LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

Calculation Package for

O'NEIL POOL DECK EXTENSION AND REMODEL

8030 SE 20TH ST, MERCER ISLAND, WA 98040

PROJECT #: S241205-3

DATE: 07/01/25

STRUCTURAL ENGINEER
L120 ENGINEERING & DESIGN
13150 91ST PL NE
KIRKLAND, WA 98034
CONTACT: MANS THURFJELL, PE
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Project Number:	Plan Name:	Sheet Number:
s241205-3	ONEIL DECK EXPANSION/REMODEL	DC
Engineer:	**Specifics:**	**Date:**
KJ	Design Criteria	1/23/2025

Gravity Criteria: Code: IBC 2021

ROOF SYSTEM		
Live Load:		
Snow	25.0	psf
Dead Load:		
Composite Roofing	2.0	psf
19/32" Plywood Sheathing	2.5	psf
Trusses at 24" o.c.	3.0	psf
Insulation	1.8	psf
(2) Layers 5/8" GWB	4.4	psf
Misc/Mech	1.3	psf
Total	**15.0**	**psf**

FLOOR SYSTEM		
Live Load:		
Residential	40.0	psf
Dead Load:		
Flooring	3.0	psf
3/4" T & G Plywood	2.5	psf
Floor Joists at 16" o.c.	2.5	psf
Insulation	0.5	psf
(1) Layers 5/8" GWB	2.2	psf
Miscellaneous	1.3	psf
Total	**12.0**	**psf**

EXTERIOR WALL SYSTEM		
2x6 at 16" o.c.	1.7	psf
Insulation	1.0	psf
1/2" Plywood Sheathing	1.5	psf
(2) layers 5/8" GWB	4.4	psf
Misc	3.4	psf
Total	**12.0**	**psf**

INTERIOR WALL SYSTEM		
2x4 at 16" o.c.	1.1	psf
Insulation	0.5	psf
(2) Layers 5/8" GWB	4.4	psf
Misc	2.0	psf
Total	**8.0**	**psf**

SEISMIC PARAMETERS:

Code Reference: ASCE 7-16
R = **6.5** Bearing Wall System, Wood Structural Panel Walls
Mapped Spectral Acceleration, Ss = **1.379**
Mapped Spectral Acceleration, S1 = **0.48**
Soil Site Class = **D**

WIND PARAMETERS:

Code Reference: ASCE 7-16
Basic Wind Speed (3 second Gust) = **100** mph
Exposure : **C**
Kzt = **1.00**

SOIL PARAMETERS:

Soil Bearing Pressure = **2,000** psf competent native soil or structural fill
1/3 increase for short-term wind or seismic loading is acceptable
Frost Depth = **18** in

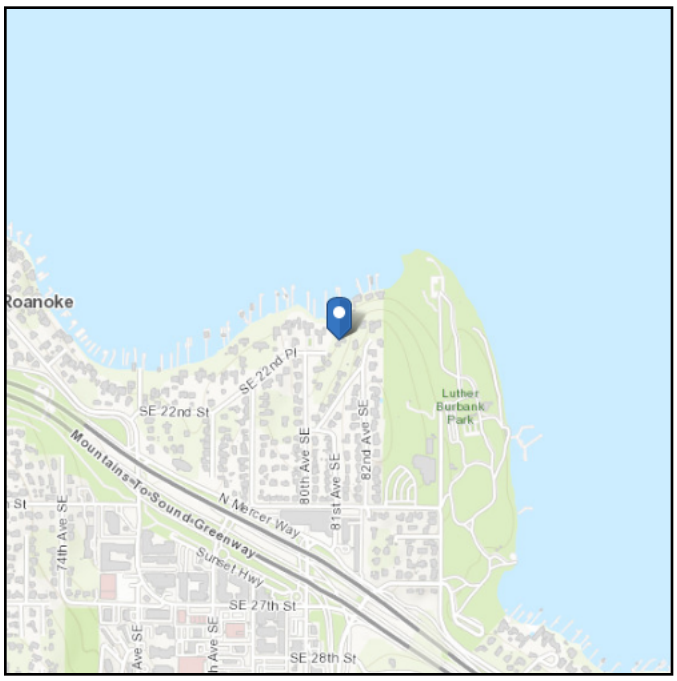
Lateral Wall Pressures:
Unrestrained Active Pressure = **35** pcf Cantilevered walls
Restrained Active Pressure = **50** pcf Plate Wall Design/Tank Walls
Passive Pressure = **250** pcf
Soil Friction Coeff. = **0.35**

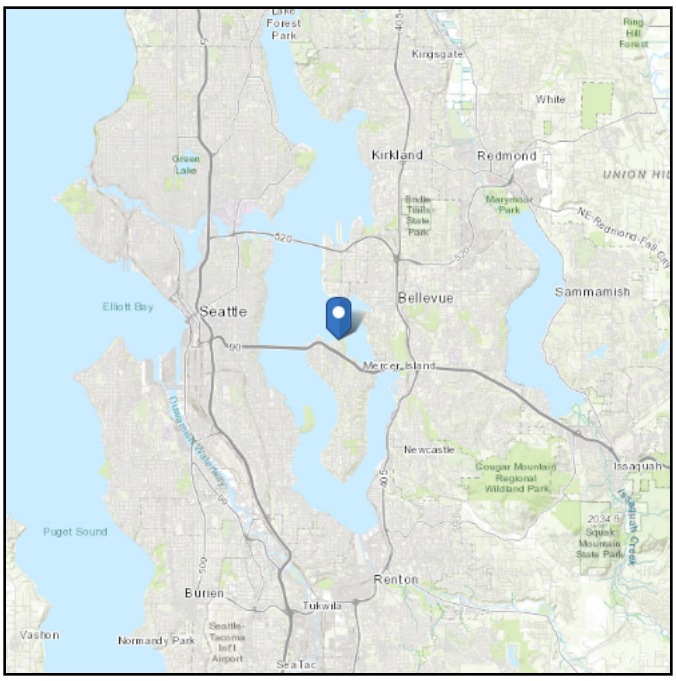
ASCE Hazards Report

Address:
8030 SE 20th St
Mercer Island, Washington
98040

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Latitude: 47.593075
Longitude: -122.230556
Elevation: 52.95587819393188 ft (NAVD 88)





Wind

Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	74 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Tue Jan 21 2025

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.379	S_{D1} :	N/A
S_1 :	0.48	T_L :	6
F_a :	1	PGA :	0.59
F_v :	N/A	PGA_M :	0.649
S_{MS} :	1.379	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	0.919	C_v :	1.376

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Tue Jan 21 2025

Date Source: USGS Seismic Design Maps

LONGITUDE
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FRAMING CALCULATIONS

BEAM REFERENCE PER PLAN

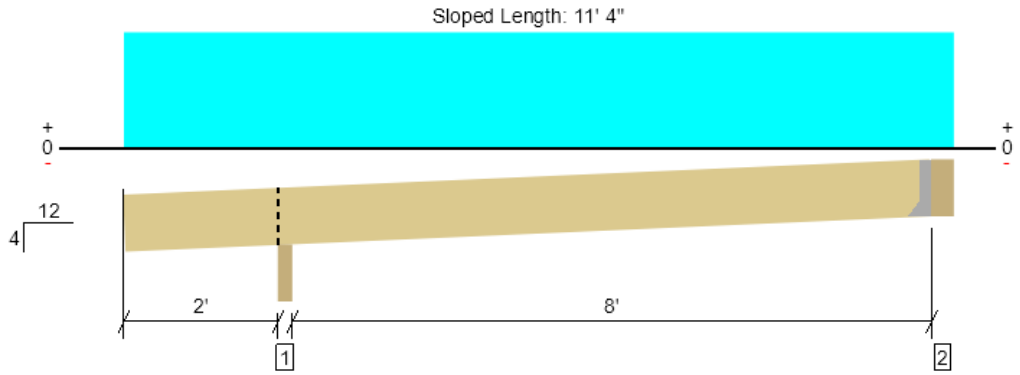
(206) 790 9502
L120Engineering.com

MEMBER REPORT

PASSED

Roof, RJ-1

1 piece(s) 2 x 10 HF No.2 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	316 @ 10' 3 1/2"	911 (1.50")	Passed (35%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	284 @ 3' 1/4"	1596	Passed (18%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	613 @ 6' 5"	2204	Passed (28%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.039 @ 6' 3 3/16"	0.429	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.062 @ 6' 3 3/8"	0.572	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 11' 1 1/4"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 4/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Birdsmouth cut has not been analyzed.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Birdsmouth - DF	3.50"	3.50"	1.50"	206	325	531	Blocking
2 - Hanger on 9 1/4" GLB beam	5.50"	Hanger[1]	1.50"	134	219	353	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 10" o/c	
Bottom Edge (Lu)	10' 10" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	LRU28Z	1.94"	N/A	6-10dx1.5	5-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 10' 9"	24"	15.0	25.0	roof

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

ForteWEB Software Operator	Job Notes
Kenny Jones L120 Engineering (817) 727-2136 kjones@l120engineering.com	

Weyerhaeuser

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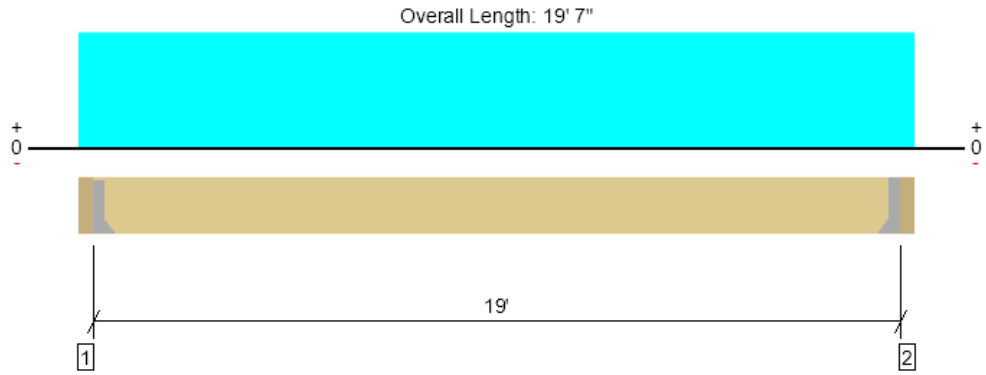
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: S241205-3 - Oneil Deck Remodel

Roof, RJ-2

1 piece(s) 2 x 10 DF No.2 @ 12" OC



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	380 @ 3 1/2"	1406 (1.50")	Passed (27%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	349 @ 1' 3/4"	1915	Passed (18%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1805 @ 9' 9 1/2"	2334	Passed (77%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.463 @ 9' 9 1/2"	0.633	Passed (L/492)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.741 @ 9' 9 1/2"	0.950	Passed (L/308)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 19'
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	147	245	392	See note [1]
2 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	147	245	392	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 11" o/c	
Bottom Edge (Lu)	19' o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	
2 - Face Mount Hanger	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 19' 7"	12"	15.0	25.0	Default Load

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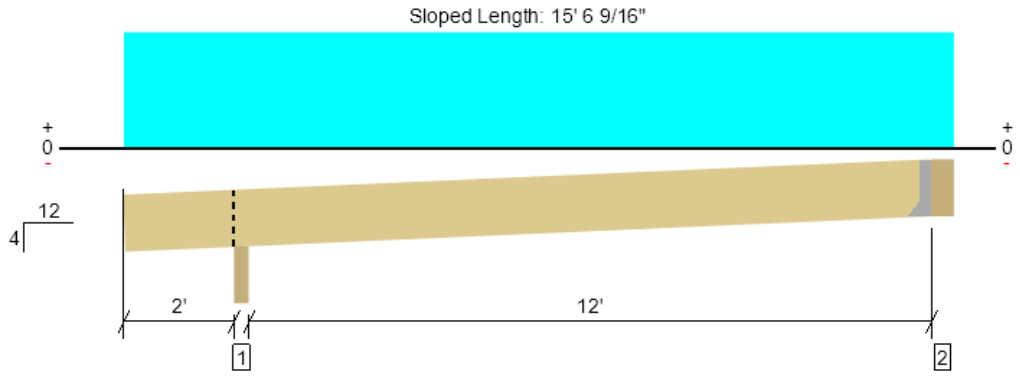
File Name: S241205-3 - Oneil Deck Remodel

Roof, RJ-3

1 piece(s) 2 x 10 HF No.2 @ 24" OC



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	485 @ 14' 3 1/2"	911 (1.50")	Passed (53%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	440 @ 3' 1/4"	1596	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1441 @ 8' 4 3/16"	2204	Passed (65%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.204 @ 8' 3"	0.640	Passed (L/755)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.327 @ 8' 3 1/8"	0.854	Passed (L/469)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 15' 3 7/8"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 4/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Birdsmouth cut has not been analyzed.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Birdsmouth - DF	3.50"	3.50"	1.50"	266	420	686	Blocking
2 - Hanger on 9 1/4" GLB beam	5.50"	Hanger[1]	1.50"	200	322	522	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 6" o/c	
Bottom Edge (Lu)	15' 1" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	LRU28Z	1.94"	N/A	6-10dx1.5	5-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 14' 9"	24"	15.0	25.0	roof

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

ForteWEB Software Operator	Job Notes
Kenny Jones L120 Engineering (817) 727-2136 kjones@l120engineering.com	

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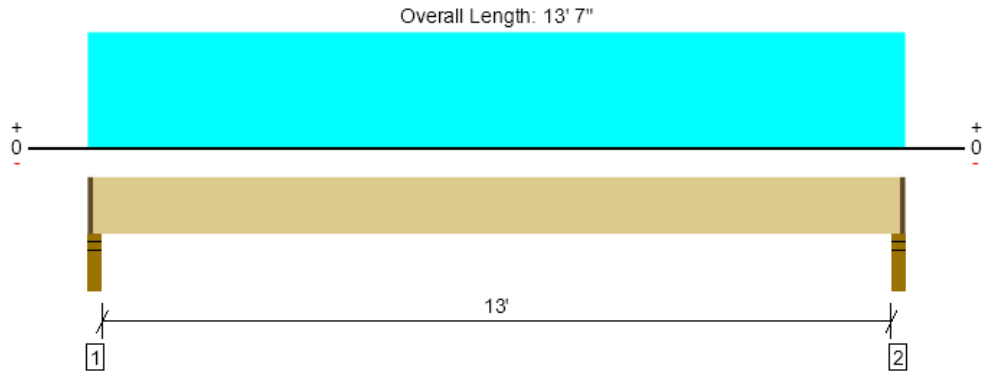
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: S241205-3 - Oneil Deck Remodel

Roof, RJ-4

1 piece(s) 2 x 10 HF No.2 @ 16" OC



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	357 @ 2 1/2"	1367 (2.25")	Passed (26%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	306 @ 1' 3/4"	1596	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1156 @ 6' 9 1/2"	2204	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.175 @ 6' 9 1/2"	0.329	Passed (L/902)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.280 @ 6' 9 1/2"	0.658	Passed (L/563)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 13' 4 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	136	226	362	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.50"	136	226	362	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 10" o/c	
Bottom Edge (Lu)	13' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 13' 7"	16"	15.0	25.0	Default Load

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ForteWEB Software Operator	Job Notes
Kenny Jones L120 Engineering (817) 727-2136 kjones@l120engineering.com	

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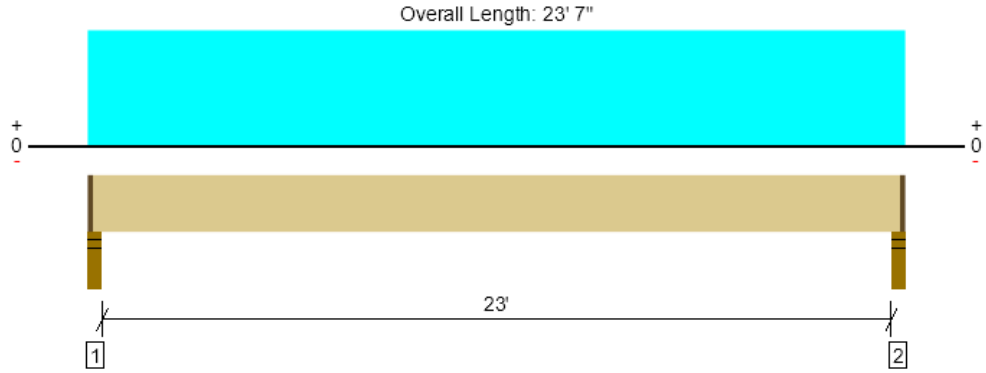
Roof, RB-1

1 piece(s) 5 1/2" x 15" 24F-V4 DF Glulam



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3974 @ 2"	5012 (2.25")	Passed (79%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3486 @ 1' 6 1/2"	16761	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	22977 @ 11' 9 1/2"	45598	Passed (50%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.472 @ 11' 9 1/2"	0.581	Passed (L/591)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.803 @ 11' 9 1/2"	1.163	Passed (L/347)	--	1.0 D + 1.0 S (All Spans)

Member Length : 23' 4 1/2"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.96 that was calculated using length L = 23' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.78"	1649	2358	4008	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.78"	1649	2358	4008	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	23' 5" o/c	
Bottom Edge (Lu)	23' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 23' 5 3/4"	N/A	20.0	--	
1 - Uniform (PSF)	0 to 23' 7" (Front)	8'	15.0	25.0	roof

• Side loads are assumed to not induce cross-grain tension.

Weyerhaeuser Notes

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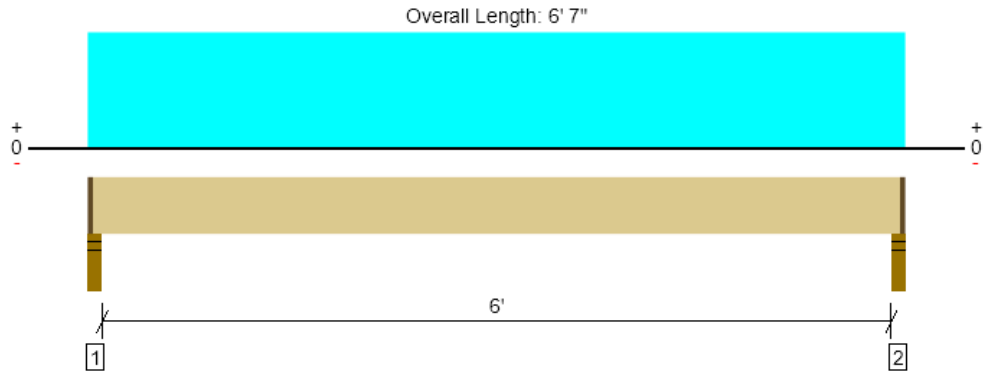
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Kenny Jones L120 Engineering (817) 727-2136 kjones@l120engineering.com	

Weyerhaeuser

Roof, RB-2

1 piece(s) 4 x 10 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1046 @ 2"	3189 (2.25")	Passed (33%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	732 @ 1' 3/4"	4468	Passed (16%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1603 @ 3' 3 1/2"	5166	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.019 @ 3' 3 1/2"	0.156	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.031 @ 3' 3 1/2"	0.313	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 6' 4 1/2"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	421	658	1079	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.50"	421	658	1079	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 5" o/c	
Bottom Edge (Lu)	6' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 6' 5 3/4"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 6' 7" (Front)	8'	15.0	25.0	roof

• Side loads are assumed to not induce cross-grain tension.

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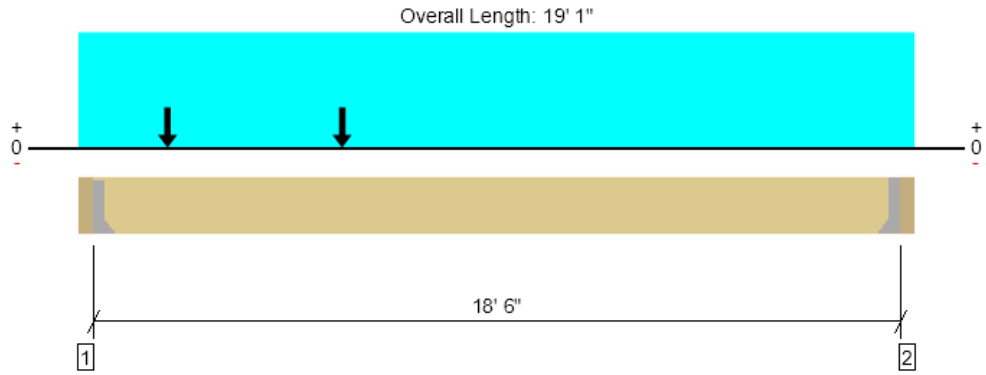
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof, RB-3

1 piece(s) 3 1/2" x 9 1/4" 2.0E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2189 @ 3 1/2"	3281 (1.50")	Passed (67%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2150 @ 1' 3/4"	7198	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	7362 @ 6'	14278	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.511 @ 8' 10 1/16"	0.617	Passed (L/434)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.891 @ 8' 10 9/16"	0.925	Passed (L/249)	--	1.0 D + 1.0 S (All Spans)

Member Length : 18' 6"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	910	1291	2201	See note [1]
2 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	405	502	908	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	18' 6" o/c	
Bottom Edge (Lu)	18' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HHUS48	3.00"	N/A	22-10d	8-10d	
2 - Face Mount Hanger	LUS48	2.00"	N/A	6-10dx1.5	4-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 18' 9 1/2"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 19' 1" (Front)	1'	15.0	25.0	roof
2 - Point (lb)	2' (Front)	N/A	421	658	Linked from: RB-2, Support 1
3 - Point (lb)	6' (Front)	N/A	421	658	Linked from: RB-2, Support 1

- Side loads are assumed to not induce cross-grain tension.

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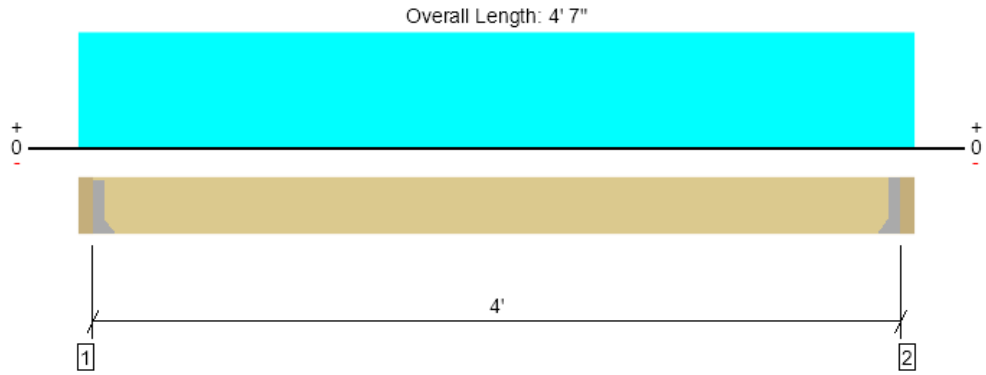
Roof, RB-4

1 piece(s) 4 x 10 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1136 @ 3 1/2"	3281 (1.50")	Passed (35%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	698 @ 1' 3/4"	4468	Passed (16%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1136 @ 2' 3 1/2"	5166	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.005 @ 2' 3 1/2"	0.133	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.009 @ 2' 3 1/2"	0.200	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 4'
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	498	802	1300	See note [1]
2 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	498	802	1300	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' o/c	
Bottom Edge (Lu)	4' o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS410	2.00"	N/A	8-10dx1.5	6-10d	
2 - Face Mount Hanger	LUS410	2.00"	N/A	8-10dx1.5	6-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 4' 3 1/2"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 4' 7" (Front)	14'	15.0	25.0	roof

- Side loads are assumed to not induce cross-grain tension.

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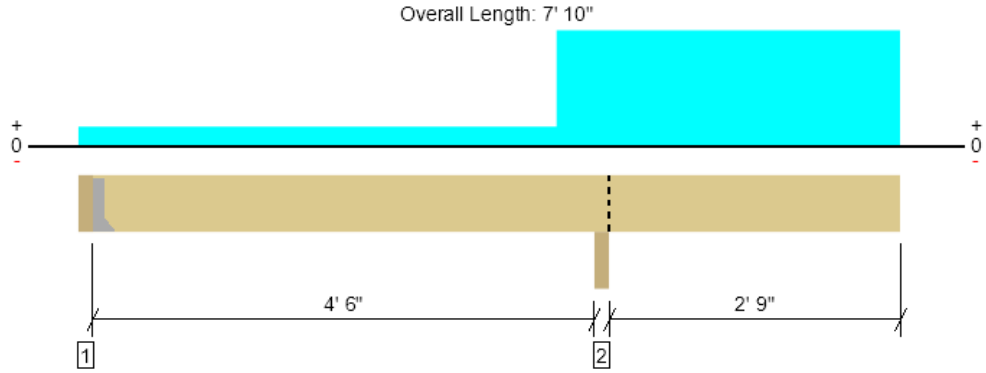
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Kenny Jones L120 Engineering (817) 727-2136 kjones@l120engineering.com	

Weyerhaeuser

Roof, RB-5

1 piece(s) 4 x 10 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2226 @ 4' 11 1/4"	4961 (3.50")	Passed (45%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	966 @ 5' 10 1/4"	4468	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-2047 @ 4' 11 1/4"	5166	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.037 @ 7' 10"	0.200	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.059 @ 7' 10"	0.290	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 7' 6 1/2"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (0.2") and TL (2L/240).
- Right cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -265 lbs uplift at support located at 3 1/2". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	-69	1/-196	-265	See note [1]
2 - Beam - HF	3.50"	3.50"	1.57"	866	1360	2226	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 7" o/c	
Bottom Edge (Lu)	7' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS48	2.00"	N/A	6-10dx1.5	4-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 7' 10"	N/A	8.2	--	
1 - Uniform (PSF)	4' 6" to 7' 10" (Front)	12'	15.0	25.0	roof
2 - Uniform (PSF)	0 to 4' 6" (Front)	2'	15.0	25.0	roof

- Side loads are assumed to not induce cross-grain tension.

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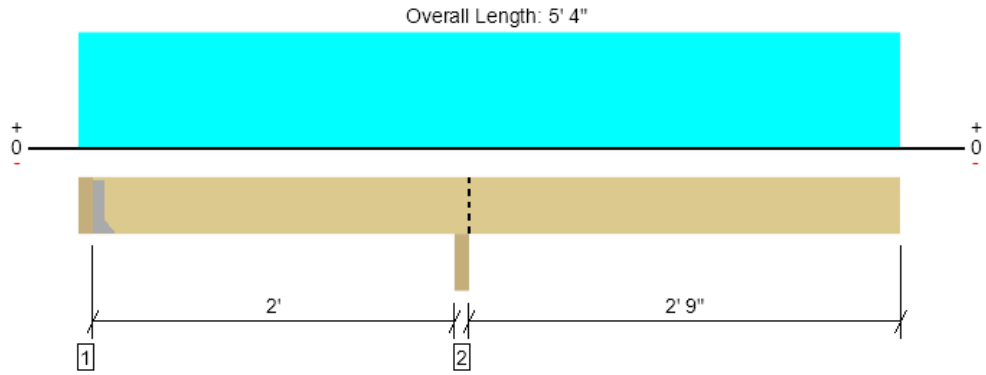
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

MEMBER REPORT

PASSED

Roof, RB-6

1 piece(s) 4 x 10 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1470 @ 2' 5 1/4"	4961 (3.50")	Passed (30%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	524 @ 1' 6 1/4"	4468	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-1041 @ 2' 5 1/4"	5166	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.012 @ 5' 4"	0.200	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.019 @ 5' 4"	0.290	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 5' 1/2"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (0.2") and TL (2L/240).
- Right cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -229 lbs uplift at support located at 3 1/2". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger[1]	1.50"	-60	58/-169	-229	See note [1]
2 - Beam - HF	3.50"	3.50"	1.50"	582	888	1470	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 1" o/c	
Bottom Edge (Lu)	5' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS48	2.00"	N/A	6-10dx1.5	4-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 5' 4"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 5' 4" (Front)	6'	15.0	25.0	roof

- Side loads are assumed to not induce cross-grain tension.

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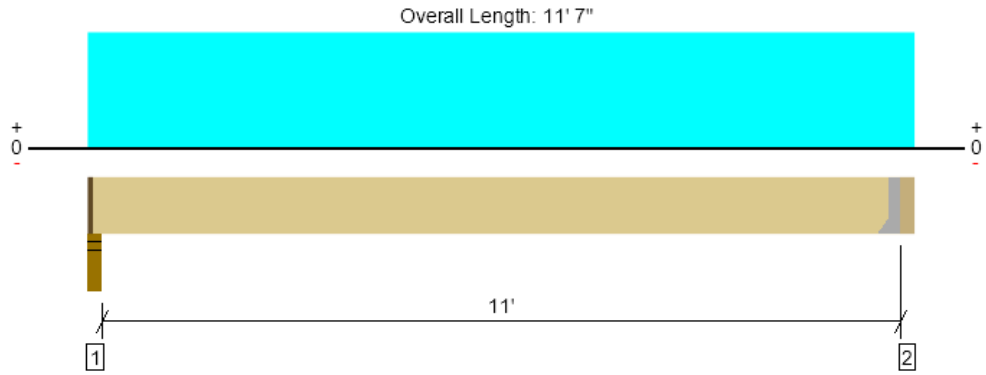
Roof, RH-1

1 piece(s) 5 1/2" x 9 1/2" 24F-V4 DF Glulam



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1421 @ 2"	5012 (2.25")	Passed (28%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1206 @ 10' 6"	10615	Passed (11%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3909 @ 5' 8 3/4"	19028	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.073 @ 5' 8 3/4"	0.278	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.123 @ 5' 8 3/4"	0.556	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 11' 2 1/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11' 1 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	587	859	1446	1 1/4" Rim Board
2 - Hanger on 9 1/2" HF beam	3.50"	Hanger[1]	1.50"	598	878	1476	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 2" o/c	
Bottom Edge (Lu)	11' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	HU610	2.50"	N/A	18-10dx1.5	8-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 11' 3 1/2"	N/A	12.7	--	
1 - Uniform (PSF)	0 to 11' 7" (Front)	6'	15.0	25.0	Default Load

- Side loads are assumed to not induce cross-grain tension.

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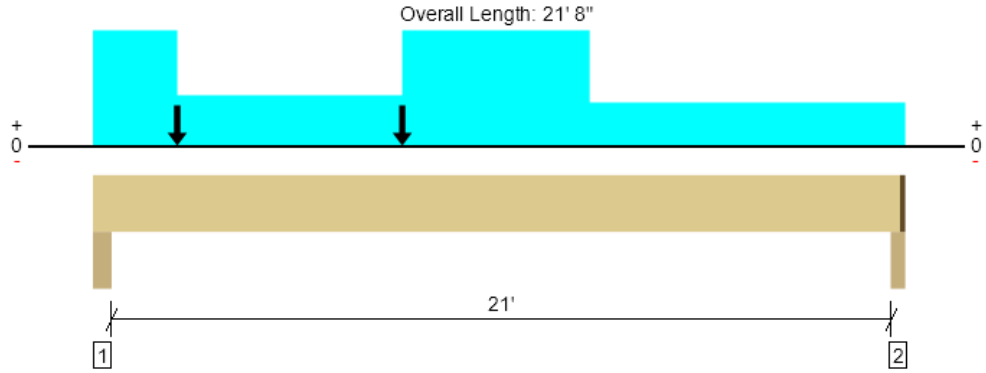
Roof, RH-2

1 piece(s) 5 1/2" x 15" 24F-V4 DF Glulam



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4897 @ 21' 6"	5012 (2.25")	Passed (98%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	7179 @ 1' 7 1/2"	16761	Passed (43%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	37089 @ 9' 1 1/4"	46010	Passed (81%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.611 @ 10' 6 1/2"	0.708	Passed (L/417)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	1.031 @ 10' 6 1/2"	1.063	Passed (L/247)	--	1.0 D + 1.0 S (All Spans)

Member Length : 21' 6 3/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.97 that was calculated using length L = 21' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Trimmer - HF	4.50"	4.50"	2.31"	3360	4892	8252	None
2 - Beam - HF	3.50"	2.25"	2.20"	2020	2903	4922	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	21' 7" o/c	
Bottom Edge (Lu)	21' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 21' 6 3/4"	N/A	20.0	--	
1 - Uniform (PSF)	0 to 21' 8" (Front)	6'	15.0	25.0	Default Load
2 - Uniform (PSF)	0 to 2' 3" (Front)	10'	15.0	25.0	Default Load
3 - Point (lb)	2' 3" (Front)	N/A	910	1291	Linked from: RB-3, Support 1
4 - Point (lb)	8' 3" (Front)	N/A	910	1291	Linked from: RB-3, Support 1
5 - Uniform (PSF)	8' 3" to 13' 3" (Front)	10'	15.0	25.0	Default Load
6 - Uniform (PSF)	2' 3" to 8' 3" (Front)	1'	15.0	25.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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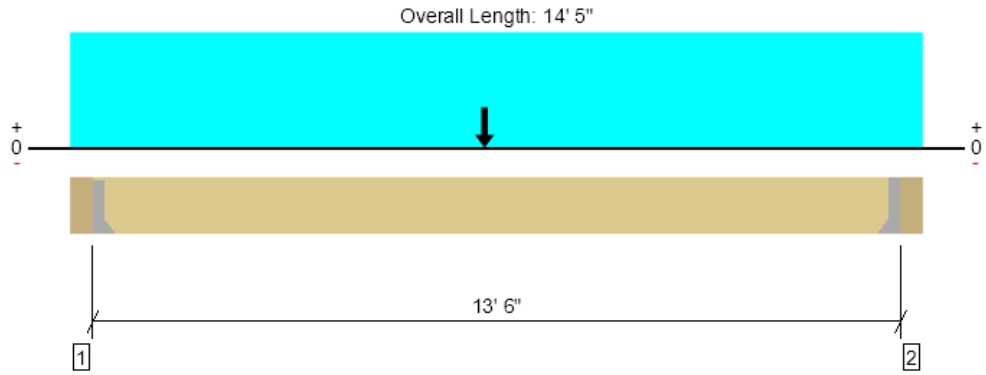
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

MEMBER REPORT

PASSED

Roof, RH-3

1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2700 @ 5 1/2"	5363 (1.50")	Passed (50%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2618 @ 1' 4"	11733	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	15651 @ 7'	23244	Passed (67%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.258 @ 7' 2"	0.450	Passed (L/629)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.445 @ 7' 2"	0.675	Passed (L/364)	--	1.0 D + 1.0 S (All Spans)

Member Length : 13' 6"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 13' 6".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 10 1/2" HF beam	5.50"	Hanger[1]	1.50"	1161	1576	2737	See note [1]
2 - Hanger on 10 1/2" HF beam	5.50"	Hanger[1]	1.50"	1110	1503	2613	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 6" o/c	
Bottom Edge (Lu)	13' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HU612	2.50"	N/A	22-10d	8-10d	
2 - Face Mount Hanger	HUC610	2.50"	N/A	18-16d	8-16d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	5 1/2" to 13' 11 1/2"	N/A	14.0	--	
1 - Uniform (PSF)	0 to 14' 5" (Front)	2'	15.0	25.0	Default Load
2 - Point (lb)	7' (Front)	N/A	1649	2358	Linked from: RB-1, Support 2

- Side loads are assumed to not induce cross-grain tension.

