STRUCTURAL CALCULATIONS

For

640 West Main Street

Lake Geneva, Wisconsin

by

United Building Solutions

(Professional Engineer seal: WISCONSIN / KURT D. FREY / E-24431 / MADISON WI / PROFESSIONAL ENGINEER, signed 5.2.2017)

Date: May 2, 2017

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www.struware.com

Code Search

Code: International Building Code 2009

Occupancy:

Occupancy Group = R   Residential

Occupancy Category & Importance Factors:

Occupancy Category = II

Wind factor = 1.00
Snow factor = 1.00
Seismic factor = 1.00

Type of Construction:

Fire Rating:

Roof = 0.0 hr
Floor = 0.0 hr

Building Geometry:

Roof angle (θ)	6.00 / 12	26.6 deg
Building length (L)	50.0 ft	
Least width (B)	40.0 ft	
Mean Roof Ht (h)	28.0 ft	
Parapet ht above grd	0.0 ft	
Minimum parapet ht	0.0 ft	

Live Loads:

Roof
0 to 200 sf: 18 psf
200 to 600 sf: 21.6 - 0.018Area, but not less than 12 psf
over 600 sf: 12 psf

Floor:

Typical Floor	40 psf
Partitions	15 psf
Public rooms & corridors serving the	100 psf
Corridors above first floor	80 psf
Balconies (exterior) - same as occup	40 psf
Storage warehouses: Light	125 psf

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Wind Loads :   ASCE 7 - 05

Basic Wind Speed	90 mph
Importance Factor	1.00
Occupancy Category	II
Exposure Category	C
Enclosure Classif.	Enclosed Building
Internal pressure	+/-0.18
Directionality (Kd)	0.85
Kh case 1	0.968
Kh case 2	0.968
Type of roof	Gable

Topographic Factor (Kzt)

Topography		Flat
Hill Height	(H)	80.0 ft
Half Hill Length (Lh)		100.0 ft
Actual H/Lh	=	0.80
Use H/Lh	=	0.50
Modified Lh	=	160.0 ft
From top of crest: x =		50.0 ft
Bldg up/down wind?		downwind

H/Lh= 0.50	K_1 = 0.000	
x/Lh = 0.31	K_2 = 0.792	
z/Lh = 0.18	K_3 = 1.000	

At Mean Roof Ht:

$$Kzt = (1+K_1 K_2 K_3)^2 = 1.00$$

ESCARPMENT

2D RIDGE or 3D AXISYMMETRICAL HILL
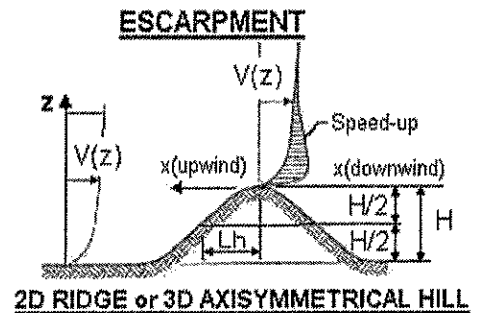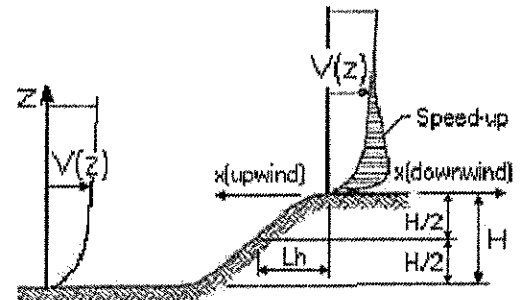
Gust Effect Factor

h =	28.0 ft
B =	40.0 ft
I_z (0.6h) =	16.8 ft

Flexible structure if natural frequency < 1 Hz (T > 1 second).
However, if building h/B < 4 then probably rigid structure (rule of thumb).
h/B = 0.70   Rigid structure

G =   0.85 Using rigid structure default

Rigid Structure

$\bar{e}$ =	0.20
ℓ =	500 ft
z_{min} =	15 ft
c =	0.20
g_Q, g_v =	3.4
L_z =	436.8 ft
Q =	0.91
I_z =	0.22
G =	0.88 use G = 0.85

Flexible or Dynamically Sensitive Structure

Natural Frequency (η_1) =	0.0 Hz				
Damping ratio (β) =	0				
I_b =	0.65				
I_α =	0.15				
Vz =	77.3				
N_1 =	0.00				
R_n =	0.000				
R_h =	28.282	η =	0.000	h =	28.0 ft
R_B =	28.282	η =	0.000		
R_L =	28.282	η =	0.000		
g_R =	0.000				
R =	0.000				
G =	0.000				

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Enclosure Classification

Test for Enclosed Building: A building that does not qualify as open or partially enclosed.

Test for Open Building: All walls are at least 80% open.
Ao ≥ 0.8Ag

Test for Partially Enclosed Building:

	Input			Test	
Ao	100000.0	sf	Ao ≥ 1.1Aoi	YES	
Ag	0.0	sf	Ao > 4' or 0.01Ag	YES	
Aoi	0.0	sf	Aoi / Agi ≤ 0.20	NO	Building is NOT
Agi	0.0	sf			Partially Enclosed

ERROR: Ag must be greater than Ao
Conditions to qualify as Partially Enclosed Building. Must satisfy all of the following:
 Ao ≥ 1.1Aoi
 Ao > smaller of 4' or 0.01 Ag
 Aoi / Agi ≤ 0.20
Where:
Ao = the total area of openings in a wall that receives positive external pressure.
Ag = the gross area of that wall in which Ao is identified.
Aoi = the sum of the areas of openings in the building envelope (walls and roof) not including Ao.
Agi = the sum of the gross surface areas of the building envelope (walls and roof) not including Ag.

Reduction Factor for large volume partially enclosed buildings (Ri) :

If the partially enclosed building contains a single room that is unpartitioned , the internal
pressure coefficient may be multiplied by the reduction factor Ri.

Total area of all wall & roof openings (Aog):   0 sf
Unpartitioned internal volume (Vi) :   0 cf
                                             Ri =   1.00

Altitude adjustment to constant 0.00256 (caution - see code) :

Altitude =   0 feet   Average Air Density =   0.0765 lbm/ft^3
Constant =   0.00256

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Wind Loads - MWFRS h≤60' (Low-rise Buildings) Enclosed/partially enclosed only

Kz = Kh (case 1) =	0.97	
Base pressure (qh) =	**17.1 psf**	
GCpi =	+/-0.18	

Edge Strip (a) =   4.0 ft
End Zone (2a) =   8.0 ft
Zone 2 length =   20.0 ft

Wind Pressure Coefficients

Surface	Transverse Direction			Longitudinal Direction			
	Perpendicular θ = 26.6 deg			Parallel θ = 0.0			
	GCpf	w/-GCpi	w/+GCpi	GCpf	w/-Gcpi	w/+GCpi	
1	0.55	0.73	0.37	0.40	0.58	0.22	
2	-0.10	0.08	-0.28	-0.69	-0.51	-0.87	
3	-0.45	-0.27	-0.63	-0.37	-0.19	-0.55	
4	-0.39	-0.21	-0.57	-0.29	-0.11	-0.47	
5	-0.45	-0.27	-0.63	-0.45	-0.27	-0.63	
6	-0.45	-0.27	-0.63	-0.45	-0.27	-0.63	
1E	0.73	0.91	0.55	0.61	0.79	0.43	
2E	-0.19	-0.01	-0.37	-1.07	-0.89	-1.25	
3E	-0.58	-0.40	-0.76	-0.53	-0.35	-0.71	
4E	-0.53	-0.35	-0.71	-0.43	-0.25	-0.61	

Nominal Wind Surface Pressures (psf)

1	12.5	6.3		9.9	3.8	
2	1.4	-4.8		-8.7	-14.8	
3	-4.6	-10.7		-3.2	-9.4	
4	-3.6	-9.7		-1.9	-8.0	
5	-4.6	-10.7		-4.6	-10.7	
6	-4.6	-10.7		-4.6	-10.7	
1E	15.5	9.3		13.5	7.3	
2E	-0.2	-6.3		-15.2	-21.3	
3E	-6.9	-13.1		-6.0	-12.1	
4E	-6.1	-12.2		-4.3	-10.4	

Parapet

Windward parapet =   0.0 psf (GCpn = +1.5)
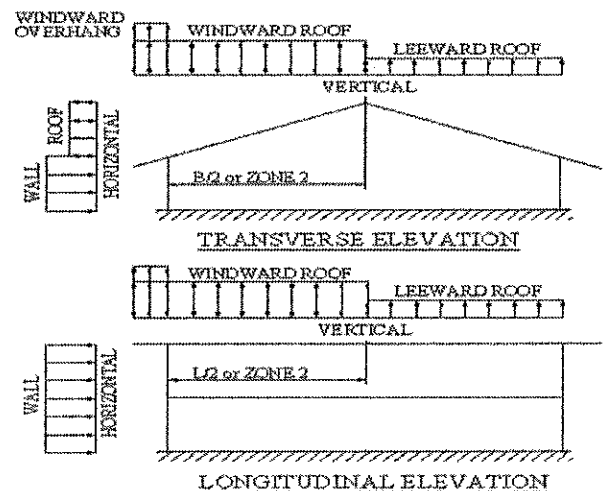Leeward parapet =   0.0 psf (GCpn = -1.0)

Windward roof
   overhangs =   11.6 psf (upward) add to
windward roof pressure

Horizontal MWFRS Simple Diaphragm Pressures (psf)

Transverse direction (normal to L)
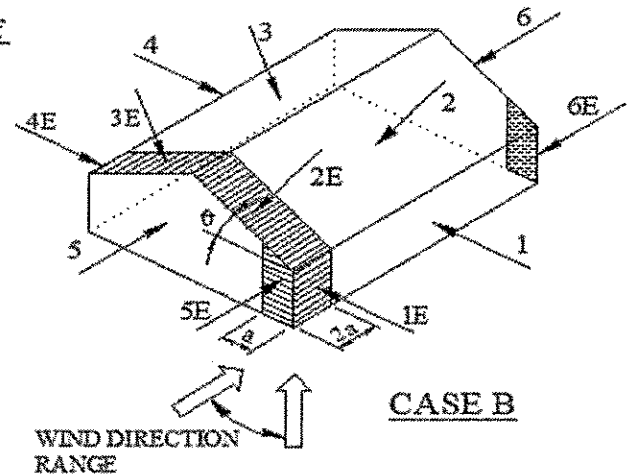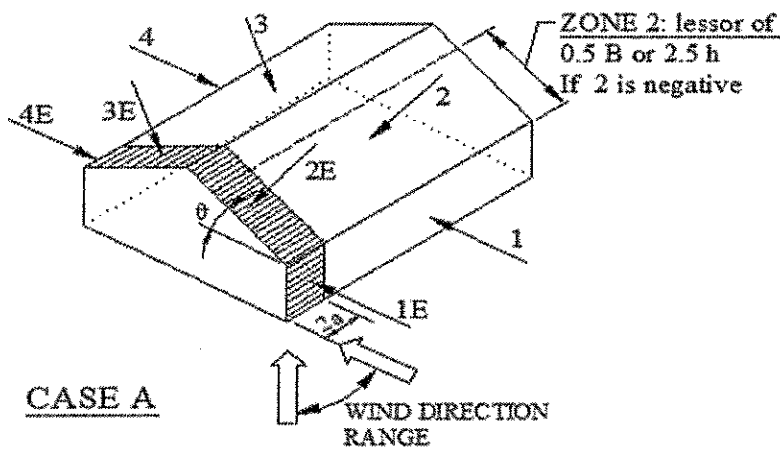Interior Zone: Wall   16.0 psf
                Roof   5.9 psf
End Zone: Wall   21.5 psf
              Roof   6.7 psf

Longitudinal direction (parallel to L)
Interior Zone: Wall   11.8 psf
End Zone: Wall   17.7 psf

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Location of MWFRS Wind Pressure Zones

ZONE 2: lessor of 0.5 B or 2.5 h If 2 is negative

CASE A — WIND DIRECTION RANGE

CASE B — WIND DIRECTION RANGE

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

ASCE 7 -99 and ASCE 7-10 (& later)

ZONE 2: lessor of 0.5 B or 2.5 h If 2 is negative

Transverse Direction

Longitudinal Direction

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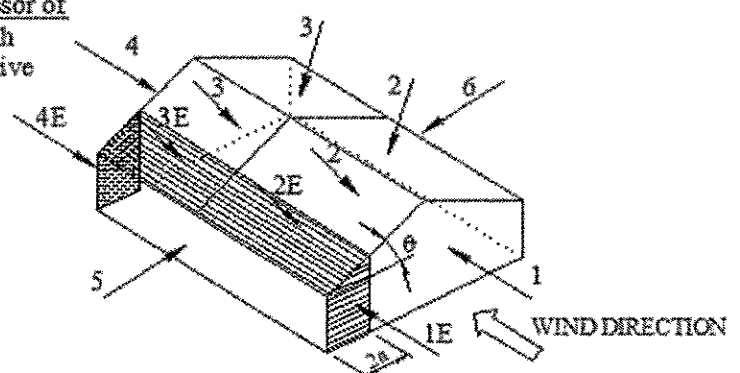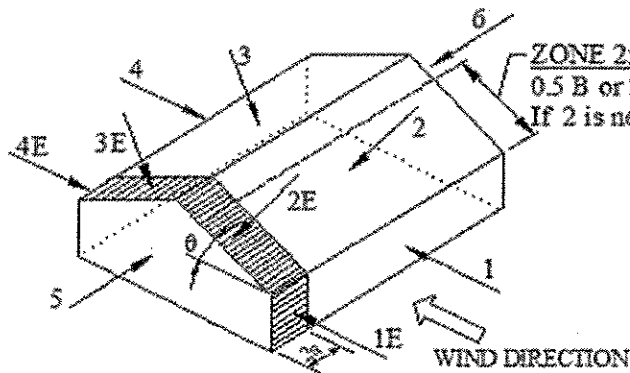
NOTE: Torsional loads are 25% of zones 1 - 4. See code for loading diagram.

