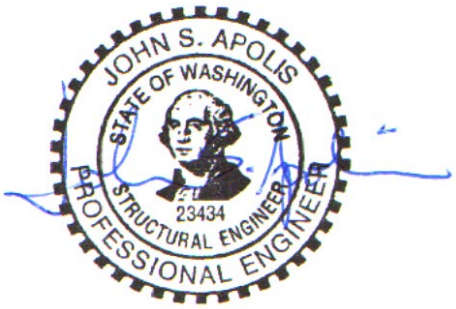
Structural Calculations Cover Sheet

Project Number:	**2022.172**	**Date:**	**December 23, 2022**
Project Name:	**Mukherjee Residence**	**Architect:**	**Suzanne Zahr**

Structural Design For: Structural design for an addition and remodel.
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
Floor Load	40 psf
Wind	110 mph, Exposure B, Per ASCE 7-16 Section 28, Kzt = 1.60
Seismic	Per ASCE 7-16 Section 12

Peak Ground Accelerations (PGA) based on USGS Hazards Program (by address).
PGA 1 sec = .507 PGA .2 sec = 1.467 %V = ..150 * 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; Fy=60,000 psi minimum	
Sawn Lumber	Joists, Rafters:	Hem-Fir #2 and better
	Beams, Posts:	DF-L #2
	Studs & Plates:	Hem-Fir Standard
Parallam Beams	2.2E PSL, Fb=2,900 psi, Fv=290 psi, E=2.2*10^6 psi (minimum)	
Microllam Beams	1.9E LVL, Fb=2,600 psi, Fv=285 psi, E=1.9*10^6 psi (minimum)	
Anchor Bolts	ASTM A325 hold down bolts, F1554 Anchor Bolts, A307 other bolts	

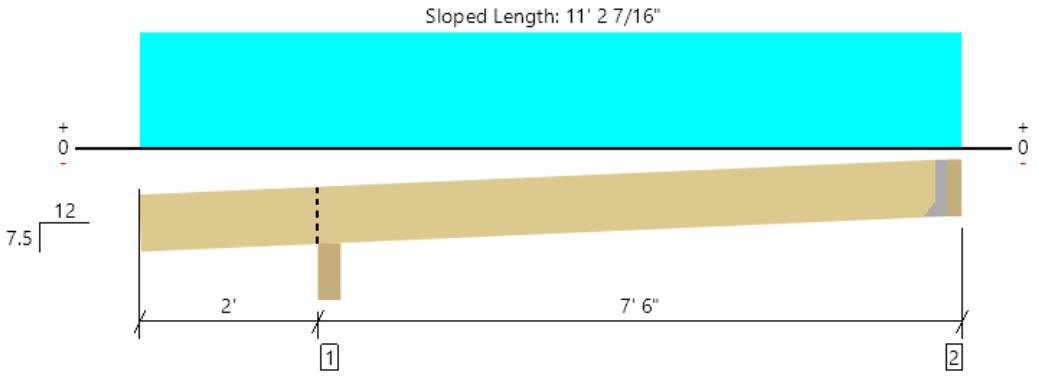
CONSULTING STRUCTURAL ENGINEERING SERVICES, INC.
6311 - 17th Avenue NE, Seattle WA 98115 (206) 527-1288 email john@cses-engineering.com
Structural Engineering Consulting and Design

FORTEWEB

MEMBER REPORT

PASSED

Roof, R1: New Roof Joist, North
1 piece(s) 2 x 8 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 : 11' 2 13/16"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 7.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	276 @ 9' 2 1/2"	911 (1.50")	Passed (30%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	265 @ 2' 11 5/8"	1251	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	448 @ 5' 11 5/8"	1477	Passed (30%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.053 @ 5' 9 5/16"	0.274	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.085 @ 5' 9 11/16"	0.412	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

- 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	Factored	
1 - Beveled Plate - HF	5.50"	5.50"	1.50"	215	304	519	Blocking
2 - Hanger on 7 1/4" SPF beam	3.50"	Hanger[1]	1.50"	120	180	300	See note [1]

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

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

- Maximum allowable bracing intervals based on applied load.

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

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 9' 6"	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	

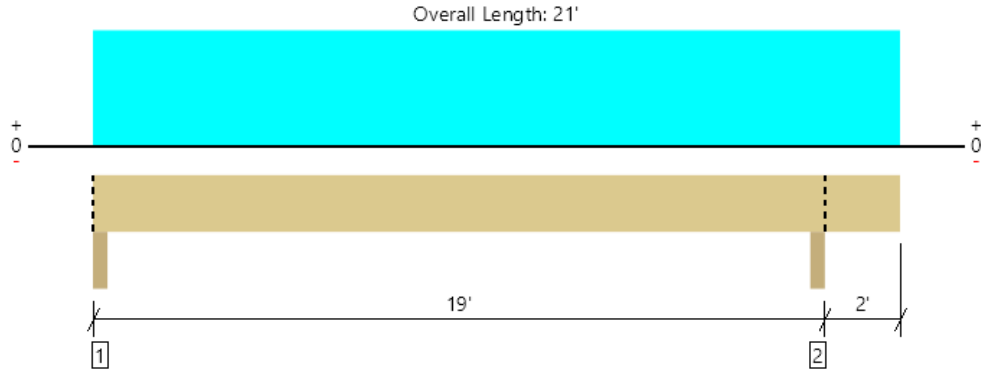
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, R2: New Roof Flush Beam, North
1 piece(s) 3 1/2" x 11 1/4" 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)	3627 @ 18' 10 1/4"	7656 (3.50")	Passed (47%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2618 @ 17' 9 1/4"	8754	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	13378 @ 9' 5 1/16"	20666	Passed (65%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.553 @ 9' 5 7/8"	0.623	Passed (L/406)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.953 @ 9' 5 3/4"	0.934	Passed (L/235)	--	1.0 D + 1.0 S (Alt 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/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Upward deflection on right cantilever exceeds overhang deflection criteria.
- 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 - Column - SPF	3.50"	3.50"	1.50"	1242	1701	2943	Blocking
2 - Column - SPF	3.50"	3.50"	1.66"	1536	2090	3627	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)	21' o/c	
Bottom Edge (Lu)	21' o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 21'	N/A	12.3	--	
1 - Uniform (PLF)	0 to 21' (Front)	N/A	60.0	90.0	Linked from: R1: New Roof Joist, North, Support 2
2 - Uniform (PLF)	0 to 21' (Back)	N/A	60.0	90.0	Linked from: R1: New Roof Joist, North, Support 2

