modified Lh =	160.0 ft
From top of crest: x =	50.0 ft
Bldg up/down wind?	downwind
H/Lh = 0.50	$K_1 = 0.000$
x/Lh = 0.31	$K_2 = 0.792$
z/Lh = 0.14	$K_3 = 1.000$
At Mean Roof Ht:	$K_{zt} = (1 + K_1 K_2 K_3)^2 = 1.00$

**ESCAPMENT****2D RIDGE or 3D AXISYMMETRICAL HILL****Gust Effect Factor**

h =	22.0 ft
B =	80.0 ft
/z (0.6h) =	15.0 ft

Flexible structure if natural frequency < 1 Hz (T > 1 second).

If building h/B > 4 then may be flexible and should be investigated.

h/B = 0.28 Rigid structure (low rise bldg)

G = 0.85 Using rigid structure default

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Wind Loads - MWFRS $h \leq 60'$ (Low-rise Buildings) except for open buildings

$K_z = K_h$ (case 1) = 0.92
Base pressure (q_h) = **16.2 psf**
 GC_{pi} = +/-0.18

Edge Strip (a) = 8.0 ft
End Zone (2a) = 16.0 ft
Zone 2 length = 40.0 ft

Wind Pressure Coefficients

Surface	Transverse Direction Perpendicular $\theta = 1.2$ deg			Longitudinal Direction Parallel $\theta = 0.0$		
	GC_{pf}	w/- GC_{pi}	w/+ GC_{pi}	GC_{pf}	w/- GC_{pi}	w/+ GC_{pi}
1	0.40	0.58	0.22	0.40	0.58	0.22
2	-0.69	-0.51	-0.87	-0.69	-0.51	-0.87
3	-0.37	-0.19	-0.55	-0.37	-0.19	-0.55
4	-0.29	-0.11	-0.47	-0.29	-0.11	-0.47
5	-0.45	-0.27	-0.63	-0.45	-0.27	-0.63
6	-0.45	-0.27	-0.63	-0.45	-0.27	-0.63
1E	0.61	0.79	0.43	0.61	0.79	0.43
2E	-1.07	-0.89	-1.25	-1.07	-0.89	-1.25
3E	-0.53	-0.35	-0.71	-0.53	-0.35	-0.71
4E	-0.43	-0.25	-0.61	-0.43	-0.25	-0.61

Nominal Wind Surface Pressures (psf)

1	9.4	3.6	9.4	3.6
2	-8.3	-14.1	-8.3	-14.1
3	-3.1	-8.9	-3.1	-8.9
4	-1.8	-7.6	-1.8	-7.6
5	-4.4	-10.2	-4.4	-10.2
6	-4.4	-10.2	-4.4	-10.2
1E	12.8	7.0	12.8	7.0
2E	-14.4	-20.3	-14.4	-20.3
3E	-5.7	-11.5	-5.7	-11.5
4E	-4.1	-9.9	-4.1	-9.9

Parapet

Windward parapet = 24.9 psf ($GC_{pn} = +1.5$)
Leeward parapet = -16.6 psf ($GC_{pn} = -1.0$)

Windward roof overhangs = 11.0 psf (upward) add to windward roof pressure

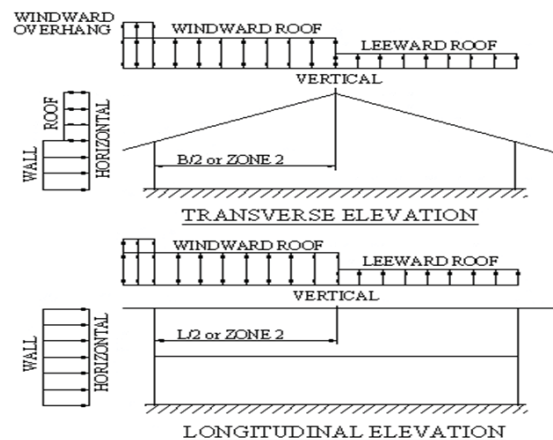
Horizontal MWFRS Simple Diaphragm Pressures (psf)**Transverse direction (normal to L)**

Interior Zone: Wall 11.2 psf
Roof -5.2 psf **
End Zone: Wall 16.9 psf
Roof -8.8 psf **

Longitudinal direction (parallel to L)

Interior Zone: Wall 11.2 psf
End Zone: Wall 16.9 psf

** NOTE: Total horiz force shall not be less than that determined by neglecting roof forces (except for MWFRS moment frames).



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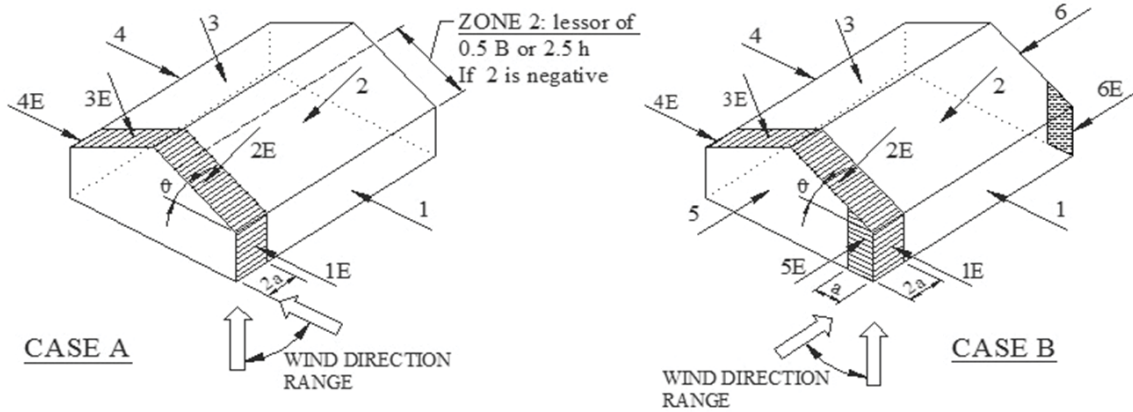
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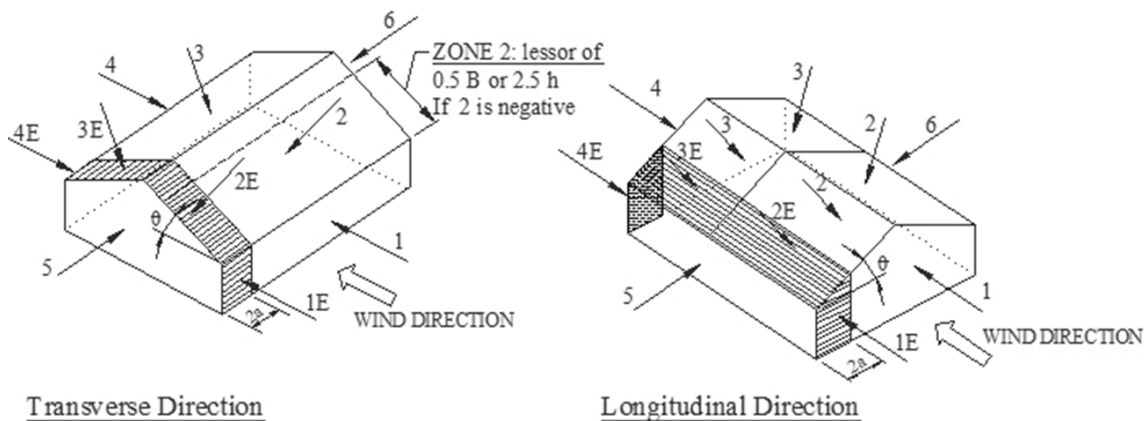
DATE _____



NOTE: Torsional loads are 25% of zones 1 - 6. See code for loading diagram.

Exception: One story buildings $h < 30'$ and 1 to 2 story buildings framed with light-frame construction or with flexible diaphragms need not be designed for the torsional load case.

ASCE 7-98 & ASCE 7-10 (& later) - MWFRS wind pressure zones



NOTE: Torsional loads are 25% of zones 1 - 4. See code for loading diagram.

Exception: One story buildings $h < 30'$ and 1 to 2 story buildings framed with light-frame construction or with flexible diaphragms need not be designed for the torsional load case.

ASCE 7-02 and ASCE 7-05 - MWFRS wind pressure zones

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Snow Loads : ASCE 7-05

Nominal Snow Forces

Roof slope = 1.2 deg
Horiz. eave to ridge dist (W) = 80.0 ft
Roof length parallel to ridge (L) = 120.0 ft

Type of Roof Monoslope
Ground Snow Load Pg = 20.0 psf
Occupancy Category = II
Importance Factor I = 1.0
Thermal Factor Ct = 1.00
Exposure Factor Ce = 0.9

Pf = $0.7 \cdot Ce \cdot Ct \cdot I \cdot Pg$ = 12.6 psf
Unobstructed Slippery Surface yes

Sloped-roof Factor Cs = 1.00
Balanced Snow Load = **12.6 psf**

Rain on Snow Surcharge Angle 1.60 deg
Code Maximum Rain Surcharge 5.0 psf
Rain on Snow Surcharge = 5.0 psf
Ps plus rain surcharge = 17.6 psf
Minimum Snow Load P_{fmin} = 20.0 psf

Uniform Roof Design Snow Load = **20.0 psf**

Near ground level surface balanced snow load = **20.0 psf**

NOTE: Alternate spans of continuous beams shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code for loading diagrams and exceptions for gable roofs..

Windward Snow Drifts 1 - Against walls, parapets, etc

Upwind fetch lu = 120.0 ft
Projection height h = 3.0 ft
Snow density g = 16.6 pcf
Balanced snow height hb = 0.76 ft
hd = 2.60 ft
hc = 2.24 ft

hc/hb > 0.2 = 3.0 **Therefore, design for drift**

Drift height (hc) = 2.24 ft
Drift width w = 12.05 ft
Surcharge load: pd = $\gamma \cdot hd$ = **37.2 psf**
Balanced Snow load: = 12.6 psf

49.8 psf

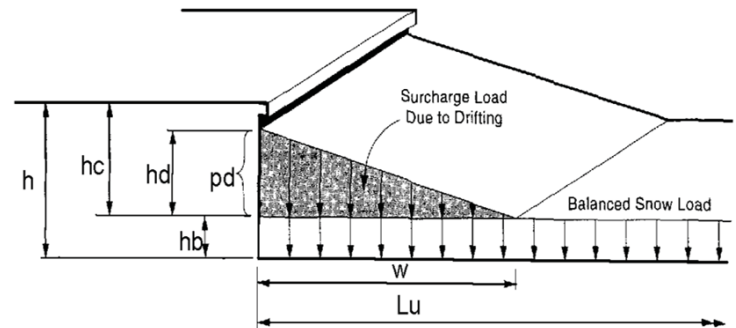
Windward Snow Drifts 2 - Against walls, parapets, etc

Upwind fetch lu = 80.0 ft
Projection height h = 2.0 ft
Snow density g = 16.6 pcf
Balanced snow height hb = 0.76 ft
hd = 2.13 ft
hc = 1.24 ft

hc/hb > 0.2 = 1.6 **Therefore, design for drift**

Drift height (hc) = 1.24 ft
Drift width w = 9.93 ft
Surcharge load: pd = $\gamma \cdot hd$ = **20.6 psf**
Balanced Snow load: = 12.6 psf

33.2 psf



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Seismic Loads:

IBC 2009

Strength Level Forces

Occupancy Category : II
Importance Factor (I) : 1.00
Site Class : C

Ss (0.2 sec) = 48.80 %g
S1 (1.0 sec) = 18.00 %g

Fa = 1.200	Sms = 0.586	S _{DS} = 0.390	Design Category = C
Fv = 1.620	Sm1 = 0.292	S _{D1} = 0.194	Design Category = C