ASCE 7 -02 and ASCE 7-05

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Nominal Wind Pressures

Wind Loads - Components & Cladding : h <= 60'

Kh (case 1) = 0.97	h =	28.0 ft
Base pressure (qh) = **17.1 psf**	a =	4.0 ft
Minimum parapet ht = 0.0 ft	GCpi =	+/-0.18
Roof Angle (θ) = 26.6 deg		
Type of roof = Gable		

Roof

Area	GCp +/- GCpi			Surface Pressure (psf)			User input	
	10 sf	50 sf	100 sf	10 sf	50 sf	100 sf	75 sf	500 sf
Negative Zone 1	-1.08	-1.01	-0.98	-18.4	-17.2	-16.7	-16.9	-16.7
Negative Zone 2	-1.88	-1.53	-1.38	-32.1	-26.1	-23.5	-24.6	-23.5
Negative Zone 3	-2.78	-2.36	-2.18	-47.4	-40.3	-37.2	-38.5	-37.2
Positive All Zones	0.68	0.54	0.48	11.6	10.0	10.0	10.0	10.0
Overhang Zone 2	-2.20	-2.20	-2.20	-37.5	-37.5	-37.5	-37.5	-37.5
Overhang Zone 3	-3.70	-2.86	-2.50	-63.1	-48.8	-42.7	-45.2	-42.7

Overhang pressures in the table above assume an internal pressure coefficient (Gcpi) of 0.0
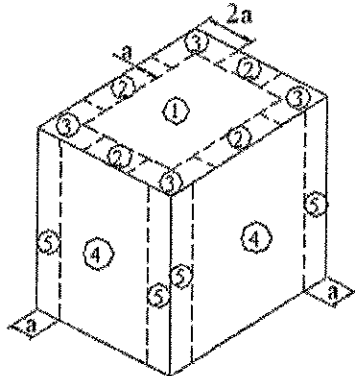
Parapet

qp = 0.0 psf

CASE A = pressure towards building (pos)
CASE B = pressure away from bldg (neg)

Solid Parapet Pressure	Surface Pressure (psf)			User input
	10 sf	100 sf	500 sf	40 sf
CASE A : Interior zone:	0.0	0.0	0.0	0.0
Corner zone:	0.0	0.0	0.0	0.0
CASE B : Interior zone:	0.0	0.0	0.0	0.0
Corner zone:	0.0	0.0	0.0	0.0

Walls

Area	GCp +/- GCpi			Surface Pressure (psf)			User input	
	10 sf	100 sf	500 sf	10 sf	100 sf	500 sf	25 sf	200 sf
Negative Zone 4	-1.28	-1.10	-0.98	-21.8	-18.8	-16.7	-20.6	-17.9
Negative Zone 5	-1.58	-1.23	-0.98	-27.0	-20.9	-16.7	-24.6	-19.1
Positive Zone 4 & 5	1.18	1.00	0.88	20.1	17.1	15.0	18.9	16.2

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Nominal Wind Pressures

Location of C&C Wind Pressure Zones

Roofs w/ θ ≤ 10°
and all walls
h > 60'
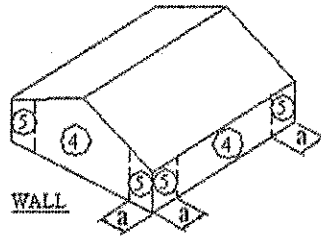
Walls h ≤ 60'
& alt design h<90'
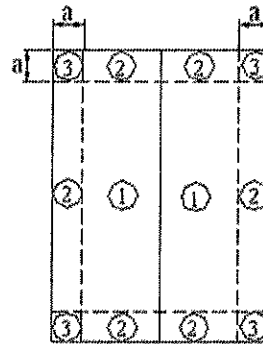
Gable, Sawtooth and
Multispan Gable θ ≤ 7 degrees &
Monoslope ≤ 3 degrees
h ≤ 60' & alt design h<90'
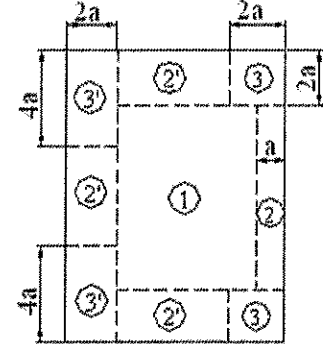
Monoslope roofs
3° < θ ≤ 10°
h ≤ 60' & alt design h<90'
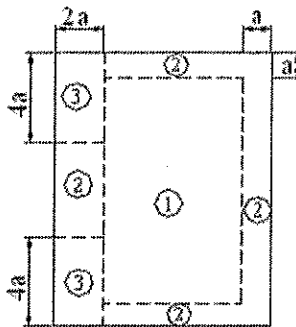
Monoslope roofs
10° < θ ≤ 30°
h ≤ 60' & alt design h<90'
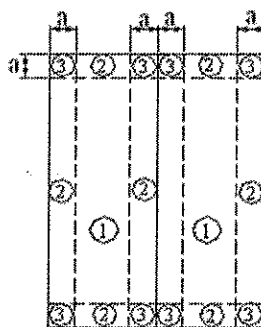
Multispan Gable &
Gable 7° < θ ≤ 45°

Hip 7° < θ ≤ 27°
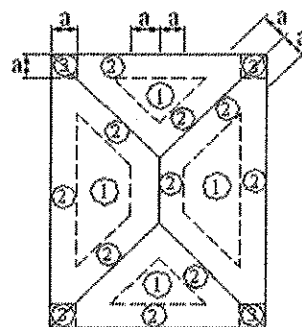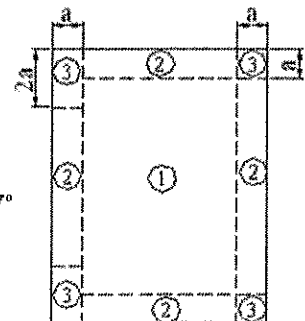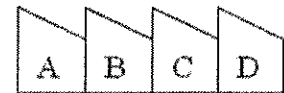
Sawtooth 10° < θ ≤ 45°
h ≤ 60' & alt design h<90'

Stepped roofs   θ ≤ 3°
h ≤ 60' & alt design h<90'

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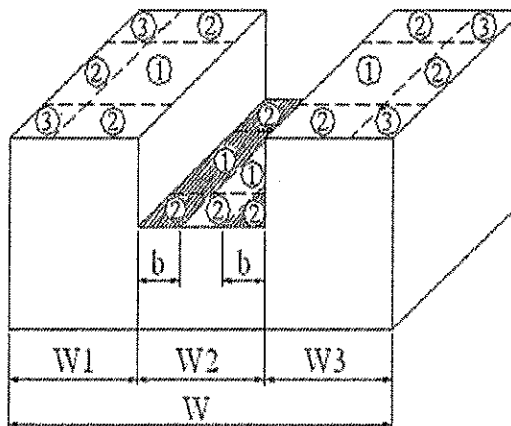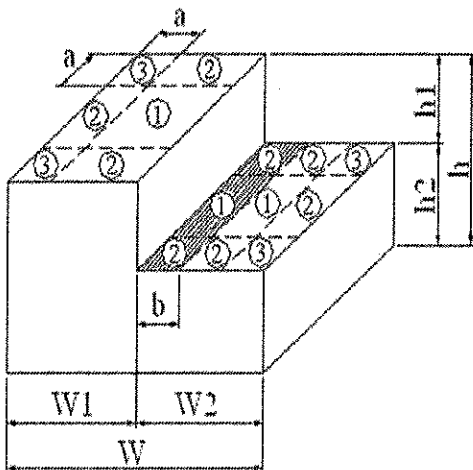
Snow Loads :   ASCE 7-05   Nominal Snow Forces

Roof slope	=	26.6 deg
Horiz. eave to ridge dist (W) =		20.0 ft
Roof length parallel to ridge (L) =		50.0 ft

Type of Roof		Hip and gable w/ trussed systems
Ground Snow Load	Pg =	30.0 psf
Occupancy Category	=	II
Importance Factor	I =	1.0
Thermal Factor	Ct =	1.10
Exposure Factor	Ce =	1.0

$Pf = 0.7*Ce*Ct*I*Pg$	=	23.1 psf
Unobstructed Slippery Surface		no

Sloped-roof Factor	Cs =	1.00
Balanced Snow Load	**Ps =**	**23.1 psf**

Rain on Snow Surcharge Angle		0.40 deg
Code Maximum Rain Surcharge		5.0 psf
Rain on Snow Surcharge	=	0.0 psf
Ps plus rain surcharge	=	23.1 psf
Minimum Snow Load	$Pfmin$ =	0.0 psf

|		
Uniform Roof Design Snow Load	=	**23.1 psf**

NOTE: Alternate spans of continuous beams and other areas shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code.

Unbalanced Snow Loads - for Hip & Gable roofs only

Required if slope is between	70.00 deg	
and larger of 2.38 degrees or 70/W + 0.5 =	4.00 deg	**Unbalanced snow loads must be applied**
Windward snow load =	6.9 psf	= 0.3Ps
Leeward snow load from ridge to 6.27' =	44.1 psf	= hdγ / √S + Ps
Leeward snow load from 6.27' to the eave =	23.1 psf	= Ps

Windward Snow Drifts 1 - Against walls, parapets, etc more than 15' long

Upwind fetch	lu =	10.0 ft
Projection height	h =	12.0 ft
Snow density	g =	17.9 pcf
Balanced snow height	hb =	1.29 ft
	hd =	1.25 ft
	hc =	10.71 ft
hc/hb >0.2 = 8.3	**Therefore, design for drift**	
Drift height (hd)	=	1.25 ft
Drift width	w =	4.99 ft
Surcharge load:	$pd = γ*hd$ =	**22.3 psf**
Balanced Snow load:	=	23.1 psf
		45.4 psf
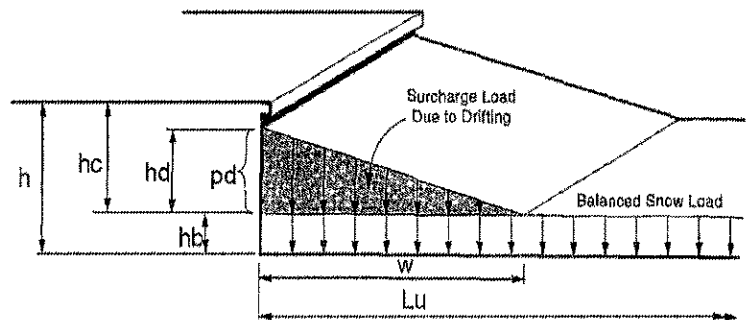
Windward Snow Drifts 2 - Against walls, parapets, etc > 15'

Upwind fetch	lu =	0.0 ft
Projection height	h =	0.0 ft
Snow density	g =	17.9 pcf
Balanced snow height	hb =	1.29 ft
	hd =	1.25 ft
	hc =	-1.29 ft
hc/hb <0.2 = -1.0	**Therefore, no drift**	
Drift height (hc)	=	0.00 ft
Drift width	w =	-10.32 ft
Surcharge load:	$pd = γ*hd$ =	**0.0 psf**
Balanced Snow load:	=	23.1 psf
		23.1 psf

Surcharge Load Due to Drifting
Balanced Snow Load

DESIGN DATA SUMMARY

GRAVITY LOADS

ROOF
SNOW = 30 psf
+ DRIFT AND/OR
UNBALANCE LOAD

DEAD = 20 psf

UNBALANCE SNOW

44.1 pss   23.1 psf
7 psf

6¹²/

6.3¹

28 FT

NOTE: UNIFORM
SNOW OF 30 psf
GOVERNS OVER UNBALANCE
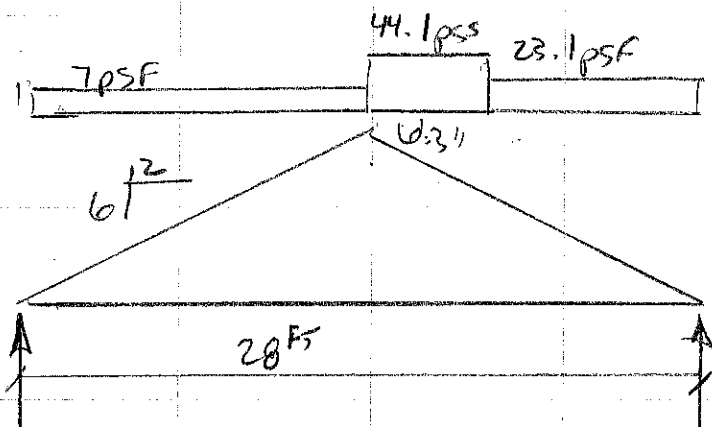
SNOW DRIFT @ FLAT AREA

SNOW DRIFT
= 23 psf

5 FT

11 FT
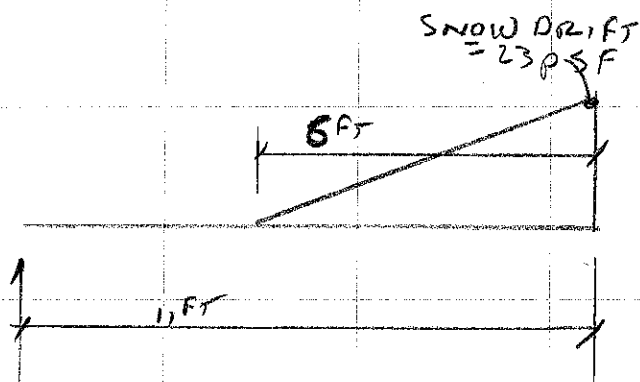
FLOOR

LIVE LOAD = 40 psf
DEAD LOAD = 15 psf
PARTITION = 15 psf

PATIO / DECKS

LIVE LOAD = 75 psf
DEAD LOAD = 15 psf

WIND

MWFRS = 17.2 psf

C & C = 22 psf (ZONE 4)
= 27 psf (ZONE 5)

FOUNDATION DESIGN
EARTH PRESSURES
ACTIVE = 35 psf/ft
AT REST = 55 psf/ft
ASSUMED ALLOWABLE SOIL BRG = 2000 psf

SERVICEABILITY

DEFLECTION LIMITS
ROOF
SNOW: $\Delta \leq L/360$

TOTAL $\Delta \leq L/240$

FLOOR

LIVE LOAD = $\Delta \leq L/480$
TOTAL LOAD = $\Delta \leq L/240$

NEW ROOF JOISTS

CRITICAL SPAN = 10'-6"

SPACING = 24" O.C.

$W_{SNDRIFT} = 23(24/12) = 46$

10'-0"

4'-6"

$W_{SN} = 30 psf (24/12) = 60^{lb}/_{FT}$
$W_{DL} = 20 psf (24/12) = 40^{lb}/_{FT}$

10'-6"

$R_{ASN} = 392$ $R_{BSN} = 477$
$R_{ADL} = 226$ $R_{BDL} = 227$
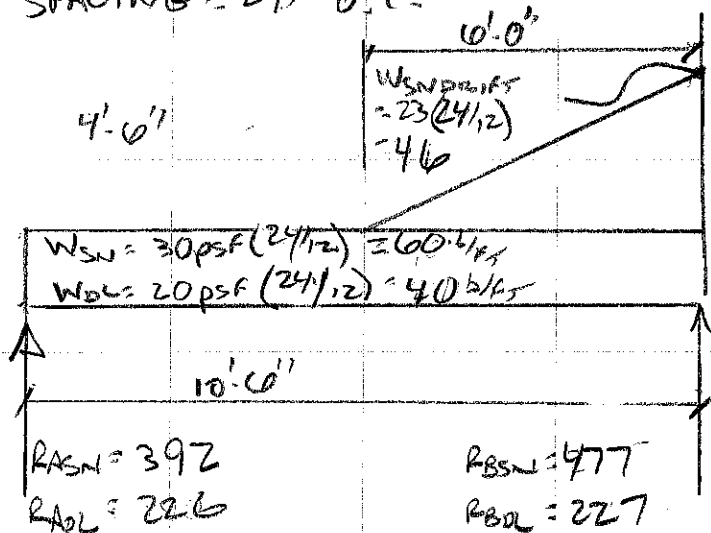
USE 2×10's @ 24"

EXISTING ROOF RAFTERS
(SPACING = 16" O.C.

