FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, WA 98003
(253) 815-9182

STRUCTURAL CALCULATIONS
for

Silver Basin Construction Residence

At

9785 S.E. 41st Street
Mercer Island, WA 98040

Project #19026

Rev 9-8-20

Codes:

2015 International Building Code

Loads:

Roof	15 psf dead load	25 psf live load, snow
Walls	10 psf dead load	
Floor	14 psf dead load	40 psf live load

Wind ASCE 7-10 Simple diaphragm, 110 mph wind speed, Exp "C", Risk category II, Kzt=1.3

Seismic ASCE 7-10 Importance factor 1.00, Site Category D, Sds=0.929, S1=0.5[illegible]

Foundation: All values assumed
footings 1500 psf allowable bearing pressure
0.35 friction
Walls 35 psf/ft active pressure
350 psf/ft passive pressure

9/9/20

ARNOLD E. FORSMAN
STATE OF WASHINGTON
30718
REGISTERED
PROFESSIONAL ENGINEER

Sheets 1-98

The items designed herein represent the entire scope of structural investigation performed. No other portions of the structure have been reviewed. These calculations apply to the location specified above. The site was not investigated and no judgment on the suitability of the site was made.

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SCOPE OF WORK

Forsman Engineering was asked to provide a lateral load analysis, shear wall design review of major framing members, and drawings review for a wood framed single family residence. The roof framing is primarily manufactured trusses, the floor framing is TJI joists, and the foundation is typical concrete strip footings with a basement slab on grade.

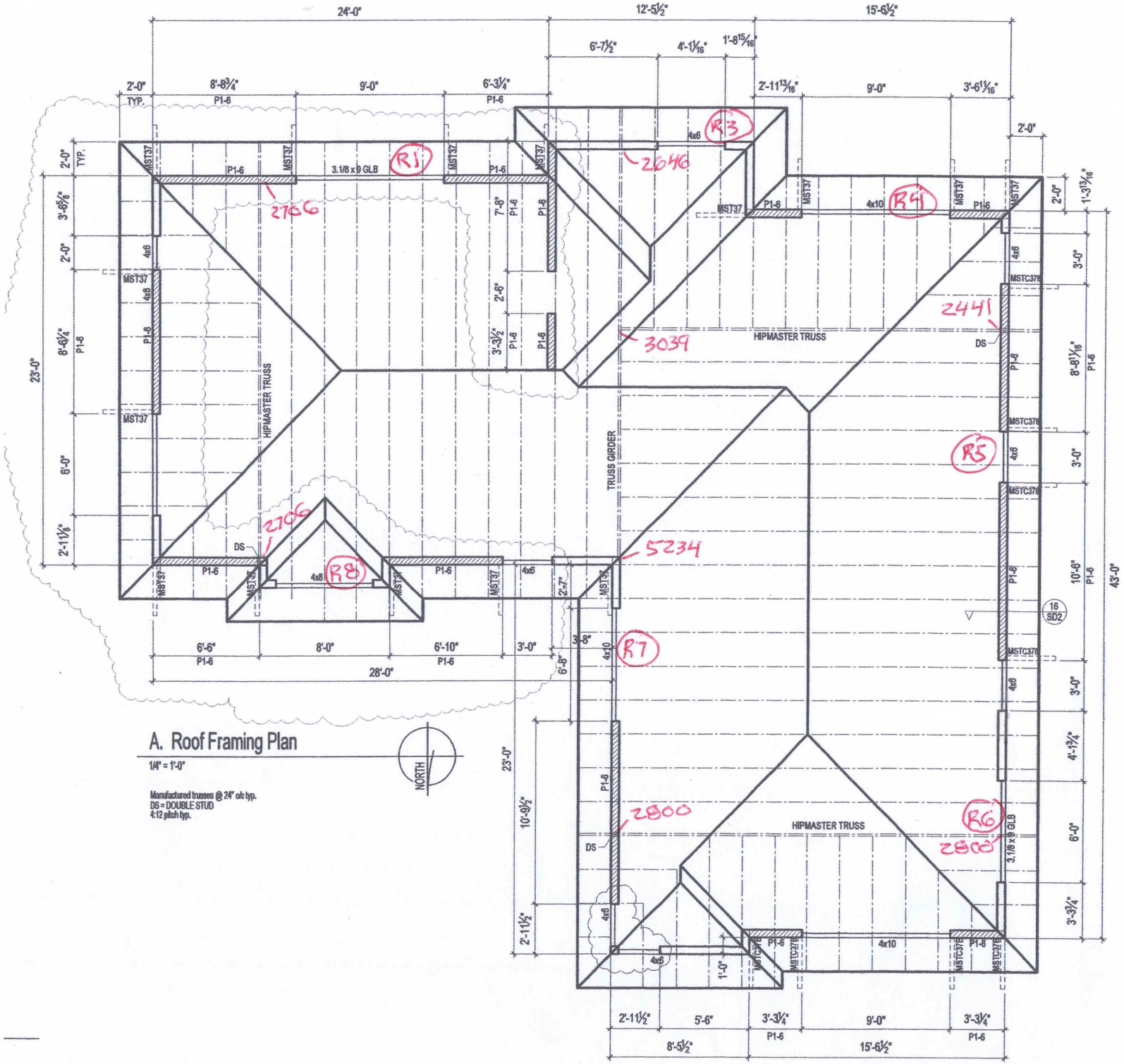
The attached calculations are to be used as a submittal for one potential building site. The cover sheet should have an original signature in blue ink over the seal.

Forsman Engineering will use that degree of care and skill ordinarily exercised under similar circumstances by members of the engineering profession in this local. No other warranty, either expressed or implied is made in connection with our rending of professional services. For any dispute, claim, or action arising out of this design, Forsman Engineering shall have liability limited to the amount of the fee received by Forsman Engineering.

Questions regarding the attached should be addressed to Forsman Engineering.

Arnold E. Forsman, P.E.
Forsman Engineering

forsmanengineering@comcast.net 253.815.9182

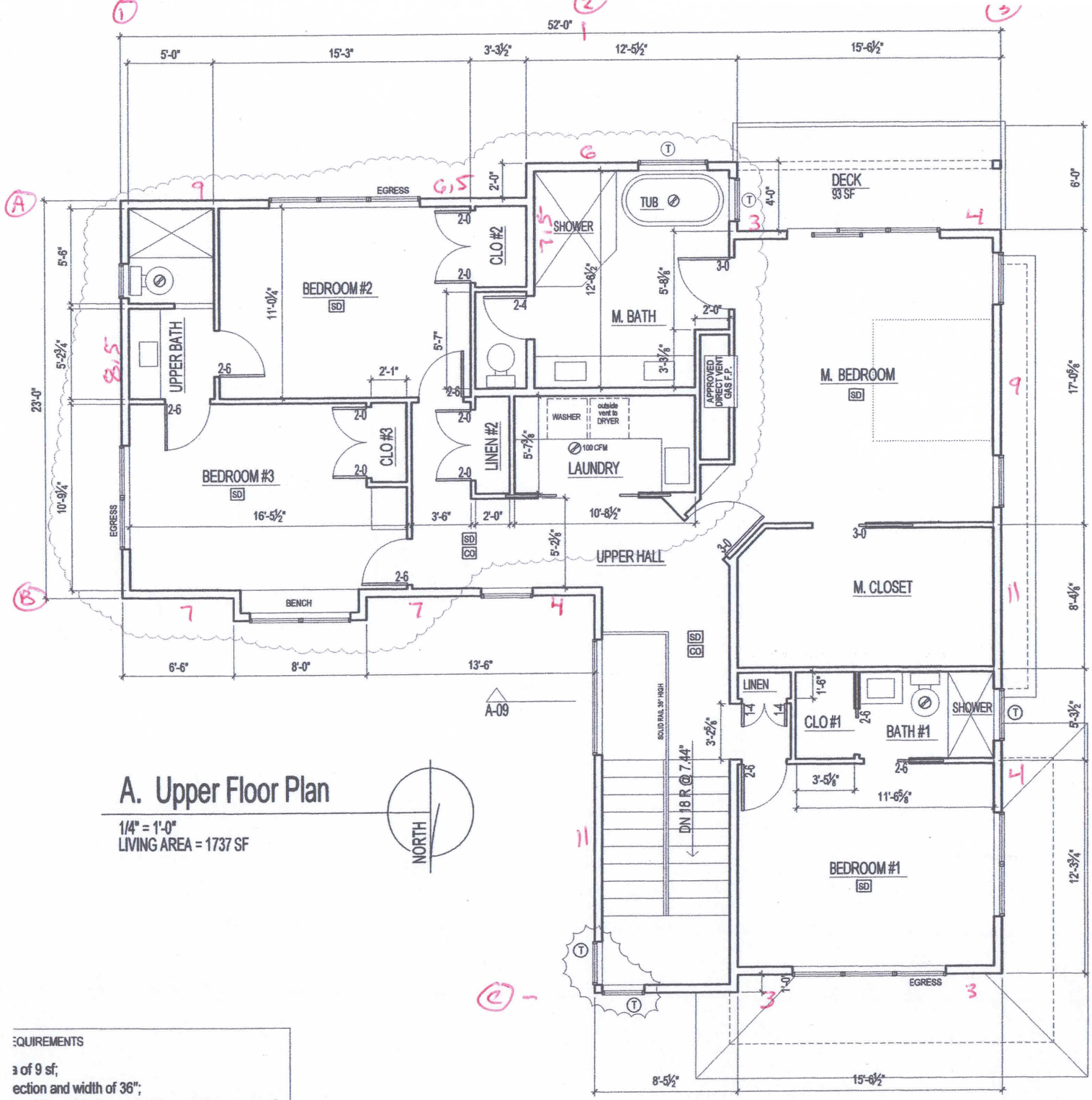


A. Roof Framing Plan

1/4" = 1'-0"

NORTH

Manufactured trusses @ 24" o/c typ.
DS = DOUBLE STUD
4:12 pitch typ.



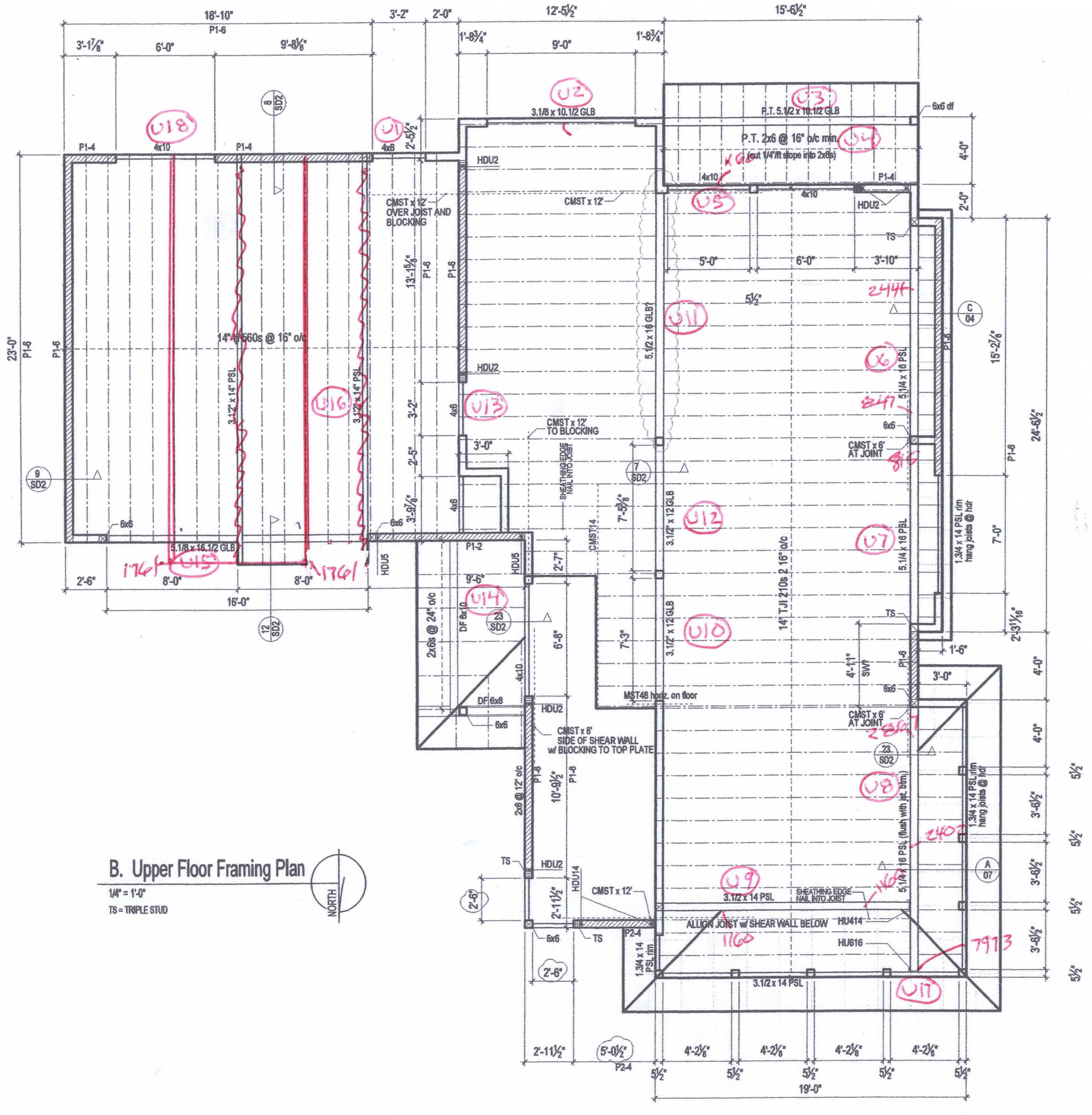
A. Upper Floor Plan

1/4" = 1'-0"
LIVING AREA = 1737 SF

NORTH

EQUIREMENTS

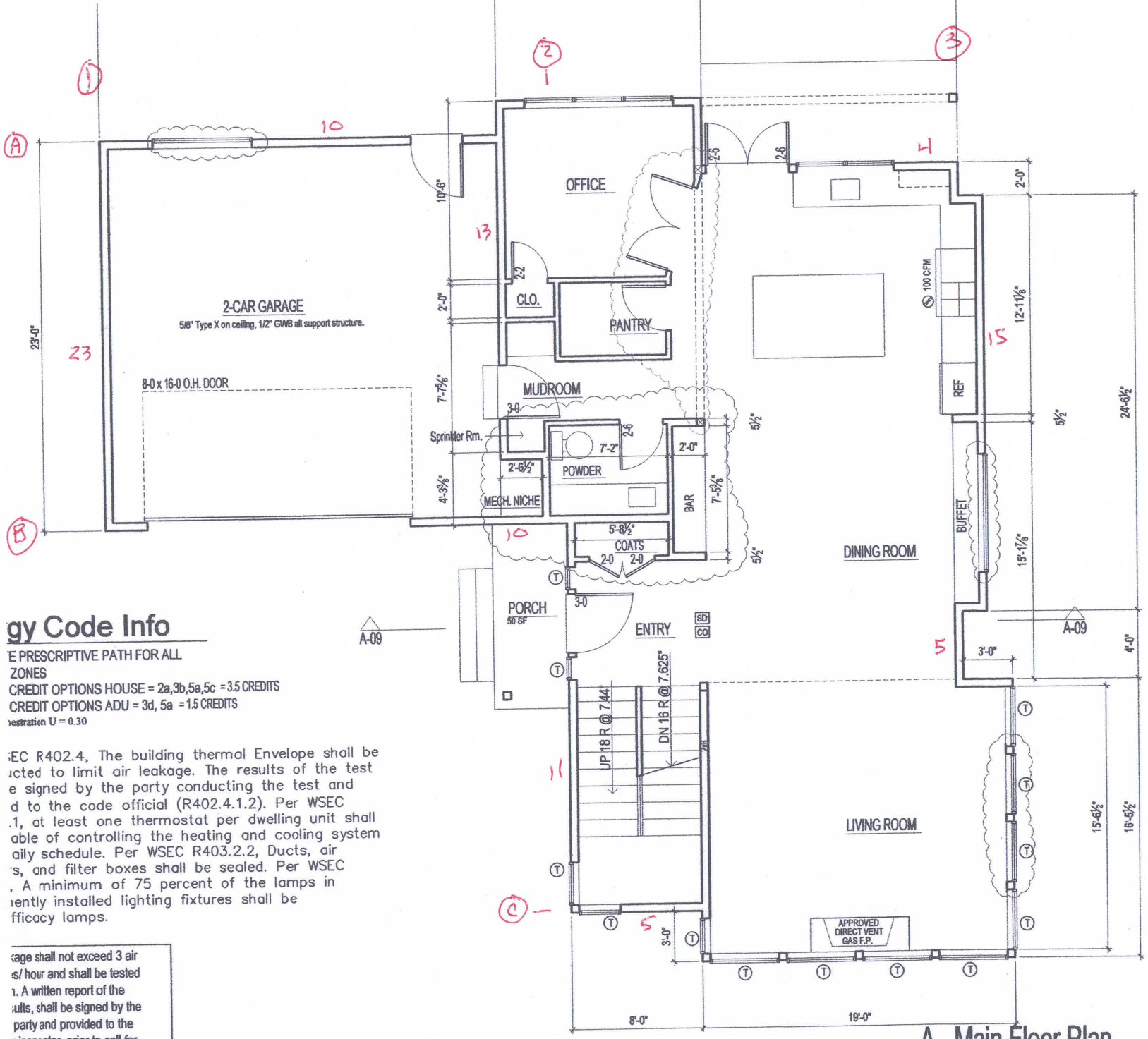
a of 9 sf;
ection and width of 36";
an 44" need to have a ladder or stair permanently



B. Upper Floor Framing Plan

1/4" = 1'-0"

TS = TRIPLE STUD



gy Code Info

E PRESCRIPTIVE PATH FOR ALL
ZONES
CREDIT OPTIONS HOUSE = 2a,3b,5a,5c =3.5 CREDITS
CREDIT OPTIONS ADU = 3d, 5a =1.5 CREDITS
estration U = 0.30

EC R402.4, The building thermal Envelope shall be
ucted to limit air leakage. The results of the test
e signed by the party conducting the test and
d to the code official (R402.4.1.2). Per WSEC
.1, at least one thermostat per dwelling unit shall
able of controlling the heating and cooling system
aily schedule. Per WSEC R403.2.2, Ducts, air
's, and filter boxes shall be sealed. Per WSEC
, A minimum of 75 percent of the lamps in
iently installed lighting fixtures shall be
fficacy lamps.

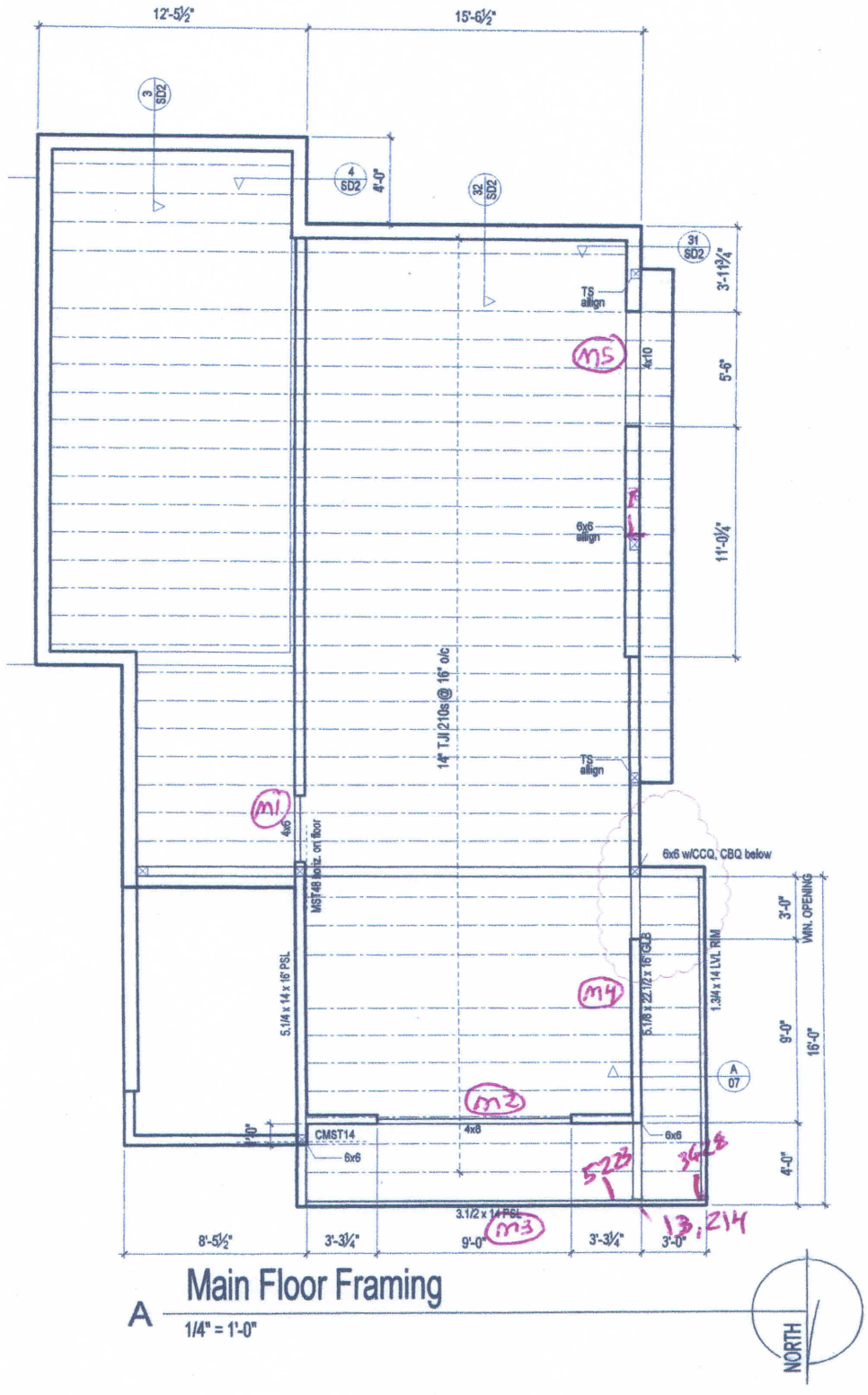
kage shall not exceed 3 air
s/ hour and shall be tested
1. A written report of the
ults, shall be signed by the
party and provided to the
inspector, prior to call for
spection."

