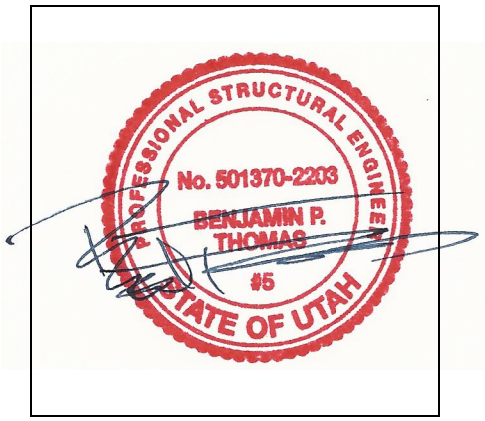
Structural Calculations

5ive Engineering – Job Name: Burton Solitude Spec Home
Job Number: 16032
Scope Number: 01

Client: Corey Solum
Company: Think Architecture
5151 South 900 East, Suite #200
Salt Lake City, UT 84117

Date: September 3, 2018



Engineer's Stamp

Revision	Date	By	Description
Δ			
Δ			
Δ			
Δ			

Basis for Design

1. **BUILDING CODE**: 2015 International Building Code

2. **Design:**

Roof Loading

Dead Load	= 25 psf
Live Load	= 20 psf
Snow Load	= 165 psf

Floor Loading

Dead Load	= 40 psf
Live Load	= 40 psf

3. **Lateral Design:**

Wind Loading

Basic Wind Speed (3s – Gust)	= 115 mph
Importance Factor	= 1.0
Wind Exposure	= C

Seismic Loading

Seismic Use Group	= I
Ss, S1	= 0.587, 0.310
R	= 6.5
Soil Site Class	= D
Seismic Design Category	= D
Lateral Force Resisting System	= Wood Shear Walls
Analysis Procedure	= Equivalent Method

4. **Foundation Design:**

Traditional foundations designed in conformance with recommendations per the minimum recommendations of the 2015 IBC. All footings shall extend a minimum of 42" below grade. Allowable dead plus live load soil pressure equals 1500 psf.

5. **Concrete Design:**

Concrete footings and slabs on grade f'c=2500 psi

6. **Concrete Reinforcing:**

Rebar #5 and larger ASTM A615 grade 60 (fy=60 ksi), bars #4 and smaller ASTM A615 grade 40 minimum (fy=40 ksi). WWF ASTM A185. PT strands 270 ksi. ½" dia. seven wire.

7. **Wood Design:**

Sawn Lumber: shall have the following minimum grade (unless noted otherwise):

Location	Specification
2x4 Studs, blocking, top plates	Douglas Fir Stud Grade
2x6 Studs, blocking, top plates	Douglas Fir #2
Joists, top plates	Douglas Fir #2
All other sawn lumber	Douglas Fir #2
6x beams and 6x posts	Douglas Fir #1

Glu-lam Beams: Douglas Fir Combination

Fb	= 2400 psi
Fv	= 165 psi
Fc (perpendicular)	= 650 psi
E	= 1,800,000 psi

Location	Specification
Simple span	24F-V4
Cantilevered & Multi-span	24F-V8

Plywood or OSB: C-D or C-C sheathing conforming to the following nominal thickness, span, rating and nailing pattern U.N.O.:

Thickness	Span Rating	Edge Nailing	Field Nailing
3/8"	24/0	8d @ 6" o.c.	8d @ 12" o.c.
1/2"	32/16	8d @ 6" o.c.	8d @ 12" o.c.
3/4"	40/20	10d @ 6" o.c.	10d @ 10" o.c.

All nails except 16d nails shall be common nails U.N.O. 16d sinker, 16d box, or 12d common U.N.O. Nails shall be driven so that the heads are flush with wood surface. Over-driven or under-driven nails will not be acceptable. Nailing shall be per IBC Table 2304.9.1 nailing schedule.

8. Connection Hardware:

Shall be Simpson Strong-tie, USP, or ICBO approved equivalent.

9. Inspection:

As required by the governing municipality.

10. Special Inspection:

Not required (U.N.O. on the plans)

Google Earth

feet 900
meters 200

Lat: 40.622286 Long: -111.593692 Elev: 8170 ft.

5ive ENGINEERING

Gravity Design Loads

Based on ASCE 7-10 & IBC 2015

Roof

Asphault Shigles/ Standing Seam	10	PSF
15/32" Plywood Sheathing	2.3	PSF
Roof Trusses	3	PSF
Insulation	0.8	PSF
5/8" Gypsum Board Ceiling	2.8	PSF
Misc.	6.1	PSF
Roof Dead Load	**25**	**PSF**
Roof Live Load	**20**	**PSF**
Additional Soffit Load	**8**	**PSF** (As Occurs)

Floor

Floor Finish	15	PSF
3/4" Plywood Sheathing	3.4	PSF
Wood I-Joists	3.5	PSF
Insulation	1.5	PSF
5/8" Gypsum Board Ceiling	2.8	PSF
Partition	10	PSF
Misc.	3.3	PSF
Floor Dead Load	**40**	**PSF**
Floor Live Load	**40**	**PSF**

Wall

7/8" Stucco	10	PSF
3/8" Plywood Sheathing	1.2	PSF
2x6 Framing	1.4	PSF
Insulation	0.3	PSF
5/8" Gypsum Board Finish	2.8	PSF
Misc.	4.3	PSF
Floor Dead Load	**20**	**PSF**
ıdditional Stone/Brick Veneer Load	**30**	**PSF** (As Occurs)

Ground Snow Load

Base ground snow load -	P_o =	43	psf
Change in snow load with elevation -	S =	63	psf
Base ground snow elevation/1000 -	A_o =	4.5	ft
Elevation above sea level/1000 -	A =	8.17	ft
	P_g =	235	psf

Snow Loads

for Flat, Hip, and Gable Roofs

Ground Snow Load, p_g: 235 psf

Exposure Factor, C_e: 1

Thermal Factor, C_t: 1

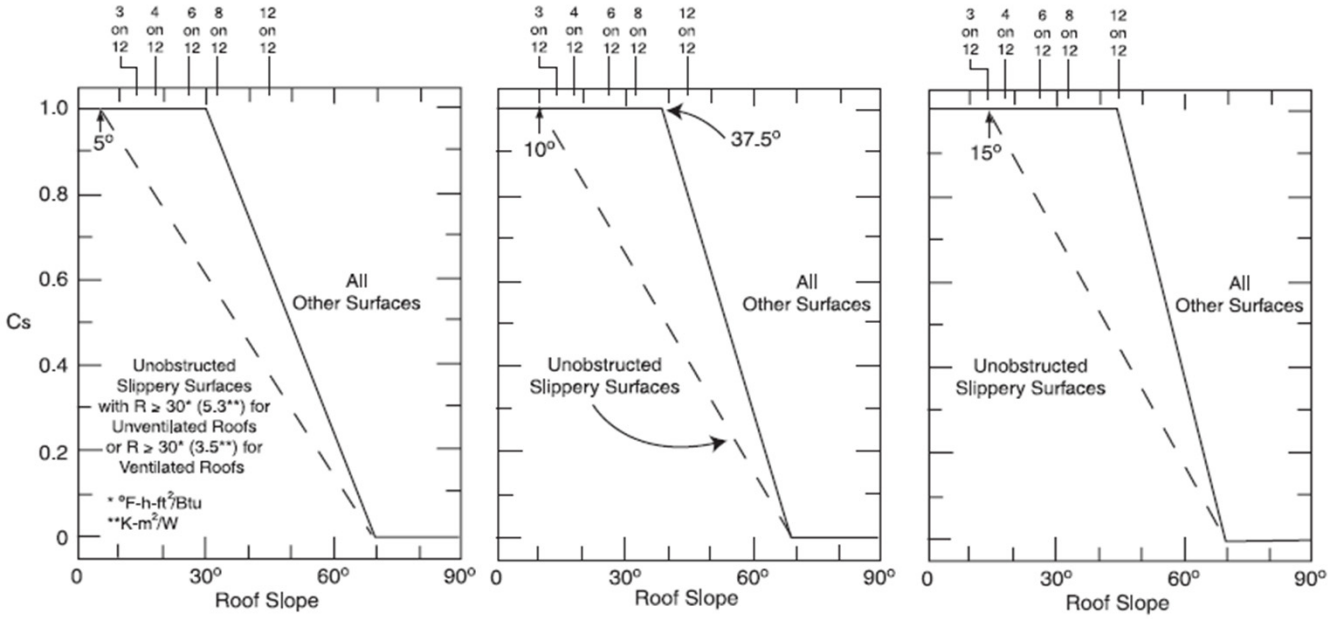
Importance Factor, I: 1

Roof Slope Factor, C_s: Use Figure 7-2a

C_s: 1

Flat Roof Snow Load, p_f: **165 psf**

Sloped Roof Snow Load, p_s: **165 psf**



7-2a: Warm roofs with C_t<1.0 7-2b: Cold roofs with C_t=1.1 7-2c: Cold roofs with C_t=1.2

FIGURE 7-2
GRAPHS FOR DETERMINING ROOF SLOPE FACTOR C, FOR WARM AND COLD ROOFS (SEE TABLE 7-3 FOR C_t DEFINITIONS)

Unbalanced Snow Loads

For Eave to Ridge Distance of 20 ft. or Less

Unbalanced Sloped Roof Snow Load on the Leeward Side, p_{su}: **247 psf**

Unbalanced Sloped Roof Snow Load on the Windward Side, p_{su}: **psf**

For Eave to Ridge Distance Greater than 20 ft.

Unbalanced Sloped Roof Snow Load on the Leeward Side, p_{su}: **247 psf**

Unbalanced Sloped Roof Snow Load on the Windward Side, p_{su}: **49 psf**

Drifting

Snow Density, γ: 30 pcf

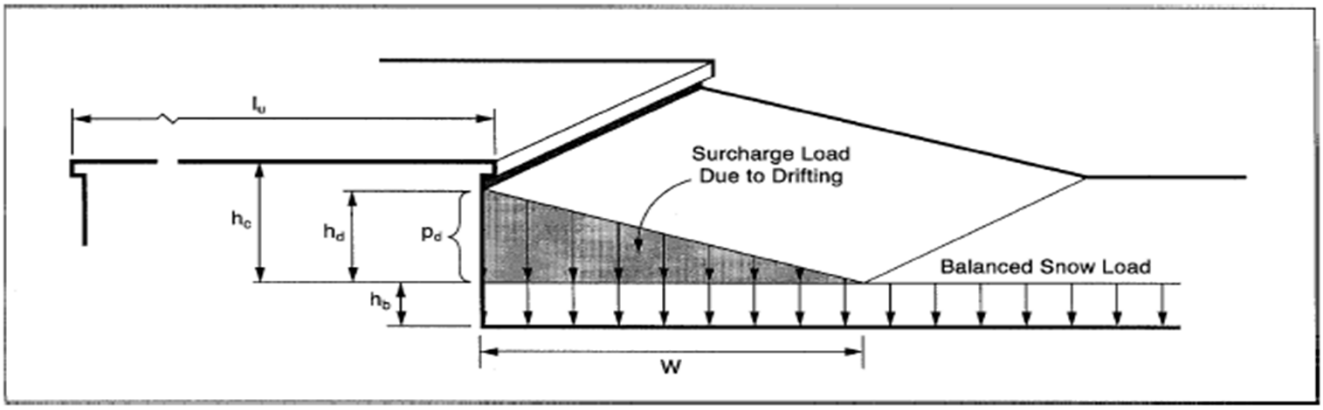
h_c: 6 ft

h_b: 5.5 ft

Length of Upper Roof, l_u: 25 ft

Length of Lower Roof, l_l: 12.5 ft

Drifting Calcs Req'd



For Leeward Drifting **For Windward Drifting**

h_{dl}: 3.5 ft

h_{dw}: 2.6 ft

Maximum Drifting Height, h_d: **3 ft**

Drift Width, W: **14 ft**

Maximum Drift Intensity, p_d: **104 psf**

Sliding Snow

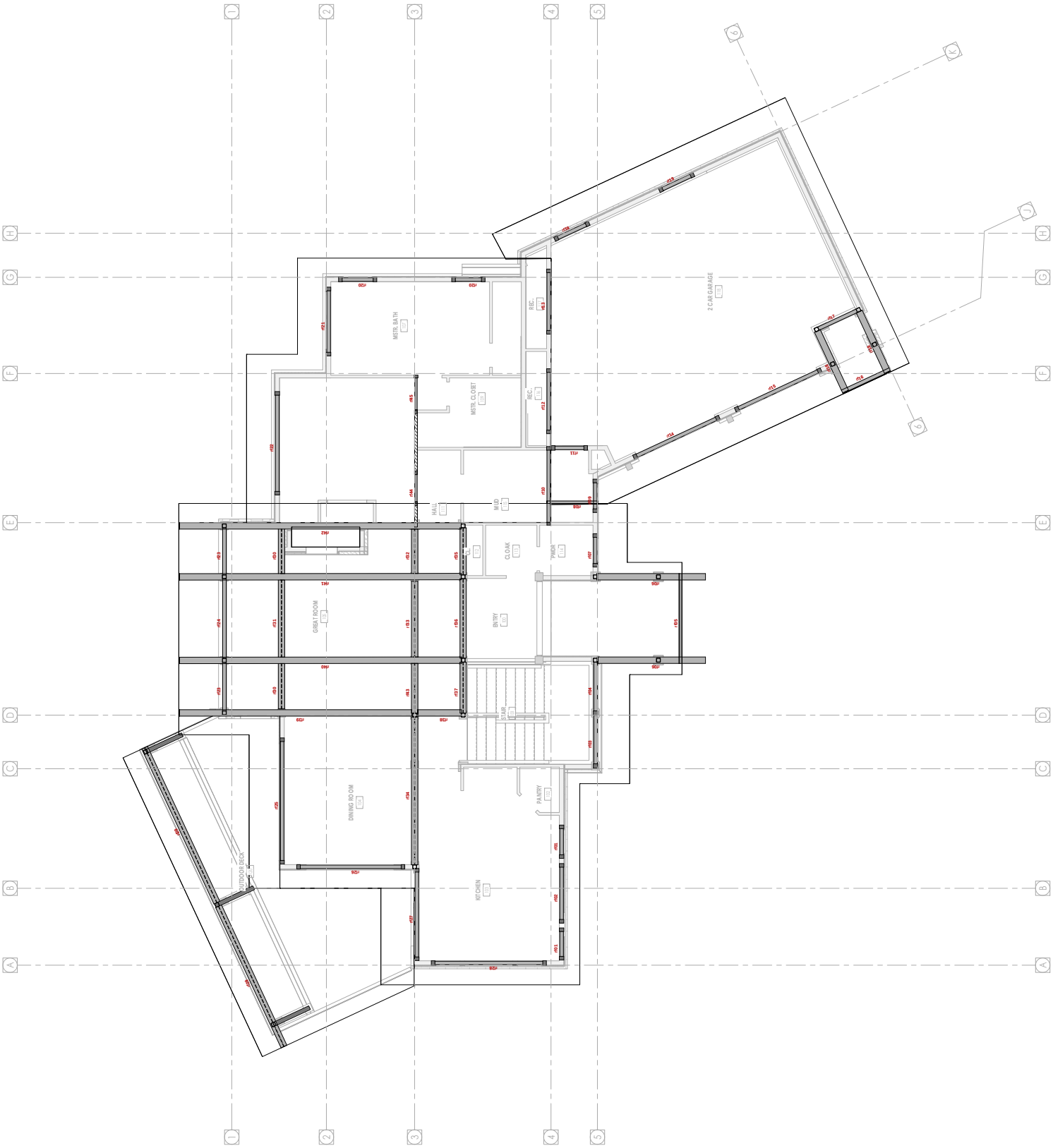
Roof Slope: 1 **:12**

For Slippery Roofs	For All Other Roofs
Design for Sliding Snow	**Design for Sliding Snow not Req'd**

Sliding Snow on Lower Roof, p_{slide}: **110 psf**

Sliding Snow Load shall be Superimposed on Balanced Snow Load

Roof Design


MSTR. BATH
MSTR. CLOSET
REC.
REC.
2 CAR GARAGE
HALL
MUD
CLOAK
PWDR
GREAT ROOM
ENTRY
STAIR
DINING ROOM
PANTRY
KITCHEN
OUTDOOR DECK

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf01
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 2.666 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 297.3%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:34:50 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.00	IN L/8310
Dead Load	0.00	in
Total Load	0.00	IN L/7136

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	2144 lb	2144 lb
Dead Load	353 lb	353 lb
Total Load	2497 lb	2497 lb
Bearing Length	0.89 in	0.89 in

BEAM DATA

Span Length	2.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

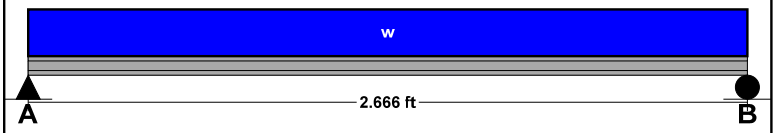
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1237	psi
	Cd=1.15 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1664 ft-lb
1.333 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 1099 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	16.15 in3	64.17 in3
Area (Shear):	7.96 in2	41.63 in2
Moment of Inertia (deflection):	8.57 in4	296.79 in4
Moment:	1664 ft-lb	6613 ft-lb
Shear:	1099 lb	5744 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	2	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	7.8	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	2.67	ft
Beam Self Weight:	BSW =	9	plf
Beam Uniform Live Load:	wL =	1609	plf
Beam Uniform Dead Load:	wD_adj =	265	plf
Total Uniform Load:	wT =	1873	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf02
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 11.25 IN x 5.666 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 18.2%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.04	IN L/1557
Dead Load	0.01	in
Total Load	0.05	IN L/1336

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	4558	lb	4558	lb
Dead Load	755	lb	755	lb
Total Load	5313	lb	5313	lb
Bearing Length	1.89	in	1.89	in

BEAM DATA

Span Length	5.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1124	psi
	Cd=1.15 CF=1.00 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 7525 ft-lb
2.833 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 3612 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	80.33 in3	94.92 in3
Area (Shear):	26.18 in2	50.63 in2
Moment of Inertia (deflection):	82.29 in4	533.94 in4
Moment:	7525 ft-lb	8892 ft-lb
Shear:	3612 lb	6986 lb

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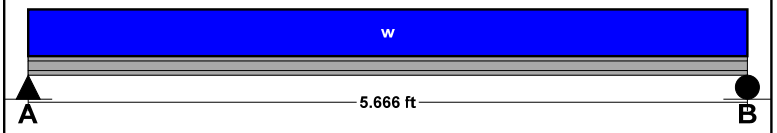

ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	2	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	7.8	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.67	ft
Beam Self Weight:	BSW =	11	plf
Beam Uniform Live Load:	wL =	1609	plf
Beam Uniform Dead Load:	wD_adj =	266	plf
Total Uniform Load:	wT =	1875	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf03
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 11.25 IN x 5.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 4.2%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.04	IN L/1468
Dead Load	0.01	in
Total Load	0.05	IN L/1272

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	5631	lb	5631	lb
Dead Load	871	lb	871	lb
Total Load	6502	lb	6502	lb
Bearing Length	2.31	in	2.31	in

BEAM DATA

Span Length	5.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

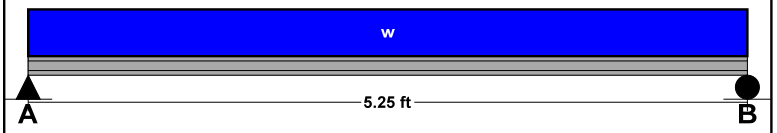
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1124	psi
	Cd=1.15 CF=1.00 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 8533 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 4291 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	91.09 in3	94.92 in3
Area (Shear):	31.09 in2	50.63 in2
Moment of Inertia (deflection):	87.28 in4	533.94 in4
Moment:	8533 ft-lb	8892 ft-lb
Shear:	4291 lb	6986 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	9.5	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.25	ft
Beam Self Weight:	BSW =	11	plf
Beam Uniform Live Load:	wL =	2145	plf
Beam Uniform Dead Load:	wD_adj =	332	plf
Total Uniform Load:	wT =	2477	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf04
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 11.25 IN x 5.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 25.3%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.04	IN L/1775
Dead Load	0.01	in
Total Load	0.04	IN L/1529

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	4656	lb	4656	lb
Dead Load	752	lb	752	lb
Total Load	5408	lb	5408	lb
Bearing Length	1.92	in	1.92	in

BEAM DATA

Span Length	5.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1124	psi
	Cd=1.15 CF=1.00 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 7098 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 3569 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	75.77 in3	94.92 in3
Area (Shear):	25.87 in2	50.63 in2
Moment of Inertia (deflection):	72.18 in4	533.94 in4
Moment:	7098 ft-lb	8892 ft-lb
Shear:	3569 lb	6986 lb

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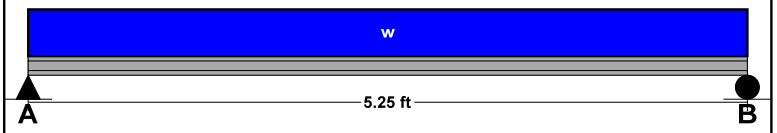

ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	7.3	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.25	ft
Beam Self Weight:	BSW =	11	plf
Beam Uniform Live Load:	wL =	1774	plf
Beam Uniform Dead Load:	wD_adj =	286	plf
Total Uniform Load:	wT =	2060	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf05
Roof Beam
[2015 International Building Code(2015 NDS)]
1.75 IN x 18.0 IN x 9.0 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 0.1%
Controlling Factor: Moment

StruCalc 9.0

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DEFLECTIONS Center

Live Load	0.17	IN L/623
Dead Load	0.03	in
Total Load	0.20	IN L/538

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	8539 lb	8539 lb
Dead Load	1353 lb	1353 lb
Total Load	9892 lb	9892 lb
Bearing Length	7.54 in	7.54 in

BEAM DATA

Span Length	9	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

MATERIAL PROPERTIES

1.9E Microllam - iLevel Trus Joist

	Base Values	Adjusted
Bending Stress:	Fb = 2600 psi	Fb' = 2830 psi
	Cd=1.15 CF=0.95	
Shear Stress:	Fv = 285 psi	Fv' = 328 psi
	Cd=1.15	
Modulus of Elasticity:	E = 1900 ksi	E' = 1900 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750 psi	Fc - ⊥' = 750 psi

Controlling Moment: 22256 ft-lb
4.5 ft from left support
Created by combining all dead and live loads.

Controlling Shear: -6726 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	94.39 in3	94.5 in3
Area (Shear):	30.78 in2	31.5 in2
Moment of Inertia (deflection):	327.57 in4	850.5 in4
Moment:	22256 ft-lb	22282 ft-lb
Shear:	-6726 lb	6883 lb

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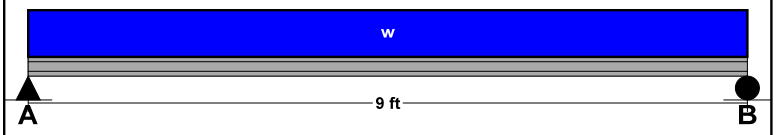

ROOF LOADING

Side One:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	11.5	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	9	ft
Beam Self Weight:	BSW =	10	plf
Beam Uniform Live Load:	wL =	1898	plf
Beam Uniform Dead Load:	wD_adj =	301	plf
Total Uniform Load:	wT =	2198	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf06
Multi-Span Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 11.5 FT (5 + 6.5)
Section Adequate By: 340.8%
Controlling Factor: Moment

StruCalc 9.0

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DEFLECTIONS	Left		Center	
Live Load	0.10	IN 2L/1160	-0.02	IN L/4519
Dead Load	0.02	in	0.00	in
Total Load	0.12	IN 2L/1000	-0.02	IN L/3955

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	16020	lb	1341	lb
Dead Load	2842	lb	-394	lb
Total Load	18862	lb	947	lb
Uplift (1.5 F.S)	0	**lb**	**-4472**	**lb**
Bearing Length	1.12	in	1.12	in

BEAM DATA	Left		Center	
Span Length	5	ft	6.5	ft
Unbraced Length-Top	0	ft	0	ft
Unbraced Length-Bottom	5	ft	6.5	ft

Roof Pitch 1 :12

STEEL PROPERTIES

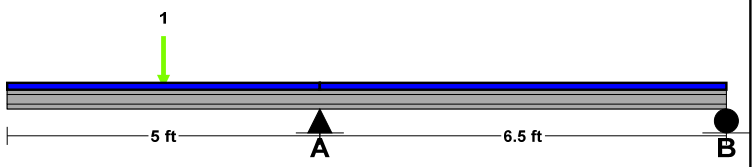
W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	5	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Elastic lateral-torsional buckling stress:	Fcr =	0	ksi
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: -31076 ft-lb
Over right support of span 1 (Left Span)
Created by combining all dead loads and live loads on span(s) 1, 2
Controlling Shear: -12430 lb
At right support of span 1 (Left Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	51.31 in4	248 in4
Moment:	-31076 ft-lb	136976 ft-lb
Shear:	-12430 lb	70700 lb

LOADING DIAGRAM



ROOF LOADING		Left		Center	
Roof Live Load	RLL =	165	psf	165	psf
Roof Dead Load	RDL =	20	psf	20	psf
Roof Tributary Width Side One	TW1 =	1.5	ft	1.5	ft
Roof Tributary Width Side Two	TW2 =	1	ft	1	ft
Wall Load	WALL =	0	plf	0	plf

POINT LOADS - LEFT SPAN

Load Number	One *
Live Load	8539 lb
Dead Load	1353 lb
Location	2.5 ft

* Load obtained from Load Tracker. See Summary Report for details.

BEAM LOADING	Left		Center	
Total Live Load	413	plf	413	plf
Total Dead Load (Adjusted for Roof Pitch)	50	plf	50	plf
Beam Self Weight	45	plf	45	plf
Total Load	508	plf	508	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf07
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 157.8%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.01	IN L/4417
Dead Load	0.00	in
Total Load	0.01	IN L/3798

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A	B
Live Load	2715 lb	2715 lb
Dead Load	442 lb	442 lb
Total Load	3157 lb	3157 lb
Bearing Length	1.12 in	1.12 in

BEAM DATA

Span Length	3.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

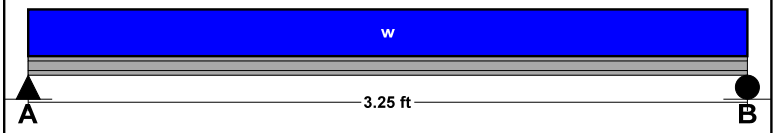
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1237	psi
	Cd=1.15 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 2565 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 1705 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	24.89 in3	64.17 in3
Area (Shear):	12.35 in2	41.63 in2
Moment of Inertia (deflection):	16.13 in4	296.79 in4
Moment:	2565 ft-lb	6613 ft-lb
Shear:	1705 lb	5744 lb

LOADING DIAGRAM



ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3.1	ft
Side Two:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	7	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	3.25	ft
Beam Self Weight:	BSW =	9	plf
Beam Uniform Live Load:	wL =	1671	plf
Beam Uniform Dead Load:	wD_adj =	272	plf
Total Uniform Load:	wT =	1943	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf08
Roof Beam
[2015 International Building Code(2015 NDS)]
1.75 IN x 7.25 IN x 5.333 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 16.3%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:34:53 PM

DEFLECTIONS Center

Live Load	0.14	IN L/450
Dead Load	0.03	in
Total Load	0.17	IN L/375

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	2200	lb	2200	lb
Dead Load	438	lb	438	lb
Total Load	2638	lb	2638	lb
Bearing Length	2.01	in	2.01	in

BEAM DATA

Span Length	5.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

MATERIAL PROPERTIES

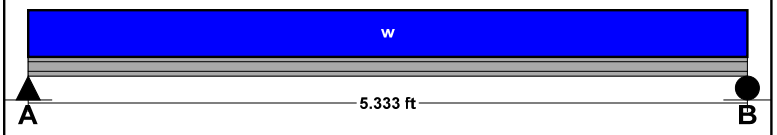
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 3202	psi
	Cd=1.15 CF=1.07			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 3517 ft-lb
2.667 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -2058 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	13.18 in3	15.33 in3
Area (Shear):	9.42 in2	12.69 in2
Moment of Inertia (deflection):	29.63 in4	55.57 in4
Moment:	3517 ft-lb	4091 ft-lb
Shear:	-2058 lb	2772 lb

LOADING DIAGRAM



ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	1	ft
Side Two:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.33	ft
Beam Self Weight:	BSW =	4	plf
Beam Uniform Live Load:	wL =	825	plf
Beam Uniform Dead Load:	wD_adj =	164	plf
Total Uniform Load:	wT =	989	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf09
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 134.9%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.01	IN L/4081
Dead Load	0.00	in
Total Load	0.01	IN L/3438

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	3660	lb	2361	lb
Dead Load	692	lb	434	lb
Total Load	4352	lb	2795	lb
Bearing Length	1.55	in	0.99	in

BEAM DATA

Span Length	3.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

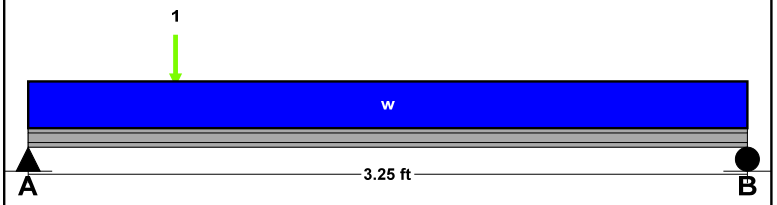
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1237	psi
	Cd=1.15 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 2816 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1758 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	27.32 in3	64.17 in3
Area (Shear):	12.74 in2	41.63 in2
Moment of Inertia (deflection):	17.46 in4	296.79 in4
Moment:	2816 ft-lb	6613 ft-lb
Shear:	-1758 lb	5744 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3.1	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	3.25	ft
Beam Self Weight:	BSW =	9	plf
Beam Uniform Live Load:	wL =	1176	plf
Beam Uniform Dead Load:	wD_adj =	212	plf
Total Uniform Load:	wT =	1387	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	2200 lb
Dead Load	438 lb
Location	0.67 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf10
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 261.0%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.01	IN L/6277
Dead Load	0.00	in
Total Load	0.01	IN L/5318

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

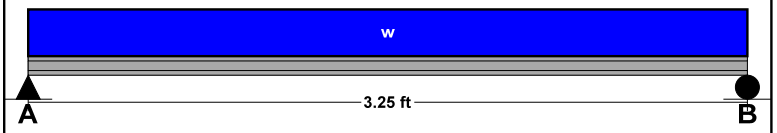
REACTIONS

	A	B
Live Load	1910 lb	1910 lb
Dead Load	344 lb	344 lb
Total Load	2254 lb	2254 lb
Bearing Length	0.80 in	0.80 in

BEAM DATA

Span Length	3.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

LOADING DIAGRAM



ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3.1	ft
Side Two:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4	ft
Wall Load:	WALL =	60	plf

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1237	psi
	Cd=1.15 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1832 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1217 lb
At a distance d from support.
Created by combining all dead and live loads.