Seismic Design Category = **C**

Redundancy Coefficient ρ = 1.30

Number of Stories: 1

Structure Type: All other building system:

Horizontal Struct Irregularities: No plan Irregularity

Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: Yes

Building System: **Bearing Wall Systems**Seismic resisting system: **Ordinary reinforced masonry shear walls**System Structural Height Limit: **160 ft**

Actual Structural Height (hn) = 22.8 ft

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 2
Over-Strength Factor (Ωo) = 2
Deflection Amplification Factor (Cd) : 1.75
S_{DS} = 0.390
S_{D1} = 0.194

Seismic Load Effect (E) = $E_h \pm E_v = \rho C_E \pm 0.2 S_{DS} D$ = $1.3 Q_E \pm 0.078 D$ Q_E = horizontal seismic force
Special Seismic Load Effect (Em) = $E_m \pm E_v = \Omega_o C_E \pm 0.2 S_{DS} D$ = $2 Q_E \pm 0.078 D$ D = dead load

PERMITTED ANALYTICAL PROCEDURES**Simplified Analysis** - Use Equivalent Lateral Force Analysis**Equivalent Lateral-Force Analysis** - Permitted

Building period coef. (C_T) = 0.020 C_u = 1.51
 Approx fundamental period (Ta) : $C_T h_n^x = 0.209 \text{ sec}$ $x = 0.75$ T_{max} = C_u Ta = 0.315
 User calculated fundamental period (T) = Use T = 0.209
 Long Period Transition Period (TL) = ASCE7 map = 12
 Seismic response coef. (Cs) = $S_{DS}/R = 0.195$
 need not exceed Cs = $S_{d1}/R_T = 0.466$
 but not less than Cs = $0.044 S_{d1} = 0.017$
 USE Cs = 0.195
 Design Base Shear V = 0.195W

Model & Seismic Response Analysis - Permitted (see code for procedure)**ALLOWABLE STORY DRIFT**

Structure Type: All other structures

Allowable story drift Δa = 0.020hsx where hsx is the story height below level x

DESIGN LOADS

Roof Loads

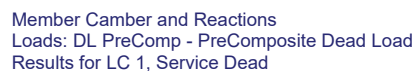
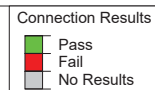
Roofing & Insulation	7.0 psf
Deck	2.0 psf
Steel Joists	3.0 psf
Miscellaneous & M.E.P. & F.P.	8.0 psf
Total Dead Load	20.0 psf
Total Ground Snow Load	20.0 psf
Total Live Load	20.0 psf

Wall Dead Load

8" CMU	55.0 psf
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RTU1 = 506#

RTU2 = 1116#



Case Engineering	Floor Plan 1	
CLS	Verve - DAP	Nov 12, 2020 at 11:05 AM
VDS-MO-02-20	Framing Results	Roof Framing.rfl

Beam Code Summary for Hot Rolled : Floor Plan 1

	Label	Size	Explicit	Studs	Camb...	Material	Bending...	Loc[ft]	LC	Defl Ch...	Loc[ft]	Cat	Shear C..	Loc[ft]	LC
1	M1	W18X35	Yes		.5	A992	.769	10.156	2	.594	11.979	DL+...	.195	0	2
2	M2	W18X35	Yes		.5	A992	.657	10.156	2	.429	12.5	DL+...	.142	0	2
3	M3	W18X35	Yes		.5	A992	.652	14.844	2	.423	12.5	DL+...	.14	25	2
4	M4	W18X35	Yes		.5	A992	.638	12.5	2	.401	12.5	DL+...	.134	0	2

Beam Design for Steel Products : Floor Plan 1

	La...	Size	Ex...	UDL[k/ft]	ULL[k/ft]	UTL[k/ft]	Max Start React...	Max End ...	Min Start Reaction...	Min End Reaction...
1	P...	26K7SP	Yes	.091	.086	.177	4.939	4.861	1.716	1.667
2	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
3	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
4	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
5	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
6	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
7	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
8	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
9	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
10	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
11	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
12	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
13	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
14	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
15	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
16	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
17	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
18	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
19	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
20	P...	26K7SP	No	.108	.1	.208	5.79	5.79	2	2
21	P...	26K7SP	Yes	.091	.086	.177	4.939	4.861	1.716	1.667
22	P...	26K7	Yes	.091	.083	.175	4.861	4.861	1.667	1.667
23	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
24	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
25	P...	26KCS4	No	0	0	.215	7.05	6.089	2	2
26	P...	26KCS4	No	0	0	.215	7.05	6.089	2	2
27	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
28	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
29	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
30	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
31	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
32	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
33	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
34	P...	26KCS4	No	0	0	.215	6.753	6.057	2	2
35	P...	26KCS4	No	0	0	.215	6.753	6.057	2	2
36	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
37	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
38	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
39	P...	26K7	No	.108	.1	.208	5.79	5.79	2	2
40	P...	26KCS4	No	0	0	.215	6.171	6.162	2	2
41	P...	26K7	Yes	.091	.083	.175	4.861	4.861	1.667	1.667
42	P...	26K7SP	Yes	.075	.098	.173	4.88	4.9	1.499	1.499
43	P...	26K7SP	No	.075	.132	.207	5.911	6.004	1.499	1.499
44	P...	26K7	Yes	.075	.097	.172	4.906	4.906	1.499	1.499

Beam Design for Steel Products : Floor Plan 1 (Continued)

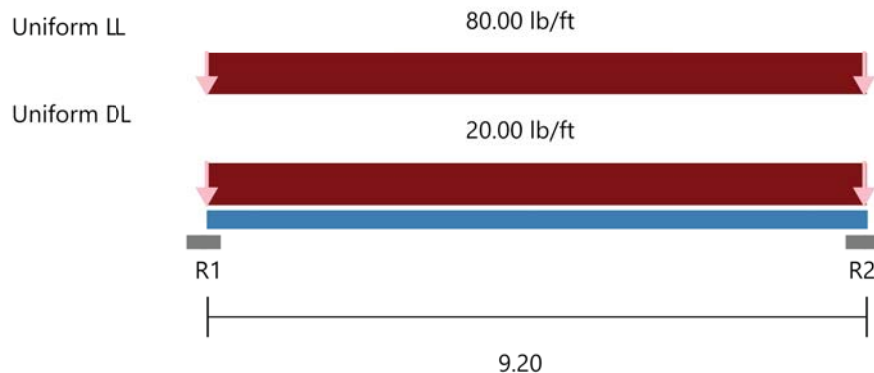
	La...	Size	Ex...	UDL[k/ft]	ULL[k/ft]	UTL[k/ft]	Max Start React...	Max End ...	Min Start Reaction..	Min End Reaction...
45	P...	26K7	No	.075	.132	.206	6.008	6.008	1.499	1.499
46	P...	26K7SP	No	.075	.132	.207	5.911	6.004	1.499	1.499
47	P...	26K7SP	Yes	.075	.098	.173	4.88	4.9	1.499	1.499
48	P...	26K7	No	.075	.132	.206	6.008	6.008	1.499	1.499
49	P...	26K7	Yes	.075	.097	.172	4.906	4.906	1.499	1.499

Beam Bending Results for Hot Rolled : Floor Plan 1

	Label	Size	...	Fy[ksi]	Lb Top[ft]	Lb Bot[ft]	L-torque[ft]	Cb	...	Mn/om[k-ft]	Mu[k-...T....	Bending Check	Loc[ft]LC	...
1	M1	W18X35	No	50	2	25	25	1.014	0	165.918	127.6...	.769	10.156	2 ...
2	M2	W18X35	No	50	2	25	25	1.001	0	165.918	108.9...	.657	10.156	2 ...
3	M3	W18X35	No	50	2	25	25	1	0	165.918	108.2...	.652	14.844	2 ...
4	M4	W18X35	No	50	2	25	25	1	0	165.918	105.9...	.638	12.5	2 ...

Hot Rolled Steel Column Code Checks

	Stack	Lift	Shape	Code C...	Elev[ft]	LC	Shear C...	Elev[ft]	Dir	LC	Pnc/om...	Pnt/om ...	Mnyy/o...	Mnzz/o...	Cb	AISC...
1	(2-B)	1	HSS6X6X4	.639	0	2	.000	0		3	61.14	144.335	25.709	25.709	1	H1-1a
2	(3-B)	1	HSS6X6X4	.590	0	2	.000	0		3	61.14	144.335	25.709	25.709	1	H1-1a
3	(4-B)	1	HSS6X6X4	.607	0	2	.000	0		3	61.14	144.335	25.709	25.709	1	H1-1a

**Section :** 600S162-54 (50 ksi) Single C Stud**Fy** = 50 ksi**Maxo** = 2527.1 Ft-Lb**Moment of Intertia, I** = 2.860 in⁴**Va** = 2822.9 lb**Joist Spacing** = 24 in**Deflection Limits:** Total Load - 240

Live Load - 360

Load Cases:

1. DL + LL All spans
2. DL + LL Even spans
3. DL + LL Odd spans
4. LL All spans
5. LL Even spans
6. LL Odd spans

Joist Flexural and Deflection Summary

	Mmax Ft-Lb	K-phi lb-in/in	Lm in	Ma-dist Ft-Lb	Mmax/Ma (Min)	Load Case	Total Ld Defl	Load Case	LL Defl	Load Case
Span	1058	0.0	110.4	2158.3	0.490	1	L/578	1	L/722	4

Joist Bending and Web Crippling Summary

Rxn	Load (lb)	Load Case	Bearing (in)	Pa (lb)	Pn (lb)	Max Intr.	Load Case	Stiffeners Required
R1	460.0	1	1.00	553.9	969.2	0.43	1	NO
R2	460.0	1	1.00	553.9	969.2	0.43	1	NO

Joist Bending and Shear Summary

Rxn	Vmax (lb)	Load Case	Va Factor	V/Va	M/Ma	Intr. Unstiffened	Load Case	Intr. Stiffened	Load Case
R1	460.0	1	0.690	0.24	0.00	0.24	1	N/A	N/A
R2	460.0	1	0.690	0.24	0.00	0.24	1	N/A	N/A

CASE

Engineering Inc.

