



STRUCTURAL CALCULATIONS

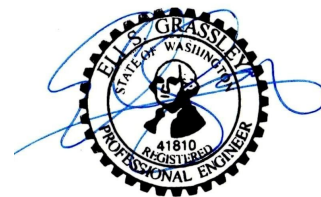
FOR

Norvell Patio
Mercer Island, WA

10/16/2020

PREPARED BY:

ESG DESIGN, PLLC
October 16, 2020





Norvell Patio

5720 91st Ave SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5512053, -122.2179692



Date	10/16/2020, 9:40:39 AM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S _S	1.449	MCE _R ground motion. (for 0.2 second period)
S ₁	0.556	MCE _R ground motion. (for 1.0s period)
S _{MS}	1.449	Site-modified spectral acceleration value
S _{M1}	0.834	Site-modified spectral acceleration value
S _{DS}	0.966	Numeric seismic design value at 0.2 second SA
S _{D1}	0.556	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F _a	1	Site amplification factor at 0.2 second
F _v	1.5	Site amplification factor at 1.0 second
PGA	0.602	MCE _G peak ground acceleration
F _{PGA}	1	Site amplification factor at PGA
PGA _M	0.602	Site modified peak ground acceleration
T _L	6	Long-period transition period in seconds
SsRT	1.449	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.527	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.567	Factored deterministic acceleration value. (0.2 second)
S1RT	0.556	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.599	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.307	Factored deterministic acceleration value. (1.0 second)
PGAd	1.367	Factored deterministic acceleration value. (Peak Ground Acceleration)
C _{RS}	0.949	Mapped value of the risk coefficient at short periods
C _{R1}	0.928	Mapped value of the risk coefficient at a period of 1 s

Project: Norvell Patio

Descriptions: Patio

Locations: Mercer Island

Patio Dimension:

L= 22.5 ft (Input based on diagrams below)

W= 14.5 ft

Code: IRC 2015
ASCE 7-10

Gravity Loads

Deck DL = 10 psf Roof Dead Load
Deck LL = 20 psf DL= 725 lbs (Shaded portion)
Snow SL = 25 psf
Soil Bearing= 1500 psf

Lateral Loads:

Seismic loads calculated per ASCE 7-10, Ch 12.14

$S_{ds} = 0.966$

Site Class= D

Risk Category= II

Type of Diaphragm= Flexible

R= 1.5 (ASCE 7-10 Table 12.2-1 Cantilevered Columns)

$\Omega_o = 1.5$

F= 1.0 (F=1.0 for 1-story, 1.1 for 2-story, 1.2 for 3-story)

$C_s = F \times S_{ds} / R = 0.644$ (ASCE 7-10 Ch. 12-14)

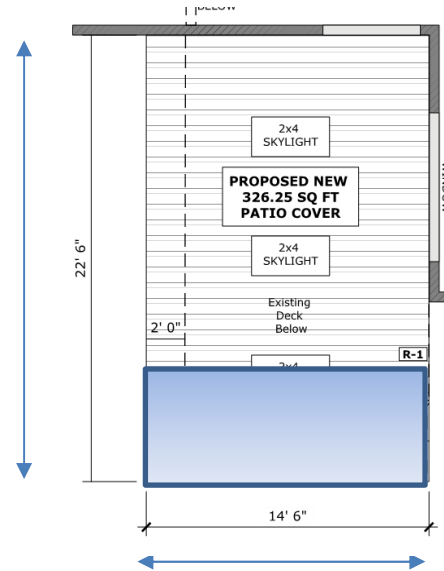
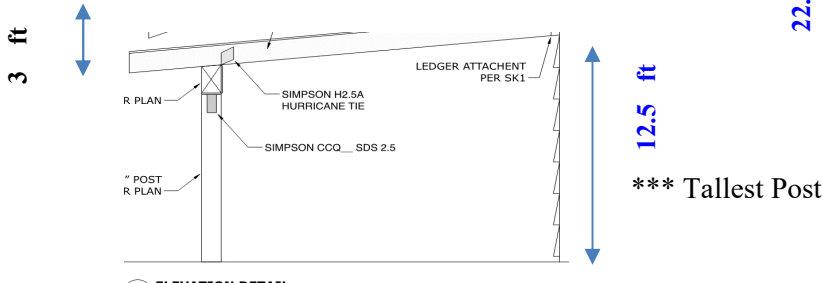
V= 0.644 x DL

Seismic

$E_h = 467 \text{ lbs}$ (Not reduced by .7)

(Total Load for Section)

Remaining in Both Directions is transferred to House



Shaded portion is supported by post (laterally)

