

Structural Calculations

For

Ramaiyah Residence

7466 E Mercer Way, Mercer Island, WA 98040

March 11, 2024



Prepared by

Brian Lampe
Mariam Soliman

STRUCTURAL CALCULATIONS SHEET INDEX

Project Name
Project Address

Item	Page #
Criteria	
• Design Criteria.....	C1.1
Gravity	
• Roof Framing	
✓ Key Plans	R1.1
✓ Beams	R2.1
• Upper Floor Framing	
✓ Key Plans	U1.1
✓ Beams	U2.1
• Main Floor Framing	
✓ Key Plans	MF1.1
✓ Beams	MF2.1
Lateral	
• Forces	
✓ Criteria	L1.1
✓ Building Geometry	L1.2
✓ Seismic Parameters	L1.3
✓ Wind Lateral Loads.....	L1.4
✓ Vertical Distribution of Lateral Forces.....	L1.5
• Shear Walls/Diaphragms	
✓ Roof Diaphragm Forces/ Upper Floor Diaphragm Forces	L2.1
✓ Shear Wall Forces	L2.2
✓ Shear Wall Analysis.....	L2.3
• Shear Wall/Diaphragm Capacities	
✓ Allowable Diaphragm Stresses.....	L3.1
✓ Allowable Shear Wall Stresses.....	L3.2
✓ Shear Wall Anchor Bolts	L3.3
✓ Shear Wall Schedule.....	L3.4
Miscellaneous	
• Stud Wall Design.....	M1.1
• Post Design	M1.3
• Footing Design	M2.1

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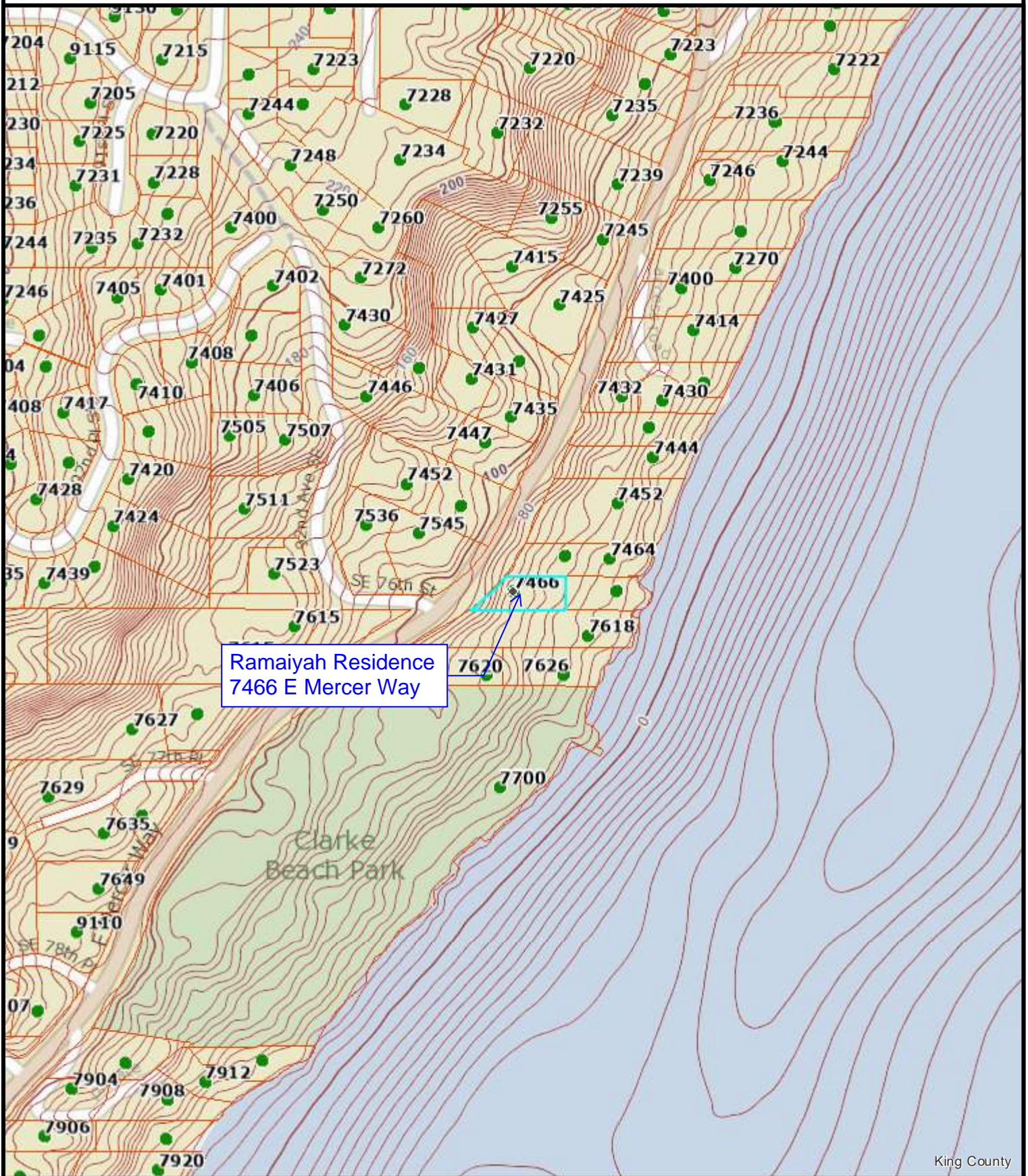
Criteria



Project: Ramaiyah Residence
Project Number: 7466 E Mercer Way

Code:	IBC 2018		
	Risk Category	II	
Earthquake:	Site Class	D	
		$I_e = 1.00$	$R = 6.5$
		$S_S = 1.454$	$\Omega_0 = 3.0$
		$S_1 = 0.502$	$C_d = 4.0$
		$\rho = 1.00$	
Wind:	Basic Design Wind Speed, V	100 MPH	
	Exposure	C	
	Topographic Factor	$K_{ZT} = 1.00$	
Soil Bearing:	1500-psf Allowable Soil Bearing Pressure		
Concrete:	2500-psi Concrete Strength		
	Higher strength may be used, but special inspection and testing reports not req'd		
Nails:	Sheathing	8d common (2½" x 0.131")	
	Framing	12d box (3¼" x 0.131")	
Roof Framing:			
<i>Snow Load</i>	Ground Snow, Pg		25 psf
		Exposure factor, Ce	1.0
		Thermal Factor, Ct	1.2
	Flat Roof Snow, Pf (0.7 Ce Ct I Pg)		21 psf
	Use Snow Load		25 psf
<i>Dead Load</i>	Roofing - Membrane		4.0 psf
	Sheathing - Plywood		2.2 psf
	Framing - I-Joists @ 24"oc		2.5 psf
	Insulation		1.0 psf
	Ceiling - 5/8 GWB		2.8 psf
	Misc.		2.5 psf
		Total	15 psf
<i>Deflection</i>	L/360 Live Load, L/240 Total Load		
Floor Framing:			
<i>Live Load</i>	Residential		40 psf
	Decks		60 psf
<i>Dead Load</i>	Finish Floor - Allowance for Tile		10.0 psf
	Sheathing - 3/4 Plywood/Edge Gold		2.5 psf
	Framing - I-Joists @ 16"oc		2.7 psf
	Ceiling - 5/8 GWB		2.8 psf
	Misc.		2.0 psf
		Total	20 psf
<i>Deflection</i>	L/480 Live Load, L/240 Total Load		
Wall Framing:			
<i>Dead Load</i>	Exterior 2x Stud Walls		10 psf
	Interior 2x Stud Walls		8 psf

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King County

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Date: 2/20/2024

Notes:



King County
C1.2



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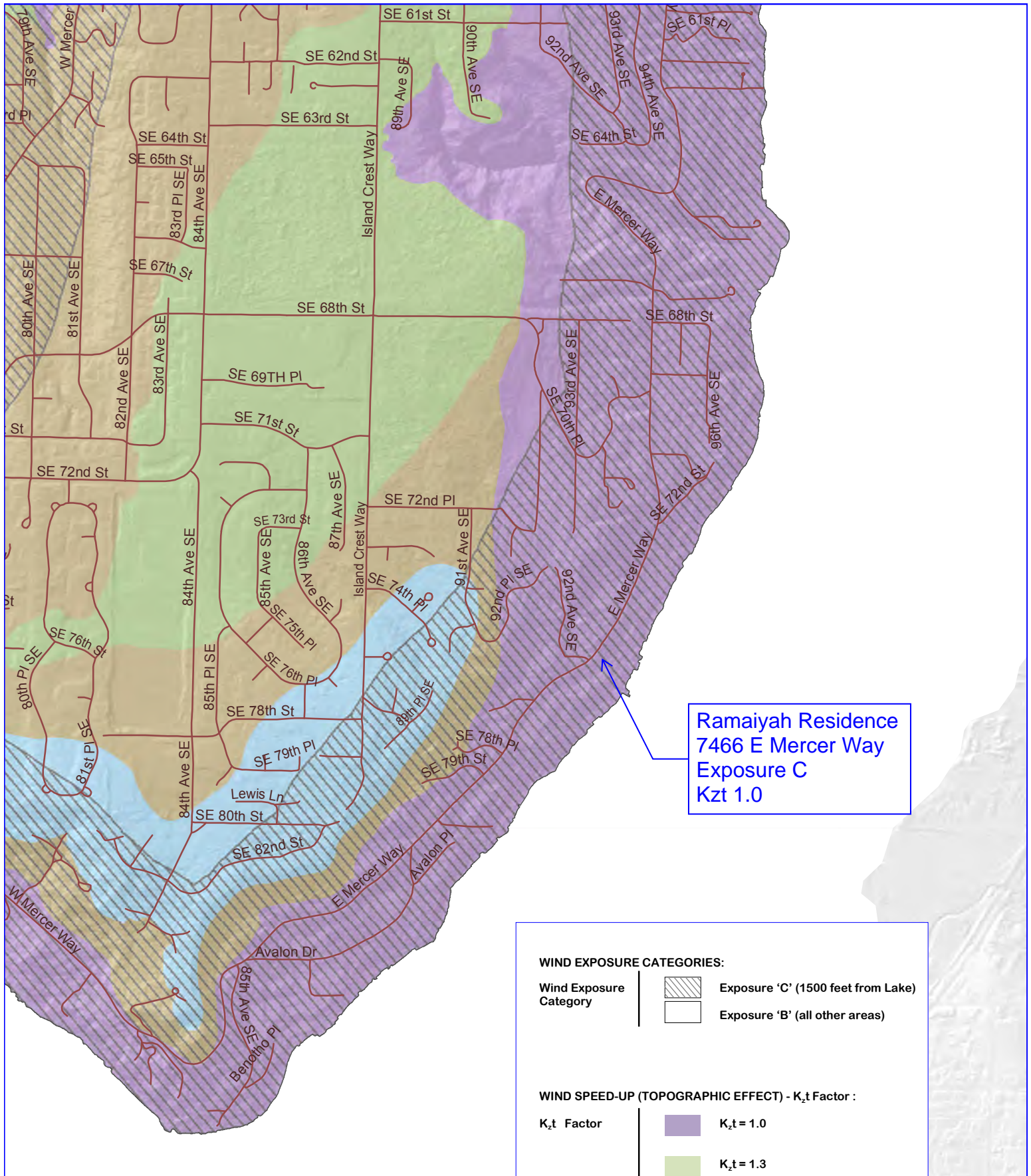
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Date	2/20/2024, 10:17:34 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S _S	1.454	MCE _R ground motion. (for 0.2 second period)
S ₁	0.502	MCE _R ground motion. (for 1.0s period)
S _{MS}	1.454	Site-modified spectral acceleration value
S _{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S _{DS}	0.969	Numeric seismic design value at 0.2 second SA
S _{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F _a	1	Site amplification factor at 0.2 second
F _v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.622	MCE _G peak ground acceleration
F _{PGA}	1.1	Site amplification factor at PGA
PGA _M	0.684	Site modified peak ground acceleration
T _L	6	Long-period transition period in seconds
SsRT	1.454	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.612	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	4.313	Factored deterministic acceleration value. (0.2 second)
S1RT	0.502	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.559	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.639	Factored deterministic acceleration value. (1.0 second)
PGA _d	1.424	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA _{UH}	0.622	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C _{RS}	0.902	Mapped value of the risk coefficient at short periods
C _{R1}	0.898	Mapped value of the risk coefficient at a period of 1 s
C _V	1.391	Vertical coefficient



Ramayah Residence
 7466 E Mercer Way
 Exposure C
 Kzt 1.0

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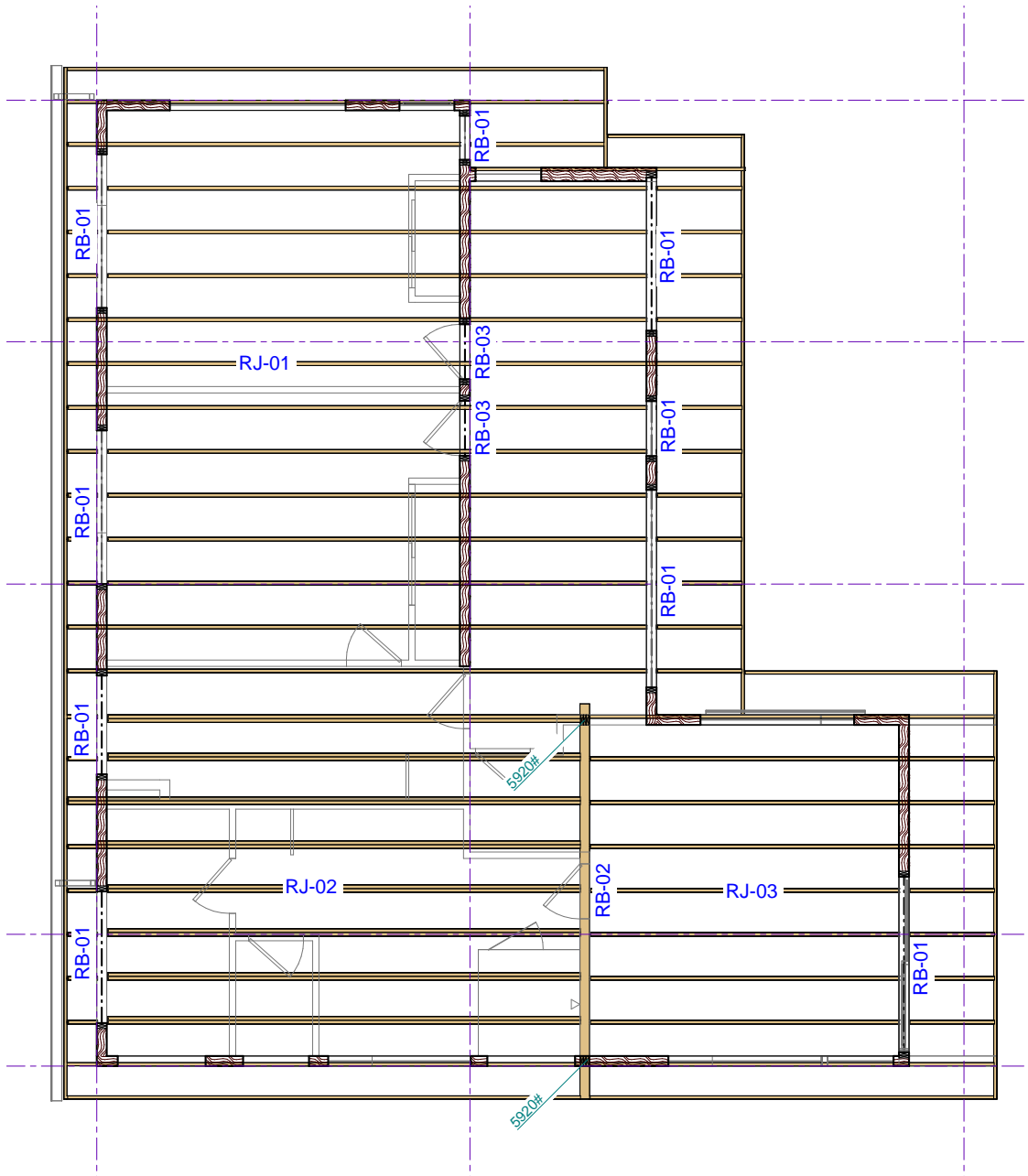
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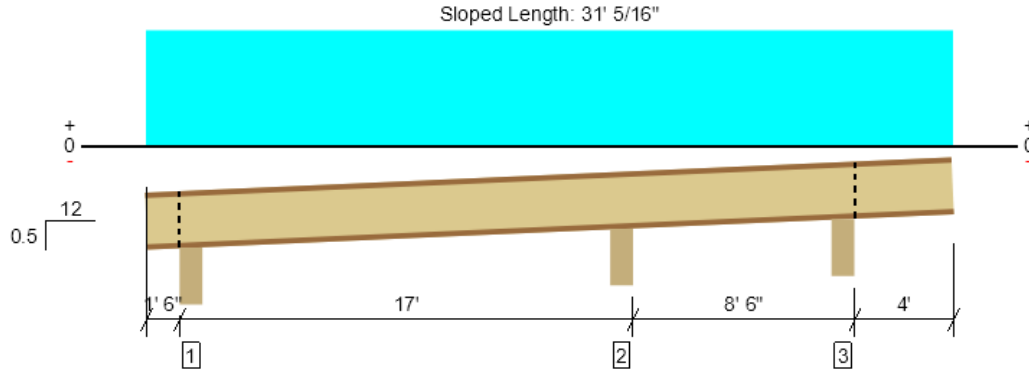
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Gravity
Roof Framing



Roof Framing Key Plan

ROOF, RJ-01
1 piece(s) 11 7/8" TJI @ 210 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1285 @ 18' 3 1/4"	2952 (5.25")	Passed (44%)	1.15	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	720 @ 18' 1/2"	1903	Passed (38%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	-1943 @ 18' 3 1/4"	4364	Passed (45%)	1.15	1.0 D + 1.0 S (Adj Spans)
Live Load Defl. (in)	0.191 @ 9' 4 3/8"	0.552	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.300 @ 9' 4 1/8"	0.828	Passed (L/662)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 31' 13/16"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.5/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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 - Beveled Plate - SPF	5.50"	5.50"	3.50"	260	438	698	Blocking
2 - Beveled Plate - SPF	5.50"	5.50"	3.50"	468	817	1285	None
3 - Beveled Plate - SPF	5.50"	5.50"	3.50"	203	404	607	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 5" o/c	
Bottom Edge (Lu)	5' 3" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 31'	24"	15.0	25.0	ROOF

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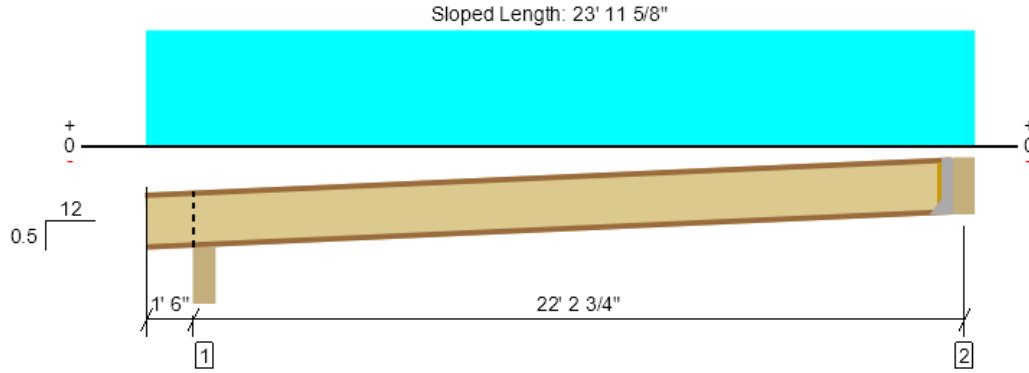
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



ROOF, RJ-02
2 piece(s) 11 7/8" TJI @ 210 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	868 @ 23' 6 1/8"	2312 (1.75")	Passed (38%)	1.15	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	868 @ 23' 6 1/8"	3807	Passed (23%)	1.15	1.0 D + 1.0 S (Alt Spans)
Moment (Ft-lbs)	4705 @ 12' 8"	8729	Passed (54%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.426 @ 12' 7 9/16"	0.727	Passed (L/614)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.680 @ 12' 7 5/8"	1.090	Passed (L/385)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 23' 6 7/8"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.5/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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 - Beveled Plate - SPF	5.50"	5.50"	3.50"	381	634	1015	Blocking
2 - Hanger on 11 7/8" PSL beam	5.25"	Hanger ¹	1.75" / - ²	338	565	903	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.
- ² Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 9" o/c	
Bottom Edge (Lu)	8' 8" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	HU4.28/9X SLD2	2.50"	N/A	18-10dx1.5	8-10d	Web Stiffeners

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

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 23' 11 3/8"	24"	15.0	25.0	ROOF

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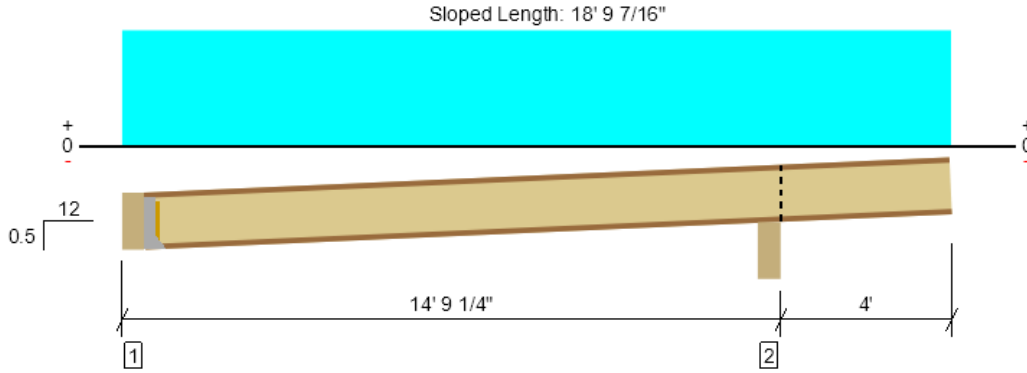
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ForteWEB Software Operator	Job Notes
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ROOF, RJ-03
1 piece(s) 11 7/8" TJI @ 210 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	529 @ 5 1/4"	1156 (1.75")	Passed (46%)	1.15	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	568 @ 14' 3 3/4"	1903	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1751 @ 7' 5/8"	4364	Passed (40%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.149 @ 7' 4 7/16"	0.471	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.229 @ 7' 3 7/8"	0.706	Passed (L/740)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 18' 4 11/16"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.5/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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 11 7/8" PSL beam	5.25"	Hanger ¹	1.75" / - ²	206	359	564	See note ¹
2 - Beveled Plate - SPF	5.50"	5.50"	3.50"	358	596	954	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.
- ² Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 7" o/c	
Bottom Edge (Lu)	8' 8" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	LSSR2.1Z	1.88"	N/A	14-10dx2.5	12-10dx1.5	Web Stiffeners

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

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 18' 9 1/4"	24"	15.0	25.0	ROOF

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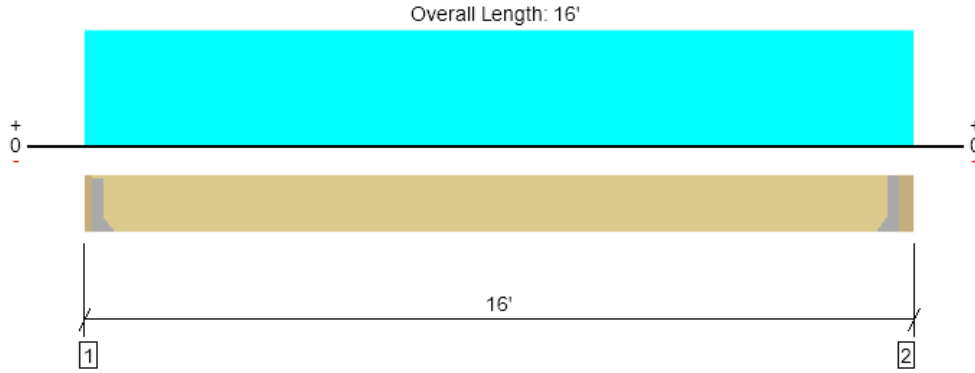
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ForteWEB Software Operator	Job Notes
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ROOF, RIM

1 piece(s) 1 3/4" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	673 @ 1 3/4"	2363 (1.50")	Passed (28%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	587 @ 1' 1 5/8"	4939	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2618 @ 7' 11 1/8"	9173	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.185 @ 7' 11 1/8"	0.778	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.320 @ 7' 11 1/8"	1.038	Passed (L/583)	--	1.0 D + 1.0 S (All Spans)

Member Length : 15' 6 3/4"
 System : Roof
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD
 Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- 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 11 7/8" LSL beam	1.75"	Hanger ¹	1.50"	288	396	685	See note ¹
2 - Hanger on 11 7/8" SPF beam	3.50"	Hanger ¹	1.50"	293	404	696	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)	14' 2" o/c	
Bottom Edge (Lu)	15' 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	IUS1.81/9.5	2.00"	N/A	8-10dx1.5	2-10dx1.5		
2 - Face Mount Hanger	IUS1.81/9.5	2.00"	N/A	8-10dx1.5	2-10dx1.5		

- 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 3/4" to 15' 8 1/2"	N/A	6.5	--	
1 - Uniform (PSF)	0 to 16' (Front)	2'	15.0	25.0	ROOF

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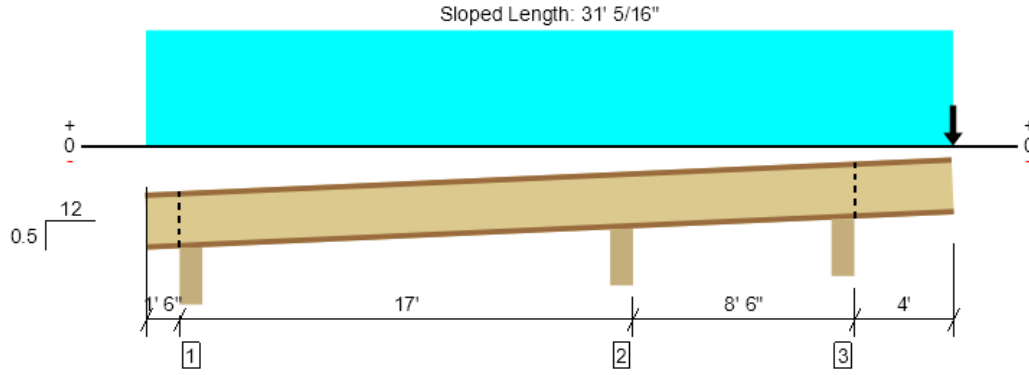
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ROOF, RJ-04
2 piece(s) 11 7/8" TJI @ 210 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1709 @ 26' 9 1/4"	5905 (5.25")	Passed (29%)	1.15	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	1017 @ 27'	3807	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-3663 @ 26' 9 1/4"	8729	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.130 @ 31'	0.282	Passed (2L/782)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.216 @ 31'	0.423	Passed (2L/470)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 31' 13/16"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0.5/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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 - Beveled Plate - SPF	5.50"	5.50"	3.50"	273	455	728	Blocking
2 - Beveled Plate - SPF	5.50"	5.50"	3.50"	285	691	976	None
3 - Beveled Plate - SPF	5.50"	5.50"	3.50"	666	1043	1709	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 4" o/c	
Bottom Edge (Lu)	5' 5" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 31'	24"	15.0	25.0	ROOF
2 - Point (lb)	31'	N/A	293	404	Linked from: RIM, Support 2

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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
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



RB-01

M = 5.56 k.ft

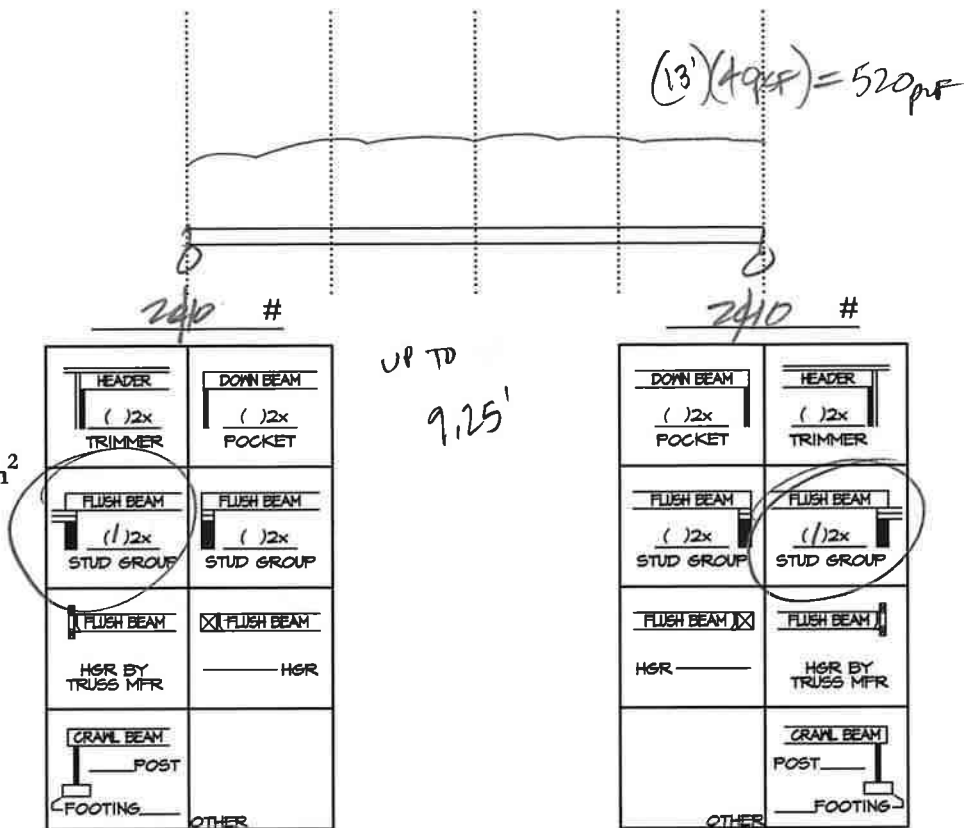
V = _____

L/360 = 0.31 in (LL)

L/240 = 0.46 in (TL)

EI_{req'd} = 133 x10⁶ lb.in²

3 1/2 x 11 7/8 L
 (FLUSH HEADER)