num of 75 percent of
iently installed lamps

A. Main Floor Plan

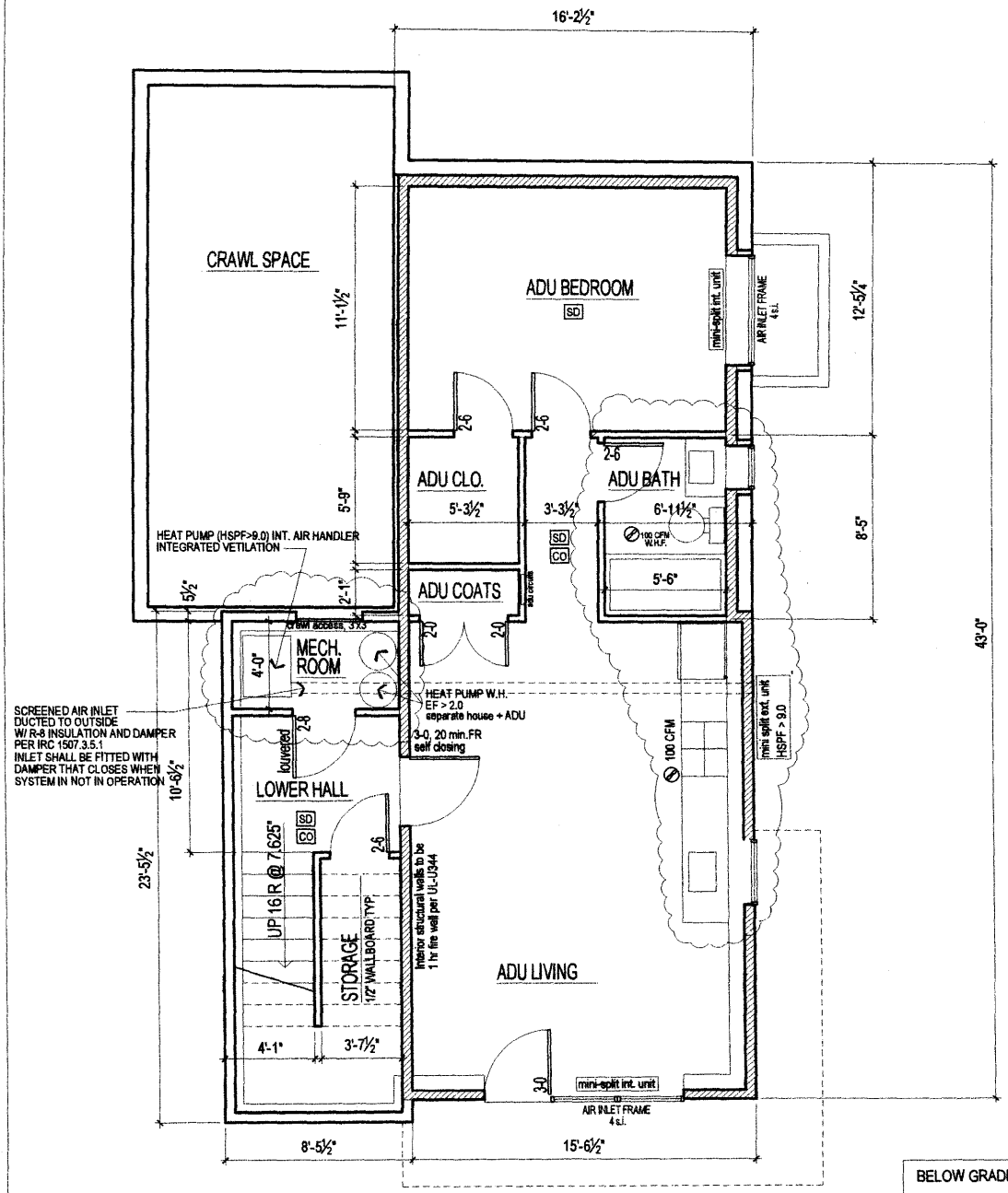
1/4" = 1'-0"
LIVING AREA = 1308.7 SF

ORTH



A Main Floor Framing

1/4" = 1'-0"



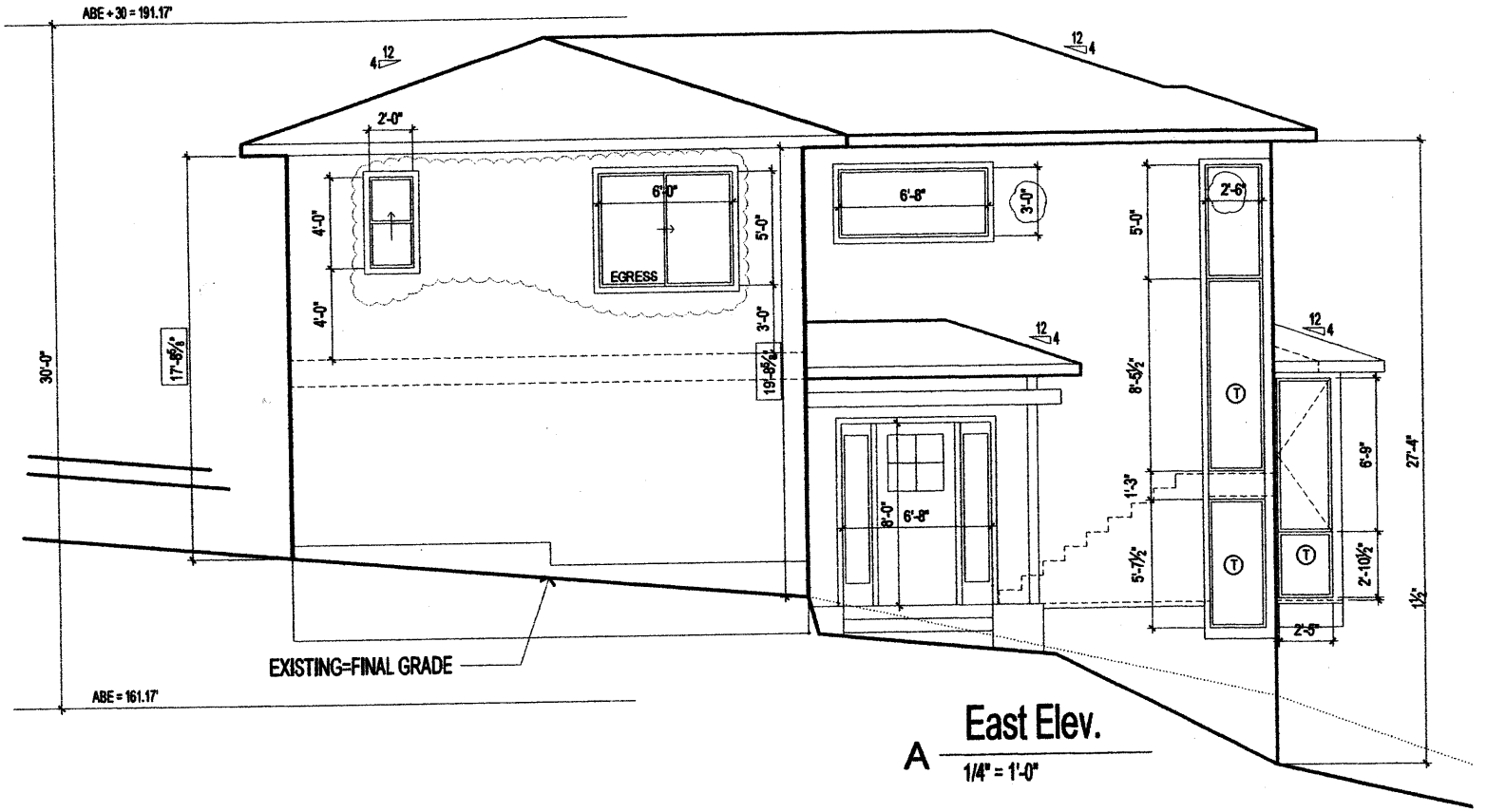
B. Lower Floor Plan - ADU

1/4" = 1'-0"
LIVING AREA = 876 SF
▨ = ADU EXTENTS/THERMAL BARRIER (2x6 WALLS, TYP.)
ADU = 688 SF

NORTH

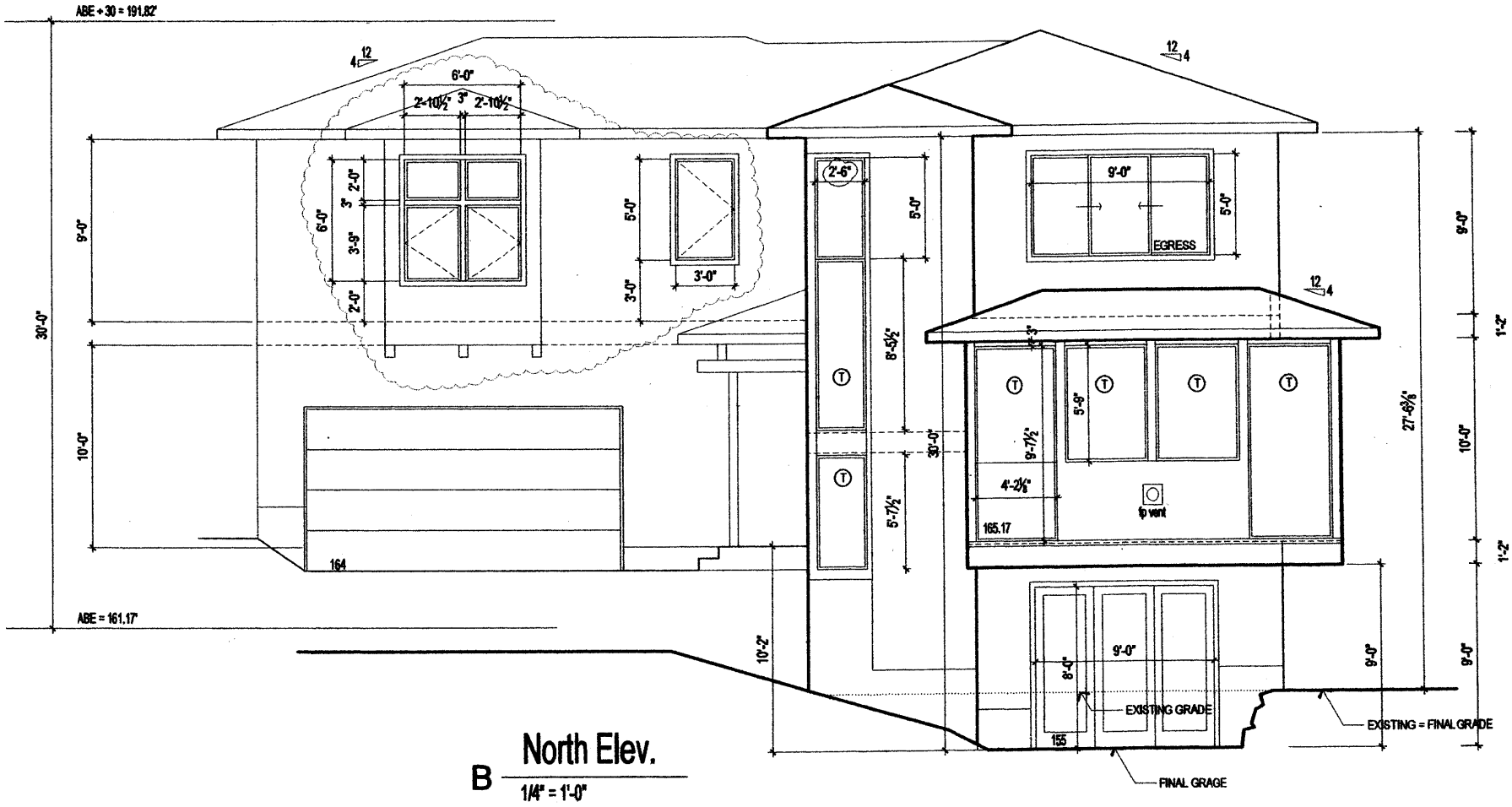
BELOW GRADE EG

a. Minimur
b. Minimur
c. Window affixed;
d. Any bar opening and are



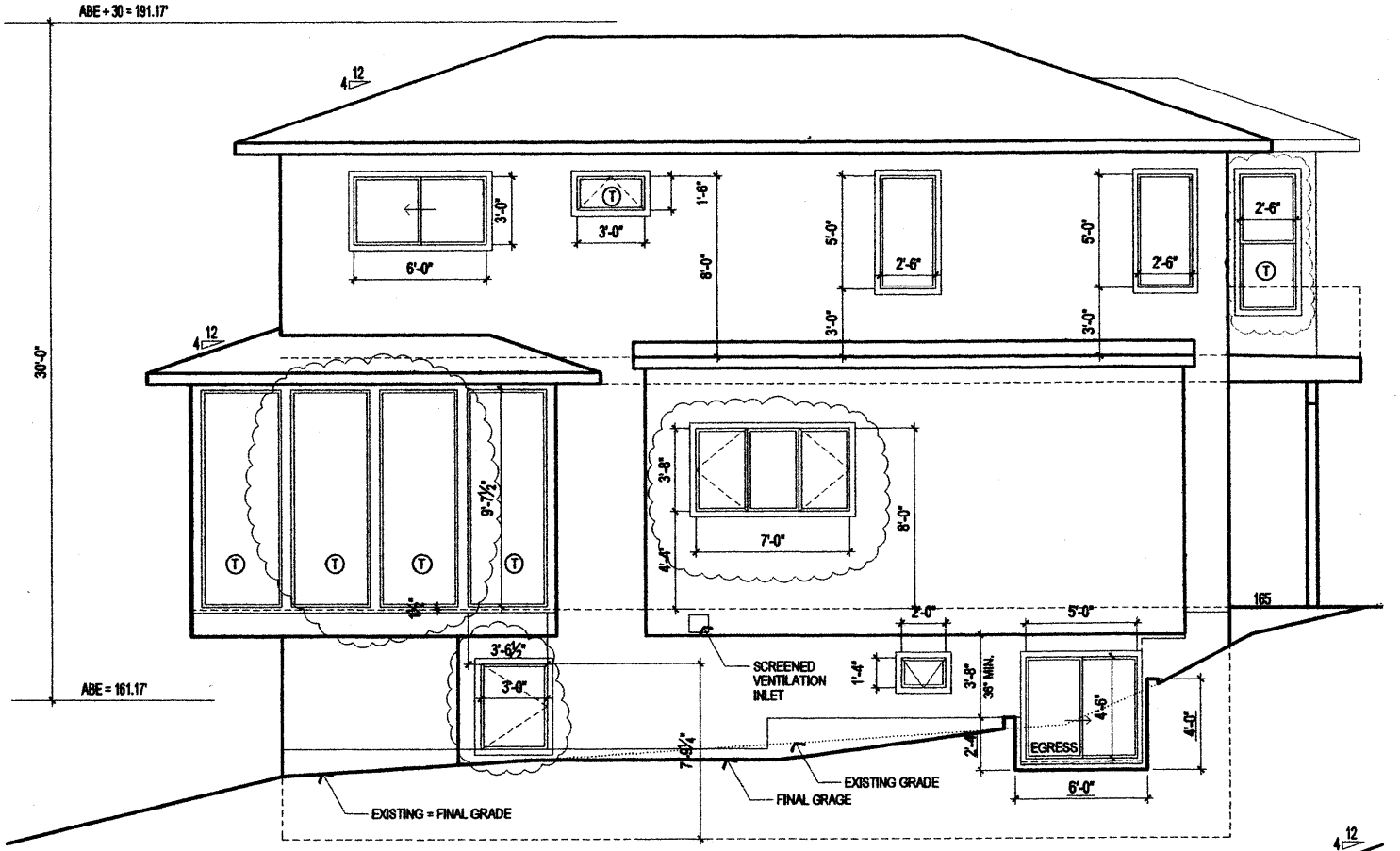
A East Elev.

1/4" = 1'-0"



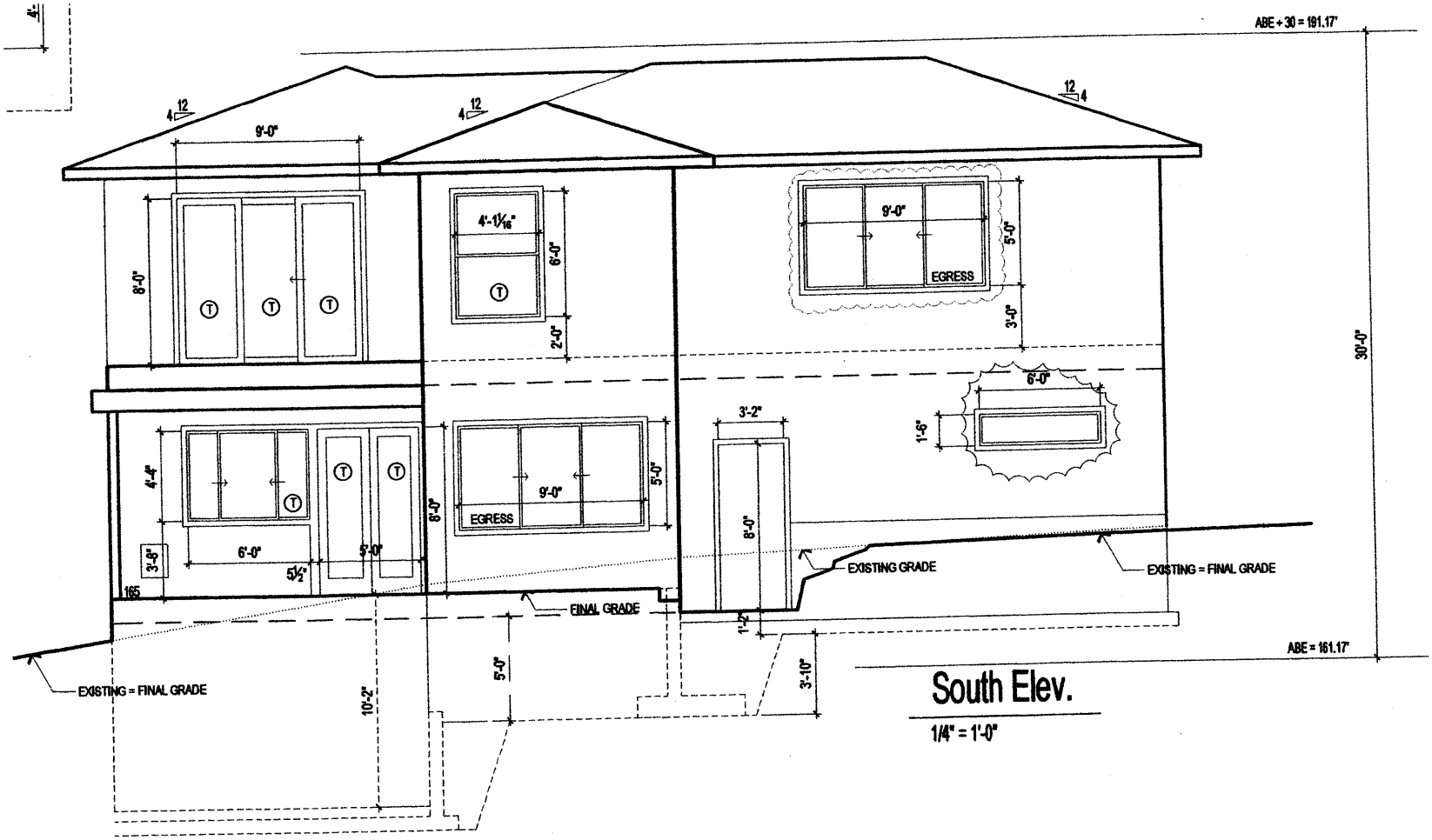
B North Elev.

1/4" = 1'-0"



West Elev.

1/4" = 1'-0"



South Elev.

1/4" = 1'-0"

FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

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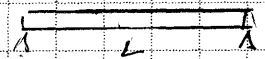
SCALE

Roof Framing

R1 L = 9.5'



~~$w_{100} = \frac{15}{2(6)}(6+2)^2 = 80$ plf~~
~~$w_{LL} = \frac{25}{2(6)}(6+2)^2 = 133$ plf~~
$w_{20D} = 15 \cdot 27/2 = 203$ plf
$w_{20L} = 25 \cdot 27/2 = 338$ plf
~~P = 2700# @ 9'~~
⇒ 3 1/8 x 9 GLB ✓

N/A
~~R2~~ L = 6'
$w_{DL} = 15 \cdot 28/2 = 210$ plf
$w_{LL} = 25 \cdot 28/2 = 350$ plf
⇒ 4×8 DF #2

R3 L = 4'
$w_{DL} = \frac{15}{2(11)}(11+2)^2 = 115$ plf
$w_{LL} = \frac{25}{2(11)}(11+2)^2 = 192$ plf
⇒ 4×6 DF #2 ✓

R4 L = 9'
$w_{DL} = \frac{15}{8(2)}(8+2)^2 = 94$ plf
$w_{LL} = \frac{25}{8(2)}(8+2)^2 = 156$ plf
⇒ 4×10 DF #2 ✓

R5 L = 3'
$w_{DL} = 15 \cdot 28/2 = 210$ plf
$w_{LL} = 25 \cdot 28/2 = 350$ plf
⇒ 4×6 DF #2 ✓

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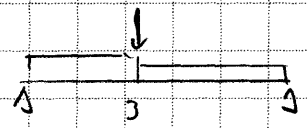
CHECKED BY DATE
SCALE

R6 L = 6'



$w_{1DL} = 15 \cdot 28/2 = 210$ plf
$w_{1LL} = 25 \cdot 28/2 = 350$ plf
$w_{2DL} = \frac{15}{8(2)}(8+2)^2 = 94$ plf
$w_{2LL} = \frac{25}{8(2)}(8+2)^2 = 156$ plf
$P = 2800\#$ @ 3'
⇒ 3 1/8 x 9 GLB ✓

R7 L = 7'

$w_{DL} = 15 \cdot 28/2 = 210$ plf
$w_{LL} = 25 \cdot 28/2 = 350$ plf
⇒ 4x10 DF #2 –

R8 L = 6'

$w_{DL} = 15 \cdot 29/2 = 218$ plf
$w_{LL} = 25 \cdot 29/2 = 363$ plf
⇒ 4x8 DF #2 ✓

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering Sep. 8, 2020 12:27	9787 SE 41st Street BeamR1

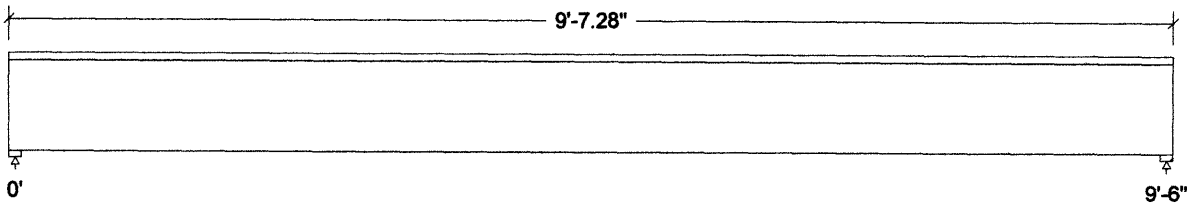
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
wd	Dead	Full UDL				203.0		plf
ws	Snow	Full UDL				338.0		plf
Self-weight	Dead	Full UDL				6.5		plf

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



Unfactored:			
Dead	995		995
Snow	1606		1606
Factored:			
Total	2601		2601
Bearing:			
Capacity			
Beam	2601		2601
Des ratio			
Beam	1.00		1.00
Load comb	#2		#2
Length	1.28		1.28
Min req'd	1.28		1.28
Cb	1.00		1.00
Cb min	1.00		1.00

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/8"x9"
6 laminations, 3-1/8" maximum width,
Supports: All - Non-wood
Total length: 9'-7.28"; Clear span: 9'-4.72"; volume = 1.9 cu.ft.
Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 115	Fv' = 305	psi	fv/Fv' = 0.38
Bending(+)	fb = 1757	Fb' = 2760	psi	fb/Fb' = 0.64
Live Defl'n	0.18 = L/628	0.32 = L/360	in	0.57
Total Defl'n	0.29 = L/388	0.47 = L/240	in	0.62

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 max = 2601, V design = 2161 lbs
Bending(+): LC #2 = D+S, M = 6176 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: ICC-IBC

CALCULATIONS:
Deflection: EI = 342e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), 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 117-2015 and manufactured in accordance with ANSI A190.1-2012
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
Forsman Engineering 19026 June 30, 2019 06:29:00	9787 SE 41st Street BeamR2

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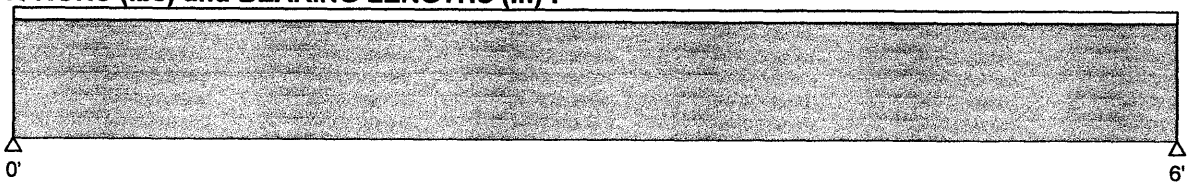
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	210.0				No
wll	Snow	Full UDL	350.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	648		648
Live	1050		1050
Total	1698		1698
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x8"