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	3.25	ft
Beam Self Weight:	BSW =	9	plf
Beam Uniform Live Load:	wL =	1176	plf
Beam Uniform Dead Load:	wD_adj =	212	plf
Total Uniform Load:	wT =	1387	plf

Comparisons with required sections:

	Req'd	Provided
Section Modulus:	17.78 in3	64.17 in3
Area (Shear):	8.82 in2	41.63 in2
Moment of Inertia (deflection):	11.35 in4	296.79 in4
Moment:	1832 ft-lb	6613 ft-lb
Shear:	-1217 lb	5744 lb

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf11
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 223.2%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.01	IN L/5590
Dead Load	0.00	in
Total Load	0.01	IN L/4762

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	2145 lb	2145 lb
Dead Load	373 lb	373 lb
Total Load	2518 lb	2518 lb
Bearing Length	0.90 in	0.90 in

BEAM DATA

Span Length	3.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

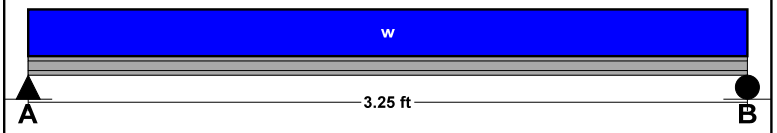
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1237	psi
	Cd=1.15 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 2046 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1360 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	19.85 in3	64.17 in3
Area (Shear):	9.85 in2	41.63 in2
Moment of Inertia (deflection):	12.74 in4	296.79 in4
Moment:	2046 ft-lb	6613 ft-lb
Shear:	-1360 lb	5744 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	3.25	ft
Beam Self Weight:	BSW =	9	plf
Beam Uniform Live Load:	wL =	1320	plf
Beam Uniform Dead Load:	wD_adj =	229	plf
Total Uniform Load:	wT =	1549	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf12
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 7.25 IN x 6.25 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 13.1%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:34:55 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.21	IN L/361
Dead Load	0.03	in
Total Load	0.24	IN L/311

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	5994	lb	5994	lb
Dead Load	954	lb	954	lb
Total Load	6948	lb	6948	lb
Bearing Length	1.76	in	1.76	in

BEAM DATA

Span Length	6.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

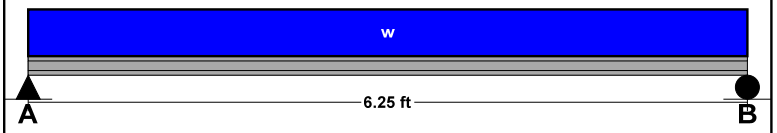
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 3202	psi
	Cd=1.15 CF=1.07			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 10856 ft-lb
3.125 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -5697 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	40.68 in3	45.99 in3
Area (Shear):	26.07 in2	38.06 in2
Moment of Inertia (deflection):	110.89 in4	166.72 in4
Moment:	10856 ft-lb	12273 ft-lb
Shear:	-5697 lb	8317 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	7.1	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	6.25	ft
Beam Self Weight:	BSW =	12	plf
Beam Uniform Live Load:	wL =	1918	plf
Beam Uniform Dead Load:	wD_adj =	305	plf
Total Uniform Load:	wT =	2223	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf13
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 11.25 IN x 6.25 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 34.4%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:34:55 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.11	IN L/697
Dead Load	0.02	in
Total Load	0.12	IN L/610

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	11602	lb	11602	lb
Dead Load	1656	lb	1656	lb
Total Load	13258	lb	13258	lb
Bearing Length	3.37	in	3.37	in

BEAM DATA

Span Length	6.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

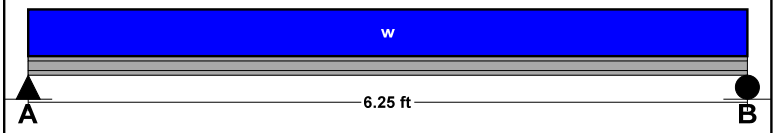
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 3016	psi
	Cd=1.15 CF=1.01			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 20715 ft-lb
3.125 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 9281 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	82.41 in3	110.74 in3
Area (Shear):	42.47 in2	59.06 in2
Moment of Inertia (deflection):	214.63 in4	622.92 in4
Moment:	20715 ft-lb	27837 ft-lb
Shear:	9281 lb	12905 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	12	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	6.25	ft
Beam Self Weight:	BSW =	18	plf
Beam Uniform Live Load:	wL =	3713	plf
Beam Uniform Dead Load:	wD_adj =	530	plf
Total Uniform Load:	wT =	4243	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf14
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 14.0 IN x 9.333 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 30.2%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.19	IN L/585
Dead Load	0.03	in
Total Load	0.22	IN L/507

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	11935	lb	11935	lb
Dead Load	1839	lb	1839	lb
Total Load	13774	lb	13774	lb
Bearing Length	3.50	in	3.50	in

BEAM DATA

Span Length	9.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

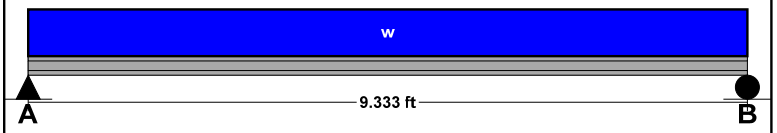
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2928	psi
	Cd=1.15 CF=0.98			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 32137 ft-lb
4.667 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -10468 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	131.71 in3	171.5 in3
Area (Shear):	47.91 in2	73.5 in2
Moment of Inertia (deflection):	492.34 in4	1200.5 in4
Moment:	32137 ft-lb	41845 ft-lb
Shear:	-10468 lb	16060 lb

LOADING DIAGRAM



ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft
Side Two:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	12.5	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	9.33	ft
Beam Self Weight:	BSW =	23	plf
Beam Uniform Live Load:	wL =	2558	plf
Beam Uniform Dead Load:	wD_adj =	394	plf
Total Uniform Load:	wT =	2952	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf15
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 14.0 IN x 9.333 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 30.2%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:34:56 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.19	IN L/585
Dead Load	0.03	in
Total Load	0.22	IN L/507

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	11935	lb	11935	lb
Dead Load	1839	lb	1839	lb
Total Load	13774	lb	13774	lb
Bearing Length	3.50	in	3.50	in

BEAM DATA

Span Length	9.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

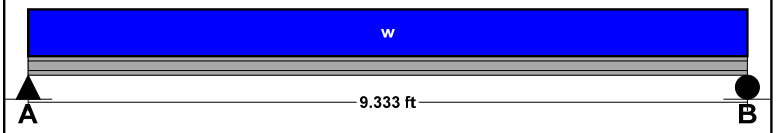
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2928	psi
	Cd=1.15 CF=0.98			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 32137 ft-lb
4.667 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -10468 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	131.71 in3	171.5 in3
Area (Shear):	47.91 in2	73.5 in2
Moment of Inertia (deflection):	492.34 in4	1200.5 in4
Moment:	32137 ft-lb	41845 ft-lb
Shear:	-10468 lb	16060 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	12.5	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	9.33	ft
Beam Self Weight:	BSW =	23	plf
Beam Uniform Live Load:	wL =	2558	plf
Beam Uniform Dead Load:	wD_adj =	394	plf
Total Uniform Load:	wT =	2952	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf16
Roof Beam
[2015 International Building Code(2015 NDS)]
1.75 IN x 7.25 IN x 5.5 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 20.6%
Controlling Factor: Moment

StruCalc 9.0

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DEFLECTIONS Center

Live Load	0.14	IN L/456
Dead Load	0.03	in
Total Load	0.17	IN L/378

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	2042 lb	2042 lb
Dead Load	424 lb	424 lb
Total Load	2466 lb	2466 lb
Bearing Length	1.88 in	1.88 in

BEAM DATA

Span Length	5.5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

MATERIAL PROPERTIES

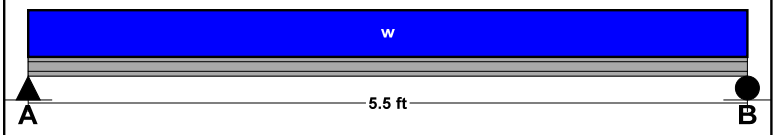
1.9E Microllam - iLevel Trus Joist

		Base Values		Adjusted	
Bending Stress:	Fb =	2600	psi	Fb' =	3202 psi
	Cd=1.15 CF=1.07				
Shear Stress:	Fv =	285	psi	Fv' =	328 psi
	Cd=1.15				
Modulus of Elasticity:	E =	1900	ksi	E' =	1900 ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	750	psi	Fc - ⊥' =	750 psi

Controlling Moment: 3391 ft-lb
2.75 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1973 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	12.71 in3	15.33 in3
Area (Shear):	9.03 in2	12.69 in2
Moment of Inertia (deflection):	29.25 in4	55.57 in4
Moment:	3391 ft-lb	4091 ft-lb
Shear:	-1973 lb	2772 lb

LOADING DIAGRAM



ROOF LOADING

Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	0.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4	ft

Wall Load: WALL = 60 plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.5	ft
Beam Self Weight:	BSW =	4	plf
Beam Uniform Live Load:	wL =	743	plf
Beam Uniform Dead Load:	wD_adj =	154	plf
Total Uniform Load:	wT =	897	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf17
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 11.25 IN x 4.666 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 20.7%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.03	IN L/1908
Dead Load	0.00	in
Total Load	0.03	IN L/1657

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	5485 lb	5485 lb
Dead Load	832 lb	832 lb
Total Load	6317 lb	6317 lb
Bearing Length	2.25 in	2.25 in

BEAM DATA

Span Length	4.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

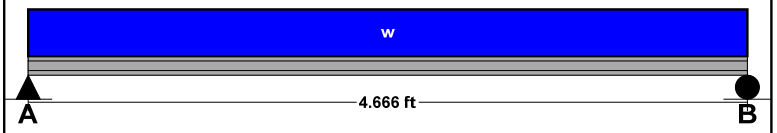
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1124	psi
	Cd=1.15 CF=1.00 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 7370 ft-lb
2.333 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -3791 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	78.67 in3	94.92 in3
Area (Shear):	27.47 in2	50.63 in2
Moment of Inertia (deflection):	67.17 in4	533.94 in4
Moment:	7370 ft-lb	8892 ft-lb
Shear:	-3791 lb	6986 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10.3	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	4.67	ft
Beam Self Weight:	BSW =	11	plf
Beam Uniform Live Load:	wL =	2351	plf
Beam Uniform Dead Load:	wD_adj =	357	plf
Total Uniform Load:	wT =	2708	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf18
Multi-Span Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x12 x 7.5 FT (3.5 + 4)
Section Adequate By: 148.5%
Controlling Factor: Moment

StruCalc 9.0

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DEFLECTIONS		Left		Center
Live Load	0.09	IN 2L/942	-0.01	IN L/4367
Dead Load	0.02	in	0.00	in
Total Load	0.11	IN 2L/798	-0.01	IN L/3750

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	7182	lb	990	lb
Dead Load	1276	lb	-311	lb
Total Load	8458	lb	679	lb
Uplift (1.5 F.S)	0	**lb**	**-2728**	**lb**
Bearing Length	0.51	in	0.51	in

BEAM DATA	Left		Center	
Span Length	3.5	ft	4	ft
Unbraced Length-Top	0	ft	0	ft
Unbraced Length-Bottom	3.5	ft	4	ft
Roof Pitch 1 :12				

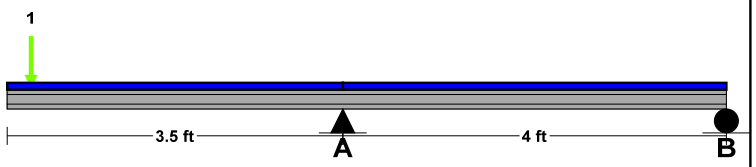
STEEL PROPERTIES
W10x12 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	9.87	in
Web Thickness:	tw =	0.19	in
Flange Width:	bf =	3.96	in
Flange Thickness:	tf =	0.21	in
Distance to Web Toe of Fillet:	k =	0.51	in
Moment of Inertia About X-X Axis:	Ix =	53.8	in4
Section Modulus About X-X Axis:	Sx =	10.9	in3
Plastic Section Modulus About X-X Axis:	Zx =	12.6	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	9.43	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	46.58	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	4	ft
Limiting Unbraced Length -			
for lateral-torsional buckling:	Lp =	2.77	ft
for Eqn. F2-2:	Lr =	8.05	ft
Nominal Flexural Strength w/ safety factor:	Mn =	28554	ft-lb
Controlling Equation:	F2-2		
Web height to thickness ratio:	h/tw =	46.58	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	37506	lb

Controlling Moment: -11489 ft-lb
Over left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 1, 2
Controlling Shear: -4451 lb
4.0 Ft from left support of span 1 (Left Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	13.7 in4	53.8 in4
Moment:	-11489 ft-lb	28554 ft-lb
Shear:	-4451 lb	37506 lb

LOADING DIAGRAM



ROOF LOADING		Left		Center	
Roof Live Load	RLL =	165	psf	165	psf
Roof Dead Load	RDL =	20	psf	20	psf
Roof Tributary Width Side One	TW1 =	2	ft	2	ft
Roof Tributary Width Side Two	TW2 =	1	ft	1	ft
Wall Load	WALL =	0	plf	0	plf

POINT LOADS - LEFT SPAN

Load Number	One *
Live Load	2042 lb
Dead Load	424 lb
Location	0.25 ft

* Load obtained from Load Tracker. See Summary Report for details.

BEAM LOADING	Left		Center	
Total Live Load	495	plf	495	plf
Total Dead Load (Adjusted for Roof Pitch)	60	plf	60	plf
Beam Self Weight	12	plf	12	plf
Total Load	567	plf	567	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf19
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 7.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 14.3%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.03	IN L/1389
Dead Load	0.00	in
Total Load	0.03	IN L/1210

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	4156	lb	4156	lb
Dead Load	614	lb	614	lb
Total Load	4770	lb	4770	lb
Bearing Length	1.70	in	1.70	in

BEAM DATA

Span Length	3.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

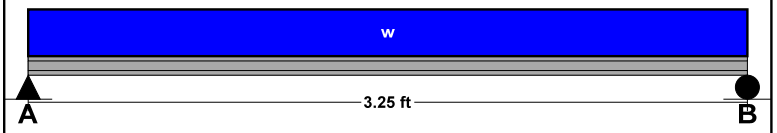
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values			Adjusted		
Bending Stress:	Fb =	850	psi	Fb' =	1349	psi
	Cd=1.15 CF=1.20 Cr=1.15					
Shear Stress:	Fv =	180	psi	Fv' =	207	psi
	Cd=1.15					
Modulus of Elasticity:	E =	1600	ksi	E' =	1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	625	psi	Fc - ⊥' =	625	psi

Controlling Moment: 3876 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 3053 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	34.48 in3	39.42 in3
Area (Shear):	22.12 in2	32.63 in2
Moment of Inertia (deflection):	24.69 in4	142.9 in4
Moment:	3876 ft-lb	4432 ft-lb
Shear:	3053 lb	4502 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	12.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	3.25	ft
Beam Self Weight:	BSW =	7	plf
Beam Uniform Live Load:	wL =	2558	plf
Beam Uniform Dead Load:	wD_adj =	378	plf
Total Uniform Load:	wT =	2936	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf20
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 7.25 IN x 2.75 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 480.8%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:34:59 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.00	IN L/8886
Dead Load	0.00	in
Total Load	0.00	IN L/7265

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	908 lb	908 lb
Dead Load	202 lb	202 lb
Total Load	1110 lb	1110 lb
Bearing Length	0.39 in	0.39 in

BEAM DATA

Span Length	2.8 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	0 ft
Roof Pitch	1 :12
Roof Duration Factor	1.15

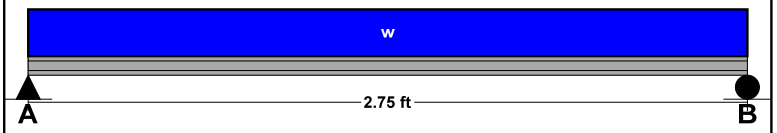
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850 psi		Fb' = 1349 psi	
	Cd=1.15 CF=1.20 Cr=1.15			
Shear Stress:	Fv = 180 psi		Fv' = 207 psi	
	Cd=1.15			
Modulus of Elasticity:	E = 1600 ksi		E' = 1600 ksi	
Comp. ⊥ to Grain:	Fc - ⊥ = 625 psi		Fc - ⊥' = 625 psi	

Controlling Moment: 763 ft-lb
1.375 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -644 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	6.79 in3	39.42 in3
Area (Shear):	4.66 in2	32.63 in2
Moment of Inertia (deflection):	3.86 in4	142.9 in4
Moment:	763 ft-lb	4432 ft-lb
Shear:	-644 lb	4502 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	1	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	2.75	ft
Beam Self Weight:	BSW =	7	plf
Beam Uniform Live Load:	wL =	660	plf
Beam Uniform Dead Load:	wD_adj =	147	plf
Total Uniform Load:	wT =	807	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf21
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 9.25 IN x 6.75 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 19.0%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.18	IN L/461
Dead Load	0.03	in
Total Load	0.20	IN L/400

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	8353	lb	8353	lb
Dead Load	1270	lb	1270	lb
Total Load	9623	lb	9623	lb
Bearing Length	2.44	in	2.44	in

BEAM DATA

Span Length	6.8	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

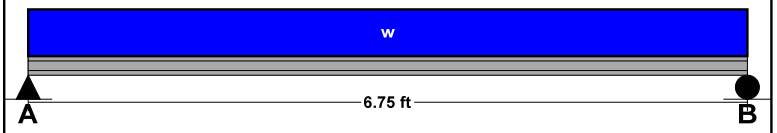
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 3098	psi
	Cd=1.15 CF=1.04			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 16239 ft-lb
3.375 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 7506 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	62.9 in3	74.87 in3
Area (Shear):	34.35 in2	48.56 in2
Moment of Inertia (deflection):	180.25 in4	346.26 in4
Moment:	16239 ft-lb	19327 ft-lb
Shear:	7506 lb	10611 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	12	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	6.75	ft
Beam Self Weight:	BSW =	15	plf
Beam Uniform Live Load:	wL =	2475	plf
Beam Uniform Dead Load:	wD_adj =	376	plf
Total Uniform Load:	wT =	2851	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf22
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 11.25 IN x 10.25 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 6.5%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:00 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.36	IN L/344
Dead Load	0.06	in
Total Load	0.42	IN L/294

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	8738	lb	8738	lb
Dead Load	1465	lb	1465	lb
Total Load	10203	lb	10203	lb
Bearing Length	2.59	in	2.59	in

BEAM DATA

Span Length	10.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

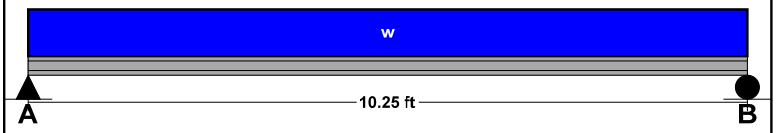
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 3016	psi
	Cd=1.15 CF=1.01			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 26145 ft-lb
5.125 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 8366 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	104.01 in3	110.74 in3
Area (Shear):	38.29 in2	59.06 in2
Moment of Inertia (deflection):	434.78 in4	622.92 in4
Moment:	26145 ft-lb	27837 ft-lb
Shear:	8366 lb	12905 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	7.3	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	10.25	ft
Beam Self Weight:	BSW =	18	plf
Beam Uniform Live Load:	wL =	1705	plf
Beam Uniform Dead Load:	wD_adj =	286	plf
Total Uniform Load:	wT =	1991	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf23
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 5.125 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 33.3%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:00 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.04	IN L/1464
Dead Load	0.01	in
Total Load	0.05	IN L/1246

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	3294 lb	3294 lb
Dead Load	577 lb	577 lb
Total Load	3871 lb	3871 lb
Bearing Length	1.38 in	1.38 in

BEAM DATA

Span Length	5.1	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

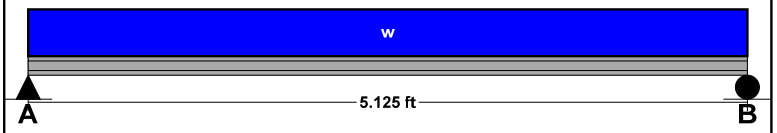
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1237	psi
	Cd=1.15 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 4960 ft-lb
2.563 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -2710 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	48.13 in3	64.17 in3
Area (Shear):	19.64 in2	41.63 in2
Moment of Inertia (deflection):	48.66 in4	296.79 in4
Moment:	4960 ft-lb	6613 ft-lb
Shear:	-2710 lb	5744 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3.1	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4.7	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.13	ft
Beam Self Weight:	BSW =	9	plf
Beam Uniform Live Load:	wL =	1286	plf
Beam Uniform Dead Load:	wD_adj =	225	plf
Total Uniform Load:	wT =	1511	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf24
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 9.25 IN x 8.5 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 41.1%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:01 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.23	IN L/445
Dead Load	0.04	in
Total Load	0.27	IN L/377

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	5463	lb	5463	lb
Dead Load	984	lb	984	lb
Total Load	6447	lb	6447	lb
Bearing Length	1.64	in	1.64	in

BEAM DATA		
Span Length	8.5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

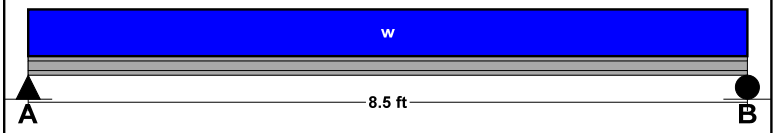
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 3098	psi
	Cd=1.15 CF=1.04			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 13701 ft-lb
4.25 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 5287 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	53.07 in3	74.87 in3
Area (Shear):	24.2 in2	48.56 in2
Moment of Inertia (deflection):	186.95 in4	346.26 in4
Moment:	13701 ft-lb	19327 ft-lb
Shear:	5287 lb	10611 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3.1	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	4.7	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	8.5	ft
Beam Self Weight:	BSW =	15	plf
Beam Uniform Live Load:	wL =	1286	plf
Beam Uniform Dead Load:	wD_adj =	232	plf
Total Uniform Load:	wT =	1517	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf25
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 18.0 IN x 12.666 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 0.2%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:01 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.34	IN L/441
Dead Load	0.05	in
Total Load	0.40	IN L/382

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	18287	lb	18287	lb
Dead Load	2791	lb	2791	lb
Total Load	21078	lb	21078	lb
Bearing Length	5.35	in	5.35	in

BEAM DATA

Span Length	12.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

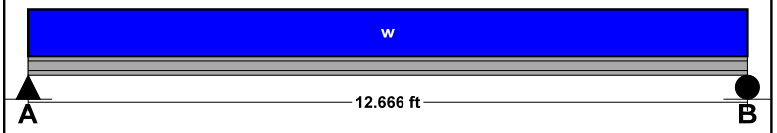
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2830	psi
	Cd=1.15 CF=0.95			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 66743 ft-lb
6.333 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 16441 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	283.06 in3	283.5 in3
Area (Shear):	75.24 in2	94.5 in2
Moment of Inertia (deflection):	1389.41 in4	2551.5 in4
Moment:	66743 ft-lb	66847 ft-lb
Shear:	16441 lb	20648 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	7	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	12.67	ft
Beam Self Weight:	BSW =	30	plf
Beam Uniform Live Load:	wL =	2888	plf
Beam Uniform Dead Load:	wD_adj =	441	plf
Total Uniform Load:	wT =	3328	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf26
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 16.0 IN x 12.666 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 7.4%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:02 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.36	IN L/417
Dead Load	0.06	in
Total Load	0.42	IN L/359

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	13584	lb	13584	lb
Dead Load	2199	lb	2199	lb
Total Load	15783	lb	15783	lb
Bearing Length	4.01	in	4.01	in

BEAM DATA

Span Length	12.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

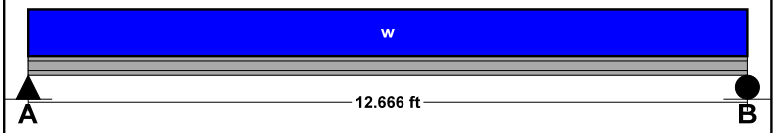
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2875	psi
	Cd=1.15 CF=0.96			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 49976 ft-lb
6.333 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -12626 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	208.58 in3	224 in3
Area (Shear):	57.79 in2	84 in2
Moment of Inertia (deflection):	1032.13 in4	1792 in4
Moment:	49976 ft-lb	53671 ft-lb
Shear:	-12626 lb	18354 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	12.67	ft
Beam Self Weight:	BSW =	26	plf
Beam Uniform Live Load:	wL =	2145	plf
Beam Uniform Dead Load:	wD_adj =	347	plf
Total Uniform Load:	wT =	2492	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf27
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 14.0 IN x 9.0 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 1.7%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:02 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.23	IN L/470
Dead Load	0.03	in
Total Load	0.26	IN L/411

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	15964	lb	15964	lb
Dead Load	2315	lb	2315	lb
Total Load	18279	lb	18279	lb
Bearing Length	4.64	in	4.64	in

BEAM DATA

Span Length	9	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

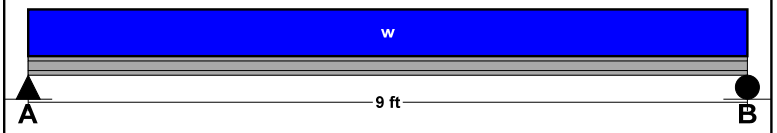
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2928	psi
	Cd=1.15 CF=0.98			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 41127 ft-lb
4.5 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 13892 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	168.56 in3	171.5 in3
Area (Shear):	63.58 in2	73.5 in2
Moment of Inertia (deflection):	612.41 in4	1200.5 in4
Moment:	41127 ft-lb	41845 ft-lb
Shear:	13892 lb	16060 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	11.5	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	9	ft
Beam Self Weight:	BSW =	23	plf
Beam Uniform Live Load:	wL =	3548	plf
Beam Uniform Dead Load:	wD_adj =	514	plf
Total Uniform Load:	wT =	4062	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf28
Roof Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 9.25 IN x 11.25 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 93.8%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:03 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.27	IN L/498
Dead Load	0.07	in
Total Load	0.35	IN L/391

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	2784	lb	2784	lb
Dead Load	762	lb	762	lb
Total Load	3546	lb	3546	lb
Bearing Length	0.90	in	0.90	in

BEAM DATA

Span Length	11.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

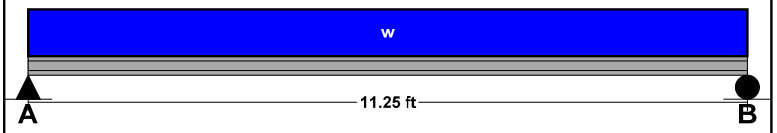
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values			Adjusted		
Bending Stress:	Fb =	2600	psi	Fb' =	3098	psi
	Cd=1.15 CF=1.04					
Shear Stress:	Fv =	285	psi	Fv' =	328	psi
	Cd=1.15					
Modulus of Elasticity:	E =	1900	ksi	E' =	1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	750	psi	Fc - ⊥' =	750	psi

Controlling Moment: 9973 ft-lb
5.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -3120 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	38.63 in3	74.87 in3
Area (Shear):	14.28 in2	48.56 in2
Moment of Inertia (deflection):	166.9 in4	346.26 in4
Moment:	9973 ft-lb	19327 ft-lb
Shear:	-3120 lb	10611 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	2	ft

Side Two:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	1	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	11.25	ft
Beam Self Weight:	BSW =	15	plf
Beam Uniform Live Load:	wL =	495	plf
Beam Uniform Dead Load:	wD_adj =	135	plf
Total Uniform Load:	wT =	630	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf29
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x39 x 18.0 FT
Section Adequate By: 21.7%
Controlling Factor: Deflection

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:03 PM

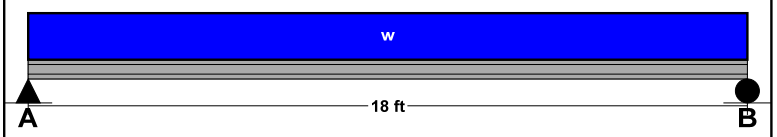
DEFLECTIONS	Center	
Live Load	0.74	IN L/292
Dead Load	0.13	in
Total Load	0.87	IN L/249

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	17078	lb	17078	lb
Dead Load	2968	lb	2968	lb
Total Load	20046	lb	20046	lb
Bearing Length	1.03	in	1.03	in

BEAM DATA		
Span Length	18	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

LOADING DIAGRAM



STEEL PROPERTIES
W10x39 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	9.92	in
Web Thickness:	tw =	0.32	in
Flange Width:	bf =	7.99	in
Flange Thickness:	tf =	0.53	in
Distance to Web Toe of Fillet:	k =	1.03	in
Moment of Inertia About X-X Axis:	Ix =	209	in4
Section Modulus About X-X Axis:	Sx =	42.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	46.8	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	7.54	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	24.95	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	6.99	ft
Nominal Flexural Strength w/ safety factor:	Mn =	116767	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	24.95	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	62496	lb

ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft
Side Two:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	1.5	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	18	ft
Beam Self Weight:	BSW =	39	plf
Beam Uniform Live Load:	wL =	1898	plf
Beam Uniform Dead Load:	wD_adj =	330	plf
Total Uniform Load:	wT =	2227	plf

Controlling Moment: 90206 ft-lb
9.0 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 20046 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	171.69 in4	209 in4
Moment:	90206 ft-lb	116767 ft-lb
Shear:	20046 lb	62496 lb

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf30
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.5 FT
Section Adequate By: 1214.6%
Controlling Factor: Shear

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:04 PM

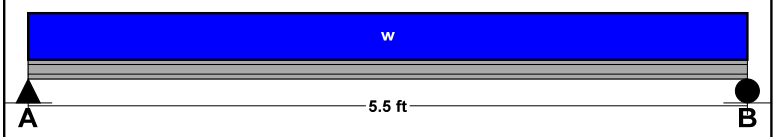
DEFLECTIONS		Center	
Live Load	0.00	IN	L/MAX
Dead Load	0.00	in	
Total Load	0.01	IN	L/MAX

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	4538	lb	4538	lb
Dead Load	841	lb	841	lb
Total Load	5379	lb	5379	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA		
Span Length	5.5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

LOADING DIAGRAM



STEEL PROPERTIES
W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft
Side Two:			
Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.5	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	1650	plf
Beam Uniform Dead Load:	wD_adj =	306	plf
Total Uniform Load:	wT =	1956	plf

Controlling Moment: 7395 ft-lb
2.75 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 5378 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	4.26 in4	248 in4
Moment:	7395 ft-lb	136976 ft-lb
Shear:	5378 lb	70700 lb

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf31
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 8.5 FT
Section Adequate By: 675.5%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:04 PM

DEFLECTIONS Center

Live Load	0.03	IN L/3786
Dead Load	0.00	in
Total Load	0.03	IN L/3194

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

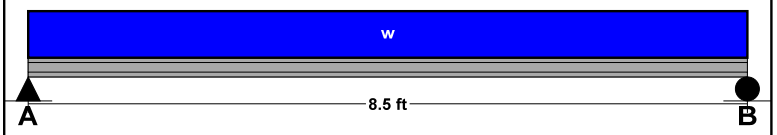
REACTIONS

	A	B
Live Load	7013 lb	7013 lb
Dead Load	1299 lb	1299 lb
Total Load	8312 lb	8312 lb
Bearing Length	1.12 in	1.12 in

BEAM DATA

Span Length	8.5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

LOADING DIAGRAM



STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 17662 ft-lb
4.25 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 8312 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	15.72 in4	248 in4
Moment:	17662 ft-lb	136976 ft-lb
Shear:	8312 lb	70700 lb

ROOF LOADING

Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft

Wall Load: WALL = 60 plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	8.5	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	1650	plf
Beam Uniform Dead Load:	wD_adj =	306	plf
Total Uniform Load:	wT =	1956	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf32
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.0 FT
Section Adequate By: 1346.0%
Controlling Factor: Shear

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:05 PM

DEFLECTIONS	Center	
Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.00	IN L/MAX

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	4125	lb	4125	lb
Dead Load	764	lb	764	lb
Total Load	4889	lb	4889	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA		
Span Length	5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

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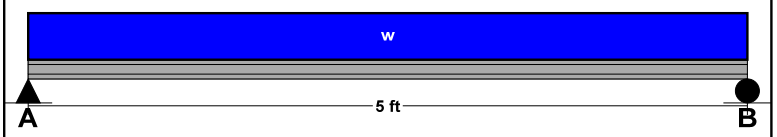


STEEL PROPERTIES
W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft
Side Two:			
Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	1650	plf
Beam Uniform Dead Load:	wD_adj =	306	plf
Total Uniform Load:	wT =	1956	plf

Controlling Moment: 6112 ft-lb
2.5 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 4889 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	3.2 in4	248 in4
Moment:	6112 ft-lb	136976 ft-lb
Shear:	4889 lb	70700 lb

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf33
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W16x40 x 19.666 FT
Section Adequate By: 8.7%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:06 PM

DEFLECTIONS Center

Live Load	0.67	IN L/353
Dead Load	0.13	in
Total Load	0.80	IN L/294

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

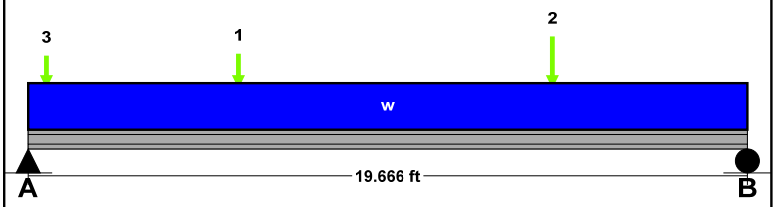
REACTIONS

	A		B	
Live Load	32893	lb	28306	lb
Dead Load	6652	lb	5509	lb
Total Load	39545	lb	33815	lb
Bearing Length	4.25	in	1.99	in

BEAM DATA

Span Length	19.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

LOADING DIAGRAM



STEEL PROPERTIES
W16x40 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	16	in
Web Thickness:	tw =	0.31	in
Flange Width:	bf =	7	in
Flange Thickness:	tf =	0.51	in
Distance to Web Toe of Fillet:	k =	0.91	in
Moment of Inertia About X-X Axis:	Ix =	518	in4
Section Modulus About X-X Axis:	Sx =	64.7	in3
Plastic Section Modulus About X-X Axis:	Zx =	73	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.93	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	46.51	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	5.55	ft
Nominal Flexural Strength w/ safety factor:	Mn =	182136	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	46.51	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	97600	lb

Controlling Moment: 167581 ft-lb
9.833 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 39545 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	352.56 in4	518 in4
Moment:	167581 ft-lb	182136 ft-lb
Shear:	39545 lb	97600 lb

ROOF LOADING

Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft

Wall Load: WALL = 60 plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	19.67	ft
Beam Self Weight:	BSW =	40	plf
Beam Uniform Live Load:	wL =	1650	plf
Beam Uniform Dead Load:	wD_adj =	301	plf
Total Uniform Load:	wT =	1951	plf

POINT LOADS - CENTER SPAN

Load Number	One *	Two *	Three *
Live Load	8064 lb	13076 lb	7610 lb
Dead Load	1879 lb	2690 lb	1679 lb
Location	5.75 ft	14.33 ft	0.5 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf34
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x30 x 15.666 FT
Section Adequate By: 3.9%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:06 PM

DEFLECTIONS Center

Live Load	0.68	IN L/276
Dead Load	0.11	in
Total Load	0.79	IN L/239

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	19387	lb	19387	lb
Dead Load	3063	lb	3063	lb
Total Load	22450	lb	22450	lb
Bearing Length	0.81	in	0.81	in

BEAM DATA

Span Length	15.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

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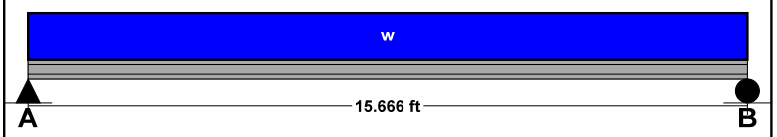

STEEL PROPERTIES
W10x30 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.5	in
Web Thickness:	tw =	0.3	in
Flange Width:	bf =	5.81	in
Flange Thickness:	tf =	0.51	in
Distance to Web Toe of Fillet:	k =	0.81	in
Moment of Inertia About X-X Axis:	Ix =	170	in4
Section Modulus About X-X Axis:	Sx =	32.4	in3
Plastic Section Modulus About X-X Axis:	Zx =	36.6	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	5.7	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	29.6	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	4.84	ft
Nominal Flexural Strength w/ safety factor:	Mn =	91317	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	29.6	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	63000	lb

Controlling Moment: 87924 ft-lb
7.833 ft from left support
Created by combining all dead and live loads.

Controlling Shear: -22450 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	147.64 in4	170 in4
Moment:	87924 ft-lb	91317 ft-lb
Shear:	-22450 lb	63000 lb

ROOF LOADING

Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	15	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft

Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	15.67	ft
Beam Self Weight:	BSW =	30	plf
Beam Uniform Live Load:	wL =	2475	plf
Beam Uniform Dead Load:	wD_adj =	391	plf
Total Uniform Load:	wT =	2866	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf35
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.25 FT
Section Adequate By: 1277.2%
Controlling Factor: Shear

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:07 PM

DEFLECTIONS Center

Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.00	IN L/MAX

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	4331	lb	4331	lb
Dead Load	802	lb	802	lb
Total Load	5133	lb	5133	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA

Span Length	5.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

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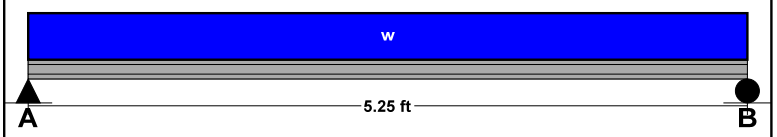

STEEL PROPERTIES

W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 6738 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 5134 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	3.7 in4	248 in4
Moment:	6738 ft-lb	136976 ft-lb
Shear:	5134 lb	70700 lb

ROOF LOADING

Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft

Wall Load: WALL = 60 plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.25	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	1650	plf
Beam Uniform Dead Load:	wD_adj =	306	plf
Total Uniform Load:	wT =	1956	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf36
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 8.5 FT
Section Adequate By: 426.4%
Controlling Factor: Moment

StruCalc 9.0

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DEFLECTIONS Center

Live Load	0.04	IN L/2524
Dead Load	0.01	in
Total Load	0.05	IN L/2168

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

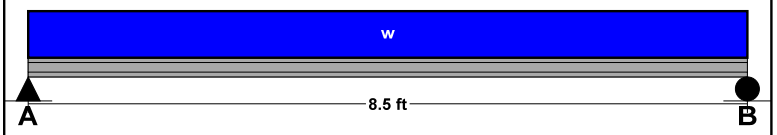
REACTIONS

	A		B	
Live Load	10519	lb	10519	lb
Dead Load	1726	lb	1726	lb
Total Load	12245	lb	12245	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA

Span Length	8.5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

LOADING DIAGRAM



STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 26019 ft-lb
4.25 ft from left support
Created by combining all dead and live loads.