CLIENT: Verve
 LOCATION: St. Louis
 SUBJECT: DAP
 PREPARED BY: CLS

PROJ # VDS-MO-02-20

Updated 9/4/2019
 Date: 11/5/2020

WIND LOADING

Horizontal MWFRS Simple Diaphragm Pressures (psf)

Windward Parapet 24.9 psf
 Leeward Parapet -16.6 psf

Transverse direction (normal to L)

Total

Interior Zone: Wall 11.2 psf End Zone (2a) = 16.0 ft
 End Zone: Wall 16.9 psf

Longitudinal direction (parallel to L)

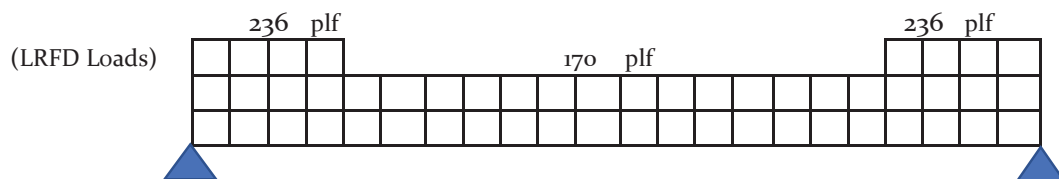
Interior Zone: Wall 11.2 psf
 End Zone: Wall 16.9 psf

NORTH/SOUTH WIND LOADING

Side Length 120 ft
 Avg Roof Deck El. 23 ft Tributary Wall Height 11.5 ft
 Parapet El 24.7 ft Tributary Parapet Height 1.7 ft

Total

End Zone Wind Pressure 236 plf
 Interior Zone Wind Pressure 170 plf



(LRFD Reactions)

Reaction	11272 lbs	11272 lbs
Diaphragm Depth	80.0 ft	80.0 ft
Diaphragm Shear	141 plf	141 plf

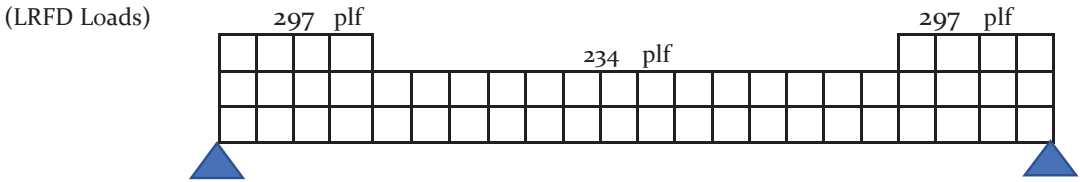
Diaphragm Moment Maximum moment along diaphragm = 307 k-ft
 Chord Forces Diaphragm flexure divided by diaph depth = 3.8 k

WIND LOADING (cont.)

EAST/WEST WIND LOADING

Side Length	80	ft		
Avg Roof Deck El.	22	ft	Tributary Wall Height	11.0 ft
Parapet El	24.67	ft	Tributary Parapet Height	2.7 ft

	Total	
End Zone Wind Pressure	296.7	plf
Interior Zone Wind Pressure	234	plf



(LRFD Reactions)					
Reaction	10363	lbs		10363	lbs
Diaphragm Depth	120	ft		120	ft
Diaphragm Shear	86	plf		86	plf

Diaphragm Moment	Maximum moment along diaphragm =	187.2	k-ft
Chord Forces	Diaphragm flexure divided by diaph depth =	1.6	k

SEISMIC LOADING

Seismic Resisting System Ordinary reinforced masonry shear walls

Seismic Response Coefficient, Cs 0.195
Redundancy Coefficient, Rho 1.30

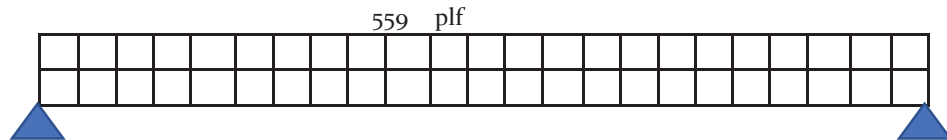
Seismic Load Development Table

Item Description	Weight, psf	Seismic Wt, psf	Tributary, ft	Line Load, plf
Roof - N/S Dir	20.00	3.90	120.0	468.00
Roof - E/W Dir	20.00	3.90	80.0	312.00
Masonry Perimeter Wall	55.00	10.73	11.5	123.34

NORTH/SOUTH EQ LOADING

Side Length 120 ft

(LRFD Loads)



(LRFD Reactions)

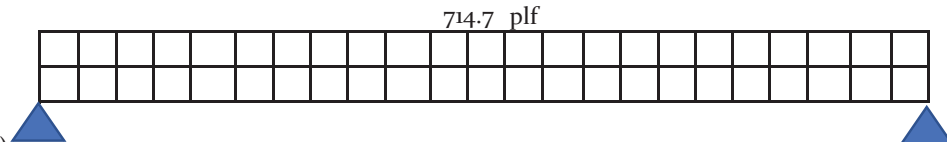
Reaction	43577 lbs	43577 lbs
Diaphragm Depth	80.0 ft	80.0 ft
Diaphragm Shear	545 plf	545 plf

Diaphragm Moment Maximum moment along diaphragm = 1006 k-ft
Chord Forces Diaphragm flexure divided by diaph depth = 12.6 k

EAST/WEST EQ LOADING

Side Length 80 ft

(LRFD Loads)



(LRFD Reactions)

Reaction	37163 lbs	37163 lbs
Diaphragm Depth	120.0	120.0
Diaphragm Shear	310 lbs	310 lbs

Diaphragm Moment Maximum moment along diaphragm = 572 k-ft
Chord Forces Diaphragm flexure divided by diaph depth = 4.8 k

1.5 (WR, IR, NR)

t = design thickness = 0.0295" 22 ga.

SUPPORT FASTENING: Buildex or Elco Textron #12 or #14 TEKS screws

SIDE-LAP FASTENING: #10 screws

 ϕ (EQ): 0.65 Ω (EQ): 2.50
 ϕ (WIND): 0.70 Ω (WIND): 2.35
 ϕ (Other): 0.65 Ω (Other): 2.50

FASTENER LAYOUT	SIDE-LAP CONN./SPAN	NOMINAL SHEAR STRENGTH, PLF									
		SPAN, FT									
		3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	K1
36/9	0	1040	915	815	720	645	580	530	485	445	0.366
	1	1185	1050	940	850	770	695	635			0.301
	2	1315	1175	1060	960	880	810	740	680	625	0.255
	3	1425	1285	1165	1065	975	900	835	775	715	0.222
	4	1530	1390	1265	1160	1070	990	920	860	805	0.196
	5	1615	1480	1360	1250	1155	1075	1000	935	880 *	0.176
36/7	0	665	575	500	445	395	360	325	300	275	0.549
	1	835	730	650	585	525	475	430			0.414
	2	985	870	780	705	640	585	540	495	455	0.333
	3	1115	1000	900	815	745	685	635	590	550	0.278
	4	1230	1110	1010	920	845	780	725	675	630	0.239
	5	1330	1210	1105	1015	935	865	805	755	705	0.209
36/5	0	590	515	460	410	365	330	300	275	255	0.659
	1	730	650	585	530	485	445	405			0.474
	2	840	760	690	635	580	540	500	465	435	0.370
	3	930	855	785	725	670	625	580	545	510	0.304
	4	1005	930	865	805	750	700	655	615	580	0.257
	5	1060	995	930	870	815	770	720	680	645	0.223
36/4	0	450	395	350	310	275	250	225	205	190	0.824
	1	585	525	475	430	395	365	330			0.554
	2	685	625	575	525	485	450	420	395	370	0.417
	3	755	705	655	605	565	530	495	465	440	0.334
	4	810	765	715	675	630	595	560	530	500	0.279
	5	850	810	765	725	690	650	620	585	560	0.240
30/6	0	605	515	450	395	355	320	290	265	245	0.732
	1	780	680	605	540	480	435	395			0.538
	2	935	825	735	665	605	550	505	460	425	0.425
	3	1075	955	860	780	710	655	605	560	520	0.351
	4	1195	1075	975	885	810	750	695	645	605	0.299
	5	1300	1180	1075	985	905	840	780	725	680	0.261
30/4	0	550	485	430	385	345	310	280	260	240	0.823
	1	685	610	550	500	460	420	390			0.585
	2	790	720	655	600	555	515	475	445	415	0.454
	3	870	805	740	685	640	595	555	520	490	0.371
	4	935	875	815	760	710	665	625	590	555	0.314
	5	985	930	875	820	775	730	690	650	615	0.272
	6	1025	975	920	875	830	785	745	705	670	0.240

* NOMINAL SHEAR SHOWN ABOVE MAY BE LIMITED BY SHEAR BUCKLING. SEE TABLE BELOW.

THE SHADED VALUES DO NOT COMPLY WITH THE MINIMUM SPACING REQUIREMENTS FOR SIDE-LAP CONNECTIONS AND SHALL NOT BE USED EXCEPT WITH PROPERLY SPACED SIDE-LAP CONNECTIONS.

 ϕ (Buckling): 0.80 Ω (Buckling): 2.00

DECK PROFILE	I in ⁴ / ft	NOMINAL SHEAR DUE TO PANEL BUCKLING (S_n), PLF / SPAN, FT								
		3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
NR	0.099	4130	3035	2320	1835	1485	1225	1030	880	755
IR	0.108	4410	3240	2480	1960	1585	1310	1100	935	810
WR	0.152	5695	4185	3205	2530	2050	1695	1420	1210	1045

NOTE:

ASD Required Strength (Service Applied Load) $\leq$ Minimum [Nominal Shear Strength / Ω (EQ or WIND), Nominal Buckling Strength S_n / Ω (Buckling)]
 LRFD Required Strength (Factored Applied Load) $\leq$ Minimum [ϕ (EQ or WIND) x Nominal Shear Strength, ϕ (Buckling) x Nominal Buckling Strength S_n]

Masonry Slender Wall

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 Case Engineering, Inc.

Lic. # : KW-06010584

DESCRIPTION: Interior Bearing Wall

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Load Combinations Used : ASCE 7-16

General Information

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Construction Type : Grouted Hollow Concrete Masonry

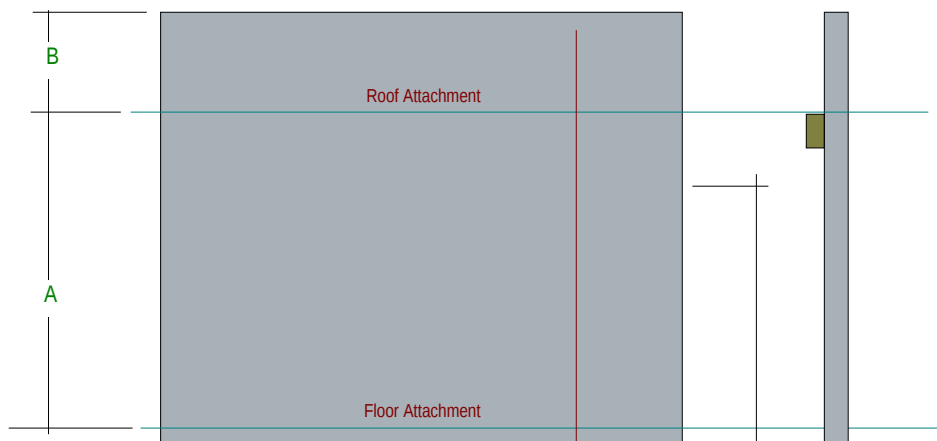
F'm	=	1.50	ksi	Nom. Wall Thickness	8	in	Temp Diff across thickness	=	100	deg F
Fy - Yield	=	60.0	ksi	Actual Thickness	7.625	in	Min Allow Out-of-plane Defl Ratio	=	0.0	
Fr - Rupture	=	61.0	psi	Rebar "d" distance	3.8125	in				
Em = f'm *	=	900.0		Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020	
Max % of $\rho_{bal.}$	=	0.1114		Bar Size	#	5				
Grout Density	=	140	pcf	Bar Spacing		32	in			
Block Weight		Normal Weight								
Wall Weight	=	58.0	psf							

Wall is grouted at rebar cells only

One-Story Wall Dimensions

A Clear Height	=	22.0	ft
B Parapet height	=		ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)

	DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load Eccentricity in					k/ft
Concentric Load	0.60	0.480		0.80	k/ft

Lateral Loads

Wind Loads :

Full area WIND load 5.0 psf

Seismic Loads :

Wall Weight Seismic Load Input Method : Factor applied to wall weight entered
 Seismic factor to be applied to wall weight 0.1950

$$F_p = \text{Wall Wt.} * 0.1950 = 11.310 \text{ psf}$$

Masonry Slender Wall

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 Case Engineering, Inc.