$W_{SN} = 30(16/12) = 40^{lb}/_{FT}$
$W_{DL} = 20(16/12) = 27^{lb}/_{FT}$

14 FT

$R_{ALL} = 280^{lb}/_{FT}$
$R_{ADL} = 189^{lb}/_{FT}$
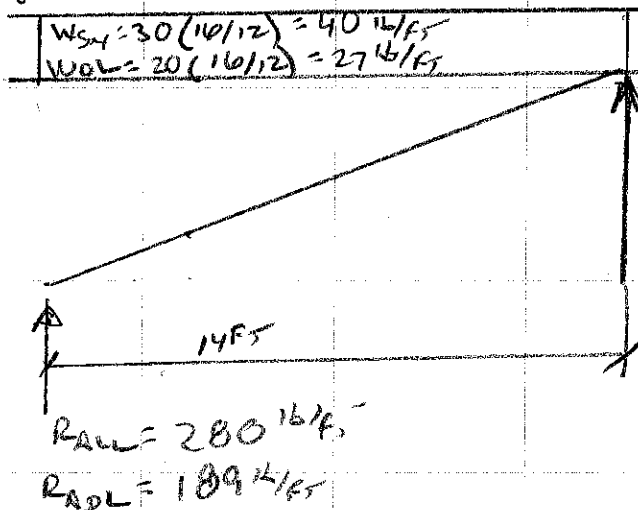
EXSTG. ROOF JOIST - NEW CANTILEVER COND.
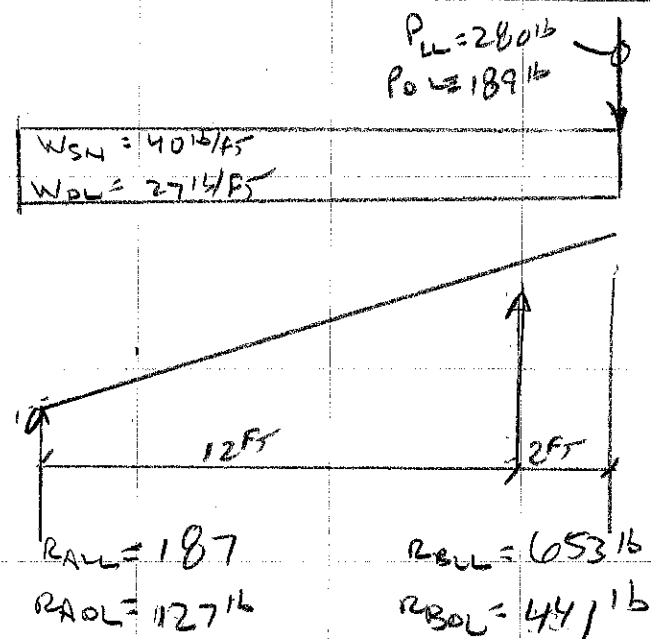
$P_{LL} = 280^{lb}$
$P_{DL} = 189^{lb}$

$W_{SN} = 40^{lb}/_{FT}$
$W_{DL} = 27^{lb}/_{FT}$

12 FT   2 FT

$R_{ALL} = 187$ $R_{BLL} = 653^{lb}$
$R_{ADL} = 127^{lb}$ $R_{BDL} = 441^{lb}$

NEW RIDGE BEAM (GRID LINE B)

$W_{SN} = 653(12/16) = 440$
$W_{DL} = 441(12/16) = 331$

18'.6"

$R_{ASN} = 4533$
$R_{ADL} = 3062$

USE 5½ x 15" GLULAM
DOUG FIR 24F. 1.8E
BALANCED

NEW BEAM @ EXISTING WALL (LINE C2)

$W_{SN} = 477/2 + 187(12/16) = 379$
$W_{DL} = 227/2 + 127(12/16) = 209$

18'.6"

$R_{BSN} = 3506$
$R_{ADL} = 1931$
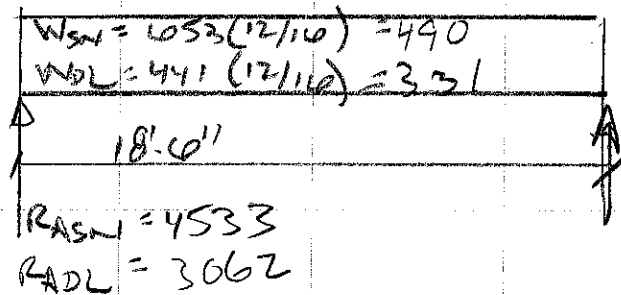
USE 5½ x 13½ GLULAM
DOUG FIR 24f.1.8E
BALANCED

NEW RIM BEAM - LINE E2

$W_{SN} = 30(5) = 150^{16}\%$
$W_{DL} = 20(5) = 100$

18'.6"

$R_{ASN} = 1388$
$R_{ADL} = 925$
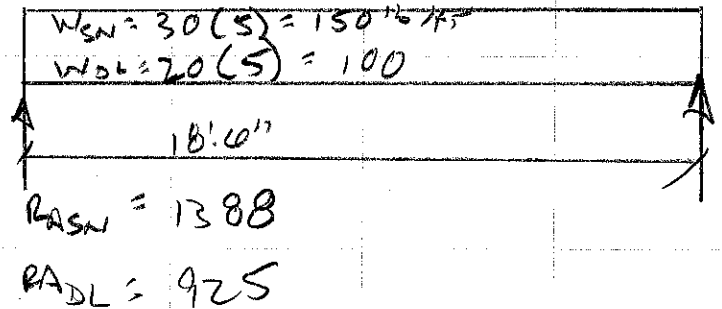
NEW CANTILEVER ROOF BEAM

$P_{SN} = 2(1388) = 2776$
$P_{DL} = 925(2) = 1850$
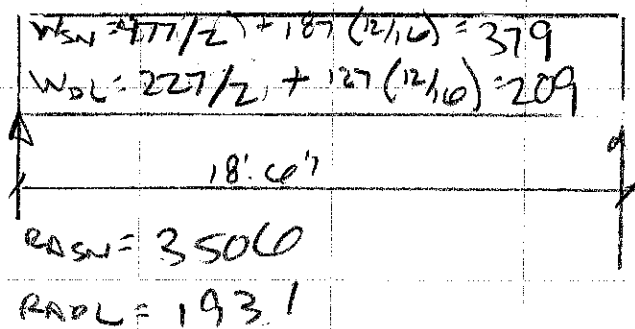
$W_{SN} = 60$ $W_{IL} = 20$
$W_{DL} = 40$ $W_{DL} = 20$

10   15

$R_{ASN} = 5427$ $R_{BSN} = -2051$
$R_{ADL} = 4092$ $R_{BDL} = 95$
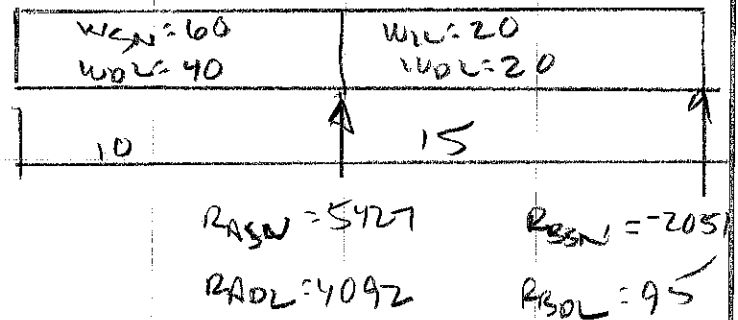
WoodWorks®	COMPANY	PROJECT
SOFTWARE FOR WOOD DESIGN	May 1, 2017 03:26	New Roof Joists over Deck Area

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Snow	Full UDL			69.0	plf
Load2	Dead	Full UDL			40.0	plf
Load3	Snow	Triangular		4.53 10.53	0.0 46.0	plf
Self-weight	Dead	Full UDL			2.8	plf

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|←——————————— 10'-7" ———————————→|

0'   10'-6"
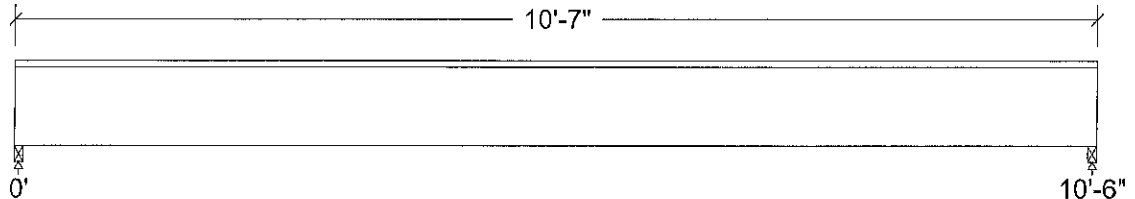
Unfactored:			
Dead	226		227
Snow	392		477
Factored:			
Total	618		703
Bearing:			
Capacity			
Joist	618		703
Support	1136		1293
Anal/Des			
Joist	1.00		1.00
Support	0.54		0.54
Load comb	#2		#2
Length	0.97		1.10
Min req'd	0.97		1.10
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.25		1.25
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Roof Joists
Lumber-soft, S-P-F, No.1/No.2, 2x10 (1-1/2"x9-1/4")
Supports: All - Timber-soft Beam, D.Fir-L No.2
Roof joist spaced at 16.0" c/c; Total length: 10'-7.0"; volume = 1.0 cu.ft.;
Lateral support: top= full, bottom= at supports; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 62	Fv' = 155	psi	fv/Fv' = 0.40
Bending(+)	fb = 943	Fb' = 1273	psi	fb/Fb' = 0.74
Live Defl'n	0.16 = L/802	0.53 = L/240	in	0.30
Total Defl'n	0.28 = L/443	0.70 = L/180	in	0.41

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fv'	135	1.15	1.00	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	875	1.15	1.00	1.00	1.000	1.100	1.00	1.15	1.00	1.00	–	2
Fcp'	425	–	1.00	1.00	–	–	–	–	1.00	1.00	–	–
E'	1.4 million		1.00	1.00	–	–	–	–	1.00	1.00	–	–
Emin'	0.51 million		1.00	1.00	–	–	–	–	1.00	1.00	–	2

CRITICAL LOAD COMBINATIONS:
```
Shear      : LC #2  = D+S, V =     698, V design =    574 lbs
Bending(+) : LC #2  = D+S, M =    1682 lbs-ft
Deflection: LC #2   = D+S   (live)
           LC #2    = D+S   (total)
```
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012

CALCULATIONS:
```
Deflection:  EI =    139e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
```

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
4. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:26	New Ridge Beam - Grid Line B

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Snow	Full UDL			490.0	plf
Load2	Dead	Full UDL			331.0	plf
Self-weight	Dead	Full UDL			13.3	plf

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

├── 18'-9.4" ──┤

0'   18'-6"
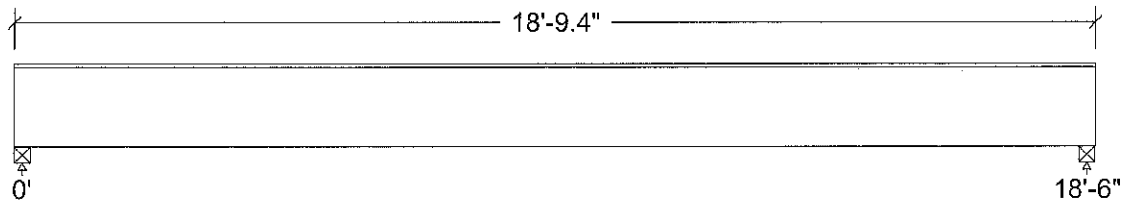
Unfactored:			
Dead	3232		3232
Snow	4603		4603
Factored:			
Total	7835		7835
Bearing:			
Capacity			
Beam	7835		7835
Support	8341		8341
Anal/Des			
Beam	1.00		1.00
Support	0.94		0.94
Load comb	#2		#2
Length	3.44		3.44
Min req'd	3.44		3.44
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Roof Joists
Glulam-Bal., West Species, 24F-1.8E WS, 3-1/2"x16-1/2"
11 laminations, 3-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 18'-9.4"; volume = 7.5 cu.ft.;
Lateral support: top= full, bottom= at supports;

WoodWorks® Sizer — SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 168	Fv' = 305	psi	fv/Fv' = 0.55
Bending(+)	fb = 2697	Fb' = 2760	psi	fb/Fb' = 0.98
Live Defl'n	0.55 = L/405	0.62 = L/360	in	0.89
Total Defl'n	1.12 = L/197	1.23 = L/180	in	0.91

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'+	2400	1.15	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	1.00	1.00	-	-	-	-	1.00	-	-	2
Eminy'	0.85 million	1.00	1.00	-	-	-	-	1.00	-	-	2

CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+S, V =   7717, V design =   6450 lbs
Bending(+): LC #2 = D+S, M = 35692 lbs-ft
Deflection: LC #2 = D+S (live)
          LC #2 = D+S (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   2358e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:25	New Beam @ Existing Wall - Grid Line C2

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Snow	Full UDL			379.0	plf
Load2	Dead	Full UDL			209.0	plf
Self-weight	Dead	Full UDL			17.1	plf

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|←——————————— 18'-7.6" ———————————→|

0'   18'-6"
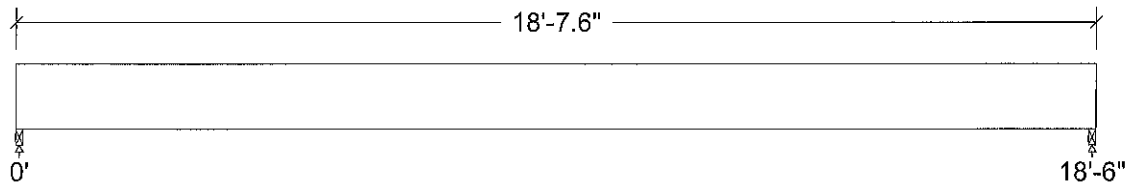
Unfactored:			
Dead	2105		2105
Snow	3531		3531
Factored:			
Total	5636		5636
Bearing:			
Capacity			
Beam	5636		5636
Support	5788		5788
Anal/Des			
Beam	1.00		1.00
Support	0.97		0.97
Load comb	#2		#2
Length	1.58		1.58
Min req'd	1.58		1.58
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Beam @ Existing Wall (Line C2)
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x13-1/2"
9 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 18'-7.6"; volume =   9.6 cu.ft.;
Lateral support: top= at supports, bottom= at supports;

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 99	Fv' = 305	psi	fv/Fv' = 0.32
Bending(+)	fb = 1859	Fb' = 2642	psi	fb/Fb' = 0.70
Live Defl'n	0.49 = L/451	0.62 = L/360	in	0.80
Total Defl'n	0.93 = L/238	1.23 = L/180	in	0.76

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.15	1.00	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.15	1.00	1.00	0.957	0.994	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	1.00	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	1.00	1.00	–	–	–	–	1.00	–	–	2	
Eminy'	0.85 million	1.00	1.00	–	–	–	–	1.00	–	–	2	

Only the lesser of CL and CV is applied, as per NDS 5.3.6
CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+S, V =   5597, V design =   4877 lbs
Bending(+): LC #2 = D+S, M = 25887 lbs-ft
Deflection: LC #2 = D+S (live)
           LC #2 = D+S (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   2030e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 18'-6.00" Le = 34'-0.50" RB =   13.50

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY**	**PROJECT**
	May 1, 2017 03:25	New Cantilever Roof Beam

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Snow	Point	Yes	0.00		2776		lbs
Load2	Dead	Point	No	0.00		1850		lbs
Load3	Dead	Partial UDL	No	0.00	10.00	40.0	40.0	plf
Load4	Snow	Partial UDL	Yes	0.00	10.00	60.0	60.0	plf
Self-weight	Dead	Full UDL	No			22.8		plf

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

| 25'-0.3" |
| 0' | 10' | 25' |
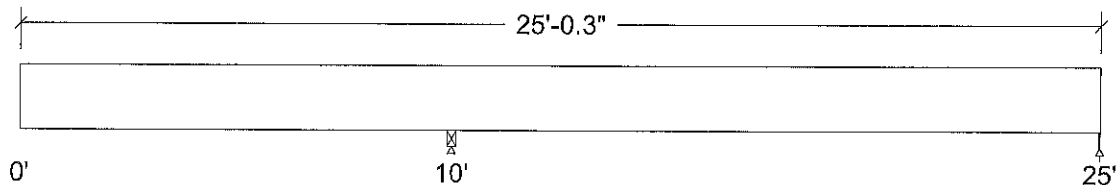
Unfactored:				
Dead		4092		95
Snow		5427		-2051
Factored:				
Uplift				3322
Total		9518		95
Bearing:				
Capacity				
Beam		10608		1787
Support		9518		1836
Anal/Des				
Beam		0.90		0.05
Support		1.00		0.05
Load comb		#2		#1
Length		2.59		0.50*
Min req'd		2.59**		0.50*
Cb		1.14		1.00
Cb min		1.14		1.00
Cb support		1.07		1.07
Fcp sup		625		625

*Minimum bearing length setting used: 1/2" for end supports
**Minimum bearing length governed by the required width of the supporting member.
Maximum reaction on at least one support is from a different load combination than the critical one for bearing design, shown here, due to Kd factor. See Analysis results for reaction from critical load combination.