14.5 ft

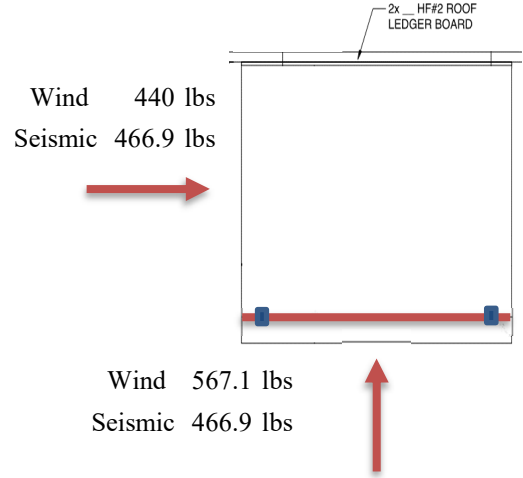


Project: Norvell Patio
Address Mercer Island
Client:

Pg. No: Lateral 1
Date: 10/16/20
Job No.: Norvell Patio

Design for Open Building (30.8)

$q_z = 10.59$ psf
 $K_d = 0.85$ Table 26.6.1
 $K_z = 0.575$
 $K_h = 0.7$ Table 30.3.-1
 $h = 13$ ft
 $z = 13$ ft
 $\alpha = 7$ (Input Based on Exposure)
 Exposure: **B**
 $Z_g = 1200$ (Input Based on Exposure)
 $K_{zt} = 1$ (If on a hill see ASCE 26.8.2)
 $V = 110$ mph
 $A_{r1} = 67.5$ ft² (Calculate based on roof type)
 $A_{r2} = 43.5$ ft² (Calculate based on roof type)
 $G = 0.85$
 $C_N = 1.7 \quad 1.8$ (Uplift per table)
 $F_1 = 440$ lbs
 $F_2 = 567$ lbs



Number of Posts = **2** (1/2 Load going to Wall)

Post Height: **12.5** ft
 Post Height for Seismic: **10** ft Based on Footing Type
 Full Load = 467 lbs

Uplift

Roof Area: 326.3 ft²
 $F = 6220$ lbs
 Attachment Length = **29** ft
 Load/ft = **214.5** plf
 Simpson H2.5A = 495 lbs (uplift) **28** in
 110 lbs (lateral) **82** in

# of Lags	Min Ledger
1	2x6
2	2x8
3	2x10
4	1.75 x 14 LVL
5	1.75 x 16 LVL

Ledger Lok Attachments:

Vertical Shear Stud Spacing = **16** in
Ledger Shear: # of lags per bay = **2** @ **16** "oc
 $R = (Dl-2)/2 \times DL + SL =$
 $Z = (0.8 \times 220\# \times 12/(s/n) \times 1.15SL) =$

254 plf
304 plf

Check: **OK**

Horizontal Shear
Ledger Shear: # of lags per bay = **2** @ **16** "oc
 Max Wind/Seismic
 $Z = (0.8 \times 220\# \times 12/(s/n) \times 1.33 * Load) =$

14 plf
351 plf

Check: **OK**



Project: Norvell Patio
 Address Mercer Island
 Client:

Pg. No: Lateral 2
 Date: 10/16/20
 Job No.: Norvell Patio

Point Load (P)

***Smaller Loads than shorter Post

Patio LL 2039 lbs
Patio DL 816 lbs

Loads into Enercalc

Footing Design

Posts: 2
E= 233.5 lbs
(not reduced by .7)

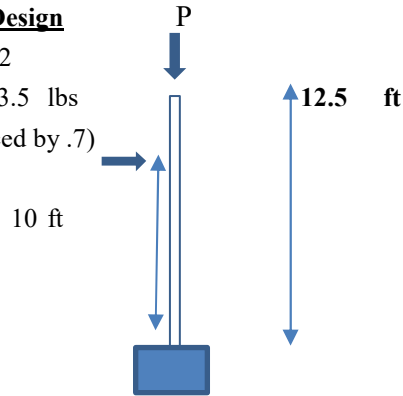


Table 2.2 Effective length factors. Theoretical values and recommended values when ideal conditions are approximated.

Effective length factor	0.5	0.7	1.0	1.0	2.0	2.0
Theoretical value	0.5	0.7	1.0	1.0	2.0	2.0
Recommended design value	0.6	0.8	1.2	1.0	2.1	2.0

Allowable Soil Bearing Pressure: 1500 psf
x 1.33 1995 psf

(Allowable for wind and Seismic)