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

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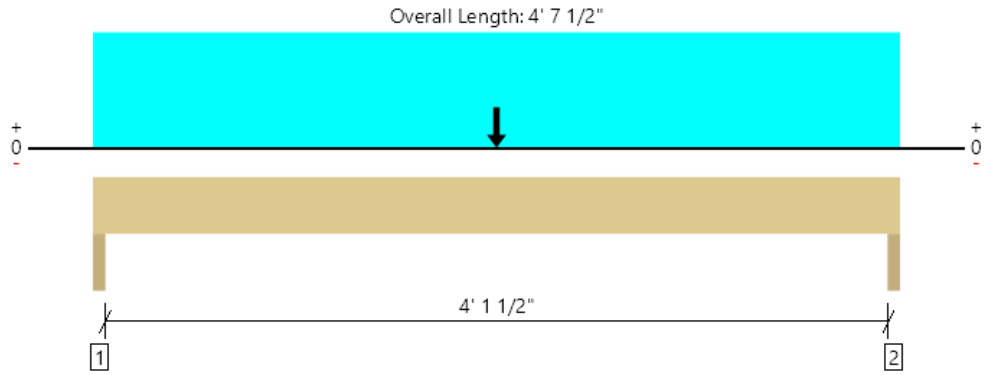
MEMBER REPORT

PASSED

Roof, R3: North Window Header
2 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL



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)	2015 @ 1 1/2"	7613 (3.00")	Passed (26%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1940 @ 10 1/4"	5544	Passed (35%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4175 @ 2' 3 3/4"	8182	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.041 @ 2' 3 3/4"	0.109	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.071 @ 2' 3 3/4"	0.219	Passed (L/736)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
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	Snow	Factored	
1 - Trimmer - HF	3.00"	3.00"	1.50"	854	1161	2015	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	854	1161	2015	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 4' 7 1/2"	N/A	7.4	--	
1 - Uniform (PSF)	0 to 4' 7 1/2"	2'	15.0	25.0	Default Load
2 - Point (lb)	2' 3 3/4"	N/A	1536	2090	Linked from: R2: New Roof Flush Beam, North, Support 2

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John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**R4**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Beam R2, South Support

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	12 ft	w(d)	0 plf	M(d)	
Axial Load	2943 lbs	w(b)	0 plf	M(b)	0 ft-lbs
Le(d)	12 ft	Le(b)	12 ft		

Material Properties:

Fb1	900 psi	Fb(d)'	1035 psi
Fb2	900 psi	Fb(b)'	1035 psi
Fc	1350 psi	Fc'	270.26 psi
E	1.6 msi	E'	1.6 msi
Emin	0.58 msi	Emin'	0.58 msi

Selected Member: DF #2 3.5 (b) x 3.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	7.1 in^3	Rb(d)	6.41
Section Modulus (b):	7.1 in^3	Rb(b)	6.41
Section Area:	12.3 in^2	c	0.8

Member stresses:	Provided			Required	
FcE(d)	282 psi	>	fc	240 psi	OK
FcE(b)	282 psi	>	fc	240 psi	OK
FbE	16917 psi	>	fb(d)	0 psi	OK
FbE	16917 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3 0.79 < 1.0 **OK**

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**R5**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Beam R2, North Support

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	2.5 ft	w(d)	0 plf	M(d)	
Axial Load	3627 lbs	w(b)	0 plf	M(b)	0 ft-lbs
Le(d)	2.5 ft	Le(b)	0.5 ft		

Material Properties:

Fb1	900 psi	Fb(d)'	1035 psi
Fb2	900 psi	Fb(b)'	1035 psi
Fc	1350 psi	Fc'	1466.8 psi
E	1.6 msi	E'	1.6 msi
Emin	0.58 msi	Emin'	0.58 msi

Selected Member: DF #2 — 3.5 (b) x 3.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	7.1 in^3	Rb(d)	2.93
Section Modulus (b):	7.1 in^3	Rb(b)	1.31
Section Area:	12.3 in^2	c	0.8

Member stresses:	Provided			Required		
FcE(d)	6489 psi	>	fc	296 psi	OK
FcE(b)	162231 psi	>	fc	296 psi	OK
FbE	81200 psi	>	fb(d)	0 psi	OK
FbE	81200 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3	0.04	<	1.0	**OK**

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**R6**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Header R3, Support

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	10 ft	w(d)	0 plf	M(d)	
Axial Load	3627 lbs	w(b)	0 plf	M(b)	0 ft-lbs
Le(d)	10 ft	Le(b)	0.5 ft		

Material Properties:

Fb1	850 psi	Fb(d)'	977.5 psi
Fb2	850 psi	Fb(b)'	977.5 psi
Fc	1300 psi	Fc'	692.21 psi
E	1.3 msi	E'	1.3 msi
Emin	0.47 msi	Emin'	0.47 msi

Selected Member: HF #2 — 3 (b) x 5.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	15.1 in^3	Rb(d)	3.45
Section Modulus (b):	8.3 in^3	Rb(b)	1.91
Section Area:	16.5 in^2	c	0.8

Member stresses:	Provided		Required		
FcE(d)	812 psi	>	fc	220 psi	OK
FcE(b)	96585 psi	>	fc	220 psi	OK
FbE	47392 psi	>	fb(d)	0 psi	OK
FbE	47392 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3	0.10	<	1.0	**OK**

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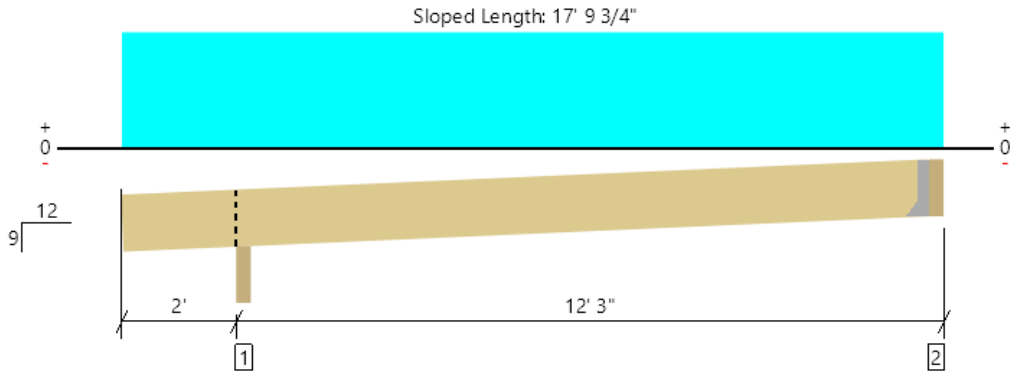
MEMBER REPORT