Controlling Shear: -12244 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	23.58 in4	248 in4
Moment:	26019 ft-lb	136976 ft-lb
Shear:	-12244 lb	70700 lb

ROOF LOADING

Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	15	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft

Wall Load: WALL = 60 plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	8.5	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	2475	plf
Beam Uniform Dead Load:	wD_adj =	406	plf
Total Uniform Load:	wT =	2881	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf37
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.25 FT
Section Adequate By: 1277.2%
Controlling Factor: Shear

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DEFLECTIONS		Center	
Live Load	0.00	IN	L/MAX
Dead Load	0.00	in	
Total Load	0.00	IN	L/MAX

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	4331	lb	4331	lb
Dead Load	802	lb	802	lb
Total Load	5133	lb	5133	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA		
Span Length	5.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

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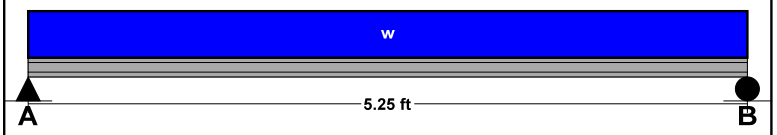

STEEL PROPERTIES
W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	10	ft
Side Two:			
Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.25	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	1650	plf
Beam Uniform Dead Load:	wD_adj =	306	plf
Total Uniform Load:	wT =	1956	plf

Controlling Moment: 6738 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 5134 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	3.7 in4	248 in4
Moment:	6738 ft-lb	136976 ft-lb
Shear:	5134 lb	70700 lb

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf38
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.25 FT
Section Adequate By: 3979.5%
Controlling Factor: Shear

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DEFLECTIONS Center

Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.00	IN L/MAX

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A	B
Live Load	1299 lb	1299 lb
Dead Load	434 lb	434 lb
Total Load	1733 lb	1733 lb
Bearing Length	1.12 in	1.12 in

BEAM DATA

Span Length	5.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

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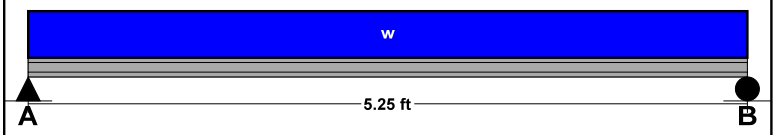

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 2275 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 1733 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	1.11 in4	248 in4
Moment:	2275 ft-lb	136976 ft-lb
Shear:	1733 lb	70700 lb

ROOF LOADING

Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	3	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.25	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	495	plf
Beam Uniform Dead Load:	wD_adj =	165	plf
Total Uniform Load:	wT =	660	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf39
Multi-Span Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 24.75 FT (20 + 4.8)
Section Adequate By: 52.5%
Controlling Factor: Deflection

StruCalc 9.0

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DEFLECTIONS	Center		Right	
Live Load	0.39	IN L/612	-0.31	IN 2L/366
Dead Load	0.07	in	-0.05	in
Total Load	0.46	IN L/517	-0.36	IN 2L/314

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A	B
Live Load	6311 lb	10757 lb
Dead Load	1245 lb	2200 lb
Total Load	7556 lb	12957 lb
Bearing Length	1.12 in	1.12 in

BEAM DATA	Center	Right
Span Length	20 ft	4.75 ft
Unbraced Length-Top	0 ft	0 ft
Unbraced Length-Bottom	20 ft	4.75 ft
Roof Pitch 1 :12		

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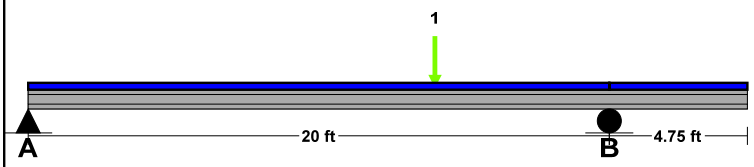


STEEL PROPERTIES
W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 47567 ft-lb
12.6 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -10106 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	162.66 in4	248 in4
Moment:	47567 ft-lb	136976 ft-lb
Shear:	-10106 lb	70700 lb

ROOF LOADING		Center	Right
Roof Live Load	RLL =	165 psf	165 psf
Roof Dead Load	RDL =	20 psf	20 psf
Roof Tributary Width Side One	TW1 =	2 ft	2 ft
Roof Tributary Width Side Two	TW2 =	1 ft	1 ft
Wall Load	WALL =	0 plf	0 plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	4538 lb
Dead Load	841 lb
Location	14 ft

* Load obtained from Load Tracker. See Summary Report for details.

BEAM LOADING	Center	Right
Total Live Load	495 plf	495 plf
Total Dead Load (Adjusted for Roof Pitch)	60 plf	60 plf
Beam Self Weight	45 plf	45 plf
Total Load	600 plf	600 plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf40
Multi-Span Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 24.75 FT (20 + 4.8)
Section Adequate By: 8.1%
Controlling Factor: Deflection

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:09 PM

DEFLECTIONS	Center		Right	
Live Load	0.53	IN L/449	-0.44	IN 2L/260
Dead Load	0.11	in	-0.08	in
Total Load	0.64	IN L/375	-0.52	IN 2L/218

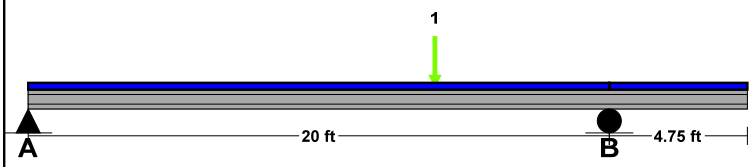
Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	6765	lb	13139	lb
Dead Load	1445	lb	2802	lb
Total Load	8210	lb	15941	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center		Right	
Span Length	20	ft	4.75	ft
Unbraced Length-Top	0	ft	0	ft
Unbraced Length-Bottom	20	ft	4.75	ft

Roof Pitch 1 :12

LOADING DIAGRAM



STEEL PROPERTIES

W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

ROOF LOADING		Center		Right	
Roof Live Load	RLL =	165	psf	165	psf
Roof Dead Load	RDL =	20	psf	20	psf
Roof Tributary Width Side One	TW1 =	1	ft	1	ft
Roof Tributary Width Side Two	TW2 =	1	ft	1	ft
Wall Load	WALL =	0	plf	0	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	11551 lb
Dead Load	2140 lb
Location	14 ft

* Load obtained from Load Tracker. See Summary Report for details.

BEAM LOADING	Center		Right	
Total Live Load	330	plf	330	plf
Total Dead Load (Adjusted for Roof Pitch)	40	plf	40	plf
Beam Self Weight	45	plf	45	plf
Total Load	415	plf	415	plf

Controlling Moment: 74266 ft-lb
14.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -13969 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	229.35 in4	248 in4
Moment:	74266 ft-lb	136976 ft-lb
Shear:	-13969 lb	70700 lb

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf41
Multi-Span Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 24.75 FT (20 + 4.8)
Section Adequate By: 8.1%
Controlling Factor: Deflection

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:10 PM

DEFLECTIONS	Center		Right	
Live Load	0.53	IN L/449	-0.44	IN 2L/260
Dead Load	0.11	in	-0.08	in
Total Load	0.64	IN L/375	-0.52	IN 2L/218

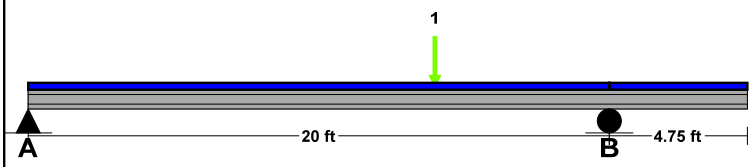
Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	6765	lb	13139	lb
Dead Load	1445	lb	2802	lb
Total Load	8210	lb	15941	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center		Right	
Span Length	20	ft	4.75	ft
Unbraced Length-Top	0	ft	0	ft
Unbraced Length-Bottom	20	ft	4.75	ft

Roof Pitch 1 :12

LOADING DIAGRAM



STEEL PROPERTIES
W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 74266 ft-lb
14.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -13969 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	229.35 in4	248 in4
Moment:	74266 ft-lb	136976 ft-lb
Shear:	-13969 lb	70700 lb

ROOF LOADING		Center		Right	
Roof Live Load	RLL =	165	psf	165	psf
Roof Dead Load	RDL =	20	psf	20	psf
Roof Tributary Width Side One	TW1 =	1	ft	1	ft
Roof Tributary Width Side Two	TW2 =	1	ft	1	ft
Wall Load	WALL =	0	plf	0	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	11551 lb
Dead Load	2140 lb
Location	14 ft

* Load obtained from Load Tracker. See Summary Report for details.

BEAM LOADING	Center		Right	
Total Live Load	330	plf	330	plf
Total Dead Load (Adjusted for Roof Pitch)	40	plf	40	plf
Beam Self Weight	45	plf	45	plf
Total Load	415	plf	415	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf42
Multi-Span Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 24.75 FT (20 + 4.8)
Section Adequate By: 52.5%
Controlling Factor: Deflection

StruCalc 9.0

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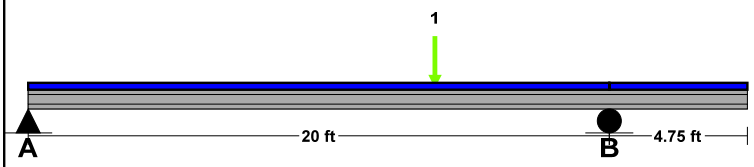
DEFLECTIONS	Center		Right	
Live Load	0.39	IN L/612	-0.31	IN 2L/366
Dead Load	0.07	in	-0.05	in
Total Load	0.46	IN L/517	-0.36	IN 2L/314

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A	B
Live Load	6311 lb	10757 lb
Dead Load	1245 lb	2200 lb
Total Load	7556 lb	12957 lb
Bearing Length	1.12 in	1.12 in

BEAM DATA	Center	Right
Span Length	20 ft	4.75 ft
Unbraced Length-Top	0 ft	0 ft
Unbraced Length-Bottom	20 ft	4.75 ft
Roof Pitch 1 :12		

LOADING DIAGRAM



STEEL PROPERTIES
W10x45 - A992-50

Properties:			
Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3
Design Properties per AISC 14th Edition Steel Manual:			
Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 47567 ft-lb
12.6 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -10106 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	162.66 in4	248 in4
Moment:	47567 ft-lb	136976 ft-lb
Shear:	-10106 lb	70700 lb

ROOF LOADING		Center	Right
Roof Live Load	RLL =	165 psf	165 psf
Roof Dead Load	RDL =	20 psf	20 psf
Roof Tributary Width Side One	TW1 =	2 ft	2 ft
Roof Tributary Width Side Two	TW2 =	1 ft	1 ft
Wall Load	WALL =	0 plf	0 plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	4538 lb
Dead Load	841 lb
Location	14 ft

* Load obtained from Load Tracker. See Summary Report for details.

BEAM LOADING	Center	Right
Total Live Load	495 plf	495 plf
Total Dead Load (Adjusted for Roof Pitch)	60 plf	60 plf
Beam Self Weight	45 plf	45 plf
Total Load	600 plf	600 plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf43
Roof Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.333 FT
Section Adequate By: 200.0%
Controlling Factor: Shear

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DEFLECTIONS Center

Live Load	0.01	IN L/9952
Dead Load	0.00	in
Total Load	0.01	IN L/8626

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	20365	lb	5258	lb
Dead Load	3206	lb	800	lb
Total Load	23571	lb	6058	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA

Span Length	5.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12

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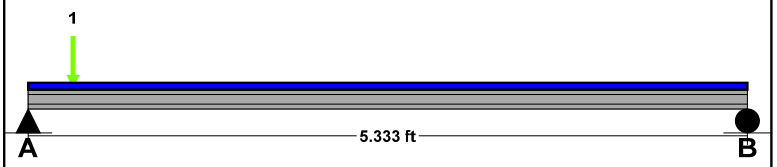

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 10175 ft-lb
2.667 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 23571 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	5.98 in4	248 in4
Moment:	10175 ft-lb	136976 ft-lb
Shear:	23571 lb	70700 lb

ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	9.5	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	0	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	5.33	ft
Beam Self Weight:	BSW =	45	plf
Beam Uniform Live Load:	wL =	1568	plf
Beam Uniform Dead Load:	wD_adj =	236	plf
Total Uniform Load:	wT =	1803	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	17263 lb
Dead Load	2749 lb
Location	0.33 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf44
Roof Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 9.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 5.6%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:11 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.02	IN L/2056
Dead Load	0.00	in
Total Load	0.02	IN L/1789

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	3888	lb	3888	lb
Dead Load	580	lb	580	lb
Total Load	4468	lb	4468	lb
Bearing Length	2.38	in	2.38	in

BEAM DATA

Span Length	3.3	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1075	psi
	Cd=1.15 CF=1.10			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 3630 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 2413 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	40.51 in3	42.78 in3
Area (Shear):	17.48 in2	27.75 in2
Moment of Inertia (deflection):	23.1 in4	197.86 in4
Moment:	3630 ft-lb	3833 ft-lb
Shear:	2413 lb	3830 lb

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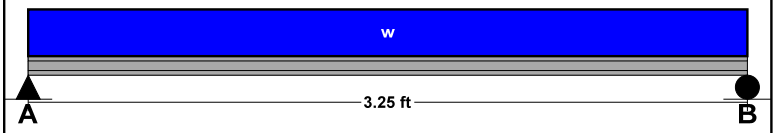

ROOF LOADING

Side One:			
Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	14.5	ft
Side Two:			
Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	3.25	ft
Beam Self Weight:	BSW =	6	plf
Beam Uniform Live Load:	wL =	2393	plf
Beam Uniform Dead Load:	wD_adj =	357	plf
Total Uniform Load:	wT =	2749	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: rf45
Roof Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 11.25 IN x 3.666 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 11.6%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/24/2018 4:35:12 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.02	IN L/2577
Dead Load	0.00	in
Total Load	0.02	IN L/2242

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	4385	lb	4385	lb
Dead Load	657	lb	657	lb
Total Load	5042	lb	5042	lb
Bearing Length	2.69	in	2.69	in

BEAM DATA		
Span Length	3.7	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	1	:12
Roof Duration Factor	1.15	

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 978	psi
	Cd=1.15 CF=1.00			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 4621 ft-lb
1.833 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -2521 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	56.73 in3	63.28 in3
Area (Shear):	18.27 in2	33.75 in2
Moment of Inertia (deflection):	33.15 in4	355.96 in4
Moment:	4621 ft-lb	5155 ft-lb
Shear:	-2521 lb	4658 lb

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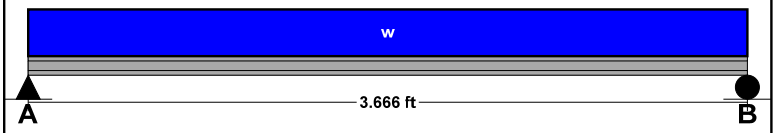

ROOF LOADING
Side One:

Roof Live Load:	LL =	165	psf
Roof Dead Load:	DL =	20	psf
Tributary Width:	TW =	14.5	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	60	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	3.67	ft
Beam Self Weight:	BSW =	7	plf
Beam Uniform Live Load:	wL =	2393	plf
Beam Uniform Dead Load:	wD_adj =	358	plf
Total Uniform Load:	wT =	2751	plf

Basement Floor Design

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff01
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 11.875 IN x 13.5 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 8.0%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:28 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.32	IN L/503
Dead Load	0.24	in
Total Load	0.56	IN L/291

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	3661	lb	3379	lb
Dead Load	2894	lb	2843	lb
Total Load	6555	lb	6222	lb
Bearing Length	1.66	in	1.58	in

BEAM DATA	Center	
Span Length	13.5	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

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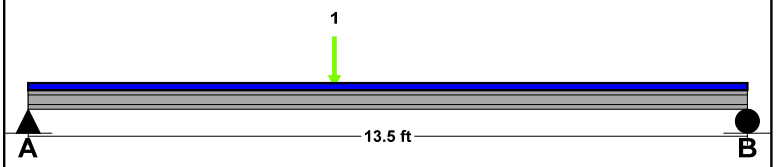

MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2604	psi
	Cd=1.00 CF=1.00			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 24797 ft-lb
6.75 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 5819 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	114.29 in3	123.39 in3
Area (Shear):	30.63 in2	62.34 in2
Moment of Inertia (deflection):	604.98 in4	732.62 in4
Moment:	24797 ft-lb	26772 ft-lb
Shear:	5819 lb	11845 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	40	psf
Floor Dead Load	FDL =	40	psf	40	psf
Floor Tributary Width	FTW =	2.5	ft	7	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	380	plf
Beam Total Dead Load:	wD =	380	plf
Beam Self Weight:	BSW =	19	plf
Total Maximum Load:	wT =	779	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	1910 lb
Dead Load	344 lb
Location	5.75 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff02
Multi-Span Combination Roof And Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 16.0 IN x 4.0 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 43.1%
Controlling Factor: Shear

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:29 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center		Right	
Live Load	0.01	IN L/5978	0.00	IN 2L/MAX
Dead Load	0.00	in	0.00	in
Total Load	0.01	IN L/4955	0.00	IN 2L/MAX

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	9285	lb	19615	lb
Dead Load	2436	lb	6288	lb
Total Load	11721	lb	25903	lb
Bearing Length	2.98	in	6.58	in

BEAM DATA	Center	Right
Span Length	4 ft	2 ft
Unbraced Length-Top	0 ft	0 ft
Unbraced Length-Bottom	4 ft	2 ft
Notch Depth	1.00	
	0.00	

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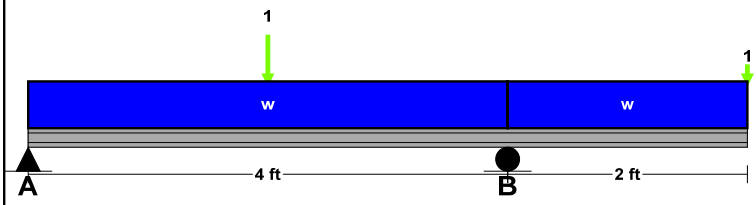


MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2875	psi
	Cd=1.15 CF=0.96			
Shear Stress:	Fv = 285	psi	Fv' = 328	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 15403 ft-lb
2.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2, 3
Controlling Shear: -12824 lb
At a distance d from right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2, 3

Comparisons with required sections:	Req'd	Provided
Section Modulus:	64.29 in3	224 in3
Area (Shear):	58.69 in2	84 in2
Moment of Inertia (deflection):	107.92 in4	1792 in4
Moment:	15403 ft-lb	53671 ft-lb
Shear:	-12824 lb	18354 lb

ROOF LOADING		Center		Right	
Live Load	RLL =	165	psf	165	psf
Dead Load	RDL =	20	psf	20	psf
Tributary Width Side One	TW1 =	14.3	ft	0	ft
Tributary Width Side Two	TW2 =	0	ft	0	ft
FLOOR LOADING		Center		Right	
Live Load	FLL =	40	psf	40	psf
Dead Load	FDL =	40	psf	40	psf
Tributary Width Side One	TW1 =	13	ft	13	ft
Tributary Width Side Two	TW2 =	0	ft	0	ft
Wall Load	WALL =	300	plf	300	plf

BEAM LOADING	Center		Right	
Roof Uniform Live Load:	2365	plf	0	plf
Roof Uniform Dead Load:	288	plf	0	plf
Floor Uniform Live Load:	520	plf	520	plf
Floor Uniform Dead Load:	520	plf	520	plf
Beam Self Weight:	26	plf	26	plf
Combined Uniform Live Load:	2885	plf	520	plf
Combined Uniform Dead Load:	1134	plf	846	plf
Combined Uniform Total Load:	4019	plf	1366	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	11935 lb
Dead Load	1839 lb
Location	2 ft

RIGHT SPAN

Load Number	One *
Live Load	4385 lb
Dead Load	657 lb
Location	2 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff03
Combination Roof And Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 6.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 25.3%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:29 PM

CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.04	IN L/1681
Dead Load	0.03	in
Total Load	0.08	IN L/948

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	1781	lb	2471	lb
Dead Load	1459	lb	1612	lb
Total Load	3240	lb	4083	lb
Bearing Length	1.15	in	1.45	in

BEAM DATA	Center	
Span Length	6.25	ft
Unbraced Length-Top	0	ft
Roof Pitch	1	:12
Floor Duration Factor	1.00	
Roof Duration Factor	1.15	
Notch Depth	0.00	

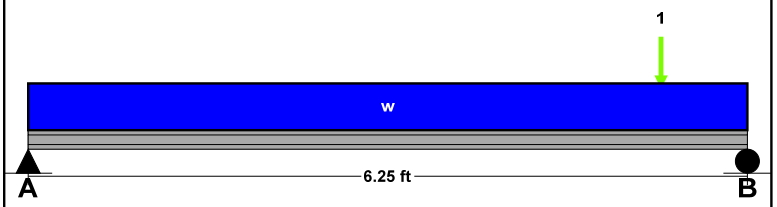
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1237	psi
	Cd=1.15 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 5279 ft-lb
3.125 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -3308 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	51.23 in3	64.17 in3
Area (Shear):	23.97 in2	41.63 in2
Moment of Inertia (deflection):	75.14 in4	296.79 in4
Moment:	5279 ft-lb	6613 ft-lb
Shear:	-3308 lb	5744 lb

LOADING DIAGRAM



ROOF LOADING

		Side 1	Side 2
Roof Live Load	RLL =	165 psf	165 psf
Roof Dead Load	RDL =	20 psf	20 psf
Roof Tributary Width	RTW =	1 ft	2 ft

FLOOR LOADING

		Side 1	Side 2
Floor Live Load	FLL =	40 psf	0 psf
Floor Dead Load	FDL =	40 psf	0 psf
Floor Tributary Width	FTW =	1 ft	0 ft
Wall Load	WALL =	350 plf	

BEAM LOADING

Roof Uniform Live Load:	wL-roof =	495 plf
Roof Uniform Dead Load:	wD-roof =	60 plf
Floor Uniform Live Load:	wL-floor =	40 plf
Floor Uniform Dead Load:	wD-floor =	40 plf
Beam Self Weight:	BSW =	9 plf
Combined Uniform Live Load:	wL =	535 plf
Combined Uniform Dead Load:	wD =	459 plf
Combined Uniform Total Load:	wT =	994 plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	908 lb
Dead Load	202 lb
Location	5.5 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff04
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 11.25 IN x 6.666 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 17.9%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.02	IN L/3752
Dead Load	0.04	in
Total Load	0.06	IN L/1303

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

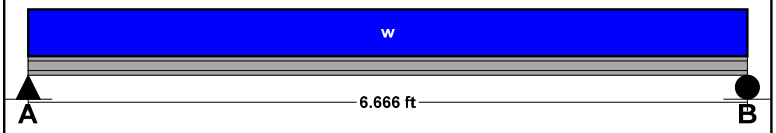
REACTIONS A B

	A		B	
Live Load	1367	lb	1367	lb
Dead Load	2569	lb	2569	lb
Total Load	3936	lb	3936	lb
Bearing Length	1.40	in	1.40	in

BEAM DATA Center

Span Length	6.67	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

LOADING DIAGRAM



MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 978	psi
	Cd=1.00 CF=1.00 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 6558 ft-lb
3.333 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 2834 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:

	Req'd	Provided
Section Modulus:	80.51 in3	94.92 in3
Area (Shear):	23.61 in2	50.63 in2
Moment of Inertia (deflection):	98.35 in4	533.94 in4
Moment:	6558 ft-lb	7732 ft-lb
Shear:	2834 lb	6075 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	10.3	ft	0	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	410	plf
Beam Total Dead Load:	wD =	760	plf
Beam Self Weight:	BSW =	11	plf
Total Maximum Load:	wT =	1181	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff05
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 5.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 74.1%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.01	IN L/5835
Dead Load	0.02	in
Total Load	0.03	IN L/1826

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS A B

Live Load	788	lb	788	lb
Dead Load	1729	lb	1729	lb
Total Load	2517	lb	2517	lb
Bearing Length	0.89	in	0.89	in

BEAM DATA Center

Span Length	5.25	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

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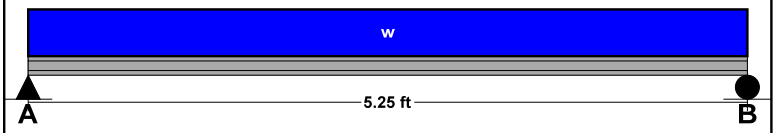

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1075	psi
	Cd=1.00 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 3304 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1812 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:

	Req'd	Provided
Section Modulus:	36.87 in3	64.17 in3
Area (Shear):	15.1 in2	41.63 in2
Moment of Inertia (deflection):	39.02 in4	296.79 in4
Moment:	3304 ft-lb	5750 ft-lb
Shear:	-1812 lb	4995 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	7.5	ft	0	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	300	plf
Beam Total Dead Load:	wD =	650	plf
Beam Self Weight:	BSW =	9	plf
Total Maximum Load:	wT =	959	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff06
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W16x40 x 19.5 FT
Section Adequate By: 11.1%
Controlling Factor: Moment

StruCalc 9.0

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DEFLECTIONS	Center	
Live Load	0.59	IN L/400
Dead Load	0.21	in
Total Load	0.80	IN L/293

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	22676	lb	22676	lb
Dead Load	8946	lb	8946	lb
Total Load	31622	lb	31622	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center	
Span Length	19.5	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W16x40 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	16	in
Web Thickness:	tw =	0.31	in
Flange Width:	bf =	7	in
Flange Thickness:	tf =	0.51	in
Distance to Web Toe of Fillet:	k =	0.91	in
Moment of Inertia About X-X Axis:	Ix =	518	in4
Section Modulus About X-X Axis:	Sx =	64.7	in3
Plastic Section Modulus About X-X Axis:	Zx =	73	in3

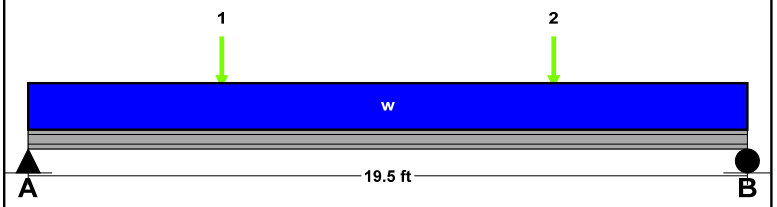
Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.93	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	46.51	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	5.55	ft
Nominal Flexural Strength w/ safety factor:	Mn =	182136	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	46.51	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	97600	lb

Controlling Moment: 164002 ft-lb
9.75 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 31622 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	466.23 in4	518 in4
Moment:	164002 ft-lb	182136 ft-lb
Shear:	31622 lb	97600 lb

LOADING DIAGRAM



FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	2	ft	0	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	80	plf
Beam Total Dead Load:	wD =	430	plf
Beam Self Weight:	BSW =	40	plf
Total Maximum Load:	wT =	550	plf

POINT LOADS - CENTER SPAN

Load Number	One *	Two *
Live Load	21896 lb	21896 lb
Dead Load	4363 lb	4363 lb
Location	5.25 ft	14.25 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff07
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 263.3%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.01	IN L/6155

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	683	lb	683	lb
Dead Load	1266	lb	1266	lb
Total Load	1949	lb	1949	lb
Bearing Length	0.69	in	0.69	in

BEAM DATA	Center	
Span Length	3.25	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

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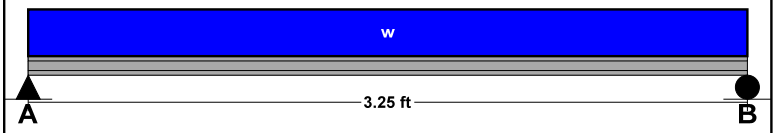

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1075	psi
	Cd=1.00 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1583 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1052 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	17.66 in3	64.17 in3
Area (Shear):	8.77 in2	41.63 in2
Moment of Inertia (deflection):	11.57 in4	296.79 in4
Moment:	1583 ft-lb	5750 ft-lb
Shear:	-1052 lb	4995 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	10.5	ft	0	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	420	plf
Beam Total Dead Load:	wD =	770	plf
Beam Self Weight:	BSW =	9	plf
Total Maximum Load:	wT =	1199	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff08
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 7.25 IN x 7.25 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 35.1%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS Center

Live Load	0.08	IN L/1056
Dead Load	0.15	in
Total Load	0.24	IN L/369

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS

	A		B	
Live Load	1523	lb	1523	lb
Dead Load	2834	lb	2834	lb
Total Load	4357	lb	4357	lb
Bearing Length	1.11	in	1.11	in

BEAM DATA Center

Span Length	7.25	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

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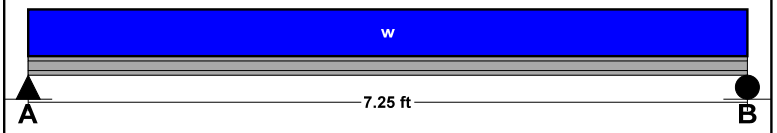

MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2785	psi
	Cd=1.00 CF=1.07			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 7897 ft-lb
3.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -3660 lb
At a distance d from support.
Created by combining all dead and live loads.

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	10.5	ft	0	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	420	plf
Beam Total Dead Load:	wD =	770	plf
Beam Self Weight:	BSW =	12	plf
Total Maximum Load:	wT =	1202	plf

Comparisons with required sections:

	Req'd	Provided
Section Modulus:	34.03 in3	45.99 in3
Area (Shear):	19.26 in2	38.06 in2
Moment of Inertia (deflection):	108.46 in4	166.72 in4
Moment:	7897 ft-lb	10672 ft-lb
Shear:	-3660 lb	7232 lb

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff09
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 3.25 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 263.3%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS		Center
Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.01	IN L/6155

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	683	lb	683	lb
Dead Load	1266	lb	1266	lb
Total Load	1949	lb	1949	lb
Bearing Length	0.69	in	0.69	in

BEAM DATA	Center	
Span Length	3.25	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

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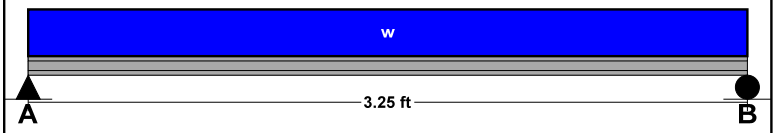

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1075	psi
	Cd=1.00 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1583 ft-lb
1.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1052 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	17.66 in3	64.17 in3
Area (Shear):	8.77 in2	41.63 in2
Moment of Inertia (deflection):	11.57 in4	296.79 in4
Moment:	1583 ft-lb	5750 ft-lb
Shear:	-1052 lb	4995 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	10.5	ft	0	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	420	plf
Beam Total Dead Load:	wD =	770	plf
Beam Self Weight:	BSW =	9	plf
Total Maximum Load:	wT =	1199	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff10
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 11.25 IN x 12.75 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 19.3%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.25	IN L/622
Dead Load	0.26	in
Total Load	0.50	IN L/305

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	3124	lb	3124	lb
Dead Load	3241	lb	3241	lb
Total Load	6365	lb	6365	lb
Bearing Length	1.62	in	1.62	in

BEAM DATA	Center	
Span Length	12.75	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

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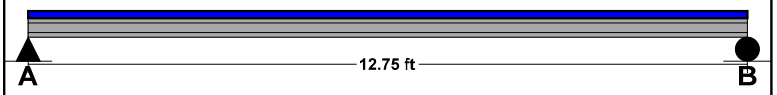

MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2623	psi
	Cd=1.00 CF=1.01			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 20289 ft-lb
6.375 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 5474 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	92.82 in3	110.74 in3
Area (Shear):	28.81 in2	59.06 in2
Moment of Inertia (deflection):	490.06 in4	622.92 in4
Moment:	20289 ft-lb	24206 ft-lb
Shear:	5474 lb	11222 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	40	psf
Floor Dead Load	FDL =	40	psf	40	psf
Floor Tributary Width	FTW =	7.3	ft	5	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	490	plf
Beam Total Dead Load:	wD =	490	plf
Beam Self Weight:	BSW =	18	plf
Total Maximum Load:	wT =	998	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff11
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.5 IN x 9.25 IN x 3.75 FT
#2 - Douglas-Fir-Larch (North) - Dry Use
Section Adequate By: 214.9%
Controlling Factor: Moment

StruCalc 9.0

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS	Center	
Live Load	0.00	IN L/MAX
Dead Load	0.01	in
Total Load	0.01	IN L/4624

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	638	lb	638	lb
Dead Load	1310	lb	1310	lb
Total Load	1948	lb	1948	lb
Bearing Length	0.69	in	0.69	in

BEAM DATA	Center	
Span Length	3.75	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

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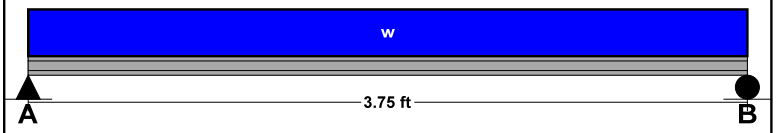

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch (North)

	Base Values		Adjusted	
Bending Stress:	Fb = 850	psi	Fb' = 1075	psi
	Cd=1.00 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1826 ft-lb
1.875 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 1169 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	20.38 in3	64.17 in3
Area (Shear):	9.74 in2	41.63 in2
Moment of Inertia (deflection):	15.41 in4	296.79 in4
Moment:	1826 ft-lb	5750 ft-lb
Shear:	1169 lb	4995 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	40	psf
Floor Dead Load	FDL =	40	psf	40	psf
Floor Tributary Width	FTW =	1	ft	7.5	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	340	plf
Beam Total Dead Load:	wD =	690	plf
Beam Self Weight:	BSW =	9	plf
Total Maximum Load:	wT =	1039	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff12
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 7.25 IN x 6.25 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 36.4%
Controlling Factor: Moment

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CAUTIONS
* Laminations are to be fully connected to provide uniform transfer of loads to all members

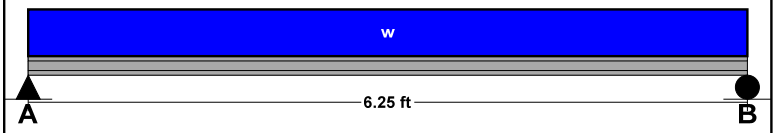
DEFLECTIONS	Center	
Live Load	0.07	IN L/1116
Dead Load	0.11	in
Total Load	0.17	IN L/432

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	1938	lb	1938	lb
Dead Load	3068	lb	3068	lb
Total Load	5006	lb	5006	lb
Bearing Length	1.27	in	1.27	in

BEAM DATA	Center	
Span Length	6.25	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

LOADING DIAGRAM



MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2785	psi
	Cd=1.00 CF=1.07			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 7822 ft-lb
3.125 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 4105 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	33.71 in3	45.99 in3
Area (Shear):	21.6 in2	38.06 in2
Moment of Inertia (deflection):	92.61 in4	166.72 in4
Moment:	7822 ft-lb	10672 ft-lb
Shear:	4105 lb	7232 lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	40	psf
Floor Dead Load	FDL =	40	psf	40	psf
Floor Tributary Width	FTW =	7.5	ft	8	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	620	plf
Beam Total Dead Load:	wD =	970	plf
Beam Self Weight:	BSW =	12	plf
Total Maximum Load:	wT =	1602	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff13
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 15.0 FT
Section Adequate By: 239.5%
Controlling Factor: Deflection

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DEFLECTIONS	Center	
Live Load	0.08	IN L/2273
Dead Load	0.14	in
Total Load	0.22	IN L/815

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	3750	lb	3750	lb
Dead Load	6713	lb	6713	lb
Total Load	10463	lb	10463	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center	
Span Length	15	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

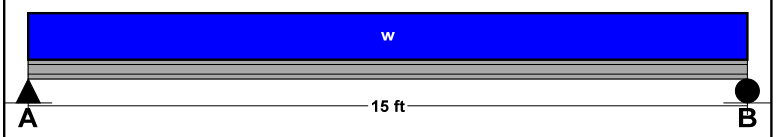
Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 39234 ft-lb
7.5 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 10463 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	73.05 in4	248 in4
Moment:	39234 ft-lb	136976 ft-lb
Shear:	10463 lb	70700 lb

LOADING DIAGRAM



FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	40	psf
Floor Dead Load	FDL =	40	psf	40	psf
Floor Tributary Width	FTW =	8.3	ft	4.3	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	500	plf
Beam Total Dead Load:	wD =	850	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	1395	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff14
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 18.25 FT
Section Adequate By: 88.5%
Controlling Factor: Deflection

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DEFLECTIONS Center

Live Load	0.17	IN L/1262
Dead Load	0.31	in
Total Load	0.48	IN L/452

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS

	A		B	
Live Load	4563	lb	4563	lb
Dead Load	8167	lb	8167	lb
Total Load	12730	lb	12730	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA

	Center	
Span Length	18.25	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 58078 ft-lb
9.125 ft from left support
Created by combining all dead and live loads.