Lic. # : KW-06010584

DESCRIPTION: **Interior Bearing Wall**

DESIGN SUMMARY

Results reported for "Strip Width" of 25.0 in

Governing Load Combination . . .		Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.239D+0.20S+2.0E	Maximum Bending Stress Ratio = 0.9932			
		Max Mu	4.421 k-ft	Phi * Mn	4.451 k-ft
PASS	Service Deflection Check +D+0.70E	Actual Defl. Ratio L/	385	Allowable Defl. Ratio	200.0
		Max. Deflection	0.6851 in		
PASS	Axial Load Check +1.239D+0.20S+2.0E	Max Pu / Ag	29.704 psi	Max. Allow. Defl.	1.320 in
		Location	10.633 ft	0.05 * f'm	75.0 psi
PASS	Reinforcing Limit Check	Actual As/bd	0.002541	Max Allow As/bd	0.1114
Maximum Reactions . . . for Load Combination....					
		Top Horizontal	+D+0.70E		0.1958 k
		Base Horizontal	+0.60D+0.70E		0.1738 k
		Vertical Reaction	+D+S		5.575 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load			Moment Values					
	Pu k	0.05*f'm*b*t k	Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal
+1.40D at 8.80 to 9.53	1.912	4.410	0.46	0.23	0.90	2.18	0.116	0.0025	0.1109
+1.20D+0.50Lr at 8.80 to 9.53	1.879	4.410	0.46	0.23	0.90	2.17	0.116	0.0025	0.1109
+1.20D+0.50S at 9.53 to 10.27	1.988	4.410	0.46	0.25	0.90	2.20	0.116	0.0025	0.1109
+1.20D+1.60Lr at 9.53 to 10.27	2.356	4.410	0.46	0.30	0.90	2.29	0.116	0.0025	0.1107
+1.20D+1.60Lr+0.50W at 9.53 to 10.27	2.356	4.410	0.46	0.46	0.90	2.29	0.116	0.0025	0.1107
+1.20D+1.60S at 9.53 to 10.27	2.868	4.410	0.46	0.37	0.90	2.41	0.116	0.0025	0.1106
+1.20D+1.60S+0.50W at 10.27 to 11.00	2.817	4.410	0.46	0.56	0.90	2.40	0.116	0.0025	0.1106
+1.20D+0.50Lr+W at 10.27 to 11.00	1.777	4.410	0.46	0.56	0.90	2.14	0.116	0.0025	0.1110
+1.20D+0.50S+W at 10.27 to 11.00	1.937	4.410	0.46	0.60	0.90	2.18	0.116	0.0025	0.1109
+0.90D+W at 10.27 to 11.00	1.152	4.410	0.46	0.45	0.90	1.99	0.116	0.0025	0.1112
+1.239D+0.20S+2.0E at 10.27 to 11.00	1.747	4.410	0.46	2.12	0.90	2.14	0.116	0.0025	0.1110
+0.8610D+2.0E at 10.27 to 11.00	1.103	4.410	0.46	1.79	0.90	1.98	0.116	0.0025	0.1112

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load		Moment Values		Stiffness		Deflections	
	Pu k		Mcr k-ft	Mactual k-ft	I gross in^4	I cracked in^4	I effective in^4	Deflection in
D Only at 10.27 to 11.00	1.281		0.46	0.16	342.40	27.04	342.400	0.030
+D+Lr at 10.27 to 11.00	1.761		0.46	0.23	342.40	28.25	342.400	0.042
+D+S at 10.27 to 11.00	2.081		0.46	0.27	342.40	29.04	342.400	0.050
+D+0.750Lr at 10.27 to 11.00	1.641		0.46	0.21	342.40	27.95	342.400	0.039
+D+0.750S at 10.27 to 11.00	1.881		0.46	0.24	342.40	28.54	342.400	0.045
+D+0.60W at 10.27 to 11.00	1.281		0.46	0.35	342.40	27.04	342.400	0.065
+D+0.750Lr+0.450W at 10.27 to 11.00	1.641		0.46	0.35	342.40	27.95	342.400	0.065
+D+0.750S+0.450W at 10.27 to 11.00	1.881		0.46	0.38	342.40	28.54	342.400	0.072
+0.60D+0.60W at 10.27 to 11.00	0.768		0.46	0.28	342.40	25.72	342.400	0.053
+D+0.70E at 10.27 to 11.00	1.281		0.46	0.71	342.40	27.04	29.459	0.685
+D+0.750S+0.5250E at 10.27 to 11.00	1.881		0.46	0.68	342.40	28.54	31.495	0.586
+0.60D+0.70E at 10.27 to 11.00	0.768		0.46	0.60	342.40	25.72	30.656	0.407
Lr Only at 10.27 to 11.00	0.480		0.46	0.06	342.40	24.96	342.400	0.012
S Only at 10.27 to 11.00	0.800		0.46	0.10	342.40	25.80	342.400	0.019

Masonry Slender Wall

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Lic. # : KW-06010584

DESCRIPTION: Exterior Bearing Wall

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Load Combinations Used : ASCE 7-16

General Information

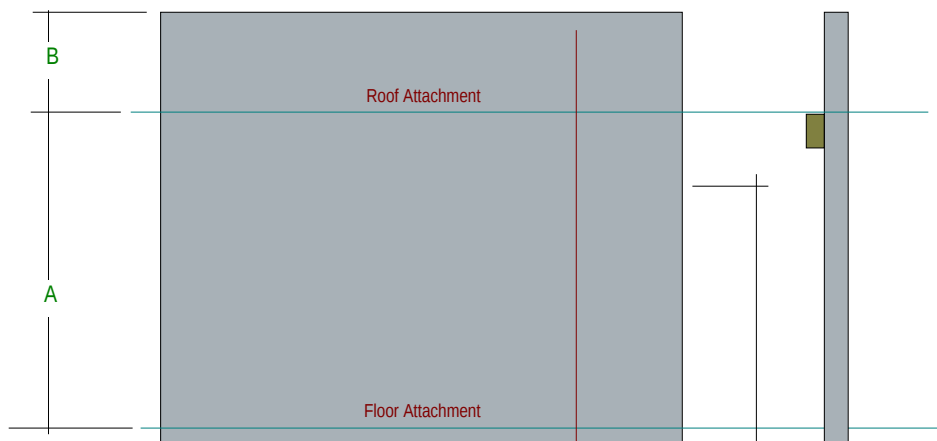
Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Construction Type : Grouted Hollow Concrete Masonry

F'm	=	1.5	ksi	Nom. Wall Thickness	8	in	Temp Diff across thickness	=	100	deg F
Fy - Yield	=	60.0	ksi	Actual Thickness	7.625	in	Min Allow Out-of-plane Defl Ratio	=	0.0	
Fr - Rupture	=	61.0	psi	Rebar "d" distance	3.8125	in				
Em = f'm *	=	900.0		Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020	
Max % of $\rho_{bal.}$	=	0.1114		Bar Size	#	5				
Grout Density	=	140	pcf	Bar Spacing		32	in			
Block Weight		Normal Weight								
Wall Weight	=	58.0	psf							
Wall is grouted at rebar cells only										

One-Story Wall Dimensions

A Clear Height	=	22.0	ft
B Parapet height	=	3.0	ft
Wall Support Condition	Top & Bottom Pinned		



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)

	DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load					k/ft
Concentric Load	0.30	0.240		0.40	k/ft

Lateral Loads

Wind Loads :

Full area WIND load 16.90 psf

Seismic Loads :

Wall Weight Seismic Load Input Method :

Seismic factor to be applied to wall weight

Factor applied to wall weight entered

0.1950

$$F_p = \text{Wall Wt.} * 0.1950 = 11.310 \text{ psf}$$

Project Title: Verve
 Engineer: CLS
 Project ID: VDS-MO-02-20
 Project Descr: DAP-St Louis

Masonry Slender Wall

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Lic. # : KW-06010584

DESCRIPTION: Exterior Bearing Wall

DESIGN SUMMARY

Results reported for "Strip Width" of 25.0 in

Governing Load Combination . . .		Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.239D+0.20S+2.0E	Maximum Bending Stress Ratio = 0.9241			
		Max Mu	4.001 k-ft	Phi * Mn	4.330 k-ft
PASS	Service Deflection Check +D+0.60W	Actual Defl. Ratio L/	259	Allowable Defl. Ratio	200.0
		Max. Deflection	1.021 in		
PASS	Axial Load Check +1.239D+0.20S+2.0E	Max Pu / Ag	25.688 psi	Max. Allow. Defl.	1.320 in
		Location	10.633 ft	0.05 * f'm	75.0 psi
PASS	Reinforcing Limit Check	Actual As/bd	0.002541	Max Allow As/bd	0.1115
Maximum Reactions . . . for Load Combination....					
		Top Horizontal	+D+0.60W		0.3166 k
		Base Horizontal	+0.60D+0.60W		0.2192 k
		Vertical Reaction	+D+S		4.479 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load			Moment Values					0.6 * rho bal
	Pu k	0.05*f'm*b*t k	Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	
+1.40D at 8.80 to 9.53	1.735	4.410	0.46	0.21	0.90	2.13	0.116	0.0025	0.1110
+1.20D+0.50Lr at 8.80 to 9.53	1.608	4.410	0.46	0.19	0.90	2.10	0.116	0.0025	0.1110
+1.20D+0.50S at 8.80 to 9.53	1.688	4.410	0.46	0.20	0.90	2.12	0.116	0.0025	0.1110
+1.20D+1.60Lr at 8.80 to 9.53	1.872	4.410	0.46	0.23	0.90	2.17	0.116	0.0025	0.1109
+1.20D+1.60Lr+0.50W at 9.53 to 10.27	1.820	4.410	0.46	0.84	0.90	2.15	0.116	0.0025	0.1109
+1.20D+1.60Lr-0.50W at 11.73 to 12.47	1.667	4.410	0.46	0.28	0.90	2.12	0.116	0.0025	0.1110
+1.20D+1.60S at 9.53 to 10.27	2.076	4.410	0.46	0.26	0.90	2.22	0.116	0.0025	0.1109
+1.20D+1.60S+0.50W at 9.53 to 10.27	2.076	4.410	0.46	0.92	0.90	2.22	0.116	0.0025	0.1109
+1.20D+1.60S-0.50W at 11.73 to 12.47	1.923	4.410	0.46	0.25	0.90	2.18	0.116	0.0025	0.1109
+1.20D+0.50Lr+W at 10.27 to 11.00	1.505	4.410	0.46	1.46	0.90	2.08	0.116	0.0025	0.1111
+1.20D+0.50Lr-W at 10.27 to 11.00	1.505	4.410	0.46	0.94	0.90	2.08	0.116	0.0025	0.1111
+1.20D+0.50S+W at 10.27 to 11.00	1.585	4.410	0.46	1.49	0.90	2.10	0.116	0.0025	0.1110
+1.20D+0.50S-W at 10.27 to 11.00	1.585	4.410	0.46	0.93	0.90	2.10	0.116	0.0025	0.1110
+0.90D+W at 10.27 to 11.00	1.039	4.410	0.46	1.28	0.90	1.96	0.116	0.0025	0.1112
+0.90D-W at 10.27 to 11.00	1.039	4.410	0.46	0.96	0.90	1.96	0.116	0.0025	0.1112
+1.239D+0.20S+2.0E at 10.27 to 11.00	1.510	4.410	0.46	1.92	0.90	2.08	0.116	0.0025	0.1111
+1.239D+0.20S-2.0E at 10.27 to 11.00	1.510	4.410	0.46	1.40	0.90	2.08	0.116	0.0025	0.1111
+0.8610D+2.0E at 10.27 to 11.00	0.994	4.410	0.46	1.68	0.90	1.95	0.116	0.0025	0.1112
+0.8610D-2.0E at 10.27 to 11.00	0.994	4.410	0.46	1.38	0.90	1.95	0.116	0.0025	0.1112

