

Structural Calculations Cover Sheet

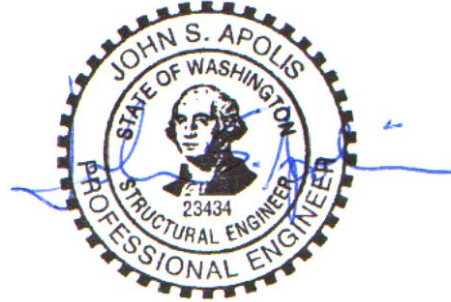
Project Number: 2021.086
Project Name: Graham Addition

Date: September 17, 2021
Architect: Shawn Sullivan

Structural Design For: Structural design for an addition to an existing residence.
Construction Type: Conventional wood framing with conventional concrete foundation.

CODES

2018 International Building Code (IBC)
2018 NDS
ASCE 7-16



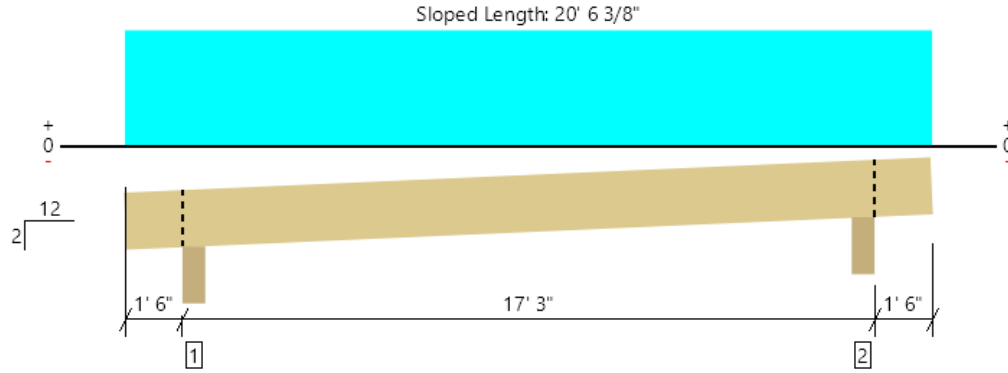
LOADS

Dead Loads As required
Roof snow Load 25 psf
Live Load 40 psf
Wind 110 mph, Exposure B, Per ASCE 7-16 Section 28, $K_{zt} = 1.6$
Seismic Per ASCE 7-16 Section 12
Peak Ground Accelerations (PGA) based on USGS Hazards Program (by address).
PGA 1 sec = .460 PGA .2 sec = 1.326 %V = .136 * DL

Material Design Values

Soils (assumed) Minimum 1,500 psf allowed bearing (subject to field verification)
Concrete $f'_c=2,500$ psi; 5-1/2 sack mix, or alternate mix pre-approved by bldg. dept.
Reinforcing Grade 60; $F_y=60,000$ psi minimum
Sawn Lumber Joists, Rafters: HF #2 and better
Beams: 4x_: DF-L #2
6x_: DF-L #2
Posts: DF-L #2
Studs & Plates: Hem-Fir Standard
Parallam Beams 2.0E PSL, $F_b=2,900$ psi, $F_v=290$ psi, $E=2.0 \times 10^6$ psi (minimum)
Anchor Bolts ASTM A325 hold down bolts, F1554 Anchor Bolts, A307 other bolts

Roof, R1: Addition Roof Joist
 1 piece(s) 2 x 12 HF No.2 @ 24" OC



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

Member Length : 20' 8 1/4"

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	816 @ 1' 8 3/4"	3387 (5.50")	Passed (24%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	585 @ 2' 10 5/8"	1941	Passed (30%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	2751 @ 10' 1 1/2"	2964	Passed (93%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.387 @ 10' 1 1/2"	0.851	Passed (L/528)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.617 @ 10' 1 1/2"	1.135	Passed (L/331)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD
 Member Pitch : 2/12

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Beveled Plate - HF	5.50"	5.50"	1.50"	308	508	816	Blocking
2 - Beveled Plate - HF	5.50"	5.50"	1.50"	308	508	816	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' 8" o/c	
Bottom Edge (Lu)	20' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

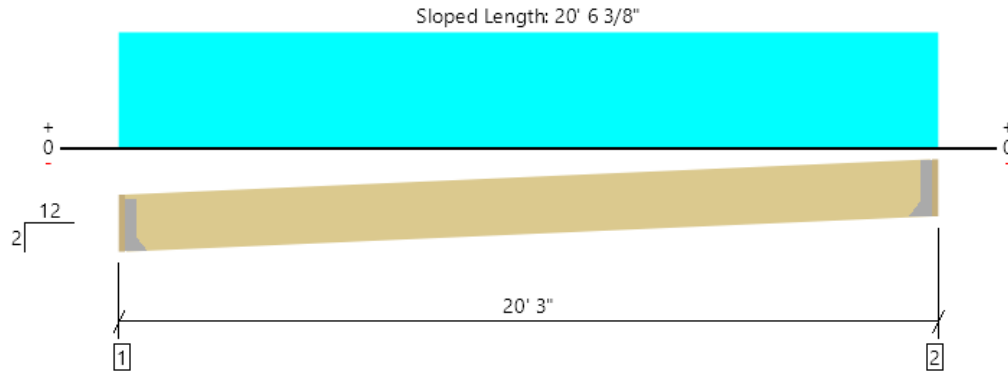
Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 20' 3"	24"	15.0	25.0	Default Load

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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
William Nocka CSES (978) 503-9935 11wnocka@gmail.com	



Roof, R2: Addition Roof Edge Joist
1 piece(s) 2 x 12 HF No.2 @ 12" OC



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

Member Length : 20' 5 3/16"

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	402 @ 1' 1/2"	911 (1.50")	Passed (44%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	365 @ 1' 5/8"	1941	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2010 @ 10' 1 1/2"	2964	Passed (68%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.400 @ 10' 1 1/2"	1.014	Passed (L/609)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.643 @ 10' 1 1/2"	1.352	Passed (L/378)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2/12

