



October 8, 2021

**STRUCTURAL CALCULATIONS**  
(Permit Submittal)

**DUBEY DECK ADDITION**  
8140 W Mercer Way  
Mercer Island, WA 98040

Quantum Job Number: 20130.02

*Prepared for:*  
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**Dubey Deck Addition**  
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**DUBEY DECK ADDITION**  
8140 W MERCER WAY  
MERCER ISLAND, WA 98040

Quantum Job Number: 20130.02

# **DESIGN CRITERIA**

## Search Information

**Address:** 8140 W Mercer Way, Mercer Island, WA 98040, USA

**Coordinates:** 47.5307921, -122.2314332

**Elevation:** 274 ft

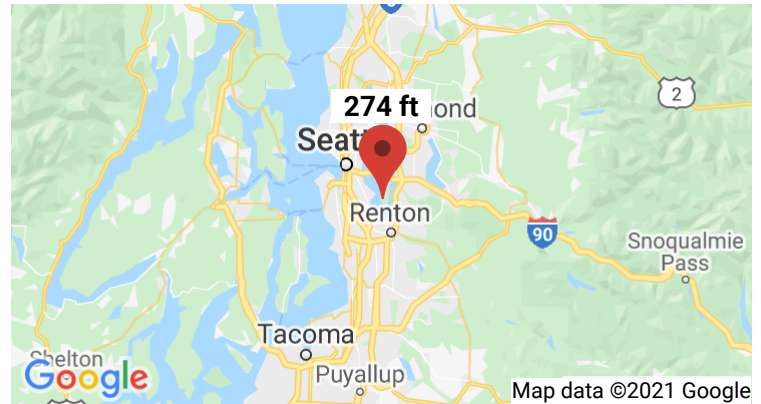
**Timestamp:** 2021-08-30T15:37:19.258Z

**Hazard Type:** Seismic

**Reference Document:** ASCE7-16

**Risk Category:** II

**Site Class:** D-default



## Basic Parameters

Name	Value	Description
$S_S$	1.469	$MCE_R$ ground motion (period=0.2s)
$S_1$	0.507	$MCE_R$ ground motion (period=1.0s)
$S_{MS}$	1.763	Site-modified spectral acceleration value
$S_{M1}$	* null	Site-modified spectral acceleration value
$S_{DS}$	1.175	Numeric seismic design value at 0.2s SA
$S_{D1}$	* null	Numeric seismic design value at 1.0s SA

\* See Section 11.4.8

## Additional Information

Name	Value	Description
SDC	* null	Seismic design category
$F_a$	1.2	Site amplification factor at 0.2s
$F_v$	* null	Site amplification factor at 1.0s
$CR_S$	0.902	Coefficient of risk (0.2s)
$CR_1$	0.898	Coefficient of risk (1.0s)
PGA	0.628	$MCE_G$ peak ground acceleration
$F_{PGA}$	1.2	Site amplification factor at PGA
$PGA_M$	0.754	Site modified peak ground acceleration

$T_L$	6	Long-period transition period (s)
SsRT	1.469	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.629	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	4.312	Factored deterministic acceleration value (0.2s)
S1RT	0.507	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.564	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.635	Factored deterministic acceleration value (1.0s)
PGAd	1.421	Factored deterministic acceleration value (PGA)

\* See Section 11.4.8

*The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.*

## Disclaimer

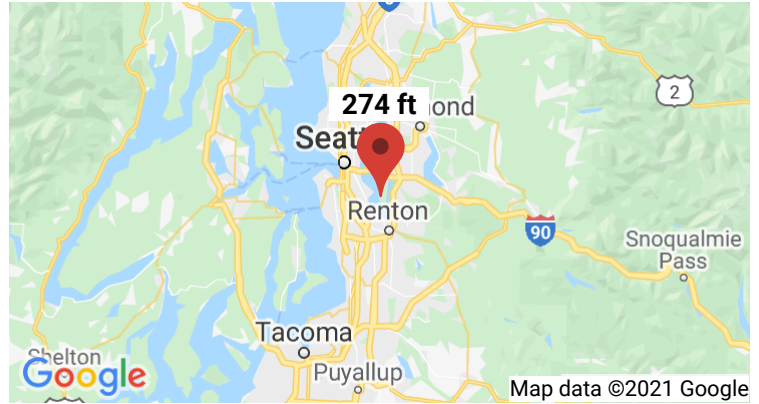
Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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# ATC Hazards by Location

## Search Information

**Address:** 8140 W Mercer Way, Mercer Island, WA 98040, USA  
**Coordinates:** 47.5307921, -122.2314332  
**Elevation:** 274 ft  
**Timestamp:** 2021-08-30T15:36:09.902Z  
**Hazard Type:** Wind



### ASCE 7-16

MRI 10-Year ..... 67 mph  
 MRI 25-Year ..... 73 mph  
 MRI 50-Year ..... 78 mph  
 MRI 100-Year ..... 83 mph  
 Risk Category I ..... 92 mph  
**Risk Category II ..... 97 mph**  
 Risk Category III ..... 104 mph  
 Risk Category IV ..... 108 mph

### ASCE 7-10

MRI 10-Year ..... 72 mph  
 MRI 25-Year ..... 79 mph  
 MRI 50-Year ..... 85 mph  
 MRI 100-Year ..... 91 mph  
 Risk Category I ..... 100 mph  
 Risk Category II ..... 110 mph  
 Risk Category III-IV ..... 115 mph

### ASCE 7-05

ASCE 7-05 Wind Speed ..... 85 mph

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## Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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# Structural Design Criteria

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**Building Code:** 2018 International Building Code  
**Building Department:** City of Mercer Island

## Seismic Criteria

$S_s$ : 1.47  $I_e$ : 1.00  
 $S_1$ : 0.51 Seismic Soil Site Class: D  
 $S_{ds}$ : 1.18 Seismic Design Category: D  
 $S_{d1}$ : 0.61  
R: 6.50 Light-Framed Wood Walls Sheathed With Wood Structural Panels

## Wind Criteria

Wind Speed: 97 MPH  
Risk Category: II  
Wind Exposure: B  
Kzt: 1.15

## Geotechnical Criteria

Allowable Bearing Pressure 1,500 PSF  
Minimum Footing Width Continuous: 18" min., Isolated: 24" min.  
Frost Depth 18" min.