RB-02

M = 23.68 k.ft

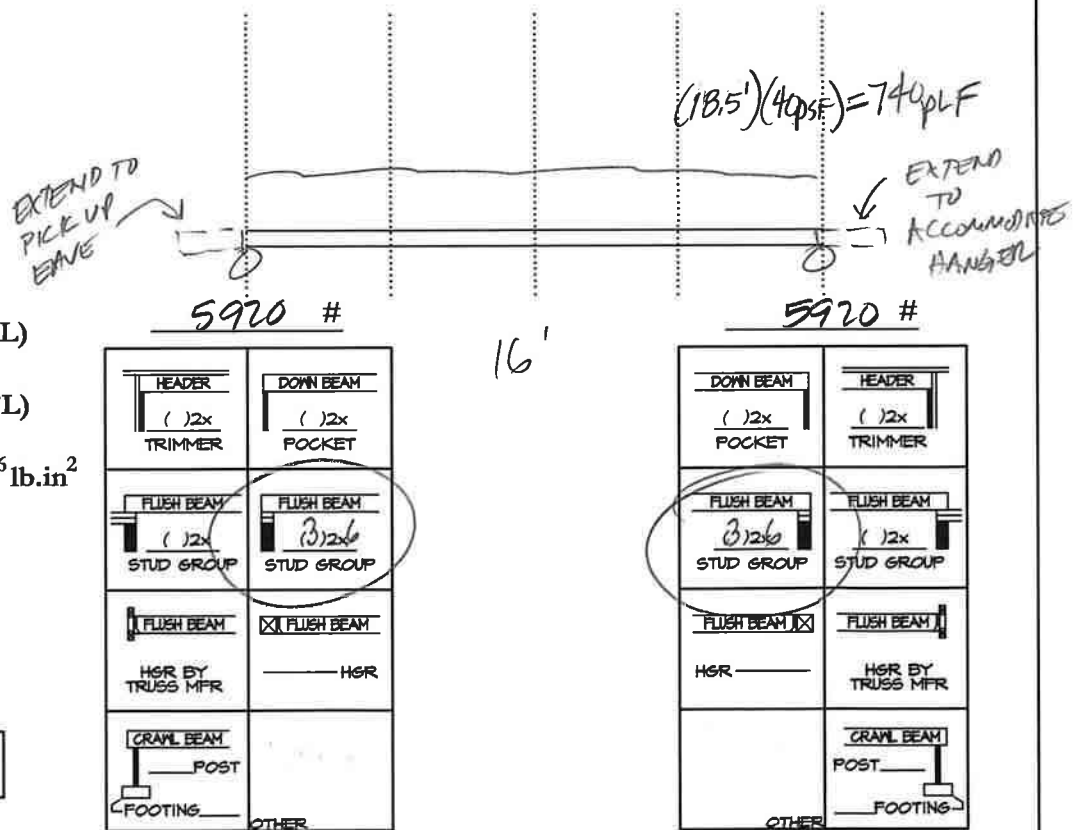
V = _____

L/360 = 0.53 in (LL)

L/240 = 0.80 in (TL)

EI_{req'd} = 1364 x10⁶ lb.in²

5 1/4 x 11 7/8 PL



RB-03

M = 041 k.ft

V = _____

L/360 = 0.09in (LL)

L/240 = 0.14in (TL)

EI_{req'd} = 5 x10⁶ lb.in²

(12.5')(400sf) = 500plf

690 #

2.75'

690 #

4x4 or
 4x6 ORIENTED FLATWISE

HEADER (1)2x TRIMMER	DOWN BEAM (1)2x POCKET
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR BY TRUSS MFR	FLUSH BEAM HGR
CRAWL BEAM POST FOOTING	OTHER

DOWN BEAM (1)2x POCKET	HEADER (1)2x TRIMMER
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR	FLUSH BEAM HGR BY TRUSS MFR
OTHER	CRAWL BEAM POST FOOTING

RB-

M = _____ k.ft

V = _____

L/360 = _____ (LL)

L/240 = _____ (TL)

EI_{req'd} = _____ x10⁶ lb.in²

#

#

HEADER (1)2x TRIMMER	DOWN BEAM (1)2x POCKET
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR BY TRUSS MFR	FLUSH BEAM HGR
CRAWL BEAM POST FOOTING	OTHER

DOWN BEAM (1)2x POCKET	HEADER (1)2x TRIMMER
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR	FLUSH BEAM HGR BY TRUSS MFR
OTHER	CRAWL BEAM POST FOOTING

Project: RAMAIYAH RESIDENCE Designed By: BTL Date: _____

Project Number: _____ Client: _____ Scale: _____ Page: R2.7

BTL

ENGINEERING

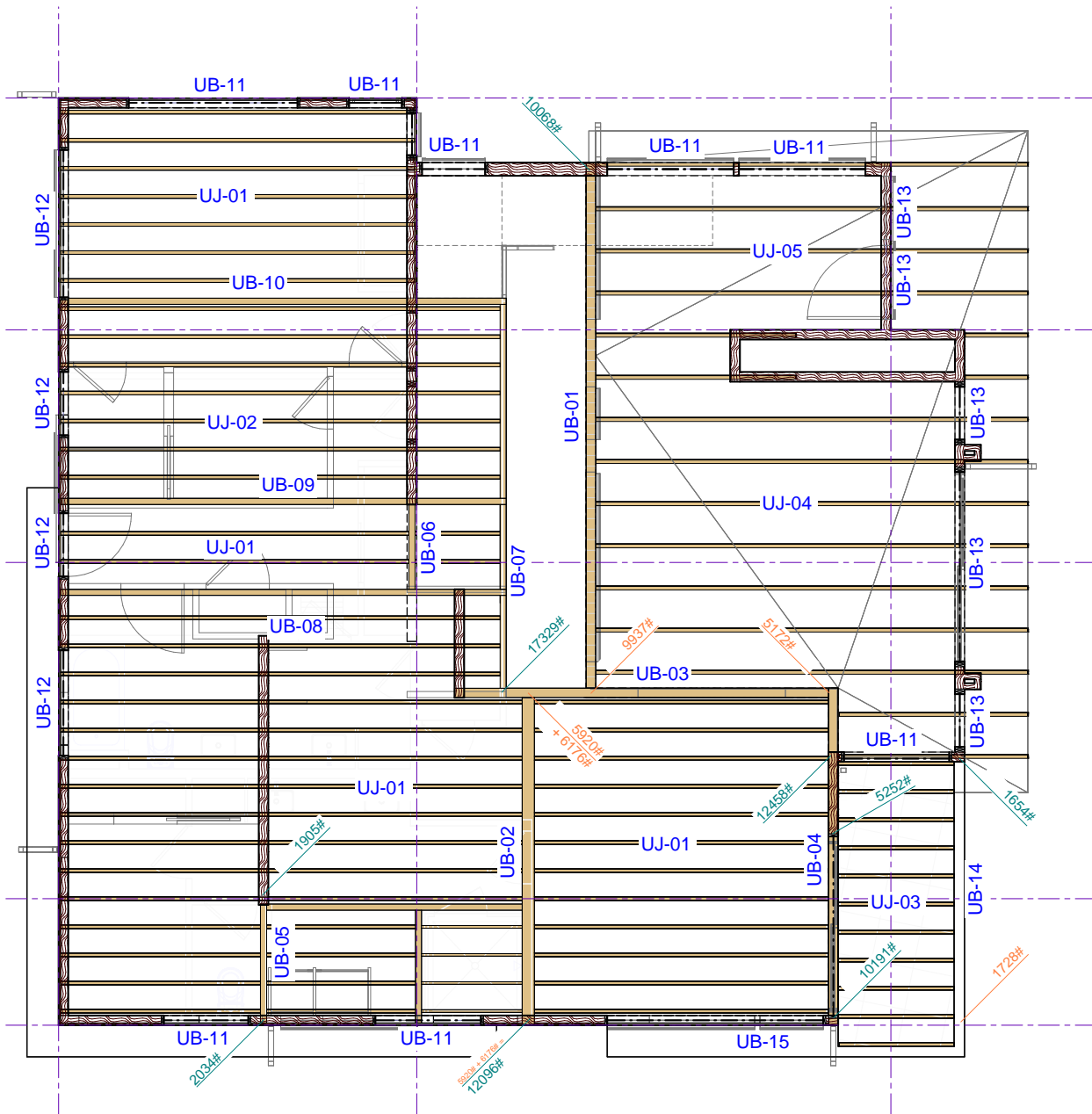
19011 Wood-Sno Road NE, Suite 100

Woodinville, WA 98072-4436

Phone: (425) 814-8448

Fax: (425) 821-2120

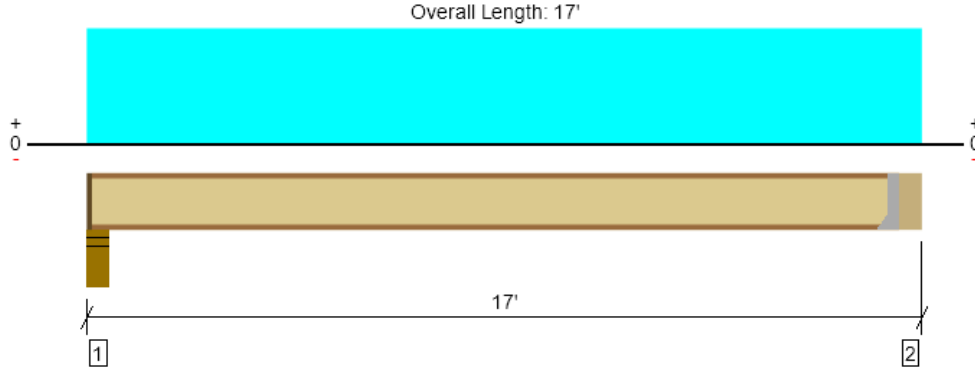
Gravity
Upper Floor Framing



Upper Floor Framing Key Plan

UPPER FLOOR, UJ-01

1 piece(s) 11 7/8" TJI @ 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	647 @ 16' 6 1/2"	1005 (1.75")	Passed (64%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	647 @ 16' 6 1/2"	1655	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2614 @ 8' 5 1/2"	3795	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.227 @ 8' 5 1/2"	0.404	Passed (L/855)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.340 @ 8' 5 1/2"	0.808	Passed (L/570)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	55	50	Passed	--	--

Member Length : 16' 5 1/4"
 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 structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 1 1/8" Panel (48" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	4.25"	1.75"	226	451	677	1 1/4" Rim Board
2 - Hanger on 11 7/8" SPF beam	5.50"	Hanger ¹	1.75" / - ²	228	456	683	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.
- ² Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 6" o/c	
Bottom Edge (Lu)	16' 5" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	IUS2.06/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17'	16"	20.0	40.0	UPPER FLOOR

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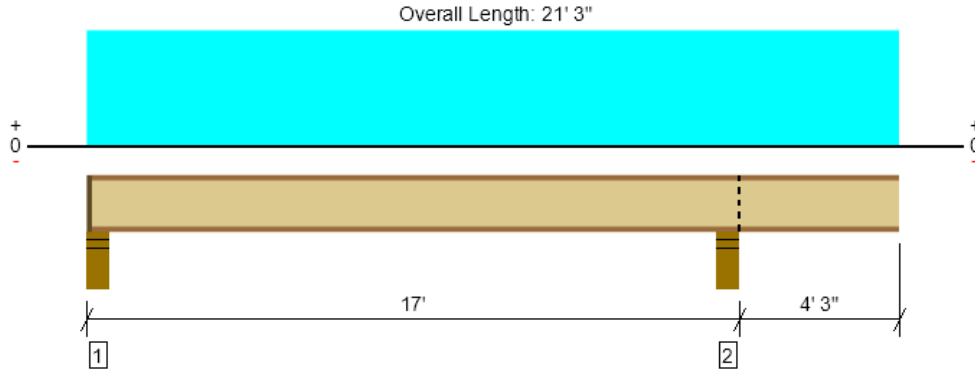
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



UPPER FLOOR, UJ-02

1 piece(s) 11 7/8" TJI @ 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	661 @ 4 1/2"	1460 (3.50")	Passed (45%)	1.00	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	633 @ 5 1/2"	1655	Passed (38%)	1.00	1.0 D + 1.0 L (Alt Spans)
Moment (Ft-lbs)	2556 @ 8' 4 7/16"	3795	Passed (67%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.239 @ 8' 6 7/8"	0.410	Passed (L/823)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.340 @ 8' 6 1/16"	0.820	Passed (L/578)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	57	50	Passed	--	--

Member Length : 21' 1 3/4"
 System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 1 1/8" Panel (48" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	4.25"	1.75"	212	457/-27	670	1 1/4" Rim Board
2 - Stud wall - SPF	5.50"	5.50"	3.50"	354	709	1063	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 6" o/c	
Bottom Edge (Lu)	8' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 21' 3"	16"	20.0	40.0	UPPER FLOOR

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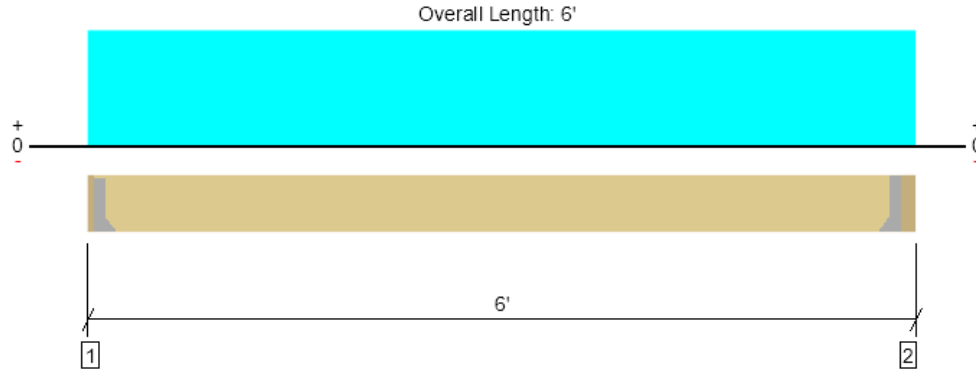
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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UPPER FLOOR, UJ-03

1 piece(s) 2 x 8 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	316 @ 1 1/2"	911 (1.50")	Passed (35%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	248 @ 8 3/4"	1088	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	442 @ 2' 11"	1284	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.028 @ 2' 11"	0.140	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.040 @ 2' 11"	0.279	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 5' 7"
 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	Floor Live	Factored	
1 - Hanger on 7 1/4" SPF Ledger	1.50"	Hanger ¹	1.50"	97	233	331	See note ¹
2 - Hanger on 7 1/4" LSL beam	3.50"	Hanger ¹	1.50"	103	247	349	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' 7" o/c	
Bottom Edge (Lu)	5' 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	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)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 6'	16"	25.0	60.0	DECK w/ PAVERS

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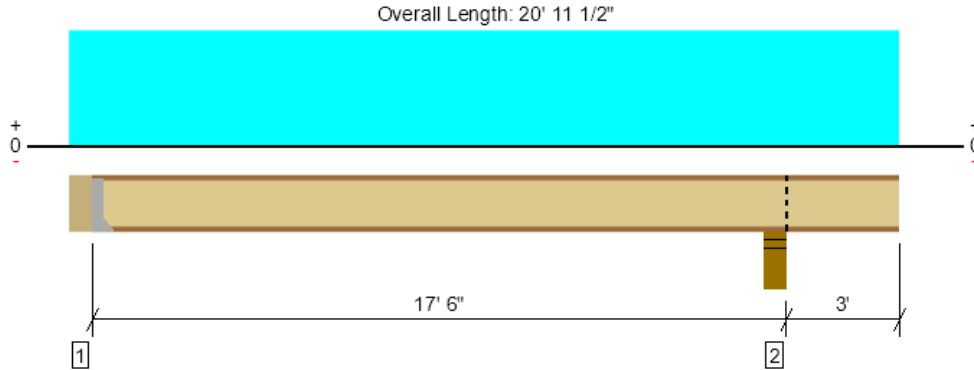
ForteWEB v3.7, Engine: V8.4.0

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U2.3

UPPER FLOOR, UJ-04

1 piece(s) 11 7/8" TJI @ 210 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	674 @ 5 1/2"	1156 (1.75")	Passed (58%)	1.15	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	674 @ 5 1/2"	1903	Passed (35%)	1.15	1.0 D + 1.0 S (Alt Spans)
Moment (Ft-lbs)	2841 @ 8' 10 5/8"	4364	Passed (65%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.338 @ 9' 1/2"	0.576	Passed (L/613)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.533 @ 9' 1/4"	0.864	Passed (L/389)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 20' 6"
 System : Roof
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD
 Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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 11 7/8" SPF beam	5.50"	Hanger ¹	1.75" / - ²	264	447	711	See note ¹
2 - Stud wall - SPF	5.50"	5.50"	3.50"	365	608	973	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.
- ² Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 4" o/c	
Bottom Edge (Lu)	8' 8" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	IUS2.06/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

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

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 20' 11 1/2"	24"	15.0	25.0	LOW ROOF

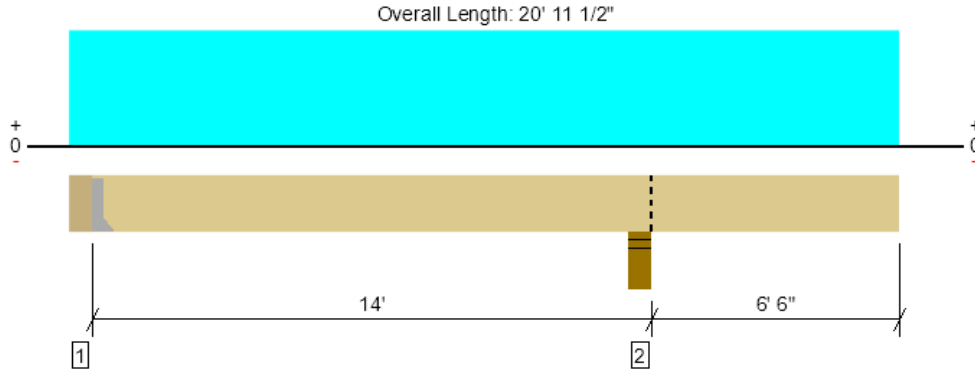
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ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@bt leng.net	





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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1221 @ 14' 2 3/4"	8181 (5.50")	Passed (15%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	585 @ 13' 1/8"	9878	Passed (6%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-1811 @ 14' 2 3/4"	19080	Passed (9%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.071 @ 20' 11 1/2"	0.449	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.089 @ 20' 11 1/2"	0.673	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 20' 6"
 System : Roof
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD
 Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- A 4% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 11 7/8" SPF beam	5.50"	Hanger ¹	1.50"	171	326	497	See note ¹
2 - Stud wall - SPF	5.50"	5.50"	1.50"	458	763	1221	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)	Continuous	
Bottom Edge (Lu)	Continuous	

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		

- 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 20' 11 1/2"	24"	15.0	25.0	LOW ROOF

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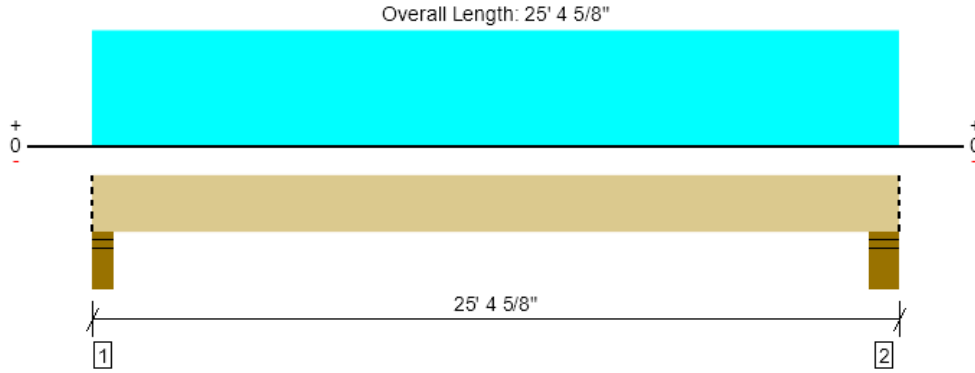
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@bt leng.net	



UPPER FLOOR, UB-01

1 piece(s) 5 1/2" x 21" 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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	9937 @ 3 3/4"	12272 (5.25")	Passed (81%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	8213 @ 2' 2 1/4"	23466	Passed (35%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	59583 @ 12' 7 5/16"	85930	Passed (69%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.478 @ 12' 7 5/16"	0.820	Passed (L/617)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.849 @ 12' 7 5/16"	1.230	Passed (L/348)	--	1.0 D + 1.0 S (All Spans)

Member Length : 25' 4 5/8"
 System : Roof
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD
 Member Pitch : 0/12

- 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 0.92 that was calculated using length L = 24' 7 1/8".
- 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 - SPF	5.25"	5.25"	4.25"	4342	5595	9937	Blocking
2 - Stud wall - SPF	7.25"	7.25"	4.31"	4399	5669	10068	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	25' 5" o/c	
Bottom Edge (Lu)	25' 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)	0 to 25' 4 5/8"	N/A	28.1	--	
1 - Uniform (PSF)	0 to 25' 4 5/8" (Top)	9'	15.0	25.0	ROOF
2 - Uniform (PSF)	0 to 25' 4 5/8" (Top)	5'	10.0	-	WALL
3 - Uniform (PSF)	0 to 25' 4 5/8" (Front)	8' 9"	15.0	25.0	LOWER ROOF

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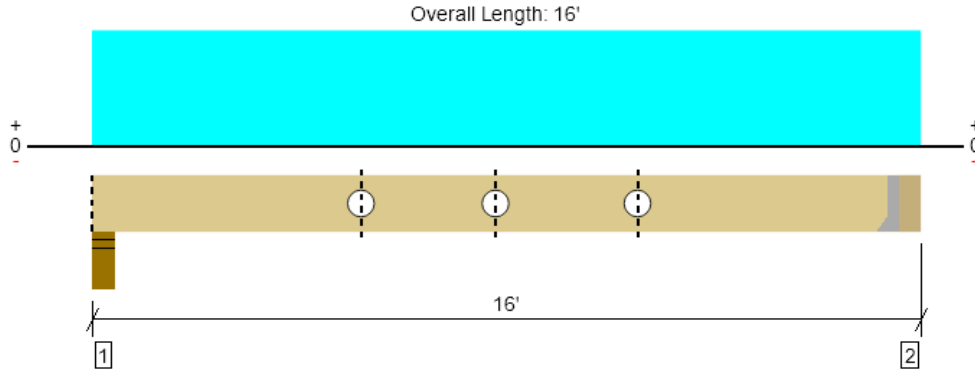
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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UPPER FLOOR, UB-02

1 piece(s) 7" x 11 7/8" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5852 @ 15' 6 3/4"	6563 (1.50")	Passed (89%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5091 @ 14' 6 7/8"	16071	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	22279 @ 7' 11 3/8"	39805	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.356 @ 7' 11 3/8"	0.381	Passed (L/514)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.506 @ 7' 11 3/8"	0.761	Passed (L/361)	--	1.0 D + 1.0 L (All Spans)

Member Length : 15' 6 3/4"
 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).
- MOE has been reduced by 9% to account for the effects of holes.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	2.05"	1816	4292	6108	Blocking
2 - Hanger on 11 7/8" PSL beam	5.25"	Hanger ¹	1.50"	1828	4348	6176	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)	15' 7" o/c	
Bottom Edge (Lu)	15' 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	
2 - Face Mount Hanger	HGUS7.25/12	4.00"	N/A	56-10d	20-10d		

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 15' 6 3/4"	N/A	26.0	--	
1 - Uniform (PSF)	0 to 16' (Top)	13' 6"	15.0	40.0	UPPER FLOOR

Holes (Size)	Direction	Diameter	Vertical Offset	Location	Shear (lbs)			Moment (Ft-lbs)			Comments
					Actual	Allowed	Result	Actual	Allowed	Result	
1 - Circular (L)	Horz	6.00"	5 15/16"	5' 4"	2201	4255	Passed (52%)	19652	34670	Passed (57%)	
2 - Circular (L)	Horz	6.00"	5 15/16"	8'	232	4255	Passed (5%)	22278	34670	Passed (64%)	
3 - Circular (L)	Horz	6.00"	5 15/16"	10' 8"	2281	4255	Passed (54%)	19439	34670	Passed (56%)	

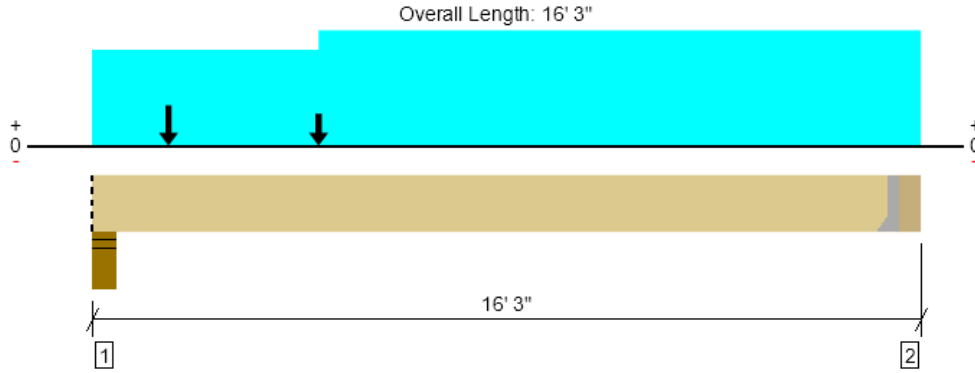
- Hole locations are measured from the outside face of left support (or left cantilever end) to the centerline of the hole.
- Vertical Offset is measured from the top of the member to the centerline of the hole.

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UPPER FLOOR, UB-03

1 piece(s) 7" x 11 7/8" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	17329 @ 4 1/2"	17850 (6.00")	Passed (97%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	17026 @ 1' 5 7/8"	18481	Passed (92%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	42214 @ 4' 6 3/4"	45776	Passed (92%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.373 @ 7' 3 15/16"	0.386	Passed (L/497)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.744 @ 7' 4 5/8"	0.772	Passed (L/249)	--	1.0 D + 1.0 S (All Spans)

Member Length : 15' 9 3/4"
 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.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	6.00"	6.00"	5.82"	8149	4235	8005	17329	Blocking
2 - Hanger on 11 7/8" PSL beam	5.25"	Hanger ¹	1.50"	2777	546	2395	5172	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)	15' 10" o/c	
Bottom Edge (Lu)	15' 10" 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	Connector not found	N/A	N/A	N/A	N/A	

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

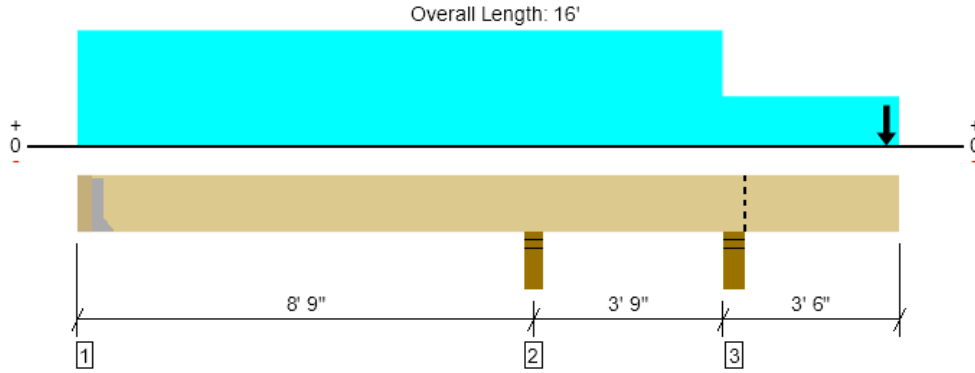
Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 15' 9 3/4"	N/A	26.0	--	--	
1 - Uniform (PSF)	0 to 16' 3" (Front)	8"	15.0	40.0	-	UPPER FLOOR
2 - Uniform (PSF)	0 to 16' 3" (Top)	8'	10.0	-	-	WALL
3 - Uniform (PSF)	4' 6 3/4" to 16' 3" (Top)	1'	15.0	-	25.0	LOW ROOF
4 - Uniform (PSF)	0 to 16' 3" (Top)	2'	15.0	-	25.0	ROOF
5 - Point (lb)	1' 6 1/2" (Front)	N/A	1828	4348	-	Linked from: UB-02, Support 2
6 - Point (lb)	4' 6 3/4" (Top)	N/A	4342	-	5595	Linked from: UB-01, Support 1
7 - Point (lb)	1' 6 1/2" (Top)	N/A	2220	-	3700	RB-02

ForteWEB Software Operator	Job Notes
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UPPER FLOOR, UB-04

1 piece(s) 5 1/4" x 11 7/8" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	12446 @ 12' 8 3/4"	12272 (5.50")	Passed (101%)	--	1.0 D + 0.75 L + 0.75 S (Adj Spans)
Shear (lbs)	5908 @ 13' 11 3/8"	13861	Passed (43%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	-17463 @ 12' 8 3/4"	34332	Passed (51%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.085 @ 16'	0.200	Passed (2L/928)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Total Load Defl. (in)	0.177 @ 16'	0.327	Passed (2L/444)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)

Member Length : 15' 8 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).
- Overhang deflection criteria: LL (0.2") and TL (2L/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	Floor Live	Snow	Factored	
1 - Hanger on 11 7/8" LSL beam	3.50"	Hanger ¹	1.50"	1902	1860	1274	4252	See note ¹
2 - Stud wall - SPF	4.50"	4.50"	2.38"	1145	4117	1423/-734	5300	None
3 - Stud wall - SPF	5.50"	5.50"	5.58"	6141	3270	5136	12446	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)	15' 9" o/c	
Bottom Edge (Lu)	15' 9" 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	HHUS5.50/10	3.00"	N/A	30-10d	10-10d		

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

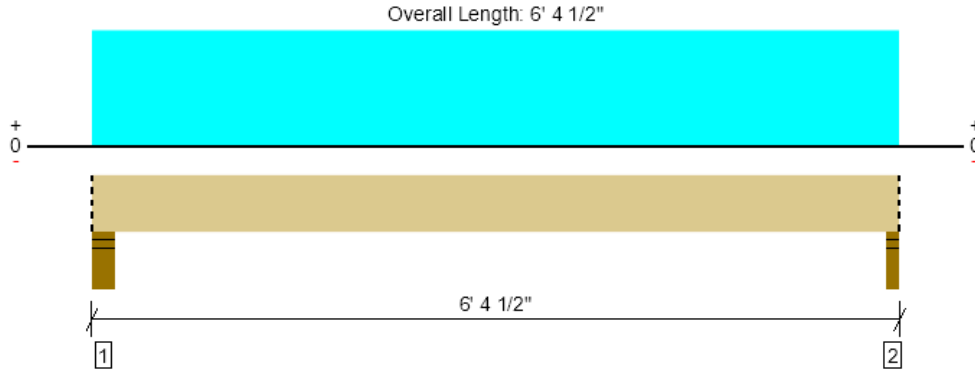
Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 16'	N/A	19.5	--	--	
1 - Uniform (PSF)	0 to 16' (Back)	7' 4"	15.0	40.0	-	UPPER FLOOR
2 - Uniform (PSF)	0 to 12' 6" (Front)	3'	25.0	60.0	-	DECK w/ PAVERS
3 - Uniform (PSF)	12' 6" to 16' (Front)	3'	15.0	-	25.0	LOW ROOF
4 - Uniform (PSF)	0 to 12' 6" (Top)	8'	10.0	-	-	WALL
5 - Uniform (PSF)	0 to 12' 6" (Top)	12'	15.0	-	25.0	ROOF
6 - Point (lb)	15' 9" (Back)	N/A	2777	546	2395	Linked from: UB-03, Support 2