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Hanger on 11 1/4" HF beam	1.50"	Hanger ¹	1.50"	154	253	407	See note ¹
2 - Hanger on 11 1/4" HF beam	1.50"	Hanger ¹	1.50"	154	253	407	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' 5" o/c	
Bottom Edge (Lu)	20' 3" 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	LRU28Z	1.94"	N/A	6-10dx1.5	5-10d		
2 - Face Mount Hanger	LRU28Z	1.94"	N/A	6-10dx1.5	5-10d		

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 20' 3"	12"	15.0	25.0	Default Load

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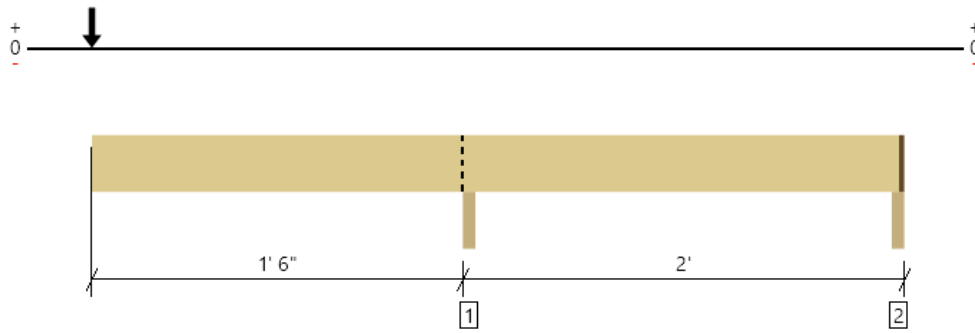
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William Nocka CSES (978) 503-9935 11wnocka@gmail.com	



Roof, R3: Addition Roof Rim
1 piece(s) 2 x 12 HF No.2

Overall Length: 3' 6"



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)	799 @ 1' 7 1/2"	1823 (3.00")	Passed (44%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	409 @ 6 3/4"	1941	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-667 @ 1' 7 1/2"	2577	Passed (26%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.006 @ 0	0.200	Passed (2L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.009 @ 0	0.217	Passed (2L/999+)	--	1.0 D + 1.0 S (All Spans)

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).
- Overhang deflection criteria: LL (2L/0.2") and TL (2L/180).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -377 lbs uplift at support located at 3' 4 1/2". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Beam - SPF	3.00"	3.00"	1.50"	311	488	799	Blocking
2 - Beam - SPF	3.00"	1.75"	1.50"	-142	-235	-377	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 5" o/c	
Bottom Edge (Lu)	3' 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 3' 4 3/4"	N/A	4.3	--	
1 - Point (lb)	0 (Front)	N/A	154	253	

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John S. Apolis, P.E. CSES, Inc.

Job number: 2021.086

Project: Graham Addition

Date: 17-Sep-21

Architect: Shawn Sullivan

Page number: R4

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC)

2018 NDS

Beam Description: East/West Header

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	6 ft	Tributary Width:	1.33 ft	P Location:	2.75 ft
Add'l uniform DL:	154 lbs/ft	DL unit load:		Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:	254 lbs/ft	SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	462 lbs	DL Reaction 2:	462 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	ASD load combinations
SL Reaction 1:	762 lbs	SL Reaction 2:	762 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	1224 lbs	Total Reaction 2:	1224 lbs	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1173 psi
Fv	150 psi	Fv'	173 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.47 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	480		
Max. allowed total defl:	0.3 in	Max LL defl:	0.15 in
Total defl. * I:	9.15 in^4	Required I:	30.51 in^4
LL defl. * I:	5.7 in^4	Required I:	37.98 in^4
Actual deflections:	TOTAL: 0.1 in		0.06 in

Force analysis:

Max. moment:	1836 ft-lb	Max Shear:	1224 lbs
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Selected Member: (2) HF#2 1.5 x 7.25

Member properties:	Provided:	Required:
Moment of inertia:	95.27 in^4	37.98 in^4
Section Modulus:	26.28 in^3	18.78 in^3
Section Area:	21.75 in^2	10.64 in^2
Bearing Area:		3.02 in^2
Minimum bearing dimensions:	3. in x	1.01 in

John S. Apolis, P.E. CSES, Inc.

Job number: 2021.086

Project: Graham Addition

Date: 17-Sep-21

Architect: Shawn Sullivan

Page number: R5

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC)

2018 NDS

Beam Description: North/South Header

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	3 ft	Tributary Width:	2 ft	P Location:	2.75 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	45 lbs	DL Reaction 2:	45 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	ASD load combinations
SL Reaction 1:	75 lbs	SL Reaction 2:	75 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	120 lbs	Total Reaction 2:	120 lbs	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1173 psi
Fv	150 psi	Fv'	173 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.47 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	480		
Max. allowed total defl:	0.15 in	Max LL defl:	0.08 in
Total defl. * I:	0.11 in^4	Required I:	0.75 in^4
LL defl. * I:	0.07 in^4	Required I:	0.93 in^4
Actual deflections:	TOTAL: 0. in		0. in

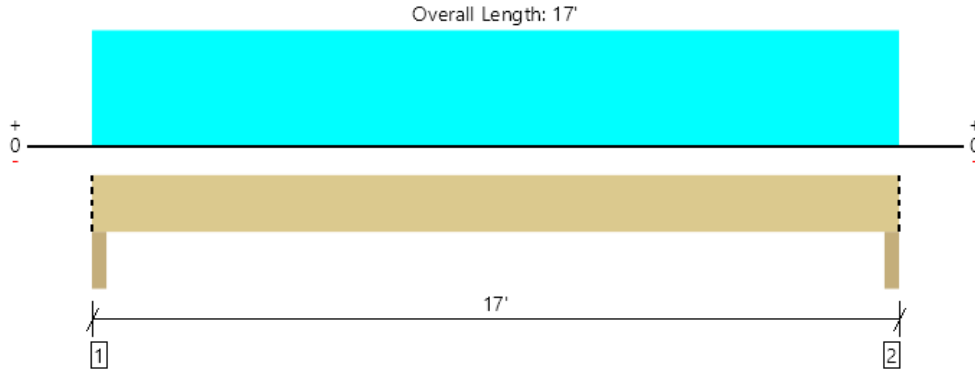
Force analysis:

Max. moment:	90 ft-lb	Max Shear:	120 lbs
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Selected Member: (2) HF#2 1.5 x 7.25

Member properties:	Provided:	Required:
Moment of inertia:	95.27 in^4	0.93 in^4
Section Modulus:	26.28 in^3	0.92 in^3
Section Area:	21.75 in^2	1.04 in^2
Bearing Area:		0.3 in^2
Minimum bearing dimensions:	3. in x	0.1 in

Roof, R6: Beam at Roof Transition
1 piece(s) 5 1/4" x 14" 2.2E Parallam® PSL



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)	5880 @ 2"	11484 (3.50")	Passed (51%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	4871 @ 1' 5 1/2"	16342	Passed (30%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	24018 @ 8' 6"	46854	Passed (51%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.268 @ 8' 6"	0.417	Passed (L/747)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.489 @ 8' 6"	0.833	Passed (L/409)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- 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	Snow	Total	
1 - Column - HF	3.50"	3.50"	1.79"	2660	1105	3188	6953	Blocking
2 - Column - HF	3.50"	3.50"	1.79"	2660	1105	3188	6953	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' o/c	
Bottom Edge (Lu)	17' 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'	N/A	23.0	--	--	
1 - Uniform (PSF)	0 to 17' (Front)	13'	20.0	10.0	25.0	Default Load
2 - Uniform (PSF)	0 to 17' (Front)	2'	15.0	-	25.0	

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Architect:

Shawn Sullivan

Page number: R7

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC)

2018 NDS

Beam Description: Roof Beam End Posts

Enter '1' for snow load: 1

Enter '1' for repetitive member:

Enter '1' for wet use:

Geometry and loads:

Height	8 ft	w(d)	plf
P	5848 lbs	w(b)	plf
Le(d)	8 ft	Le(b)	8 ft

Material Properties:

Fb1	900 psi	Fb(d)'	1035 psi
Fb2	900 psi	Fb(b)'	1035 psi
Fc	1350 psi	Fc'	568 psi
E	1.6 x10^6psi	E'	1.6 x10^6psi
Emin	0.58 x10^6psi	Emin'	0.58 x10^6psi

Selected Member: DF#2 3.5 x 3.5

b d

Member properties:

Section Modulus (d):	7.1 in^3
Section Modulus (b):	7.1 in^3
Section Area:	12.3 in^2

Variables:

Rb(d)	5.24
Rb(b)	5.24
c	0.8

Member stresses: Provided

FcE(d)	634 psi	>
FcE(b)	634 psi	>
FbE	25375 psi	>
FbE	25375 psi	>

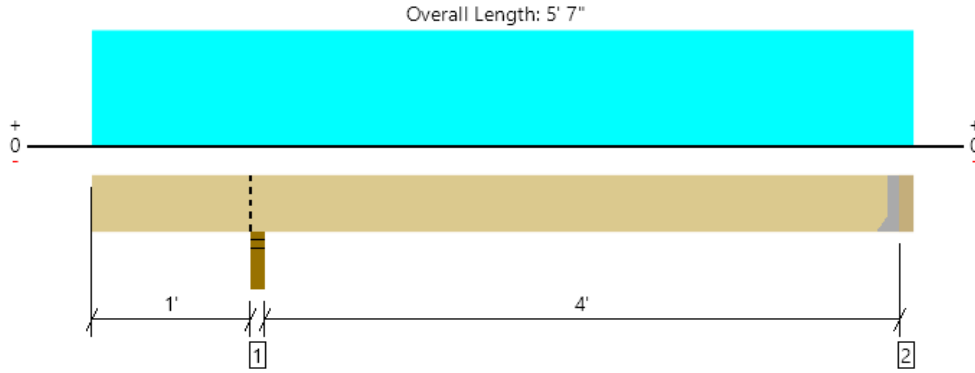
Required

fc	477 psi
fc	477 psi
fb(d)	0 psi
fb(b)	0 psi

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3 0.71 < 1.0

Roof, R8: Entry Joist
1 piece(s) 2 x 6 HF No.2 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	157 @ 5' 3 1/2"	911 (1.50")	Passed (17%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	130 @ 1' 9"	949	Passed (14%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	154 @ 3' 3 15/16"	921	Passed (17%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.011 @ 3' 2 7/8"	0.138	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.017 @ 3' 2 15/16"	0.207	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

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.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	101	169	270	Blocking
2 - Hanger on 5 1/2" SPF beam	3.50"	Hanger ¹	1.50"	66	114	180	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)	5' 4" o/c	
Bottom Edge (Lu)	5' 4" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie							
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories	
2 - Face Mount Hanger	LU26	1.50"	N/A	6-10dx1.5	4-10dx1.5		

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 5' 7"	24"	15.0	25.0	Default Load

Weyerhaeuser Notes

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

ForteWEB Software Operator	Job Notes
William Nocka CSES (978) 503-9935 11wnocka@gmail.com	



John S. Apolis, P.E. CSES, Inc.

Job number: 2021.086

Project: Graham Addition

Date: 17-Sep-21

Architect: Shawn Sullivan

Page number: R9

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC)

2018 NDS

Beam Description: Entry Roof Header

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	3.5 ft	Tributary Width:	5 ft	P Location:	2.75 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	131 lbs	DL Reaction 2:	131 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	ASD load combinations
SL Reaction 1:	219 lbs	SL Reaction 2:	219 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	350 lbs	Total Reaction 2:	350 lbs	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1271 psi
Fv	150 psi	Fv'	173 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.47 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	480		
Max. allowed total defl:	0.18 in	Max LL defl:	0.09 in
Total defl. * I:	0.52 in^4	Required I:	2.97 in^4
LL defl. * I:	0.32 in^4	Required I:	3.71 in^4
Actual deflections:	TOTAL: 0.01 in		0.01 in

Force analysis:

Max. moment:	306 ft-lb	Max Shear:	350 lbs
--------------	-----------	------------	---------

Selected Member: (2) HF#2 1.5 x 5.5

Member properties:	Provided:	Required:
Moment of inertia:	41.59 in^4	3.71 in^4
Section Modulus:	15.13 in^3	2.89 in^3
Section Area:	16.5 in^2	3.04 in^2
Bearing Area:		0.86 in^2
Minimum bearing dimensions:	3. in x	0.29 in

John S. Apolis, P.E. CSES, Inc.

