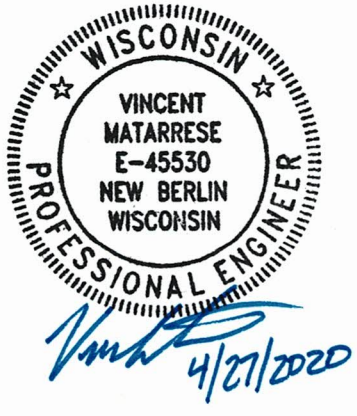
VM ENGINEERING

PROJECT:	**PHASE I – COMMERCIAL ALTERATION & ADDITION**
ADDRESS:	425 E. BROADWAY WAUKESHA, WI 53186
CLIENT:	EAST COAST HAIR DESIGN 425 E. BROADWAY WAUKESHA, WI 53186
SCOPE:	CALCULATION PACKAGE FOR COMMERICAL ALTERATION AND ADDITION PER THE WISCONSIN UNIFORM BUILDING CODE. EXISTING STRUCTURE VERIFIED AS NEEDED. FRONT AND BACK REMODEL MEMBERS ARE SIZED FOR POTENTIAL 3RD STORY ADDITIONS.
ENGINEER OF RECORD:	VINCENT M. MATARRESE, PE
LICENSE:	E-45530



VM Engineering LTD - 2412 Tanager Ct. Waukesha WI
C (262) 364-8744 Vince@VMproeng.com

VM ENGINEERING

PROJECT: FIRST FLOOR HEADER

ADDRESS: 425 E BROADWAY

DATE: 4/27/2020

ASD DESIGN FORCES L= 29 FT

EQ. DIST LOAD	605	PLF
END REACTION	8772.5	#
SHEAR	8772.5	#
MOMENT	63600.6	#-FT

(SIZED FOR THIRD STORY ADDITION W/ BEARING)

DESIGN STEEL BEAM:

Wa = 605 plf
L = 29 ft

TRIAL: ***W 10x49*** TABLE 3-2 AISC 14th EDITION (SEE ATTACHED REF.)

Vn/Ω =	68	kips	>	Va=	8.77	lbs	OK
Mn/Ω =	99.5	kips*ft	>	Ma=	63.60	kips*ft	OK

CHECK DEFLECTION

E=	29000	ksi	Δ=	1.22	in
I=	272	in4	L/	285	OK

USE: W10x49 STEEL BEAM

DESIGN STEEL COLUMN:

Pu = 26.3 kips

TRIAL: 4 in. Dia. TABLE 4-6 AISC 14th EDITION (SEE ATTACHED REF.)

ϕPn =	45.1	kips	>	26.32 kips	OK

USE:4 in. DIA. STEEL STANDARD PIPE COLUMN

VM ENGINEERING
Vincent Matarrese, P.E.
Professional Engineering Services
P262-364-8744
Vince@VMproeng.com

Project: FND + Soil Pressures
Address: 425 E. BROADWAY
Date: 2/28/2020 Page: 1/1 By: VMM

EXISTING FND WALL: thk = 22" WD FIELD STONE + MORTAR

1- Verify Soil LOADS from ADDITION
- Note, Front and back walls are NON-load brg to original structure
- USE (3) Story PHASE II LOADS

(2nd Story): 9' x (40psf + 15psf) = 495
(3rd Story): 9' x (40psf + 15psf) = 495
(ROOF): 9' x (24psf + 18psf) = 378
1368 plf
(FND): 6.5' x 22/12 x 150 = 1790 plf
3158#

- Assumed Soil Capacity $\sigma_{brg} = 2{,}000$ psf

$\frac{3158\#}{(12\times22)/144} = 1722$ psf < 2,000 psf OK

2- BRG/Comp. Stress At BEAM POST

$P_{ASD} = 25.6$ kips
$P_u = 38.4$ kips

Comp. Strength (LANNON STONE) ASTM $\sigma_c = 8{,}000$ psi

$\phi = 0.65$

$A_{req-BP} = \frac{38{,}400\#}{0.65 \cdot 8{,}000 psi} = 7.5\,in^2$ min., 6"x6" = $36\,in^2$
$\sigma = 712$ psi

* Note, Grout Wall at this location if deteriorated.
$A_1 = 36\,in^2$ $A_2 = 484\,in^2$ $\sqrt{A_2/A_1} = 3.7$
$\phi P_p = 0.16 \cdot 0.85 \cdot 8{,}000 \cdot 36 = 147$ kips ok

BASE PLATE YIELDING $t = 1/2"$ $m/n = 1.25"$ $B/N = 6"$

$f_{pu} = 712$ psi $t_{min} = 1.25" \sqrt{\frac{2 \cdot 38.4}{0.9 \cdot 36 \cdot 36}} = 3/8"$

USE 3/4"ϕ Epoxy Anchor or threaded ROD

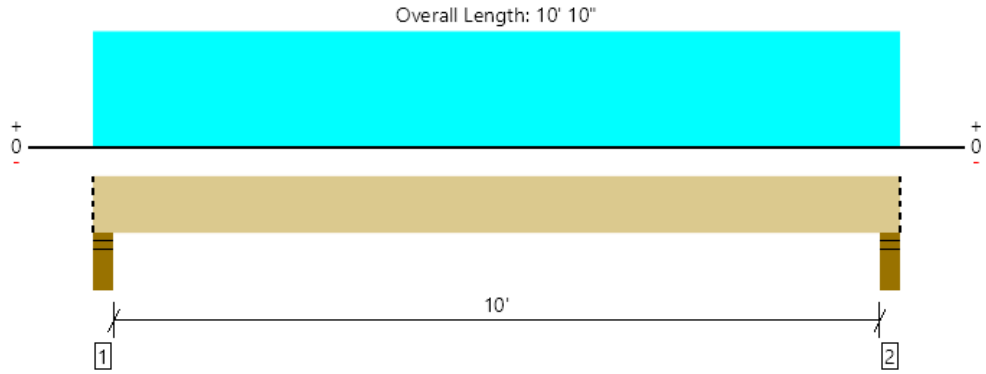
FORTE WEB

MEMBER REPORT

PASSED

2nd Floor, kitchen header 12'

2 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2746 @ 3 1/2"	7438 (5.00")	Passed (37%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2112 @ 1' 2 1/4"	6151	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	6559 @ 5' 5"	11204	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.145 @ 5' 5"	0.342	Passed (L/850)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.296 @ 5' 5"	0.512	Passed (L/415)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 10' 10" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 10' 10" o/c based on loads applied, unless detailed otherwise.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Stud wall - SPF	5.00"	5.00"	1.85"	1405	1300	488	3193	Blocking
2 - Stud wall - SPF	5.00"	5.00"	1.85"	1405	1300	488	3193	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 10' 10"	N/A	9.4	--	--	
1 - Uniform (PSF)	0 to 10' 10" (Top)	3'	15.0	40.0	-	3rd floor
2 - Uniform (PSF)	0 to 10' 10" (Top)	3'	15.0	40.0	30.0	Roof
3 - Uniform (PLF)	0 to 10' 10" (Top)	N/A	160.0	-	-	Wall Wt

Member Notes

Kitchen header at existing bldb ext.

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by VMM

ForteWEB Software Operator	Job Notes
Vince Matarrese VM Engineering LTD (262) 364-8744 Vince@VMproeng.com	Commercial Alteration and Addition

Weyerhaeuser

4/27/2020 10:16:21 AM UTC

ForteWEB v2.4, Engine: V8.0.1.5, Data: V7.3.2.0

File Name: 425 E Broadway

	MWFRS Wind Loads *ASCE 7-10* *Enclosed & Partially Enclosed Buildings of All Heights* Address: 425 E. Broadway	Job No: Designer: Checker: VMM Date: 4/27/2020

Basic Parameters

Risk Category	II	Table 1.5-1
Basic Wind Speed, V	115 mph	Figure 26.5-1A
Wind Directionality Factor, K_d	0.85	Table 26.6-1
Exposure Category	B	Section 26.7
Topographic Factor, K_{zt}	1.00	Section 26.8
Gust Effect Factor, G or G_f	0.850	Section 26.9
Enclosure Classification	Enclosed	Section 26.10
Internal Pressure Coefficient, GC_{pi}	+/- 0.18	Table 26.11-1
Terrain Exposure Constant, α	7.0	Table 26.9-1
Terrain Exposure Constant, z_g	1,200 ft	Table 26.9-1

Wall Pressure Coefficients

Windward Wall Width, B	30 ft	
Side Wall Width, L	74 ft	
L/B Ratio	2.47	
Windward Wall Coefficient, C_p	0.80	Figure 27.4-1
Leeward Wall Coefficient, C_p	-0.28	Figure 27.4-1
Side Wall Coefficient, C_p	-0.70	Figure 27.4-1

Roof Pressure Coefficients

Roof Slope, θ	35.0°	
Median Roof Height, h	30 ft	
Velocity Pressure Exposure Coef., K_h	0.70	Table 27.3-1
Velocity Pressure, q_h	20.2 psf	Equation 27.3-1
h/L Ratio	0.41	
Windward Roof Area	0 ft²	
Roof Area Within 15 ft of WW Edge	0 ft²	

Location	*Min/Max*	*Horiz Distance From Windward Edge*			
		0 ft	*15 ft*	*30 ft*	*60 ft*
Windward Roof Coefficient Normal to Ridge, C_p	Min	-0.12	-0.12	-0.12	-0.12
	Max	0.34	0.34	0.34	0.34
Leeward Roof Coefficient Normal to Ridge, C_p	Min	-0.60	-0.60	-0.60	-0.60
	Max	-0.60	-0.60	-0.60	-0.60
Roof Coefficient Parallel to Ridge, C_p	Min	-0.90	-0.90	-0.50	-0.30
	Max	-0.18	-0.18	-0.18	-0.18

Figure 27.4-1

Structure Pressure Summary (Add Internal Pressure q_zGC_{pi} or q_hGC_{pi} as Necessary)

Height, z	K_z	q_z	*Walls*				*Roof*			Internal	
			WW	*LW*	*WW + LW*	*Side*	*Normal to Ridge* *WW*	*Normal to Ridge* *LW*	*Parallel to Ridge*	Positive	Negative
0 ft	0.57	16.5 psf	11.2 psf		16.0 psf					3.6 psf	
3 ft	0.57	16.5 psf	11.2 psf		16.0 psf		Min:	Min:	Min:	3.6 psf	
6 ft	0.57	16.5 psf	11.2 psf		16.0 psf		-2.1 psf	-10.3 psf	-15.4 psf	3.6 psf	
9 ft	0.57	16.5 psf	11.2 psf		16.0 psf					3.6 psf	
12 ft	0.57	16.5 psf	11.2 psf		16.0 psf					3.6 psf	
15 ft	0.57	16.5 psf	11.2 psf	-4.7 psf	16.0 psf	-12.0 psf				3.6 psf	-3.6 psf
18 ft	0.61	17.4 psf	11.8 psf		16.6 psf					3.6 psf	
21 ft	0.63	18.2 psf	12.4 psf		17.1 psf		Max:	Max:	Max:	3.6 psf	
24 ft	0.66	18.9 psf	12.9 psf		17.6 psf		5.8 psf	-10.3 psf	-3.1 psf	3.6 psf	
27 ft	0.68	19.6 psf	13.3 psf		18.0 psf					3.6 psf	
30 ft	0.70	20.2 psf	13.7 psf		18.5 psf					3.6 psf	

VM ENGINEERING
Vincent Matarrese, P.E.
Professional Engineering Services
P262-364-8744
Vince@VMproeng.com

Project: WIND CALC - REAR ADDITION
Address: 425 E. BROADWAY
Date: 4/25/20 Page: _____ By: VMM

GEOMETRY:

Rear wall W = 27'-3", SIDE WALL = 18'-0"

SW ht = 7'-6" SW LG: A_{SW} = 13', B_{1SW} = 5'-6", B_{2SW} = 5'-8"

C_{RW1} = 9' C_{RW2} = 4"

RW_{AREA} = 286 sq.ft.

SW_{AREA} = 165 sq.ft.