Reduced Load

$P_{DL} = 816$ lbs

$P_{SL} = 2039$ lbs

$P_{WL(+)} = 283.6$ lbs

$P_{WL(-)} = 0$ lbs

$P_{0.7E} = 163.4$ lbs

$M_{DL} = 0.00$ lb-ft

$M_{LL} = 0.00$ lb-ft

$M_{WL(+)} = 2836$ lb-ft

$M_{WL(-)} = 0.00$ lb-ft

$M_{0.7E} = 1634.2$ lb-ft

$P_{(DL+WL)} = 1099$ lbs

$P_{(DL+0.7E)} = 979$ lbs

$P_{(DL+0.75*LL+0.75*WL)} = 2558$ lbs

$P_{(0.6*DL+WL)} = 772.9$ lbs

$M_{(DL+WL)} = 2836$ lb-ft

$M_{(DL+0.7E)} = 1634$ lb-ft

$M_{(DL+0.75*LL+0.75*WL)} = 2127$ lb-ft

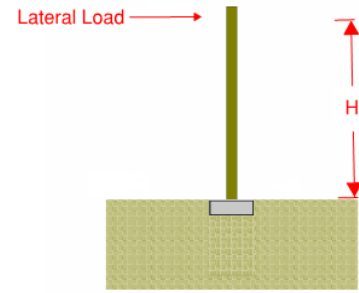
$M_{(0.6*DL+WL)} = 2836$ lb-ft



Project: Norvell Patio
Address Mercer Island
Client:

Pg. No: Lateral 3
Date: 10/16/20
Job No.: Norvell Patio

Project: **Norvell**
 Date: 10/16/2020
 Soils Report # -
 Geotechnical Eng, -
 Recommended Capacity lbs

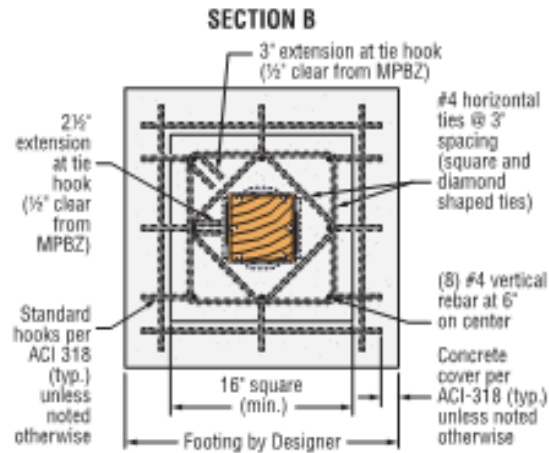
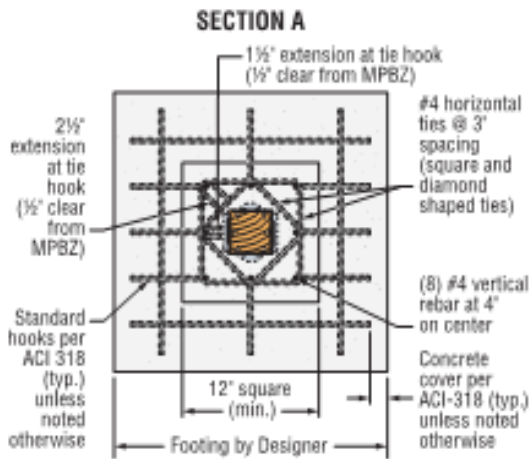
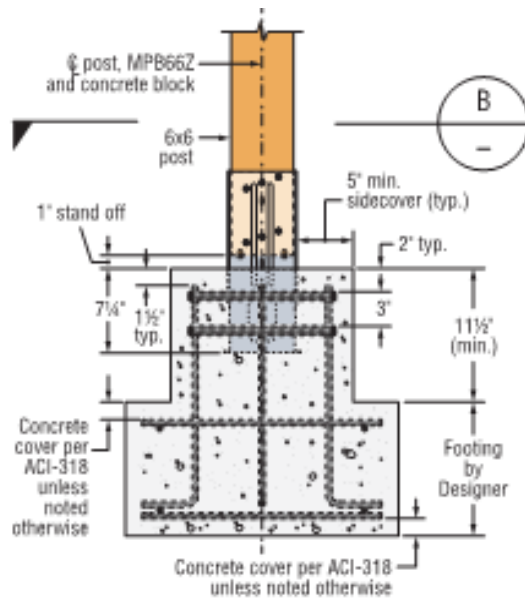
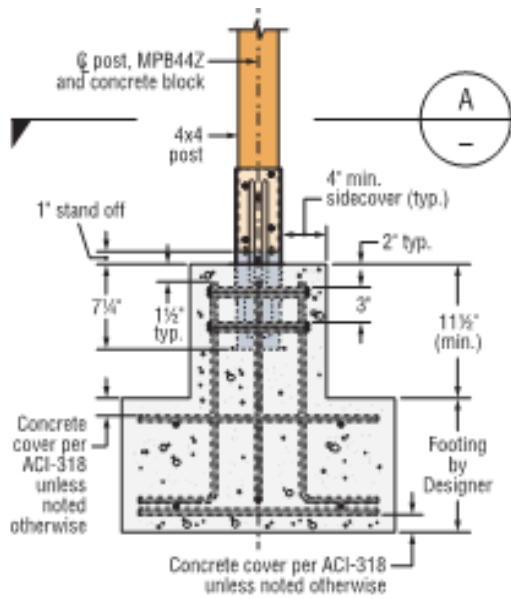