PASSED

Roof, R7: New Roof Joist, Garage

1 piece(s) 2 x 10 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 : 18' 5/16"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 9/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	505 @ 13' 11 1/2"	911 (1.50")	Passed (55%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	467 @ 2' 10 7/8"	1596	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1455 @ 8' 2 5/16"	2204	Passed (66%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.256 @ 8' 1 1/16"	0.492	Passed (L/693)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.439 @ 8' 1 3/16"	0.738	Passed (L/403)	--	1.0 D + 1.0 S (Alt Spans)

- 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	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	309	412	722	Blocking
2 - Hanger on 9 1/4" SPF beam	3.50"	Hanger[1]	1.50"	223	305	528	See note [1]

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 5" o/c	
Bottom Edge (Lu)	17' 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
2 - Face Mount Hanger	LRU28Z	1.94"	N/A	6-10dx1.5	5-10d	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 14' 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

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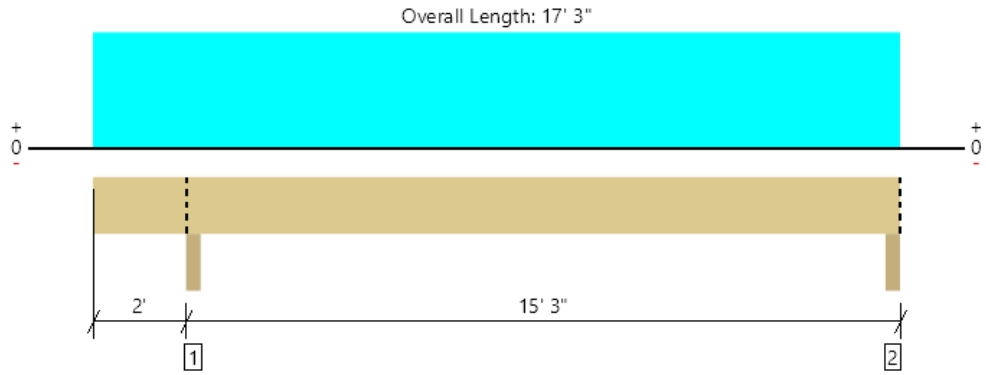
R7

FORTEWEB

MEMBER REPORT

PASSED

Roof, R8: New Roof Flush Beam, Garage South
1 piece(s) 3 1/2" x 11 1/4" 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)	5278 @ 2' 1 3/4"	7656 (3.50")	Passed (69%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3533 @ 3' 2 3/4"	8754	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	14627 @ 9' 8 11/16"	20666	Passed (71%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.387 @ 9' 7 11/16"	0.498	Passed (L/463)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.679 @ 9' 7 13/16"	0.747	Passed (L/264)	--	1.0 D + 1.0 S (Alt 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/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Upward deflection on left cantilever exceeds overhang deflection criteria.
- 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 - Column - SPF	3.50"	3.50"	2.41"	2299	2979	5278	Blocking
2 - Column - SPF	3.50"	3.50"	1.86"	1760	2305	4066	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' 3" o/c	
Bottom Edge (Lu)	17' 3" 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 17' 3"	N/A	12.3	--	
1 - Uniform (PLF)	0 to 17' 3" (Front)	N/A	111.5	152.5	Linked from: R7: New Roof Joist, Garage, Support 2
2 - Uniform (PLF)	0 to 17' 3" (Back)	N/A	111.5	152.5	Linked from: R7: New Roof Joist, Garage, Support 2

Weyerhaeuser Notes

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

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

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

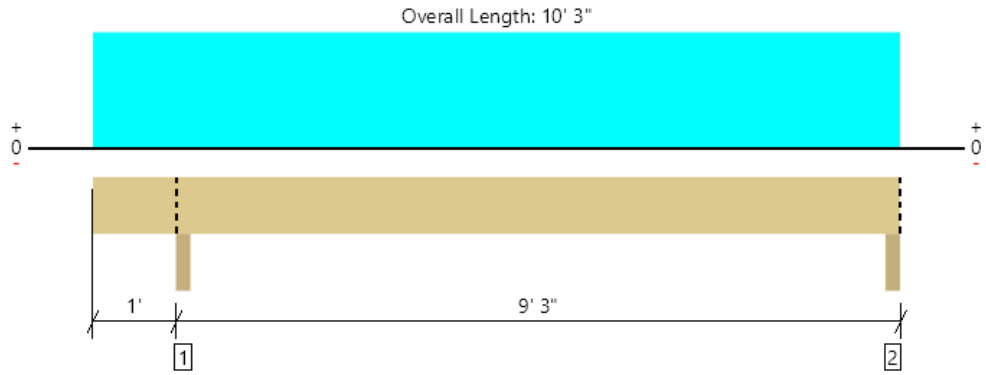
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, R9: New Roof Flush Beam, Garage North
1 piece(s) 3 1/2" x 11 1/4" 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)	3073 @ 1' 1 3/4"	7656 (3.50")	Passed (40%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1869 @ 2' 2 3/4"	8754	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5268 @ 5' 8"	20666	Passed (25%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.055 @ 5' 7 1/2"	0.298	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.097 @ 5' 7 9/16"	0.447	Passed (L/999+)	--	1.0 D + 1.0 S (Alt 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/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 - Column - SPF	3.50"	3.50"	1.50"	1338	1735	3073	Blocking
2 - Column - SPF	3.50"	3.50"	1.50"	1073	1403	2476	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)	10' 3" o/c	
Bottom Edge (Lu)	10' 3" 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 10' 3"	N/A	12.3	--	
1 - Uniform (PLF)	0 to 10' 3" (Front)	N/A	111.5	152.5	Linked from: R7: New Roof Joist, Garage, Support 2
2 - Uniform (PLF)	0 to 10' 3" (Back)	N/A	111.5	152.5	Linked from: R7: New Roof Joist, Garage, 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
William Nocka CSES (978) 503-9935 11wnocka@gmail.com	

Weyerhaeuser

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**R10**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage South Window Header

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

Geometry and Loads:

Span:	6.5 ft	Tributary Width:	2 ft	P Location:	3.25 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	2299 lbs
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	2979 lbs
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1247 lbs	DL Reaction 2:	1247 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	ASD load combinations
SL Reaction 1:	1652 lbs	SL Reaction 2:	1652 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2899 lbs**	Total Reaction 2:	**2899 lbs**	

Material Properties:

E	2 msi	E'	2 msi
Fb	2600 psi	Fb'	3098 psi
Fv	285 psi	Fv'	328 psi
Fc perp	750 psi	Fc perp'	750 psi
Emin	1.016 msi	Emin'	1.016 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/			240		
For LL only: Allowed deflection criteria, span/			360		
Max. allowed total defl:	0.33 in		Max LL defl:	0.22 in	
Total defl. * I:	27.7 in^4		Required I:	85.22 in^4	
LL defl. * I:	15.73 in^4		Required I:	72.6 in^4	
Actual deflections:	TOTAL:	0.12 in		0.07 in	

Force analysis:

Max. moment:	8999 ft-lb	Max Shear:	2899 lbs

Selected Member	(2) LVL	**1.75**	**x**	**9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	230.84 in^4		85.22 in^4
Section Modulus:	49.91 in^3		34.86 in^3
Section Area:	32.38 in^2		13.27 in^2
Bearing Area:			3.87 in^2
Minimum bearing dimensions:	3.5 in	x	1.1 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**R11**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Upper Floor Garage Central Post

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	8 ft	w(d)	0 plf	M(d)	
Axial Load	6542 lbs	w(b)	0 plf	M(b)	0 ft-lbs
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'	568.13 psi
E	1.6 msi	E'	1.6 msi
Emin	0.58 msi	Emin'	0.58 msi

Selected Member: DF #2 — 3.5 (b) x 5.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	17.6 in^3	Rb(d)	3.33
Section Modulus (b):	11.2 in^3	Rb(b)	6.57
Section Area:	19.3 in^2	c	0.8

Member stresses:	Provided			Required		
FcE(d)	1565 psi	>	fc	340 psi	OK
FcE(b)	634 psi	>	fc	340 psi	OK
FbE	16148 psi	>	fb(d)	0 psi	OK
FbE	16148 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3	0.36	<	1.0	**OK**

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U1**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: North Floor Joists

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

Geometry and Loads:

Span:	14 ft	Tributary Width:	1.33 ft	P Location:	3.833 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:	112 lbs	DL Reaction 2:	112 lbs	Note: Design automatically uses
LL Reaction 1:	372 lbs	LL Reaction 2:	372 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:	**484 lbs**	Total Reaction 2:	**484 lbs**	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1075 psi
Fv	150 psi	Fv'	150 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/ 360

Max. allowed total defl:	0.7 in	Max LL defl:	0.47 in
Total defl. * I:	45.98 in^4	Required I:	65.69 in^4
LL defl. * I:	35.37 in^4	Required I:	75.8 in^4
Actual deflections:	TOTAL: 0.46 in		0.36 in

Force analysis:

Max. moment:	1694 ft-lb	Max Shear:	484 lbs

Selected Member	(1) HF #2	**1.5**	**x**	**9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	98.93 in^4		75.8 in^4
Section Modulus:	21.39 in^3		18.91 in^3
Section Area:	13.88 in^2		4.84 in^2
Bearing Area:			1.2 in^2
Minimum bearing dimensions:	1.5 in	x	0.8 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2022.172**

Project: **Mukherjee Residence** Date: 23-Dec-22

Architect: **Suzanne Zahr** Page number: **U2**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage South East Flush Beam

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

Geometry and Loads:

Span:	13.75 ft	Tributary Width:	6 ft	P Location:	3.833 ft
Add'l uniform DL:	120 lbs/ft	DL unit load:	12 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:	200 lbs/ft	SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1320 lbs	DL Reaction 2:	1320 lbs	Note: Design automatically uses
LL Reaction 1:	1650 lbs	LL Reaction 2:	1650 lbs	ASD load combinations
SL Reaction 1:	1375 lbs	SL Reaction 2:	1375 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**3589 lbs**	Total Reaction 2:	**3589 lbs**	

Material Properties:

E	2.2 msi	E'	2.2 msi
Fb	2900 psi	Fb'	3359 psi
Fv	290 psi	Fv'	334 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.914 msi	Emin'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.69 in	Max LL defl:	0.34 in
Total defl. * I:	231.04 in^4	Required I:	336.06 in^4
LL defl. * I:	160.85 in^4	Required I:	467.93 in^4
Actual deflections:	TOTAL: 0.37 in		0.26 in

Force analysis:

Max. moment:	12336 ft-lb	Max Shear:	3589 lbs

Selected Member (1) PSL **5.25** **x** **11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	622.92 in^4		467.93 in^4
Section Modulus:	110.74 in^3		44.07 in^3
Section Area:	59.06 in^2		16.14 in^2
Bearing Area:			5.74 in^2
Minimum bearing dimensions:	5.25 in	x	1.09 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U3**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Beam U2 Support Post

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	8 ft	w(d)	0 plf	M(d)	
Axial Load	3588.75 lbs	w(b)	0 plf	M(b)	0 ft-lbs
Le(d)	8 ft	Le(b)	8 ft		

Material Properties:

Fb1	850 psi	Fb(d)'	977.5 psi
Fb2	850 psi	Fb(b)'	977.5 psi
Fc	1300 psi	Fc'	355.15 psi
E	1.3 msi	E'	1.3 msi
Emin	0.47 msi	Emin'	0.47 msi

Selected Member: HF #2 3 (b) x 5.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	15.1 in^3	Rb(d)	3.09
Section Modulus (b):	8.3 in^3	Rb(b)	7.66
Section Area:	16.5 in^2	c	0.8

Member stresses:	Provided		Required		
FcE(d)	1268 psi	>	fc	218 psi	OK
FcE(b)	377 psi	>	fc	218 psi	OK
FbE	9614 psi	>	fb(d)	0 psi	OK
FbE	9614 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3	0.38	<	1.0	**OK**

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U4**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage Floor Flush Beam South

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

Geometry and Loads:

Span:	14.75 ft	Tributary Width:	12 ft	P Location:	3.833 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:	1062 lbs	DL Reaction 2:	1062 lbs	Note: Design automatically uses
LL Reaction 1:	3540 lbs	LL Reaction 2:	3540 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:	**4602 lbs**	Total Reaction 2:	**4602 lbs**	

Material Properties:

E	2.2 msi	E'	2.2 msi
Fb	2900 psi	Fb'	2903 psi
Fv	290 psi	Fv'	290 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.914 msi	Emin'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.74 in	Max LL defl:	0.37 in
Total defl. * I:	302.07 in^4	Required I:	409.59 in^4
LL defl. * I:	232.36 in^4	Required I:	630.14 in^4
Actual deflections:	TOTAL: 0.41 in		0.32 in

