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

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=0.535

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

7/3/19
ARNOLD E. FORSMAN
STATE OF WASHINGTON
30718
REGISTERED
PROFESSIONAL ENGINEER

Sheets 1-83

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

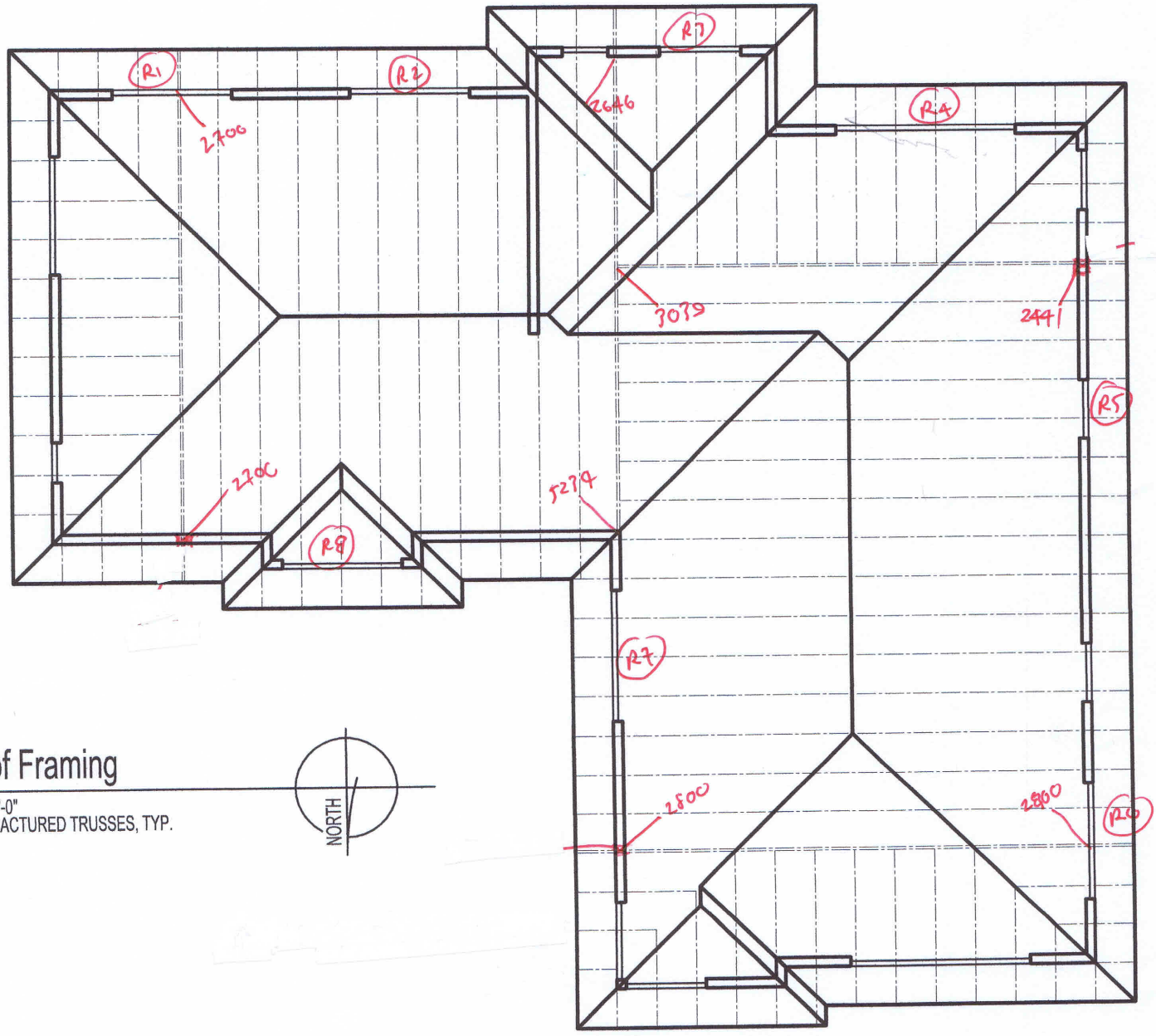
Forsman Engineering was asked to provide a lateral load analysis, shear wall design review of major framing members, and drawings review for a wood framed single family residence. The roof framing is primarily manufactured trusses, the floor framing is TJI joists, and the foundation is typical concrete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

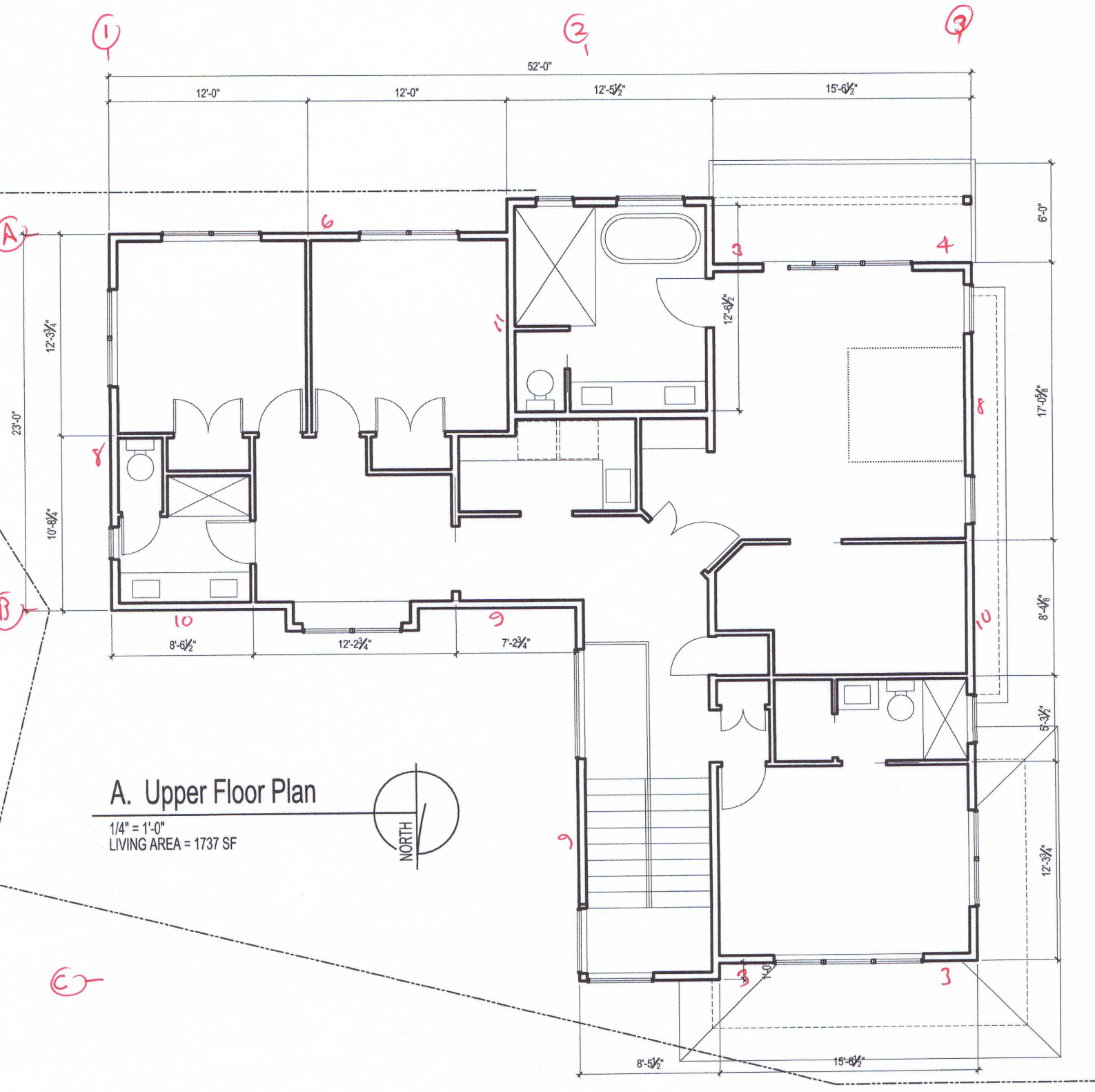
Arnold E. Forsman, P.E.
Forsman Engineering



Roof Framing

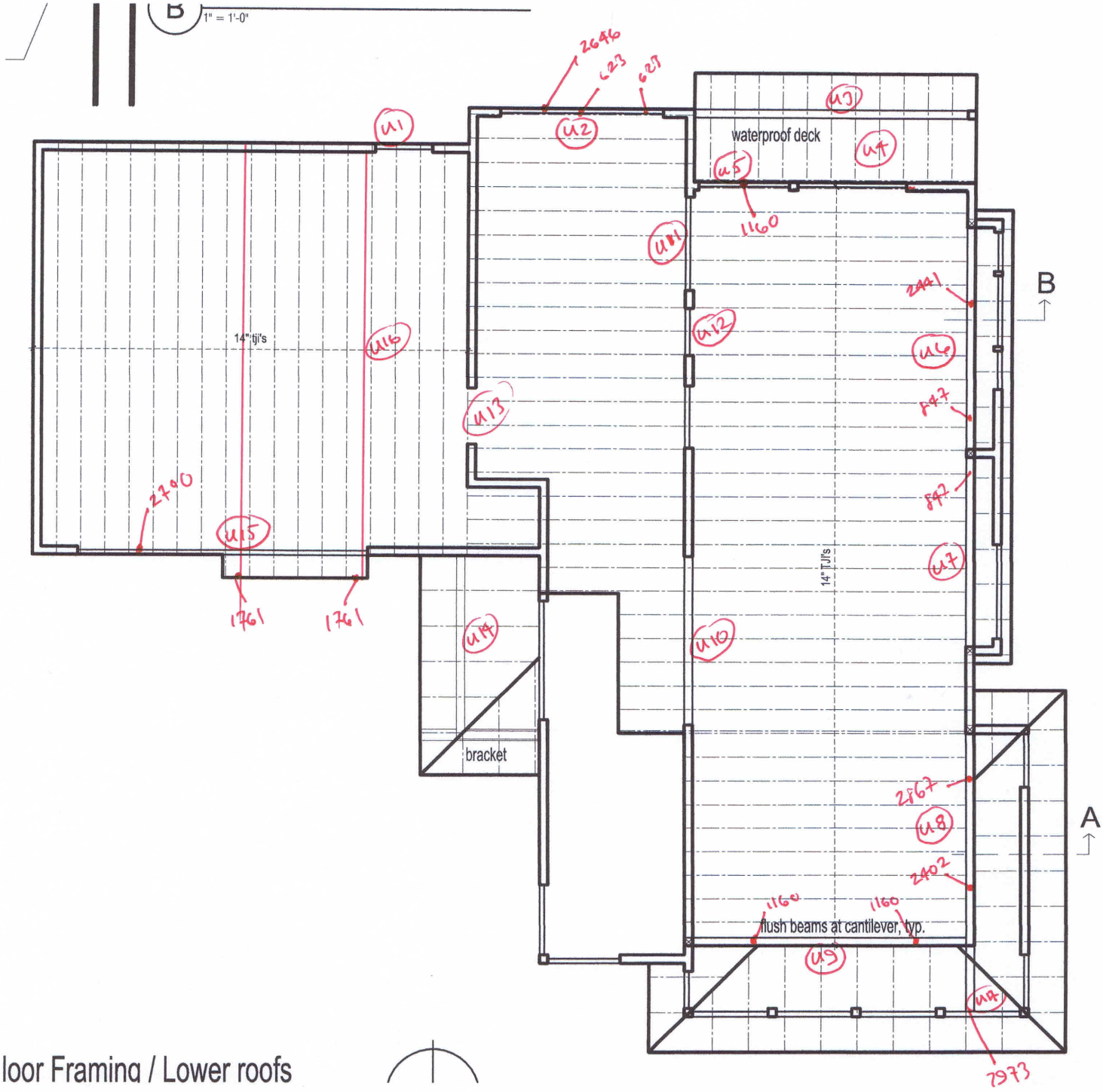
1/8" = 1'-0"
MANUFACTURED TRUSSES, TYP.