ForteWEB Software Operator	Job Notes
Kenny Jones L120 Engineering (817) 727-2136 kjones@l120engineering.com	

Weyerhaeuser

1/23/2025 5:12:31 PM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: S241205-3 - Oneil Deck Remodel

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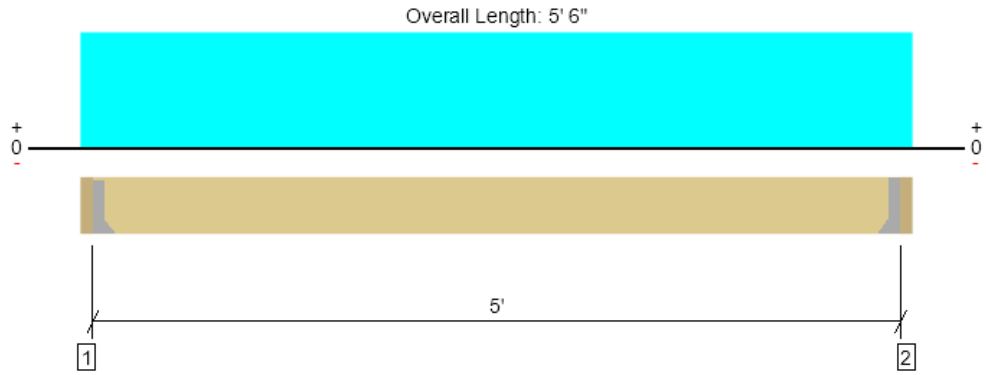
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

MEMBER REPORT

PASSED

Roof, RH-4

1 piece(s) 4 x 8 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1016 @ 3"	3281 (1.50")	Passed (31%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	771 @ 10 1/4"	3502	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1270 @ 2' 9"	3438	Passed (37%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.020 @ 2' 9"	0.167	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.032 @ 2' 9"	0.250	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 5'
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 7 1/4" HF beam	3.00"	Hanger[1]	1.50"	429	687	1116	See note [1]
2 - Hanger on 7 1/4" HF beam	3.00"	Hanger[1]	1.50"	429	687	1116	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' o/c	
Bottom Edge (Lu)	5' o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS46	2.00"	N/A	4-16d	4-16d	
2 - Face Mount Hanger	HUC46	2.50"	N/A	12-10dx1.5	6-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3" to 5' 3"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 5' 6" (Front)	10'	15.0	25.0	Default Load

- Side loads are assumed to not induce cross-grain tension.

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

ForteWEB Software Operator	Job Notes
Kenny Jones L120 Engineering (817) 727-2136 kjones@l120engineering.com	

Weyerhaeuser

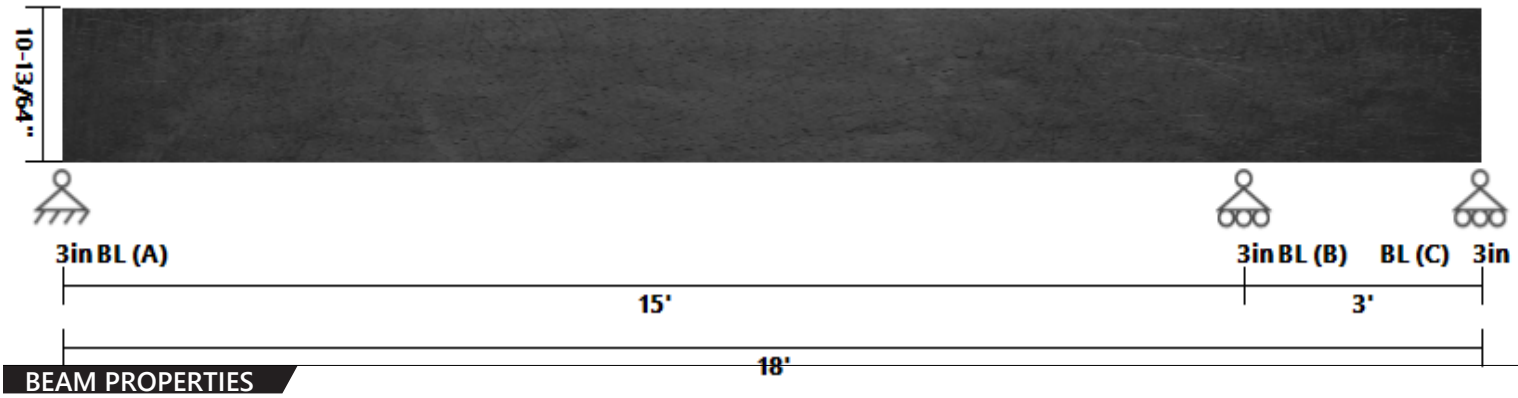
1/23/2025 5:12:31 PM UTC
ForteWEB v3.8, Engine: V8.4.1.24, Data: V8.1.6.3
File Name: S241205-3 - Oneil Deck Remodel

PASS

DATE:	1/21/2025	COMPANY:	L120 Engineering & Design
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Spencer Boyle
CUSTOMER:		REVIEWED BY:	--
PROJ. ADDRESS:	--	PROJECT NAME:	Oneil Deck
	--		
LEVEL:	NOT YET ASSIGNED	LOADING:	ASD
MEMBER NAME:	DB-1	CODE:	2018 International Building Code
MEMBER TYPE:	FLOOR BEAM	AISC:	AISC 360-16
MATERIAL:	Steel		

W Shapes	W10x22	A36-36			

DB-1 DIAGRAM



BEAM PROPERTIES

Start (ft): 0 End (ft): 18 Member Slope: 0/12 Actual Length (ft): 18

Es x10³ (psi)	Fy x10³ (psi)	Fu x10³ (psi)	Area (in²)	depth (in)	tw (in)	tf (in)	bf (in)	Ix (in⁴)	Iy (in⁴)	Zx (in³)	Zy (in³)	J (in⁴)	Cw (in⁶)
29000	36	58	6.49	10.2	0.24	0.36	5.75	118	11.4	26	6.1	0.239	275

DESIGN PROPERTIES

Lp (in)	Lr (in)	Flange Flexure	Web Flexure	Flange Compression	Web Compression	Cv	Cv_WA
66	207	Compact	Compact	Non-Slender	Non-Slender	1	1

BEAM DATA

		Unbraced Length		Beam End								
Span	Length	Top	Bottom	Elev. Diff	Pnt/Ω	Pnc/Ω	Mn/Ω	Mn-OOP/Ω	Vn/Ω	Vn-OOP/Ω	Cb	Cb-OOP
1	15	15	15	0	0	0	46.71	10.96	35.25	44.71	1.603	1
1	3	3	3	0	0	0	46.71	10.96	35.25	44.71	1.759	1

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	AISC CODE	LOAD COMBO
Shear Force Y (lbf)	PASS (81.5%)	6518.1	35251.2	15.12	G2-1	D+0.75L+0.75S
Moment Y (lbf-ft)	PASS (65.2%)	16255.4	46706.6	14.94	F2-1	D+0.75L+0.75S
Deflection Y (in)	PASS (84.7%)	0.115 (=L/1878)	0.750 (=L/288)	6.66		D+L

REACTIONS

Units for V: lbf Units for M: lbf-ft

Y axis	DEAD	LIVE	SNOW	TOTAL
A	1908	2133	889	4930
B	5940	6641	2767	15348
C	-2052	-2294	-956	-5302

Reaction Location

LOAD LIST

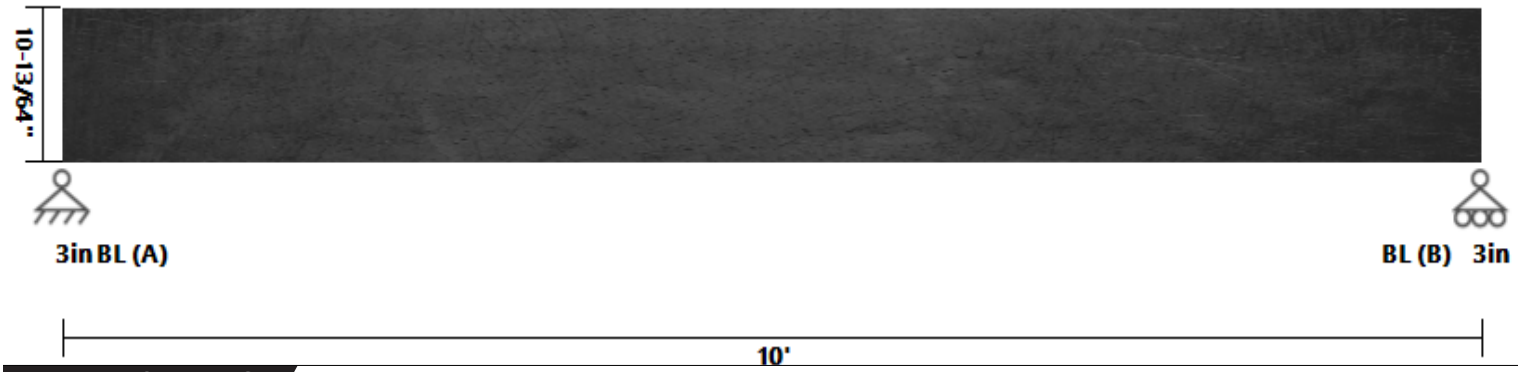
Type	Name	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Uniform (lbf/ft)		360	360	0	18	Live	Y
Uniform (lbf/ft)	Uniform	300	300	0	18	Dead	Y
Uniform (lbf/ft)	Uniform	150	150	0	18	Snow	Y
Self Weight (lbf/ft)	-	22	22	0	18	Dead	Y

PASS

DATE:	1/21/2025	COMPANY:	L120 Engineering & Design
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Spencer Boyle
CUSTOMER:		REVIEWED BY:	--
PROJ. ADDRESS:	--	PROJECT NAME:	Oneil Deck
	--		
LEVEL:	NOT YET ASSIGNED	LOADING:	ASD
MEMBER NAME:	DB-2	CODE:	2018 International Building Code
MEMBER TYPE:	FLOOR BEAM	AISC:	AISC 360-16
MATERIAL:	Steel		

W Shapes	W10x22	A36-36			

DB-2 DIAGRAM



BEAM PROPERTIES

Start (ft): 0 End (ft): 10 Member Slope: 0/12 Actual Length (ft): 10

Es x10^3 (psi)	Fy x10^3 (psi)	Fu x10^3 (psi)	Area (in^2)	depth (in)	tw (in)	tf (in)	bf (in)	Ix (in^4)	Iy (in^4)	Zx (in^3)	Zy (in^3)	J (in^4)	Cw (in^6)
29000	36	58	6.49	10.2	0.24	0.36	5.75	118	11.4	26	6.1	0.239	275

DESIGN PROPERTIES

Lp (in)	Lr (in)	Flange Flexure	Web Flexure	Flange Compression	Web Compression	Cv	Cv_WA
66	207	Compact	Compact	Non-Slender	Non-Slender	1	1

BEAM DATA

		Unbraced Length		Beam End								
Span	Length	Top	Bottom	Elev. Diff	Pnt/ω	Pnc/ω	Mn/ω	Mn-OOP/ω	Vn/ω	Vn-OOP/ω	Cb	Cb-OOP
1	10	0	10	0	0	0	0	0	0	0	1.136	1

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	AISC CODE	LOAD COMBO
Shear Force Y (lbf)	PASS (74.2%)	9110.0	35251.2	0	G2-1	D+L
Moment Y (lbf-ft)	PASS (51.2%)	22775.0	46706.6	5	F2-1	D+L
Deflection Y (in)	PASS (69.4%)	0.102 (=L/1176)	0.333 (=L/360)	5		L

REACTIONS

Units for V: lbf Units for M: lbf-ft

Y axis	DEAD	LIVE	SNOW	TOTAL
A	1360	7750	625	9735
B	1360	7750	625	9735

Reaction Location

LOAD LIST

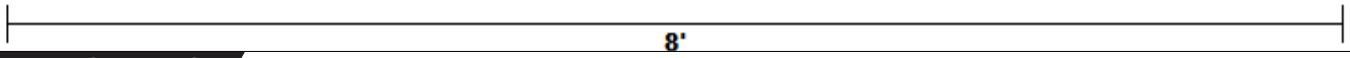
Type	Name	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Uniform (lbf/ft)		300	300	0	10	Live	Y
Uniform (lbf/ft)	Uniform	250	250	0	10	Dead	Y
Uniform (lbf/ft)	Uniform	125	125	0	10	Snow	Y
Uniform (lbf/ft)	hot tub	1250	1250	0	10	Live	Y
	hot tub loading						
Self Weight (lbf/ft)	-	22	22	0	10	Dead	Y

PASS

DATE:	1/21/2025	COMPANY:	L120 Engineering & Design
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Spencer Boyle
CUSTOMER:		REVIEWED BY:	--
PROJ. ADDRESS:	--	PROJECT NAME:	Oneil Deck
	--		
LEVEL:	NOT YET ASSIGNED	LOADING:	ASD
MEMBER NAME:	New Column	CODE:	2018 International Building Code
MEMBER TYPE:	COLUMN	AISC:	AISC 360-16
MATERIAL:	Steel		

HSS Square	HSS4x4x.375	A500 Gr.B-46			

New Column DIAGRAM



COLUMN PROPERTIES

Start(ft) 0 End(ft): 8

Es x10^3 (psi)	Fy x10^3 (psi)	Fu x10^3 (psi)	Area (in^2)	Ix (in^4)	Iy (in^4)	Zx (in^3)	Zy (in^3)	J (in^4)	Cw (in^6)
29000	46	58	4.78	10.3	10.3	6.39	6.39	17.5	0

DESIGN PROPERTIES

Lp (in)	Lr (in)	Flange Flexure	Web Flexure	Flange Compression	Web Compression	Cv	Cv_WA
172	4721	Compact	Compact	Non-Slender	Non-Slender	1	1

COLUMN DATA

		Unbraced Length		Column End								
Span	Length	Top	Bottom	Elev. Diff	Pnt/и	Pnc/и	Mn/и	Mn-OOP/и	Vn/и	Vn-OOP/и	Cb	Cb-OOP
1	8	0	0	0	0	0	0	0	0	0	1	1

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	AISC CODE	LOAD COMBO
Shear Force Y (lbf)	PASS (98.5%)	-525.0	34030.6	6.08	G4-1	D+0.7E(-)
Moment Y (lbf-ft)	PASS (92.8%)	1050.0	14667.7	6	F7-1	D+0.7E(-)
Compressive Force (lbf)	PASS (82.0%)	20138.2	112043.0	0	E3-1	D+L
Bending-Compression (Unit)	PASS (86.8%)	0.13	1.00	0	H1-1b	D+0.75L+0.525E(-)+0.75S

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	SEISMIC -	TOTAL
A	10138	10000	0	20138
B	0	0	0	0
Y axis				
A	0	0	250	250
B	0	0	750	750

Reaction Location

LOAD LIST

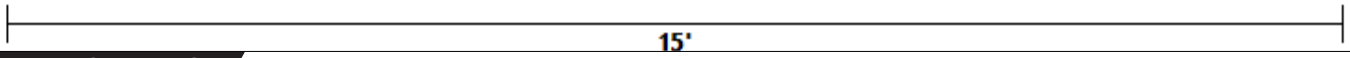
Type	Name	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Axial (lbf)	Axial	-10000	-10000	8	8	Dead	Z
Axial (lbf)	Axial	-10000	-10000	8	8	Live	Z
Point (lbf)	Point	1000	-	6	-	SeismicMinus	Y
Self Weight (lbf/ft)	-	17.27	17.27	0	8	Dead	Z

PASS

DATE:	1/21/2025	COMPANY:	L120 Engineering & Design
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Spencer Boyle
CUSTOMER:		REVIEWED BY:	--
PROJ. ADDRESS:	-- --	PROJECT NAME:	Oneil Deck
LEVEL:	NOT YET ASSIGNED	LOADING:	ASD
MEMBER NAME:	hss brace	CODE:	2018 International Building Code
MEMBER TYPE:	COLUMN	AISC:	AISC 360-16
MATERIAL:	Steel		

HSS Square	HSS2x2x.250	A500 Gr.B-46			

hss brace DIAGRAM



COLUMN PROPERTIES

Start(ft) 0 End(ft): 15

Es x10^3 (psi)	Fy x10^3 (psi)	Fu x10^3 (psi)	Area (in^2)	Ix (in^4)	Iy (in^4)	Zx (in^3)	Zy (in^3)	J (in^4)	Cw (in^6)
29000	46	58	1.51	0.747	0.747	0.964	0.964	1.31	0

DESIGN PROPERTIES

Lp (in)	Lr (in)	Flange Flexure	Web Flexure	Flange Compression	Web Compression	Cv	Cv_WA
84	2388	Compact	Compact	Non-Slender	Non-Slender	1	1

COLUMN DATA

		Unbraced Length		Column End								
Span	Length	Top	Bottom	Elev. Diff	Pnt/ϕ	Pnc/ϕ	Mn/ϕ	Mn-OOP/ϕ	Vn/ϕ	Vn-OOP/ϕ	Cb	Cb-OOP
1	15	15	15	0	0	3.47	2.17	2.21	10.01	16.72	1	1

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	AISC CODE	LOAD COMBO
Compressive Force (lbf)	PASS (75.5%)	851.2	3471.8	0	E3-1	D+0.7E(+)

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	SEISMIC +	TOTAL
A	81	1100	1181
B	0	0	0

Reaction Location

LOAD LIST

Type	Name	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Axial (lbf)	Axial	-1100	-1100	15	15	SeismicPlus	Z
Self Weight (lbf/ft)	-	5.41	5.41	0	15	Dead	Z

WARNING

1. Calculation: The X-Direction Slenderness ratio (Lcx/rx) of 255.68 exceeds the minimum suggested value of 200 for Load Combination D.
2. Calculation: The Y-Direction Slenderness ratio (Lcy/ry) of 255.68 exceeds the minimum suggested value of 200 for Load Combination D.
3. Calculation: The X-Direction Slenderness ratio (Lcx/rx) of 255.68 exceeds the minimum suggested value of 200 for Load Combination D+0.7E(+).
4. Calculation: The Y-Direction Slenderness ratio (Lcy/ry) of 255.68 exceeds the minimum suggested value of 200 for Load Combination D+0.7E(+).
5. Calculation: The X-Direction Slenderness ratio (Lcx/rx) of 255.68 exceeds the minimum suggested value of 200 for Load Combination D+0.75L+0.525E(+)+0.75S.
6. Calculation: The Y-Direction Slenderness ratio (Lcy/ry) of 255.68 exceeds the minimum suggested value of 200 for Load Combination D+0.75L+0.525E(+)+0.75S.
7. Calculation: The X-Direction Slenderness ratio (Lcx/rx) of 255.68 exceeds the minimum suggested value of 200 for Load Combination 0.6D+0.7E(+).
8. Calculation: The Y-Direction Slenderness ratio (Lcy/ry) of 255.68 exceeds the minimum suggested value of 200 for Load Combination 0.6D+0.7E(+).

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

FOUNDATION CALCULATIONS

FOOTING REFERENCE PER PLAN

(206) 790 9502
L120Engineering.com

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	24x24x10	CODE:	2021 International Building Code
MEMBER TYPE:	ISOLATED FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

2 (ft) X 2 (ft) X 10 (in)	Soil Depth TOF: 0 (ft)	(3) #4 Long, (3) #4 Short

MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft^3)	Width (ft)	Length (ft)	Depth (in)	Volume (ft^3)
2500	2880952	145	2	2	10	3.33

CALCULATION VARIABLES

Bo (in)	Φ-X	Φ-Y
42	0	0

COLUMN

Width (in)	Length (in)	Material	Offset (in)
4	4	Wood	0

SOIL

Bearing Strength (lbf/ft^2)	Density (lbf/ft^3)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	3

REBAR

Bar Size #	# Bars Long	# Bars Short	fy (psi)	Es (psi)
4	3	3	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft^2)	PASS (0.0%)	2000.0	2000.0	D+L
Two-Way Shear (Punching) (lbf)	PASS (72.6%)	11200.0	40950.0	1.2D+1.6L+0.5Lr
One-Way Shear X (lbf)	PASS (86.0%)	1633.3	11700.0	1.2D+1.6L+0.5Lr
Moment X (lbf-ft)	PASS (39.2%)	1944.4	3200.0	1.2D+1.6L+0.5Lr
One-Way Shear Y (lbf)	PASS (86.0%)	1633.3	11700.0	1.2D+1.6L+0.5Lr
Moment Y (lbf-ft)	PASS (39.2%)	1944.4	3200.0	1.2D+1.6L+0.5Lr
Crushing (psi)	PASS (49.3%)	700.0	1381.3	1.2D+1.6L+0.5Lr

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	4000	-	0	-	Dead	Z
Point (lbf)	4000	-	0	-	Live	Z

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	30x30x10	CODE:	2021 International Building Code
MEMBER TYPE:	ISOLATED FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

2.5 (ft) X 2.5 (ft) X 10 (in)	Soil Depth TOF: 0 (ft)	(3) #4 Long, (4) #4 Short

MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft^3)	Width (ft)	Length (ft)	Depth (in)	Volume (ft^3)
2500	2733229	140	2.5	2.5	10	5.21

CALCULATION VARIABLES

Bo (in)	Φ-X	Φ-Y
42	0	0

COLUMN

Width (in)	Length (in)	Material	Offset (in)
4	4	Wood	0

SOIL

Bearing Strength (lbf/ft^2)	Density (lbf/ft^3)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	3

REBAR

Bar Size #	# Bars Long	# Bars Short	fy (psi)	Es (psi)
4	4	3	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft^2)	PASS (2.8%)	1944.0	2000.0	D+L
Two-Way Shear (Punching) (lbf)	PASS (58.4%)	17040.0	40950.0	1.2D+1.6L+0.5Lr
One-Way Shear X (lbf)	PASS (74.8%)	3692.0	14625.0	1.2D+1.6L+0.5Lr
Moment X (lbf-ft)	PASS (0.0%)	3999.7	4000.0	1.2D+1.6L+0.5Lr
One-Way Shear Y (lbf)	PASS (74.8%)	3692.0	14625.0	1.2D+1.6L+0.5Lr
Moment Y (lbf-ft)	PASS (0.0%)	3999.7	4000.0	1.2D+1.6L+0.5Lr
Crushing (psi)	PASS (22.9%)	1065.0	1381.3	1.2D+1.6L+0.5Lr

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	6000	-	0	-	Dead	Z
Point (lbf)	6150	-	0	-	Live	Z

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	36x36x12	CODE:	2021 International Building Code
MEMBER TYPE:	ISOLATED FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

3 (ft) X 3 (ft) X 12 (in)	Soil Depth TOF: 0 (ft)	(4) #4 Long, (4) #4 Short

MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft^3)	Width (ft)	Length (ft)	Depth (in)	Volume (ft^3)
2500	2733229	140	3	3	12	9

CALCULATION VARIABLES

Bo (in)	Φ-X	Φ-Y
56	0	0

COLUMN

Width (in)	Length (in)	Material	Offset (in)
5.5	5.5	Wood	0

SOIL

Bearing Strength (lbf/ft^2)	Density (lbf/ft^3)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	3

REBAR

Bar Size #	# Bars Long	# Bars Short	fy (psi)	Es (psi)
4	4	4	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft^2)	PASS (0.0%)	2000.0	2000.0	D+L
Two-Way Shear (Punching) (lbf)	PASS (64.7%)	25200.0	71400.0	1.2D+1.6L+0.5Lr
One-Way Shear X (lbf)	PASS (79.4%)	4725.0	22950.0	1.2D+1.6L+0.5Lr
Moment X (lbf-ft)	PASS (65.9%)	6783.1	19898.0	1.2D+1.6L+0.5Lr
One-Way Shear Y (lbf)	PASS (79.4%)	4725.0	22950.0	1.2D+1.6L+0.5Lr
Moment Y (lbf-ft)	PASS (65.9%)	6783.1	19898.0	1.2D+1.6L+0.5Lr
Crushing (psi)	PASS (39.7%)	833.1	1381.3	1.2D+1.6L+0.5Lr

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	9000	-	0	-	Dead	Z
Point (lbf)	9000	-	0	-	Live	Z

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	42x42x12	CODE:	2021 International Building Code
MEMBER TYPE:	ISOLATED FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

3.5 (ft) X 3.5 (ft) X 12 (in)	Soil Depth TOF: 0 (ft)	(6) #4 Long, (6) #4 Long, (6) #4 Short

MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft^3)	Width (ft)	Length (ft)	Depth (in)	Volume (ft^3)
2500	2733229	140	3.5	3.5	12	12.25

CALCULATION VARIABLES

Bo (in)	Φ-X	Φ-Y
56	0	0

COLUMN

Width (in)	Length (in)	Material	Offset (in)
5.5	5.5	Wood	0

SOIL

Bearing Strength (lbf/ft^2)	Density (lbf/ft^3)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	3

REBAR

Bar Size #	# Bars Long	# Bars Short	fy (psi)	Es (psi)
4	6	6	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft^2)	PASS (2.0%)	1959.2	2000.0	D+L
Two-Way Shear (Punching) (lbf)	PASS (52.9%)	33600.0	71400.0	1.2D+1.6L+0.5Lr
One-Way Shear X (lbf)	PASS (70.9%)	7800.0	26775.0	1.2D+1.6L+0.5Lr
Moment X (lbf-ft)	PASS (62.5%)	11102.1	29631.9	1.2D+1.6L+0.5Lr
One-Way Shear Y (lbf)	PASS (70.9%)	7800.0	26775.0	1.2D+1.6L+0.5Lr
Moment Y (lbf-ft)	PASS (62.5%)	11102.1	29631.9	1.2D+1.6L+0.5Lr
Crushing (psi)	PASS (19.6%)	1110.7	1381.3	1.2D+1.6L+0.5Lr

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	12000	-	0	-	Dead	Z
Point (lbf)	12000	-	0	-	Live	Z

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	48x48x12	CODE:	2021 International Building Code
MEMBER TYPE:	ISOLATED FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

4 (ft) X 4 (ft) X 12 (in)	Soil Depth TOF: 0 (ft)	(6) #4 Long, (6) #4 Short

MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft^3)	Width (ft)	Length (ft)	Depth (in)	Volume (ft^3)
2500	2733229	140	4	4	12	16

CALCULATION VARIABLES

Bo (in)	Φ-X	Φ-Y
58	0	0

COLUMN

Width (in)	Length (in)	Material	Offset (in)
6	6	Wood	0

SOIL

Bearing Strength (lbf/ft^2)	Density (lbf/ft^3)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	3

REBAR

Bar Size #	# Bars Long	# Bars Short	fy (psi)	Es (psi)
4	6	6	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft^2)	PASS (6.3%)	1875.0	2000.0	D+L
Two-Way Shear (Punching) (lbf)	PASS (43.2%)	42000.0	73950.0	1.2D+1.6L+0.5Lr
One-Way Shear X (lbf)	PASS (64.3%)	10937.5	30600.0	1.2D+1.6L+0.5Lr
Moment X (lbf-ft)	PASS (46.0%)	16078.1	29752.9	1.2D+1.6L+0.5Lr
One-Way Shear Y (lbf)	PASS (64.3%)	10937.5	30600.0	1.2D+1.6L+0.5Lr
Moment Y (lbf-ft)	PASS (46.0%)	16078.1	29752.9	1.2D+1.6L+0.5Lr
Crushing (psi)	PASS (15.5%)	1166.7	1381.3	1.2D+1.6L+0.5Lr

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	15000	-	0	-	Dead	Z
Point (lbf)	15000	-	0	-	Live	Z

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	12in wide cont	CODE:	2021 International Building Code
MEMBER TYPE:	CONTINUOUS FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

1 (ft) Wide X 12 (in) Deep	Soil Depth TOF: 0 (ft)	Longit: (2) #4 Bars

MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft^3)	Width (ft)	Depth (in)
2500	2733229	140	1	12

STEM WALL

Width (in)	Height (in)	Material	Offset (in)
12	8	Concrete	0

SOIL

Bearing Strength (lbf/ft^2)	Density (lbf/ft^3)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	0

REBAR

Bar Size #	Transv. Spacing (in)	# Longit. Bars	fy (psi)	Es (psi)
4	None	2	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft^2)	PASS (0.2%)	1996.7	2000.0	D+L
Moment Y (lbf-ft)	PASS (86.0%)	349.5	2500.0	1.2D+1.6L+0.5Lr

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Uniform (lbf/ft)	1000	1000	0	1	Live	Z
Uniform (lbf/ft)	900	900	0	1	Dead	Z
Stemwall Weight (lbf/ft)	96.67	96.67	0	1	Dead	Z

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	cont 12 in wide stem max point	CODE:	2021 International Building Code
MEMBER TYPE:	ISOLATED FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

1 (ft) X 3.33 (ft) X 20 (in)	Soil Depth TOF: 0 (ft)	(2) #4 Long, (5) #4 Short

MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft^3)	Width (ft)	Length (ft)	Depth (in)	Volume (ft^3)
2500	2880952	145	1	3.33	20	5.55

CALCULATION VARIABLES

Bo (in)	Φ-X	Φ-Y
0	0	0

COLUMN

Width (in)	Length (in)	Material	Offset (in)
4	4	Wood	0

SOIL

Bearing Strength (lbf/ft^2)	Density (lbf/ft^3)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	3

REBAR

Bar Size #	# Bars Long	# Bars Short	fy (psi)	Es (psi)
4	2	5	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft^2)	PASS (9.9%)	1801.8	2000.0	D+L
One-Way Shear X (lbf)	PASS (97.6%)	355.6	14850.0	1.2D+1.6L+0.5Lr
Moment X (lbf-ft)	PASS (83.3%)	3236.0	19423.5	1.2D+1.6L+0.5Lr
Moment Y (lbf-ft)	PASS (98.0%)	533.3	26973.0	1.2D+1.6L+0.5Lr
Crushing (psi)	PASS (56.6%)	600.0	1381.3	1.2D+1.6L+0.5Lr