Loads:
 DL= **0.5** k
 LL= **3.1** k
 E= 233 lbs
 E= **163** k = E x *0.7
 H= **10** ft
 M= 1631 k-ft

Seismic Design Category **D**
 Moment= **1631 lb-ft**

Post Size **6x6**
 Post Type: Hem Fir #2
Unreinforced 1645 lb-ft **Reinforced 2872.1 lb-ft** **Unreinforced OK**
Table Value Reduced by 0.77

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.
		W ₁ / W ₂	D	H		Uplift		Lateral F ₁		Moment M (ft.-lb.)		Download (100)	Download (160)	Moment M (ft.-lb.) (160)		
						Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked					
Non-Reinforced Concrete																
Wind and Seismic Design Category A&B																
MPB44Z	4x4	3 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(16) 1/4" x 2 1/2"	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	5 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(24) 1/4" x 2 1/2"	5,815	5,815	3,435	2,405	2,680	1,875	9,360	10,855	3,730	2,405,000	—
MPB88Z	8x8	7 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(36) 1/4" 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	3 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(16) 1/4" x 2 1/2"	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	5 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(24) 1/4" x 2 1/2"	5,815	5,815	3,015	2,110	2,055	1,645	9,360	10,855	3,730	2,405,000	—
MPB88Z	8x8	7 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(36) 1/4" 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	3 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(16) 1/4" x 2 1/2"	4,900	3,820	1,750	1,225	1,540	1,540	6,240	6,410	1,540	1,245,000	—
MPB66Z	6x6	5 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(24) 1/4" x 2 1/2"	5,815	5,815	3,435	2,405	3,730	3,190	9,360	10,855	3,730	2,405,000	—
MPB88Z	8x8	7 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(36) 1/4" 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	3 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(16) 1/4" x 2 1/2"	4,785	3,350	1,535	1,075	1,540	1,540	6,240	6,410	1,540	1,245,000	—
MPB66Z	6x6	5 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(24) 1/4" x 2 1/2"	5,815	5,815	3,015	2,110	3,350	2,795	9,360	10,855	3,730	2,405,000	—
MPB88Z	8x8	7 ⁹ / ₁₆	7 ¹ / ₄	7 ¹ / ₄	(36) 1/4" x 3"	7,420	6,100	6,965	4,875	4,525	4,525	15,120	17,585	4,525	5,500,000	—



MPB44Z
Reinforced Concrete Footing

MPB66Z
Reinforced Concrete Footing

See Enercal for Footing Design

Project:	Norvell	Date:	10/16/2020
Location:	Mercer Island	Page #	2

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General Footing

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DESCRIPTION: **Patio Footing**

Code References

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

General Information

Material Properties

f _c : Concrete 28 day strength	=	2.50	ksi
f _y : Rebar Yield	=	60.0	ksi
E _c : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Soil Design Values

Allowable Soil Bearing	=	1.950	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Analysis Settings

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.0	: 1
Min. Sliding Safety Factor	=	1.0	: 1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	No	
Use Pedestal wt for stability, mom & shear	:	No	

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

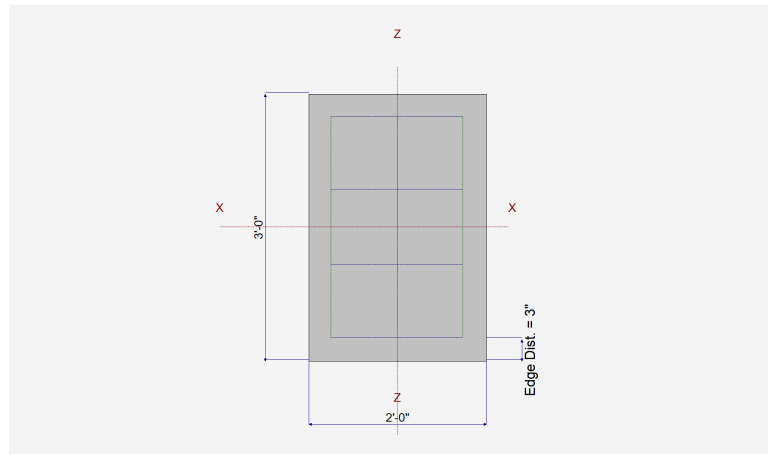
Increases based on footing plan dimension

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

Dimensions

Width parallel to X-X Axis	=	2.0	ft
Length parallel to Z-Z Axis	=	3.0	ft
Footing Thickness	=	12.0	in