Force analysis:

Max. moment:	16970 ft-lb	Max Shear:	4602 lbs

Selected Member (1) PSL **5.25** **x** **11.875**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	732.62 in^4		630.14 in^4
Section Modulus:	123.39 in^3		70.14 in^3
Section Area:	62.34 in^2		23.8 in^2
Bearing Area:			7.36 in^2
Minimum bearing dimensions:	5.25 in	x	1.4 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U5**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage Floor Flush Beam West of Stair

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

Geometry and Loads:

Span:	4 ft	Tributary Width:	4 ft	P Location:	3.833 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:	96 lbs	DL Reaction 2:	96 lbs	Note: Design automatically uses
LL Reaction 1:	320 lbs	LL Reaction 2:	320 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:	**416 lbs**	Total Reaction 2:	**416 lbs**	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	935 psi
Fv	150 psi	Fv'	150 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:	0.2 in		Max LL defl:	0.1 in	
Total defl. * I:	0.92 in^4		Required I:	4.61 in^4	
LL defl. * I:	0.71 in^4		Required I:	7.09 in^4	
Actual deflections:	TOTAL:	0. in		0. in	

Force analysis:

Max. moment:	416 ft-lb	Max Shear:	416 lbs

Selected Member	(2) HF#2	**1.5**	**x**	**9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	197.86 in^4		7.09 in^4
Section Modulus:	42.78 in^3		5.34 in^3
Section Area:	27.75 in^2		4.16 in^2
Bearing Area:			1.03 in^2
Minimum bearing dimensions:	3. in	x	0.34 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U6**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage Floor Flush Beam 2 Top of Stair

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

Geometry and Loads:

Span:	12 ft	Tributary Width:	1.33 ft	P Location:	8.25 ft
Add'l uniform DL:		DL unit load:	12 psf	Concentrated DL:	96 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	320 lbs
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	162 lbs	DL Reaction 2:	126 lbs	Note: Design automatically uses
LL Reaction 1:	539 lbs	LL Reaction 2:	419 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:	**701 lbs**	Total Reaction 2:	**545 lbs**	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	935 psi
Fv	150 psi	Fv'	150 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:	0.6 in	Max LL defl:	0.3 in
Total defl. * I:	41.24 in^4	Required I:	68.73 in^4
LL defl. * I:	31.72 in^4	Required I:	105.74 in^4
Actual deflections:	TOTAL: 0.21 in		0.16 in

Force analysis:

Max. moment:	2147 ft-lb	Max Shear:	701 lbs

Selected Member (2) HF#2 **1.5** **x** **9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	197.86 in^4		105.74 in^4
Section Modulus:	42.78 in^3		27.56 in^3
Section Area:	27.75 in^2		7.01 in^2
Bearing Area:			1.73 in^2
Minimum bearing dimensions:	3. in	x	0.58 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U7**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage Floor Flush Beam North

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

Geometry and Loads:

Span:	6 ft	Tributary Width:	12 ft	P Location:	5.25 ft
Add'l uniform DL:		DL unit load:	12 psf	Concentrated DL:	161.76 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	539.2 lbs
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	574 lbs	DL Reaction 2:	452 lbs	Note: Design automatically uses
LL Reaction 1:	1912 lbs	LL Reaction 2:	1507 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:	**2485 lbs**	Total Reaction 2:	**1960 lbs**	

Material Properties:

E	2 msi	E'	2 msi
Fb	2600 psi	Fb'	2694 psi
Fv	285 psi	Fv'	285 psi
Fc perp	750 psi	Fc perp'	750 psi
Emin	1.016 msi	Emin'	1.016 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:	10.12 in^4		Required I:	33.74 in^4	
LL defl. * I:	7.79 in^4		Required I:	51.91 in^4	
Actual deflections:	TOTAL:	0.03 in		0.02 in	

Force analysis:

Max. moment:	3077 ft-lb	Max Shear:	2485 lbs

Selected Member (3) LVL **1.75** **x** **9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	346.26 in^4		51.91 in^4
Section Modulus:	74.87 in^3		13.71 in^3
Section Area:	48.56 in^2		13.08 in^2
Bearing Area:			3.31 in^2
Minimum bearing dimensions:	5.25 in	x	0.63 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U8**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Garage Central Post

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	8 ft	w(d)	0 plf	M(d)	
Axial Load	11841.77 lbs	w(b)	0 plf	M(b)	0 ft-lbs
Le(d)	8 ft	Le(b)	8 ft		

Material Properties:

Fb1	875 psi	Fb(d)'	1006.3 psi
Fb2	875 psi	Fb(b)'	1006.3 psi
Fc	1350 psi	Fc'	1077 psi
E	1.6 msi	E'	1.6 msi
Emin	0.58 msi	Emin'	0.58 msi

Selected Member: DF #2 — 5.5 (b) x 5.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	27.7 in^3	Rb(d)	4.18
Section Modulus (b):	27.7 in^3	Rb(b)	4.18
Section Area:	30.3 in^2	c	0.8

Member stresses:	Provided			Required	
FcE(d)	1565 psi	>	fc	391 psi	OK
FcE(b)	1565 psi	>	fc	391 psi	OK
FbE	39875 psi	>	fb(d)	0 psi	OK
FbE	39875 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3	0.13	<	1.0	**OK**

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U9**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: West Window Header

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

Geometry and Loads:

Span:	5.5 ft	Tributary Width:	6 ft	P Location:	2.5 ft
Add'l uniform DL:	155 lbs/ft	DL unit load:	12 psf	Concentrated DL:	125.76 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	419.2 lbs
Add'l uniform SL:	206 lbs/ft	SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	693 lbs	DL Reaction 2:	681 lbs	Note: Design automatically uses
LL Reaction 1:	889 lbs	LL Reaction 2:	851 lbs	ASD load combinations
SL Reaction 1:	567 lbs	SL Reaction 2:	567 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**1784 lbs**	Total Reaction 2:	**1744 lbs**	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1075 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:	0.28 in		Max LL defl:	0.14 in	
Total defl. * I:	13.14 in^4		Required I:	47.79 in^4	
LL defl. * I:	8.97 in^4		Required I:	65.26 in^4	
Actual deflections:	TOTAL:	0.07 in		0.05 in	

Force analysis:

Max. moment:	2706 ft-lb	Max Shear:	1784 lbs

Selected Member	(2) HF #2	**1.5**	**x**	**9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	197.86 in^4		65.26 in^4
Section Modulus:	42.78 in^3		30.2 in^3
Section Area:	27.75 in^2		15.51 in^2
Bearing Area:			4.41 in^2
Minimum bearing dimensions:	3. in	x	1.47 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2022.172**

