Structal Calculations and Lateral Analysis

for

KH2340 Plan
Parcel #282392-4-049-2000
Kitsap County

for

King Homes
P.O. Box 547
Olalla,WA 98359

by

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2453 Bethel Avenue
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NLO #10526-18

July-20

Scope of Work:

Engineering for single story single family residence.
Analysis was done using the 2015 International Building Code

Materials:
Framing: HF #2 or better
Beams: DF #2 or better
Glulam: Douglas Fir 24F-V4 for simple supported and 24F-V8 for continuous or cantilevered beams

Reinforcing Steel: ASTM A615 Grade 60
Concrete: f'c = 2500 psi

Design Assumptions:
Soil Properties: 1500 psf Bearing Capacity, 250 psf/ft lateral capacity (assumed)

Design Wind: 110 MPH 3 sec gust

Seismic Zone D

S_s = 160%

S_1 = 60.0%

Snow Load: 30 psf Ground

CONTENTS:

Dead Loads

Floor =	12	psf(3 Joists,3 subfloor, 4 coverings)
Wall =	10	psf(1.5 studs,2.5 sheathing,0.5 insul. 3 paneling)
Roof =	15	psf (2 psf truss, 1 insulation, 3 ceiling, 5, roofing)

Live Loads

Floor, L_f =	40	psf (60 psf Deck)
Roof, L_r =	25	psf

Snow Loads

Exposure Category	C		(ASCE 7-10 26.7.3)
Risk Category	II		(ASCE 7-10 1.5-1)
Ct =	1.1		(ASCE 7-10 Table 7-3)
Ce =	0.9		(ASCE 7-10 Table 7-2)
Is =	1		(ASCE 7-10 Table 1.5-2)
Cs =	1		(ASCE 7-10 Figure 7-2)
Pg =	30	psf	(ASCE 7-10 Figure 7-1)

Pf = 0.7Ce*Ct*Is*Pg

Pf = 20.79 psf (ASCE 7-10 7.3-1)

Ps = Cs*Pf

Ps = 20.79 psf (ASCE 7-10 7.4-1)

Use 25 psf for design

Wind Loads

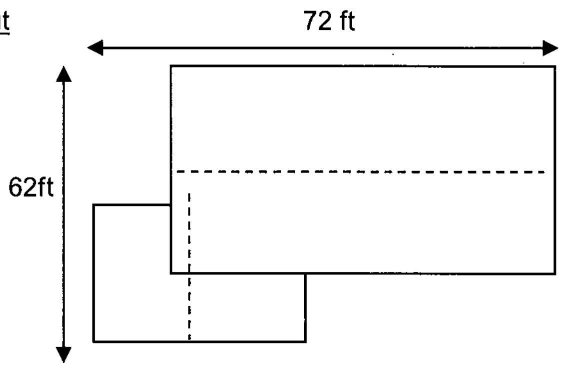
Vult = 110 mph (3 Sec. Gust)
Exposure B

Seismic Loads

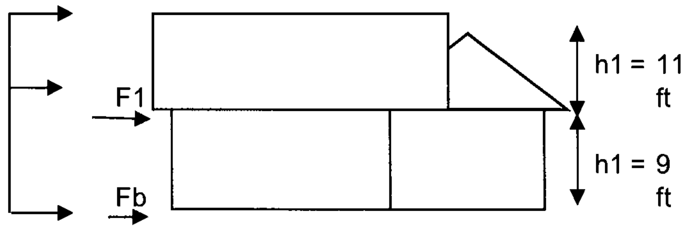
Site Class	D	(Assumed)
Ss =	1.6	(USGS)
S1 =	0.6	(USGS)

Permit Number: 20-03414

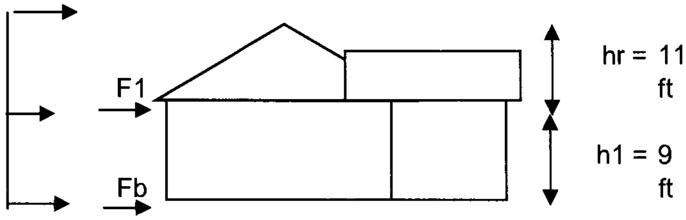
Building Layout



Wind Loads (Simplified Envelope Method) (Per ASCE 7-10 Section 28.2-1)



b = 72.00 ft
Case A - East-West Wind



b = 62.00 ft
Case B - North-South Wind

Roof Angle	6:12 or 26	degrees	
V =	110 mph		(ASCE 7-10 Figure 26.5-1)
a =	6.2 ft		
$\lambda =$	1		
A =	24.1 psf		(ASCE 7-10 Figure 28.6-1)
B =	8 psf		
C =	17.4 psf		
D =	8 psf		