Controlling Shear: -12729 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	131.55 in4	248 in4
Moment:	58078 ft-lb	136976 ft-lb
Shear:	-12729 lb	70700 lb

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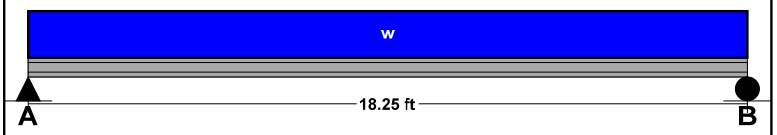

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	40	psf
Floor Dead Load	FDL =	40	psf	40	psf
Floor Tributary Width	FTW =	8.3	ft	4.3	ft
Wall Load	WALL =	350	plf		

BEAM LOADING

Beam Total Live Load:	wL =	500	plf
Beam Total Dead Load:	wD =	850	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	1395	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff15
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.25 FT
Section Adequate By: 3087.4%
Controlling Factor: Shear

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DEFLECTIONS Center

Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.00	IN L/MAX

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS

	A		B	
Live Load	1050	lb	1050	lb
Dead Load	1168	lb	1168	lb
Total Load	2218	lb	2218	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA Center

Span Length	5.25	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 2911 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -2218 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	1.9 in4	248 in4
Moment:	2911 ft-lb	136976 ft-lb
Shear:	-2218 lb	70700 lb

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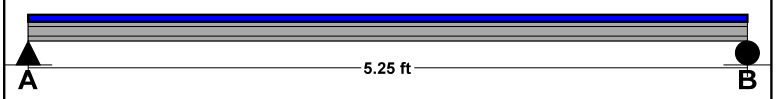

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	10	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	400	plf
Beam Total Dead Load:	wD =	400	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	845	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff16
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.25 FT
Section Adequate By: 2382.3%
Controlling Factor: Shear

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DEFLECTIONS		Center	
Live Load	0.00	IN	L/MAX
Dead Load	0.00	in	
Total Load	0.00	IN	L/MAX

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	1365	lb	1365	lb
Dead Load	1483	lb	1483	lb
Total Load	2848	lb	2848	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center	
Span Length	5.25	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 3738 ft-lb
2.625 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 2848 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	2.44 in4	248 in4
Moment:	3738 ft-lb	136976 ft-lb
Shear:	2848 lb	70700 lb

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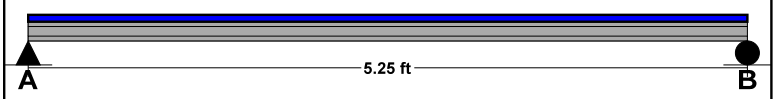

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	13	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	520	plf
Beam Total Dead Load:	wD =	520	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	1085	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff17
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 9.0 FT
Section Adequate By: 1146.9%
Controlling Factor: Moment

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DEFLECTIONS		Center
Live Load	0.01	IN L/MAX
Dead Load	0.01	in
Total Load	0.02	IN L/4850

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	2340 lb	2340 lb
Dead Load	2543 lb	2543 lb
Total Load	4883 lb	4883 lb
Bearing Length	1.12 in	1.12 in

BEAM DATA	Center
Span Length	9 ft
Unbraced Length-Top	0 ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 10986 ft-lb
4.5 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 4883 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	12.27 in4	248 in4
Moment:	10986 ft-lb	136976 ft-lb
Shear:	4883 lb	70700 lb

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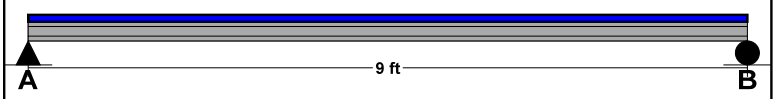

FLOOR LOADING

		Side 1	Side 2
Floor Live Load	FLL =	40 psf	0 psf
Floor Dead Load	FDL =	40 psf	0 psf
Floor Tributary Width	FTW =	13 ft	0 ft
Wall Load	WALL =	0 plf	

BEAM LOADING

Beam Total Live Load:	wL =	520	plf
Beam Total Dead Load:	wD =	520	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	1085	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff18
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.5 FT
Section Adequate By: 1729.8%
Controlling Factor: Shear

StruCalc 9.0

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DEFLECTIONS	Center	
Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.00	IN L/MAX

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	1870	lb	1870	lb
Dead Load	1994	lb	1994	lb
Total Load	3864	lb	3864	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center	
Span Length	5.5	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 5313 ft-lb
2.75 ft from left support
Created by combining all dead and live loads.

Controlling Shear: 3864 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	3.63 in4	248 in4
Moment:	5313 ft-lb	136976 ft-lb
Shear:	3864 lb	70700 lb

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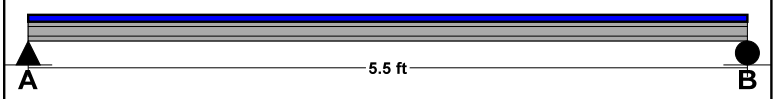


FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	17	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	680	plf
Beam Total Dead Load:	wD =	680	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	1405	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff19
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 9.0 FT
Section Adequate By: 1997.4%
Controlling Factor: Moment

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:35 PM

DEFLECTIONS		Center
Live Load	0.01	IN L/MAX
Dead Load	0.01	in
Total Load	0.01	IN L/8159

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	1350	lb	1350	lb
Dead Load	1553	lb	1553	lb
Total Load	2903	lb	2903	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center	
Span Length	9	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

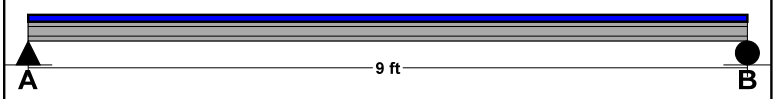
Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 6531 ft-lb
4.5 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -2903 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	7.3 in4	248 in4
Moment:	6531 ft-lb	136976 ft-lb
Shear:	-2903 lb	70700 lb

LOADING DIAGRAM



FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	7.5	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	300	plf
Beam Total Dead Load:	wD =	300	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	645	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff20
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.5 FT
Section Adequate By: 8920.7%
Controlling Factor: Shear

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:35 PM

DEFLECTIONS	Center	
Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.00	IN L/MAX

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	330	lb	330	lb
Dead Load	454	lb	454	lb
Total Load	784	lb	784	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center	
Span Length	5.5	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

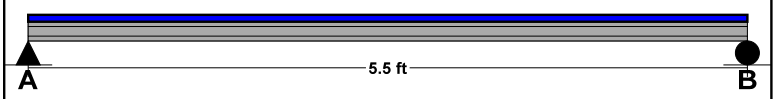
Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 1078 ft-lb
2.75 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 784 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	0.74 in4	248 in4
Moment:	1078 ft-lb	136976 ft-lb
Shear:	784 lb	70700 lb

LOADING DIAGRAM



FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	3	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	120	plf
Beam Total Dead Load:	wD =	120	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	285	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff21
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 5.5 FT
Section Adequate By: 8920.7%
Controlling Factor: Shear

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:35 PM

DEFLECTIONS	Center	
Live Load	0.00	IN L/MAX
Dead Load	0.00	in
Total Load	0.00	IN L/MAX

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	330 lb	330 lb
Dead Load	454 lb	454 lb
Total Load	784 lb	784 lb
Bearing Length	1.12 in	1.12 in

BEAM DATA	Center
Span Length	5.5 ft
Unbraced Length-Top	0 ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

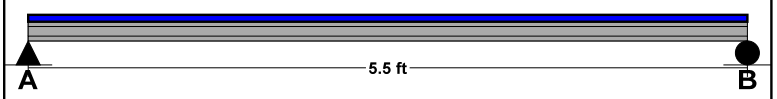
Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 1078 ft-lb
2.75 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 784 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	0.74 in4	248 in4
Moment:	1078 ft-lb	136976 ft-lb
Shear:	784 lb	70700 lb

LOADING DIAGRAM



FLOOR LOADING

		Side 1	Side 2
Floor Live Load	FLL =	40 psf	0 psf
Floor Dead Load	FDL =	40 psf	0 psf
Floor Tributary Width	FTW =	3 ft	0 ft
Wall Load	WALL =	0 plf	

BEAM LOADING

Beam Total Live Load:	wL =	120	plf
Beam Total Dead Load:	wD =	120	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	285	plf

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff22
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 24.0 FT
Section Adequate By: 125.9%
Controlling Factor: Deflection

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:36 PM

DEFLECTIONS Center

Live Load	0.24	IN L/1221
Dead Load	0.30	in
Total Load	0.53	IN L/542

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS

	A		B	
Live Load	3893	lb	1732	lb
Dead Load	4687	lb	2339	lb
Total Load	8580	lb	4071	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA Center

Span Length	24	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

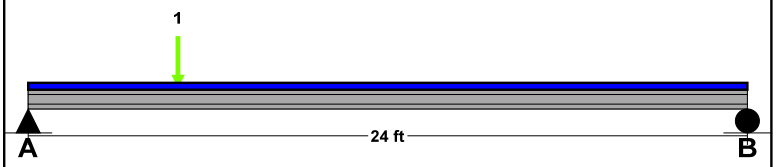
Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 40332 ft-lb
12.0 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 8580 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	109.79 in4	248 in4
Moment:	40332 ft-lb	136976 ft-lb
Shear:	8580 lb	70700 lb

LOADING DIAGRAM



FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	2	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	80	plf
Beam Total Dead Load:	wD =	80	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	205	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	3705 lb
Dead Load	4026 lb
Location	5 ft

* Load obtained from Load Tracker. See Summary Report for details.

Project: 16032 (Burton Solitude Spec Home V2 - Think)

Location: ff23
Uniformly Loaded Floor Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W10x45 x 24.0 FT
Section Adequate By: 109.3%
Controlling Factor: Deflection

StruCalc 9.0

StruCalc Version 10.0.1.5 8/27/2018 3:49:36 PM

DEFLECTIONS Center

Live Load	0.26	IN L/1122
Dead Load	0.32	in
Total Load	0.57	IN L/502

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS

	A		B	
Live Load	4293	lb	1837	lb
Dead Load	5092	lb	2445	lb
Total Load	9385	lb	4282	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA Center

Span Length	24	ft
Unbraced Length-Top	0	ft

STEEL PROPERTIES
W10x45 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	10.1	in
Web Thickness:	tw =	0.35	in
Flange Width:	bf =	8.02	in
Flange Thickness:	tf =	0.62	in
Distance to Web Toe of Fillet:	k =	1.12	in
Moment of Inertia About X-X Axis:	Ix =	248	in4
Section Modulus About X-X Axis:	Sx =	49.1	in3
Plastic Section Modulus About X-X Axis:	Zx =	54.9	in3

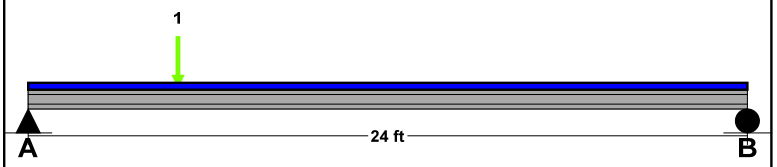
Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.47	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	22.46	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	7.1	ft
Nominal Flexural Strength w/ safety factor:	Mn =	136976	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	22.46	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	70700	lb

Controlling Moment: 44345 ft-lb
12.0 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 9385 lb
At support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	118.48 in4	248 in4
Moment:	44345 ft-lb	136976 ft-lb
Shear:	9385 lb	70700 lb

LOADING DIAGRAM



FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	40	psf	0	psf
Floor Tributary Width	FTW =	2	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	80	plf
Beam Total Dead Load:	wD =	80	plf
Beam Self Weight:	BSW =	45	plf
Total Maximum Load:	wT =	205	plf

POINT LOADS - CENTER SPAN

Load Number	One *
Live Load	4210 lb
Dead Load	4537 lb
Location	5 ft

* Load obtained from Load Tracker. See Summary Report for details.

Wood Post Design

Based on ASCE 7-10 & IBC 2015

Post Height	Post Type	Allowable Vertical Load
8'-0"	(2) 2x4	2250#
8'-0"	(3) 2x4	7800#
8'-0"	(4) 2x4	11500#
8'-0"	(5) 2x4	14000#
8'-0"	4x4	6500#
8'-0"	4x6	10000#
8'-0"	4x8	14000#
8'-0"	4x10	17000#

Post Height	Post Type	Allowable Vertical Load
8'-0"	(2) 2x6	4000#
8'-0"	(3) 2x6	12000#
8'-0"	(4) 2x6	22000#
8'-0"	(5) 2x6	30000#
8'-0"	4x6	10000#
8'-0"	6x6	17500#
8'-0"	6x8	23000#

Post Height	Post Type	Allowable Vertical Load
9'-0"	(2) 2x4	2100#
9'-0"	(3) 2x4	6500#
9'-0"	(4) 2x4	9500#
9'-0"	(5) 2x4	12000#
9'-0"	4x4	5500#
9'-0"	4x6	8500#
9'-0"	4x8	11500#
9'-0"	4x10	14000#

Post Height	Post Type	Allowable Vertical Load
9'-0"	(2) 2x6	3350#
9'-0"	(3) 2x6	10000#
9'-0"	(4) 2x6	20000#
9'-0"	(5) 2x6	29000#
9'-0"	4x6	10000#
9'-0"	6x6	16000#
9'-0"	6x8	22000#

Post Height	Post Type	Allowable Vertical Load
10'-0"	(2) 2x4	1750#
10'-0"	(3) 2x4	5450#
10'-0"	(4) 2x4	7900#
10'-0"	(5) 2x4	9900#
10'-0"	4x4	4550#
10'-0"	4x6	7150#
10'-0"	4x8	9400#
10'-0"	4x10	11950#

Post Height	Post Type	Allowable Vertical Load
10'-0"	(2) 2x6	2750#
10'-0"	(3) 2x6	8550#
10'-0"	(4) 2x6	17000#
10'-0"	(5) 2x6	26000#
10'-0"	4x6	7150#
10'-0"	6x6	14500#
10'-0"	6x8	19900#
10'-0"	8x8	34000#

Post Height	Post Type	Allowable Vertical Load
11'-0"	(2) 2x4	1400#
11'-0"	(3) 2x4	4700#
11'-0"	(4) 2x4	6600#
11'-0"	(5) 2x4	8300#
11'-0"	4x4	3800#
11'-0"	4x6	6000#
11'-0"	4x8	7900#
11'-0"	4x10	10100#

Post Height	Post Type	Allowable Vertical Load
11'-0"	(2) 2x6	2300#
11'-0"	(3) 2x6	7400#
11'-0"	(4) 2x6	15500#
11'-0"	(5) 2x6	25000#
11'-0"	4x6	6000#
11'-0"	6x6	13500#
11'-0"	6x8	19000#

Post Height	Post Type	Allowable Vertical Load
12'-0"	(2) 2x4	1200#
12'-0"	(3) 2x4	4000#
12'-0"	(4) 2x4	5500#
12'-0"	(5) 2x4	7000#
12'-0"	4x4	3200#
12'-0"	4x6	5000#
12'-0"	4x8	6700#
12'-0"	4x10	8500#

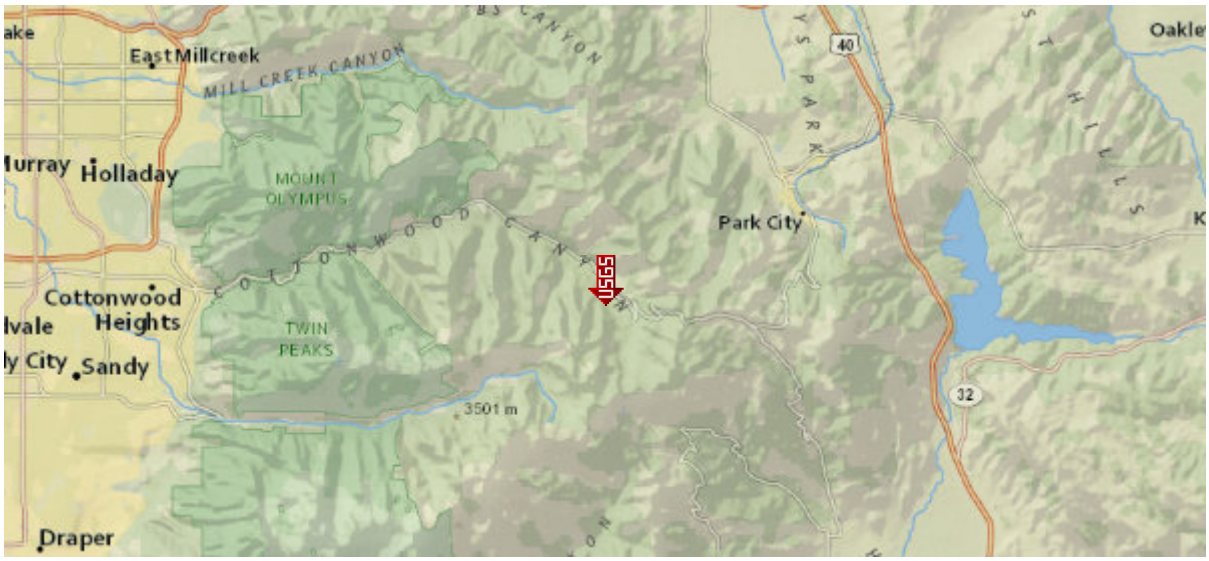
Post Height	Post Type	Allowable Vertical Load
12'-0"	(2) 2x6	1900#
12'-0"	(3) 2x6	6300#
12'-0"	(4) 2x6	13500#
12'-0"	(5) 2x6	23000#
12'-0"	4x6	5000#
12'-0"	6x6	12500#
12'-0"	6x8	17500#

Lateral Design

Design Maps Summary Report

User–Specified Input

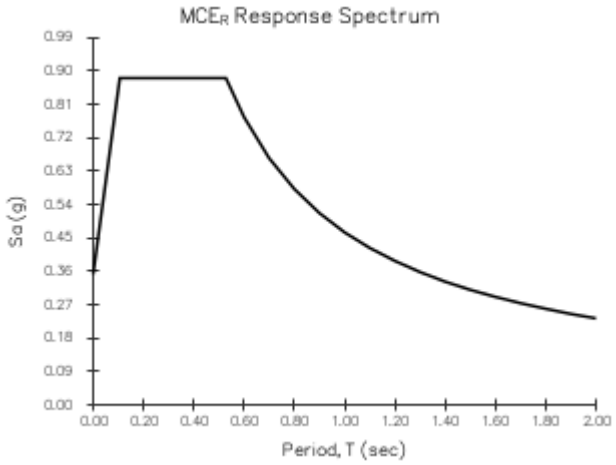
Report Title	17014 (Solitude Mountain Lot No 9 - Think (Corey Solum)) Wed May 17, 2017 15:48:25 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	40.62229°N, 111.59369°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

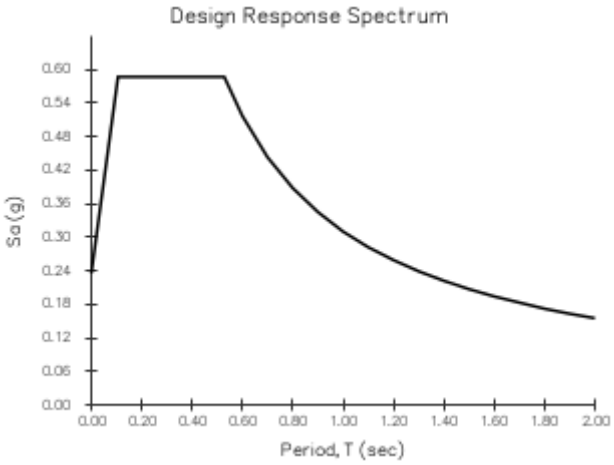


USGS–Provided Output

S_S =	0.720 g	S_{MS} =	0.881 g	S_{DS} =	0.587 g
S_1 =	0.243 g	S_{M1} =	0.465 g	S_{D1} =	0.310 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Earthquake Design

Based on ASCE 7-10 & IBC 2015

Design Input

Design Method : **ASD**

Building Height (ft.) :	30
# of Stories :	2
Use & Occupancy :	II
Diaphragm Type :	Flexible
Horizontal Irregularity :	None
Vertical Irregularity :	None
ype of Seismic Force Resisting System :	Light Framed walls with wood structural panels.
S_S :	0.720
S_1 :	0.243
Site Class :	D
Soil Profile Type :	D
R :	6.5
Ω_0 [A]:	3
C_d :	4
S_{MS} :	0.881
S_{M1} :	0.465
S_{ds} :	0.587
S_{d1} :	0.310
Seismic Design Category :	D
C_t :	0.020
X :	0.750
T_a :	0.256
T_L [B]:	8
Occupancy Importance Factor (I) :	1.00

Analytical Procedure

Equivalent Lateral Force Analysis (Section 12.8)

Seismic Base Shear (V_s) :	0.065	*W		
Maximum Base Shear (V_{max}) :	0.186	*W	Max :	0.065
Minimum Base Shear (V_{min}) :	0.010	*W		

Design Base Shear (V) : 0.065 *W

(Use only for Equivalent Lateral Force Analysis)

[A] May be reduced by half for flexible diaphragms. Shall not be taken as less than 2.

[B] See Long-Period Transition maps in ASCE 7-05 Figure 22-15 (page 228)

Equivalent Lateral Analysis of Structure

Based on ASCE 7-10 & IBC 2015

Seismic Design

Shear Line	Roof DL (psf)	Roof ML (psf)	Roof SL (psf)	Roof Length (ft)	Wall DL @ Roof (psf)	Wall Height @ Roof (ft)	Parapet Height (ft.)	3rd Floor DL (psf)	3rd Floor PL (psf)	3rd Floor Length (ft)	Wall DL @ 3rd Floor (psf)	Wall Height @ 3rd Floor (ft)	2nd Floor DL (psf)	2nd Floor PL (psf)	2nd Floor Length (ft)	Wall DL @ 2nd Floor (psf)	Wall Height @ 2nd Floor (ft)	1st Floor DL (psf)	1st Floor PL (psf)	1st Floor Length (ft)	Wall DL @ 1st Floor (psf)	Wall Height @ 1st Floor (ft)
V1	25		32	53	25	15																
V2	25		32	53	25	15																
V3	25		32	40	25	15																
V4	25		32	81	25	15																
V5	25		32	76	25	15																
V6	25		32	38	25	12																
V7	25		32	31	25	12																
V8																						
V9																						
V10																						
V11																						
V12																						
V13																						
V14																						
V15																						
V16																						
V17																						
V18																						

Base Shear

Line	Seismic Coeff.	Wt. of Roof (plf)	Wt. of 3rd Floor (plf)	Wt. of 2nd Floor (plf)	Wt. of 1st Floor (plf)	Base Shear (plf)
V1	0.0645	3396				219.060659
V2	0.0645	3396				219.060659
V3	0.0645	2655				171.262088
V4	0.0645	4992				322.011429
V5	0.0645	4707				303.627363
V6	0.0645	2466				159.070549
V7	0.0645	2067				133.332857
V8	0.0645					0
V9	0.0645					0
V10	0.0645					0
V11	0.0645					0
V12	0.0645					0
V13	0.0645					0
V14	0.0645					0
V15	0.0645					0
V16	0.0645					0
V17	0.0645					0
V18	0.0645					0

Vertically Distributed Shear K = 1.00

V1	W_R (plf)=	3396	H_R (ft)=	15	$W_R*H_R^K$ =	50940	C_{VR} =	1	V_{1R} =	**219.06**
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	0	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	0	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	0	V_{11} =	
					$W*H_{Total}$ =	50940				
V2	W_R (plf)=	3396	H_R (ft)=	15	$W_R*H_R^K$ =	50940	C_{VR} =	1	V_{1R} =	**219.06**
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	0	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	0	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	0	V_{11} =	
					$W*H_{Total}$ =	50940				
V3	W_R (plf)=	2655	H_R (ft)=	15	$W_R*H_R^K$ =	39825	C_{VR} =	1	V_{1R} =	**171.26**
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	0	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	0	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	0	V_{11} =	
					$W*H_{Total}$ =	39825				
V4	W_R (plf)=	4992	H_R (ft)=	15	$W_R*H_R^K$ =	74880	C_{VR} =	1	V_{1R} =	**322.01**
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	0	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	0	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	0	V_{11} =	
					$W*H_{Total}$ =	74880				
V5	W_R (plf)=	4707	H_R (ft)=	15	$W_R*H_R^K$ =	70605	C_{VR} =	1	V_{1R} =	**303.63**
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	0	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	0	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	0	V_{11} =	
					$W*H_{Total}$ =	70605				
V6	W_R (plf)=	2466	H_R (ft)=	12	$W_R*H_R^K$ =	29592	C_{VR} =	1	V_{1R} =	**159.07**
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	0	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	0	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	0	V_{11} =	
					$W*H_{Total}$ =	29592				

V7	W_R (plf)=	2067	H_R (ft)=	12	$W_R*H_R^K$ =	24804	C_{VR} =	1	V_{1R} =	**133.33**
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	0	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	0	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	0	V_{11} =	
					$W*H_{Total}$ =	24804				
V8	W_R (plf)=		H_R (ft)=	0	$W_R*H_R^K$ =	0	C_{VR} =	#DIV/0!	V_{1R} =	
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	#DIV/0!	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	#DIV/0!	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	#DIV/0!	V_{11} =	
					$W*H_{Total}$ =	0				
V9	W_R (plf)=		H_R (ft)=	0	$W_R*H_R^K$ =	0	C_{VR} =	#DIV/0!	V_{1R} =	
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	#DIV/0!	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	#DIV/0!	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	#DIV/0!	V_{11} =	
					$W*H_{Total}$ =	0				
V10	W_R (plf)=		H_R (ft)=	0	$W_R*H_R^K$ =	0	C_{VR} =	#DIV/0!	V_{1R} =	
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	#DIV/0!	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	#DIV/0!	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	#DIV/0!	V_{11} =	
					$W*H_{Total}$ =	0				
V11	W_R (plf)=		H_R (ft)=	0	$W_R*H_R^K$ =	0	C_{VR} =	#DIV/0!	V_{1R} =	
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	#DIV/0!	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	#DIV/0!	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	#DIV/0!	V_{11} =	
					$W*H_{Total}$ =	0				
V12	W_R (plf)=		H_R (ft)=	0	$W_R*H_R^K$ =	0	C_{VR} =	#DIV/0!	V_{1R} =	
	W_3 (plf)=		H_3 (ft)=	0	$W_3*H_3^K$ =	0	C_{V3} =	#DIV/0!	V_{13} =	
	W_2 (plf)=		H_2 (ft)=	0	$W_2*H_2^K$ =	0	C_{V2} =	#DIV/0!	V_{12} =	
	W_1 (plf)=		H_1 (ft)=	0	$W_1*H_1^K$ =	0	C_{V1} =	#DIV/0!	V_{11} =	
					$W*H_{Total}$ =	0				

Building Information

Horizontal dimension of building measured parallel to wind direction (L) =	75	ft
Horizontal dimension of building measured perpendicular to wind direction (B) =	28	ft
Mean Roof Height (h) =	16	ft
Width of Pressure Coefficient Zone (a) =	3	ft

Design Input

Step 1

Risk Category of Building =	II	

Step 2

Basic Wind Speed for applicable risk category, V =	115	mph

Step 3

Wind Directionality Factor, Kd =	0.85	
Exposure Category =	C	
Topographic Factor, Kzt =	1.00	
Enclosure Classification =	Enclosed Building	
Internal Pressure Coefficient, (Gcpi) =	0.18	
	-0.18	

Step 4

Mean Roof Height, z =	16.00	ft
zg =	900	ft
α =	9.50	
Velocity Pressure Exposure Coefficient, Kz =	0.860	

Step 5

Velocity Pressure, qz =	24.763	psf

Step 6

Roof Pitch =	1	/12
Roof Angle =	5.00	degrees

External Pressure Coefficients

Load Case A - (Transverse)

Building Surface

Roof Angle	1	2	3	4	1E	2E	3E	4E
0-5	0.40	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43
20	0.53	-0.69	-0.48	-0.43	0.80	-1.07	-0.69	-0.64
30-45	0.56	0.21	-0.43	-0.37	0.69	0.27	-0.53	-0.48
90	0.56	0.56	-0.37	-0.37	0.69	0.69	-0.48	-0.48
5.00	**0.40**	**-0.69**	**-0.37**	**-0.29**	**0.61**	**-1.07**	**-0.53**	**-0.43**

External Pressure Coefficients

Load Case B - (Longitudinal)

Building Surface

Roof Angle	1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
0-90	-0.45	-0.69	-0.37	-0.45	0.40	-0.29	-0.48	-1.07	-0.53	-0.48	0.61	-0.43
5.00	**-0.45**	**-0.69**	**-0.37**	**-0.45**	**0.40**	**-0.29**	**-0.48**	**-1.07**	**-0.53**	**-0.48**	**0.61**	**-0.43**

0	0.40	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43
5	0.40	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43

Step 7

Load Case A (Transverse)

1	2	3	4	1E	2E	3E	4E
5.45	-21.54	-13.62	-11.64	10.65	-30.95	-17.58	-15.11

Load Case B - (Longitudinal)

1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
-15.60	-21.54	-13.62	-15.60	5.45	-11.64	-16.34	-30.95	-17.58	-16.34	10.65	-15.11

Wind Loading @ Roof Level

Height to Ridge (ft) =	19
Height to Top Plate (ft) =	17
Height to Sill/Sole Plate (ft) =	0
Least Horizontal Dimension (ft) =	28
2a (ft) =	6
a (ft) =	3

Load Case A (Transverse)

1	2	3	4	1E	2E	3E	4E
46.31	-3.76	-2.37	-98.93	44.20	-1.64	-0.69	-29.47

Total Horizontal Load (plf)

143.85

Total Horizontal Edge Load (lbs)

436.32

Load Case B (Longitudinal)

1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
-133	-21.5	-13.6	-133	51.8	111	-6.31	-9.41	-3.96	-6.31	49.4	32.9

Total Horizontal Load (plf)

162.32

Total Horizontal Edge Load (lbs)

247.01

Wind Loading @ Roof Level minus 1

Height to Top Plate (ft) =	0
Height to Sill/Sole Plate (ft) =	0
Least Horizontal Dimension (ft) =	28
2a (ft) =	6
a (ft) =	3

All Load Cases

1	4	1E	4E
0.00	0.00	0.00	0.00

Total Horizontal Load (plf)

0.00

Total Horizontal Edge Load (lbs)

0.00

Wind Loading @ Roof Level minus 2

Height to Top Plate (ft) =	0
Height to Sill/Sole Plate (ft) =	0
Least Horizontal Dimension (ft) =	28
2a (ft) =	6
a (ft) =	3

Load Case A (Transverse)

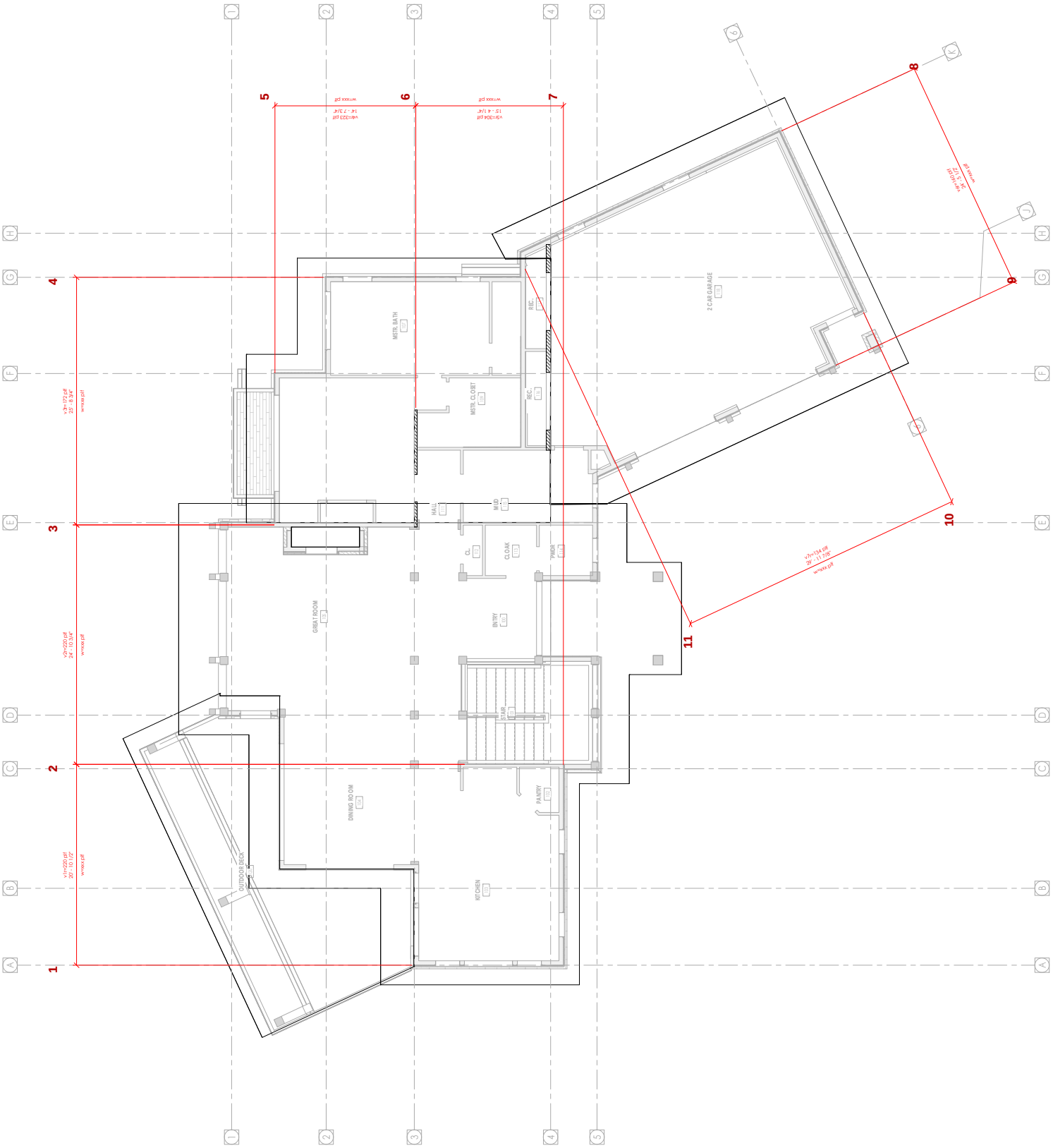
1	4	1E	4E
0.00	0.00	0.00	0.00

Total Horizontal Load (plf)

0.00

Total Horizontal Edge Load (lbs)

0.00


MSTR. BATH
MSTR. CLOSET
REC.
REC.
2 CAR GARAGE
HALL
MUD
CL.
CLOAK
PWDR
GREAT ROOM
ENTRY
STAIR
DINING ROOM
PANTRY
KITCHEN
OUTDOOR DECK

SIMPSON STRONG-TIE COMPANY INC.
(800) 999-5099
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

Job Name: 16032 (Burton Solitude Spec Home - Think)
Wall Name: Roof Line 1
Application: Standard Wall on Concrete

Design Criteria:

* 2015 International Bldg Code
* Seismic R=6.5
* 2500 psi concrete
* ASD Design Shear = 2310 lbs

Selected Strong-Wall® Panel Solution:

Model	Type	W (in)	H (in)	T (in)	Sill Anchor	End Anchor Bolts	Total Axial Load (lbs)	Actual Uplift (lbs)
SSW21x12	Steel	21	141.25	5.5	N/A	2 - 1"	100	15290 lb
SSW15x12	Steel	15	141.25	5.5	N/A	2 - 1"	100	8127 lb

Actual Shear & Drift Distribution:

Model	RR Relative Rigidity	Actual Shear (lbs)		Allowable Shear (lbs)		Actual / Allow Shear	Actual Drift (in)	Drift Limit (in)
SSW21x12	0.73	1688	≤	2210	OK	0.76	0.48	0.63
SSW15x12	0.27	622	≤	815	OK	0.76	0.48	0.63

Notes:

1. Steel Strong-Wall Shearwalls have been evaluated to the 2015 IBC/IRC.
   See www.strongtie.com for additional design and installation information.