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

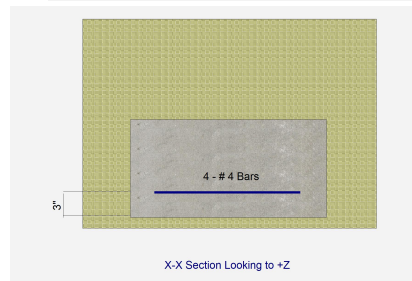


Reinforcing

Bars parallel to X-X Axis	=	4.0	
Number of Bars	=	# 4	
Reinforcing Bar Size	=	# 4	
Bars parallel to Z-Z Axis	=	3.0	
Number of Bars	=	# 4	
Reinforcing Bar Size	=	# 4	
Bandwidth Distribution Check (ACI 15.4.4.2)			
Direction Requiring Closer Separation			

Bars along X-X Axis

# Bars required within zone	80.0 %
# Bars required on each side of zone	20.0 %



Applied Loads

	D	L _r	L	S	W	E	H	
P : Column Load	=	0.80			2.0			k
OB : Overburden	=							ksf
M-xx	=					2.334		k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

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General Footing

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DESCRIPTION: **Patio Footing**

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.7103	Soil Bearing	1.385 ksf	1.950 ksf	+0.60D+0.70E about X-X axis
PASS	1.284	Overturning - X-X	1.634 k-ft	2.097 k-ft	+0.60D+0.70E
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.03326	Z Flexure (+X)	0.3467 k-ft/ft	10.424 k-ft/ft	+1.20D+1.60S
PASS	0.03326	Z Flexure (-X)	0.3467 k-ft/ft	10.424 k-ft/ft	+1.20D+1.60S
PASS	0.07784	X Flexure (+Z)	0.9087 k-ft/ft	11.674 k-ft/ft	+0.90D+E
PASS	0.06682	X Flexure (-Z)	0.780 k-ft/ft	11.674 k-ft/ft	+1.20D+1.60S
PASS	0.02054	1-way Shear (+X)	1.541 psi	75.0 psi	+1.20D+1.60S
PASS	0.02054	1-way Shear (-X)	1.541 psi	75.0 psi	+1.20D+1.60S
PASS	0.09198	1-way Shear (+Z)	6.898 psi	75.0 psi	+0.90D+E
PASS	0.06420	1-way Shear (-Z)	4.815 psi	75.0 psi	+1.20D+1.60S
PASS	0.07747	2-way Punching	11.620 psi	150.0 psi	+1.20D+1.60S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.950	n/a	0.0	0.3883	0.3883	n/a	n/a	0.199
X-X, +D+S	1.950	n/a	0.0	0.7217	0.7217	n/a	n/a	0.370
X-X, +D+0.750S	1.950	n/a	0.0	0.6383	0.6383	n/a	n/a	0.327
X-X, +0.60D	1.950	n/a	0.0	0.2330	0.2330	n/a	n/a	0.120
X-X, +D+0.70E	1.950	n/a	8.414	0.0	0.9662	n/a	n/a	0.496
X-X, +D+0.750S+0.5250E	1.950	n/a	3.839	0.2340	1.043	n/a	n/a	0.535
X-X, +0.60D+0.70E	1.950	n/a	14.024	0.0	1.385	n/a	n/a	0.710
Z-Z, D Only	1.950	0.0	n/a	n/a	n/a	0.3883	0.3883	0.199
Z-Z, +D+S	1.950	0.0	n/a	n/a	n/a	0.7217	0.7217	0.370
Z-Z, +D+0.750S	1.950	0.0	n/a	n/a	n/a	0.6383	0.6383	0.327
Z-Z, +0.60D	1.950	0.0	n/a	n/a	n/a	0.2330	0.2330	0.120
Z-Z, +D+0.70E	1.950	0.0	n/a	n/a	n/a	0.3883	0.3883	0.199
Z-Z, +D+0.750S+0.5250E	1.950	0.0	n/a	n/a	n/a	0.6383	0.6383	0.327
Z-Z, +0.60D+0.70E	1.950	0.0	n/a	n/a	n/a	0.2330	0.2330	0.120

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+S	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750S	None	0.0 k-ft	Infinity	OK
X-X, +0.60D	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	1.634 k-ft	3.495 k-ft	2.139	OK
X-X, +D+0.750S+0.5250E	1.225 k-ft	5.745 k-ft	4.688	OK
X-X, +0.60D+0.70E	1.634 k-ft	2.097 k-ft	1.284	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+S	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.750S	None	0.0 k-ft	Infinity	OK
Z-Z, +0.60D	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.70E	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.750S+0.5250E	None	0.0 k-ft	Infinity	OK
Z-Z, +0.60D+0.70E	None	0.0 k-ft	Infinity	OK