Case A

F1 =	13644 lbs
Fb =	18891 lbs

Case B

F1 =	13233 lbs
Fb =	19324 lbs

Permit Number: 20-03414

Seismic Loads

Site Class D			
Risk Category II			
Ss = 1.6			
Fa = 1			(ASCE 7-10 Table 11.4-1)
Sms = Fa*Ss = 1.6			
Sds = (2/3)*Sms = 1.000	→ Design Category	D	(ASCE 7-10 Table 11.6-1)
S1 = 0.6			
Fv = 1.5			(ASCE 7-10 Table 11.4-2)
Sm1 = S1*Fv = 0.9			
Sd1 =(2/3)*Sm1 = 0.55	→ Design Category	D	(ASCE 7-10 Table 11.6-2)

R = 6.5	(ASCE 7-10 Table 12.2-1)
O = 3	(ASCE 7-10 Table 12.2-1)
Cd = 4	(ASCE 7-10 Table 12.2-1)
Ie = 1	(ASCE 7-10 Table 1.5-2)

Approximate period per ASCE 7-10 Section 12.8.2.1

Ct = 0.02
x = 0.75
TL = 6
T = 0.2169 seconds

Cs = (Sds)/(R/Ie) = 0.1538
Csmax = 0.3902
Csmin = 0.044

Use Cs = 0.154

Weight of the Structure

Weight @ Roof = 80750	lbs	
Wtotal = 80750	lbs	
V = CsW = 12423	lbs	Total applied earthquake load
K = 1		(ASCE 7-10 12.8.3)
Cv1 = 1.000		
F1 = 12423	lbs	(Includes 1/2 walls and roof)
Base Shear = 12423	lbs	

Permit Number: 20-03414

North Wall (Main Floor) (Perforated Method) (Seismic)

H =	9 ft	(Wall height)
W =	15.67 ft	(Wall width)
Wf =	9.34 ft	(Wall width w/ full height sheathing)
F =	2360.4 lbs	(Horizontal load)
w =	283.5 lb/ft	(Vertical load)
	F	(Attatchment)

Check Shear

ρ = 1.3

v = 548 lb/ft vs = 560 lb/ft (SDPWS Table 4.3A)

φ = 0.8

Use 7/16in sheathing w/ 8d nails@ 4in edge spacing

Check Studs

Co = 60.0%

T = C = 2259.46 lb Try 2"x6" A = 8.25 in^2

fc = 273.87	psi	Fc' = 2080	psi	Works
ft = 273.87	psi	Ft' = 1260	psi	Works

Use No.2 HF 2x6 @ wall ends

Check Anchors

z = 1922.4 lb/bolt (NDS Table 11E, ts=1 1/2in, 5/8", HF)

S = 3.51 ft

Use 5/8in anchor bolts @ 36in

Check Holddowns

Fto = 716 lbs Net Uplift

Use STHD14RJ

Check Deflections

Ga = 14 Cd = 4 (ASCE 7-10 12.8.6)

Wall Deflection = 2.06 in Allowable Deflection =.02H = 2.16 in

Meets deflection criteria

Permit Number: 20-03414

South/Interior Garage Wall (Main Floor) (Segmented Method) (Seismic)

H =	9	ft	(Wall height)
W =	22.66	ft	(Wall width)
Wf =	22.66	ft	(Wall width w/ full height sheathing)
F =	6211.5	lbs	(Horizontal load)
w =	178.5	lb/ft	(Vertical load)
	F		(Attatchment)

Check Shear

ρ = 1.3

v = 356 lb/ft   vs = 384 lb/ft (SDPWS Table 4.3A)

φ = 0.8

Use 7/16in sheathing w/ 8d nails@ 6in edge spacing

Check Studs

Co = 100.0%

T = C = 2467.07 lb   Try 2"x6"   A = 8.25 in^2

fc = 299.04 psi   Fc' = 2080 psi   Works

ft = 299.04 psi   Ft' = 1260 psi   Works

Use No.2 HF 2x6 @ wall ends

Check Anchors

z = 1922.4 lb/bolt   (NDS Table 11E, ts=1 1/2in, 5/8", HF)

S = 5.39 ft

Use 5/8in anchor bolts @ 48in

Check Holddowns

Fto = 2731 lbs   Net Uplift

Use STHD14RJ or HDU2

Check Deflections

Ga = 11   Cd = 4   (ASCE 7-10 12.8.6)

Wall Deflection = 1.60 in   Allowable Deflection =.02H = 2.16 in

Meets deflection criteria

SouthGarage Wall (Main Floor) (APA Portal Frame) (Seismic)

F =	1356.6	lbs	(Allowable)
Allowable Per Panel =	1300	lbs	
# of Panels =	4		
Total Resistance =	5200	lbs	