LOAD LIST

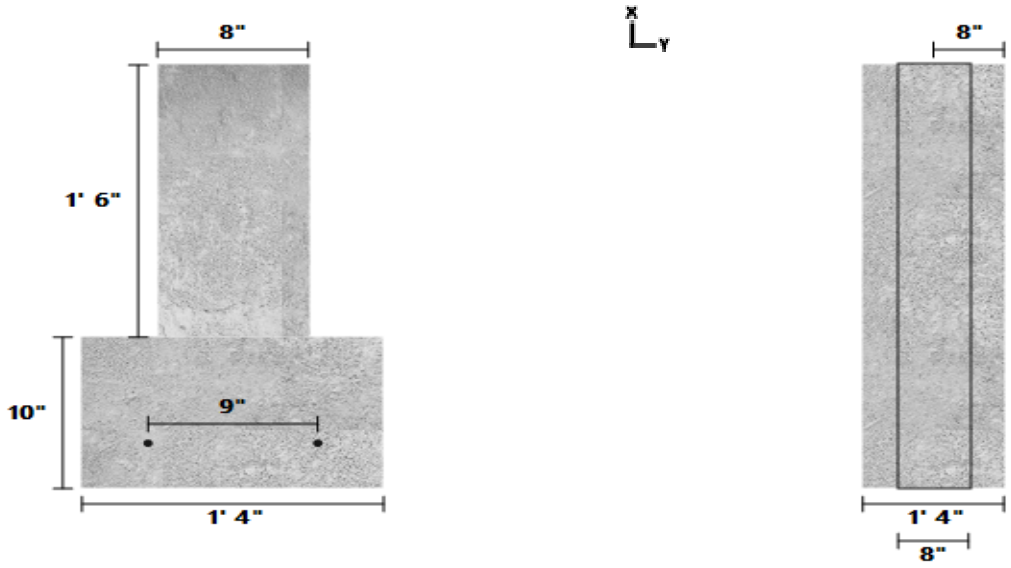
Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	3000	-	0	-	Live	Z
Point (lbf)	3000	-	0	-	Live	Z

PASS

DATE:	2/20/2023	COMPANY:	L120 Engineering & Design, LLC
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJ. ADDRESS:	-- --	PROJECT NAME:	2021 foundation 2000psf
LEVEL:	Basement	LOADING:	
MEMBER NAME:	16in cont footing	CODE:	2021 International Building Code
MEMBER TYPE:	CONTINUOUS FOOTING	ACI:	ACI 318-19
MATERIAL:	Concrete		

1.3334 (ft) Wide X 10 (in) Deep	Soil Depth TOF: 0 (ft)	Longit: (2) #4 Bars

16in cont footing DIAGRAMS



MATERIAL PROPERTIES

FOOTING

fc' (psi)	Ec (psi)	Density (lbf/ft³)	Width (ft)	Depth (in)
2500	2880952	145	1.3334	10

STEM WALL

Width (in)	Height (in)	Material	Offset (in)
8	18	Concrete	0

SOIL

Bearing Strength (lbf/ft²)	Density (lbf/ft³)	Cohesion	Friction Angle	Depth (ft)	Rankine Coefficient (Kp)
2000	140	0	30	0	0

REBAR

Bar Size #	Transv. Spacing (in)	# Longit. Bars	fy (psi)	Es (psi)
4	None	2	40000	2.9E+07

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOAD COMBO
Soil Bearing Pressure (lbf/ft²)	PASS (0.8%)	1983.7	2000.0	D+L
One-Way Shear Y (lbf)	PASS (89.1%)	350.1	3202.8	1.2D+1.6L+0.5Lr
Moment Y (lbf-ft)	PASS (61.1%)	622.4	1600.0	1.2D+1.6L+0.5Lr

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Uniform (lbf/ft)	1100	1100	0	1	Dead	Z
Uniform (lbf/ft)	1400	1400	0	1	Live	Z
Stemwall Weight (lbf/ft)	145	145	0	1	Dead	Z

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

LIC# : KW-06018526, Build:20.23.2.14 L120 Engineering & Design, LLC

DESCRIPTION: L SITE WALL (4FT) (2000PSF)

Code Reference

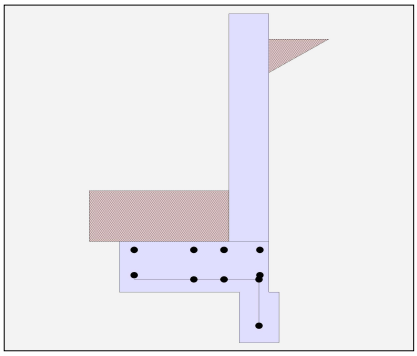
Calculations per IBC 2012 1807.3, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform

Multiplier Used	=	10.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	50.000
Total Seismic Force	=	250.000

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: L SITE WALL (4FT) (2000PSF)

Design Summary

Wall Stability Ratios

Overturning	=	1.36	Ratio < 1.5!
Sliding	=	1.98	OK
Global Stability	=	1.64	

Total Bearing Load	=	1,144 lbs	
...resultant ecc.	=	9.73 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,744 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,442 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	11.3 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	737.5 lbs	
less 100% Passive Force	-	1,000.0 lbs	
less 100% Friction Force	-	457.6 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.214**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	776.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,168.0		
Moment.....Allowable	=	5,448.0		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	10.3		
Shear.....Allowable	psi =	82.2		
Anet (Masonry)	in2 =			
Wall Weight	psf =	100.0		
Rebar Depth 'd'	in =	6.25		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: L SITE WALL (4FT) (2000PSF)

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0438 in2/ft		
(4/3) * As :	0.0583 in2/ft	Min Stem T&S Reinf Area 0.864 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.016 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.83 ft
Heel Width	=	0.67
Total Footing Width	=	2.50
Footing Thickness	=	12.00 in
Key Width	=	8.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	2.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 9.00 @ Btm.= 3.00 in

Footing Design Results

		Toe		Heel	
Factored Pressure	=	2,442		0	psf
Mu' : Upward	=	2,231		0	ft-#
Mu' : Downward	=	543		0	ft-#
Mu: Design	=	1,688	OK	0	ft-# OK
phiMn	=	10,188		OK - Flush	
Actual 1-Way Shear	=	11.28		0.00	psi
Allow 1-Way Shear	=	82.16		82.16	psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 13.88 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 0.65 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: L SITE WALL (4FT) (2000PSF)

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		562.5	1.67	937.5	Soil Over HL (ab. water tbl)	0.0	2.50	0.0
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.50	0.0
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	219.6	0.92	200.9
Seismic Earth Load	=	175.0	2.50	437.5	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	450.0	2.16	973.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	374.5	1.25	467.5
					Key Weight	=	100.0	2.33	233.3
					Vert. Component	=			
Total	=	737.5	**O.T.M.** =	1,375.0	**Total =**		1,144.1 lbs	**R.M.=**	1,875.3

Resisting/Overturning Ratio = **1.36**
Vertical Loads used for Soil Pressure = 1,144.1 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.087	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: L SITE WALL (4FT) (2000PSF)

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

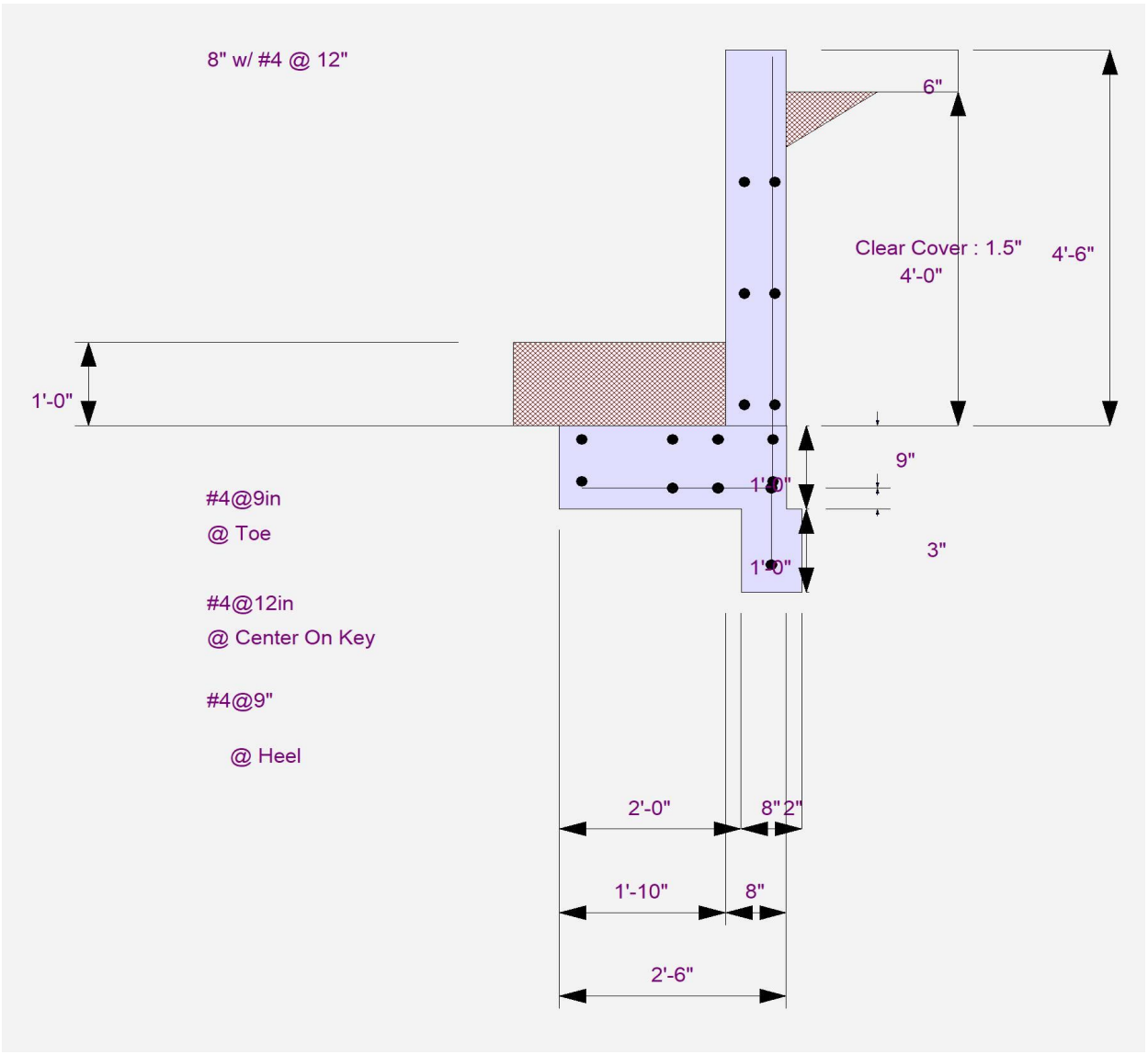
Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	7.67 in
As Provided =	0.2000 in2/ft
As Required =	0.1728 in2/ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: L SITE WALL (4FT) (2000PSF)

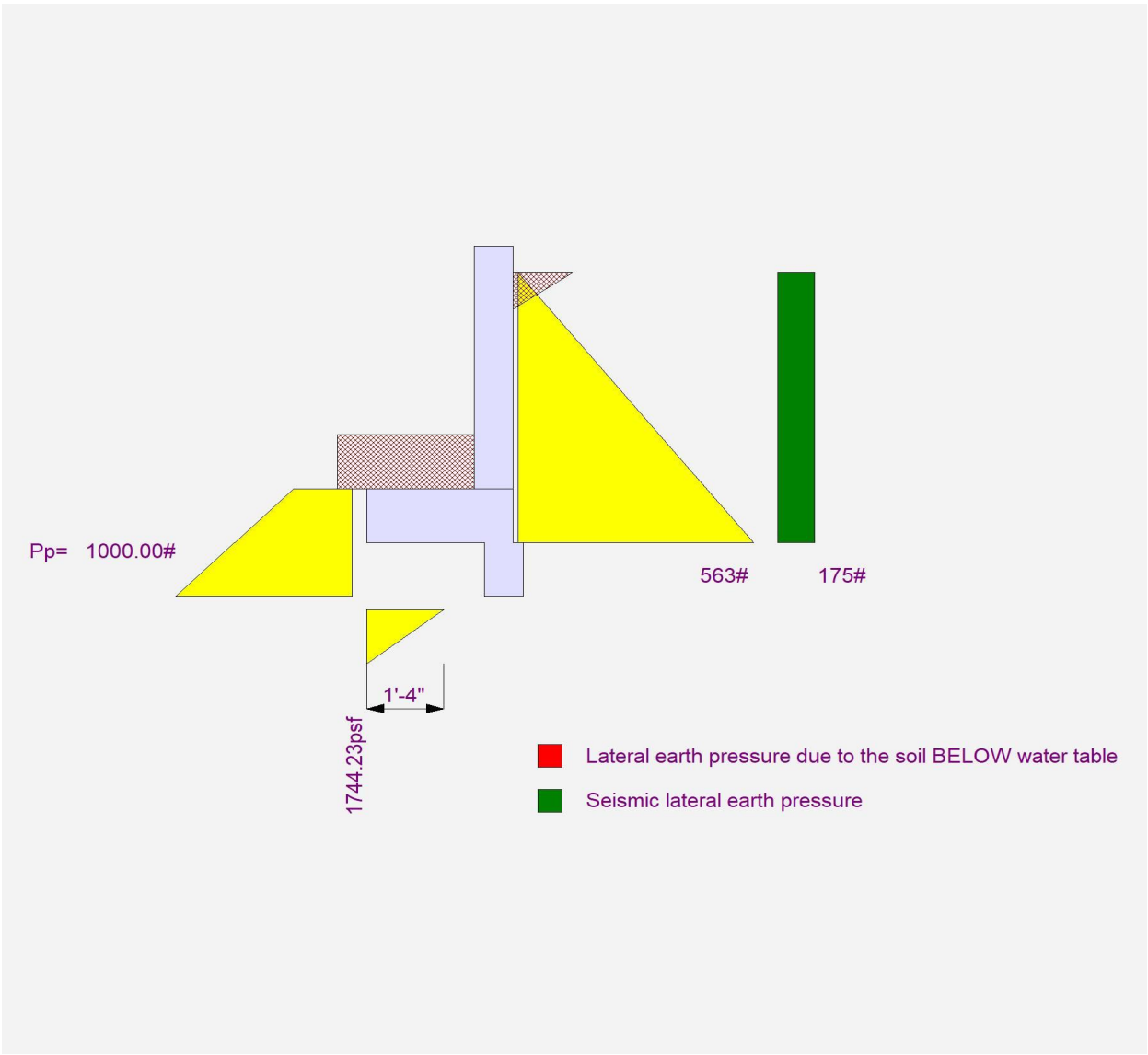


Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: L SITE WALL (4FT) (2000PSF)



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 4 ft max site wall (2000PSF)

Code Reference

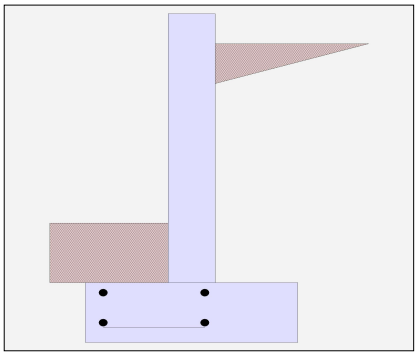
Calculations per IBC 2012 1807.3, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	100.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	7.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	35.000
Total Seismic Force	=	175.000

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 4 ft max site wall (2000PSF)

Design Summary

Wall Stability Ratios

Overturning	=	2.19	OK
Sliding	=	1.50	OK
Global Stability	=	2.89	

Total Bearing Load	=	1,717 lbs	
...resultant ecc.	=	6.35 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,179 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,650 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	5.2 psi	OK
Footing Shear @ Heel	=	6.2 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	705.8 lbs	
less 100% Passive Force	-	375.0 lbs	
less 100% Friction Force	-	686.7 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		

Design Data

fb/FB + fa/Fa	=	**0.229**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	774.7
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	1,250.7
Moment.....Allowable	=	5,448.0
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	10.3
Shear.....Allowable	psi =	82.2
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 4 ft max site wall (2000PSF)

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0469 in2/ft		
(4/3) * As :	0.0625 in2/ft	Min Stem T&S Reinf Area 0.864 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.016 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.17 ft
Heel Width	=	1.83
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 9.00 @ Btm.= 3.00 in

Footing Design Results

		Toe		Heel		
Factored Pressure	=	1,650		0	psf	
Mu' : Upward	=	973		119	ft-#	
Mu' : Downward	=	221		623	ft-#	
Mu: Design	=	753	OK	505	ft-#	OK
phiMn	=	10,188		2,739	ft-#	
Actual 1-Way Shear	=	5.16		6.15	psi	
Allow 1-Way Shear	=	82.16		43.82	psi	

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 13.89 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Heel: phiMn = ph*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 0.78 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 4 ft max site wall (2000PSF)

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		437.5	1.67	729.2	Soil Over HL (ab. water tbl)	560.0	2.42	1,353.3
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.42	1,353.3
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=	145.8	2.50	364.6	Surcharge Over Heel	= 116.7	2.42	281.9
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	= 140.0	0.58	81.7
Seismic Earth Load	=	122.5	2.50	306.3	Surcharge Over Toe	=		
	=				Stem Weight(s)	= 450.0	1.50	675.0
					Earth @ Stem Transitions	=		
Total	=	705.8	**O.T.M.** =	1,400.0	Footing Weight	= 450.0	1.50	675.0
					Key Weight	=		
					Vert. Component	=		
					Total =	1,716.7 lbs	**R.M.=**	3,066.9

Resisting/Overturning Ratio = **2.19**
Vertical Loads used for Soil Pressure = 1,716.7 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.049	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 4 ft max site wall (2000PSF)

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

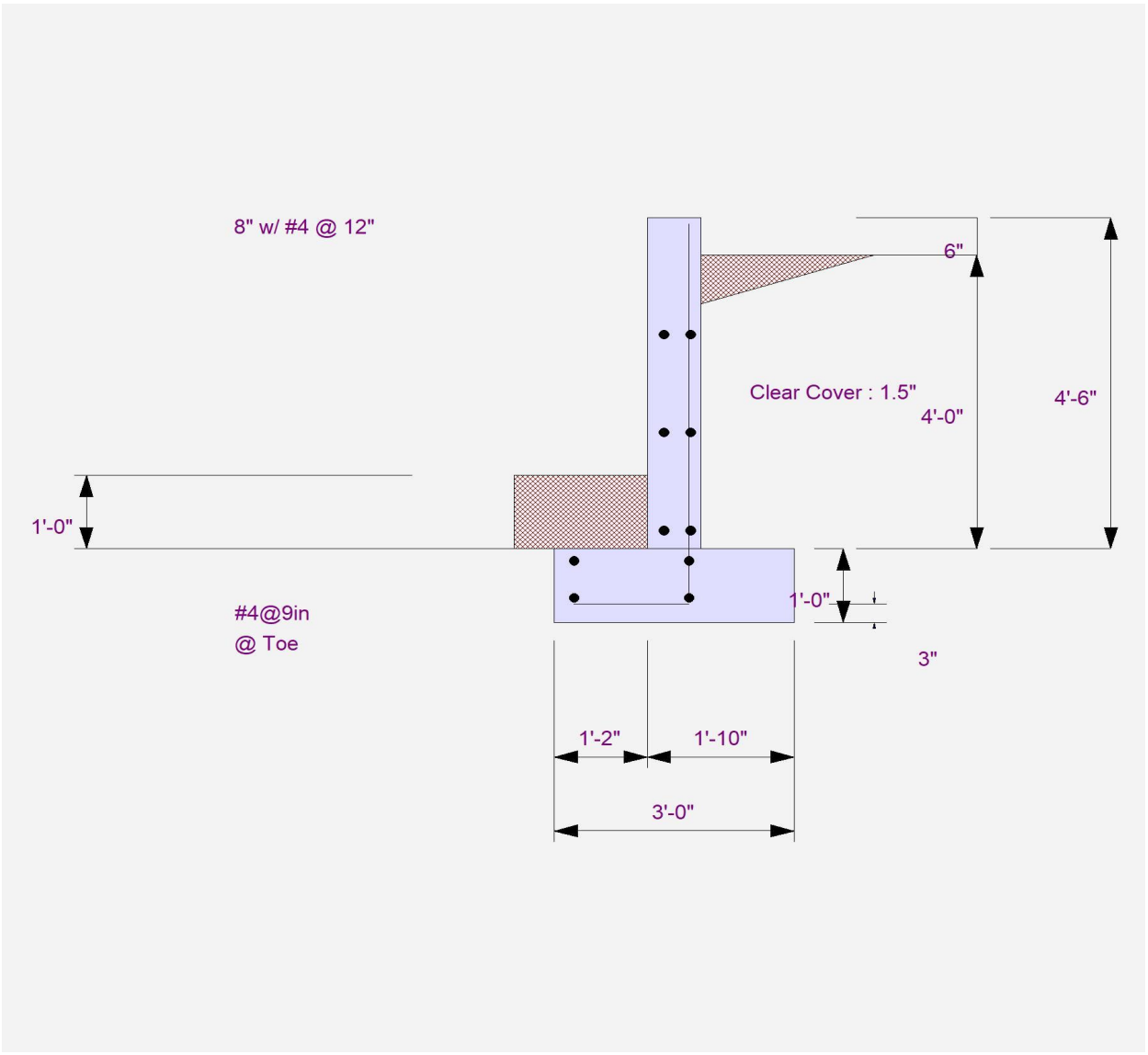
Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	7.67 in
As Provided =	0.2000 in2/ft
As Required =	0.1728 in2/ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 4 ft max site wall (2000PSF)

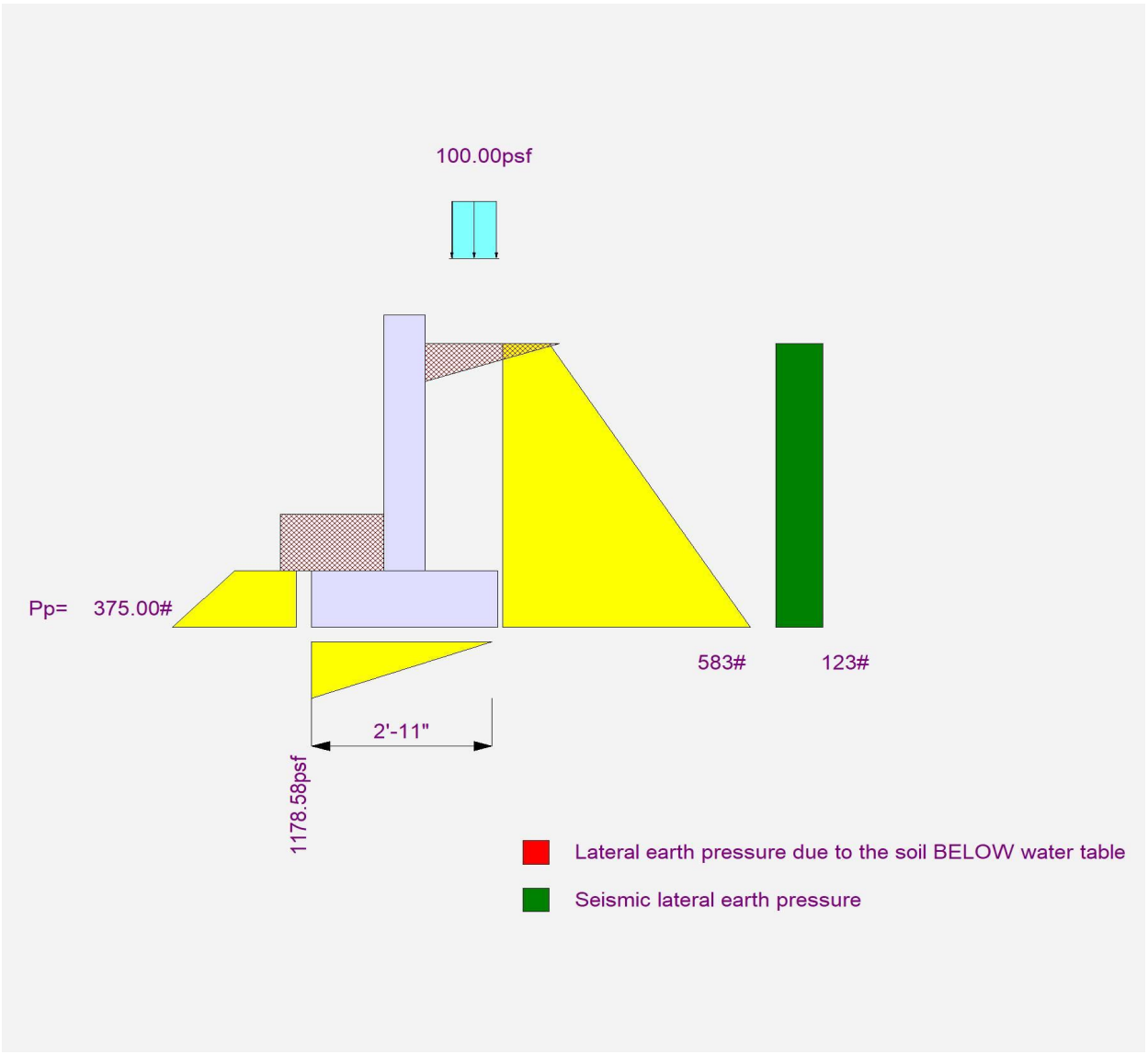


Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 4 ft max site wall (2000PSF)



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 6 ft max site wall (2000PSF)

Code Reference

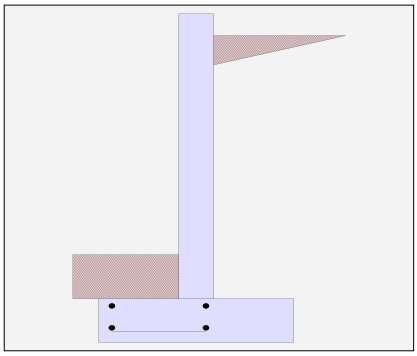
Calculations per IBC 2012 1807.3, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	100.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	7.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	49.000
Total Seismic Force	=	343.000

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 6 ft max site wall (2000PSF)

Design Summary

Wall Stability Ratios

Overturning	=	1.74	OK
Sliding	=	1.11	Ratio < 1.5!
Global Stability	=	2.38	

Total Bearing Load	=	2,662	lbs
...resultant ecc.	=	10.66	in

Eccentricity outside middle third

Soil Pressure @ Toe	=	1,798	psf OK
Soil Pressure @ Heel	=	0	psf OK
Allowable	=	2,000	psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	2,518	psf
ACI Factored @ Heel	=	0	psf
Footing Shear @ Toe	=	14.6	psi OK
Footing Shear @ Heel	=	13.5	psi OK
Allowable	=	82.2	psi

Sliding Calcs

Lateral Sliding Force	=	1,301.8	lbs
less 100% Passive Force	-	375.0	lbs
less 100% Friction Force	-	1,064.7	lbs
Added Force Req'd	=	0.0	lbs OK
....for 1.5 Stability	=	513.0	lbs NG

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		

Design Data

fb/FB + fa/Fa	=	**0.686**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,582.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	3,738.0
Moment.....Allowable	=	5,448.0
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	21.1
Shear.....Allowable	psi =	82.2
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 6 ft max site wall (2000PSF)

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.14 in2/ft		
(4/3) * As :	0.1867 in2/ft	Min Stem T&S Reinf Area 1.248 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1867 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.016 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.54 ft
Heel Width	=	2.21
Total Footing Width	=	3.75
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 9.00 @ Btm.= 3.00 in

Footing Design Results

		Toe		Heel	
Factored Pressure	=	2,518		0	psf
Mu' : Upward	=	2,472		60	ft-#
Mu' : Downward	=	385		1,431	ft-#
Mu: Design	=	2,087	OK	1,371	ft-# OK
phiMn	=	10,188		2,739	ft-#
Actual 1-Way Shear	=	14.63		13.46	psi
Allow 1-Way Shear	=	82.16		43.82	psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 13.89 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Heel: phiMn = ph*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 0.97 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 6 ft max site wall (2000PSF)

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		857.5	2.33	2,000.8	Soil Over HL (ab. water tbl)	1,110.0	2.98	3,306.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.98	3,306.9
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=	204.2	3.50	714.6	Surcharge Over Heel	= 154.2	2.98	459.3
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	= 185.0	0.77	142.6
Seismic Earth Load	=	240.1	3.50	840.4	Surcharge Over Toe	=		
	=				Stem Weight(s)	= 650.0	1.88	1,218.8
					Earth @ Stem Transitions	=		
					Footing Weight	= 562.5	1.88	1,054.7
					Key Weight	=		
					Vert. Component	=		
Total	=	1,301.8	**O.T.M.** =	3,555.8	**Total =**	2,661.7 lbs	**R.M.=**	6,182.2

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Resisting/Overturning Ratio = **1.74**
Vertical Loads used for Soil Pressure = 2,661.7 lbs

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.087	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 6 ft max site wall (2000PSF)

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

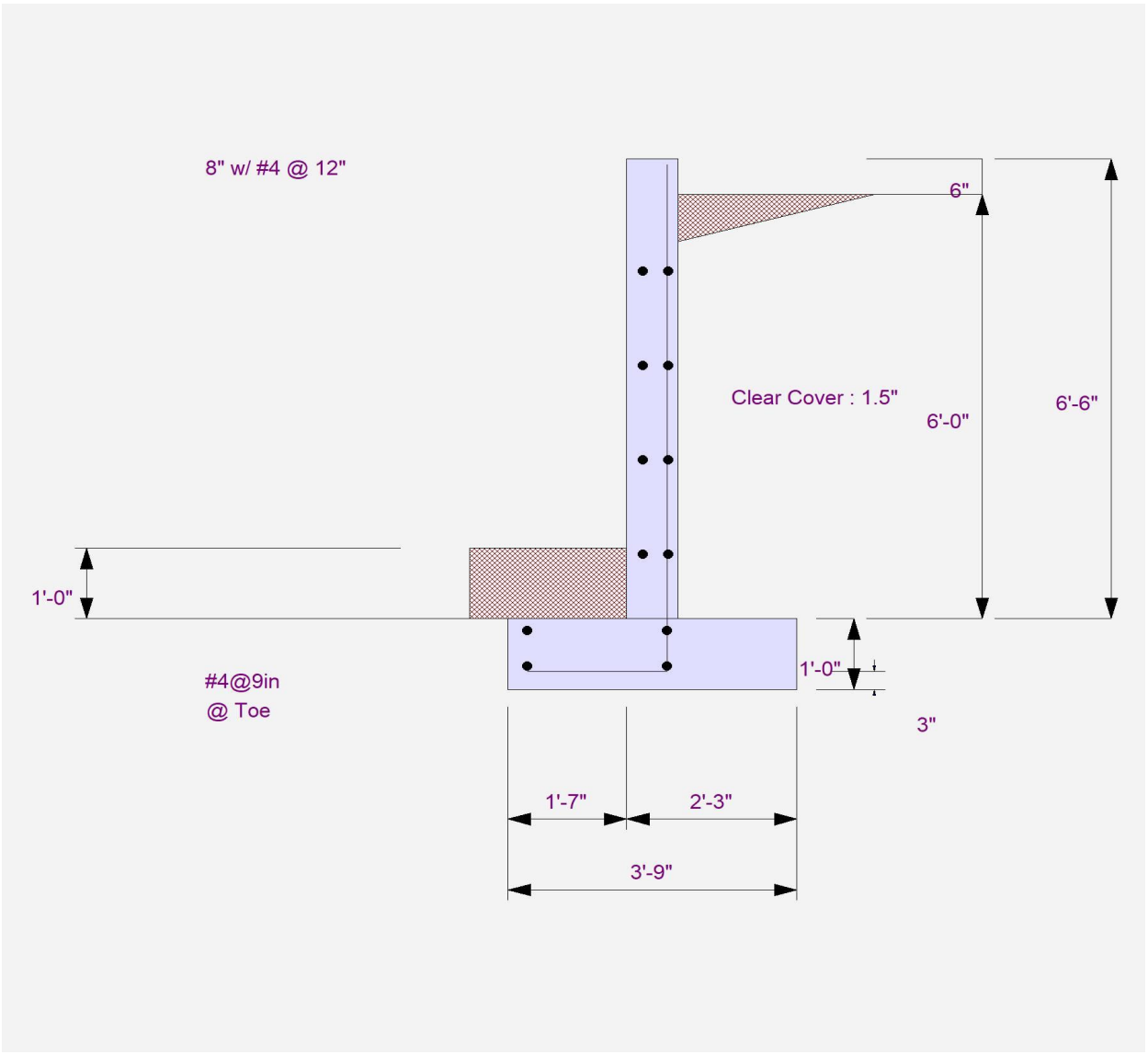
Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	7.67 in
As Provided =	0.2000 in2/ft
As Required =	0.1867 in2/ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 6 ft max site wall (2000PSF)