Lake Geneva - Vacation Rental - New Cantilever Roof Beam
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x18"
12 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 25'-0.3"; volume = 17.2 cu.ft.;
Lateral support: top= at supports, bottom= at supports;

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

This section FAILS the design check
WARNING: This section violates the following design criteria: Deflection

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 86	Fv' = 305	psi	fv/Fv' = 0.28
Bending(-)	fb = 2117	Fb' = 2586	psi	fb/Fb' = 0.82
Deflection:				
Interior Live	-0.16 = <L/999	0.50 = L/360	in	0.32
Total	-0.32 = L/562	1.00 = L/180	in	0.32
Cantil. Live	0.91 = L/131	0.67 = L/180	in	1.37
Total	1.85 = L/64	1.33 = L/90	in	1.39

Additional Data:
```
FACTORS:   F/E(psi)CD   CM    Ct    CL     CV    Cfu    Cr    Cfrt Notes Cn*Cvr LC#
Fv'         265    1.15  1.00  1.00   -      -      -      -    1.00  1.00  1.00    2
Fb'-       2400    1.15  1.00  1.00  0.974  0.937  1.00   1.00 1.00  1.00   -       2
Fcp'        650     -    1.00  1.00   -      -      -      -    1.00   -     -       -
E'         1.8 million 1.00 1.00    -      -      -      -    1.00   -     -        2
Eminy'    0.85 million 1.00 1.00    -      -      -      -    1.00   -     -        2
```
Only the lesser of CL and CV is applied, as per NDS 5.3.6
CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+S, V = 5854, V design = 5669 lbs
Bending(-): LC #2 = D+S, M = 52400 lbs-ft
Deflection: LC #2 = D+S (live)
           LC #2 = D+S (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load Patterns: s=S/2, X=L+S or L+Lr, _=no pattern load in this span
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI = 4811e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
Lateral stability (-): Lu = 10' Le = 18'-8.38" RB = 11.56

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. Grades with equal bending capacity in the top and bottom edges of the beam cross-section are recommended for continuous beams.
5. GLULAM: bxd = actual breadth x actual depth.
6. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
7. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks®	COMPANY	PROJECT
SOFTWARE FOR WOOD DESIGN	May 1, 2017 03:26	New Rim Beam - Line E.2

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Snow	Full UDL			150.0	plf
Load2	Dead	Full UDL			100.0	plf
Self-weight	Dead	Full UDL			10.9	plf

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

```
                    |------------------- 18'-7.1" -------------------|

      0'                                                          18'-6"
```
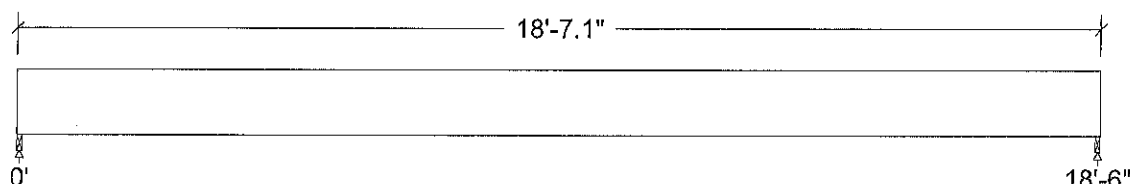
Unfactored:			
Dead	1030		1030
Snow	1394		1394
Factored:			
Total	2424		2424
Bearing:			
Capacity			
Beam	2424		2424
Support	2581		2581
Anal/Des			
Beam	1.00		1.00
Support	0.94		0.94
Load comb	#2		#2
Length	1.07		1.07
Min req'd	1.07		1.07
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Beam @ Existing Wall (Line C2)
Glulam-Bal., West Species, 24F-1.8E WS, 3-1/2"x13-1/2"
9 laminations, 3-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 18'-7.1"; volume = 6.1 cu.ft.;
Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 67	Fv' = 305	psi	fv/Fv' = 0.22
Bending(+)	fb = 1260	Fb' = 2002	psi	fb/Fb' = 0.63
Live Defl'n	0.31 = L/725	0.62 = L/360	in	0.50
Total Defl'n	0.65 = L/343	1.23 = L/180	in	0.52

	WoodWorks® Sizer	SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.15	1.00	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.15	1.00	1.00	0.725	1.000	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	1.00	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	1.00	1.00	–	–	–	–	1.00	–	–	2	
Eminy'	0.85 million	1.00	1.00	–	–	–	–	1.00	–	–	2	

CRITICAL LOAD COMBINATIONS:
```
Shear      : LC #2  = D+S, V =   2413, V design =   2108 lbs
Bending(+): LC #2   = D+S, M =  11161 lbs-ft
Deflection: LC #2   = D+S  (live)
            LC #2   = D+S  (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
```
CALCULATIONS:
```
Deflection:  EI =   1292e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 18'-6.00"  Le = 34'-0.50"  RB =   21.22
```
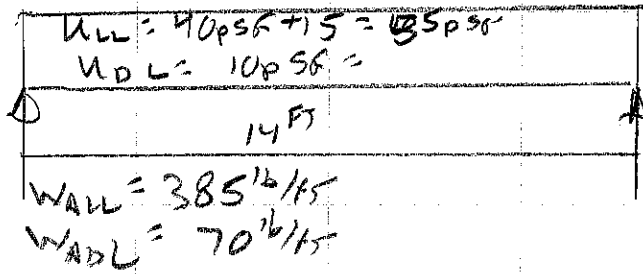
Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
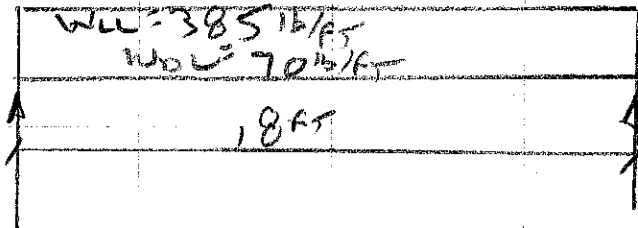6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

2ND & 1ST FLOOR JOIST REACTIONS

SPAN = 14'.0"

$W_{LL} = 40 psf + 15 = 55 psf$
$W_{DL} = 10 psf =$

14 FT

$W_{ALL} = 385 \, lb/ft$
$W_{ADL} = 70 \, lb/ft$

BEAM - LINE C.2

$W_{LL} = 385 \, lb/ft$
$W_{DL} = 70 \, lb/ft$

18 FT

USE $5\frac{1}{2} \times 13\frac{1}{2}"$
GLULAM

NEW FLOOR JOISTS A SCREEN PATIO
(SPACING = 16"0.C.

$W_{LL} = (40+15)16/12 = 74$
$W_{DL} = 15(16/12) = 20 \, lb/ft$

15'.0"

$R_{ALL} = 555$
$R_{ADL} = 150$

USE $2 \times 12's$ } N.G.
@ 16"
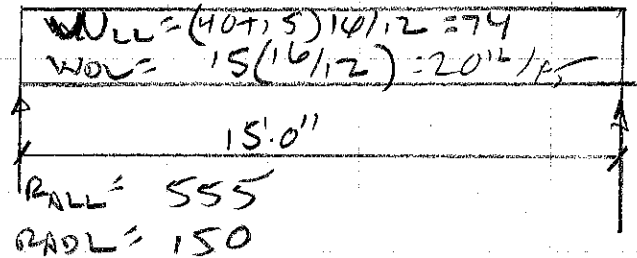
SPACE @ 12" O.C.

BEAM - LINE C.2 (SCREEN PATIO)

$W_{LL} = 55 psf (7.5+3.5) = 605$
$W_{DL} = 15 psf (7.5+3.5) = 165$

16'.6"
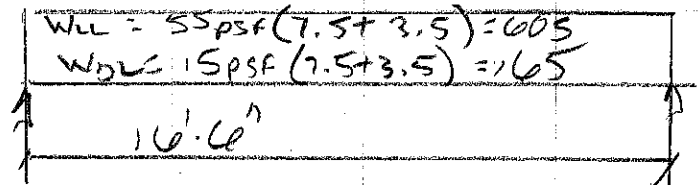
$5\frac{1}{2} \times 13\frac{1}{2}$ GLULAM

NEW GLULAM - LINE B
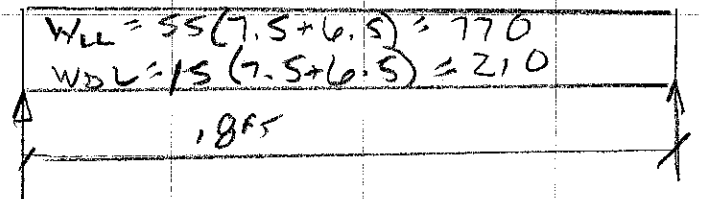
$W_{LL} = 55(7.5+6.5) = 770$
$W_{DL} = 15(7.5+6.5) = 210$

18 FT

$5\frac{1}{2} \times 16\frac{1}{2}$ GLULAM

SECOND FLOOR FRAMING

NEW DECK JOISTS

(SPACING = 16" O.C.)

$$W_{LL} = 75(16/12) = 100\ lb/ft$$
$$W_{DL} = 15(16/12) = 20\ lb/ft$$

10 FT

$$R_{ALL} = 500\ lb$$
$$R_{ADL} = 100\ lb$$

TREATED 2×10'S @ 16"

NEW DECK RIM BEAM

$$W_{LL} = 75(5) = 375\ lb/ft$$
$$W_{DL} = 15(5) = 75\ lb/ft$$

14'-6"

$$R_{AL} = 2719$$
$$R_{ADL} = 544\ lb$$

3½ × 13½ GLULAM

BEAM ALONG STAIR

$$P_{LL} = 920\ lb$$
$$P_{DL} = 245$$

15'   3'-6"   319

$$W_{LL} = 75 \times 2.5 = 188$$ $$W_{LL} = 75(2.5 + 1.75)$$
$$W_{DL} = 20 \times 2.5 = 50$$ $$W_{DL} = 15(2.5 + 1.75)$$ = 64

18'-6"

3½ × 15" GLULAM
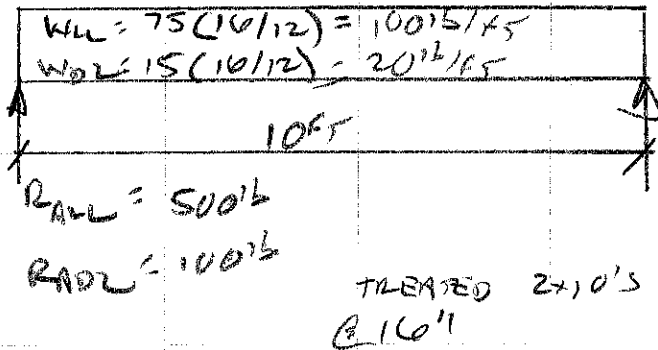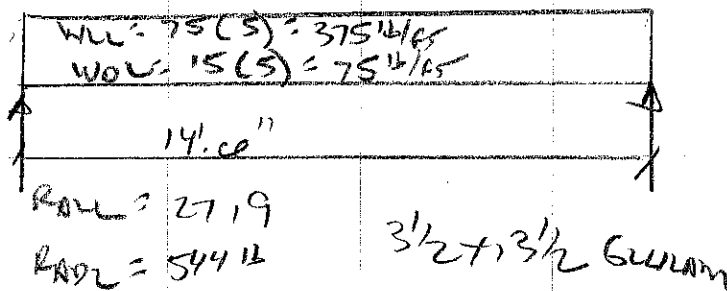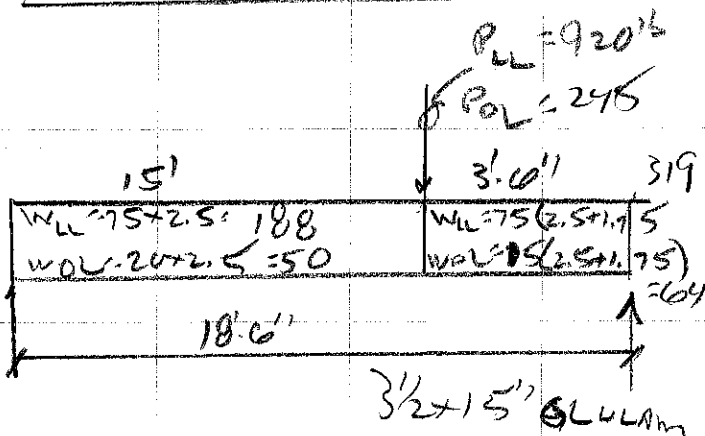
NEW DECK STAIR STRINGER

$$W_{LL} = 75(2) = 150$$
$$W_{DL} = 20(2) = 40$$

15 FT
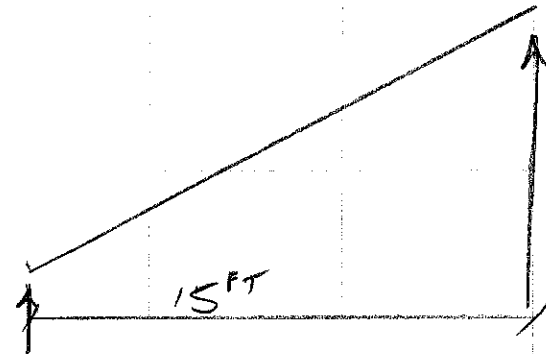
3⅛ × 12" GLULAM

CANTILEVERED BM - LINE 2
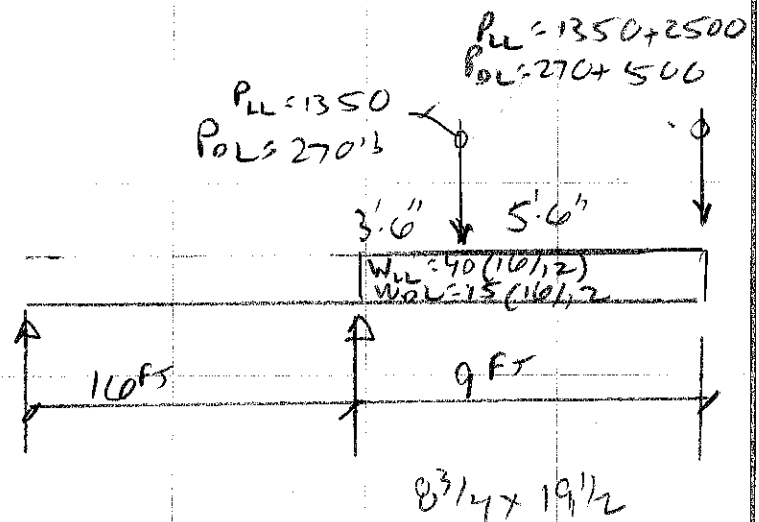
$$P_{LL} = 1350 + 2500$$
$$P_{DL} = 270 + 500$$

$$P_{LL} = 1350$$
$$P_{DL} = 270\ lb$$

3'-6"   5'-6"

$$W_{LL} = 40(16/12)$$
$$W_{DL} = 15(16/12)$$

16 FT   9 FT

8¾ × 19½

LINE 3   8¾ × 16½
LINE 1   8¾ × 19½
LINE 5   5½ × 16½

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:28	New Deck Joists

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load3	Dead	Full UDL			20.0	plf
Load4	Snow	Full UDL			100.0	plf
Self-weight	Dead	Full UDL			2.8	plf

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

10'-1.5"

0'   10'
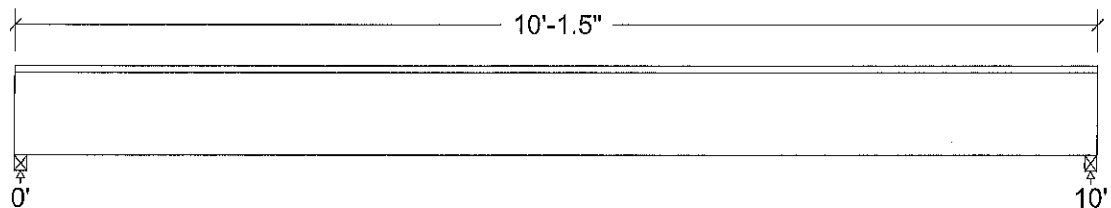
Unfactored:			
Dead	115		115
Snow	506		506
Factored:			
Total	621		621
Bearing:			
Capacity			
Joist	621		621
Support	1142		1142
Anal/Des			
Joist	1.00		1.00
Support	0.54		0.54
Load comb	#2		#2
Length	1.45		1.45
Min req'd	1.45		1.45
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.25		1.25
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Deck Joists
Lumber-soft, S-P-F, No.1/No.2, 2x10 (1-1/2"x9-1/4")
Supports: All - Timber-soft Beam, D.Fir-L No.2
Floor joist spaced at 16.0" c/c; Total length: 10'-1.5"; volume = 1.0 cu.ft.;
Service: wet; Lateral support: top= full, bottom= at supports; Repetitive factor: applied where permitted (refer to online help);

WoodWorks® Sizer — SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 55	Fv' = 151	psi	fv/Fv' = 0.37
Bending(+)	fb = 861	Fb' = 1273	psi	fb/Fb' = 0.68
Live Defl'n	0.18 = L/664	0.33 = L/360	in	0.54
Total Defl'n	0.26 = L/456	0.50 = L/240	in	0.53

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fv'	135	1.15	0.97	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	875	1.15	1.00	1.00	1.000	1.100	1.00	1.15	1.00	1.00	–	2
Fcp'	425	–	0.67	1.00	–	–	–	–	1.00	1.00	–	–
E'	1.4 million	0.90	1.00	–	–	–	–	1.00	1.00	–	2
Emin'	0.51 million	0.90	1.00	–	–	–	–	1.00	1.00	–	2

CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+S, V =   614, V design =   512 lbs
Bending(+): LC #2 = D+S, M =   1535 lbs-ft
Deflection: LC #2 = D+S (live)
            LC #2 = D+S (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   139e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
4. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.