NORTH



A. Upper Floor Plan

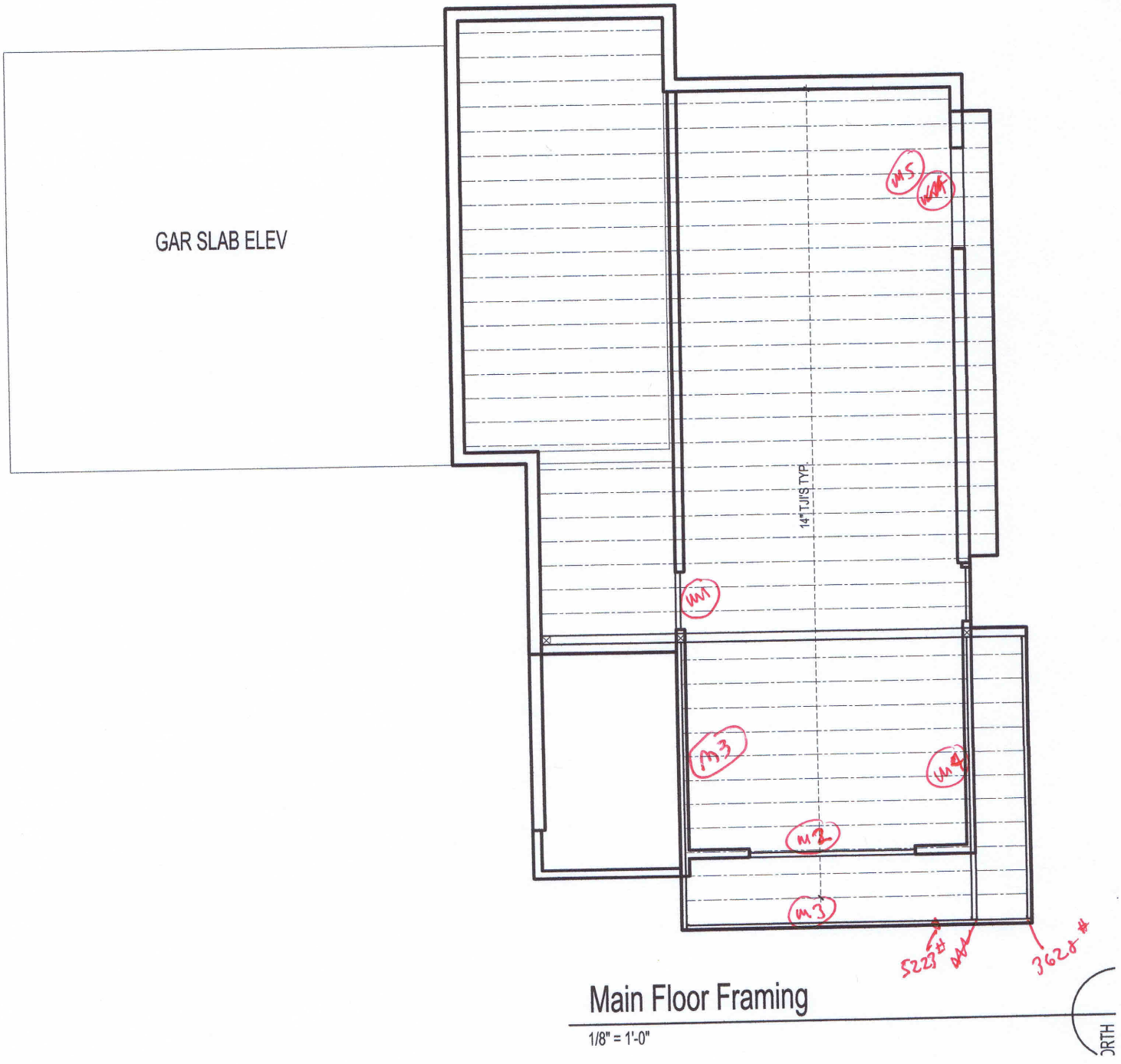
1/4" = 1'-0"
LIVING AREA = 1737 SF



loor Framing / Lower roofs

A. Main Floor Plan

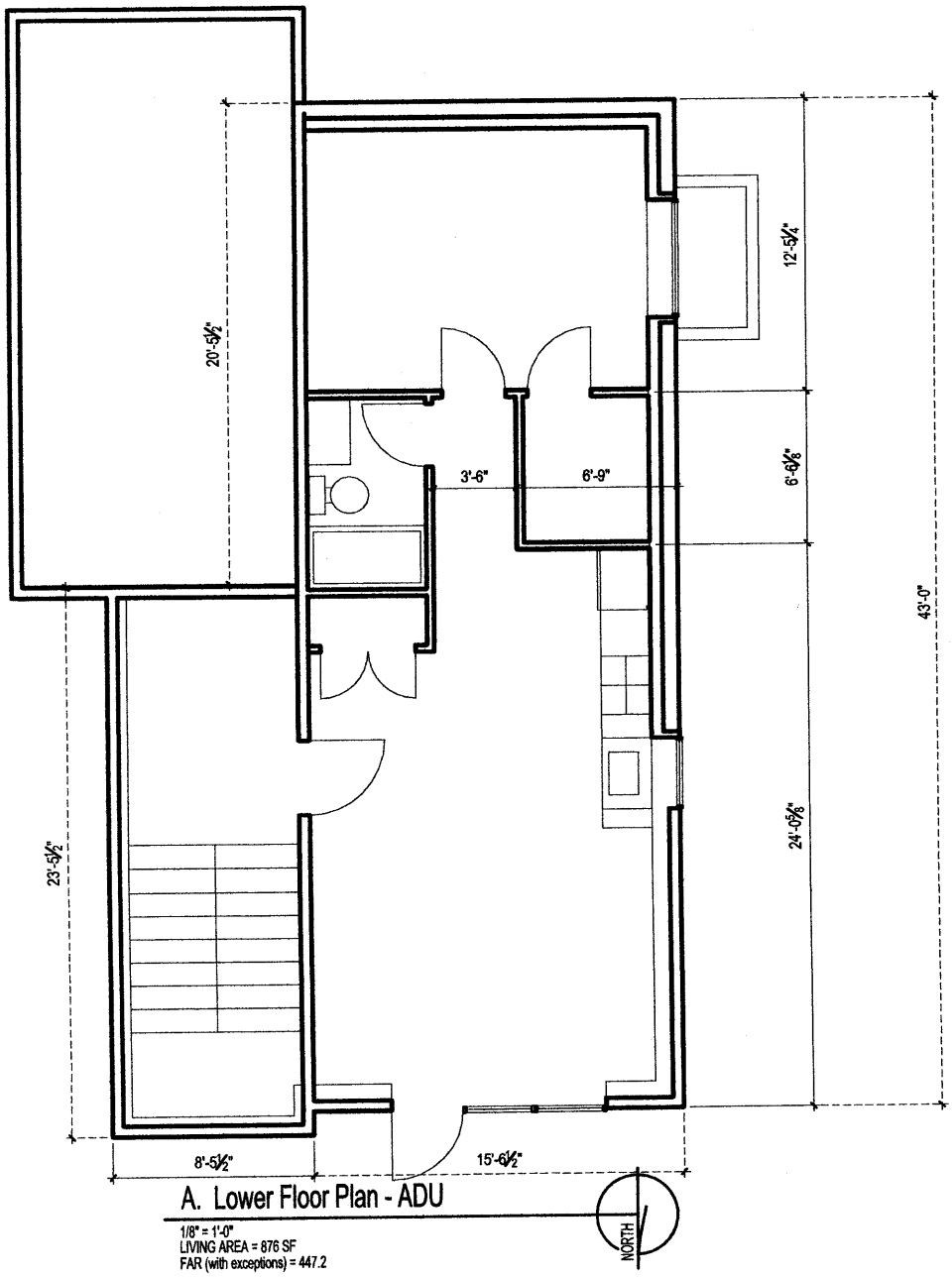
1/8" = 1'-0"
LIVING AREA = 1346 SF
GARAGE AREA = 567.3 SF
stair exception = 90.5 sf



Main Floor Framing

1/8" = 1'-0"

NORTH

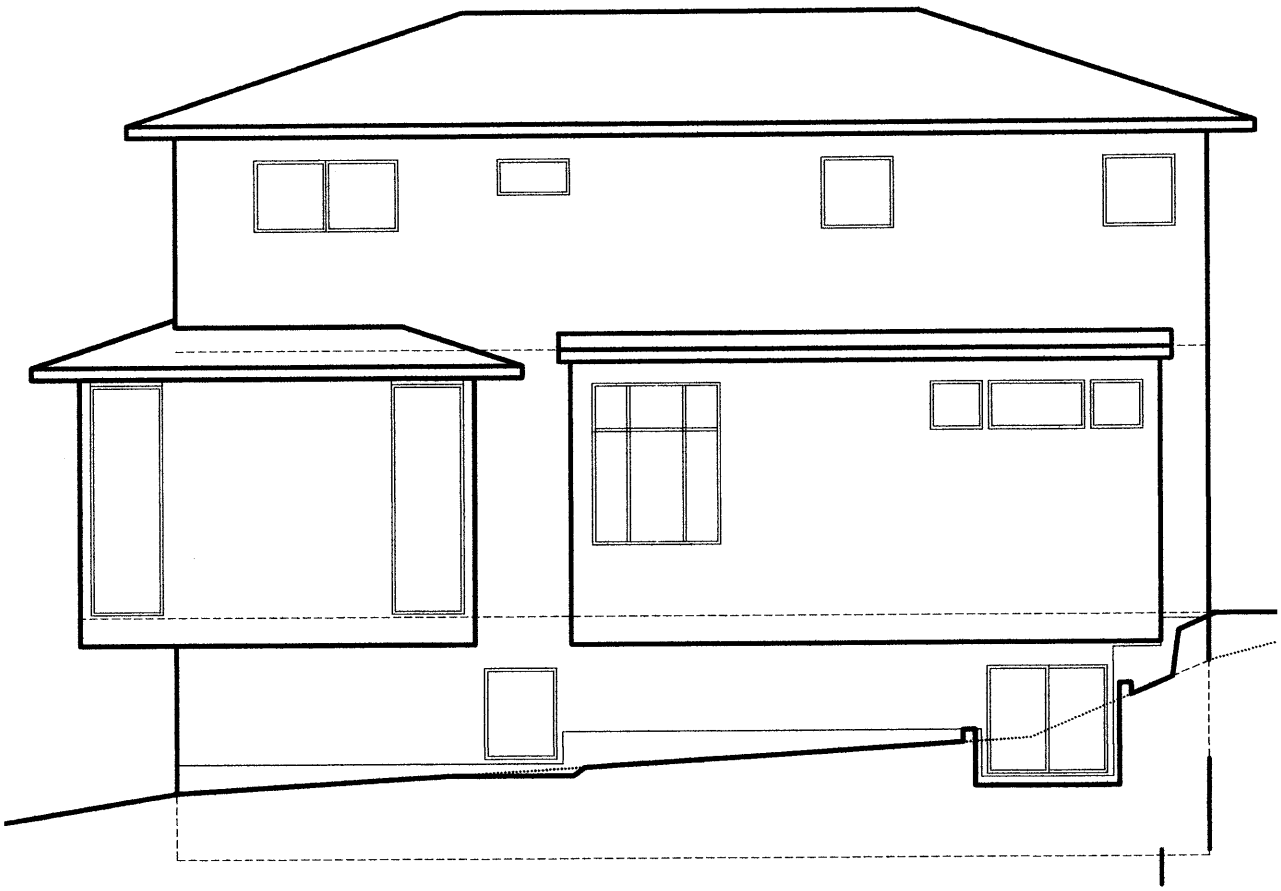


A. Lower Floor Plan - ADU

1/8" = 1'-0"
LIVING AREA = 876 SF
FAR (with exceptions) = 447.2

South Elev.