2. Anchor templates are recommended for proper anchor bolt placement, and are required in some jurisdictions.

Disclaimer:

It is the Designer's responsibility to verify product suitability under applicable building codes. In order to verify code listed applications please refer to the appropriate product code reports at www.strongtie.com or contact Simpson Strong-Tie Company Inc. at 1-800-999-5099.

SIMPSON STRONG-TIE COMPANY INC.
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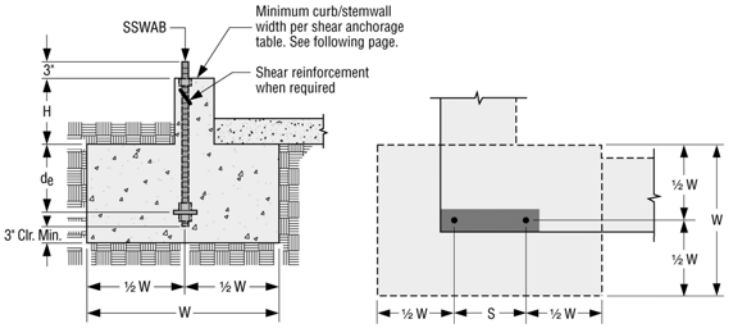
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

Job Name: 16032 (Burton Solitude Spec Home - Think)
Wall Name: Roof Line 1
Application: Standard Wall on Concrete

Design Criteria:

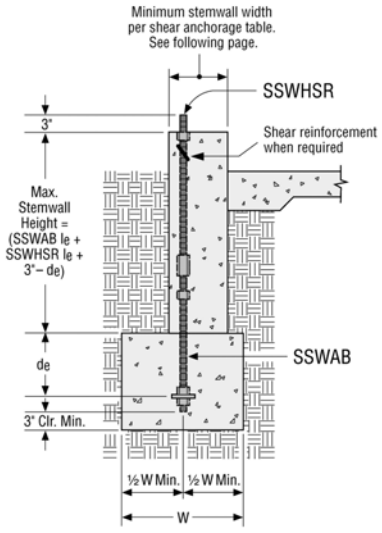
* Stemwall - Perimeter
* 2015 International Bldg Code
* Seismic R=6.5
* 2500 psi concrete

Anchor Solution Details:



Curb or Stemwall Section View

Footing Plan



Section at Stemwall SSWAB and SSWHSR Extension Application

Anchor Solution Assuming Cracked Concrete Design:

Model	W	de	S	Anchor Bolt	Strength
SSW21x12	33	11	15.25	SSWAB1	Standard
SSW15x12	33	11	9.25	SSWAB1	Standard

Anchor Solution Assuming Uncracked Concrete Design:

Model	W	de	S	Anchor Bolt	Strength
SSW21x12	28	10	15.25	SSWAB1	Standard
SSW15x12	28	10	9.25	SSWAB1	Standard

Notes:

1. Anchorage designs conform to ACI 318-14 and 318-11 Appendix D with no supplementary reinforcement for cracked and uncracked concrete as noted.
2. Anchorage strength indicates required grade of SSWAB anchor bolt. Standard (ASTM F1554 Grade 36) or High Strength (HS)(ASTM A449).
3. Seismic indicates Seismic Design Category C though F. Detached 1 & 2 family dwellings in SDC C may use wind anchorage solutions. Seismic anchorage designs conform to ACI 318-11 section D.3.3.4.3 and ACI 318-14 section 17.2.3.4.3
4. Footing dimensions are for anchorage only. Foundation design (size and reinforcement) by Designer. The registered design professional may specify alternate embedment, footing size or anchor bolt.

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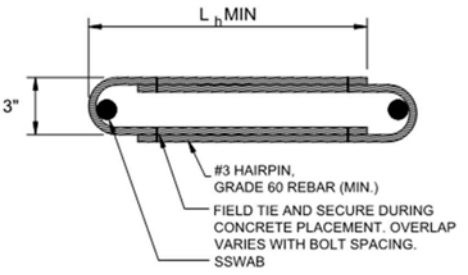
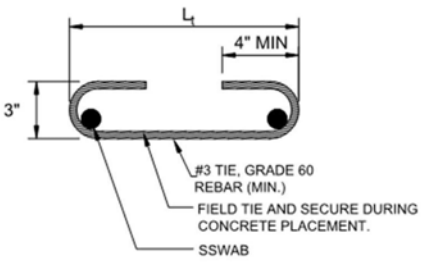
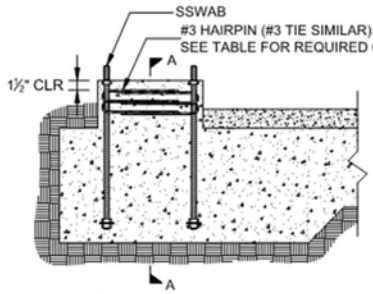
STEEL STRONG-WALL® SHEAR ANCHORAGE



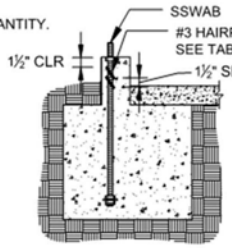
HAIRPIN SHEAR REINFORCEMENT



TIE SHEAR REINFORCEMENT



HAIRPIN INSTALLATION
(GARAGE CURB SHOWN. OTHER FOOTING TYPES SIMILAR.)



SECTION A-A

REGISTERED DESIGN PROFESSIONAL IS PERMITTED TO MODIFY DETAILS FOR SPECIFIC CONDITIONS.

STEEL STRONG-WALL SHEAR ANCHORAGE

MODEL	SEISMIC[3]			WIND[4]					
	L_t OR L_h (in.)	SHEAR REINFORCEMENT	MIN. CURB / STEMWALL WIDTH (in.)	SHEAR REINFORCEMENT	MIN. CURB / STEMWALL WIDTH (in.)	ASD ALLOWABLE SHEAR LOAD V (lbs.)[6]			
						6" MIN CURB / STEMWALL		8" MIN CURB / STEMWALL	
						UNCRACKED	CRACKED	UNCRACKED	CRACKED
SSW12	9	(1) #3 TIE	6	NONE REQUIRED	-	1230	880	1440	1030
SSW15	12	(2) #3 TIES	6	NONE REQUIRED	-	1590	1135	1810	1295
SSW18	14	(1) #3 HAIRPIN	8[5]	(1) #3 HAIRPIN	6	HAIRPIN REINFORCEMENT ACHIEVES MAXIMUM ALLOWABLE SHEAR LOAD OF THE STEEL STRONG-WALL PANEL			
SSW21	15	(2) #3 HAIRPIN	8[5]	(1) #3 HAIRPIN	6				
SSW24	17	(2) #3 HAIRPIN	8[5]	(1) #3 HAIRPIN	6				

NOTES:
1. SHEAR ANCHORAGE DESIGNS CONFORM TO ACI 318-14 AND ACI 318-11 AND ASSUME MINIMUM f'c=2,500 PSI CONCRETE. SEE DETAILS 1/SSW1 TO 3/SSW1 FOR TENSION ANCHORAGE.
2. SHEAR REINFORCEMENT IS NOT REQUIRED FOR PANELS INSTALLED ON A WOOD FLOOR, INTERIOR FOUNDATION APPLICATIONS (PANEL INSTALLED AWAY FROM EDGE OF CONCRETE), OR BRACED WALL PANEL APPLICATIONS.
3. SEISMIC INDICATES SEISMIC DESIGN CATEGORY C THROUGH F. DETACHED 1 AND 2 FAMILY DWELLINGS IN SDC C MAY USE WIND ANCHORAGE SOLUTIONS.
4. WIND INCLUDES SEISMIC DESIGN CATEGORY A AND B.
5. MINIMUM CURB/STEMWALL WIDTH IS 6" WHEN STANDARD STRENGTH SSWAB IS USED.
6. USE (1) #3 TIE FOR SSW12 AND SSW15 WHEN THE STEEL STRONG-WALL PANEL DESIGN SHEAR FORCE EXCEEDS THE TABULATED ANCHORAGE ALLOWABLE SHEAR LOAD.
7. CONCRETE EDGE DISTANCE FOR ANCHORS MUST COMPLY WITH ACI 318-14 SECTION 17.7.2 AND ACI 318-11 D.8.2.

Shear Walls 2015

High Roof — Line **2**

Shear Force (E)			Wall Segments
5060	Length (ft) :	**13**	Total (ft.) 13.00
Shear Force (W)	Height (ft) :	**15**	
3749	Roof Trib. (ft) :	**2**	
(E) F_v (plf)	Floor Trib. (ft) :	**0**	
389.2307692	W_{pl} (plf) :	489	
(W) F_v (plf)	**Seismic Force (lbs) :**	5060	
288.3846154	Overturning Moment (lb-ft) :	75900	
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	24792.3	
57	Uplift (lbs) :	3931.361538	
Floor Dead Load (psf)	Height/Width Ratio :	OK	
40	Shear Wall (E) :		SW2
Wall Self Weight (psf)	**Wind Force (lbs) :**	3749	
25	Overturning Moment (lb-ft) :	56235	
Dead Load Factor	Resisting Moment (lb-ft) :	24792.3	
0.6	Uplift (lbs) :	2418.669231	
Height/Width Ratio (E)	Height/Width Ratio :	OK	
2.0 : 1	Shear Wall (W) :		SW1
Height/Width Ratio (W)	Maximum Uplift :	3931.361538	
3.5 : 1	Upper Story Hold Down :	(2)CS14	
	Concrete Strap Tie Anchor :	No Good	
	Bolt Anchor :	HDU4-SDS2.5	

Shear Walls 2015

High Roof	Line **3**			Wall Segments	
Shear Force (E)					Total (ft.)
4986	Length (ft) :	**19**			19.00
Shear Force (W)	Height (ft) :	**15**			
4156.5	Roof Trib. (ft) :	**2**			
(E) F_v (plf)	Floor Trib. (ft) :	**0**			
262.4210526	W_{dl} (plf) :	489			
(W) F_v (plf)	**Seismic Force (lbs) :**	4986			
218.7631579	Overturning Moment (lb-ft) :	74790			
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	52958.7			
57	Uplift (lbs) :	1149.015789			
Floor Dead Load (psf)	Height/Width Ratio :	OK			
40	Shear Wall (E) :			SW1	
Wall Self Weight (psf)	**Wind Force (lbs) :**	4156.5			
25	Overturning Moment (lb-ft) :	62347.5			
Dead Load Factor	Resisting Moment (lb-ft) :	52958.7			
0.6	Uplift (lbs) :	494.1473684			
Height/Width Ratio (E)	Height/Width Ratio :	OK			
2.0 : 1	Shear Wall (W) :			SW1	
Height/Width Ratio (W)	Maximum Uplift :	1149.015789			
3.5 : 1	Upper Story Hold Down :	CS16			
	Concrete Strap Tie Anchor :	LSTHD8/ LSTHD8RJ			
	Bolt Anchor :	HDU2-SDS2.5			

Shear Walls 2015

High Roof	Line **4**			Wall Segments	
Shear Force (E)					Total (ft.)
2236	Length (ft) :	**8.5**			8.50
Shear Force (W)	Height (ft) :	**15**			
2369	Roof Trib. (ft) :	**2**			
(E) F_v (plf)	Floor Trib. (ft) :	**0**			
263.0588235	W_{dl} (plf) :	489			
(W) F_v (plf)	**Seismic Force (lbs) :**	2236			
278.7058824	Overturning Moment (lb-ft) :	33540			
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	10599.075			
57	Uplift (lbs) :	2698.932353			
Floor Dead Load (psf)	Height/Width Ratio :	OK			
40	Shear Wall (E) :			SW1	
Wall Self Weight (psf)	**Wind Force (lbs) :**	2369			
25	Overturning Moment (lb-ft) :	35535			
Dead Load Factor	Resisting Moment (lb-ft) :	10599.075			
0.6	Uplift (lbs) :	2933.638235			
Height/Width Ratio (E)	Height/Width Ratio :	OK			
2.0 : 1	Shear Wall (W) :			SW1	
Height/Width Ratio (W)	Maximum Uplift :	2933.638235			
3.5 : 1	Upper Story Hold Down :	(2)CS16			
	Concrete Strap Tie Anchor :	STHD14/ STHD14RJ			
	Bolt Anchor :	HDU2-SDS2.5			

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(800) 999-5099
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

Job Name: 16032 (Burton Solitude Spec Home - Think)
Wall Name: Roof Line 5
Application: Two-Story Stacked

Design Criteria:

* 2015 International Bldg Code
* Seismic R=6.5
* 2500 psi concrete
* 2nd Story Wall Design Shear = 2423 lbs
* 1st Story Wall Design Shear = 1000 lbs
* Floor Joist Depth = 16"

Selected Strong-Wall® Panel Solution:

Model	Level	Type	W (in)	H (in)	T (in)	Sill Anchor	End Anchor Bolts	Total Axial Load (lbs)	Actual Uplift (lbs)
SSW24x11	2nd Story	Steel	24	129.25	5.5	Plate	2 - 1"	100	10215 lb
SSW21x11	2nd Story	Steel	21	129.25	5.5	Plate	2 - 1"	100	8639 lb
SSW24x10-STK	1st Story	Steel	24	117.25	3.5	N/A	2 - 1"	200	26222 lb
SSW21x10-STK	1st Story	Steel	21	117.25	3.5	N/A	2 - 1"	200	23180 lb

Actual Shear & Drift Distribution:

Model	Level	RR Relative Rigidity	Actual Shear (lbs)		Allowable Shear (lbs)		Actual / Allow Shear	Actual Drift (in)	Drift Limit (in)	Moment Base (ft-lbs)	Moment Allow (ft-lbs)
SSW24x11	2nd Story	0.59	1419	≤	1436	OK	0.99	0.39	0.58	NA	NA
SSW21x11	2nd Story	0.41	1004	≤	1198	OK	0.84	0.39	0.58	NA	NA
SSW24x10-STK	1st Story	0.56	1908	≤	3835	OK	0.50	0.48	0.52	36583	37470
SSW21x10-STK	1st Story	0.44	1515	≤	3045	OK	0.50	0.48	0.52	27530	29750

SSW21 requires SSW21-2KT Connection Kit.
SSW24 requires SSW24-2KT Connection Kit.

Notes:

1. Steel Strong-Wall Shearwalls have been evaluated to the 2015 IBC/IRC.
   See www.strongtie.com for additional design and installation information.

2. Anchor templates are recommended for proper anchor bolt placement, and are required in some jurisdictions.

3. Two-story stacked solutions evaluate cumulative overturning effects.

4. Two-Story Stacked Application requires SSW__-2KT Connection Kit based on panel width (example: SSW15-2KT).

5. Plate denotes shear transfer plate in Two-Story Stacked Connection Kit.

Disclaimer:

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www.strongtie.com

It is the Designer's responsibility to verify product suitability under applicable building codes. In order to verify code listed applications please refer to the appropriate product code reports at www.strongtie.com or contact Simpson Strong-Tie Company Inc. at 1-800-999-5099.

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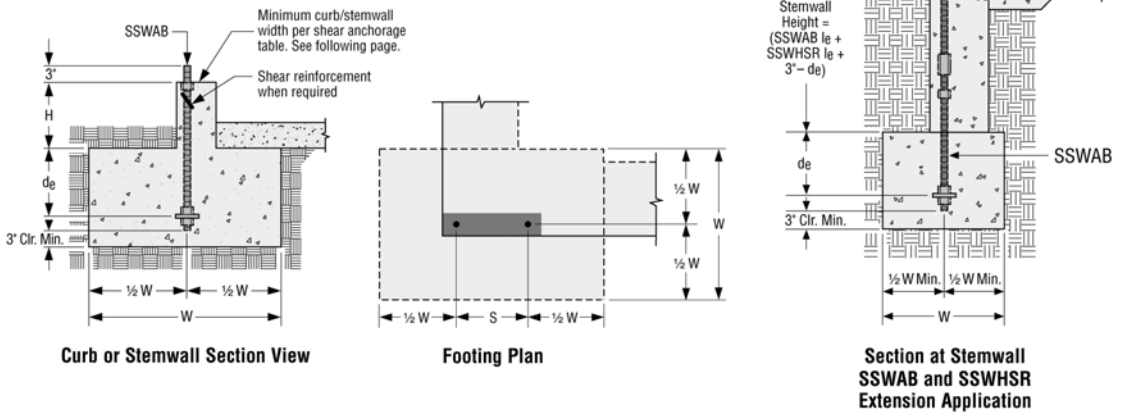
www.strongtie.com

Job Name: 16032 (Burton Solitude Spec Home - Think)
Wall Name: Roof Line 5
Application: Two-Story Stacked

Design Criteria:

* Stemwall - Perimeter
* 2015 International Bldg Code
* Seismic R=6.5
* 2500 psi concrete

Anchor Solution Details:



Anchor Solution Assuming Cracked Concrete Design:

Model	W	de	S	Anchor Bolt	Strength
SSW24	51	17	18.25	SSWAB1	High Strength
SSW21	51	17	15.25	SSWAB1	High Strength

Anchor Solution Assuming Uncracked Concrete Design:

Model	W	de	S	Anchor Bolt	Strength
SSW24	44	15	18.25	SSWAB1	High Strength
SSW21	44	15	15.25	SSWAB1	High Strength

Notes:

1. Anchorage designs conform to ACI 318-14 and 318-11 Appendix D with no supplementary reinforcement for cracked and uncracked concrete as noted.
2. Anchorage strength indicates required grade of SSWAB anchor bolt. Standard (ASTM F1554 Grade 36) or High Strength (HS)(ASTM A449).
3. Seismic indicates Seismic Design Category C though F. Detached 1 & 2 family dwellings in SDC C may use wind anchorage solutions. Seismic anchorage designs conform to ACI 318-11 section D.3.3.4.3 and ACI 318-14 section 17.2.3.4.3
4. Footing dimensions are for anchorage only. Foundation design (size and reinforcement) by Designer. The registered design professional may specify alternate embedment, footing size or anchor bolt.

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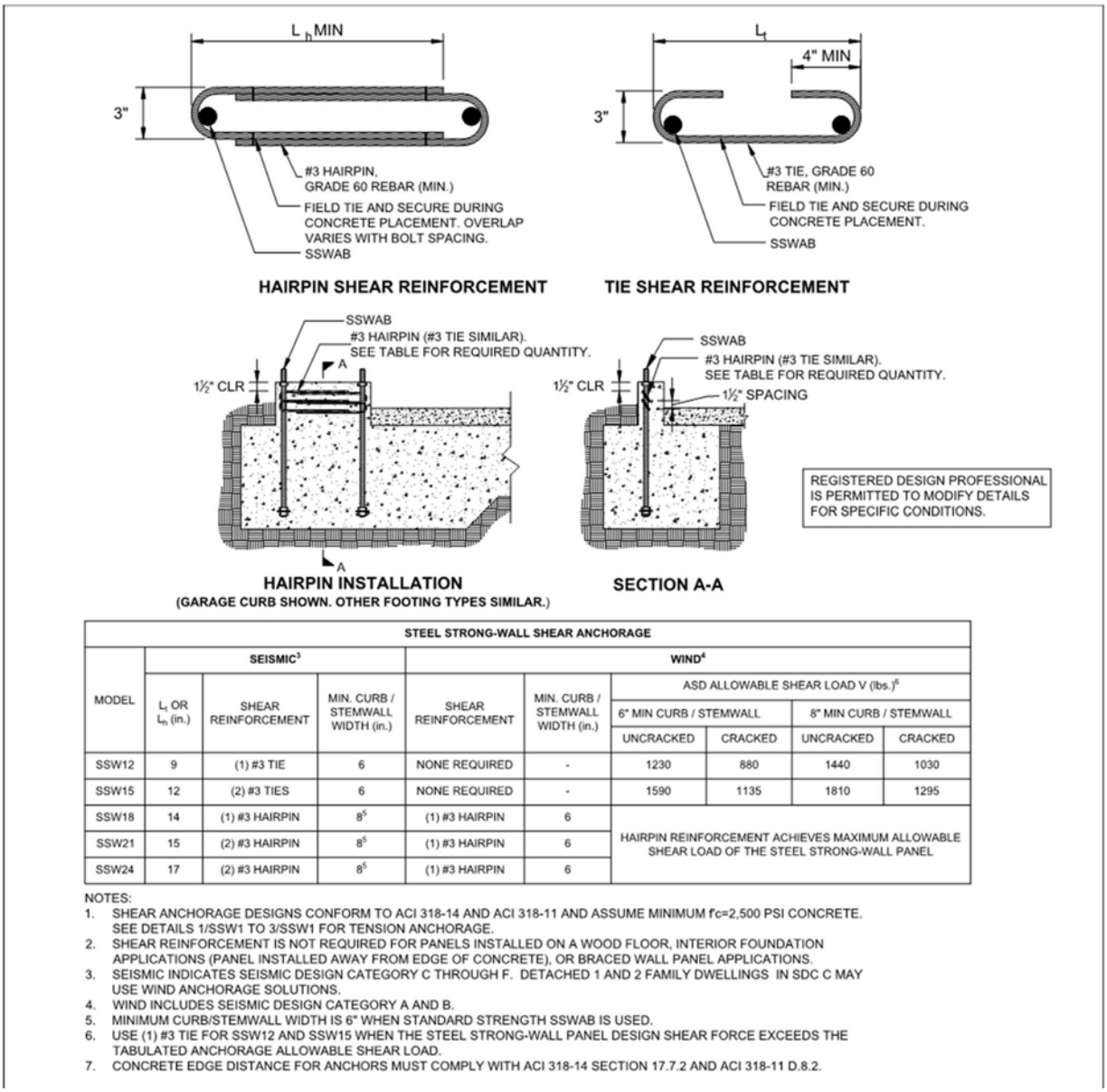
STEEL STRONG-WALL® SHEAR ANCHORAGE



STEEL STRONG-WALL SHEAR ANCHORAGE

MODEL	SEISMIC[3]			WIND[4]					
	L_t OR L_h (in.)	SHEAR REINFORCEMENT	MIN. CURB / STEMWALL WIDTH (in.)	SHEAR REINFORCEMENT	MIN. CURB / STEMWALL WIDTH (in.)	ASD ALLOWABLE SHEAR LOAD V (lbs.)[6]			
						6" MIN CURB / STEMWALL		8" MIN CURB / STEMWALL	
						UNCRACKED	CRACKED	UNCRACKED	CRACKED
SSW12	9	(1) #3 TIE	6	NONE REQUIRED	-	1230	880	1440	1030
SSW15	12	(2) #3 TIES	6	NONE REQUIRED	-	1590	1135	1810	1295
SSW18	14	(1) #3 HAIRPIN	8[5]	(1) #3 HAIRPIN	6	HAIRPIN REINFORCEMENT ACHIEVES MAXIMUM ALLOWABLE SHEAR LOAD OF THE STEEL STRONG-WALL PANEL			
SSW21	15	(2) #3 HAIRPIN	8[5]	(1) #3 HAIRPIN	6				
SSW24	17	(2) #3 HAIRPIN	8[5]	(1) #3 HAIRPIN	6				

NOTES:
1. SHEAR ANCHORAGE DESIGNS CONFORM TO ACI 318-14 AND ACI 318-11 AND ASSUME MINIMUM f'c=2,500 PSI CONCRETE. SEE DETAILS 1/SSW1 TO 3/SSW1 FOR TENSION ANCHORAGE.
2. SHEAR REINFORCEMENT IS NOT REQUIRED FOR PANELS INSTALLED ON A WOOD FLOOR, INTERIOR FOUNDATION APPLICATIONS (PANEL INSTALLED AWAY FROM EDGE OF CONCRETE), OR BRACED WALL PANEL APPLICATIONS.
3. SEISMIC INDICATES SEISMIC DESIGN CATEGORY C THROUGH F. DETACHED 1 AND 2 FAMILY DWELLINGS IN SDC C MAY USE WIND ANCHORAGE SOLUTIONS.
4. WIND INCLUDES SEISMIC DESIGN CATEGORY A AND B.
5. MINIMUM CURB/STEMWALL WIDTH IS 6" WHEN STANDARD STRENGTH SSWAB IS USED.
6. USE (1) #3 TIE FOR SSW12 AND SSW15 WHEN THE STEEL STRONG-WALL PANEL DESIGN SHEAR FORCE EXCEEDS THE TABULATED ANCHORAGE ALLOWABLE SHEAR LOAD.
7. CONCRETE EDGE DISTANCE FOR ANCHORS MUST COMPLY WITH ACI 318-14 SECTION 17.7.2 AND ACI 318-11 D.8.2.

Shear Walls 2015

High Roof — Line **6**

Shear Force (E)			Wall Segments
2356	Length (ft) :	**6.666**	Total (ft.)
Shear Force (W)	Height (ft) :	**11**	6.67
1263.25	Roof Trib. (ft) :	**14**	
(E) F_v (plf)	Floor Trib. (ft) :	**0**	
353.4353435	W_{dl} (plf) :	1073	
(W) F_v (plf)	**Seismic Force (lbs) :**	2356	
189.5064506	Overturning Moment (lb-ft) :	25916	
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	14303.80548	
57	Uplift (lbs) :	1742.003379	
Floor Dead Load (psf)	Height/Width Ratio :	OK	
40	Shear Wall (E) :		SW2
Wall Self Weight (psf)	**Wind Force (lbs) :**	1263.25	
25	Overturning Moment (lb-ft) :	13895.75	
Dead Load Factor	Resisting Moment (lb-ft) :	14303.80548	
0.6	Uplift (lbs) :	0	
Height/Width Ratio (E)	Height/Width Ratio :	OK	
2.0 : 1	Shear Wall (W) :		SW1
Height/Width Ratio (W)	Maximum Uplift :	1742.003379	
3.5 : 1	Upper Story Hold Down :	(2)CS16	
	Concrete Strap Tie Anchor :	LSTHD8/ LSTHD8RJ	
	Bolt Anchor :	HDU2-SDS2.5	

Shear Walls 2015

High Roof — Line **7**

Shear Force (E)			Wall Segments
2945	Length (ft) :	**6**	Total (ft.)
Shear Force (W)	Height (ft) :	**15**	6.00
1513.25	Roof Trib. (ft) :	**8.5**	
(E) F_v (plf)	Floor Trib. (ft) :	**0**	
490.8333333	W_{dl} (plf) :	859.5	
(W) F_v (plf)	**Seismic Force (lbs) :**	2945	
252.2083333	Overturning Moment (lb-ft) :	44175	
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	9282.6	
57	Uplift (lbs) :	5815.4	
Floor Dead Load (psf)	Height/Width Ratio :	Seismic Load Multiplied	
40	Shear Wall (E) :		SW3
Wall Self Weight (psf)	**Wind Force (lbs) :**	1513.25	
25	Overturning Moment (lb-ft) :	22698.75	
Dead Load Factor	Resisting Moment (lb-ft) :	9282.6	
0.6	Uplift (lbs) :	2236.025	
Height/Width Ratio (E)	Height/Width Ratio :	OK	
2.0 : 1	Shear Wall (W) :		SW1
Height/Width Ratio (W)	Maximum Uplift :	5815.4	
3.5 : 1	Upper Story Hold Down :	CMST14	
	Concrete Strap Tie Anchor :	No Good	
	Bolt Anchor :	HDU8-SDS2.5	

Shear Walls 2015

High Roof — Line **8**

Shear Force (E)			Wall Segments
1960	Length (ft) :	**8.75**	Total (ft.)
Shear Force (W)	Height (ft) :	**11**	8.75
2246.75	Roof Trib. (ft) :	**14**	
(E) F_v (plf)	Floor Trib. (ft) :	**0**	
224	W_{dl} (plf) :	1073	
(W) F_v (plf)	**Seismic Force (lbs) :**	1960	
256.7714286	Overturning Moment (lb-ft) :	21560	
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	24645.46875	
57	Uplift (lbs) :	0	
Floor Dead Load (psf)	Height/Width Ratio :	OK	
40	Shear Wall (E) :		SW1
Wall Self Weight (psf)	**Wind Force (lbs) :**	2246.75	
25	Overturning Moment (lb-ft) :	24714.25	
Dead Load Factor	Resisting Moment (lb-ft) :	24645.46875	
0.6	Uplift (lbs) :	7.860714286	
Height/Width Ratio (E)	Height/Width Ratio :	OK	
2.0 : 1	Shear Wall (W) :		SW1
Height/Width Ratio (W)	Maximum Uplift :	7.860714286	
3.5 : 1	Upper Story Hold Down :	No Hold Down Req'd	
	Concrete Strap Tie Anchor :	No Hold Down Req'd	
	Bolt Anchor :	No Hold Down Req'd	

Shear Walls 2015

High Roof — Line **9**

Shear Force (E)			Wall Segments
2068.888889	Length (ft) :	**4.5**	Total (ft.)
Shear Force (W)	Height (ft) :	**9.5**	4.50
2246.75	Roof Trib. (ft) :	**14**	
(E) F_v (plf)	Floor Trib. (ft) :	**0**	
459.7530864	W_{dl} (plf) :	1035.5	
(W) F_v (plf)	**Seismic Force (lbs) :**	2068.888889	
499.2777778	Overturning Moment (lb-ft) :	19654.44444	
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	6290.6625	
57	Uplift (lbs) :	2969.729321	
Floor Dead Load (psf)	Height/Width Ratio :	Seismic Load Multiplied	
40	Shear Wall (E) :		SW2
Wall Self Weight (psf)	**Wind Force (lbs) :**	2246.75	
25	Overturning Moment (lb-ft) :	21344.125	
Dead Load Factor	Resisting Moment (lb-ft) :	6290.6625	
0.6	Uplift (lbs) :	3345.213889	
Height/Width Ratio (E)	Height/Width Ratio :	OK	
2.0 : 1	Shear Wall (W) :		SW2
Height/Width Ratio (W)	Maximum Uplift :	3345.213889	
3.5 : 1	Upper Story Hold Down :	(2)CS16	
	Concrete Strap Tie Anchor :	STHD14/ STHD14RJ	
	Bolt Anchor :	HDU4-SDS2.5	

Shear Walls 2015

High Roof	Line **10**			Wall Segments	
Shear Force (E)					Total (ft.)
2010	Length (ft) :	**16**			16.00
Shear Force (W)	Height (ft) :	**5**			
2695	Roof Trib. (ft) :	**2**			
(E) F_v (plf)	Floor Trib. (ft) :	**0**			
125.625	W_{dl} (plf) :	239			
(W) F_v (plf)	**Seismic Force (lbs) :**	2010			
168.4375	Overturning Moment (lb-ft) :	10050			
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	18355.2			
57	Uplift (lbs) :	0			
Floor Dead Load (psf)	Height/Width Ratio :	OK			
40	Shear Wall (E) :			SW1	
Wall Self Weight (psf)	**Wind Force (lbs) :**	2695			
25	Overturning Moment (lb-ft) :	13475			
Dead Load Factor	Resisting Moment (lb-ft) :	18355.2			
0.6	Uplift (lbs) :	0			
Height/Width Ratio (E)	Height/Width Ratio :	OK			
2.0 : 1	Shear Wall (W) :			SW1	
Height/Width Ratio (W)	Maximum Uplift :	0			
3.5 : 1	Upper Story Hold Down :	No Hold Down Req'd			
	Concrete Strap Tie Anchor :	No Hold Down Req'd			
	Bolt Anchor :	No Hold Down Req'd			

Shear Walls 2015

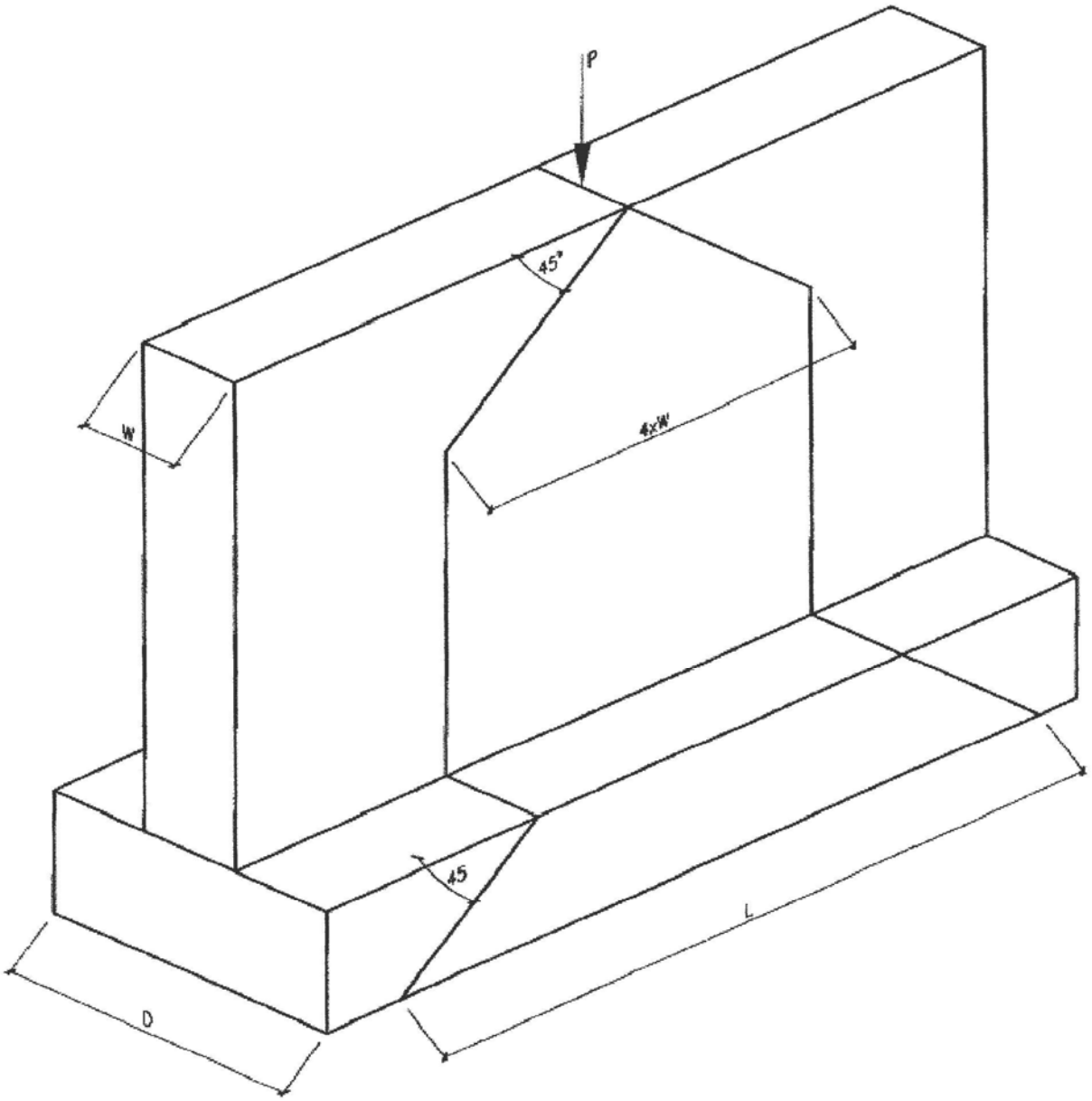
High Roof	Line **11**			Wall Segments	
Shear Force (E)					Total (ft.)
2010	Length (ft) :	**12**			12.00
Shear Force (W)	Height (ft) :	**12**			
2695	Roof Trib. (ft) :	**2**			
(E) F_v (plf)	Floor Trib. (ft) :	**0**			
167.5	W_{dl} (plf) :	414			
(W) F_v (plf)	**Seismic Force (lbs) :**	2010			
224.5833333	Overturning Moment (lb-ft) :	24120			
Roof Dead Load (psf)	Resisting Moment (lb-ft) :	17884.8			
57	Uplift (lbs) :	519.6			
Floor Dead Load (psf)	Height/Width Ratio :	OK			
40	Shear Wall (E) :			SW1	
Wall Self Weight (psf)	**Wind Force (lbs) :**	2695			
25	Overturning Moment (lb-ft) :	32340			
Dead Load Factor	Resisting Moment (lb-ft) :	17884.8			
0.6	Uplift (lbs) :	1204.6			
Height/Width Ratio (E)	Height/Width Ratio :	OK			
2.0 : 1	Shear Wall (W) :			SW1	
Height/Width Ratio (W)	Maximum Uplift :	1204.6			
3.5 : 1	Upper Story Hold Down :	CS16			
	Concrete Strap Tie Anchor :	LSTHD8/ LSTHD8RJ			
	Bolt Anchor :	HDU2-SDS2.5			