Job number: 2021.086

Project: Graham Addition

Date: 17-Sep-21

Architect: Shawn Sullivan

Page number: R10

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC)

2018 NDS

Beam Description: Entry Roof Interior Header

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	6 ft	Tributary Width:	5 ft	P Location:	2.75 ft
Add'l uniform DL:	285 lbs/ft	DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:	475 lbs/ft	SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1080 lbs	DL Reaction 2:	1080 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	ASD load combinations
SL Reaction 1:	1800 lbs	SL Reaction 2:	1800 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	2880 lbs	Total Reaction 2:	2880 lbs	

Material Properties:

E	1.6 msi	E'	1.6 msi
Fb	900 psi	Fb'	1242 psi
Fv	180 psi	Fv'	207 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.58 msi	Emin'	0.58 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	480		
Max. allowed total defl:	0.3 in	Max LL defl:	0.15 in
Total defl. * I:	17.5 in^4	Required I:	58.32 in^4
LL defl. * I:	10.94 in^4	Required I:	72.9 in^4
Actual deflections:	TOTAL: 0.08 in		0.05 in

Force analysis:

Max. moment:	4320 ft-lb	Max Shear:	2880 lbs
--------------	------------	------------	----------

Selected Member: (1) DF#2 3.5 x 9.25

Member properties:	Provided:	Required:
Moment of inertia:	230.84 in^4	72.9 in^4
Section Modulus:	49.91 in^3	41.74 in^3
Section Area:	32.38 in^2	20.87 in^2
Bearing Area:		4.61 in^2
Minimum bearing dimensions:	3.5 in x	1.32 in

John S. Apolis, P.E. CSES, Inc.

Job number: 2021.086

Project: Graham Addition

Date: 17-Sep-21

Architect: Shawn Sullivan

Page number: M1

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC)

2018 NDS

Beam Description: North Header

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	6 ft	Tributary Width:	1.33 ft	P Location:	2.75 ft
Add'l uniform DL:	214.5 lbs/ft	DL unit load:	12 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:	237.5 lbs/ft	SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	691 lbs	DL Reaction 2:	691 lbs	Note: Design automatically uses
LL Reaction 1:	160 lbs	LL Reaction 2:	160 lbs	ASD load combinations
SL Reaction 1:	713 lbs	SL Reaction 2:	713 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	1404 lbs	Total Reaction 2:	1404 lbs	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1173 psi
Fv	150 psi	Fv'	173 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.47 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	480		
Max. allowed total defl:	0.3 in	Max LL defl:	0.15 in
Total defl. * I:	11.69 in^4	Required I:	38.97 in^4
LL defl. * I:	6.52 in^4	Required I:	43.47 in^4
Actual deflections:	TOTAL: 0.12 in		0.07 in

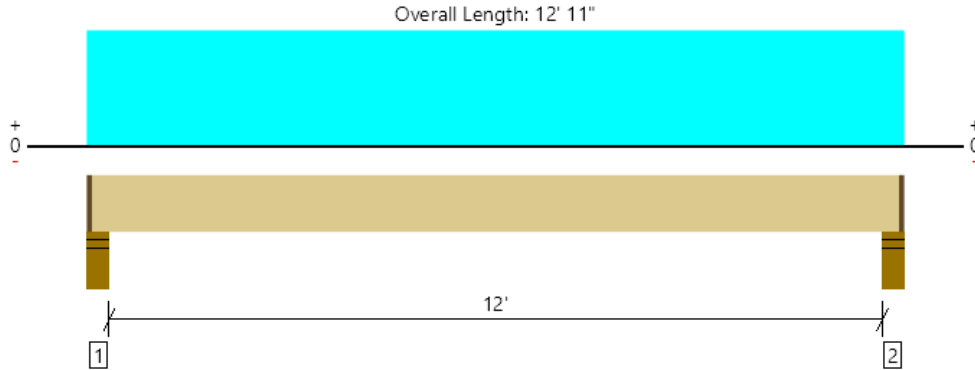
Force analysis:

Max. moment:	2106 ft-lb	Max Shear:	1404 lbs
--------------	------------	------------	----------

Selected Member: (2) HF#2 1.5 x 7.25

Member properties:	Provided:	Required:
Moment of inertia:	95.27 in^4	43.47 in^4
Section Modulus:	26.28 in^3	21.54 in^3
Section Area:	21.75 in^2	12.21 in^2
Bearing Area:		3.47 in^2
Minimum bearing dimensions:	3. in x	1.16 in

Main Floor, M2: Floor Joist
1 piece(s) 2 x 10 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	441 @ 4 1/2"	2582 (4.25")	Passed (17%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	363 @ 1' 2 3/4"	1388	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1283 @ 6' 5 1/2"	1917	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.204 @ 6' 5 1/2"	0.304	Passed (L/714)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.266 @ 6' 5 1/2"	0.608	Passed (L/549)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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	Total	
1 - Stud wall - SPF	5.50"	4.25"	1.50"	103	344	447	1 1/4" Rim Board
2 - Stud wall - SPF	5.50"	4.25"	1.50"	103	344	447	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 5" o/c	
Bottom Edge (Lu)	12' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 12' 11"	16"	12.0	40.0	Default Load