## Materials Criteria

### Concrete (28 Day Strength):

Foundation/Slab on Grade  $F'_c$ = 2,500 PSI

### Reinforcing Steel:

Grade 40 (#3 & #4 bar)  $F_y$ = 40,000 PSI

### Wood Framing:

2x Framing Members HF#2 or DF#2  
6x Framing Members Varies (see plan)  
Wood Sheathing APA RATED

# Residential Building Loads

<b>Snow Load</b>	Roof	25 psf
<b>Live Load</b>	Residential	40 psf
	Residential exterior decks / balconies	60 psf

## Assembly Loads

Deck Roof Loads		Comments
Standard Roofing	4.0 psf	
1/2" Plywood Shtg	1.5 psf	
Joists @ 16" o.c.	2.8 psf	
Ceiling Liner	3.0 psf	
Miscellaneous	0.7 psf	
Total: 12.0 psf		SL=25 PSF

Deck Floor Loads		Comments
Composite Decking	5.0 psf	
P/T Joists @ 16" o.c.	2.3 psf	
Miscellaneous	0.7 psf	
Total: 8.0 psf		LL=60 PSF

## Deflection Criteria

Roof	Walls	Floor
Live Load: L/240	L/120	Live Load: L/360
Total Load: L/240	L/240	Total Load: L/240
	*flexible finishes	
	*brittle finish	
	*supporting glass	

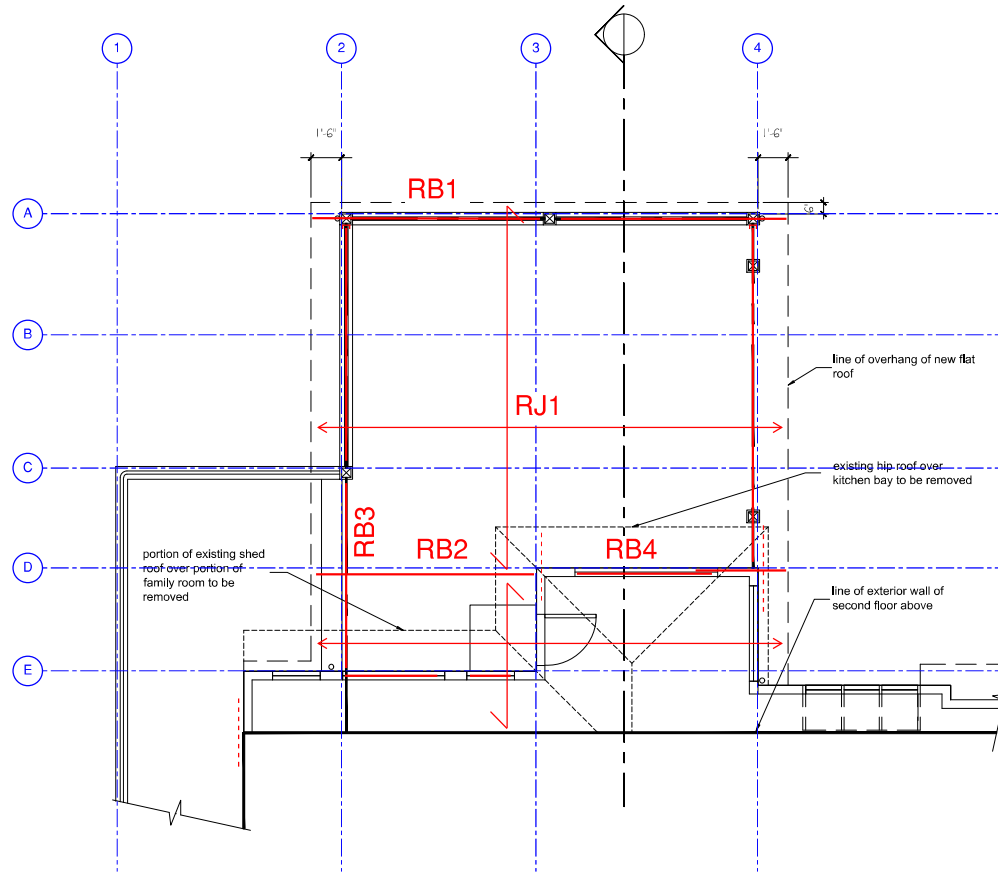
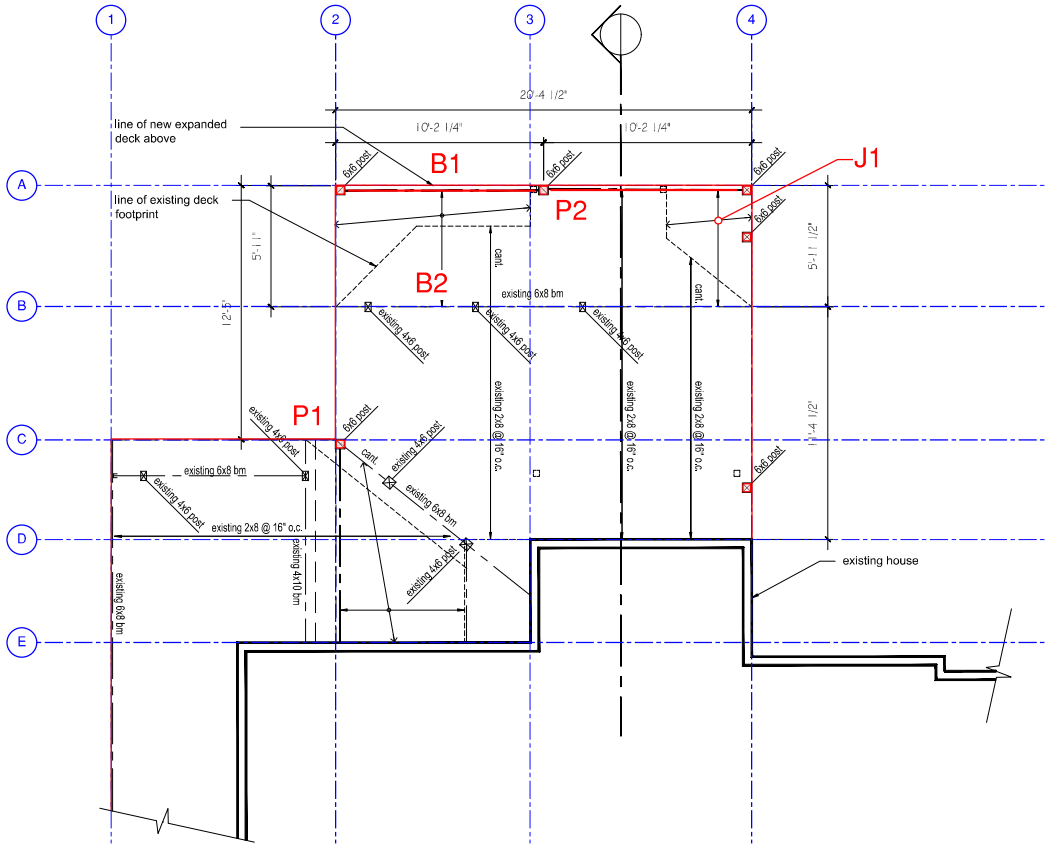




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8140 W MERCER WAY  
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**GRAVITY DESIGN**



DECK STRUCTURAL PLAN  
1/4" = 1'-0"

DECK ROOF STRUCTURAL PLAN  
1/4" = 1'-0"