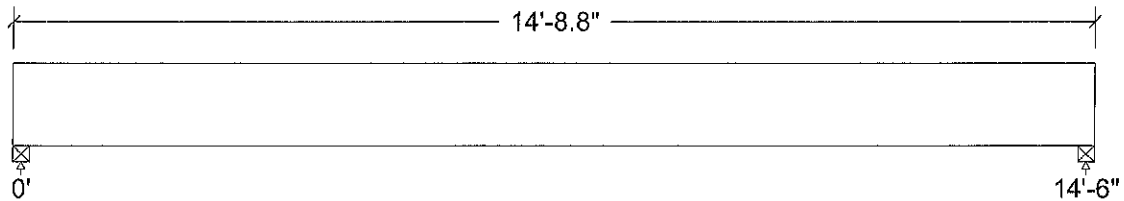| **WoodWorks**® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
		2ND Floor
	May 1, 2017 03:29	New Deck Rim Beam

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load3	Dead	Full UDL			75.0	plf
Load4	Live	Full UDL			375.0	plf
Self-weight	Dead	Full UDL			10.9	plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

```
                          |————————————— 14'-8.8" —————————————|

             ⊠                                                   ⊠
             0'                                                 14'-6"
```

Unfactored:			
Dead	631		631
Live	2763		2763
Factored:			
Total	3394		3394
Bearing:			
Capacity			
Beam	3394		3394
Support	4568		4568
Anal/Des			
Beam	1.00		1.00
Support	0.74		0.74
Load comb	#2		#2
Length	2.82		2.82
Min req'd	2.82		2.82
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Deck Rim Beam
Glulam-Bal., West Species, 24F-1.8E WS, 3-1/2"x13-1/2"
9 laminations, 3-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 14'-8.8"; volume = 4.8 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	f_v = 88	F_v' = 232	psi	f_v/F_v' = 0.38
Bending(+)	f_b = 1367	F_b' = 1705	psi	f_b/F_b' = 0.80
Live Defl'n	0.35 = L/501	0.48 = L/360	in	0.72
Total Defl'n	0.51 = L/344	0.72 = L/240	in	0.70

| | **WoodWorks® Sizer** | **SOFTWARE FOR WOOD DESIGN** |

Additional Data:

```
FACTORS:    F/E(psi)CD    CM    Ct    CL    CV    Cfu    Cr    Cfrt  Notes Cn*Cvr LC#
 Fv'         265   1.00  0.88  1.00   -     -     -     -    1.00  1.00  1.00   2
 Fb'+       2400   1.00  0.80  1.00  0.888 1.000 1.00  1.00  1.00  1.00   -     2
 Fcp'        650    -    0.53  1.00   -     -     -     -    1.00   -     -     -
 E'         1.8 million 0.83  1.00   -     -     -     -    1.00   -     -     -
 Eminy'     0.85 million 0.83 1.00   -     -     -     -    1.00   -     -     2
```

CRITICAL LOAD COMBINATIONS:
```
Shear      : LC #2  = D+L, V =   3341, V design =   2769 lbs
Bending(+): LC #2  = D+L, M =  12112 lbs-ft
Deflection: LC #2  = D+L  (live)
            LC #2  = D+L  (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
```
CALCULATIONS:
```
Deflection:  EI =   1292e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 14'-6.00"  Le = 27'-0.13"  RB =   18.90
```

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

	COMPANY	PROJECT
WoodWorks® *SOFTWARE FOR WOOD DESIGN*		*2ND FLOOR*
	May 1, 2017 03:28	New Beam Along Stair

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load3	Live	Partial UDL		0.00	15.00	188.0	188.0	plf
Load4	Dead	Partial UDL		0.00	15.00	50.0	50.0	plf
Load5	Live	Partial UDL		15.00	18.50	319.0	319.0	plf
Load6	Dead	Partial UDL		15.00	18.50	64.0	64.0	plf
Load7	Dead	Point		15.00		245		lbs
Load8	Live	Point		15.00		920		lbs
Self-weight	Dead	Full UDL				12.1		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

```
      |←————————————————— 18'-8.6" ——————————————————→|
      ⊠                                                ⊠
      0'                                              18'-6"
```
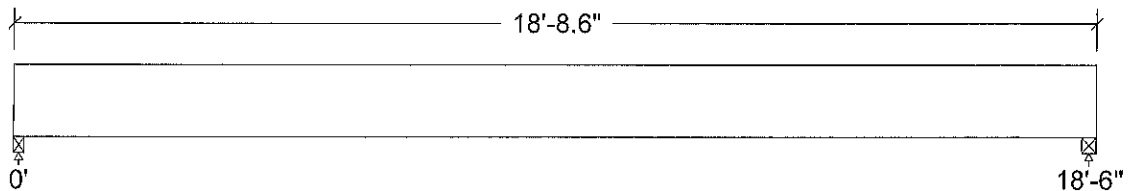
Unfactored:			
Dead	631		811
Live	1980		2876
Factored:			
Total	2612		3687
Bearing:			
Capacity			
Beam	2612		3687
Support	3515		4962
Anal/Des			
Beam	1.00		1.00
Support	0.74		0.74
Load comb	#2		#2
Length	2.17		3.06
Min req'd	2.17		3.06
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Deck Rim Beam
Glulam-Bal., West Species, 24F-1.8E WS, 3-1/2"x15"
10 laminations, 3-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 18'-8.6"; volume = 6.8 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 91	Fv' = 232	psi	fv/Fv' = 0.39
Bending(+)	fb = 1226	Fb' = 1464	psi	fb/Fb' = 0.84
Live Defl'n	0.43 = L/510	0.62 = L/360	in	0.71
Total Defl'n	0.70 = L/315	0.93 = L/240	in	0.76

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.00	0.80	1.00	0.762	1.000	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	0.53	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million		0.83	1.00	–	–	–	–	1.00	–	–	2
Eminy'	0.85 million		0.83	1.00	–	–	–	–	1.00	–	–	2

CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+L, V =   3687, V design =   3186 lbs
Bending(+): LC #2 = D+L, M = 13410 lbs-ft
Deflection: LC #2 = D+L (live)
            LC #2 = D+L (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   1772e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 18'-6.00" Le = 34'-0.50" RB =   22.36

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

![WoodWorks logo] **WoodWorks**® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:28	New Beam Along Stair-1st Floor

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load3	Live	Partial UDL		0.00	15.00	188.0	188.0	plf
Load4	Dead	Partial UDL		0.00	15.00	50.0	50.0	plf
Load5	Live	Partial UDL		15.00	18.50	319.0	319.0	plf
Load6	Dead	Partial UDL		15.00	18.50	64.0	64.0	plf
Load7	Dead	Point		15.00		245		lbs
Load8	Live	Point		15.00		920		lbs
Self-weight	Dead	Full UDL				15.2		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

18'-7.7"

0'   18'-6"

Unfactored:			
Dead	658		842
Live	1972		2885
Factored:			
Total	2630		3727
Bearing:			
Capacity			
Beam	2630		3727
Support	3415		4839
Anal/Des			
Beam	1.00		1.00
Support	0.77		0.77
Load comb	#2		#2
Length	1.39		1.97
Min req'd	1.39		1.97
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Deck Rim Beam-1st Floor
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x12"
8 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 18'-7.7"; volume = 8.5 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

WoodWorks® Sizer | SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 76	Fv' = 232	psi	fv/Fv' = 0.33
Bending(+)	fb = 1228	Fb' = 1868	psi	fb/Fb' = 0.66
Live Defl'n	0.54 = L/411	0.62 = L/360	in	0.87
Total Defl'n	0.89 = L/250	0.93 = L/240	in	0.96

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.00	0.80	1.00	0.973	1.000	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	0.53	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	0.83	1.00	–	–	–	–	1.00	–	–	2	
Eminy'	0.85 million	0.83	1.00	–	–	–	–	1.00	–	–	2	

CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+L, V =   3727, V design =   3323 lbs
Bending(+): LC #2 = D+L, M = 13510 lbs-ft
Deflection: LC #2 = D+L (live)
          LC #2 = D+L (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   1426e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 18'-6.00" Le = 34'-0.50" RB =   12.73

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

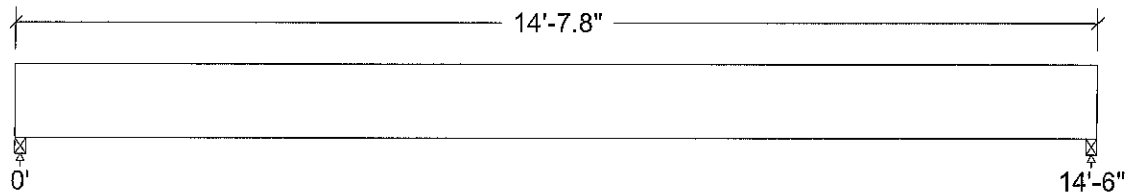| WoodWorks®	COMPANY	PROJECT
SOFTWARE FOR WOOD DESIGN	May 1, 2017 03:29	New Deck Rim Beam-1st Floor

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load3	Dead	Full UDL				75.0		plf
Load4	Live	Full UDL				375.0		plf
Self-weight	Dead	Full UDL				15.2		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

```
|---------------------------- 14'-7.8" ----------------------------|

  0'                                                          14'-6"
```

Unfactored:			
Dead	660		660
Live	2747		2747
Factored:			
Total	3406		3406
Bearing:			
Capacity			
Beam	3406		3406
Support	4423		4423
Anal/Des			
Beam	1.00		1.00
Support	0.77		0.77
Load comb	#2		#2
Length	1.80		1.80
Min req'd	1.80		1.80
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Deck Rim Beam-1st Floor
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x12"
8 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 14'-7.8"; volume = 6.7 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 65	Fv' = 232	psi	fv/Fv' = 0.28
Bending(+)	fb = 1111	Fb' = 1883	psi	fb/Fb' = 0.59
Live Defl'n	0.31 = L/553	0.48 = L/360	in	0.65
Total Defl'n	0.47 = L/374	0.72 = L/240	in	0.64

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.00	0.80	1.00	0.981	1.000	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	0.53	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	0.83	1.00	–	–	–	–	1.00	–	–	2	
Eminy'	0.85 million	0.83	1.00	–	–	–	–	1.00	–	–	2	

CRITICAL LOAD COMBINATIONS:
```
Shear      : LC #2  = D+L, V =   3373, V design =   2873 lbs
Bending(+) : LC #2  = D+L, M =  12226 lbs-ft
Deflection : LC #2  = D+L  (live)
             LC #2  = D+L  (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
```
CALCULATIONS:
```
Deflection:  EI =   1426e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 14'-6.00"  Le = 26'-8.19"  RB =   11.27
```

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

|	COMPANY	PROJECT
WoodWorks® SOFTWARE FOR WOOD DESIGN		
	May 1, 2017 03:29	New Deck Stair Stringer Beam

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Live	Full UDL			150.0	plf
Load2	Dead	Full UDL			40.0	plf
Self-weight	Dead	Full UDL			8.6	plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|---------------------------- 15'-1.4" ----------------------------|

0'   15'
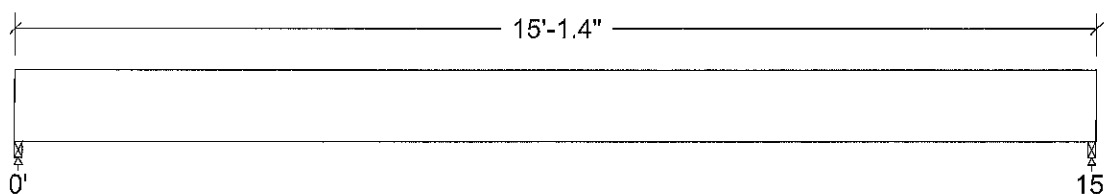
Unfactored:			
Dead	367		367
Live	1134		1134
Factored:			
Total	1501		1501
Bearing:			
Capacity			
Beam	1501		1501
Support	2043		2043
Anal/Des			
Beam	1.00		1.00
Support	0.73		0.73
Load comb	#2		#2
Length	1.39		1.39
Min req'd	1.39		1.39
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.12		1.12
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Deck Stair Stringer
Glulam-Bal., West Species, 24F-1.8E WS, 3-1/8"x12"
8 laminations, 3-1/8" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 15'-1.4"; volume = 3.9 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 51	Fv' = 232	psi	fv/Fv' = 0.22
Bending(+)	fb = 894	Fb' = 1630	psi	fb/Fb' = 0.55
Live Defl'n	0.25 = L/710	0.50 = L/360	in	0.51
Total Defl'n	0.42 = L/431	0.75 = L/240	in	0.56

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	--	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.00	0.80	1.00	0.849	1.000	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	0.53	1.00	--	–	–	–	1.00	--	–	–
E'	1.8 million		0.83	1.00	–	–	–	–	1.00	–	–	2
Eminy'	0.85 million		0.83	1.00	–	–	–	–	1.00	--	--	2

CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+L, V =   1490, V design =   1280 lbs
Bending(+): LC #2 = D+L, M =   5587 lbs-ft
Deflection: LC #2 = D+L (live)
          LC #2 = D+L (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   810e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 15' Le = 27'-7.19" RB =   20.17

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

| COMPANY	PROJECT
May 1, 2017 03:30	New Floor Beam Line B

WoodWorks®
SOFTWARE FOR WOOD DESIGN

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pattern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Live	Full UDL			770.0	plf
Load2	Dead	Full UDL			210.0	plf
Self-weight	Dead	Full UDL			20.9	plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|← 18'-2.5" →|

0'   18'
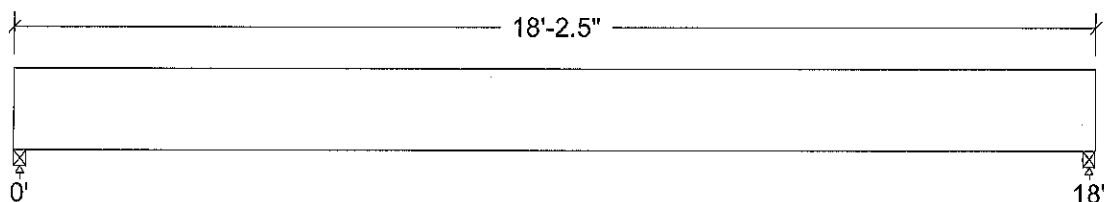
Unfactored:			
Dead	2100		2100
Live	7012		7012
Factored:			
Total	9112		9112
Bearing:			
Capacity			
Beam	9112		9112
Support	9359		9359
Anal/Des			
Beam	1.00		1.00
Support	0.97		0.97
Load comb	#2		#2
Length	2.55		2.55
Min req'd	2.55		2.55
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Beam Line B
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x16-1/2"
11 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 18'-2.5"; volume = 11.5 cu.ft.;
Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 124	Fv' = 265	psi	fv/Fv' = 0.47
Bending(+)	fb = 1949	Fb' = 2289	psi	fb/Fb' = 0.85
Live Defl'n	0.49 = L/440	0.60 = L/360	in	0.82
Total Defl'n	0.71 = L/303	0.90 = L/240	in	0.79

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	1.00	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.00	1.00	1.00	0.954	0.977	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	1.00	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	1.00	1.00	–	–	–	–	1.00	–	–	2
Eminy'	0.85 million	1.00	1.00	–	–	–	–	1.00	–	–	2

Only the lesser of CL and CV is applied, as per NDS 5.3.6

CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+L, V =   9008, V design =   7526 lbs
Bending(+): LC #2 = D+L, M =   40536 lbs-ft
Deflection: LC #2 = D+L (live)
            LC #2 = D+L (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012

CALCULATIONS:
Deflection: EI =   3706e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 18' Le = 33'-5.56" RB =   14.80

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

|	COMPANY	PROJECT
WoodWorks® SOFTWARE FOR WOOD DESIGN		
	May 1, 2017 03:30	New Floor Beam - Line C.2

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Live	Full UDL			385.0	plf
Load2	Dead	Full UDL			70.0	plf
Self-weight	Dead	Full UDL			17.1	plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|⟵———————————— 18'-7.2" ————————————⟶|

0'   18'-6"
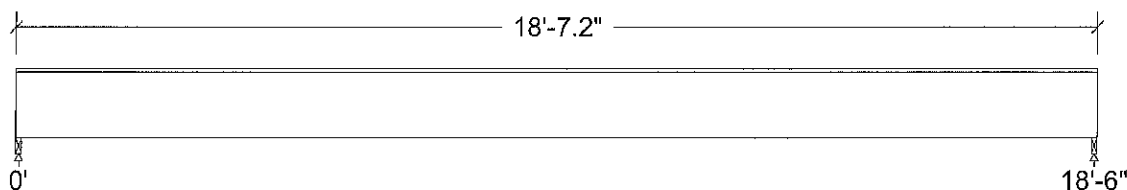
Unfactored:			
Dead	809		809
Live	3581		3581
Factored:			
Total	4390		4390
Bearing:			
Capacity			
Beam	4390		4390
Support	4509		4509
Anal/Des			
Beam	1.00		1.00
Support	0.97		0.97
Load comb	#2		#2
Length	1.23		1.23
Min req'd	1.23		1.23
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Floor Beam - Line C.2
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x13-1/2"
9 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 18'-7.2"; volume = 9.6 cu.ft.;
Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 77	Fv' = 265	psi	fv/Fv' = 0.29
Bending(+)	fb = 1451	Fb' = 2385	psi	fb/Fb' = 0.61
Live Defl'n	0.50 = L/444	0.62 = L/360	in	0.81
Total Defl'n	0.67 = L/331	0.93 = L/240	in	0.72

WoodWorks® Sizer — SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	1.00	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.00	1.00	1.00	1.000	0.994	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	1.00	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	1.00	1.00	–	–	–	–	1.00	–	–	2	
Eminy'	0.85 million	1.00	1.00	–	–	–	–	1.00	–	–	2	

CRITICAL LOAD COMBINATIONS:
```
Shear      : LC #2  = D+L, V =   4367, V design =   3812 lbs
Bending(+): LC #2  = D+L, M =  20197 lbs-ft
Deflection: LC #2  = D+L  (live)
           LC #2  = D+L  (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
```
CALCULATIONS:
```
Deflection:  EI =   2030e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
```

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

| WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:30	New Floor Joists Screen Patio (12 inches o.c.)