Weyerhaeuser Notes

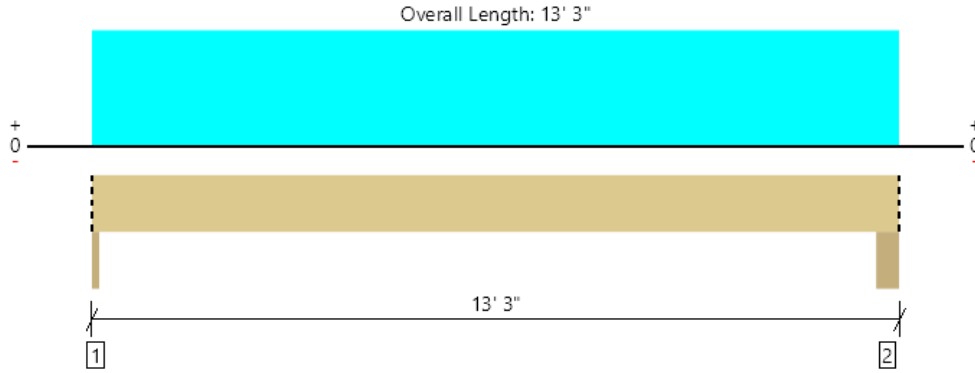
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
William Nocka CSES (978) 503-9935 11wnocka@gmail.com	



Main Floor, M3: East Header, North
1 piece(s) 6 x 12 DF No.2



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)	2316 @ 1/4"	6016 (1.75")	Passed (38%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1921 @ 1' 1 1/4"	7168	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	7443 @ 6' 5 5/8"	8840	Passed (84%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.165 @ 6' 5 5/8"	0.258	Passed (L/939)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.246 @ 6' 5 5/8"	0.645	Passed (L/629)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/600) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Column - DF	1.75"	1.75"	1.50"	763	1553	323	2639	Blocking
2 - Column - DF	5.50"	5.50"	1.50"	800	1628	339	2767	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)	13' 3" o/c	
Bottom Edge (Lu)	13' 3" 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 13' 3"	N/A	16.0	--	--	
1 - Uniform (PSF)	0 to 13' 3" (Top)	6'	12.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 13' 3" (Top)	2'	15.0	-	25.0	Default Load

Weyerhaeuser Notes

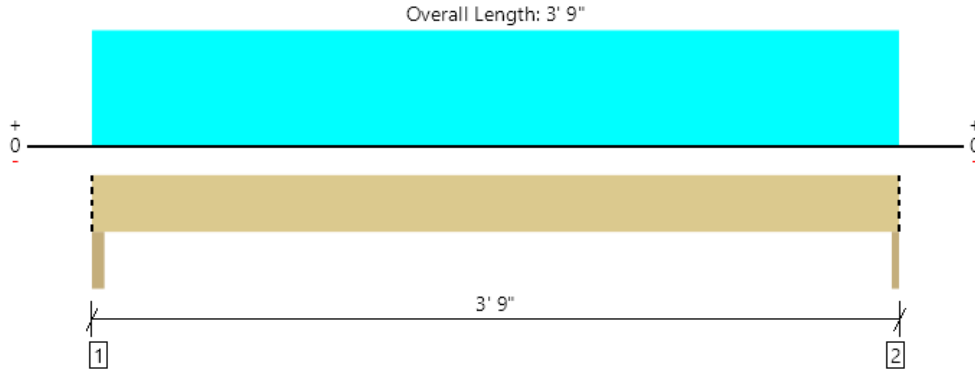
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
William Nocka CSES (978) 503-9935 11wnocka@gmail.com	



Main Floor, M4: East Header, South
2 piece(s) 2 x 8 HF No.2



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)	633 @ 3' 8 3/4"	2126 (1.75")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	373 @ 10 1/4"	2175	Passed (17%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	564 @ 1' 11 1/8"	2234	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.007 @ 1' 11 1/8"	0.072	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 1' 11 1/8"	0.180	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/600) 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 - Column - DF	3.00"	3.00"	1.50"	207	463	96	766	Blocking
2 - Column - DF	1.75"	1.75"	1.50"	196	438	91	725	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)	3' 9" o/c	
Bottom Edge (Lu)	3' 9" 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 3' 9"	N/A	5.5	--	--	
1 - Uniform (PSF)	0 to 3' 9" (Front)	6'	12.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 3' 9" (Front)	2'	15.0	-	25.0	Default Load

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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
William Nocka CSES (978) 503-9935 11wnocka@gmail.com	



John S. Apolis, P.E.

CSES, Inc.

Job number: 2021.086

Project:

Graham Addition

Date: 17-Sep-21

Architect:

Shawn Sullivan

Page number: M5

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC)

2018 NDS

Beam Description: Mid-Post East Beam

Enter '1' for snow load:

Enter '1' for repetitive member:

Enter '1' for wet use:

Geometry and loads:

Height	8 ft	w(d)	plf
P	2950 lbs	w(b)	plf
Le(d)	8 ft	Le(b)	8 ft

Material Properties:

Fb1	850 psi	Fb(d)'	850 psi
Fb2	850 psi	Fb(b)'	850 psi
Fc	1300 psi	Fc'	351 psi
E	1.3 x10 ⁶ psi	E'	1.3 x10 ⁶ psi
Emin	0.47 x10 ⁶ psi	Emin'	0.47 x10 ⁶ psi

Selected Member: HF#2 3 x 3.5

b d

Member properties:

Section Modulus (d):	6.1 in ³
Section Modulus (b):	5.3 in ³
Section Area:	10.5 in ²

Variables:

Rb(d)	4.85
Rb(b)	6.11
c	0.8

Member stresses: Provided

FcE(d)	514 psi	>
FcE(b)	377 psi	>
FbE	15107 psi	>
FbE	15107 psi	>

Required

fc	281 psi
fc	281 psi
fb(d)	0 psi
fb(b)	0 psi

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3 0.64 < 1.0

John S. Apolis, P.E. CSES, Inc.