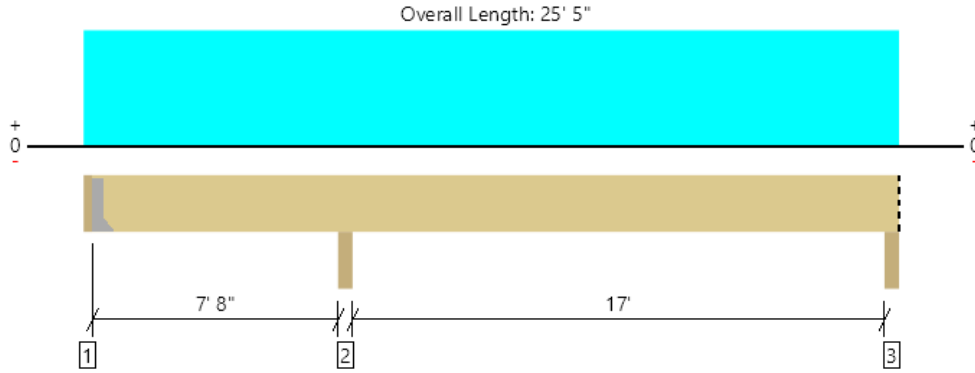
**FRAMING KEY PLANS**

Roof			
Member Name	Results	Current Solution	Comments
RJ1 - Flat Roof Joist, 17'-0" span	Passed	1 piece(s) 2 x 12 HF No.2 @ 24" OC	
RB1 - Grid A drop beam, 9'-6" span	Passed	1 piece(s) 6 x 8 DF No.1	
RB2 - Grid D flush beam, single span	Passed	2 piece(s) 2 x 12 HF No.2	
RB3 - Grid 2, single span	Passed	1 piece(s) 6 x 8 DF No.1	
RB4 - Grid D Header, 7'-0" span	Passed	2 piece(s) 2 x 10 HF No.2	
Deck			
Member Name	Results	Current Solution	Comments
J1 - Deck Joist, 6'-0" span	Passed	1 piece(s) 2 x 8 HF No.2 @ 16" OC	
B1 - Grid A drop beam, 9'-6" span	Passed	1 piece(s) 6 x 8 HF No.1	
B2 - Grid B existing beam, 5'-0" span	Passed	1 piece(s) 6 x 8 HF No.1	
P1 - Deck Post at Grid C/2	Passed	1 piece(s) 6 x 6 HF No.1	
P1 - Deck Post at Grid A/3	Passed	1 piece(s) 6 x 6 HF No.1	

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Roof, RJ1 - Flat Roof Joist, 17'-0" span  
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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1311 @ 7' 11 3/4"	2127 (3.50")	Passed (62%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	677 @ 9' 3/4"	1941	Passed (35%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-2065 @ 7' 11 3/4"	2964	Passed (70%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.246 @ 17' 4 1/2"	0.862	Passed (L/840)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.361 @ 17' 4 11/16"	1.149	Passed (L/573)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof  
Member Type : Joist  
Building Use : Residential  
Building Code : IBC 2015  
Design Methodology : ASD  
Member Pitch : 0.25/12

- 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 ledger On Masonry	2.00"	Hanger <sup>1</sup>	1.50"	12	107/-65	119/-65	See note <sup>1</sup>
2 - Beam - HF	3.50"	3.50"	2.16"	425	886	1311	None
3 - Beam - HF	3.50"	3.50"	1.50"	173	364	537	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 1" o/c	
Bottom Edge (Lu)	5' 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		

- 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 25' 5"	24"	12.0	25.0	Roof Load

**Weyerhaeuser Notes**

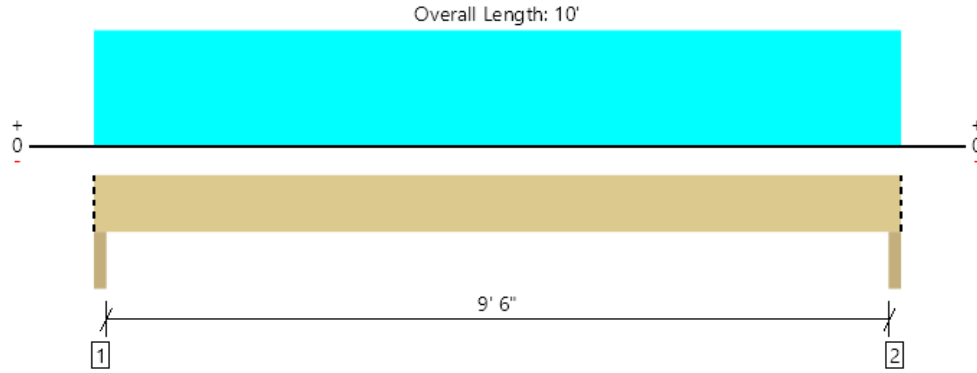
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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Roof, RB1 - Grid A drop beam, 9'-6" span  
1 piece(s) 6 x 8 DF No.1



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)	1625 @ 1 1/2"	10313 (3.00")	Passed (16%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1340 @ 10 1/2"	5376	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3861 @ 5'	5930	Passed (65%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.140 @ 5'	0.488	Passed (L/838)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.214 @ 5'	0.650	Passed (L/548)	--	1.0 D + 1.0 S (All Spans)

System : Roof  
Member Type : Drop Beam  
Building Use : Residential  
Building Code : IBC 2015  
Design Methodology : ASD  
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Column - HF	3.00"	3.00"	1.50"	562	1062	1624	Blocking
2 - Column - HF	3.00"	3.00"	1.50"	562	1062	1624	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' o/c	
Bottom Edge (Lu)	10' 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'	N/A	10.4	--	
1 - Uniform (PSF)	0 to 10' (Front)	8' 6"	12.0	25.0	Roof

**Weyerhaeuser Notes**

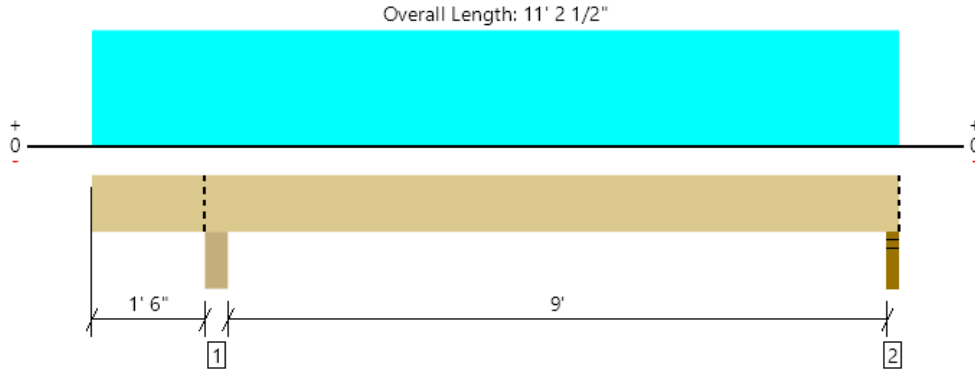
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ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	