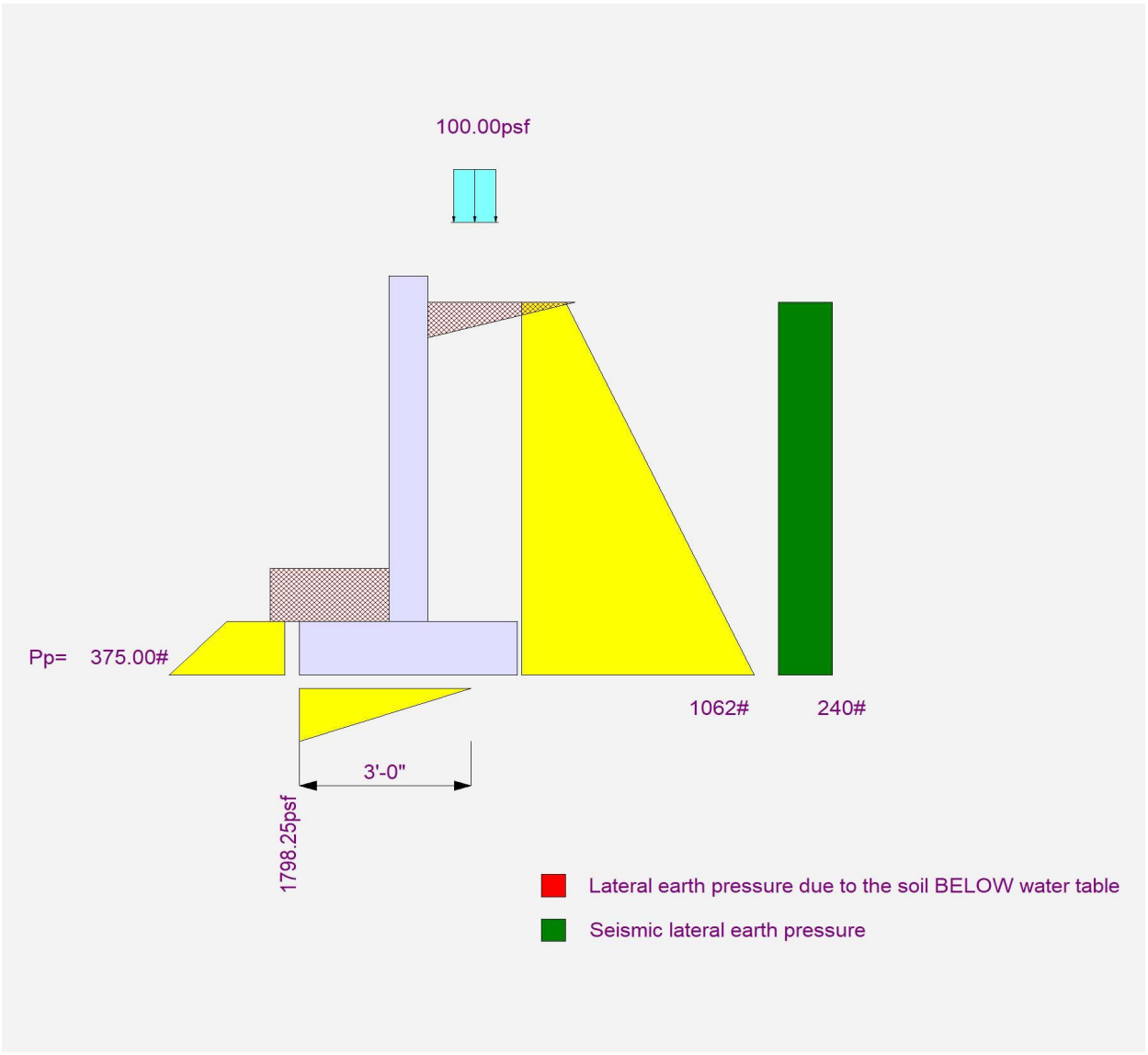


Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: site walls.ec6

DESCRIPTION: 6 ft max site wall (2000PSF)



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Site Retaining Walls (2000psf).ec6

LIC# : KW-06018526, Build:20.23.2.14 L120 Engineering & Design, LLC

DESCRIPTION: 4ft Max Retaing (L - Footing)

Code Reference

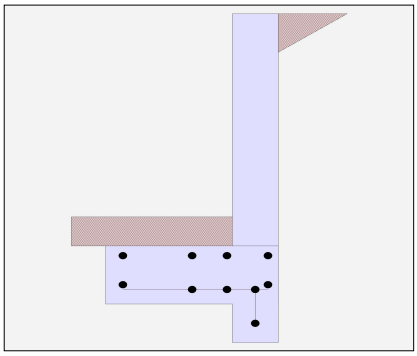
Calculations per IBC 2012 1807.3, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	7.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	35.000
Total Seismic Force	=	175.000

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Site Retaining Walls (2000psf).ec6

DESCRIPTION: 4ft Max Retaing (L - Footing)

Design Summary

Wall Stability Ratios

Overturning	=	18.80	OK
Sliding	=	1.50	OK
Global Stability	=	2.04	

Total Bearing Load	=	946 lbs	
...resultant ecc.	=	8.11 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,088 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,523 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	8.4 psi	OK
Footing Shear @ Heel	=	0.1 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	560.0 lbs	
less 100% Passive Force	-	461.8 lbs	
less 100% Friction Force	-	378.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom				
		Stem OK				
Design Height Above Ftg	ft =	0.00				
Wall Material Above "Ht"	=	Concrete				
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	8.00				
Rebar Size	=	# 4				
Rebar Spacing	=	18.00				
Rebar Placed at	=	Edge				

Design Data

fb/FB + fa/Fa	=	**0.239**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	588.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	877.3
Moment.....Allowable	=	3,655.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	7.8
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25

Note: for conditions without key, battered piles shall resist 1200lbs of sliding force

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Site Retaining Walls (2000psf).ec6

DESCRIPTION: 4ft Max Retaing (L - Footing)

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0329 in2/ft		
(4/3) * As :	0.0438 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0012bh : 0.0012(12)(8) :	0.1152 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1152 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.1333 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.84 ft
Heel Width	=	0.67
Total Footing Width	=	2.51
Footing Thickness	=	12.00 in
Key Width	=	8.00 in
Key Depth	=	8.00 in
Key Distance from Toe	=	1.84 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 9.00 @ Btm.= 3.00 in

Footing Design Results

		Toe		Heel	
Factored Pressure	=	1,523		0	psf
Mu' : Upward	=	1,669		0	ft-#
Mu' : Downward	=	416		0	ft-#
Mu: Design	=	1,253	OK	0	ft-# OK
phiMn	=	26,913		OK - Flush	
Actual 1-Way Shear	=	8.43		0.08	psi
Allow 1-Way Shear	=	75.00		75.00	psi

Toe Reinforcing = # 8 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 13.88 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 0.65 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Site Retaining Walls (2000psf).ec6

DESCRIPTION: 4ft Max Retaing (L - Footing)

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		437.5	1.67	729.2	Soil Over HL (ab. water tbl)	1.5	2.51	3.7
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.51	3.7
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	101.2	0.92	93.1
Seismic Earth Load	=	122.5	2.50	306.3	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	400.0	2.17	869.3
Total	=	560.0	**O.T.M.** =	1,035.4	Earth @ Stem Transitions	=		
					Footing Weight	=	376.5	1.26	472.5
					Key Weight	=	66.7	2.17	144.9
					Vert. Component	=			
					Total =		945.8 lbs	**R.M.=**	19,468.0

Resisting/Overturning Ratio = **18.80**
Vertical Loads used for Soil Pressure = 945.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.048	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

DESCRIPTION: 4ft Max Retaing (L - Footing)

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	8.40 in
As Provided =	0.1333 in2/ft
As Required =	0.1152 in2/ft

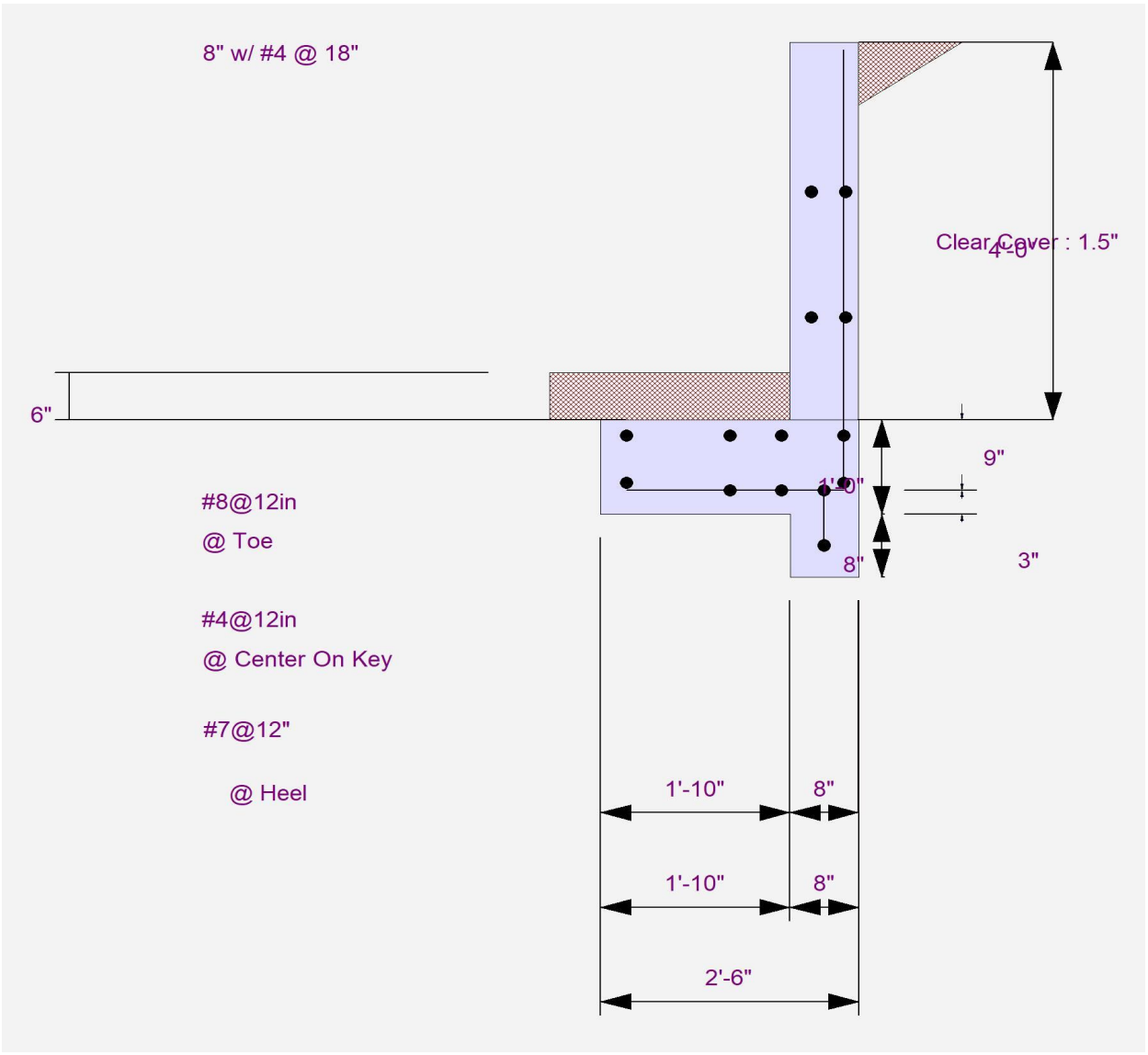
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Site Retaining Walls (2000psf).ec6

LIC# : KW-06018526, Build:20.23.2.14 L120 Engineering & Design, LLC

DESCRIPTION: 4ft Max Retaing (L - Footing)

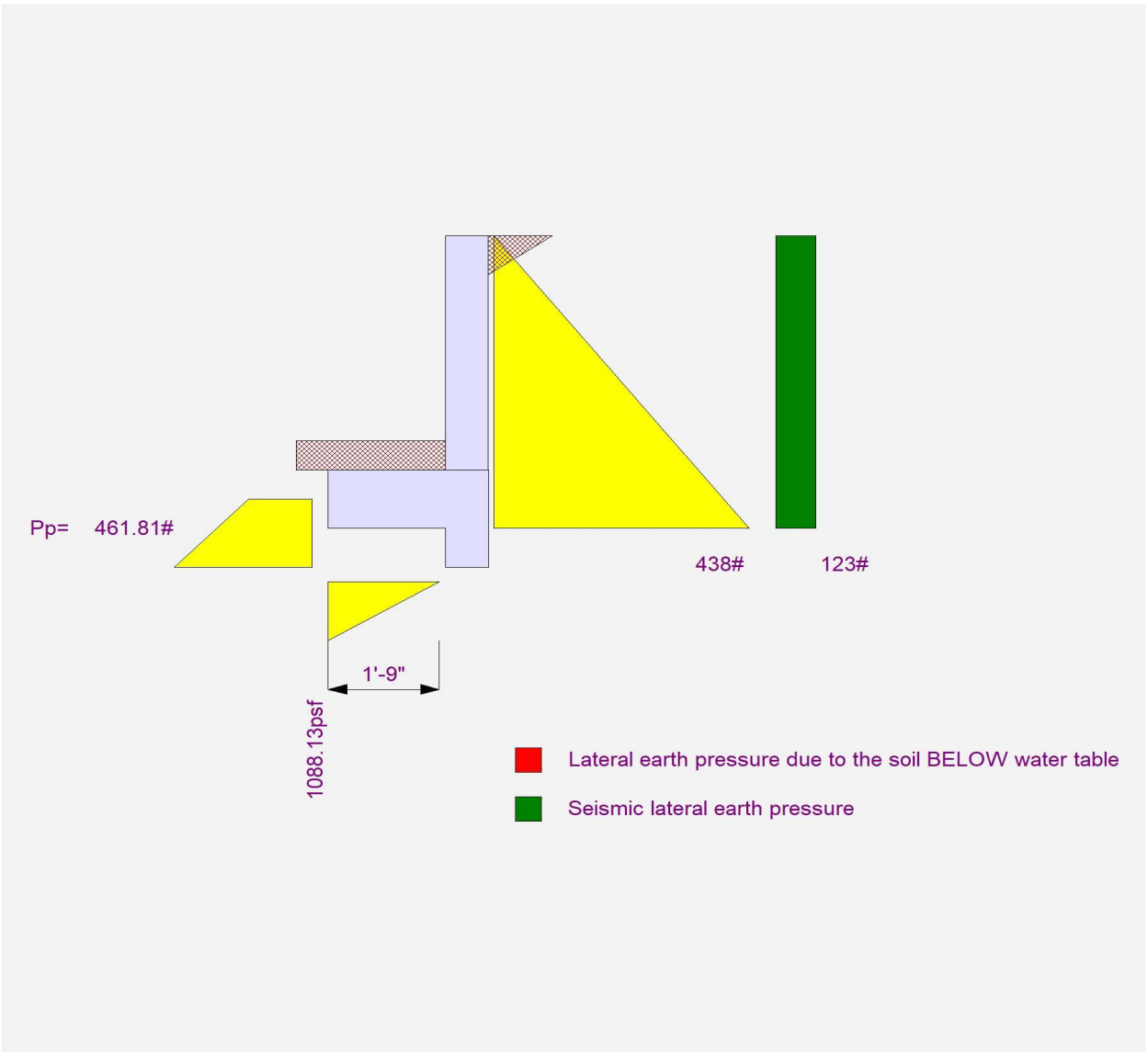


Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Site Retaining Walls (2000psf).ec6

DESCRIPTION: 4ft Max Retaing (L - Footing)



LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

OVERTURNING ON PILES

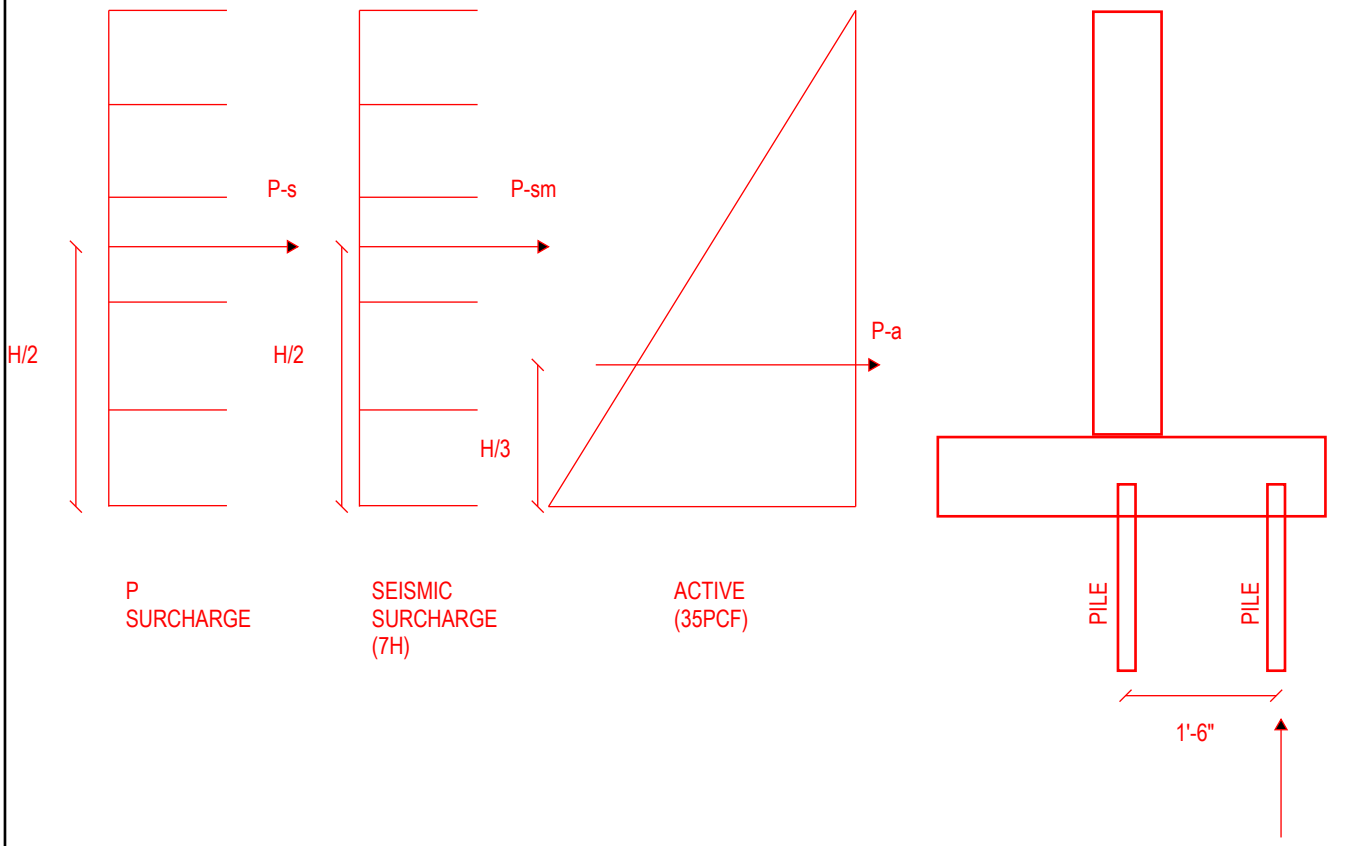
LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

PROJECT NO.	SHEET NO.

PROJECT _____

SUBJECT _____

BY _____ DATE / /



P
SURCHARGE

SEISMIC
SURCHARGE
(7H)

ACTIVE
(35PCF)

H=6FT (WORST CASE):

Pa= 35*H^2/2 = 630 LBS
P-sm = 7H^2 =252 LBS
P-s= w*h = 300 LBS

SUM MOMENT= Pa*H/3 + Psm * H/2 + Ps* H/2 => M = 2916 lb-ft/ft
Length between adjacent pile = 3ft
M = 8750 lb

Resultant = M/1.5' = _5800_lbs

ALLOWABLE PILE CAPACITY = 6000 LBS (2IN PIN PILE PER GEO) THUS OK

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

LATERAL CALCULATIONS

SHEAR-WALL REFERENCE PER PLAN

AT THE NEW PATIO EXPANSION, THE LATERAL FORCE RESISTING SYSTEM WILL CONSIST OF NEW WOOD FRAMED SHEARWALLS AT THE SIDES AND REAR OF THE PATIO.

AT THE NEW COVERED PATIO ROOF SECTION, THE EXISTING RESISTENCE SHALL RESIST ANY NEW APPLIED LATERAL LOADING (NONE EXPECTED AS NEW ROOF IS FLAT AND LOCATED WITHIN EXISTING RESIDENCE PROFILE WITHOUT ANY ADDITIONAL WALLS.

AT THE NEW DECK EXPANSION, ALL NEW LATERAL AND GRAVITY LOADING SHALL BE RESISTED BY THE NEW DECK SYSTEM (INDEPENDENT OF THE EXISTING DECK SYSTEM).
LATERAL LOADS SHALL BE RESISTED BY A COMBINATION OF CROSS BRACING AT VARIOUS LOCATIONS STIFFEN UP THE NEW DECK, AS WELL AS BATTERED PILES AT EACH FOOTING SUPPORT. IN ADDITION, HELICAL TIEBACK ANCHORS WILL BE APPLIED AT THE LOW SIDE FOOTINGS TO AID IN SLIDING AND STABILITY.

NEW PATIO ROOF FRAMING LATERAL ANALYSIS:

Wind Design - Chapter 29.5 ASCE-7 (Other Structures) (OPEN BUILDING)				
Roof Pitch	**4**			
Roof Angle (degrees)	18.43495			
Height of Roof from Ground (h) =	15	ft		
Height of Roof Extent (h1)	4	ft		
Width of Roof (looking Side-Side)	14	ft		
Width of Roof (looking F-B)	28	ft		
Risk Category =	2		Table 1.5-1	
Wind speed (V)=	100	mph	Figure 26.5-1A, B or C	
Wind Directionality Factor (Kd)=	0.85		Section 26.6 and Table 26.6-1	
Exposure	C		Section 26.7	
Topographic Factor) Kzt =	1		Section 26.8 and Figure 26.8-1	
Gust Factor (G) =	0.85		Section 26.9	
Internal Pressure Coefficient (GCpi)	0		Table 26.11-1	
velocity pressure exposure coef (Kh or Kz) =	0.85		Table 27.3-1	**Varies with Exposure
velocity pressure (qz or qh) =	18.496	lb/ft^2	Eq 27.3-1	
external press Coefficient (Cn) =	2.2		Figure 27.4.4	
pressure (qh*G*Cn)	34.58752	psf		
Fh=p*L*h1*0.6*1.3 (S-S)	1510.783	LBS	controls	((S-S)
min Fh =16*L*h1*0.6*1.3	1397.76	lbs	N/A	
Fh=p*L*h1*0.6*1.3 (F-B)	3021.566	LBS	controls	(F-B)
min Fh =16*L*h1*0.6*1.3	1397.76	lbs	N/A	
Add'l Walls (S-S)				
Wall Width	20	ft		
Wall Height=	10	ft		
Additional pressure force on wall	5395.653	lbs		
Add'l Walls (F-B)				
Wall Width	12	ft		
Wall Height=	10	ft		
Additional pressure force on wall	3237.392	lbs		

Fh (S-S)	**6906.436**	**lbs**
Fh (F-B)	**6258.958**	**lbs**

$$F = qzGCfAf$$

NEW PATIO ROOF FRAMING LATERAL ANALYSIS:

SEISMIC ANALYSIS - ASCE 7-16		
Roof Height=	15	ft
Length (L) =	28	ft
Width (W)=	14	ft
Exposure=	C	
Wind Velocity=	100	mph
WEIGHT	15	psf
Cs=	0.16	
R =	6.5	
Governing Force =	Seismic	
Base Shear (Vs)=	672	lbs

$$\frac{[L * W * w] * Cs}{1.4}$$

# OF RESISTING ELEMENTS SIDE TO SIDE =	3	
FORCE PER ELEMENT	224	LBS
# OF RESISTING ELEMENTS F-B =	1	
FORCE PER ELEMENT	672	LBS

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

NEW PATIO ROOF FRAMING LATERAL ANALYSIS:

WIND GOVERNS FOR LATERAL RESISTANCE AT THE NEW PATIO ROOF FRAMING:

RESISTING WALLS IN THE S-S DIRECTION =
WALL LINE 1 = 3'-9" ==> (6906/2 * 0.3)/3.75' = 276 PLF ==**USE SW4 WITH HDU5 HD**
WALL LINE 1.1 (EXISTING) = 10'-0" ==> 6906/2 * 0.7 = 240 PLF ==> **ASSUME EXISTING SW6 (240PLF THUS OK)**
WALL 2 = 12'-0" ==> 6906/2/12'-0" = 287PLF ==> **USE SW4 WITH HDU5 HD**

RESISTING WALLS IN THE F-B DIRECTION =
WALL 1 = 18'-0" ==> 6259/18 = 347PLF == **USE SW4 WITH HDU5 HD**

NEW DECK FRAMING LATERAL ANALYSIS:

SEISMIC ANALYSIS - ASCE 7-16				
equivalent AREA=	900	ft^2	**Height=**	8 ft
			Length (L) =	20 ft
			Width (W)=	45 ft
			Exposure=	C
			Wind Velocity=	100 mph
			WEIGHT	75 psf
			Cs=	0.16
			R =	6.5
			Governing Force =	Seismic
			Base Shear (Vs)=	7714 lbs

$$\frac{[L * W * w] * Cs}{1.4}$$

# OF RESISTING ELEMENTS SIDE TO SIDE =	11	
FORCE PER ELEMENT	701.2987013	LBS
# OF RESISTING ELEMENTS F-B =	7	
FORCE PER ELEMENT	1102.040816	LBS

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NEW DECK FRAMING LATERAL ANALYSIS:

SEISMIC GOVERNS FOR LATERAL RESISTANCE AT THE NEW DECK:

IN THE SIDE TO SIDE DIRECTION THERE ARE A COMBINATION OF LATERAL BRACES AS WELL AS BATTERED PIN PILES. EACH PIN PILE HAS AN ALLOWABLE LOAD OF 1KIP. BY OBSERVATION THERE ARE MORE THAN 8 PIN PILES WHICH WOULD BE GREATER THAN LATERAL DEMAND. THUS SUFFICIENT.

ADDITIONALLY, THERE ARE 11 BRACES LOCATED ON PLAN ==> 7.8K/11 = 710LBS. REF CALC FOR HSS BRACE - SUFFICIENT BY INSPECTION.

FINALLY, THERE ARE 7 HELICAL TIEBACKS WITH MIN ALLOWABLE LOAD SPECIFIED AT 3KIPS EA. BY INSPECTION 7.8K/7 = 1.12 KIP REQUIRED. 3K> 1.12K THUS SUFFICIENT.

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Hand-rail Calculations

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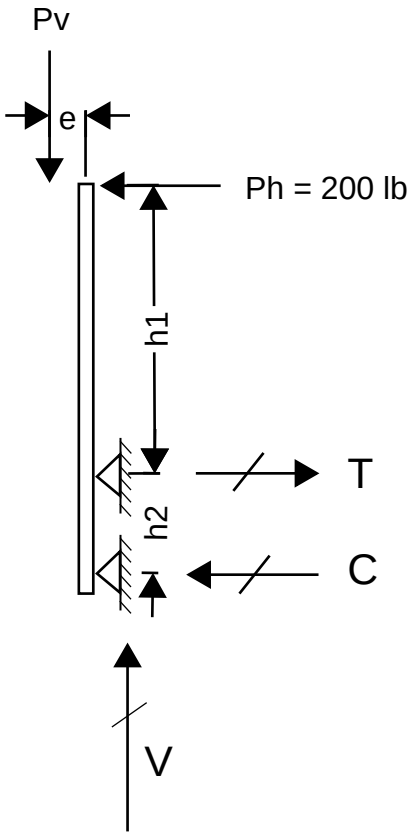
End Post Anchor Bolt Design:



Pv = 25 lbs

Ph = 200 lbs

h1 = 46"

h2 = 5.5"

e = 1.5"

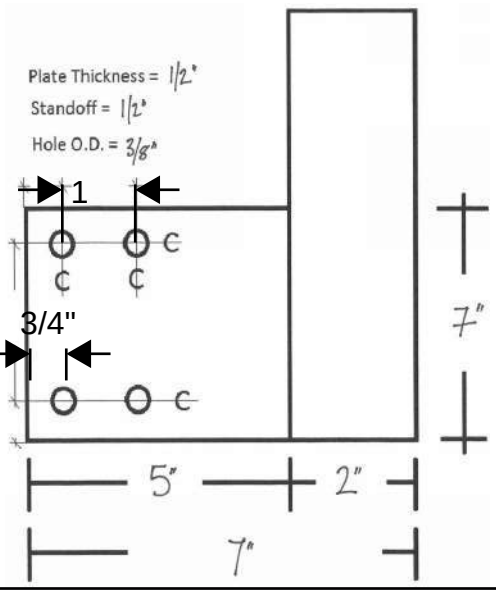
Anchor Moment Mx = Pv(e) + Ph (h1 + h2/2)
= 25 x 1.5 + 200x (46+5.5/2)
= 9788 #"

My = 200# x 4.5" = 900 #"

Anchor Forces T = [Pv (e) + Ph (h1+h2)] / h2 + My/1.5"
= 2480 #

Anchor Forces C = T - Ph
= 2280 #

Each Bolt Force T = T / 2 = 1240 #
V = Pv / 4 + Pv x 4.5"/(4x2.85")= 16 #



Wood Lag Screw: 3/8" dia with 3" min. embed into DF beam.

Withdrawal Wa = 305 #/" x 1.6 x 3" = 1460 # > T O.K.
Shear Za = 180 # x 1.6 = 280 # O.K.

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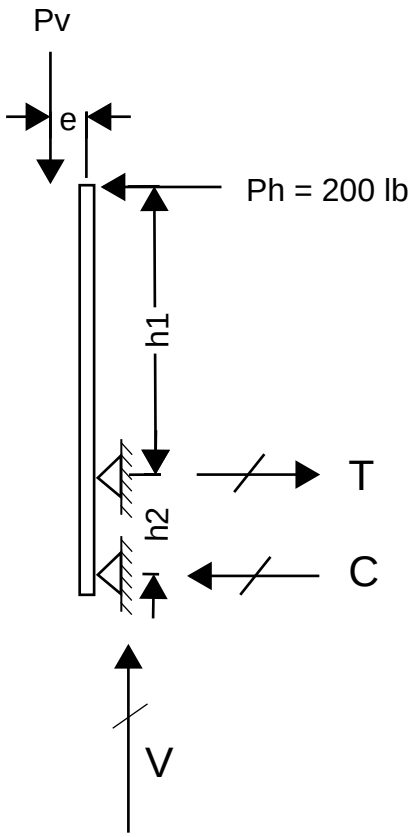
Middle Post Anchor Bolt Design:



Pv = 25 lbs

Ph = 250 lbs

h1 = 46"

h2 = 5.5"

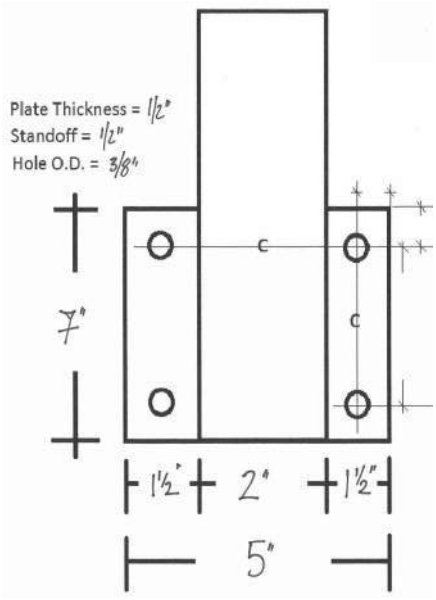
e = 1.5"

Anchor Moment M = Pv(e) + Ph (h1 + h2/2)
= 25 x 1.5 + 250 (46+5.5/2)
= 12,250

Anchor Forces T = [Pv (e) + Ph (h1+h2)] / h2
= 2347 #

Anchor Forces C = T - Ph
= 2147 #

Each Bolt Force T = T / 2 = 1174 #
V = Pv / 4 = 6 #



Wood Lag Screw: 3/8" dia with 3" min. embed into DF beam.

Withdrawal Wa = 305 #/" x 1.6 x 3" = 1460 # > T O.K.
Shear Za = 180 # x 1.6 = 280 # O.K.

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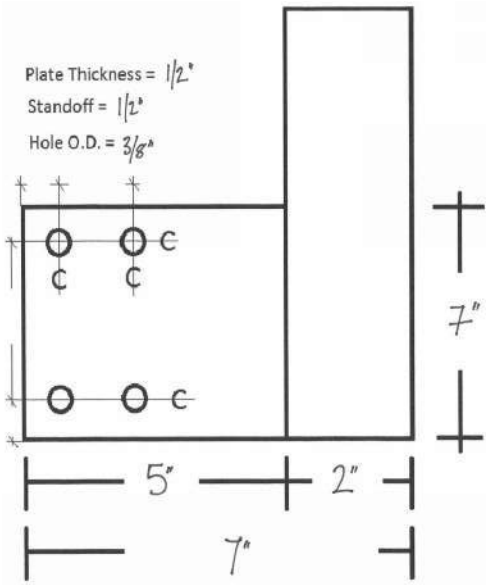
Mounting Plate Design:



Apply Forces: Mx = 9788 #"
My = 900 #"
T = 200 #
V = 25 #

Try 1/2" thick Plate

Plate Bending Stress: fbx = Mx/2/Sx
= 9788/2/(1/4 x 5" x (1/2)^2)
= 15,660 psi
fby = My/Sy
= 900/(1/4 x 7" x (1/2)^2)
= 2,057 psi

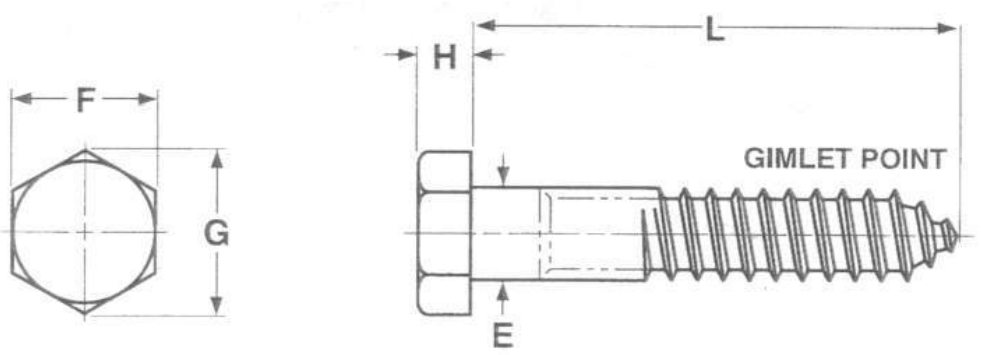
For Plate 6061-T6 Fb =35 ksi / 1.65
= 21,200 psi > fb O.K.