SIDE WALL A:

P_W = 13.5psf F_W = 13.5 · ½ · 286 = 1930# v_W = 1930/13 = 150plf

USE 15/32" w/ 10d NAILS @ 6" O.C. PANEL EDGES v_{ALL} = 280

HD TENSION, T = 150plf x 7.5' = 1125#, CLR SPAN = 9.25 + 0.75 + 4.5 = 14.5"

USE SIMPSON MSTC 40 w/ (32) 16d SINKERS TOTAL, T_{all} = 3,080#

CK END STUDS (See Attached) USE (2) 2x6 STUDS

SIDE WALL B:

P_W = 13.5psf F_W = 1930# v_W = 1930/(5'-6" + 5'-8") = 175plf

"

HD Tension, T = 175plf x 7.5' = 1315#, CLR SP. = 14.5"

"

REAR WALL:

P_W = 18psf F_W = 18 x ½ x 165 = 1485#, v_W = 1485#/8 = 186plf

"

HD Tension, T = 1400#, Clr = 14.5"

"

SHEAR WALL END STUDS

# of studs	2	
Stud Width (d_y)	3.00	in
Stud Depth (d_x)	3.50	in
Stud Length (L)	8.00	ft
Stud Spacing	16	in
Stud Species and Grade	2X4 DF Stud	
Top/Sill Plt. Species	HF	

Design Values

F_b	700	psi
F_c	850	psi
$F_{c\perp}$	405	psi
E	1,400,000	psi
E_{min}	510,000	psi
C_{F_b}	1.10	
C_{F_c}	1.05	
A	21.00	in^2
S_x	12.25	in^3
I_x	21.44	in^4
C_{t_c}	1.00	
C_{M_c}	1.00	
C_{i_c}	1.00	

Load Case 1: Gravity Loads Only

l_y (unbraced length)	8.0	ft
C_D	1.60	(Wind/Seismic)
(le/d)y	32.00	(governs)
(le/d)x	27.43	
E'min	510,000	psi
F_{cE}	409.39	psi
Fc*	1428.00	psi
c	0.80	sawn lumber
FcE/Fc*	0.287	
1 + FcE/Fc*/2c	0.804	
Cp	0.267	
Fc'	381.57	psi
fc	285.71	psi
CSI (axial)	**0.75**	**OK**

Bearing on Stud Wall Plates

lb	3.00	in
Cb	1.00	(conservative)
$F_{c\perp}'$	405.00	psi
$f_{c\perp}$	285.71	psi
CSI (bearing)	**0.71**	**OK**

Deflection

E'	1,400,000	psi
ΔWIND (.42C&C)*	0.18	in
L/d**	**522**	**OK**

*IBC 2015 Sec. 1604.3

**IRC 2015 Sec. 301.7

Vertical Loads

Wall LL (w_{LL})	423.5	plf
Wall DL (w_{DL})	366.85	plf
Wall DL (w_{TL})	790.35	plf
Trib. Length	1.33	ft
Pc	6000.00	lbs

Lateral Loads (Wind MWFRS)

Wind Load (windward wall)	38.72	psf
MWFRS Wind Load ASD	23.23	psf
Wind A_{trib}	10.67	ft^2
W	247.81	lbs
w	25.00	plf

Lateral Loads (Wind C&C)

Wind Load (Zone 4)	53.43	psf
CC Wind Load ASD	32.06	psf
W	341.95	lbs
w	42.74	plf

Load Case 2: Lateral Loads Only (Wind C&C)

M_{max}	341.95	ft-lbs
	4103.42	in-lbs
f_{bx}	334.97	psi
CSI (bending C&C)	**0.24**	**OK**

Load Case 3: Gravity Loads and Lateral Loads

C_D	1.60	(Wind/Seismic)
M_{max}	200.00	ft-lbs
	2400.00	in-lbs
C_L	0.99	
C_r	1.15	@ 16 O/C
F_{bx}'	1403.67	psi
f_{bx}	195.92	psi
CSI (bending MWFRFS)	**0.14**	**OK**

Combined Stress

(re-evaluate compression values with CD = 1.6)

F_{cEx}	557.23	psi
F_{cE}	409.39	psi
Fc*	1428.00	psi
c	0.80	sawn lumber
F_{cE}/F_c^*	0.287	
$1 + F_{cE}/F_c^*/2c$	0.804	
C_p	0.267	
Fc'	381.57	psi

$$\left(\frac{f_c}{F_c'}\right)^2 + \left(\frac{1}{1-\frac{f_c}{F_{cEx}}}\right)\left(\frac{f_{bx}}{F_{bx}'}\right) = \mathbf{0.15}\ \mathbf{OK}$$

Load Case: LC5

*LCMAX takes 100% of all loads for axial and bending.

DOUBLE 2X STUDS AT SHEARWALL ENDS ARE ACCEPTABLE

Strap Ties

Codes: See p. 14 for Code Reference Key Chart

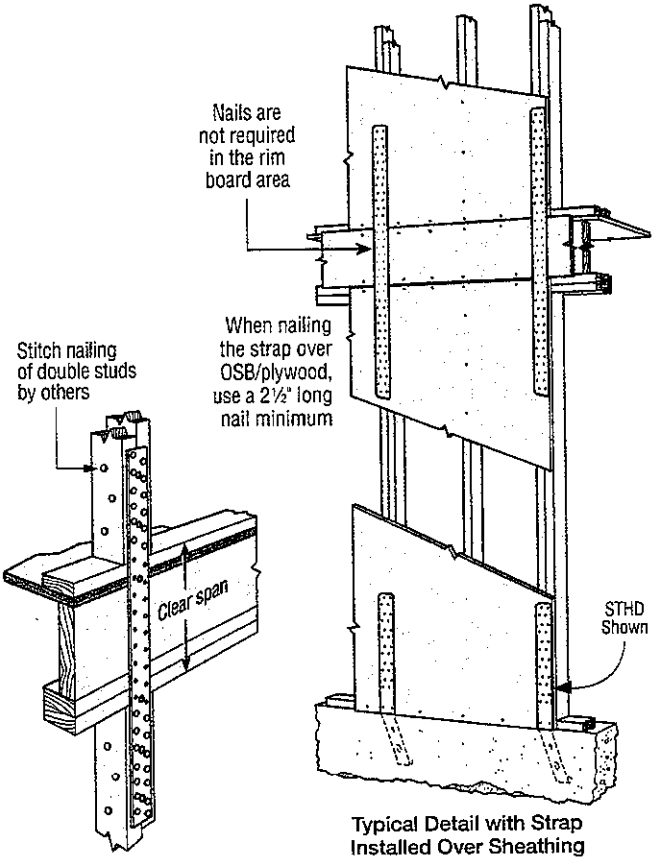
These products are available with additional corrosion protection. For more information, see p. 18.

These products are approved for installation with the Strong-Drive® SD Connector screw. See pp. 39–40 for more information.

Floor-to-Floor Clear Span Table

Model No.	Clear Span (in.)	Fasteners (Total)	Allowable Tension Loads (DF/SP) (160)	Allowable Tension Loads (SPF/HF) (160)
MSTA49	18	(26) 10d	2,020	2,020
	16	(26) 10d	2,020	2,020
MSTC28	18	(12) 16d sinkers	1,155	995
	16	(16) 16d sinkers	1,540	1,325
MSTC40	24	(20) 16d sinkers	2,310	1,985
	18	(28) 16d sinkers	2,695	2,320
	16	(32) 16d sinkers	3,080	2,650
MSTC52	24	(36) 16d sinkers	3,465	2,980
	18	(44) 16d sinkers	4,235	3,645
	16	(48) 16d sinkers	4,620	3,975
MSTC66	30	(48) 16d sinkers	4,780	4,120
	24	(54) 16d sinkers	5,380	4,640
	18	(64) 16d sinkers	5,860	5,495
	16	(68) 16d sinkers	5,860	5,840
MSTC78	30	(64) 16d sinkers	5,860	5,495
	24	(72) 16d sinkers	5,860	5,860
	18	(76) 16d sinkers	5,860	5,860
MST37	24	(14) 16d	1,725	1,495
	18	(20) 16d	2,465	2,135
	16	(22) 16d	2,710	2,345
MST48	24	(26) 16d	3,215	2,780
	18	(32) 16d	3,960	3,425
	16	(34) 16d	4,205	3,640
MST60	30	(34) 16d	4,605	3,995
	24	(40) 16d	5,240	4,700
	18	(46) 16d	6,235	5,405
MST72	30	(48) 16d	6,505	5,640
	24	(54) 16d	6,730	6,345
	18	(62) 16d	6,730	6,475

See footnotes below.

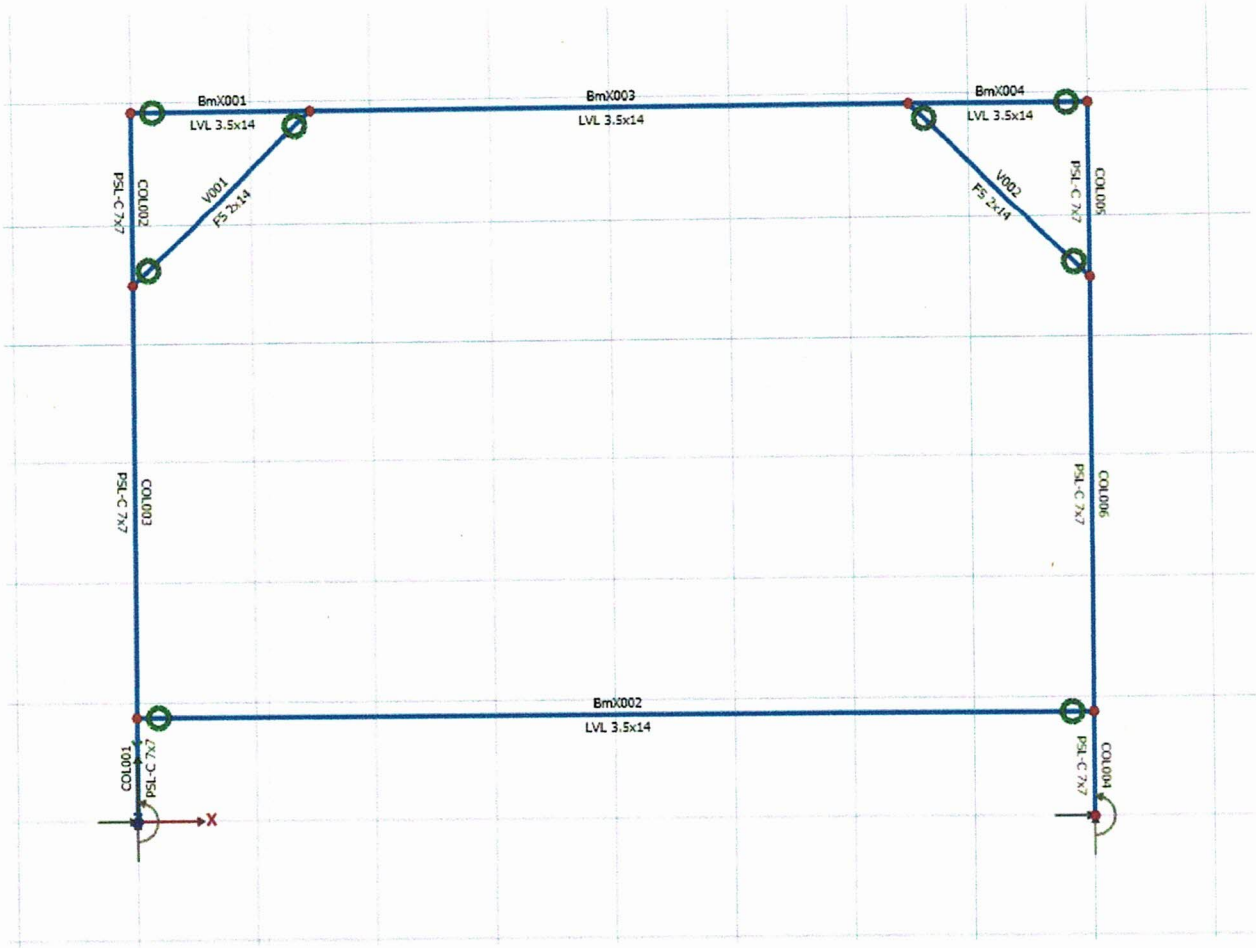


Floor-to-Floor Tie Installation Showing a Clear Span

Typical Detail with Strap Installed Over Sheathing

Model No.	Ga.	Dimensions (in.) W	Dimensions (in.) L	Fasteners (Total) Nails	Fasteners (Total) Bolts Qty.	Fasteners (Total) Bolts Dia.	Allowable Tension Loads (DF/SP) Nails (160)	Allowable Tension Loads (DF/SP) Bolts (160)	Allowable Tension Loads (SPF/HF) Nails (160)	Allowable Tension Loads (SPF/HF) Bolts (160)	Code Ref.
MST27	12	2 1/16	27	(30) 16d	4	½	3,700	2,165	3,200	2,000	I4, L3, FL
MST37	12	2 1/16	37½	(42) 16d	6	½	5,080	3,025	4,480	2,805	
MST48	12	2 1/16	48	(50) 16d	8	½	5,310	3,675	5,190	3,410	
MST60	10	2 1/16	60	(68) 16d	10	½	6,730	4,485	6,475	4,175	
MST72	10	2 1/16	72	(68) 16d	10	½	6,730	4,485	6,475	4,175	
HST2	7	2½	21¼	—	6	⅝	—	5,220	—	4,835	
HST5	7	5	21¼	—	12	⅝	—	10,650	—	9,870	
HST3	3	3	25½	—	6	¾	—	7,680	—	6,660	
HST6	3	6	25½	—	12	¾	—	15,470	—	13,320	