1/8" = 1'-0"



West Elev.

1/8" = 1'-0"

North Elev.

1/8" = 1'-0"

East Elev.

1/8" = 1'-0"

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

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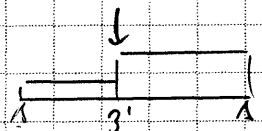
Roof Framing

R1 L = 6'



$w_{1DL} = \frac{15}{2(6)}(6+2)^2 = 80$ plf

$w_{1LL} = \frac{25}{2(6)}(6+2)^2 = 133$ plf

$w_{2DL} = 15 \cdot 27/2 = 203$ plf

$w_{2LL} = 25 \cdot 27/2 = 338$ plf

P = 2700# @ 3'

⇒ 3-1¾ x 7½ GLB

R2 L = 6'

$w_{DL} = 15 \cdot 28/2 = 210$ plf

$w_{LL} = 25 \cdot 28/2 = 350$ plf

⇒ 4x8 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

⇒ 4x6 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

⇒ 4x10 DF #2

R5 L = 3'

$w_{DL} = 15 \cdot 28/2 = 210$ plf

$w_{LL} = 25 \cdot 21/2 = 350$ plf

⇒ 4x6 DF #2

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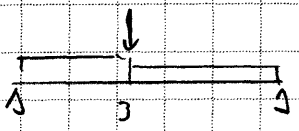
R6 L = 6'



$w_{inL} = 15 \cdot 28/2 = 210$ plf
$w_{inL} = 25 \cdot 28/2 = 350$ plf
$w_{2nL} = \frac{15}{8(21)}(6+2)^2 = 34$ plf
$w_{2L} = \frac{25}{8(2)}(8+2)^2 = 156$ 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 19026 June 30, 2019 06:27:50	9787 SE 41st Street BeamR1

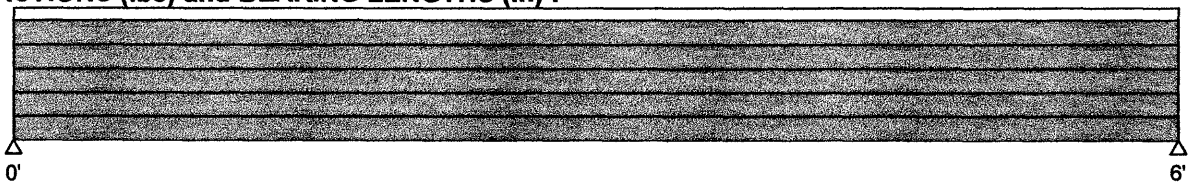
Design Check Calculation Sheet

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	80.0	80.0	0.00	3.00	No
w1ll	Snow	Partial UDL	133.0	133.0	0.00	3.00	No
w2dl	Dead	Partial UDL	203.0	203.0	3.00	6.00	No
w2ll	Snow	Partial UDL	338.0	338.0	3.00	6.00	No
p	Dead	Point	2700		3.00		No

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



	0'	6'
Dead	1698	1883
Live	553	860
Total	2251	2743
Bearing:		
LC number	2	2
Length	1.1	1.4

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/8x7-1/2"

Self Weight of 5.4 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 = 154	Fv' = 276	fv/Fv' = 0.56
Bending(+)	fb = 1930	Fb' = 2160	fb/Fb' = 0.89
Live Defl'n	0.03 = <L/999	0.20 = L/360	0.17
Total Defl'n	0.16 = L/442	0.30 = L/240	0.54

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 = 4711 lbs-ft
Shear : LC# 2 = D+S, V = 2743, V design = 2412 lbs
Deflection: LC# 2 = D+S EI= 197.75e06 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).

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COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 06:29:00	9787 SE 41st Street BeamR2

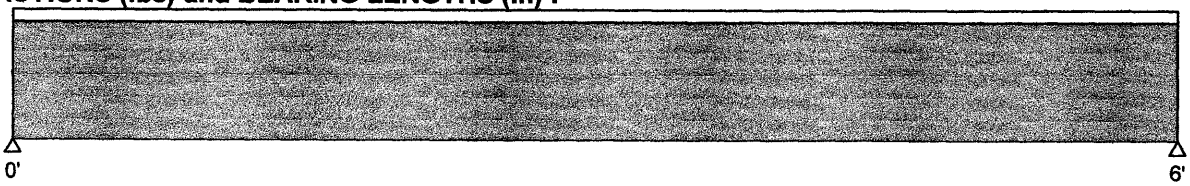
Design Check Calculation Sheet

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

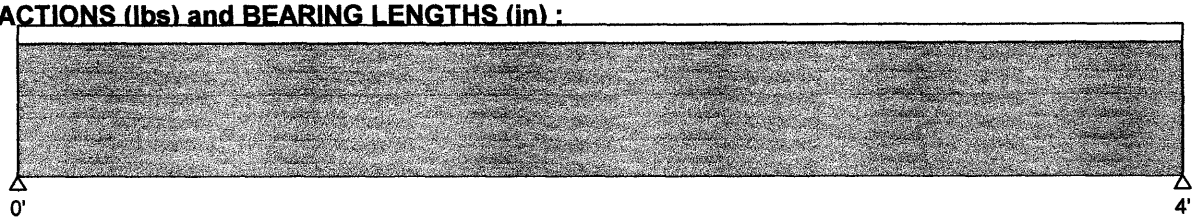
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	115.0				No
wll	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.

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

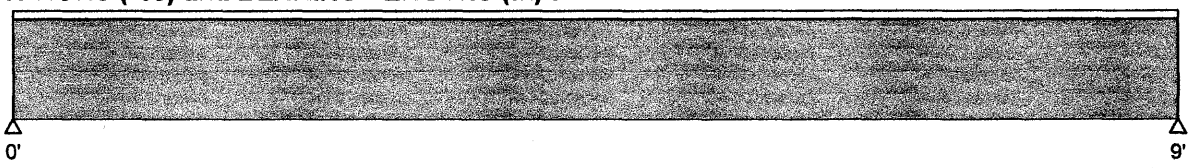
Design Check Calculation Sheet

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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COMPANY	PROJECT
Forsman Engineering 19026 June 30, 2019 06:31:15	9787 SE 41st Street BeamR5

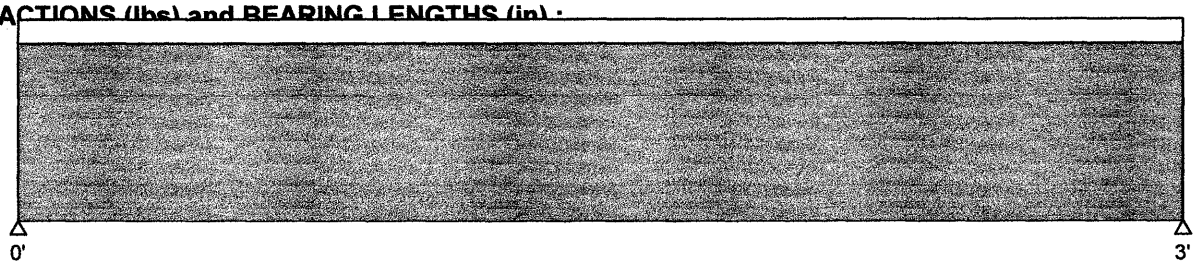
Design Check Calculation Sheet

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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

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

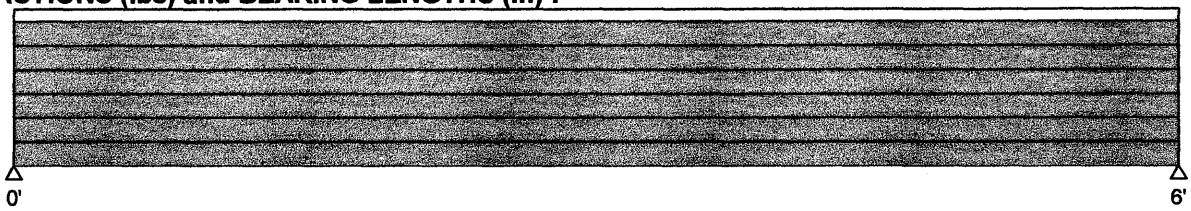
Design Check Calculation Sheet

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).

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COMPANY
Forsman Engineering
19026
June 30, 2019 06:34:01

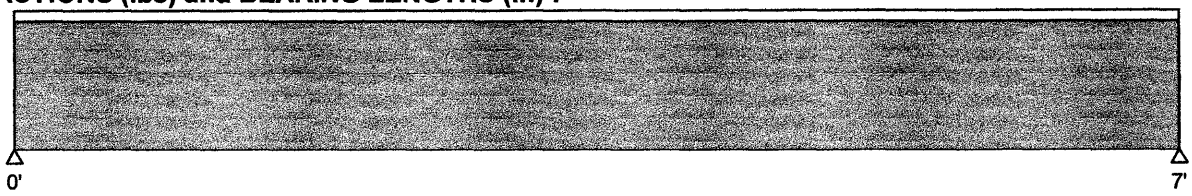
PROJECT
9787 SE 41st Street
BeamR7

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.

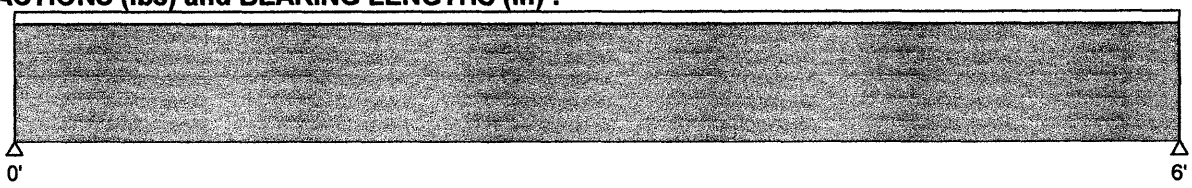
Design Check Calculation Sheet

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
SHEET NO. 23 OF
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SCALE

Upper Floor

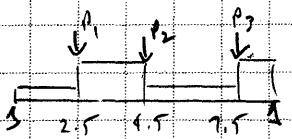
U1 L = 3'

$w_{DL} = 14 \cdot 25/2 = 175$ plf

$w_{LL} = 40 \cdot 25/2 = 500$ 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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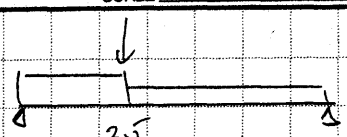
SCALE

u5 L = 5'



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

$w_{1L} = \frac{25}{2(7)}(7+2)^2 + 40 \cdot 2 + 60 \cdot 4/2 = 345$ plf

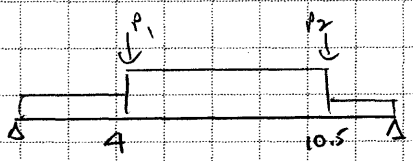
$w_{2D} = 14 \cdot 6/2 = 42$ plf

$w_{2L} = 40 \cdot 2 + 60 \cdot 4/2 = 200$ plf

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

⇒ 4x10 of #2

u6 L = 13'