Roof, RB2 - Grid D flush beam, single span  
2 piece(s) 2 x 12 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)	1747 @ 11' 1"	3645 (3.00")	Passed (48%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	1364 @ 2' 10 3/4"	3881	Passed (35%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3891 @ 6' 6 1/16"	5155	Passed (75%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.098 @ 6' 5 3/16"	0.468	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.131 @ 6' 5 5/16"	0.624	Passed (L/856)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof  
Member Type : Drop Beam  
Building Use : Residential  
Building Code : IBC 2015  
Design Methodology : ASD  
Member Pitch : 0/12

- 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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Column - HF	5.50"	5.50"	2.01"	634	1806	2440	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	448	1299	1747	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)	9' o/c	
Bottom Edge (Lu)	11' 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 11' 2 1/2"	N/A	8.6	--	
1 - Uniform (PSF)	0 to 11' 2 1/2" (Top)	11'	8.0	25.0	Roof

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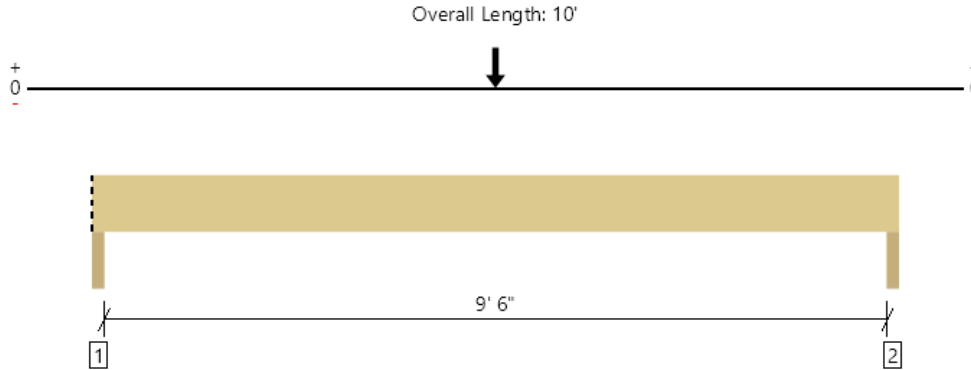
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Roof, RB3 - Grid 2, single span  
1 piece(s) 6 x 8 DF No.1



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)	1272 @ 9' 10 1/2"	6683 (3.00")	Passed (19%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1263 @ 10 1/2"	5376	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	6072 @ 5'	5930	Passed (102%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.195 @ 5'	0.488	Passed (L/601)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.270 @ 5'	0.650	Passed (L/433)	--	1.0 D + 1.0 S (All Spans)

System : Roof  
Member Type : Drop Beam  
Building Use : Residential  
Building Code : IBC 2015  
Design Methodology : ASD  
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Column - HF	3.00"	3.00"	1.50"	369	903	1272	Blocking
2 - Beam - HF	3.00"	3.00"	1.50"	369	903	1272	None

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6" o/c	
Bottom Edge (Lu)	10' o/c	

•Maximum allowable bracing intervals based on applied load.

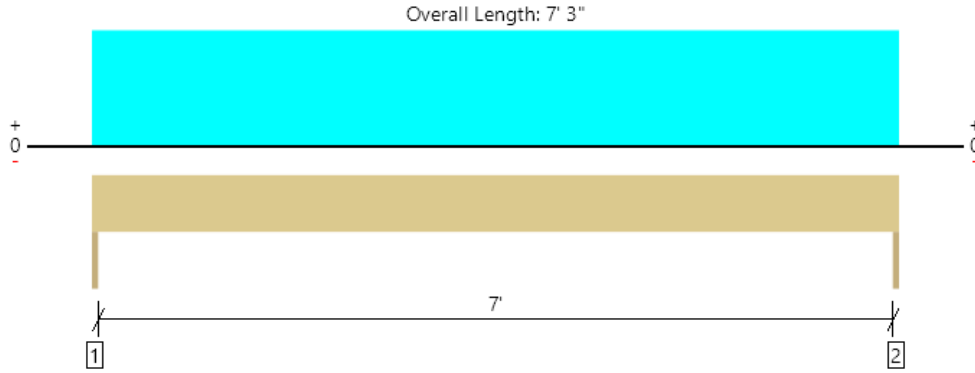
Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 10'	N/A	10.4	--	
1 - Point (lb)	5' (Front)	N/A	634	1806	Linked from: RB2 - Middle Drop Beam, single span, Support 1

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ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	



Roof, RB4 - Grid D Header, 7'-0" span  
2 piece(s) 2 x 10 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)	1501 @ 0	1823 (1.50")	Passed (82%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1130 @ 10 3/4"	3191	Passed (35%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2720 @ 3' 7 1/2"	3833	Passed (71%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.066 @ 3' 7 1/2"	0.363	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.100 @ 3' 7 1/2"	0.483	Passed (L/869)	--	1.0 D + 1.0 S (All Spans)

System : Roof  
Member Type : Drop Beam  
Building Use : Residential  
Building Code : IBC 2015  
Design Methodology : ASD  
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - HF	1.50"	1.50"	1.50"	504	997	1501	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	504	997	1501	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 3"	N/A	7.0	--	
1 - Uniform (PSF)	0 to 7' 3" (Top)	11'	12.0	25.0	Roof

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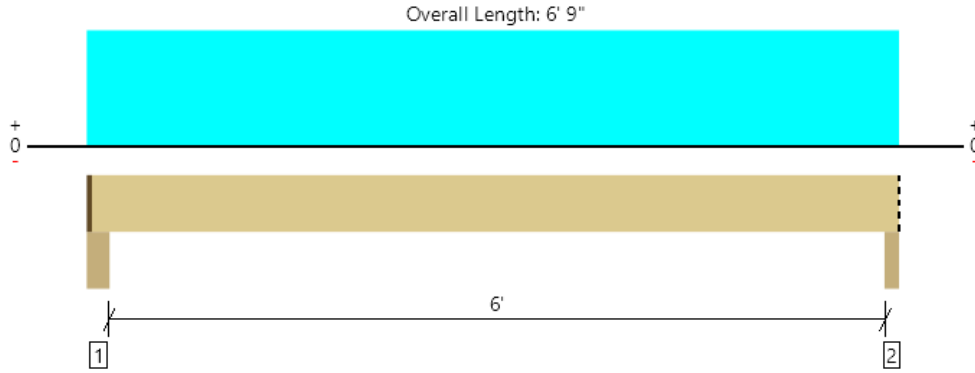
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ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	





Deck, J1 - Deck Joist, 6'-0" span  
1 piece(s) 2 x 8 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)	298 @ 6' 6 1/2"	2126 (3.50")	Passed (14%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	217 @ 1' 3/4"	1088	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	431 @ 3' 5 1/2"	1284	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.042 @ 3' 5 1/2"	0.154	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.048 @ 3' 5 1/2"	0.308	Passed (L/999+)	--	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 2015  
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 - Beam - HF	5.50"	4.25"	1.50"	37	277	314	1 1/4" Rim Board
2 - Beam - HF	3.50"	3.50"	1.50"	35	263	298	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 8" o/c	
Bottom Edge (Lu)	6' 8" 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 6' 9"	16"	8.0	60.0	Deck