1. Allowable loads have been increased for wind or seismic loading with no further increase allowed; reduce where other loads govern.
2. Install bolts or nails as specified by Designer. Bolt and nail values may not be combined.
3. Allowable bolt loads are based on parallel-to-grain loading and these minimum member thicknesses: MST – 2½"; HST2 and HST5 – 4"; HST3 and HST6 – 4½".
4. Splitting may be a problem with installations on lumber smaller than 3½"; either fill every nail hole with 10d x 1½" nails or fill every-other hole with 16d common nails. Reduce the allowable load based upon the size and quantity of fasteners used.
5. Use half of the required nails in each member being connected to achieve the listed loads.
6. When installing strap over wood structural panel sheathing, use 2½" long nail minimum.
7. Tension loads apply for uplift as well when installed vertically.
8. **Nails:** 16d = 0.162" dia. x 3½" long, 16d sinker = 0.148" dia. x 3¼" long, 10d x 1½" = 0.148" dia. x 1½" long. See pp. 26–27 for other nail sizes and information.


BmX001
LVL 3.5x14
BmX003
LVL 3.5x14
BmX004
LVL 3.5x14
V001
FS 2x14
V002
FS 2x14
COL002
PSL-C 7x7
COL005
PSL-C 7x7
COL003
PSL-C 7x7
COL006
PSL-C 7x7
BmX002
LVL 3.5x14
COL001
PSL-C 7x7
COL004
PSL-C 7x7
X

Node Results

(extreme rows only)

Node	Result Case	DX ft	DY ft	FX lb	FY lb	MZ lb-ft
N001	2. D+L	0.0000	0.0000	**-3750.8144**	**10439.5449**	1401.2585
N001	W+X	0.0000	0.0000	-510.1464	**-1170.1092**	**2546.4337**
N006	2. D+L	0.0000	0.0000	**3750.8144**	**10439.5449**	**-1401.2585**
N007	2. D+L	**-0.0168**	-0.0008	0.0000	0.0000	0.0000
N008	6. D+0.75(L+0.6W+Lr) »+X	**0.0216**	-0.0007	0.0000	0.0000	0.0000
N010	2. D+L	-0.0001	**-0.0196**	0.0000	0.0000	0.0000
N010	W+X	0.0192	**0.0015**	0.0000	0.0000	0.0000

Model Check Information

No errors were found in your model.

Members

Name	Node 1	Node 2	Shape	Material	End Connection	Crossing Connection?	Beta, B deg	Length ft	Weight lb	Offset y ft	Offset z ft	Framing	Action
BmX001	N003	N009	LVL 3.5x14	Microllam LVL 1.9E (Beam)	RZ1	Yes	0.0000	3.0000	31.7520	0.0000	0.0000	Beam	Normal
BmX002	N002	N005	LVL 3.5x14	Microllam LVL 1.9E (Beam)	RZ1,RZ2	Yes	0.0000	16.0000	169.3440	0.0000	0.0000	Beam	Normal
BmX003	N009	N010	LVL 3.5x14	Microllam LVL 1.9E (Beam)	Rigid Connect	Yes	0.0000	10.0000	105.8400	0.0000	0.0000	Beam	Normal
BmX004	N010	N004	LVL 3.5x14	Microllam LVL 1.9E (Beam)	RZ2	Yes	0.0000	3.0000	31.7520	0.0000	0.0000	Beam	Normal
COL001	N001	N002	PSL-C 7x7	Parallam PSL 1.8E (Column)	Rigid Connect	Yes	0.0000	1.7500	18.5220	0.0000	0.0000	Column	Normal
COL002	N003	N007	PSL-C 7x7	Microllam LVL 1.9E (Beam)	Rigid Connect	Yes	0.0000	2.8333	29.9880	0.0000	0.0000	Column	Normal
COL003	N007	N002	PSL-C 7x7	Microllam LVL 1.9E (Beam)	Rigid Connect	Yes	0.0000	7.2500	76.7340	0.0000	0.0000	Column	Normal
COL004	N005	N006	PSL-C 7x7	Parallam PSL 1.8E (Column)	Rigid Connect	Yes	0.0000	1.7500	18.5220	0.0000	0.0000	Column	Normal
COL005	N004	N008	PSL-C 7x7	Microllam LVL 1.9E (Beam)	Rigid Connect	Yes	0.0000	2.8333	29.9880	0.0000	0.0000	Column	Normal
COL006	N008	N005	PSL-C 7x7	Microllam LVL 1.9E (Beam)	Rigid Connect	Yes	0.0000	7.2500	76.7340	0.0000	0.0000	Column	Normal
V001	N007	N009	FS 2x14	Douglas Fir-Larch-No.2	RZ1,RZ2	Yes	0.0000	4.1265	24.9569	0.0000	0.0000	Bracing	Normal
V002	N010	N008	FS 2x14	Douglas Fir-Larch-No.2	RZ1,RZ2	Yes	0.0000	4.1265	24.9569	0.0000	0.0000	Bracing	Normal

Member Loads, Concentrated

Member	Service Case	Direction	Magnitude	Offset ft
BmX003	W+X	Force Y	-1125.0000 lb	2.9167

Member Loads, Concentrated (continued)

Member	Service Case	Direction	Magnitude	Offset ft
BmX003	W+X	Force Y	1125.0000 lb	7.9167

Member Loads, Uniform

Member	Service Case	Direction	Magnitude	Full Length?	Start Offset ft	End Offset ft	Projected?	Predefined Load
BmX001	D	Force Y	-232.0000 lb/ft	Yes	0.0000	3.0000	No	N.A.
BmX001	L	Force Y	-676.0000 lb/ft	Yes	0.0000	3.0000	No	N.A.
BmX002	D	Force Y	-82.0000 lb/ft	Yes	0.0000	16.0000	No	N.A.
BmX002	L	Force Y	-275.0000 lb/ft	Yes	0.0000	16.0000	No	N.A.
BmX003	D	Force Y	-232.0000 lb/ft	Yes	0.0000	10.0000	No	N.A.
BmX003	L	Force Y	-676.0000 lb/ft	Yes	0.0000	10.0000	No	N.A.
BmX004	D	Force Y	-232.0000 lb/ft	Yes	0.0000	3.0000	No	N.A.
BmX004	L	Force Y	-676.0000 lb/ft	Yes	0.0000	3.0000	No	N.A.

Nodal Loads

Node	Service Case	Type & Direction	Magnitude	Predefined Load
N003	W+X	Force X	965.0000 lb	N.A.
N003	W+X	Force Y	1125.0000 lb	N.A.
N004	W+X	Force Y	-1125.0000 lb	N.A.

Member Forces

(extreme force at ...)

Member	Fx Min lb	Fx Max lb	Vy lb	Vz lb	Torsion lb-ft	My Min lb-ft	My Max lb-ft	Mz Min lb-ft	Mz Max lb-ft
BmX002	42.0570 (3)	**5605.3556 (5)**	2940.6720 (5)	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (8)	11762.6880 (5)
BmX003	-1854.5411 (5)	-295.1144 (10)	**-4592.9200 (5)**	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (10)	-3145.1966 (3)	**15894.8344 (5)**
BmX004	**465.1908 (10)**	2923.3261 (5)	-2848.7208 (5)	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (10)	-3145.1966 (3)	4412.5344 (5)
COL001	**-10439.5449 (5)**	1170.1092 (3)	**3750.8144 (5)**	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (10)	-2546.4337 (3)	5162.6667 (5)
COL004	**-10439.5449 (5)**	**-1170.1092 (3)**	-3750.8144 (5)	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (10)	**-1401.2585 (5)**	5162.6667 (5)
COL005	-2878.7091 (5)	-76.6012 (3)	-2923.3258 (5)	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (10)	**-8282.7564 (5)**	0.0000 (3)
V002	-6580.4802 (5)	-1040.6520 (10)	-9.0720 (5)	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (10)	0.0000 (5)	**9.3588 (7)**

Node Reactions

(extreme rows only)

Node	Result Case	FX lb	FY lb	MZ lb-ft
N001	2. D+L	**-3750.8144**	**10439.5449**	1401.2585
N001	W+X	-510.1464	**-1170.1092**	**2546.4337**
N006	2. D+L	**3750.8144**	**10439.5449**	**-1401.2585**

MPBZ

Moment Post Base

The patent-pending MPBZ is specifically designed to provide moment resistance for columns or posts. An innovative overlapping sleeve design encapsulates the post, helping to resist rotation around its base. It is available for 4x4, 6x6 and 8x8 posts. The MPBZ is ideal for outdoor structures, such as carports, fences and decks. Built-in stand-off tabs provide the required 1" stand-off to resist decay of the post while eliminating multiple parts and assembly. Additionally, the MPBZ is available in ZMAX® as the standard finish to meet exposure conditions in many environments.

Features:

- Internal top-of-concrete tabs
- 1" standoff tabs
- Additional holes provided to attach trim material
- Weep hole provided for water drainage

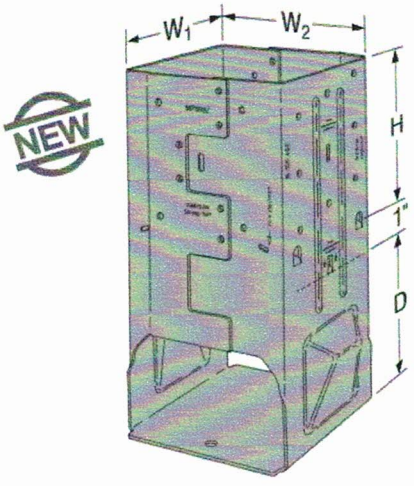
Material: 12 gauge

Finish: ZMAX coating

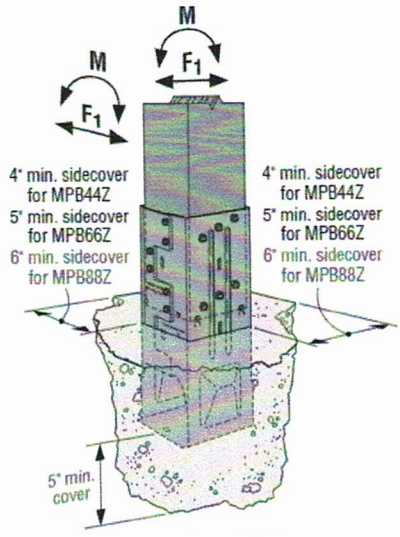
Installation:

- Use all specified fasteners; see General Notes.
- Install MPBZ before concrete is placed using embedment level indicators and form board attachment holes.
- Place post on tabs 1" above top of concrete.
- Install Strong-Drive SDS Heavy-Duty Connector screws, which are supplied with the MPBZ. (Lag screws will not achieve the same load.)
- Concrete level inside the part must not exceed ¼" above embedment line to allow for water drainage.
- Annual inspection of connectors used in outdoor application is advised. If significant corrosion is apparent or suspected, then the wood, fasteners and connectors should be evaluated by a qualified engineer or inspector.