Project: **Mukherjee Residence** Date: 23-Dec-22

Architect: **Suzanne Zahr** Page number: **U10**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage Door Headers

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

Geometry and Loads:

Span:	9.5 ft	Tributary Width:	2 ft	P Location:	7 ft
Add'l uniform DL:	112 lbs/ft	DL unit load:	15 psf	Concentrated DL:	1247 lbs
Add'l uniform LL:	53.2 lbs/ft	LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	1652 lbs
Add'l uniform WL:		WL unit load:		Concentrated WL:	3213 lbs

DL Reaction 1:	1593 lbs	DL Reaction 2:	1002 lbs	Note: Design automatically uses
LL Reaction 1:	253 lbs	LL Reaction 2:	253 lbs	ASD load combinations
SL Reaction 1:	1455 lbs	SL Reaction 2:	672 lbs	
WL Reaction 1:	2367 lbs	WL Reaction 2:	846 lbs	
Total Reaction 1:	**4649 lbs**	Total Reaction 2:	**2330 lbs**	

Material Properties:

E	2 msi	E'	2 msi
Fb	2600 psi	Fb'	4310 psi
Fv	285 psi	Fv'	456 psi
Fc perp	750 psi	Fc perp'	750 psi
Emin	1.016 msi	Emin'	1.016 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.48 in		Max LL defl:	0.24 in
Total defl. * I:	91.1 in^4		Required I:	191.78 in^4
LL defl. * I:	28.01 in^4		Required I:	117.92 in^4
Actual deflections:	TOTAL:	0.39 in		0.12 in

Force analysis:

Max. moment:	10938 ft-lb	Max Shear:	4649 lbs

Selected Member (2) LVL **1.75** **x** **9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	230.84 in^4		191.78 in^4
Section Modulus:	49.91 in^3		30.45 in^3
Section Area:	32.38 in^2		15.29 in^2
Bearing Area:			6.2 in^2
Minimum bearing dimensions:	3.5 in	x	1.77 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U11**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Garage Beam U4 South Support

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	8 ft	w(d)	0 plf	M(d)	
Axial Load	4602 lbs	w(b)	0 plf	M(b)	0 ft-lbs
Le(d)	8 ft	Le(b)	8 ft		

Material Properties:

Fb1	675 psi	Fb(d)'	776.25 psi
Fb2	675 psi	Fb(b)'	776.25 psi
Fc	1300 psi	Fc'	716.83 psi
E	1.3 msi	E'	1.3 msi
Emin	0.47 msi	Emin'	0.47 msi

Selected Member: HF #2 4.5 (b) x 5.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	22.7 in^3	Rb(d)	3.78
Section Modulus (b):	18.6 in^3	Rb(b)	5.11
Section Area:	24.8 in^2	c	0.8

Member stresses:	Provided		Required		
FcE(d)	1268 psi	>	fc	186 psi	OK
FcE(b)	849 psi	>	fc	186 psi	OK
FbE	21631 psi	>	fb(d)	0 psi	OK
FbE	21631 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3	0.07	<	1.0	**OK**

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U12**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Beam Below North Dormer Ridge Post

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

Geometry and Loads:

Span:	10 ft	Tributary Width:	6 ft	P Location:	5 ft
Add'l uniform DL:	64 lbs/ft	DL unit load:	12 psf	Concentrated DL:	1242 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	1701 lbs
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1301 lbs	DL Reaction 2:	1301 lbs	Note: Design automatically uses
LL Reaction 1:	1200 lbs	LL Reaction 2:	1200 lbs	ASD load combinations
SL Reaction 1:	851 lbs	SL Reaction 2:	851 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2839 lbs**	Total Reaction 2:	**2839 lbs**	

Material Properties:

E	2.2 msi	E'	2.2 msi
Fb	2900 psi	Fb'	3433 psi
Fv	290 psi	Fv'	334 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.914 msi	Emin'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/			240		
For LL only: Allowed deflection criteria, span/			480		
Max. allowed total defl:	0.5 in		Max LL defl:	0.25 in	
Total defl. * I:	86.61 in^4		Required I:	173.23 in^4	
LL defl. * I:	52.38 in^4		Required I:	209.52 in^4	
Actual deflections:	TOTAL:	0.25 in		0.15 in	

Force analysis:

Max. moment:	9494 ft-lb	Max Shear:	2839 lbs

Selected Member	(1) PSL	**5.25**	**x**	**9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	346.26 in^4		209.52 in^4
Section Modulus:	74.87 in^3		33.19 in^3
Section Area:	48.56 in^2		12.77 in^2
Bearing Area:			4.54 in^2
Minimum bearing dimensions:	5.25 in	x	0.87 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U13**

Post Design (Combined Axial and Moment Loading)

2018 International Building Code (IBC) **2018 NDS**

Post Description: Beam U12 Support

Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:	

Geometry and loads:

Height	8 ft	w(d)	0 plf	M(d)	
Axial Load	2839 lbs	w(b)	0 plf	M(b)	0 ft-lbs
Le(d)	8 ft	Le(b)	8 ft		

Material Properties:

Fb1	850 psi	Fb(d)'	977.5 psi
Fb2	850 psi	Fb(b)'	977.5 psi
Fc	1300 psi	Fc'	355.15 psi
E	1.3 msi	E'	1.3 msi
Emin	0.47 msi	Emin'	0.47 msi

Selected Member: HF #2 3 (b) x 3.5 (d)

Member properties:		**Variables:**	
Section Modulus (d):	6.1 in^3	Rb(d)	4.85
Section Modulus (b):	5.3 in^3	Rb(b)	6.11
Section Area:	10.5 in^2	c	0.8

Member stresses:	Provided		Required		
FcE(d)	514 psi	>	fc	270 psi	OK
FcE(b)	377 psi	>	fc	270 psi	OK
FbE	15107 psi	>	fb(d)	0 psi	OK
FbE	15107 psi	>	fb(b)	0 psi	OK

Bending and Axial Compression Check:

NDS 2018 EQ 3.9-3	0.58	<	1.0	**OK**

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2022.172**
Project:	**Mukherjee Residence**	Date:	23-Dec-22
Architect:	**Suzanne Zahr**	Page number:	**U14**

BEAM DESIGN (Uniform Load+Concentrated Load)

2018 International Building Code (IBC) **2018 NDS**

Beam Description: Garage Floor Joists

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

Geometry and Loads:

Span:	12 ft	Tributary Width:	1.33 ft	P Location:	3.833 ft
Add'l uniform DL:		DL unit load:	12 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	50 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	96 lbs	DL Reaction 2:	96 lbs	Note: Design automatically uses
LL Reaction 1:	399 lbs	LL Reaction 2:	399 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:	**495 lbs**	Total Reaction 2:	**495 lbs**	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1075 psi
Fv	150 psi	Fv'	150 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/ 360

Max. allowed total defl:	0.6 in	Max LL defl:	0.4 in
Total defl. * I:	29.59 in^4	Required I:	49.32 in^4
LL defl. * I:	23.87 in^4	Required I:	59.67 in^4
Actual deflections:	TOTAL: 0.3 in		0.24 in

Force analysis:

Max. moment:	1484 ft-lb	Max Shear:	495 lbs

Selected Member	(1) HF #2	**1.5**	**x**	**9.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	98.93 in^4		59.67 in^4
Section Modulus:	21.39 in^3		16.56 in^3
Section Area:	13.88 in^2		4.95 in^2
Bearing Area:			1.22 in^2
Minimum bearing dimensions:	1.5 in	x	0.81 in

2022.172 Mukherjee

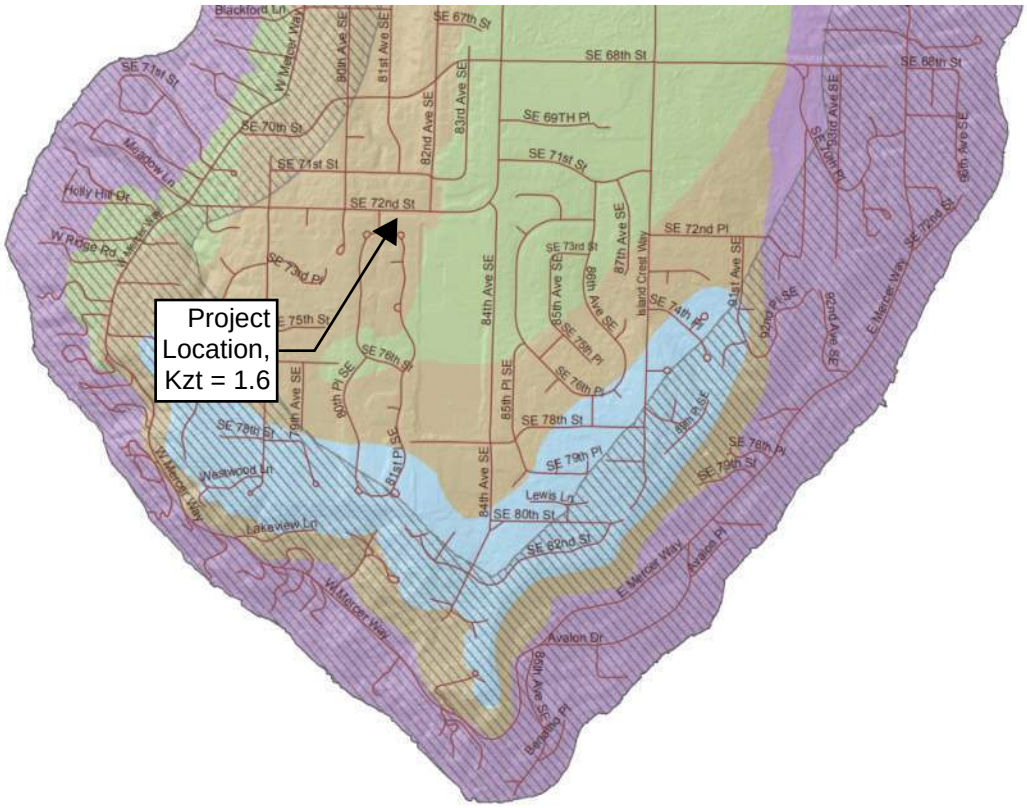
8116 SE 73rd St, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5381851, -122.2305458

Date	12/20/2022, 7:06:25 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.467	MCE_R ground motion. (for 0.2 second period)
S_1	0.507	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.761	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.174	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 Topographic Effects



WIND EXPOSURE CATEGORIES:

Wind Exposure Category	
	Exposure 'C' (1500 feet from Lake)
	Exposure 'B' (all other areas)

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_zt Factor :

K_zt Factor	
	$K_zt = 1.0$
	$K_zt = 1.3$
	$K_zt = 1.6$
	$K_zt = 1.9$

John S. Apolis, P.E. **CSES, Inc.** Job number: **2022.172**
Project: **Mukherjee Residence** Date: 23-Dec-22
Architect: **Suzanne Zahr** Page number: **L1**

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: **9.00** : 12 = 36.9

Least Horizontal Dimension, feet: **72** Mean Roof Ht, feet: **23** (degrees)

lambda = 1.00 a = 7.2 ft, 2a = 14.4 ft

Iw = 1.00 KzT = **1.60**

Tabulated Ps(30): (Refer to ASCE 7-16, Figure 28.6-1)	Zone	Tabulated Wind Pressure		Calc'd Design Pressure (*lambda*KzT*0.6)	Min Design Pressure
(horizontal)	A	21.6	psf	**20.7**	**20.7**
"	B	14.8	psf	**14.2**	**14.2**
"	C	17.2	psf	**16.5**	**16.5**
"	D	11.8	psf	**11.3**	**11.3**
(vertical)	E	8.3	psf	**8.0**	
"	F	-13.1	psf	**-12.6**	
"	G	7.2	psf	**6.9**	
"	H	-11.3	psf	**-10.8**	
(uplift on overhangs)	E(oh)	-7.6	psf	**-7.3**	
"	G(oh)	-8.7	psf	**-8.4**	

(Per section 28.6.4 minimum tabulated wind pressure is 16 PSF for zonesA,C, and 8 PSF for zones B, D)

(Equivalent Lateral Force Procedure, Section 12.8)

SEISMIC LOADS Ie 1.0 R = 6.5 ASCE 7-16, Table 12.2.1

Seismic Parameters per ASCE 7-16) Group I Site Class: **D**

PGA (.2 sec) 1.4670 Fa = 1.00 ASCE 7-16 Table 11.4-1

PGA (1 sec) 0.5070 Fv = 1.50 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 = 1.4670 Sms = Fa * Ss = 1.47 Equation 11.4-1