**Weyerhaeuser Notes**

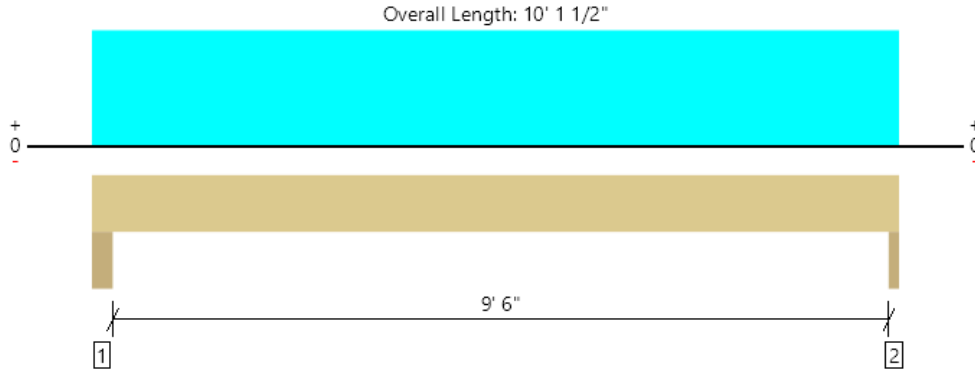
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Deck, B1 - Grid A drop beam, 9'-6" span  
1 piece(s) 6 x 8 HF No.1



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)	1063 @ 10' 1/2"	5569 (2.50")	Passed (19%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	885 @ 1' 1/2"	3850	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2548 @ 5' 2"	4190	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.146 @ 5' 2"	0.325	Passed (L/804)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.173 @ 5' 2"	0.488	Passed (L/674)	--	1.0 D + 1.0 L (All Spans)

System : Floor  
Member Type : Drop Beam  
Building Use : Residential  
Building Code : IBC 2015  
Design Methodology : ASD

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - HF	5.00"	5.00"	1.50"	178	930	1108	None
2 - Column - HF	2.50"	2.50"	1.50"	171	893	1064	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 2" o/c	
Bottom Edge (Lu)	10' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 10' 1 1/2"	N/A	10.4	--	
1 - Uniform (PSF)	0 to 10' 1 1/2" (Front)	3'	8.0	60.0	Deck

**Weyerhaeuser Notes**

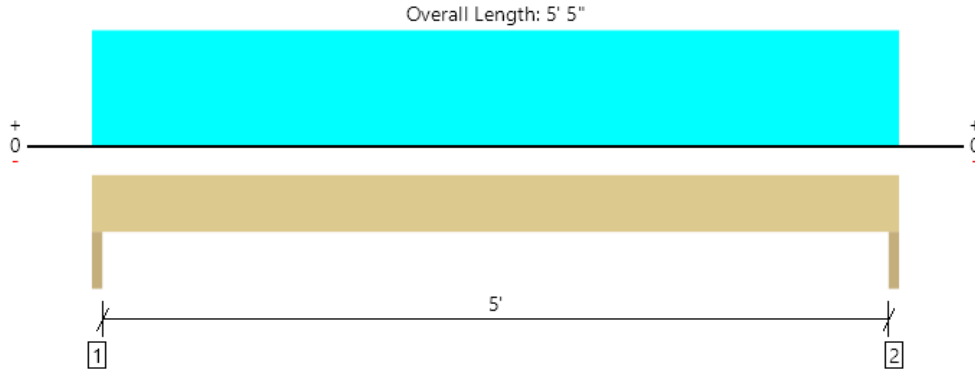
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Deck, B2 - Grid B existing beam, 5'-0" span  
1 piece(s) 6 x 8 HF No.1



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)	581 @ 1"	5569 (2.50")	Passed (10%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	402 @ 10"	3850	Passed (10%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	739 @ 2' 8 1/2"	4190	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.012 @ 2' 8 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.015 @ 2' 8 1/2"	0.262	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor  
Member Type : Drop Beam  
Building Use : Residential  
Building Code : IBC 2015  
Design Methodology : ASD

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - HF	2.50"	2.50"	1.50"	93	488	581	None
2 - Column - HF	2.50"	2.50"	1.50"	93	488	581	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 5' 5"	N/A	10.4	--	
1 - Uniform (PSF)	0 to 5' 5" (Front)	3'	8.0	60.0	Deck

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Deck, P1 - Deck Post at Grid C/2  
1 piece(s) 6 x 6 HF No.1

Post Height: 9'



Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	20	50	Passed (39%)	--	--
Compression (lbs)	1722	20682	Passed (8%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	1722	898425	Passed (0%)	--	1.0 D + 1.0 S
Bending/Compression	0.06	1	Passed (6%)	1.15	1.0 D + 1.0 S

- Input axial load eccentricity for this design is 16.67% of applicable member side dimension.
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Member Type : Free Standing Post  
Building Code : IBC 2015  
Design Methodology : ASD

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Drawing is Conceptual

Vertical Loads	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	150	300	Beam Reaction
2 - Point (lb)	369	903	Linked from: RB3 - Grid 2, single span, Support 1

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ForteWEB Software Operator	Job Notes
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Deck, P1 - Deck Post at Grid A/3  
1 piece(s) 6 x 6 HF No.1

Post Height: 9'



Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	20	50	Passed (39%)	--	--
Compression (lbs)	4468	20682	Passed (22%)	1.15	1.0 D + 0.75 L + 0.75 S
Base Bearing (lbs)	4468	898425	Passed (0%)	--	1.0 D + 0.75 L + 0.75 S
Bending/Compression	0.21	1	Passed (21%)	1.15	1.0 D + 0.75 L + 0.75 S

- Input axial load eccentricity for this design is 16.67% of applicable member side dimension.
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Member Type : Free Standing Post  
Building Code : IBC 2015  
Design Methodology : ASD

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Drawing is Conceptual

Vertical Loads	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Point (lb)	562	-	1062	Linked from: RB1 - Grid A drop beam, 9'-6" span, Support 1
2 - Point (lb)	562	-	1062	Linked from: RB1 - Grid A drop beam, 9'-6" span, Support 1
3 - Point (lb)	178	930	-	Linked from: B1 - Grid A drop beam, 9'-6" span, Support 1
4 - Point (lb)	178	930	-	Linked from: B1 - Grid A drop beam, 9'-6" span, Support 1

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Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	





**DUBEY DECK ADDITION**  
8140 W MERCER WAY  
MERCER ISLAND, WA 98040

Quantum Job Number: 20130.02

# **LATERAL DESIGN**

# Seismic Base Shear for the Equivalent Lateral Force Procedure

Per IBC 2018 & ASCE 7-16

Structure: **Dubey Deck Addition**  
 Address: **8140 West Mercer Way, Mercer Island, WA**  
 Latitude: **47.5308** Longitude: **-122.2314**