Self Weight of 6.03 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 80	Fv' = 207	fv/Fv' = 0.39
Bending(+)	fb = 997	Fb' = 1345	fb/Fb' = 0.74
Live Defl'n	0.06 = <L/999	0.20 = L/360	0.29
Total Defl'n	0.09 = L/775	0.30 = L/240	0.31

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.15	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 2547 lbs-ft
Shear : LC# 2 = D+S, V = 1698, V design = 1356 lbs
Deflection: LC# 2 = D+S EI= 177.83e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

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COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 06:29:50	9787 SE 41st Street BeamR3

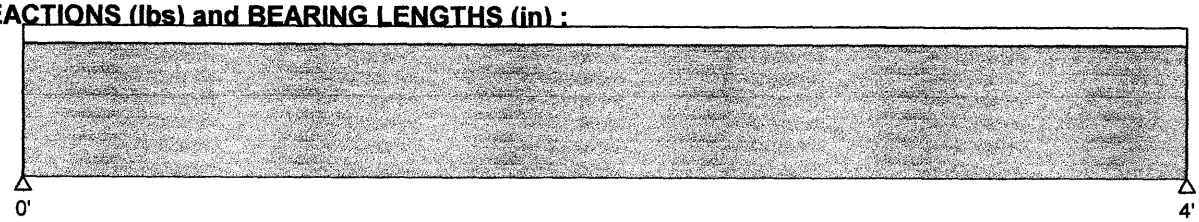
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wd1	Dead	Full UDL	115.0				No
wl1	Snow	Full UDL	192.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	239		239
Live	384		384
Total	623		623
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x6"

Self Weight of 4.57 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 37	Fv' = 207	fv/Fv' = 0.18
Bending(+)	fb = 424	Fb' = 1345	fb/Fb' = 0.31
Live Defl'n	0.01 = <L/999	0.13 = L/360	0.11
Total Defl'n	0.02 = <L/999	0.20 = L/240	0.12

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.15	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 623 lbs-ft
Shear : LC# 2 = D+S, V = 623, V design = 480 lbs
Deflection: LC# 2 = D+S EI= 77.64e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 06:30:32	9787 SE 41st Street BeamR4

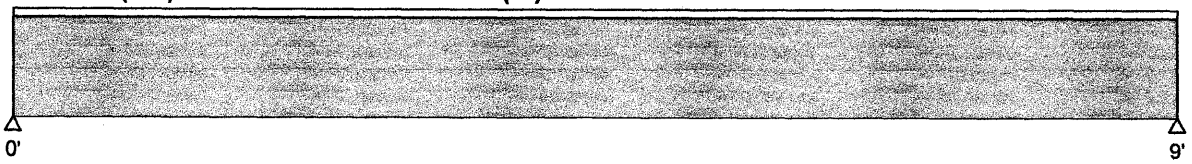
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	94.0				No
wll	Snow	Full UDL	156.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	458		458
Live	702		702
Total	1160		1160
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x10"

Self Weight of 7.69 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 45	Fv' = 207	fv/Fv' = 0.22
Bending(+)	fb = 627	Fb' = 1242	fb/Fb' = 0.51
Live Defl'n	0.06 = <L/999	0.30 = L/360	0.21
Total Defl'n	0.10 = <L/999	0.45 = L/240	0.23

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.15	1.00	1.00	1.000	1.200	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 2609 lbs-ft
Shear : LC# 2 = D+S, V = 1160, V design = 961 lbs
Deflection: LC# 2 = D+S EI= 369.34e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

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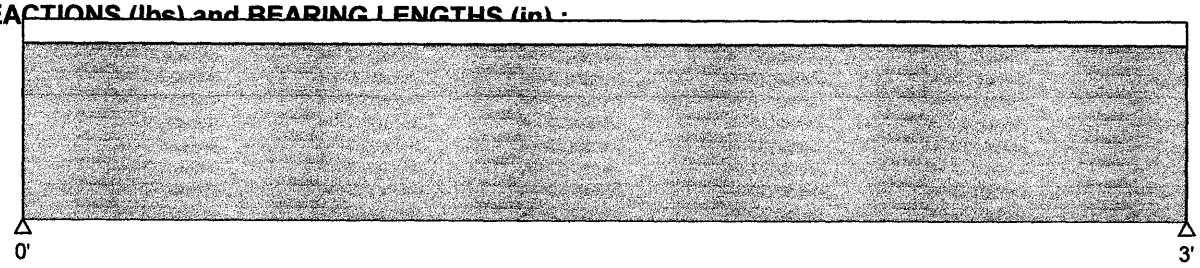
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	210.0				No
wll	Snow	Full UDL	350.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	322		322
Live	525		525
Total	847		847
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x6"

Self Weight of 4.57 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 46	Fv' = 207	fv/Fv' = 0.22
Bending(+)	fb = 432	Fb' = 1345	fb/Fb' = 0.32
Live Defl'n	0.01 = <L/999	0.10 = L/360	0.08
Total Defl'n	0.01 = <L/999	0.15 = L/240	0.09

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.15	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 635 lbs-ft
Shear : LC# 2 = D+S, V = 847, V design = 588 lbs
Deflection: LC# 2 = D+S EI= 77.64e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

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COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 06:33:06	9787 SE 41st Street BeamR6

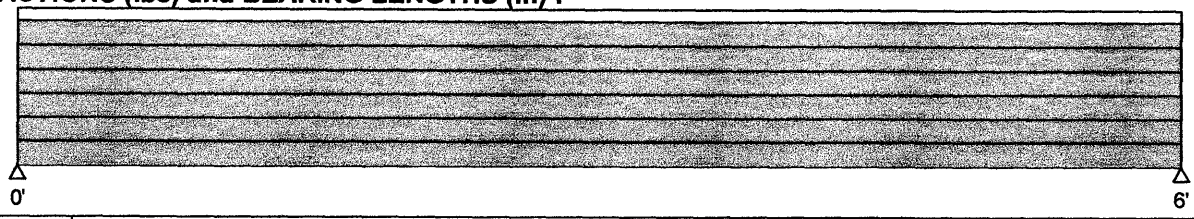
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	210.0	210.0	0.00	3.00	No
w1ll	Snow	Partial UDL	350.0	350.0	0.00	3.00	No
w2dl	Dead	Partial UDL	94.0	94.0	3.00	6.00	No
w2ll	Snow	Partial UDL	156.0	156.0	3.00	6.00	No
p	Dead	Point	2800		3.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



	0'	6'
Dead	1962	1788
Live	905	613
Total	2867	2402
Bearing:		
LC number	2	2
Length	1.4	1.2

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/8x9"

Self Weight of 6.48 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 131	Fv' = 276	fv/Fv' = 0.47
Bending(+)	fb = 1398	Fb' = 2160	fb/Fb' = 0.65
Live Defl'n	0.02 = <L/999	0.20 = L/360	0.11
Total Defl'n	0.10 = L/728	0.30 = L/240	0.33

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	0.90	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	1
Fv'	240	1.15	1.00	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

Bending(+): LC# 1 = D only, M = 4913 lbs-ft
Shear : LC# 2 = D+S, V = 2867, V design = 2457 lbs
Deflection: LC# 2 = D+S EI= 341.71e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT	
Forsman Engineering 19026 June 30, 2019 06:34:01	9787 SE 41st Street BeamR7	22

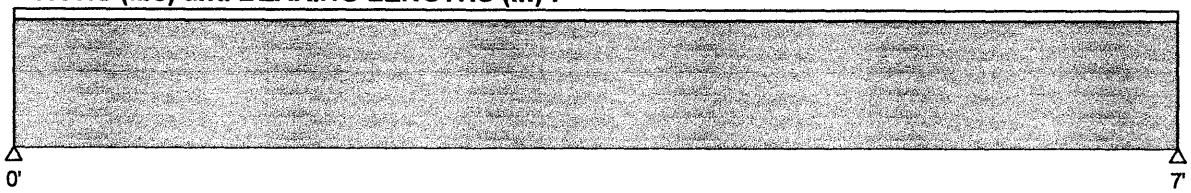
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	210.0				No
wll	Snow	Full UDL	350.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	762		762
Live	1225		1225
Total	1987		1987
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x10"

Self Weight of 7.69 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 72	Fv' = 207	fv/Fv' = 0.35
Bending(+)	fb = 836	Fb' = 1242	fb/Fb' = 0.67
Live Defl'n	0.05 = <L/999	0.23 = L/360	0.22
Total Defl'n	0.08 = <L/999	0.35 = L/240	0.24

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.15	1.00	1.00	1.000	1.200	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 3477 lbs-ft
Shear : LC# 2 = D+S, V = 1987, V design = 1549 lbs
Deflection: LC# 2 = D+S EI= 369.34e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 06:34:49	9787 SE 41st Street BeamR8

27

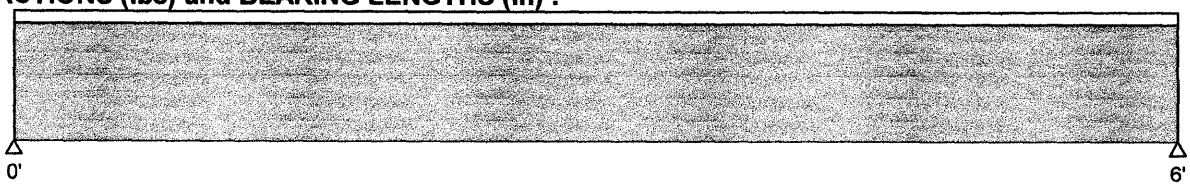
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	218.0				No
wll	Snow	Full UDL	363.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	672		672
Live	1089		1089
Total	1761		1761
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x8"

Self Weight of 6.03 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 83	Fv' = 207	fv/Fv' = 0.40
Bending(+)	fb = 1034	Fb' = 1345	fb/Fb' = 0.77
Live Defl'n	0.06 = <L/999	0.20 = L/360	0.30
Total Defl'n	0.10 = L/747	0.30 = L/240	0.32

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.15	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 2642 lbs-ft
Shear : LC# 2 = D+S, V = 1761, V design = 1406 lbs
Deflection: LC# 2 = D+S EI= 177.83e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

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JOB 19026
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SCALE

Upper Floor

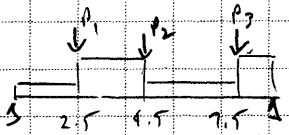
U1 L = 3'

$w_{DL} = 14 \cdot 2.5/2 = 175$ plf

$w_{LL} = 40 \cdot 2.5/2 = 500$ plf

⇒ 4x8 DF #2

U2 L = 9'



$w_{1DL} = 14 \cdot 2 = 28$ plf

$w_{1LL} = 40 \cdot 2 = 80$ plf

$w_{2DL} = \frac{15}{2(11)}(11+2)^2 + 80 + 14 \cdot 2 = 223$ plf

$w_{2LL} = \frac{25}{2(11)}(11+2)^2 + 40 \cdot 2 = 272$ plf

$P_1 = 2646^{\#}$ @ 2.5'

$P_2 = 623^{\#}$ @ 4.5'

$P_3 = 623^{\#}$ @ 7.5'

⇒ 3 1/8 x 10 1/2 GLB

U3 L = 16'

$w_{DL} = \frac{14}{(4)2}(4+2)^2 = 63$ plf

$w_{LL} = \frac{60}{(4)2}(4+2)^2 = 270$ plf

⇒ 5 1/8 x 10 1/2 GLB

U4 L = 4 + 2' cant

$w_{DL} = 14$ psf

$w_{LL} = 40$ psf

⇒ 2x6 HF #2 @ 16" O.C.

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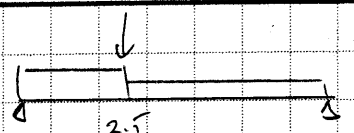
u5 L = 5'



$w_{1DL} = \frac{15}{2(7)}(7+2)^2 + 80 + 14 \cdot 6/2 = 200$ plf

$w_{1LL} = \frac{25}{2(7)}(7+2)^2 + 40.2 + 60 \cdot 4/2 = 345$ plf

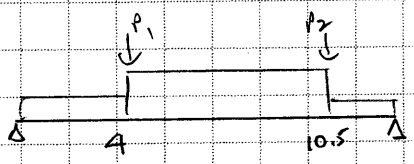
$w_{2DL} = 14 \cdot 6/2 = 42$ plf

$w_{2LL} = 40.2 + 60 \cdot 4/2 = 200$ plf

$P = 1160^{\#}$ @ 2.5'

⇒ 4x10 OF #2

u6 L = 13'



$w_{1DL} = 15.6 + 80 + 14 \cdot 16/2 = 252$ plf

$w_{1LL} = 25.6 + 40 \cdot 16/2 = 470$ plf

$w_{2DL} = 15 \cdot 28/2 + 80 + 14 \cdot 16/2 = 402$ plf

$w_{2LL} = 25 \cdot 28/2 + 40 \cdot 16/2 = 670$ plf

$w_{3DL} = 14 \cdot 16/2 = 112$ plf

$w_{3LL} = 40 \cdot 16/2 = 320$ plf

$P_1 = 2491^{\#}$ @ 4'

$P_2 = 847^{\#}$ @ 10.5'

⇒ $5\frac{1}{8} \times 13\frac{1}{2}$ GLB
or $5\frac{1}{4} \times 14$ PSL

u7 L = 11.5'

$w_{DL} = 15 \cdot 28/2 + 80 + 14 \cdot 16/2 = 402$ plf

$w_{LL} = 25 \cdot 28/2 + 40 \cdot 16/2 = 670$ plf

$P = 847^{\#}$ @ 1'

⇒ $5\frac{1}{8} \times 12$ GLB
or $5\frac{1}{4} \times 14$ PSL

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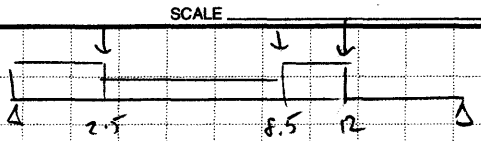
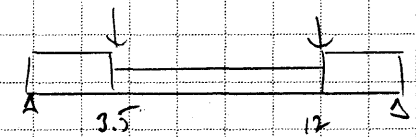
u8 L = 16'



$w_{1D} = 15 \cdot 28/2 + 80 + 14 \cdot 16/2 + 15.2 = 432$ plf
$w_{1LL} = 25 \cdot 24/2 + 40 \cdot 16/2 + 25.2 = 720$ plf
$w_{2D} = 14 \cdot 16/2 + 15.2 = 142$ plf
$w_{2LL} = 40 \cdot 16/2 + 25.2 = 370$ plf
$w_{3D} = 15.6 + 80 + 14 \cdot 16/2 + 15.2 = 312$ plf
$w_{3LL} = 25.6 + 40 \cdot 16/2 + 25.2 = 520$ plf
$P_1 = 2867\#$ @ 2.5'
$P_2 = 2402\#$ @ 8.5'
(u3) $P_3 = 3856$ @ 12'

⇒ 5 1/4 x 16 PSL

u9 L = 15.5



$w_{1D} = 15.6 + 80 + 14.2 + 15.2 = 228$ plf
$w_{1LL} = 25.6 + 40.2 + 25.2 = 280$ plf
$w_{2D} = 14.2 + 15.2 = 58$ plf
$w_{2LL} = 40.2 + 25.2 = 130$ plf
$P_1 = P_2 = 1160\#$

⇒ 3 1/2 x 14 PSL

u10 L = 8'

$w_{DL} = \frac{14}{2(16)}(16+4)^2 = 175$ plf

$w_{LL} = \frac{40}{2(16)}(16+4)^2 = 500$ plf

⇒ 3 1/8 x 12 GLB

u11 L = 15'

$w_{DL} = 14 \cdot 28/2 = 196$ plf
$w_{LL} = 40 \cdot 25/2 = 560$ plf

⇒ 5 1/8 x 12" GLB

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253.815.9182
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U12 L=8'

$w_{DL} = 156$ plf
$w_{LL} = 560$ plf
$\Rightarrow$ 3⅛ x 9 GLB

U13 L=9'

$w_{DL} = 14 \cdot 14/2 = 98$ plf
$w_{LL} = 40 \cdot 14/2 = 280$ plf
$\Rightarrow$ 4x6 DF #2

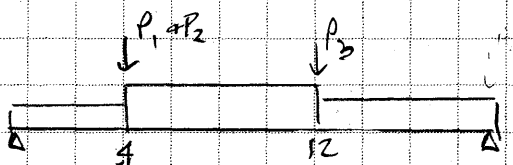
U14 L=11'

$w_{DL} = \frac{15}{2(4)}(4+2)^2 = 68$ plf

$w_{LL} = \frac{25}{2(4)}(4+2)^2 = 113$ plf

$\Rightarrow$ 6x10 DF #2

U15 L=16'



$w_{1DL} = 15 \cdot 6 + 80 + 14 \cdot 27/2 = 331$ plf
$w_{1LL} = 25 \cdot 6 + 40 \cdot 23/2 = 610$ plf
$w_{3DL} = 15 \cdot 27/2 + 80 + 14 \cdot 23/2 = 444$ plf
$w_{3LL} = 25 \cdot 27/2 + 40 \cdot 23/2 = 798$ plf
$w_{2DL} = \frac{14}{2(23)}(23+1.5)^2 = 183$ plf
$w_{2LL} = \frac{40}{2(23)}(23+1.5)^2 = 522$ plf
$P_L = P_3 = 1761\left(\frac{21.5}{23}\right) = 1876$ #
$P_1 = 2700$ # @ 4'
$\Rightarrow$ 5⅛ x 16½ GLB

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253.815.9182
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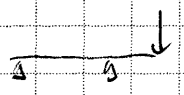
U16 L = 23' + 1.5



w_{DL} = 14.2 = 28 plf
w_{LL} = 40.2 = 80 plf
P = 1761 #
⇒ 3 1/2 x 14 PSL

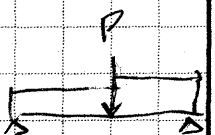
Over Garage Joists L = 23'
w_{DL} = 14 psf
w_{LL} = 40 psf
⇒ 14" TJI 560 @ 16" O.C.

Floor Joists L = 16'
w_{DL} = 14 psf
w_{LL} = 40 psf
⇒ 14" TJI 210 @ 16" O.C.

cantilever joists L = 16' + 4' cant
w_{DL} = 14 psf
w_{LL} = 40 psf
⇒ 14" TJI 210 @ 16" O.C.

U17 L = 5'
w_{DL} = 15.4 = 60 plf
w_{LL} = 25.4 = 100 plf
P = 7073 @ 2'
⇒ 5 1/4 x 9 1/2 PSL

U18 L = 6.5



w_{DL} = 14 · 23/2 + 80 = 241 plf
w_{LL} = 40 · 23/2 = 460 plf
@ 3.25 P = 2706 #
⇒ 3 1/8 * 9" GLB

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 07:34:42	9787 SE 41st Street BeamU1

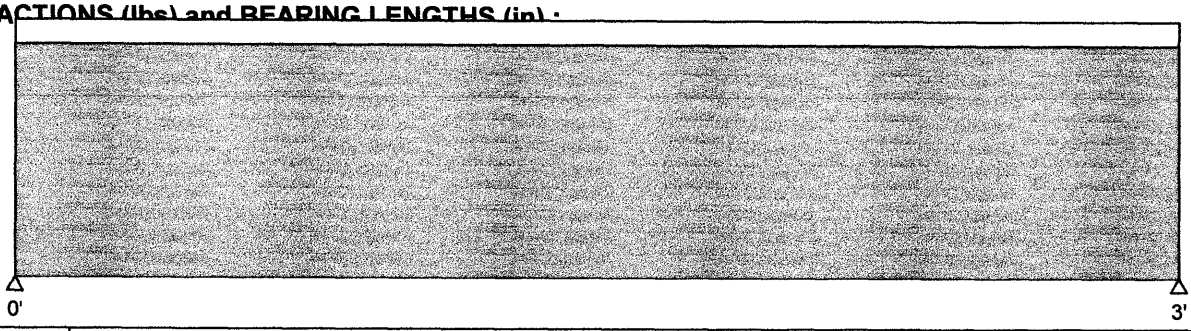
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	175.0				No
wll	Live	Full UDL	500.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	272		272
Live	750		750
Total	1022		1022
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x8"

Self Weight of 6.03 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 36	Fv' = 180	fv/Fv' = 0.20
Bending(+)	fb = 300	Fb' = 1170	fb/Fb' = 0.26
Live Defl'n	0.01 = <L/999	0.10 = L/360	0.05
Total Defl'n	0.01 = <L/999	0.15 = L/240	0.05

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.00	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 766 lbs-ft
Shear : LC# 2 = D+L, V = 1022, V design = 610 lbs
Deflection: LC# 2 = D+L EI= 177.83e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY
Forsman Engineering
19026
June 30, 2019 07:38:35

PROJECT
9787 SE 41st Street
BeamU2

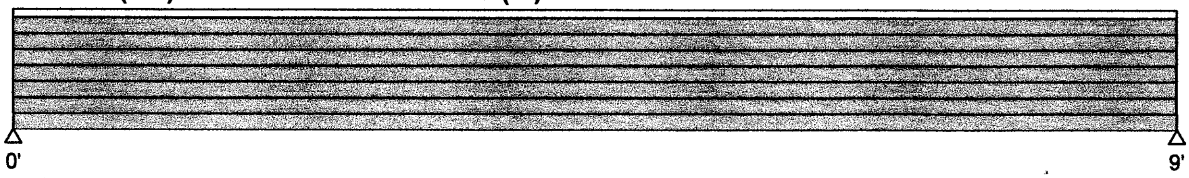
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	28.0	28.0	0.00	2.50	No
w1ll	Live	Partial UDL	80.0	80.0	0.00	2.50	No
w2dl	Dead	Partial UDL	223.0	223.0	2.50	4.50	No
w2ll	Live	Partial UDL	272.0	272.0	2.50	4.50	No
w3dl	Dead	Partial UDL	28.0	28.0	4.50	7.50	No
w3ll	Live	Partial UDL	80.0	80.0	4.50	7.50	No
w4dl	Dead	Partial UDL	223.0	223.0	7.50	9.00	No
w4ll	Live	Partial UDL	272.0	272.0	7.50	9.00	No
p1	Live	Point	2646		2.50		No
p2	Live	Point	623		4.50		No
p3	Live	Point	623		7.50		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	423		580
Live	2945		2339
Total	3368		2919
Bearing:			
LC number	2		2
Length	1.7		1.4

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/8x10-1/2"

Self Weight of 7.55 plf automatically included in loads;
Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 149	Fv' = 240	fv/Fv' = 0.62
Bending(+)	fb = 1723	Fb' = 2400	fb/Fb' = 0.72
Live Defl'n	0.18 = L/591	0.30 = L/360	0.61
Total Defl'n	0.21 = L/507	0.45 = L/240	0.47

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	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

Bending(+): LC# 2 = D+L, M = 8244 lbs-ft
Shear : LC# 2 = D+L, V = 3368, V design = 3250 lbs
Deflection: LC# 2 = D+L EI= 542.63e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 07:39:51	9787 SE 41st Street BeamU3

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	63.0				No
wll	Live	Full UDL	270.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	603		603
Live	2160		2160
Total	2763		2763
Bearing:			
LC number	2		2
Length	1.0		1.0

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x10-1/2"

Self Weight of 12.39 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 69	Fv' = 240	fv/Fv' = 0.29
Bending(+)	fb = 1408	Fb' = 2400	fb/Fb' = 0.59
Live Defl'n	0.45 = L/429	0.53 = L/360	0.84
Total Defl'n	0.57 = L/335	0.80 = L/240	0.72