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values		I gross in^4	Stiffness		Deflections	
		Mcr k-ft	Mactual k-ft		I cracked in^4	I effective in^4	Deflection in	Defl. Ratio
D Only at 10.27 to 11.00	1.155	0.46	0.15	342.40	26.71	342.400	0.027	9,750.4
+D+Lr at 10.27 to 11.00	1.395	0.46	0.18	342.40	27.33	342.400	0.033	7,995.1
+D+S at 10.27 to 11.00	1.555	0.46	0.20	342.40	27.73	342.400	0.037	7,133.5
+D+0.750Lr at 10.27 to 11.00	1.335	0.46	0.17	342.40	27.17	342.400	0.032	8,373.0
+D+0.750S at 10.27 to 11.00	1.455	0.46	0.18	342.40	27.48	342.400	0.035	7,649.2
+D+0.60W at 10.27 to 11.00	1.155	0.46	0.83	342.40	26.71	28.010	1.021	258.5
+D+0.750Lr+0.450W at 10.27 to 11.00	1.335	0.46	0.67	342.40	27.17	30.232	0.575	459.2
+D+0.750S+0.450W at 10.27 to 11.00	1.455	0.46	0.70	342.40	27.48	30.049	0.649	407.0

Masonry Slender Wall

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Lic. # : KW-06010584

DESCRIPTION: Exterior Non-Bearing Wall

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-16

General Information

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Construction Type : Grouted Hollow Concrete Masonry

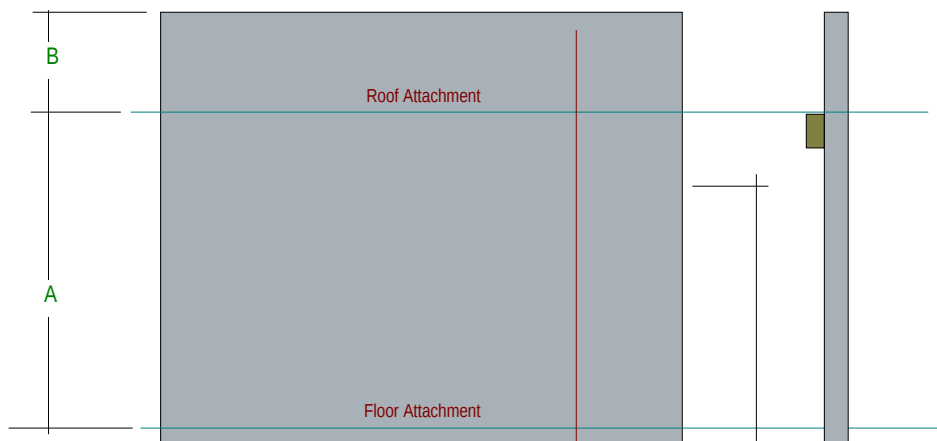
F'm	=	1.50	ksi	Nom. Wall Thickness	8	in	Temp Diff across thickness	=	100.0	deg F
Fy - Yield	=	60.0	ksi	Actual Thickness	7.625	in	Min Allow Out-of-plane Defl Ratio	=	0.0	
Fr - Rupture	=	61.0	psi	Rebar "d" distance	3.8125	in	Minimum Vertical Steel %	=	0.0020	
Em = f'm *	=	900.0		Lower Level Rebar . . .						
Max % of $\rho_{bal.}$	=	0.1115		Bar Size	#	5				
Grout Density	=	140	pcf	Bar Spacing		32	in			
Block Weight		Normal Weight								
Wall Weight	=	58.0	psf							

Wall is grouted at rebar cells only

One-Story Wall Dimensions

A Clear Height	=	22.0	ft
B Parapet height	=	3.0	ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)

		DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	0.030	0.040		0.10	k/ft
Concentric Load						k/ft

Lateral Loads

Wind Loads :

Full area WIND load 16.90 psf

Seismic Loads :

Wall Weight Seismic Load Input Method : Factor applied to wall weight entered
 Seismic factor to be applied to wall weight 0.1950

$$F_p = \text{Wall Wt.} * 0.1950 = 11.310 \text{ psf}$$

Masonry Slender Wall

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Lic. # : KW-06010584

DESCRIPTION: **Exterior Non-Bearing Wall**

DESIGN SUMMARY

Results reported for "Strip Width" of 25.0 in

Governing Load Combination . . .		Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.239D+0.20S+2.0E	Maximum Bending Stress Ratio = 0.880			
		Max Mu	3.630 k-ft	Phi * Mn	4.125 k-ft
PASS	Service Deflection Check +D+0.60W	Actual Defl. Ratio L/	303	Allowable Defl. Ratio	200.0
		Max. Deflection	0.8702 in		
PASS	Axial Load Check +1.239D+0.20S+2.0E	Max Pu / Ag	18.979 psi	Max. Allow. Defl.	1.320 in
		Location	10.633 ft	0.05 * f'm	75.0 psi
PASS	Reinforcing Limit Check				
		Actual As/bd	0.002541	Max Allow As/bd	0.1115
Maximum Reactions . . . for Load Combination...					
		Top Horizontal	+D+0.60W		0.3147 k
		Base Horizontal	+0.60D+0.60W		0.2201 k
		Vertical Reaction	+D+S		3.292 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load			Moment Values					0.6 * rho bal
	Pu k	0.05*f'm*b*t k	Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	
+1.40D at 8.80 to 9.53	1.357	4.410	0.46	0.17	0.90	2.04	0.116	0.0025	0.1111
+1.20D+0.50Lr at 8.80 to 9.53	1.184	4.410	0.46	0.15	0.90	2.00	0.116	0.0025	0.1112
+1.20D+0.50S at 8.80 to 9.53	1.214	4.410	0.46	0.16	0.90	2.00	0.116	0.0025	0.1112
+1.20D+1.60Lr at 8.80 to 9.53	1.228	4.410	0.46	0.16	0.90	2.01	0.116	0.0025	0.1112
+1.20D+1.60Lr+0.50W at 10.27 to 11.00	1.125	4.410	0.46	0.70	0.90	1.98	0.116	0.0025	0.1112
+1.20D+1.60Lr-0.50W at 11.00 to 11.73	1.074	4.410	0.46	0.34	0.90	1.97	0.116	0.0025	0.1112
+1.20D+1.60S at 9.53 to 10.27	1.272	4.410	0.46	0.19	0.90	2.02	0.116	0.0025	0.1111
+1.20D+1.60S+0.50W at 10.27 to 11.00	1.221	4.410	0.46	0.75	0.90	2.01	0.116	0.0025	0.1112
+1.20D+1.60S-0.50W at 11.00 to 11.73	1.170	4.410	0.46	0.32	0.90	1.99	0.116	0.0025	0.1112
+1.20D+0.50Lr+W at 10.27 to 11.00	1.081	4.410	0.46	1.31	0.90	1.97	0.116	0.0025	0.1112
+1.20D+0.50Lr-W at 10.27 to 11.00	1.081	4.410	0.46	0.95	0.90	1.97	0.116	0.0025	0.1112
+1.20D+0.50S+W at 10.27 to 11.00	1.111	4.410	0.46	1.33	0.90	1.98	0.116	0.0025	0.1112
+1.20D+0.50S-W at 10.27 to 11.00	1.111	4.410	0.46	0.94	0.90	1.98	0.116	0.0025	0.1112
+0.90D+W at 10.27 to 11.00	0.796	4.410	0.46	1.21	0.90	1.90	0.116	0.0025	0.1113
+0.90D-W at 10.27 to 11.00	0.796	4.410	0.46	0.96	0.90	1.90	0.116	0.0025	0.1113
+1.239D+0.20S+2.0E at 10.27 to 11.00	1.116	4.410	0.46	1.74	0.90	1.98	0.116	0.0025	0.1112
+1.239D+0.20S-2.0E at 10.27 to 11.00	1.116	4.410	0.46	1.37	0.90	1.98	0.116	0.0025	0.1112
+0.8610D+2.0E at 10.27 to 11.00	0.762	4.410	0.46	1.59	0.90	1.89	0.116	0.0025	0.1113
+0.8610D-2.0E at 10.27 to 11.00	0.762	4.410	0.46	1.36	0.90	1.89	0.116	0.0025	0.1113

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values		I gross in^4	Stiffness		Deflections	
		Mcr k-ft	Mactual k-ft		I cracked in^4	I effective in^4	Deflection in	Defl. Ratio
D Only at 10.27 to 11.00	0.885	0.46	0.11	342.40	26.02	342.400	0.022	12,238.9
+D+Lr at 10.27 to 11.00	0.925	0.46	0.13	342.40	26.12	342.400	0.024	10,973.5
+D+S at 10.27 to 11.00	0.985	0.46	0.14	342.40	26.28	342.400	0.028	9,498.1
+D+0.750Lr at 10.27 to 11.00	0.915	0.46	0.12	342.40	26.10	342.400	0.023	11,264.8
+D+0.750S at 10.27 to 11.00	0.960	0.46	0.14	342.40	26.21	342.400	0.026	10,062.1
+D+0.60W at 10.27 to 11.00	0.885	0.46	0.77	342.40	26.02	27.731	0.870	303.4
+D+0.750Lr+0.450W at 10.27 to 11.00	0.915	0.46	0.59	342.40	26.10	31.339	0.385	686.5
+D+0.750S+0.450W at 10.27 to 11.00	0.960	0.46	0.61	342.40	26.21	30.739	0.435	607.3

Masonry Shear Wall

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 Case Engineering, Inc.