East Wall (House) (Perforated Method) (Seismic)

H =	9	ft	(Wall height)
W =	44	ft	(Wall width)
Wf =	35	ft	(Wall width w/ full height sheathing)
F =	4720.8	lbs	(Horizontal load)
w =	73.5	lb/ft	(Vertical load)
	F		(Attatchment)

Check Shear

ρ = 1.3

v = 254 lb/ft   vs = 384 lb/ft (SDPWS Table 4.3A)

φ = 0.8

Use 7/16in sheathing w/ 8d nails@ 6in edge spacing

Check Studs

Co = 69.0%

T = C = 1399.44 lb   Try 2"x6"   A = 8.25 in^2

fc = 169.63	psi	Fc' = 2080	psi	Works
ft = 169.63	psi	Ft' = 1260	psi	Works

Use No.2 HF 2x6 @ wall ends

Check Anchors

z = 1922.4 lb/bolt   (NDS Table 11E, ts=1 1/2in, 5/8", HF)

S = 7.56 ft

Use 5/8in anchor bolts @ 48in

Check Holddowns

Fto = 202 lbs   Net Uplift

No Holdown Required

Check Deflections

Ga = 11   Cd = 4   (ASCE 7-10 12.8.6)

Wall Deflection = 1.05 in   Allowable Deflection =.02H = 2.16 in

Meets deflection criteria

East Wall (House) (Perforated Method) (Seismic)

H =	9	ft	(Wall height)
W =	36.5	ft	(Wall width)
Wf =	31.5	ft	(Wall width w/ full height sheathing)
F =	4720.8	lbs	(Horizontal load)
w =	73.5	lb/ft	(Vertical load)
	F		(Attatchment)

Check Shear

ρ = 1.3

v = 260 lb/ft   vs = 384 lb/ft (SDPWS Table 4.3A)

φ = 0.8

Use 7/16in sheathing w/ 8d nails@ 6in edge spacing

Check Studs

Co = 75.0%

T = C = 1552.03 lb   Try 2"x6"   A = 8.25 in^2

fc = 188.13	psi	Fc' = 2080	psi	Works
ft = 188.13	psi	Ft' = 1260	psi	Works

Use No.2 HF 2x6 @ wall ends

Check Anchors

z = 1922.4 lb/bolt   (NDS Table 11E, ts=1 1/2in, 5/8", HF)

S = 7.40 ft

Use 5/8in anchor bolts @ 48in

Check Holddowns

Fto = 676 lbs   Net Uplift

No Holdown Required

Check Deflections

Ga = 11   Cd = 4   (ASCE 7-10 12.8.6)

Wall Deflection = 1.11 in   Allowable Deflection =.02H = 2.16 in

Meets deflection criteria

Permit Number: 20-03414

East/West Wall (Garage, Main Floor) (Segmented Method) (Seismic)

H =	9 ft	(Wall height)
W =	20 ft	(Wall width)
Wf =	20 ft	(Wall width w/ full height sheathing)
F =	1490.8 lbs	(Horizontal load)
w =	63 lb/ft	(Vertical load)
	F	(Attatchment)

Check Shear

ρ = 1.3

v = 97 lb/ft vs = 384 lb/ft (SDPWS Table 4.3A)

φ = 0.8

Use 7/16in sheathing w/ 8d nails@ 6in edge spacing

Check Studs

Co = 100.0%

T = C = 670.85 lb Try 2"x6" A = 8.25 in^2

fc = 81.31	psi	Fc' = 2080	psi	Works
ft = 81.31	psi	Ft' = 1260	psi	Works

Use No.2 HF 2x6 @ wall ends

Check Anchors

z = 1922.4 lb/bolt (NDS Table 11E, ts=1 1/2in, 5/8", HF)

S = 19.84 ft

Use 5/8in anchor bolts @ 48in

Check Holddowns

Fto = 242 lbs Net Uplift

No Holdown Required

Check Deflections

Ga = 11 Cd = 4 (ASCE 7-10 12.8.6)

Wall Deflection = 0.78 in Allowable Deflection =.02H = 2.16 in

Meets deflection criteria

Permit Number: 20-03414

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

Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 28 SEP 2018, 1:55PM

Multiple Simple Beam

File = \\SERVER\Shared Folders\Users\nlevengood\KH2340\KH2340.ec6 .
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Description :

Wood Beam Design : Garage Door Header

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **3.5x12, GLB, Fully Braced**
Using Load Resistance Factor Design with IBC 2018 Load Combinations, Major Axis Bending