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Live	Full UDL				55.0		plf
Load2	Dead	Full UDL				15.0		plf
Self-weight	Dead	Full UDL				3.4		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

15'-0.9"

0'   15'
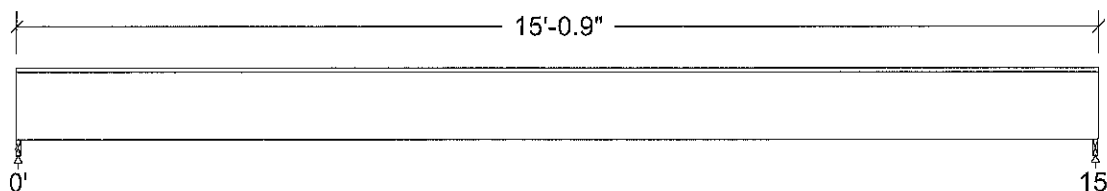
Unfactored:			
Dead	139		139
Live	414		414
Factored:			
Total	553		553
Bearing:			
Capacity			
Joist	553		553
Support	1017		1017
Anal/Des			
Joist	1.00		1.00
Support	0.54		0.54
Load comb	#2		#2
Length	0.87		0.87
Min req'd	0.87		0.87
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.25		1.25
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Floor Joists Screen Patio
Lumber-soft, S-P-F, No.1/No.2, 2x12 (1-1/2"x11-1/4")
Supports: All - Timber-soft Beam, D.Fir-L No.2
Floor joist spaced at 12.0" c/c; Total length: 15'-0.9"; volume = 1.8 cu.ft.;
Lateral support: top= full, bottom= at supports; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 43	Fv' = 135	psi	fv/Fv' = 0.32
Bending(+)	fb = 783	Fb' = 1006	psi	fb/Fb' = 0.78
Live Defl'n	0.25 = L/715	0.50 = L/360	in	0.50
Total Defl'n	0.38 = L/476	0.75 = L/240	in	0.50

WoodWorks® Sizer — SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fv'	135	1.00	1.00	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	875	1.00	1.00	1.00	1.000	1.000	1.00	1.15	1.00	1.00	–	2
Fcp'	425	–	1.00	1.00	–	–	–	–	1.00	1.00	–	–
E'	1.4 million	1.00	1.00	–	–	–	–	1.00	1.00	–	2
Emin'	0.51 million	1.00	1.00	–	–	–	–	1.00	1.00	–	2

CRITICAL LOAD COMBINATIONS:
```
Shear      : LC #2  = D+L, V =    551, V design =    479 lbs
Bending(+): LC #2   = D+L, M =   2065 lbs-ft
Deflection: LC #2   = D+L   (live)
            LC #2   = D+L   (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
```

CALCULATIONS:
```
Deflection:  EI =    249e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
```

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
4. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.

| **WoodWorks®** SOFTWARE FOR WOOD DESIGN	**COMPANY**	**PROJECT**
	May 1, 2017 03:30	New Floor Beam Line C.2 @ Screen Patio

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Live	Full UDL			605.0	plf
Load2	Dead	Full UDL			165.0	plf
Self-weight	Dead	Full UDL			17.1	plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|← 16'-7.8" →|

0'   16'-6"
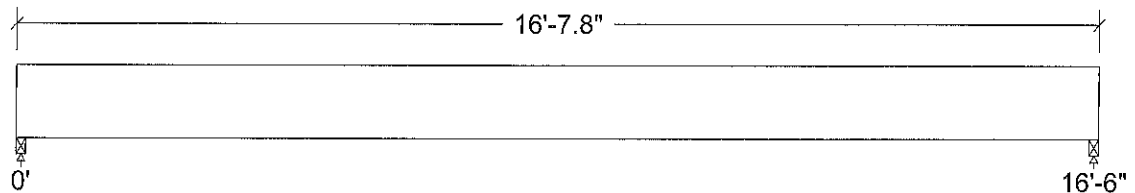
Unfactored:			
Dead	1515		1515
Live	5037		5037
Factored:			
Total	6552		6552
Bearing:			
Capacity			
Beam	6552		6552
Support	6730		6730
Anal/Des			
Beam	1.00		1.00
Support	0.97		0.97
Load comb	#2		#2
Length	1.83		1.83
Min req'd	1.83		1.83
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Lake Geneva - Vacation Rental - New Beam Line B
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x13-1/2"
9 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 16'-7.8"; volume = 8.6 cu.ft.;
Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 112	Fv' = 265	psi	fv/Fv' = 0.42
Bending(+)	fb = 1924	Fb' = 2331	psi	fb/Fb' = 0.83
Live Defl'n	0.50 = L/398	0.55 = L/360	in	0.90
Total Defl'n	0.72 = L/274	0.82 = L/240	in	0.87

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	1.00	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'+	2400	1.00	1.00	1.00	0.971	1.000	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	1.00	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	1.00	1.00	–	–	–	–	1.00	–	–	2
Eminy'	0.85 million	1.00	1.00	–	–	–	–	1.00	–	–	2

CRITICAL LOAD COMBINATIONS:
```
Shear     : LC #2  = D+L, V =   6494, V design =   5548 lbs
Bending(+): LC #2  = D+L, M =  26786 lbs-ft
Deflection: LC #2  = D+L  (live)
            LC #2  = D+L  (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012
```
CALCULATIONS:
```
Deflection:  EI =   2030e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 16'-6.00"  Le = 30'-4.31"  RB =   12.75
```

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

	COMPANY	PROJECT
![WoodWorks logo] **Wood**Works® SOFTWARE FOR WOOD DESIGN		
	May 1, 2017 03:27	Cantilever Beam - Line 1

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load3	Dead	Partial UDL	No	16.00	23.00	10.0	10.0	plf
Load5	Live	Partial UDL	Yes	16.00	26.00	50.0	50.0	plf
Load7	Live	Point	No	26.00		2531		lbs
Load8	Dead	Point	No	26.00		506		lbs
Self-weight	Dead	Full UDL	No			39.3		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|←————————————— 26'-0.3" —————————————→|

```
0'                                          16'              26'
```
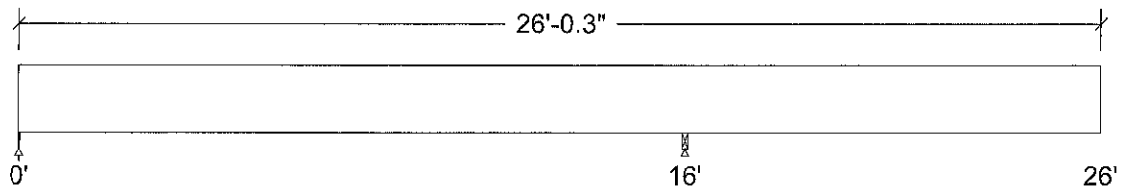
Unfactored:				
Dead	192		1737	
Live	-1734		4765	
Factored:				
Uplift	1873			
Total	192		6502	
Bearing:				
Capacity				
Beam	1507		6502	
Support	1832		6529	
Anal/Des				
Beam	0.13		1.00	
Support	0.10		1.00	
Load comb	#1		#2	
Length	0.50*		1.78	
Min req'd	0.50*		1.78	
Cb	1.00		1.21	
Cb min	1.00		1.21	
Cb support	1.00		1.00	
Fcp sup	625		625	

*Minimum bearing length setting used: 1/2" for end supports
Maximum reaction on at least one support is from a different load combination than the critical one for bearing design, shown here, due to Kd factor. See Analysis results for reaction from critical load combination.

Lake Geneva - Vacation Rental - Cantievered Beam Line 1
Glulam-Bal., West Species, 24F-1.8E WS, 8-3/4"x19-1/2"
13 laminations, 8-3/4" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 26'-0.3"; volume = 30.8 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 34	Fv' = 232	psi	fv/Fv' = 0.15
Bending(-)	fb = 757	Fb' = 1697	psi	fb/Fb' = 0.45
Deflection:				
Interior Live	-0.10 = <L/999	0.53 = L/360	in	0.18
Total	-0.13 = <L/999	0.80 = L/240	in	0.17
Cantil. Live	0.51 = L/236	0.67 = L/180	in	0.76
Total	0.74 = L/162	1.00 = L/120	in	0.74

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'-	2400	1.00	0.80	1.00	0.988	0.884	1.00	1.00	1.00	1.00	-	2
Fcp'	650	-	0.53	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	0.83	1.00	-	-	-	-	1.00	-	-	2	
Eminy'	0.85 million	0.83	1.00	-	-	-	-	1.00	-	-	2	

Only the lesser of CL and CV is applied, as per NDS 5.3.6
CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+L, V =   3999, V design =   3839 lbs
Bending(-): LC #2 = D+L, M =   34995 lbs-ft
Deflection: LC #2 = D+L   (live)
           LC #2 = D+L   (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load Patterns: s=S/2, X=L+S or L+Lr, _=no pattern load in this span
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   9732e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (-): Lu = 16' Le = 27'-11.00" RB =   9.24

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. Grades with equal bending capacity in the top and bottom edges of the beam cross-section are recommended for continuous beams.
5. GLULAM: bxd = actual breadth x actual depth.
6. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
7. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:27	Cantilever Beam - Line 2- with added column

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load3	Dead	Partial UDL	No	16.02 25.02	20.0 20.0	plf
Load5	Live	Partial UDL	Yes	16.02 25.02	75.0 75.0	plf
Load4	Dead	Point	No	19.52	270	lbs
Load6	Live	Point	Yes	19.52	1350	lbs
Load7	Live	Point	No	25.02	3850	lbs
Load8	Dead	Point	No	25.02	770	lbs
Self-weight	Dead	Full UDL	No		23.3	plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

```
|------------------------ 25'-0.3" ------------------------|
```
0'   16'   19'-6"   25'
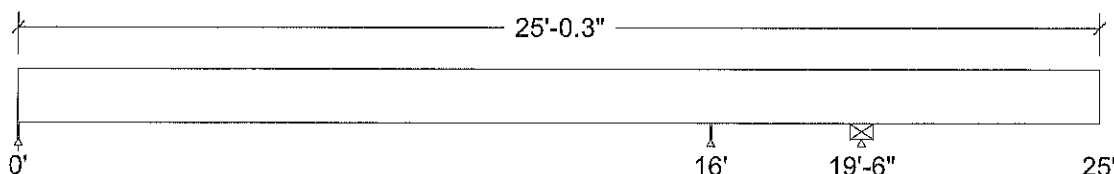
Unfactored:					
Dead	175		331	2698	
Live	125		-7071	12684	
Factored:					
Uplift			8142		
Total	300		331	15382	
Bearing:					
Capacity					
Beam	1163		2035	15382	
Support	1413		1413	18698	
Anal/Des					
Beam	0.26		0.16	1.00	
Support	0.21		0.23	0.82	
Load comb	#6		#1	#2	
Length	0.50*		0.50*	6.62	
Min req'd	0.50*		0.50*	6.62	
Cb	1.00		1.75	1.00	
Cb min	1.00		1.75	1.00	
Cb support	1.00		1.00	1.00	
Fcp sup	625		625	625	

*Minimum bearing length setting used: 1/2" for end supports and 1/2" for interior supports
Maximum reaction on at least one support is from a different load combination than the critical one for bearing design, shown here, due to Kd factor. See Analysis results for reaction from critical load combination.

Lake Geneva - Vacation Rental - Cantievered Beam Line 2
Glulam-Bal., West Species, 24F-1.8E WS, 6-3/4"x15"
10 laminations, 6-3/4" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 25'-0.3"; volume = 17.6 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

WoodWorks® Sizer — SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 125	Fv' = 232	psi	fv/Fv' = 0.54
Bending(+)	fb = 92	Fb' = 1874	psi	fb/Fb' = 0.05
Bending(-)	fb = 1289	Fb' = 1910	psi	fb/Fb' = 0.67
Deflection:				
Interior Live	-0.01 = <L/999	0.12 = L/360	in	0.08
Total	-0.01 = <L/999	0.17 = L/240	in	0.08
Cantil. Live	0.22 = L/302	0.37 = L/180	in	0.59
Total	0.31 = L/210	0.55 = L/120	in	0.57

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'+	2400	1.00	0.80	1.00	0.985	0.976	1.00	1.00	1.00	1.00	-	2
Fb'-	2400	1.00	0.80	1.00	0.995	1.000	1.00	1.00	1.00	1.00	-	2
Fcp'	650	-	0.53	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	0.83	1.00	-	-	-	-	1.00	-	-	6	
Eminy'	0.85 million	0.83	1.00	-	-	-	-	1.00	-	-	6	

Only the lesser of CL and CV is applied, as per NDS 5.3.6

CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+L, V =   8492, V design =   8414 lbs
Bending(+): LC #2 = D+L, M =   1940 lbs-ft
Bending(-): LC #2 = D+L, M =   27199 lbs-ft
Deflection: LC #6 =   (live)
           LC #6 =   (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load Patterns: s=S/2, X=L+S or L+Lr, _=no pattern load in this span
Load combinations: ASCE 7-10 / IBC 2012

CALCULATIONS:
Deflection: EI =   3417e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (+): Lu = 16' Le = 26'-9.50" RB =   10.29
Lateral stability (-): Lu = 5'-6.00" Le = 10'-3.44" RB =   6.37

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. Grades with equal bending capacity in the top and bottom edges of the beam cross-section are recommended for continuous beams.
5. GLULAM: bxd = actual breadth x actual depth.
6. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
7. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

|	COMPANY	PROJECT
WoodWorks® SOFTWARE FOR WOOD DESIGN		
	May 1, 2017 03:27	Cantilever Beam - Line 3

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load3	Dead	Partial UDL	No	16.00	22.52	20.0	20.0	plf
Load5	Live	Partial UDL	Yes	16.00	22.52	75.0	75.0	plf
Load4	Dead	Point	No	19.50		270		lbs
Load6	Live	Point	Yes	19.50		1350		lbs
Load7	Live	Point	No	22.52		3263		lbs
Load8	Dead	Point	No	22.52		770		lbs
Self-weight	Dead	Full UDL	No			33.2		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :
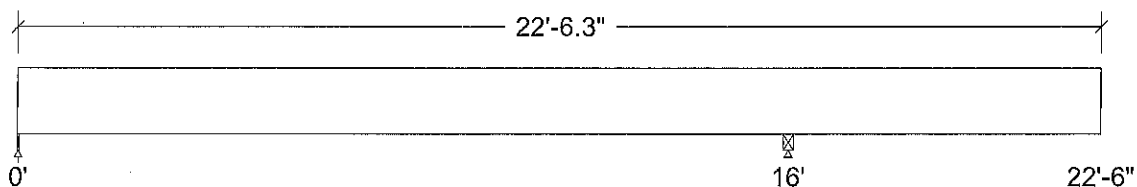
Unfactored:					
Dead	222		2094		
Live	-1718		6820		
Factored:					
Uplift	1894				
Total	222		8914		
Bearing:					
Capacity					
Beam	1507		8914		
Support	1832		9462		
Anal/Des					
Beam	0.15		1.00		
Support	0.12		0.94		
Load comb	#1		#2		
Length	0.50*		2.58		
Min req'd	0.50*		2.58		
Cb	1.00		1.15		
Cb min	1.00		1.15		
Cb support	1.00		1.00		
Fcp sup	625		625		

*Minimum bearing length setting used: 1/2" for end supports
Maximum reaction on at least one support is from a different load combination than the critical one for bearing design, shown here, due to Kd factor. See Analysis results for reaction from critical load combination.