Job number: 2021.086

Project: Graham Addition

Date: 17-Sep-21

Architect: Shawn Sullivan

Page number: M6

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC)

2018 NDS

Beam Description: West Header

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	3 ft	Tributary Width:	14 ft	P Location:	2.75 ft
Add'l uniform DL:		DL unit load:	12 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	252 lbs	DL Reaction 2:	252 lbs	Note: Design automatically uses
LL Reaction 1:	840 lbs	LL Reaction 2:	840 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	1092 lbs	Total Reaction 2:	1092 lbs	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1173 psi
Fv	150 psi	Fv'	173 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.47 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	480		
Max. allowed total defl:	0.15 in	Max LL defl:	0.08 in
Total defl. * I:	1.02 in^4	Required I:	6.8 in^4
LL defl. * I:	0.79 in^4	Required I:	10.47 in^4
Actual deflections:	TOTAL: 0.01 in		0.01 in

Force analysis:

Max. moment:	819 ft-lb	Max Shear:	1092 lbs
--------------	-----------	------------	----------

Selected Member: (2) HF#2 1.5 x 7.25

Member properties:	Provided:	Required:
Moment of inertia:	95.27 in^4	10.47 in^4
Section Modulus:	26.28 in^3	8.38 in^3
Section Area:	21.75 in^2	9.5 in^2
Bearing Area:		2.7 in^2
Minimum bearing dimensions:	3. in x	0.9 in

FOOTING DESIGN

ISOLATED FOOTING @ NW CORNER OF ADDITION

$$P_{max} = 5,848 \# \text{ (Support 2 from R6)}$$

$$q = 1,500 \text{ psf}$$

$$A_{req} = \frac{P_{max}}{q} = 3.90 \text{ ft}^2$$

$$s = 2' \Rightarrow A = 4 \text{ ft}^2 \text{ OK}$$

CONSULTING STRUCTURAL ENGINEERING SERVICES

Residential and Commercial Structural Design

6311 17th Avenue NE, Seattle, WA 98115

Phone: (206)527-1288 Email: john@cses-engineering.com

Project No. 2021.086 Date 9-17-21

Project Name GRAHAM

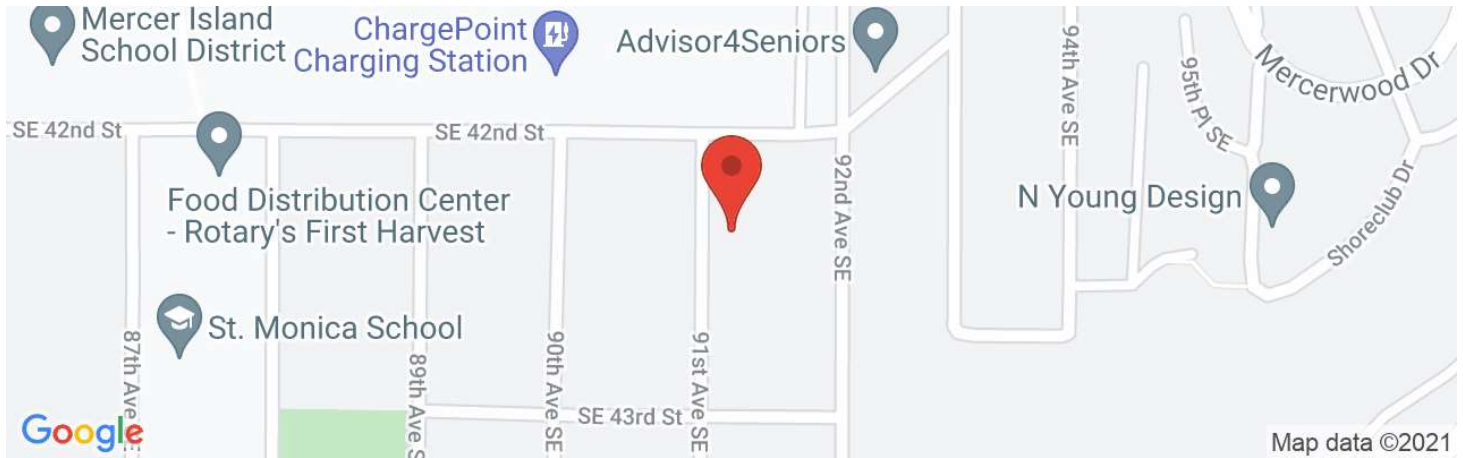
Comments _____

Revision _____ Page F1

2021.086 Graham Addition

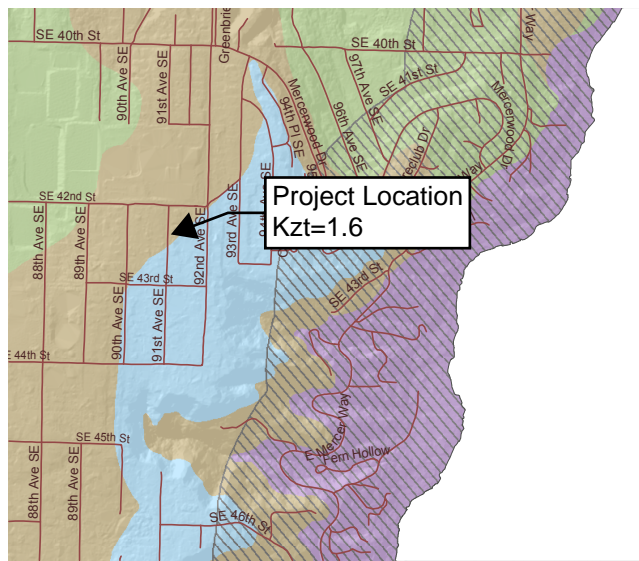
4220 91st Ave SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5702879, -122.2172141



Date	9/13/2021, 10:49:00 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.415	MCE_R ground motion. (for 0.2 second period)
S_1	0.492	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.698	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.132	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



WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_{zt} Factor :

K_{zt} Factor

- $K_{zt} = 1.0$
- $K_{zt} = 1.3$
- $K_{zt} = 1.6$
- $K_{zt} = 1.9$

Lateral Loads Design per ASCE 7-16, Wind: Section 28 Seismic: Section 12

(Simplified Envelope Procedure Part 2)

2015 & 2018 International Building Code (IBC)