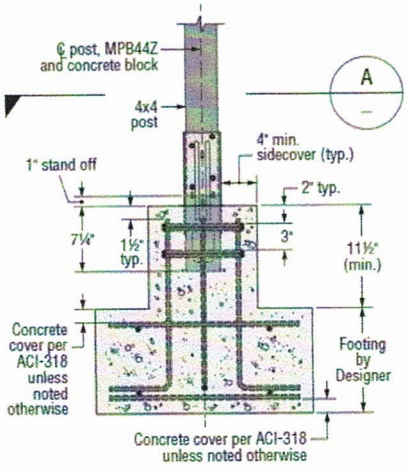
Codes: See p. 12 for Code Reference Key Chart

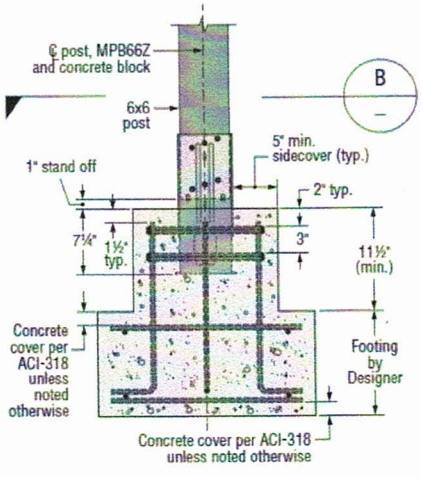


MPB88Z
(MPB44Z, MPB66Z similar)
U.S Patent Pending

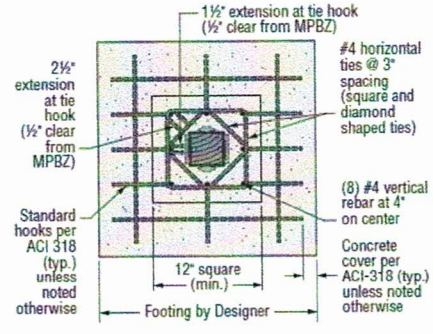


Typical MPB66Z
Non-Reinforced Installation
(others similar)

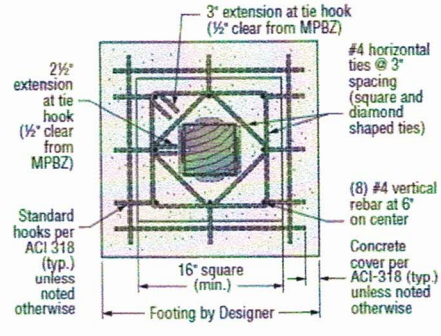




SECTION A



SECTION B



MPB44Z
Reinforced Concrete Footing
Footing (size and reinforcement) by Designer. Standard hook geometry in accordance with ACI 318 unless noted otherwise.

MPB66Z
Reinforced Concrete Footing
Footing (size and reinforcement) by Designer. Standard hook geometry in accordance with ACI 318 unless noted otherwise.

These reinforced MPBZ details are available on **strongtie.com/mpbz**.

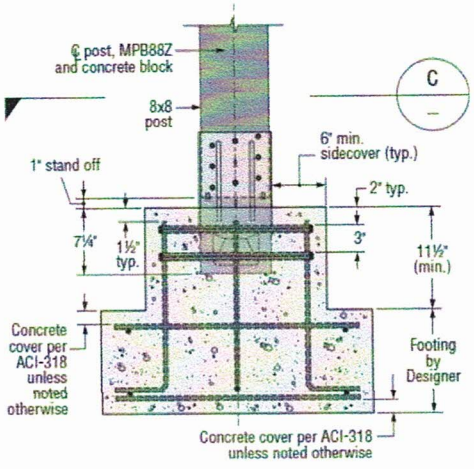
MPBZ

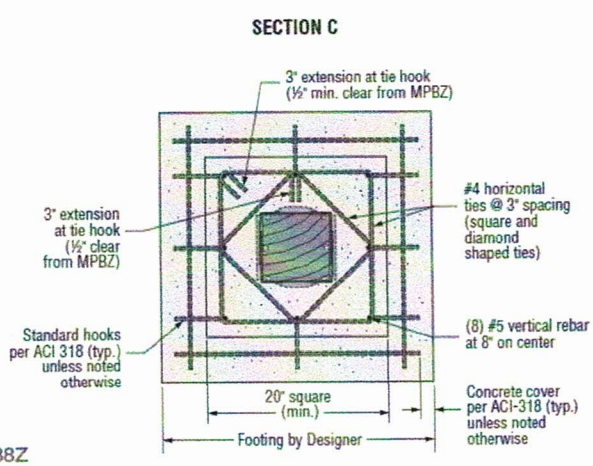
Moment Post Base (cont.)

These products are available with additional corrosion protection. For more information, see p. 15.

Model No.	Nominal Column Size	Dimensions (in.)			Strong-Drive® SDS Screws	Concrete Allowable Loads						Wood Assembly Allowable Loads (DF/SP)			Rotational Stiffness (in.-lb./rad.)	Code Ref.
						Uplift		Lateral F_1		Moment M (ft.-lb.)		Download (100)	Download (160)	Moment M (ft.-lb.) (160)		
		W_1 / W_2	D	H		Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked					
Non-Reinforced Concrete																
Wind and Seismic Design Category A&B																
MPB44Z	4x4	3⁹⁄₁₆	7¼	7¼	(16) ¼" x 2½"	4,900	3,820	1,750	1,225	1,350	945	6,240	6,410	1,540	1,245,000	IBC, FL, LA
MPB66Z	6x6	5⁹⁄₁₆	7¼	7¼	(24) ¼" x 2½"	5,815	5,815	3,435	2,405	2,680	1,875	9,360	10,855	3,730	2,405,000	
MPB88Z	8x8	7⁹⁄₁₆	7¼	7¼	(36) ¼" x 3"	9,945	6,960	7,200	5,560	4,160	2,910	15,120	17,585	4,525	5,500,000	—
Seismic Design Category C–F																
MPB44Z	4x4	3⁹⁄₁₆	7¼	7¼	(16) ¼" x 2½"	4,785	3,350	1,535	1,075	1,180	830	6,240	6,410	1,540	1,245,000	IBC, FL, LA
MPB66Z	6x6	5⁹⁄₁₆	7¼	7¼	(24) ¼" x 2½"	5,815	5,815	3,015	2,110	2,055	1,645	9,360	10,855	3,730	2,405,000	
MPB88Z	8x8	7⁹⁄₁₆	7¼	7¼	(36) ¼" x 3"	7,420	6,100	6,965	4,875	3,470	2,550	15,120	17,585	4,525	5,500,000	—
Reinforced Concrete																
Wind and Seismic Design Category A&B																
MPB44Z	4x4	3⁹⁄₁₆	7¼	7¼	(16) ¼" x 2½"	4,900	3,820	1,750	1,225	1,540	1,540	6,240	6,410	1,540	1,245,000	
MPB66Z	6x6	5⁹⁄₁₆	7¼	7¼	(24) ¼" x 2½"	5,815	5,815	3,435	2,405	3,730	3,190	9,360	10,855	3,730	2,405,000	—
MPB88Z	8x8	7⁹⁄₁₆	7¼	7¼	(36) ¼" x 3"	9,945	6,960	7,200	5,560	4,525	4,525	15,120	17,585	4,525	5,500,000	
Seismic Design Category C–F																
MPB44Z	4x4	3⁹⁄₁₆	7¼	7¼	(16) ¼" x 2½"	4,785	3,350	1,535	1,075	1,540	1,540	6,240	6,410	1,540	1,245,000	
MPB66Z	6x6	5⁹⁄₁₆	7¼	7¼	(24) ¼" x 2½"	5,815	5,815	3,015	2,110	3,350	2,795	9,360	10,855	3,730	2,405,000	—
MPB88Z	8x8	7⁹⁄₁₆	7¼	7¼	(36) ¼" x 3"	7,420	6,100	6,965	4,875	4,525	4,525	15,120	17,585	4,525	5,500,000	

1. Loads may not be increased for duration of load.
2. Higher download can be achieved by solidly packing grout in the 1" standoff area before installation of the post. Allowable download shall be based on either the wood post design or the concrete design calculated per code.
3. Concrete shall have a minimum compressive strength of f'_c = 2,500 psi.
4. Tabulated rotational stiffness accounts for the rotation of the base assembly attributable to deflection of the connector, fastener slip, and post deformation. Designer must account for additional deflection attributable to bending of the post.
5. To obtain LRFD values, multiply ASD seismic load values by 1.4 and wind load values by 1.67 (1.6 for 2012 IBC).
6. In accordance with IBC, Section 1613.1, detached one- and two-family dwellings in Seismic Design Category (SDC) C may use "Wind and SDC A&B" allowable loads.
7. Foundation dimensions are for anchorage only. Foundation design (size and reinforcement) by Designer.
8. Allowable load shall be the lesser of the wood assembly or concrete allowable load. To achieve full wood assembly allowable moment loads, additional concrete design and reinforcement by Designer is required.
9. For loading simultaneously in more than one direction, the allowable load must be evaluated using the following equation: (Design Uplift / Allowable Uplift, or Design Download / Allowable Download) + (Design Moment / Allowable Moment) + (Design Lateral / Allowable Lateral) ≤ 1.0.
10. To account for shrinkage up to 3%, multiply rotational stiffness by 0.75. Reduction may be linearly interpolated for shrinkage less than 3%.
11. Tabulated load values may be used for rough sawn lumber or larger size posts without reduction factors. Rough-size and larger-size posts shall be planed uniformly on all four sides such that center line of post is concentric with the center line of MPBZ.





MPB88Z
Reinforced Concrete Footing

Footing (size and reinforcement) by Designer. Standard hook geometry in accordance with ACI 318 unless noted otherwise.

DESIGN PROPERTIES

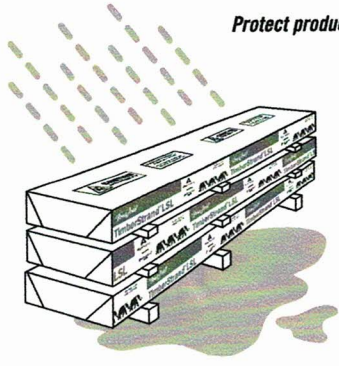
Allowable Design Properties[1] (100% Load Duration)

Grade	Width	Design Property	Depth											
			4⅜"	5½"	5½" Plank Orientation	7¼"	9¼"	9½"	11¼"	11⅞"	14"	16"	18"	20"
TimberStrand® LSL														
1.3E	3½"	Moment (ft-lbs)	1,735	2,685	1,780	4,550								
		Shear (lbs)	4,340	5,455	1,925	7,190								
		Moment of Inertia (in.⁴)	24	49	20	111								
		Weight (plf)	4.5	5.6	5.6	7.4								
1.55E	1¾"	Moment (ft-lbs)						5,210		7,975	10,920	14,090		
		Shear (lbs)						3,435		4,295	5,065	5,785		
		Moment of Inertia (in.⁴)						125		244	400	597		
		Weight (plf)						5.2		6.5	7.7	8.8		
	3½"	Moment (ft-lbs)						10,420		15,955	21,840	28,180		
		Shear (lbs)						6,870		8,590	10,125	11,575		
		Moment of Inertia (in.⁴)						250		488	800	1,195		
		Weight (plf)						10.4		13	15.3	17.5		
Microllam® LVL														
2.0E	1¾"	Moment (ft-lbs)		2,125		3,555	5,600	5,885	8,070	8,925	12,130	15,555	19,375	23,580
		Shear (lbs)		1,830		2,410	3,075	3,160	3,740	3,950	4,655	5,320	5,985	6,650
		Moment of Inertia (in.⁴)		24		56	115	125	208	244	400	597	851	1,167
		Weight (plf)		2.8		3.7	4.7	4.8	5.7	6.1	7.1	8.2	9.2	10.2
Parallam® PSL														
2.0E	3½"	Moment (ft-lbs)					12,415	13,055	17,970	19,900	27,160	34,955	43,665	
		Shear (lbs)					6,260	6,430	7,615	8,035	9,475	10,825	12,180	
		Moment of Inertia (in.⁴)					231	250	415	488	800	1,195	1,701	
		Weight (plf)					10.1	10.4	12.3	13.0	15.3	17.5	19.7	
	5¼"	Moment (ft-lbs)					18,625	19,585	26,955	29,855	40,740	52,430	65,495	
		Shear (lbs)					9,390	9,645	11,420	12,055	14,210	16,240	18,270	
		Moment of Inertia (in.⁴)					346	375	623	733	1,201	1,792	2,552	
		Weight (plf)					15.2	15.6	18.5	19.5	23.0	26.3	29.5	
	7"	Moment (ft-lbs)					24,830	26,115	35,940	39,805	54,325	69,905	87,325	
		Shear (lbs)					12,520	12,855	15,225	16,070	18,945	21,655	24,360	
		Moment of Inertia (in.⁴)					462	500	831	977	1,601	2,389	3,402	
		Weight (plf)					20.2	20.8	24.6	26.0	30.6	35.0	39.4	

(1) For product in beam orientation, unless otherwise noted.