## Structure Classification

Risk Category: **II** per ASCE Table 1.5-1

Seismic Force-Resisting System: **Light-Framed Wood Walls Sheathed with Structural Panels**

R: **6 1/2** per ASCE Table 12.2-1  
 W<sub>o</sub>: **3** per ASCE Table 12.2-1  
 C<sub>d</sub>: **4** per ASCE Table 12.2-1  
 h<sub>n</sub> (ft): **20.00** height above the base to the highest level of the structure

## Site Ground Motion

Reg. Structure/5 Stories Max: **Yes** **S<sub>ds</sub> (max) = 1.0** Per ASCE 12.8.1.3  
 S<sub>1</sub> (g-sec): **0.51** S<sub>s</sub> (g-sec): **1.47**  
 Site Class: **D** **Assumed Value** per ASCE 11.4.3  
 ASCE 11.4.8 Exception 2 Used  
 F<sub>v</sub> **1.79** F<sub>a</sub> **1.20**  
 1.2 Min Value where SC D Assumed  
 S<sub>M1</sub> (g-sec): **0.91** S<sub>MS</sub> (g-sec): **1.76** per ASCE 11.4.4  
 S<sub>D1</sub> (g-sec): **0.61** S<sub>DS</sub> (g-sec): **1.18** per ASCE 11.4.5  
 SDC: **D** per ASCE 11.6  
 I<sub>E</sub>: **1.00** per ASCE Table 1.5-2

## Fundamental Period per ASCE 12.8.2

Period Method: **Approximate Fundamental Period**  
 Structure Type: **All Other Structural Systems**  
 T<sub>L</sub> (sec): **6.00** ASCE Figures 22-14 through 22-17  
 T<sub>s</sub>: 0.52  
 T<sub>a</sub> (sec): 0.19 C<sub>t</sub> \* h<sub>n</sub> per ASCE Eq. 12.8-7  
 T<sub>use</sub> (sec): **0.19** T ≤ T<sub>L</sub>

## Equivalent Lateral Force Procedure Design Base Shear per ASCE 12.8

C<sub>s</sub>: 0.18 = S<sub>DS</sub> / (R/I<sub>E</sub>) per ASCE Eq. 12.8-2  
 C<sub>s-max</sub>: 0.49 = S<sub>D1</sub> / (T<sub>a</sub>\*R/I<sub>E</sub>) for T ≤ T<sub>L</sub> per ASCE Eq. 12.8-3  
 C<sub>s-max</sub>: 16 = S<sub>D1</sub>\*T<sub>L</sub> / (T<sub>a</sub><sup>2</sup>\*R/I<sub>E</sub>) for T > T<sub>L</sub> per ASCE Eq. 12.8-4  
 C<sub>s-min</sub>: 0.05 per ASCE Eq. 12.8-5  
 C<sub>s-min</sub>: -- = 0.5S<sub>1</sub> / (R/I<sub>E</sub>) for S<sub>1</sub> ⇒ 0.6g per ASCE Eq. 12.8-6  
 C<sub>s-use</sub>: 0.181

**V : 0.181 W = C<sub>s-use</sub> \* W per ASCE Eq. 12.8-1**



**Quantum Consulting Engineers LLC**  
 1511 Third Avenue, Suite 323  
 Seattle, WA 98101

Project: <b>Dubey Deck Addition</b>	Date: <b>9/30/21</b>	Job No: <b>20130.02</b>
Client: <b>Tutmarc Associates</b>	Designer: <b>MKS</b>	Sheet: <b>1</b>
Checked By:		

# Wind Loads Criteria

ASCE 7-16

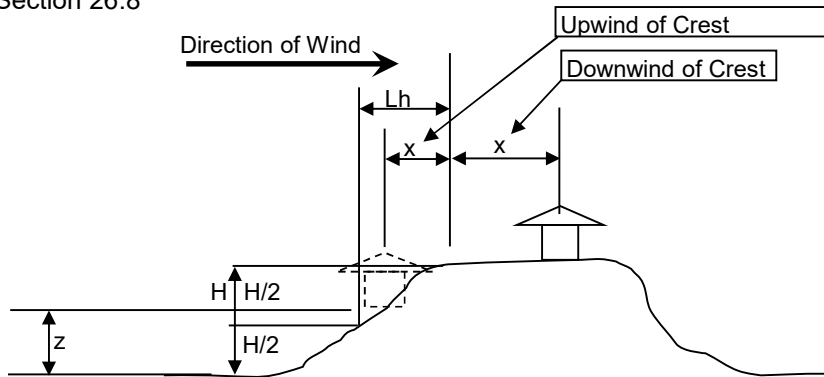
## Wind Load Criteria

Risk Category: **II** Table 1.5-1  
 Basic Wind Speed: **98** Figure 26.5.1  
 Exposure Category: **B** Section 26.7.3  
 Ground Elevation: **274 ft**  
 Wall Ht: **9.0 ft**

Roof Type: **Flat**  $\leq 3$ deg  
 Roof Slope: **0.3:12** 1.2 DEG  
 Mean Roof HT: **10.0 ft** UP TO 160FT  
 Parapet: **No** UP TO 160FT

### Wind Topographic Factor, $K_{zt}$ :

per Section 26.8



Terrain Type: **2-dimensional ridges**  
 Direction: **Upwind of Crest**

$L_h$ : **1050 ft** DIST UPWIND OF CREST TO HALF HT OF HILL OR ESCARP.  
 $H$ : **320 ft** HT. OF HILL OR ESCARP. RELATIVE TO THE UPWIND TERRAIN  
 $x$ : **950 ft** DIST. (UPWIND OR DOWNWIND) FROM THE CREST TO THE BUILDING  
 $z$ : **270 ft** HEIGHT ABOVE GROUND SURFACE AT BUILDING SITE

$K_{zt}$ : 1.15 EQUATION 26.8-1  
 $K_{zt}$ : **1.15** MANUALLY INPUT

$K_e$ : **0.990** ASCE 26.10.1

$K_d$ : **0.85** ASCE 26.6



# Wind Loads - Main Wind Force Resisting System

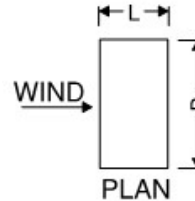
ASCE 7-16 Chapter 27.3 Part 1 - Enclosed Simple Diaphragm,  $h < 160\text{ft}$

## Wind Load Criteria

Risk Category:	<b>II</b>	Table 1.5-1	$K_e$ :	<b>0.9901</b>	Section 26.10.1
Basic Wind Speed:	<b>98 mph</b>	Figure 26.5.1	$K_d$ :	<b>0.85</b>	Section 26.6
Exposure Category:	<b>B</b>	Section 26.7.3	$G$ :	<b>0.85</b>	Section 26.11
$K_{zt}$ :	<b>1.15</b>	Section 26.8	Wall Height:	<b>9.0 ft</b>	