$w_{1D} = 15 \cdot 6 + 80 + 14 \cdot 16/2 = 282$ plf

$w_{1L} = 25 \cdot 6 + 40 \cdot 16/2 = 470$ plf

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

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

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

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

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

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

⇒ 5 1/8 x 13 1/2 GLB
or 5 1/8 x 14 PSL

u7 L = 11.5'

$w_{1D} = 15 \cdot 28/2 + 80 + 14 \cdot 16/2 = 402$ plf

$w_{1L} = 25 \cdot 28/2 + 40 \cdot 16/2 = 670$ plf

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

⇒ 5 1/8 x 12 GLB
or 5 1/8 x 14 PSL

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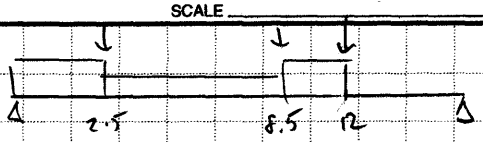
SCALE

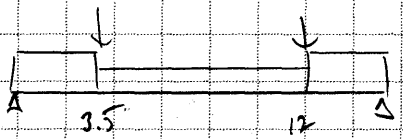
u8 L = 16'



$w_{1DL} = 15 \cdot 28/2 + 80 + 14 \cdot 16/2 + 15.2 = 432$ plf
$w_{1LL} = 25 \cdot 28/2 + 40 \cdot 16/2 + 25.2 = 720$ plf
$w_{2DL} = 14 \cdot 16/2 + 15.2 = 142$ plf
$w_{2LL} = 40 \cdot 16/2 + 25.2 = 370$ plf
$w_{3DL} = 15.6 + 80 + 14 \cdot 16/2 + 15.2 = 312$ plf
$w_{3LL} = 25.6 + 40 \cdot 16/2 + 25.2 = 520$ plf
$P_1 = 2867\#$ @ 3.5'
$P_2 = 2402\#$ @ 8.5'
(u3) $P_3 = 3856$ @ 12'

⇒ 5 1/4 x 16 PSL

u9 L = 15.5



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

⇒ 3 1/2 x 14 PSL

u10 L = 10'

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

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

⇒ 5 1/8 x 9 GLB

u11 L = 5'

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

⇒ 4x10 DF #2

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253.815.9182
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U12 $L = 3'$

$w_{DL} = 156$ plf
$w_{LL} = 560$ plf
$\Rightarrow$ 4x6 DF #2

U13 $L = 3'$

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

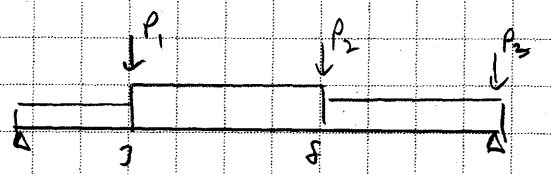
U14 $L = 11'$

$w_{DL} = \frac{15}{2(4)}(4+2)^2 = 68$ 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
$w_{1LL} = 25 \cdot 6 + 40 \cdot 27/2 = 610$ plf
$w_{2DL} = 15 \cdot 27/2 + 80 + 14 \cdot 27/2 = 444$ plf
$w_{2LL} = 25 \cdot 27/2 + 40 \cdot 27/2 = 798$ plf
$w_{3DL} = \frac{14}{2(27)}(27+1.5)^2 = 189$ plf
$w_{3LL} = \frac{40}{2(27)}(27+1.5)^2 = 522$ plf
$P_L = P_3 = 1761\left(\frac{24.5}{27}\right) = 1876$ #
$P_1 = 2700$ # @ 3' $\Rightarrow$ 5 1/8 x 16 1/2 GLB

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253.815.9182
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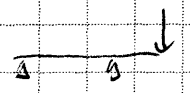
U16 L = 23' + 1.5



w_{DL} = 14.2 = 20 plf
w_{LL} = 40.2 = 80 plf
P = 1761 #
⇒ 3½ 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 = 7973 @ 2'
⇒ 5¼ x 9½ PSL

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT	
Forsman Engineering 19026 June 30, 2019 07:34:42	9787 SE 41st Street BeamU1	28

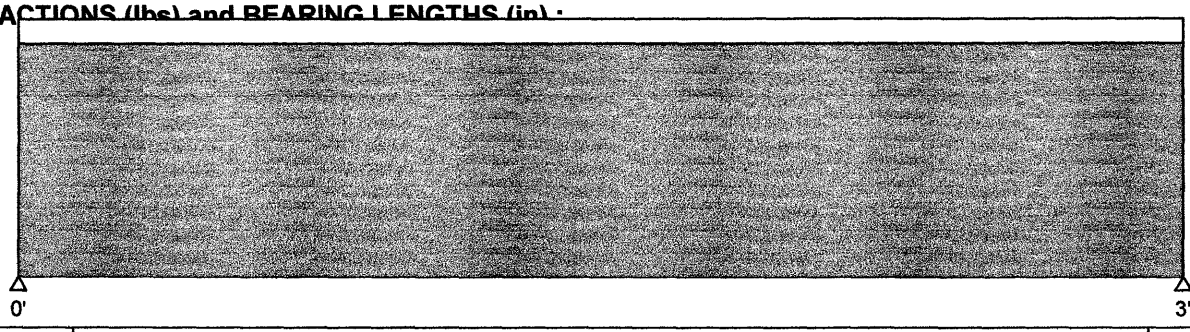
Design Check Calculation Sheet

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

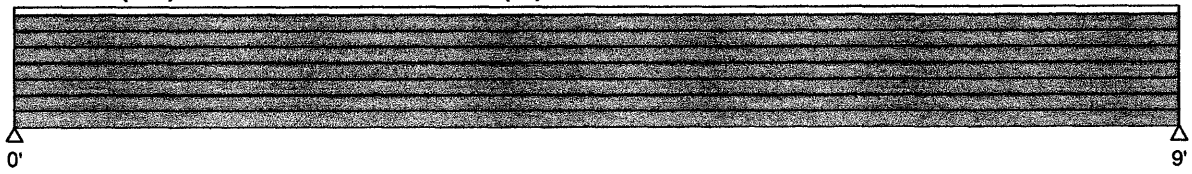
PROJECT
9787 SE 41st Street
BeamU2

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

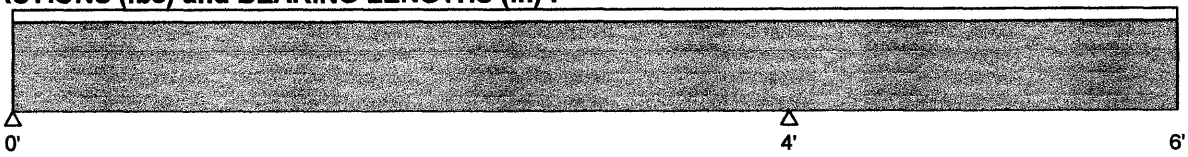
Sizer 2004

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

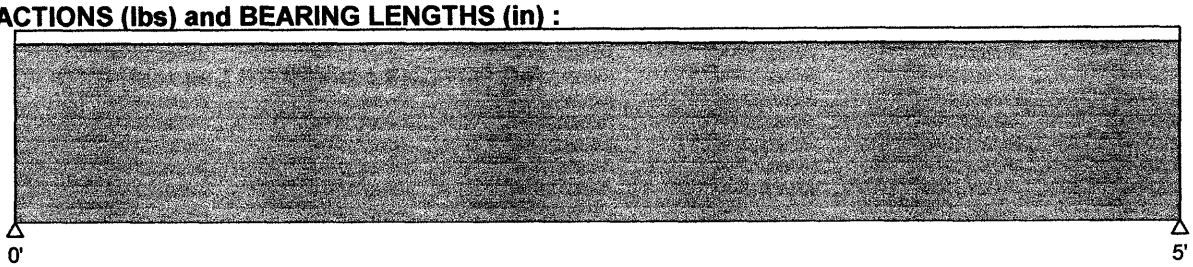
Design Check Calculation Sheet

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) :



	0'	5'
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.

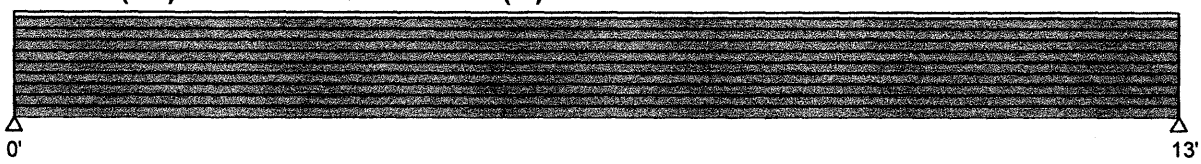
Design Check Calculation Sheet

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) :



	0'	13'
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?
wdl	Dead	Full UDL	402.0				No
wll	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
Forsman Engineering
19026
June 30, 2019 08:02:00

PROJECT
9787 SE 41st Street
BeamU8

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 19026 June 30, 2019 07:57:54	9787 SE 41st Street BeamU9

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 19026 June 30, 2019 08:03:39	9787 SE 41st Street BeamU10

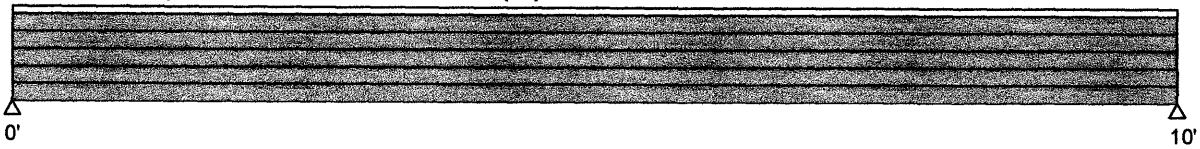
Design Check Calculation Sheet

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	928		928
Live	2500		2500
Total	3428		3428
Bearing:			
LC number	2		2
Length	1.0		1.0

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x9"

Self Weight of 10.62 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 = 95	Fv' = 240	fv/Fv' = 0.39
Bending(+)	fb = 1486	Fb' = 2400	fb/Fb' = 0.62
Live Defl'n	0.20 = L/597	0.33 = L/360	0.60
Total Defl'n	0.28 = L/435	0.50 = L/240	0.55

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 = 8570 lbs-ft
Shear : LC# 2 = D+L, V = 3428, V design = 2914 lbs
Deflection: LC# 2 = D+L EI= 560.41e06 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 Forsman Engineering 19026 June 30, 2019 08:04:58	PROJECT 9787 SE 41st Street BeamU11

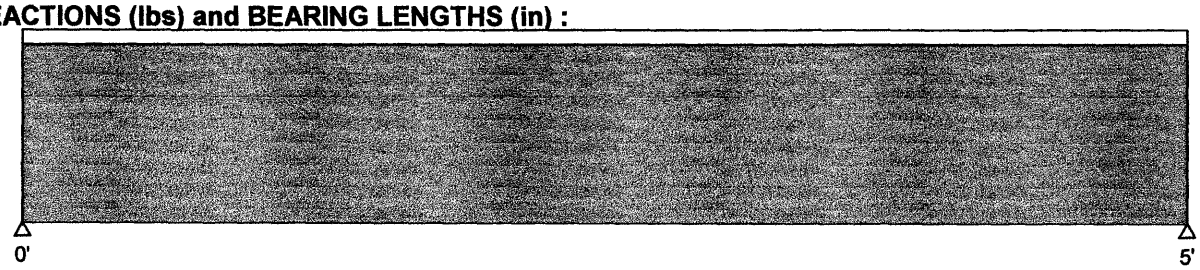
Design Check Calculation Sheet

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	196.0				No
wll	Live	Full UDL	560.0				No

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



Dead	509		509
Live	1400		1400
Total	1909		1909
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 = 61	Fv' = 180	fv/Fv' = 0.34
Bending(+)	fb = 574	Fb' = 1080	fb/Fb' = 0.53
Live Defl'n	0.02 = <L/999	0.17 = L/360	0.13
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 = 2387 lbs-ft
Shear : LC# 2 = D+L, V = 1909, V design = 1321 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 08:05:51	9787 SE 41st Street BeamU12