Some sizes may not be available in your region.

PRODUCT STORAGE



Protect product from sun and water

CAUTION:
Wrap is slippery when wet or icy

Align stickers (2x3 or larger) directly over support blocks

Use support blocks (6x6 or larger) at 10' on-center to keep bundles out of mud and water

Knee Brace

TYPE:	LUMBER		Fb=	1000	PSI		Fv=	180	PSI		SIZE FACTORS
GRADE:	DFL (#1)		Fc=	1500	PSI		E=	1700000	PSI		bending 1
LENGTH :	4.25	FT	WEAK AXIS BRACED?			YES		c =	0.8		shear 1
	WET SERVICE USE (Y or N)		NO	Fb		Fv	Fc^		Fc	E	tension 1
			C_m :	1		1	1		1	1	compr parall 1
	C_D :	1.60	C_L :	1.00		C_r :	1.00	C_T :	1.00		compr perp 1
	C_r :	1.00	C_F :	1.00		C_i :	1.00	C_p :	0.98		
	C_t :	1.00	C_{fu} :	1.00		SPACING =		IN. O.C.			SHEAR(KIP)
LOADS:	AXIAL:	6,580	LBS	Defl. (in) =			SHEAR:		LBS		
	DIST LOAD:		LBS/FT	Defl. = L/			MOMENT:		FT-LBS		MOMENT(FT-KIP)
	Ly/d = 34			Lx/d = 4.53333333			Le/d = 4.5333333				
TRIAL SIZE:	(1)	2	X	12		A=	16.875	Sx=	31.64063		
	1.5		X	11.25		fc/Fc' =	0.17	V(#) =	0		
		Fb'=	1600.00	PSI			Fv'=	288.00	PSI		
		Fc'=	2350.80	PSI			E'=	1,700,000	PSI		
		fb=	0.00	PSI			fv=	0	PSI		
FORMULAS:		fc=	389.93	PSI		FC*:	2400.00	FCE:	24816.18		
	$(fc/Fc')^2 + fb/\{Fb'[1-(fc/FcE)]\} <= 1.0$					Fc' = Cp*Fc*		FcE = .3*E/(l/d)^2			
	$Cp = [(1+(FcE/Fc^*))/2c]-SQRT([(1+FcE/Fc^*)/2c]^2-(FcE/Fc^*)/c)$							fv = 3*V/(2*b*d)			
SOLUTION:		fc/Fc' =	**0.17**	**≤ 1.0**	**O.K.**			**SHEAR**	**O.K.**		

USE: (1) 2 x 12 DFL (#1) WOOD MEMBER

DOUBLE SHEAR BOLTED CONNECTION DESIGN

GROUP ADJUSTMENT FACTOR (Cg)
Cg = [m(1-m^2n)/n[1+Rea*m^n)(1+m)-1+m^2n]]*[1+Rea/1-m]
Rea = Lesser of EsAs/EmAm or EmAm/EsAs
m = u-sqrt(u^2-1) u = 1+y*s/2[1/EmAm + 1/EsAs]
y = 180000*D^1.5 for wood/wood connection
y = 270000*D^1.5 for wood/metal connection

DATA ENTRY				CALCULATED VALUES	
BOLT DIA. - D (IN.)	7/8			EmAm =	139650000
WOOD TO WOOD	Y			EsAs =	27000000
WOOD TO METAL	N			y =	147327.76
SPACING - s (IN.)	3			u =	1.0097673
MODULUS (Em)	1.9E+06			m =	0.8696599
MODULUS (Es)	1.6E+06			Rea =	0.1933405
MAIN DIMS. (tmXd)	5.25	X	14		
SIDE DIMS. (tsXd)	1.5	X	11.25	Cg =	1
NO. OF FASTENERS/ROW	1				
WOOD SPECIFIC GRAVITY	0.55				

BOLT DESIGN VALUE (Z) DOUBLE SHEAR

Z = LESSER OF Eq. 8.3-1, 8.3-2, 8.3-3 & 8.3-4
8.3-1 Z = D*tm*Fem/(4*Ka)
8.3-2 Z=D*ts*Fes/(2*Ka)
8.3-3 Z = k3*D*ts*Fem/(1.6*(2+Re)*Ka)
8.3-4 Z = (D^2/1.6*Ka)*(SQRT((2*Fem*Fyb)/(3*(1+Re))))
Ka = 1+(a/360)
k3 = -1 + SQRT((2*(1+Re)/Re+((2*Fyb*(2+Re)*D^2)/(3*Fem*ts^2)))
Re = Fem/Fes
Fea = Fe||*Fe_/(Fe||*sin^2a+Fe_*cos^2a)

DATA ENTRY		CALCULATED VALUES			
DOWEL BRG. PAR. - Fe|| (PSI)	6160	Ka =	1.13		
DOWEL BRG. PERP. - Fe_ (PSI)	2741	Re =	0.58		
MAIN DOWEL BRG. - Fem (PSI)	3236	k3 =	2.74		
SIDE DOWEL BRG. - Fes (PSI)	5600	Fea =	3236.41		
ANGLE TO GRAIN - a (DEG.)	45	Z1 =	3303.83		
BOLT YIELD - Fyb (PSI)	47000	Z2 =	3266.67		
WET SERVICE (Y OR N)	n	Z3 =	2504.05	C^=	1
DESIGN LOAD - P (LBS) =	6580	Z4 =	4315.58	Cm =	1.00
		Z =	2504.05	Zallow = Z*Cg*Cm*Cd	
NO. OF FASTENERS REQ'D =	**2**	**Zallow =**	**4006.48**	ASSUME Cd = 1	

NDS Bolt Spacing Requirements

DIA. (in)	Edge (in)		End (in)		Bolt Spacing (in)		Row Spacing (in)	
	perp	par	perp	par	perp	par	perp	par
0.38	1.50	0.56	1.50	1.50	1.50	1.50	0.94	0.84
0.50	2.00	0.75	2.00	2.00	2.00	2.00	1.25	1.13
0.63	2.50	0.94	2.50	2.50	2.50	2.50	1.56	1.41
0.75	3.00	1.13	3.00	3.00	3.00	3.00	1.88	1.69
0.88	3.50	1.31	3.50	3.50	3.50	3.50	2.19	1.97
1.00	4.00	1.50	4.00	4.00	4.00	4.00	2.50	2.25
1.13	4.50	1.69	4.50	4.50	4.50	4.50	2.81	2.53
1.25	5.00	1.88	5.00	5.00	5.00	5.00	3.13	2.81

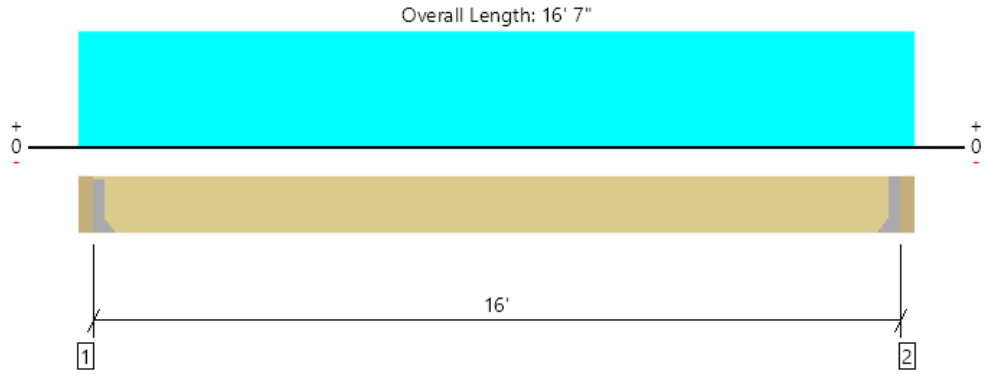
FORTE WEB

MEMBER REPORT

PASSED

Garage, B1 2ND STORY PLUS ROOF

3 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7436 @ 3 1/2"	7436 (1.89")	Passed (100%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	6351 @ 1' 5 1/2"	13965	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	29742 @ 8' 3 1/2"	36387	Passed (82%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.449 @ 8' 3 1/2"	0.533	Passed (L/428)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.617 @ 8' 3 1/2"	0.800	Passed (L/311)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 9" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' o/c based on loads applied, unless detailed otherwise.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 14" PSL beam	3.50"	Hanger[1]	1.89"	2095	5605	7700	See note [1]
2 - Hanger on 14" PSL beam	3.50"	Hanger[1]	1.89"	2095	5605	7700	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Face Mount Hanger	HGUS5.50/10	4.00"	N/A	46-10d	16-10d	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 16' 3 1/2"	N/A	21.5	--	
1 - Uniform (PLF)	0 to 16' 7" (Top)	N/A	232.0	676.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by VMM

ForteWEB Software Operator	Job Notes
Vince Matarrese VM Engineering LTD (262) 364-8744 Vince@VMproeng.com	Commercial Alteration and Addition

Weyerhaeuser

4/27/2020 11:27:08 AM UTC

ForteWEB v2.4, Engine: V8.0.1.5, Data: V7.3.2.0

File Name: 425 E Broadway

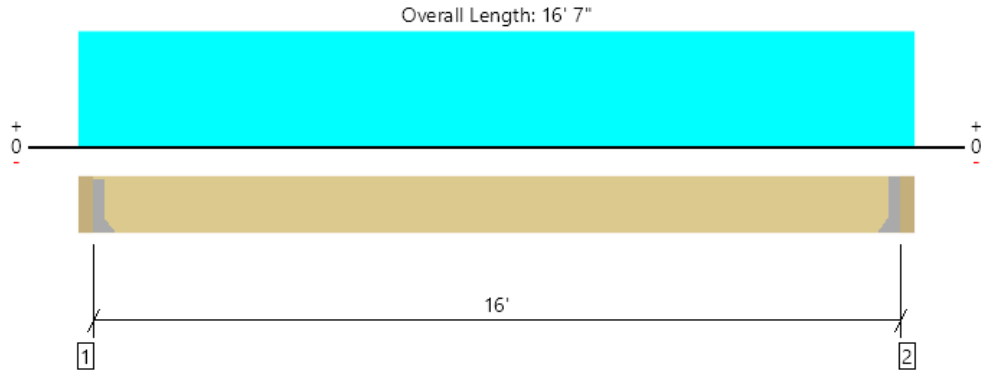
FORTE WEB

MEMBER REPORT

PASSED

Garage, B2

2 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5366 @ 3 1/2"	5366 (2.04")	Passed (100%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4584 @ 1' 5 1/2"	9310	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	21465 @ 8' 3 1/2"	24258	Passed (88%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.503 @ 8' 3 1/2"	0.533	Passed (L/382)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.668 @ 8' 3 1/2"	0.800	Passed (L/287)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 5" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' o/c based on loads applied, unless detailed otherwise.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 14" SPF beam	3.50"	Hanger[1]	2.04"	1371	4187	5558	See note [1]
2 - Hanger on 14" SPF beam	3.50"	Hanger[1]	2.04"	1371	4187	5558	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HGUS410	4.00"	N/A	46-10d	16-10d	
2 - Face Mount Hanger	HGUS410	4.00"	N/A	46-10d	16-10d	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 16' 3 1/2"	N/A	14.3	--	
1 - Uniform (PSF)	0 to 16' 7" (Front)	12' 7 1/2"	12.0	40.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by VMM