## L/B Ratio:

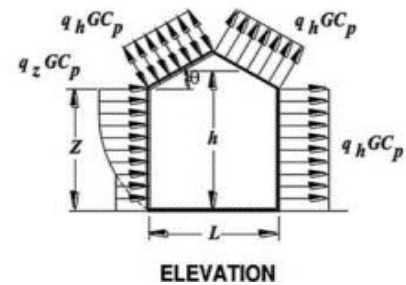
Short Dimension:	<b>80.0 ft</b>
Long Dimension:	<b>104.0 ft</b>
Transverse Wind L/B:	0.7692308
Longitudinal Wind L/B:	1.3



\*NOTE: INTERNAL BUILDING PRESSURE CANCEL EACH OTHER OUT IN ENCLOSED BUILDING

## Wall Pressures:

$K_h$ & $K_z$ :	0.570	At Top of Wall
$K_z$ :	0.57	0 ft to 15 ft



	<u>Transverse</u> Wind Direction		<u>Longitudinal</u> Wind Direction	
Top of Wall:	<b>16.0 psf</b> MIN		<b>16.0 psf</b> MIN	
0 ft to 15 ft Wall:	<b>16.0 psf</b> MIN	ASCE 27.1.5	<b>16.0 psf</b> MIN	ASCE 27.1.5

ASCE EQ 27.3-1  
ASCE EQ 27.3-1

\*Enveloped Leeward and Windward Pressure

\*All Values Ultimate (multiply x0.6 for ASD)



**Quantum Consulting Engineers LLC**  
1511 Third Avenue, Suite 323  
Seattle, WA 98101

Project: Dubey Deck Addition

Date: 9/30/21

Job No: 20130

Designer: MKS

Sheet: 2

Client: Tutmarc Associates

Checked By:



# Wind Loads - Components and Cladding

ASCE 7-16 Chapter 30.3 & 30.5 - Part 1 and Part 3 Enclosed Buildings With  $h < 160$  FT

## Wind Load Criteria

Risk Category:	<b>II</b>	Table 1.5-1	$K_d$ :	<b>0.85</b>	Section 26.6
Basic Wind Speed:	<b>98 mph</b>	Figure 26.5.1	Roof Type:	<b>Flat</b>	
Exposure Category:	<b>B</b>	Section 26.7.3	Roof Slope:	<b>0.3:12</b>	= 1.2 DEG
$K_{zt}$ :	<b>1.15</b>	Section 26.8	Mean Roof Height:	<b>10.0 ft</b>	
$K_e$ :	<b>0.99</b>	Section 26.10.1	Wall Height:	<b>9.0 ft</b>	

## Zone Dimensions

Least Horiz. BLDG Dimension:	<b>110 ft</b>	a:	<b>4.4 ft</b>
		2a:	<b>8.8 ft</b>

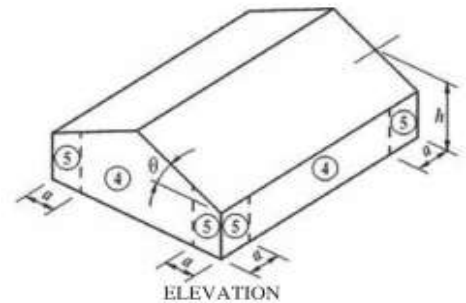
## Wall Pressures

$K_z$ :	0.575	Table 26.10-1	0-15 ft (PART 3)
$K_h$ :	0.570	Table 26.10-1	
Effective Wind Area:	Zone 4:	<b>400 ft<sup>2</sup></b>	
	Zone 5:	<b>400 ft<sup>2</sup></b>	

Load Case	At Top of Wall		0 FT TO 15 FT (>60' bldg)	
	4	5	4	5
1	<b>16.0</b>	<b>16.0</b>		
2	<b>-16.0</b>	<b>-16.0</b>		

### 16 PSF Min. Wind per 30.2.2

- \*Negative indicates pressure away from surface
- \*Okay to interpolate between 15ft and top of wall (>60' bldg)
- \*All Values Ultimate (multiply x0.6 for ASD)



## Roof Pressures

$K_h$ :	0.570	Table 26.10-1
Overhang?:	<b>No</b>	

Effective Wind Area:	Zone 1:	<b>75 ft<sup>2</sup></b>	Zone 2:	<b>75 ft<sup>2</sup></b>	Zone 3:	<b>75 ft<sup>2</sup></b>
	Zone 1':	<b>75 ft<sup>2</sup></b>	Zone 2e:	<b>75 ft<sup>2</sup></b>	Zone 3e:	<b>75 ft<sup>2</sup></b>
			Zone 2n:	<b>75 ft<sup>2</sup></b>	Zone 3r:	<b>75 ft<sup>2</sup></b>
			Zone 2r:	<b>75 ft<sup>2</sup></b>	Zone 3':	<b>75 ft<sup>2</sup></b>
			Zone 2':	<b>75 ft<sup>2</sup></b>		

Load Case	Zone (PSF)	
	1	1'
1	<b>5.3</b>	<b>5.3</b>
2	<b>-20.6</b>	<b>-9.8</b>

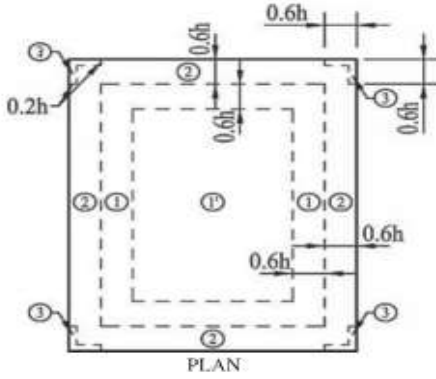
Load Case	2	2e	2n	2r	2'
	1	<b>11.2</b>	-	-	-
2	<b>-27.4</b>	-	-	-	-

Load Case	3	3e	3r	3'
	1	<b>11.2</b>	-	-
2	<b>-27.4</b>	-	-	-

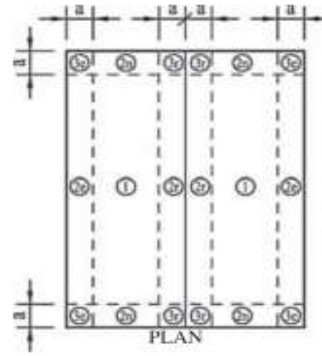
- \*Negative indicates pressure away from surface
- \*All Values Ultimate (multiply x0.6 for ASD)

# Wind Loads - Components and Cladding (Cont.)

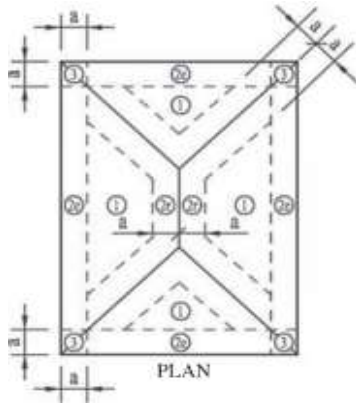
ASCE 7-16 Chapter 30 - Part 4 Enclosed Buildings With  $h < 160$  FT (Simplified)