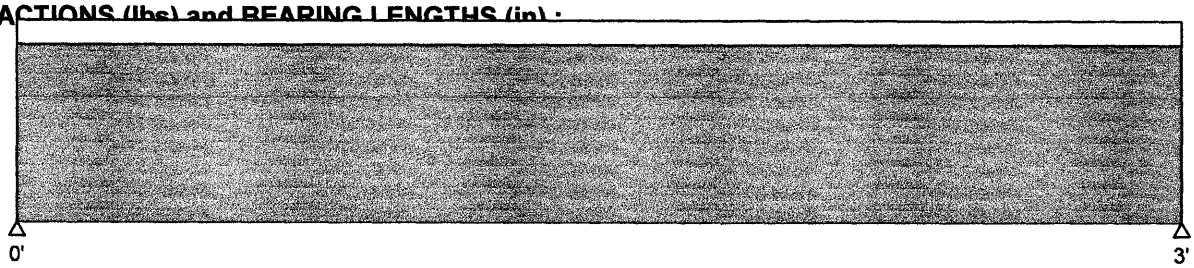
Design Check Calculation Sheet

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	196.0				No
wll	Live	Full UDL	560.0				No

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



Dead	301		301
Live	840		840
Total	1141		1141
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 = 62	Fv' = 180	fv/Fv' = 0.34
Bending(+)	fb = 582	Fb' = 1170	fb/Fb' = 0.50
Live Defl'n	0.01 = <L/999	0.10 = L/360	0.13
Total Defl'n	0.02 = <L/999	0.15 = 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	1.300	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 = 856 lbs-ft
Shear : LC# 2 = D+L, V = 1141, V design = 792 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 08:08:17	9787 SE 41st Street BeamU13

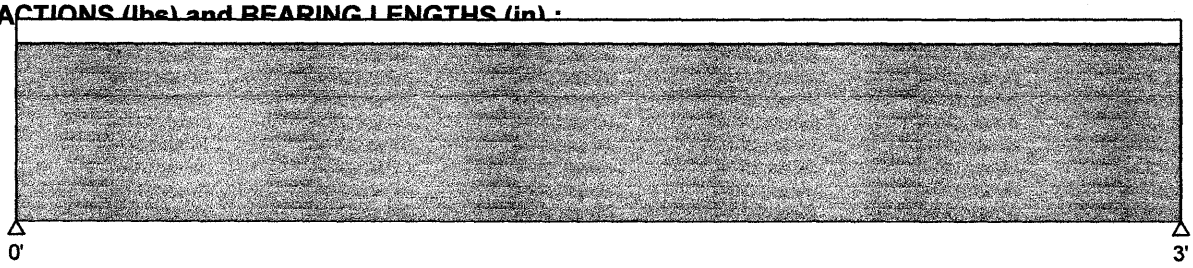
Design Check Calculation Sheet

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 19026 June 30, 2019 08:13:42	9787 SE 41st Street BeamU15

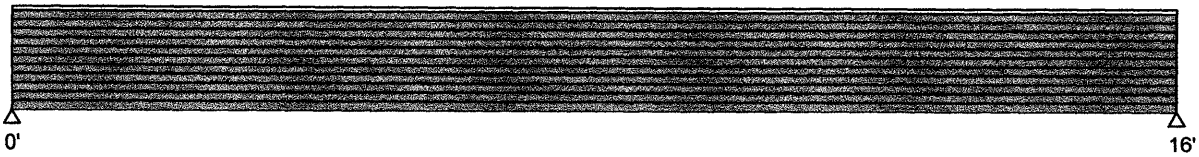
Design Check Calculation Sheet

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	331.0	331.0	0.00	3.00	No
w1ll	Live	Partial UDL	610.0	610.0	0.00	3.00	No
w2dl	Dead	Partial UDL	444.0	444.0	3.00	8.00	No
w2ll	Live	Partial UDL	798.0	798.0	3.00	8.00	No
w3dl	Dead	Partial UDL	183.0	183.0	8.00	16.00	No
w3ll	Live	Partial UDL	522.0	522.0	8.00	16.00	No
p1	Live	Point	2700		3.00		No
p2	Live	Point	1876		8.00		No
p3	Live	Point	1876		16.00		No

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



Dead	2879		2110
Live	8453		7995
Total	11331		10105
Bearing:			
LC number	2		2
Length	3.4		3.0

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

Self Weight of 19.47 plf automatically included in loads;

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

WARNING: point loads applied at support locations only affect maximum reactions and bearing lengths. The point loads have been added to the reactions without regard for load patterns.

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

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 178	Fv' = 240	fv/Fv' = 0.74
Bending(+)	fb = 2207	Fb' = 2389	fb/Fb' = 0.92
Live Defl'n	0.42 = L/460	0.53 = L/360	0.78
Total Defl'n	0.56 = L/345	0.80 = L/240	0.69

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	0.995	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 = 42771 lbs-ft
Shear : LC# 2 = D+L, V = 11331, V design = 10024 lbs
Deflection: LC# 2 = D+L EI=3453.27e06 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 08:15:05	9787 SE 41st Street BeamU16

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.

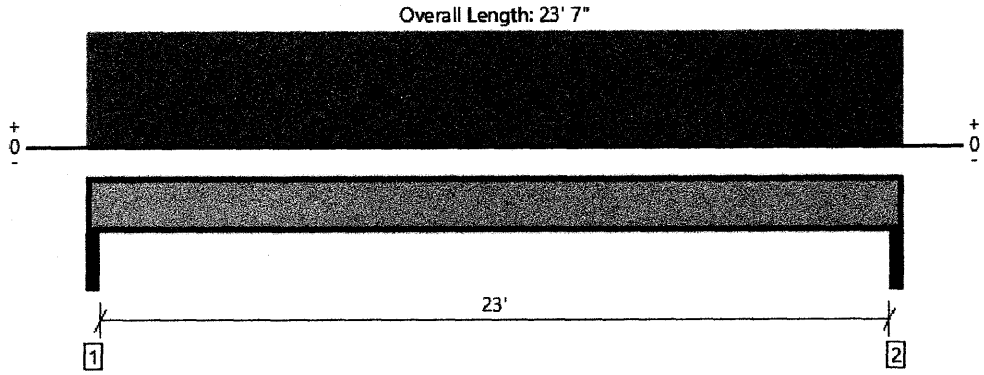
FORTE WEB

MEMBER REPORT

PASSED 44

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

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

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

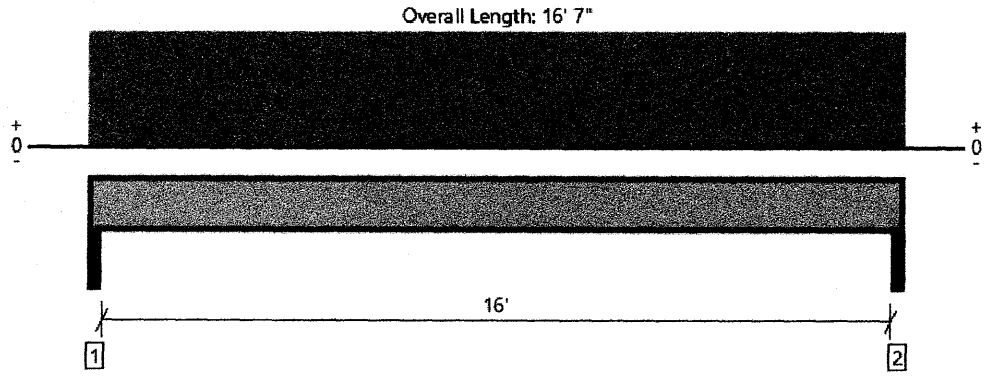
FORTE WEB

MEMBER REPORT

PASSED 45

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

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

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

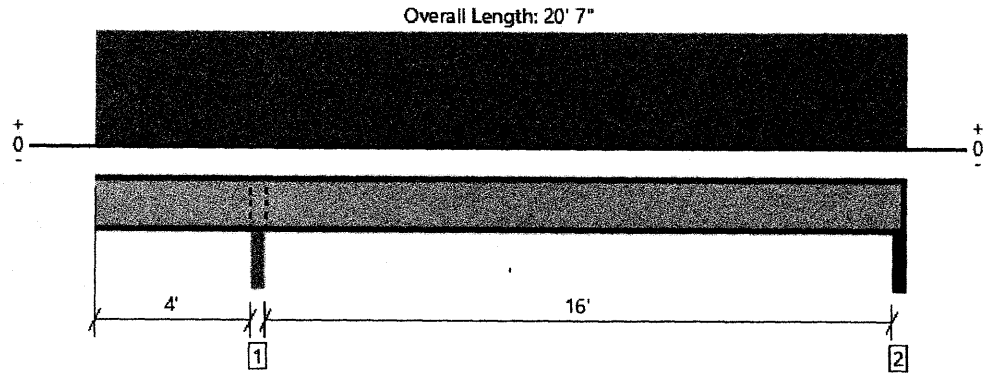
FORTE WEB

MEMBER REPORT

PASSED 4/6

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

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

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

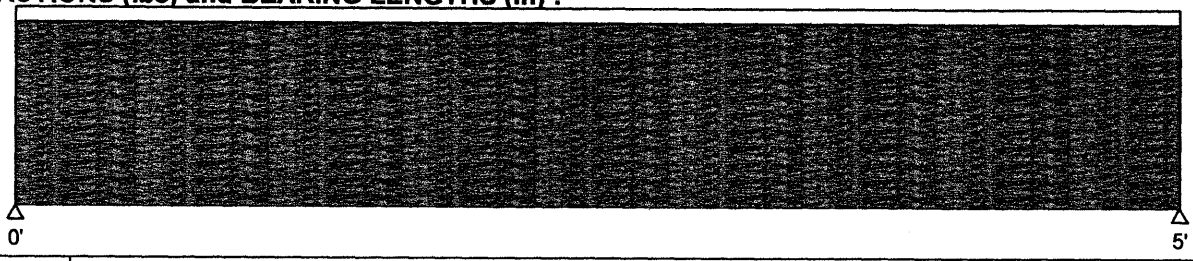
Design Check Calculation Sheet

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.