WIND LOADS **110** mph Basic Wind Speed **2018 NDS**

Ps = lambda * Kzt * Ps(30) * 0.6 Exposure **B** Roof Slope: **2.00** : 12 = 9.5

Least Horizontal Dimension, feet: **48** Mean Roof Ht, feet: **20** (degrees)

lambda = 1.00 a = 4.8 ft, 2a = 9.6 ft

Iw = 1.00 KzT = **1.60**

<u>Tabulated Ps(30):</u>	<u>Zone</u>	<u>Tabulated Wind Pressure</u>	<u>Calc'd Design Pressure</u>	<u>Min Design Pressure</u>	(Per section 28.6.4 minimum tabulated wind pressure is 16 PSF for zones A, C, and 8 PSF for zones B, D)
(Refer to ASCE 7-16, Figure 28.6-1)			(*lambda*KzT*0.6)		
(horizontal)	A	21.3	psf	20.5	20.5
"	B	-9.1	psf	-8.7	8.7
"	C	14.2	psf	13.6	15.4
"	D	-5.3	psf	-5.1	7.7
(vertical)	E	-23.1	psf	-22.2	
"	F	-14.0	psf	-13.4	
"	G	-16.0	psf	-15.4	
"	H	-10.7	psf	-10.3	
(uplift on overhangs)	E(oh)	-32.3	psf	-31.0	
"	G(oh)	-25.3	psf	-24.3	

(Equivalent Lateral Force Procedure, Section 12.8)

<u>SEISMIC LOADS</u>	Ie	R =	ASCE 7-16, Table 12.2.1
Seismic Parameters	Group I	D	
per ASCE 7-16)	PGA (.2 sec)	Fa = 1.00	ASCE 7-16 Table 11.4-1
	PGA (1 sec)	Fv = 1.60	ASCE 7-16 Table 11.4-2

Seismic Design Categories per ASCE 7-16 Tables 11.6-1, 11.6-2

Based on Sds: **D** Based on Sd1: **D**

PGA's based on peak ground accelerations per latest USGS Hazards Program (based on lat/lon).

Ss = 1.3260 Sms = Fa * Ss = 1.33 Equation 11.4-1

S1 = 0.4600 Sm1 = Fv * S1 = 0.74 Equation 11.4-2

Equations 11.4-3, 11.4-4 Sds = 2/3 * Sms = 0.88 Sd1 = 2/3 * Sm1 = 0.49

Equation 12.14-11 Cs (%V) = (Sds / (R/I)) = 0.136 **Building period < 0.5 s per IBC eq 12.8-7**

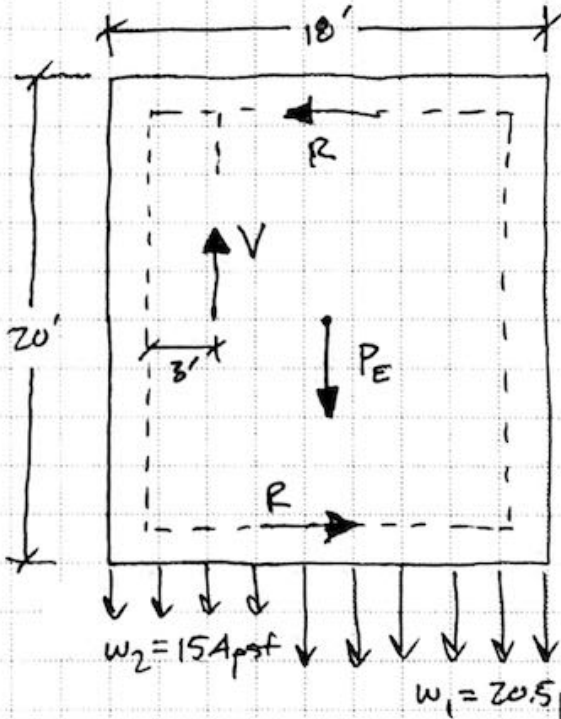
Base Shear = %V * W * 0.7 = 4.28 psf, uniformly distributed over floor area
(0.7 reduction factor per ASCE 7-16, Section 2.4.1, Eq (seismic vertical distribution per IBC eqs 12.8-11 & 12)

	<u>Roof DL</u>	<u>Wall DL (psf)</u>	<u>Story Height</u>	<u>Lateral</u>
Base = top of foundation	<u>(psf)</u>	<u>dist. over floor area</u>	<u>Above Base (ft)</u>	<u>Load (psf)</u>
Roof	15	6	18	2.73
Main Floor	12	12	9	1.56
Lower Floor				0.00
Total Seismic DL:	45		Sum	4.28

LATERAL DESIGN - ROOF LEVEL

Addition roof is designed as a 3-sided diaphragm.

North/South Loading:



Earthquake:

$$P_E = 2.73 \text{ psf} \times 20' \times 18'$$

$$P_E = 983 \#$$

$$\Sigma F \Rightarrow V_E = 983 \#$$

$$\Sigma M \Rightarrow R_E = \frac{983 \# \times 4.5'}{17'} = 260 \#$$

Wind:

$$P_w = 20.5 \text{ psf} \times 9.6' \times 6' + 15.4 \text{ psf} \times 8.4' \times 6'$$

$$P_w = 1,957 \#$$

$$\Sigma F \Rightarrow V_w = 1,957 \#$$

$$\Sigma M \Rightarrow R_w = 591 \#$$

NORTH SHEAR WALL - L=5'

$$P_w = 15.4 \text{ psf} \times 10' \times 6' \quad P_w = 924 \# \quad \leftarrow \text{CONTROLS}$$

$$P_E = 2.73 \text{ psf} \times 10' \times 18' \quad P_E = 491 \#$$

$$v = \frac{924 \#}{5'} = 185 \text{ plf} < 230 \text{ plf} \Rightarrow \underline{\text{SW 1}}$$

$$\text{UPLIFT: } 185 \text{ plf} \times 11' = 2,035 \# < 2,490 \# \Rightarrow \underline{\text{CS 14}}$$

$$\text{ASPECT RATIO CHECK: } 230 \text{ plf} \left(1.25 - .125 \left(\frac{11}{5} \right) \right) = 224 \text{ plf} \quad \underline{\text{OK}}$$