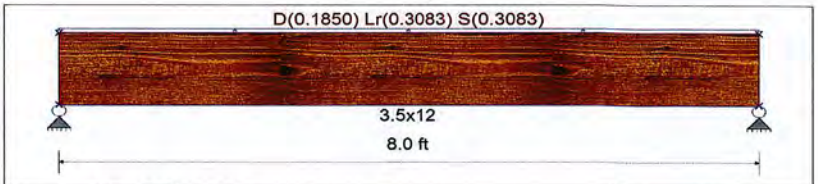
Wood Species :	DF/DF			Wood Grade : 24F - V4					
Fb - Tension	2400 psi	Fc - Prll	1650 psi	Fv	265 psi	Ebend- xx	1800 ksi	Density	31.2 pcf
Fb - Compr	1850 psi	Fc - Perp	650 psi	Ft	1100 psi	Eminbend - xx	950 ksi		

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0150, Lr = 0.0250, S = 0.0250 k/ft, Trib= 12.330 ft

Design Summary

Max fb/Fb Ratio = **0.200** : 1
fb : Actual : 829.78 psi at 4.000 ft in Span # 1
Fb : Allowable : 4,147.20 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H
Max fv/FvRatio = **0.171** : 1
fv : Actual : 78.14 psi at 0.000 ft in Span # 1
Fv : Allowable : 457.92 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H



Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.78		1.23	1.23			
Right Support	0.78		1.23	1.23			

Max Deflections

Transient Downward	0.031 in	Total Downward	0.051 in
Ratio	3049 >360	Ratio	1871 >180
	LC: Lr Only		LC: +D+Lr+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : Entry Roof Beam

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **6x10, Sawn, Fully Braced**
Using Load Resistance Factor Design with IBC 2018 Load Combinations, Major Axis Bending

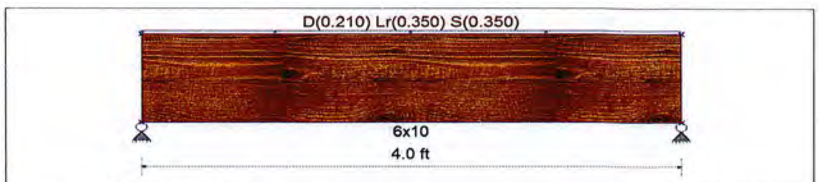
Wood Species :	Hem Fir			Wood Grade : No.2					
Fb - Tension	850 psi	Fc - Prll	1300 psi	Fv	150 psi	Ebend- xx	1300 ksi	Density	26.83 pcf
Fb - Compr	850 psi	Fc - Perp	405 psi	Ft	525 psi	Eminbend - xx	470 ksi		

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0150, Lr = 0.0250, S = 0.0250 k/ft, Trib= 14.0 ft

Design Summary

Max fb/Fb Ratio = **0.163** : 1
fb : Actual : 238.95 psi at 2.000 ft in Span # 1
Fb : Allowable : 1,468.80 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H
Max fv/FvRatio = **0.111** : 1
fv : Actual : 28.69 psi at 0.000 ft in Span # 1
Fv : Allowable : 259.20 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H



Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.44		0.70	0.70			
Right Support	0.44		0.70	0.70			

Max Deflections

Transient Downward	0.004 in	Total Downward	0.006 in
Ratio	9999 >360	Ratio	7432 >180
	LC: Lr Only		LC: +D+Lr+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Permit Number: 20-03414

Multiple Simple Beam

Wood Beam Design : Patio Beam

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **6.75x12, GLB, Fully Braced**
Using Load Resistance Factor Design with IBC 2018 Load Combinations, Major Axis Bending

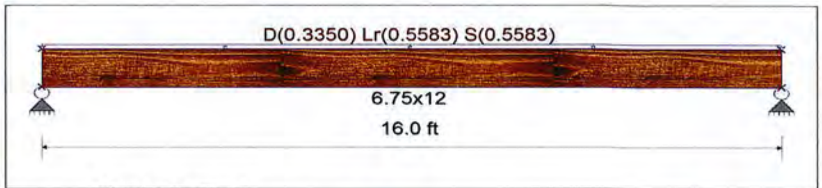
Wood Species : DF/DF   Wood Grade : 24F - V4

Fb - Tension	2,400.0 psi	Fc - Prll	1,650.0 psi	Fv	265.0 psi	Ebend- xx	1,800.0 ksi	Density	31.20 pcf
Fb - Compr	1,850.0 psi	Fc - Perp	650.0 psi	Ft	1,100.0 psi	Eminbend - xx	950.0 ksi		

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0150, Lr = 0.0250, S = 0.0250 k/ft, Trib= 22.330 ft