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

JOB 19026
SHEET NO. 48 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

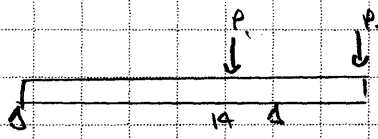
M2 L = 0'

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

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

⇒ 4×8 DF #2

M3 L = 16' + 3'



$w_{DL} = \frac{15}{4(2)}(4+2)^2 + 80 + 14 \cdot 2 = 176$ plf

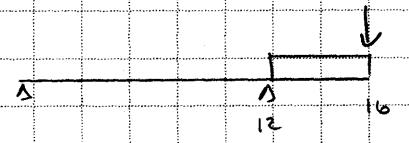
$w_{LL} = \frac{25}{4(2)}(4+2)^2 + 40 \cdot 2 = 193$ plf

$P_1 = 5227\#$ @ 14'

$P_2 = 3628\#$ @ 19'

⇒ 3½ × 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'

⇒ 5½ × 22½ GLB

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

JOB 19026
SHEET NO. 49 OF
CALCULATED BY DATE
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SCALE

MS $L = 5.5'$

$w_{DL} = \frac{14}{16(2)}(16+2)^2 = 142$ 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	PROJECT
Forsman Engineering 19026 June 30, 2019 08:55:02	9787 SE 41st Street BeamM1

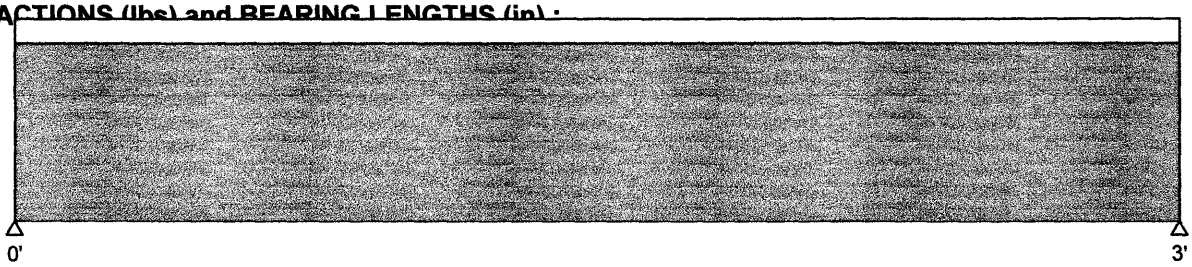
Design Check Calculation Sheet

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

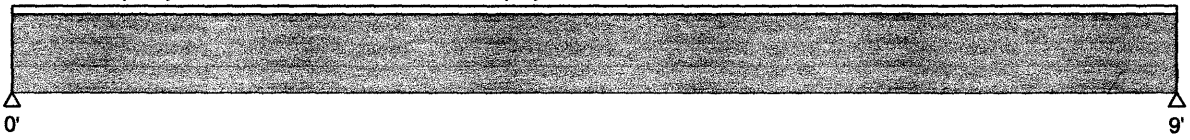
Design Check Calculation Sheet

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	PROJECT
Forsman Engineering	9787 SE 41st Street
July 2, 2019 15:56	BeamM3

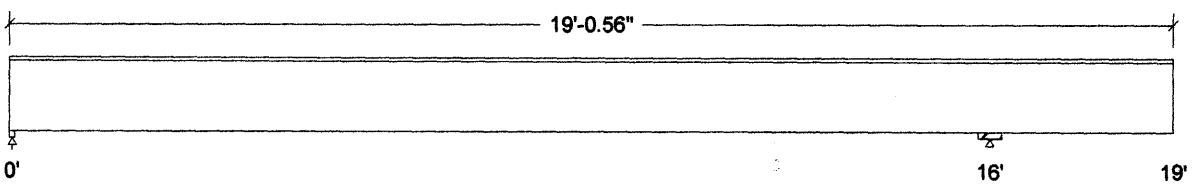
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
wdl	Dead	Full UDL	No			176.0		plf
wll	Live	Full UDL	No			193.0		plf
pl	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

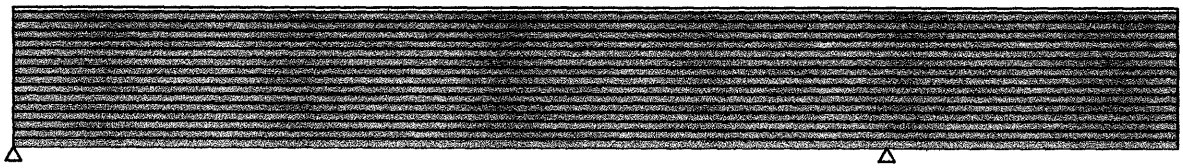
Design Check Calculation Sheet

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) :



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	PROJECT
Forsman Engineering 19026 June 30, 2019 09:05:57	9787 SE 41st Street BeamM5

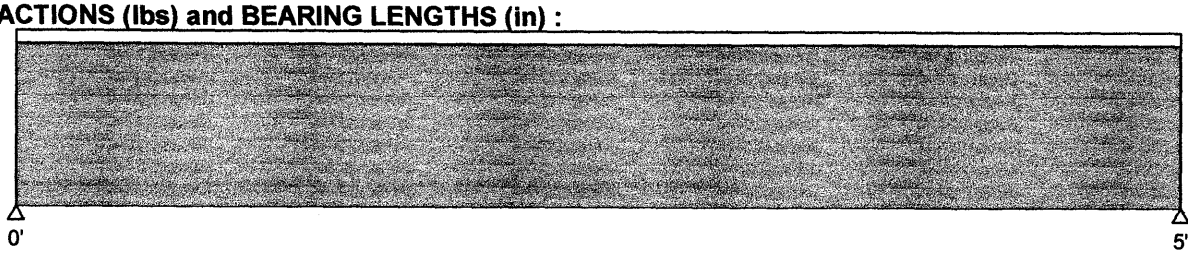
Design Check Calculation Sheet

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	142.0				No
wl1	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

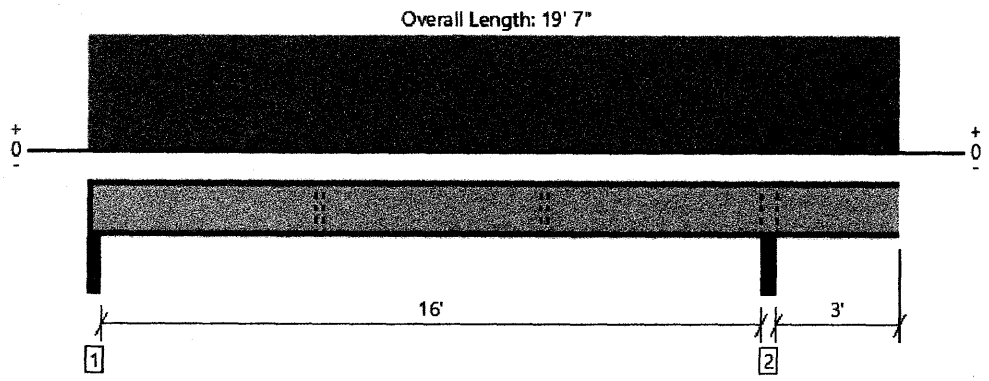
MEMBER REPORT

PASSED

56/

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	-	

Weyerhaeuser Notes

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

The product application, input design loads, dimensions and support information have been provided by 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. 57 OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

Post Loads:

Height = 9'-0"

H.F.#2 (2) 2x4 - wall — Pall = 3900#

H.F.#2 (2) 2x6 - wall — Pall = 6500#

H.F.#2 (3) 2x6 - wall — Pall = 10,300#

Height 10'0"

H.F.#2 (2) 2x6 - wall — Pall = 5900#

H.F.#2 (3) 2x6 - wall — Pall = 9,000#

D.F.#2 4x6 - unbraced — Pall = 7200#

D.F.#2 6x6 - unbraced — Pall = 14,600

WoodWorks® SOFTWARE FOR WOOD DESIGN

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

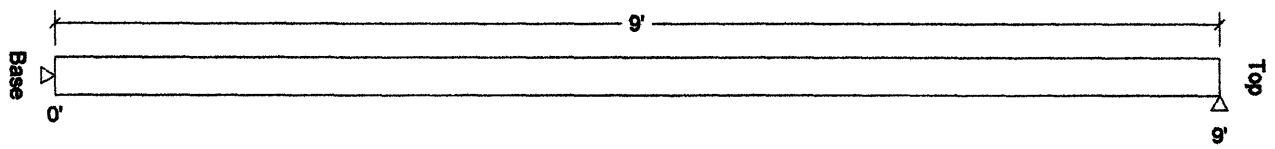
Design Check Calculation Sheet

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	PROJECT
Forsman Engineering July 2, 2019 10:14	JN 18060 RealFine Painting Column 2- 2x6

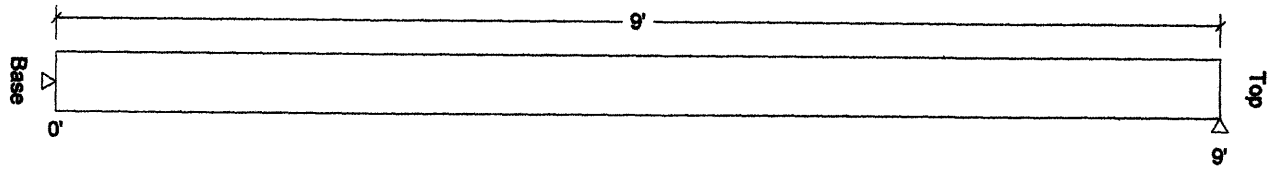
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Pd	Dead	Axial	(Ecc. = 0.92")		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

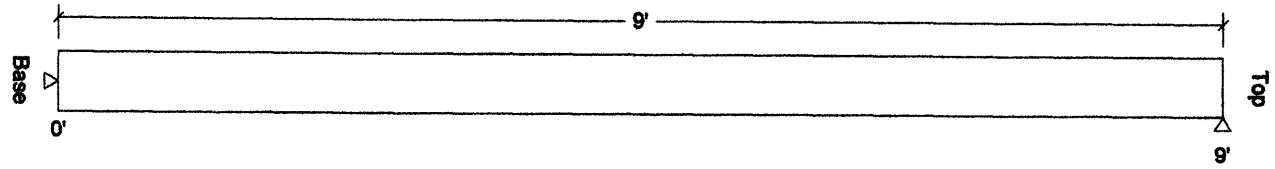
Design Check Calculation Sheet

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	PROJECT
Forsman Engineering July 2, 2019 12:38	JN 18060 RealFine Painting Column 2- 2x6x10

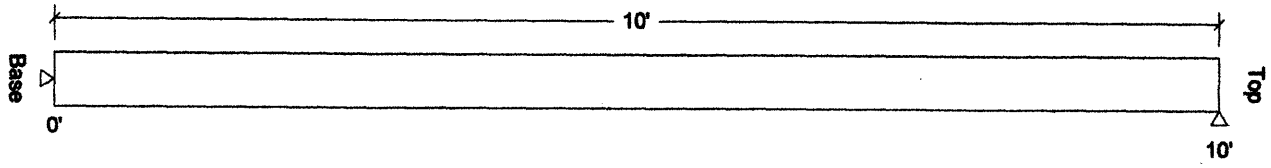
Design Check Calculation Sheet

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

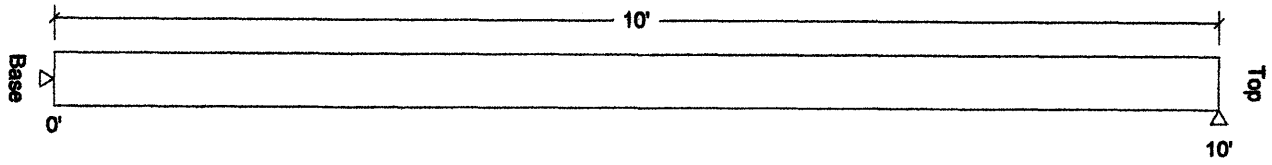
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	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			-69
Load comb			#1
L->R	69		
Load comb	#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	PROJECT
Forsman Engineering July 2, 2019 12:54	JN 18060 RealFine Painting Column 4x6x10

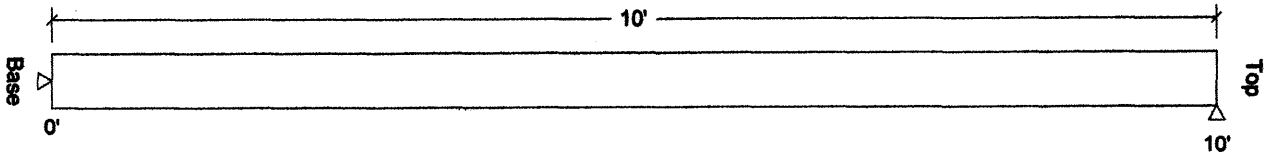
Design Check Calculation Sheet

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	68

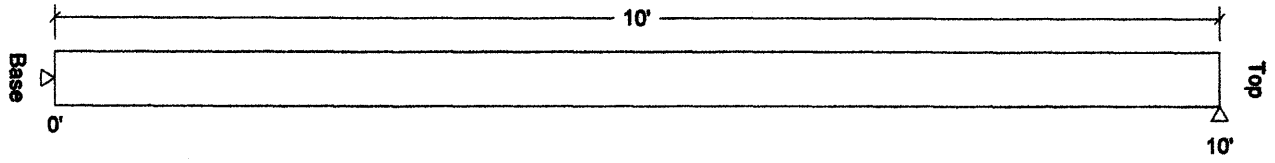
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Pd	Dead	Axial	(Ecc. = 0.00")		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