Plate Combined Stress
fbx/Fb + fby/Fb = 0.83 < 1.0 O.K.

Page 1 of 1	**Fastenal Product Standard**	REV-00
Date: January 11, 2012	FASTENAL	LAG.HDG

Hex Lag Screws, Hot Dipped Galvanized

The information below lists the required dimensional, chemical and physical characteristics of the products in this purchase order. If the order received does not meet these requirements, it may result in a supplier corrective action request, which could jeopardize your status as an approved vendor. Unless otherwise specified, all referenced consensus standards must be adhered to in their entirety.



Diameter	E		F		G		H	
	Body Diameter		Width Across Flats		Width Across Corners		Height	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
10	.199	.178	.281	.271	.323	.309	.140	.110
1/4	.260	.237	.438	.425	.505	.484	.188	.150
5/16	.324	.298	.500	.484	.577	.552	.235	.195
3/8	.388	.360	.562	.544	.650	.620	.268	.226
7/16	.452	.421	.625	.603	.722	.687	.316	.272
1/2	.515	.482	.750	.725	.866	.826	.364	.302
5/8	.642	.605	.938	.906	1.083	1.033	.444	.378
3/4	.768	.729	1.125	1.088	1.299	1.240	.524	.455
7/8	.895	.852	1.312	1.269	1.516	1.447	.604	.531
1	1.022	.976	1.500	1.450	1.732	1.653	.700	.591
1 1/8	1.149	1.098	1.688	1.631	1.949	1.859	.780	.658
1 1/4	1.277	1.223	1.875	1.812	2.165	2.066	.876	.749

Dimensions above are prior to coating

Specification Requirements:

- Dimensions: ASME B18.2.1.
- Material: Per ASTM A307, Grade A
- Thread requirements: The minimum thread length must be equal to one half the nominal Screw length plus ½", or 6 inch, whichever is shorter. Screws too short to conform to this formula must be threaded as close to the head as possible.
- Coating: Hot Dip Zinc per ASTM F2329 or in accordance with Class C of ASTM A153 and Class D for 3/8" diameter and less.

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Table 2.3.2 Frequently Used Load Duration Factors, C_D[1]

Load Duration	C_D	Typical Design Loads
Permanent	0.9	Dead Load
Ten years	1.0	Occupancy Live Load
Two months	1.15	Snow Load
Seven days	1.25	Construction Load
Ten minutes	1.6	Wind/Earthquake Load
Impact[2]	2.0	Impact Load

1. Load duration factors shall not apply to reference modulus of elasticity, E, reference modulus of elasticity for beam and column stability, E_{min}, nor to reference compression perpendicular to grain design values, $F_{c\perp}$, based on a deformation limit.
2. Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with water-borne preservatives (see Reference 30), or fire retardant chemicals. The impact load duration factor shall not apply to connections.

2.3.3 Temperature Factor, C_t

Reference design values shall be multiplied by the temperature factors, C_t, in Table 2.3.3 for structural members that will experience sustained exposure to elevated temperatures up to 150°F (see Appendix C).

2.3.4 Fire Retardant Treatment

The effects of fire retardant chemical treatment on strength shall be accounted for in the design. Adjusted design values, including adjusted connection design values, for lumber and structural glued laminated timber pressure-treated with fire retardant chemicals shall be obtained from the company providing the treatment and redrying service. Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with fire retardant chemicals (see Table 2.3.2).

2.3.5 Format Conversion Factor, K_F (LRFD Only)

For LRFD, reference design values shall be multiplied by the format conversion factor, K_F, specified in Table 2.3.5. The format conversion factor, K_F, shall not apply for designs in accordance with ASD methods specified herein.

2.3.6 Resistance Factor, ϕ (LRFD Only)

For LRFD, reference design values shall be multiplied by the resistance factor, ϕ, specified in Table 2.3.6. The resistance factor, ϕ, shall not apply for designs in accordance with ASD methods specified herein.

2.3.7 Time Effect Factor, λ (LRFD Only)

For LRFD, reference design values shall be multiplied by the time effect factor, λ, specified in Appendix N.3.3. The time effect factor, λ, shall not apply for designs in accordance with ASD methods specified herein.

Table 2.3.3 Temperature Factor, C_t

Reference Design Values	In-Service Moisture Conditions[1]	C_t		
		T≤100°F	100°F<T≤125°F	125°F<T≤150°F
F_t, E, E_{min}	Wet or Dry	1.0	0.9	0.9
F_b, F_v, F_c, and $F_{c\perp}$	Dry	1.0	0.8	0.7
	Wet	1.0	0.7	0.5

1. Wet and dry service conditions for sawn lumber, structural glued laminated timber, prefabricated wood I-joists, structural composite lumber, wood structural panels and cross-laminated timber are specified in 4.1.4, 5.1.4, 7.1.4, 8.1.4, 9.3.3, and 10.1.5 respectively.

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Table 11.3.1 Applicability of Adjustment Factors for Connections

		ASD Only	ASD and LRFD									LRFD Only		
		Load Duration Factor[1]	Wet Service Factor	Temperature Factor	Group Action Factor	Geometry Factor[3]	Penetration Depth Factor[3]	End Grain Factor[3]	Metal Side Plate Factor[3]	Diaphragm Factor[3]	Toe-Nail Factor[3]	Format Conversion Factor K_F	Resistance Factor ϕ	Time Effect Factor
Lateral Loads														
Dowel-type Fasteners (e.g. bolts, lag screws, wood screws, nails, spikes, drift bolts, & drift pins)	$Z' = Z$ x	C_D	C_M	C_t	C_g	C_Δ	-	C_{eg}	-	C_{di}	C_{tn}	3.32	0.65	λ
Split Ring and Shear Plate Connectors	$P' = P$ x	C_D	C_M	C_t	C_g	C_Δ	C_d	-	C_{st}	-	-	3.32	0.65	λ
	$Q' = Q$ x	C_D	C_M	C_t	C_g	C_Δ	C_d	-	-	-	-	3.32	0.65	λ
Timber Rivets	$P' = P$ x	C_D	C_M	C_t	-	-	-	-	C_{st}[4]	-	-	3.32	0.65	λ
	$Q' = Q$ x	C_D	C_M	C_t	-	C_Δ[5]	-	-	C_{st}[4]	-	-	3.32	0.65	λ
Spike Grids	$Z' = Z$ x	C_D	C_M	C_t	-	C_Δ	-	-	-	-	-	3.32	0.65	λ
Withdrawal Loads														
Nails, spikes, lag screws, wood screws, & drift pins	$W' = W$ x	C_D	C_M[2]	C_t	-	-	-	C_{eg}	-	-	C_{tn}	3.32	0.65	λ

1. The load duration factor, C_D, shall not exceed 1.6 for connections (see 11.3.2).
2. The wet service factor, C_M, shall not apply to toe-nails loaded in withdrawal (see 12.5.4.1).
3. Specific information concerning geometry factors C_Δ, penetration depth factors C_d, end grain factors, C_{eg}, metal side plate factors, C_{st}, diaphragm factors, C_{di}, and toe-nail factors, C_{tn}, is provided in Chapters 12, 13, and 14.
4. The metal side plate factor, C_{st}, is only applied when rivet capacity (P_r, Q_r) controls (see Chapter 14).
5. The geometry factor, C_Δ, is only applied when wood capacity, Q_w, controls (see Chapter 14).

11.3.2 Load Duration Factor, C_D (ASD Only)

Reference design values shall be multiplied by the load duration factors, $C_D \leq 1.6$, specified in 2.3.2 and Appendix B, except when the capacity of the connection is controlled by metal strength or strength of concrete/masonry (see 11.2.3, 11.2.4, and Appendix B.3). The impact load duration factor shall not apply to connections.

11.3.3 Wet Service Factor, C_M

Reference design values are for connections in wood seasoned to a moisture content of 19% or less and used under continuously dry conditions, as in most covered structures. For connections in wood that is unseasoned or partially seasoned, or when connections are exposed to wet service conditions in use, reference design values shall be multiplied by the wet service factors, C_M, specified in Table 11.3.3.

11.3.4 Temperature Factor, C_t

Reference design values shall be multiplied by the temperature factors, C_t, in Table 11.3.4 for connections that will experience sustained exposure to elevated temperatures up to 150°F (see Appendix C).

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Table 12.2A Lag Screw Reference Withdrawal Design Values, W[1]

Tabulated withdrawal design values (W) are in pounds per inch of thread penetration into side grain of wood member. Length of thread penetration in main member shall not include the length of the tapered tip (see 12.2.1.1).

Specific Gravity, G[2]	Lag Screw Diameter, D										
	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"
0.73	397	469	538	604	668	789	905	1016	1123	1226	1327
0.71	381	450	516	579	640	757	868	974	1077	1176	1273
0.68	357	422	484	543	600	709	813	913	1009	1103	1193
0.67	349	413	473	531	587	694	796	893	987	1078	1167
0.58	281	332	381	428	473	559	641	719	795	869	940
0.55	260	307	352	395	437	516	592	664	734	802	868
0.51	232	274	314	353	390	461	528	593	656	716	775
0.50	225	266	305	342	378	447	513	576	636	695	752
0.49	218	258	296	332	367	434	498	559	617	674	730
0.47	205	242	278	312	345	408	467	525	580	634	686
0.46	199	235	269	302	334	395	453	508	562	613	664
0.44	186	220	252	283	312	369	423	475	525	574	621
0.43	179	212	243	273	302	357	409	459	508	554	600
0.42	173	205	235	264	291	344	395	443	490	535	579
0.41	167	198	226	254	281	332	381	428	473	516	559
0.40	161	190	218	245	271	320	367	412	455	497	538
0.39	155	183	210	236	261	308	353	397	438	479	518
0.38	149	176	202	227	251	296	340	381	422	461	498
0.37	143	169	194	218	241	285	326	367	405	443	479
0.36	137	163	186	209	231	273	313	352	389	425	460
0.35	132	156	179	200	222	262	300	337	373	407	441
0.31	110	130	149	167	185	218	250	281	311	339	367

1. Tabulated withdrawal design values, W, for lag screw connections shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Specific gravity, G, shall be determined in accordance with Table 12.3.3A.

12.2.3.2 For calculation of the fastener reference withdrawal design value in pounds, the unit reference withdrawal design value in lbs/in. of fastener penetration from 12.2.3.1 shall be multiplied by the length of fastener penetration, p_t, into the wood member.

12.2.3.3 The reference withdrawal design value, in lbs/in. of penetration, for a single post-frame ring shank nail driven in the side grain of the main member, with the nail axis perpendicular to the wood fibers, shall be determined from Table 12.2D or Equation 12.2-4, within the range of specific gravities and nail diameters given in Table 12.2D. Reference withdrawal design values, W, shall be multiplied by all applicable adjustment factors (see Table 11.3.1) to obtain adjusted withdrawal design values, W'.

$$W = 1800\,G^2\,D \qquad (12.2\text{-}4)$$

12.2.3.4 For calculation of the fastener reference withdrawal design value in pounds, the unit reference withdrawal design value in lbs/in. of ring shank penetration from 12.2.3.3 shall be multiplied by the length of ring shank penetration, p_t, into the wood member.

12.2.3.5 Nails and spikes shall not be loaded in withdrawal from end grain of wood (C_{eg}=0.0).

12.2.3.6 Nails, and spikes shall not be loaded in withdrawal from end-grain of laminations in cross-laminated timber (C_{eg}=0.0).

12.2.4 Drift Bolts and Drift Pins

Reference withdrawal design values, W, for connections using drift bolt and drift pin connections shall be determined in accordance with 11.1.1.3.

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Table 12.3.3A Assigned Specific Gravities

Species Combination	Specific[1] Gravity, G
Alaska Cedar	0.47
Alaska Hemlock	0.46
Alaska Spruce	0.41
Alaska Yellow Cedar	0.46
Aspen	0.39
Balsam Fir	0.36
Beech-Birch-Hickory	0.71
Coast Sitka Spruce	0.39
Cottonwood	0.41
Douglas Fir-Larch	0.50
Douglas Fir-Larch (North)	0.49
Douglas Fir-South	0.46
Eastern Hemlock	0.41
Eastern Hemlock-Balsam Fir	0.36
Eastern Hemlock-Tamarack	0.41
Eastern Hemlock-Tamarack (North)	0.47
Eastern Softwoods	0.36
Eastern Spruce	0.41
Eastern White Pine	0.36
Engelmann Spruce-Lodgepole Pine	0.38
Hem-Fir	0.43
Hem-Fir (North)	0.46
Mixed Maple	0.55
Mixed Oak	0.68
Mixed Southern Pine	0.51
Mountain Hemlock	0.47
Northern Pine	0.42
Northern Red Oak	0.68
Northern Species	0.35
Northern White Cedar	0.31
Ponderosa Pine	0.43
Red Maple	0.58
Red Oak	0.67
Red Pine	0.44
Redwood, close grain	0.44
Redwood, open grain	0.37
Sitka Spruce	0.43
Southern Pine	0.55
Spruce-Pine-Fir	0.42
Spruce-Pine-Fir (South)	0.36
Western Cedars	0.36
Western Cedars (North)	0.35
Western Hemlock	0.47
Western Hemlock (North)	0.46
Western White Pine	0.40
Western Woods	0.36
White Oak	0.73
Yellow Poplar	0.43

Species Combinations of MSR and MEL Lumber	Specific[1] Gravity, G
Douglas Fir-Larch	
E=1,900,000 psi and lower grades of MSR	0.50
E=2,000,000 psi grades of MSR	0.51
E=2,100,000 psi grades of MSR	0.52
E=2,200,000 psi grades of MSR	0.53
E=2,300,000 psi grades of MSR	0.54
E=2,400,000 psi grades of MSR	0.55
Douglas Fir-Larch (North)	
E=1,900,000 psi and lower grades of MSR and MEL	0.49
E=2,000,000 psi to 2,200,000 psi grades of MSR and MEL	0.53
E=2,300,000 psi and higher grades of MSR and MEL	0.57
Douglas Fir-Larch (South)	
E=1,000,000 psi and higher grades of MSR	0.46
Engelmann Spruce-Lodgepole Pine	
E=1,400,000 psi and lower grades of MSR	0.38
E=1,500,000 psi and higher grades of MSR	0.46
Hem-Fir	
E=1,500,000 psi and lower grades of MSR	0.43
E=1,600,000 psi grades of MSR	0.44
E=1,700,000 psi grades of MSR	0.45
E=1,800,000 psi grades of MSR	0.46
E=1,900,000 psi grades of MSR	0.47
E=2,000,000 psi grades of MSR	0.48
E=2,100,000 psi grades of MSR	0.49
E=2,200,000 psi grades of MSR	0.50
E=2,300,000 psi grades of MSR	0.51
E=2,400,000 psi grades of MSR	0.52
Hem-Fir (North)	
E=1,000,000 psi and higher grades of MSR and MEL	0.46
Southern Pine	
E=1,700,000 psi and lower grades of MSR and MEL	0.55
E=1,800,000 psi and higher grades of MSR and MEL	0.57
Spruce-Pine-Fir	
E=1,700,000 psi and lower grades of MSR and MEL	0.42
E=1,800,000 psi and 1,900,000 grades of MSR and MEL	0.46
E=2,000,000 psi and higher grades of MSR and MEL	0.50
Spruce-Pine-Fir (South)	
E=1,100,000 psi and lower grades of MSR	0.36
E=1,200,000 psi to1,900,000 psi grades of MSR	0.42
E=2,000,000 psi and higher grades of MSR	0.50
Western Cedars	
E=1,000,000 psi and higher grades of MSR	0.36
Western Woods	
E=1,000,000 psi and higher grades of MSR	0.36

1. Specific gravity, G, based on weight and volume when oven-dry. Different specific gravities, G, are possible for different grades of MSR and MEL lumber (see Table 4C, Footnote 2).

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LAG SCREWS

Table 12K **LAG SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3,4]**

for sawn lumber or SCL with ASTM A653, Grade 33 steel side plate (for t_s<1/4") or ASTM A 36 steel side plate (for t_s=1/4")
(tabulated lateral design values are calculated based on an assumed length of lag screw penetration, p, into the main member equal to 8D)

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.5 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_s	D	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.075	1/4	170	130	160	120	150	110	150	110	150	100	140	100	140	100	130	90	130	90	130	90
(14 gage)	5/16	220	160	200	140	190	130	190	130	190	130	180	120	180	120	170	110	170	110	160	100
	3/8	220	160	200	140	200	130	190	130	190	120	180	120	180	120	170	110	170	100	170	100
0.105	1/4	180	140	170	130	160	120	160	120	160	110	150	110	150	110	140	100	140	100	140	90
(12 gage)	5/16	230	170	210	150	200	140	200	140	190	130	190	130	190	120	180	110	170	110	170	110
	3/8	230	160	210	140	200	140	200	130	200	130	190	120	190	120	180	110	180	110	170	110
0.120	1/4	190	150	180	130	170	120	170	120	160	120	160	110	160	110	150	100	150	100	140	100
(11 gage)	5/16	230	170	210	150	210	140	200	140	200	140	190	130	190	130	180	120	180	120	180	110
	3/8	240	170	220	150	210	140	210	140	200	130	200	130	190	120	180	110	180	110	180	110
0.134	1/4	200	150	180	140	180	130	170	130	170	120	160	120	160	110	150	110	150	100	150	100
(10 gage)	5/16	240	180	220	160	210	150	210	140	200	140	200	130	200	130	190	120	180	120	180	120
	3/8	240	170	220	150	220	140	210	140	210	140	200	130	200	130	190	120	190	120	180	110
0.179	1/4	220	170	210	150	200	150	200	140	190	140	190	130	190	130	180	120	170	120	170	120
(7 gage)	5/16	260	190	240	170	230	160	230	160	230	150	220	150	220	150	210	130	200	130	200	130
	3/8	270	190	250	170	240	160	240	160	230	150	220	140	220	140	210	130	210	130	200	130
0.239	1/4	240	180	220	160	210	150	210	150	200	140	190	140	190	130	180	120	180	120	180	120
(3 gage)	5/16	300	220	280	190	270	180	260	180	260	170	250	160	250	160	230	150	230	150	230	140
	3/8	310	220	280	190	270	180	270	180	260	170	250	160	250	160	240	140	230	140	230	140
	7/16	420	290	390	260	380	240	370	240	360	230	350	220	350	220	330	200	330	200	320	190
	1/2	510	340	470	300	460	290	450	280	440	270	430	260	420	260	400	240	400	230	390	230
	5/8	770	490	710	430	680	400	680	400	660	380	640	370	630	360	600	330	590	330	580	320
	3/4	1110	670	1020	590	980	560	970	550	950	530	920	500	910	500	860	450	850	450	840	440
	7/8	1510	880	1390	780	1330	730	1320	710	1280	690	1250	650	1230	650	1170	590	1160	590	1140	570
	1	1940	1100	1780	960	1710	910	1700	890	1650	860	1600	820	1590	810	1500	740	1480	730	1460	710
1/4	1/4	240	180	220	160	210	150	210	150	200	140	200	140	190	130	180	120	180	120	180	120
	5/16	310	220	280	200	270	180	270	180	260	170	250	170	250	160	230	150	230	150	230	140
	3/8	320	220	290	190	280	180	270	180	270	170	260	160	250	160	240	150	240	140	230	140
	7/16	480	320	440	280	420	270	420	260	410	250	390	240	390	230	370	220	360	210	360	210
	1/2	580	390	540	340	520	320	510	320	500	310	480	290	480	290	460	270	450	260	440	260
	5/8	850	530	780	470	750	440	740	440	720	420	700	400	690	400	660	370	650	360	640	350
	3/4	1200	730	1100	640	1060	600	1050	590	1020	570	990	540	980	530	930	490	920	480	900	470
	7/8	1600	930	1470	820	1410	770	1400	750	1360	720	1320	690	1310	680	1240	630	1220	620	1200	600
	1	2040	1150	1870	1000	1800	950	1780	930	1730	900	1680	850	1660	840	1570	770	1550	760	1530	740

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "reduced body diameter" lag screws (see Appendix Table L2) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 8D; dowel bearing strengths, F_e, of 61,850 psi for ASTM A653, Grade 33 steel and 87,000 psi for ASTM A36 steel and screw bending yield strengths, F_{yb}, of 70,000 psi for D = 1/4", 60,000 psi for D = 5/16", and 45,000 psi for D ≥3/8".
3. Where the lag screw penetration, p, is less than 8D but not less than 4D, tabulated lateral design values, Z, shall be multiplied by p/8D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.
4. The length of lag screw penetration, p, not including the length of the tapered tip, E (see Appendix Table L2), of the lag screw into the main member shall not be less than 4D. See 12.1.4.6 for minimum length of penetration, p_{min}.

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

To determine the minimum required hand-rail connections, with a pre-manufactured hand-rail system provided by others. Our scope is limited to assess the minimum connection requirements of the hand-rail system as listed below. Our assumptions are that the base-plates, welds and metal member properties of the pre-manufactured complete system are sufficient in strength to support the code prescribed design loads, for which our design have been provided to comply with.

We have analyzed and verified the minimum connection requirements, for the following conditions:

- Wall connection (sloping wall @ stair)
  Result: minimum (2) ¼" DIA x 3" SDS screws to a minimum of (1) support studs at each connection

- Base-plate connection (vertical post application, typical)
  Result: The base-plate column connection to have a minimum of (4) 3/8" x 4 ½ lag-screws into full width support member/beams below

- *Wall connection (horizontal typical application)*
  Result: (2) ¼" DIA x 3" SDS screws to a minimum of (2) support studs at each connection

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

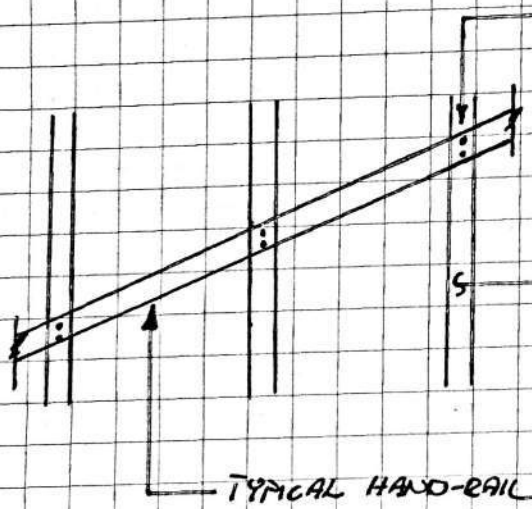
PROJECT

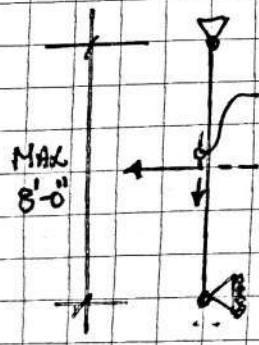
SUBJECT

BY MRT, P.E DATE 12/4/2017

CALCULATIONS

CASE 1: SLOPING HAND-RAIL @ WALL / STAIR





→ SEE ATTACHED CALCULATION OF STUD MEMBER ANALYSIS

V = Shear capacity ($C_f = C_t = 1.0$, $C_M = 1.0$, $C_g = 0.9$)

$V = C_D \times \underbrace{100\ \text{Lbs}}_{1/4"\Phi\ @\ 2X} = 1.6 \times 100\ \text{Lbs} \times 1.0 \times 0.9 \approx 160\ \text{Lbs}$

$V_{(2)\ 1/4"\Phi\ \text{LAGS MIN INTO 2X HF \#2 OR BETTER}} = 2 \times 160 = 320\ \text{Lbs}$

200 Lbs demand < 320 Lbs CAPACITY ✓

LONGITUDE ONE TWENTY° ENGINEERING & DESIGN

PROJECT

SUBJECT

BY MRT, P.E DATE 12/4/2017

CONT. CASE 1: SLOPING HAND RAIL @ WALL/STAIR

W = WITHDRAWAL CAPACITY ($C_t = C_t = C_{eg} = 1.0$) = 179 Lbs/inch

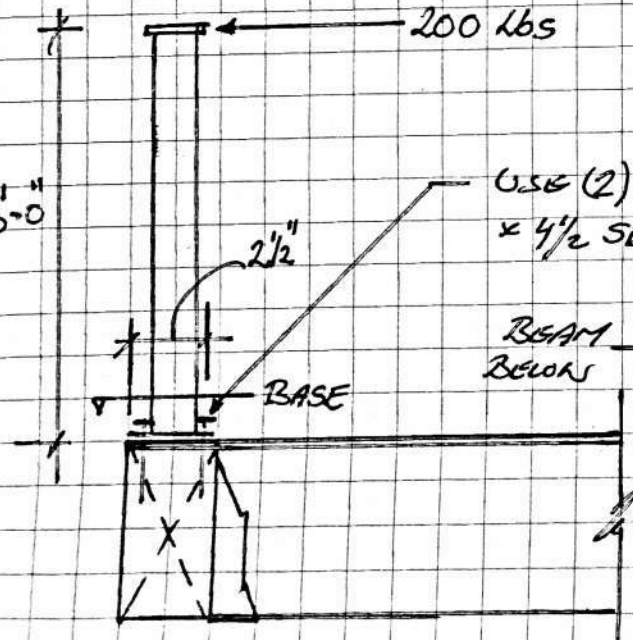
W_{CD} = 1.6 x 440 Lbs per SCREW/LAG

= 179 Lbs/inch x 2½" ≅ 446 Lbs PER ¼"Ø LAG x 3"

$W_{(2)\ 1/4"\ LAGS \times 3"\ MIN}$ = 2 x 440 Lbs x 1.6 = 1,408 Lbs

200 Lbs WITHDRAWAL DEMAND < 1,408 Lbs CAPACITY OK

CASE 2: BASE PLATE CONNECTION



M_{ROT} = 200 Lbs x 36" / 2½" = 2,880 Lbs

WITHDRAWAL CAPACITY W/ ¼" x 4½ LAG-SCREWS = 179 Lbs/inch

W = 179 Lbs/in x 4" x 1.6 (2 x ¼"Ø x 4½" LAGS) = 1,145 Lbs PER ¼"Ø LAG x 4½"

"NOT WORKING" $W_{(2)\ 1/4" \times 4\frac{1}{2}}$ 6 x 2 = 1,145 Lbs

$W_{(2)\ 3/8" \times 4\frac{1}{2} \times 2}$ = 243 x 4". x 2 x 1.6 = 3,110 Lbs

2,880 Lbs demand < 3,110 CAPACITY

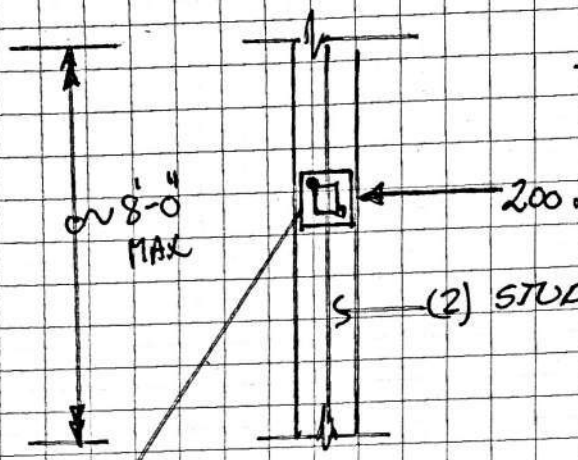
LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

PROJECT

SUBJECT

BY MRT, P.E DATE 12/4/2014

CASE 3: HORIZONTAL END-PLATE CONNECTIONS



→ SEE ATTACHED CALCULATIONS OF STUD CALCULATIONS.