Footing & Foundation Design

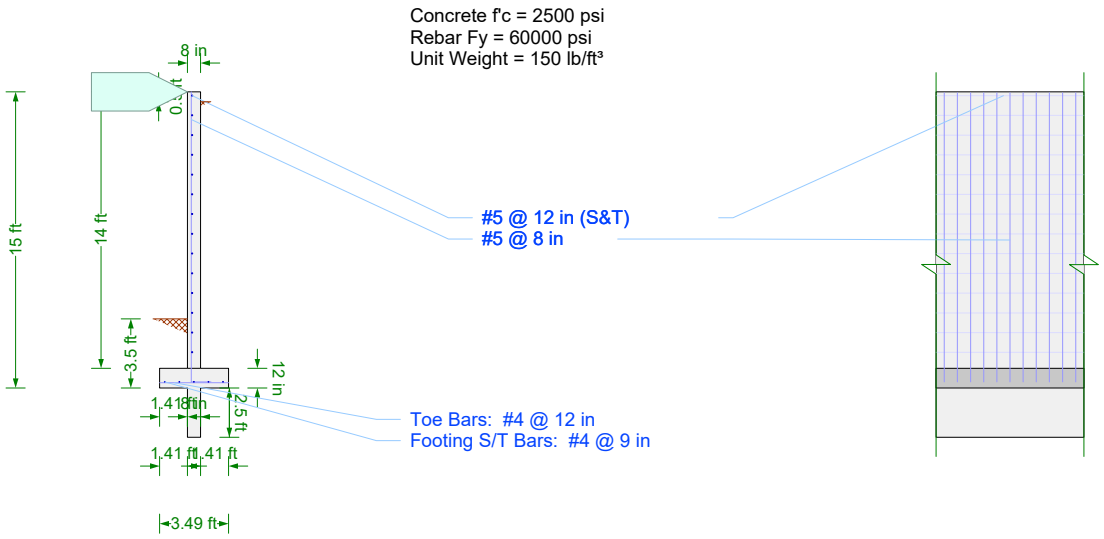
Allowable Load at Top of Concrete Wall

Wall Thickness (W):	8 in		
Footing Width (D):	18 in	Effective Area of Footing:	7 ft^2
Footing Thickness (t):	12 in	Allowable Soil Bearing:	1500 psf
Wall Height (h):	2.5 ft		
Effective Footing Length (L):	4.67 ft		

Allowable Point Load: 10500 lbs



Design Detail



Check Summary

Ratio	Check	Provided	Required	Combination
----- Stability Checks -----				
✓ 0.955	Sliding	1.57	1.50	0.6D + 1.0H
✓ 0.845	Bearing Pressure	2000 psf	1691 psf	1.0D + 1.0H
✓ 0.332	Bearing Eccentricity	2.32 in	6.99 in	1.0D + 1.0H
----- Toe Checks -----				
✓ 0.147	Shear	7.88 k/ft	1.16 k/ft	1.4D + 1.6H
✓ 0.215	Moment	7.66 ft·k/ft	1.65 ft·k/ft	1.4D + 1.6H
✓ 0.090	Min Strain	0.0444	0.0040	1.4D + 1.6H
✓ 0.000	Min Steel	0.02 in²	0 in²	1.4D + 1.6H
✓ 0.546	Development	21.96 in	12 in	1.4D + 1.6H
✓ 0.500	S&T Max Spacing	9 in	18 in	1.4D + 1.6H
✓ 0.972	S&T Min Rho	0.0019	0.0018	1.4D + 1.6H
----- Heel Checks -----				
✓ 0.618	Shear	4.8 k/ft	2.97 k/ft	1.4D + 1.6H
✓ 0.839	Moment	2.5 ft·k/ft	2.1 ft·k/ft	1.4D + 1.6H
----- Stem Checks -----				
✓ 0.976	Moment	10.76 ft·k/ft	10.5 ft·k/ft	1.4D + 1.6H
✓ 0.773	Shear	5.12 k/ft	3.96 k/ft	1.4D + 1.6H
✓ 0.000	Max Steel	Infinite	0.0040	1.4D + 1.6H
✓ 0.000	Min Steel	0 in²/in	0 in²/in	1.4D + 1.6H
✗ 1.167	Base Development	9 in	10.5 in	1.4D + 1.6H
✓ 0.000	Horz Bar Rho	0.0000	0.0000	1.4D + 1.6H
✓ 0.667	Horz Bar Spacing	12 in	18 in	1.4D + 1.6H

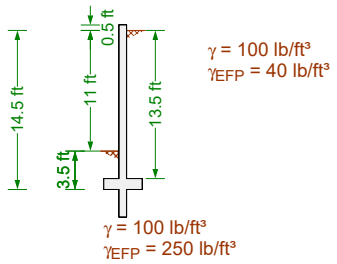
Criteria

Use basic criteria from common project settings	No
Building Code	IBC 2015
Concrete Load Combs	ASCE 7-10 (Streng...
Masonry Load Combs	ASCE 7-10 (ASD)
Stability Load Combs	ASCE 7-10 (ASD)
Apply Sds Factor to Seismic Combinations for Ev	Yes
Sds (from ASCE 7)	0.59
Restrained Against Sliding	No
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.50
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	2000 psf
Req'd Bearing Location	Middle third
Wall Friction Angle	25°
Friction Coefficent	0.35
Soil Reaction Modulus	172800 lb/ft³

Loads

Loading Options/Assumptions

Passive pressure neglects top 0 ft of soil.



Load Combinations

ASCE 7-10 (Strength)

1.4D + 1.6H
1.4D + 0.9H
1.2D + 1.6H
1.2D + 0.9H
0.9D + 1.6H
0.9D + 0.9H

Strength Check Results Summary

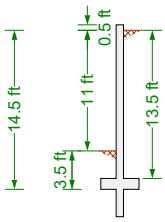
Load Combination	Stem M-applied (ft·k/ft)	Stem M-allow (ft·k/ft)	Stem V-applied (k/ft)	Stem V-allow (k/ft)	Stem Min. Id (in)	Stem Actual Id (in)	Heel M-applied (ft·k/ft)
1.4D + 1.6H	10.5	10.76	3.96	5.12	10.5	9	2.1
1.4D + 0.9H	5.91	10.76	2.23	5.12	10.5	9	2.1
1.2D + 1.6H	10.5	10.76	3.96	5.12	10.5	9	1.8
1.2D + 0.9H	5.91	10.76	2.23	5.12	10.5	9	1.8
0.9D + 1.6H	10.5	10.76	3.96	5.12	10.5	9	1.35
0.9D + 0.9H	5.91	10.76	2.23	5.12	10.5	9	1.35

Load Combination	Heel M-allow (ft·k/ft)	Heel V-applied (k/ft)	Heel V-allow (k/ft)	Toe M-applied (ft·k/ft)	Toe M-allow (ft·k/ft)	Toe V-applied (k/ft)	Toe V-allow (k/ft)
1.4D + 1.6H	2.5	2.97	4.8	1.65	7.66	1.16	7.88
1.4D + 0.9H	2.5	2.97	4.8	1.65	7.66	1.16	7.88
1.2D + 1.6H	2.5	2.54	4.8	1.41	7.66	0.99	7.88
1.2D + 0.9H	2.5	2.54	4.8	1.41	7.66	0.99	7.88
0.9D + 1.6H	2.5	1.91	4.8	1.06	7.66	0.75	7.88
0.9D + 0.9H	2.5	1.91	4.8	1.06	7.66	0.75	7.88

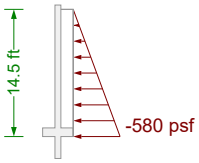
Stability Check Results Summary

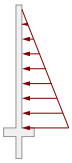
Load Combination	Sliding Force (lb/in)	Resisting Force (lb/in)	Sliding F.S.	Sliding F.S. Req'd	Sliding F.S. Req'd Seis...	Bearing Pressure Actual (psf)	Bearing Pressure Allowable (psf)	earing Eccentricity Actual (in)	aring Eccentricity Allowable (in)
1.0D + 1.0H	350.4	602	1.718	1.500	1.500	1691	2000	2.32	6.99
1.0D + 0.6H	210.3	412.9	1.964	1.500	1.500	1691	2000	2.32	6.99
0.6D + 1.0H	350.4	550.3	1.570	1.500	1.500	1015	2000	2.32	6.99
0.6D + 0.6H	210.3	361.2	1.718	1.500	1.500	1015	2000	2.32	6.99

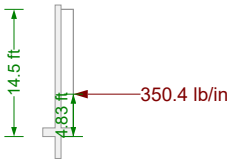
Backfill Pressure

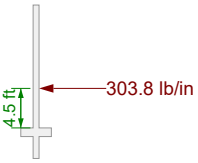


γ = 100 lb/ft³
γ_{EFP} = 40 lb/ft³









Lateral Earth Pressure

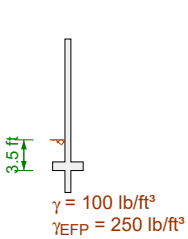
Equivalent Fluid Pressure

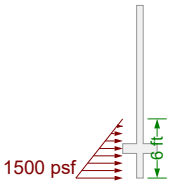
$\sigma_h = H \gamma_{fluid}$ = (14.5 ft)(40 lb / ft³) = 580 psf

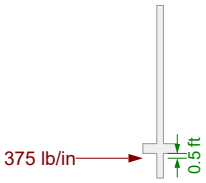
Lateral Earth Pressure (stem only)

$\sigma_h = H \gamma_{fluid}$ = (13.5 ft)(40 lb / ft³) = 540 psf

Passive Pressure





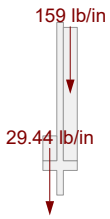


Lateral Earth Pressure

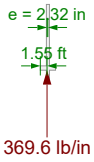
Equivalent Fluid Pressure

$\sigma_h = H\,\gamma_{fluid} = (6\text{ ft})(250\text{ lb / ft}^3) = 1500\text{ psf}$

Wall/Soil Weights



Bearing Pressure



Friction

$F = \mu R = (0.350)(369.6 \text{ lb / in}) = 129.4 \text{ lb / in}$

Bearing Pressure Calculation

Contributing Forces

	Vert Force	...offset	Horz Force	...offset	OT Moment
Backfill Pressure	-0 lb/in	-	0 lb/in	-	-0 in·lb/ft
Footing Weight	-43.67 lb/in	1.75 ft	0 lb/in	-	-10982.62 in·lb/ft
Stem Weight	-116.67 lb/in	1.75 ft	0 lb/in	-	-29343.44 in·lb/ft
Key Weight	-20.83 lb/in	1.75 ft	0 lb/in	-	-5239.9 in·lb/ft
Backfill Weight	-159 lb/in	2.79 ft	0 lb/in	-	-63800.87 in·lb/ft
Soil over toe Weight	-29.44 lb/in	0.71 ft	0 lb/in	-	-2996.13 in·lb/ft
Stem Base Shear	-0 lb/in	-	-206.12 lb/in	1 ft	29681 in·lb/ft
Stem Base Moment	0 lb/in	-	0 lb/in	-	0 in·lb/ft
	-369.61 lb/in				-82682.24 in·lb/ft

$$\frac{-82682.24 \text{ in·lb / ft}}{-369.61 \text{ lb / in}} = 1.55 \text{ ft}$$

Stability Checks [1.0D + 1.0H]

Overturning Check

Check not performed; wall has lateral support.

Sliding Check

Sliding Force(s)

Backfill pressure	350.4 lb/in
Total:	350.4 lb/in

Resisting Force(s)

Passive pressure @ toe	375 lb/in
Friction	129.4 lb/in
Lateral Support Reaction	97.63 lb/in
Total:	602 lb/in

$$\text{F.S.} = \frac{RF}{SF} = \frac{602 \text{ lb / in}}{350.4 \text{ lb / in}} = 1.718 > 1.50 \text{ (OK)}$$

Bearing Capacity Check

Bearing pressure < allowable (1691 psf < 2000 psf) - OK
Bearing resultant eccentricity < allowable (2.32 in < 6.99 in) - OK

Wall Top Displacement

Not calculated because this wall has a lateral restraint.

Stability Checks [0.6D + 1.0H]

Overturning Check

Check not performed; wall has lateral support.

Sliding Check

Sliding Force(s)

Backfill pressure	350.4 lb/in
Total:	350.4 lb/in

Resisting Force(s)

Passive pressure @ toe	375 lb/in
Friction	77.62 lb/in
Lateral Support Reaction	97.63 lb/in
Total:	550.3 lb/in

$$F.S. = \frac{RF}{SF} = \frac{550.3 \text{ lb / in}}{350.4 \text{ lb / in}} = 1.570 > 1.50 \text{ (OK)}$$

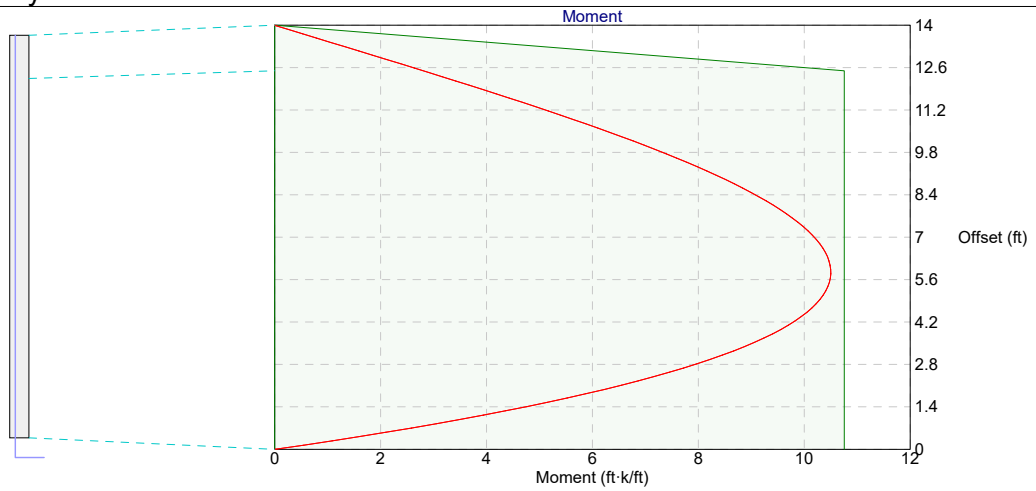
Bearing Capacity Check

Bearing pressure < allowable (1015 psf < 2000 psf) - OK
Bearing resultant eccentricity < allowable (2.32 in < 6.99 in) - OK

Wall Top Displacement

Not calculated because this wall has a lateral restraint.

Stem Flexural Capacity



Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 0 ft from base [Negative bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(1.69 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 0 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0.04 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 1.09 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.04 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.69 \text{ in}) - (1.09 \text{ in}) / 2] = 10.76 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 12.5 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0.04 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 1.09 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.04 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.69 \text{ in}) - (1.09 \text{ in}) / 2] = 10.76 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 14 ft from base [Negative bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

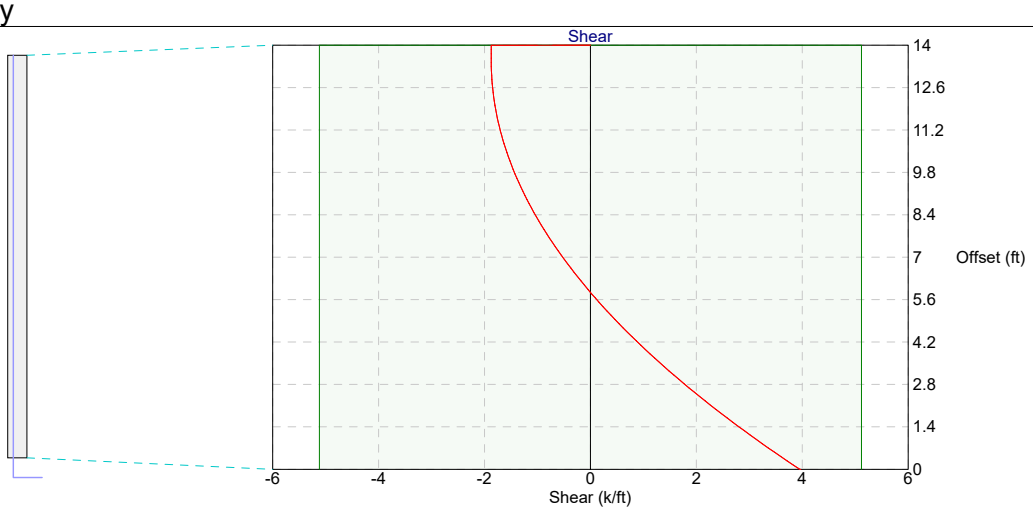
$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(1.69 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 14 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.69 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Stem Shear Capacity



Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 0 ft from base [Positive shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500 \text{ psi}}$ (5.69 in) = 6.83 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.83 k / ft) = 5.12 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 0 ft from base [Negative shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500 \text{ psi}}$ (5.69 in) = 6.83 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.83 k / ft) = 5.12 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 14 ft from base [Positive shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500 \text{ psi}}$ (5.69 in) = 6.83 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.83 k / ft) = 5.12 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 14 ft from base [Negative shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500 \text{ psi}}$ (5.69 in) = 6.83 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.83 k / ft) = 5.12 k / ft

Stem Development/Lap Length Calculations

Main vertical stem bars (bottom end) - Development Length Calculation (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.3)

ψ_e = 1.0 (uncoated hooked bars)

ψ_c = 0.70 (based on side cover and extension cover)

ψ_r = 1.0 (no confining reinforcement)

λ = 1.0 (normal weight concrete)

$$l_{dh} = \left(\frac{f_y \, \psi_e \, \psi_c \, \psi_r}{50 \, \lambda \sqrt{F'_c}} \right) d_b = \left[\frac{(60000 \text{ psi}) \, (1.0) \, (0.70) \, (1.0)}{50 \, (1.0) \sqrt{2500 \text{ psi}}} \right] (0.63 \text{ in}) = 10.5 \text{ in}$$

$8 \, d_b = 8 \, (0.63 \text{ in}) = 5.0$ (minimum limit, does not control)

Main vertical stem bars (top end) - Development Length Calculation (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.3)

ψ_t = 1.0 (bars are not horizontal)

ψ_e = 1.0 (bar not epoxy coated)

ψ_s = 0.80 (bars are #6 or smaller)

λ = 1.0 (normal weight concrete)

$s / 2 = (8 \text{ in}) / 2 = 4 \text{ in}$

$\text{cover} + d_b / 2 = (2 \text{ in}) + (0.63 \text{ in}) / 2 = 2.31 \text{ in}$

c_b = 2.31 in (lesser of half spacing, ctr to surface)

K_{tr} = 0.0 (no transverse reinforcement)

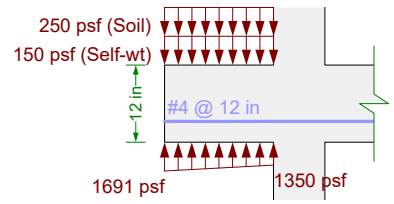
$$\frac{c_b + K_{tr}}{d_b} = \frac{(2.31 \text{ in}) + (0.0)}{(0.63 \text{ in})} = 3.70$$

$$l_d = \left(\frac{3.}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t \, \psi_e \, \psi_s}{2.5} \right) d_b = \left[\frac{3.}{40} \frac{(60000 \text{ psi})}{(1.0) \sqrt{2500 \text{ psi}}} \frac{(1.0) \, (1.0) \, (0.80)}{2.5} \right] (0.63 \text{ in}) = 18 \text{ in}$$

Toe Checks [1.4D + 1.6H]

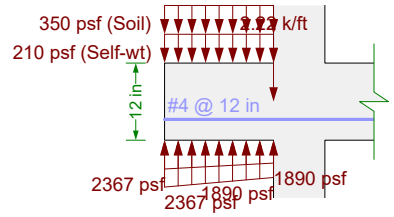
Toe Unfactored Loads

Unfactored Loads



Toe Factored Loads

1.4D + 1.6H



Controlling Moment

Note: Design toe moment is not limited to stem moment because stem base is pinned

M_{toe} = 1.65 ft·k / ft

Flexure Check (ACI 318-14 13.3.2.1, 7.5.2.1, »22.3, »22.2, 7.5.1.1a)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})[(8.75 \text{ in}) - (0.47 \text{ in}) / 2] = 7.66 \text{ ft·k / ft}$$

ϕM_n = 7.66 ft·k / ft ≥ M_u = 1.65 ft·k / ft ✓

Shear Check (ACI 318-14 13.3.2.1, 7.5.3.1, »22.5.1, »22.5.5, 7.5.1.1b)

λ = 1.0 (normal weight concrete)

$$V_c = 2 \lambda \sqrt{F'_c} d = 2 (1.0) \sqrt{2500 \text{ psi}} (8.75 \text{ in}) = 10.5 \text{ k / ft}$$

$$\phi V_n = \phi V_c = (0.750)(10.5 \text{ k / ft}) = 7.88 \text{ k / ft}$$

ϕV_n = 7.88 k / ft ≥ V_u = 1.16 k / ft ✓

Minimum Strain Check (ACI 318-14 13.3.2.1, 7.3.3.1)

β_1 = 0.850 ($F'_c \le 4000$ psi)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$$

$$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(8.75 \text{ in})}{(0.47 \text{ in}) / (0.850)} - 1 \right] = 0.0444$$

ε_t = 0.0444 ≥ 0.004 ✓

Minimum Steel Check (ACI 318-14 13.3.2.1, 9.6.1)

ϕM_n = 7.66 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (1.65 ft·k / ft) = 2.19 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Shrinkage and Temperature Steel (ACI 318-14 13.2.8.1, 7.6.4.1, 24.4.3.2, 24.4.3.3)

$$\rho_{ST\_prov} = \frac{A_{ST}}{t\, s_{ST}} = \frac{(0.2 \text{ in}^2 / \text{in})}{(12 \text{ in})(9 \text{ in})} = 0.0019$$

$$\rho_{ST\_prov} = \frac{A_{ST}}{t\, s_{ST}} = \frac{(0.2 \text{ in}^2 / \text{in})}{(12 \text{ in})(9 \text{ in})} = 0.0019$$

$$\frac{0.0018 (60000)}{f_y} = \frac{0.0018 (60000)}{(60000 \text{ psi})} = 0.0018$$

ρ_{ST_min} = 0.0018

ρ_{ST_prov} = 0.0019 ≥ ρ_{ST_min} = 0.0018 ✓

18 inch limit governs

s_{ST_max} = 18 in

s_{ST} = 9 in ≤ s_{ST_max} = 18 in ✓

Development Check (ACI 318-14 13.2.8.1, 25.4.2.3, 25.4.10)

$$\frac{M_u}{\phi M_n} = \frac{(1.65 \text{ ft·k / ft})}{(7.66 \text{ ft·k / ft})} = 0.2148$$ (ratio to represent excess reinforcement)

ψ_t = 1.0 (12 inches or less cast below - 3.00 inches)

ψ_e = 1.0 (bar not epoxy coated)

ψ_s = 0.80 (bars are #6 or smaller)

λ = 1.0 (normal weight concrete)

s / 2 = (12 in) / 2 = 6 in

cover + d_b / 2 = (3 in) + (0.5 in) / 2 = 3.25 in

c_b = 3.25 in (lesser of half spacing, ctr to surface)

K_{tr} = 0.0 (no transverse reinforcement)

$$\frac{c_b + K_{tr}}{d_b} = \frac{(3.25 \text{ in}) + (0.0)}{(0.5 \text{ in})} = 6.50$$

$$l_d = \left(\frac{3.}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t \psi_e \psi_s}{2.5} \right) d_b = \left[\frac{3.}{40} \frac{(60000 \text{ psi})}{(1.0) \sqrt{2500 \text{ psi}}} \frac{(1.0)(1.0)(0.80)}{2.5} \right] (0.5 \text{ in}) = 14.4 \text{ in}$$

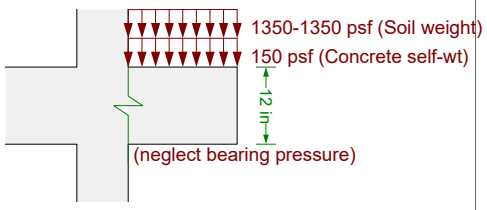
Factoring l_d by the excess reinforcement ratio (0.2148) per 25.4.10: l_d = 3.09 in

12 inch minimum controls

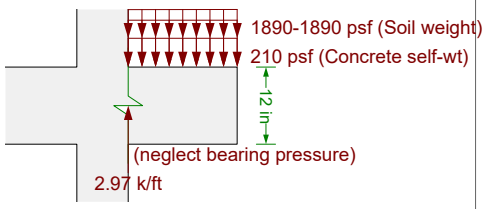
l_{d_prov} = 21.96 in ≥ l_d = 12 in ✓

Heel Checks [1.4D + 1.6H]

Heel Unfactored Loads



Heel Factored Loads



Controlling Moment

Note: Design heel moment is not limited to stem moment because stem base is pinned

M_{heel} = 2.1 ft·k / ft

Shear Check (ACI 318-14 13.3.2.1, 7.5.3.1, »22.5.1, »22.5.5, 7.5.1.1b)

λ = 1.0 (normal weight concrete)

Unreinforced, use plain concrete provisions: ACI 14.5.5

Note: Effective thickness reduced by 2 inches for concrete cast on soil (ACI 22.4.8)

$V_n = \frac{4}{3} \lambda \sqrt{F'_c}\, h = \frac{4}{3} (1.0) \sqrt{2500\ psi}\, (10\ in) = 8$ k / ft

$\phi V_n = \phi\, V_n = (0.60)\,(8\ k / ft) = 4.8$ k / ft

$\phi V_n = 4.8$ k / ft ≥ $V_u = 2.97$ k / ft ✓

Flexure Check (ACI 318-14 13.3.2.1, 7.5.2.1, »22.3, »22.2, 7.5.1.1a)

Unreinforced, use plain concrete provisions: ACI 14.5.2

Note: Effective thickness reduced by 2 inches for concrete cast on soil (ACI 22.4.8)

$M_n = 5\, \lambda \sqrt{F'_c}\, S_m = 5\,(1.0) \sqrt{2500\ psi}\,(200\ in^3 / ft) = 4.17$ ft·k / ft (as limited by tension)

$M_n = 0.85\, F'_c\, S_m = 0.85\,(2500\ psi)\,(200\ in^3 / ft) = 35.42$ ft·k / ft (as limited by compression)

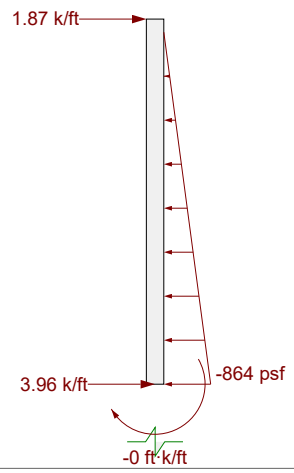
Tension controls

$\phi M_n = \phi\, M_n = (0.60)\,(4.17\ ft·k / ft) = 2.5$ ft·k / ft

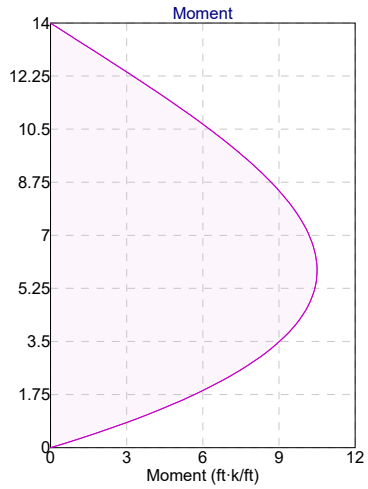
$\phi M_n = 2.5$ ft·k / ft ≥ $M_u = 2.1$ ft·k / ft ✓

Stem Forces [1.4D + 1.6H]

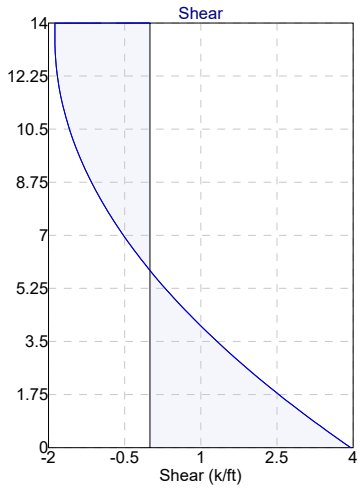
Stem Internal Forces



Stem Internal Forces



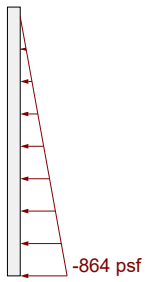
Stem Internal Forces



Stem Joint Force Transfer

Location	Force
@ stem base	3.96 k/ft

Stem Internal Forces



Stem Moment Checks [1.4D + 1.6H]

Check (ACI 318-14 11.5.5.1b) @ 5.8 ft from base [Positive bending]

ϕM_n = 10.76 ft·k / ft ≥ M_u = 10.5 ft·k / ft ✓

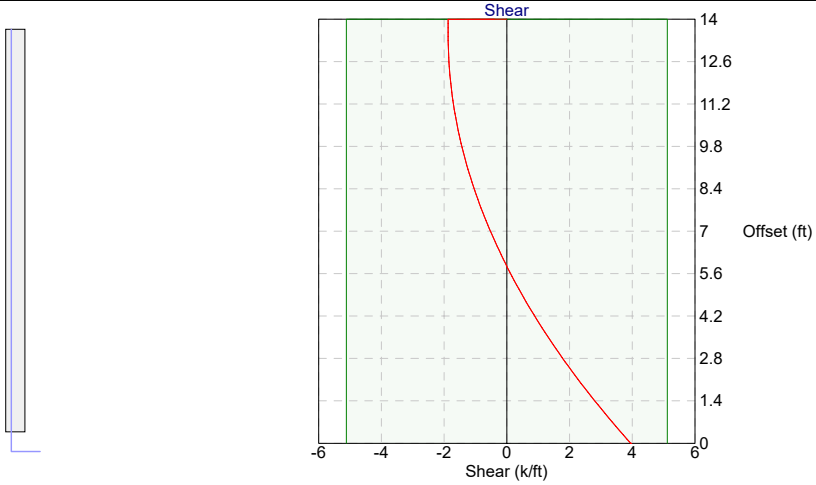
Check (ACI 318-14 11.5.5.1b) @ 12.5 ft from base [Positive bending]

ϕM_n = 10.76 ft·k / ft ≥ M_u = 2.9 ft·k / ft ✓

Check (ACI 318-14 11.5.5.1b) @ 12.59 ft from base [Positive bending]

ϕM_n = 10.14 ft·k / ft ≥ M_u = 2.64 ft·k / ft ✓

Stem Shear Checks [1.4D + 1.6H]



Shear Check (ACI 318-14 11.5.5.1c) @ 0 ft from base [Positive shear]

ϕV_n = 5.12 k / ft ≥ V_u = 3.96 k / ft ✓

Shear Check (ACI 318-14 11.5.5.1c) @ 13.58 ft from base [Negative shear]

ϕV_n = 5.12 k / ft ≥ V_u = 1.87 k / ft ✓

Stem Miscellaneous Checks [1.4D + 1.6H]

Minimum Steel Check (ACI 318-14 9.6.1) @ 0 ft from base [Stem in negative flexure]

ϕM_n = 0 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (0 ft·k / ft) = 0 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Minimum Steel Check (ACI 318-14 9.6.1) @ 14 ft from base [Stem in negative flexure]

ϕM_n = 0 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (0 ft·k / ft) = 0 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Maximum Steel Check (ACI 318-14 9.3.3.1) @ 0 ft from base [Stem in negative flexure]

β_1 = 0.850 ($F'_c \le 4000$ psi)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(1.69 \text{ in})}{(0 \text{ in}) / (0.850)} - 1 \right] = \text{INF}$$

ε_t = INF ≥ 0.004 ✓

Maximum Steel Check (ACI 318-14 9.3.3.1) @ 14 ft from base [Stem in negative flexure]

β_1 = 0.850 ($F'_c \le 4000$ psi)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(1.69 \text{ in})}{(0 \text{ in}) / (0.850)} - 1 \right] = \text{INF}$$

ε_t = INF ≥ 0.004 ✓

Wall Horizontal Steel (ACI 318-14 11.6.1, 11.7.3)

$$\rho_t = \frac{A_{s\_horz} / s_{horz}}{t} = \frac{(0.31 \text{ in}^2) / (12 \text{ in})}{(8 \text{ in})} = 0.0032$$

ρ_{t_min} = 0.0020 (bars No. 5 or less, not less than 60 ksi)

ρ_t = 0.0032 ≥ ρ_{t_min} = 0.0020 ✓

3 h = 3 (8 in) = 24 in

18 inch limit governs

s_{horz} = 12 in ≤ s_{horz_max} = 18 in ✓

Development Check (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.10)

$\frac{M_u}{\phi M_n} = \frac{(0 \text{ ft·k / ft})}{(0 \text{ ft·k / ft})}$ = INF (ratio to represent excess reinforcement)

ψ_e = 1.0 (uncoated hooked bars)

ψ_c = 0.70 (based on side cover and extension cover)

ψ_r = 1.0 (no confining reinforcement)

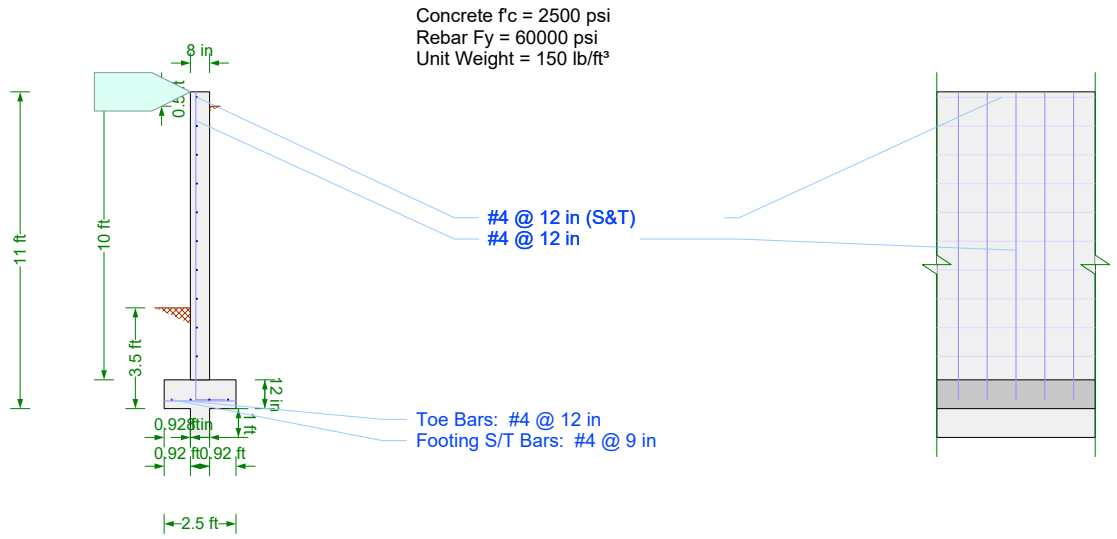
λ = 1.0 (normal weight concrete)

$$l_{dh} = \left(\frac{f_y \psi_e \psi_c \psi_r}{50 \lambda \sqrt{F'_c}} \right) d_b = \left[\frac{(60000 \text{ psi})(1.0)(0.70)(1.0)}{50 (1.0) \sqrt{2500 \text{ psi}}} \right] (0.63 \text{ in}) = 10.5 \text{ in}$$

8 d_b = 8 (0.63 in) = 5.0 (minimum limit, does not control)

l_{dh_prov} = 9 in < l_{dh} = 10.5 in ✗

Design Detail



Check Summary

Ratio	Check	Provided	Required	Combination
----- Stability Checks -----				
✓ 0.908	Sliding	1.65	1.50	0.6D + 1.0H
✓ 0.865	Bearing Pressure	2000 psf	1730 psf	1.0D + 1.0H
✓ 0.679	Bearing Eccentricity	3.39 in	4.99 in	1.0D + 1.0H
----- Toe Checks -----				
✓ 0.042	Shear	7.88 k/ft	0.33 k/ft	1.4D + 1.6H
✓ 0.089	Moment	7.66 ft·k/ft	0.68 ft·k/ft	1.4D + 1.6H
✓ 0.090	Min Strain	0.0444	0.0040	1.4D + 1.6H
✓ 0.000	Min Steel	0.02 in²	0 in²	1.4D + 1.6H
✓ 0.751	Development	15.98 in	12 in	1.4D + 1.6H
✓ 0.500	S&T Max Spacing	9 in	18 in	1.4D + 1.6H
✓ 0.972	S&T Min Rho	0.0019	0.0018	1.4D + 1.6H
----- Heel Checks -----				
✓ 0.294	Shear	4.8 k/ft	1.41 k/ft	1.4D + 1.6H
✓ 0.258	Moment	2.5 ft·k/ft	0.64 ft·k/ft	1.4D + 1.6H
----- Stem Checks -----				
✓ 0.749	Moment	4.96 ft·k/ft	3.72 ft·k/ft	1.4D + 1.6H
✓ 0.381	Shear	5.17 k/ft	1.97 k/ft	1.4D + 1.6H
✓ 0.000	Max Steel	Infinite	0.0040	1.4D + 1.6H
✓ 0.000	Min Steel	0 in²/in	0 in²/in	1.4D + 1.6H
✓ 0.933	Base Development	9 in	8.4 in	1.4D + 1.6H
✓ 0.000	Horz Bar Rho	0.0000	0.0000	1.4D + 1.6H
✓ 0.667	Horz Bar Spacing	12 in	18 in	1.4D + 1.6H

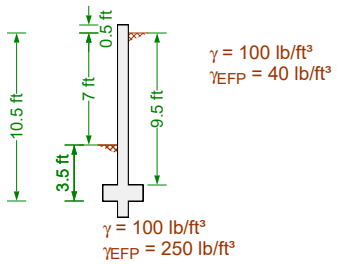
Criteria

Use basic criteria from common project settings	No
Building Code	IBC 2015
Concrete Load Combs	ASCE 7-10 (Streng...
Masonry Load Combs	ASCE 7-10 (ASD)
Stability Load Combs	ASCE 7-10 (ASD)
Apply Sds Factor to Seismic Combinations for Ev	Yes
Sds (from ASCE 7)	0.59
Restrained Against Sliding	No
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.50
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	2000 psf
Req'd Bearing Location	Middle third
Wall Friction Angle	25°
Friction Coefficent	0.35
Soil Reaction Modulus	172800 lb/ft³

Loads

Loading Options/Assumptions

Passive pressure neglects top 0 ft of soil.