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	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

Bending(+): LC# 2 = D+L, M = 11052 lbs-ft
Shear : LC# 2 = D+L, V = 2763, V design = 2461 lbs
Deflection: LC# 2 = D+L EI= 889.91e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 07:41:13	9787 SE 41st Street BeamU4

Design Check Calculation Sheet

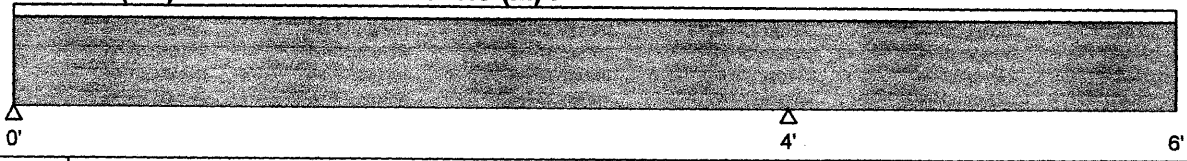
Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full Area	14.00 (16.0)*				No
wll	Live	Full Area	60.00 (16.0)*				Yes

*Tributary Width (in)

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



	0'		4'		6'
Dead	31		92		
Live	160		360		
Uplift	9				
Total	190		451		
Bearing:					
LC number	3		2		1
Length	1.0		1.0		0.0
Cb	1.00		2.02		0.00

Lumber-soft, Hem-Fir, No.2, 2x6"

Spaced at 16" c/c; Self Weight of 1.7 plf automatically included in loads;
Lateral support: top= full, bottom= at supports; Repetitive factor: applied where permitted (refer to online help); Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 37	Fv' = 120	fv/Fv' = 0.31
Bending(+)	fb = 287	Fb' = 1017	fb/Fb' = 0.28
Bending(-)	fb = 318	Fb' = 988	fb/Fb' = 0.32
Deflection:			
Interior Live	0.02 = <L/999	0.13 = L/360	0.13
Total	0.02 = <L/999	0.20 = L/240	0.10
Cantil. Live	0.04 = L/608	0.13 = L/180	0.30
Total	0.04 = L/569	0.20 = L/120	0.21

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	850	1.00	1.00	1.00	1.000	1.300	1.00	1.15	1.00	0.80	-	3
Fb'-	850	1.00	1.00	1.00	0.972	1.300	1.00	1.15	1.00	0.80	-	4
Fv'	150	1.00	1.00	1.00	-	-	-	-	1.00	0.80	1.00	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	0.95	-	3

Bending(+): LC# 3 = D+L (pattern: L_), M = 181 lbs-ft
Bending(-): LC# 4 = D+L (pattern: _L), M = 201 lbs-ft
Shear : LC# 2 = D+L, V = 251, V design = 205 lbs
Deflection: LC# 3 = D+L (pattern: L_) EI= 27.04e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)
(Load Pattern: s=S/2, X=L+S or L+C, _=no pattern load in this span)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Continuous or Cantilevered Beams: NDS Clause 4.2.5.5 requires that normal grading provisions be extended to the middle 2/3 of 2 span beams and to the full length of cantilevers and other spans.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
4. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 07:48:38	9787 SE 41st Street BeamU5

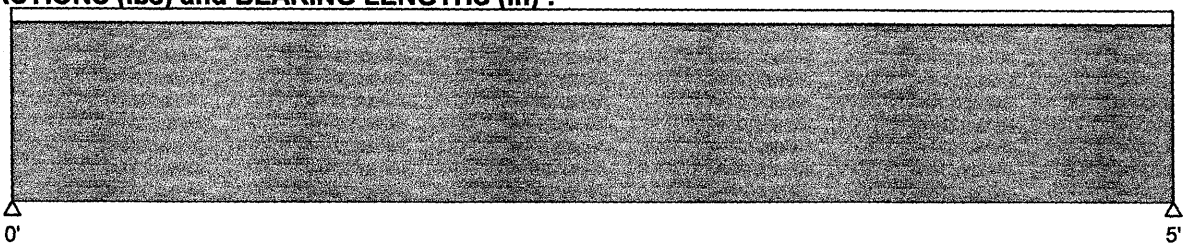
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	209.0	209.0	0.00	2.50	No
w1ll	Live	Partial UDL	345.0	345.0	0.00	2.50	No
w2dl	Dead	Partial UDL	42.0	42.0	2.50	5.00	No
w2ll	Live	Partial UDL	200.0	200.0	2.50	5.00	No
p	Live	Point	1160		2.50		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	437		229
Live	1352		1171
Total	1789		1399
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x10"

Self Weight of 7.69 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 64	Fv' = 180	fv/Fv' = 0.35
Bending(+)	fb = 653	Fb' = 1080	fb/Fb' = 0.61
Live Defl'n	0.02 = <L/999	0.17 = L/360	0.15
Total Defl'n	0.03 = <L/999	0.25 = L/240	0.12

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.00	1.00	1.00	1.000	1.200	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million	1.00	1.00	-	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 2718 lbs-ft
Shear : LC# 2 = D+L, V = 1789, V design = 1375 lbs
Deflection: LC# 2 = D+L EI= 369.34e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 07:51:37	9787 SE 41st Street BeamU6

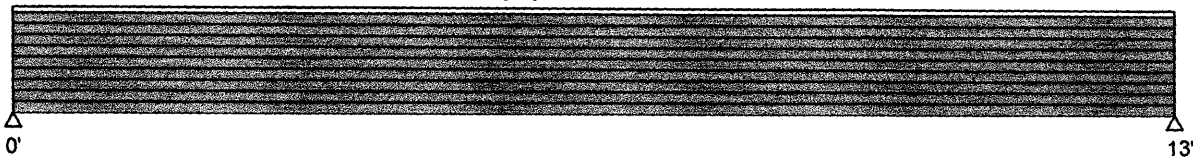
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	282.0	282.0	0.00	4.00	No
w1ll	Live	Partial UDL	470.0	470.0	0.00	4.00	No
w2dl	Live	Partial UDL	402.0	402.0	4.00	10.50	No
w2ll	Live	Partial UDL	670.0	670.0	4.00	10.50	No
w3dl	Dead	Partial UDL	112.0	112.0	10.50	13.00	No
w3ll	Live	Partial UDL	320.0	320.0	10.50	13.00	No
p1	Live	Point	2441		4.00		No
p2	Live	Point	847		10.50		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	1085		530
Live	6602		6333
Total	7687		6864
Bearing:			
LC number	2		2
Length	2.3		2.1

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x13-1/2"

Self Weight of 15.93 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 148	Fv' = 240	fv/Fv' = 0.62
Bending(+)	fb = 2064	Fb' = 2400	fb/Fb' = 0.86
Live Defl'n	0.40 = L/389	0.43 = L/360	0.92
Total Defl'n	0.43 = L/363	0.65 = L/240	0.66

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	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

Bending(+): LC# 2 = D+L, M = 26777 lbs-ft
Shear : LC# 2 = D+L, V = 7687, V design = 6839 lbs
Deflection: LC# 2 = D+L EI=1891.38e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 07:54:09	9787 SE 41st Street BeamU7

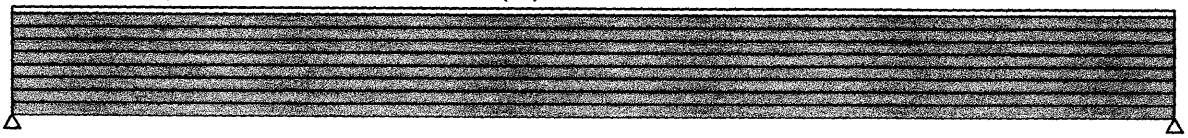
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wd1	Dead	Full UDL	402.0				No
wl1	Live	Full UDL	670.0				No
p	Live	Point	847		1.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	2393		2393
Live	4626		3926
Total	7019		6319
Bearing:			
LC number	2		2
Length	2.1		1.9

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x12"

Self Weight of 14.16 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 145	Fv' = 240	fv/Fv' = 0.60
Bending(+)	fb = 1793	Fb' = 2400	fb/Fb' = 0.75
Live Defl'n	0.21 = L/665	0.38 = L/360	0.54
Total Defl'n	0.33 = L/417	0.58 = L/240	0.58

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	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

Bending(+): LC# 2 = D+L, M = 18381 lbs-ft
Shear : LC# 2 = D+L, V = 7019, V design = 5933 lbs
Deflection: LC# 2 = D+L EI=1328.38e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT	
Forsman Engineering 19026 June 30, 2019 08:02:00	9787 SE 41st Street BeamU8	36

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	432.0	432.0	0.00	2.50	No
w1ll	Live	Partial UDL	720.0	720.0	0.00	2.50	No
w2dl	Dead	Partial UDL	142.0	142.0	2.50	8.50	No
w2ll	Live	Partial UDL	370.0	370.0	2.50	8.50	No
w3dl	Dead	Partial UDL	312.0	312.0	8.50	12.00	No
w3ll	Live	Partial UDL	520.0	520.0	8.50	12.00	No
p1	Live	Point	2867		2.50		No
p2	Live	Point	2402		8.50		No
p3	Live	Point	3856		12.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	2157		1287
Live	8279		6686
Total	10436		7973
Bearing:			
LC number	2		2
Length	2.7		2.0

PSL, 2.0E, 2900Fb, 5-1/4x16"

Self Weight of 26.25 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (lbs, lbs-ft, or in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 159	Fv' = 285	fv/Fv' = 0.56
Bending(+)	fb = 2167	Fb' = 2810	fb/Fb' = 0.77
Live Defl'n	0.42 = L/458	0.53 = L/360	0.78
Total Defl'n	0.51 = L/378	0.80 = L/240	0.63

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	2900	1.00	-	1.00	1.000	0.97	-	1.00	1.00	-	-	2
Fv'	285	1.00	-	1.00	-	-	-	-	1.00	-	1.00	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 40458 lbs-ft
Shear : LC# 2 = D+L, V = 10436, V design = 8929 lbs
Deflection: LC# 2 = D+L EI=3583.94e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. SCL-BEAMS (Structural Composite Lumber): the attached SCL selection is for preliminary design only. For final member design contact your local SCL manufacturer.
3. Size factors vary from one manufacturer to another for SCL materials. They can be changed in the database editor.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering	9787 SE 41st Street
19026	BeamU9
June 30, 2019 07:57:54	

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	228.0	228.0	0.00	3.50	No
w1ll	Live	Partial UDL	280.0	280.0	0.00	3.50	No
w2dl	Dead	Partial UDL	58.0	58.0	3.50	12.00	No
w2ll	Live	Partial UDL	130.0	130.0	3.50	12.00	No
w3dl	Dead	Partial UDL	228.0	228.0	12.00	15.50	No
w3ll	Live	Partial UDL	280.0	280.0	12.00	15.50	No
p1	Live	Point	1160		3.50		No
p2	Live	Point	1160		12.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	1163		1163
Live	2692		2692
Total	3856		3856
Bearing:			
LC number	2		2
Length	1.5		1.5

PSL, 2.0E, 2900Fb, 3-1/2x14"

Self Weight of 15.31 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (lbs, lbs-ft, or in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 99	Fv' = 285	fv/Fv' = 0.35
Bending(+)	fb = 1273	Fb' = 2851	fb/Fb' = 0.45
Live Defl'n	0.26 = L/723	0.52 = L/360	0.50
Total Defl'n	0.35 = L/532	0.77 = L/240	0.45

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	2900	1.00	-	1.00	1.000	0.98	-	1.00	1.00	-	-	2
Fv'	285	1.00	-	1.00	-	-	-	-	1.00	-	1.00	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 12126 lbs-ft
Shear : LC# 2 = D+L, V = 3856, V design = 3245 lbs
Deflection: LC# 2 = D+L EI=1600.64e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. SCL-BEAMS (Structural Composite Lumber): the attached SCL selection is for preliminary design only. For final member design contact your local SCL manufacturer.
3. Size factors vary from one manufacturer to another for SCL materials. They can be changed in the database editor.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering May 9, 2020 15:44	9787 SE 41st Street BeamU10

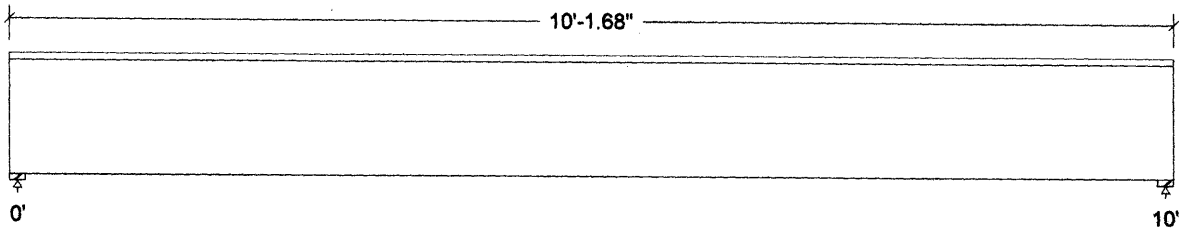
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
wdl	Dead	Full UDL				175.0		plf
wll	Live	Full UDL				500.0		plf
Self-weight	Dead	Full UDL				8.6		plf

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



Unfactored:			
Dead	918		918
Live	2500		2500
Factored:			
Total	3418		3418
Bearing:			
Capacity			
Beam	3418		3418
Des ratio			
Beam	1.00		1.00
Load comb	#2		#2
Length	1.68		1.68
Min req'd	1.68		1.68
Cb	1.00		1.00
Cb min	1.00		1.00

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/8"x12"

8 laminations, 3-1/8" maximum width,

Supports: All - Non-wood

Total length: 10'-1.68"; Clear span: 9'-10.32"; volume = 2.6 cu.ft.

Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 107	Fv' = 265	psi	fv/Fv' = 0.41
Bending(+)	fb = 1367	Fb' = 2400	psi	fb/Fb' = 0.57
Live Defl'n	0.14 = L/863	0.33 = L/360	in	0.42
Total Defl'n	0.22 = L/557	0.50 = L/240	in	0.43

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	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 max = 3418, V design = 2687 lbs

Bending(+): LC #2 = D+L, M = 8545 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: ICC-IBC

CALCULATIONS:

Deflection: EI = 810e06 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 2015), the National Design Specification (NDS 2015), 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 117-2015 and manufactured in accordance with ANSI A190.1-2012
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
Forsman Engineering Sep. 8, 2020 15:01	9787 SE 41st Street BeamU11

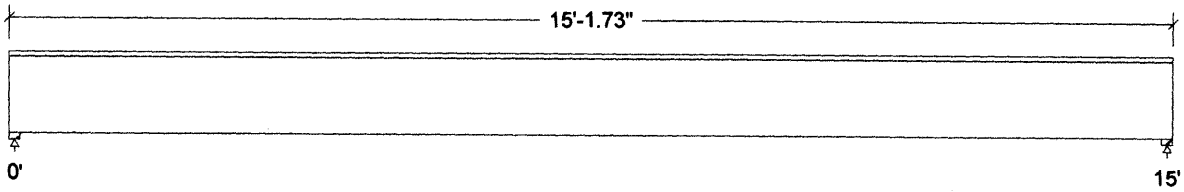
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
wdl	Dead	Full UDL				196.0		plf
wll	Live	Full UDL				560.0		plf
Self-weight	Dead	Full UDL				14.2		plf

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



Unfactored:			
Dead	1576		1576
Live	4200		4200
Factored:			
Total	5776		5776
Bearing:			
Capacity			
Beam	5776		5776
Des ratio			
Beam	1.00		1.00
Load comb	#2		#2
Length	1.73		1.73
Min req'd	1.73		1.73
Cb	1.00		1.00
Cb min	1.00		1.00

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8"x12"
8 laminations, 5-1/8" maximum width,
Supports: All - Non-wood
Total length: 15'-1.73"; Clear span: 14'-10.27"; volume = 6.5 cu.ft.
Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 121	Fv' = 265	psi	fv/Fv' = 0.46
Bending(+)	fb = 2113	Fb' = 2400	psi	fb/Fb' = 0.88
Live Defl'n	0.48 = L/374	0.50 = L/360	in	0.96
Total Defl'n	0.75 = L/239	0.75 = L/240	in	1.00

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	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 max = 5776, V design = 4950 lbs
Bending(+): LC #2 = D+L, M = 21661 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: ICC-IBC

CALCULATIONS:

Deflection: EI = 1328e06 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 2015), the National Design Specification (NDS 2015), 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 117-2015 and manufactured in accordance with ANSI A190.1-2012
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
Forsman Engineering	9787 SE 41st Street
Sep. 8, 2020 15:09	BeamU12

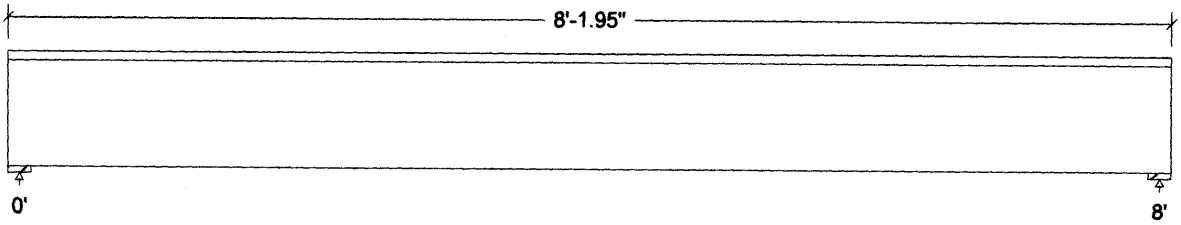
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pattern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
wdl	Dead	Full UDL				196.0		plf
wll	Live	Full UDL				560.0		plf
Self-weight	Dead	Full UDL				5.5		plf

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



Unfactored:			
Dead	806		806
Live	2240		2240
Factored:			
Total	3046		3046
Bearing:			
Capacity			
Beam	3046		3046
Des ratio			
Beam	1.00		1.00
Load comb	#2		#2
Length	1.95		1.95
Min req'd	1.95		1.95
Cb	1.00		1.00
Cb min	1.00		1.00

Glulam-Unbal., West Species, 24F-1.7E WS, 3-1/8"x9"

6 laminations, 3-1/8" maximum width,

Supports: All - Non-wood

Total length: 8'-1.95"; Clear span: 7'-10.05"; volume = 1.6 cu.ft.

Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 129	Fv' = 210	psi	fv/Fv' = 0.61
Bending(+)	fb = 1733	Fb' = 2400	psi	fb/Fb' = 0.72
Live Defl'n	0.16 = L/600	0.27 = L/360	in	0.60
Total Defl'n	0.25 = L/389	0.40 = L/240	in	0.62

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	210	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fcp'	500	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.7 million		1.00	1.00	-	-	-	-	1.00	-	-	2
Eminy'	0.69 million		1.00	1.00	-	-	-	-	1.00	-	-	2

CRITICAL LOAD COMBINATIONS:

Shear : LC #2 = D+L, V max = 3046, V design = 2413 lbs

Bending(+): LC #2 = D+L, M = 6092 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: ICC-IBC

CALCULATIONS:

Deflection: EI = 323e06 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 2015), the National Design Specification (NDS 2015), 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 117-2015 and manufactured in accordance with ANSI A190.1-2012
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
Forsman Engineering 19026 June 30, 2019 08:08:17	9787 SE 41st Street BeamU13

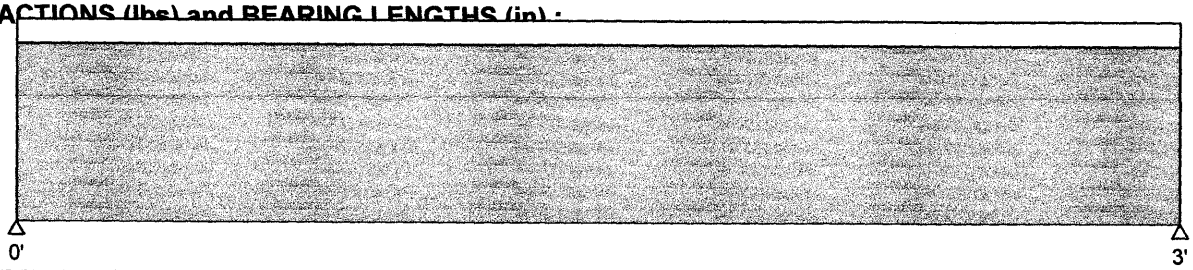
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	98.0				No
wll	Live	Full UDL	280.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	154		154
Live	420		420
Total	574		574
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x6"

Self Weight of 4.57 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 31	Fv' = 180	fv/Fv' = 0.17
Bending(+)	fb = 293	Fb' = 1170	fb/Fb' = 0.25
Live Defl'n	0.01 = <L/999	0.10 = L/360	0.07
Total Defl'n	0.01 = <L/999	0.15 = L/240	0.06

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.00	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 430 lbs-ft
Shear : LC# 2 = D+L, V = 574, V design = 399 lbs
Deflection: LC# 2 = D+L EI= 77.64e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 08:07:44	9787 SE 41st Street BeamU14

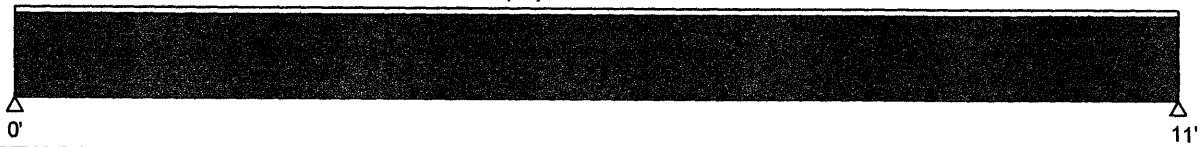
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	68.0				No
wll	Live	Full UDL	113.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	442		442
Live	621		621
Total	1064		1064
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 26	Fv' = 170	fv/Fv' = 0.15
Bending(+)	fb = 424	Fb' = 875	fb/Fb' = 0.48
Live Defl'n	0.07 = <L/999	0.37 = L/360	0.20
Total Defl'n	0.12 = <L/999	0.55 = L/240	0.23

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 2925 lbs-ft
Shear : LC# 2 = D+L, V = 1064, V design = 911 lbs
Deflection: LC# 2 = D+L EI= 510.84e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering	9787 SE 41st Street
Sep. 8, 2020 15:42	BeamU15

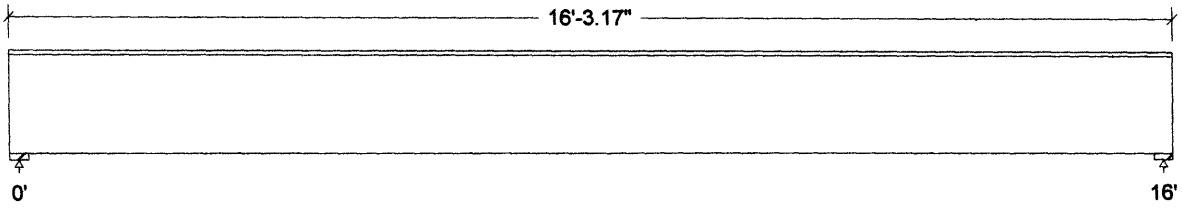
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
w1dl	Dead	Partial UDL		0.13	4.13	331.0	331.0	plf
w1ll	Live	Partial UDL		0.13	4.13	610.0	610.0	plf
w2dl	Dead	Partial UDL		4.13	12.13	183.0	183.0	plf
w2ll	Live	Partial UDL		4.13	12.13	522.0	522.0	plf
w3dl	Dead	Partial UDL		12.13	16.13	444.0	444.0	plf
w3ll	Live	Partial UDL		12.13	16.13	798.0	798.0	plf
p1	Live	Point		4.13		2700		lbs
p2	Live	Point		4.13		1876		lbs
p3	Live	Point		12.13		1876		lbs
Self-weight	Dead	Full UDL				19.5		plf

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



Unfactored:			
Dead	2268		2607
Live	8523		7737
Factored:			
Total	10791		10344
Bearing:			
Capacity			
Beam	10791		10344
Des ratio			
Beam	1.00		1.00
Load comb	#2		#2
Length	3.24		3.11
Min req'd	3.24		3.11
Cb	1.00		1.00
Cb min	1.00		1.00

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8"x16-1/2"

11 laminations, 5-1/8" maximum width,

Supports: All - Non-wood

Total length: 16'-3.17"; Clear span: 15'-8.83"; volume = 9.6 cu.ft.

Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 165	Fv' = 265	psi	fv/Fv' = 0.62
Bending(+)	fb = 2032	Fb' = 2389	psi	fb/Fb' = 0.85
Live Defl'n	0.43 = L/441	0.53 = L/360	in	0.81
Total Defl'n	0.60 = L/318	0.80 = L/240	in	0.75

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	0.995	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 max = 10791, V design = 9320 lbs

Bending(+): LC #2 = D+L, M = 39368 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: ICC-IBC

CALCULATIONS:

Deflection: EI = 3453e06 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 2015), the National Design Specification (NDS 2015), 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 117-2015 and manufactured in accordance with ANSI A190.1-2012
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 Forsman Engineering 19026 June 30, 2019 08:15:05	PROJECT 9787 SE 41st Street BeamU16	4/8

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	28.0				No
wll	Live	Full UDL	80.0				Yes
p	Live	Point	1876		24.50		Yes

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	496		565	
Live	920		3042	
Total	1416		3607	
Bearing:				
LC number	3		2	1
Length	1.0		1.0	0.0
Cb	1.00		1.38	0.00

PSL, 2.0E, 2900Fb, 3-1/2x14"

Self Weight of 15.31 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (lbs, lbs-ft, or in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 60	Fv' = 285	fv/Fv' = 0.21
Bending(+)	fb = 853	Fb' = 2851	fb/Fb' = 0.30
Bending(-)	fb = 310	Fb' = 2753	fb/Fb' = 0.11
Deflection:			
Interior Live	0.31 = L/877	0.77 = L/360	0.41
Total	0.48 = L/571	1.15 = L/240	0.42
Cantil. Live	0.07 = L/274	0.10 = L/180	0.66
Total	0.10 = L/178	0.15 = L/120	0.67

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	2900	1.00	-	1.00	1.000	0.98	-	1.00	1.00	-	-	3
Fb'-	2900	1.00	-	1.00	0.949	1.00	-	1.00	1.00	-	-	4
Fv'	285	1.00	-	1.00	-	-	-	-	1.00	-	1.00	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	-	3

Bending(+): LC# 3 = D+L (pattern: L_), M = 8130 lbs-ft
Bending(-): LC# 4 = D+L (pattern: _L), M = 2953 lbs-ft
Shear : LC# 2 = D+L, V = 2061, V design = 1966 lbs
Deflection: LC# 3 = D+L (pattern: L_) EI=1600.64e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)
(Load Pattern: s=S/2, X=L+S or L+C, _=no pattern load in this span)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. SCL-BEAMS (Structural Composite Lumber): the attached SCL selection is for preliminary design only. For final member design contact your local SCL manufacturer.
3. Size factors vary from one manufacturer to another for SCL materials. They can be changed in the database editor.
4. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

FORTE WEB

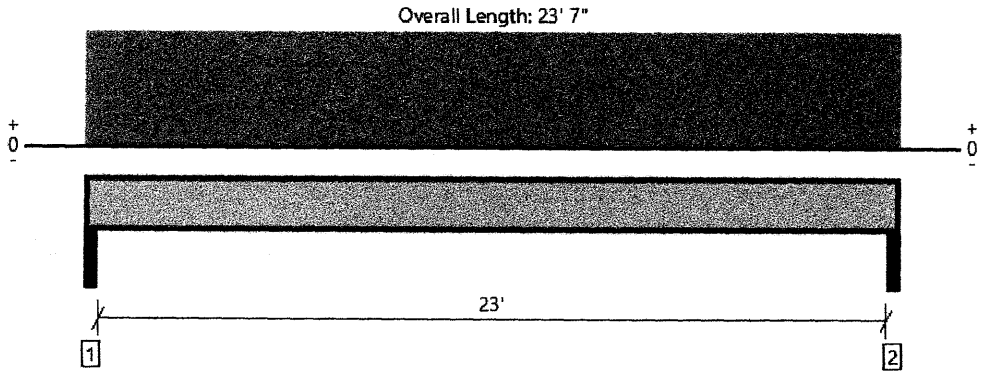
MEMBER REPORT

PASSED

49

Upper Floor, Garage Joists

1 piece(s) 14" TJI® 560 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	842 @ 2 1/2"	1396 (2.25")	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	828 @ 3 1/2"	2390	Passed (35%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4830 @ 11' 9 1/2"	11275	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.378 @ 11' 9 1/2"	0.579	Passed (L/735)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.510 @ 11' 9 1/2"	1.158	Passed (L/545)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	43	40	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 10" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 23' 5" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	220	629	849	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	220	629	849	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 23' 7"	16"	14.0	40.0	Default Load

Weyerhaeuser Notes

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

Weyerhaeuser SUSTAINABLE FORESTRY INITIATIVE

ForteWEB Software Operator	Job Notes
Arnold Forsman Forsman Engineering (253) 815-9182 forsmanengineering@comcast.net	

6/30/2019 3:20:22 PM UTC
ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2
File Name: 19026

FORTE WEB

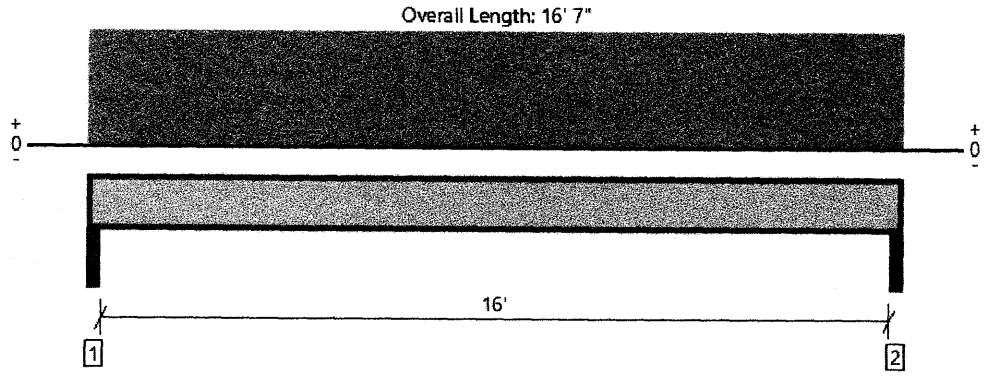
MEMBER REPORT

PASSED

50

Upper Floor, Upper Floor Joist

1 piece(s) 14" TJI® 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	590 @ 2 1/2"	1134 (2.25")	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	576 @ 3 1/2"	1945	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2352 @ 8' 3 1/2"	4490	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.172 @ 8' 3 1/2"	0.404	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.233 @ 8' 3 1/2"	0.808	Passed (L/834)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	51	40	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 3" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' 5" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	155	442	597	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	155	442	597	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 16' 7"	16"	14.0	40.0	Default Load

Weyerhaeuser Notes

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

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

ForteWEB Software Operator	Job Notes
Arnold Forsman Forsman Engineering (253) 815-9182 forsmanengineering@comcast.net	

6/30/2019 3:21:51 PM UTC
ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2
File Name: 19026

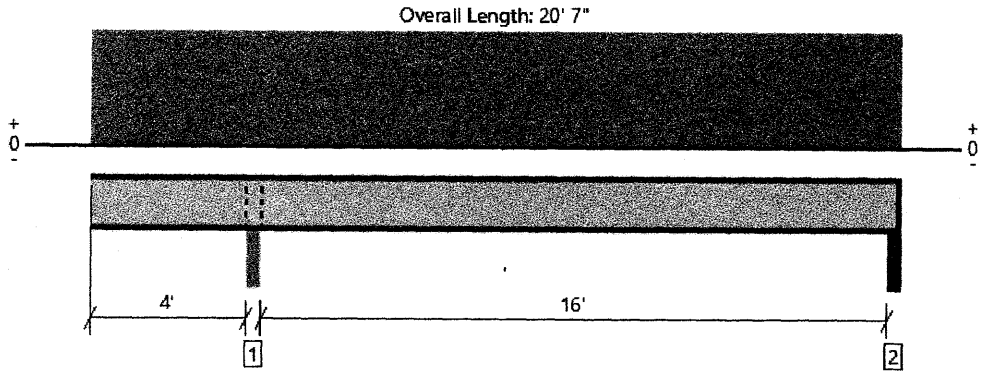
FORTE WEB

MEMBER REPORT

PASSED

Upper Floor, Upper Floor Cantilever

1 piece(s) 14" TJI® 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	582 @ 20' 4 1/2"	1134 (2.25")	Passed (51%)	1.00	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	585 @ 4' 3 1/2"	1945	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2291 @ 12' 4 3/4"	4490	Passed (51%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.175 @ 12' 3 1/8"	0.406	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.228 @ 12' 3 11/16"	0.811	Passed (L/854)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	52	40	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 4" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 8" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 1/2" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Beam - SPF	3.50"	3.50"	3.50"	239	682	921	Blocking
2 - Stud wall - SPF	3.50"	2.25"	1.75"	145	444/-23	589/-23	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 7"	16"	14.0	40.0	Default Load

Weyerhaeuser Notes

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

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

ForteWEB Software Operator	Job Notes
Arnold Forsman Forsman Engineering (253) 815-9182 forsmanengineering@comcast.net	

6/30/2019 3:25:15 PM UTC
ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2
File Name: 19026

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 08:40:44	9787 SE 41st Street BeamU17

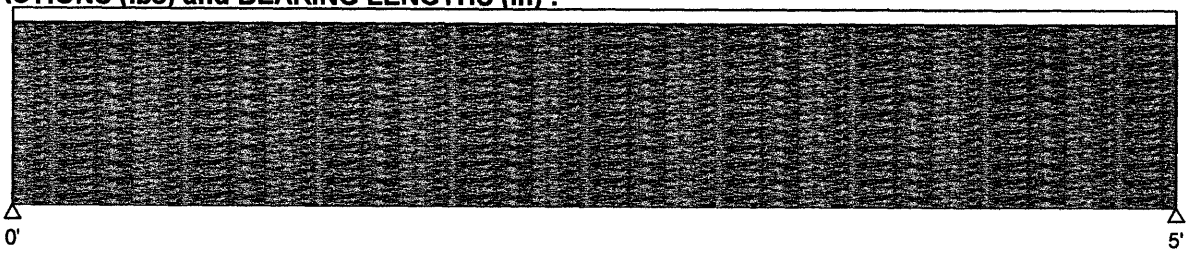
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	60.0				No
wll	Live	Full UDL	100.0				No
p	Live	Point	7973		2.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	189		189
Live	5034		3439
Total	5223		3628
Bearing:			
LC number	2		2
Length	1.3		1.0

PSL, 2.0E, 2900Fb, 5-1/4x9-1/2"

Self Weight of 15.59 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (lbs, lbs-ft, or in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 153	Fv' = 285	fv/Fv' = 0.54
Bending(+)	fb = 1534	Fb' = 2975	fb/Fb' = 0.52
Live Defl'n	0.05 = <L/999	0.17 = L/360	0.28
Total Defl'n	0.05 = <L/999	0.25 = L/240	0.19

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	2900	1.00	-	1.00	1.000	1.03	-	1.00	1.00	-	-	2
Fv'	285	1.00	-	1.00	-	-	-	-	1.00	-	1.00	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 10094 lbs-ft
Shear : LC# 2 = D+L, V = 5223, V design = 5084 lbs
Deflection: LC# 2 = D+L EI= 750.19e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. SCL-BEAMS (Structural Composite Lumber): the attached SCL selection is for preliminary design only. For final member design contact your local SCL manufacturer.
3. Size factors vary from one manufacturer to another for SCL materials. They can be changed in the database editor.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering	9787 SE 41st Street
Sep. 8, 2020 17:14	BeamU18

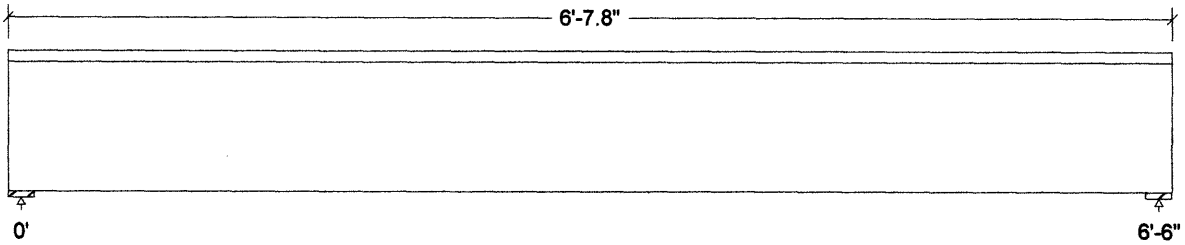
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
wdl	Dead	Full UDL				241.0		plf
wll	Live	Full UDL				460.0		plf
P	Dead	Point		3.32		2706		lbs
Self-weight	Dead	Full UDL				6.5		plf

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



Unfactored:			
Dead	2157		2157
Live	1495		1495
Factored:			
Total	3652		3652
Bearing:			
Capacity			
Beam	3652		3652
Des ratio			
Beam	1.00		1.00
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

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/8"x9"

6 laminations, 3-1/8" maximum width,

Supports: All - Non-wood

Total length: 6'-7.8"; Clear span: 6'-4.2"; volume = 1.3 cu.ft.

Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 164	Fv' = 265	psi	fv/Fv' = 0.62
Bending(+)	fb = 2314	Fb' = 2400	psi	fb/Fb' = 0.96
Live Defl'n	0.05 = <L/999	0.22 = L/360	in	0.25
Total Defl'n	0.22 = L/362	0.33 = L/240	in	0.66

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	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:

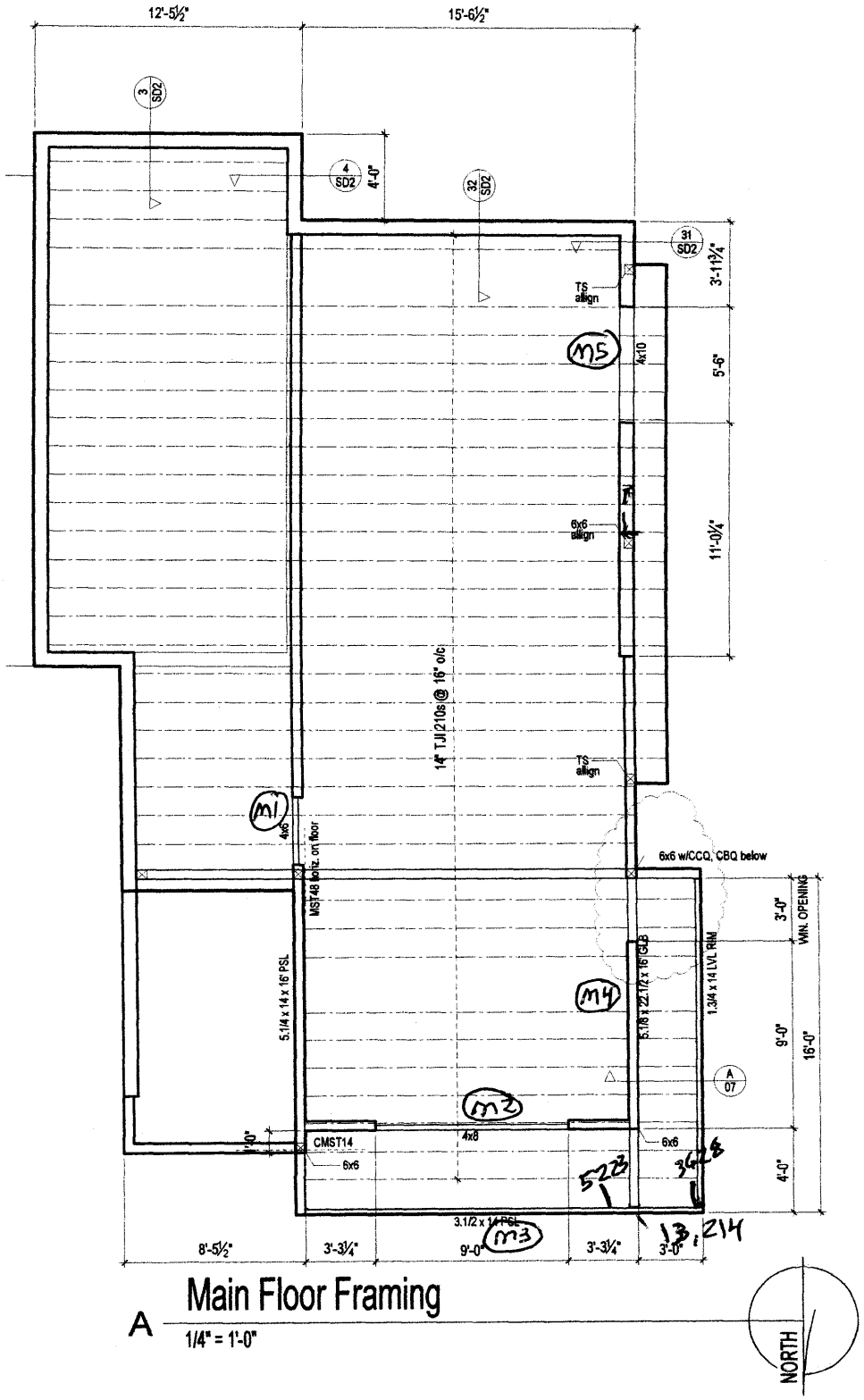
```
Shear      : LC #2  = D+L, V max =   3652, V design =   3069 lbs
Bending(+): LC #2  = D+L, M =   8134 lbs-ft
Deflection: LC #2  = D+L  (live)
            LC #2  = D+L  (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ICC-IBC
```

CALCULATIONS:

```
Deflection:  EI =    342e06 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 2015), the National Design Specification (NDS 2015), 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 117-2015 and manufactured in accordance with ANSI A190.1-2012
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).



A Main Floor Framing

1/4" = 1'-0"

FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

JOB 19026
SHEET NO. 56 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Main Floor Framing

M1 L = 3

$w_{DL} = 14 \cdot 24/2 = 168$ plf

$w_{LL} = 40 \cdot 24/2 = 480$ plf

⇒ 4×6 DF #2

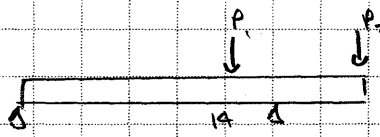
M2 L = 9'

$w_{DL} = 14 \cdot 4 = 56$ plf

$w_{LL} = 40 \cdot 4 = 160$ plf

⇒ 4×8 DF #2

M3 L = 16' + 3'



$w_{DL} = \frac{15}{4(2)}(4+2)^2 + 50 + 14 \cdot 2 = 176$ plf

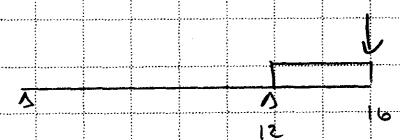
$w_{LL} = \frac{25}{4(2)}(4+2)^2 + 40 \cdot 2 = 193$ plf

$P_1 = 5227\#$ @ 14'

$P_2 = 3628\#$ @ 19'

⇒ 3 1/2 × 14 PSL

M4 L = 12' + 4'



$w_{DL} = \frac{14}{16(2)}(16+3)^2 = 158$ plf

$w_{LL} = \frac{40}{16(2)}(16+3)^2 = 451$ plf

(M3) P = 13214 @ 16'

⇒ 5 1/4 × 22 1/2 GLB

FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

JOB 19026
SHEET NO. 57 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

M5 $L = 5.5'$

$w_{DL} = \frac{14}{16(2)}(16+2)^2 = 142$ plf

$w_{LL} = \frac{40}{16(2)}(16+2)^2 = 405$ plf

$\Rightarrow$ 4x10 DF #2

cant. joists $l = 16+3'$

$w_{DL} = 14$ psf

$w_{LL} = 40$ psf

$P = [(15+25)(6)+80]1.33 = 426^{\#}$ @ 19"

$\Rightarrow$ 14" TJI 210 @ 16" O.C.

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY Forsman Engineering 19026 June 30, 2019 08:55:02	PROJECT 9787 SE 41st Street BeamM1

58

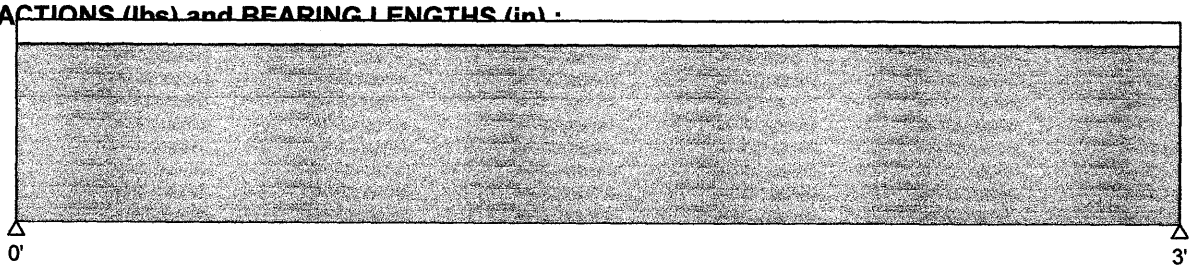
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	168.0				No
wll	Live	Full UDL	480.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	259		259
Live	720		720
Total	979		979
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x6"

Self Weight of 4.57 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 53	Fv' = 180	fv/Fv' = 0.29
Bending(+)	fb = 499	Fb' = 1170	fb/Fb' = 0.43
Live Defl'n	0.01 = <L/999	0.10 = L/360	0.11
Total Defl'n	0.02 = <L/999	0.15 = L/240	0.10

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.00	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 734 lbs-ft
Shear : LC# 2 = D+L, V = 979, V design = 680 lbs
Deflection: LC# 2 = D+L EI= 77.64e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 08:56:08	9787 SE 41st Street BeamM2

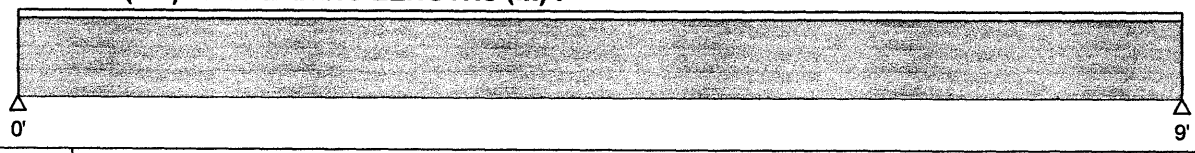
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	56.0				No
wll	Live	Full UDL	160.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	279		279
Live	720		720
Total	999		999
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x8"

Self Weight of 6.03 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 51	Fv' = 180	fv/Fv' = 0.28
Bending(+)	fb = 880	Fb' = 1170	fb/Fb' = 0.75
Live Defl'n	0.13 = L/813	0.30 = L/360	0.44
Total Defl'n	0.18 = L/585	0.45 = L/240	0.41

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.00	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 2248 lbs-ft
Shear : LC# 2 = D+L, V = 999, V design = 865 lbs
Deflection: LC# 2 = D+L EI= 177.83e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY Forsman Engineering July 2, 2019 15:56	PROJECT 9787 SE 41st Street BeamM3

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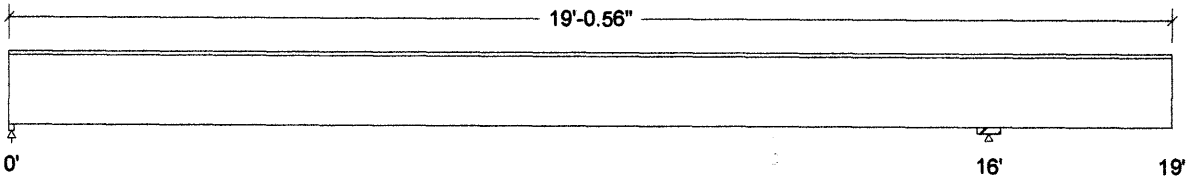
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
wdl	Dead	Full UDL	No			176.0		plf
wll	Live	Full UDL	No			193.0		plf
p1	Live	Point	No	14.05		5223		lbs
p2	Live	Point	No	19.05		3628		lbs
Self-weight	Dead	Full UDL	No			15.3		plf

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



Unfactored:						
Dead	1477			2158		
Live	1462			11056		
Factored:						
Total	2939			13214		
Bearing:						
Capacity						
Beam	2939			13214		
Des ratio						
Beam	1.00			1.00		
Load comb	#2			#2		
Length	1.12			4.66		
Min req'd	1.12			4.66		
Cb	1.00			1.08		
Cb min	1.00			1.08		

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.

PSL, 2.0E, 2.0E, 3-1/2"x14"

Supports: All - Non-wood

Total length: 19'-0.56"; Clear span: 15'-9.11", 2'-9.67"; volume = 6.5 cu.ft.

Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 242	Fv' = 290	psi	fv/Fv' = 0.84
Bending(+)	fb = 1179	Fb' = 2851	psi	fb/Fb' = 0.41
Bending(-)	fb = 1324	Fb' = 2536	psi	fb/Fb' = 0.52
Deflection:				
Interior Live	0.15 = <L/999	0.53 = L/360	in	0.28
Total	0.39 = L/487	0.80 = L/240	in	0.49
Cantil. Live	-0.01 = <L/999	0.20 = L/180	in	0.07
Total	-0.15 = L/244	0.30 = L/120	in	0.49

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fv'	290	1.00	-	1.00	-	-	-	-	1.00	-	1.00	2
Fb'+	2900	1.00	-	1.00	1.000	0.98	-	1.00	1.00	-	-	2
Fb'-	2900	1.00	-	1.00	0.874	0.98	-	1.00	1.00	-	-	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	-	2
Eminy'	1.04 million		-	1.00	-	-	-	-	1.00	-	-	2

CRITICAL LOAD COMBINATIONS:

```
Shear     : LC #2  = D+L, V max =   8433, V design =   7914 lbs
Bending(+): LC #2  = D+L, M =  11238 lbs-ft
Bending(-): LC #2  = D+L, M =  12613 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: ICC-IBC
```

CALCULATIONS:

```
Deflection:  EI =   1601e06 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'  Le = 26'-6.50"  RB = 19.1; Lu based on full span
```

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. SCL-BEAMS (Structural Composite Lumber): the attached SCL selection is for preliminary design only. For final member design contact your local SCL manufacturer.
4. Size factors vary from one manufacturer to another for SCL materials. They can be changed in the database editor.
5. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 09:02:10	9787 SE 41st Street BeamM4

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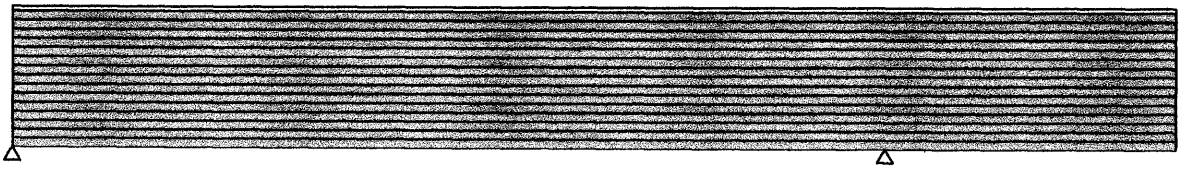
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Partial UDL	158.0	158.0	12.00	16.00	No
wll	Live	Partial UDL	451.0	451.0	12.00	16.00	Yes
p	Live	Point	13214		16.00		Yes

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



	0'		12'		16'
Dead	36		1021		
Live			19723		
Uplift	4669				
Total	36		20744		
Bearing:					
LC number	1		2		1
Length	1.0		6.2		0.0

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x22-1/2"

Self Weight of 26.55 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 193	Fv' = 240	fv/Fv' = 0.80
Bending(+)	fb = 10	Fb' = 2160	fb/Fb' = 0.00
Bending(-)	fb = 1608	Fb' = 2269	fb/Fb' = 0.71
Deflection:			
Interior Live	0.10 = <L/999	0.40 = L/360	0.25
Total	0.10 = <L/999	0.60 = L/240	0.17
Cantil. Live	0.24 = L/202	0.27 = L/180	0.89
Total	0.24 = L/199	0.40 = L/120	0.60

ADDITIONAL DATA:

FACTORS: F		CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	0.90	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	1
Fb'-	2400	1.00	1.00	1.00	0.945	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	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