Lic. # : KW-06010584

DESCRIPTION: **Bearing Shear Wall**

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-05

General Information

Wall Material	MASONRY	f'm	1.50 ksi	Block Class	
Total Wall Height	22.0 ft	Fy - Rebar	60.0 ksi	Concrete Density	150.0 pcf
Base Wall Length	25.0 ft	Fy - HJR	70.0 ksi	Min. Bending As %	0.00180
R: Resp. Mod Factor	2.0	Em	3,120.0 ksi		
Ie: Seismic Import. Factor	1.0	Phi - Shear	0.80	Phi : Axial & Flexure	0.90

Wall Data

Bottom

Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	25.0 ft
Effective Length 'd'	292.0 in
Nominal Block Thickness	8.0 in
Solid Grout?	Partial Groute

Reinforcing in Field of Wall

Vertical Bar Size #	5
Vertical Bar Spacing	32 in
Horiz. joint reinf. area (HJR)	.0344 in
HJR Spacing	16 in
Bond beam reinf. area	in
Spacing of bond beams	48 in

In each chord cell:

Vertical rebar size #	6
# Chord Cells @ Each End	2.0

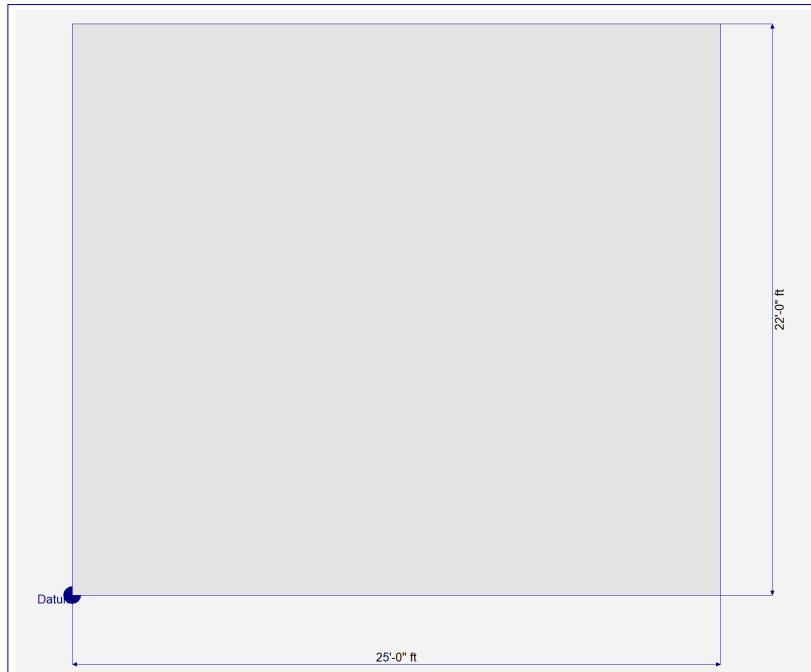
Masonry Shear Wall

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DESCRIPTION: **Bearing Shear Wall**

Wall Sketch



SHEAR ANALYSIS

Bottom Level

Special Boundary	
Elements Req'd?	Not Req'd
Vu : Story Shear	39.479 k
for Load Combination	+1.278D+0.20S+2.0E
Controlling Mu/(Vud)	0.76
Vn Masonry	176.825 k
Vn Steel	0.0 k
Vn Masonry + Vn Steel	176.825 k
Vn Max	209.317 k
Phi Vn	141.460 k
Ratio: Vu/PhiVn (controlling)	0.2791
Vertical As >= Av/3	OK
Vertical Bar Spacing <= 96"	OK

AXIAL ANALYSIS

Bottom Level

H / d Ratio	0.90
Pu	65.110 k
for Load Combination	+1.20D+1.60S
Phi Pn	+1.20D+1.60S k
Ratio: Pu/PhiPn (controlling)	0.03848

Masonry Shear Wall

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Lic. #: KW-06010584

DESCRIPTION: Bearing Shear Wall

BENDING ANALYSIS

Bottom Level

"a" : Flexural compression	5.77 in
Length of defined chord zone	
is >= the "a" dimension or the masonry (the compression zone)	OK
"d" : Eff depth to tension reinf	292.0
As-flex < As-max ?	0.880 <= 19.730
Mu	753.82 k
for Load Combination	+1.278D+0.20S+2.0E
Phi Mn	1,144.89 k
Ratio: Mu/PhiMn (controlling)	0.6584

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
+1.40D							
Wall Level : 1			57.295				
+1.20D+0.50Lr							
Wall Level : 1			52.110				
+1.20D+0.50S							
Wall Level : 1			54.110				
+1.20D+1.60Lr							
Wall Level : 1			58.710				
+1.20D+1.60Lr+0.80W							
Wall Level : 1	3.006	66.123	58.710	1.126	9.835		
+1.20D+1.60Lr-0.80W							
Wall Level : 1	3.006	66.123	58.710	1.126	2.803		
+1.20D+1.60S							
Wall Level : 1			65.110				
+1.20D+1.60S+0.80W							
Wall Level : 1	3.006	66.123	65.110	1.016	11.045		
+1.20D+1.60S-0.80W							
Wall Level : 1	3.006	66.123	65.110	1.016	1.593		
+1.20D+0.50Lr+1.60W							
Wall Level : 1	6.011	132.246	52.110	2.538	4.294		
+1.20D+0.50Lr-1.60W							
Wall Level : 1	6.011	132.246	52.110	2.538	2.025		
+1.20D+0.50S+1.60W							
Wall Level : 1	6.011	132.246	54.110	2.444	4.483		
+1.20D+0.50S-1.60W							
Wall Level : 1	6.011	132.246	54.110	2.444	1.836		
+1.278D+0.20S+2.0E							
Wall Level : 1	39.479	753.816	54.303	11.769	0.880	15.045	15.045
+1.278D+0.20S-2.0E							
Wall Level : 1	39.479	753.816	54.303	11.769	0.427	15.045	15.045
+0.90D+1.60W							
Wall Level : 1	6.011	132.246	36.833	3.590	3.797		
+0.90D-1.60W							
Wall Level : 1	6.011	132.246	36.833	3.590	2.521		
+0.8220D+2.0E							
Wall Level : 1	39.479	753.816	33.641	18.998	0.774	12.261	12.261
+0.8220D-2.0E							
Wall Level : 1	39.479	753.816	33.641	18.998	0.533	12.261	12.261

Project Title: Verve
 Engineer: CLS
 Project ID: VDS-MO-02-20
 Project Descr: DAP-St Louis

Masonry Shear Wall

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Lic. # : KW-06010584

DESCRIPTION: Bearing Shear Wall

Footing Information

Footing Dimensions

Dist. Left	1.0 ft	f'c	4.0 ksi	Rebar Cover	3.0 in
Wall Length	25.0 ft	Fy	60.0 ksi	Footing Thickness	12.0 in
Dist. Right	1.0 ft			Width	2.0 ft
Total Ftg Length	27.0 ft				

Max Factored Soil Pressures

@ Left Side of Footing	17,414.5 psf
.... governing load comb	+1.278D+0.20S-2.0E
@ Right Side of Footing	17,414.5 psf
.... governing load comb	+1.278D+0.20S+2.0E

Max UNfactored Soil Pressures

@ Left Side of Footing	2,412.32 psf
.... governing load comb	+0.60D-0.70E
@ Right Side of Footing	2,412.32 psf
.... governing load comb	+0.60D+0.70E

Footing One-Way Shear Check...

vu @ Left End of Footing	45.829 psi
vu @ Right End of Footing	45.829 psi
vn * phi : Allowable	107.517 psi

Overturning Stability...

	@ Left End of Ftg	@ Right End of Ftg
Overturning Moment	277.653 k-ft	277.653 k-ft
Resisting Moment	383.983 k-ft	383.983 k-ft
Stability Ratio	1.383 : 1	1.383 : 1
.... governing load comb	+0.60D+0.70E	+0.60D+0.70E

Footing Bending Design...

	@ Left End	@ Right End
Mu	15.852 k-ft	15.852 k-ft
Ru	108.724 psi	108.724 psi
As % Req'd	0.002456 in^2	0.002456 in^2
As Req'd in Footing Width	0.5305 in^2	0.5305 in^2

Masonry Shear Wall

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 Case Engineering, Inc.

Lic. # : KW-06010584

DESCRIPTION: Non-Bearing Shear Wall

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-05

General Information

Wall Material	MASONRY	f'm	1.50 ksi	Block Class	
Total Wall Height	22.0 ft	Fy - Rebar	60.0 ksi	Concrete Density	150.0 pcf
Base Wall Length	25.0 ft	Fy - HJR	70.0 ksi	Min. Bending As %	0.00180
R: Resp. Mod Factor	2.0	Em	3,120.0 ksi		
Ie: Seismic Import. Factor	1.0	Phi - Shear	0.80	Phi : Axial & Flexure	0.90

Wall Data

Bottom

Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	25.0 ft
Effective Length 'd'	292.0 in
Nominal Block Thickness	8.0 in
Solid Grout?	Partial Groute

Reinforcing in Field of Wall

Vertical Bar Size #	5
Vertical Bar Spacing	32 in
Horiz. joint reinf. area (HJR)	.0344 in
HJR Spacing	16 in
Bond beam reinf. area	in
Spacing of bond beams	48 in

In each chord cell:

Vertical rebar size #	6
# Chord Cells @ Each End	2.0

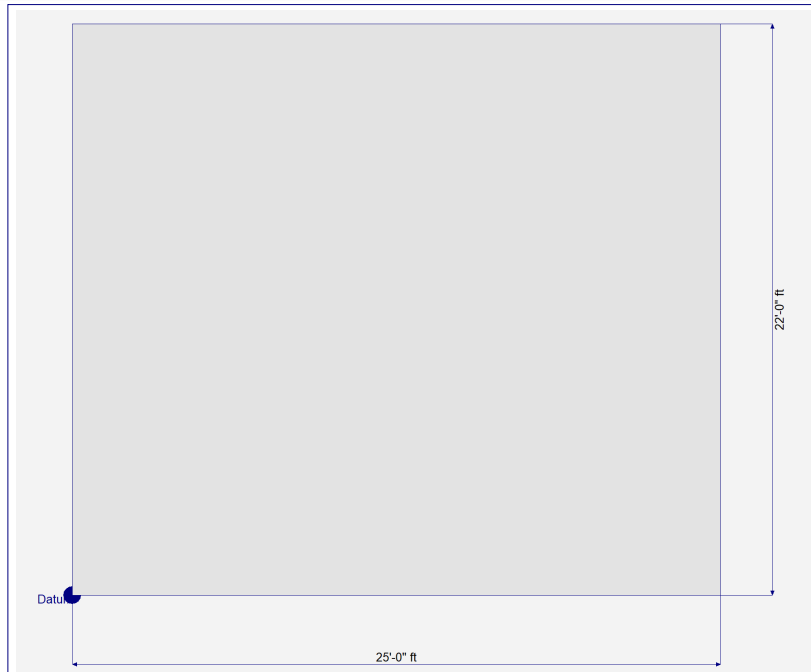
Masonry Shear Wall

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Lic. # : KW-06010584

DESCRIPTION: Non-Bearing Shear Wall

Wall Sketch



SHEAR ANALYSIS

Bottom Level

Special Boundary	
Elements Req'd?	Not Req'd
Vu : Story Shear	47.591 k
for Load Combination	+1.278D+0.20S+2.0E
Controlling Mu/(Vud)	0.78
Vn Masonry	170.419 k
Vn Steel	0.0 k
Vn Masonry + Vn Steel	170.419 k
Vn Max	206.928 k
Phi Vn	136.335 k
Ratio: Vu/PhiVn (controlling)	0.3491
Vertical As >= Av/3	OK
Vertical Bar Spacing <= 96"	OK

AXIAL ANALYSIS

Bottom Level

H / d Ratio	0.90
Pu	47.845 k
for Load Combination	+1.40D
Phi Pn	+1.40D k
Ratio: Pu/PhiPn (controlling)	0.02828

Masonry Shear Wall

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Lic. #: KW-06010584

DESCRIPTION: Non-Bearing Shear Wall

BENDING ANALYSIS

Bottom Level

"a" : Flexural compression	5.77 in
Length of defined chord zone is >= the "a" dimension or the masonry (the compression zone)	OK
"d" : Eff depth to tension reinf	292.0
As-flex < As-max ?	0.880 <= 19.730
Mu	932.28 k
for Load Combination	+1.278D+0.20S+2.0E
Phi Mn	1,144.89 k
Ratio: Mu/PhiMn (controlling)	0.8143