V = SHEAR CAPACITY ($C_t = C_i = C_M = 1.0$, $C_g = 0.9$)

$V = C_D \times \underbrace{100\,\text{LBS}}_{1/4"\phi\ \text{W/2x}} = 1.6 \times 0.9 \times 100\,\text{LBS} = 144\,\text{LBS}$

$V_{(2)\,1/4"\phi \times 3"\ \text{LAG-SCREWS}} = 2 \times 144\,\text{LBS} = 288\,\text{LBS}$

200 LBS demand < 288 LBS CAPACITY ✓

SIMPSON Strong-Tie

Anchor Designer™ Software
Version 2.5.6582.0

Company:	L120 Engineering & Design	Date:	5/3/2018
Engineer:	MRT	Page:	1/5
Project:	Hand-rail calculation		
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

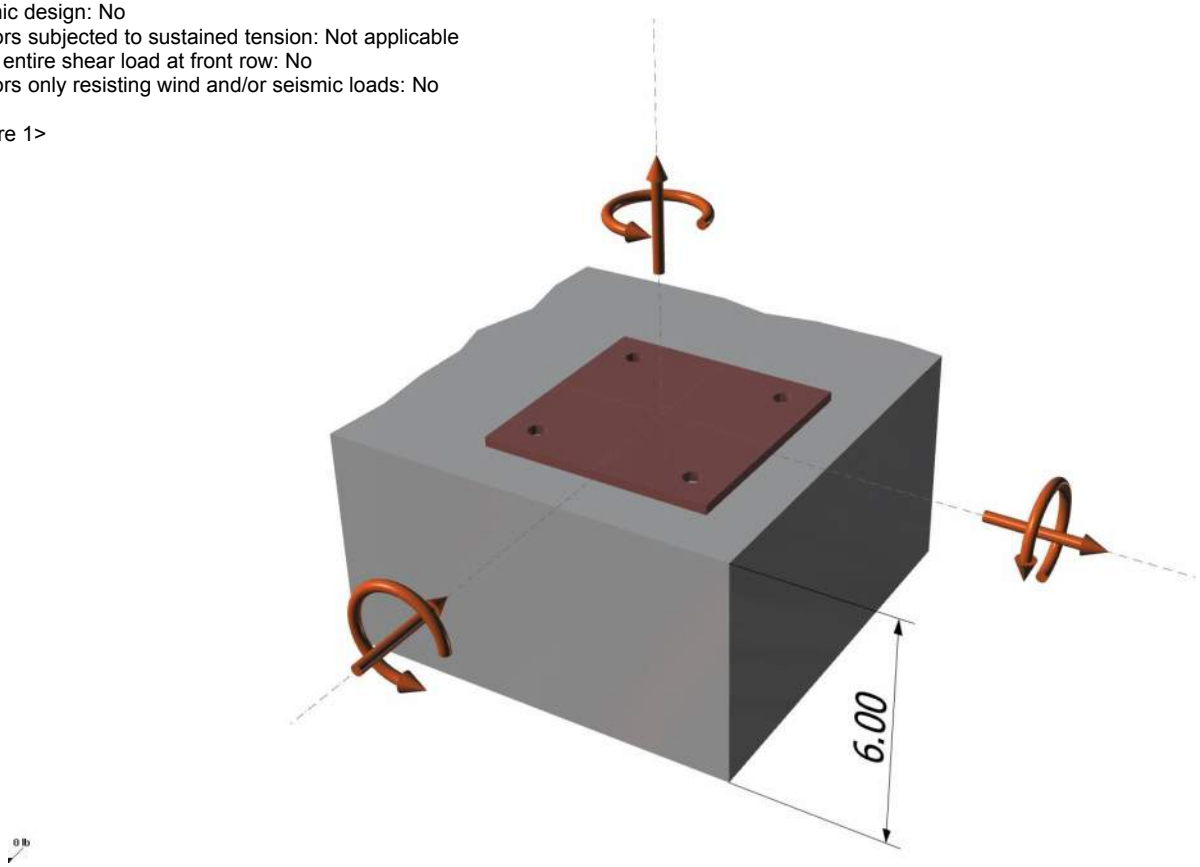
Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.375
Nominal Embedment depth (inch): 3.250
Effective Embedment depth, h_{ef} (inch): 2.400
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 5.00
c_{ac} (inch): 3.63
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: U = 1.2(D + F) + 1.6(L) + 0.5(Lr or S or R)
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

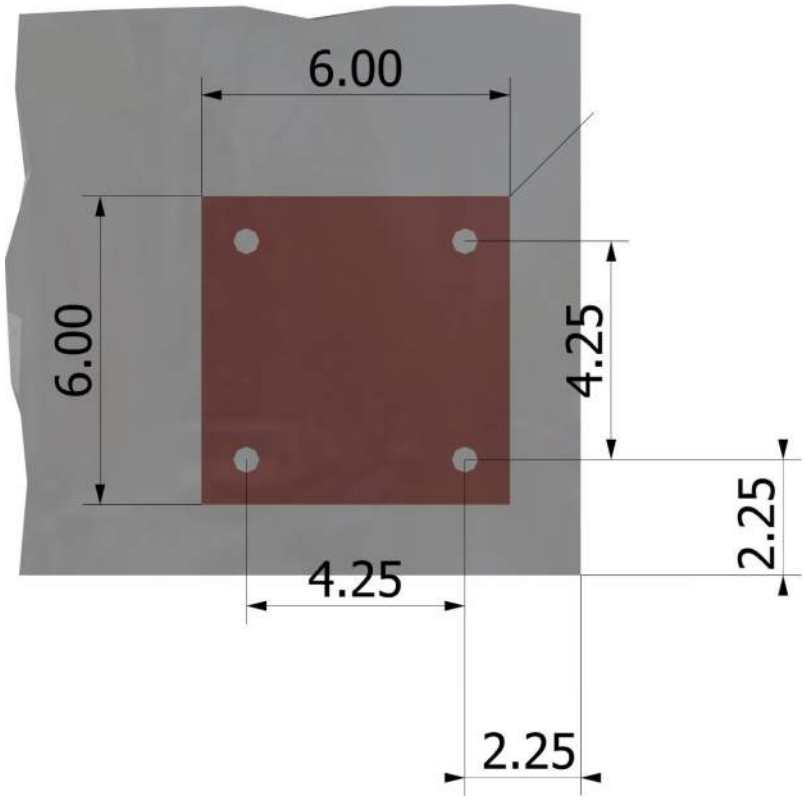
Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 6.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 6.00 x 6.00 x 0.25

<Figure 1>



<Figure 2>



Recommended Anchor
Anchor Name: Titen HD® - 3/8"Ø Titen HD, hnom:3.25" (83mm)
Code Report: ICC-ES ESR-2713

SIMPSON Strong-Tie

Anchor Designer™ Software
Version 2.5.6582.0

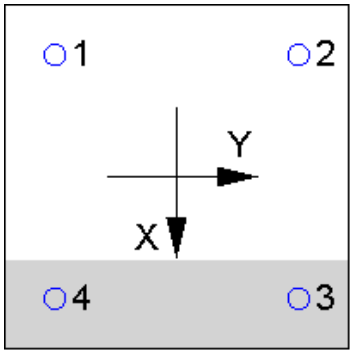
Company:	L120 Engineering & Design	Date:	5/3/2018
Engineer:	MRT	Page:	3/5
Project:	Hand-rail calculation		
Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	1250.4	-80.0	0.0	80.0
2	1250.4	-80.0	0.0	80.0
3	0.0	-80.0	0.0	80.0
4	0.0	-80.0	0.0	80.0
Sum	2500.7	-320.0	0.0	320.0

Maximum concrete compression strain (‰): 0.12
Maximum concrete compression stress (psi): 538
Resultant tension force (lb): 2501
Resultant compression force (lb): 2501
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
10890	0.65	7079

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	2.400	3160

$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1b)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
72.72	51.84	2.25	1.000	0.888	1.00	1.000	3160	0.65	2557

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$\phi N_{pn} = \phi \Psi_{c,P} \lambda_a N_p (f'_c / 2{,}500)^n$ (Sec. 17.3.1, Eq. 17.4.3.1 & Code Report)

$\Psi_{c,P}$	λ_a	N_p (lb)	f'_c (psi)	n	ϕ	ϕN_{pn} (lb)
1.0	1.00	2700	2500	0.50	0.65	1755

8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
4460	1.0	0.60	2676

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear parallel to edge in x-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
2.40	0.375	1.00	2500	2.25	1049

$\phi V_{cbgx} = \phi\ (2)(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\,\Psi_{ed,V}\,\Psi_{c,V}\,\Psi_{h,V}V_{by}$ (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgx} (lb)
33.33	22.78	1.000	1.000	1.000	1.000	1049	0.70	2148

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi k_{cp}N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
1.0	102.01	51.84	1.000	0.888	1.000	1.000	3160	0.70	3863

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN$_n$ (lb)	Ratio	Status
Steel	1250	7079	0.18	Pass
Concrete breakout	**2501**	**2557**	**0.98**	**Pass (Governs)**
Pullout	1250	1755	0.71	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV$_n$ (lb)	Ratio	Status
Steel	80	2676	0.03	Pass
|| Concrete breakout y+	160	2148	0.07	Pass
Pryout	**320**	**3863**	**0.08**	**Pass (Governs)**

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.98	0.00	97.8 %	1.0	Pass

3/8"Ø Titen HD, hnom:3.25" (83mm) meets the selected design criteria.

12. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Sections 17.7.1 and 17.7.2 for torqued cast-in-place anchor is waived per designer option.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Project:

Location: Single 2x4 stud (staircase)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
1.5 IN x 3.5 IN x 8.0 FT
#2 - Hem-Fir - Dry Use
Section Adequate By: 0.8%
Controlling Factor: Deflection

StruCalc 9.0

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StruCalc Version 10.0.1.6 12/4/2017 4:33:33 PM

DEFLECTIONS	Center	
Live Load	0.53	IN L/181
Dead Load	0.01	in
Total Load	0.54	IN L/177

Live Load Deflection Criteria: L/180 Total Load Deflection Criteria: L/120

REACTIONS	A		B	
Live Load	100	lb	100	lb
Dead Load	4	lb	4	lb
Total Load	104	lb	104	lb
Bearing Length	0.17	in	0.17	in

BEAM DATA	Center	
Span Length	8	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	8	ft
Live Load Duration Factor	1.60	
Notch Depth	0.00	

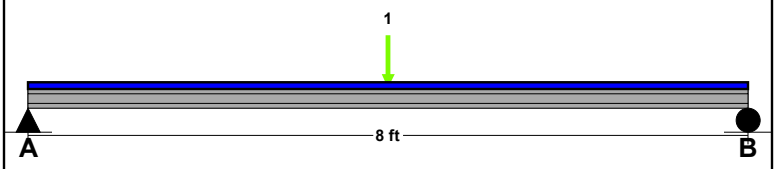
MATERIAL PROPERTIES
#2 - Hem-Fir

	Base Values			Adjusted		
Bending Stress:	Fb =	850	psi	Fb' =	2040	psi
	Cd=1.60 CF=1.50					
Shear Stress:	Fv =	150	psi	Fv' =	240	psi
	Cd=1.60					
Modulus of Elasticity:	E =	1300	ksi	E' =	1300	ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	405	psi	Fc - ⊥' =	405	psi

Controlling Moment: 408 ft-lb
4.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -104 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd		Provided	
Section Modulus:	2.4	in3	3.06	in3
Area (Shear):	0.65	in2	5.25	in2
Moment of Inertia (deflection):	5.32	in4	5.36	in4
Moment:	408	ft-lb	521	ft-lb
Shear:	-104	lb	840	lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	0	plf
Uniform Dead Load	0	plf
Beam Self Weight	1	plf
Total Uniform Load	1	plf

POINT LOADS - CENTER SPAN	
Load Number	One
Live Load	200 lb
Dead Load	0 lb
Location	4 ft

Project:

Location: Single 2x6 stud (staircase)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
1.5 IN x 5.5 IN x 9.0 FT
#2 - Hem-Fir - Dry Use
Section Adequate By: 139.3%
Controlling Factor: Moment

StruCalc 9.0

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StruCalc Version 10.0.1.6 12/4/2017 4:34:53 PM

DEFLECTIONS	Center	
Live Load	0.19	IN L/556
Dead Load	0.01	in
Total Load	0.20	IN L/533

Live Load Deflection Criteria: L/180 Total Load Deflection Criteria: L/120

REACTIONS	A		B	
Live Load	100	lb	100	lb
Dead Load	7	lb	7	lb
Total Load	107	lb	107	lb
Bearing Length	0.18	in	0.18	in

BEAM DATA	Center	
Span Length	9	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	9	ft
Live Load Duration Factor	1.60	
Notch Depth	0.00	

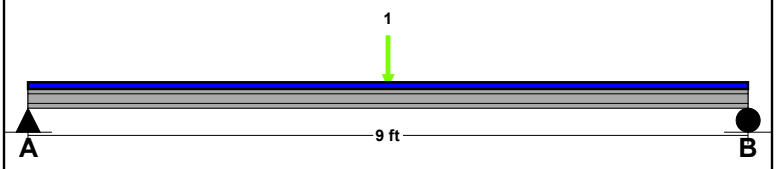
MATERIAL PROPERTIES
#2 - Hem-Fir

	Base Values			Adjusted		
Bending Stress:	Fb =	850	psi	Fb' =	1768	psi
	Cd=1.60 CF=1.30					
Shear Stress:	Fv =	150	psi	Fv' =	240	psi
	Cd=1.60					
Modulus of Elasticity:	E =	1300	ksi	E' =	1300	ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	405	psi	Fc - ⊥' =	405	psi

Controlling Moment: 466 ft-lb
4.5 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -107 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	3.16 in3	7.56 in3
Area (Shear):	0.67 in2	8.25 in2
Moment of Inertia (deflection):	6.73 in4	20.8 in4
Moment:	466 ft-lb	1114 ft-lb
Shear:	-107 lb	1320 lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	0	plf
Uniform Dead Load	0	plf
Beam Self Weight	2	plf
Total Uniform Load	2	plf

POINT LOADS - CENTER SPAN	
Load Number	One
Live Load	200 lb
Dead Load	0 lb
Location	4.5 ft

Project:

Location: Double 2x4 stud (flat orientation connection/top)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 3.5 IN x 8.0 FT
#2 - Hem-Fir - Dry Use
Section Adequate By: 101.6%
Controlling Factor: Deflection

StruCalc 9.0

page of

StruCalc Version 10.0.1.6 12/4/2017 4:38:42 PM

DEFLECTIONS	Center	
Live Load	0.26	IN L/363
Dead Load	0.01	in
Total Load	0.28	IN L/346

Live Load Deflection Criteria: L/180 Total Load Deflection Criteria: L/120

REACTIONS	A		B	
Live Load	100	lb	100	lb
Dead Load	8	lb	8	lb
Total Load	108	lb	108	lb
Bearing Length	0.09	in	0.09	in

BEAM DATA	Center	
Span Length	8	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	8	ft
Live Load Duration Factor	1.60	
Notch Depth	0.00	

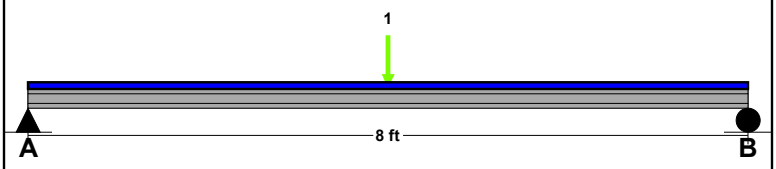
MATERIAL PROPERTIES
#2 - Hem-Fir

	Base Values			Adjusted		
Bending Stress:	Fb =	850	psi	Fb' =	2040	psi
	Cd=1.60 CF=1.50					
Shear Stress:	Fv =	150	psi	Fv' =	240	psi
	Cd=1.60					
Modulus of Elasticity:	E =	1300	ksi	E' =	1300	ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	405	psi	Fc - ⊥' =	405	psi

Controlling Moment: 416 ft-lb
4.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 108 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd		Provided	
Section Modulus:	2.45	in3	6.13	in3
Area (Shear):	0.67	in2	10.5	in2
Moment of Inertia (deflection):	5.32	in4	10.72	in4
Moment:	416	ft-lb	1041	ft-lb
Shear:	108	lb	1680	lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	0	plf
Uniform Dead Load	0	plf
Beam Self Weight	2	plf
Total Uniform Load	2	plf

POINT LOADS - CENTER SPAN		
Load Number	One	
Live Load	200	lb
Dead Load	0	lb
Location	4	ft

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Table 12.3.3A Assigned Specific Gravities

Species Combination	Specific[1] Gravity, G
Alaska Cedar	0.47
Alaska Hemlock	0.46
Alaska Spruce	0.41
Alaska Yellow Cedar	0.46
Aspen	0.39
Balsam Fir	0.36
Beech-Birch-Hickory	0.71
Coast Sitka Spruce	0.39
Cottonwood	0.41
Douglas Fir-Larch	0.50
Douglas Fir-Larch (North)	0.49
Douglas Fir-South	0.46
Eastern Hemlock	0.41
Eastern Hemlock-Balsam Fir	0.36
Eastern Hemlock-Tamarack	0.41
Eastern Hemlock-Tamarack (North)	0.47
Eastern Softwoods	0.36
Eastern Spruce	0.41
Eastern White Pine	0.36
Engelmann Spruce-Lodgepole Pine	0.38
Hem-Fir	0.43
Hem-Fir (North)	0.46
Mixed Maple	0.55
Mixed Oak	0.68
Mixed Southern Pine	0.51
Mountain Hemlock	0.47
Northern Pine	0.42
Northern Red Oak	0.68
Northern Species	0.35
Northern White Cedar	0.31
Ponderosa Pine	0.43
Red Maple	0.58
Red Oak	0.67
Red Pine	0.44
Redwood, close grain	0.44
Redwood, open grain	0.37
Sitka Spruce	0.43
Southern Pine	0.55
Spruce-Pine-Fir	0.42
Spruce-Pine-Fir (South)	0.36
Western Cedars	0.36
Western Cedars (North)	0.35
Western Hemlock	0.47
Western Hemlock (North)	0.46
Western White Pine	0.40
Western Woods	0.36
White Oak	0.73
Yellow Poplar	0.43

Species Combinations of MSR and MEL Lumber	Specific[1] Gravity, G
Douglas Fir-Larch	
E=1,900,000 psi and lower grades of MSR	0.50
E=2,000,000 psi grades of MSR	0.51
E=2,100,000 psi grades of MSR	0.52
E=2,200,000 psi grades of MSR	0.53
E=2,300,000 psi grades of MSR	0.54
E=2,400,000 psi grades of MSR	0.55
Douglas Fir-Larch (North)	
E=1,900,000 psi and lower grades of MSR and MEL	0.49
E=2,000,000 psi to 2,200,000 psi grades of MSR and MEL	0.53
E=2,300,000 psi and higher grades of MSR and MEL	0.57
Douglas Fir-Larch (South)	
E=1,000,000 psi and higher grades of MSR	0.46
Engelmann Spruce-Lodgepole Pine	
E=1,400,000 psi and lower grades of MSR	0.38
E=1,500,000 psi and higher grades of MSR	0.46
Hem-Fir	
E=1,500,000 psi and lower grades of MSR	0.43
E=1,600,000 psi grades of MSR	0.44
E=1,700,000 psi grades of MSR	0.45
E=1,800,000 psi grades of MSR	0.46
E=1,900,000 psi grades of MSR	0.47
E=2,000,000 psi grades of MSR	0.48
E=2,100,000 psi grades of MSR	0.49
E=2,200,000 psi grades of MSR	0.50
E=2,300,000 psi grades of MSR	0.51
E=2,400,000 psi grades of MSR	0.52
Hem-Fir (North)	
E=1,000,000 psi and higher grades of MSR and MEL	0.46
Southern Pine	
E=1,700,000 psi and lower grades of MSR and MEL	0.55
E=1,800,000 psi and higher grades of MSR and MEL	0.57
Spruce-Pine-Fir	
E=1,700,000 psi and lower grades of MSR and MEL	0.42
E=1,800,000 psi and 1,900,000 grades of MSR and MEL	0.46
E=2,000,000 psi and higher grades of MSR and MEL	0.50
Spruce-Pine-Fir (South)	
E=1,100,000 psi and lower grades of MSR	0.36
E=1,200,000 psi to1,900,000 psi grades of MSR	0.42
E=2,000,000 psi and higher grades of MSR	0.50
Western Cedars	
E=1,000,000 psi and higher grades of MSR	0.36
Western Woods	
E=1,000,000 psi and higher grades of MSR	0.36

1. Specific gravity, G, based on weight and volume when oven-dry. Different specific gravities, G, are possible for different grades of MSR and MEL lumber (see Table 4C, Footnote 2).

BEAMS (DF #2, and Engineered Lumber)

Joists and 2x members (HF #2)

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LAG SCREWS

Table 12K **LAG SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3,4]**

for sawn lumber or SCL with ASTM A653, Grade 33 steel side plate (for t_s<1/4") or ASTM A 36 steel side plate (for t_s=1/4")
(tabulated lateral design values are calculated based on an assumed length of lag screw penetration, p, into the main member equal to 8D)

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.5 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_s	D	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.075	1/4	170	130	160	120	150	110	150	110	150	100	140	100	140	100	130	90	130	90	130	90
(14 gage)	5/16	220	160	200	140	190	130	190	130	190	130	180	120	180	120	170	110	170	110	160	100
	3/8	220	160	200	140	200	130	190	130	190	120	180	120	180	120	170	110	170	100	170	100
0.105	1/4	180	140	170	130	160	120	160	120	160	110	150	110	150	110	140	100	140	100	140	90
(12 gage)	5/16	230	170	210	150	200	140	200	140	190	130	190	130	190	120	180	110	170	110	170	110
	3/8	230	160	210	140	200	140	200	130	200	130	190	120	190	120	180	110	180	110	170	110
0.120	1/4	190	150	180	130	170	120	170	120	160	120	160	110	160	110	150	100	150	100	140	100
(11 gage)	5/16	230	170	210	150	210	140	200	140	200	140	190	130	190	130	180	120	180	120	180	110
	3/8	240	170	220	150	210	140	210	140	200	130	200	130	190	120	180	110	180	110	180	110
0.134	1/4	200	150	180	140	180	130	170	130	170	120	160	120	160	110	150	110	150	100	150	100
(10 gage)	5/16	240	180	220	160	210	150	210	140	200	140	200	130	200	130	190	120	180	120	180	120
	3/8	240	170	220	150	220	140	210	140	210	140	200	130	200	130	190	120	190	120	180	110
0.179	1/4	220	170	210	150	200	150	200	140	190	140	190	130	190	130	180	120	170	120	170	120
(7 gage)	5/16	260	190	240	170	230	160	230	160	230	150	220	150	220	150	210	130	200	130	200	130
	3/8	270	190	250	170	240	160	240	160	230	150	220	140	220	140	210	130	210	130	200	130
0.239	1/4	240	180	220	160	210	150	210	150	200	140	190	140	190	130	180	120	180	120	180	120
(3 gage)	5/16	300	220	280	190	270	180	260	180	260	170	250	160	250	160	230	150	230	150	230	140
	3/8	310	220	280	190	270	180	270	180	260	170	250	160	250	160	240	140	230	140	230	140
	7/16	420	290	390	260	380	240	370	240	360	230	350	220	350	220	330	200	330	200	320	190
	1/2	510	340	470	300	460	290	450	280	440	270	430	260	420	260	400	240	400	230	390	230
	5/8	770	490	710	430	680	400	680	400	660	380	640	370	630	360	600	330	590	330	580	320
	3/4	1110	670	1020	590	980	560	970	550	950	530	920	500	910	500	860	450	850	450	840	440
	7/8	1510	880	1390	780	1330	730	1320	710	1280	690	1250	650	1230	650	1170	590	1160	590	1140	570
	1	1940	1100	1780	960	1710	910	1700	890	1650	860	1600	820	1590	810	1500	740	1480	730	1460	710
1/4	1/4	240	180	220	160	210	150	210	150	200	140	200	140	190	130	180	120	180	120	180	120
	5/16	310	220	280	200	270	180	270	180	260	170	250	170	250	160	230	150	230	150	230	140
	3/8	320	220	290	190	280	180	270	180	270	170	260	160	250	160	240	150	240	140	230	140
	7/16	480	320	440	280	420	270	420	260	410	250	390	240	390	230	370	220	360	210	360	210
	1/2	580	390	540	340	520	320	510	320	500	310	480	290	480	290	460	270	450	260	440	260
	5/8	850	530	780	470	750	440	740	440	720	420	700	400	690	400	660	370	650	360	640	350
	3/4	1200	730	1100	640	1060	600	1050	590	1020	570	990	540	980	530	930	490	920	480	900	470
	7/8	1600	930	1470	820	1410	770	1400	750	1360	720	1320	690	1310	680	1240	630	1220	620	1200	600
	1	2040	1150	1870	1000	1800	950	1780	930	1730	900	1680	850	1660	840	1570	770	1550	760	1530	740

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "reduced body diameter" lag screws (see Appendix Table L2) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 8D; dowel bearing strengths, F_e, of 61,850 psi for ASTM A653, Grade 33 steel and 87,000 psi for ASTM A36 steel and screw bending yield strengths, F_{yb}, of 70,000 psi for D = 1/4", 60,000 psi for D = 5/16", and 45,000 psi for D ≥3/8".
3. Where the lag screw penetration, p, is less than 8D but not less than 4D, tabulated lateral design values, Z, shall be multiplied by p/8D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.
4. The length of lag screw penetration, p, not including the length of the tapered tip, E (see Appendix Table L2), of the lag screw into the main member shall not be less than 4D. See 12.1.4.6 for minimum length of penetration, p_{min}.

SDS connection of steel plate to wood, assuming HF, 100 lbs per 1/4" DIA SDS un-factored, without group action reduction, pending application/spacing.

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Table 12L **WOOD SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3]**

for sawn lumber or SCL with both members of identical specific gravity (tabulated lateral design values are calculated based on an assumed length of wood screw penetration, p, into the main member equal to 10D)

Side Member Thickness t_s in.	Wood Screw Diameter D in.	Wood Screw Number	G=0.67 Red Oak lbs.	G=0.55 Mixed Maple Southern Pine lbs.	G=0.5 Douglas Fir-Larch lbs.	G=0.49 Douglas Fir-Larch(N) lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) lbs.	G=0.43 Hem-Fir lbs.	G=0.42 Spruce-Pine-Fir lbs.	G=0.37 Redwood (open grain) lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods lbs.	G=0.35 Northern Species lbs.
1/2	0.138	6	88	67	59	57	53	49	47	41	40	38
	0.151	7	96	74	65	63	59	54	52	45	44	42
	0.164	8	107	82	73	71	66	61	59	51	50	48
	0.177	9	121	94	83	81	76	70	68	59	58	56
	0.190	10	130	101	90	87	82	75	73	64	63	60
	0.216	12	156	123	110	107	100	93	91	79	78	75
	0.242	14	168	133	120	117	110	102	99	87	86	83
5/8	0.138	6	94	76	66	64	59	53	52	44	43	41
	0.151	7	104	83	72	70	64	58	56	48	47	45
	0.164	8	120	92	80	77	72	65	63	54	53	51
	0.177	9	136	103	91	88	81	74	72	62	61	58
	0.190	10	146	111	97	94	88	80	78	67	65	63
	0.216	12	173	133	117	114	106	97	95	82	80	77
	0.242	14	184	142	126	123	115	106	103	89	87	84
3/4	0.138	6	94	79	72	71	65	58	57	47	46	44
	0.151	7	104	87	80	77	71	64	62	52	50	48
	0.164	8	120	101	88	85	78	71	69	58	56	54
	0.177	9	142	114	99	96	88	80	78	66	64	61
	0.190	10	153	122	107	103	95	86	83	71	69	66
								03	100	86	84	80
								11	108	93	91	87
								3	61	55	54	51
								9	68	60	59	56
								0	78	67	65	62
	0.177	9	142	118	108	106	100	94	90	75	73	70
	0.190	10	153	128	117	114	108	101	97	81	78	75
	0.216	12	193	161	147	143	131	118	114	96	93	89
	0.242	14	213	178	157	152	139	126	122	102	100	95
1-1/4	0.138	6	94	79	72	71	67	63	61	55	54	52
	0.151	7	104	87	80	78	74	69	68	60	59	57
	0.164	8	120	101	92	90	85	80	78	70	68	66
	0.177	9	142	118	108	106	100	94	92	82	80	78
	0.190	10	153	128	117	114	108	101	99	88	87	84
	0.216	12	193	161	147	144	137	128	125	108	105	100
	0.242	14	213	178	163	159	151	141	138	115	111	106
1-1/2	0.138	6	94	79	72	71	67	63	61	55	54	52
	0.151	7	104	87	80	78	74	69	68	60	59	57
	0.164	8	120	101	92	90	85	80	78	70	68	66
	0.177	9	142	118	108	106	100	94	92	82	80	78
	0.190	10	153	128	117	114	108	101	99	88	87	84
	0.216	12	193	161	147	144	137	128	125	111	109	106
	0.242	14	213	178	163	159	151	141	138	123	120	117
1-3/4	0.138	6	94	79	72	71	67	63	61	55	54	52
	0.151	7	104	87	80	78	74	69	68	60	59	57
	0.164	8	120	101	92	90	85	80	78	70	68	66
	0.177	9	142	118	108	106	100	94	92	82	80	78
	0.190	10	153	128	117	114	108	101	99	88	87	84
	0.216	12	193	161	147	144	137	128	125	111	109	106
	0.242	14	213	178	163	159	151	141	138	123	120	117

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for rolled thread wood screws (see Appendix Table L3) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 10D; and screw bending yield strengths, F_{yb}, of 100,000 psi for 0.099" ≤ D ≤ 0.142", 90,000 psi for 0.142" < D ≤ 0.177", 80,000 psi for 0.177" < D ≤ 0.236", and 70,000 psi for 0.236" < D ≤ 0.273".
3. Where the wood screw penetration, p, is less than 10D but not less than 6D, tabulated lateral design values, Z, shall be multiplied by p/10D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.

Exterior: Typical Ledger connection w/ SDS, un-factored since typical Deck loading application with duration = 1. Minimum (3) SDSW screws into RIM @ 12" o.c stud. Assuming worst case with 12' deck framing with connections into RIM @ 12" o.c w/ 60 psf LL and 10 psf DL - loading on each connection, staggered, (and ignoring capacity of typical nailing of rim). Connection is 6' x 72 psf x 1.00 = 432# versus capacity into DF/Engineered lumber (LSL) - 489#, ok.

Interior: Typical Ledger connection w/ SDS, un-factored since typical floor loading application with duration = 1. Minimum (3) SDSW screws into studs/rim @ 16" o.c stud. Assuming worst case with 14' floor framing with connections into RIM @ 16" o.c w/ 40 psf LL and 12 psf DL - loading on each connection, staggered, (and ignoring capacity of typical nailing of rim). Connection is 7' x 52 psf x 1.00 = 364# versus capacity into HF lumber (SS) - 423#, ok.

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Table 12.2A Lag Screw Reference Withdrawal Design Values, W[1]

Tabulated withdrawal design values (W) are in pounds per inch of thread penetration into side grain of wood member. Length of thread penetration in main member shall not include the length of the tapered tip (see 12.2.1.1).

Specific Gravity, G[2]	Lag Screw Diameter, D										
	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"
0.73	397	469	538	604	668	789	905	1016	1123	1226	1327
0.71	381	450	516	579	640	757	868	974	1077	1176	1273
0.68	357	422	484	543	600	709	813	913	1009	1103	1193
0.67	349	413	473	531	587	694	796	893	987	1078	1167
0.58	281	332	381	428	473	559	641	719	795	869	940
0.55	260	307	352	395	437	516	592	664	734	802	868
0.51	232	274	314	353	390	461	528	593	656	716	775
0.50	225	266	305	342	378	447	513	576	636	695	752
0.49	218	258	296	332	367	434	498	559	617	674	730
0.47	205	242	278	312	345	408	467	525	580	634	686
0.46	199	235	269	302	334	395	453	508	562	613	664
0.44	186	220	252	283	312	369	423	475	525	574	621
0.43	179	212	243	273	302	357	409	459	508	554	600
0.42	173	205	235	264	291	344	395	443	490	535	579
0.41	167	198	226	254	281	332	381	428	473	516	559
0.40	161	190	218	245	271	320	367	412	455	497	538
0.39	155	183	210	236	261	308	353	397	438	479	518
0.38	149	176	202	227	251	296	340	381	422	461	498
0.37	143	169	194	218	241	285	326	367	405	443	479
0.36	137	163	186	209	231	273	313	352	389	425	460
0.35	132	156	179	200	222	262	300	337	373	407	441
0.31	110	130	149	167	185	218	250	281	311	339	367

1. Tabulated withdrawal design values, W, for lag screw connections shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Specific gravity, G, shall be determined in accordance with Table 12.3.3A.

12.2.3.2 For calculation of the fastener reference withdrawal design value in pounds, the unit reference withdrawal design value in lbs/in. of fastener penetration from 12.2.3.1 shall be multiplied by the length of fastener penetration, p_t, into the wood member.

12.2.3.3 The reference withdrawal design value, in lbs/in. of penetration, for a single post-frame ring shank nail driven in the side grain of the main member, with the nail axis perpendicular to the wood fibers, shall be determined from Table 12.2D or Equation 12.2-4, within the range of specific gravities and nail diameters given in Table 12.2D. Reference withdrawal design values, W, shall be multiplied by all applicable adjustment factors (see Table 11.3.1) to obtain adjusted withdrawal design values, W'.

$$W = 1800\ G^2\ D \qquad (12.2\text{-}4)$$

12.2.3.4 For calculation of the fastener reference withdrawal design value in pounds, the unit reference withdrawal design value in lbs/in. of ring shank penetration from 12.2.3.3 shall be multiplied by the length of ring shank penetration, p_t, into the wood member.

12.2.3.5 Nails and spikes shall not be loaded in withdrawal from end grain of wood (C_{eg}=0.0).

12.2.3.6 Nails, and spikes shall not be loaded in withdrawal from end-grain of laminations in cross-laminated timber (C_{eg}=0.0).

12.2.4 Drift Bolts and Drift Pins

Reference withdrawal design values, W, for connections using drift bolt and drift pin connections shall be determined in accordance with 11.1.1.3.

Ledger withdrawal capacity - assuming minimum 1 1/2" embed (tip discounted) into SS/HF material = 179# x 1.5 x 3 = 805# per 16" of ledger connection (maximum utilized)

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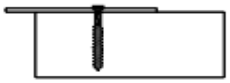
WOOD SCREWS

Table 12M **WOOD SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3]**

for sawn lumber or SCL with ASTM 653, Grade 33 steel side plate
(tabulated lateral design values are calculated based on an assumed length of wood screw penetration, p, into the main member equal to 10D)



Side Member Thickness t_s in.	Wood Screw Diameter D in.	Wood Screw Number	G=0.67 Red Oak lbs.	G=0.55 Mixed Maple Southern Pine lbs.	G=0.5 Douglas Fir-Larch lbs.	G=0.49 Douglas Fir-Larch(N) lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) lbs.	G=0.43 Hem-Fir lbs.	G=0.42 Spruce-Pine-Fir lbs.	G=0.37 Redwood (open grain) lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods lbs.	G=0.35 Northern Species lbs.
0.036	0.138	6	89	76	70	69	66	62	60	54	53	52
(20 gage)	0.151	7	99	84	78	76	72	68	67	60	59	57
	0.164	8	113	97	89	87	83	78	77	69	67	66
0.048	0.138	6	90	77	71	70	67	63	61	55	54	53
(18 gage)	0.151	7	100	85	79	77	74	69	68	61	60	58
	0.164	8	114	98	90	89	84	79	78	70	69	67
0.060	0.138	6	92	79	73	72	68	64	63	57	56	54
(16 gage)	0.151	7	101	87	81	79	75	71	70	63	61	60
	0.164	8	116	100	92	90	86	81	79	71	70	68
	0.177	9	136	116	107	105	100	94	93	83	82	79
	0.190	10	146	125	116	114	108	102	100	90	88	86
0.075	0.138	6	95	82	76	75	71	67	66	59	58	57
(14 gage)	0.151	7	105	90	84	82	78	74	72	65	64	62
	0.164	8	119	103	95	93	89	84	82	74	73	71
	0.177	9	139	119	110	108	103	97	95	86	84	82
	0.190	10	150	128	119	117	111	105	103	92	91	88
	0.216	12	186	159	147	145	138	130	127	114	112	109
	0.242	14	204	175	162	158	151	142	139	125	123	120
0.105	0.138	6	104	90	84	82	79	74	73	66	65	63
(12 gage)	0.151	7	114	99	92	90	86	81	80	72	71	69
	0.164	8	129	111	103	102	97	92	90	81	80	77
	0.177	9	148	128	119	116	111	105	103	93	91	89
	0.190	10	160	138	128	125	120	113	111	100	98	96
	0.216	12	196	168	156	153	146	138	135	122	120	116
	0.242	14	213	183	170	167	159	150	147	132	130	126
0.120	0.138	6	110	95	89	87	83	79	77	70	68	67
(11 gage)	0.151	7	120	104	97	95	91	86	84	76	75	73
	0.164	8	135	117	109	107	102	96	94	85	84	82
	0.177	9	154	133	124	121	116	110	107	97	95	93
	0.190	10	166	144	133	131	125	118	116	104	103	100
	0.216	12	202	174	162	159	152	143	140	126	124	121
	0.242	14	219	189	175	172	164	155	152	137	134	131
0.134	0.138	6	116	100	93	92	88	83	81	73	72	70
(10 gage)	0.151	7	126	110	102	100	96	91	89	80	79	77
	0.164	8	141	122	114	112	107	101	99	89	88	86
	0.177	9	160	139	129	127	121	114	112	101	100	97
	0.190	10	173	149	139	136	130	123	121	109	107	104
	0.216	12	209	180	167	164	157	148	145	131	129	126
	0.242	14	226	195	181	177	169	160	157	141	139	135
0.179	0.138	6	126	107	99	97	92	86	84	76	74	72
(7 gage)	0.151	7	139	118	109	107	102	95	93	84	82	80
	0.164	8	160	136	126	123	117	110	108	96	95	92
	0.177	9	184	160	148	145	138	129	127	113	111	108
	0.190	10	198	172	159	156	149	140	137	122	120	117
	0.216	12	234	203	189	186	178	168	165	149	146	143
	0.242	14	251	217	202	198	190	179	176	159	156	152
0.239	0.138	6	126	107	99	97	92	86	84	76	74	72
(3 gage)	0.151	7	139	118	109	107	102	95	93	84	82	80
	0.164	8	160	136	126	123	117	110	108	96	95	92
	0.177	9	188	160	148	145	138	129	127	113	111	108
	0.190	10	204	173	159	156	149	140	137	122	120	117
	0.216	12	256	218	201	197	187	176	172	154	151	147
	0.242	14	283	241	222	217	207	194	190	170	167	162

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for rolled thread wood screws (see Appendix L) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 10D; dowel bearing strength, F_e, of 61,850 psi for ASTM A653, Grade 33 steel and screw bending yield strengths, F_{yb}, of 100,000 psi for $0.099" \le D \le 0.142"$, 90,000 psi for $0.142" < D \le 0.177"$, 80,000 psi for $0.177" < D \le 0.236"$, 70,000 psi for $0.236" < D \le 0.273"$.
3. Where the wood screw penetration, p, is less than 10D but not less than 6D, tabulated lateral design values, Z, shall be multiplied by p/10D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.