Forteweb Software Operator	Job Notes
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UPPER FLOOR, UB-05

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1905 @ 6' 3"	4463 (3.00")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1139 @ 1' 5 3/8"	8590	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2704 @ 3' 3 1/2"	15953	Passed (17%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.023 @ 3' 3 1/2"	0.148	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.032 @ 3' 3 1/2"	0.296	Passed (L/999+)	--	1.0 D + 1.0 L (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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	1.50"	586	1448	2034	Blocking
2 - Stud wall - SPF	3.00"	3.00"	1.50"	549	1357	1905	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to 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)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 6' 4 1/2"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 6' 4 1/2" (Top)	11'	15.0	40.0	UPPER FLOOR

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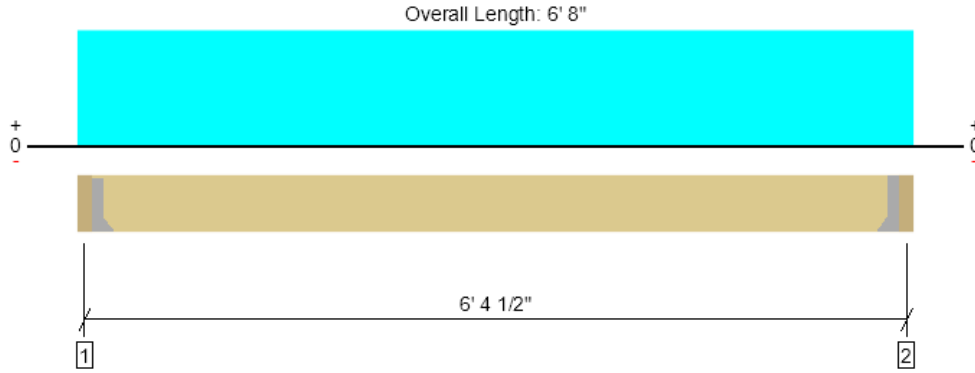
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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UPPER FLOOR, UB-06

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1838 @ 3 1/2"	4725 (1.50")	Passed (39%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1240 @ 1' 3 3/8"	8590	Passed (14%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2795 @ 3' 4"	15953	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.025 @ 3' 4"	0.152	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.035 @ 3' 4"	0.304	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 6' 1"
 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" LSL beam	3.50"	Hanger ¹	1.50"	577	1433	2010	See note ¹
2 - Hanger on 11 7/8" LSL beam	3.50"	Hanger ¹	1.50"	577	1433	2010	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)	6' 1" o/c	
Bottom Edge (Lu)	6' 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	LUS410	2.00"	N/A	8-16d	6-16d		
2 - Face Mount Hanger	LUS410	2.00"	N/A	8-16d	6-16d		

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 6' 4 1/2"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 6' 8" (Top)	10' 9"	15.0	40.0	UPPER FLOOR

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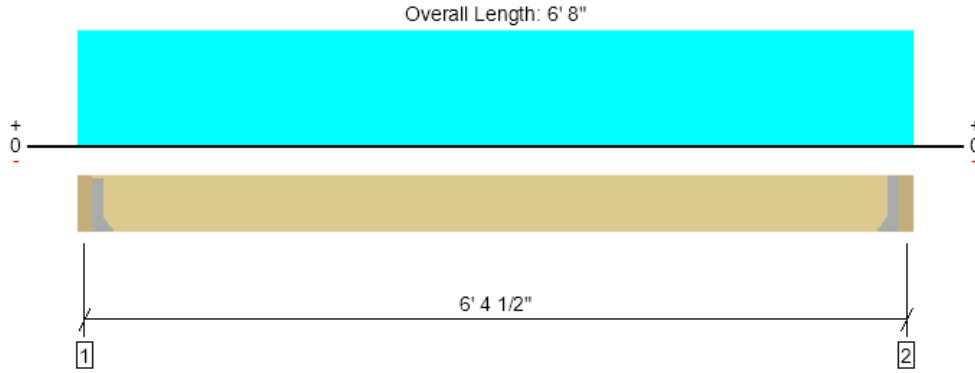
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
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UPPER FLOOR, UB-07

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	395 @ 3 1/2"	4725 (1.50")	Passed (8%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	267 @ 1' 3 3/8"	8590	Passed (3%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	601 @ 3' 4"	15953	Passed (4%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.005 @ 3' 4"	0.152	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.007 @ 3' 4"	0.304	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 6' 1"
 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" LSL beam	3.50"	Hanger ¹	1.50"	146	283	429	See note ¹
2 - Hanger on 11 7/8" LSL beam	3.50"	Hanger ¹	1.50"	146	283	429	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)	6' 1" o/c	
Bottom Edge (Lu)	6' 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	HUC410	2.50"	N/A	14-10dx1.5	6-10d	
2 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 6' 4 1/2"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 6' 8" (Top)	2' 1 1/2"	15.0	40.0	UPPER FLOOR

Weyerhaeuser Notes

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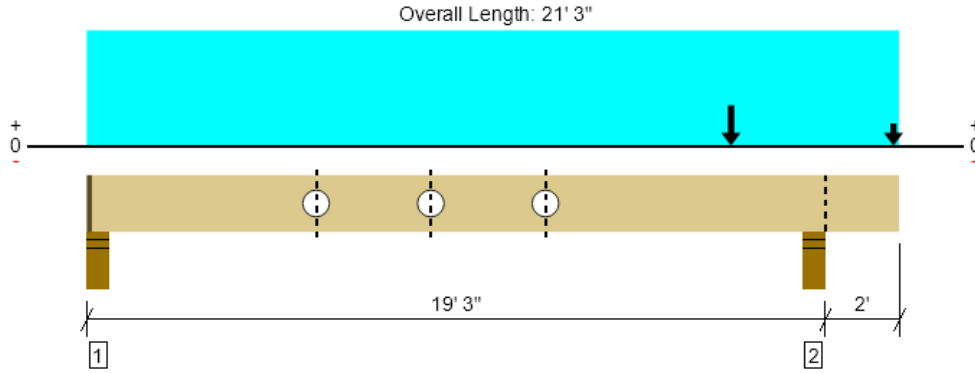
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@bt leng.net	



UPPER FLOOR, UB-08

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3264 @ 19' 1/4"	8181 (5.50")	Passed (40%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2538 @ 17' 9 5/8"	8590	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	6014 @ 12' 1 5/8"	15953	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.397 @ 10' 3 1/16"	0.467	Passed (L/565)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.582 @ 10' 2 1/16"	0.934	Passed (L/385)	--	1.0 D + 1.0 L (All Spans)

Member Length : 21' 1 3/4"
 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).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Upward deflection on right cantilever exceeds overhang deflection criteria.
- MOE has been reduced by 9% to account for the effects of holes.
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	4.25"	1.50"	364	682/-33	1046	1 1/4" Rim Board
2 - Stud wall - SPF	5.50"	5.50"	2.19"	1059	2206	3264	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	21' 2" o/c	
Bottom Edge (Lu)	21' 2" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 1/4" to 21' 3"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 21' 3" (Top)	1' 4"	15.0	40.0	UPPER FLOOR
2 - Point (lb)	16' 10 1/4" (Back)	N/A	577	1433	Linked from: UB-06, Support 1
3 - Point (lb)	21' 1 1/4" (Back)	N/A	146	283	Linked from: UB-07, Support 1

Holes (Size)	Direction	Diameter	Vertical Offset	Location	Shear (lbs)			Moment (Ft-lbs)			Comments
					Actual	Allowed	Result	Actual	Allowed	Result	
1 - Circular (L)	Horz	6.00"	5 15/16"	6'	551	5476	Passed (10%)	4388	13895	Passed (32%)	
2 - Circular (L)	Horz	6.00"	5 15/16"	9'	292	5476	Passed (5%)	5589	13895	Passed (40%)	
3 - Circular (L)	Horz	6.00"	5 15/16"	12'	210	5476	Passed (4%)	6013	13895	Passed (43%)	

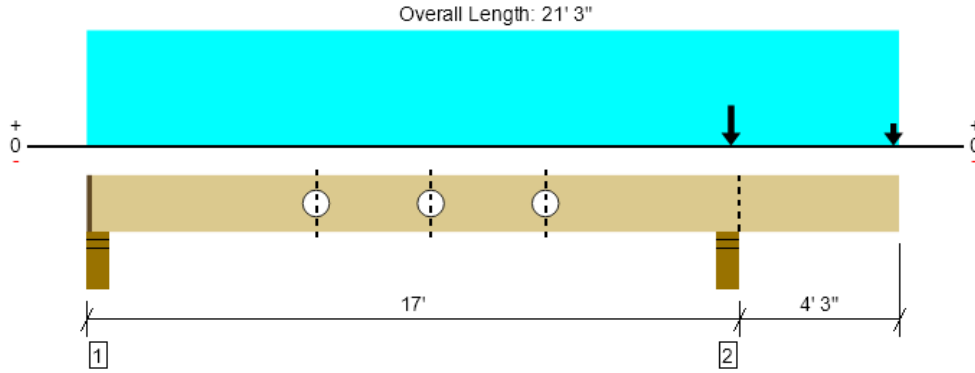
- Hole locations are measured from the outside face of left support (or left cantilever end) to the centerline of the hole.
- Vertical Offset is measured from the top of the member to the centerline of the hole.

ForteWEB Software Operator Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@bt leng.net	Job Notes
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UPPER FLOOR, UB-09

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3701 @ 16' 9 1/4"	8181 (5.50")	Passed (45%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	770 @ 15' 6 5/8"	8590	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-2725 @ 16' 9 1/4"	15953	Passed (17%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.142 @ 21' 3"	0.224	Passed (2L/756)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.151 @ 21' 3"	0.448	Passed (2L/710)	--	1.0 D + 1.0 L (All Spans)

Member Length : 21' 1 3/4"
 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).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- MOE has been reduced by 9% to account for the effects of holes.
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	4.25"	1.50"	222	456/-102	678	1 1/4" Rim Board
2 - Stud wall - SPF	5.50"	5.50"	2.49"	1201	2500	3701	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	21' 2" o/c	
Bottom Edge (Lu)	21' 2" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 1/4" to 21' 3"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 21' 3" (Top)	1' 4"	15.0	40.0	UPPER FLOOR
2 - Point (lb)	16' 10 1/4" (Front)	N/A	577	1433	Linked from: UB-06, Support 2
3 - Point (lb)	21' 1 1/4" (Front)	N/A	146	283	Linked from: UB-07, Support 2

Holes (Size)	Direction	Diameter	Vertical Offset	Location	Shear (lbs)			Moment (Ft-lbs)			Comments
					Actual	Allowed	Result	Actual	Allowed	Result	
1 - Circular (L)	Horz	6.00"	5 15/16"	6'	210	5476	Passed (4%)	2302	13895	Passed (17%)	
2 - Circular (L)	Horz	6.00"	5 15/16"	9'	226	5476	Passed (4%)	2399	13895	Passed (17%)	
3 - Circular (L)	Horz	6.00"	5 15/16"	12'	485	5476	Passed (9%)	1719	13895	Passed (12%)	

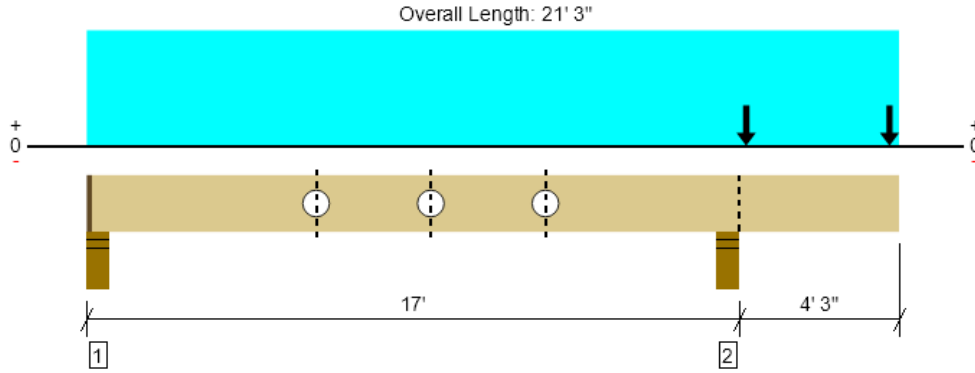
- Hole locations are measured from the outside face of left support (or left cantilever end) to the centerline of the hole.
- Vertical Offset is measured from the top of the member to the centerline of the hole.

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



UPPER FLOOR, UB-10

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2795 @ 16' 9 1/4"	8181 (5.50")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1183 @ 17' 11 7/8"	8590	Passed (14%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-4256 @ 16' 9 1/4"	15953	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.223 @ 21' 3"	0.224	Passed (2L/482)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.271 @ 21' 3"	0.448	Passed (2L/396)	--	1.0 D + 1.0 L (Alt Spans)

Member Length : 21' 1 3/4"
 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).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- MOE has been reduced by 9% to account for the effects of holes.
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	4.25"	1.50"	192	456/-164	648	1 1/4" Rim Board
2 - Stud wall - SPF	5.50"	5.50"	1.88"	988	1807	2795	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	21' 2" o/c	
Bottom Edge (Lu)	21' 2" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 1/4" to 21' 3"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 21' 3" (Top)	1' 4"	15.0	40.0	UPPER FLOOR
2 - Point (lb)	17' 3" (Back)	N/A	240	480	STAIRS
3 - Point (lb)	21' (Back)	N/A	240	480	STAIRS

Holes (Size)	Direction	Diameter	Vertical Offset	Location	Shear (lbs)			Moment (Ft-lbs)			Comments
					Actual	Allowed	Result	Actual	Allowed	Result	
1 - Circular (L)	Horz	6.00"	5 15/16"	6'	210	5476	Passed (4%)	2131	13895	Passed (15%)	
2 - Circular (L)	Horz	6.00"	5 15/16"	9'	319	5476	Passed (6%)	2137	13895	Passed (15%)	
3 - Circular (L)	Horz	6.00"	5 15/16"	12'	578	5476	Passed (11%)	2103	13895	Passed (15%)	

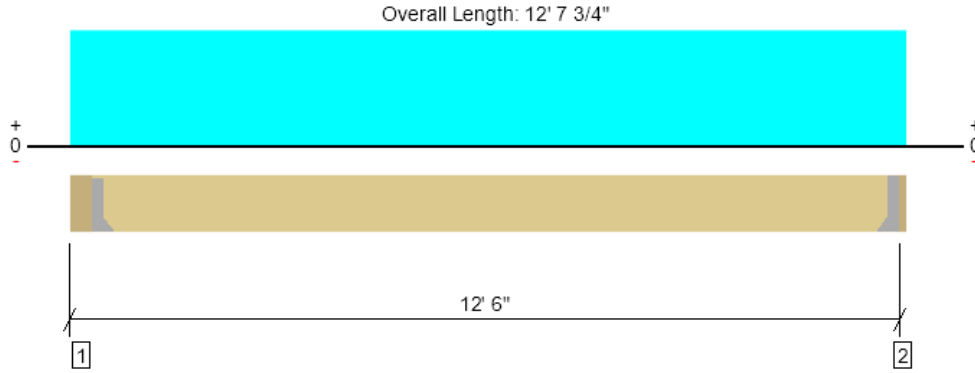
- Hole locations are measured from the outside face of left support (or left cantilever end) to the centerline of the hole.
- Vertical Offset is measured from the top of the member to the centerline of the hole.

Forteweb Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



UPPER FLOOR, UB-14

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1616 @ 5 1/4"	4725 (1.50")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1351 @ 1' 5 1/8"	8590	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4874 @ 6' 5 5/8"	15953	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.125 @ 6' 5 5/8"	0.302	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.186 @ 6' 5 5/8"	0.603	Passed (L/778)	--	1.0 D + 1.0 L (All Spans)

Member Length : 12' 3/4"
 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" PSL beam	5.25"	Hanger ¹	1.50"	564	1164	1728	See note ¹
2 - Hanger on 11 7/8" LSL beam	1.75"	Hanger ¹	1.50"	542	1112	1654	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)	12' 1" o/c	
Bottom Edge (Lu)	12' 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	HUC410	2.50"	N/A	18-10dx1.5	10-10d		
2 - Face Mount Hanger	HUC410	2.50"	N/A	18-10dx1.5	10-10d		

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	5 1/4" to 12' 6"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 12' 7 3/4" (Back)	3'	25.0	60.0	DECK w/ PAVERS

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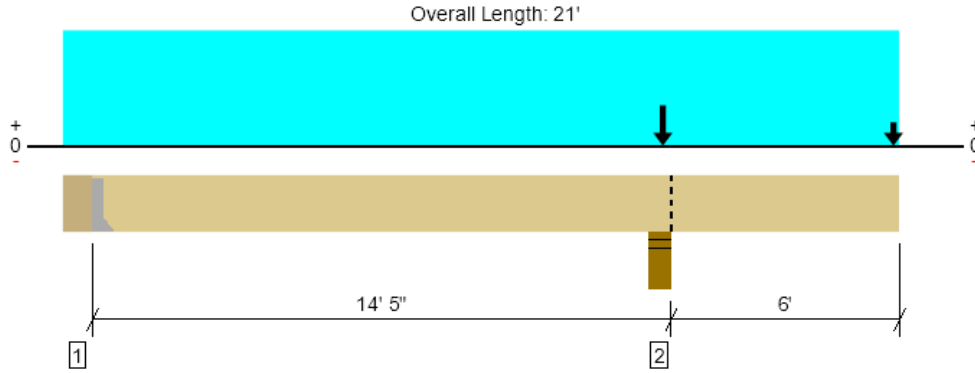
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@bt leng.net	



UPPER FLOOR, UB-15

1 piece(s) 5 1/4" x 11 7/8" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	10191 @ 14' 9 1/4"	12272 (5.50")	Passed (83%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2861 @ 15' 11 7/8"	12053	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-14900 @ 14' 9 1/4"	29854	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.393 @ 21'	0.415	Passed (2L/380)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.563 @ 21'	0.623	Passed (2L/266)	--	1.0 D + 1.0 L (Alt Spans)

Member Length : 20' 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).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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	Floor Live	Snow	Factored	
1 - Hanger on 11 7/8" SPF beam	7.00"	Hanger ¹	1.50"	722	550/-555	525	1528	See note ¹
2 - Stud wall - SPF	5.50"	5.50"	4.57"	4977	4576	2376	10191	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)	20' 5" o/c	
Bottom Edge (Lu)	20' 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	HUC610	2.50"	N/A	14-10dx1.5	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)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	7" to 21'	N/A	19.5	--	--	
1 - Uniform (PSF)	0 to 21' (Top)	8"	15.0	40.0	-	UPPER FLOOR
2 - Uniform (PLF)	0 to 21' (Top)	N/A	80.0	-	-	WALL
3 - Uniform (PSF)	0 to 21' (Top)	3'	15.0	15.0	25.0	ROOF
4 - Point (lb)	14' 10 1/4" (Back)	N/A	1902	1860	1274	Linked from: UB-04, Support 1
5 - Point (lb)	20' 10 1/4" (Back)	N/A	564	1164	-	Linked from: UB-14, Support 1

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@bt leng.net	



UB-11

M = 2.66 k.ft
 V = _____

* 60 p.f (Floor)
 OR
 75 p.f (DECK)
 +
 40 p.f (LAWYER)
 WORST CASE
 = 115 p.f

(3) (40 p.f) = 120 p.f (Roof)
 80 p.f (WALL)
 115 p.f *

1300 #

HEADER (1) 2x TRIMMER	DOWN BEAM (1) 2x POCKET
FLASH BEAM (1) 2x STUD GROUP	FLASH BEAM (1) 2x STUD GROUP
FLASH BEAM HGR BY TRUSS MFR	FLASH BEAM HGR
CRAWL BEAM POST FOOTING	OTHER

UP TO 8.25'

1300 #

DOWN BEAM (1) 2x POCKET	HEADER (1) 2x TRIMMER
FLASH BEAM (1) 2x STUD GROUP	FLASH BEAM (1) 2x STUD GROUP
FLASH BEAM HGR	FLASH BEAM HGR BY TRUSS MFR
OTHER	CRAWL BEAM POST FOOTING

3 1/2 x 9 GUB

UB-12

M = 7.29 k.ft
 V = _____

420 p.f (Roof)
 80 p.f (WALL)
 (17 1/2) (60 p.f) = 510 p.f (Floor)

4020 #

HEADER (1) 2x TRIMMER	DOWN BEAM (1) 2x POCKET
FLASH BEAM (1) 2x STUD GROUP	FLASH BEAM (1) 2x STUD GROUP
FLASH BEAM HGR BY TRUSS MFR	FLASH BEAM HGR
CRAWL BEAM POST FOOTING	OTHER

UP TO 7.25'

ONLY 1 TRIMMER PER OC 3 FT OPENINGS

4020 #

DOWN BEAM (1) 2x POCKET	HEADER (1) 2x TRIMMER
FLASH BEAM (1) 2x STUD GROUP	FLASH BEAM (1) 2x STUD GROUP
FLASH BEAM HGR	FLASH BEAM HGR BY TRUSS MFR
OTHER	CRAWL BEAM POST FOOTING

3 1/2 x 9 GUB

UB-13

M = 5.35 k.ft

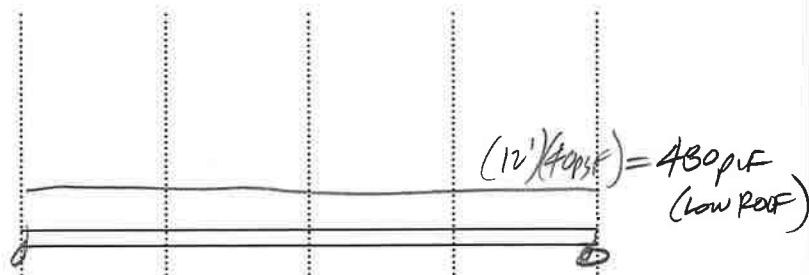
V = _____

L/360 = 0.31 in (LL)

L/240 = 0.46 in (TL)

EI_{req'd} = 178 x10⁶ lb.in²

3 1/2 x 9 GLB



2310 #

2310 #

UP TO
9.25'

HEADER (1)2x TRIMMER	DOWN BEAM (1)2x POCKET
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR BY TRUSS MFR	FLUSH BEAM HGR
CRAWL BEAM POST FOOTING	OTHER

DOWN BEAM (1)2x POCKET	HEADER (1)2x TRIMMER
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR	FLUSH BEAM HGR BY TRUSS MFR
OTHER	CRAWL BEAM POST FOOTING

UB-

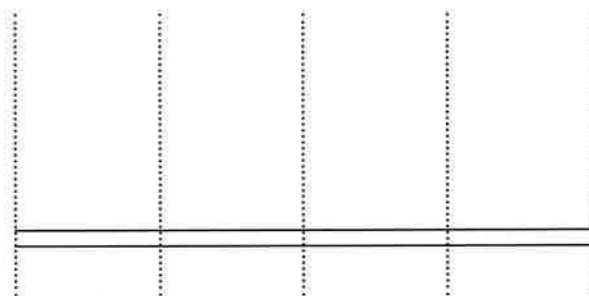
M = _____ k.ft

V = _____

L/ = _____ (LL)

L/240 = _____ (TL)

EI_{req'd} = _____ x10⁶ lb.in²



#

#

HEADER (1)2x TRIMMER	DOWN BEAM (1)2x POCKET
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR BY TRUSS MFR	FLUSH BEAM HGR
CRAWL BEAM POST FOOTING	OTHER

DOWN BEAM (1)2x POCKET	HEADER (1)2x TRIMMER
FLUSH BEAM (1)2x STUD GROUP	FLUSH BEAM (1)2x STUD GROUP
FLUSH BEAM HGR	FLUSH BEAM HGR BY TRUSS MFR
OTHER	CRAWL BEAM POST FOOTING

BTL

ENGINEERING

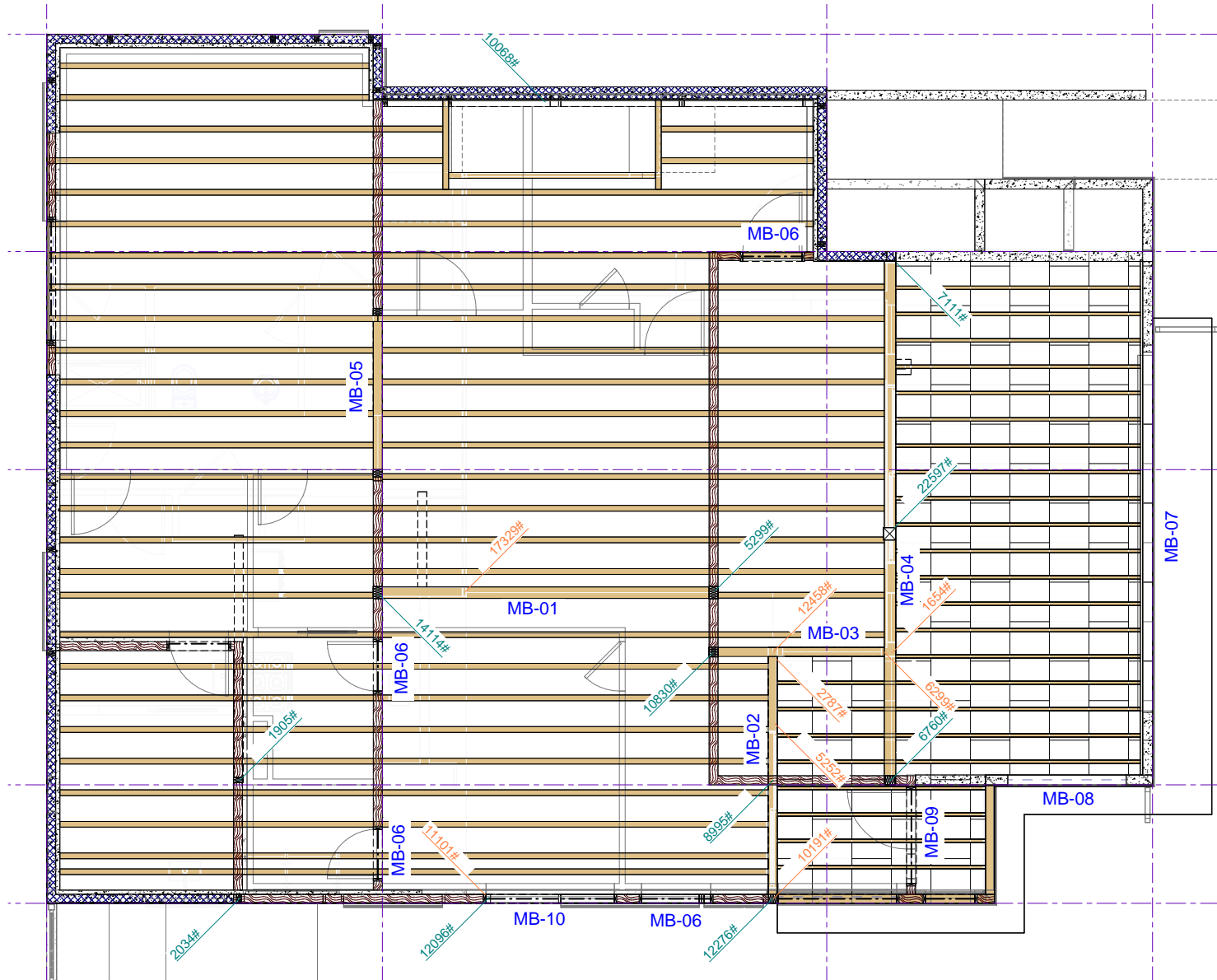
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Woodinville, WA 98072-4436

Phone: (425) 814-8448

Fax: (425) 821-2120

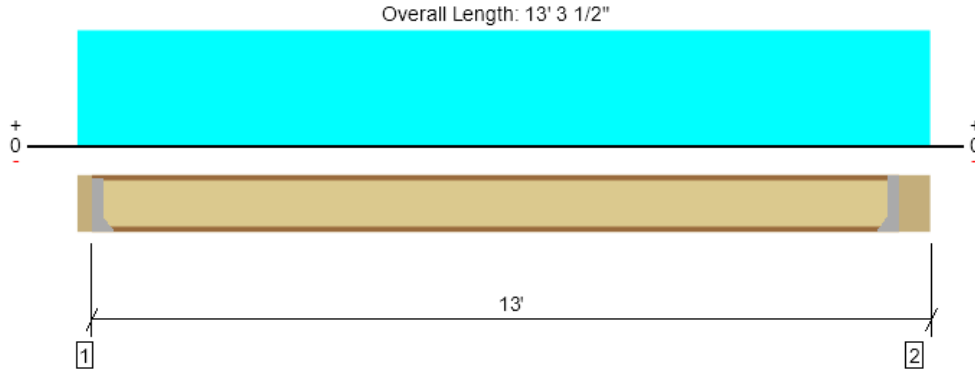
Gravity
Main Floor Framing



Main Floor Framing Key Plan

MAIN FLOOR, MJ-01

1 piece(s) 11 7/8" TJI @ 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	701 @ 3 1/2"	1005 (1.75")	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	701 @ 3 1/2"	1655	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2169 @ 6' 5 3/4"	3795	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.128 @ 6' 5 3/4"	0.309	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.182 @ 6' 5 3/4"	0.619	Passed (L/817)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	63	45	Passed	--	--

Member Length : 12' 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 structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 1 1/8" Panel (48" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" GLB beam	3.50"	Hanger ¹	1.75" / - ²	216	518	734	See note ¹
2 - Hanger on 11 7/8" SPF Ledger	7.50"	Hanger ¹	1.75" / - ²	227	545	772	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.
- ² Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' o/c	
Bottom Edge (Lu)	12' 5" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	IUS2.06/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	
2 - Face Mount Hanger	IUS2.06/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 3 1/2"	16"	25.0	60.0	DECK w/ PAVERS

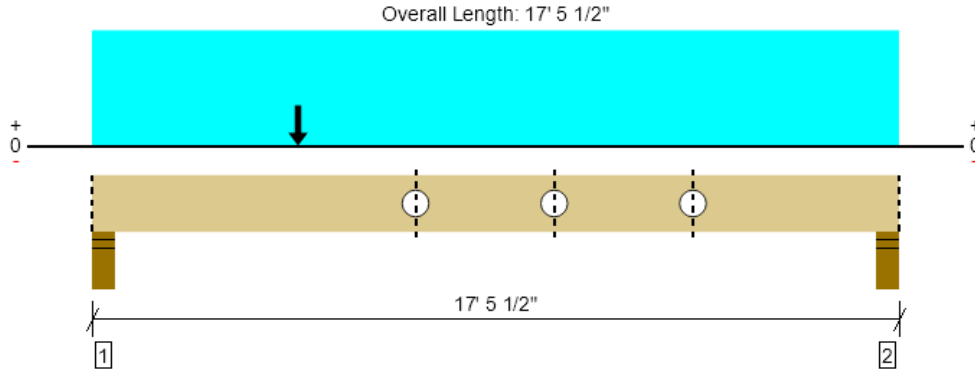
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 The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



MAIN FLOOR, MB-01

1 piece(s) 7" x 18" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	14114 @ 4"	16363 (5.50")	Passed (86%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	13880 @ 1' 11 1/2"	28014	Passed (50%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	57041 @ 4' 5 1/2"	100429	Passed (57%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.174 @ 7' 3"	0.420	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.337 @ 7' 3"	0.840	Passed (L/599)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

Member Length : 17' 5 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.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	4.74"	6770	3753	6039	14114	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.78"	2625	1599	1966	5299	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 6" o/c	
Bottom Edge (Lu)	17' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 17' 5 1/2"	N/A	39.4	--	--	
1 - Uniform (PSF)	0 to 17' 5 1/2" (Top)	1' 7 3/16"	20.0	40.0	-	MAIN FLOOR
2 - Point (lb)	4' 5 1/2" (Top)	N/A	8149	4235	8005	Linked from: UB-03, Support 1

Holes (Size)	Direction	Diameter	Vertical Offset	Location	Shear (lbs)			Moment (Ft-lbs)			Comments
					Actual	Allowed	Result	Actual	Allowed	Result	
1 - Circular (S)	Horz	6.00"	9"	7'	4080	10457	Passed (39%)	47131	96710	Passed (49%)	
2 - Circular (S)	Horz	6.00"	9"	10'	4439	10457	Passed (42%)	34442	96710	Passed (36%)	
3 - Circular (S)	Horz	6.00"	9"	13'	4797	10457	Passed (46%)	20679	96710	Passed (21%)	

- Hole locations are measured from the outside face of left support (or left cantilever end) to the centerline of the hole.
- Vertical Offset is measured from the top of the member to the centerline of the hole.