All units k

Sliding Stability

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

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DESCRIPTION: **Patio 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
X-X, +1.40D	0.210	+Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.40D	0.210	-Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D	0.180	+Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D	0.180	-Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D+0.50S	0.3675	+Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D+0.50S	0.3675	-Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D+1.60S	0.780	+Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D+1.60S	0.780	-Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +0.90D	0.1350	+Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +0.90D	0.1350	-Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D+0.20S+E	0.8756	+Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +1.20D+0.20S+E	0.2913	-Z	Top	0.2592	Min Temp %	0.30	11.674	OK
X-X, +0.90D+E	0.9087	+Z	Bottom	0.2592	Min Temp %	0.30	11.674	OK
X-X, +0.90D+E	0.2582	-Z	Top	0.2592	Min Temp %	0.30	11.674	OK
Z-Z, +1.40D	0.09333	-X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.40D	0.09333	+X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D	0.080	-X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D	0.080	+X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D+0.50S	0.1633	-X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D+0.50S	0.1633	+X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D+1.60S	0.3467	-X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D+1.60S	0.3467	+X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +0.90D	0.060	-X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +0.90D	0.060	+X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D+0.20S+E	0.1133	-X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +1.20D+0.20S+E	0.1133	+X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +0.90D+E	0.060	-X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK
Z-Z, +0.90D+E	0.060	+X	Bottom	0.2592	Min Temp %	0.2667	10.424	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.41 psi	0.41 psi	1.30 psi	1.30 psi	1.30 psi	75.00 psi	0.02	OK
+1.20D	0.36 psi	0.36 psi	1.11 psi	1.11 psi	1.11 psi	75.00 psi	0.01	OK
+1.20D+0.50S	0.73 psi	0.73 psi	2.27 psi	2.27 psi	2.27 psi	75.00 psi	0.03	OK
+1.20D+1.60S	1.54 psi	1.54 psi	4.82 psi	4.82 psi	4.82 psi	75.00 psi	0.06	OK
+0.90D	0.27 psi	0.27 psi	0.83 psi	0.83 psi	0.83 psi	75.00 psi	0.01	OK
+1.20D+0.20S+E	0.50 psi	0.50 psi	2.12 psi	5.93 psi	5.93 psi	75.00 psi	0.08	OK
+0.90D+E	0.27 psi	0.27 psi	1.59 psi	6.90 psi	6.90 psi	75.00 psi	0.09	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	3.13 psi	150.00psi	0.02086	OK
+1.20D	2.68 psi	150.00psi	0.01788	OK
+1.20D+0.50S	5.48 psi	150.00psi	0.0365	OK
+1.20D+1.60S	11.62 psi	150.00psi	0.07747	OK
+0.90D	2.01 psi	150.00psi	0.01341	OK
+1.20D+0.20S+E	3.87 psi	150.00psi	0.02578	OK
+0.90D+E	2.62 psi	150.00psi	0.01747	OK

Norvel

Rafters

Date: 10/16/20

Selection

2x 8 HF #2 @ 16 in oc

Lu = 1.0 Ft

Lu @OH = 1.0 Ft

Conditions

NDS 2015, Overhang, Repetitive Use, DL adj: 3:12 pitch

Min Bearing Area R1= 0.7 in² R2= 0.9 in² (1.5) DL Defl= 0.14 in.

Data

Beam Span	12.0 ft	Reaction 1 LL	194 #	Reaction 2 LL	272 #
Beam Wt per ft	0 #	Reaction 1 TL	275 #	Reaction 2 TL	384 #
Bm Wt Included	0 #	Maximum V	290 #	Overhang Length	2.0 ft
Max Moment	801 #	Max V (Reduced)	262 #	Total Beam Length	14.0 ft
TL Max Defl	L / 180	TL Actual Defl	L / 381	OH TL Actual Defl	L / 230
LL Max Defl	L / 240	LL Actual Defl	L / 616	OH LL Actual Defl	L / 372

Attributes

	Section (in ³)	Shear (in ²)	TL Defl (in)	LL Defl	OH TL Defl	OH LL Defl
Actual	13.14	10.88	0.38	0.23	-0.21	-0.13
Critical	8.27	2.62	0.80	0.60	0.27	0.20
Status	OK	OK	OK	OK	OK	OK
Ratio	63%	24%	47%	39%	78%	64%

Values

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc _L (psi)
Reference Values	850	150	1.3	405
Adjusted Values	1162	150	1.3	405

Adjustments

CF Size Factor	1.200			
Cd Duration	1.00	1.00		
Cr Repetitive	1.15			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00
CI Stability	0.9904	Rb = 8.92	Le = 2.06 Ft	
CI Stability @ OH	0.9942	Rb = 7.17	Le = 1.33 Ft	

Loads

Uniform LL: 33

Uniform TL: 47 = A

(Uniform Ld on Backspan)

	Par Unif LL	Par Unif TL	Start	End
	33	K = 47 (OH)	0	2.0

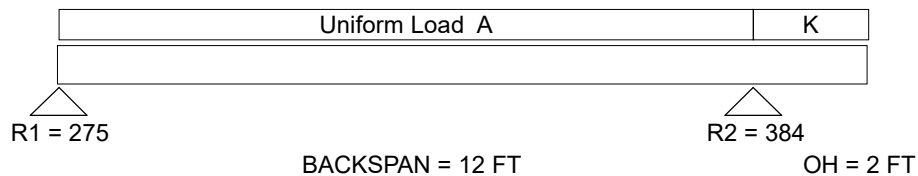
Options for 24" OC

Solid Sawm Lumber and Timber Sizes - Nominal Size

Using NDS 2015 Values

	2x	(2) 2x	(3) 2x	(4) 2x	4x	6x	8x	10x
HF #2	10	8	6	6	8			
HF #1	10	8	6	6	6			
DF-L #2	8	8	6	6	6			
DF-L #1	8	8	6	6	6			

Your selection must always be tested. Make your selection and click OK Test.