ForteWEB Software Operator	Job Notes
Vince Matarrese VM Engineering LTD (262) 364-8744 Vince@VMproeng.com	Commercial Alteration and Addition

Weyerhaeuser

4/10/2020 11:48:15 AM UTC

ForteWEB v2.4, Engine: V8.0.1.5, Data: V7.3.2.0

File Name: 425 E Broadway

FORTE WEB

MEMBER REPORT

PASSED

Garage, C1

1 piece(s) 7" x 7" 1.8E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	17	50	Passed (34%)	--	--
Compression (lbs)	17435	94140	Passed (19%)	1.00	1.0 D + 1.0 L
Base Bearing (lbs)	17435	1587600	Passed (1%)	--	1.0 D + 1.0 L
Bending/Compression	0.13	1	Passed (13%)	1.00	1.0 D + 1.0 L

- Input axial load eccentricity for this design is 10% of applicable member side dimension.
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Floor Live (1.00)	Comments
1 - Point (lb)	6135	11300	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by VMM

ForteWEB Software Operator	Job Notes
Vince Matarrese VM Engineering LTD (262) 364-8744 Vince@VMproeng.com	Commercial Alteration and Addition

Weyerhaeuser

4/10/2020 12:00:34 PM UTC
ForteWEB v2.4, Engine: V8.0.1.5, Data: V7.3.2.0
File Name: 425 E Broadway

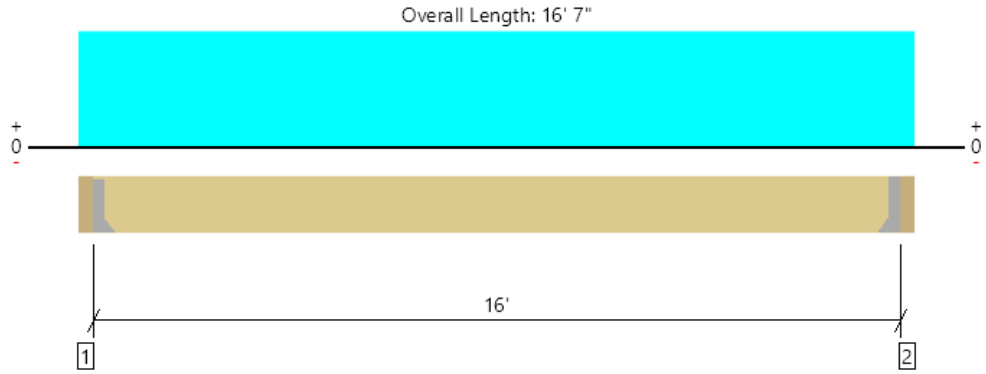
FORTE WEB

MEMBER REPORT

PASSED

Garage, B1

2 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2921 @ 3 1/2"	3938 (1.50")	Passed (74%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2578 @ 1' 2 3/4"	7481	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	11683 @ 8' 3 1/2"	16137	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.508 @ 8' 3 1/2"	0.533	Passed (L/378)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.682 @ 8' 3 1/2"	0.800	Passed (L/281)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 10' 10" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' o/c based on loads applied, unless detailed otherwise.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 11 1/4" PSL beam	3.50"	Hanger[1]	1.50"	768	2255	3023	See note [1]
2 - Hanger on 11 1/4" PSL beam	3.50"	Hanger[1]	1.50"	768	2255	3023	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HUC412	2.50"	N/A	22-16d	10-10d	
2 - Face Mount Hanger	HHUS48	3.00"	N/A	22-10d	8-10d	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 16' 3 1/2"	N/A	11.5	--	
1 - Uniform (PSF)	0 to 16' 7" (Front)	6' 9 5/8"	12.0	40.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by VMM

ForteWEB Software Operator	Job Notes
Vince Matarrese VM Engineering LTD (262) 364-8744 Vince@VMproeng.com	Commercial Alteration and Addition

Weyerhaeuser

4/27/2020 10:57:38 AM UTC

ForteWEB v2.4, Engine: V8.0.1.5, Data: V7.3.2.0

File Name: 425 E Broadway

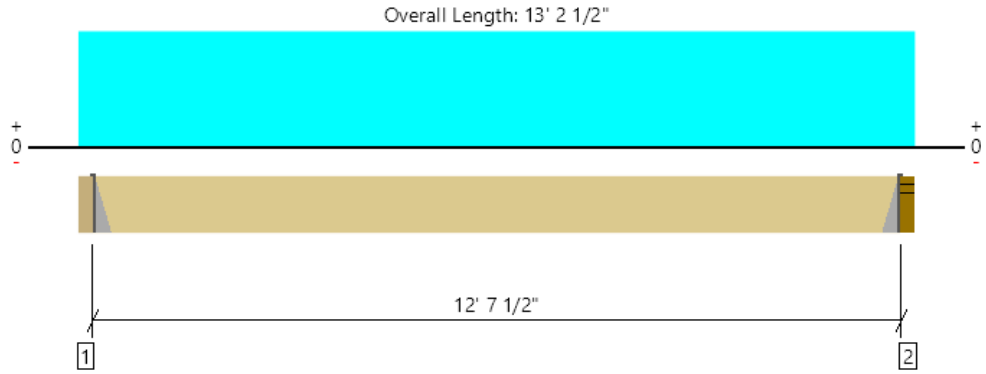
FORTE WEB

MEMBER REPORT

PASSED

Garage, new joists

1 piece(s) 2 x 10 Spruce-Pine-Fir No. 1 / No. 2 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	438 @ 3 1/2"	956 (1.50")	Passed (46%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	384 @ 1' 3/4"	1249	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1381 @ 6' 7 1/4"	1973	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.220 @ 6' 7 1/4"	0.421	Passed (L/688)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.286 @ 6' 7 1/4"	0.631	Passed (L/529)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' 5" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 12' 8" o/c based on loads applied, unless detailed otherwise.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 9 1/4" SPF beam	3.50"	Hanger[1]	1.50"	106	352	458	See note [1]
2 - Hanger on SPF studWall	3.50"	Hanger[1]	1.50"	106	352	458	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	THA213	1.75"	4-10d	2-10d	4-10dx1.5	
2 - Top Mount Hanger	BA1.62X H=9.125	3.00"	6-10d	8-10d	2-10dx1.5	

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 2 1/2"	16"	12.0	40.0	Floor loading

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by VMM

ForteWEB Software Operator	Job Notes
Vince Matarrese VM Engineering LTD (262) 364-8744 Vince@VMproeng.com	Commercial Alteration and Addition

Weyerhaeuser

4/10/2020 11:41:19 AM UTC

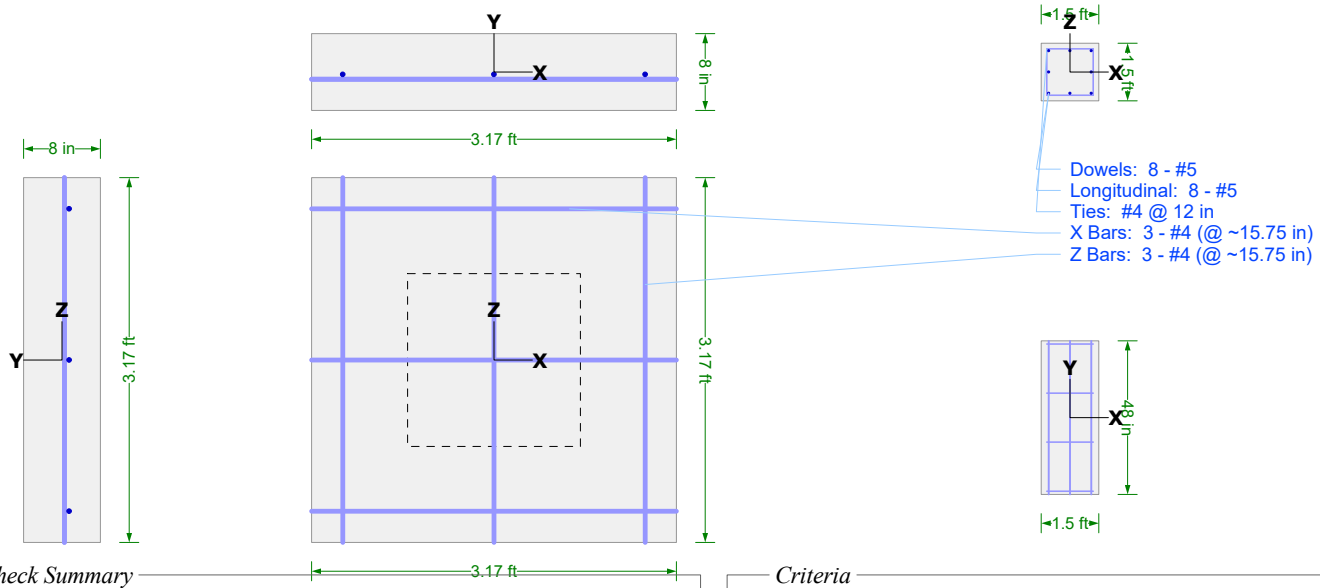
ForteWEB v2.4, Engine: V8.0.1.5, Data: V7.3.2.0

File Name: 425 E Broadway

VINCE MATARRESE
VM ENGINEERING

425 E Broadway - Garage Footing

Design Detail



Check Summary

Ratio	Check	Provided	Required	Combination
----- Footing -----				
✓ 0.283	X Flexure (-Z)	131.7 in·k	37.29 in·k	1.2D + 1.6L
✓ 0.283	X Flexure (+Z)	131.7 in·k	37.29 in·k	1.2D + 1.6L
✓ 0.252	Z Flexure (-X)	147.9 in·k	37.29 in·k	1.2D + 1.6L
✓ 0.252	Z Flexure (+X)	147.9 in·k	37.29 in·k	1.2D + 1.6L
✓ 0.323	Shear (-Z)	13.27 k	4.29 k	1.2D + 1.6L
✓ 0.323	Shear (+Z)	13.27 k	4.29 k	1.2D + 1.6L
✓ 0.264	Shear (-X)	14.83 k	3.92 k	1.2D + 1.6L
✓ 0.264	Shear (+X)	14.83 k	3.92 k	1.2D + 1.6L
✓ 0.912	Min Steel Z	0.6 in²	0.55 in²	1.4D
✓ 0.912	Min Steel X	0.6 in²	0.55 in²	1.4D
✓ 0.153	Min Strain Z	0.0262	0.0040	1.4D
✓ 0.135	Min Strain X	0.0296	0.0040	1.4D
✓ 0.259	Punching Shear	164.3 psi	42.48 psi	1.2D + 1.6L
----- Pedestal -----				
✓ 0.054	Axial	503.7 k	27.14 k	1.2D + 1.6L
✓ 0.000	Biaxial Bending	0.000	1.000	1.4D
✓ 0.000	Shear X	47.11 k	0 k	1.4D
✓ 0.000	Shear Z	47.11 k	0 k	1.4D
----- Interface -----				
✓ 0.023	Bearing (footing)	1171 k	27.14 k	1.2D + 1.6L
✓ 0.043	Bearing (pedestal)	633.8 k	27.14 k	1.2D + 1.6L
✓ 0.000	Tension	133.9 k	0 k	1.4D
✓ 0.000	Dowel Dev (ftg)	5 in	0 in	1.4D
✓ 0.000	Dowel Dev (ped)	46.5 in	0 in	1.4D
✓ 0.653	Min Steel	2.48 in²	1.62 in²	1.4D
----- Stability -----				
✓ 0.990	Bearing Pressure	2000 psf	1980 psf	1.0D + 1.0L
✓ 0.000	Overturning-X	Infinite	1.500	1.0D + 1.0L
✓ 0.000	Overturning-Z	Infinite	1.500	1.0D + 1.0L
✓ 0.000	Sliding-X	Infinite	1.500	1.0D + 1.0L
✓ 0.000	Sliding-Z	Infinite	1.500	1.0D + 1.0L
✓ 0.000	Uplift	Infinite	1.500	1.0D + 1.0L