Lake Geneva - Vacation Rental - Cantievered Beam Line 3
Glulam-Bal., West Species, 24F-1.8E WS, 8-3/4"x16-1/2"
11 laminations, 8-3/4" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 22'-6.3"; volume = 22.6 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

	WoodWorks® Sizer	SOFTWARE FOR WOOD DESIGN

This section FAILS the design check
WARNING: This section violates the following design criteria: Deflection

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 66	Fv' = 232	psi	fv/Fv' = 0.28
Bending(-)	fb = 1044	Fb' = 1751	psi	fb/Fb' = 0.60
Deflection:				
Interior Live	-0.16 = <L/999	0.53 = L/360	in	0.30
Total	-0.22 = L/868	0.80 = L/240	in	0.28
Cantil. Live	0.46 = L/168	0.43 = L/180	in	1.07
Total	0.67 = L/116	0.65 = L/120	in	1.03

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'-	2400	1.00	0.80	1.00	0.991	0.912	1.00	1.00	1.00	1.00	-	2
Fcp'	650	-	0.53	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	0.83	1.00	-	-	-	-	1.00	-	-	2	
Eminy'	0.85 million	0.83	1.00	-	-	-	-	1.00	-	-	2	

Only the lesser of CL and CV is applied, as per NDS 5.3.6
CRITICAL LOAD COMBINATIONS:
Shear   : LC #2 = D+L, V =   6487, V design =   6312 lbs
Bending(-): LC #2 = D+L, M = 34553 lbs-ft
Deflection: LC #2 = D+L (live)
         LC #2 = D+L (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load Patterns: s=S/2, X=L+S or L+Lr, _=no pattern load in this span
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   5896e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (-): Lu = 16' Le = 27'-2.00" RB =   8.38

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. Grades with equal bending capacity in the top and bottom edges of the beam cross-section are recommended for continuous beams.
5. GLULAM: bxd = actual breadth x actual depth.
6. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
7. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:28	Cantilever Beam - Line 5

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pattern	Location [ft] Start	End	Magnitude Start	End	Unit
Load3	Dead	Partial UDL	No	16.00	21.00	10.0	10.0	plf
Load5	Live	Point	Yes	21.00		1913		lbs
Load4	Dead	Point	No	21.00		383		lbs
Load6	Live	Partial UDL	Yes	16.00	21.00	50.0	50.0	plf
Self-weight	Dead	Full UDL	No			20.9		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :

|------------------------ 21'-0.3" ------------------------|

0'   16'   21'
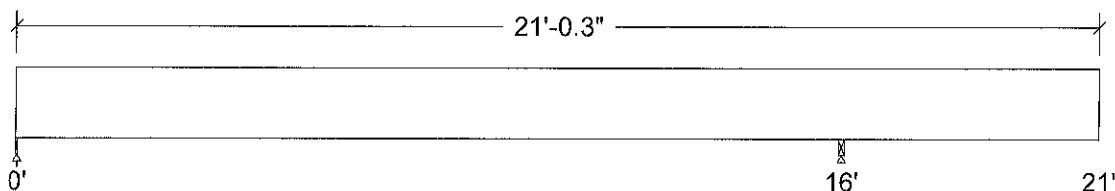
Unfactored:				
Dead	151		848	
Live	0		2797	
Factored:				
Uplift	610			
Total	151		3645	
Bearing:				
Capacity				
Beam	947		3645	
Support	1230		3810	
Anal/Des				
Beam	0.16		1.00	
Support	0.12		0.96	
Load comb	#1		#2	
Length	0.50*		1.55	
Min req'd	0.50*		1.55	
Cb	1.00		1.24	
Cb min	1.00		1.24	
Cb support	1.07		1.07	
Fcp sup	625		625	

*Minimum bearing length setting used: 1/2" for end supports
Maximum reaction on at least one support is from a different load combination than the critical one for bearing design, shown here, due to Kd factor. See Analysis results for reaction from critical load combination.

Lake Geneva - Vacation Rental - Cantievered Beam Line 1
Glulam-Bal., West Species, 24F-1.8E WS, 5-1/2"x16-1/2"
11 laminations, 5-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 21'-0.3"; volume = 13.2 cu.ft.;
Service: wet; Lateral support: top= at supports, bottom= at supports;

WoodWorks® Sizer   SOFTWARE FOR WOOD DESIGN

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 43	Fv' = 232	psi	fv/Fv' = 0.18
Bending(-)	fb = 598	Fb' = 1847	psi	fb/Fb' = 0.32
Deflection:				
Interior Live	-0.09 = <L/999	0.53 = L/360	in	0.17
Total	-0.12 = <L/999	0.80 = L/240	in	0.15
Cantil. Live	0.20 = L/303	0.33 = L/180	in	0.59
Total	0.27 = L/224	0.50 = L/120	in	0.53

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	0.88	1.00	–	–	–	–	1.00	1.00	1.00	2
Fb'-	2400	1.00	0.80	1.00	0.969	0.962	1.00	1.00	1.00	1.00	–	2
Fcp'	650	–	0.53	1.00	–	–	–	–	1.00	–	–	–
E'	1.8 million	0.83	1.00	–	–	–	–	1.00	–	–	2	
Eminy'	0.85 million	0.83	1.00	–	–	–	–	1.00	–	–	2	

Only the lesser of CL and CV is applied, as per NDS 5.3.6
CRITICAL LOAD COMBINATIONS:
Shear   : LC #2   = D+L, V =   2699, V design =   2595 lbs
Bending(-): LC #2   = D+L, M = 12433 lbs-ft
Deflection: LC #2   = D+L (live)
           LC #2   = D+L (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load Patterns: s=S/2, X=L+S or L+Lr, _=no pattern load in this span
Load combinations: ASCE 7-10 / IBC 2012
CALCULATIONS:
Deflection: EI =   3706e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 2.00(Dead Load Deflection) + Live Load Deflection.
Lateral stability (-): Lu = 16' Le = 27'-2.00" RB =   13.33

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. Grades with equal bending capacity in the top and bottom edges of the beam cross-section are recommended for continuous beams.
5. GLULAM: bxd = actual breadth x actual depth.
6. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
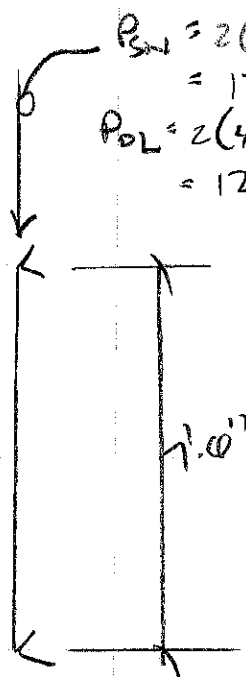7. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

NEW POST - LINE C2

$P_{SN} = 2(5427) + 2(3506)$
$= 17866$
$P_{DL} = 2(4092) + 2(1931)$
$= 12046$

IGNORE
UP LIFT
SNOW
LOAD

$7'-0''$

USE $5\frac{1}{8} \times 6''$
DOUG FIR L2

NEW POST - BRIDGE BEAM

$P_{SN} = 2(4533) = 9066$
$P_{DL} = 2(3062) = 6124$

13
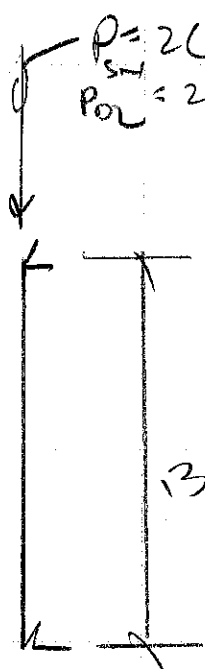
WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:31	New Post - Line C2

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Dead	Axial		(Ecc. = 0.00")	12046	lbs
Load2	Snow	Axial		(Ecc. = 0.00")	17866	lbs
Self-weight	Dead	Axial			53	lbs

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Lateral Reactions (lbs):

```
                              ─────────────── 7'-6" ───────────────
        Base  △ ┌────────────────────────────────────────────────┐ △  Top
              0'└────────────────────────────────────────────────┘
                                                                  7'-6"
```
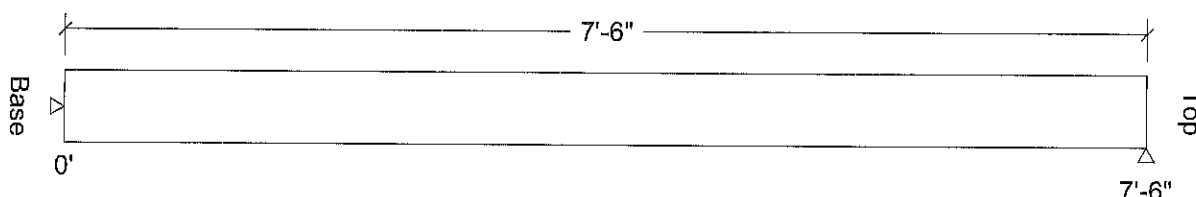
New Post - Line C2
Glulam-Axial, West Species, 2 (DF L2), 5-1/8"x6"
4 laminations, 5-1/8" maximum width,
Support: Non-wood
Total length: 7'-6.0"; volume = 1.6 cu.ft.;
Pinned base; Load face = width(b); Ke x Lb: 1.0 x 7.5 = 7.5 [ft]; Ke x Ld: 1.0 x 7.5 = 7.5 [ft];

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Axial	fc = 974	Fc' = 1712	psi	fc/Fc' = 0.57
Axial Bearing	fc = 974	Fc* = 2242	psi	fc/Fc* = 0.43

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CV	Cfu	Cr	Cfrt	Notes	LC#
Fc'	1950	1.15	1.00	1.00	0.764	–	–	–	1.00	–	2
Fc*	1950	1.15	1.00	1.00	–	–	–	–	1.00	–	2

CRITICAL LOAD COMBINATIONS:
Axial   : LC #2 = D+S, P = 29965 lbs
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.

WoodWorks® Sizer SOFTWARE FOR WOOD DESIGN

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	May 1, 2017 03:31	New Post @ Ridge Beam Line B

Design Check Calculation Sheet
WoodWorks Sizer 10.4

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start End	Magnitude Start End	Unit
Load1	Dead	Axial		(Ecc. = 0.00")	6124	lbs
Load2	Snow	Axial		(Ecc. = 0.00")	9066	lbs
Self-weight	Dead	Axial			92	lbs

Load magnitude does not include Normal Importance factor from Table 4.2.3.2, which is applied during analysis.

Lateral Reactions (lbs):

New Post - Ridge Beam
Glulam-Axial, West Species, 2 (DF L2), 5-1/8"x6"
4 laminations, 5-1/8" maximum width,
Support: Non-wood
Total length: 13'; volume = 2.8 cu.ft.;
Pinned base; Load face = width(b); Ke x Lb: 1.0 x 13.0 = 13.0 [ft]; Ke x Ld: 1.0 x 13.0 = 13.0 [ft];

Analysis vs. Allowable Stress and Deflection using NDS 2012 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Axial	fc = 497	Fc' = 720	psi	fc/Fc' = 0.69
Axial Bearing	fc = 497	Fc* = 2242	psi	fc/Fc* = 0.22

Additional Data:
FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CV	Cfu	Cr	Cfrt	Notes	LC#
Fc'	1950	1.15	1.00	1.00	0.321	–	–	–	1.00	–	2
Fc*	1950	1.15	1.00	1.00	–	–	–	–	1.00	–	2

CRITICAL LOAD COMBINATIONS:
Axial   : LC #2 = D+S, P = 15282 lbs
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2012

Design Notes:
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2012), the National Design Specification (NDS 2012), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2010 and manufactured in accordance with ANSI A190.1-2007
4. GLULAM: bxd = actual breadth x actual depth.

PROJECT _____

DESCR. _____ PROJ. NO. _____

CALCULATED BY _____ DATE _____

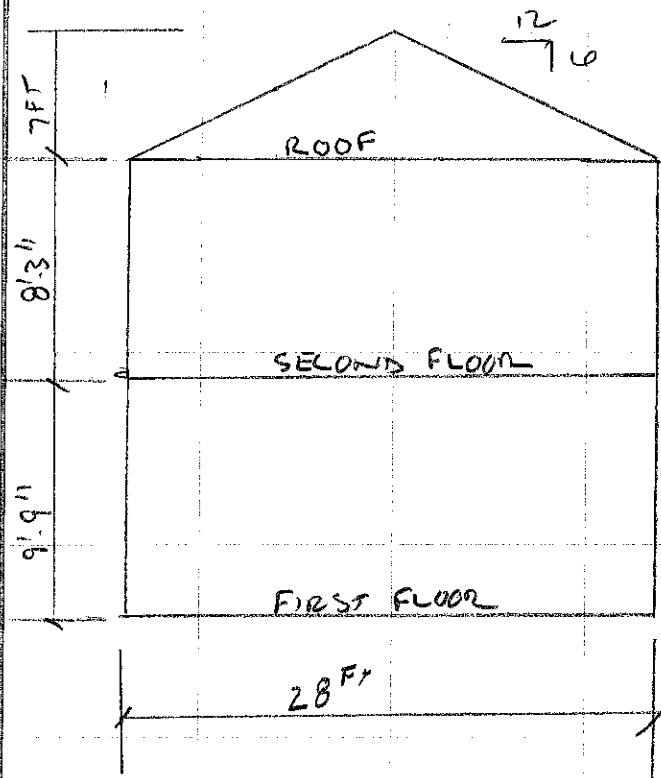CHECKED BY _____ DATE _____

SCALE _____ SHEET NO. _____

LATERAL BRACING

NEW WALL BRACING @ LINE C

MWFRS BASE PRESSURE = 17.1 psf

END WALL WIND PRESSURE

GABLE END ROOF
PROJECTION AREA = $\frac{1}{2}(28^{ft} \times 7^{ft})$
$= 98 ft^2$

ROOF

SECOND FLOOR

FIRST FLOOR

7 ft

8'3"

9'9"