S1 = 0.5070 Sm1 = Fv * S1 = 0.76 Equation 11.4-2

Equations 11.4-3, 11.4-4 Sds = 2/3 * Sms = 0.98 Sd1 = 2/3 * Sm1 = 0.51

Equation 12.14-11 Cs (%V) = (Sds / (R/I)) = 0.150 **Building period < 0.5 s per IBC eq 12.8-7**

Base Shear = %V * W * 0.7 = 4.74 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)

Base = top of foundation	Roof DL (psf)	Wall DL (psf) dist. over floor area	Story Height Above Base (ft)	Lateral Load (psf)
Roof	**15**	**6**	**17**	**2.95**
Upper Floor	**12**	**12**	**9**	**1.79**

Total Seismic DL: **45** Sum **4.74**

LATERAL DESIGN

NORTH ADDITION, NORTH WALL

ROOF LEVEL - L = 2.25' + 2.25'

$P_W = 10.5' \times 5' \times 14.2\,psf + 10.5' \times 3' \times 20.7\,psf = 1,398\#$ //

$P_E = 10.5' \times 19' \times 2.95\,psf = 588\#$

$v = \frac{1,398\#}{5.5'} = 254\,plf < 350\,plf \Rightarrow$ SW2

$H_1 = 254\,plf \times 3' = 762\# \Rightarrow$ CONTINUOUS (2) STUD POSTS

$H_2 = 762\# + 254\,plf \times 6' = 2,286\# < (2)\,1,705\# \Rightarrow$ (2) CS16

$2,286 \approx 2,215\# \Rightarrow$ HDU2 BELOW

UPPER FLOOR LEVEL

$P_{W,EXIST} = 11' \times 14.4' \times 14.2\,psf + 11' \times 7' \times 11.3\,psf + 12' \times 14.4' \times 20.7\,psf + 12' \times 7' \times 16.5\,psf = 8,082\#$

$P_{W,NEW} = P_{W,EXIST} + 6' \times 6' \times 14.2\,psf + 4' \times 3' \times 20.7\,psf = 8,842\#$

$\Rightarrow$ 9.4% INCREASE

$P_{E,EXIST} = 75' \times 21' \times 2.95\,psf + 52' \times 21' \times 1.79\,psf = 6,601\#$

$P_{E,NEW} = 6,601\# + 588\# = 7,189\# \Rightarrow$ 8.9% INCREASE

<10% INCREASE IN LOADS & NO CHANGE TO FULL HEIGHT WALLS @ UPPER FLOOR

$\Rightarrow$ NO LATERAL UPGRADE REQUIRED

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

LATERAL DESIGN

NORTH ADDITION, EAST WALL - L = 18'

$P_W = 9' \times 10' \times 16.5 psf = 1,485\#$

$P_E = 9' \times 21' \times 2.95 psf = 558\#$

$v = \frac{1,485\#}{18'} = 83 plf < 100 plf \Rightarrow$ SW6

$H = 83 plf \times 8' = 664\# < 1,705\# \Rightarrow$ CS16

NORTH ADDITION, WEST WALL - L = 3.75'

$P_W = 1,485\#$ $P_E = 558\#$

$v = \frac{1,485\#}{3.75'} = 396 plf < 550 plf \Rightarrow$ SW3

$H = 396 plf \times 8' = 3,168\# < (2)1,705\# \Rightarrow$ (2) CS16
$< 4,340\# \Rightarrow$ HDU5

NORTH ADDITION, NORTH LOADING (TOTAL)

$P_{W,EXIST} = (48ft^2 + 48ft^2) \times 20.7 psf + (98ft^2 + 98ft^2) \times 14.2 psf + 391 ft^2 \times 16.5 psf + 522 ft^2 \times 11.3 psf = 17,121\#$

$P_{W,NEW} = P_{W,EXIST} + 156 ft^2 \times (16.5 psf - 11.3 psf) = 17,932\#$

$\Rightarrow$ 4.7% INCREASE

$P_{E,EXIST} = 75' \times 40' \times 2.95 psf + (30' \times 37' + 20' \times 13') \times 1.79 psf = 11,302\#$

$P_{E,NEW} = P_{E,EXIST} + 19' \times 15' \times 1.79 psf = 11,812\#$

$\Rightarrow$ 4.5% INCREASE

$\Rightarrow$ <10% CHANGE IN LOADING, NO LATERAL UPGRADE REQUIRED

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

Project No. 2022.172 Date 12-23-22
Project Name MUKHERJEE
Comments
Revision Page L3

LATERAL DESIGN

GARAGE, NORTH WALL

ROOF LEVEL & UPPER FLOOR LEVEL

P_w: NO CHANGE TO WIND LOADING

P_E: NO CHANGE TO EQ LOADING

NO CHANGE TO WALL OPENINGS

⇒ NO LATERAL DESIGN REQUIRED

GARAGE, SOUTH WALL

ROOF LEVEL - L = 9'

$P_w = 14A' \times 11' \times 14.2\text{psf} + 2.6' \times 11' \times 11.3\text{ psf} + 14A' \times 35' \times 20.7\text{psf}$

$P_w = 3,616\#$

$P_E = 18' \times 30' \times (2.95\text{psf} + 1.79\text{psf}) = 2,560\#$

$v = \frac{3,616\#}{9'} = 444\text{ plf} < 550\text{ plf} \Rightarrow$ SW3

$H = 444\text{plf} \times 7' = 3,108\# < 3,900\# \Rightarrow$ MSTC48B3

UPPER FLOOR LEVEL - L = 5.25'

$P_w = 3,616\#$ $P_E = 2,560\#$

$v = \frac{3,616\#}{5.25'} = 689\text{ plf} < 710\text{ plf} \Rightarrow$ SW3X

$H = 689\text{ plf} \times 7' = 4,823\# < 5,645\# \Rightarrow$ HDU5 w/ DF post

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LATERAL DESIGN

GARAGE, EAST WALL - L = 14'

$P_w = (88 ft^2 + 60 ft^2) \times 16.5 ft^2 = 2,442\#$

$P_E = 16' \times 30' \times (2.95 psf + 1.79 psf) = 2,275\#$

$v = \frac{2,442\#}{14'} = 174 plf < 230 plf \Rightarrow$ SW1

$H = 174 plf \times 7' = 1,218\# < 2,215\# \Rightarrow$ HDU2

GARAGE, WEST WALL - L = 14' min.

$P_w = 148 ft^2 \times 20.7 psf = 3,064\#$

$P_E = 2,275\#$

$v = \frac{3,064\#}{14'} = 219 plf < 230 plf \Rightarrow$ SW1

$H = 219 plf \times 7' = 1,533\# < 2,215\# \Rightarrow$ HDU2

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