```
Bending(+): LC# 1 = D only, M =    378 lbs-ft
Bending(-): LC# 2 = D+L, M =  57940 lbs-ft
Shear     : LC# 2 = D+L, V =  15756, V design =  14832 lbs
Deflection: LC# 2 = D+L   EI=8756.40e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
  (D=dead  L=live  S=snow  W=wind  I=impact  C=construction  CLd=concentrated)
  (All LC's are listed in the Analysis output)
  (Load Pattern: s=S/2,  X=L+S or L+C,  _=no pattern load in this span)
```

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. Grades with equal bending capacity in the top and bottom edges of the beam cross-section are recommended for continuous beams.
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).
7. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY Forsman Engineering 19026 June 30, 2019 09:05:57	PROJECT 9787 SE 41st Street BeamM5

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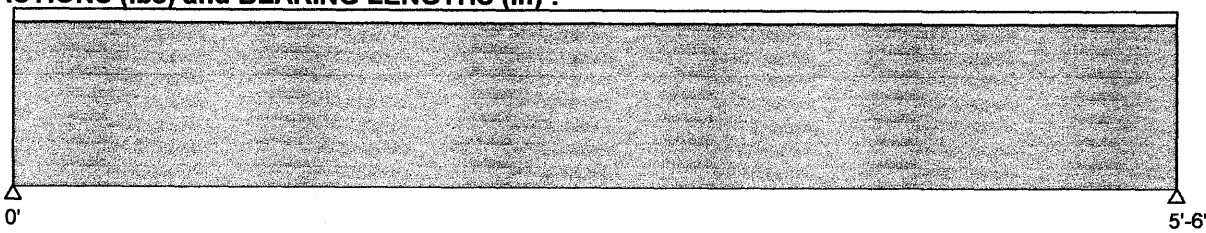
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	142.0				No
wll	Live	Full UDL	405.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	412		412
Live	1114		1114
Total	1525		1525
Bearing:			
LC number	2		2
Length	1.0		1.0

Lumber-soft, D.Fir-L, No.2, 4x10"

Self Weight of 7.69 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 51	Fv' = 180	fv/Fv' = 0.28
Bending(+)	fb = 504	Fb' = 1080	fb/Fb' = 0.47
Live Defl'n	0.02 = <L/999	0.18 = L/360	0.12
Total Defl'n	0.03 = <L/999	0.28 = L/240	0.11

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	900	1.00	1.00	1.00	1.000	1.200	1.00	1.00	1.00	1.00	-	2
Fv'	180	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 2097 lbs-ft
Shear : LC# 2 = D+L, V = 1525, V design = 1098 lbs
Deflection: LC# 2 = D+L EI= 369.34e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

FORTE WEB

MEMBER REPORT

PASSED

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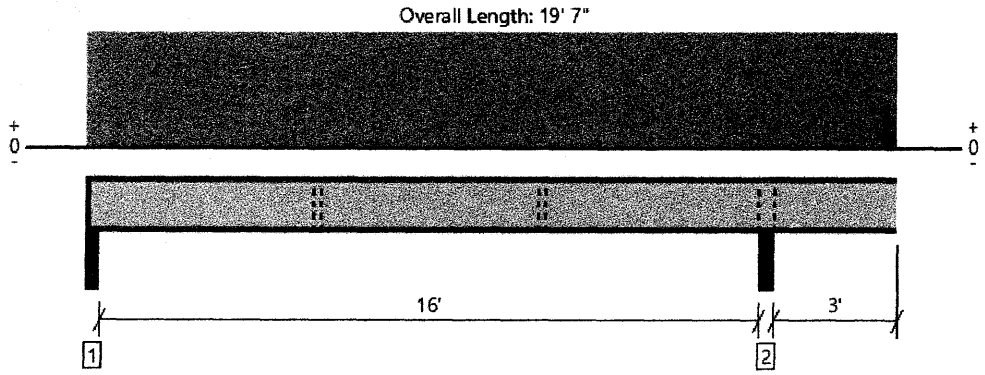
Upper Floor, Main Floor Cantilever

1 piece(s) 14" TJI® 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1335 @ 16' 5 1/4"	2145 (3.50")	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	642 @ 16' 3 1/2"	1945	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1590 @ 16' 5 1/4"	3368	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.175 @ 8' 3 7/8"	0.406	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.090 @ 19' 7"	0.315	Passed (2L/840)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	55	40	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 2" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6' 5" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 1/2" Gypsum ceiling.
- Permanent bracing at third points In the back span or a direct applied ceiling over the entire back span length is required at the right end of the member. See literature detail (PB1) For clarification.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	74	444/-11	518/-11	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	3.50"	3.50"	718	617	1335	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 19' 7"	16"	14.0	40.0	Default Load
2 - Point (lb)	19' 4"	N/A	426	-	

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

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

ForteWEB Software Operator	Job Notes
Arnold Forsman Forsman Engineering (253) 815-9182 forsmanengineering@comcast.net	

6/30/2019 4:10:15 PM UTC
ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2
File Name: 19026

FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

JOB _____
SHEET NO. 65 OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Post Loads:

Height = 9'-0"

H.F.#2 (2) 2x4 - wall $P_{all} = 3900^{\#}$

H.F.#2 (2) 2x6 - wall $P_{all} = 6500^{\#}$

H.F.#2 (3) 2x6 - wall $P_{all} = 10,300^{\#}$

Height 10'0"

H.F.#2 (2) 2x6 - wall $P_{all} = 5900^{\#}$

H.F.#2 (3) 2x6 - wall $P_{all} = 9,000^{\#}$

D.F.#2 4x6 - unbraced $P_{all} = 7200^{\#}$

D.F.#2 6x6 - unbraced $P_{all} = 14,600$

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering July 2, 2019 15:01	JN 18060 RealFine Painting Column 2- 2x4

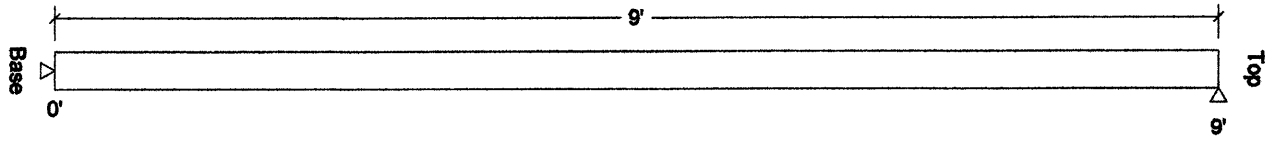
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Pd	Dead	Axial	(Ecc. = 0.00")		3900		lbs
Self-weight	Dead	Axial			20		lbs

Lateral Reactions (lbs):



Double 2x4

Lumber n-ply, Hem-Fir, No.2, 2x4, 2-ply (3"x3-1/2")

Support: Non-wood

Total length: 9'; Clear span: 9'; volume = 0.7 cu.ft.

Pinned base; Load face = width(b); Built-up fastener: nails; Ke x Lb: 1.0 x 0.0 = 0.0 [ft]; Ke x Ld: 1.0 x 9.0 = 9.0 [ft]; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Axial	fc = 373	Fc' = 376	psi	fc/Fc' = 0.99
Axial Bearing	fc = 373	Fc* = 1345	psi	fc/Fc* = 0.28

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fc'	1300	0.90	1.00	1.00	0.280	1.150	-	-	1.00	1.00	1
Fc*	1300	0.90	1.00	1.00	-	1.150	-	-	1.00	1.00	1

CRITICAL LOAD COMBINATIONS:

Axial : LC #1 = D only, P = 3920 lbs Kf = 1.00

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 2015

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. BUILT-UP COLUMNS: nailed or bolted built-up columns shall conform to the provisions of NDS Clause 15.3.

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY Forsman Engineering July 2, 2019 10:14	PROJECT JN 18060 RealFine Painting Column 2- 2x6	67

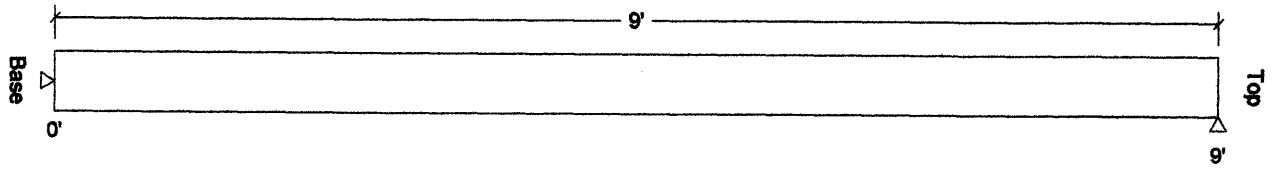
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Pd	Dead	Axial	(Ecc. = 0.92")		6500		lbs
Self-weight	Dead	Axial			31		lbs

Lateral Reactions (lbs):



Unfactored:			
Dead	55		-55
Factored:			
R->L Load comb			-55 #1
L->R Load comb	55 #1		#1

Double 2x6

Lumber n-ply, Hem-Fir, No.2, 2x6, 2-ply (3"x5-1/2")

Support: Non-wood

Total length: 9'; Clear span: 9'; volume = 1.0 cu.ft.

Pinned base; Load face = width(b); Built-up fastener: nails; Ke x Lb: 1.0 x 0.0 = 0.0 [ft]; Ke x Ld: 1.0 x 9.0 = 9.0 [ft]; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 5	Fv' = 135	psi	fv/Fv' = 0.04
Bending(+)	fb = 395	Fb' = 994	psi	fb/Fb' = 0.40
Axial	fc = 396	Fc' = 771	psi	fc/Fc' = 0.51
Combined (axial + eccentric moment)				Eq.15.4-3 = 0.98
Axial Bearing	fc = 396	Fc* = 1287	psi	fc/Fc* = 0.31
Live Defl'n	negligible			
Total Defl'n	0.12 = L/871	0.90 = L/120	in	0.14

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	0.90	1.00	1.00	-	-	-	-	1.00	1.00	1
Fb'+	850	0.90	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	1
Fc'	1300	0.90	1.00	1.00	0.599	1.100	-	-	1.00	1.00	1
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Emin'	0.47 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Fc*	1300	0.90	1.00	1.00	-	1.100	-	-	1.00	1.00	1

CRITICAL LOAD COMBINATIONS:

Shear : LC #1 = D only, V max = 55, V design = 55 lbs
Bending(+): LC #1 = D only, M = 498 lbs-ft
Deflection: LC #1 = D only (total)
Axial : LC #1 = D only, P = 6531 lbs Kf = 1.00
Eq.15.4-3 : LC #1 = D only Fb'= 994
FcE= 1002 Pxe/S=fc(6xe/d)= 395
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 2015

CALCULATIONS:

Deflection: EI = 27.0e06 lb-in2/ply
"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 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. BUILT-UP COLUMNS: nailed or bolted built-up columns shall conform to the provisions of NDS Clause 15.3.
4. Axial load eccentricity applied in direction of load face only. It is the designers responsibility to check for effect of eccentricity in the other direction.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering July 2, 2019 10:34	JN 18060 RealFine Painting Column 3- 2x6

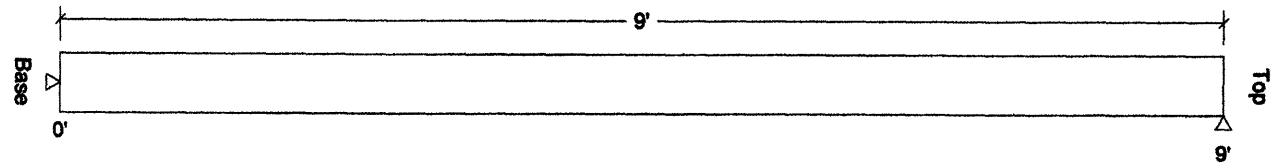
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Pd	Dead	Axial	(Ecc. = 0.92")		10300		lbs
Self-weight	Dead	Axial			46		lbs

Lateral Reactions (lbs):



Unfactored:			
Dead	88		-88
Factored:			
R->L Load comb			-88 #1
L->R Load comb	88 #1		#1

Triple 2x6

Lumber n-ply, Hem-Fir, No.2, 2x6, 3-ply (4-1/2"x5-1/2")

Support: Non-wood

Total length: 9'; Clear span: 9'; volume = 1.5 cu.ft.

Pinned base; Load face = width(b); Built-up fastener: nails; Ke x Lb: 1.0 x 0.0 = 0.0 [ft]; Ke x Ld: 1.0 x 9.0 = 9.0 [ft]; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 5	Fv' = 135	psi	fv/Fv' = 0.04
Bending(+)	fb = 417	Fb' = 1144	psi	fb/Fb' = 0.36
Axial	fc = 418	Fc' = 771	psi	fc/Fc' = 0.54
Combined (axial + eccentric moment)				Eq.15.4-3 = 0.98
Axial Bearing	fc = 418	Fc* = 1287	psi	fc/Fc* = 0.32
Live Defl'n	negligible			
Total Defl'n	0.13 = L/824	0.90 = L/120	in	0.15

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	0.90	1.00	1.00	-	-	-	-	1.00	1.00	1
Fb'+	850	0.90	1.00	1.00	1.000	1.300	1.00	1.15	1.00	1.00	1
Fc'	1300	0.90	1.00	1.00	0.599	1.100	-	-	1.00	1.00	1
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Emin'	0.47 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Fc*	1300	0.90	1.00	1.00	-	1.100	-	-	1.00	1.00	1

CRITICAL LOAD COMBINATIONS:

Shear : LC #1 = D only, V max = 88, V design = 88 lbs

Bending(+): LC #1 = D only, M = 788 lbs-ft

Deflection: LC #1 = D only (total)

Axial : LC #1 = D only, P = 10346 lbs Kf = 1.00

Eq.15.4-3 : LC #1 = D only Fb'= 1144

FcE= 1002 Pxe/S=fc(6xe/d)= 417

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 2015

CALCULATIONS:

Deflection: EI = 27.0e06 lb-in2/ply

"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 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. BUILT-UP COLUMNS: nailed or bolted built-up columns shall conform to the provisions of NDS Clause 15.3.
4. Axial load eccentricity applied in direction of load face only. It is the designers responsibility to check for effect of eccentricity in the other direction.

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY Forsman Engineering July 2, 2019 12:38	PROJECT JN 18060 RealFine Painting Column 2- 2x6x10

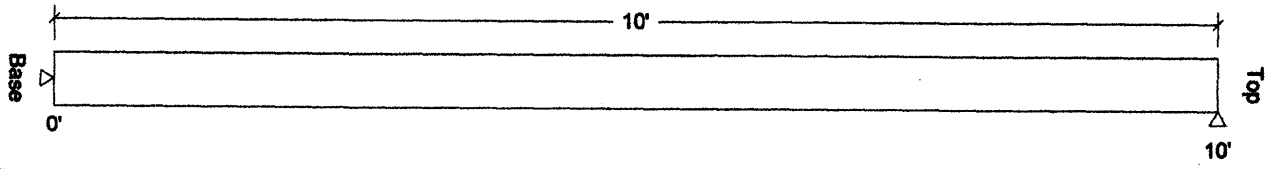
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Pd	Dead	Axial	(Ecc. = 0.92")		5900		lbs
Self-weight	Dead	Axial			34		lbs

Lateral Reactions (lbs):



Unfactored: Dead	45		-45
Factored: R->L Load comb			-45 #1
L->R Load comb	45 #1		#1

Double 2x6

Lumber n-ply, Hem-Fir, No.2, 2x6, 2-ply (3"x5-1/2")

Support: Non-wood

Total length: 10'; Clear span: 10'; volume = 1.1 cu.ft.

Pinned base; Load face = width(b); Built-up fastener: nails; Ke x Lb: 1.0 x 0.0 = 0.0 [ft]; Ke x Ld: 1.0 x 10.0 = 10.0 [ft]; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 4	Fv' = 135	psi	fv/Fv' = 0.03
Bending(+)	fb = 358	Fb' = 994	psi	fb/Fb' = 0.36
Axial	fc = 360	Fc' = 668	psi	fc/Fc' = 0.54
Combined (axial + eccentric moment)				Eq.15.4-3 = 1.00
Axial Bearing	fc = 360	Fc* = 1287	psi	fc/Fc* = 0.28
Live Defl'n	negligible			
Total Defl'n	0.14 = L/864	1.00 = L/120	in	0.14

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	0.90	1.00	1.00	-	-	-	-	1.00	1.00	1
Fb'+	850	0.90	1.00	1.00	1.000	1.300	1.00	1.00	1.00	1.00	1
Fc'	1300	0.90	1.00	1.00	0.519	1.100	-	-	1.00	1.00	1
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Emin'	0.47 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Fc*	1300	0.90	1.00	1.00	-	1.100	-	-	1.00	1.00	1

CRITICAL LOAD COMBINATIONS:

Shear : LC #1 = D only, V max = 45, V design = 45 lbs
Bending(+): LC #1 = D only, M = 452 lbs-ft
Deflection: LC #1 = D only (total)
Axial : LC #1 = D only, P = 5934 lbs Kf = 1.00
Eq.15.4-3 : LC #1 = D only Fb'= 994
FcE= 812 Pxe/S=fc(6xe/d)= 358

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 2015

CALCULATIONS:

Deflection: EI = 27.0e06 lb-in2/ply
"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 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. BUILT-UP COLUMNS: nailed or bolted built-up columns shall conform to the provisions of NDS Clause 15.3.
4. Axial load eccentricity applied in direction of load face only. It is the designers responsibility to check for effect of eccentricity in the other direction.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering July 2, 2019 12:32	JN 18060 RealFine Painting Column 3- 2x6x10

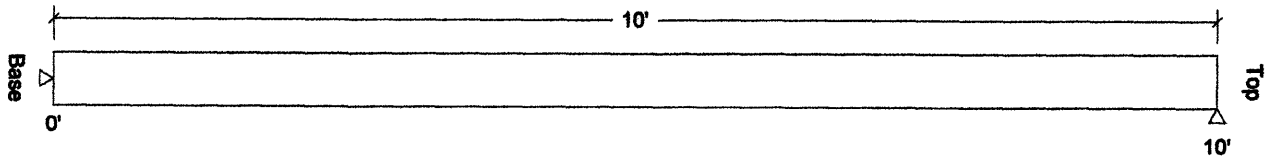
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Pd	Dead	Axial	(Ecc. = 0.92")		9000		lbs
Self-weight	Dead	Axial			51		lbs

Lateral Reactions (lbs):



Unfactored:			
Dead	69		-69
Factored:			
R->L Load comb			-69 #1
L->R Load comb	69 #1		#1

Triple 2x6

Lumber n-ply, Hem-Fir, No.2, 2x6, 3-ply (4-1/2"x5-1/2")

Support: Non-wood

Total length: 10'; Clear span: 10'; volume = 1.7 cu.ft.

Pinned base; Load face = width(b); Built-up fastener: nails; Ke x Lb: 1.0 x 0.0 = 0.0 [ft]; Ke x Ld: 1.0 x 10.0 = 10.0 [ft]; Repetitive factor: applied where permitted (refer to online help);

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 4	Fv' = 135	psi	fv/Fv' = 0.03
Bending(+)	fb = 364	Fb' = 1144	psi	fb/Fb' = 0.32
Axial	fc = 366	Fc' = 668	psi	fc/Fc' = 0.55
Combined (axial + eccentric moment)				Eq.15.4-3 = 0.94
Axial Bearing	fc = 366	Fc* = 1287	psi	fc/Fc* = 0.28
Live Defl'n	negligible			
Total Defl'n	0.14 = L/849	1.00 = L/120	in	0.14

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	0.90	1.00	1.00	-	-	-	-	1.00	1.00	1
Fb'+	850	0.90	1.00	1.00	1.000	1.300	1.00	1.15	1.00	1.00	1
Fc'	1300	0.90	1.00	1.00	0.519	1.100	-	-	1.00	1.00	1
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Emin'	0.47 million		1.00	1.00	-	-	-	-	1.00	1.00	1
Fc*	1300	0.90	1.00	1.00	-	1.100	-	-	1.00	1.00	1

CRITICAL LOAD COMBINATIONS:

Shear : LC #1 = D only, V max = 69, V design = 69 lbs
Bending(+): LC #1 = D only, M = 689 lbs-ft
Deflection: LC #1 = D only (total)
Axial : LC #1 = D only, P = 9051 lbs Kf = 1.00
Eq.15.4-3 : LC #1 = D only Fb'= 1144
FcE= 812 Pxe/S=fc(6xe/d)= 364
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 2015

CALCULATIONS:

Deflection: EI = 27.0e06 lb-in2/ply
"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 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. BUILT-UP COLUMNS: nailed or bolted built-up columns shall conform to the provisions of NDS Clause 15.3.
4. Axial load eccentricity applied in direction of load face only. It is the designers responsibility to check for effect of eccentricity in the other direction.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY
Forsman Engineering
July 2, 2019 12:54

PROJECT
JN 18060 RealFine Painting
Column 4x6x10

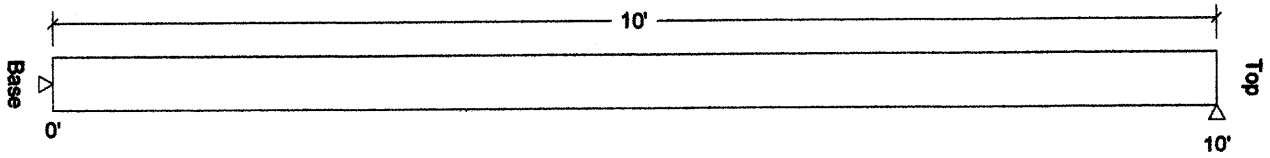
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Pd	Dead	Axial	(Ecc. = 0.00")		7200		lbs
Self-weight	Dead	Axial			46		lbs

Lateral Reactions (lbs):



4x6

Lumber Post, D.Fir-L, No.2, 4x6 (3-1/2"x5-1/2")

Support: Non-wood

Total length: 10'; Clear span: 10'; volume = 1.3 cu.ft.

Pinned base; Load face = width(b); Ke x Lb: 1.0 x 10.0 = 10.0 [ft]; Ke x Ld: 1.0 x 10.0 = 10.0 [ft];

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Axial	fc = 376	Fc' = 376	psi	fc/Fc' = 1.00
Axial Bearing	fc = 376	Fc* = 1336	psi	fc/Fc* = 0.28

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fc'	1350	0.90	1.00	1.00	0.281	1.100	-	-	1.00	1.00	1
Fc*	1350	0.90	1.00	1.00	-	1.100	-	-	1.00	1.00	1

CRITICAL LOAD COMBINATIONS:

Axial : LC #1 = D only, P = 7246 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 2015

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY Forsman Engineering July 2, 2019 12:49	PROJECT JN 18060 RealFine Painting Column 6x6x10

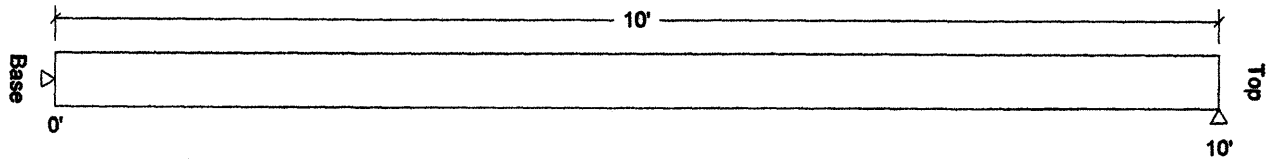
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Pd	Dead	Axial	(Ecc. = 0.00")		14600		lbs
Self-weight	Dead	Axial			72		lbs

Lateral Reactions (lbs):



6x6 Post

Timber-soft, D.Fir-L, No.2, 6x6 (5-1/2"x5-1/2")

Support: Non-wood

Total length: 10'; Clear span: 10'; volume = 2.1 cu.ft.; Post and timber

Pinned base; Load face = width(b); Ke x Lb: 1.0 x 10.0 = 10.0 [ft]; Ke x Ld: 1.0 x 10.0 = 10.0 [ft];

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Axial	fc = 485	Fc' = 485	psi	fc/Fc' = 1.00
Axial Bearing	fc = 485	Fc* = 630	psi	fc/Fc* = 0.77*

*Column requires a bearing plate at top as per NDS 3.10.1.3

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fc'	700	0.90	1.00	1.00	0.771	1.000	-	-	1.00	1.00	1
Fc*	700	0.90	1.00	1.00	-	1.000	-	-	1.00	1.00	1

CRITICAL LOAD COMBINATIONS:

Axial : LC #1 = D only, P = 14672 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 2015

Design Notes:

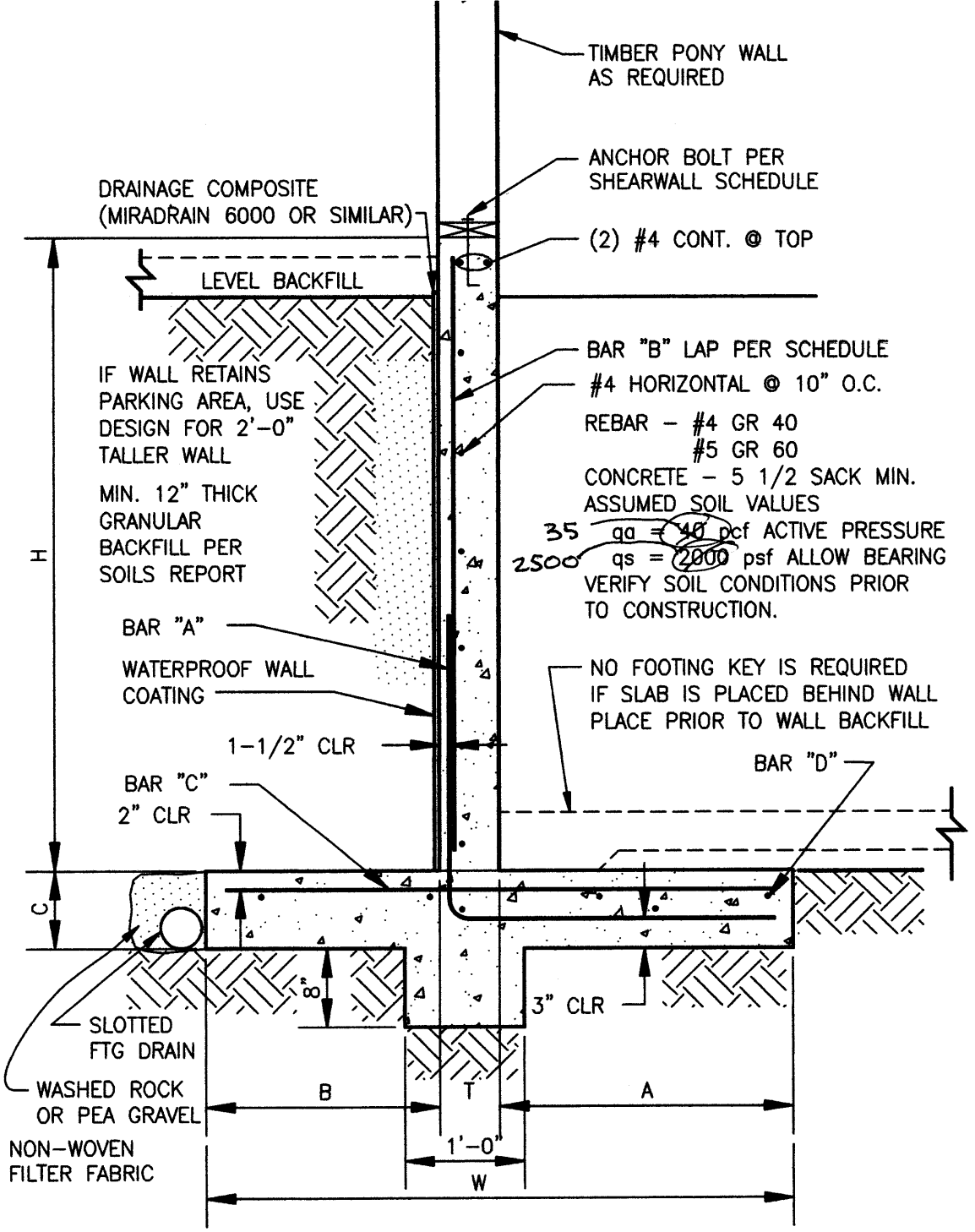
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.

FOOTING CAPACITY PONT LOAD

Allowable Soil Bearing Pressure 2500 psf

Name	Rebar ea way *	Width (ft)	Length (ft)	Thickness (in)	Area (ft^2)	Capacity (lbs)
F1.5	(2) #4	1.5	1.5	8	2.25	5625
F2	(2) #4	2	2	10	4.00	10000
F2.5	(3) #4	2.5	2.5	10	6.25	15625
F3	(3) #4	3	3	10	9.00	22500
F3.5	(4) #4	3.5	3.5	10	12.25	30625
F4	(4) #4	4	4	12	16.00	40000
F4.5	(5) # 5	4.5	4.5	12	20.25	50625
F5	(5) # 5	5	5	12	25.00	62500
F6	(6) #5	6	6	12	36.00	90000
F-Dia 12		12" Dia		8	0.79	1975
F-Dia 18		18" Dia		8	1.77	4425
F-Dia 24		24" Dia		8	3.14	7850
12" Cont		12" Continuous	3	8	3	7500
16" Cont		16" Continuous	3	8	4	10000
24" Cont		24" Continuous	4	8	8	20000

* Rebar mats to be 3" cover at bottom of footing



RETAINING WALL SCHEDULE										
H	T	A	B	C	W	BAR "A"	BAR "B"	BAR "C"	BAR "D"	KEY
4'-0"	6"	6"	1'-6"	8"	2'-6"	#4 @ 16"	-----	-----	(2) #4	NO
6'-0"	8"	1'-4"	1'-0"	10"	3'-0"	#4 @ 12"	#4 @ 12" LAP 24"	#4 @ 12"	(4) #4	YES
8'-0"	8"	10"	3'-6"	1'-0"	5'-0"	#5 @ 12"	#4 @ 12" LAP 36"	#5 @ 12"	(6) #4	YES
10'-0"	10"	1'-5"	4'-0"	1'-0"	6'-3"	#6 @ 10"	#4 @ 10" LAP 36"	#5 @ 10"	(7) #4	YES

#6

TYPICAL RETAINING WALL DETAIL

30
SD2

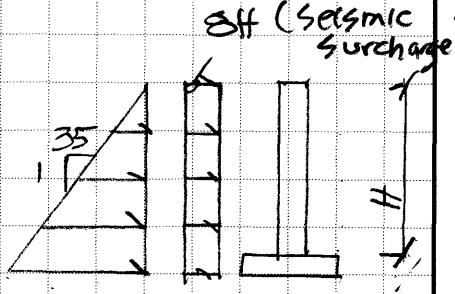
3/4" = 1'-0"

FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

JOB _____
SHEET NO. 79 OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

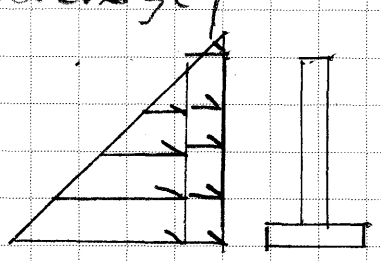
Cantilever Wall loading w/ earth only

EFP = 35 pcf
passive = 300 pcf
μ = .45
γ = 130 pcf



+ Seismic = +8H
* Only use F.S. = 1.2 for seismic surcharge

4'	32 pcf / 35 = .9	
6'	48 pcf / 35 = 1.4'	
8'	64 pcf / 35 = 1.8'	
10'	80 pcf / 35 = 2.3'	
12'	96 pcf / 35 = 2.7'	
		h'_s



Conservatively model as w/o surcharge w/ E.F.P. but still height taller w/ h + h'_s

h	h'(H+C+E)
4'	4+.67+.9 = 5.6'
6'	6+.83+1.4' = 8.2'
8'	8+1.0 +1.8' = 10.8'
10'	10+1.0 +2.3' = 13.3'

(For wall steel, 12.3' o.c.)

At

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	5.167	ft
Hgt soil heel	4.670	ft
Hgt soil toe	0.670	ft
Toe	0.500	ft
Heel	1.500	ft
Thick wall	6.000	in
Thick ftg	8.000	in
Thick Key	8.000	in
Depth Key	0.010	ft
Width ftg	2.500	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	40.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	1.389	kip
X resultant	0.978	ft
Sum F resist	0.694	kip
Sum F horiz	0.382	kip
F.S. sliding	1.819	
Sum M resist	1.968	k-ft
Sum M O.T.	0.594	k-ft
F.S. O.T.	3.312	

Eccentricity:

M ecc	0.377	k-ft
X ecc	0.272	ft
X zero	2.500	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.140	ksf
ph ftg base	0.163	ksf
ph key base	0.164	ksf
pv toe	0.918	ksf
pv wall toe	0.773	ksf
pv wall heel	0.628	ksf
pv heel	0.193	ksf

Wall Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	1.500	in
d	4.250	in
0.0020 Ag	0.144	sq-in
0.0025 Ag	0.180	sq-in
As min	0.255	sq-in
As max	1.183	sq-in
Mu	0.636	k-ft
Phi Mn	1.859	k-ft
Vu	0.536	kip
Phi Vc	4.335	kip

Toe Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	3.000	in
d	4.750	in
0.0018 Ag	0.173	sq-in
0.0020 Ag	0.192	sq-in
As min	0.285	sq-in
As max	1.322	sq-in
Mu	0.175	k-ft
Phi Mn	2.084	k-ft
Vu	0.719	kip
Phi Vc	4.845	kip

Heel Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	2.000	in
d	5.750	in
0.0018 Ag	0.173	sq-in
0.0020 Ag	0.192	sq-in
As min	0.345	sq-in
As max	1.601	sq-in
Mu	0.982	k-ft
Phi Mn	2.534	k-ft
Vu	1.310	kip
Phi Vc	5.865	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	7.530	ft
Hgt soil heel	6.830	ft
Hgt soil toe	0.833	ft
Toe	1.333	ft
Heel	1.000	ft
Thick wall	8.000	in
Thick ftg	10.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	3.000	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	1.962	kip