Force Summary

Load Combination Wall Level	Values for Wall section			Resultant Ecc (ft)	Overturning Ratio	Uplift (k)	
	Vu (k)	Mu (k)	Pu (k)			Left	Right
+1.40D							
Wall Level : 1			47.845				
+1.20D+0.50Lr							
Wall Level : 1			41.260				
+1.20D+0.50S							
Wall Level : 1			42.260				
+1.20D+1.60Lr							
Wall Level : 1			41.810				
+1.20D+1.60Lr+0.80W							
Wall Level : 1	4.145	91.186	41.810	2.181	4.815		
+1.20D+1.60Lr-0.80W							
Wall Level : 1	4.145	91.186	41.810	2.181	4.349		
+1.20D+1.60S							
Wall Level : 1			45.010				
+1.20D+1.60S+0.80W							
Wall Level : 1	4.145	91.186	45.010	2.026	5.254		
+1.20D+1.60S-0.80W							
Wall Level : 1	4.145	91.186	45.010	2.026	3.910		
+1.20D+0.50Lr+1.60W							
Wall Level : 1	8.290	182.371	41.260	4.420	2.370		
+1.20D+0.50Lr-1.60W							
Wall Level : 1	8.290	182.371	41.260	4.420	2.212		
+1.20D+0.50S+1.60W							
Wall Level : 1	8.290	182.371	42.260	4.315	2.438		
+1.20D+0.50S-1.60W							
Wall Level : 1	8.290	182.371	42.260	4.315	2.144		
+1.278D+0.20S+2.0E							
Wall Level : 1	47.591	932.280	44.176	18.507	0.533	17.177	17.177
+1.278D+0.20S-2.0E							
Wall Level : 1	47.591	932.280	44.176	18.507	0.489	17.177	17.177
+0.90D+1.60W							
Wall Level : 1	8.290	182.371	30.758	5.929	2.337		
+0.90D-1.60W							
Wall Level : 1	8.290	182.371	30.758	5.929	2.245		
+0.8220D+2.0E							
Wall Level : 1	47.591	932.280	28.092	29.103	0.521	16.745	16.745
+0.8220D-2.0E							
Wall Level : 1	47.591	932.280	28.092	29.103	0.502	16.745	16.745

Project Title: Verve
 Engineer: CLS
 Project ID: VDS-MO-02-20
 Project Descr: DAP-St Louis

Masonry Shear Wall

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Lic. # : KW-06010584

DESCRIPTION: Non-Bearing Shear Wall

Footing Information

Footing Dimensions

Dist. Left	4.0 ft	f'c	4.0 ksi	Rebar Cover	3.0 in
Wall Length	25.0 ft	Fy	60.0 ksi	Footing Thickness	12.0 in
Dist. Right	4.0 ft			Width	2.0 ft
Total Ftg Length	33.0 ft				

Max Factored Soil Pressures

@ Left Side of Footing	1,346.06 psf
.... governing load comb	+1.20D+0.50S-1.60W
@ Right Side of Footing	1,346.06 psf
.... governing load comb	+1.20D+0.50S+1.60W

Max UNfactored Soil Pressures

@ Left Side of Footing	2,231.07 psf
.... governing load comb	+0.60D-0.70E
@ Right Side of Footing	2,231.07 psf
.... governing load comb	+0.60D+0.70E

Footing One-Way Shear Check...

vu @ Left End of Footing	45.823 psi
vu @ Right End of Footing	45.823 psi
vn * phi : Allowable	107.517 psi

Overturning Stability...

Overturning Moment	332.005 k-ft
Resisting Moment	416.744 k-ft
Stability Ratio	1.255 : 1
.... governing load comb	+0.60D+0.70E

@ Left End of Ftg

Overturning Moment	332.005 k-ft
Resisting Moment	416.744 k-ft
Stability Ratio	1.255 : 1
.... governing load comb	+0.60D+0.70E

@ Right End of Ftg

Overturning Moment	332.005 k-ft
Resisting Moment	416.744 k-ft
Stability Ratio	1.255 : 1
.... governing load comb	+0.60D+0.70E

Footing Bending Design...

Mu	20.858 k-ft
Ru	143.058 psi
As % Req'd	0.003249 in^2
As Req'd in Footing Width	0.7018 in^2

@ Left End

@ Right End

Mu	20.858 k-ft
Ru	143.058 psi
As % Req'd	0.003249 in^2
As Req'd in Footing Width	0.7018 in^2

Masonry Column

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 Case Engineering, Inc.

Lic. # : KW-06010584

DESCRIPTION: **CMU Column**

Code References

Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-16

General Information

Material Properties		Column Data		Analysis Settings	
F'm	= 1,500.0 psi	Column width along X-X	= 15.625 in	Analysis Method	= Allowable Design
Fr - Rupture	= 75.0 psi	Column depth along Y-Y	= 15.625 in	End Fixity Condition	= Top Pinned, Bottom Pinned
Em = f'm *	= 900.0	Longitudinal Bar Size	= # 5.0	Overall Column Height	= 22.0 ft
Column Density	= 130.0 pcf	Bars per side at +Y & -Y	= 2	Construction Type	Solid Grouted Hollow Concrete Masonry
Rebar Grade	= Grade 60	Bars per side at +X & -X	= 2	Tie Bar Size	= # 3
Fy - Yield	= 60000 psi	Cover from ties	= 3.50 in	Tie Bar Spacing	= 8.0 in
Fs - Allowable	= 32,000.0 psi	Actual Edge to Bar Center	= 4.1875 in		
E - Rebar	= 29,000.0 ksi				

Brace condition for deflection (buckling) along columns :

X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 22.0 ft, K = 1.0

Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 22.0 ft, K = 1.0

Applied Loads

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

Column self weight included : 4,848.90 lbs * Dead Load Factor
 AXIAL LOADS . . .

Column: Axial Load at 22.0 ft, D = 7.50, LR = 6.0, S = 10.0 k
 BENDING LOADS . . .

DESIGN SUMMARY

Bending Check Results

PASS	Maximum Bending Stress Ratio =	0.226 : 1	Maximum SERVICE Load Reactions . .		
	Load Combination	+D+S	Top along X-X	0.000 k	
	Location of max.above base	0.000 ft	Bottom along X-X	0.000 k	
	At maximum location values are . . .				
	Axial - Applied	22.349 k	Maximum SERVICE Load Deflections . . .		
	Axial - Allowable	96.483 k	Along x-x	0.000 in	at 0.000 ft above base
	Moment - Applied	0.000 k-ft	for load combination :		
	Moment - Allowable	21.025 k-ft			
PASS	Reinforcing Area Check	(ACI 530-11, Sec 3.3.4.	Compressive Strength	96.497 k	(ACI 530-11, Sec 3.3.4.
	As : Actual Reinforcement	1.240	Pa = (0.25 f _m A _n + 0.65 A _{st} F _s) * [1-(h/(140*r))^2]		
	Min: 0.0025 * A _n	0.610	PASS Check Column Ties		(ACI 530-11, Sec 2.1.6.
	Max: 0.04 * A _n	9.766	Min. Tie Dia. = 1/4", # 3 bar provided		
	Dimensional Checks		Max Tie Spacing = 10.00 in, Provided = 8.00 in		
	Min. Side Dim. >= 8"	(ACI 530-11, Sec 3.4.4.			
PASS	Governing K * L _u / Dimension <= 25	(ACI 530-11, Sec 3.4.4.			

Load Combination Results

Load Combination	Maximum Bending Stress Ratios			Maximum Axial Load		Maximum Moments	
	Stress Ratio	Status	Location	Actual	Allow	Actual	Allow
D Only	0.1251	PASS	0.0 ft	12.349 k	96.483 k	0.0 k-ft	21.025 k-ft
+D+Lr	0.1858	PASS	0.0 ft	18.349 k	96.483 k	0.0 k-ft	21.025 k-ft
+D+S	0.2263	PASS	0.0 ft	22.349 k	96.483 k	0.0 k-ft	21.025 k-ft
+D+0.750Lr	0.1706	PASS	0.1477 ft	16.849 k	96.483 k	0.0 k-ft	21.025 k-ft
+D+0.750S	0.2010	PASS	0.0 ft	19.849 k	96.483 k	0.0 k-ft	21.025 k-ft
+0.60D	0.07503	PASS	0.0 ft	7.409 k	96.483 k	0.0 k-ft	21.025 k-ft
+1.027D	0.1285	PASS	0.0 ft	12.686 k	96.483 k	0.0 k-ft	21.025 k-ft
+1.020D+0.750S	0.2036	PASS	0.0 ft	20.102 k	96.483 k	0.0 k-ft	21.025 k-ft
+0.5727D	0.07162	PASS	0.0 ft	7.072 k	96.483 k	0.0 k-ft	21.025 k-ft

Masonry Column

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DESCRIPTION: CMU Column

Maximum Reactions

Note: Only non-zero reactions are listed.

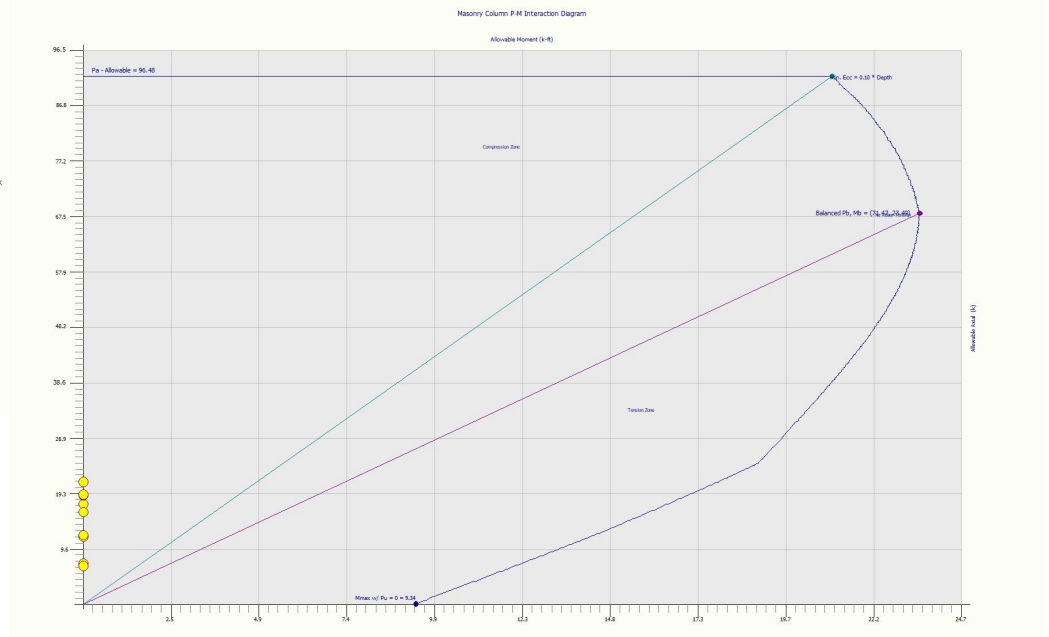
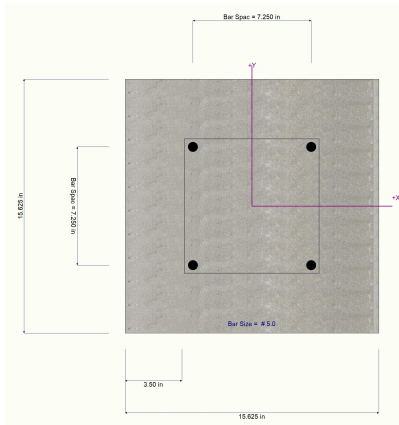
Load Combination	Y-Y Axis Reaction		Axial Reaction @ Base
	@ Base	@ Top	
D Only	k	k	12.349 k
+D+Lr	k	k	18.349 k
+D+S	k	k	22.349 k
+D+0.750Lr	k	k	16.849 k
+D+0.750S	k	k	19.849 k
+0.60D	k	k	7.409 k
Lr Only	k	k	6.000 k
S Only	k	k	10.000 k