28 ft

$\frac{12}{6}$

END WALL WIND LOAD

ROOF LEVEL

$$P_{W_R} = \frac{17.1 psf (98 ft^2) + 17.1 psf (8.25/2)(28^{ft})}{2}$$

$$P_{W_R} = 1825^{lb}$$

USE 2000 lb

SECOND FLOOR

$$P_{W_{2ND}} = \frac{17.1 psf (8.25/2 + 9.75/2) 28^{ft}}{2}$$
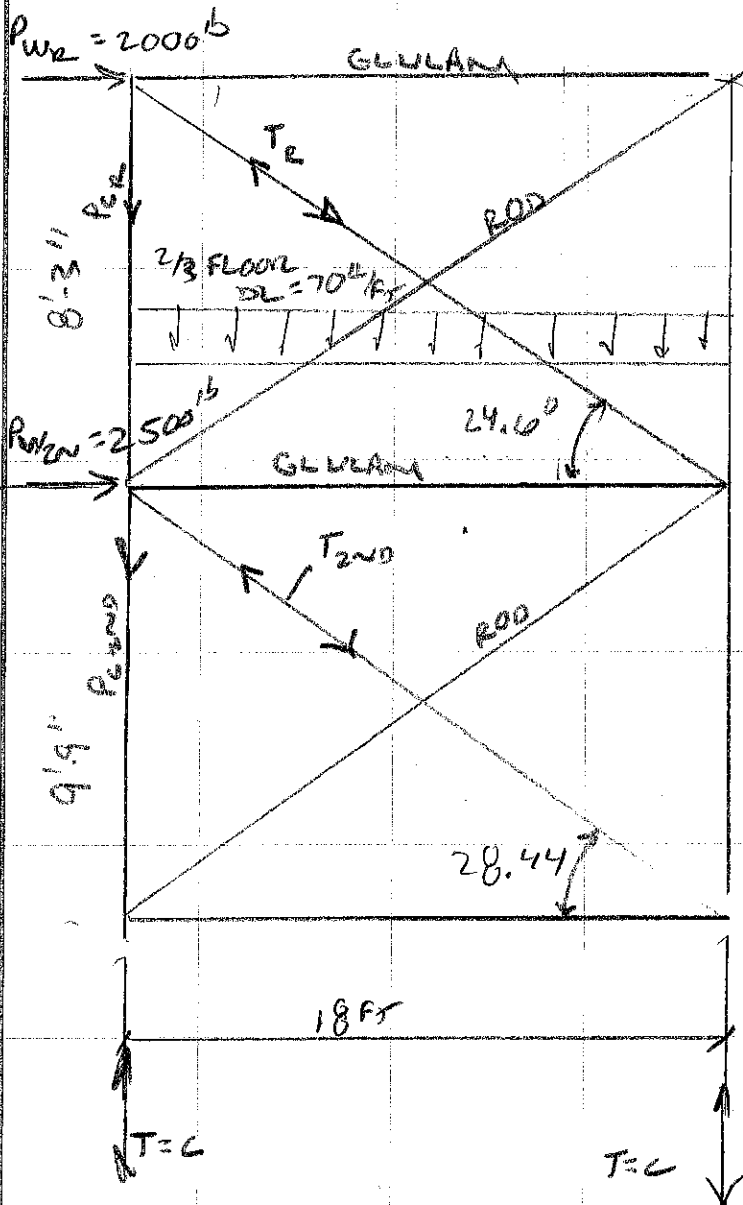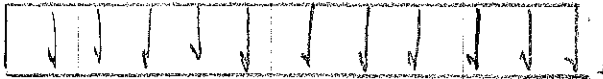
$$P_{W_{2ND}} = 2155 psf$$

USE 2500 lb

LATERAL BRACING LOADING DIAGRAM

$2/3$ ROOF DL = $15 \text{psf} (2/3) 14 \frac{\text{ft}}{2} = 70 \text{ lb/ft}$

$P_{WR} = 2000^{lb}$

GLULAM

T_R

ROD

$2/3$ FLOOR DL $= 70 \text{ lb/ft}$

$P_{W2N} = 2500^{lb}$

GLULAM

$24.6°$

$8'-3''$ ROD

T_{2ND}

ROD

$9.9'$ ROD P_{C2ND}

28.44

18 FT

$T = C$ $T = C$

ROD $F_y = 36,000 \text{ psi}$

ALLOW TEN $= 0.6(36,000) = 21,600^{*}$

2ND FLOOR BRACE

$P_{WR} = 2000^{lb}$

$T_R = \dfrac{2000^{lb}}{\cos 24.6°} = 2200^{lb}$

$A_{ROD} = \dfrac{2200^{lb}}{21,600} = 0.10 \text{ in}^2 \qquad A = \dfrac{\pi d^2}{4}$

MIN $d = 0.36''$

USE $1/2'' \phi$ ROD

$P_{CR} = 2200^{lb} (\sin 24.6°)$
$\underline{= 916^{lb}}$

1ST FLOOR

$P_{W1ST} = 2000^{lb} + 2500^{lb} = 4500^{lb}$

$T_{2ND} = \dfrac{4500^{lb}}{\cos 28.44} = 5118^{lb}$

$A_{ROD} = \dfrac{5118}{21,600} = 0.24 \text{ in}^2$

MIN $d = 0.55 \text{ in}$

USE $3/4'' \phi$ ROD

$P_{C2ND} = 5118 (\sin 28.44°) = \underline{2438^{lb}}$

NET UPLIFT @ COLUMN BASE

$T = C = \dfrac{2000^{lb}(18 \text{ft}) + 2500(9.75) - 70(2)(18)\frac{7}{2}}{18 \text{ft}}$

$T = C = 2094^{lb}$

SUPPLEMENTAL FOUNDATION CALCULATIONS

For

640 West Main Street
Lake Geneva, Wisconsin

by

United
Building
Solutions

Date: May 14, 2017

United Building Solutions
A Wall-tech Company

PROJECT __LAKE GENEVA · VACATION RENTAL__
DESCR._____ PROJ. NO._____
CALCULATED BY __KBD__ DATE_____
CHECKED BY _____ DATE_____
SCALE_____ SHEET NO._____

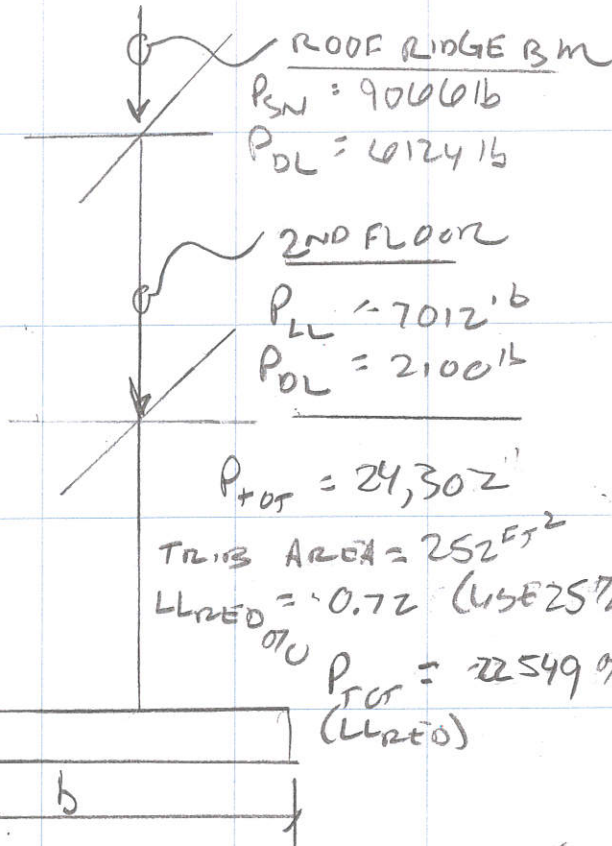## FOUNDATION

- ASSUMED ALLOWABLE SOIL BRG PRESSURE = 1750 psf
- CONCRETE f'_c = 3000 psi
- F_y (REBAR) = 60,000 psi

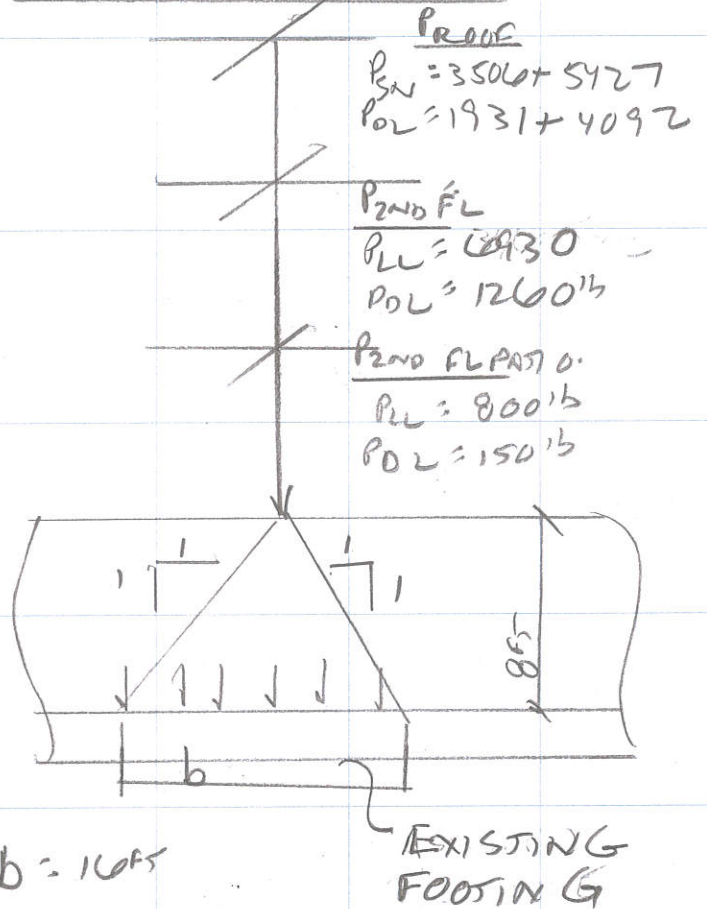### NEW FTG (NEW INTERIOR COL. (LOCATION B-2)

__NEW FTG. COL. LOAD (COL. B-2)__

ROOF RIDGE BM
P_{SN} = 9066 lb
P_{DL} = 6124 lb

2ND FLOOR
P_{LL} = 7012 lb
P_{DL} = 2100 lb

P_{TOT} = 24,302'

TRIB AREA = 252 ft²
LL_{RED} = 0.72 (USE 25%)
P_{TOT} = 22549 # (LL RED)

$b = \sqrt{\dfrac{22549}{1750 psf}} = 3.58$ FT

USE 4'-0" × 4'-0" × 12"
W/ 5 #4'S EACH WAY

EXISTING WALL FTG CHK - LINE C.2

POST LOCATION C.1·2

P_{ROOF}
P_{SN} = 3506 + 5427
P_{DL} = 1931 + 4092

$P_{2ND FL}$
P_{LL} = 6930
P_{DL} = 1260 lb

$P_{2ND FL PATIO}$
P_{LL} = 800 lb
P_{DL} = 150 lb

EXISTING FOOTING

$b = 16$ FT

$\underline{P_{TOTAL} = 17856 \text{ lb}}$

MIN. EXISTING FTG WIDTH NEEDED

$a = \dfrac{17856^{\#} + \left(\tfrac{10}{12}\right) 8 ft (150 pcf)}{16^{F}}$ ← WALL WT

$a = 2116 \text{ lb/ft}$

MIN $b_{REQ} = \dfrac{2116 \text{ lb/ft}}{1750 psf} = 1.21$ FT

MIN EXISTING FTG WIDTH
NEEDED IS 1'-3" ← FIELD VERIFY

PROJECT ___LAKE GENEVA - VACTION RENTAL___
DESCR._____ PROJ. NO._____
CALCULATED BY _KDF_____ DATE_____
CHECKED BY _____ DATE_____
SCALE_____ SHEET NO._____

United
Building
Solutions

A Wall-tech Company

DRILLED PIER @ DECK
POST @ STAIR

$P_{LL} = 12084^{lb}$

$P_{DL} = 2698^{lb}$

CANTILEVER BEAM
LINE 2 - WITH
ADDED COL.

↑
PG FF.25
CALS
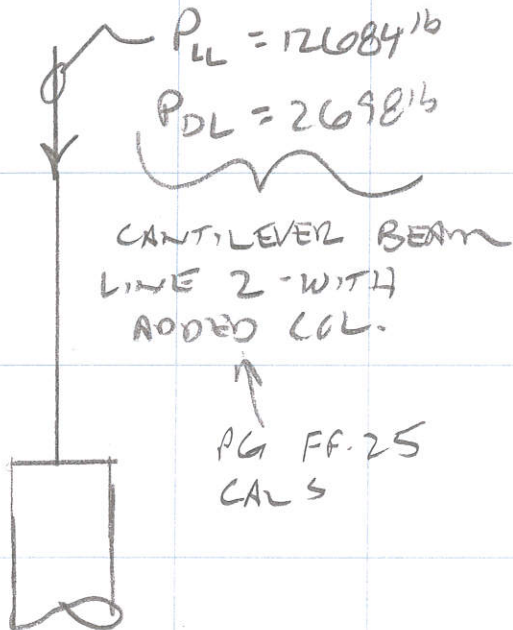
$A_{ST} = 1.5\%$

$A_{ST} = 1.88_{in}^2$

USE - 8 - #5
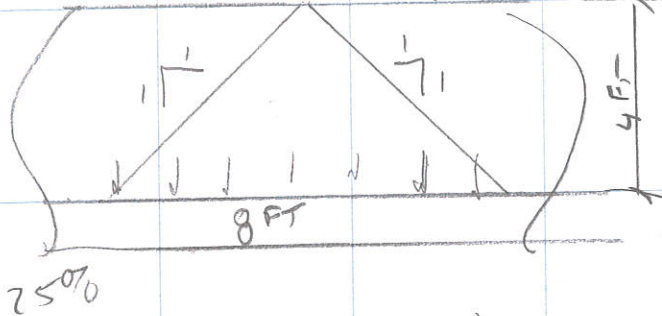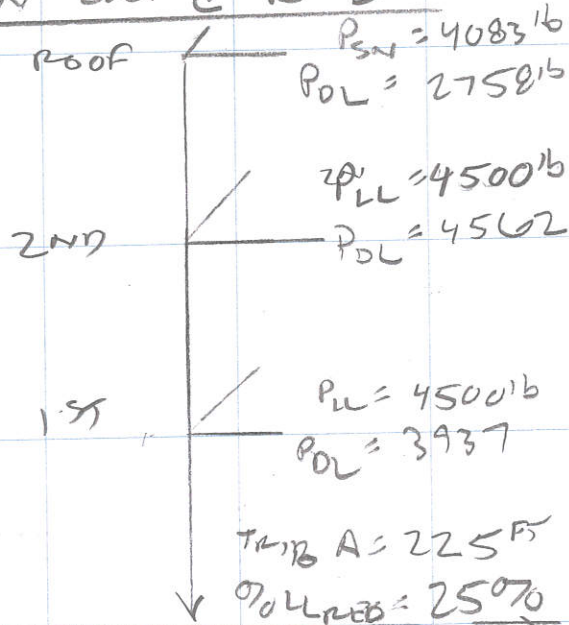BARS
VERTICAL

MIN PIER DIAMETER REQ'D

$A = \pi d^2 / 4$

$A_{REQ'D} = \dfrac{12084^{lb} + 2698}{1750} = 8.79_{ft}^2$

$d = \sqrt{\dfrac{8.79\,(4)}{\pi}} = 3.34^{ft}$

28" ⌀ PIER
N.G.

REVISE TO 40" ⌀
PIER

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PROJECT LAKE GENEVA - VACATION RENTAL
DESCR. _____ PROJ. NO. _____
CALCULATED BY KDP _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____ SHEET NO. _____

EXISTING FDN WALL CHK
@ NEW COL. @ B-5.0

ROOF
$P_{SN} = 4083^{lb}$
$P_{DL} = 2758^{lb}$

2ND
$2P_{LL} = 4500^{lb}$
$P_{DL} = 4562$

1ST
$P_{LL} = 4500^{lb}$
$P_{DL} = 3937$

TRIB A = 225^{FT}
% LL RED = 25%

1' — 7' — 4 FT

8 FT

25%

$P_{TOT} = 22090^{lb}$
(W/ L.L. RED)

LINE LOAD (OVER 8 FT)

$W_{lb/FT} = \dfrac{22090}{8} + \dfrac{10}{12}(4)(.50)$

$W_{lb/FT} = 3261^{lb}/_{FT}$

MIN WALL FTG = $\dfrac{3261^{lb}/_{FT}}{1750}$

WIDTH = 1.86^{FT}

FOUNDATION SUMMARY

1. ORIGINAL FTG SHOWN
AS 3'.0" x 3'.0" IS 4.6%
OVERSTRESSED
   a. REVISE TO 4'.0" x 4'.0" x 2"
   DEEP W/ 5 - #4'S EACH WAY

2. EXISTING FOUNDATION
WALLS W/ NEW COLUMNS
ON TOP REQUIRES A
MIN OF 1'.3" WIDE @ FULL
HEIGHT WALL ₹ 2'.0"
WIDE @ LINE 5.0

3. REVISE 28"∅ DRILLED
PIER TO 40" WIDE