Load Combinations

ASCE 7-10 (Strength)

1.4D + 1.6H
1.4D + 0.9H
1.2D + 1.6H
1.2D + 0.9H
0.9D + 1.6H
0.9D + 0.9H

Strength Check Results Summary

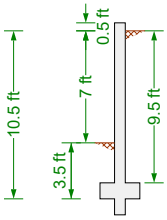
Load Combination	Stem M-applied (ft·k/ft)	Stem M-allow (ft·k/ft)	Stem V-applied (k/ft)	Stem V-allow (k/ft)	Stem Min. Id (in)	Stem Actual Id (in)	Heel M-applied (ft·k/ft)
1.4D + 1.6H	3.72	4.96	1.97	5.17	8.4	9	0.64
1.4D + 0.9H	2.09	4.96	1.11	5.17	8.4	9	0.64
1.2D + 1.6H	3.72	4.96	1.97	5.17	8.4	9	0.55
1.2D + 0.9H	2.09	4.96	1.11	5.17	8.4	9	0.55
0.9D + 1.6H	3.72	4.96	1.97	5.17	8.4	9	0.41
0.9D + 0.9H	2.09	4.96	1.11	5.17	8.4	9	0.41

Load Combination	Heel M-allow (ft·k/ft)	Heel V-applied (k/ft)	Heel V-allow (k/ft)	Toe M-applied (ft·k/ft)	Toe M-allow (ft·k/ft)	Toe V-applied (k/ft)	Toe V-allow (k/ft)
1.4D + 1.6H	2.5	1.41	4.8	0.68	7.66	0.33	7.88
1.4D + 0.9H	2.5	1.41	4.8	0.68	7.66	0.33	7.88
1.2D + 1.6H	2.5	1.21	4.8	0.58	7.66	0.28	7.88
1.2D + 0.9H	2.5	1.21	4.8	0.58	7.66	0.28	7.88
0.9D + 1.6H	2.5	0.91	4.8	0.44	7.66	0.21	7.88
0.9D + 0.9H	2.5	0.91	4.8	0.44	7.66	0.21	7.88

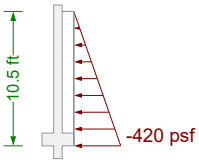
Stability Check Results Summary

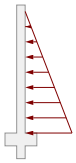
Load Combination	Sliding Force (lb/in)	Resisting Force (lb/in)	Sliding F.S.	Sliding F.S. Req'd	Sliding F.S. Req'd Seis...	Bearing Pressure Actual (psf)	Bearing Pressure Allowable (psf)	earing Eccentricity Actual (in)	aring Eccentricity Allowable (in)
1.0D + 1.0H	183.8	333.6	1.816	1.500	1.500	1730	2000	3.39	4.99
1.0D + 0.6H	110.3	230.2	2.088	1.500	1.500	1730	2000	3.39	4.99
0.6D + 1.0H	183.8	303.6	1.652	1.500	1.500	1038	2000	3.39	4.99
0.6D + 0.6H	110.3	200.2	1.816	1.500	1.500	1038	2000	3.39	4.99

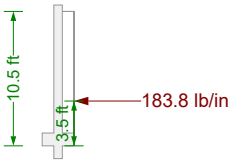
Backfill Pressure

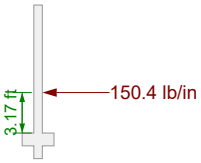


γ = 100 lb/ft³
γ_{EFP} = 40 lb/ft³









Lateral Earth Pressure

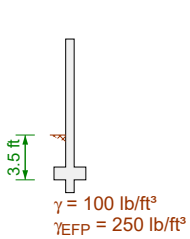
Equivalent Fluid Pressure

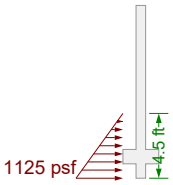
$\sigma_h = H\,\gamma_{fluid}$ = (10.5 ft)(40 lb / ft³) = 420 psf

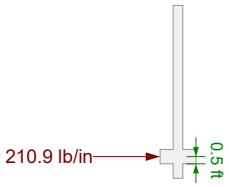
Lateral Earth Pressure (stem only)

$\sigma_h = H\,\gamma_{fluid}$ = (9.5 ft)(40 lb / ft³) = 380 psf

Passive Pressure





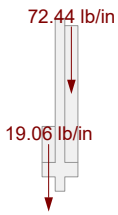


Lateral Earth Pressure

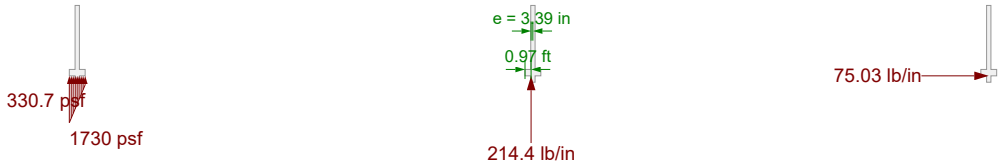
Equivalent Fluid Pressure

$\sigma_h = H\,\gamma_{fluid} = (4.5\text{ ft})(250\text{ lb / ft}^3) = 1125\text{ psf}$

Wall/Soil Weights



Bearing Pressure



Friction

$F = \mu R = (0.350)(214.4 \text{ lb / in}) = 75.03 \text{ lb / in}$

Bearing Pressure Calculation

Contributing Forces

	Vert Force	...offset	Horz Force	...offset	OT Moment
Backfill Pressure	-0 lb/in	-	0 lb/in	-	-0 in·lb/ft
Footing Weight	-31.21 lb/in	1.25 ft	0 lb/in	-	-5610.01 in·lb/ft
Stem Weight	-83.33 lb/in	1.25 ft	0 lb/in	-	-14980 in·lb/ft
Key Weight	-8.33 lb/in	1.25 ft	0 lb/in	-	-1498 in·lb/ft
Backfill Weight	-72.44 lb/in	2.04 ft	0 lb/in	-	-21270.55 in·lb/ft
Soil over toe Weight	-19.06 lb/in	0.46 ft	0 lb/in	-	-1255.84 in·lb/ft
Stem Base Shear	-0 lb/in	-	-102.78 lb/in	1 ft	14801 in·lb/ft
Stem Base Moment	0 lb/in	-	0 lb/in	-	0 in·lb/ft
	-214.38 lb/in				-29813.4 in·lb/ft

$$\frac{-29813.4 \text{ in·lb / ft}}{-214.38 \text{ lb / in}} = 0.97 \text{ ft}$$

Stability Checks [1.0D + 1.0H]

Overturning Check

Check not performed; wall has lateral support.

Sliding Check

Sliding Force(s)

Backfill pressure	183.8 lb/in
Total:	183.8 lb/in

Resisting Force(s)

Passive pressure @ toe	210.9 lb/in
Friction	75.03 lb/in
Lateral Support Reaction	47.63 lb/in
Total:	333.6 lb/in

$$F.S. = \frac{RF}{SF} = \frac{333.6 \text{ lb / in}}{183.8 \text{ lb / in}} = 1.816 > 1.50 \text{ (OK)}$$

Bearing Capacity Check

Bearing pressure < allowable (1730 psf < 2000 psf) - OK
Bearing resultant eccentricity < allowable (3.39 in < 4.99 in) - OK

Wall Top Displacement

Not calculated because this wall has a lateral restraint.

Stability Checks [0.6D + 1.0H]

Overturning Check

Check not performed; wall has lateral support.

Sliding Check

Sliding Force(s)

Backfill pressure	183.8 lb/in
Total:	183.8 lb/in

Resisting Force(s)

Passive pressure @ toe	210.9 lb/in
Friction	45.02 lb/in
Lateral Support Reaction	47.63 lb/in
Total:	303.6 lb/in

$$F.S. = \frac{RF}{SF} = \frac{303.6 \text{ lb / in}}{183.8 \text{ lb / in}} = 1.652 > 1.50 \text{ (OK)}$$

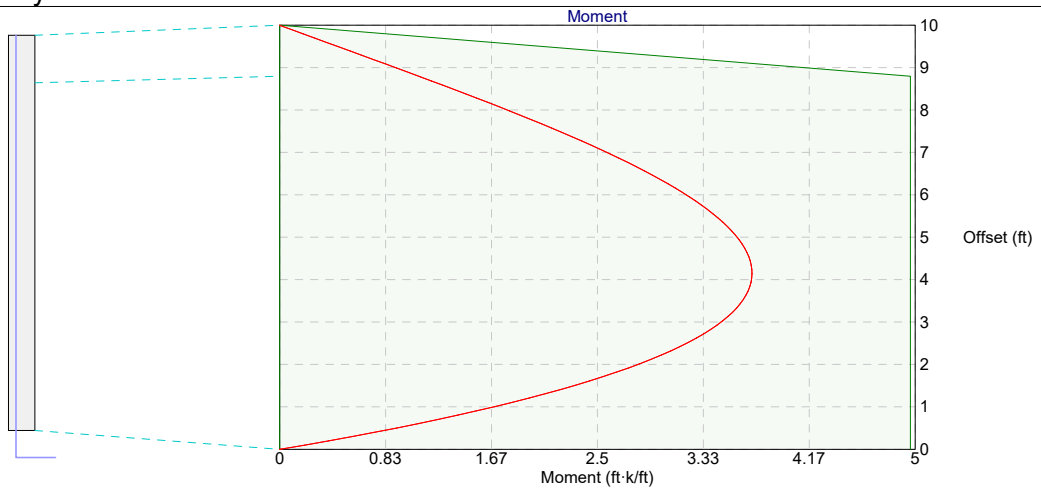
Bearing Capacity Check

Bearing pressure < allowable (1038 psf < 2000 psf) - OK
Bearing resultant eccentricity < allowable (3.39 in < 4.99 in) - OK

Wall Top Displacement

Not calculated because this wall has a lateral restraint.

Stem Flexural Capacity



Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 0 ft from base [Negative bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(1.75 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 0 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.75 \text{ in}) - (0.47 \text{ in}) / 2] = 4.96 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 8.8 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.75 \text{ in}) - (0.47 \text{ in}) / 2] = 4.96 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 10 ft from base [Negative bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

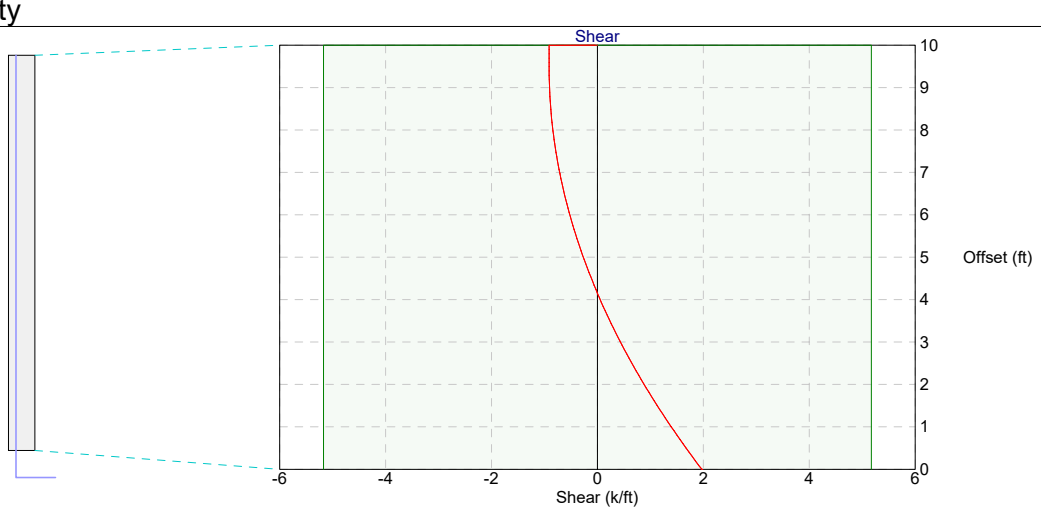
$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(1.75 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 10 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 f'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.75 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Stem Shear Capacity



Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 0 ft from base [Positive shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.75 in) = 6.9 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.9 k / ft) = 5.17 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 0 ft from base [Negative shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.75 in) = 6.9 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.9 k / ft) = 5.17 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 10 ft from base [Positive shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.75 in) = 6.9 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.9 k / ft) = 5.17 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 10 ft from base [Negative shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.75 in) = 6.9 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.9 k / ft) = 5.17 k / ft

Stem Development/Lap Length Calculations

Main vertical stem bars (bottom end) - Development Length Calculation (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.3)

ψ_e = 1.0 (uncoated hooked bars)

ψ_c = 0.70 (based on side cover and extension cover)

ψ_r = 1.0 (no confining reinforcement)

λ = 1.0 (normal weight concrete)

$$l_{dh} = \left(\frac{f_y \, \psi_e \, \psi_c \, \psi_r}{50 \, \lambda \sqrt{F'_c}} \right) d_b = \left[\frac{(60000 \text{ psi}) \, (1.0) \, (0.70) \, (1.0)}{50 \, (1.0) \sqrt{2500 \text{ psi}}} \right] (0.5 \text{ in}) = 8.4 \text{ in}$$

$8 \, d_b = 8 \, (0.5 \text{ in}) = 4.0$ (minimum limit, does not control)

Main vertical stem bars (top end) - Development Length Calculation (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.3)

ψ_t = 1.0 (bars are not horizontal)

ψ_e = 1.0 (bar not epoxy coated)

ψ_s = 0.80 (bars are #6 or smaller)

λ = 1.0 (normal weight concrete)

$s / 2 = (12 \text{ in}) / 2 = 6 \text{ in}$

$\text{cover} + d_b / 2 = (2 \text{ in}) + (0.5 \text{ in}) / 2 = 2.25 \text{ in}$

c_b = 2.25 in (lesser of half spacing, ctr to surface)

K_{tr} = 0.0 (no transverse reinforcement)

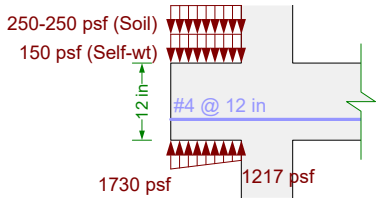
$$\frac{c_b + K_{tr}}{d_b} = \frac{(2.25 \text{ in}) + (0.0)}{(0.5 \text{ in})} = 4.50$$

$$l_d = \left(\frac{3.}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t \, \psi_e \, \psi_s}{2.5} \right) d_b = \left[\frac{3.}{40} \frac{(60000 \text{ psi})}{(1.0) \sqrt{2500 \text{ psi}}} \frac{(1.0) \, (1.0) \, (0.80)}{2.5} \right] (0.5 \text{ in}) = 14.4 \text{ in}$$

Toe Checks [1.4D + 1.6H]

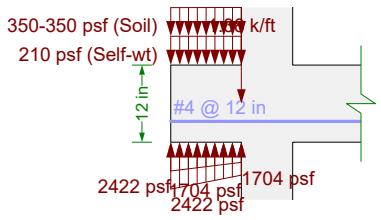
Toe Unfactored Loads

Unfactored Loads



Toe Factored Loads

1.4D + 1.6H



Controlling Moment

Note: Design toe moment is not limited to stem moment because stem base is pinned

M_{toe} = 0.68 ft·k / ft

Flexure Check (ACI 318-14 13.3.2.1, 7.5.2.1, »22.3, »22.2, 7.5.1.1a)

$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$

$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})[(8.75 \text{ in}) - (0.47 \text{ in}) / 2] = 7.66 \text{ ft·k / ft}$

ϕM_n = 7.66 ft·k / ft ≥ M_u = 0.68 ft·k / ft ✓

Shear Check (ACI 318-14 13.3.2.1, 7.5.3.1, »22.5.1, »22.5.5, 7.5.1.1b)

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c} d = 2 (1.0) \sqrt{2500 \text{ psi}} (8.75 \text{ in}) = 10.5 \text{ k / ft}$

$\phi V_n = \phi V_c = (0.750)(10.5 \text{ k / ft}) = 7.88 \text{ k / ft}$

ϕV_n = 7.88 k / ft ≥ V_u = 0.33 k / ft ✓

Minimum Strain Check (ACI 318-14 13.3.2.1, 7.3.3.1)

β_1 = 0.850 ($F'_c \le 4000$ psi)

$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$

$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(8.75 \text{ in})}{(0.47 \text{ in}) / (0.850)} - 1 \right] = 0.0444$

ε_t = 0.0444 ≥ 0.004 ✓

Minimum Steel Check (ACI 318-14 13.3.2.1, 9.6.1)

ϕM_n = 7.66 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (0.68 ft·k / ft) = 0.91 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Shrinkage and Temperature Steel (ACI 318-14 13.2.8.1, 7.6.4.1, 24.4.3.2, 24.4.3.3)

$\rho_{ST\_prov} = \frac{A_{ST}}{t\, s_{ST}} = \frac{(0.2 \text{ in}^2 / \text{in})}{(12 \text{ in})(9 \text{ in})} = 0.0019$

$\rho_{ST\_prov} = \frac{A_{ST}}{t\, s_{ST}} = \frac{(0.2 \text{ in}^2 / \text{in})}{(12 \text{ in})(9 \text{ in})} = 0.0019$

$\frac{0.0018 (60000)}{f_y} = \frac{0.0018 (60000)}{(60000 \text{ psi})} = 0.0018$

ρ_{ST_min} = 0.0018

ρ_{ST_prov} = 0.0019 ≥ ρ_{ST_min} = 0.0018 ✓

18 inch limit governs

s_{ST_max} = 18 in

s_{ST} = 9 in ≤ s_{ST_max} = 18 in ✓

Development Check (ACI 318-14 13.2.8.1, 25.4.2.3, 25.4.10)

$\frac{M_u}{\phi M_n} = \frac{(0.68 \text{ ft·k / ft})}{(7.66 \text{ ft·k / ft})} = 0.0886$ (ratio to represent excess reinforcement)

ψ_t = 1.0 (12 inches or less cast below - 3.00 inches)

ψ_e = 1.0 (bar not epoxy coated)

ψ_s = 0.80 (bars are #6 or smaller)

λ = 1.0 (normal weight concrete)

s / 2 = (12 in) / 2 = 6 in

cover + d_b / 2 = (3 in) + (0.5 in) / 2 = 3.25 in

c_b = 3.25 in (lesser of half spacing, ctr to surface)

K_{tr} = 0.0 (no transverse reinforcement)

$\frac{c_b + K_{tr}}{d_b} = \frac{(3.25 \text{ in}) + (0.0)}{(0.5 \text{ in})} = 6.50$

$l_d = \left(\frac{3.}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t \psi_e \psi_s}{2.5} \right) d_b = \left[\frac{3.}{40} \frac{(60000 \text{ psi})}{(1.0) \sqrt{2500 \text{ psi}}} \frac{(1.0)(1.0)(0.80)}{2.5} \right] (0.5 \text{ in}) = 14.4 \text{ in}$

Factoring l_d by the excess reinforcement ratio (0.0886) per 25.4.10: l_d = 1.28 in

12 inch minimum controls

l_{d_prov} = 15.98 in ≥ l_d = 12 in ✓

Heel Checks [1.4D + 1.6H]

Controlling Moment

Note: Design heel moment is not limited to stem moment because stem base is pinned

M_{heel} = 0.64 ft·k / ft

Shear Check (ACI 318-14 13.3.2.1, 7.5.3.1, »22.5.1, »22.5.5, 7.5.1.1b)

λ = 1.0 (normal weight concrete)

Unreinforced, use plain concrete provisions: ACI 14.5.5

Note: Effective thickness reduced by 2 inches for concrete cast on soil (ACI 22.4.8)

$V_n = \frac{4}{3} \lambda \sqrt{F'_c}\, h = \frac{4}{3} (1.0) \sqrt{2500\ psi}\, (10\ in) = 8$ k / ft

$\phi V_n = \phi\, V_n = (0.60)\,(8\ k / ft) = 4.8$ k / ft

$\phi V_n = 4.8$ k / ft ≥ $V_u = 1.41$ k / ft ✓

Flexure Check (ACI 318-14 13.3.2.1, 7.5.2.1, »22.3, »22.2, 7.5.1.1a)

Unreinforced, use plain concrete provisions: ACI 14.5.2

Note: Effective thickness reduced by 2 inches for concrete cast on soil (ACI 22.4.8)

$M_n = 5 \lambda \sqrt{F'_c}\, S_m = 5\,(1.0) \sqrt{2500\ psi}\, (200\ in^3 / ft) = 4.17$ ft·k / ft (as limited by tension)

$M_n = 0.85\, F'_c\, S_m = 0.85\,(2500\ psi)\,(200\ in^3 / ft) = 35.42$ ft·k / ft (as limited by compression)

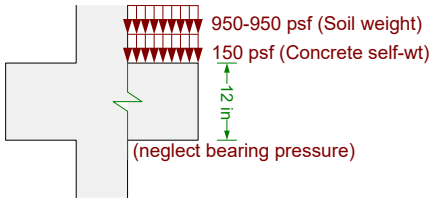
Tension controls

$\phi M_n = \phi\, M_n = (0.60)\,(4.17\ ft·k / ft) = 2.5$ ft·k / ft

$\phi M_n = 2.5$ ft·k / ft ≥ $M_u = 0.64$ ft·k / ft ✓

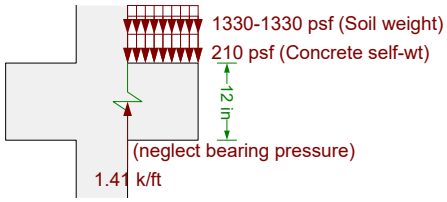
Heel Unfactored Loads

Unfactored Loads



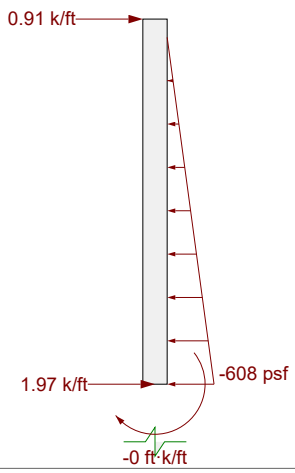
Heel Factored Loads

1.4D + 1.6H

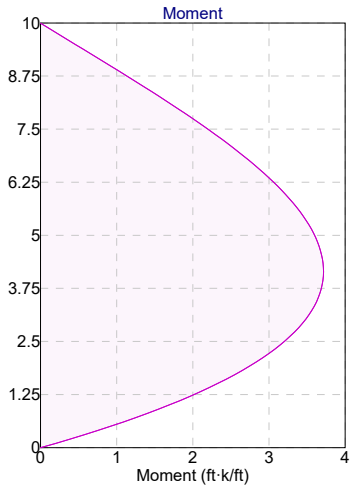


Stem Forces [1.4D + 1.6H]

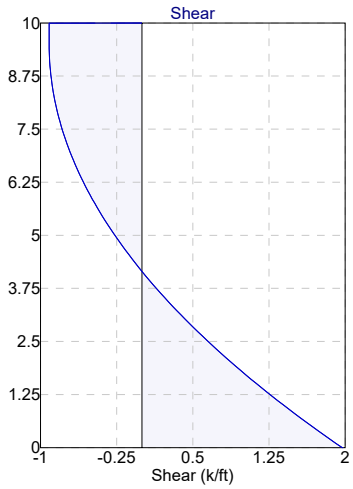
Stem Internal Forces



Stem Internal Forces



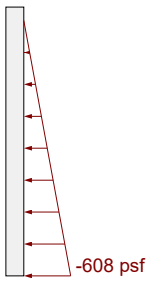
Stem Internal Forces



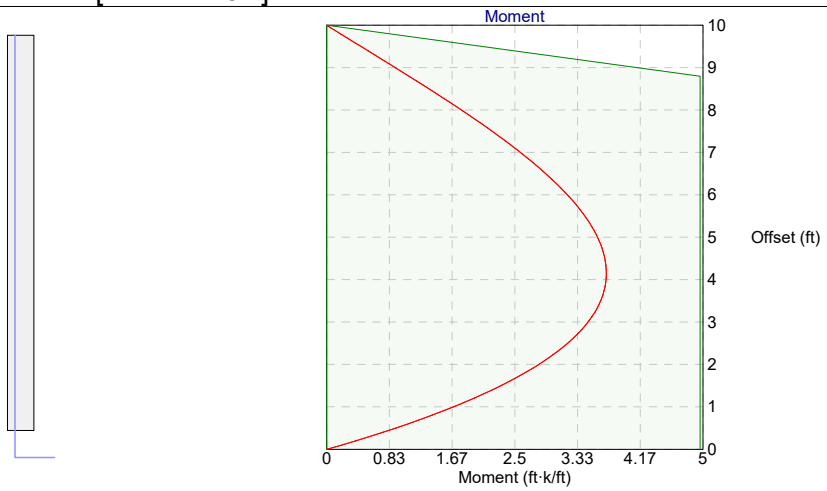
Stem Joint Force Transfer

Location	Force
@ stem base	1.97 k/ft

Stem Internal Forces



Stem Moment Checks [1.4D + 1.6H]



Check (ACI 318-14 11.5.5.1b) @ 4.14 ft from base [Positive bending]

ϕM_n = 4.96 ft·k / ft ≥ M_u = 3.72 ft·k / ft ✓

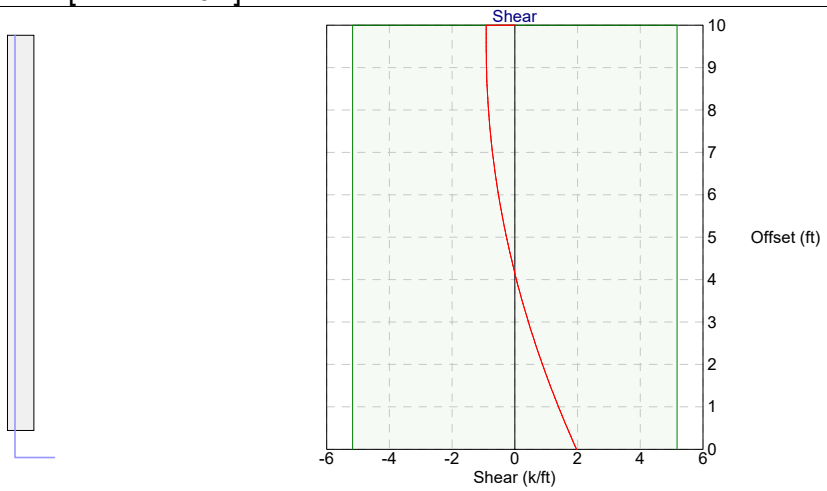
Check (ACI 318-14 11.5.5.1b) @ 8.8 ft from base [Positive bending]

ϕM_n = 4.96 ft·k / ft ≥ M_u = 1.1 ft·k / ft ✓

Check (ACI 318-14 11.5.5.1b) @ 8.89 ft from base [Positive bending]

ϕM_n = 4.6 ft·k / ft ≥ M_u = 1.01 ft·k / ft ✓

Stem Shear Checks [1.4D + 1.6H]



Shear Check (ACI 318-14 11.5.5.1c) @ 0 ft from base [Positive shear]

ϕV_n = 5.17 k / ft ≥ V_u = 1.97 k / ft ✓

Shear Check (ACI 318-14 11.5.5.1c) @ 9.6 ft from base [Negative shear]

ϕV_n = 5.17 k / ft ≥ V_u = 0.91 k / ft ✓

Stem Miscellaneous Checks [1.4D + 1.6H]

Minimum Steel Check (ACI 318-14 9.6.1) @ 0 ft from base [Stem in negative flexure]

ϕM_n = 0 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (0 ft·k / ft) = 0 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Minimum Steel Check (ACI 318-14 9.6.1) @ 10 ft from base [Stem in negative flexure]

ϕM_n = 0 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (0 ft·k / ft) = 0 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Maximum Steel Check (ACI 318-14 9.3.3.1) @ 0 ft from base [Stem in negative flexure]

β_1 = 0.850 ($F'_c \le 4000$ psi)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(1.75 \text{ in})}{(0 \text{ in}) / (0.850)} - 1 \right] = \text{INF}$$

ε_t = INF ≥ 0.004 ✓

Maximum Steel Check (ACI 318-14 9.3.3.1) @ 10 ft from base [Stem in negative flexure]

β_1 = 0.850 ($F'_c \le 4000$ psi)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(1.75 \text{ in})}{(0 \text{ in}) / (0.850)} - 1 \right] = \text{INF}$$

ε_t = INF ≥ 0.004 ✓

Wall Horizontal Steel (ACI 318-14 11.6.1, 11.7.3)

$$\rho_t = \frac{A_{s\_horz} / s_{horz}}{t} = \frac{(0.2 \text{ in}^2) / (12 \text{ in})}{(8 \text{ in})} = 0.0021$$

ρ_{t_min} = 0.0020 (bars No. 5 or less, not less than 60 ksi)

ρ_t = 0.0021 ≥ ρ_{t_min} = 0.0020 ✓

3 h = 3 (8 in) = 24 in

18 inch limit governs

s_{horz} = 12 in ≤ s_{horz_max} = 18 in ✓

Development Check (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.10)

$$\frac{M_u}{\phi M_n} = \frac{(0 \text{ ft·k / ft})}{(0 \text{ ft·k / ft})} = \text{INF}$$ (ratio to represent excess reinforcement)

ψ_e = 1.0 (uncoated hooked bars)

ψ_c = 0.70 (based on side cover and extension cover)

ψ_r = 1.0 (no confining reinforcement)

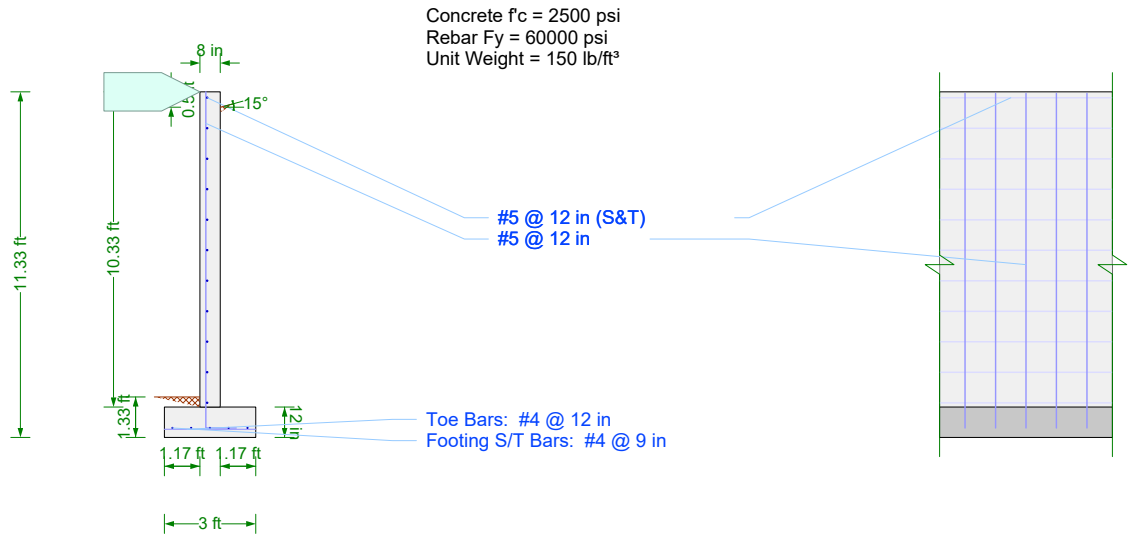
λ = 1.0 (normal weight concrete)

$$l_{dh} = \left(\frac{f_y \psi_e \psi_c \psi_r}{50 \lambda \sqrt{F'_c}} \right) d_b = \left[\frac{(60000 \text{ psi})(1.0)(0.70)(1.0)}{50 (1.0) \sqrt{2500 \text{ psi}}} \right] (0.5 \text{ in}) = 8.4 \text{ in}$$

8 d_b = 8 (0.5 in) = 4.0 (minimum limit, does not control)

l_{dh_prov} = 9 in ≥ l_{dh} = 8.4 in ✓

Design Detail



Check Summary

Ratio	Check	Provided	Required	Combination
----- Stability Checks -----				
✓ 0.708	Bearing Pressure	2000 psf	1416 psf	1.0D + 1.0H
✓ 0.580	Bearing Eccentricity	3.48 in	6 in	1.0D + 1.0H
----- Toe Checks -----				
✓ 0.090	Shear	7.88 k/ft	0.71 k/ft	1.4D + 1.6H
✓ 0.136	Moment	7.66 ft·k/ft	1.04 ft·k/ft	1.4D + 1.6H
✓ 0.090	Min Strain	0.0444	0.0040	1.4D + 1.6H
✓ 0.000	Min Steel	0.02 in²	0 in²	1.4D + 1.6H
✓ 0.632	Development	18.99 in	12 in	1.4D + 1.6H
✓ 0.500	S&T Max Spacing	9 in	18 in	1.4D + 1.6H
✓ 0.972	S&T Min Rho	0.0019	0.0018	1.4D + 1.6H
----- Heel Checks -----				
✓ 0.391	Shear	4.8 k/ft	1.88 k/ft	1.4D + 1.6H
✓ 0.439	Moment	2.5 ft·k/ft	1.1 ft·k/ft	1.4D + 1.6H
----- Stem Checks -----				
✓ 0.761	Moment	7.43 ft·k/ft	5.65 ft·k/ft	1.4D + 1.6H
✓ 0.567	Shear	5.12 k/ft	2.9 k/ft	1.4D + 1.6H
✓ 0.000	Max Steel	Infinite	0.0040	1.4D + 1.6H
✓ 0.000	Min Steel	0 in²/in	0 in²/in	1.4D + 1.6H
✗ 1.167	Base Development	9 in	10.5 in	1.4D + 1.6H
✓ 0.000	Horz Bar Rho	0.0000	0.0000	1.4D + 1.6H
✓ 0.667	Horz Bar Spacing	12 in	18 in	1.4D + 1.6H

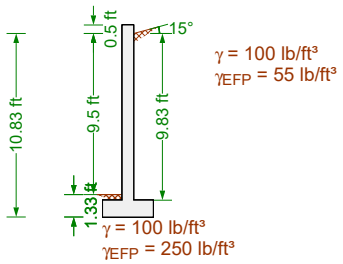
Criteria

Use basic criteria from common project settings	No
Building Code	IBC 2015
Concrete Load Combs	ASCE 7-10 (Streng...
Masonry Load Combs	ASCE 7-10 (ASD)
Stability Load Combs	ASCE 7-10 (ASD)
Apply Sds Factor to Seismic Combinations for Ev	Yes
Sds (from ASCE 7)	0.59
Restrained Against Sliding	Yes
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.50
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	2000 psf
Req'd Bearing Location	Middle third
Wall Friction Angle	25°
Friction Coefficent	0.35
Soil Reaction Modulus	172800 lb/ft³

Loads

Loading Options/Assumptions

Passive pressure neglects top 0 ft of soil.