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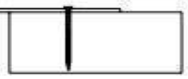
Table 12P (Cont.) **COMMON, BOX, or SINKER STEEL WIRE NAILS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3]**



for sawn lumber or SCL with ASTM 653, Grade 33 steel side plate
(tabulated lateral design values are calculated based on an assumed length of nail penetration, p, into the main member equal to 10D)

Side Member Thickness	Nail Diameter	Common Wire Nail	Box Nail	Sinker Nail	G=0.67 Red Oak	G=0.55 Mixed Maple Southern Pine	G=0.5 Douglas Fir-Larch	G=0.49 Douglas Fir-Larch (N)	G=0.46 Douglas Fir(S) Hem-Fir(N)	G=0.43 Hem-Fir	G=0.42 Spruce-Pine-Fir	G=0.37 Redwood (open grain)	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods	G=0.35 Northern Species
t_s	D	Pennyweight												
in.	in.				lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.120	0.099		6d	7d	90	78	72	71	68	64	63	57	56	53
(11 gage)	0.113	6d	8d	8d	110	95	89	87	83	79	77	70	68	66
	0.120			10d	121	105	97	96	91	86	85	76	75	73
	0.128		10d		134	116	108	106	101	96	94	85	83	81
	0.131	8d			140	121	112	110	105	99	97	88	86	84
	0.135		16d	12d	147	127	118	116	110	104	102	92	91	88
	0.148	10d	20d	16d	165	143	133	130	124	117	115	104	102	99
	0.162	16d	40d		193	166	154	152	145	137	134	121	119	115
	0.177			20d	218	188	174	171	163	154	151	136	134	130
	0.192	20d		30d	226	195	181	177	169	159	156	141	138	135
	0.207	30d		40d	244	210	194	191	182	172	168	151	149	145
	0.225	40d			265	228	211	207	198	186	183	164	161	157
	0.244	50d		60d	272	234	217	213	203	191	187	169	166	161
0.134	0.099		6d	7d	95	82	76	74	71	66	65	58	56	54
(10 gage)	0.113	6d	8d	8d	116	100	93	92	88	83	81	73	72	69
	0.120			10d	127	110	102	100	96	91	89	80	79	76
	0.128		10d		140	122	113	111	106	100	98	89	87	85
	0.131	8d			146	126	117	115	110	104	102	92	90	88
	0.135		16d	12d	153	132	123	121	115	109	107	96	95	92
	0.148	10d	20d	16d	172	148	138	135	129	122	120	108	106	104
	0.162	16d	40d		199	172	160	157	150	142	139	125	123	120
	0.177			20d	224	194	180	176	169	159	156	141	138	135
	0.192	20d		30d	232	200	186	182	174	164	161	145	143	139
	0.207	30d		40d	249	215	199	196	187	176	173	156	153	149
	0.225	40d			270	233	216	212	202	191	187	168	165	161
	0.244	50d		60d	277	239	221	217	207	195	192	173	170	165
0.179	0.099		6d	7d	97	82	76	74	71	66	65	58	56	54
(7 gage)	0.113	6d	8d	8d	126	107	99	97	92	86	84	76	74	70
	0.120			10d	142	121	111	109	104	97	95	85	83	79
	0.128		10d		161	137	126	124	118	111	108	97	94	90
	0.131	8d			168	144	132	130	123	116	114	102	99	94
	0.135		16d	12d	175	152	141	138	131	123	121	108	105	100
	0.148	10d	20d	16d	195	170	158	155	148	140	137	123	121	117
	0.162	16d	40d		224	194	180	177	169	160	157	142	140	136
	0.177			20d	249	215	200	197	188	178	174	157	155	151
	0.192	20d		30d	256	222	206	203	194	183	179	162	159	155
	0.207	30d		40d	272	236	219	215	205	194	190	172	169	164
	0.225	40d			292	252	234	230	220	207	203	184	180	176
	0.244	50d		60d	299	258	240	235	225	212	208	188	185	180
0.239	0.099		6d	7d	97	82	76	74	71	66	65	58	56	54
(3 gage)	0.113	6d	8d	8d	126	107	99	97	92	86	84	76	74	70
	0.120			10d	142	121	111	109	104	97	95	85	83	79
	0.128		10d		161	137	126	124	118	111	108	97	94	90
	0.131	8d			169	144	132	130	123	116	114	102	99	94
	0.135		16d	12d	180	153	141	138	131	123	121	108	105	100
	0.148	10d	20d	16d	205	174	160	157	149	140	137	123	121	117
	0.162	16d	40d		245	209	192	188	179	168	165	147	145	140
	0.177			20d	284	241	222	218	207	195	191	170	167	162
	0.192	20d		30d	295	251	231	227	216	202	198	177	174	169
	0.207	30d		40d	310	270	251	246	236	222	217	194	191	185
	0.225	40d			328	285	265	260	249	235	231	209	205	200
	0.244	50d		60d	336	291	271	266	254	240	236	213	210	204

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for common, box, or sinker steel wire nails (see Appendix Table L4) inserted in side grain with nail axis perpendicular to wood fibers; nail penetration, p, into the main member equal to 10D; dowel bearing strength, F_e, of 61,850 psi for ASTM A653, Grade 33 steel and nail bending yield strengths, F_{yb}, of 100,000 psi for 0.099" ≤ D ≤ 0.142", 90,000 psi for 0.142" < D ≤ 0.177", 80,000 psi for 0.177" < D ≤ 0.236", 70,000 psi for 0.236" < D ≤ 0.273".
3. Where the nail or spike penetration, p, is less than 10D but not less than 6D, tabulated lateral design values, Z, shall be multiplied by p/10D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.

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Table 11.3.6A Group Action Factors, C_g, for Bolt or Lag Screw Connections with Wood Side Members[2]

For D = 1", s = 4", E = 1,400,000 psi

A_s/A_m[1]	A_s[1] in.^{2}	Number of fasteners in a row										
		2	3	4	5	6	7	8	9	10	11	12
0.5	5	0.98	0.92	0.84	0.75	0.68	0.61	0.55	0.50	0.45	0.41	0.38
	12	0.99	0.96	0.92	0.87	0.81	0.76	0.70	0.65	0.61	0.57	0.53
	20	0.99	0.98	0.95	0.91	0.87	0.83	0.78	0.74	0.70	0.66	0.62
	28	1.00	0.98	0.96	0.93	0.90	0.87	0.83	0.79	0.76	0.72	0.69
	40	1.00	0.99	0.97	0.95	0.93	0.90	0.87	0.84	0.81	0.78	0.75
	64	1.00	0.99	0.98	0.97	0.95	0.93	0.91	0.89	0.87	0.84	0.82
1	5	1.00	0.97	0.91	0.85	0.78	0.71	0.64	0.59	0.54	0.49	0.45
	12	1.00	0.99	0.96	0.93	0.88	0.84	0.79	0.74	0.70	0.65	0.61
	20	1.00	0.99	0.98	0.95	0.92	0.89	0.86	0.82	0.78	0.75	0.71
	28	1.00	0.99	0.98	0.97	0.94	0.92	0.89	0.86	0.83	0.80	0.77
	40	1.00	1.00	0.99	0.98	0.96	0.94	0.92	0.90	0.87	0.85	0.82
	64	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.93	0.91	0.90	0.88

1. Where $A_s/A_m > 1.0$, use A_m/A_s and use A_m instead of A_s.
2. Tabulated group action factors (C_g) are conservative for D < 1", s < 4", or E > 1,400,000 psi.

Table 11.3.6B Group Action Factors, C_g, for 4" Split Ring or Shear Plate Connectors with Wood Side Members[2]

s = 9", E = 1,400,000 psi

A_s/A_m[1]	A_s[1] in.^{2}	Number of fasteners in a row										
		2	3	4	5	6	7	8	9	10	11	12
0.5	5	0.90	0.73	0.59	0.48	0.41	0.35	0.31	0.27	0.25	0.22	0.20
	12	0.95	0.83	0.71	0.60	0.52	0.45	0.40	0.36	0.32	0.29	0.27
	20	0.97	0.88	0.78	0.69	0.60	0.53	0.47	0.43	0.39	0.35	0.32
	28	0.97	0.91	0.82	0.74	0.66	0.59	0.53	0.48	0.44	0.40	0.37
	40	0.98	0.93	0.86	0.79	0.72	0.65	0.59	0.54	0.49	0.45	0.42
	64	0.99	0.95	0.91	0.85	0.79	0.73	0.67	0.62	0.58	0.54	0.50
1	5	1.00	0.87	0.72	0.59	0.50	0.43	0.38	0.34	0.30	0.28	0.25
	12	1.00	0.93	0.83	0.72	0.63	0.55	0.48	0.43	0.39	0.36	0.33
	20	1.00	0.95	0.88	0.79	0.71	0.63	0.57	0.51	0.46	0.42	0.39
	28	1.00	0.97	0.91	0.83	0.76	0.69	0.62	0.57	0.52	0.47	0.44
	40	1.00	0.98	0.93	0.87	0.81	0.75	0.69	0.63	0.58	0.54	0.50
	64	1.00	0.98	0.95	0.91	0.87	0.82	0.77	0.72	0.67	0.62	0.58

1. Where $A_s/A_m > 1.0$, use A_m/A_s and use A_m instead of A_s.
2. Tabulated group action factors (C_g) are conservative for 2-1/2" split ring connectors, 2-5/8" shear plate connectors, s < 9", or E > 1,400,000 psi.

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Table 11.3.6C Group Action Factors, C_g, for Bolt or Lag Screw Connections with Steel Side Plates[1]

For D = 1", s = 4", E_{wood} = 1,400,000 psi, E_{steel} = 30,000,000 psi

A_m/A_s	A_m in.^{2}	Number of fasteners in a row										
		2	3	4	5	6	7	8	9	10	11	12
12	5	0.97	0.89	0.80	0.70	0.62	0.55	0.49	0.44	0.40	0.37	0.34
	8	0.98	0.93	0.85	0.77	0.70	0.63	0.57	0.52	0.47	0.43	0.40
	16	0.99	0.96	0.92	0.86	0.80	0.75	0.69	0.64	0.60	0.55	0.52
	24	0.99	0.97	0.94	0.90	0.85	0.81	0.76	0.71	0.67	0.63	0.59
	40	1.00	0.98	0.96	0.94	0.90	0.87	0.83	0.79	0.76	0.72	0.69
	64	1.00	0.99	0.98	0.96	0.94	0.91	0.88	0.86	0.83	0.80	0.77
	120	1.00	0.99	0.99	0.98	0.96	0.95	0.93	0.91	0.90	0.87	0.85
	200	1.00	1.00	0.99	0.99	0.98	0.97	0.96	0.95	0.93	0.92	0.90
18	5	0.99	0.93	0.85	0.76	0.68	0.61	0.54	0.49	0.44	0.41	0.37
	8	0.99	0.95	0.90	0.83	0.75	0.69	0.62	0.57	0.52	0.48	0.44
	16	1.00	0.98	0.94	0.90	0.85	0.79	0.74	0.69	0.65	0.60	0.56
	24	1.00	0.98	0.96	0.93	0.89	0.85	0.80	0.76	0.72	0.68	0.64
	40	1.00	0.99	0.97	0.95	0.93	0.90	0.87	0.83	0.80	0.77	0.73
	64	1.00	0.99	0.98	0.97	0.95	0.93	0.91	0.89	0.86	0.83	0.81
	120	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.93	0.92	0.90	0.88
	200	1.00	1.00	0.99	0.99	0.98	0.98	0.97	0.96	0.95	0.94	0.92
24	40	1.00	0.99	0.97	0.95	0.93	0.89	0.86	0.83	0.79	0.76	0.72
	64	1.00	0.99	0.98	0.97	0.95	0.93	0.91	0.88	0.85	0.83	0.80
	120	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.93	0.91	0.90	0.88
	200	1.00	1.00	0.99	0.99	0.98	0.98	0.97	0.96	0.95	0.93	0.92
30	40	1.00	0.98	0.96	0.93	0.89	0.85	0.81	0.77	0.73	0.69	0.65
	64	1.00	0.99	0.97	0.95	0.93	0.90	0.87	0.83	0.80	0.77	0.73
	120	1.00	0.99	0.99	0.97	0.96	0.94	0.92	0.90	0.88	0.85	0.83
	200	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.92	0.90	0.89
35	40	0.99	0.97	0.94	0.91	0.86	0.82	0.77	0.73	0.68	0.64	0.60
	64	1.00	0.98	0.96	0.94	0.91	0.87	0.84	0.80	0.76	0.73	0.69
	120	1.00	0.99	0.98	0.97	0.95	0.92	0.90	0.88	0.85	0.82	0.79
	200	1.00	0.99	0.99	0.98	0.97	0.95	0.94	0.92	0.90	0.88	0.86
42	40	0.99	0.97	0.93	0.88	0.83	0.78	0.73	0.68	0.63	0.59	0.55
	64	0.99	0.98	0.95	0.92	0.88	0.84	0.80	0.76	0.72	0.68	0.64
	120	1.00	0.99	0.97	0.95	0.93	0.90	0.88	0.85	0.81	0.78	0.75
	200	1.00	0.99	0.98	0.97	0.96	0.94	0.92	0.90	0.88	0.85	0.83
50	40	0.99	0.96	0.91	0.85	0.79	0.74	0.68	0.63	0.58	0.54	0.51
	64	0.99	0.97	0.94	0.90	0.85	0.81	0.76	0.72	0.67	0.63	0.59
	120	1.00	0.98	0.97	0.94	0.91	0.88	0.85	0.81	0.78	0.74	0.71
	200	1.00	0.99	0.98	0.96	0.95	0.92	0.90	0.87	0.85	0.82	0.79

1. Tabulated group action factors (C_g) are conservative for D < 1" or s < 4".

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Table 11.3.6D Group Action Factors, C_g, for 4" Shear Plate Connectors with Steel Side Plates[1]

$s = 9"$, $E_{wood} = 1{,}400{,}000$ psi, $E_{steel} = 30{,}000{,}000$ psi

A_m/A_s	A_m in.^{2}	Number of fasteners in a row										
		2	3	4	5	6	7	8	9	10	11	12
12	5	0.91	0.75	0.60	0.50	0.42	0.36	0.31	0.28	0.25	0.23	0.21
	8	0.94	0.80	0.67	0.56	0.47	0.41	0.36	0.32	0.29	0.26	0.24
	16	0.96	0.87	0.76	0.66	0.58	0.51	0.45	0.40	0.37	0.33	0.31
	24	0.97	0.90	0.82	0.73	0.64	0.57	0.51	0.46	0.42	0.39	0.35
	40	0.98	0.94	0.87	0.80	0.73	0.66	0.60	0.55	0.50	0.46	0.43
	64	0.99	0.96	0.91	0.86	0.80	0.74	0.69	0.63	0.59	0.55	0.51
	120	0.99	0.98	0.95	0.91	0.87	0.83	0.79	0.74	0.70	0.66	0.63
	200	1.00	0.99	0.97	0.95	0.92	0.89	0.85	0.82	0.79	0.75	0.72
18	5	0.97	0.83	0.68	0.56	0.47	0.41	0.36	0.32	0.28	0.26	0.24
	8	0.98	0.87	0.74	0.62	0.53	0.46	0.40	0.36	0.32	0.30	0.27
	16	0.99	0.92	0.82	0.73	0.64	0.56	0.50	0.45	0.41	0.37	0.34
	24	0.99	0.94	0.87	0.78	0.70	0.63	0.57	0.51	0.47	0.43	0.39
	40	0.99	0.96	0.91	0.85	0.78	0.72	0.66	0.60	0.55	0.51	0.47
	64	1.00	0.97	0.94	0.89	0.84	0.79	0.74	0.69	0.64	0.60	0.56
	120	1.00	0.99	0.97	0.94	0.90	0.87	0.83	0.79	0.75	0.71	0.67
	200	1.00	0.99	0.98	0.96	0.94	0.91	0.89	0.86	0.82	0.79	0.76
24	40	1.00	0.96	0.91	0.84	0.77	0.71	0.65	0.59	0.54	0.50	0.46
	64	1.00	0.98	0.94	0.89	0.84	0.78	0.73	0.68	0.63	0.58	0.54
	120	1.00	0.99	0.96	0.94	0.90	0.86	0.82	0.78	0.74	0.70	0.66
	200	1.00	0.99	0.98	0.96	0.94	0.91	0.88	0.85	0.82	0.78	0.75
30	40	0.99	0.93	0.86	0.78	0.70	0.63	0.57	0.52	0.47	0.43	0.40
	64	0.99	0.96	0.90	0.84	0.78	0.71	0.66	0.60	0.56	0.51	0.48
	120	0.99	0.98	0.94	0.90	0.86	0.81	0.76	0.71	0.67	0.63	0.59
	200	1.00	0.98	0.96	0.94	0.91	0.87	0.83	0.79	0.76	0.72	0.68
35	40	0.98	0.91	0.83	0.74	0.66	0.59	0.53	0.48	0.43	0.40	0.36
	64	0.99	0.94	0.88	0.81	0.73	0.67	0.61	0.56	0.51	0.47	0.43
	120	0.99	0.97	0.93	0.88	0.82	0.77	0.72	0.67	0.62	0.58	0.54
	200	1.00	0.98	0.95	0.92	0.88	0.84	0.80	0.76	0.71	0.68	0.64
42	40	0.97	0.88	0.79	0.69	0.61	0.54	0.48	0.43	0.39	0.36	0.33
	64	0.98	0.92	0.84	0.76	0.69	0.62	0.56	0.51	0.46	0.42	0.39
	120	0.99	0.95	0.90	0.85	0.78	0.72	0.67	0.62	0.57	0.53	0.49
	200	0.99	0.97	0.94	0.90	0.85	0.80	0.76	0.71	0.67	0.62	0.59
50	40	0.95	0.86	0.75	0.65	0.56	0.49	0.44	0.39	0.35	0.32	0.30
	64	0.97	0.90	0.81	0.72	0.64	0.57	0.51	0.46	0.42	0.38	0.35
	120	0.98	0.94	0.88	0.81	0.74	0.68	0.62	0.57	0.52	0.48	0.45
	200	0.99	0.96	0.92	0.87	0.82	0.77	0.71	0.66	0.62	0.58	0.54

1. Tabulated group action factors (C_g) are conservative for 2-5/8" shear plate connectors or $s < 9"$.

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Low-Roof Awning Calculations

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OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (pounds)
26. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies:		
Fabric construction supported by a skeleton structure	5 Nonreducible	
All other construction, except one- and two-family dwellings	20	
Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	
Primary roof members exposed to a work floor		
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages		2,000
All other primary roof members		300
Occupiable roofs:		
Roof gardens	100	
Assembly areas	100^{m}	
All other similar areas	Note 1	Note 1

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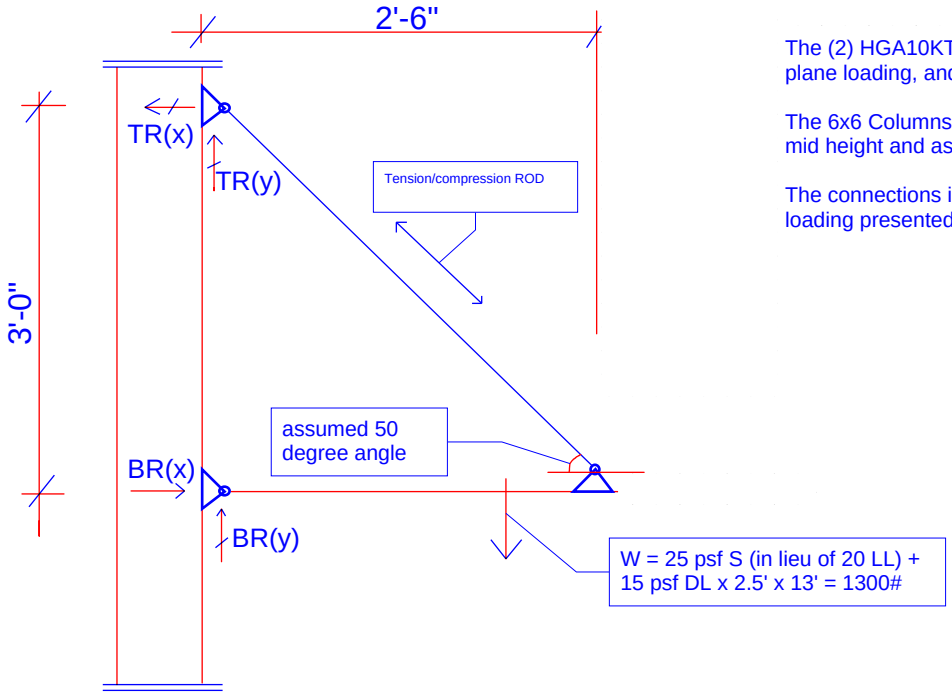
Notes (un-factored loads):

- Wind-loading is less than gravity, and hence system/connections are multi directional the gravity design governs the connection demand.



The (2) HGA10KT clips top and bottom of 6x6 post is sufficient for the out of plane loading, and estimated at a total capacity of 1500# +.

The 6x6 Columns are adequate to withstand an out of plan load of 675#, mid height and assumed to be balloon framed.

The connections in shear and withdrawal are adequate to withstand the loading presented here, see attached NDS documents/calculations.

M

R x Cos40 x 2.5 - W x 1.25 = 0
R = W x 1.25 / (2.5 x cos40)
R = 1300 x 1.25 / (2.5 x cos40) = R (each ROD) = 850#

V(y)

TR(y) = 850 x cos40 = 650#

BR(y) = TR(y) - W = 650#

V(x)

TR(x) = 850 x cos50 = 550#

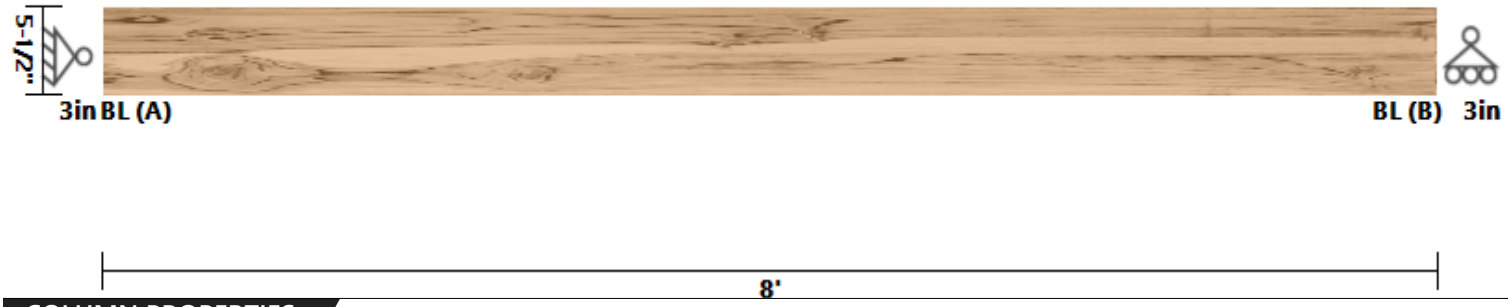
BR(x) = 850 x cos50 = 550#

PASS

DATE:	1/21/2025	COMPANY:	L120 Engineering & Design
STRUCALC BUILD:	StruCalc Plus	DESIGNED BY:	Spencer Boyle
CUSTOMER:		REVIEWED BY:	--
PROJ. ADDRESS:	-- --	PROJECT NAME:	Oneil Deck
LEVEL:	Roof	LOADING:	ASD
MEMBER NAME:	6x6 awning post	CODE:	2018 International Building Code
MEMBER TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	Solid Sawn		

Douglas Fir-Larch	No. 2	(1) 5.5 X 5.5	DRY		

6x6 awning post DIAGRAM



COLUMN PROPERTIES

Start(ft) 0 End(ft): 8

Area (in^2)	Ix (in^4)	Iy (in^4)	BSW (lbf/ft)	Lams	G	Kcr Creep Factor
30.25	76.25	76.25	6.9	1	0.5	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	750	475	170	700	625	1300	470
Adjusted Values	750	475	170	700	625	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1	1	1	1	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

Span	Length (ft)	Unbraced Length (ft) X	Unbraced Length (ft) Y	Column End Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	8	0	0.85	1.00	1.00	17.45	17.45

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Shear Stress Y (psi)	PASS (90.0%)	17.0	170.0	0	D+L	1
Bending Stress Y (psi)	PASS (40.8%)	442.7	748.3	3.04	D+L	1
Deflection Y (in)	PASS (64.7%)	0.094 (=L/1021)	0.267 (=L/360)	3.68	L	0
Compressive Stress (psi)	PASS (96.1%)	23.3	594.9	0	D+L	1
Bearing Stress (psi)	PASS (97.0%)	20.8	700.0	0	D+L	1
Bending-Compression (Unit)	PASS (39.9%)	0.60	1.00	2.96	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	WIND -	TOTAL
A	55	650	0	705
B	0	0	0	0
Y axis				
A	0	344	160	504
B	0	206	160	366

Reaction Location

A B

LOAD LIST

Type	Name	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Axial (lbf)	Axial	-650	-650	3	3	Live	Z
Point (lbf)	Point	550	-	3	-	Live	Y
Uniform (lbf/ft)	Uniform	40	40	0	8	WindMinus	Y
Self Weight (lbf/ft)	-	6.9	6.9	0	8	Dead	Z

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Table 2.3.2 Frequently Used Load Duration Factors, C_D[1]

Load Duration	C_D	Typical Design Loads
Permanent	0.9	Dead Load
Ten years	1.0	Occupancy Live Load
Two months	1.15	Snow Load
Seven days	1.25	Construction Load
Ten minutes	1.6	Wind/Earthquake Load
Impact[2]	2.0	Impact Load

1. Load duration factors shall not apply to reference modulus of elasticity, E, reference modulus of elasticity for beam and column stability, E_{min}, nor to reference compression perpendicular to grain design values, $F_{c\perp}$, based on a deformation limit.
2. Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with water-borne preservatives (see Reference 30), or fire retardant chemicals. The impact load duration factor shall not apply to connections.

2.3.3 Temperature Factor, C_t

Reference design values shall be multiplied by the temperature factors, C_t, in Table 2.3.3 for structural members that will experience sustained exposure to elevated temperatures up to 150°F (see Appendix C).

2.3.4 Fire Retardant Treatment

The effects of fire retardant chemical treatment on strength shall be accounted for in the design. Adjusted design values, including adjusted connection design values, for lumber and structural glued laminated timber pressure-treated with fire retardant chemicals shall be obtained from the company providing the treatment and redrying service. Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with fire retardant chemicals (see Table 2.3.2).

2.3.5 Format Conversion Factor, K_F (LRFD Only)

For LRFD, reference design values shall be multiplied by the format conversion factor, K_F, specified in Table 2.3.5. The format conversion factor, K_F, shall not apply for designs in accordance with ASD methods specified herein.

2.3.6 Resistance Factor, ϕ (LRFD Only)

For LRFD, reference design values shall be multiplied by the resistance factor, ϕ, specified in Table 2.3.6. The resistance factor, ϕ, shall not apply for designs in accordance with ASD methods specified herein.

2.3.7 Time Effect Factor, λ (LRFD Only)

For LRFD, reference design values shall be multiplied by the time effect factor, λ, specified in Appendix N.3.3. The time effect factor, λ, shall not apply for designs in accordance with ASD methods specified herein.

Table 2.3.3 Temperature Factor, C_t

Reference Design Values	In-Service Moisture Conditions[1]	C_t		
		T≤100°F	100°F<T≤125°F	125°F<T≤150°F
F_t, E, E_{min}	Wet or Dry	1.0	0.9	0.9
F_b, F_v, F_c, and $F_{c\perp}$	Dry	1.0	0.8	0.7
	Wet	1.0	0.7	0.5

1. Wet and dry service conditions for sawn lumber, structural glued laminated timber, prefabricated wood I-joists, structural composite lumber, wood structural panels and cross-laminated timber are specified in 4.1.4, 5.1.4, 7.1.4, 8.1.4, 9.3.3, and 10.1.5 respectively.

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Table 4.3.1 Applicability of Adjustment Factors for Sawn Lumber

		ASD only	ASD and LRFD										LRFD only		
		Load Duration Factor	Wet Service Factor	Temperature Factor	Beam Stability Factor	Size Factor	Flat Use Factor	Incising Factor	Repetitive Member Factor	Column Stability Factor	Buckling Stiffness Factor	Bearing Area Factor	Format Conversion Factor K_F	Resistance Factor ϕ	Time Effect Factor
$F_b' = F_b$	x	C_D	C_M	C_t	C_L	C_F	C_{fu}	C_i	C_r	-	-	-	2.54	0.85	λ
$F_t' = F_t$	x	C_D	C_M	C_t	-	C_F	-	C_i	-	-	-	-	2.70	0.80	λ
$F_v' = F_v$	x	C_D	C_M	C_t	-	-	-	C_i	-	-	-	-	2.88	0.75	λ
$F_c' = F_c$	x	C_D	C_M	C_t	-	C_F	-	C_i	-	C_P	-	-	2.40	0.90	λ
$F_{c\perp}' = F_{c\perp}$	x	-	C_M	C_t	-	-	-	C_i	-	-	-	C_b	1.67	0.90	-
$E' = E$	x	-	C_M	C_t	-	-	-	C_i	-	-	-	-	-	-	-
$E_{min}' = E_{min}$	x	-	C_M	C_t	-	-	-	C_i	-	-	C_T	-	1.76	0.85	-

4.3.5 Beam Stability Factor, C_L

Reference bending design values, F_b, shall be multiplied by the beam stability factor, C_L, specified in 3.3.3.

4.3.6 Size Factor, C_F

4.3.6.1 Reference bending, tension, and compression parallel to grain design values for visually graded dimension lumber 2" to 4" thick shall be multiplied by the size factors specified in Tables 4A and 4B.

4.3.6.2 Where the depth of a rectangular sawn lumber bending member 5" or thicker exceeds 12", the reference bending design values, F_b, in Table 4D shall be multiplied by the following size factor:

$$C_F = (12 / d)^{1/9} \leq 1.0 \qquad (4.3\text{-}1)$$

4.3.6.3 For beams of circular cross section with a diameter greater than 13.5", or for 12" or larger square beams loaded in the plane of the diagonal, the size factor shall be determined in accordance with 4.3.6.2 on the basis of an equivalent conventionally loaded square beam of the same cross-sectional area.

4.3.6.4 Reference bending design values for all species of 2" thick or 3" thick Decking, except Redwood, shall be multiplied by the size factors specified in Table 4E.

4.3.7 Flat Use Factor, C_{fu}

When sawn lumber 2" to 4" thick is loaded on the wide face, multiplying the reference bending design value, F_b, by the flat use factors, C_{fu}, specified in Tables 4A, 4B, 4C, and 4F, shall be permitted.