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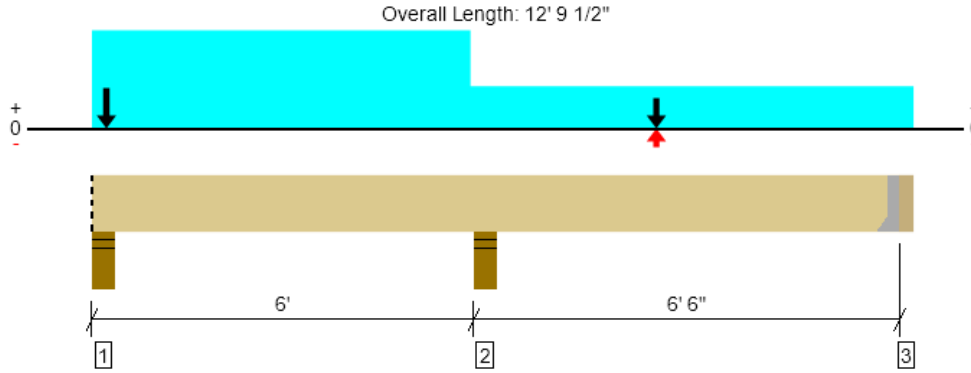
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



MAIN FLOOR, MB-02

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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern) [Group]
Member Reaction (lbs)	12276 @ 4"	12856 (5.50")	Passed (95%)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans) [8]
Shear (lbs)	4745 @ 7' 8 1/2"	14575	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans) [1]
Pos Moment (Ft-lbs)	7064 @ 8' 10"	41250	Passed (17%)	1.00	1.0 D + 1.0 L (Alt Spans) [1]
Neg Moment (Ft-lbs)	-6230 @ 6' 2 3/4"	31797	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans) [1]
Live Load Defl. (in)	0.011 @ 9' 4 7/8"	0.157	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans) [1]
Total Load Defl. (in)	0.014 @ 9' 5 1/4"	0.314	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans) [1]

Member Length : 12' 6"
 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 = 5' 3 1/4".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 3' 6 3/8".
- 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	Floor Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	5.25"	5696	6359/-550	2453	12276	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.85"	2531	6465	1123/-579	8995	None
3 - Hanger on 15" GLB beam	3.50"	Hanger ¹	1.50"	669	2118/-125	450/-232	2787	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)	12' 6" o/c	
Bottom Edge (Lu)	12' 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
3 - Face Mount Hanger	HU612	2.50"	N/A	22-10d	8-10d	

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

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12' 6"	N/A	20.0	--	--	
1 - Uniform (PSF)	0 to 6' (Top)	10'	20.0	40.0	-	MAIN FLOOR
2 - Uniform (PSF)	6' to 12' 9 1/2" (Top)	1' 6"	20.0	40.0	-	MAIN FLOOR
3 - Uniform (PSF)	0 to 12' 9 1/2" (Top)	3' 6"	25.0	60.0	-	MAIN DECK w/ PAVERS
4 - Point (lb)	8' 10" (Top)	N/A	1145	4117	1423/-734	Linked from: UB-04, Support 2
5 - Point (lb)	2 3/4" (Top)	N/A	4977	4576	2376	Linked from: UB-15, Support 2

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ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



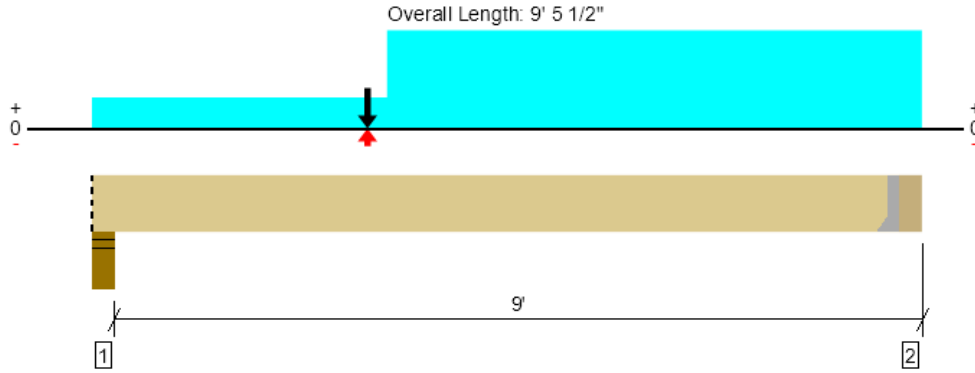
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MF2.4

MAIN FLOOR, MB-03

1 piece(s) 5 1/2" x 18" 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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern) [Group]
Member Reaction (lbs)	6177 @ 9'	6177 (1.73")	Passed (100%)	--	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Shear (lbs)	10626 @ 1' 11 1/2"	20114	Passed (53%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Pos Moment (Ft-lbs)	30824 @ 3' 2 3/4"	68310	Passed (45%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Live Load Defl. (in)	0.037 @ 4' 4 5/16"	0.217	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Total Load Defl. (in)	0.069 @ 4' 4 3/8"	0.433	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans) [1]

Member Length : 9'
 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 = 8' 8".
- 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	Floor Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	4.63"	5007	4000	3764	10830	Blocking
2 - Hanger on 18" GLB beam	5.50"	Hanger ¹	1.73"	3036	2378	1972	6299	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)	9' o/c	
Bottom Edge (Lu)	9' 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	HGUS5.50/14	4.00"	N/A	66-10d	22-10d	

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

ForteWEB Software Operator	Job Notes
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@bt leng.net	



Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 9'	N/A	24.1	--	--	
1 - Uniform (PSF)	0 to 3' 5 1/2" (Top)	1' 7 3/16"	20.0	40.0	-	MAIN FLOOR
2 - Uniform (PSF)	3' 5 1/2" to 9' 5 1/2" (Top)	9 5/8"	20.0	40.0	-	MAIN FLOOR
3 - Uniform (PSF)	3' 5 1/2" to 9' 5 1/2" (Top)	9 5/8"	25.0	60.0	-	MAIN DECK w/ PAVERS
4 - Uniform (PLF)	3' 5 1/2" to 9' 5 1/2" (Top)	N/A	80.0	-	-	WALL
5 - Uniform (PSF)	3' 5 1/2" to 9' 5 1/2" (Top)	9 5/8"	25.0	60.0	-	UPPER DECK w/ PAVERS
6 - Uniform (PSF)	3' 5 1/2" to 9' 5 1/2" (Top)	1'	15.0	-	25.0	LOW ROOF
7 - Point (lb)	3' 2 3/4" (Front)	N/A	669	2118/-125	450/-232	Linked from: MB-02, Support 3
8 - Point (lb)	3' 2 3/4" (Top)	N/A	6141	3270	5136	Linked from: UB-04, Support 3

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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
Brian Lampe BTL Engineering (425) 814-8448 brian.lampe@btleng.net	



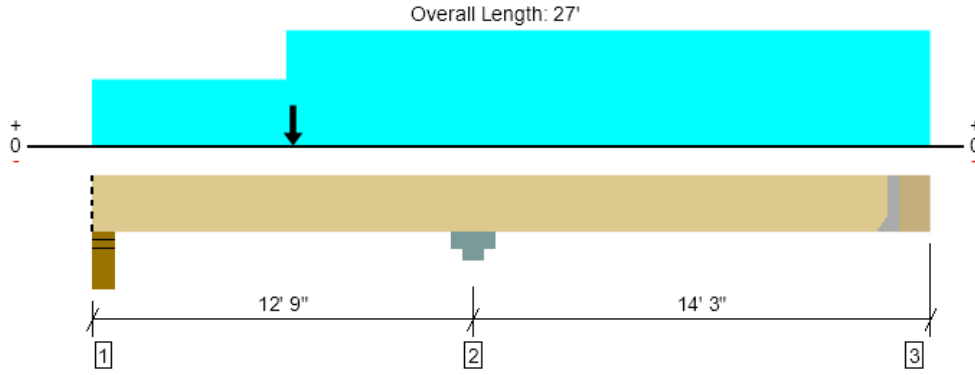
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MF2.6

MAIN FLOOR, MB-04

1 piece(s) 7" x 11 7/8" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	6511 @ 26' 4 1/2"	6563 (1.50")	Passed (99%)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Shear (lbs)	9984 @ 11' 3 5/8"	16071	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-28746 @ 12' 9"	39805	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.187 @ 6' 6"	0.310	Passed (L/798)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Total Load Defl. (in)	0.299 @ 6' 6"	0.621	Passed (L/499)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)

Member Length : 26' 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.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Stud wall - SPF	5.50"	5.50"	2.27"	2519	4245/-557	986	7750/-557	Blocking
2 - Column Cap - steel	11.00"	11.00"	5.24"	10384	10928	5781	27093	None
3 - Hanger on 11 7/8" SPF Ledger	7.50"	Hanger ¹	1.50"	3023	3731/-224	1905	8659/-224	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)	26' 5" o/c	
Bottom Edge (Lu)	26' 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	
3 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A		

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

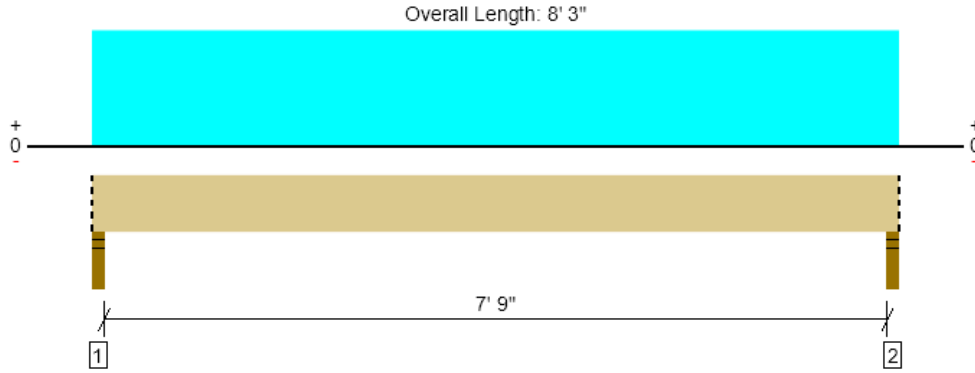
Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 26' 4 1/2"	N/A	26.0	--	--	
1 - Uniform (PSF)	6' 6" to 27' (Top)	4' 6"	20.0	40.0	-	MAIN FLOOR
2 - Uniform (PSF)	0 to 6' 6" (Back)	3'	25.0	60.0	-	MAIN DECK w/ PAVERS
3 - Uniform (PSF)	0 to 27' (Front)	6' 6"	25.0	60.0	-	MAIN DECK w/ PAVERS
4 - Uniform (PLF)	6' 6" to 27' (Top)	N/A	80.0	-	-	WALL
5 - Uniform (PSF)	6' 6" to 27' (Top)	12' 6"	15.0	-	25.0	LOW ROOF
6 - Point (lb)	6' 8 3/4" (Back)	N/A	3036	2378	1972	Linked from: MB-03, Support 2

ForteWEB Software Operator	Job Notes
Mariam Soliman BTL Engineering PS (425) 814-8448 mariam.soliman@btleng.net	



MAIN FLOOR, MB-05

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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4142 @ 1' 1/2"	7013 (3.00")	Passed (59%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2636 @ 1' 6"	14575	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	8032 @ 4' 1 1/2"	41250	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.022 @ 4' 1 1/2"	0.267	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.033 @ 4' 1 1/2"	0.400	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 8' 3"
 System : Floor
 Member Type : Drop 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 = 8'.
- 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	Floor Live	Factored	
1 - Stud wall - SPF	3.00"	3.00"	1.77"	1436	2706	4142	Blocking
2 - Stud wall - SPF	3.00"	3.00"	1.77"	1436	2706	4142	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 3" o/c	
Bottom Edge (Lu)	8' 3" o/c	

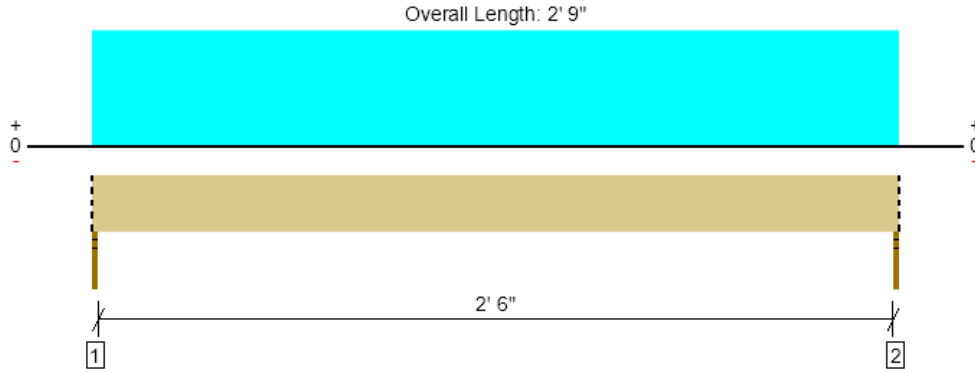
•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 3"	N/A	20.0	--	
1 - Uniform (PSF)	0 to 8' 3" (Front)	16' 4 13/16"	20.0	40.0	Main Floor

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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	978 @ 0	2231 (1.50")	Passed (44%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	459 @ 8 3/4"	3045	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	673 @ 1' 4 1/2"	2989	Passed (22%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 1' 4 1/2"	0.092	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.005 @ 1' 4 1/2"	0.138	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 2' 9"
 System : Floor
 Member Type : Drop 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	Floor Live	Factored	
1 - Stud wall - SPF	1.50"	1.50"	1.50"	332	646	978	Blocking
2 - Stud wall - SPF	1.50"	1.50"	1.50"	332	646	978	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 9" o/c	
Bottom Edge (Lu)	2' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 2' 9"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 2' 9" (Front)	11' 9"	20.0	40.0	Main Floor

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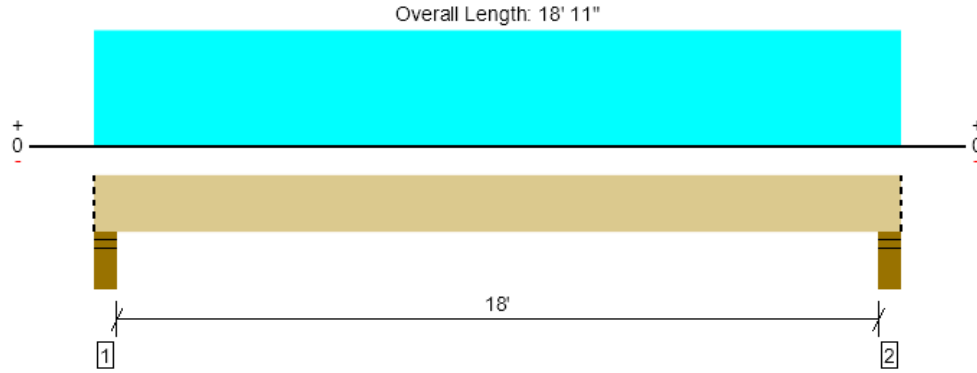
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MAIN FLOOR, MB-07

1 piece(s) 5 1/4" x 11 7/8" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2596 @ 4"	12272 (5.50")	Passed (21%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2199 @ 1' 5 3/8"	12053	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	11427 @ 9' 5 1/2"	29854	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.291 @ 9' 5 1/2"	0.456	Passed (L/752)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.444 @ 9' 5 1/2"	0.913	Passed (L/493)	--	1.0 D + 1.0 L (All Spans)

Member Length : 18' 11"
 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	5.50"	5.50"	1.50"	894	1703	2597	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	894	1703	2597	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	18' 11" o/c	
Bottom Edge (Lu)	18' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 18' 11"	N/A	19.5	--	
1 - Uniform (PSF)	0 to 18' 11" (Back)	3'	25.0	60.0	MAIN DECK w/ PAVERS

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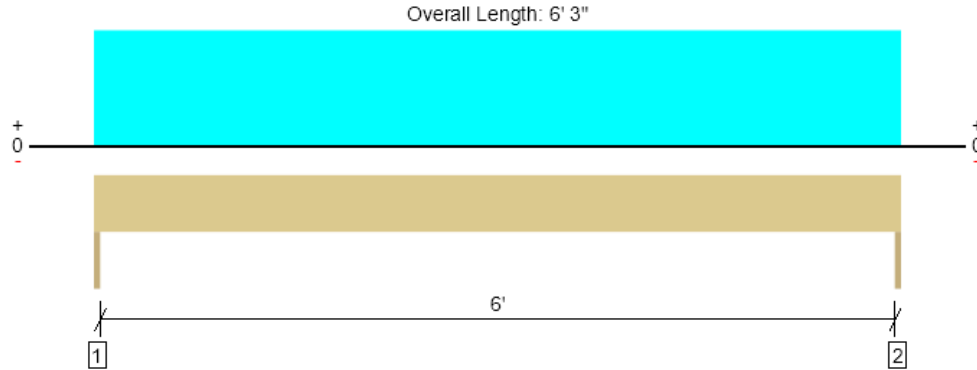
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MF2.10

MAIN FLOOR, MB-08

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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	205 @ 0	3281 (1.50")	Passed (6%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	151 @ 8 3/4"	3045	Passed (5%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	308 @ 3' 1 1/2"	2989	Passed (10%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 3' 1 1/2"	0.208	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.013 @ 3' 1 1/2"	0.313	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

Member Length : 6' 3"
 System : Wall
 Member Type : Header
 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	Floor Live	Snow	Total	
1 - Trimmer - SPF	1.50"	1.50"	1.50"	72	125	52	249	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	72	125	52	249	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	6' 3" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 3"	N/A	6.4	--	--	
1 - Uniform (PSF)	0 to 6' 3"	8"	25.0	60.0	25.0	Main Deck w/ Pavers

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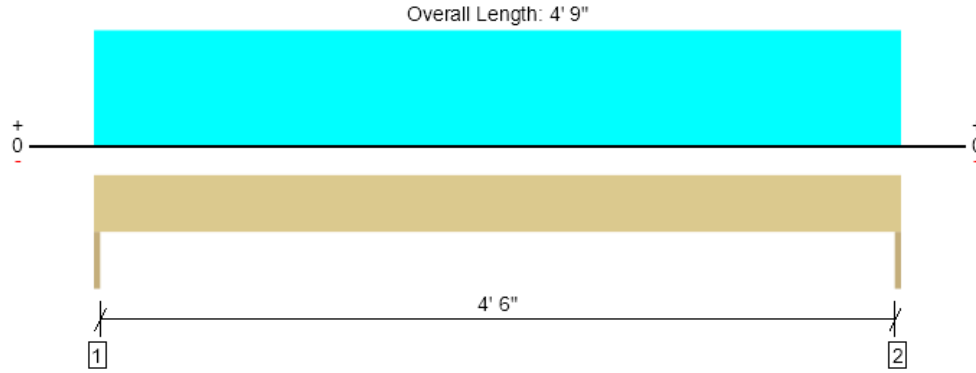
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MF2.11



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1169 @ 0	3281 (1.50")	Passed (36%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	778 @ 8 3/4"	3045	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1333 @ 2' 4 1/2"	2989	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.022 @ 2' 4 1/2"	0.158	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.032 @ 2' 4 1/2"	0.237	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

Member Length : 4' 9"
 System : Wall
 Member Type : Header
 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	Floor Live	Snow	Factored	
1 - Trimmer - SPF	1.50"	1.50"	1.50"	374	748	312	1169	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	374	748	312	1169	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 9" o/c	
Bottom Edge (Lu)	4' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 4' 9"	N/A	6.4	--	--	
1 - Uniform (PSF)	0 to 4' 9"	5' 3"	25.0	60.0	25.0	Main Deck w/ Pavers
2 - Uniform (PLF)	0 to 4' 9"	N/A	20.0	-	-	Wall

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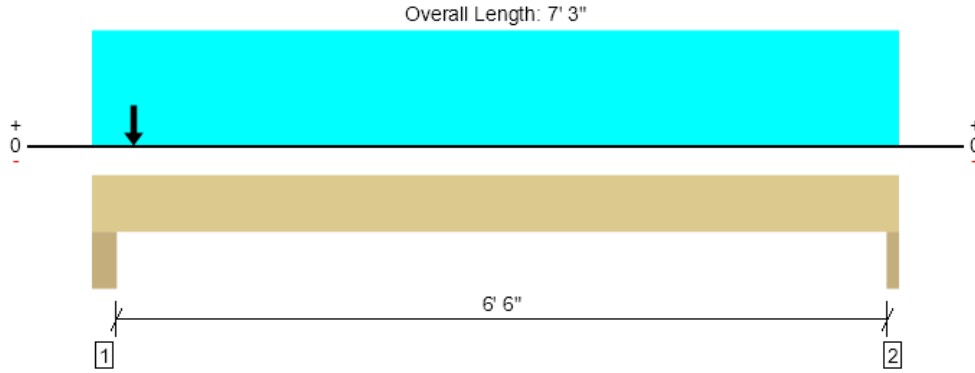
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MAIN FLOOR, MB-10
1 piece(s) 4 x 8 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	11101 @ 4 1/2"	13125 (6.00")	Passed (85%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	758 @ 1' 1 1/4"	3045	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1631 @ 3' 9"	2989	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.014 @ 3' 9"	0.225	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.075 @ 3' 9"	0.313	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 7' 3"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (5/16").
- 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	Floor Live	Snow	Factored	
1 - Trimmer - SPF	6.00"	6.00"	5.07"	4910	4492	3763	11101	None
2 - Trimmer - SPF	3.00"	3.00"	1.50"	816	187	58	1002	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 3" o/c	
Bottom Edge (Lu)	7' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 3"	N/A	6.4	--	--	
1 - Uniform (PSF)	0 to 7' 3"	8"	20.0	40.0	25.0	Main Floor
2 - Uniform (PLF)	0 to 7' 3"	N/A	100.0	-	-	Wall
3 - Uniform (PSF)	0 to 7' 3"	8"	20.0	40.0	-	Upper Floor
4 - Uniform (PLF)	0 to 7' 3"	N/A	100.0	-	-	Wall
5 - Point (lb)	4 1/2"	N/A	1816	4292	-	Linked from: UB-02, Support 1
6 - Point (lb)	4 1/2"	N/A	2220	-	3700	Pt Load From RB-02

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BTL

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Lateral
Forces



Ramaiyah Residence
 7466 E Mercer Way

Revision Date: 1/11/2021

Criteria

Code: 2018 IBC
 Allowable Stress Design (ASD)

Seismic Design: **ASCE 7-16: 12.8 Equivalent Lateral Force Procedure**

Wind Design: **ASCE 7-16: Ch. 28 Envelope Procedure, Low Rise**

Risk Category: II - Other Structures *Table 1.5-1*

Snow Importance Factor $I_s = 1.00$ *Table 1.5-2*
 Ice Importance Factor - Thickness $I_i = 1.00$ *Table 1.5-2*
 Ice Importance Factor - Wind $I_w = 1.00$ *Table 1.5-2*
 Seismic Importance Factor $I_e = 1.00$ *Table 1.5-2*

Spectral Response, Short Period $S_s = 1.454$ (Mapped)

Spectral Response, 1-s Period $S_1 = 0.502$ (Mapped)

Site Class based on Geotechnical Report

Site Class: D *Table 20.3-1*

Site Coefficient $F_a = 1.01$ *Table 11.4-1*

Site Coefficient $F_v = 1.80$ *Table 11.4-2*

Structural Systems:

Light framed walls with shear panels

All other structural systems $T_L = 6$ (*Figs. 22-14 thru 22-17*)

Response Modification Coefficient $R = 6.5$ *Table 12.2-1*

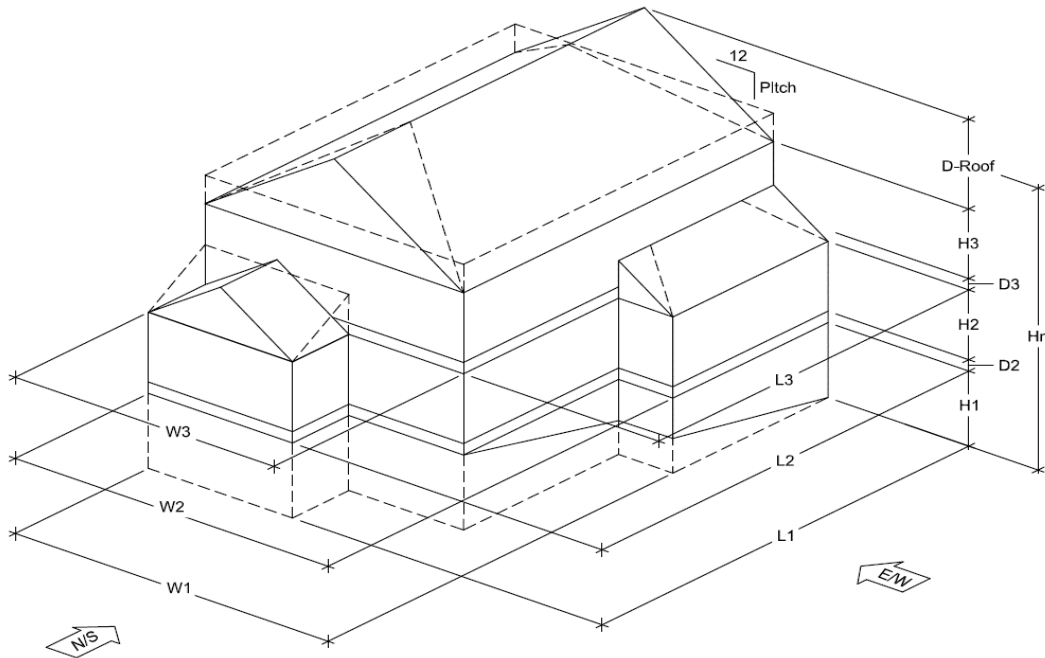
Overstrength Factor $\Omega_0 = 3$ *Table 12.2-1*

Deflection Amplification Factor $C_d = 4$ *Table 12.2-1*

Basic Wind Speed: 100 mph

Exposure to Wind: Exposure C *Section 26.7.3*

Topographical Factor $K_{ZT} = 1.00$



Roof	
Geometry	
Mean Roof Height	Hn = 29.5 ft
Roof Depth	D-Roof = 1 ft
Overhang Length	18 in
Pitch	1:12
Floor 2	
Geometry	
Width	W3 = 37 ft
Length	L3 = 44 ft
Plate Height	H3 = 8 ft
Floor Depth	D3 = 18 in
Floor 1	
Geometry	
Width	W2 = 43 ft
Length	L2 = 44 ft
Plate Height	H2 = 9 ft
Floor Depth	D2 = 18 in
Basement	
Geometry	
Width	W1 = 56 ft
Length	L1 = 44 ft
Plate Height	H1 = 9 ft

Seismic Weight - Roof			
Roof Area 1	1660 SF	15 psf	24,900#
Roof Area 2			
Roof Area 3			
Exterior Wall 1	162 LF	4 ft	10 psf
Exterior Wall 2			
Exterior Wall 3			
Interior Wall	45 LF	4 ft	8 psf
			1,440#
			Total
			32,820#

Seismic Weight - Floor 2			
Roof Area 1	550 SF	15 psf	8,250#
Floor Area 1	1710 SF	20 psf	34,200#
Floor Area 2			
Floor Area 3			
Exterior Wall 1	162 LF	4 ft	10 psf
Exterior Wall 2	174 LF	4.5 ft	10 psf
Exterior Wall 3			
Interior Wall1	45 LF	4 ft	8 psf
Interior Wall2	50 LF	4.5 ft	8 psf
			1,800#
			Total
			60,000#