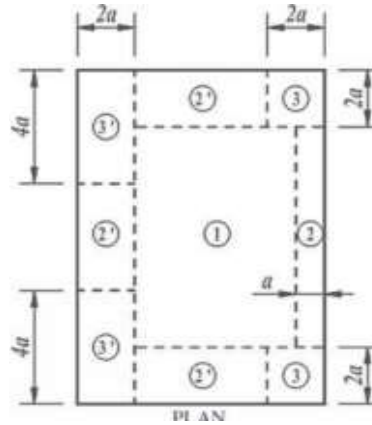
**ASCE FIG 30.3-2A**  
FLAT/GABLE ROOF  $\theta \leq 7^\circ$



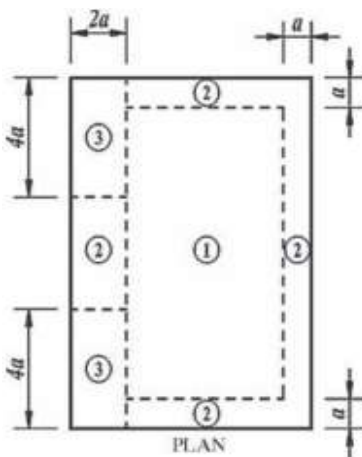
**ASCE FIG 30.3-2B to D**  
GABLE ROOF  $7^\circ < \theta \leq 45^\circ$



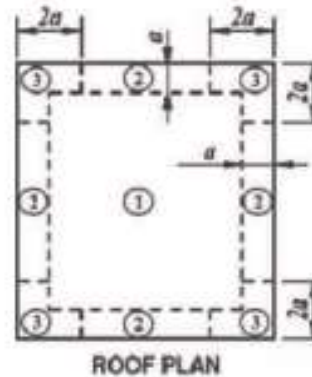
**ASCE FIG 30.3-2E to I**  
HIP ROOF  $7^\circ < \theta \leq 45^\circ$



**ASCE FIG 30.3-5A**  
Monoslope ROOF  $3^\circ < \theta \leq 10^\circ$



**ASCE FIG 30.3-5B**  
Monoslope ROOF  $10^\circ < \theta \leq 30^\circ$



**ASCE FIG 30.5-1**  
ROOF  $H > 60$ ft,  $\theta \leq 7^\circ$

**Wood Beam**

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File: Dubey.ec6  
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**QUANTUM CONSULTING ENGINEERS**

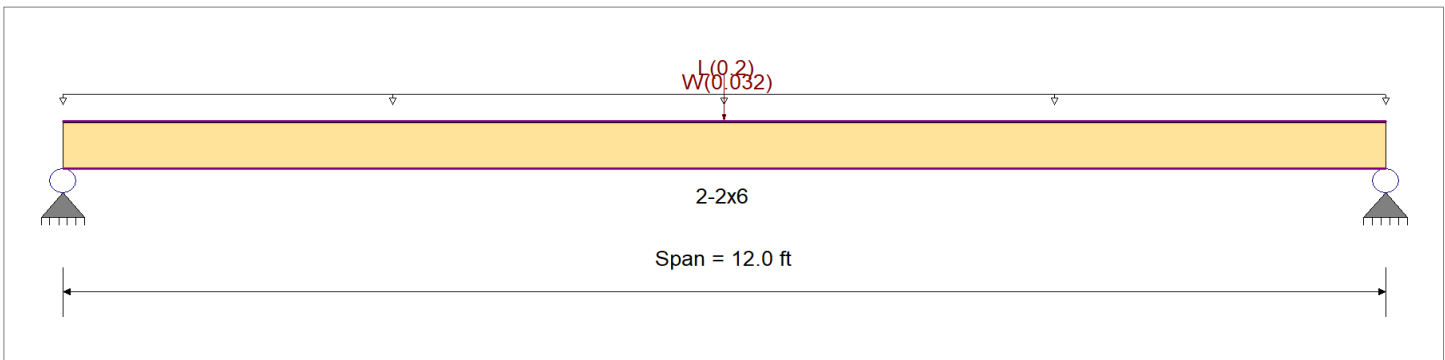
DESCRIPTION: Deck Parapet Double Top Plate

**CODE REFERENCES**

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : ASCE 7-16

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	850 psi	E : Modulus of Elasticity	
Load Combination ASCE 7-16	Fb -	850 psi	Ebend- xx	1300 ksi
	Fc - Prll	1300 psi	Eminbend - xx	470 ksi
Wood Species : Hem-Fir	Fc - Perp	405 psi		
Wood Grade : No.2	Fv	150 psi		
	Ft	525 psi	Density	26.84 pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations

Uniform Load : W = 0.0160 ksf, Tributary Width = 2.0 ft, (Out of Plane Wind)  
 Point Load : L = 0.20 k @ 6.0 ft, (200lb Point Load)

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.431</b> : 1	Maximum Shear Stress Ratio =	<b>0.061</b> : 1
Section used for this span =	<b>2-2x6</b>	Section used for this span =	<b>2-2x6</b>
fb: Actual =	476.03 psi	fv: Actual =	9.09 psi
Fb: Allowable =	1,105.00 psi	Fv: Allowable =	150.00 psi
Load Combination =	L Only	Load Combination =	L Only
Location of maximum on span =	6.000ft	Location of maximum on span =	6.000ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.117 in	Ratio =	1234 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.298 in	Ratio =	482 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>FV</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v		
	Length = 12.0 ft	1			0.90	1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	135.00
L Only	Length = 12.0 ft	1	0.431	0.061	1.00	1.300	1.00	1.00	1.00	1.00	1.00	0.60	476.03	1105.00	0.00	0.00	0.00	0.00	0.00
+0.750L	Length = 12.0 ft	1	0.258	0.036	1.25	1.300	1.00	1.00	1.00	1.00	1.00	0.45	357.02	1381.25	0.00	0.00	0.00	0.00	0.00
+0.60W	Length = 12.0 ft	1	0.155	0.040	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.35	274.20	1768.00	0.00	0.00	0.00	0.00	0.00
+0.750L+0.450W	Length = 12.0 ft	1	0.318	0.059	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.71	562.67	1768.00	0.00	0.00	0.00	0.00	0.00
	Length = 12.0 ft	1			1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.71	562.67	1768.00	0.16	14.10	0.00	0.00	240.00

**Wood Beam**

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**QUANTUM CONSULTING ENGINEERS**

DESCRIPTION: Deck Parapet Double Top Plate

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+0.750L+0.450W	1	0.2985	6.044		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.192	0.192
Overall MINimum	0.192	0.192
L Only	0.100	0.100
+0.750L	0.075	0.075
+0.60W	0.115	0.115
+0.750L+0.450W	0.161	0.161
W Only	0.192	0.192