Uniform and partial uniform loads are lbs per lineal ft. Overhanging load distances are from R2.

Norvel

Beam

Date: 10/16/20

Selection **5-1/8x 12 GLB 24F-V4 DF/DF** Lu = 1.0 Ft

Conditions NDS 2015
 Min Bearing Area R1= 5.6 in² R2= 5.6 in² (1.5) DL Defl= 0.47 in Recom Camber= 0.70 in

Data

Beam Span	20.0 ft	Reaction 1 LL	2500 #	Reaction 2 LL	2500 #
Beam Wt per ft	14.94 #	Reaction 1 TL	3649 #	Reaction 2 TL	3649 #
Bm Wt Included	299 #	Maximum V	3649 #	"HUCQ610SDS= 3875 LBS (HF/SL CONTROLS)"	
Max Moment	18247 #	Max V (Reduced)	3285 #		
TL Max Defl	L / 180	TL Actual Defl	L / 210		
LL Max Defl	L / 240	LL Actual Defl	L / 355		

Attributes

	Section (in ³)	Shear (in ²)	TL Defl (in)	LL Defl
Actual	123.00	61.50	1.14	0.68
Critical	79.45	17.85	1.33	1.00
Status	OK	OK	OK	OK
Ratio	65%	29%	86%	68%

Values

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc _L (psi)
Reference Values	2400	240	1.8	650
Adjusted Values	2756	276	1.8	650

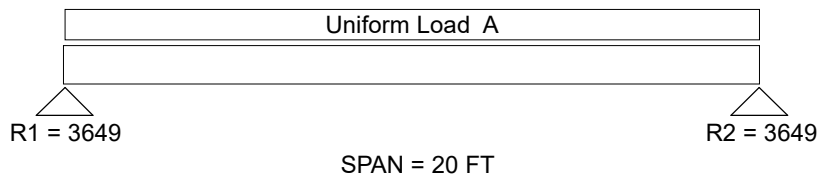
Adjustments

Cv Volume	1.000			
Cd Duration	1.15	1.15		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00
CI Stability	0.9986	Rb = 3.36	Le = 2.06 Ft	

Loads

Uniform LL: 250

Uniform TL: 350 = A



Uniform and partial uniform loads are lbs per lineal ft.

Norvel

Beam

Date: 10/16/20

Selection (2) 2x 8 HF #2 Lu = 1.0 Ft Lu @OH = 1.0 Ft

Conditions NDS 2015, Overhang

Min Bearing Area R1= 1.7 in² R2= 2.1 in² (1.5) DL Defl= -0.04 in.

Data

Beam Span	6.75 ft	Reaction 1 LL	495 #	Reaction 2 LL	580 #
Beam Wt per ft	5.29 #	Reaction 1 TL	708 #	Reaction 2 TL	846 #
Bm Wt Included	49 #	Maximum V	745 #	Overhang Length	2.5 ft
Max Moment	1170 #	Max V (Reduced)	615 #	Total Beam Length	9.25 ft
TL Max Defl	L / 180	TL Actual Defl	L / 928	OH TL Actual Defl	L / 594
LL Max Defl	L / 240	LL Actual Defl	L / >1000	OH LL Actual Defl	L / 960

Attributes

	Section (in ³)	Shear (in ²)	TL Defl (in)	LL Defl	OH TL Defl	OH LL Defl
Actual	26.28	21.75	0.09	0.05	-0.10	-0.06
Critical	12.00	5.35	0.45	0.34	0.33	0.25
Status	OK	OK	OK	OK	OK	OK
Ratio	46%	25%	19%	16%	30%	25%

Values

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc _L (psi)
Reference Values	850	150	1.3	405
Adjusted Values	1171	173	1.3	405

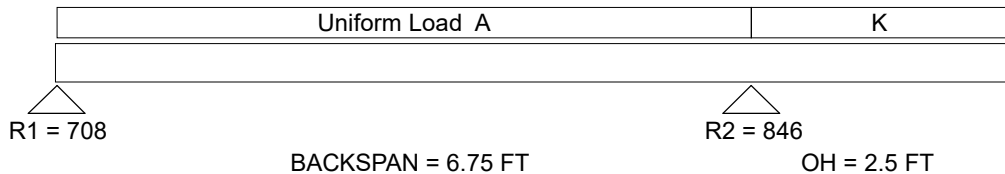
Adjustments

CF Size Factor	1.200			
Cd Duration	1.15	1.15		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00
CI Stability	0.9979	Rb = 4.46	Le = 2.06 Ft	
CI Stability @ OH	0.9986	Rb = 3.59	Le = 1.33 Ft	

Loads

Uniform LL: 150 Uniform TL: 210 = A (Uniform Ld on Backspan)

	Par Unif LL	Par Unif TL	Start	End
	25	K = 35 (OH)	0	2.5



Uniform and partial uniform loads are lbs per lineal ft. Overhanging load distances are from R2.