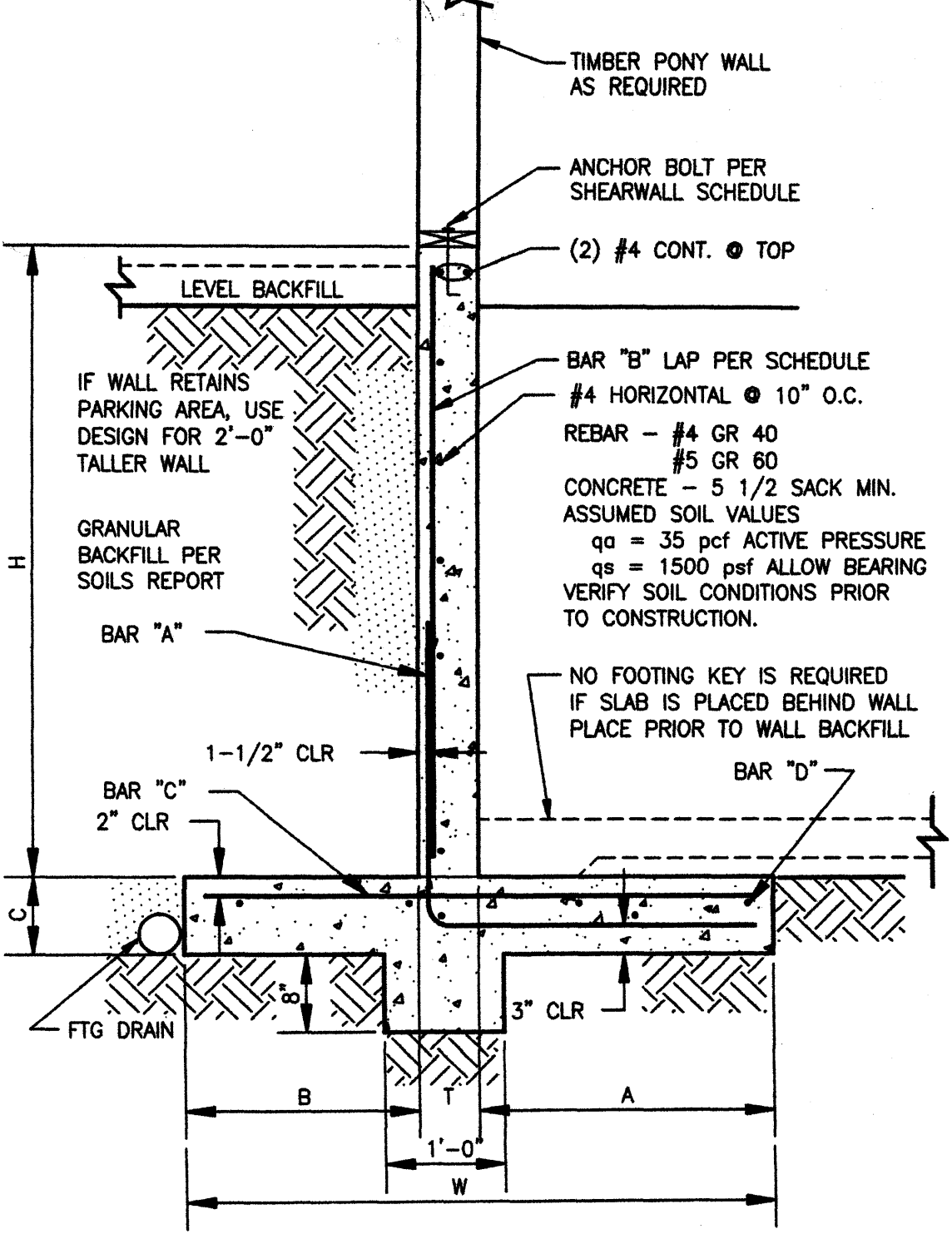
Design Notes:

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

Allowable Soil Bearing Pressure 1500 psf

Width (ft)	Length (ft)	Area (ft^2)	Capacity (lbs)	
1.5	1.5	2.25	3375	
2	2	4.00	6000	
2.5	2.5	6.25	9375	
3	3	9.00	13500	
3.5	3.5	12.25	18375	
4	4	16.00	24000	
4.5	4.5	20.25	30375	
5	5	25.00	37500	
6	6	36.00	54000	
12"	cont.	1	1500	plf
16"	cont.	1.333	1999.5	plf



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"	1'-4"	3'-0"	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'-6"	#5 @ 10"	#4 @ 10" LAP 36"	#5 @ 10"	(7) #4	YES
12'-0"	10"	2'-2"	5'-0"	1'-0"	8'-0"	#6 @ 10"	#5 @ 10" LAP 36"	#6 @ 6"	(9) #4	YES

TYPICAL RETAINING WALL DETAIL 30

Forsman Engineering 4' Des _____ Job # _____

REINFORCED CONCRETE CANTILEVER RETAINING WALL

Wall:

Hgt wall	4.667	ft
Hgt soil heel	4.667	ft
Hgt soil toe	0.667	ft
Toe	0.500	ft
Heel	1.500	ft
Thick wall	6.000	in
Thick ftg	8.000	in
Thick Key	0.000	in
Depth Key	0.000	ft
Width ftg	2.500	ft

Soil:

Wgt soil	0.120	kcf
EFP active	0.035	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.350	

Concrete:

Wgt conc	0.160	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	1.307	kip
X resultant	0.949	ft
Sum F resist	0.535	kip
Sum F horiz	0.381	kip
F.S. sliding	1.404	
Sum M resist	1.851	k-ft
Sum M O.T.	0.593	k-ft
F.S. O.T.	3.122	

Eccentricity:

M ecc	0.393	k-ft
X ecc	0.301	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	0.163	ksf
pv toe	0.900	ksf
pv wall toe	0.749	ksf
pv wall heel	0.598	ksf
pv heel	0.146	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	0.635	k-ft
Phi Mn	1.859	k-ft
Vu	0.476	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	0.170	k-ft
Phi Mn	2.084	k-ft
Vu	0.701	kip
Phi Vc	4.845	kip

Heel Reinforcing :

bar	4	#
spacing	16.000	in
As	0.150	sq-in
cover	1.500	in
d	6.250	in
0.0018 Ag	0.173	sq-in
0.0020 Ag	0.192	sq-in
As min	0.375	sq-in
As max	1.740	sq-in
Mu	0.924	k-ft
Phi Mn	2.759	k-ft
Vu	1.232	kip
Phi Vc	6.375	kip

Forsman Engineering 6' Des _____ Job # _____

REINFORCED CONCRETE CANTILEVER RETAINING WALL

Wall:

Hgt wall	6.833	ft
Hgt soil heel	6.833	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	0.120	kcf
EFP active	0.035	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.350	

Concrete:

Wgt conc	0.160	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	1.867	kip
X resultant	1.012	ft
Sum F resist	1.241	kip
Sum F horiz	0.817	kip
F.S. sliding	1.519	
Sum M resist	3.522	k-ft
Sum M O.T.	1.861	k-ft
F.S. O.T.	1.892	

Eccentricity:

M ecc	0.910	k-ft
X ecc	0.488	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	1.229	ksf
pv wall toe	0.690	ksf
pv wall heel	0.420	ksf
pv heel	0.015	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	0.375	sq-in
As max	1.740	sq-in
Mu	2.142	k-ft
Phi Mn	3.656	k-ft
Vu	1.071	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	0.405	sq-in
As max	1.879	sq-in
Mu	1.766	k-ft
Phi Mn	3.956	k-ft
Vu	2.174	kip
Phi Vc	6.885	kip

Heel Reinforcing :

bar	4	#
spacing	18.000	in
As	0.133	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	0.465	sq-in
As max	2.158	sq-in
Mu	0.597	k-ft
Phi Mn	3.058	k-ft
Vu	1.195	kip
Phi Vc	7.905	kip

Forsman Engineering 8' Des _____ Job # _____

REINFORCED CONCRETE CANTILEVER RETAINING WALL

Wall:

Hgt wall	9.000	ft
Hgt soil heel	9.000	ft
Hgt soil toe	1.000	ft
Toe	1.333	ft
Heel	3.000	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	0.120	kcf
EFP active	0.035	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.350	

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	4.640	kip
X resultant	2.101	ft
Sum F resist	2.324	kip
Sum F horiz	1.418	kip
F.S. sliding	1.640	
Sum M resist	13.767	k-ft
Sum M O.T.	4.253	k-ft
F.S. O.T.	3.237	

Eccentricity:

M ecc	1.853	k-ft
X ecc	0.399	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	1.373	ksf
pv wall toe	1.135	ksf
pv wall heel	1.017	ksf
pv heel	0.483	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	1.904	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	2.034	k-ft
Phi Mn	11.609	k-ft
Vu	2.842	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	7.056	k-ft
Phi Mn	13.004	k-ft
Vu	4.704	kip
Phi Vc	9.881	kip

Forsman Engineering 10' Des _____ Job # _____

REINFORCED CONCRETE CANTILEVER RETAINING WALL

Wall:

Hgt wall	11.000	ft
Hgt soil heel	11.000	ft
Hgt soil toe	1.000	ft
Toe	1.667	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	6.500	ft

Soil:

Wgt soil	0.120	kcf
EFP active	0.035	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.350	

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	7.280	kip
X resultant	2.837	ft
Sum F resist	3.248	kip
Sum F horiz	2.118	kip
F.S. sliding	1.534	
Sum M resist	28.182	k-ft
Sum M O.T.	7.764	k-ft
F.S. O.T.	3.630	

Eccentricity:

M ecc	3.009	k-ft
X ecc	0.413	ft
X zero	6.500	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	1.547	ksf
pv wall toe	1.328	ksf
pv wall heel	1.219	ksf
pv heel	0.693	ksf

Wall Reinforcing :

bar	5	#
spacing	10.000	in
As	0.372	sq-in
cover	1.500	in
d	8.188	in
0.0020 Ag	0.240	sq-in
0.0025 Ag	0.300	sq-in
As min	0.328	sq-in
As max	1.313	sq-in
Mu	9.917	k-ft
Phi Mn	12.971	k-ft
Vu	2.975	kip
Phi Vc	8.351	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	3.308	k-ft
Phi Mn	13.808	k-ft
Vu	4.073	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

Forsman Engineering

Des _____ Job # _____

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-89)

Wall:

Hgt wall	13.000	ft
Hgt soil heel	12.500	ft
Hgt soil toe	1.000	ft
Toe	2.167	ft
Heel	5.000	ft
Thick wall	10.000	in
Thick ftg	12.000	in
Thick Key	8.000	in
Depth Key	1.000	ft
Width ftg	8.000	ft

Soil:

Wgt soil	0.120	kcf
EFP active	0.035	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.350	

Concrete:

Wgt conc	0.160	kcf
f'c	3.000	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	9.887	kip
X resultant	3.705	ft
Sum F resist	4.160	kip
Sum F horiz	2.734	kip
F.S. sliding	1.521	
Sum M resist	47.787	k-ft
Sum M O.T.	11.393	k-ft
F.S. O.T.	4.194	

Eccentricity:

M ecc	2.919	k-ft
X ecc	0.295	ft
X zero	8.000	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.403	ksf
ph ftg base	0.438	ksf
ph key base	0.473	ksf
pv toe	1.510	ksf
pv wall toe	1.361	ksf
pv wall heel	1.304	ksf
pv heel	0.962	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	1.563	sq-in
Mu	15.082	k-ft
Phi Mn	18.071	k-ft
Vu	4.106	kip
Phi Vc	9.079	kip

Toe Reinforcing :

bar	5	#
spacing	10.000	in
As	0.880	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	1.672	sq-in
Mu	5.629	k-ft
Phi Mn	30.976	k-ft
Vu	5.287	kip
Phi Vc	9.707	kip

Heel Reinforcing :

bar	6	#
spacing	6.000	in
As	0.880	sq-in
cover	2.000	in
d	9.625	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.385	sq-in
As max	1.852	sq-in
Mu	26.950	k-ft
Phi Mn	34.688	k-ft
Vu	10.780	kip
Phi Vc	10.755	kip

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

JOB 19026
SHEET NO. 76 OF
CALCULATED BY DATE
CHECKED BY DATE
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

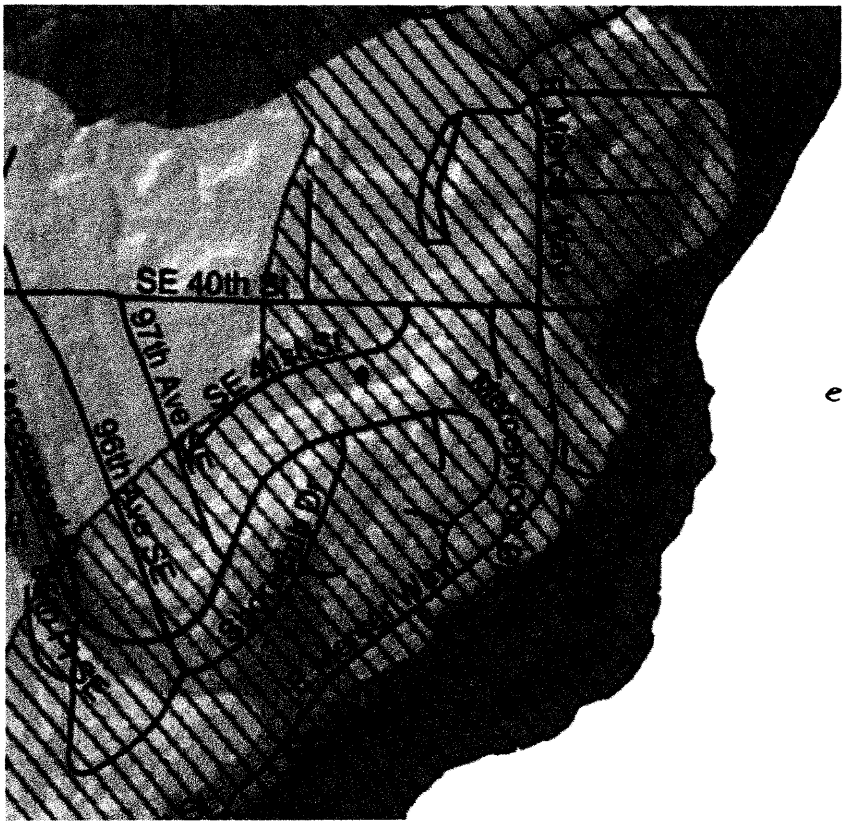
Upper Floor Shear Walls

			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	$384(6) + 255\ 24/2 + 2302 = 7284$	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
98th Ave SE

exp C

$K_{zt} = 1.3$

2010 ASCE 7 Wind Forces - Simple Diaphragm Low Rise Buildings

Based on ASCE7-10 Chapter 28

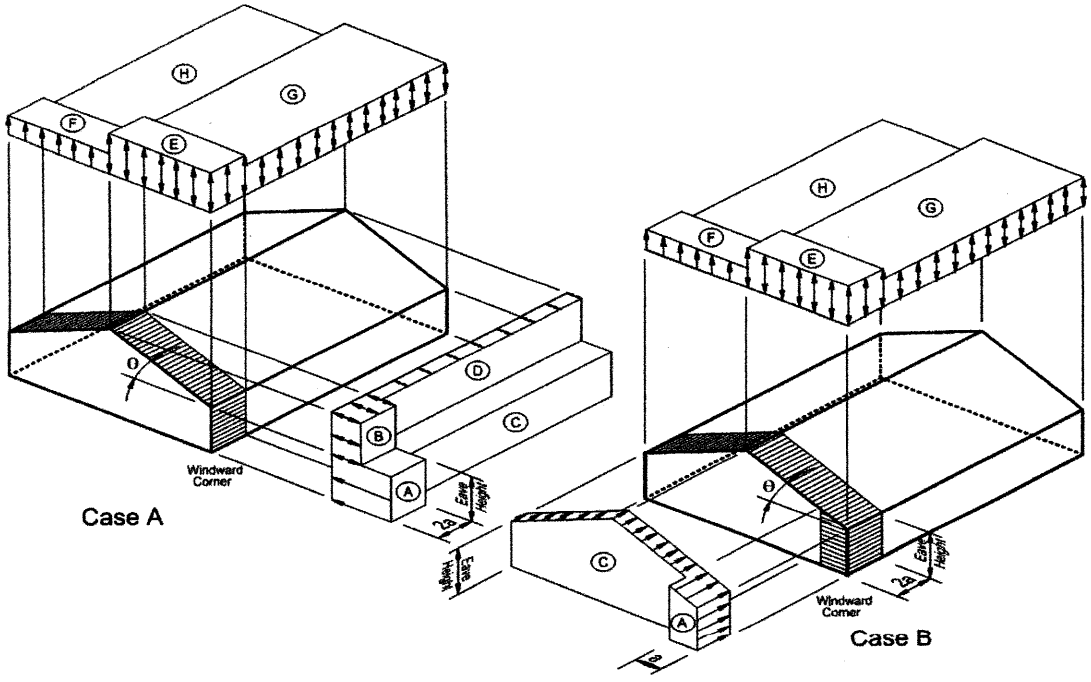
Risk Category	II	Table 1.5-1	Project	19026
Wind Speed	110	mph		**9787 SE 41st**
Exposure Category	C		Date	6/30/2019
Topographic Factor	1.30	K_{zt}		
Mean Roof Height	20	ft		
Roof Pitch	15	degrees		
Adjustment Factor	1.29	λ, Figure 28.6-1		

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

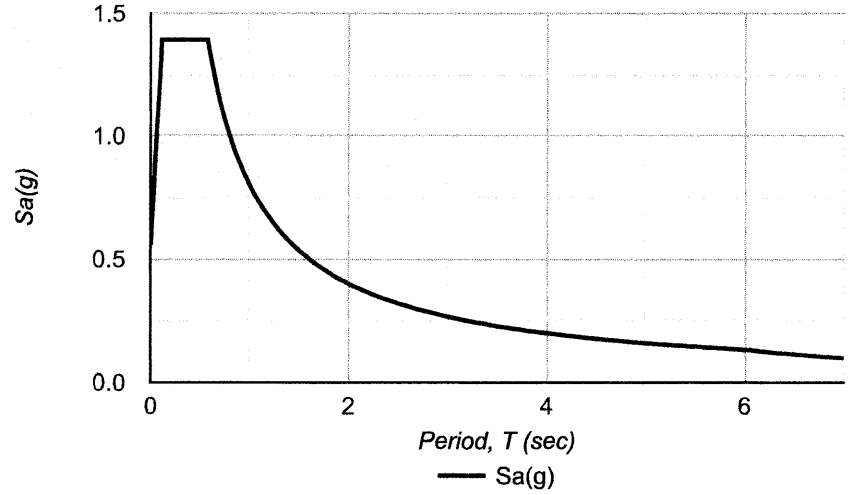
Latitude, Longitude: 47.5740029, -122.20728059999999

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

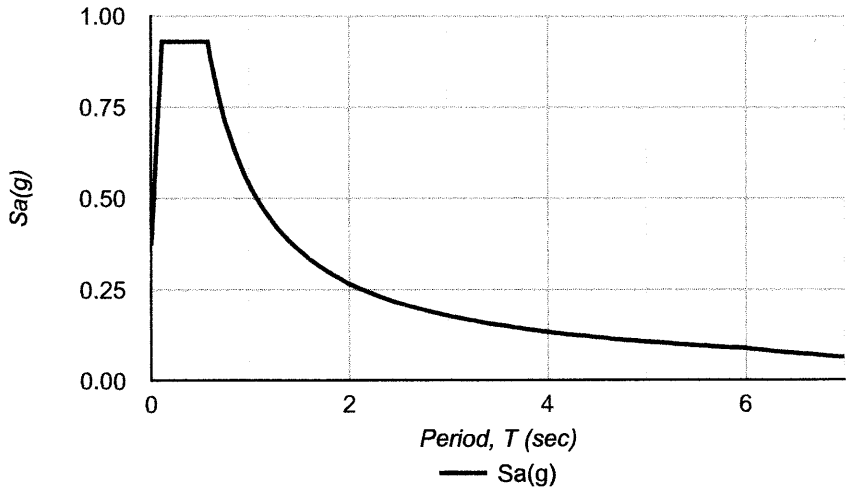
Type	Value	Description
S_S	1.393	MCE_R ground motion. (for 0.2 second period)
S_1	0.535	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.393	Site-modified spectral acceleration value
S_{M1}	0.802	Site-modified spectral acceleration value
S_{DS}	0.929	Numeric seismic design value at 0.2 second SA
S_{D1}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



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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
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SHEET NO. 82 OF
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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 $784/2135\ (5808) = 2133^{\#}$

Main Floor Shear Walls

Line A $538/1737\ (3780) + 2133 = 3434^{\#}$

Line B $(.5)\ 3780 + 2904 = 4794^{\#}$

Line C $600/1737\ (3780) + 990 = 2296^{\#}$

Line 1 $323/1737\ (3780) + 598 = 1299^{\#}$

Line 2 $(.5)(3780) + 2904 = 4794^{\#}$

Line 3 $325/1737\ (3780) + 2133 = 2840^{\#}$

Shear Wall Summary 9787 SE 41st

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

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	13	10	1381	2133	106	164	3	3187	4922	6	3		855	891	1507	P1-6	MST 37	(2)2x	
B	19	10	1742	2904	92	153	9	8252	13756	10	9		10125	242	1000	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	10	1345	298	168	37	8	13450	2980	6	8		6080	1225	15	P1-6	MST 37	(2)2x	
2	20	10	1888	2904	94	145	9	8496	13068	10	9		10125	269	923	P1-6			
3	18	10	1200	2133	67	119	8	5333	9480	10	8		8000	67	715	P1-6	MSTC37B	(2)2x	
Lower Floor Shear Walls																			
A	23	9	4370	3434	190	149	4	6840	5375	4	4	4	1648	1463	1150	P1-6	HDU2	(2)2x	5/8"
B	9.5	9	5414	4794	570	505	9.5	48726	43146	10	9.5	12	18411	3966	3631	P1-2	HDU5	(2)2x	5/8"
C	3.5	9	4181	2296	1195	656	3.5	37629	20664	6	3.5	4	1446	10503	5710	P2-4	HDU14	6x6	1"
1	23	9	4181	1299	182	56	23	37629	11691	6	23	2	55016	201	-616	P1-6			
2	22	9	5866	4794	267	218	9	21598	17651	10	9	2	10854	1676	1394	P1-6	HDU2	(2)2x	5/8"
3	18	9	3730	2840	207	158	9	16785	12780	10	9	8	14256	915	676	P1-6			

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