Criteria

Use basic criteria from common project settings	Yes
Building Code	IBC 2018
Strength Load Combinations	IBC 2018 (Strength)
Stability Load Combinations	ASCE 7-16 (ASD)
Apply Sds Factor to Seismic Combinations for Ev	No
Factor of Safety: Overturning	1.50
Factor of Safety: Sliding	1.50
Factor of Safety: Uplift	1.50
Perimeter Skin Friction	0 psf
Additional Uplift Resistance	0 k
Allowable Bearing Pressure	2000 psf
Separate Allowable Pressure for Dead Only	No
Separate Allowable Pressure for Dead+Live Only	No
Separate Allowable Pressure for Wind/Seismic	No
Gross / Net (Allowable Bearing)	Gross
Friction Coefficient	0.40
Cohesion (@ soil interface)	0 psf
Passive Soil Resistance (Fixed)	0 lb
Calculate Depth-Dependent Passive Pressure	No
Additional Sliding Resistance	0 k
Concrete Weight	150 lb/ft³
Parme beta (for biaxial)	0.65
Include footing weight in strength bearing pressure	Yes
Include overburden in strength bearing pressure	Yes

Loads Summary (Service Loads)

Load Set	Name	Source	P	Mx	Mz	Vx	Vz	Overburden
Edge	Edge	Dead	6.2 k	0 in·k	0 in·k	0 k	0 k	0 psf
Edge	Edge	Live	11.3 k	0 in·k	0 in·k	0 k	0 k	0 psf

Strength Check Results Summary

Load Combination	Factored Axial (k)	Factored Moment-X (in·k)	Factored Moment-Z (in·k)	Factored Shear-X (k)	Factored Shear-Z (k)	Factored Overburden (psf)	Factored Footing Weight (k)	Factored Pedestal Weight (k)	Mu +X Cantilever (in·k)
Set: Edge : 1.4D	8.68	0	0	0	0	0	1.4	1.89	15.76
Set: Edge : 1.2D + 1.6L	25.52	0	0	0	0	0	1.2	1.62	37.29
Set: Edge : 1.2D + 0.5L	13.09	0	0	0	0	0	1.2	1.62	20.94
Set: Edge : 1.2D	7.44	0	0	0	0	0	1.2	1.62	13.5
Set: Edge : 0.9D	5.58	0	0	0	0	0	0.9	1.22	10.13

Strength Check Results Summary (continued)

Load Combination	Mu -X Cantilever (in·k)	Mu +Z Cantilever (in·k)	Mu -Z Cantilever (in·k)	Vu +X Cantilever (k)	Vu -X Cantilever (k)	Vu +Z Cantilever (k)	Vu -Z Cantilever (k)	Vu Punching (k)	vu Punching (psi)
Set: Edge : 1.4D	15.76	15.76	15.76	1.65	1.65	1.81	1.81	6.37	15.73
Set: Edge : 1.2D + 1.6L	37.29	37.29	37.29	3.92	3.92	4.29	4.29	17.2	42.48
Set: Edge : 1.2D + 0.5L	20.94	20.94	20.94	2.2	2.2	2.41	2.41	9.13	22.55
Set: Edge : 1.2D	13.5	13.5	13.5	1.42	1.42	1.55	1.55	5.46	13.49
Set: Edge : 0.9D	10.13	10.13	10.13	1.06	1.06	1.16	1.16	4.1	10.11

Load Combination	Pu Pedestal (k)	Mu-X Pedestal (in·k)	Mu-Z Pedestal (in·k)	Vu-X Pedestal (k)	Vu-Z Pedestal (k)	Reqd dowel dev (footing) (in)	Reqd dowel dev (pedestal) (in)
Set: Edge : 1.4D	8.68	0	0	0	0	13.69	13.69
Set: Edge : 1.2D + 1.6L	25.52	0	0	0	0	13.69	13.69
Set: Edge : 1.2D + 0.5L	13.09	0	0	0	0	13.69	13.69
Set: Edge : 1.2D	7.44	0	0	0	0	13.69	13.69
Set: Edge : 0.9D	5.58	0	0	0	0	13.69	13.69

Stability Check Results Summary

Load Combination	Factored Axial (k)	Factored Moment-X (in·k)	Factored Moment-Z (in·k)	Factored Shear-X (k)	Factored Shear-Z (k)	Factored Overburden (psf)	Factored Footing Weight (k)	Factored Pedestal Weight (k)	Max Applied Bearing (psf)
Set: Edge : 1.0D + 1.0L	17.5	0	0	0	0	0	1	1.35	1980
Set: Edge : 1.0D	6.2	0	0	0	0	0	1	1.35	852.9
Set: Edge : 1.0D + 0.75L	14.68	0	0	0	0	0	1	1.35	1698
Set: Edge : 0.6D	3.72	0	0	0	0	0	0.6	0.81	511.7

Load Combination	Allowable Bearing (psf)	Actual F.S. Overturning-X	Actual F.S. Overturning-Z	Required F.S. Overturning	Actual F.S. Sliding-X	Actual F.S. Sliding-Z	Required F.S. Sliding	Actual F.S. Uplift	Required F.S. Uplift
Set: Edge : 1.0D + 1.0L	2000	1.#IO	1.#IO	1.500	1.#IO	1.#IO	1.500	1.#IO	1.500
Set: Edge : 1.0D	2000	1.#IO	1.#IO	1.500	1.#IO	1.#IO	1.500	1.#IO	1.500
Set: Edge : 1.0D + 0.75L	2000	1.#IO	1.#IO	1.500	1.#IO	1.#IO	1.500	1.#IO	1.500
Set: Edge : 0.6D	2000	1.#IO	1.#IO	1.500	1.#IO	1.#IO	1.500	1.#IO	1.500

Capacity Calcs

Footing X-Direction Capacity

General Section Calcs (ACI 318-14 13.3.3.1», 7.5.2.1», 22.3», 22.2)

$$a = \frac{A_s f_y}{0.85 F'_c b_w} = \frac{(0.6\ in^2)(60000\ psi)}{0.85\ (3000\ psi)\ (38\ in)} = 0.37\ in$$

$\beta_1 = 0.850$ $(F'_c \le 4000\ psi)$

$x = a / \beta_1 = (0.37\ in) / (0.850) = 0.44\ in$

Capacity Calcs (ACI 318-14 13.3.3.1», 7.5.2.1», 7.5.3.1», 22.3», 22.2, 7.6.1.1, 22.5.5.1, 19.2.4, 21.2)

$\lambda = 1.0$ (normal weight concrete)

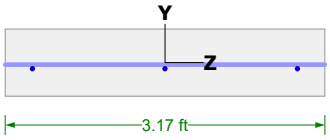
$\phi M_n = \phi\ A_s\ f_y\ (d - a / 2) = (0.90)\ (0.6\ in^2)\ (60000\ psi)\ [(4.75\ in) - (0.37\ in) / 2] = 147.9\ in{\cdot}k$

$\phi V_c = \phi\ 2\ \lambda\ \sqrt{F'_c}\ b_w\ d = (0.750)\ 2\ (1.0)\ \sqrt{3000\ psi}\ (38\ in)\ (4.75\ in) = 14.83\ k$

$A_{smin} = \frac{0.0018\ (60000)}{f_y} A_g = \frac{0.0018\ (60000)}{(60000\ psi)} (2.11\ ft^2) = 0.55\ in^2$

$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(4.75\ in)}{(0.37\ in) / (0.850)} - 1 \right] = 0.0296$

Development (ACI 318-14 13.2.8.1», 25.4.2)



$\psi_t = 1.0$ (12 inches or less cast below - 3.00 inches)

$\psi_e = 1.0$ (bar not epoxy coated)

$\psi_s = 0.80$ (bars are #6 or smaller)

$\lambda = 1.0$ (normal weight concrete)

$s / 2 = (10.5\ in) / 2 = 5.25\ in$

$cover + d_b / 2 = (3\ in) + (0.5\ in) / 2 = 3.25\ in$

$c_b = 3.25\ in$ (lesser of half spacing, ctr to surface)

$K_{tr} = 0.0$ (no transverse reinforcement)

$$\frac{c_b + K_{tr}}{d_b} = \frac{(3.25\ in) + (0.0)}{(0.5\ in)} = 6.50$$

$$l_d = \left(\frac{3.}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t\ \psi_e\ \psi_s}{2.5} \right) d_b = \left[\frac{3.}{40} \frac{(60000\ psi)}{(1.0) \sqrt{3000\ psi}} \frac{(1.0)\ (1.0)\ (0.80)}{2.5} \right] (0.5\ in) = 13.15\ in$$

Capacity Calcs (continued)

Footing Z-Direction Capacity

General Section Calcs (ACI 318-14 13.3.3.1», 7.5.2.1», 22.3», 22.2)

$a = \frac{A_s f_y}{0.85 F'_c b_w} = \frac{(0.6\ in^2)(60000\ psi)}{0.85\ (3000\ psi)\ (38\ in)} = 0.37\ in$

$\beta_1 = 0.850 \quad (F'_c \le 4000\ psi)$

$x = a / \beta_1 = (0.37\ in) / (0.850) = 0.44\ in$

Capacity Calcs (ACI 318-14 13.3.3.1», 7.5.2.1», 7.5.3.1», 22.3», 22.2, 7.6.1.1, 22.5.5.1, 19.2.4, 21.2)

$\lambda = 1.0 \quad$ (normal weight concrete)

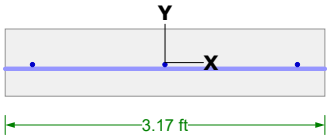
$\phi M_n = \phi\ A_s\ f_y\ (d - a / 2) = (0.90)\ (0.6\ in^2)\ (60000\ psi)\ [(4.25\ in) - (0.37\ in) / 2] = 131.7\ in{\cdot}k$

$\phi V_c = \phi\ 2\ \lambda\ \sqrt{F'_c}\ b_w\ d = (0.750)\ 2\ (1.0)\ \sqrt{3000\ psi}\ (38\ in)\ (4.25\ in) = 13.27\ k$

$A_{smin} = \frac{0.0018\ (60000)}{f_y} A_g = \frac{0.0018\ (60000)}{(60000\ psi)} (2.11\ ft^2) = 0.55\ in^2$

$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(4.25\ in)}{(0.37\ in) / (0.850)} - 1 \right] = 0.0262$

Development (ACI 318-14 13.2.8.1», 25.4.2)



$\psi_t = 1.0 \quad$ (12 inches or less cast below - 3.00 inches)

$\psi_e = 1.0 \quad$ (bar not epoxy coated)

$\psi_s = 0.80 \quad$ (bars are #6 or smaller)

$\lambda = 1.0 \quad$ (normal weight concrete)

$s / 2 = (10.5\ in) / 2 = 5.25\ in$

$cover + d_b / 2 = (3\ in) + (0.5\ in) / 2 = 3.25\ in$

$c_b = 3.25\ in \quad$ (lesser of half spacing, ctr to surface)

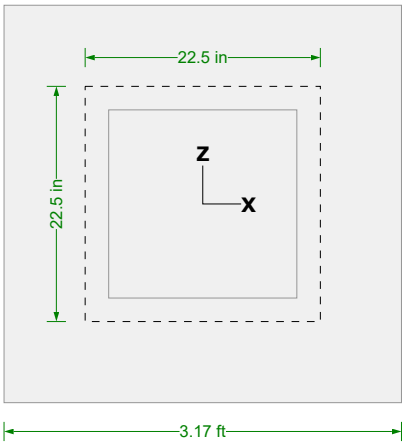
$K_{tr} = 0.0 \quad$ (no transverse reinforcement)