Design Summary



Max fb/Fb Ratio = **0.753** : 1
fb : Actual : 3,119.88 psi at 8.000 ft in Span # 1
Fb : Allowable : 4,145.76 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H
Max fv/FvRatio = **0.375** : 1
fv : Actual : 171.59 psi at 0.000 ft in Span # 1
Fv : Allowable : 457.92 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	2.82		4.47	4.47			
Right Support	2.82		4.47	4.47			

Max Deflections

Transient Downward	0.473 in	Total Downward	0.772 in
Ratio	405 >360	Ratio	248 >180
	LC: Lr Only		LC: +D+Lr+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : Patio Roof Beam

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **5.5x9, GLB, Fully Braced**
Using Load Resistance Factor Design with IBC 2018 Load Combinations, Major Axis Bending

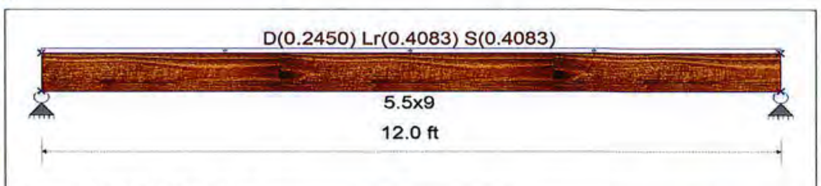
Wood Species : DF/DF   Wood Grade : 24F - V4

Fb - Tension	2,400.0 psi	Fc - Prll	1,650.0 psi	Fv	265.0 psi	Ebend- xx	1,800.0 ksi	Density	31.20 pcf
Fb - Compr	1,850.0 psi	Fc - Perp	650.0 psi	Ft	1,100.0 psi	Eminbend - xx	950.0 ksi		

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0150, Lr = 0.0250, S = 0.0250 k/ft, Trib= 16.330 ft

Design Summary



Max fb/Fb Ratio = **0.673** : 1
fb : Actual : 2,792.76 psi at 6.000 ft in Span # 1
Fb : Allowable : 4,147.20 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H
Max fv/FvRatio = **0.335** : 1
fv : Actual : 153.60 psi at 11.280 ft in Span # 1
Fv : Allowable : 457.92 psi
Load Comb : +1.20D+1.60Lr+0.50L+1.60H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	1.53		2.45	2.45			
Right Support	1.53		2.45	2.45			

Max Deflections

Transient Downward	0.318 in	Total Downward	0.518 in
Ratio	452 >360	Ratio	278 >180
	LC: Lr Only		LC: +D+Lr+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Permit Number: 20-03414

Multiple Simple Beam

Wood Beam Design : Floor Joists

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

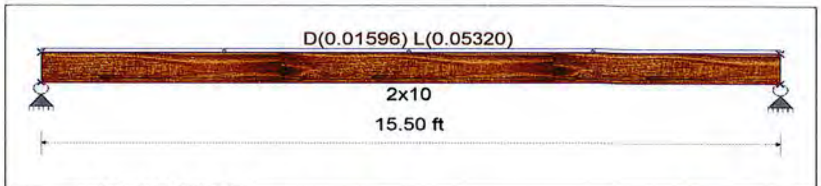
BEAM Size : **2x10, Sawn, Fully Braced**
Using Load Resistance Factor Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir - Larch				Wood Grade : No.2				
Fb - Tension	900 psi	Fc - Prll	1350 psi	Fv	180 psi	Ebend- xx	1600 ksi	Density	31.2 pcf
Fb - Compr	900 psi	Fc - Perp	625 psi	Ft	575 psi	Eminbend - xx	580 ksi		

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0120, L = 0.040 k/ft, Trib= 1.330 ft

Design Summary



Max fb/Fb Ratio = **0.924** : 1
fb : Actual : 1,817.48 psi at 7.750 ft in Span # 1
Fb : Allowable : 1,967.33 psi
Load Comb : +1.20D+0.50Lr+1.60L+1.60H
Max fv/FvRatio = **0.263** : 1
fv : Actual : 81.95 psi at 14.777 ft in Span # 1
Fv : Allowable : 311.04 psi
Load Comb : +1.20D+0.50Lr+1.60L+1.60H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.15	0.41					
Right Support	0.15	0.41					

Max Deflections

Transient Downward	0.439 in	Total Downward	0.595 in
Ratio	423 >360	Ratio	312 >180
	LC: L Only		LC: +D+L+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : Floor Joists