Maximum Deflections for Load Combinations

Load Combination	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft
+D+Lr	0.0000 in	0.000 ft
+D+S	0.0000 in	0.000 ft
+D+0.750Lr	0.0000 in	0.000 ft
+D+0.750S	0.0000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft
Lr Only	0.0000 in	0.000 ft
S Only	0.0000 in	0.000 ft

Cross Section

Interaction Diagram



General Footing

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Lic. #: KW-06010584

DESCRIPTION: Column Footing

Code References

Calculations per ACI 318-11, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-05

General Information

Material Properties

f _c : Concrete 28 day strength	=	4.0 ksi
f _y : Rebar Yield	=	60.0 ksi
E _c : Concrete Elastic Modulus	=	3,605.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1

Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	Yes
Use Pedestal wt for stability, mom & shear	:	Yes

Soil Design Values

Allowable Soil Bearing	=	2.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	2.0 ft
Allow press. increase per foot of depth when footing base is below	=	ksf

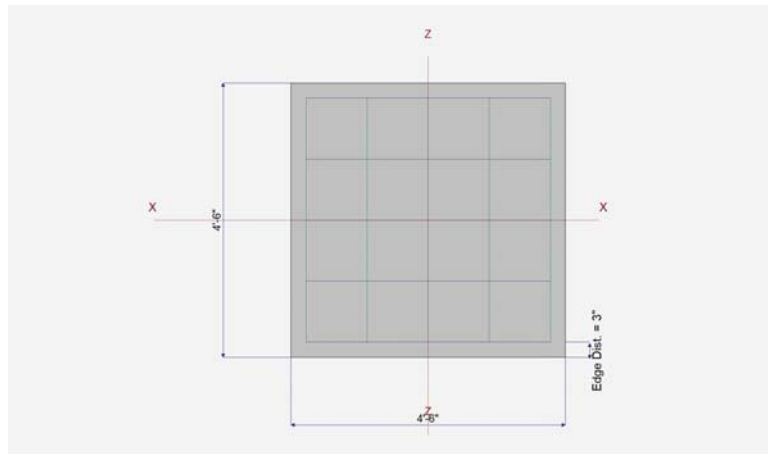
Increases based on footing plan dimension

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

Dimensions

Width parallel to X-X Axis	=	4.50 ft
Length parallel to Z-Z Axis	=	4.50 ft
Footing Thickness	=	12.0 in

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



Reinforcing

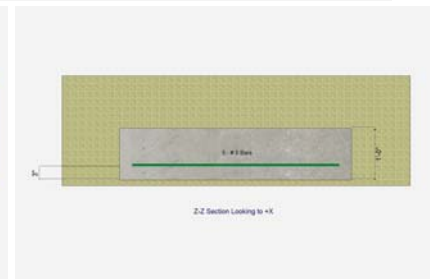
Bars parallel to X-X Axis	=	
Number of Bars	=	5
Reinforcing Bar Size	=	# 5

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

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

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



Applied Loads

	D	L _r	L	S	W	E	H
P : Column Load	=	24.9	12.0	14.220			k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

General Footing

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DESCRIPTION: Column Footing

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8748	Soil Bearing	2.187 ksf	2.50 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.4853	Z Flexure (+X)	6.579 k-ft/ft	13.557 k-ft/ft	+1.20D+1.60S
PASS	0.4853	Z Flexure (-X)	6.579 k-ft/ft	13.557 k-ft/ft	+1.20D+1.60S
PASS	0.4853	X Flexure (+Z)	6.579 k-ft/ft	13.557 k-ft/ft	+1.20D+1.60S
PASS	0.4853	X Flexure (-Z)	6.579 k-ft/ft	13.557 k-ft/ft	+1.20D+1.60S
PASS	0.3767	1-way Shear (+X)	35.738 psi	94.868 psi	+1.20D+1.60S
PASS	0.3767	1-way Shear (-X)	35.738 psi	94.868 psi	+1.20D+1.60S
PASS	0.3767	1-way Shear (+Z)	35.738 psi	94.868 psi	+1.20D+1.60S
PASS	0.3767	1-way Shear (-Z)	35.738 psi	94.868 psi	+1.20D+1.60S
PASS	0.8342	2-way Punching	158.286 psi	189.737 psi	+1.20D+1.60S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
			(in)	Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	2.50	n/a	0.0	1.485	1.485	n/a	n/a	0.594
X-X, +D+Lr	2.50	n/a	0.0	2.077	2.077	n/a	n/a	0.831
X-X, +D+S	2.50	n/a	0.0	2.187	2.187	n/a	n/a	0.875
X-X, +D+0.750Lr	2.50	n/a	0.0	1.929	1.929	n/a	n/a	0.772
X-X, +D+0.750S	2.50	n/a	0.0	2.011	2.011	n/a	n/a	0.804
X-X, +0.60D	2.50	n/a	0.0	0.8908	0.8908	n/a	n/a	0.356
Z-Z, D Only	2.50	0.0	n/a	n/a	n/a	1.485	1.485	0.594
Z-Z, +D+Lr	2.50	0.0	n/a	n/a	n/a	2.077	2.077	0.831
Z-Z, +D+S	2.50	0.0	n/a	n/a	n/a	2.187	2.187	0.875
Z-Z, +D+0.750Lr	2.50	0.0	n/a	n/a	n/a	1.929	1.929	0.772
Z-Z, +D+0.750S	2.50	0.0	n/a	n/a	n/a	2.011	2.011	0.804
Z-Z, +0.60D	2.50	0.0	n/a	n/a	n/a	0.8908	0.8908	0.356

Overturning Stability

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

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	4.358	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.40D	4.358	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+0.50Lr	4.485	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+0.50Lr	4.485	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+0.50S	4.624	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+0.50S	4.624	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+1.60Lr	6.135	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+1.60Lr	6.135	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+1.60S	6.579	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.20D+1.60S	6.579	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.291D+0.20S	4.372	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +1.291D+0.20S	4.372	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +0.90D	2.801	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +0.90D	2.801	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +0.8094D	2.519	+Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
X-X, +0.8094D	2.519	-Z	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.40D	4.358	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.40D	4.358	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK

General Footing

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DESCRIPTION: Column Footing

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
Z-Z, +1.20D+0.50Lr	4.485	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.20D+0.50Lr	4.485	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.20D+0.50S	4.624	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.20D+0.50S	4.624	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.20D+1.60Lr	6.135	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.20D+1.60Lr	6.135	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.20D+1.60S	6.579	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.20D+1.60S	6.579	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.291D+0.20S	4.372	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +1.291D+0.20S	4.372	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +0.90D	2.801	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +0.90D	2.801	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +0.8094D	2.519	-X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK
Z-Z, +0.8094D	2.519	+X	Bottom	0.2592	Min Temp %	0.3444	13.557	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	23.67 psi	23.67 psi	23.67 psi	23.67 psi	23.67 psi	94.87 psi	0.25	OK
+1.20D+0.50Lr	24.36 psi	24.36 psi	24.36 psi	24.36 psi	24.36 psi	94.87 psi	0.26	OK
+1.20D+0.50S	25.12 psi	25.12 psi	25.12 psi	25.12 psi	25.12 psi	94.87 psi	0.26	OK
+1.20D+1.60Lr	33.33 psi	33.33 psi	33.33 psi	33.33 psi	33.33 psi	94.87 psi	0.35	OK
+1.20D+1.60S	35.74 psi	35.74 psi	35.74 psi	35.74 psi	35.74 psi	94.87 psi	0.38	OK
+1.291D+0.20S	23.75 psi	23.75 psi	23.75 psi	23.75 psi	23.75 psi	94.87 psi	0.25	OK
+0.90D	15.22 psi	15.22 psi	15.22 psi	15.22 psi	15.22 psi	94.87 psi	0.16	OK
+0.8094D	13.69 psi	13.69 psi	13.69 psi	13.69 psi	13.69 psi	94.87 psi	0.14	OK

Two-Way "Punching" Shear

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	104.84 psi	189.74 psi	0.5525	OK
+1.20D+0.50Lr	107.91 psi	189.74 psi	0.5687	OK
+1.20D+0.50S	111.24 psi	189.74 psi	0.5863	OK
+1.20D+1.60Lr	147.60 psi	189.74 psi	0.7779	OK
+1.20D+1.60S	158.29 psi	189.74 psi	0.8342	OK
+1.291D+0.20S	105.20 psi	189.74 psi	0.5544	OK
+0.90D	67.40 psi	189.74 psi	0.3552	OK
+0.8094D	60.61 psi	189.74 psi	0.3195	OK

All units k

Masonry Beam

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DESCRIPTION: OH Door Lintel

Code References

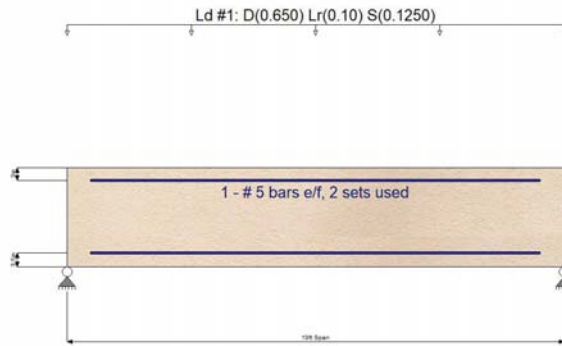
Calculations per ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-05

General Information

f'm	1,500.0 psi	Clear Span	10.0 ft	Rebar Size	5
Fs	24,000.0 psi	Beam Depth	2.0 ft	# Bars E/F	1
Em = f'm *	750.0	Thickness	8 in	Top Clear	3.0 in
Wall Wt Mult	1.0	End Fixity	Pin-Pin	Btm Clear	3.50 in
Block Type	Normal Wt	Equiv. Solid Thick	7.60 in	# Bar Sets	2
Lateral Wind Load	15.0 psf	Wall Weight	84.0 psf	Bar Spacing	3.0 in
Beam is Fully Braced ?	No	E	1,125.0 ksi	Shear Reinf Bar Size	# 3
Lateral Wall Weight Seismic Factor	0.1950	n	25.778	Shear Reinf Bar Spacing	16.0 in

Calculate vertical beam weight ? Yes

Note! Shear calculated at "d/2" from edge of beam



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	0.0 ft	10.0 ft	0.650		0.10	0.1250		k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft

DESIGN SUMMARY

						Design OK	
Maximum Stress Ratios...		Vertical	Lateral	SRSS Combination	Maximum Moment	Actual	Allowable k-ft
fb/Fb	0.5272	0.06543	0.5313	: 1.00	Vertical Loads	11.787 k-ft	22.358 k-ft
fv/Fv	0.3857	0.03038	0.3869	: 1.00	for Load Combination : +D+S		
					Lateral Loads	0.3748 k-ft	5.729
					for Load Combination : +D+W		
Minimum Mn = 1.3 * Fcr * S =			7.930 k-ft		Maximum Shear	Actual	Allowable
					Vertical Loads	25.151 psi	65.210 psi
					for Load Combination : +D+S		
					Lateral Loads	1.176 psi	38.730 psi
					for Load Combination : +D+W		
Vertical Strength					Lateral Strength	(Checking lateral bending for span)	
As		0.620 in^2			As		0.620 in^2
rho		0.003966			rho		0.004863
np		0.1022			np		0.1254
k : ((np)^2+2np)^.5-np		0.3614			k : (np^2+2np)^.5-np		0.3908
j = 1 - k/3		0.8795			j = 1 - k/3		0.8697
M:mas=Fb k j b d^2/2		28.645 k-ft			M:mas=Fb k j b d^2/2		6.475 k-ft
M:Stl = Fs As j d		22.358 k-ft			M:Stl = Fs As j d		5.729 k-ft

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