4.3.8 Incising Factor, C_i

Reference design values shall be multiplied by the following incising factor, C_i, when dimension lumber is incised parallel to grain a maximum depth of 0.4", a maximum length of 3/8", and density of incisions up to

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Table 5.3.1 Applicability of Adjustment Factors for Structural Glued Laminated Timber

	ASD only	ASD and LRFD										LRFD only		
	Load Duration Factor	Wet Service Factor	Temperature Factor	Beam Stability Factor [1]	Volume Factor [1]	Flat Use Factor	Curvature Factor	Stress Interaction Factor	Shear Reduction Factor	Column Stability Factor	Bearing Area Factor	Format Conversion Factor K_F	Resistance Factor ϕ	Time Effect Factor
$F_b' = F_b$ x	C_D	C_M	C_t	C_L	C_V	C_{fu}	C_c	C_I	-	-	-	2.54	0.85	λ
$F_t' = F_t$ x	C_D	C_M	C_t	-	-	-	-	-	-	-	-	2.70	0.80	λ
$F_v' = F_v$ x	C_D	C_M	C_t	-	-	-	-	-	C_{vr}	-	-	2.88	0.75	λ
$F_{rt}' = F_{rt}$ x	C_D	C_M	C_t	-	-	-	-	-	-	-	-	2.88	0.75	λ
$F_c' = F_c$ x	C_D	C_M	C_t	-	-	-	-	-	-	C_P	-	2.40	0.90	λ
$F_{c\perp}' = F_{c\perp}$ x	-	C_M	C_t	-	-	-	-	-	-	-	C_b	1.67	0.90	-
$E' = E$ x	-	C_M	C_t	-	-	-	-	-	-	-	-	-	-	-
$E_{min}' = E_{min}$ x	-	C_M	C_t	-	-	-	-	-	-	-	-	1.76	0.85	-

1. The beam stability factor, C_L, shall not apply simultaneously with the volume factor, C_V, for structural glued laminated timber bending members (see 5.3.6). Therefore, the lesser of these adjustment factors shall apply.

5.3.4 Temperature Factor, C_t

When structural members will experience sustained exposure to elevated temperatures up to 150°F (see Appendix C), reference design values shall be multiplied by the temperature factors, C_t, specified in 2.3.3.

5.3.5 Beam Stability Factor, C_L

Reference bending design values, F_b, shall be multiplied by the beam stability factor, C_L, specified in 3.3.3. The beam stability factor, C_L, shall not apply simultaneously with the volume factor, C_V, for structural glued laminated timber bending members (see 5.3.6). Therefore, the lesser of these adjustment factors shall apply.

5.3.6 Volume Factor, C_V

When structural glued laminated timber members are loaded in bending about the x-x axis, the reference bending design values, $\mathbf{F_{bx}^+}$, and $\mathbf{F_{bx}^-}$, shall be multiplied by the following volume factor:

$$C_v = \left(\frac{21}{L}\right)^{1/x}\left(\frac{12}{d}\right)^{1/x}\left(\frac{5.125}{b}\right)^{1/x} \le 1.0 \qquad (5.3\text{-}1)$$

where:

L = length of bending member between points of zero moment, ft

d = depth of bending member, in.

b = width (breadth) of bending member. For multiple piece width layups, b = width of widest piece used in the layup. Thus, b ≤ 10.75".

x = 20 for Southern Pine

x = 10 for all other species

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Table 8.3.1 Applicability of Adjustment Factors for Structural Composite Lumber

		ASD only	ASD and LRFD							LRFD only		
		Load Duration Factor	Wet Service Factor	Temperature Factor	Beam Stability Factor[1]	Volume Factor[1]	Repetitive Member Factor	Column Stability Factor	Bearing Area Factor	Format Conversion Factor K_F	Resistance Factor ϕ	Time Effect Factor
$F_b' = F_b$	x	C_D	C_M	C_t	C_L	C_V	C_r	-	-	2.54	0.85	λ
$F_t' = F_t$	x	C_D	C_M	C_t	-	-	-	-	-	2.70	0.80	λ
$F_v' = F_v$	x	C_D	C_M	C_t	-	-	-	-	-	2.88	0.75	λ
$F_c' = F_c$	x	C_D	C_M	C_t	-	-	-	C_P	-	2.40	0.90	λ
$F_{c\perp}' = F_{c\perp}$	x	-	C_M	C_t	-	-	-	-	C_b	1.67	0.90	-
$E' = E$	x	-	C_M	C_t	-	-	-	-	-	-	-	-
$E_{min}' = E_{min}$	x	-	C_M	C_t	-	-	-	-	-	1.76	0.85	-

1. See 8.3.6 for information on simultaneous application of the volume factor, C_v, and the beam stability factor, C_L.

8.3.2 Load Duration Factor, C_D (ASD Only)

All reference design values except modulus of elasticity, E, modulus of elasticity for beam and column stability, E_{min}, and compression perpendicular to grain, $F_{c\perp}$, shall be multiplied by load duration factors, C_D, as specified in 2.3.2.

8.3.3 Wet Service Factor, C_M

Reference design values for structural composite lumber are applicable to dry service conditions as specified in 8.1.4 where $C_M = 1.0$. When the service conditions differ from the specified conditions, adjustments for high moisture shall be in accordance with information provided by the structural composite lumber manufacturer.

8.3.4 Temperature Factor, C_t

When structural members will experience sustained exposure to elevated temperatures up to 150°F (see Appendix C), reference design values shall be multiplied by the temperature factors, C_t, specified in 2.3.3.

8.3.5 Beam Stability Factor, C_L

Structural composite lumber bending members shall be laterally supported in accordance with 3.3.3.

8.3.6 Volume Factor, C_V

Reference bending design values, F_b, for structural composite lumber shall be multiplied by the volume factor, C_V, and shall be obtained from the structural composite lumber manufacturer's literature or code evaluation reports. When $C_V \leq 1.0$, the volume factor,

LONGITUDE ONE TWENTY° ENGINEERING & DESIGN

PROJECT NO.	SHEET NO.

PROJECT _____

SUBJECT _____

BY _____ DATE ___/___/___

Table 11.3.1 Applicability of Adjustment Factors for Connections

		ASD Only	ASD and LRFD									LRFD Only		
		Load Duration Factor[1]	Wet Service Factor	Temperature Factor	Group Action Factor	Geometry Factor[3]	Penetration Depth Factor[3]	End Grain Factor[3]	Metal Side Plate Factor[3]	Diaphragm Factor[3]	Toe-Nail Factor[3]	Format Conversion Factor K_F	Resistance Factor ϕ	Time Effect Factor
Lateral Loads														
Dowel-type Fasteners (e.g. bolts, lag screws, wood screws, nails, spikes, drift bolts, & drift pins)	$Z' = Z$ x	C_D	C_M	C_t	C_g	C_Δ	-	C_{eg}	-	C_{di}	C_{tn}	3.32	0.65	λ
Split Ring and Shear Plate Connectors	$P' = P$ x	C_D	C_M	C_t	C_g	C_Δ	C_d	-	C_{st}	-	-	3.32	0.65	λ
	$Q' = Q$ x	C_D	C_M	C_t	C_g	C_Δ	C_d	-	-	-	-	3.32	0.65	λ
Timber Rivets	$P' = P$ x	C_D	C_M	C_t	-	-	-	-	C_{st}[4]	-	-	3.32	0.65	λ
	$Q' = Q$ x	C_D	C_M	C_t	-	C_Δ[5]	-	-	C_{st}[4]	-	-	3.32	0.65	λ
Spike Grids	$Z' = Z$ x	C_D	C_M	C_t	-	C_Δ	-	-	-	-	-	3.32	0.65	λ
Withdrawal Loads														
Nails, spikes, lag screws, wood screws, & drift pins	$W' = W$ x	C_D	C_M[2]	C_t	-	-	-	C_{eg}	-	-	C_{tn}	3.32	0.65	λ

1. The load duration factor, C_D, shall not exceed 1.6 for connections (see 11.3.2).
2. The wet service factor, C_M, shall not apply to toe-nails loaded in withdrawal (see 12.5.4.1).
3. Specific information concerning geometry factors C_Δ, penetration depth factors C_d, end grain factors, C_{eg}, metal side plate factors, C_{st}, diaphragm factors, C_{di}, and toe-nail factors, C_{tn}, is provided in Chapters 12, 13, and 14.
4. The metal side plate factor, C_{st}, is only applied when rivet capacity (P_r, Q_r) controls (see Chapter 14).
5. The geometry factor, C_Δ, is only applied when wood capacity, Q_w, controls (see Chapter 14).

11.3.2 Load Duration Factor, C_D (ASD Only)

Reference design values shall be multiplied by the load duration factors, $C_D \leq 1.6$, specified in 2.3.2 and Appendix B, except when the capacity of the connection is controlled by metal strength or strength of concrete/masonry (see 11.2.3, 11.2.4, and Appendix B.3). The impact load duration factor shall not apply to connections.

11.3.3 Wet Service Factor, C_M

Reference design values are for connections in wood seasoned to a moisture content of 19% or less and used under continuously dry conditions, as in most covered structures. For connections in wood that is unseasoned or partially seasoned, or when connections are exposed to wet service conditions in use, reference design values shall be multiplied by the wet service factors, C_M, specified in Table 11.3.3.

11.3.4 Temperature Factor, C_t

Reference design values shall be multiplied by the temperature factors, C_t, in Table 11.3.4 for connections that will experience sustained exposure to elevated temperatures up to 150°F (see Appendix C).

Strong-Drive®
SDWS **TIMBER** Screw

Structural Wood-to-Wood Connections Including Ledgers, Indoor/Outdoor Projects

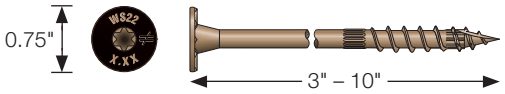
Designed to provide an easy-to-install, high-strength alternative to through-bolting and traditional lag screws. The Strong-Drive SDWS Timber screws are ideal for the contractor and do-it-yourselfer alike.

Double-barrier coating provides corrosion resistance equivalent to hot-dip galvanization, making it suitable for certain exterior and preservative-treated wood applications, as described in the evaluation report.

Codes/Standards: IAPMO-UES ER-192, State of Florida FL13975

US Patent 9,523,383

For more information, see p. 53, C-F-2019 Fastening Systems Catalog



SDWS Timber Screw — Allowable Shear Loads — Douglas Fir–Larch and Southern Pine Lumber

Size Dia.x L (in.)	Model No.	Thread Length (in.)	Reference DFL/SP Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2	2.5	3	3.5	4	4.5	6	8
0.22 x 3	SDWS22300DB	1½	255	—	—	—	—	—	—	—	—
0.22 x 4	SDWS22400DB	2⅜	405	405	305	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2¾	405	405	360	360	325	—	—	—	—
0.22 x 6	SDWS22600DB	2¾	405	405	405	405	365	365	355	—	—
0.22 x 8	SDWS22800DB	2¾	405	405	405	405	395	395	395	395	—
0.22 x 10	SDWS221000DB	2¾	405	405	405	405	395	395	395	395	395

1.15*325 *(4) screws min at ea connection = 1495#

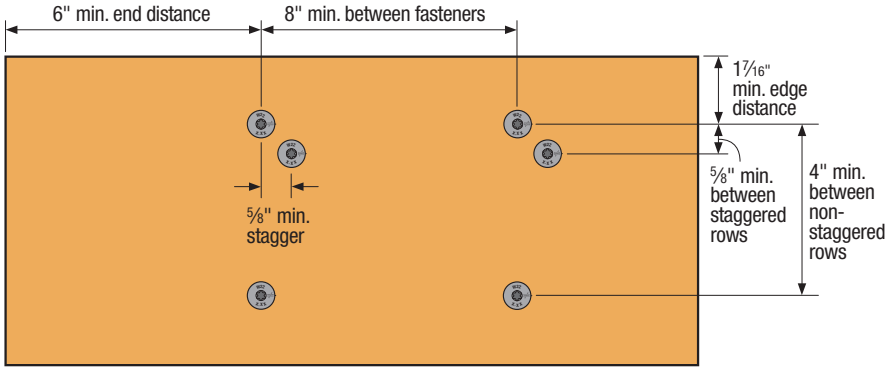
See footnotes below.

SDWS Timber Screw — Allowable Shear Loads — Spruce-Pine-Fir and Hem-Fir Lumber

Size Dia.x L (in.)	Model No.	Thread Length (in.)	Reference SPF/HF Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2	2.5	3	3.5	4	4.5	6	8
0.22 x 3	SDWS22300DB	1½	190	—	—	—	—	—	—	—	—
0.22 x 4	SDWS22400DB	2⅜	385	285	215	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2¾	405	290	290	290	195	—	—	—	—
0.22 x 6	SDWS22600DB	2¾	405	365	365	365	310	310	210	—	—
0.22 x 8	SDWS22800DB	2¾	405	365	365	365	310	310	280	280	—
0.22 x 10	SDWS221000DB	2¾	405	365	365	365	310	310	280	280	280

1. All applications are based on full penetration into the main member. Full penetration is the screw length minus the side member thickness.
2. Allowable loads are shown at the wood load duration factor of C_D = 1.0. Loads may be increased for load duration per the building code up to a C_D = 1.6. Tabulated values must be multiplied by all applicable adjustment factors per the NDS.
3. Minimum fastener spacing requirements to achieve table loads: 6" end distance, 1 7⁄16" edge distance, ⅝" between staggered rows of fasteners, 4" between non-staggered rows of fasteners and 8" between fasteners in a row.
4. For in-service moisture content greater than 19%, use C_M = 0.7.
5. Loads are based on installation into the side grain of the wood with the screw axis perpendicular to the face of the member.

Strong-Drive® SDWS **TIMBER** Screw (cont.)



SDWS Timber Screw Spacing Requirements

SDWS Timber Screw — Allowable Withdrawal Loads — Douglas Fir–Larch, Southern Pine, Spruce-Pine-Fir and Hem-Fir Lumber

Model No.	Fastener Length (in.)	Thread Length (in.)	Reference Withdrawal Design Value, W (lb./in.)		Max. Reference Withdrawal Design Value, W_{max} (lb.)	
			DFL and SP Main Member	HF and SPF Main Member	DFL and SP Main Member	HF and SPF Main Member
SDWS22300DB	3	1½	164	151	245	225
SDWS22400DB	4	2⅜	179	160	425	380
SDWS22500DB	5	2¾	214	187	590	495
SDWS22600DB	6	2¾	214	187	590	495
SDWS22800DB	8	2¾	214	187	590	495
SDWS221000DB	10	2¾	214	187	590	495

1. The tabulated reference withdrawal design value, W, is in pounds per inch of the thread penetration into the side grain of the main member.
2. The tabulated reference withdrawal design value, W_{Max}, is in pounds where the entire thread length must penetrate into the side grain of the main member.
3. Tabulated reference withdrawal design values, W and W_{Max}, are shown at a C_D = 1.0. Loads may be increased for load duration per the building code up to a C_D = 1.6. Tabulated values must be multiplied by all applicable adjustment factors from the NDS as referenced in the IBC or IRC.
4. Embedded thread length is that portion held in the main member including the screw tip.
5. Values are based on the lesser of withdrawal from the main member or pull-through of a 1½" side member.
6. For in-service moisture content greater than 19%, use C_M = 0.7.

1.15*214*3"min*(4) screws min at ea connection = 2953#

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

TYPICAL POSTS

PASS

DATE:	3/3/2021	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Roof	LOADING:	ASD
LOCATION:	2X4 STUD @ 16"	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(1) 1.5 X 3.5	DRY		

2X4 STUD @ 16" DIAGRAM

COLUMN PROPERTIES

Start (ft): 0 End (ft): 8 Member Slope: 0/12 Actual Length (ft): 8

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
5.25	5.36	0.98	1.04	1	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1275	788	150	1495	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.5	1.5	1	1.15	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	4	0	0.24	1.00	1.00	27.43	32

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (90.5%)	0.025 (=L/3795)	0.267 (=L/360)	8	L	
Compressive Stress (psi)	PASS (3.0%)	344.4	355.2	0	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	8	1800	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-1800	-	8	-	Live	Z
Self Weight (lbf/ft)	1.04	1.04	0	8	Dead	Z

NOTES

PASS

DATE:	10/8/2020	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Main Floor	LOADING:	ASD
LOCATION:	2x4 @ 12" o.c.	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(1) 1.5 X 3.5	DRY		

2x4 @ 12" o.c. DIAGRAM

COLUMN PROPERTIES

Start (ft): 0 End (ft): 9 Member Slope: 0/12 Actual Length (ft): 9

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
5.25	5.36	0.98	1.04	1	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1275	788	150	1495	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.5	1.5	1	1.15	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	9	9	2	0	0.25	1.00	1.00	30.86	16

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (89.7%)	0.031 (=L/3495)	0.300 (=L/360)	9	L	
Compressive Stress (psi)	PASS (1.8%)	373.2	379.9	0	D+L	1
Tensile Stress (psi)	PASS (100.0%)	0.0	708.8	9	D	0.9

REACTIONS

V-(lbf) M-(lbf-ft)

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	9	1950	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-1950	-	9	-	Live	Z
Self Weight (lbf/ft)	1.04	1.04	0	9	Dead	Z

NOTES

PASS

DATE:	3/3/2021	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Roof	LOADING:	ASD
LOCATION:	(2) 2x4 (unbraced)	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(2) 1.5 X 3.5	DRY		

COLUMN PROPERTIES

Start (ft): 0 End (ft): 8 Member Slope: 0/12 Actual Length (ft): 8

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
10.5	10.72	1.97	2.07	2	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1275	788	150	1495	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.5	1.5	1	1.15	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	8	0	0.14	1.00	1.00	27.43	32

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (96.0%)	0.011 (=L/9144)	0.267 (=L/360)	8	L	
Compressive Stress (psi)	PASS (0.9%)	211.1	213.1	0	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	717	1500	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-1500	-	8	-	Live	Z
Point (lbf)	-700	-	8	-	Dead	Z
Self Weight (lbf/ft)	2.07	2.07	0	8	Dead	Z

NOTES

PASS

DATE:	3/3/2021	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Roof	LOADING:	ASD
LOCATION:	(3) 2x4 (unbraced)	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(3) 1.5 X 3.5	DRY		

COLUMN PROPERTIES

Start (ft): 0 End (ft): 8 Member Slope: 0/12 Actual Length (ft): 8

Area (in^2)	Ix (in^4)	Iy (in^4)	BSW (lbf/ft)	Lams	G	Kcr Creep Factor
15.75	16.08	2.95	3.11	3	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1275	788	150	1495	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.5	1.5	1	1.15	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	8	0	0.29	1.00	1.00	27.43	21.33

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (93.0%)	0.019 (=L/5107)	0.267 (=L/360)	8	L	
Compressive Stress (psi)	PASS (3.7%)	414.3	430.1	0	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	2525	4000	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-4000	-	8	-	Live	Z
Point (lbf)	-2500	-	8	-	Dead	Z
Self Weight (lbf/ft)	3.11	3.11	0	8	Dead	Z

NOTES

PASS

DATE:	3/3/2021	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Roof	LOADING:	ASD
LOCATION:	(4) 2x4 (Unbraced)	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(4) 1.5 X 3.5	DRY		

COLUMN PROPERTIES

Start (ft): 0 End (ft): 8 Member Slope: 0/12 Actual Length (ft): 8

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
21	21.44	3.94	4.14	4	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1275	788	150	1495	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.5	1.5	1	1.15	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	8	0	0.32	1.00	1.00	27.43	16

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (92.7%)	0.019 (=L/4975)	0.267 (=L/360)	8	L	
Compressive Stress (psi)	PASS (3.5%)	454.0	470.3	0	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	4033	5500	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-4000	-	8	-	Dead	Z
Point (lbf)	-5500	-	8	-	Live	Z
Self Weight (lbf/ft)	4.14	4.14	0	8	Dead	Z

NOTES

PASS

DATE:	10/9/2020	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Main Floor	LOADING:	ASD
LOCATION:	2x6 stud	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(1) 1.5 X 5.5	DRY		

2x6 stud DIAGRAM

COLUMN PROPERTIES

Start (ft): 0 End (ft): 9 Member Slope: 0/12 Actual Length (ft): 9

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
8.25	20.8	1.55	1.63	1	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1105	682	150	1430	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.3	1.3	1	1.1	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	9	9	2	0	0.56	1.00	1.00	19.64	16

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (88.3%)	0.035 (=L/3068)	0.300 (=L/360)	9	L	
Compressive Stress (psi)	PASS (1.2%)	789.7	799.3	0	D+L	1

REACTIONS

V-(lbf) M-(lbf-ft)

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	3015	3500	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-3500	-	9	-	Live	Z
Point (lbf)	-3000	-	9	-	Dead	Z
Self Weight (lbf/ft)	1.63	1.63	0	9	Dead	Z

NOTES

PASS

DATE:	3/3/2021	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Roof	LOADING:	ASD
LOCATION:	(2) 2x6 (Unbraced)	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(2) 1.5 X 5.5	DRY		

COLUMN PROPERTIES

Start (ft): 0 End (ft): 8 Member Slope: 0/12 Actual Length (ft): 8

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
16.5	41.59	3.09	3.26	2	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1105	682	150	1430	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.3	1.3	1	1.1	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	8	0	0.15	1.00	1.00	17.45	32

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (96.6%)	0.009 (=L/10668)	0.267 (=L/360)	8	L	
Compressive Stress (psi)	PASS (2.2%)	207.6	212.4	0	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	1426	2000	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-1400	-	8	-	Dead	Z
Point (lbf)	-2000	-	8	-	Live	Z
Self Weight (lbf/ft)	3.26	3.26	0	8	Dead	Z

NOTES

PASS

DATE:	3/3/2021	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Roof	LOADING:	ASD
LOCATION:	(3) 2x6 (Unbraced)	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(3) 1.5 X 5.5	DRY		

COLUMN PROPERTIES

Start (ft): 0 End (ft): 8 Member Slope: 0/12 Actual Length (ft): 8

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
24.75	62.39	4.64	4.88	3	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1105	682	150	1430	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.3	1.3	1	1.1	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	8	0	0.30	1.00	1.00	17.45	21.33

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (93.3%)	0.018 (=L/5364)	0.267 (=L/360)	8	L	
Compressive Stress (psi)	PASS (4.7%)	405.6	425.6	0	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	4039	6000	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-4000	-	8	-	Dead	Z
Point (lbf)	-6000	-	8	-	Live	Z
Self Weight (lbf/ft)	4.88	4.88	0	8	Dead	Z

NOTES

PASS

DATE:	3/3/2021	COMPANY:	L120 Engineering & Design, LLC
VITRUVIUS BUILD:	StruCalc	DESIGNED BY:	Mans Thurfjell
CUSTOMER:		REVIEWED BY:	Mans Thurfjell
PROJECT LOCATION:	,		
LEVEL:	Roof	LOADING:	ASD
LOCATION:	(4) 2x6 (Unbraced)	CODE:	2018 International Building Code
TYPE:	COLUMN	NDS:	2018 NDS
MATERIAL:	SOLID SAWN		

Hem-Fir	No. 2	(4) 1.5 X 5.5	DRY		

COLUMN PROPERTIES

Start (ft): 0 End (ft): 8 Member Slope: 0/12 Actual Length (ft): 8

Area	Ix	Iy	BSW	Lams	G	Kcr
(in^2)	(in^4)	(in^4)	(lbf/ft)			Creep Factor
33	83.19	6.19	6.51	4	0.43	1

STRENGTH PROPERTIES

	Fb (psi)	Ft (psi)	Fv (psi)	Fc (psi)	Fc⊥ (psi)	E (psi) x10^3	Emin (psi) x10^3
Base Values	850	525	150	1300	405	1300	470
Adjusted Values	1105	682	150	1430	405	1300	470
C_M	1	1	1	1	1	1	1
C_T	1	1	1	1	1	1	1
C_i	1	1	1	1	1	1	1
C_F	1.3	1.3	1	1.1	1	1	1

Bending Adjustment Factors C_{fu} = 1 C_r = 1

COLUMN DATA

		Unbraced Length (ft)		Column End					
Span	Length (ft)	X	Y	Offset	CP	Ke(X Axis)	Ke(Y Axis)	KeL/d (X Axis)	KeL/d (Y Axis)
1	8	8	8	0	0.43	1.00	1.00	17.45	16

PASS-FAIL

	PASS/FAIL	MAGNITUDE	STRENGTH	LOCATION (ft)	LOAD COMBO	DURATION FACTOR CD
Deflection (in)	PASS (91.6%)	0.022 (=L/4286)	0.267 (=L/360)	8	L	
Compressive Stress (psi)	PASS (10.1%)	547.0	608.6	0	D+L	1

REACTIONS

Units for V: lbf Units for M: lbf-ft

Z axis	DEAD	LIVE	LIVE ROOF	SNOW	WIND +	WIND -	SEISMIC +	SEISMIC -	ICE	RAIN	EARTH
A	8052	10000	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0

Reaction Location

A B

LOAD LIST

Type	Left Magnitude	Right Magnitude	Load Start (ft)	Load End (ft)	Load Type	Direction
Point (lbf)	-8000	-	8	-	Dead	Z
Point (lbf)	-10000	-	8	-	Live	Z
Self Weight (lbf/ft)	6.51	6.51	0	8	Dead	Z

NOTES

MEMBER REPORT

PASSED

Level, 4x4 POST (10FT)

1 piece(s) 4 x 4 Douglas Fir-Larch No. 2

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	34	50	Passed (69%)	--	--
Compression (lbs)	4500	4710	Passed (96%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	4500	396900	Passed (1%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	2000	2500	Default Load

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

MEMBER REPORT

PASSED

Level, 4x4 POST (9FT)

1 piece(s) 4 x 4 Douglas Fir-Larch No. 2

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	31	50	Passed (62%)	--	--
Compression (lbs)	5500	5727	Passed (96%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	5500	396900	Passed (1%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	2000	3500	Default Load

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

PASSED

Level, 4x6 POST (10FT)

1 piece(s) 4 x 6 Douglas Fir-Larch No. 2

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	34	50	Passed (69%)	--	--
Compression (lbs)	7000	7380	Passed (95%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	7000	623700	Passed (1%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	3000	4000	Default Load

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MEMBER REPORT

PASSED

Level, 4x6 POST (9FT)

1 piece(s) 4 x 6 Douglas Fir-Larch No. 2

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	31	50	Passed (62%)	--	--
Compression (lbs)	8500	8966	Passed (95%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	8500	623700	Passed (1%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	4000	4500	Default Load

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MEMBER REPORT

PASSED

Level, 4x8 POST (10FT)

1 piece(s) 4 x 8 Douglas Fir-Larch No. 2

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	34	50	Passed (69%)	--	--
Compression (lbs)	9500	9698	Passed (98%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	9500	822150	Passed (1%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	4500	5000	Default Load

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MEMBER REPORT

PASSED

Level, 4x8 POST (9FT)

1 piece(s) 4 x 8 Douglas Fir-Larch No. 2

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	31	50	Passed (62%)	--	--
Compression (lbs)	11000	11769	Passed (93%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	11000	822150	Passed (1%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	5000	6000	Default Load

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

MEMBER REPORT

PASSED

Level, 6x6 POST (10FT)

1 piece(s) 6 x 6 Douglas Fir-Larch No. 2

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	22	50	Passed (44%)	--	--
Compression (lbs)	16500	16897	Passed (98%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	16500	980100	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	8000	8500	Default Load

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

PASSED

Level, 6x6 POST (9FT)

1 piece(s) 6 x 6 Douglas Fir-Larch No. 2

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	20	50	Passed (39%)	--	--
Compression (lbs)	18000	18529	Passed (97%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	18000	980100	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	9000	9000	Default Load

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PASSED

Level, 6x8 POST (10FT)

1 piece(s) 6 x 8 Douglas Fir-Larch No. 2

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	22	50	Passed (44%)	--	--
Compression (lbs)	22000	23041	Passed (95%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	22000	1336500	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	11000	11000	Default Load

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

PASSED

Level, 6x8 POST (9FT)

1 piece(s) 6 x 8 Douglas Fir-Larch No. 2

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	20	50	Passed (39%)	--	--
Compression (lbs)	24000	25267	Passed (95%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	24000	1336500	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	11000	13000	Default Load

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MEMBER REPORT

PASSED

Level, 3.5X3.5 PSL (10FT)

1 piece(s) 3 1/2" x 3 1/2" 1.8E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	34	50	Passed (69%)	--	--
Compression (lbs)	7500	7626	Passed (98%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	7500	396900	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	3500	4000	Default Load

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MEMBER REPORT

PASSED

Level, 3.5X3.5 PSL (9FT)

1 piece(s) 3 1/2" x 3 1/2" 1.8E Parallam® PSL

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	31	50	Passed (62%)	--	--
Compression (lbs)	9250	9338	Passed (99%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	9250	396900	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	4250	5000	Default Load

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FORTE WEB

MEMBER REPORT

PASSED

Level, 3.5X5.25 PSL (10FT)

1 piece(s) 3 1/2" x 5 1/4" 1.8E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	34	50	Passed (69%)	--	--
Compression (lbs)	11000	11439	Passed (96%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	11000	595350	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	5000	6000	Default Load

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FORTE WEB

MEMBER REPORT

PASSED

Level, 3.5X5.25 PSL (9FT)

1 piece(s) 3 1/2" x 5 1/4" 1.8E Parallam® PSL

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	31	50	Passed (62%)	--	--
Compression (lbs)	14000	14007	Passed (100%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	14000	595350	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	6500	7500	Default Load

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MEMBER REPORT

PASSED

Level, 3.5X7PSL (10FT)

1 piece(s) 3 1/2" x 7" 1.8E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	34	50	Passed (69%)	--	--
Compression (lbs)	15000	15252	Passed (98%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	15000	793800	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	7000	8000	Default Load

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MEMBER REPORT

PASSED

Level, 3.5X7PSL (9FT)

1 piece(s) 3 1/2" x 7" 1.8E Parallam® PSL

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	31	50	Passed (62%)	--	--
Compression (lbs)	18000	18677	Passed (96%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	18000	793800	Passed (2%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	8500	9500	Default Load

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FORTE WEB

MEMBER REPORT

PASSED

Level, 5.25X5.25 PSL (10FT)
1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	23	50	Passed (46%)	--	--
Compression (lbs)	35000	36546	Passed (96%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	35000	893025	Passed (4%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	15000	20000	Default Load

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FORTE WEB

MEMBER REPORT

PASSED

Level, 5.25X5.25 PSL (9FT)

1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	21	50	Passed (41%)	--	--
Compression (lbs)	42500	43634	Passed (97%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	42500	893025	Passed (5%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	20000	22500	Default Load

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MEMBER REPORT

PASSED

Level, 5.25X7 PSL (10FT)

1 piece(s) 5 1/4" x 7" 1.8E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	23	50	Passed (46%)	--	--
Compression (lbs)	47500	48728	Passed (97%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	47500	1190700	Passed (4%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	20000	27500	Default Load

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MEMBER REPORT

PASSED

Level, 5.25X7 PSL (9FT)

1 piece(s) 5 1/4" x 7" 1.8E Parallam® PSL

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	21	50	Passed (41%)	--	--
Compression (lbs)	57500	58179	Passed (99%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	57500	1190700	Passed (5%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	25000	32500	Default Load

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

MEMBER REPORT

PASSED

Level, 7X7 PSL (10FT)

1 piece(s) 7" x 7" 1.8E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	17	50	Passed (34%)	--	--
Compression (lbs)	100000	100441	Passed (100%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	100000	1587600	Passed (6%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	50000	50000	Default Load

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MEMBER REPORT

PASSED

Level, 7X7 PSL (9FT)

1 piece(s) 7" x 7" 1.8E Parallam® PSL

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	15	50	Passed (31%)	--	--
Compression (lbs)	110000	111804	Passed (98%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	110000	1587600	Passed (7%)	--	1.0 D + 1.0 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	50000	60000	Default Load

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

MEMBER REPORT

PASSED

Level, 7X9.25 PSL (10FT)

1 piece(s) 7" x 9 1/4" 2.0E Parallam® PSL

Post Height: 10'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	17	50	Passed (34%)	--	--
Compression (lbs)	125000	149992	Passed (83%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	125000	2097900	Passed (6%)	--	1.0 D + 1.0 S
Bending/Compression	0.89	1	Passed (89%)	1.15	1.0 D + 1.0 S

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- Initial eccentricity applied as per ESR-1387.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	50000	75000	Default Load

Weyerhaeuser Notes

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

FORTE WEB

MEMBER REPORT

PASSED

Level, 7X9.25 PSL (9FT)

1 piece(s) 7" x 9 1/4" 2.0E Parallam® PSL

Post Height: 9'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	15	50	Passed (31%)	--	--
Compression (lbs)	145000	168143	Passed (86%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	145000	2097900	Passed (7%)	--	1.0 D + 1.0 S
Bending/Compression	0.91	1	Passed (91%)	1.15	1.0 D + 1.0 S

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- Initial eccentricity applied as per ESR-1387.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	65000	80000	Default Load

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