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

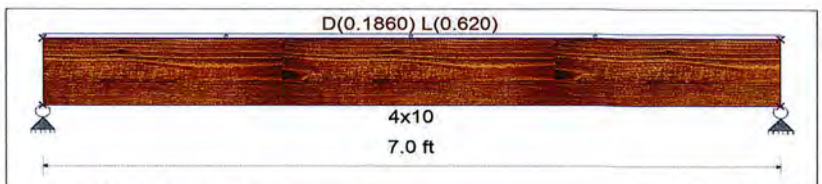
BEAM Size : **4x10, Sawn, Fully Braced**
Using Load Resistance Factor Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species :	Hem Fir				Wood Grade : No.2				
Fb - Tension	850 psi	Fc - Prll	1300 psi	Fv	150 psi	Ebend- xx	1300 ksi	Density	26.83 pcf
Fb - Compr	850 psi	Fc - Perp	405 psi	Ft	525 psi	Eminbend - xx	470 ksi		

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0120, L = 0.040 k/ft, Trib= 15.50 ft

Design Summary



Max fb/Fb Ratio = **0.888** : 1
fb : Actual : 1,800.17 psi at 3.500 ft in Span # 1
Fb : Allowable : 2,026.94 psi
Load Comb : +1.20D+0.50Lr+1.60L+1.60H
Max fv/FvRatio = **0.597** : 1
fv : Actual : 154.62 psi at 6.230 ft in Span # 1
Fv : Allowable : 259.20 psi
Load Comb : +1.20D+0.50Lr+1.60L+1.60H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.67	2.17					
Right Support	0.67	2.17					

Max Deflections

Transient Downward	0.112 in	Total Downward	0.147 in
Ratio	748 >360	Ratio	571 >180
	LC: L Only		LC: +D+L+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

General Footing

Description : 36" Footing

Code References

Calculations per ACI 318-14, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2018

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.5 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

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

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

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

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	0.0 ksf
when max. length or width is greater than	=	0.0 ft

Dimensions

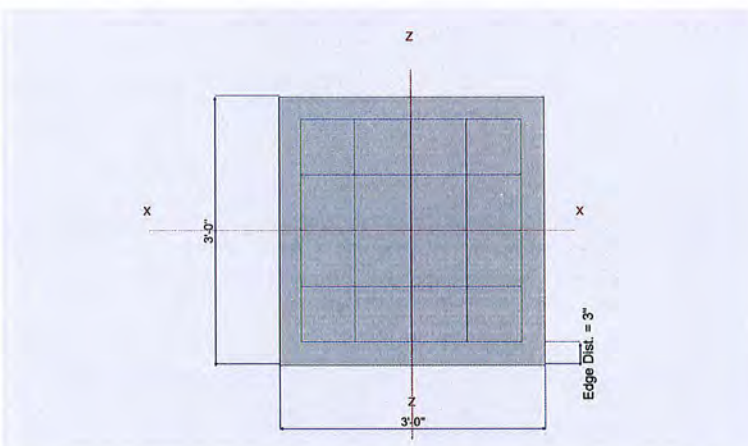
Width parallel to X-X Axis	=	3 ft
Length parallel to Z-Z Axis	=	3.0 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	0.0 in
pz : parallel to Z-Z Axis	=	0.0 in
Height	=	0.0 in

Rebar Centerline to Edge of Concrete...

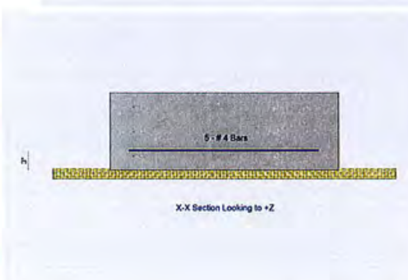
at Bottom of footing	=	3.0 in

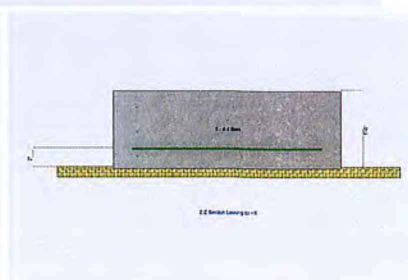


Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars		5
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis		
Number of Bars	=	5
Reinforcing Bar Size	=	# 4

Bandwidth Distribution Check (ACI 15.4.4.2)
Direction Requiring Closer Separation n/a
Bars required within zone n/a
Bars required on each side of zone n/a





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.80	6.30	0.0	6.30	0.0	0.0	0.0	k
OB : Overburden	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ksf
M-xx	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
M-zz	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	k-ft
V-x	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	k
V-z	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	k