Norvel

Prepared by: Date: 10/16/20

Selection **6x 6 Hem-Fir #2 Solid Wood Column**

Conditions NDS 2015, Using values for 5x + solid sawn, Posts and Timbers.
Incised

Data

Load	4000 #	Column Area	30.25 in ²	Kf	1.00
Actual Height	12.0 ft	le d1 Effective Ht	144 in	c	0.80
Unbraced L1	12.0 ft	le d2 Effective Ht	144 in	KcE	0.30
Unbraced L2	12.0 ft	Ke Buckling Mode	1.0	FcE	458

Attributes and Values **Controlling d is 5.5 inches**

	le/d	psi	Area (in ²)	Fc (psi)	E (psi x mil)
Actual	26	132	30.25	575	1.1
Critical	50	317	12.62	317	1.0
Status	OK	OK	OK		
Ratio	52%	42%	42%		

Reference Values	575	1.1
Adjusted Values	317	1.0
CF Size Factor	1.00	
Cd Duration	1.00	
Ci Incised	0.80	0.95
Cp Stability	0.69	

Note: A wood plate under this column must have an Fc value, perpendicular to the grain, greater than 132 psi.

LedgerLok®

LEDGER BOARD FASTENER

INSTALLATION PROCEDURE

LedgerLok should be installed using a high torque, 1/2" variable speed drill (at least 18V if cordless). Choose the proper length LedgerLok so that threads fully engage the main member (i.e., rim joist). Bring washer flush to side member – do not countersink.

Lateral Design Values (in pounds per Fastener) for single shear connections loaded perpendicular to grain

Wood	Specific Gravity**	FastenMaster LedgerLok	Nails		Lags	
			16D	20D	3/8"	1/2"
Red Oak	0.67	373	184	222	160	280
Southern Pine	0.55	290	154	185	140	230
Doug. Fir-L, SCL*	0.50	255	141	170	130	200
Doug. Fir-S	0.46	233	131	157	120	190
Hem. Fir	0.43	216	122	147	120	180
E. Spruce, W. Cedar	0.36	179	104	126	100	150

* SCL=Structural Composite Lumber (LVL,PSL and LSL)

** Wood species identified typically have average specific gravity similar to the values shown on this table.

All design values based on 1 1/2" side member thickness and penetration into main member as follows: LedgerLok 2", Nails 10x diameter, Lags 8x diameter. Design values may be subject to adjustment factors (section 10.3 in NDS) based on conditions existing during installation as well as those expected during service life.

The lag screw and nail design values included in these tables are compiled directly from the 2005 National Design Specification for Wood Construction (2005 NDS).

For correct fastening patterns and complete installation procedures when attaching the deck ledger to rim joist, consult our Deck Ledger to Rim Joist Technical Bulletin at www.FastenMaster.com. In some ledger board connections, LedgerLok may not be a one-to-one replacement for 1/2" lag screw patterns.

For use of LedgerLok in non-ledger applications, please consult a design professional for designing all connections, which include the number and location of all fasteners to meet the national and local code requirements.

Ledger Board Attachment Comparative Data

The statement "Faster, Easier, Stronger than 1/2" lag screws" refers to the comparison of LedgerLok design values in ICC-ES Report #1078 and 1/2" lag screws as published in the current NDS.

For complete design values and engineering data, available through ICC-ES, see report ESR #1078 at www.icc-es.org.

For technical assistance or questions regarding proper use of this fastener, please contact FastenMaster Technical Support at 800-518-3569 or visit www.FastenMaster.com.

Item #	Screw Length	Quantity per Pack
FMLL358-12	3 5/8"	12
FMLL005-12	5"	12
FMLL358-50	3 5/8"	50
FMLL005-50	5"	50
FMLL358-250	3 5/8"	250
FMLL005-250	5"	250

FMLLSHEET (0211)

PRODUCT FEATURES

5/16" HEX WITH OVERSIZED WASHER HEAD

MADE OF HEAT TREATED STEEL FOR DRAMATICALLY INCREASED STRENGTH AND DRIVABILITY

MULTI-COATED FOR GUARANTEED CORROSION PROTECTION. ACQ APPROVED

SUPER-SIZED THREADS FOR INCREASED HOLDING POWER

GIMLET POINT FOR FAST DRILLING