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LATERAL DESIGN - ROOF LEVEL

SOUTH SHEAR WALL - $L = 12'$

$$P_w = 20.5 \text{ psf} \times 10' \times 5' \quad P_w = 1,025 \# \quad \Leftarrow \text{WIND GOVERNS}$$

$$P_E = 491 \#$$

$$R_w = 591 \#$$

$$V = \frac{1,025 \#}{12'} = 85 \text{ plf} < 100 \text{ plf} \Rightarrow \text{UNBLOCKED WALL}$$

$$H = 85 \text{ plf} \times 9' = 765 \# < 1,705 \# \Rightarrow \text{CS16}$$

WEST SHEAR WALL (PARTIAL HEIGHT) - $L = 2.75'$

$$P_w = 1,957 \# \quad \Leftarrow \text{WIND GOVERNS}$$

$$P_E = 983 \#$$

$$V = \frac{1,957 \#}{2.75'} = 712 \text{ plf} \approx 710 \text{ plf} \Rightarrow \text{SW3X}$$

$$H = 712 \text{ plf} \times 3' = 2,136 \# \quad (\text{CONTINUOUS POSTS TO BELOW})$$

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LATERAL DESIGN - ROOF LEVEL

WEST SHEAR WALL - $L = 2.75' + 2.5'$

$$P_w = 1,957\# + 15.4 \text{ psf} \times 15' \times 6' \quad P_w = 3,343\#$$

$$P_E = 983\# + 2.73 \text{ psf} \times 56' \times 17' \quad P_E = 3,582\# \leftarrow \text{EQ GOVERNS}$$

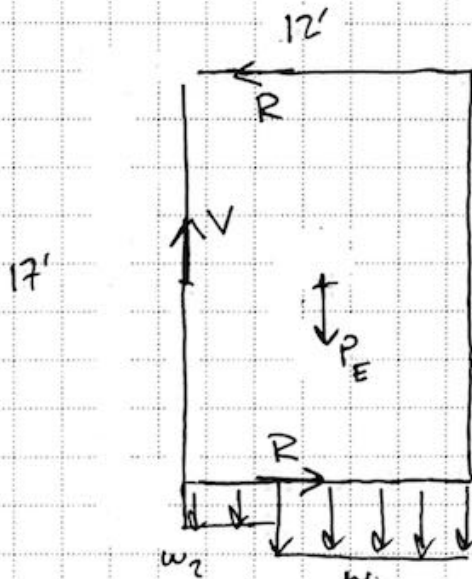
$$V = \frac{3,582\#}{5.25'} = 682 \text{ plf} < 710 \text{ plf} \Rightarrow \text{SW3X}$$

$$H = 682 \text{ plf} \times 8' = 5,456\# < 6,475\# \Rightarrow \text{CMST14}$$
$$5,456\# + 2,136\# = 7,592\# < 9,215\# \Rightarrow$$

CMST12

LATERAL DESIGN - MAIN FLOOR

North/South Loading:



Earthquake:

$$P_E = 1.56 \text{ psf} \times 17' \times 12' \quad P_E = 318\#$$

$$\Sigma F \Rightarrow V_E = 318\#$$

$$\Sigma M \Rightarrow R_E = 112\#$$

Wind:

$$P_w = 20.5 \text{ psf} \times 8' \times 9' + 15.4 \text{ psf} \times 4' \times 9'$$
$$P_w = 2,030\#$$

$$\Sigma F \Rightarrow V_w = 2,030\#$$

$$\Sigma M \Rightarrow R_w = 760\#$$

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LATERAL DESIGN - MAIN FLOOR

NORTH SHEAR WALL - L = 5'

$$P_w = 924 \# + 15.4 \text{ psf} \times 7.5' \times 9' \\ (L2)$$

$$P_w = 1,964 \# \leftarrow \begin{matrix} \text{WIND} \\ \text{CONTROLS} \end{matrix}$$

$$P_E = 491 \# + 1.56 \text{ psf} \times 15' \times 8.5' \\ (L3)$$

$$P_E = 690 \#$$

$$R_w = 591 \# + 760 \# \\ (L2) \quad (L4)$$

$$R_w = 1,351 \#$$

$$V = \frac{1,964 \#}{5'} = 393 \text{ plf} < 550 \text{ plf} \Rightarrow \text{SW3}$$

$$H = 393 \text{ plf} \times 8' = 3,144 \# + 2,057 \# = 5,201 \# < 5,645 \# \\ \Rightarrow \text{HDU5 w/ PF studs}$$

SOUTH SHEAR WALL - L = 12'

$$P_w = 1,025 \# + 20.5 \text{ psf} \times 10' \times 9' \\ (L3)$$

$$P_w = 2,870 \#$$

↑
WIND GOVERNS

$$P_E = 491 \# + 1.56 \text{ psf} \times 15' \times 8.5' \\ (L3)$$

$$P_E = 690 \#$$

$$R_w = 1,351 \#$$

$$V = \frac{2,870 \#}{12'} = 239 \text{ plf} < 350 \text{ plf} \Rightarrow \text{SW2}$$

$$H = 239 \text{ plf} \times 8' = 1,912 \# < 2,215 \# \Rightarrow \text{HDU2}$$

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LATERAL DESIGN - MAIN FLOOR

WEST SHEAR WALL (@ TRANSITION TO HOUSE) - L = 4' + 7'

$$P_w = 3,343 \# + 154 \text{ psf} \times 9' \times 15.5' + 2,030 \# \quad P_w = 7,521 \#$$

(L4) (L4)

$$P_E = 3,582 \# + 1.56 \text{ psf} \times 53' \times 15.5' + 318 \# \quad P_E = 5,182 \#$$

(L4) (L4)

$$v = \frac{7,521 \#}{11'} = 684 \text{ plf} < 710 \text{ plf} \Rightarrow \text{SW3X} \quad \text{WIND GOVERNS}$$

$$H = 684 \text{ plf} \times 8' = 5,472 \# < 5,645 \# \Rightarrow \text{HDUS w/ DF studs}$$

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