X resultant	1.070	ft
Sum F resist	1.387	kip
Sum F horiz	0.816	kip
F.S. sliding	1.699	
Sum M resist	3.762	k-ft
Sum M O.T.	1.859	k-ft
F.S. O.T.	2.024	

Eccentricity:

M ecc	0.843	k-ft
X ecc	0.430	ft
X zero	3.000	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.210	ksf
ph ftg base	0.239	ksf
ph key base	0.274	ksf
pv toe	1.217	ksf
pv wall toe	0.717	ksf
pv wall heel	0.467	ksf
pv heel	0.092	ksf

Wall Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	1.500	in
d	6.250	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.250	sq-in
As max	1.002	sq-in
Mu	2.138	k-ft
Phi Mn	5.413	k-ft
Vu	1.195	kip
Phi Vc	6.375	kip

Toe Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	3.000	in
d	6.750	in
0.0018 Ag	0.216	sq-in
0.0020 Ag	0.240	sq-in
As min	0.270	sq-in
As max	1.082	sq-in
Mu	1.334	k-ft
Phi Mn	5.863	k-ft
Vu	2.191	kip
Phi Vc	6.885	kip

Heel Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	2.000	in
d	7.750	in
0.0018 Ag	0.216	sq-in
0.0020 Ag	0.240	sq-in
As min	0.310	sq-in
As max	1.243	sq-in
Mu	0.636	k-ft
Phi Mn	6.763	k-ft
Vu	1.272	kip
Phi Vc	7.905	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	9.500	ft
Hgt soil heel	9.000	ft
Hgt soil toe	1.000	ft
Toe	0.833	ft
Heel	3.500	ft
Thick wall	8.000	in
Thick ftg	12.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	5.000	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	5.397	kip
X resultant	2.042	ft
Sum F resist	3.028	kip
Sum F horiz	1.418	kip
F.S. sliding	2.137	
Sum M resist	15.074	k-ft
Sum M O.T.	4.253	k-ft
F.S. O.T.	3.545	

Eccentricity:

M ecc	2.470	k-ft
X ecc	0.458	ft
X zero	5.000	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.280	ksf
ph ftg base	0.315	ksf
ph key base	0.350	ksf
pv toe	1.672	ksf
pv wall toe	1.475	ksf
pv wall heel	1.316	ksf
pv heel	0.487	ksf

Wall Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	1.500	in
d	6.188	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.248	sq-in
As max	0.992	sq-in
Mu	5.077	k-ft
Phi Mn	8.121	k-ft
Vu	2.023	kip
Phi Vc	6.311	kip

Toe Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	3.000	in
d	8.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.348	sq-in
As max	1.393	sq-in
Mu	0.909	k-ft
Phi Mn	11.609	k-ft
Vu	2.229	kip
Phi Vc	8.861	kip

Heel Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	2.000	in
d	9.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.388	sq-in
As max	1.553	sq-in
Mu	10.247	k-ft
Phi Mn	13.004	k-ft
Vu	5.856	kip
Phi Vc	9.881	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	11.500	ft
Hgt soil heel	11.000	ft
Hgt soil toe	1.000	ft
Toe	1.417	ft
Heel	4.000	ft
Thick wall	10.000	in
Thick ftg	12.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	6.250	ft

Soil:

Wgt soil	0.120	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.160	kcf
f'c	2.500	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	7.307	kip
X resultant	2.595	ft
Sum F resist	3.888	kip
Sum F horiz	2.118	kip
F.S. sliding	1.836	
Sum M resist	26.523	k-ft
Sum M O.T.	7.764	k-ft
F.S. O.T.	3.416	

Eccentricity:

M ecc	3.875	k-ft
X ecc	0.530	ft
X zero	6.250	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.350	ksf
ph ftg base	0.385	ksf
ph key base	0.420	ksf
pv toe	1.764	ksf
pv wall toe	1.494	ksf
pv wall heel	1.336	ksf
pv heel	0.574	ksf

Wall Reinforcing :

bar	6	#
spacing	10.000	in
As	0.528	sq-in
cover	1.500	in
d	8.125	in
0.0020 Ag	0.240	sq-in
0.0025 Ag	0.300	sq-in
As min	0.325	sq-in
As max	1.303	sq-in
Mu	9.917	k-ft
Phi Mn	17.825	k-ft
Vu	3.124	kip
Phi Vc	8.288	kip

Toe Reinforcing :

bar	5	#
spacing	10.000	in
As	0.372	sq-in
cover	3.000	in
d	8.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.348	sq-in
As max	1.393	sq-in
Mu	2.703	k-ft
Phi Mn	13.808	k-ft
Vu	3.924	kip
Phi Vc	8.861	kip

Heel Reinforcing :

bar	5	#
spacing	10.000	in
As	0.372	sq-in
cover	2.000	in
d	9.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.388	sq-in
As max	1.553	sq-in
Mu	15.232	k-ft
Phi Mn	15.482	k-ft
Vu	7.616	kip
Phi Vc	9.881	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	6.100	ft
Hgt soil heel	5.600	ft
Hgt soil toe	0.670	ft
Toe	0.500	ft
Heel	1.500	ft
Thick wall	6.000	in
Thick ftg	8.000	in
Thick Key	8.000	in
Depth Key	0.010	ft
Width ftg	2.500	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	40.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	1.643	kip
X resultant	0.791	ft
Sum F resist	0.809	kip
Sum F horiz	0.549	kip
F.S. sliding	1.473	
Sum M resist	2.340	k-ft
Sum M O.T.	1.024	k-ft
F.S. O.T.	2.284	

Eccentricity:

M ecc	0.753	k-ft
X ecc	0.459	ft
X zero	2.374	ft
compression	94.975	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.173	ksf
ph ftg base	0.196	ksf
ph key base	0.196	ksf
pv toe	1.384	ksf
pv wall toe	1.091	ksf
pv wall heel	0.802	ksf
pv heel	0.000	ksf

Wall Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	1.500	in
d	4.250	in
0.0020 Ag	0.144	sq-in
0.0025 Ag	0.180	sq-in
As min	0.255	sq-in
As max	1.183	sq-in
Mu	1.191	k-ft
Phi Mn	1.859	k-ft
Vu	0.797	kip
Phi Vc	4.335	kip

Toe Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	3.000	in
d	4.750	in
0.0018 Ag	0.173	sq-in
0.0020 Ag	0.192	sq-in
As min	0.285	sq-in
As max	1.322	sq-in
Mu	0.253	k-ft
Phi Mn	2.084	k-ft
Vu	1.052	kip
Phi Vc	4.845	kip

Heel Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	2.000	in
d	5.750	in
0.0018 Ag	0.173	sq-in
0.0020 Ag	0.192	sq-in
As min	0.345	sq-in
As max	1.601	sq-in
Mu	1.173	k-ft
Phi Mn	2.534	k-ft
Vu	1.564	kip
Phi Vc	5.865	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	8.700	ft
Hgt soil heel	8.200	ft
Hgt soil toe	0.833	ft
Toe	1.333	ft
Heel	1.000	ft
Thick wall	8.000	in
Thick ftg	10.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	3.000	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	2.261	kip
X resultant	0.614	ft
Sum F resist	1.522	kip
Sum F horiz	1.177	kip
F.S. sliding	1.293	
Sum M resist	4.409	k-ft
Sum M O.T.	3.216	k-ft
F.S. O.T.	1.371	

Eccentricity:

M ecc	2.003	k-ft
X ecc	0.886	ft
X zero	1.842	ft
compression	61.418	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.258	ksf
ph ftg base	0.287	ksf
ph key base	0.322	ksf
pv toe	2.455	ksf
pv wall toe	0.902	ksf
pv wall heel	0.309	ksf
pv heel	0.000	ksf

Wall Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	1.500	in
d	6.250	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.250	sq-in
As max	1.002	sq-in
Mu	3.964	k-ft
Phi Mn	5.413	k-ft
Vu	1.724	kip
Phi Vc	6.375	kip

Toe Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	3.000	in
d	6.750	in
0.0018 Ag	0.216	sq-in
0.0020 Ag	0.240	sq-in
As min	0.270	sq-in
As max	1.082	sq-in
Mu	2.145	k-ft
Phi Mn	5.863	k-ft
Vu	3.804	kip
Phi Vc	6.885	kip

Heel Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	2.000	in
d	7.750	in
0.0018 Ag	0.216	sq-in
0.0020 Ag	0.240	sq-in
As min	0.310	sq-in
As max	1.243	sq-in
Mu	0.761	k-ft
Phi Mn	6.763	k-ft
Vu	1.522	kip
Phi Vc	7.905	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	11.400	ft
Hgt soil heel	10.800	ft
Hgt soil toe	1.000	ft
Toe	0.833	ft
Heel	3.500	ft
Thick wall	8.000	in
Thick ftg	12.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	5.000	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	6.412	kip
X resultant	1.687	ft
Sum F resist	3.485	kip
Sum F horiz	2.041	kip
F.S. sliding	1.708	
Sum M resist	17.965	k-ft
Sum M O.T.	7.348	k-ft
F.S. O.T.	2.445	

Eccentricity:

M ecc	5.213	k-ft
X ecc	0.813	ft
X zero	5.000	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.343	ksf
ph ftg base	0.378	ksf
ph key base	0.413	ksf
pv toe	2.534	ksf
pv wall toe	2.117	ksf
pv wall heel	1.783	ksf
pv heel	0.031	ksf

Wall Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	1.500	in
d	6.188	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.248	sq-in
As max	0.992	sq-in
Mu	9.333	k-ft
Phi Mn	8.121	k-ft
Vu	3.032	kip
Phi Vc	6.311	kip

Toe Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	3.000	in
d	8.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.348	sq-in
As max	1.393	sq-in
Mu	1.331	k-ft
Phi Mn	11.609	k-ft
Vu	3.294	kip
Phi Vc	8.861	kip

Heel Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	2.000	in
d	9.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.388	sq-in
As max	1.553	sq-in
Mu	12.254	k-ft
Phi Mn	13.004	k-ft
Vu	7.002	kip
Phi Vc	9.881	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	13.800	ft
Hgt soil heel	13.300	ft
Hgt soil toe	1.000	ft
Toe	1.417	ft
Heel	4.000	ft
Thick wall	10.000	in
Thick ftg	12.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	6.250	ft

Soil:

Wgt soil	0.120	kcf
EFP active	0.035	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.160	kcf
f'c	2.500	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	8.717	kip
X resultant	2.094	ft
Sum F resist	4.523	kip
Sum F horiz	3.096	kip
F.S. sliding	1.461	
Sum M resist	31.777	k-ft
Sum M O.T.	13.724	k-ft
F.S. O.T.	2.316	

Eccentricity:

M ecc	8.988	k-ft
X ecc	1.031	ft
X zero	6.250	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.431	ksf
ph ftg base	0.466	ksf
ph key base	0.501	ksf
pv toe	2.775	ksf
pv wall toe	2.149	ksf
pv wall heel	1.781	ksf
pv heel	0.014	ksf

Wall Reinforcing :

bar	6	#
spacing	10.000	in
As	0.528	sq-in
cover	1.500	in
d	8.125	in
0.0020 Ag	0.240	sq-in
0.0025 Ag	0.300	sq-in
As min	0.325	sq-in
As max	1.303	sq-in
Mu	18.454	k-ft
Phi Mn	17.825	k-ft
Vu	4.684	kip
Phi Vc	8.288	kip

Toe Reinforcing :

bar	5	#
spacing	10.000	in
As	0.372	sq-in
cover	3.000	in
d	8.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.348	sq-in
As max	1.393	sq-in
Mu	4.023	k-ft
Phi Mn	13.808	k-ft
Vu	5.930	kip
Phi Vc	8.861	kip

Heel Reinforcing :

bar	5	#
spacing	10.000	in
As	0.372	sq-in
cover	2.000	in
d	9.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.388	sq-in
As max	1.553	sq-in
Mu	18.323	k-ft
Phi Mn	15.482	k-ft
Vu	9.162	kip
Phi Vc	9.881	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	5.167	ft
Hgt soil heel	4.670	ft
Hgt soil toe	0.670	ft
Toe	0.500	ft
Heel	1.500	ft
Thick wall	6.000	in
Thick ftg	8.000	in
Thick Key	8.000	in
Depth Key	0.010	ft
Width ftg	2.500	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.045	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	40.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	1.389	kip
X resultant	0.856	ft
Sum F resist	0.694	kip
Sum F horiz	0.491	kip
F.S. sliding	1.415	
Sum M resist	1.968	k-ft
Sum M O.T.	0.764	k-ft
F.S. O.T.	2.576	

Eccentricity:

M ecc	0.547	k-ft
X ecc	0.394	ft
X zero	2.500	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.180	ksf
ph ftg base	0.210	ksf
ph key base	0.211	ksf
pv toe	1.081	ksf
pv wall toe	0.871	ksf
pv wall heel	0.661	ksf
pv heel	0.030	ksf

Wall Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	1.500	in
d	4.250	in
0.0020 Ag	0.144	sq-in
0.0025 Ag	0.180	sq-in
As min	0.255	sq-in
As max	1.183	sq-in
Mu	0.818	k-ft
Phi Mn	1.859	k-ft
Vu	0.689	kip
Phi Vc	4.335	kip

Toe Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	3.000	in
d	4.750	in
0.0018 Ag	0.173	sq-in
0.0020 Ag	0.192	sq-in
As min	0.285	sq-in
As max	1.322	sq-in
Mu	0.200	k-ft
Phi Mn	2.084	k-ft
Vu	0.829	kip
Phi Vc	4.845	kip

Heel Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	2.000	in
d	5.750	in
0.0018 Ag	0.173	sq-in
0.0020 Ag	0.192	sq-in
As min	0.345	sq-in
As max	1.601	sq-in
Mu	0.982	k-ft
Phi Mn	2.534	k-ft
Vu	1.310	kip
Phi Vc	5.865	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	7.530	ft
Hgt soil heel	6.830	ft
Hgt soil toe	0.833	ft
Toe	1.333	ft
Heel	1.000	ft
Thick wall	8.000	in
Thick ftg	10.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	3.000	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.045	ksf/ft
EFP passive	0.300	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	2.500	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	0.000	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	1.962	kip
X resultant	0.799	ft
Sum F resist	1.387	kip
Sum F horiz	1.050	kip
F.S. sliding	1.322	
Sum M resist	3.762	k-ft
Sum M O.T.	2.390	k-ft
F.S. O.T.	1.574	

Eccentricity:

M ecc	1.374	k-ft
X ecc	0.700	ft
X zero	2.398	ft
compression	79.954	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.270	ksf
ph ftg base	0.307	ksf
ph key base	0.352	ksf
pv toe	1.636	ksf
pv wall toe	0.756	ksf
pv wall heel	0.349	ksf
pv heel	0.000	ksf

Wall Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	1.500	in
d	6.250	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.250	sq-in
As max	1.002	sq-in
Mu	2.749	k-ft
Phi Mn	5.413	k-ft
Vu	1.536	kip
Phi Vc	6.375	kip

Toe Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	3.000	in
d	6.750	in
0.0018 Ag	0.216	sq-in
0.0020 Ag	0.240	sq-in
As min	0.270	sq-in
As max	1.082	sq-in
Mu	1.585	k-ft
Phi Mn	5.863	k-ft
Vu	2.711	kip
Phi Vc	6.885	kip

Heel Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	2.000	in
d	7.750	in
0.0018 Ag	0.216	sq-in
0.0020 Ag	0.240	sq-in
As min	0.310	sq-in
As max	1.243	sq-in
Mu	0.636	k-ft
Phi Mn	6.763	k-ft
Vu	1.272	kip
Phi Vc	7.905	kip

FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

JOB 19026
SHEET NO. 90 OF
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SCALE

Wind 110 mph exp. C $K_{zt} = 1.3$

Upper Floor End Zone $(40.4)\ 9/2 = 182$ plf
middle $(26.8)\ 9/2 = 121$ plf

Main Floor End Zone $40.4\left(\frac{10+9}{2}\right) = 384$ plf
middle $26.8\left(\frac{10+9}{2}\right) = 255$ plf

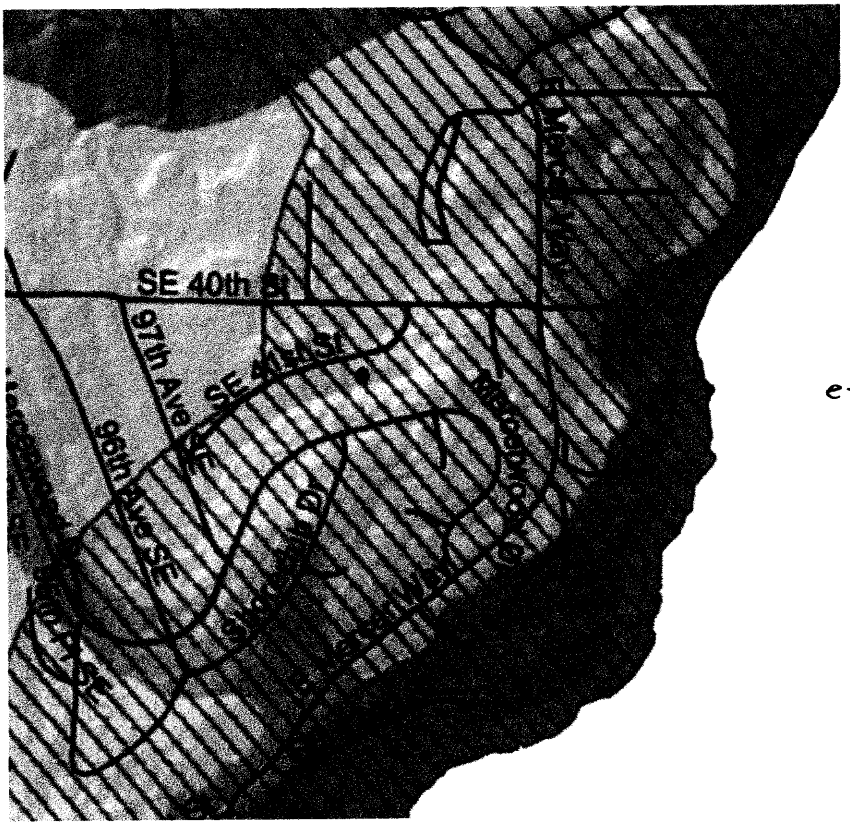
Upper Floor Shear Walls

				ASD
Line A	$(182)6 + 121\ 20/2 = 2302$	x .6		1381 #
Line B	$121\ 48/2 = 2904$	x .6		1742 #
Line C	$182(6) + 121\ 19/2 = 2241$	x .6		1345 #
Line 1	$182(6) + 121\ 19/2 = 2241$	x .6		1345 #
Line 2	$121\ 52/2 = 3146$	x .6		1888 #
Line 3	$182(6) + 121\ 15/2 = 2000$	x .6		1200 #

Main Floor Shear Walls

Line A	$384(6) + 255\ 2/2 + 2302 = 7284$	x .6		4370
Line B	$255\ 48/2 + 2904 = 9024$	x .6		5414 #
Line C	$384(6) + 255\ 19/2 + 2241 = 6968$	x .6		4181 #
Line 1	$384(6) + 255\ 19/2 + 2241 = 6968$	x .6		4181 #
Line 2	$255\ 52/2 + 3146 = 9776$	x .6		5866 #
Line 3	$384(6) + 255\ 15/2 + 2000 = 6217$	x .6		3730 #


9787 Southeast
41st Street
9789 SE 41st St
Mercer Island, WA 98040
47.574006, -122.207497


SE 40th St
97th Ave SE
SE 41st St
96th Ave SE

exp C

$K_{zt} = 1.3$

2010 ASCE 7 Wind Forces - Simple Diaphragm Low Rise Buildings

Based on ASCE7-10 Chapter 28

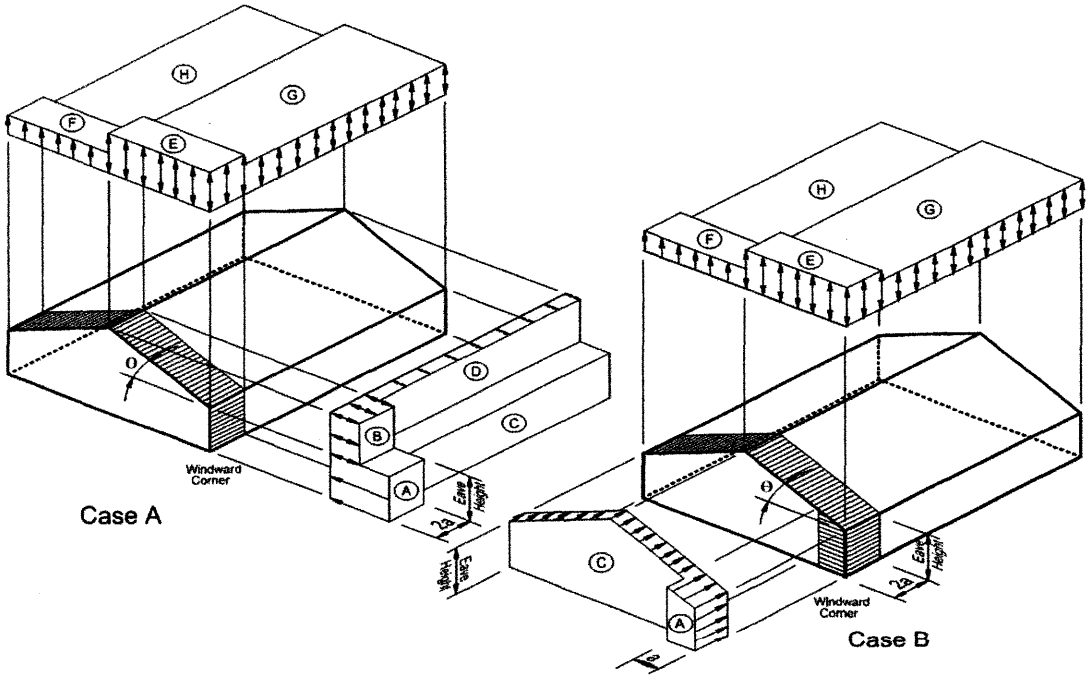
Risk Category	II	Table 1.5-1	Project	19026
Wind Speed	110	mph		**9787 SE 41st**
Exposure Category	C		Date	6/30/2019
Topographic Factor	1.30	K_{zt}		
Mean Roof Height	20	ft		
Roof Pitch	15	degrees		
Adjustment Factor	1.29	λ, Figure 28.6-1		

Zone	λ	K_{zt}	P_{s30}	Total	
A	1.29	1.30	24.1	40.4	psf
B	1.29	1.30	-8.0	-13.4	psf
C	1.29	1.30	16.0	26.8	psf
D	1.29	1.30	-4.6	-7.7	psf

P_{s30} values from Figure 28.6-1

Calculate End Zone Distance, a

Least horizontal distance	23	ft	
10% Least Horizontal Distance	2.3	ft	
0.4h	8	ft	2.3
0.04 Least Horizontal Distance	0.92	ft	
3ft min	3	ft	3
End Zone Distance a:	3	ft	



OSHPD

19026

9789 SE 41st St, Mercer Island, WA 98040, USA

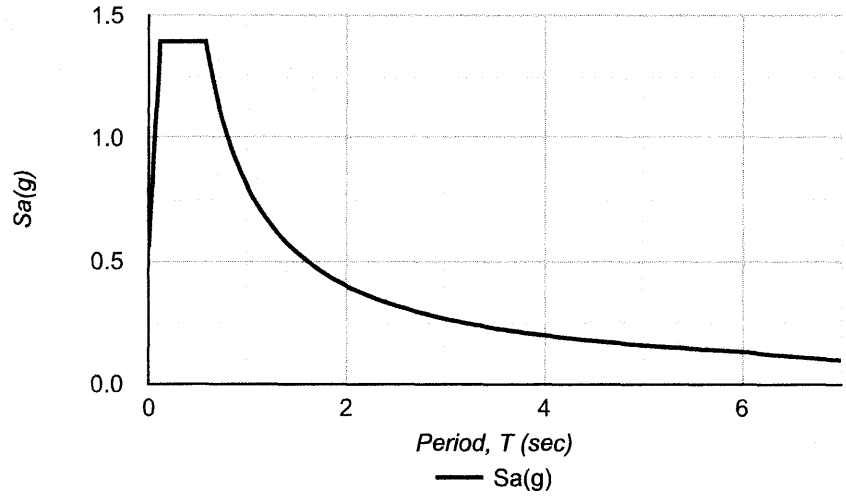
Latitude, Longitude: 47.5740029, -122.20728059999999

Date	6/30/2019, 5:48:24 AM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

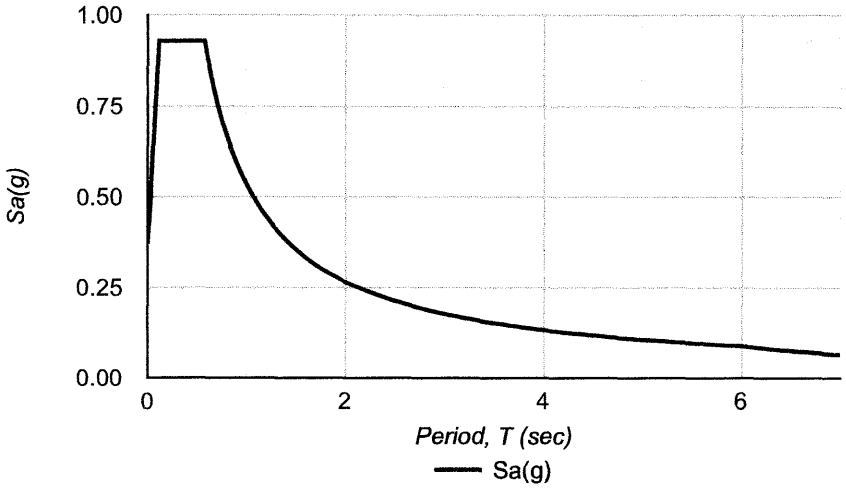
Type	Value	Description
S_S	1.393	MCE_R ground motion. (for 0.2 second period)
S_1	0.535	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.393	Site-modified spectral acceleration value
S_{M1}	0.802	Site-modified spectral acceleration value
S_{DS}	0.929	Numeric seismic design value at 0.2 second SA
S_{D1}	0.535	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.574	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.574	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.393	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.453	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.196	Factored deterministic acceleration value. (0.2 second)
S1RT	0.535	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.573	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.298	Factored deterministic acceleration value. (1.0 second)
PGAd	1.236	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.959	Mapped value of the risk coefficient at short periods
C_{R1}	0.934	Mapped value of the risk coefficient at a period of 1 s

MCER Response Spectrum



Design Response Spectrum



Seismic Vertical Distribution

Project: **19026**
Date: 6/30/2019

S_{DS}=	0.929
R=	6.5
I_e=	1.0
Cs=	0.143

Dead Loads:

Roof:	15	PSF
Wall:	10	PSF
Floor:	14	PSF

Level	Area	DL (psf)	w_i	h_i	$w_i * h_i$	%	v_i	
Roof	2135	15	32025	20	640500	0.61	6382	lbs
Loft	1737	24	41688	10	416880	0.39	4154	lbs
		Total	73713		1057380			

Base Shear: 10535 lbs

FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

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Seismic - $S_{DS} = 0.929$

$V_1 = 6382^{\#} \times .7 \times 1.3 = 5808^{\#}$
$V_2 = 4154 \times .7 \times 1.3 = 3780^{\#}$

Upper Floor Shear Walls

Line A $\frac{784}{2135}(5808) = 2133^{\#}$

Line B $(.5)\ 5808 = 2904^{\#}$
Line C $364/2135\ (5808) = 990^{\#}$
Line 1 $220/2135\ (5808) = 598^{\#}$
Line 2 $(.5)\ 5808 = 2904^{\#}$
Line 3 $784/2135\ (5808) = 2130^{\#}$

Main Floor Shear Walls

Line A $535/1777\ (3780) + 2133 = 3434^{\#}$
Line B $(.5)\ 3780 + 2904 = 4794^{\#}$
Line C $600/1777\ (3780) + 990 = 2296^{\#}$

Line 1 $323/1777\ (3780) + 598 = 1293^{\#}$
Line 2 $(.5)(3780) + 2904 = 4794^{\#}$
Line 3 $325/1777\ (3780) + 2133 = 2840^{\#}$

Shear Wall Schedule and Hardware Values

Shear Wall Schedule (plf)		
Type	Seismic	Wind
P1-6	242	339
P1-4	353	495
P1-3	456	637
P1-2	595	832
P2-4	706	990
P2-3	912	1274
P2-2	1190	1664

Strap tie Values	
Type	Allowable Tension
MST37	2345
MST48	3640
MST60	4830
MST72	4830
CMST14	6490
CMST12	9215

Strap Tie Hold-downs		
Type	Location	Allowable Tension
LSTHD8	Midwall	2250
	Corner	1975
	Endwall	1220
STHD10	Midwall	3400
	Corner	2940
	Endwall	2175
STHD14	Midwall	3815
	Corner	3815
	Endwall	3500

Hold-down Values		
Type	Post	*Allowable* Tension
HDU2	3	2215
HDU4	3	3285
HDU5	3	4065
HDU8	3	4305
	3.5	5020
	4.5	5665
HDU11	5.5	6865
	7.25	8045
HDU14	7.25	10435
	5.5	10350
HDQ8	3	4115
	3.5	5495
	4.5	6645
HHDQ11	5.5	8505
HHDQ14	7.25	9370
	5.5	10745

Shear Wall Summary 9787 SE 41st

Project: **19026 rev 3**
Date: 9/8/2020

S_{DS}= 0.929

Dead Loads:
Roof: 15 PSF
Wall: 10 PSF
Floor: 14 PSF

Grid Line	Total Wall Length (ft)	Plate Height (ft)	Total Forces (lb) Wind	Total Forces (lb) Seismic	Wall Forces (PLF) Wind	Wall Forces (PLF) Seismic	Check Length (ft)	OTM (lb-ft) Wind	OTM (lb-ft) Seismic	Dead Load Trib (ft) Roof	Dead Load Trib (ft) Wall	Dead Load Trib (ft) Floor	DLRM (lb-ft)	Net uplift (lb) Wind	Net uplift (lb) Seismic	Wall Type	Hold-down	Post	Anchor
Upper Floor Shear Walls																			
A	28.5	10	1381	2133	48	75	3	1454	2245	6	3		855	314	614	P1-6	MST 37	(2)2x	
B	18	10	1742	2904	97	161	4	3871	6453	10	9		3000	518	1261	P1-6	MST 37	(2)2x	
C	6	10	1345	990	224	165	3	6725	4950	6	3		855	2071	1516	P1-6	MST 37	(2)2x	
1	8.5	10	1345	298	158	35	8.5	13450	2980	6	8		6651	1113	-17	P1-6	MST 37	(2)2x	
2	18.5	10	1888	2904	102	157	7.5	7654	11773	10	9		7594	413	1094	P1-6	MST 37	(2)2x	
3	24	10	1200	2133	50	89	4	2000	3555	10	8		2800	80	560	P1-6	MSTC37B	(2)2x	
Lower Floor Shear Walls																			
A	14	9	4370	3434	312	245	4	11237	8830	4	4	4	1648	2562	2014	P1-4	HDU2	(2)2x	5/8"
B	10	9	5414	4794	541	479	9.5	46290	40989	10	9.5	12	18411	3710	3404	P1-2	HDU5	(2)2x	5/8"
C	5	9	4181	2296	836	459	5	37629	20664	6	3.5	4	2613	7212	3887	P2-4	HDU14	6x6	1"
1	23	9	4181	1299	182	56	23	37629	11691	6	23	2	55016	201	-616	P1-6			
2	24	9	5866	4794	244	200	11	24197	19775	10	9	2	15224	1369	1147	P1-6	HDU2	(2)2x	5/8"
3	20	9	3730	2840	187	142	5	8393	6390	10	9	8	5300	1043	780	P1-6	MST-37	(2)2x	

Overturning Load Combinations based on ASCE 7-10	
0.6D + 0.6W	ASCE 7-10 section2.4
$(0.6-0.14S_{DS})D + 0.7Q_E$	ASCE 7-10 Section 12.4.2.3

9/8/20