Seismic Weight - Floor 1			
Roof Area 1			
Floor Area 1	2175 SF	20 psf	43,500#
Floor Area 2	423 SF	25 psf	10,575#
Floor Area 3			
Exterior Wall 1	174 LF	4.5 ft	10 psf
Exterior Wall 2	200 LF	4.5 ft	10 psf
Exterior Wall 3			
Interior Wall1	50 LF	4.5 ft	8 psf
Interior Wall2	80 LF	4.5 ft	8 psf
			2,880#
			Total
			75,585#

N/S Projected Area - Roof	
Sloped Roof Area	90 SF
Gable/Parapet Area	
Wall Area	148 SF

E/W Projected Area - Roof	
Sloped Roof Area	
Gable/Parapet Area	
Wall Area	176 SF

N/S Projected Area - Floor 2	
Sloped Roof Area	0 SF
Gable/Parapet Area	0 SF
Wall Area	397 SF

E/W Projected Area - Floor 2	
Sloped Roof Area	
Gable/Parapet Area	0 SF
Wall Area	440 SF

N/S Projected Area - Floor 1	
Sloped Roof Area	0 SF
Gable/Parapet Area	0 SF
Wall Area	510 SF

E/W Projected Area - Floor 1	
Sloped Roof Area	
Gable/Parapet Area	0 SF
Wall Area	462 SF

Ramaiyah Residence
 7466 E Mercer Way

Revision Date: 1/11/2021

Redundancy, $\rho = 1.0$ (Section 12.3.4)

Design Base Shear

$$S_{MS} = F_a S_S \quad (\text{Eq. 11.4-1})$$

$$= 1.467$$

$$S_{DS} = \frac{2}{3} S_{MS} \quad (\text{Eq. 11.4-3})$$

$$= 0.978$$

$$S_{M1} = F_v S_1 \quad (\text{Eq. 11.4-2})$$

$$= 0.903$$

$$S_{D1} = \frac{2}{3} S_{M1} \quad (\text{Eq. 11.4-4})$$

$$= 0.602$$

Seismic Design Category:

Structure Period and Weight:

Short Period -- D

1-Second Period -- D

$$C_t = 0.020 \quad \text{Table 12.8-2}$$

$$x = 0.75$$

Building Height (Mean Roof), $h_n = 30$ ft

$$\text{Approximate Fundamental Period, } T_a = C_t (h_n)^x \quad (\text{Eq. 12.8-7})$$

$$T = T_a = 0.25$$

$$T_L = 6 \quad (\text{Figs. 22-14 thru 22-17})$$

Calculated design base shear:

$$V = C_s W \quad (\text{Eq. 12.8-1})$$

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)} \quad (\text{Eq. 12.8-2})$$

$$C_s = 0.151$$

The total design base shear need not exceed:

$$(\text{Eq. 12.8-3}) \quad (\text{Eq. 12.8-4})$$

$$\text{for } T \leq T_L \quad C_s = \frac{S_{D1}}{T \left(\frac{R}{I_e}\right)} \quad \text{for } T > T_L \quad C_s = \frac{S_{D1} T_L}{T^2 \left(\frac{R}{I_e}\right)}$$

$$C_s = 0.366$$

$$C_s = 8.67$$

$$C_s = 0.366 \quad T \leq T_L$$

$$C_s = 0.549 \quad 1.5 \text{ times } C_s \text{ in accordance with 11.4.8}$$

The total design base shear shall not be less than:

$$C_s = 0.044 S_{DS} I_e \geq 0.01 \quad (\text{Eq. 12.8-5})$$

$$C_s = 0.043$$

nor where $S_1 \geq 0.6g$:

$$C_s = 0.5 S_1 / (R/I_e) \quad (\text{Eq. 12.8-6})$$

$$C_s = 0.000$$

$$C_s = 0.151$$

$$V = 0.151 W$$



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 7466 E Mercer Way

Revision Date: 1/11/2021

$\rho_s = \lambda K_{ZT} \rho_{s30}$ (28.5-1) Exposure = C
 $\lambda = 1.39$ (Fig. 28.5.1) Mean Roof Ht hn (ft) = 30 ft
 $K_{ZT} = 1.00$ (Section 26.8) a (roof) = 3.7 ft
 a (upper/main floor) = 4.3 ft
 Basic Wind Speed = 100 mph
 Roof Angle = 3

North/South Loading

28.5.4 Minimum Design Loads

Zone	Area	p_{s30} (psf)	$p_{s30\ design}$ (psf)	ρ (psf)	Force (#)	ASD Force (#)	Force (#)	ASD Force (#)
Roof								
A _{wall}	30	15.9	15.9	22.1	654	393	474	284
Agable	0	15.9	15.9	22.1	0	0	0	0
B	7	-8.2	0.0	0.0	0	0	59	36
C _{wall}	118	10.5	10.5	14.6	1728	1037	1894	1137
C _{gable}	0	10.5	10.5	14.6	0	0	0	0
D	83	-4.9	0.0	0.0	0	0	661	396
Total Area =	238			Total Load =	2382	1429	3088	1853
				Design :	3088	1853		
Floor 2								
A _{wall}	81	15.9	15.9	22.1	1795	1077	1299	780
Agable	0	15.9	15.9	22.1	0	0	0	0
B	0	-8.2	0.0	0.0	0	0	0	0
C _{wall}	316	10.5	10.5	14.6	4609	2765	5053	3032
C _{gable}	0	10.5	10.5	14.6	0	0	0	0
D	0	-4.9	0.0	0.0	0	0	0	0
Total Area =	397			Total Load =	6404	3842	6352	3811
				Design :	6404	3842		

East/West Loading

28.5.4 Minimum Design Loads

Zone	Area	p_{s30} (psf)	$p_{s30\ design}$ (psf)	ρ (psf)	Force (#)	ASD Force (#)	Force (#)	ASD Force (#)
Roof								
A _{wall}	30	15.9	15.9	22.1	654	393	474	284
Agable	0	15.9	15.9	22.1	0	0	0	0
B	0	-8.2	0.0	0.0	0	0	0	0
C _{wall}	146	10.5	10.5	14.6	2137	1282	2342	1405
C _{gable}	0	10.5	10.5	14.6	0	0	0	0
D	0	-4.9	0.0	0.0	0	0	0	0
Total Area =	176			Total Load =	2791	1675	2816	1690
				Design :	2816	1690		
Floor 2								
A _{wall}	75	15.9	15.9	22.1	1652	991	1196	718
Agable	0	15.9	15.9	22.1	0	0	0	0
B	0	-8.2	0.0	0.0	0	0	0	0
C _{wall}	365	10.5	10.5	14.6	5331	3198	5844	3506
C _{gable}	0	10.5	10.5	14.6	0	0	0	0
D	0	-4.9	0.0	0.0	0	0	0	0
Total Area =	440			Total Load =	6983	4190	7040	4224
				Design :	7040	4224		
Floor 1								
A _{wall}	90	15.9	15.9	22.1	1996	1197	1445	867
Agable	0	15.9	15.9	22.1	0	0	0	0
B	0	-8.2	0.0	0.0	0	0	0	0
C _{wall}	372	10.5	10.5	14.6	5425	3255	5947	3568
C _{gable}	0	10.5	10.5	14.6	0	0	0	0
D	0	-4.9	0.0	0.0	0	0	0	0
Total Area =	462			Total Load =	7421	4452	7392	4435
				Design :	7421	4452		

Date: 3/4/2024

Page: L1.4

Ramayah Residence
 7466 E Mercer Way

Revision Date: 1/11/2021

Vertical Distribution of Lateral Forces

Base Shear:

$$V = 25.34 \text{ kips}$$

Shear Walls:

$$F_x = C_{vx} V \quad (\text{Eq. 12.8-11})$$

$$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^n w_i h_i^k} \quad (\text{Eq. 12.8-12})$$

Diaphragms:

$$F_{px} = \left(\sum_{i=x}^n F_i / \sum_{i=x}^n w_i \right) (w_{px}) \dots [\text{Eq. 12.10 - 1}]$$

$$F_{px} = 0.2 S_{DS} I_e w_{px} \dots [\text{Eq. 12.10 - 2}] (\text{min})$$

$$F_{px} = 0.4 S_{DS} I_e w_{px} \dots [\text{Eq. 12.10 - 3}] (\text{max})$$

Strength Design Seismic Forces (E)								
Floor Level (from base)	Height, h_x (ft)	Story Weight, w_x (Kips)	$w_x h_x$ (ft-Kips)	Lateral Force, F_x (Kips)	Story Shear, ΣF_x (Kips)	Story Moment (ft-Kips)	Portion of Weight at i , Σw_i (Kips)	Diaphragm Force, F_{px} (Kips)
Roof	19.0	32.82	624	6.95	6.95	59	33	6.95
Floor 2	10.5	60.00	630	7.02	13.97	206	93	11.74
Floor 1	-	75.59	-	11.38	25.34	-	168	14.79

Totals $W = 168.41$ Kips
 $\Sigma w_x h_x = 1254$ ft-Kips

Strength Design Wind Forces (W)				
Floor Level (from base)	Lateral Force N/S, H_x (Kips)	Story Shear N/S, ΣH_x (Kips)	Lateral Force E/W, H_x (Kips)	Story Shear E/W, ΣH_x (Kips)
Roof	3.09	3.09	2.82	2.82
Floor 2	6.40	9.49	7.04	9.86
Floor 1	-	-	7.42	17.28

	Diaphragm (ASD)		
	Seismic, [0.7E] (kips)	Wind N/S [0.6W] (kips)	Wind E/W [0.6W] (kips)
Roof	4.86	1.85	1.69
Floor 2	8.22	3.84	4.22
Floor 1	10.35	-	4.45

	Shear Walls (ASD)		
	Seismic, [0.7E] (kips)	Wind N/S [0.6W] (kips)	Wind E/W [0.6W] (kips)
Floor 2	4.86	1.85	1.69
Floor 1	4.91	3.84	4.22
Basement	7.96	-	4.45

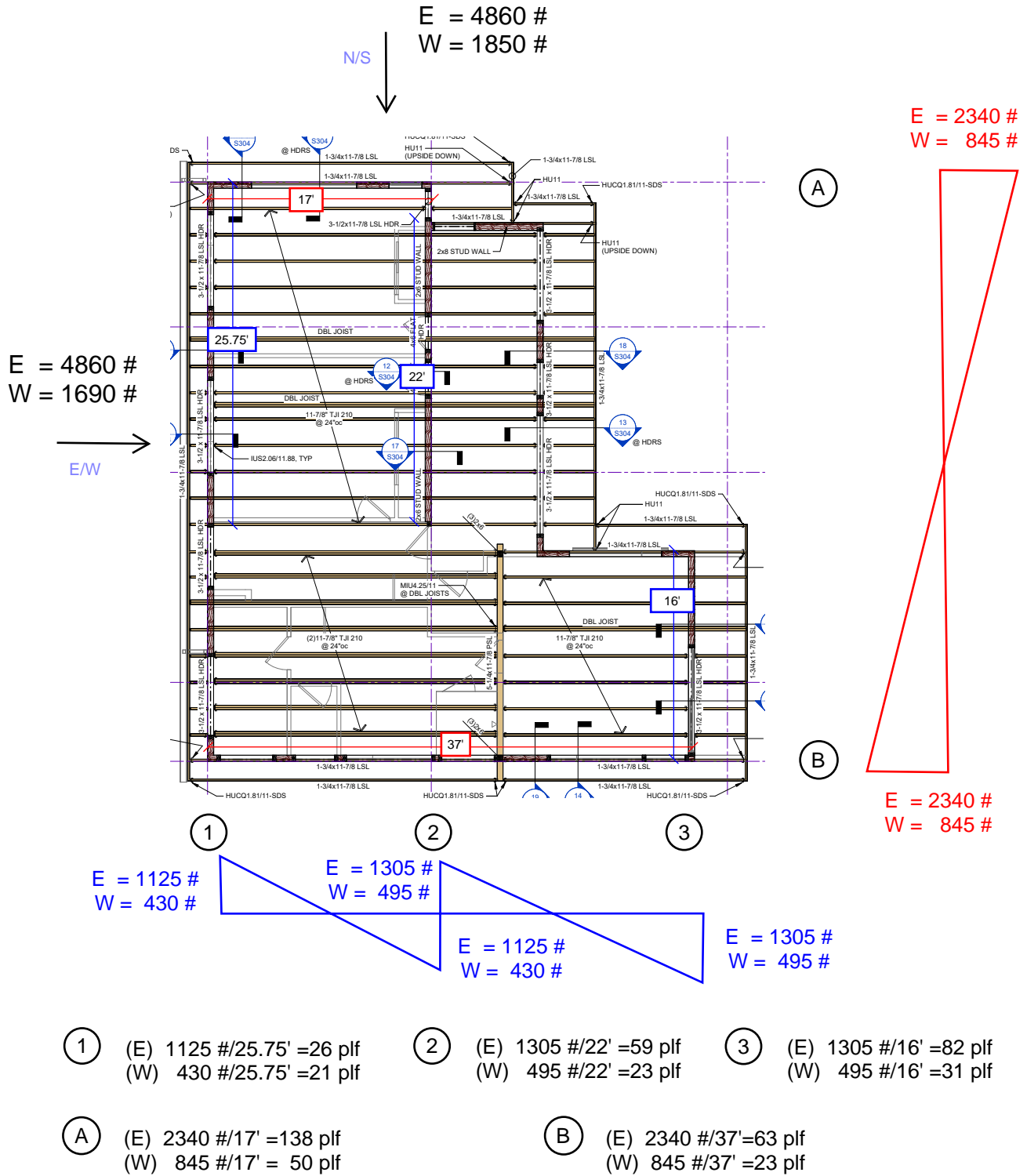
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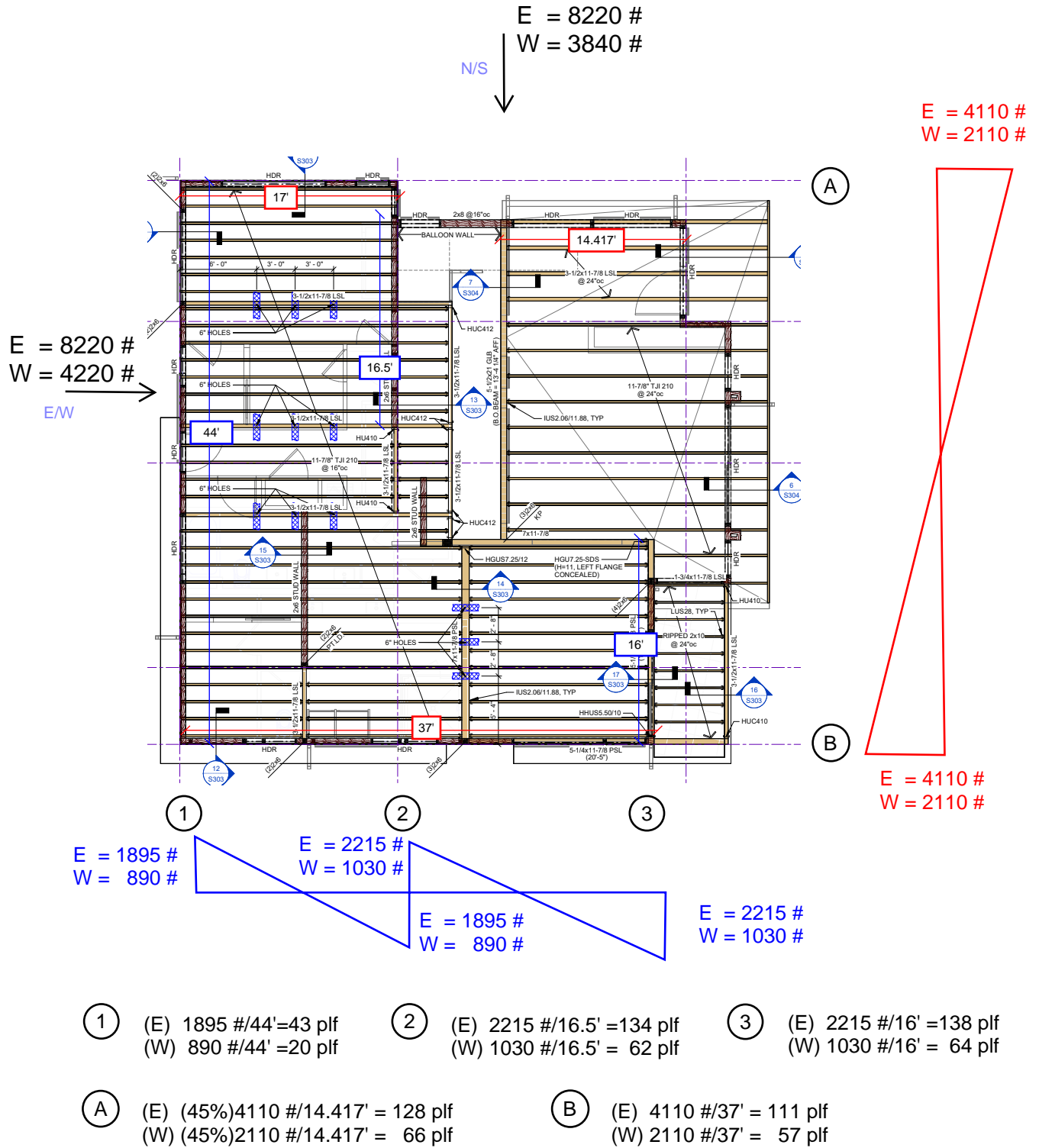
Lateral
Shear Walls/Diaphragms

Roof Diaphragm



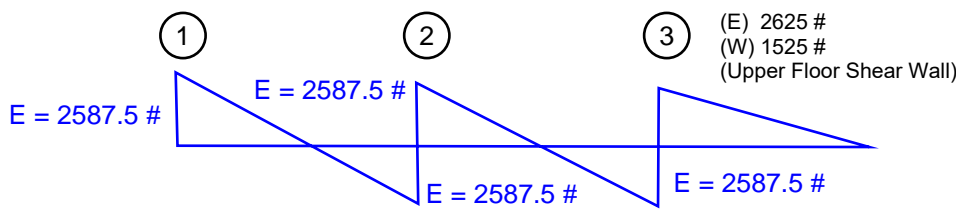
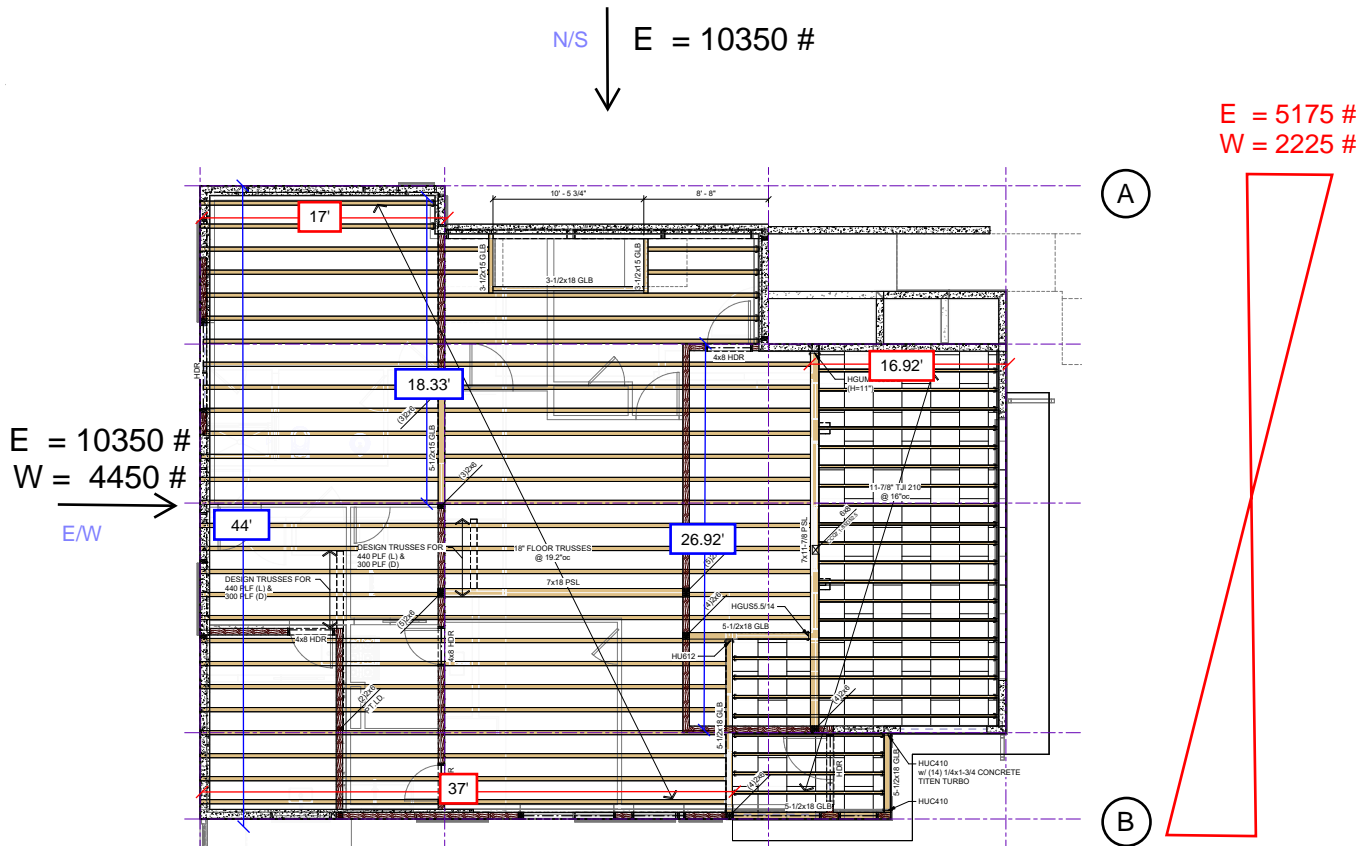
UNBLOCKED

Upper Floor Diaphragm



UNBLOCKED

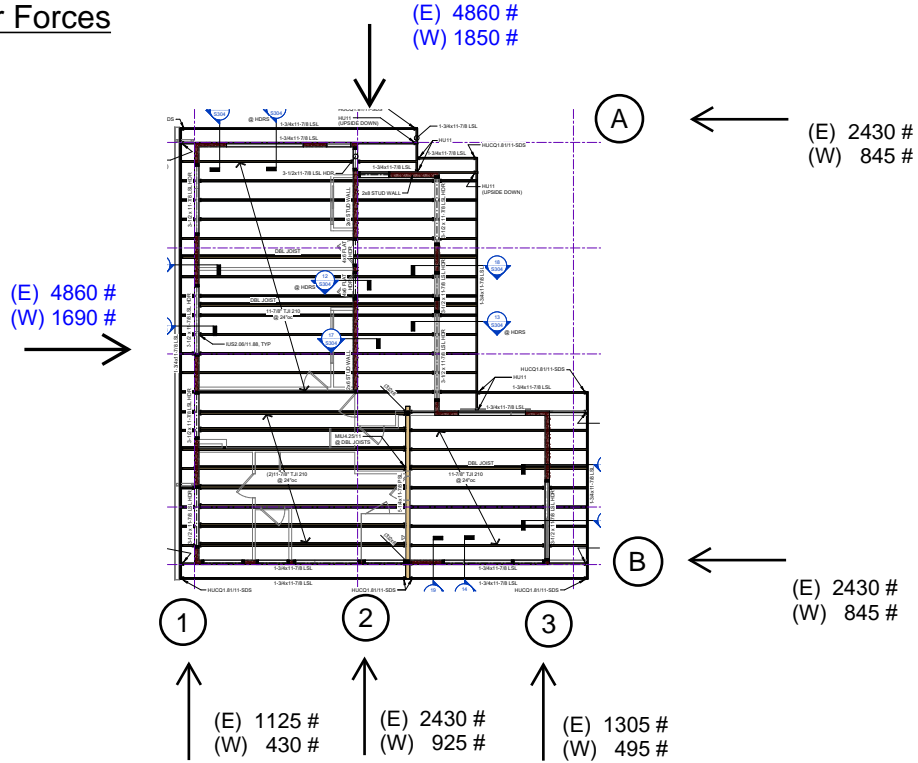
Main Floor Diaphragm



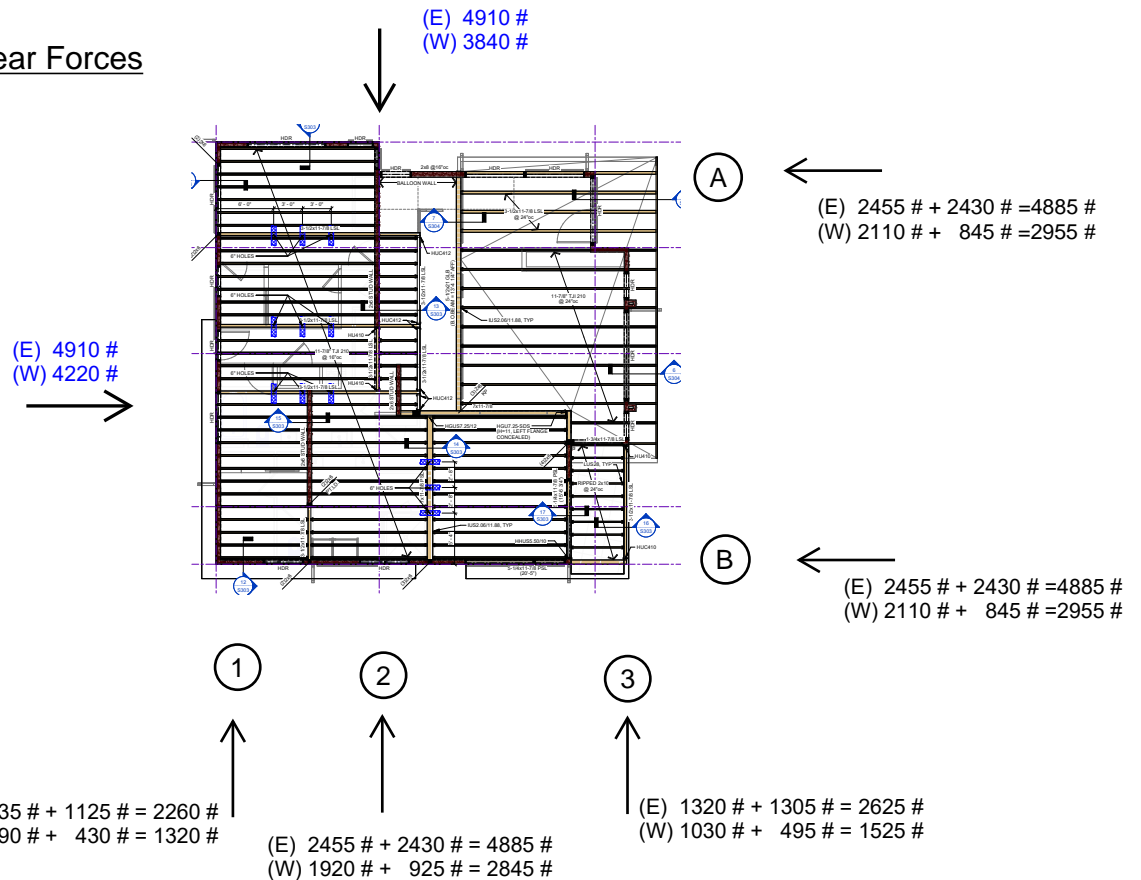
- ① (E) 2587.5 #/44' = 117 plf
- ② (E) 2587.5 #/18.33' = 141 plf
- ③ (E) 2587.5 #/26.92' = 96 plf
- (E) 2625 #/26.92' = 98 plf
- (W) 1525#/26.92' = 57 plf
- Ⓐ (E) (50%)5175 #/17' = 152 plf
- (W) (50%)2225 #/17' = 65 plf
- Ⓑ (E) 5175 #/37' = 140 plf
- (W) 2225#/37' = 60 plf

UNBLOCKED

Upper Floor Shear Forces



Main Floor Shear Forces

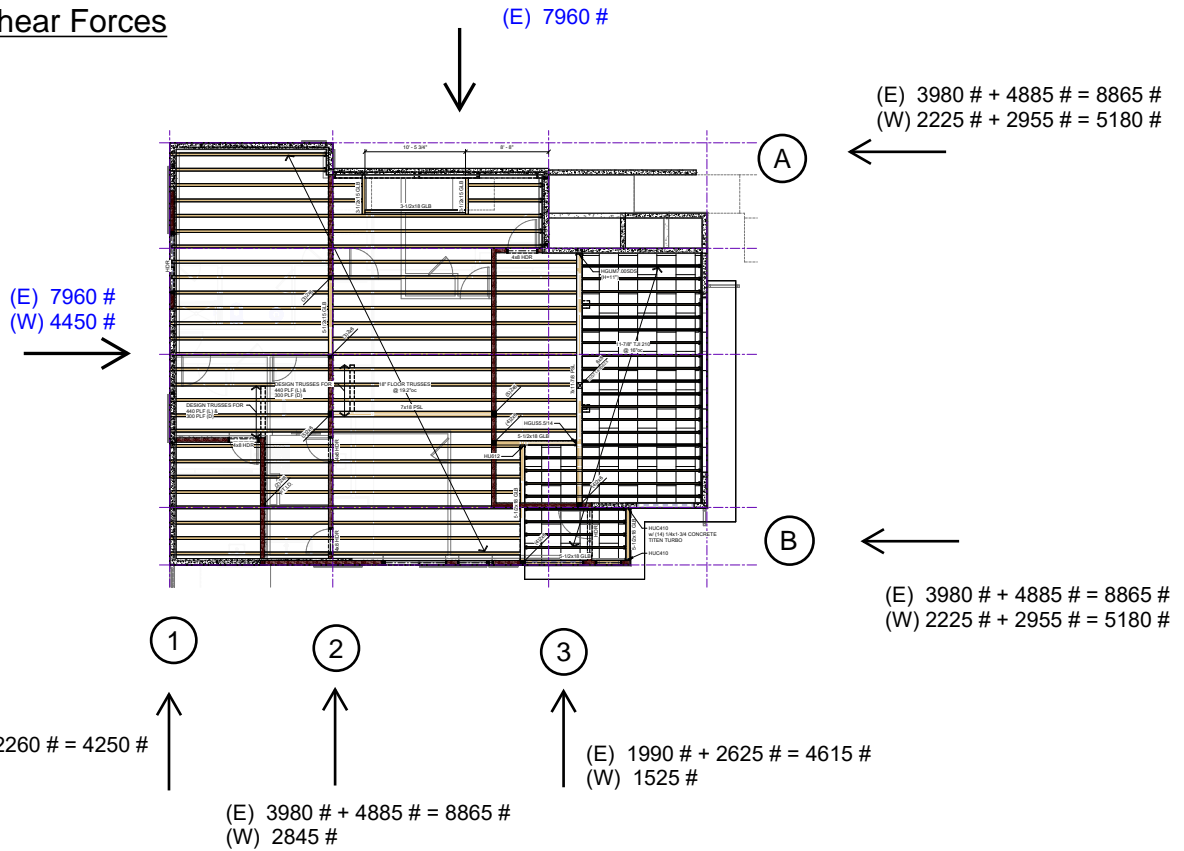


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Project Number: _____ Client: _____ Scale: _____ Page: L2.4