$\frac{c_b + K_{tr}}{d_b} = \frac{(3.25\ in) + (0.0)}{(0.5\ in)} = 6.50$

$l_d = \left(\frac{3.}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t\ \psi_e\ \psi_s}{2.5} \right) d_b = \left[\frac{3.}{40} \frac{(60000\ psi)}{(1.0) \sqrt{3000\ psi}} \frac{(1.0)\ (1.0)\ (0.80)}{2.5} \right] (0.5\ in) = 13.15\ in$

Capacity Calcs (continued)

Footing Punching Shear Capacity



Punching Shear (ACI 318-14 13.3.3.1», 8.5.3.1.2», 22.6.5, 22.6.1.2, 21.2.1)

α_s = 40.0 (interior column)

λ = 1.0 (normal weight concrete)

(a) $v_c = 4 \lambda \sqrt{F'_c} = 4\,(1.0)\sqrt{3000\ psi} = 219.1\ psi$

(b) $v_c = \left(2 + \frac{4}{\beta}\right) \lambda \sqrt{F'_c} = \left[2 + \frac{4}{(1.0)}\right](1.0)\sqrt{3000\ psi} = 328.6\ psi$

(c) $v_c = \left(2 + \frac{\alpha_s\, d}{b_o}\right) \lambda \sqrt{F'_c} = \left[2 + \frac{(40.0)\,(4.5\ in)}{(90\ in)}\right](1.0)\sqrt{3000\ psi} = 219.1\ psi$

$\phi v_n = \phi\, v_c = (0.750)\,(219.1\ psi) = 164.3\ psi$

Values needed for check (ACI 318-14 8.4.4.2.2, 8.4.2.3.2, R8.4.4.2.3)

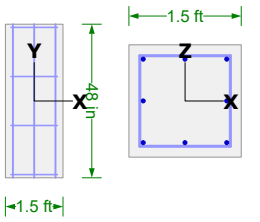
$$\gamma_{vx} = 1 - \frac{1}{1 + \frac{2}{3.}\sqrt{\frac{b_z}{b_x}}} = 1 - \frac{1}{1 + \frac{2}{3.}\sqrt{\frac{(22.5\ in)}{(22.5\ in)}}} = 0.40$$

$$\gamma_{vz} = 1 - \frac{1}{1 + \frac{2}{3.}\sqrt{\frac{b_x}{b_z}}} = 1 - \frac{1}{1 + \frac{2}{3.}\sqrt{\frac{(22.5\ in)}{(22.5\ in)}}} = 0.40$$

J_x = 34514 in ^ 4 (calculated from ACI 318 R8.4.2.2.3)

J_z = 34514 in ^ 4 (calculated from ACI 318 R8.4.2.2.3)

Pedestal Shear Capacity



Shear - X (ACI 318-14 22.5.6.1, 22.5.10.5.3, 22.5.1.1, 21.2)

$$\phi V_c = \phi\, 2\left[1 + \frac{N_u}{2000\, A_g}\right] \lambda \sqrt{F'_c}\, b_w\, d = (0.750)\, 2\left[1 + \frac{(0\ k)}{2000\ (2.25\ ft^2)}\right](1.0)\sqrt{3000\ psi}\,(18\ in)\,(15.69\ in) = 23.2\ k$$

$$\phi V_s = \phi \frac{A_v\, f_{yt}\, d}{s} = (0.750)\frac{(0.4\ in^2)\,(60000\ psi)\,(15.69\ in)}{(12\ in)} = 23.53\ k$$

$\phi V_n = \phi V_c + \phi V_s = (23.2\ k) + (23.53\ k) = 46.73\ k$

Shear - Z (ACI 318-14 22.5.6.1, 22.5.10.5.3, 22.5.1.1, 21.2)

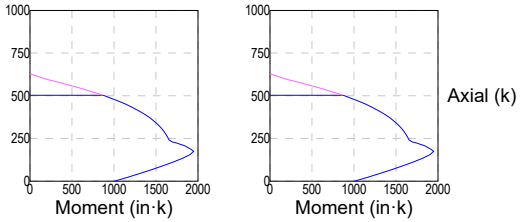
$$\phi V_c = \phi\, 2\left[1 + \frac{N_u}{2000\, A_g}\right] \lambda \sqrt{F'_c}\, b_w\, d = (0.750)\, 2\left[1 + \frac{(0\ k)}{2000\ (2.25\ ft^2)}\right](1.0)\sqrt{3000\ psi}\,(18\ in)\,(15.69\ in) = 23.2\ k$$

$$\phi V_s = \phi \frac{A_v\, f_{yt}\, d}{s} = (0.750)\frac{(0.4\ in^2)\,(60000\ psi)\,(15.69\ in)}{(12\ in)} = 23.53\ k$$

$\phi V_n = \phi V_c + \phi V_s = (23.2\ k) + (23.53\ k) = 46.73\ k$

Capacity Calcs (continued)

Pedestal Axial + Flexural Capacity



Axial (ACI 318-14 22.4.2)

$P_o = 0.85\ F'_c\ (A_g - A_{st}) + f_y\ A_{st}$
$= 0.85\ (3000\ psi)\ [(2.25\ ft^2) - (2.48\ in^2)] + (60000\ psi)\ (2.48\ in^2)$
$= 968.7\ k$

$\phi P_{nmax} = 0.80\ \phi\ P_o = 0.80\ (0.650)\ (968.7\ k) = 503.7\ k$

$\rho_g = A_s / A_g = (2.48\ in^2) / (2.25\ ft^2) = 0.0077$

$\gamma_{Xaxis} = 0.7431$ (ratio extreme bar distance Z to width Z)

$\gamma_{Zaxis} = 0.7431$ (ratio extreme bar distance X to width X)

Capacity Calcs (continued)

Footing-Pedestal Interface Capacity

Compressive Force Transfer (Footing) (ACI 318-14 16.3.3.4, 16.3.1.2, 22.8.3.2)

A_2 = 10.03 ft² (modified footing area)

A_1 = 2.25 ft² (column area)

$\sqrt{A_2 / A_1}\,(0.85\,F'_c\,A_g) = \sqrt{(10.03\text{ ft}^2) / (2.25\text{ ft}^2)}\,[0.85\,(3000\text{ psi})\,(2.25\text{ ft}^2)]$ = 1744 k

$2\,(0.85\,F'_c\,A_1) = 2\,[0.85\,(3000\text{ psi})\,(2.25\text{ ft}^2)]$ = 1652 k → controls

$\phi P_{nc} = \phi\,B_n = (0.650)\,(1652\text{ k})$ = 1074 k

$\phi P_{ns} = \phi\,A_s\,f_y = (0.650)\,(2.48\text{ in}^2)\,(60000\text{ psi})$ = 96.72 k

$\phi P_{nb} = \phi P_{nc} + \phi P_{ns} = (1074\text{ k}) + (96.72\text{ k})$ = 1171 k

Dowel Development Into Footing (Compression) (ACI 318-14 16.3.5.4(c), 25.4.9)

ψ_r = 1.0 (no confining reinforcement)

λ = 1.0 (normal weight concrete)

$l_{dc} = \left(\left[f_y\,\psi_r / 50\,\lambda\,\sqrt{F'_c}\right]\right) d_b = \left[\left[(60000\text{ psi})\,(1.0) / 50\,(1.0)\,\sqrt{3000\text{ psi}}\right]\right](0.63\text{ in})$ = 13.69 in

$l_{dc} = 0.0003\,f_y\,\psi_r\,d_b = 0.0003\,(60000\text{ psi})\,(1.0)\,(0.63\text{ in})$ = 11.25 in

l_{dc} = 13.69 in (max value governs)

Dowel Development Into Footing (Tension) (ACI 318-14 13.2.8.1», 25.4.3)

ψ_e = 1.0 (uncoated hooked bars)

ψ_c = 0.70 (based on side cover and extension cover)

ψ_r = 1.0 (no confining reinforcement)

λ = 1.0 (normal weight concrete)

$$l_{dh} = \left(\frac{f_y\,\psi_e\,\psi_c\,\psi_r}{50\,\lambda\,\sqrt{F'_c}}\right) d_b = \left[\frac{(60000\text{ psi})\,(1.0)\,(0.70)\,(1.0)}{50\,(1.0)\,\sqrt{3000\text{ psi}}}\right](0.63\text{ in}) = 9.59\text{ in}$$

$8\,d_b = 8\,(0.63\text{ in})$ = 5.0 (minimum limit, does not control)

Compressive Force Transfer (Column) (ACI 318-14 16.3.3.4, 16.3.1.2, 22.8.3.2)

$B_n = 0.85\,F'_c\,A_1 = 0.85\,(3000\text{ psi})\,(2.25\text{ ft}^2)$ = 826.2 k (supporting surface not larger than loaded area)

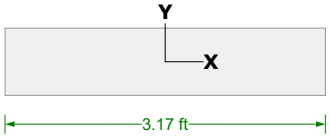
$\phi P_{nc} = \phi\,B_n = (0.650)\,(826.2\text{ k})$ = 537 k

$\phi P_{ns} = \phi\,A_s\,f_y = (0.650)\,(2.48\text{ in}^2)\,(60000\text{ psi})$ = 96.72 k

$\phi P_{nb} = \phi P_{nc} + \phi P_{ns} = (537\text{ k}) + (96.72\text{ k})$ = 633.8 k

Tension Force Transfer (ACI 318-14 16.3.1.2, 22.4.3.1)

$\phi P_{nt} = \phi\,f_y\,A_{st} = (0.90)\,(60000\text{ psi})\,(2.48\text{ in}^2)$ = 133.9 k



Minimum Steel Across Interface (ACI 318-14 16.3.4.1)

$A_{smin} = 0.005\,A_1 = 0.005\,(2.25\text{ ft}^2)$ = 1.62 in²

Dowel Development Into Pedestal (Compression) (ACI 318-14 25.4.9)

ψ_r = 1.0 (no confining reinforcement)

λ = 1.0 (normal weight concrete)

$l_{dc} = \left(\left[f_y\,\psi_r / 50\,\lambda\,\sqrt{F'_c}\right]\right) d_b = \left[\left[(60000\text{ psi})\,(1.0) / 50\,(1.0)\,\sqrt{3000\text{ psi}}\right]\right](0.63\text{ in})$ = 13.69 in

$l_{dc} = 0.0003\,f_y\,\psi_r\,d_b = 0.0003\,(60000\text{ psi})\,(1.0)\,(0.63\text{ in})$ = 11.25 in

l_{dc} = 13.69 in (max value governs)

Dowel Development Into Pedestal (Tension) (ACI 318-14 13.2.8.1», 25.4.2.3)

ψ_t = 1.0 (bars are not horizontal)

ψ_e = 1.0 (bar not epoxy coated)

ψ_s = 0.80 (bars are #6 or smaller)

λ = 1.0 (normal weight concrete)

$s / 2 = (7.34\text{ in}) / 2$ = 3.67 in

$\text{cover} + d_b / 2 = (1.5\text{ in}) + (0.63\text{ in}) / 2$ = 1.81 in

c_b = 1.81 in (lesser of half spacing, ctr to surface)

K_{tr} = 0.0 (no transverse reinforcement)

$$\frac{c_b + K_{tr}}{d_b} = \frac{(1.81\text{ in}) + (0.0)}{(0.63\text{ in})} = 2.90$$

$$l_d = \left(\frac{3.}{40}\,\frac{f_y}{\lambda\,\sqrt{F'_c}}\,\frac{\psi_t\,\psi_e\,\psi_s}{2.5}\right) d_b = \left[\frac{3.}{40}\,\frac{(60000\text{ psi})}{(1.0)\,\sqrt{3000\text{ psi}}}\,\frac{(1.0)\,(1.0)\,(0.80)}{2.5}\right](0.63\text{ in}) = 16.43\text{ in}$$