General Footing

Lic. # : KW-06002029 **Licensee : OLSON & ASSOCIATES**

Description : 36" Footing

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8447	Soil Bearing	1.267 ksf	1.50 ksf	+D+S+H about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1417	Z Flexure (+X)	1.830 k-ft/ft	12.912 k-ft/ft	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.1417	Z Flexure (-X)	1.830 k-ft/ft	12.912 k-ft/ft	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.1417	X Flexure (+Z)	1.830 k-ft/ft	12.912 k-ft/ft	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.1417	X Flexure (-Z)	1.830 k-ft/ft	12.912 k-ft/ft	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.1506	1-way Shear (+X)	11.296 psi	75.0 psi	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.1506	1-way Shear (-X)	11.296 psi	75.0 psi	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.1506	1-way Shear (+Z)	11.296 psi	75.0 psi	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.1506	1-way Shear (-Z)	11.296 psi	75.0 psi	+1.20D+1.60Lr+0.50L+1.60H
PASS	0.2824	2-way Punching	42.361 psi	150.0 psi	+1.20D+1.60Lr+0.50L+1.60H

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location: Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, +D+H	1.50	n/a	0.0	0.5672	0.5672	n/a	n/a	0.378
X-X, +D+L+H	1.50	n/a	0.0	0.5672	0.5672	n/a	n/a	0.378
X-X, +D+Lr+H	1.50	n/a	0.0	1.267	1.267	n/a	n/a	0.845
X-X, +D+S+H	1.50	n/a	0.0	1.267	1.267	n/a	n/a	0.845
X-X, +D+0.750Lr+0.750L+H	1.50	n/a	0.0	1.092	1.092	n/a	n/a	0.728
X-X, +D+0.750L+0.750S+H	1.50	n/a	0.0	1.092	1.092	n/a	n/a	0.728
X-X, +D+0.60W+H	1.50	n/a	0.0	0.5672	0.5672	n/a	n/a	0.378
X-X, +D+0.70E+H	1.50	n/a	0.0	0.5672	0.5672	n/a	n/a	0.378
X-X, +D+0.750Lr+0.750L+0.450W+H	1.50	n/a	0.0	1.092	1.092	n/a	n/a	0.728
X-X, +D+0.750L+0.750S+0.450W+H	1.50	n/a	0.0	1.092	1.092	n/a	n/a	0.728
X-X, +D+0.750L+0.750S+0.5250E+H	1.50	n/a	0.0	1.092	1.092	n/a	n/a	0.728
X-X, +0.60D+0.60W+0.60H	1.50	n/a	0.0	0.3403	0.3403	n/a	n/a	0.227
X-X, +0.60D+0.70E+0.60H	1.50	n/a	0.0	0.3403	0.3403	n/a	n/a	0.227
Z-Z, +D+H	1.50	0.0	n/a	n/a	n/a	0.5672	0.5672	0.378
Z-Z, +D+L+H	1.50	0.0	n/a	n/a	n/a	0.5672	0.5672	0.378
Z-Z, +D+Lr+H	1.50	0.0	n/a	n/a	n/a	1.267	1.267	0.845
Z-Z, +D+S+H	1.50	0.0	n/a	n/a	n/a	1.267	1.267	0.845
Z-Z, +D+0.750Lr+0.750L+H	1.50	0.0	n/a	n/a	n/a	1.092	1.092	0.728
Z-Z, +D+0.750L+0.750S+H	1.50	0.0	n/a	n/a	n/a	1.092	1.092	0.728
Z-Z, +D+0.60W+H	1.50	0.0	n/a	n/a	n/a	0.5672	0.5672	0.378
Z-Z, +D+0.70E+H	1.50	0.0	n/a	n/a	n/a	0.5672	0.5672	0.378
Z-Z, +D+0.750Lr+0.750L+0.450W+H	1.50	0.0	n/a	n/a	n/a	1.092	1.092	0.728
Z-Z, +D+0.750L+0.750S+0.450W+H	1.50	0.0	n/a	n/a	n/a	1.092	1.092	0.728
Z-Z, +D+0.750L+0.750S+0.5250E+H	1.50	0.0	n/a	n/a	n/a	1.092	1.092	0.728
Z-Z, +0.60D+0.60W+0.60H	1.50	0.0	n/a	n/a	n/a	0.3403	0.3403	0.227
Z-Z, +0.60D+0.70E+0.60H	1.50	0.0	n/a	n/a	n/a	0.3403	0.3403	0.227

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+1.60H	0.6650	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.40D+1.60H	0.6650	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	0.9638	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	0.9638	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60L+0.50S+1.60H	0.9638	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60L+0.50S+1.60H	0.9638	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60Lr+0.50L+1.60H	1.830	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60Lr+0.50L+1.60H	1.830	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	1.830	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	1.830	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK

General Footing

Description : 36" 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, +1.20D+0.50L+1.60S+1.60H	1.830	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50L+1.60S+1.60H	1.830	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60S+0.50W+1.60H	1.830	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+1.60S+0.50W+1.60H	1.830	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50Lr+0.50L+W+1.60H	0.9638	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50Lr+0.50L+W+1.60H	0.9638	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50L+0.50S+W+1.60H	0.9638	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50L+0.50S+W+1.60H	0.9638	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50L+0.70S+E+1.60H	1.121	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +1.20D+0.50L+0.70S+E+1.60H	1.121	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +0.90D+W+0.90H	0.4275	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +0.90D+W+0.90H	0.4275	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +0.90D+E+0.90H	0.4275	+Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
X-X, +0.90D+E+0.90H	0.4275	-Z	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.40D+1.60H	0.6650	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.40D+1.60H	0.6650	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	0.9638	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	0.9638	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	0.9638	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	0.9638	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60Lr+0.50L+1.60H	1.830	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60Lr+0.50L+1.60H	1.830	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	1.830	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	1.830	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50L+1.60S+1.60H	1.830	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50L+1.60S+1.60H	1.830	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	1.830	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	1.830	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50Lr+0.50L+W+1.60H	0.9638	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50Lr+0.50L+W+1.60H	0.9638	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50L+0.50S+W+1.60H	0.9638	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50L+0.50S+W+1.60H	0.9638	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50L+0.70S+E+1.60H	1.121	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +1.20D+0.50L+0.70S+E+1.60H	1.121	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +0.90D+W+0.90H	0.4275	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +0.90D+W+0.90H	0.4275	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +0.90D+E+0.90H	0.4275	-X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK
Z-Z, +0.90D+E+0.90H	0.4275	+X	Bottom	0.2592	Min Temp %	0.3333	12.912	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	4.11 psi	4.11 psi	4.11 psi	4.11 psi	4.11 psi	75.00 psi	0.05	OK
+1.20D+0.50Lr+1.60L+1.60H	5.95 psi	5.95 psi	5.95 psi	5.95 psi	5.95 psi	75.00 psi	0.08	OK
+1.20D+1.60L+0.50S+1.60H	5.95 psi	5.95 psi	5.95 psi	5.95 psi	5.95 psi	75.00 psi	0.08	OK
+1.20D+1.60Lr+0.50L+1.60H	11.30 psi	11.30 psi	11.30 psi	11.30 psi	11.30 psi	75.00 psi	0.15	OK
+1.20D+1.60Lr+0.50W+1.60H	11.30 psi	11.30 psi	11.30 psi	11.30 psi	11.30 psi	75.00 psi	0.15	OK
+1.20D+0.50L+1.60S+1.60H	11.30 psi	11.30 psi	11.30 psi	11.30 psi	11.30 psi	75.00 psi	0.15	OK
+1.20D+1.60S+0.50W+1.60H	11.30 psi	11.30 psi	11.30 psi	11.30 psi	11.30 psi	75.00 psi	0.15	OK
+1.20D+0.50Lr+0.50L+W+1.60H	5.95 psi	5.95 psi	5.95 psi	5.95 psi	5.95 psi	75.00 psi	0.08	OK
+1.20D+0.50L+0.50S+W+1.60H	5.95 psi	5.95 psi	5.95 psi	5.95 psi	5.95 psi	75.00 psi	0.08	OK
+1.20D+0.50L+0.70S+E+1.60H	6.92 psi	6.92 psi	6.92 psi	6.92 psi	6.92 psi	75.00 psi	0.09	OK
+0.90D+W+0.90H	2.64 psi	2.64 psi	2.64 psi	2.64 psi	2.64 psi	75.00 psi	0.04	OK
+0.90D+E+0.90H	2.64 psi	2.64 psi	2.64 psi	2.64 psi	2.64 psi	75.00 psi	0.04	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	15.39 psi	150.00psi	0.1026	OK
+1.20D+0.50Lr+1.60L+1.60H	22.31 psi	150.00psi	0.1487	OK
+1.20D+1.60L+0.50S+1.60H	22.31 psi	150.00psi	0.1487	OK
+1.20D+1.60Lr+0.50L+1.60H	42.36 psi	150.00psi	0.2824	OK
+1.20D+1.60Lr+0.50W+1.60H	42.36 psi	150.00psi	0.2824	OK
+1.20D+0.50L+1.60S+1.60H	42.36 psi	150.00psi	0.2824	OK

Permit Number: 20-03414

General Footing

Description : 36" Footing

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.20D+1.60S+0.50W+1.60H	42.36 psi	150.00 psi	0.2824	OK
+1.20D+0.50Lr+0.50L+W+1.60H	22.31 psi	150.00 psi	0.1487	OK
+1.20D+0.50L+0.50S+W+1.60H	22.31 psi	150.00 psi	0.1487	OK
+1.20D+0.50L+0.70S+E+1.60H	25.96 psi	150.00 psi	0.173	OK
+0.90D+W+0.90H	9.90 psi	150.00 psi	0.06597	OK
+0.90D+E+0.90H	9.90 psi	150.00 psi	0.06597	OK