Basement Shear Forces



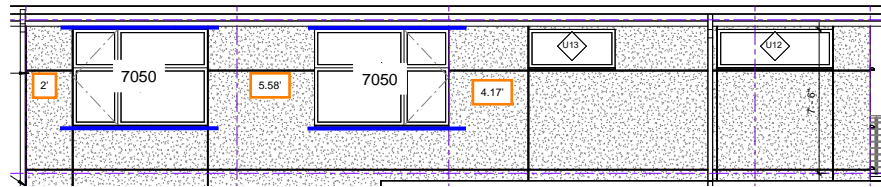
Shear Wall Line 1

E= 1125 #
 W= 430 #

D = 3291 #

$7.75' \times 10 \text{ psf} + 9' \times 15 \text{ psf} = 213 \text{ plf}$
 $D = 0.6 \times 213 \text{ plf} \times 25.75' = 3291 \text{ #}$

3rd Floor: 7.75' PLT



$25.75' - 14' = 11.75'$

E = -1307 #
 W = -1516 #

NO UPLIFT

$E = 1125 \text{ #} / 11.75' = 96 \text{ plf}$
 $W = 430 \text{ #} / 11.75' = 37 \text{ plf}$

$h/b < 2, < 240\text{-plf}$

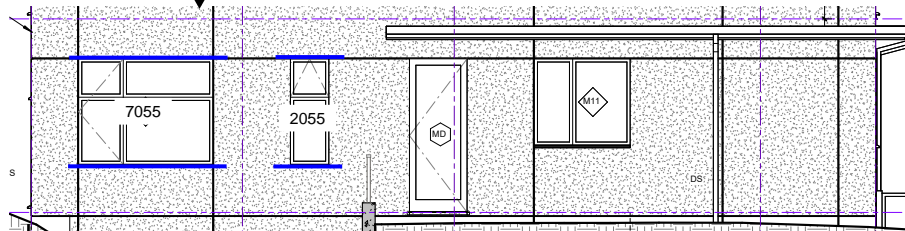
P1-6

E= 2260 #
 W= 1320 #

D = 2951 #

$9' \times 10 \text{ psf} + 8' \times 20 \text{ psf} = 250 \text{ plf}$
 $D = 0.6 \times 250 \text{ plf} \times 19.67' = 2951 \text{ #}$

2nd Floor: 9' PLT



$19.67' - 9' = 10.67'$

E = -441 #
 W = -872 #

NO UPLIFT

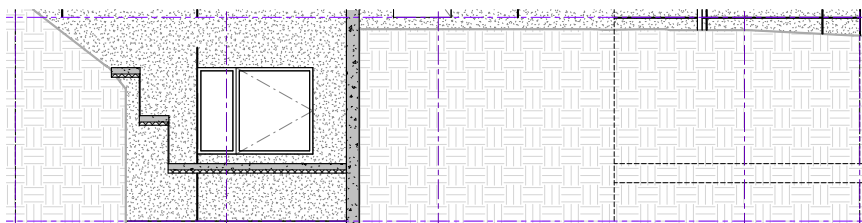
$E = 2260 \text{ #} / 10.67' = 212 \text{ plf}$
 $W = 1320 \text{ #} / 10.67' = 124 \text{ plf}$

$h/b < 2, < 240\text{-plf}$

P1-6

E= 4250 #
 W= 1320 #

1st Floor: 9' PLT



8'

NO UPLIFT

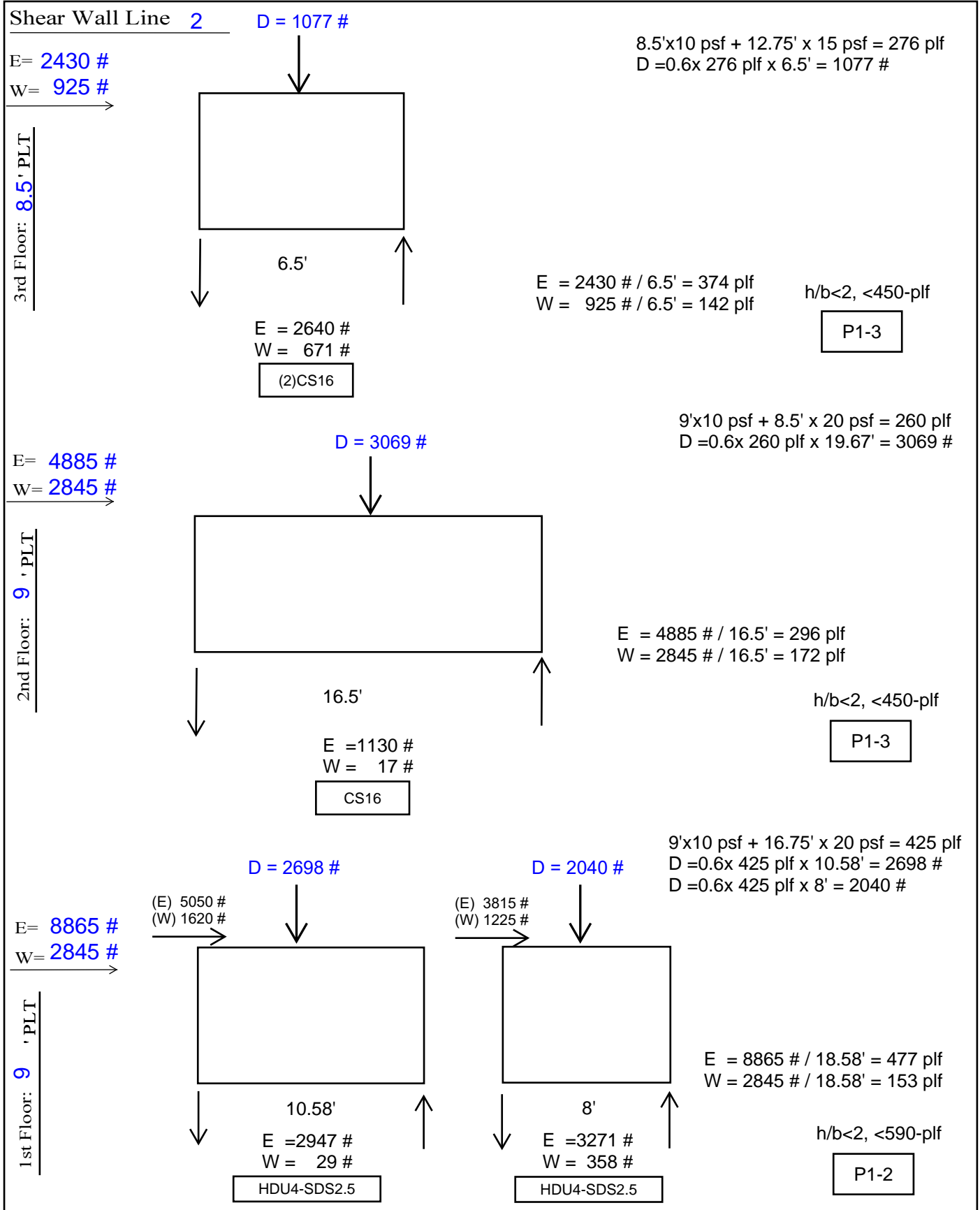
$E = 4250 \text{ #} / [8'' \times (8' \times 12''/1)] = 5.5 \text{ psi}$
 $W = 1320 \text{ #} / [8'' \times (8' \times 12''/1)] = 1.7 \text{ psi}$

$V_c = 2 \times \text{sqrt}(f_c) = 2 \times \text{sqrt}(2500 \text{ psi}) = 100 \text{ psi}$
 Concrete Wall Ok

Project: Ramaiyah Residence

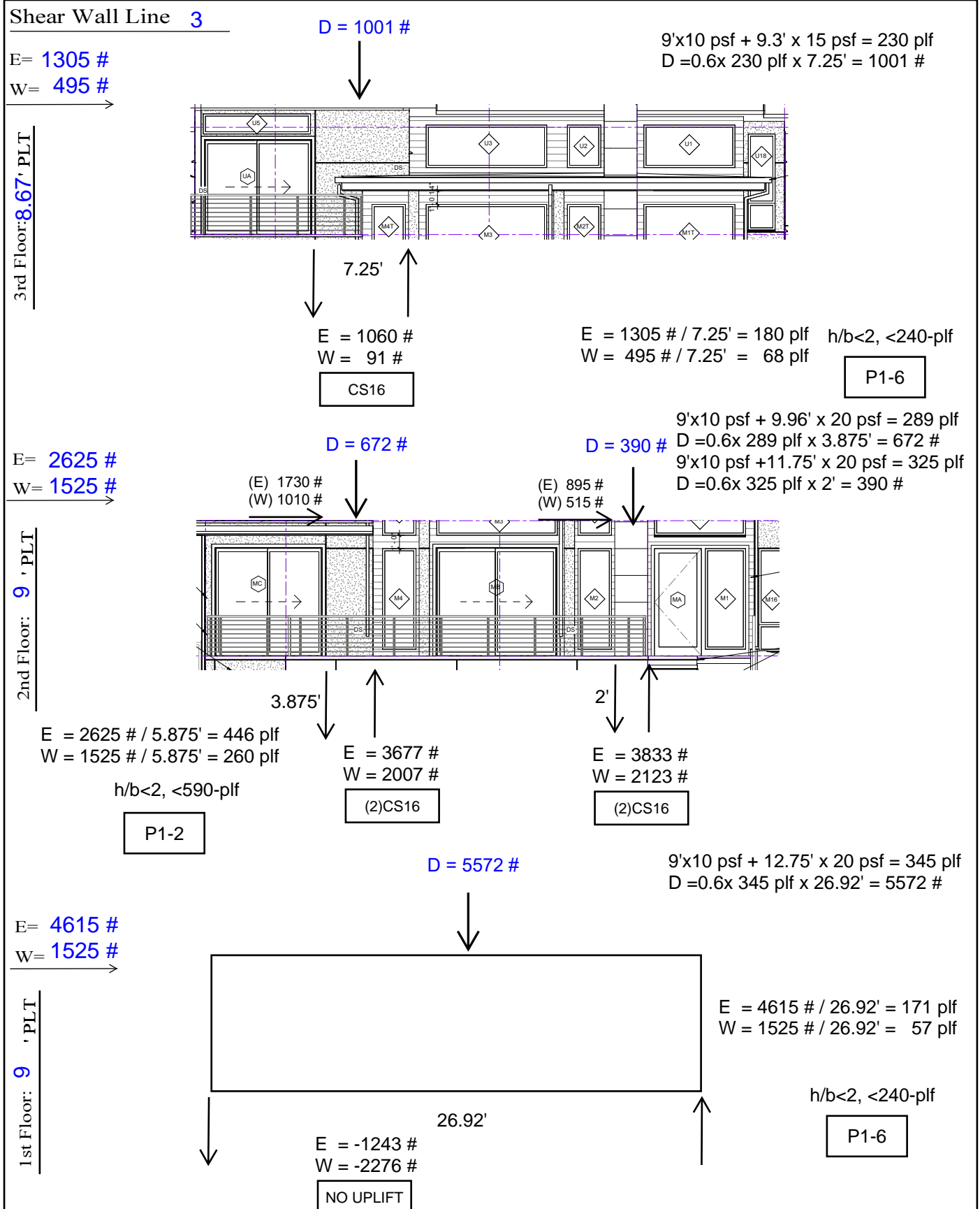
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Project Number: _____ Client: _____ Scale: _____ Page: L2.7



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Project Number: _____ Client: _____ Scale: _____ Page: L2.8

Shear Wall Line **A**

E= 2430 #
 W= 845 #

D = 1275 # $8' \times 10 \text{ psf} + 3' \times 15 \text{ psf} = 125 \text{ plf}$
 $D = 0.6 \times 125 \text{ plf} \times 17' = 1275 \text{ #}$

3rd Floor: 8' PLT



E = 2430 # / 9' = 270 plf
 W = 845 # / 9' = 94 plf

$h/b < 2, < 350\text{-plf}$

P1-4

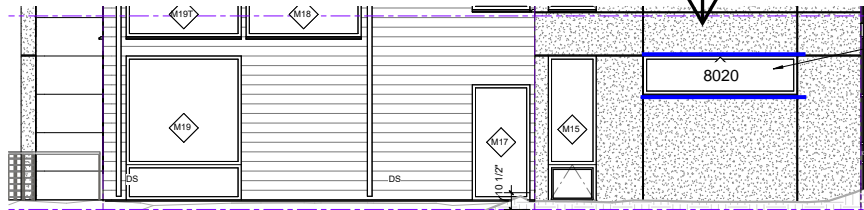
E = 506 #
 W = -240 #

CS16

E= 4885 #
 W= 2955 #

D = 1122 # $9' \times 10 \text{ psf} + 1' \times 20 \text{ psf} = 110 \text{ plf}$
 $D = 0.6 \times 110 \text{ plf} \times 17' = 1122 \text{ #}$

2nd Floor: 9' PLT



E = 2025 #
 W = 1003 #

HDU2-SDS2.5

E = 4885 # / 9' = 543 plf
 W = 2955 # / 9' = 328 plf

$h/b < 2, < 820\text{-plf}$

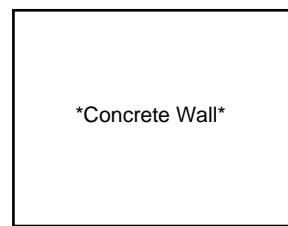
P1-2

E= 8865 #
 W= 5180 #

1st Floor: 9' PLT

E = 8865 # / [8" * (8' * 12"/1)] = 12 psi
 W = 5180 # / [8" * (8' * 12"/1)] = 6.7 psi

$V_c = 2 * \text{sqrt}(f'_c) = 2 * \text{sqrt}(2500 \text{ psi}) = 100 \text{ psi}$
 Concrete Wall Ok



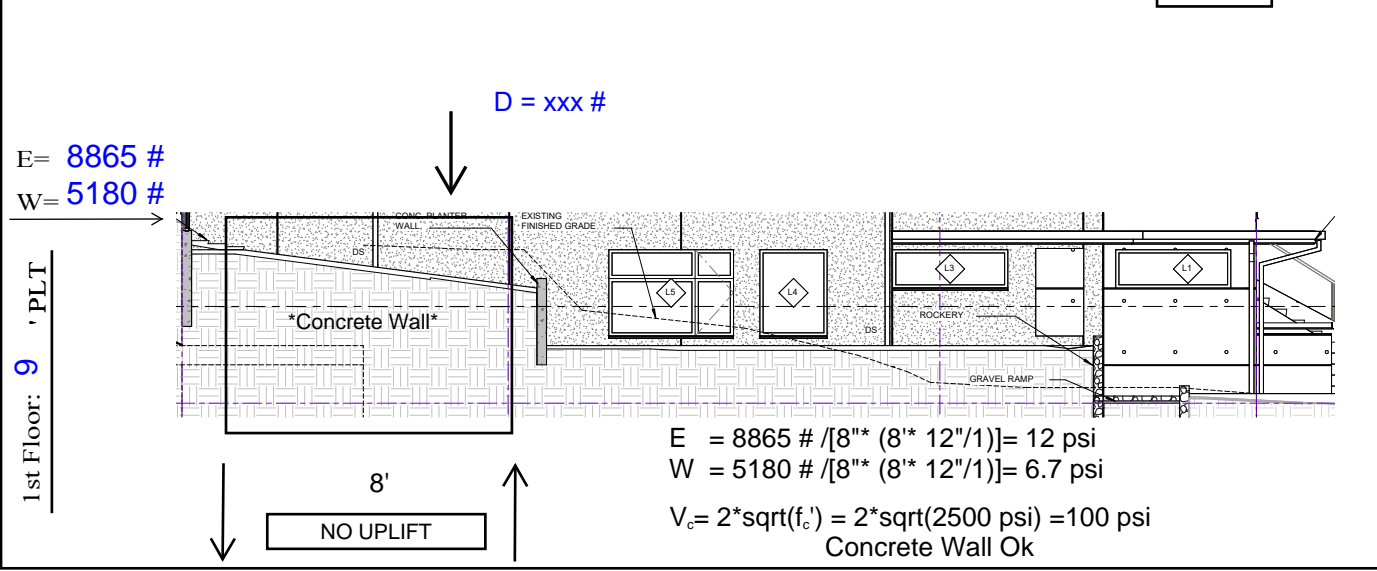
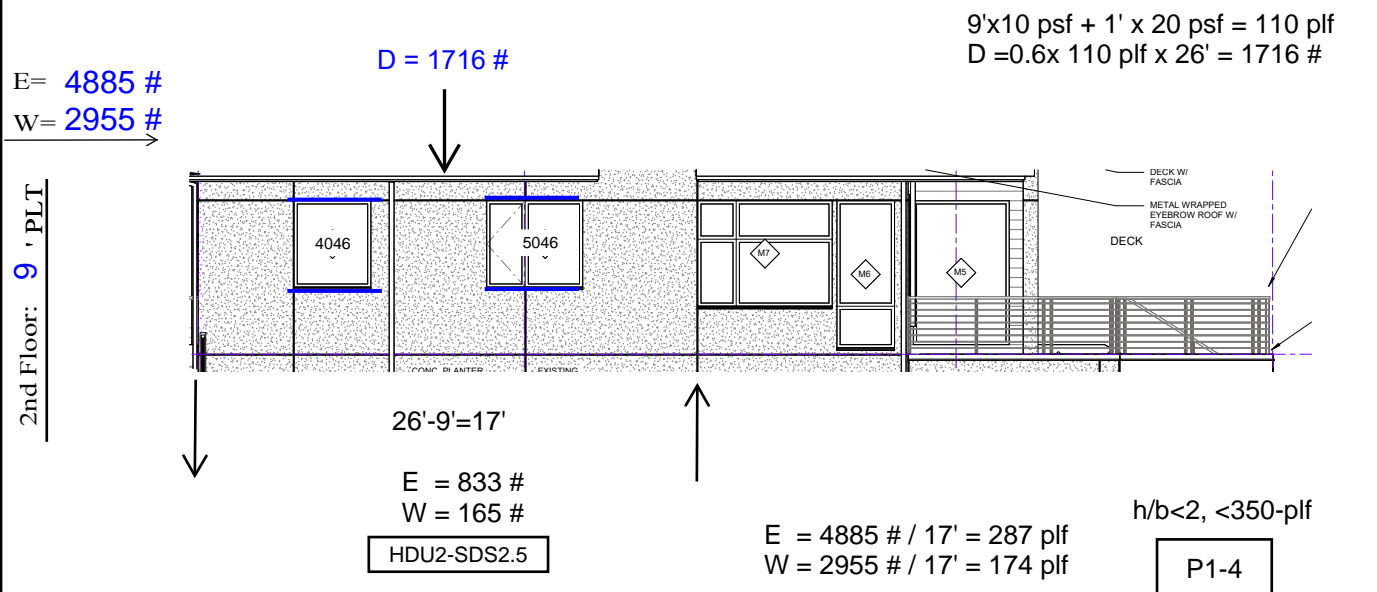
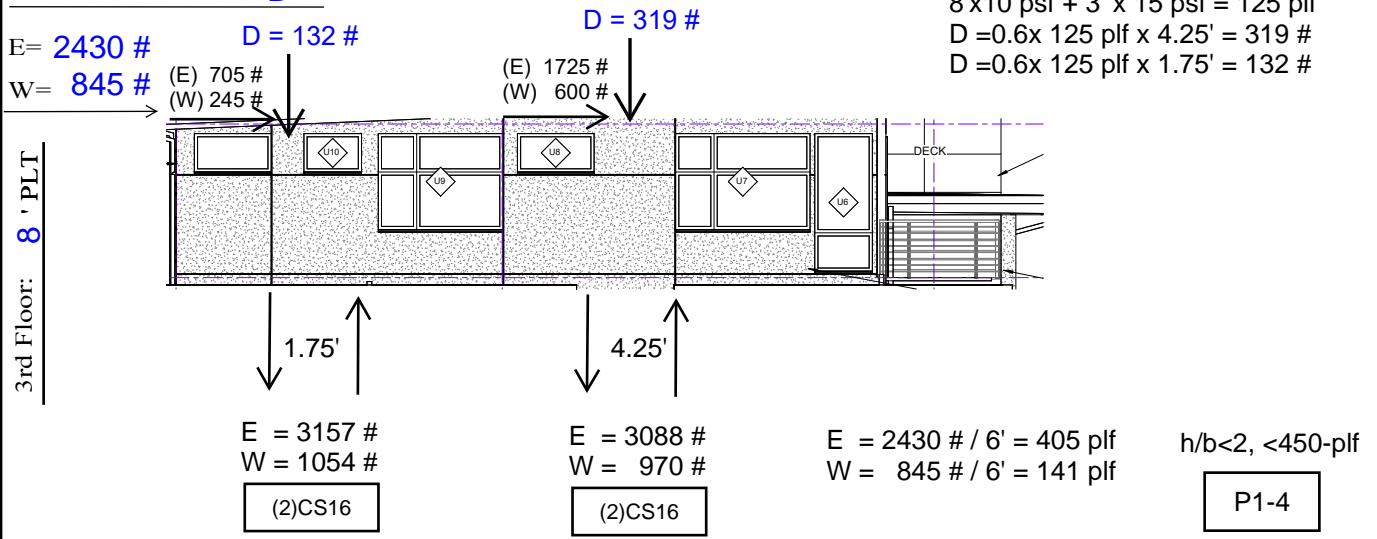
8'
 NO UPLIFT

Project: **Ramaiyah Residence**

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Shear Wall Line **B**



Project: **Ramayah Residence**

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Lateral
Shear Wall/Diaphragm Capacities

2018 IBC/SDPWS 2015 – Diaphragms (8d Nailing)

Table 4.2C Nominal Unit Shear Capacities for Wood-Frame Diaphragms

Unblocked Wood Structural Panel Diaphragms^{1,2,3,4,5}

Sheathing Grade	Common Nail Size	Minimum Fastener Penetration in Framing (in.)	Minimum Nominal Panel Thickness (in.)	Minimum Nominal Width of Nailed Face at Supported Edges and Boundaries (in.)	A SEISMIC				B WIND	
					6 in. Nail Spacing at diaphragm boundaries and supported panel edges				6 in. Nail Spacing at diaphragm boundaries and supported panel edges	
					Case 1		Cases 2,3,4,5,6		Case 1	Cases 2,3,4,5,6
V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)	V_n (plf)	V_n (plf)					
Structural I	6d	1-1/4	5/16	2	OSB	PLY	OSB	PLY	460	350
					370	7.0	6.0	280	4.5	4.0
					480	8.5	7.0	360	6.0	4.5
	8d	1-3/8	3/8	2	530	7.5	6.0	400	5.0	4.0
					570	14	10	430	9.5	7.0
					640	12	9.0	480	8.0	6.0
10d	1-1/2	15/32	2	300	9.0	6.5	220	6.0	4.0	
				340	7.0	5.5	250	5.0	3.5	
				330	7.5	5.5	250	5.0	4.0	
Sheathing and Single-Floor	8d	1-3/8	3/8	2	370	6.0	4.5	280	4.0	3.0
					480	7.5	5.5	360	5.0	3.5
					510	7.0	5.5	380	4.5	3.5
	10d	1-1/2	15/32	2	480	7.5	5.5	360	5.0	4.0
					530	8.5	6.0	420	4.0	3.5
					510	15	9.0	380	10	6.0
19/32	3	3	3	580	12	8.0	430	8.0	5.5	
				570	13	8.5	430	8.5	5.5	
3	3	3	3	640	10	7.5	480	7.0	5.0	

- Nominal unit shear capacities shall be adjusted in accordance with 4.2.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.2.6. For specific requirements, see 4.2.7.1 for wood structural panel diaphragms. See Appendix A for common nail dimensions.
- For species and grades of framing other than Douglas-Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = $[1 - (0.5 - G)]$, where G = Specific Gravity of the framing lumber from the NDS (Table 12.3.3.A). The Specific Gravity Adjustment Factor shall not be greater than 1.
- Apparent shear stiffness values, G_n , are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for diaphragms constructed with either OSB or 3-ply plywood panels. When 4-ply or 5-ply plywood panels or composite panels are used, G_n values shall be permitted to be multiplied by 1.2.
- Where moisture content of the framing is greater than 19% at time of fabrication, G_n values shall be multiplied by 0.5.
- Diaphragm resistance depends on the direction of continuous panel joints with respect to the loading direction and direction of framing members, and is independent of the panel orientation.

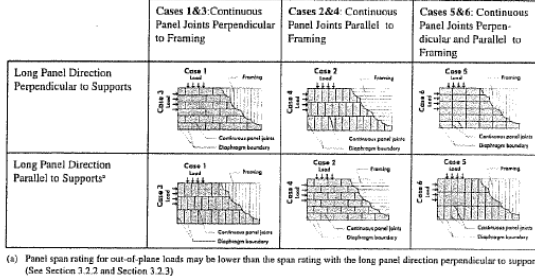
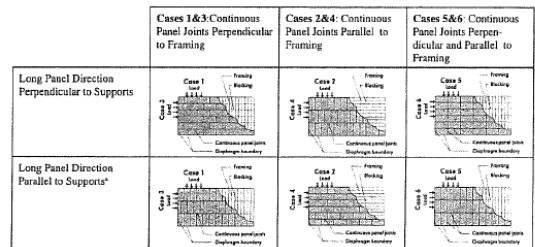


Table 4.2A Nominal Unit Shear Capacities for Wood-Frame Diaphragms

Blocked Wood Structural Panel Diaphragms^{1,2,3,4,5}

Sheathing Grade	Common Nail Size	Minimum Fastener Penetration in Framing Member or Blocking (in.)	Minimum Nominal Panel Thickness (in.)	Minimum Nominal Width of Nailed Face at Adjoining Panel Edges and Boundaries (in.)	A SEISMIC						B WIND									
					Nail Spacing (in.) at diaphragm boundaries (all cases), at continuous panel edges parallel to load (Cases 3 & 4), and at all panel edges (Cases 5 & 6)						Nail Spacing (in.) at diaphragm boundaries (all cases), at continuous panel edges parallel to load (Cases 3 & 4), and at all panel edges (Cases 5 & 6)									
					6		4		2-1/2		2		6		4		2-1/2		2	
V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)	V_n (plf)	G_n (kips/in.)					
Structural I	6d	1-1/4	5/16	2	OSB	PLY	OSB	PLY	OSB	PLY	OSB	PLY	OSB	PLY	OSB	PLY				
					370	15	12	500	8.5	7.5	750	12	10	840	20	15	520	700	1050	1175
					420	12	9.5	560	7.0	6.0	840	9.5	8.5	950	17	13	590	785	1175	1330
	8d	1-3/8	3/8	2	540	14	11	720	9.0	7.5	1050	13	10	1250	21	15	755	1010	1485	1680
					600	12	10	800	7.5	6.5	1200	10	9.0	1350	18	13	840	1120	1680	1890
					640	24	17	850	15	12	1280	20	15	1460	31	21	895	1190	1790	2045
10d	1-1/2	15/32	2	720	20	15	960	12	9.5	1440	18	13	1640	26	18	1010	1345	2015	2295	
				340	15	10	450	9.0	7.0	670	13	9.5	760	21	13	475	630	940	1085	
				369	12	9.0	500	7.0	6.0	760	10	8.0	850	17	12	530	700	1050	1205	
Sheathing and Single-Floor	8d	1-3/8	3/8	2	370	13	9.5	500	7.0	6.0	750	10	8.0	840	18	12	520	700	1050	1175
					420	10	8.0	560	5.5	5.0	840	8.5	7.0	950	14	10	590	785	1175	1330
					480	15	11	640	9.5	7.5	960	13	9.5	1080	21	13	670	895	1345	1525
	10d	1-1/2	15/32	2	240	12	9.5	720	7.5	6.0	1080	11	8.5	1220	18	12	755	1010	1510	1710
					510	14	10	680	9.5	7.0	1010	12	9.5	1150	20	13	715	950	1435	1610
					570	11	9.0	750	7.0	6.0	1140	10	8.0	1290	17	12	800	1055	1595	1805
19/32	3	3	3	540	13	9.5	720	7.5	6.5	1060	11	8.5	1200	19	13	755	1010	1485	1680	
				600	10	8.5	850	6.0	5.5	1200	9.0	7.5	1350	15	11	840	1120	1680	1890	
3	3	3	3	650	25	15	770	15	11	1150	21	14	1310	33	18	910	1190	1610	1810	
				650	21	14	860	12	9.5	1300	17	12	1470	28	16	910	1205	1820	2040	
3	3	3	3	640	21	14	860	13	9.5	1280	18	12	1460	28	17	895	1190	1790	2045	
				720	17	12	960	10	8.0	1440	14	11	1640	24	15	1010	1345	2015	2295	

- Nominal unit shear capacities shall be adjusted in accordance with 4.2.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.2.6. For specific requirements, see 4.2.7.1 for wood structural panel diaphragms. See Appendix A for common nail dimensions.
- For species and grades of framing other than Douglas-Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = $[1 - (0.5 - G)]$, where G = Specific Gravity of the framing lumber from the NDS (Table 12.3.3.A). The Specific Gravity Adjustment Factor shall not be greater than 1.
- Apparent shear stiffness values, G_n , are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for diaphragms constructed with either OSB or 3-ply plywood panels. When 4-ply or 5-ply plywood panels or composite panels are used, G_n values shall be permitted to be multiplied by 1.2.
- Where moisture content of the framing is greater than 19% at time of fabrication, G_n values shall be multiplied by 0.5.
- Diaphragm resistance depends on the direction of continuous panel joints with respect to the loading direction and direction of framing members, and is independent of the panel orientation.