Load Combinations

ASCE 7-10 (Strength)

1.4D + 1.6H
1.4D + 0.9H
1.2D + 1.6H
1.2D + 0.9H
0.9D + 1.6H
0.9D + 0.9H

Strength Check Results Summary

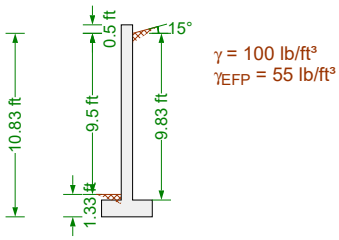
Load Combination	Stem M-applied (ft·k/ft)	Stem M-allow (ft·k/ft)	Stem V-applied (k/ft)	Stem V-allow (k/ft)	Stem Min. Id (in)	Stem Actual Id (in)	Heel M-applied (ft·k/ft)
1.4D + 1.6H	5.65	7.43	2.9	5.12	10.5	9	1.1
1.4D + 0.9H	3.18	7.43	1.63	5.12	10.5	9	1.1
1.2D + 1.6H	5.65	7.43	2.9	5.12	10.5	9	0.94
1.2D + 0.9H	3.18	7.43	1.63	5.12	10.5	9	0.94
0.9D + 1.6H	5.65	7.43	2.9	5.12	10.5	9	0.71
0.9D + 0.9H	3.18	7.43	1.63	5.12	10.5	9	0.71

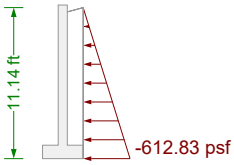
Load Combination	Heel M-allow (ft·k/ft)	Heel V-applied (k/ft)	Heel V-allow (k/ft)	Toe M-applied (ft·k/ft)	Toe M-allow (ft·k/ft)	Toe V-applied (k/ft)	Toe V-allow (k/ft)
1.4D + 1.6H	2.5	1.88	4.8	1.04	7.66	0.71	7.88
1.4D + 0.9H	2.5	1.88	4.8	1.04	7.66	0.71	7.88
1.2D + 1.6H	2.5	1.61	4.8	0.9	7.66	0.61	7.88
1.2D + 0.9H	2.5	1.61	4.8	0.9	7.66	0.61	7.88
0.9D + 1.6H	2.5	1.21	4.8	0.67	7.66	0.45	7.88
0.9D + 0.9H	2.5	1.21	4.8	0.67	7.66	0.45	7.88

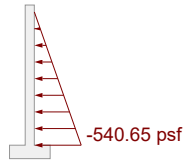
Stability Check Results Summary

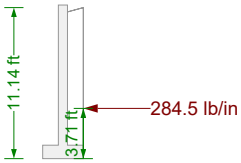
Load Combination	Sliding Force (lb/in)	Resisting Force (lb/in)	Sliding F.S.	Sliding F.S. Req'd	Sliding F.S. Req'd Seis...	Bearing Pressure Actual (psf)	Bearing Pressure Allowable (psf)	earing Eccentricity Actual (in)	aring Eccentricity Allowable (in)
1.0D + 1.0H	284.5	167	0.587	1.500	1.500	1416	2000	3.48	6
1.0D + 0.6H	170.7	131.5	0.770	1.500	1.500	1416	2000	3.48	6
0.6D + 1.0H	284.5	135.7	0.477	1.500	1.500	849.3	2000	3.48	6
0.6D + 0.6H	170.7	100.2	0.587	1.500	1.500	849.3	2000	3.48	6

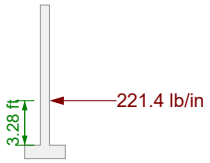
Backfill Pressure











Lateral Earth Pressure

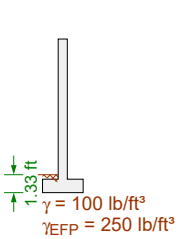
Equivalent Fluid Pressure

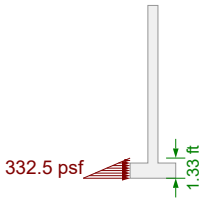
$\sigma_h = H\,\gamma_{fluid}$ = (11.14 ft)(55 lb / ft³) = 612.8 psf

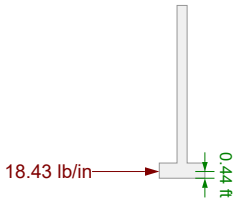
Lateral Earth Pressure (stem only)

$\sigma_h = H\,\gamma_{fluid}$ = (9.83 ft)(55 lb / ft³) = 540.6 psf

Passive Pressure





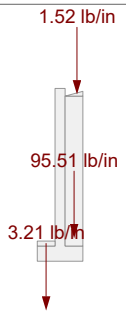


Lateral Earth Pressure

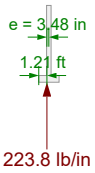
Equivalent Fluid Pressure

$\sigma_h = H\,\gamma_{fluid} = (1.33\text{ ft})(250\text{ lb / ft}^3) = 332.5\text{ psf}$

Wall/Soil Weights



Bearing Pressure



Friction

$F = \mu R = (0.350)(223.8 \text{ lb / in}) = 78.33 \text{ lb / in}$

Bearing Pressure Calculation

Contributing Forces

	Vert Force	...offset	Horz Force	...offset	OT Moment
Backfill Pressure	-0 lb/in	-	0 lb/in	-	-0 in·lb/ft
Footing Weight	-37.48 lb/in	1.5 ft	0 lb/in	-	-8092.8 in·lb/ft
Stem Weight	-86.08 lb/in	1.5 ft	0 lb/in	-	-18585.74 in·lb/ft
Backfill Weight	-95.51 lb/in	2.42 ft	0 lb/in	-	-33225.41 in·lb/ft
Backfill Weight	-1.52 lb/in	2.61 ft	0 lb/in	-	-570.48 in·lb/ft
Soil over toe Weight	-3.21 lb/in	0.58 ft	0 lb/in	-	-269.19 in·lb/ft
Stem Base Shear	-0 lb/in	-	-151.2 lb/in	1 ft	21773 in·lb/ft
Stem Base Moment	0 lb/in	-	0 lb/in	-	0 in·lb/ft
	-223.81 lb/in				-38970.78 in·lb/ft

$$\frac{-38970.78 \text{ in·lb / ft}}{-223.81 \text{ lb / in}} = 1.21 \text{ ft}$$

Note: Bearing resultant used for friction calcs is 223.8 lb/in - reduced per user options (for sliding check).

Stability Checks [1.0D + 1.0H]

Overturning Check

Check not performed; wall has lateral support.

Sliding Check

Check not performed; restrained against sliding.

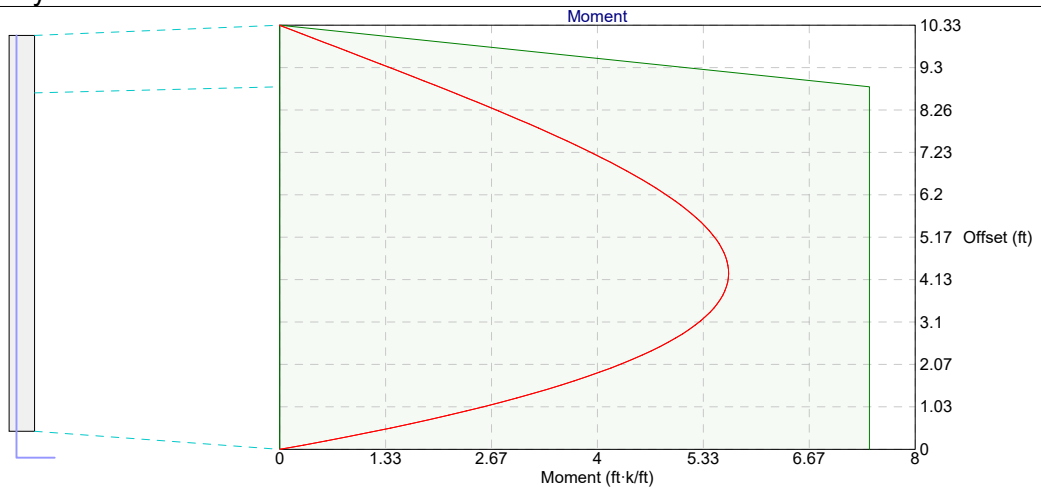
Bearing Capacity Check

Bearing pressure < allowable (1416 psf < 2000 psf) - OK
Bearing resultant eccentricity < allowable (3.48 in < 6 in) - OK

Wall Top Displacement

Not calculated because this wall has a lateral restraint.

Stem Flexural Capacity



Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 0 ft from base [Negative bending]

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(1.69 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 0 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.03 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.73 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.03 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.69 \text{ in}) - (0.73 \text{ in}) / 2] = 7.43 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 8.83 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.03 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.73 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.03 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.69 \text{ in}) - (0.73 \text{ in}) / 2] = 7.43 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 10.33 ft from base [Negative bending]

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

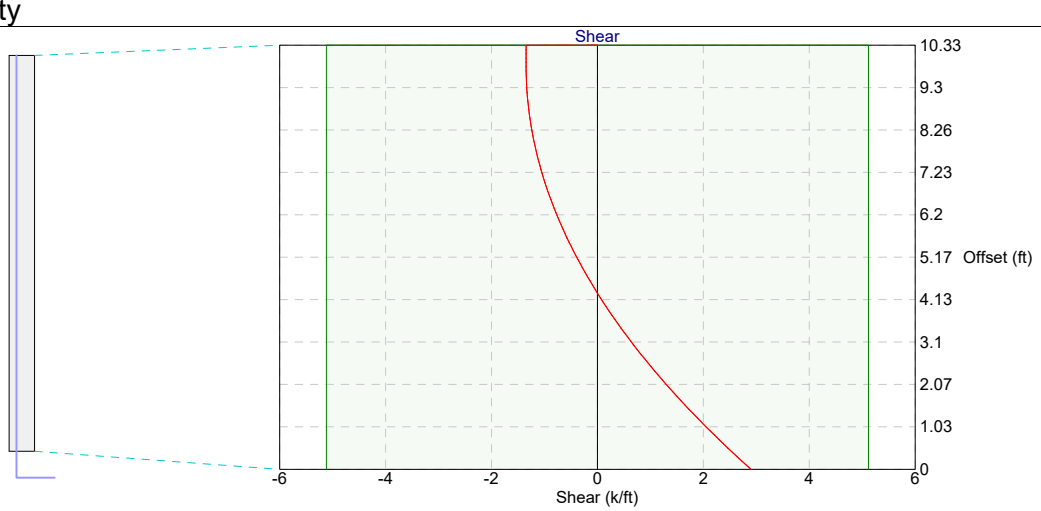
$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(1.69 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Capacity (ACI 318-14 11.5.2.2, »22.3, »22.2) @ 10.33 ft from base [Positive bending]

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0 \text{ in}^2 / \text{in})(60000 \text{ psi})[(5.69 \text{ in}) - (0 \text{ in}) / 2] = 0 \text{ ft·k / ft}$$

Stem Shear Capacity



Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 0 ft from base [Positive shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.69 in) = 6.82 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.82 k / ft) = 5.12 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 0 ft from base [Negative shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.69 in) = 6.82 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.82 k / ft) = 5.12 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 10.33 ft from base [Positive shear]

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$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.69 in) = 6.82 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.82 k / ft) = 5.12 k / ft

Shear Capacity (ACI 318-14 11.5.5.1, 22.5.1.1, 22.5.5.1) @ 10.33 ft from base [Negative shear]

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c}\, d$ = 2 (1.0) $\sqrt{2500\ psi}$ (5.69 in) = 6.82 k / ft

$\phi V_n = \phi V_c$ = (0.750) (6.82 k / ft) = 5.12 k / ft

Stem Development/Lap Length Calculations

Main vertical stem bars (bottom end) - Development Length Calculation (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.3)

ψ_e = 1.0 (uncoated hooked bars)

ψ_c = 0.70 (based on side cover and extension cover)

ψ_r = 1.0 (no confining reinforcement)

λ = 1.0 (normal weight concrete)

$$l_{dh} = \left(\frac{f_y \, \psi_e \, \psi_c \, \psi_r}{50 \, \lambda \sqrt{F'_c}} \right) d_b = \left[\frac{(60000 \text{ psi}) \, (1.0) \, (0.70) \, (1.0)}{50 \, (1.0) \sqrt{2500 \text{ psi}}} \right] (0.63 \text{ in}) = 10.5 \text{ in}$$

$8 \, d_b = 8 \, (0.63 \text{ in}) = 5.0$ (minimum limit, does not control)

Main vertical stem bars (top end) - Development Length Calculation (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.3)

ψ_t = 1.0 (bars are not horizontal)

ψ_e = 1.0 (bar not epoxy coated)

ψ_s = 0.80 (bars are #6 or smaller)

λ = 1.0 (normal weight concrete)

$s / 2 = (12 \text{ in}) / 2 = 6 \text{ in}$

$\text{cover} + d_b / 2 = (2 \text{ in}) + (0.63 \text{ in}) / 2 = 2.31 \text{ in}$

c_b = 2.31 in (lesser of half spacing, ctr to surface)

K_{tr} = 0.0 (no transverse reinforcement)

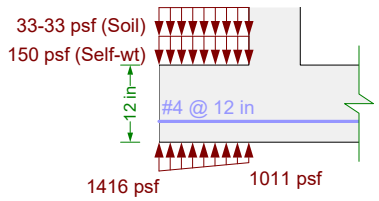
$$\frac{c_b + K_{tr}}{d_b} = \frac{(2.31 \text{ in}) + (0.0)}{(0.63 \text{ in})} = 3.70$$

$$l_d = \left(\frac{3.}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t \, \psi_e \, \psi_s}{2.5} \right) d_b = \left[\frac{3.}{40} \frac{(60000 \text{ psi})}{(1.0) \sqrt{2500 \text{ psi}}} \frac{(1.0) \, (1.0) \, (0.80)}{2.5} \right] (0.63 \text{ in}) = 18 \text{ in}$$

Toe Checks [1.4D + 1.6H]

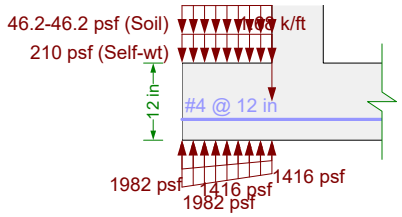
Toe Unfactored Loads

Unfactored Loads



Toe Factored Loads

1.4D + 1.6H



Controlling Moment

Note: Design toe moment is not limited to stem moment because stem base is pinned

M_{toe} = 1.04 ft·k / ft

Flexure Check (ACI 318-14 13.3.2.1, 7.5.2.1, »22.3, »22.2, 7.5.1.1a)

$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$

$\phi M_n = \phi A_s f_y (d - a / 2) = (0.90)(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})[(8.75 \text{ in}) - (0.47 \text{ in}) / 2] = 7.66 \text{ ft·k / ft}$

ϕM_n = 7.66 ft·k / ft ≥ M_u = 1.04 ft·k / ft ✓

Shear Check (ACI 318-14 13.3.2.1, 7.5.3.1, »22.5.1, »22.5.5, 7.5.1.1b)

λ = 1.0 (normal weight concrete)

$V_c = 2 \lambda \sqrt{F'_c} d = 2 (1.0) \sqrt{2500 \text{ psi}} (8.75 \text{ in}) = 10.5 \text{ k / ft}$

$\phi V_n = \phi V_c = (0.750)(10.5 \text{ k / ft}) = 7.88 \text{ k / ft}$

ϕV_n = 7.88 k / ft ≥ V_u = 0.71 k / ft ✓

Minimum Strain Check (ACI 318-14 13.3.2.1, 7.3.3.1)

β_1 = 0.850 ($F'_c \le 4000$ psi)

$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0.02 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0.47 \text{ in}$

$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(8.75 \text{ in})}{(0.47 \text{ in}) / (0.850)} - 1 \right] = 0.0444$

ε_t = 0.0444 ≥ 0.004 ✓

Minimum Steel Check (ACI 318-14 13.3.2.1, 9.6.1)

ϕM_n = 7.66 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (1.04 ft·k / ft) = 1.39 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Shrinkage and Temperature Steel (ACI 318-14 13.2.8.1, 7.6.4.1, 24.4.3.2, 24.4.3.3)

$\rho_{ST\_prov} = \frac{A_{ST}}{t\, s_{ST}} = \frac{(0.2 \text{ in}^2 / \text{in})}{(12 \text{ in})(9 \text{ in})} = 0.0019$

$\rho_{ST\_prov} = \frac{A_{ST}}{t\, s_{ST}} = \frac{(0.2 \text{ in}^2 / \text{in})}{(12 \text{ in})(9 \text{ in})} = 0.0019$

$\frac{0.0018 (60000)}{f_y} = \frac{0.0018 (60000)}{(60000 \text{ psi})} = 0.0018$

ρ_{ST_min} = 0.0018

ρ_{ST_prov} = 0.0019 ≥ ρ_{ST_min} = 0.0018 ✓

18 inch limit governs

s_{ST_max} = 18 in

s_{ST} = 9 in ≤ s_{ST_max} = 18 in ✓

Development Check (ACI 318-14 13.2.8.1, 25.4.2.3, 25.4.10)

$\frac{M_u}{\phi M_n} = \frac{(1.04 \text{ ft·k / ft})}{(7.66 \text{ ft·k / ft})} = 0.1363$ (ratio to represent excess reinforcement)

ψ_t = 1.0 (12 inches or less cast below - 3.00 inches)

ψ_e = 1.0 (bar not epoxy coated)

ψ_s = 0.80 (bars are #6 or smaller)

λ = 1.0 (normal weight concrete)

s / 2 = (12 in) / 2 = 6 in

cover + d_b / 2 = (3 in) + (0.5 in) / 2 = 3.25 in

c_b = 3.25 in (lesser of half spacing, ctr to surface)

K_{tr} = 0.0 (no transverse reinforcement)

$\frac{c_b + K_{tr}}{d_b} = \frac{(3.25 \text{ in}) + (0.0)}{(0.5 \text{ in})} = 6.50$

$l_d = \left(\frac{3}{40} \frac{f_y}{\lambda \sqrt{F'_c}} \frac{\psi_t \psi_e \psi_s}{2.5} \right) d_b = \left[\frac{3}{40} \frac{(60000 \text{ psi})}{(1.0) \sqrt{2500 \text{ psi}}} \frac{(1.0)(1.0)(0.80)}{2.5} \right] (0.5 \text{ in}) = 14.4 \text{ in}$

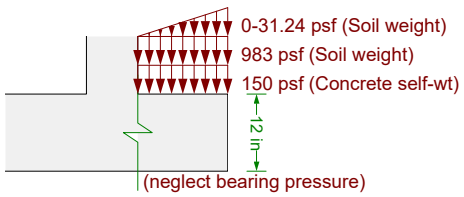
Factoring l_d by the excess reinforcement ratio (0.1363) per 25.4.10: l_d = 1.96 in

12 inch minimum controls

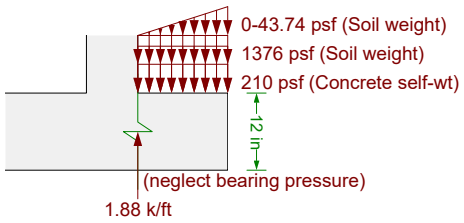
l_{d_prov} = 18.99 in ≥ l_d = 12 in ✓

Heel Checks [1.4D + 1.6H]

Heel Unfactored Loads



Heel Factored Loads



Controlling Moment

Note: Design heel moment is not limited to stem moment because stem base is pinned

M_{heel} = 1.1 ft·k / ft

Shear Check (ACI 318-14 13.3.2.1, 7.5.3.1, »22.5.1, »22.5.5, 7.5.1.1b)

λ = 1.0 (normal weight concrete)

Unreinforced, use plain concrete provisions: ACI 14.5.5

Note: Effective thickness reduced by 2 inches for concrete cast on soil (ACI 22.4.8)

$V_n = \frac{4}{3} \lambda \sqrt{F'_c}\, h = \frac{4}{3} (1.0) \sqrt{2500\ psi}\, (10\ in) = 8$ k / ft

$\phi V_n = \phi\, V_n = (0.60)\,(8\ k / ft) = 4.8$ k / ft

$\phi V_n = 4.8$ k / ft ≥ $V_u = 1.88$ k / ft ✓

Flexure Check (ACI 318-14 13.3.2.1, 7.5.2.1, »22.3, »22.2, 7.5.1.1a)

Unreinforced, use plain concrete provisions: ACI 14.5.2

Note: Effective thickness reduced by 2 inches for concrete cast on soil (ACI 22.4.8)

$M_n = 5\, \lambda \sqrt{F'_c}\, S_m = 5\,(1.0) \sqrt{2500\ psi}\, (200\ in^3 / ft) = 4.17$ ft·k / ft (as limited by tension)

$M_n = 0.85\, F'_c\, S_m = 0.85\,(2500\ psi)\,(200\ in^3 / ft) = 35.42$ ft·k / ft (as limited by compression)

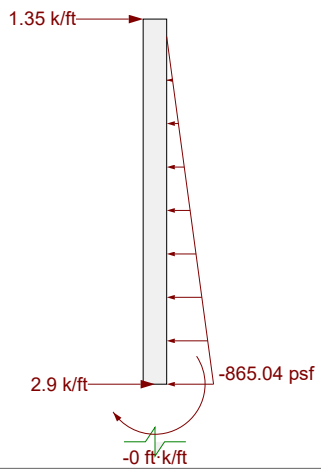
Tension controls

$\phi M_n = \phi\, M_n = (0.60)\,(4.17\ ft·k / ft) = 2.5$ ft·k / ft

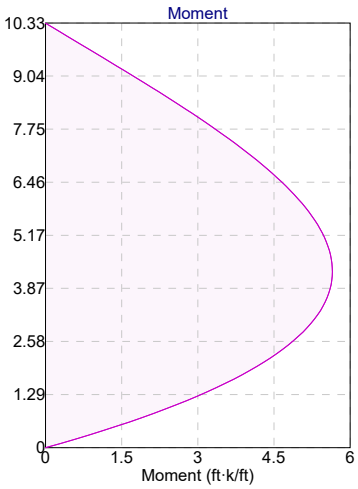
$\phi M_n = 2.5$ ft·k / ft ≥ $M_u = 1.1$ ft·k / ft ✓

Stem Forces [1.4D + 1.6H]

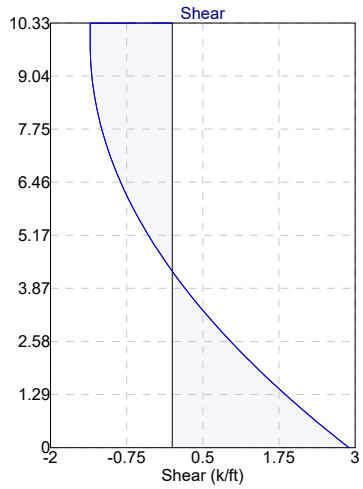
Stem Internal Forces



Stem Internal Forces



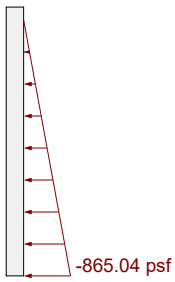
Stem Internal Forces



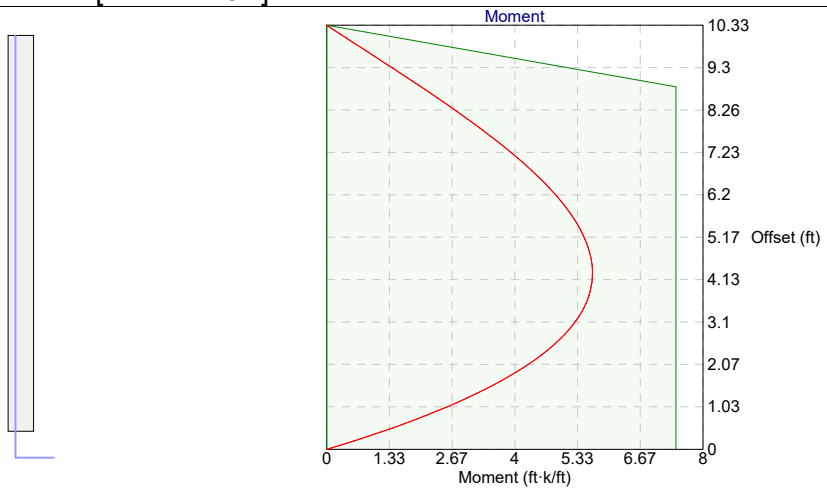
Stem Joint Force Transfer

Location	Force
@ stem base	2.9 k/ft

Stem Internal Forces



Stem Moment Checks [1.4D + 1.6H]



Check (ACI 318-14 11.5.5.1b) @ 4.28 ft from base [Positive bending]

ϕM_n = 7.43 ft·k / ft ≥ M_u = 5.65 ft·k / ft ✓

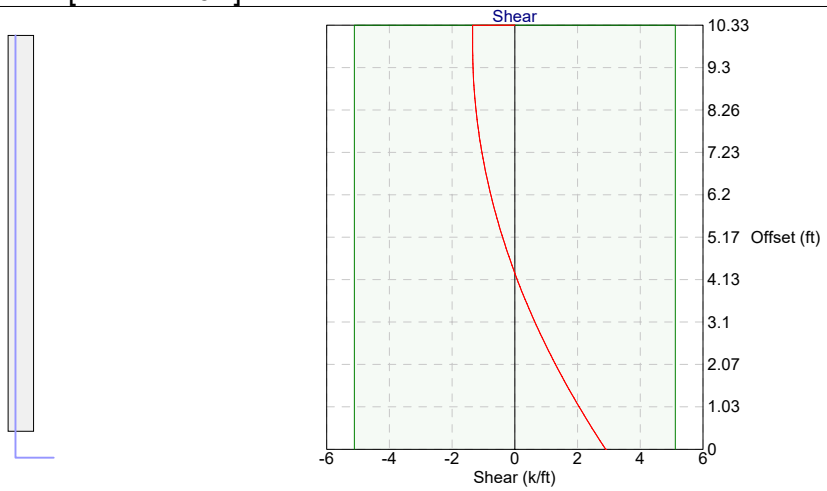
Check (ACI 318-14 11.5.5.1b) @ 8.83 ft from base [Positive bending]

ϕM_n = 7.43 ft·k / ft ≥ M_u = 1.96 ft·k / ft ✓

Check (ACI 318-14 11.5.5.1b) @ 8.87 ft from base [Positive bending]

ϕM_n = 7.23 ft·k / ft ≥ M_u = 1.96 ft·k / ft ✓

Stem Shear Checks [1.4D + 1.6H]



Shear Check (ACI 318-14 11.5.5.1c) @ 0 ft from base [Positive shear]

ϕV_n = 5.12 k / ft ≥ V_u = 2.9 k / ft ✓

Shear Check (ACI 318-14 11.5.5.1c) @ 9.91 ft from base [Negative shear]

ϕV_n = 5.12 k / ft ≥ V_u = 1.35 k / ft ✓

Stem Miscellaneous Checks [1.4D + 1.6H]

Minimum Steel Check (ACI 318-14 9.6.1) @ 0 ft from base [Stem in negative flexure]

ϕM_n = 0 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (0 ft·k / ft) = 0 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Minimum Steel Check (ACI 318-14 9.6.1) @ 10.33 ft from base [Stem in negative flexure]

ϕM_n = 0 ft·k / ft ≥ (4 / 3) M_u = [4 / 3] (0 ft·k / ft) = 0 ft·k / ft

Check is waived per ACI 9.6.1.3 ✓

Maximum Steel Check (ACI 318-14 9.3.3.1) @ 0 ft from base [Stem in negative flexure]

β_1 = 0.850 ($F'_c \le 4000$ psi)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(1.69 \text{ in})}{(0 \text{ in}) / (0.850)} - 1 \right] = \text{INF}$$

ε_t = INF ≥ 0.004 ✓

Maximum Steel Check (ACI 318-14 9.3.3.1) @ 10.33 ft from base [Stem in negative flexure]

β_1 = 0.850 ($F'_c \le 4000$ psi)

$$a = \frac{A_s f_y}{0.85 F'_c} = \frac{(0 \text{ in}^2 / \text{in})(60000 \text{ psi})}{0.85 (2500 \text{ psi})} = 0 \text{ in}$$

$$\varepsilon_t = 0.003 \left(\frac{d}{a / \beta_1} - 1 \right) = 0.003 \left[\frac{(1.69 \text{ in})}{(0 \text{ in}) / (0.850)} - 1 \right] = \text{INF}$$

ε_t = INF ≥ 0.004 ✓

Wall Horizontal Steel (ACI 318-14 11.6.1, 11.7.3)

$$\rho_t = \frac{A_{s\_horz} / s_{horz}}{t} = \frac{(0.31 \text{ in}^2) / (12 \text{ in})}{(8 \text{ in})} = 0.0032$$

ρ_{t_min} = 0.0020 (bars No. 5 or less, not less than 60 ksi)

ρ_t = 0.0032 ≥ ρ_{t_min} = 0.0020 ✓

3 h = 3 (8 in) = 24 in

18 inch limit governs

s_{horz} = 12 in ≤ s_{horz_max} = 18 in ✓

Development Check (ACI 318-14 11.7.1.2, 25.4.2.3, 25.4.10)

$$\frac{M_u}{\phi M_n} = \frac{(0 \text{ ft·k / ft})}{(0 \text{ ft·k / ft})} = \text{INF}$$ (ratio to represent excess reinforcement)

ψ_e = 1.0 (uncoated hooked bars)

ψ_c = 0.70 (based on side cover and extension cover)

ψ_r = 1.0 (no confining reinforcement)

λ = 1.0 (normal weight concrete)

$$l_{dh} = \left(\frac{f_y \psi_e \psi_c \psi_r}{50 \lambda \sqrt{F'_c}} \right) d_b = \left[\frac{(60000 \text{ psi})(1.0)(0.70)(1.0)}{50 (1.0) \sqrt{2500 \text{ psi}}} \right] (0.63 \text{ in}) = 10.5 \text{ in}$$

8 d_b = 8 (0.63 in) = 5.0 (minimum limit, does not control)

l_{dh_prov} = 9 in < l_{dh} = 10.5 in ✗

Isolated Footing Design

Based on ASCE 7-10 & IBC 2015

Allowable Soil Bearing = 1500 Psf

Mark	Width	Length	Depth	Bar Size	Axial	# of Bars
FS20	2	2	1	4	**6.00**	**3**
FS26	2.5	2.5	1	4	**9.38**	**4**
FS30	3	3	1	4	**13.50**	**5**
FS36	3.5	3.5	1	4	**18.38**	**6**
FS40	4	4	1	4	**24.00**	**6**
FS46	4.5	4.5	1	4	**30.38**	**7**
FS50	5	5	1	4	**37.50**	**8**
FS56	5.5	5.5	1	4	**45.38**	**9**
FS60	6	6	1	4	**54.00**	**9**
FS66	6.5	6.5	1	4	**63.38**	**10**
FS70	7	7	1	4	**73.50**	**11**
FS76	7.5	7.5	1	4	**84.38**	**12**
FS80	8	8	1	4	**96.00**	**12**