- Reduction Factor = 2
- $G = 0.42$ (SPF or Hem Fir)... Adjustment Factor = $[1 - (0.5 - 0.42)] = 0.92$ or 0.5 (I-Joists or Douglas Fir)... Adjustment Factor = 1.0

Diaphragm	Sheathing Thickness	Nail Spacing Edge/Intermediate	Blocked	Framing	Seismic Capacity (Case 1/Other)	Wind Capacity (Case 1/Other)
Roof – Unblocked	7/16"	6"/12" oc	N	2x (SPF/HF)	212-plf/156-plf	297-plf/219-plf
Roof – Blocked	7/16"	4"/12" oc	Y	2x (SPF/HF)	313-plf	437-plf
Floor – Unblocked	3/4"	6"/12" oc	N	2x (DF) or 3x (HF)	240-plf/180-plf	335-plf/252-plf
Floor – Blocked	3/4"	4"/12" oc,	Y	2x (DF) or 3x (HF)	360-plf	505-plf

2018 IBC/SDPWS 2015 – Shear Wall Schedule

7/16" OSB; 0.131" φ Nails; SPF or HF Studs @ 16" oc

Table 4.3A Nominal Unit Shear Capacities for Wood-Frame Shear Walls^{1,3,6,7}

Wood-based Panels ⁴																			
Sheathing Material	Minimum Nominal Panel Thickness (in.)	Minimum Fastener Penetration in Framing Member or Blocking (in.)	Fastener Type & Size	A SEISMIC								B WIND							
				Panel Edge Fastener Spacing (in.)								Panel Edge Fastener Spacing (in.)							
				6		4		3		2		6		4		3			
				v_s (plf)	G_s (kips/in.)	v_s (plf)	G_s (kips/in.)	v_s (plf)	G_s (kips/in.)	v_s (plf)	G_s (kips/in.)	v_w (plf)	v_w (plf)	v_w (plf)	v_w (plf)				
Wood Structural Panels - Structural I ^{1,5}	5/16	1-1/4	Nail (common or galvanized box) 6d	400	13	10	600	18	13	780	23	16	1020	35	22	580	840	1090	1430
	3/8	1-3/8	8d	460	19	14	720	24	17	920	30	20	1220	43	24	645	1010	1290	1710
	7/16			510	16	13	790	21	16	1010	27	19	1340	40	24	715	1105	1415	1875
	15/32			560	14	11	860	18	14	1100	24	17	1460	37	23	785	1205	1540	2045
	15/32	1-1/2	10d	680	22	16	1020	29	20	1330	36	22	1740	51	28	950	1430	1860	2435
Wood Structural Panels - Sheathing ^{1,5}	5/16	1-1/4	6d	360	13	9.5	540	18	12	700	24	14	900	37	18	505	755	980	1260
	3/8			400	11	8.5	600	15	11	780	20	13	1020	32	17	560	840	1090	1430
	7/16	1-3/8	8d	440	17	12	640	25	15	820	31	17	1060	45	20	615	895	1150	1485
	15/32			480	15	11	700	22	14	900	28	17	1170	42	21	670	980	1260	1640
	15/32	1-1/2	10d	520	13	10	760	19	13	960	25	15	1260	39	20	730	1065	1370	1790
	19/32			620	22	14	920	30	17	1200	37	19	1540	52	23	870	1290	1680	2165
	19/32	1-1/2	10d	680	19	13	1020	26	16	1330	33	18	1740	48	22	950	1430	1860	2435
Plywood Siding	5/16	1-1/4	Nail (galvanized casing) 6d	280	13		420	16		550	17		720	21		390	590	770	1010
	3/8	1-3/8	8d	320	16		480	18		620	20		820	22		450	670	870	1150
Particleboard Sheathing - (M-S "Exterior Glue" and M-2 "Exterior Glue")	3/8		Nail (common or galvanized box) 6d	240	15		360	17		460	19		600	22		335	505	645	840
	3/8		8d	260	18		380	20		480	21		630	23		365	530	670	880
	1/2			280	16		420	20		540	22		700	24		390	590	755	980
	1/2		10d	370	21		550	23		720	24		920	25		520	770	1010	1290
	5/8			400	21		610	23		790	24		1040	26		560	855	1105	1455
Structural Fiberboard Sheathing	1/2		Nail (galvanized roofing) 11 ga. galv. roofing nail (0.120" x 1-1/2" long x 7/16" head)				340	4.0		460	5.0		520	5.5			475	645	730
	25/32		11 ga. galv. roofing nail (0.120" x 1-3/4" long x 3/8" head)				340	4.0		460	5.0		520	5.5			475	645	730

- Nominal unit shear capacities shall be adjusted in accordance with 4.3.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.3.6. For specific requirements, see 4.3.7.1 for wood structural panel shear walls, 4.3.7.2 for particleboard shear walls, and 4.3.7.3 for fiberboard shear walls. See Appendix A for common and box nail dimensions.
- Shears are permitted to be increased to values shown for 15/32 inch (nominal) sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.
- For species and grades of framing other than Douglas-Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = $[1 - (0.5 - G)]$, where G = Specific Gravity of the framing lumber from the NDS (Table 12.3.3A). The Specific Gravity Adjustment Factor shall not be greater than 1.
- Apparent shear stiffness values G_s are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for shear walls constructed with either OSB or 3-ply plywood panels. When 4-ply or 5-ply plywood panels or composite panels are used, G_s values shall be permitted to be multiplied by 1.2.
- Where moisture content of the framing is greater than 19% at time of fabrication, G_s values shall be multiplied by 0.5.
- Where panels are applied on both faces of a shear wall and nail spacing is less than 6" on center on either side, panel joints shall be offset to fall on different framing members as shown below. Alternatively, the width of the nailed face of framing members shall be 3" nominal or greater at adjoining panel edges and nails at all panel edges shall be staggered.
- Galvanized nails shall be hot-dipped or tumbled.

- Reduction Factor = 2
- 16" oc studs – use values for 15/32
- $G = 0.42$ (SPF or Hem Fir)... Adjustment Factor = $[1 - (0.5 - 0.42)] = 0.92$

Wall Type	Blocked	Sheathing (1) or (2) Sides	Nail Spacing Edge/Intermediate	Framing	Sill Plate	Seismic Capacity $h/b_s = 2$	Seismic Capacity $h/b_s = 3.5$	Wind Capacity $h/b_s = 2$	Wind Capacity $h/b_s = 3.5$
P1-6	Y	1	6"/12" oc	2x	2x	240-plf	194-plf	335-plf	272-plf
P1-4	Y	1	4"/12" oc	2x	2x	350-plf	284-plf	490-plf	398-plf
P1-3	Y	1	3"/12" oc	2-2x	2x	450-plf	366-plf	630-plf	512-plf
P1-2	Y	1	2"/12" oc	2-2x	2x	590-plf	478-plf	820-plf	669-plf
P2-4	Y	2	4"/12" oc, ea. side	2-2x	3x	700-plf	568-plf	980-plf	796-plf
P2-3	Y	2	3"/12" oc, ea. side	2-2x	3x	900-plf	733-plf	1260-plf	1024-plf
P2-2	Y	2	2"/12" oc, ea. side	2-2x	3x	1180-plf	957-plf	1640-plf	1338-plf

2018 IBC/NDS 2015 – Shear Wall Framing Clips

Model No.	Type of Connection	Fasteners (in.)	Direction of Load	DF/SP Allowable Loads			SPF/HF Allowable Loads		
				Floor (100)	Roof (125)	(160)	Floor (100)	Roof (125)	(160)
SS A34	1	(8) 0.131 x 1 1/2	F ₁	395	465	465	340	400	400
			F ₂ ⁶	395	430	430	340	370	370
	1	(8) #9 x 1 1/2 SD	F ₁	640	640	640	550	550	550
			F ₂	495	495	495	425	425	425
			Uplift	240	240	240	170	170	170
SS A35	2	(9) 0.131 x 1 1/2	A ₁	295	350	350	255	300	300
			E	295	360	385	255	310	330
			C ₁	185	185	185	160	160	160
	3	(12) 0.131 x 1 1/2	A ₂	295	325	325	255	280	280
			C ₂	295	330	330	255	285	285
			D	225	225	225	195	195	195
			F ₁	590	650	650	510	560	560
	4	(12) 0.131 x 1 1/2	F ₂ ⁶	590	670	670	510	575	575
			5	(12) PH612I	F ₁	420	420	420	360
	LTP4	6	(12) 0.131 x 1 1/2	G	580	625	625	500	540
H				580	525	525	500	450	450
LTP5	7	(12) 0.131 x 1 1/2	G	580	565	565	500	485	485
			H	545	490	490	470	420	420

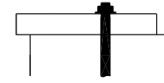
- Allowable loads are for one angle. When angles are installed on each side of the joist, the minimum joist thickness is 3".
- Some illustrations show connections that could cause cross-grain tension or bending of the wood during loading if not reinforced sufficiently. In this case, mechanical reinforcement should be considered.
- LTP4 can be installed over 3/8" wood structural panel sheathing with 0.131" x 1 1/2" nails and achieve 0.72 of the listed load, or over 1/2" sheathing and achieve 0.64 of the listed load. 0.131" x 2 1/2" nails will achieve 100% load.
- LTP4 satisfies the IRC continuously sheathed portal frame (CS-PF) framing anchor requirements when installed over raised wood floor framing per Figure R602.10.6.4.
- The LTP5 may be installed over wood structural panel sheathing up to 1/2" thick using 0.131" x 1 1/2" nails with no reduction in load.
- Connectors are required on both sides to achieve F₂ loads in both directions.
- Fasteners: Nail dimensions in the table are diameter by length. SD screws are Simpson Strong-Tie® Strong-Drive® screws. PH612I is a pan-head #6 x 1/2" screw available from Simpson Strong-Tie. For additional information, see Fastener Types and Sizes Specified for Simpson Strong-Tie Connectors.

Wall Type	Capacity	A35 Capacity	A35 Spacing	LTP4 Capacity	LTP4 Spacing
P1-6U	144-plf (E)	560#	44" oc	540#	44" oc
P1-6	240-plf (E)	560#	27" oc	540#	27" oc
P1-4	350-plf (E)	560#	18" oc	540#	18" oc
P1-3	450-plf (E)	560#	14" oc	540#	14" oc
P1-2	820-plf (W)	560#	7 1/2" oc	540#	7 1/2" oc
P2-4	700-plf (E)	560#	9" oc	540#	LTP5 18" oc + A35 18" oc
P2-3	900-plf (E)	560#	7" oc	540#	LTP5 14" oc + A35 14" oc
P2-2	1640-plf (W)	560#	2 rows 8" oc	540#	LTP5 8" oc + A35 8" oc

2018 IBC/NDS 2018 – Shear Wall Bolts

Table 12E BOLTS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections^{1,2,3,4}

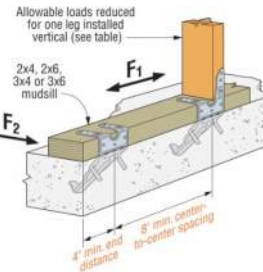
for sawn lumber or SCL to concrete



Embedment Depth in Concrete	Thickness	Side Member	Bolt Diameter	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	
				$Z_{ }$	Z_{\perp}	$Z_{ }$	Z_{\perp}	$Z_{ }$	Z_{\perp}	$Z_{ }$	Z_{\perp}	$Z_{ }$	Z_{\perp}
				lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
6.0 and greater	1-1/2	1/2	1/2	590	340	590	340	550	310	540	290	530	290
			5/8	860	420	850	410	810	350	800	330	780	320
			3/4	1200	460	1190	450	1130	370	1120	360	1100	350
			7/8	1580	500	1540	490	1360	410	1330	390	1280	370
			1	1800	540	1760	530	1560	440	1520	420	1460	410
			1/2	640	360	630	350	580	320	580	310	560	310
		1-3/4	5/8	910	490	900	480	840	400	830	380	810	370
			3/4	1230	540	1220	530	1160	430	1140	420	1120	410
			7/8	1630	580	1610	570	1540	470	1520	460	1490	430
			1	2090	630	2060	610	1820	510	1770	490	1710	470
			1/2	730	410	730	400	700	360	690	340	680	340
			5/8	1070	540	1060	530	980	480	960	470	940	460
	2-1/2	3/4	1400	710	1380	700	1290	620	1270	600	1240	580	
		7/8	1790	830	1770	810	1660	680	1640	660	1600	610	
		1	2230	900	2210	880	2080	730	2060	700	2030	680	
		1/2	730	470	730	470	700	430	690	410	690	400	
		5/8	1140	620	1140	610	1090	550	1080	530	1070	520	
		3/4	1650	780	1640	770	1540	680	1510	670	1470	660	
	3-1/2	7/8	2100	960	2070	950	1910	870	1880	850	1840	820	
		1	2550	1190	2520	1180	2340	1020	2310	980	2260	950	

1. Tabulated lateral design values, Z, for bolted connections shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "full-body diameter" bolts (see Appendix Table L1) with bolt bending yield strength, F_y , of 45,000 psi.
3. Tabulated lateral design values, Z, are based on dowel bearing strength, F_e , of 7,500 psi for concrete with minimum $f'_c=2,500$ psi.
4. Six inch anchor embedment assumed.

Model No.	Sill Size	Fasteners (in.)		Allowable Loads											
		Sides	Top	Uncracked						Cracked					
				Wind and SDC A&B ^{5,6}			SDC C-F ⁵			Wind and SDC A&B ^{5,6}			SDC C-F ⁵		
Standard Installation – Attached to DF/SP Sill Plate															
MASA or MASAP	2x4, x6, x8, x10	(3) 0.148 x 1 1/2	(6) 0.148 x 1 1/2	920	1,475	1,095	745	1,235	1,045	750	1,475	875	660	1,235	765
	3x4, 3x6	(5) 0.148 x 1 1/2	(4) 0.148 x 1 1/2	630	1,165	725	550	1,020	725	475	1,165	725	415	1,020	640
One-Leg-Up Installation – Attached to DF/SP Sill Plate															
MASA or MASAP	2x4, x6, x8, x10	(6) 0.148 x 1 1/2	(3) 0.148 x 1 1/2	755	965	995	660	845	995	570	965	930	500	845	810
	3x4, 3x6	(7) 0.148 x 1 1/2	(2) 0.148 x 1 1/2	—	760	—	685	—	—	—	760	—	685	—	—
Two-Legs-Up Installation – Attached to DF/SP Sill Plate and Rimboard															
MASA or MASAP	2x4, x6, x8, x10	(9) 0.148 x 1 1/2	—	810	1,105	865	740	965	755	620	1,105	630	560	965	550
Double 2x Installation – Attached to DF/SP Sill Plate															
MASA or MASAP	Double 2x4, Double 2x6	(5) 0.148 x 1 1/2	(2) 0.148 x 1 1/2	840	1,030	785	735	900	785	635	1,030	785	555	900	785
Standard Installation – Attached to Hem Fir Sill Plate															
MASA or MASAP	2x4, x6, x8, x10	(3) 0.148 x 1 1/2	(6) 0.148 x 1 1/2	790	1,250	940	640	1,060	900	650	1,250	755	570	1,060	660
	3x4, 3x6	(5) 0.148 x 1 1/2	(4) 0.148 x 1 1/2	535	1,005	625	475	875	625	410	1,005	625	355	875	550
One-Leg-Up Installation – Attached to Hem Fir Sill Plate and HF/SP Stud															
MASA or MASAP	2x4, x6, x8, x10	(6) 0.148 x 1 1/2	(3) 0.148 x 1 1/2	650	830	855	565	725	855	490	830	795	430	725	695
	3x4, 3x6	(7) 0.148 x 1 1/2	(2) 0.148 x 1 1/2	—	670	—	590	—	—	—	670	—	590	—	—
Two-Legs-Up Installation – Hem Fir Sill Plate and HF/SP Rimboard															
MASA or MASAP	2x4, x6, x8, x10	(9) 0.148 x 1 1/2	—	700	950	745	635	830	650	545	950	540	480	830	475
Double 2x Installation – Attached to Hem Fir Sill Plate															
MASA or MASAP	Double 2x4, Double 2x6	(5) 0.148 x 1 1/2	(2) 0.148 x 1 1/2	720	890	675	630	775	675	545	890	675	555	775	675



Wall Type	Capacity	Sill Plate	Single 5/8" ϕ Bolt Capacity	5/8" ϕ Anchor Bolt Spacing	MASAP Anchor Capacity	MASAP Anchor Spacing
P1-6U	144-plf (E)	2x	1376#	60" oc	1060#	60" oc
P1-6	240-plf (E)	2x	1376#	60" oc	1060#	52" oc
P1-4	350-plf (E)	2x	1376#	46" oc	1060#	36" oc
P1-3	450-plf (E)	2x	1376#	36" oc	1060#	28" oc
P1-2	820-plf (W)	2x	1376#	20" oc	1250#	18" oc
P2-4	700-plf (E)	3x	1712#	28" oc	875#	15" oc
P2-3	900-plf (E)	3x	1712#	22" oc	875#	11" oc
P2-2	1640-plf (W)	3x	1712#	12" oc	1005#	7" oc

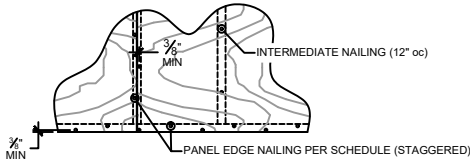
SHEAR WALL SCHEDULE

(IN ACCORDANCE w/ ANSI/AF&PA SDPWS-2015 SECTION 4.3)
Updated 1/20/2021

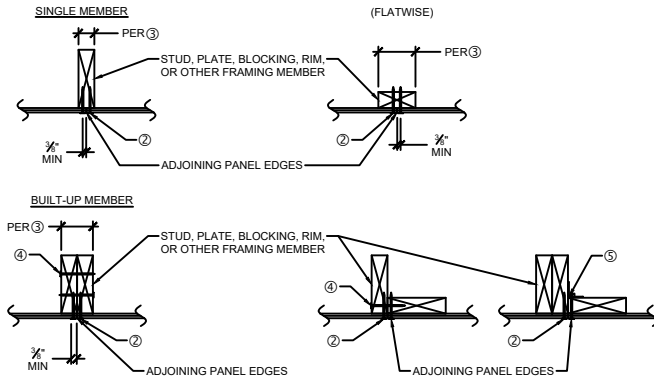
WALL TYPE	SHEATHING	PANEL EDGE NAILING ②	MINIMUM WIDTH OF NAILED FACE OF FRAMING @ ADJOINING PANEL EDGES ③		MUDSILL PLATE	FACE NAILING ④	FRAMING CLIPS ⑤	ANCHORAGE TO CONCRETE ⑥		SEISMIC CAPACITY - h/b = 2 h/b = 3.5	WIND CAPACITY - h/b = 2 h/b = 3.5
			SINGLE MEMBER	BUILT-UP MEMBER				ANCHOR BOLTS	MUDSILL ANCHORS		
P1-6	1 SIDE	6" oc	2x	2x	2x	6" oc	A35 @ 27" oc or LTP4 @ 27" oc	5/8" @ 60" oc	MASAP @ 52" oc	240-plf 194-plf	240-plf 194-plf
P1-4	1 SIDE	4" oc	2x	2x	2x	4" oc	A35 @ 18" oc or LTP4 @ 18" oc	5/8" @ 46" oc	MASAP @ 36" oc	350-plf 284-plf	350-plf 284-plf
P1-3	1 SIDE	3" oc	3x	(2)2x	2x	3" oc	A35 @ 14" oc or LTP4 @ 14" oc	5/8" @ 36" oc	MASAP @ 28" oc	450-plf 366-plf	450-plf 366-plf
P1-2	1 SIDE	2" oc	3x	(2)2x	2x	2" oc	A35 @ 11" oc or LTP4 @ 11" oc	5/8" @ 20" oc	MASAP @ 18" oc	590-plf 478-plf	820-plf 669-plf
P2-4	2 SIDES	4" oc	3x	(2)2x	3x	(2) Rows, 4" oc	A35 @ 18" oc and LTP4 @ 18" oc	5/8" @ 28" oc	MASAP @ 15" oc	700-plf 568-plf	700-plf 568-plf
P2-3	2 SIDES	3" oc	3x	(2)2x	3x	(2) Rows, 3" oc	A35 @ 14" oc and LTP4 @ 14" oc	5/8" @ 22" oc	MASAP @ 11" oc	900-plf 733-plf	900-plf 733-plf
P2-2	2 SIDES	2" oc	3x	(2)2x	3x	(2) Rows, 2" oc	A35 @ 8" oc and LTP4 @ 8" oc	5/8" @ 12" oc	MASAP @ 7" oc	1180-plf 957-plf	1640-plf 1338-plf

SHEAR WALL SCHEDULE NOTES

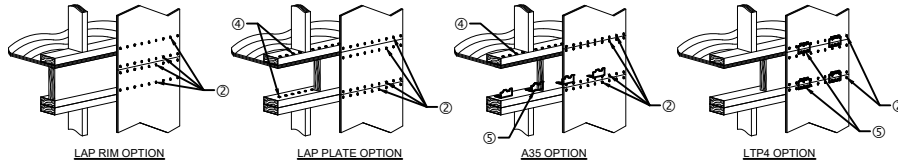
- (SECTION 4.3.7.1.1)
5/8" OSB or 5/8" PLYWOOD SHEATHING OR SIDING EXCEPT GROUP 5 SPECIES. MINIMUM PANEL SPAN RATING OF (24/0). PANELS SHALL NOT BE LESS THAN 4x8', EXCEPT AT BOUNDARIES AND CHANGES IN FRAMING. ALL EDGES OF ALL PANELS SHALL BE SUPPORTED BY AND FASTENED TO FRAMING MEMBERS OR BLOCKING.
- ② (SECTION 4.3.7.1.2. & SECTION 4.3.7.1.3)
PANEL EDGE NAILING APPLIES TO ALL SHEATHING PANEL EDGES. NAIL SHEATHING TO INTERMEDIATE FRAMING MEMBERS WITH SHEATHING NAILS @ 12" oc. MAXIMUM STUD SPACING SHALL BE 16" oc. SHEATHING NAILS SHALL BE 0.131"Ø x 2 1/2". PLYWOOD EDGE NAILING SHALL BE STAGGERED. NAILS SHALL BE LOCATED AT LEAST 1/4" FROM THE PANEL EDGES.



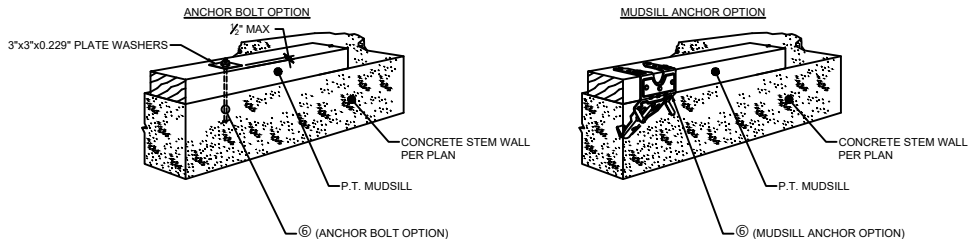
- ③ (SECTION 4.3.7.1.4)
THE MINIMUM NOMINAL WIDTH OF THE NAILED FACE OF FRAMING AND BLOCKING AT ADJOINING PANEL EDGES SHALL BE AS INDICATED IN THE SCHEDULE.



- ④ FACE NAILING APPLIES TO CONDITIONS WHERE FRAMING NAILS CAN BE STRAIGHT DRIVEN THRU FIRST MEMBER AND PENETRATE MAIN MEMBER MINIMUM OF 1/4". FRAMING NAILS SHALL BE 0.131"Ø x 3 1/4". 0.131"Ø x 3" NAILS MAY BE USED WHEN STITCHING TOGETHER (2)2x MEMBERS WITH NO SPACERS.
- ⑤ AT ADJOINING PANEL EDGES WHERE SHEATHING CANNOT LAP ON SINGLE MEMBER AND FACE NAILING CANNOT BE ACCOMPLISHED, FRAMING CLIPS SHALL BE USED TO FASTEN BUILT-UP MEMBERS. USE 0.131"Ø x 2 1/2" NAILS AT LTP4 CLIP WHEN INSTALLED OVER 1/2" SHEATHING.



- ⑥ (SECTION 4.3.6.4.3)
ANCHOR BOLTS EMBEDMENT SHALL BE 7". U.O.N. ALL ANCHORS SHALL HAVE 3" x 3" x 0.229" PLATE WASHERS. PLATE WASHER SHALL EXTEND TO WITHIN 1/2" OF THE EDGE OF THE BOTTOM PLATE ON THE SIDE WITH SHEATHING. IF SHEATHING IS ON BOTH SIDES OF THE WALL, STAGGER THE ANCHOR BOLTS. AS REQUIRED, SO THAT HALF OF THE PLATE WASHERS ARE WITHIN 1/2" OF THE EDGE OF THE BOTTOM PLATE ON EACH SIDE. HOLE IN PLATE WASHERS MAY BE DIAGONALLY SLOTTED.



BTL

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Miscellaneous

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1 \quad \text{in which: } F_{cE} = 0.822(E_{min}')/(l_e/d)^2$$

Wall: Exterior Walls	Wall Height:	9 ft
No Fire Rating ▼	Desired Stud Spacing:	24 in oc
2x6 ▼	Design Axial Dead Load:	683 plf
SPF Stud ▼	Design Axial Live Load:	960 plf
	Design Axial Snow Load:	538 plf
	Design Lateral Pressure (0.6W):	15 psf
	Deflection Criteria:	L/ 240

STUD CHECK	$l_e/d < 50$	OK
D+0.6W ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.53 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75(0.6W)+0.75S ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.92 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75S ($C_D = 1.15$)		
$f_c/F_c' =$	0.72 < 1	OK
D+L ($C_D = 1.0$)		
$f_c/F_c' =$	0.71 < 1	OK
Deflection (No Increase for Load Duration):		
Defl: L/ 240 = 0.45	0.18 < 0.45	OK
SPF Stud 2x6 @ 24 oc		OK

PLATE CRUSHING CHECK ¹		
Checks Crushing for Stud Spacing ²		
No Stress Increase for Load Duration		
Hem Fir Plates:	$f_c/F_{c\perp}' =$	0.87 < 1 OK
Douglas Fir Plates:	$f_c/F_{c\perp}' =$	0.56 < 1 OK

¹ Plate must also be checked for bending.

² Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate.

Also, no stress increase is allowed due to load duration.

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1 \quad \text{in which: } F_{cE} = 0.822(E_{min}')/(\ell_e/d)^2$$

Wall: Exterior Walls	Wall Height:	19.25 ft
No Fire Rating ▼	Desired Stud Spacing:	16 in oc
(2)2x6 ▼	Design Axial Dead Load:	323 plf
SPF Stud ▼	Design Axial Live Load:	0 plf
	Design Axial Snow Load:	538 plf
	Design Lateral Pressure (0.6W):	15 psf
	Deflection Criteria:	L/ 180

STUD CHECK	$\ell_e/d < 50$	OK
D+0.6W ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.70 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75(0.6W)+0.75S ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.71 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75S ($C_D = 1.15$)		
$f_c/F_c' =$	0.30 < 1	OK
D+L ($C_D = 1.0$)		
$f_c/F_c' =$	0.14 < 1	OK
Deflection (No Increase for Load Duration):		
Defl: L/ 180 = 1.28	1.24 < 1.28	OK
SPF Stud (2)2x6 @ 16 oc		OK

PLATE CRUSHING CHECK ¹		
Checks Crushing for Stud Spacing ²		
No Stress Increase for Load Duration		
Hem Fir Plates:	$f_c/F_{c\perp}' =$	0.13 < 1 OK
Douglas Fir Plates:	$f_c/F_{c\perp}' =$	0.08 < 1 OK

¹ Plate must also be checked for bending.

² Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate.

Also, no stress increase is allowed due to load duration.

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1 \quad \text{in which: } F_{cE} = 0.822(E_{min}')/(l_e/d)^2$$

Wall: Interior Walls	Wall Height:	9 ft
No Fire Rating ▼	Desired Stud Spacing:	24 in oc
2x4 ▼	Design Axial Dead Load:	203 plf
SPF Stud ▼	Design Axial Live Load:	540 plf
	Design Axial Snow Load:	0 plf
	Design Lateral Pressure (0.6W):	5 psf
	Deflection Criteria:	L/ 180

STUD CHECK	$l_e/d < 50$	OK
D+0.6W ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.41 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75(0.6W)+0.75S ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.99 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75S ($C_D = 1.15$)		
$f_c/F_c' =$	0.69 < 1	OK
D+L ($C_D = 1.0$)		
$f_c/F_c' =$	0.86 < 1	OK
Deflection (No Increase for Load Duration):		
Defl: L/ 180 = 0.60	0.23 < 0.60	OK
SPF Stud 2x4 @ 24 oc		OK

PLATE CRUSHING CHECK ¹		
Checks Crushing for Stud Spacing ²		
No Stress Increase for Load Duration		
Hem Fir Plates:	$f_c/F_{c\perp}' =$	0.46 < 1 OK
Douglas Fir Plates:	$f_c/F_{c\perp}' =$	0.30 < 1 OK

¹ Plate must also be checked for bending.

² Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate.

Also, no stress increase is allowed due to load duration.

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1 \quad \text{in which: } F_{cE} = 0.822(E_{min}')/(\ell_e/d)^2$$

Wall: Interior Walls	Wall Height:	9 ft
	Desired Stud Spacing:	16 in oc
No Fire Rating ▼	Design Axial Dead Load:	338 plf
2x4 ▼	Design Axial Live Load:	900 plf
SPF Stud ▼	Design Axial Snow Load:	0 plf
	Design Lateral Pressure (0.6W):	5 psf
	Deflection Criteria:	L/ 180

STUD CHECK	$\ell_e/d < 50$	OK
D+0.6W ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.31 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75(0.6W)+0.75S ($C_D = 1.60$)		
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] =$	0.99 < 1	OK
$f_c/F_{cE2} + (f_b/F_{bE})^2 =$	0.00 < 1	OK
D+0.75L+0.75S ($C_D = 1.15$)		
$f_c/F_c' =$	0.76 < 1	OK
D+L ($C_D = 1.0$)		
$f_c/F_c' =$	0.95 < 1	OK
Deflection (No Increase for Load Duration):		
Defl: L/ 180 = 0.60	0.15 < 0.60	OK
SPF Stud 2x4 @ 16 oc		OK

PLATE CRUSHING CHECK ¹		
Checks Crushing for Stud Spacing ²		
No Stress Increase for Load Duration		
Hem Fir Plates:	$f_c/F_{c\perp}' =$	0.51 < 1 OK
Douglas Fir Plates:	$f_c/F_{c\perp}' =$	0.33 < 1 OK

¹ Plate must also be checked for bending.

² Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate.

Also, no stress increase is allowed due to load duration.

2018 NDS

3.7-SOLID COLUMNS and 15.3-BUILT-UP COLUMNS

Solid Column	▼	$F_c = 800$ psi	$E_{min} = 440$ ksi
Visually graded lumber (Dimensional)	▼	$C_D = 1.00$	$E_{min}' = 440$ ksi
No Fire Rating	▼	$C_M = 1.00$	$l = 9.0$ ft
Hem-Fir Stud	▼	$C_t = 1.00$	$d = 5 \frac{1}{2}$ in
		$C_F = 1.00$	$K_e = 1.0$
			$l_e = 108.0$ in
			$l_e/d = 19.6$

$$F_c' = F_c^* C_p$$

$$F_c^* = F_c C_D C_M C_t C_F$$

$$F_c^* = 800 \text{ psi}$$

$$C_p = 0.743$$

$$F_c' = 594 \text{ psi}$$

$$C_p = K_f \left[\frac{1 + \left(\frac{F_{cE}}{F_c^*} \right)}{2c} - \sqrt{\left[\frac{1 + \left(\frac{F_{cE}}{F_c^*} \right)}{2c} \right]^2 - \frac{F_{cE}/F_c^*}{c}} \right]$$

$$F_{cE} = 938$$

$$F_{cE} = \frac{0.822 E_{min}'}{\left(l_e/d \right)^2}$$

$$c = 0.8$$

$$K_f = 1.0$$

	<u>STUD</u>	<u>HF Plate Crushing</u>	<u>DF Plate Crushing</u>
(1) 2x6	4904	3341	5156
(2) 2x6	9807	6683	10313
(3) 2x6	14711	10024	15469
(4) 2x6	19614	13365	20625
(5) 2x6	24518	16706	25781

2018 NDS

3.7-SOLID COLUMNS and 15.3-BUILT-UP COLUMNS

Solid Column	▼	$F_c = 800$ psi	$E_{min} = 440$ ksi
Visually graded lumber (Dimensional)	▼	$C_D = 1.00$	$E_{min}' = 440$ ksi
No Fire Rating	▼	$C_M = 1.00$	$l = 9.0$ ft
Hem-Fir Stud	▼	$C_t = 1.00$	$d = 3 \frac{1}{2}$ in
		$C_F = 1.00$	$K_e = 1.0$
			$l_e = 108.0$ in
			$l_e/d = 30.9$

$$F_c' = F_c^* C_p$$

$$F_c^* = F_c C_D C_M C_t C_F$$

$$F_c^* = 800 \text{ psi}$$

$$C_p = 0.416$$

$F_c' = 333$ psi

$$C_p = K_f \left[\frac{1 + \left(\frac{F_{cE}}{F_c^*} \right)}{2c} - \sqrt{\left[\frac{1 + \left(\frac{F_{cE}}{F_c^*} \right)}{2c} \right]^2 - \frac{F_{cE}}{F_c^*}} \right]$$

$$F_{cE} = 380$$

$$F_{cE} = \frac{0.822 E_{min}'}{\left(\frac{l_e}{d} \right)^2}$$

$$c = 0.8$$

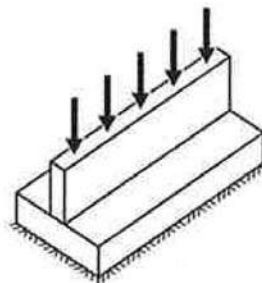
$$K_f = 1.0$$

	<u>STUD</u>	<u>HF Plate Crushing</u>	<u>DF Plate Crushing</u>
(1) 2x4	1746	2126	3281
(2) 2x4	3492	4253	6563
(3) 2x4	5237	6379	9844
(4) 2x4	6983	8505	13125
(5) 2x4	8729	10631	16406

Project: **Continuous Strip Footing**
18" wide x 8" thick

IBC Section 13.3.2: One-way shallow foundations

Footing width, $B =$ 18 in
 Footing Thickness, $t =$ 8 in
 Stem Wall width, $C =$ 8 in
 Stem Wall Height = 24 in



Strip footing

Normalweight $f'_c =$ 2500 psi
 Uncoated $f_y =$ 40000 psi
 Longitudinal Reinforcement: (2) #4
 Bar Diameter = 0.500 in
 Bar Area = 0.20 in²
 $A_s =$ 0.40 in²

Cover: 3 in
 Stem Wall Reinforcement: #4 @ 24" oc Straight Dowels
 Bar Diameter = 0.500 in
 Bar Area = 0.20 in²
 $A_s =$ 0.00 in²
 Cover: 3 in
 $b_w =$ 12 in (per ft)
 $d =$ 4.75 in

Footing + Stem Wall Weight - Weight of Displaced Soil = 240 plf

One-way shear, no shear reinforcement:

[22.5.5.1] $V_c = 2\lambda\sqrt{f'_c}b_wd =$ 5700 # per foot length $\phi =$ 0.75

[22.5.10.1] $V_u \leq \phi V_c$

$$V_u = q_u b_w \left(\frac{B-C}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{b_w \left(\frac{B-C}{2} - d \right)}$$

$q_u =$ 51300 psf
 Max Uniform Load on Stem = 76950 plf [Ultimate]
 48094 plf [Service]

Moment:

[22.2.1.1] $M_n = A_s f_y (d - a/2) =$ 0.000 k-ft per foot length $\phi =$ 0.90

$$M_u \leq \phi M_n$$

$$M_u = \frac{q_u b_w \left(\frac{B-C}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{b_w \left(\frac{B-C}{2} \right)^2}$$

$a = \frac{A_s f_y}{0.85 f'_c b} =$ 0.00 in

$q_u =$ NO MOMENT
 Max Uniform Load on Stem = 12000 plf [Ultimate]
 7500 plf [Service]

Development of Reinforcement:

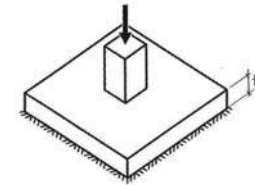
[25.4.2.3] $l_d = \left(\frac{3}{40} \frac{f_y}{\lambda \sqrt{f'_c}} \frac{\psi_t \psi_e \psi_s}{\left(\frac{c_b + K_{tr}}{d_b} \right)} \right) d_b =$ N/A

OK

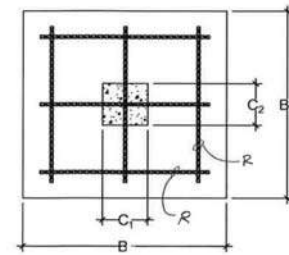
Allowable Soil Bearing Pressure	1500 psf	2000 psf	2500 psf	3000 psf	3500 psf	4000 psf
Max Uniform Load, Soil	2010 plf	2760 plf	3510 plf	4260 plf	5010 plf	5760 plf
Max Uniform Load, Shear	48094 plf	48094 plf	48094 plf	48094 plf	48094 plf	48094 plf
Max Uniform Load, Moment	7500 plf	7500 plf	7500 plf	7500 plf	7500 plf	7500 plf
Max Uniform Load (Service)	2010 plf	2760 plf	3510 plf	4260 plf	5010 plf	5760 plf
Max Uniform Load (Ultimate)	3216 plf	4416 plf	5616 plf	6816 plf	8016 plf	9216 plf
Max Point Load (Service)	16080 #	22080 #	28080 #	34080 #	40080 #	46080 #
Max Point Load (Ultimate)	25728 #	35328 #	44928 #	54528 #	64128 #	73728 #

Project: **Typical Footing**
 Footing: **18" x 18" x 8" thick**

Footing $B = 1.50$ ft
 $t = 8$ in
 Reinforcement $R = (2)$ #4
 $A_{s1} = 0.40$ in²
 $d = 4.25$ in Cover: **3 in**
 Column $C_1 = 3.50$ in $C_2 = 3.50$ in
 Materials $f'_c = 2500$ psi Normalweight $\lambda = 1.00$
 $f_y = 40000$ psi Uncoated $\psi_e = 1.00$



Isolated footing



Net Footing Weight
 $P_{FTG} = 0.06$ k

Soil Pressure:
 $P_{ASD} = q_a B^2 - P_{FTG} =$

One-way shear: $\phi = 0.75$
 $V_c = 2\lambda\sqrt{f'_c}Bd = 7.65$ k
 $V_u \leq \phi V_c$ $\phi V_c = 5.74$ k
 $V_u = q_u B \left(\frac{B - C_2}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_2}{2} - d \right)}$
 $q_u = 10392$ psf or

$$V_u = q_u B \left(\frac{B - C_1}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_1}{2} - d \right)}$$

$$P_u = q_u B^2 = 23383 \#$$

Two-way shear: $\phi = 0.75$
 [22.6.5.2(a)] $v_c = 4\lambda\sqrt{f'_c} = 200$ psi \Leftarrow
 [22.6.5.2(b)] $v_c = \left(2 + \frac{4}{\beta} \right) \lambda\sqrt{f'_c} = 300$ psi
 [22.6.5.2(c)] $v_c = \left(2 + \frac{\alpha_x d}{b_o} \right) \lambda\sqrt{f'_c} = 374$ psi
 $V_u \leq \phi V_c$ $\phi V_c = \phi v_c b_o d = 19.76$ k
 $V_u = q_u [B^2 - (C_1 + d)(C_2 + d)] \rightarrow q_u = \frac{\phi V_c}{[B^2 - (C_1 + d)(C_2 + d)]}$
 $q_u = 10782$ psf

$$P_u = q_u B^2 = 24260 \#$$

$\beta = 1.00$
 $\alpha_x = 40$
 $b_o = 2(C_1 + d) + 2(C_2 + d) = 31$

Moment: $\phi = 0.90$
 $M_n = A_s f_y (d - a/2) = 5.4$ k-ft
 $a = A_s f_y / (0.85 f'_c B) = 0.42$ in
 $M_u \leq \phi M_n$ $\phi M_n = 4.8$ k-ft
 $M_u = \frac{q_u B \left(\frac{B - C_2}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_2}{2} \right)^2}$
 $q_u = 17712$ psf or

$$M_u = \frac{q_u B \left(\frac{B - C_1}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_1}{2} \right)^2}$$

$$P_u = q_u B^2 = 39853 \#$$

Development of Reinforcement:

$$l_d = \left(\frac{3}{40} \frac{f_y}{\lambda\sqrt{f'_c}} \frac{\psi_t \psi_e \psi_s}{\left(\frac{C_b + K_{tr}}{d_b} \right)} \right) d_b = 4$$
 in ...4 in available **OK**
 Adjusted

Soil Bearing Pressure	1500 psf	2000 psf	2500 psf	3000 psf	3500 psf	4000 psf
Max Load (lbs), Soil	3315	4440	5565	6690	7815	8940
Max Load (lbs), One-Way Shear	14614	14614	14614	14614	14614	14614
Max Load (lbs), Two-Way Shear	15162	15162	15162	15162	15162	15162
Max Load (lbs), Moment	24908	24908	24908	24908	24908	24908
Max Load (ASD)	3315	4440	5565	6690	7815	8940
Max Load (Factored)	5304	7104	8904	10704	12504	14304

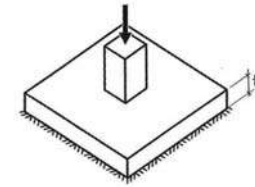
Project: **Typical Footing**
Footing: **24" x 24" x 8" thick**

Footing **B = 2.00 ft**
t = 8 in

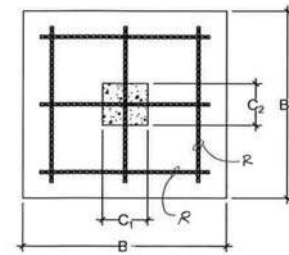
Reinforcement **R = (2) #4**
A_{s1} = 0.40 in²
d = 4.25 in **Cover: 3 in**

Column **C₁ = 3.50 in** **C₂ = 3.50 in**

Materials **f'_c = 2500 psi** Normalweight **λ = 1.00**
f_y = 40000 psi Uncoated **ψ_e = 1.00**



Isolated footing



Net Footing Weight
P_{FTG} = 0.11 k

Soil Pressure:
P_{ASD} = q_aB² - P_{FTG} =

One-way shear: **φ = 0.75**
V_c = 2λ√f'_cBd = 10.20 k
V_u ≤ φV_c φV_c = 7.65 k

$$V_u = q_u B \left(\frac{B - C_2}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_2}{2} - d \right)}$$

q_u = 5649 psf or 5649 psf

$$V_u = q_u B \left(\frac{B - C_1}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_1}{2} - d \right)}$$

P_u = q_uB² = 22597 #

Two-way shear: **φ = 0.75**
[22.6.5.2(a)] **v_c = 4λ√f'_c = 200 psi** ←
[22.6.5.2(b)] **v_c = (2 + 4/β)λ√f'_c = 300 psi**
[22.6.5.2(c)] **v_c = (2 + α_xd/b_o)λ√f'_c = 374 psi**

V_u ≤ φV_c φV_c = φv_cb_od = 19.76 k

β = 1.00
α_x = 40
b_o = 2(C₁+d)+2(C₂+d) = 31

$$V_u = q_u [B^2 - (C_1 + d)(C_2 + d)] \rightarrow q_u = \frac{\phi V_c}{[B^2 - (C_1 + d)(C_2 + d)]}$$

q_u = 5516 psf P_u = q_uB² = 22063 #

Moment: **φ = 0.90**
M_n = A_sf_y(d - a/2) = 5.5 k-ft
a = A_sf_y/(0.85f'_cB) = 0.31 in
M_u ≤ φM_n φM_n = 4.9 k-ft

$$M_u = \frac{q_u B \left(\frac{B - C_2}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_2}{2} \right)^2}$$

q_u = 6732 psf or 6732 psf

$$M_u = \frac{q_u B \left(\frac{B - C_1}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_1}{2} \right)^2}$$

P_u = q_uB² = 26929 #

Development of Reinforcement:

$$l_d = \left(\frac{3 f_y \psi_t \psi_e \psi_s}{40 \lambda \sqrt{f'_c} \left(\frac{c_b + K_{tr}}{d_b} \right)} \right) d_b = 7 \text{ in} \quad \dots 7 \text{ in available} \quad \text{OK}$$

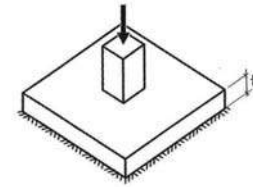
Adjusted

Soil Bearing Pressure	1500 psf	2000 psf	2500 psf	3000 psf	3500 psf	4000 psf
Max Load (lbs), Soil	5893	7893	9893	11893	13893	15893
Max Load (lbs), One-Way Shear	14123	14123	14123	14123	14123	14123
Max Load (lbs), Two-Way Shear	13789	13789	13789	13789	13789	13789
Max Load (lbs), Moment	16830	16830	16830	16830	16830	16830
Max Load (ASD)	5893	7893	9893	11893	12710	12710
Max Load (Factored)	9429	12629	15829	19029	20337	20337

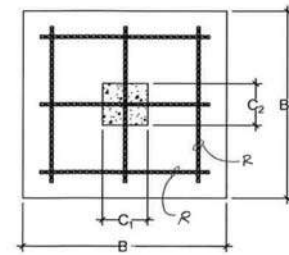
Date: 3/19/2018

Project: **Typical Footing**
 Footing: **30" x 30" x 8" thick**

Footing $B = 2.50$ ft
 $t = 8$ in
 Reinforcement $R = (3)$ #4
 $A_{s1} = 0.60$ in²
 $d = 4.25$ in Cover: **3 in**
 Column $C_1 = 3.50$ in $C_2 = 3.50$ in
 Materials $f'_c = 2500$ psi Normalweight $\lambda = 1.00$
 $f_y = 40000$ psi Uncoated $\psi_e = 1.00$



Isolated footing



Net Footing Weight
 $P_{FTG} = 0.17$ k

Soil Pressure:
 $P_{ASD} = q_a B^2 - P_{FTG} =$

One-way shear: $\phi = 0.75$
 $V_c = 2\lambda\sqrt{f'_c}Bd = 12.75$ k
 $V_u \leq \phi V_c$ $\phi V_c = 9.56$ k
 $V_u = q_u B \left(\frac{B - C_2}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_2}{2} - d \right)}$
 $q_u = 3974$ psf or

$$V_u = q_u B \left(\frac{B - C_1}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_1}{2} - d \right)}$$

$$P_u = q_u B^2 = 24838 \text{ \#}$$

Two-way shear: $\phi = 0.75$
 [22.6.5.2(a)] $v_c = 4\lambda\sqrt{f'_c} = 200$ psi \leftarrow

[22.6.5.2(b)] $v_c = \left(2 + \frac{4}{\beta} \right) \lambda\sqrt{f'_c} = 300$ psi

[22.6.5.2(c)] $v_c = \left(2 + \frac{\alpha_x d}{b_o} \right) \lambda\sqrt{f'_c} = 374$ psi

$V_u \leq \phi V_c$ $\phi V_c = \phi v_c b_o d = 19.76$ k

$\beta = 1.00$
 $\alpha_x = 40$
 $b_o = 2(C_1 + d) + 2(C_2 + d) = 31$

$$V_u = q_u [B^2 - (C_1 + d)(C_2 + d)] \rightarrow q_u = \frac{\phi V_c}{[B^2 - (C_1 + d)(C_2 + d)]}$$

$$q_u = 3388 \text{ psf} \quad P_u = q_u B^2 = 21176 \text{ \#}$$

Moment: $\phi = 0.90$
 $M_n = A_s f_y (d - a/2) = 8.1$ k-ft
 $a = A_s f_y / (0.85 f'_c B) = 0.38$ in
 $M_u \leq \phi M_n$ $\phi M_n = 7.3$ k-ft

$$M_u = \frac{q_u B \left(\frac{B - C_2}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_2}{2} \right)^2}$$

$$q_u = 4797 \text{ psf} \quad \text{or}$$

$$M_u = \frac{q_u B \left(\frac{B - C_1}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_1}{2} \right)^2}$$

$$q_u = 4797 \text{ psf} \quad P_u = q_u B^2 = 29984 \text{ \#}$$

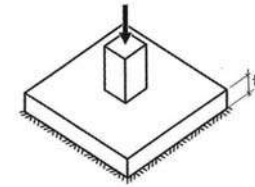
Development of Reinforcement:

$$l_d = \left(\frac{3}{40} \frac{f_y}{\lambda\sqrt{f'_c}} \frac{\psi_t \psi_e \psi_s}{\left(\frac{c_b + K_{tr}}{d_b} \right)} \right) d_b = 10 \text{ in} \quad \dots 10 \text{ in available} \quad \text{OK}$$

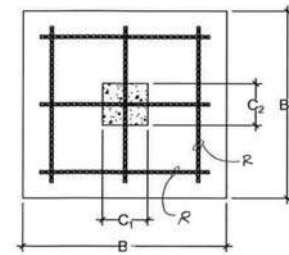
Soil Bearing Pressure	1500 psf	2000 psf	2500 psf	3000 psf	3500 psf	4000 psf
Max Load (lbs), Soil	9208	12333	15458	18583	21708	24833
Max Load (lbs), One-Way Shear	15524	15524	15524	15524	15524	15524
Max Load (lbs), Two-Way Shear	13235	13235	13235	13235	13235	13235
Max Load (lbs), Moment	18740	18740	18740	18740	18740	18740
Max Load (ASD)	9208	12333	13235	13235	13235	13235
Max Load (Factored)	14733	19733	21176	21176	21176	21176

Project: **Typical Footing**
 Footing: **36" x 36" x 12" thick**

Footing $B = 3.00$ ft
 $t = 12$ in
 Reinforcement $R = (3)$ #4
 $A_{s1} = 0.60$ in²
 $d = 8.25$ in Cover: **3 in**
 Column $C_1 = 5.50$ in $C_2 = 5.50$ in
 Materials $f'_c = 2500$ psi Normalweight $\lambda = 1.00$
 $f_y = 40000$ psi Uncoated $\psi_e = 1.00$



Isolated footing



Net Footing Weight
 $P_{FTG} = 0.36$ k

Soil Pressure:
 $P_{ASD} = q_a B^2 - P_{FTG} =$

One-way shear: $\phi = 0.75$
 $V_c = 2\lambda\sqrt{f'_c}Bd = 29.70$ k
 $V_u \leq \phi V_c$ $\phi V_c = 22.28$ k
 $V_u = q_u B \left(\frac{B - C_2}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_2}{2} - d \right)}$
 $q_u = 7128$ psf or

$$V_u = q_u B \left(\frac{B - C_1}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_1}{2} - d \right)}$$

$$P_u = q_u B^2 = 64152 \text{ \#}$$

Two-way shear: $\phi = 0.75$
 [22.6.5.2(a)] $v_c = 4\lambda\sqrt{f'_c} = 200$ psi \leftarrow
 [22.6.5.2(b)] $v_c = \left(2 + \frac{4}{\beta} \right) \lambda\sqrt{f'_c} = 300$ psi
 [22.6.5.2(c)] $v_c = \left(2 + \frac{\alpha_x d}{b_o} \right) \lambda\sqrt{f'_c} = 400$ psi
 $V_u \leq \phi V_c$ $\phi V_c = \phi v_c b_o d = 68.06$ k
 $V_u = q_u [B^2 - (C_1 + d)(C_2 + d)] \rightarrow q_u = \frac{\phi V_c}{[B^2 - (C_1 + d)(C_2 + d)]}$
 $q_u = 8854$ psf $P_u = q_u B^2 = 79687$ \#

$$\beta = 1.00$$

$$\alpha_x = 40$$

$$b_o = 2(C_1 + d) + 2(C_2 + d) = 55$$

Moment: $\phi = 0.90$
 $M_n = A_s f_y (d - a/2) = 16.2$ k-ft
 $a = A_s f_y / (0.85 f'_c B) = 0.31$ in
 $M_u \leq \phi M_n$ $\phi M_n = 14.6$ k-ft
 $M_u = \frac{q_u B \left(\frac{B - C_2}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_2}{2} \right)^2}$
 $q_u = 6013$ psf or

$$M_u = \frac{q_u B \left(\frac{B - C_1}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_1}{2} \right)^2}$$

$$P_u = q_u B^2 = 54121 \text{ \#}$$

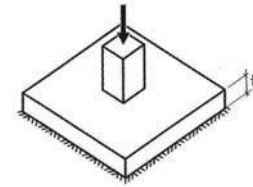
Development of Reinforcement:

$$l_d = \left(\frac{3 f_y}{40 \lambda \sqrt{f'_c}} \left(\frac{\psi_t \psi_e \psi_s}{c_b + K_{tr}} \right) \right) d_b = 12 \text{ in} \quad \dots 12 \text{ in available OK}$$

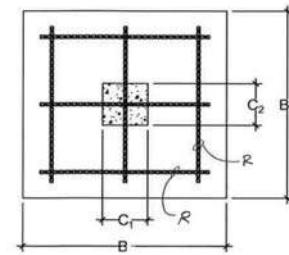
Soil Bearing Pressure	1500 psf	2000 psf	2500 psf	3000 psf	3500 psf	4000 psf
Max Load (lbs), Soil	13140	17640	22140	26640	31140	35640
Max Load (lbs), One-Way Shear	40095	40095	40095	40095	40095	40095
Max Load (lbs), Two-Way Shear	49805	49805	49805	49805	49805	49805
Max Load (lbs), Moment	33825	33825	33825	33825	33825	33825
Max Load (ASD)	13140	17640	22140	26640	31140	33825
Max Load (Factored)	21024	28224	35424	42624	49824	54121

Project: **Typical Footing**
 Footing: **42" x 42" x 12" thick**

Footing $B = 3.50$ ft
 $t = 12$ in
 Reinforcement $R = (4)$ #4
 $A_{s1} = 0.80$ in²
 $d = 8.25$ in Cover: **3 in**
 Column $C_1 = 5.50$ in $C_2 = 5.50$ in
 Materials $f'_c = 2500$ psi Normalweight $\lambda = 1.00$
 $f_y = 40000$ psi Uncoated $\psi_e = 1.00$



Isolated footing



Net Footing Weight
 $P_{FTG} = 0.49$ k

Soil Pressure:
 $P_{ASD} = q_a B^2 - P_{FTG} =$

One-way shear: $\phi = 0.75$
 $V_c = 2\lambda\sqrt{f'_c}Bd = 34.65$ k
 $V_u \leq \phi V_c$ $\phi V_c = 25.99$ k
 $V_u = q_u B \left(\frac{B - C_2}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_2}{2} - d \right)}$
 $q_u = 5606$ psf or

$$V_u = q_u B \left(\frac{B - C_1}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_1}{2} - d \right)}$$

$$P_u = q_u B^2 = 68677 \text{ \#}$$

Two-way shear: $\phi = 0.75$
 [22.6.5.2(a)] $v_c = 4\lambda\sqrt{f'_c} = 200$ psi \Leftarrow
 [22.6.5.2(b)] $v_c = \left(2 + \frac{4}{\beta} \right) \lambda\sqrt{f'_c} = 300$ psi
 [22.6.5.2(c)] $v_c = \left(2 + \frac{\alpha_x d}{b_o} \right) \lambda\sqrt{f'_c} = 400$ psi
 $V_u \leq \phi V_c$ $\phi V_c = \phi v_c b_o d = 68.06$ k

$$\beta = 1.00$$

$$\alpha_x = 40$$

$$b_o = 2(C_1 + d) + 2(C_2 + d) = 55$$

$$V_u = q_u [B^2 - (C_1 + d)(C_2 + d)] \rightarrow q_u = \frac{\phi V_c}{[B^2 - (C_1 + d)(C_2 + d)]}$$

$$q_u = 6223 \text{ psf} \quad P_u = q_u B^2 = 76233 \text{ \#}$$

Moment: $\phi = 0.90$
 $M_n = A_s f_y (d - a/2) = 21.5$ k-ft
 $a = A_s f_y / (0.85 f'_c B) = 0.36$ in
 $M_u \leq \phi M_n$ $\phi M_n = 19.4$ k-ft
 $M_u = \frac{q_u B \left(\frac{B - C_2}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_2}{2} \right)^2}$
 $q_u = 4785$ psf or

$$M_u = \frac{q_u B \left(\frac{B - C_1}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_1}{2} \right)^2}$$

$$P_u = q_u B^2 = 58622 \text{ \#}$$

Development of Reinforcement:

$$l_d = \left(\frac{3 f_y \psi_t \psi_e \psi_s}{40 \lambda \sqrt{f'_c} \left(\frac{c_b + K_{tr}}{d_b} \right)} \right) d_b = 12 \text{ in} \quad \dots 15 \text{ in available} \quad \text{OK}$$

Soil Bearing Pressure	1500 psf	2000 psf	2500 psf	3000 psf	3500 psf	4000 psf
Max Load (lbs), Soil	17885	24010	30135	36260	42385	48510
Max Load (lbs), One-Way Shear	42923	42923	42923	42923	42923	42923
Max Load (lbs), Two-Way Shear	47646	47646	47646	47646	47646	47646
Max Load (lbs), Moment	36639	36639	36639	36639	36639	36639
Max Load (ASD)	17885	24010	30135	36260	36639	36639
Max Load (Factored)	28616	38416	48216	58016	58622	58622

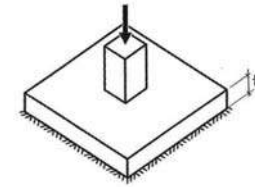
Project: **Typical Footing**
Footing: **48" x 48" x 12" thick**

Footing **B = 4.00 ft**
t = 12 in

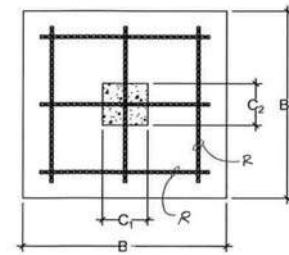
Reinforcement **R = (5) #4**
A_{s1} = 1.00 in²
d = 8.25 in **Cover: 3 in**

Column **C₁ = 5.50 in** **C₂ = 5.50 in**

Materials **f'_c = 2500 psi** Normalweight **λ = 1.00**
f_y = 40000 psi Uncoated **ψ_e = 1.00**



Isolated footing



Net Footing Weight
P_{FTG} = 0.64 k

Soil Pressure:
P_{ASD} = q_aB² - P_{FTG} =

One-way shear: **φ = 0.75**
V_c = 2λ√f'_cBd = 39.60 k
V_u ≤ φV_c φV_c = 29.70 k

$$V_u = q_u B \left(\frac{B - C_2}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_2}{2} - d \right)}$$

q_u = 4644 psf or

$$V_u = q_u B \left(\frac{B - C_1}{2} - d \right) \rightarrow q_u = \frac{\phi V_c}{B \left(\frac{B - C_1}{2} - d \right)}$$

4644 psf **P_u = q_uB² = 74298 #**

Two-way shear: **φ = 0.75**
[22.6.5.2(a)] **v_c = 4λ√f'_c = 200 psi** ←
[22.6.5.2(b)] **v_c = (2 + 4/β)λ√f'_c = 300 psi**
[22.6.5.2(c)] **v_c = (2 + α_xd/b_o)λ√f'_c = 400 psi**
V_u ≤ φV_c φV_c = φv_cb_od = 68.06 k

β = 1.00
α_x = 40
b_o = 2(C₁+d)+2(C₂+d) = 55

$$V_u = q_u [B^2 - (C_1 + d)(C_2 + d)] \rightarrow q_u = \frac{\phi V_c}{[B^2 - (C_1 + d)(C_2 + d)]}$$

q_u = 4634 psf **P_u = q_uB² = 74147 #**

Moment: **φ = 0.90**
M_n = A_sf_y(d - a/2) = 26.8 k-ft
a = A_sf_y/(0.85f'_cB) = 0.39 in
M_u ≤ φM_n φM_n = 24.2 k-ft

$$M_u = \frac{q_u B \left(\frac{B - C_2}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_2}{2} \right)^2}$$

q_u = 3853 psf or

$$M_u = \frac{q_u B \left(\frac{B - C_1}{2} \right)^2}{2} \rightarrow q_u = \frac{2\phi M_n}{B \left(\frac{B - C_1}{2} \right)^2}$$

3853 psf **P_u = q_uB² = 61640 #**

Development of Reinforcement:
l_d = (3 f_y ψ_t ψ_e ψ_s) / (40 λ √f'_c (c_b + K_{tr})) d_b = 12 in ...18 in available **OK**

Soil Bearing Pressure	1500 psf	2000 psf	2500 psf	3000 psf	3500 psf	4000 psf
Max Load (lbs), Soil	23360	31360	39360	47360	55360	63360
Max Load (lbs), One-Way Shear	46436	46436	46436	46436	46436	46436
Max Load (lbs), Two-Way Shear	46342	46342	46342	46342	46342	46342
Max Load (lbs), Moment	38525	38525	38525	38525	38525	38525
Max Load (ASD)	23360	31360	38525	38525	38525	38525
Max Load (Factored)	37376	50176	61640	61640	61640	61640