QUANTUM
CONSULTING ENGINEERS

April 3, 2024

STRUCTURAL CALCULATIONS
(Permit Re-Submittal)

INTRACHAT RESIDENCE
7929 East Mercer Way
Mercer Island, WA 98040

Quantum Job Number: 22252.01

Prepared for:
LINDAL CEDAR HOMES
6840 Fort Dent Way Suite 220
Seattle, WA 98188

Prepared by:
QUANTUM CONSULTING ENGINEERS
1511 Third Avenue, Suite 323
Seattle, WA 98101
TEL 206.957.3900
FAX 206.957.3901

QUANTUM | CONSULTING ENGINEERS
1511 Third Avenue, Suite 323
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TEL 206.957.3900
FAX 206.957.3901

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7929 EAST MERCER WAY
MERCER ISLAND, WA

QUANTUM JOB NUMBER: 22252.01

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DESIGN CRITERIA

Structural Design Criteria

Building Code: 2018 International Building Code with City of Mercer Island Amendments
Building Department: City of Mercer Island

Seismic Criteria

S_s:	1.46	I_e:	1.00
S_1:	0.50	Seismic Soil Site Class:	D
S_{ds}:	0.97	Seismic Design Category:	D
S_{d1}:	0.60		
R:	6.50	Light-Framed Wood Walls Sheathed With Wood Structural Panels	

Wind Criteria

Wind Speed:	98 MPH
Risk Category:	II
Wind Exposure:	B
Kzt:	1.43

Geotechnical Criteria

Steel Pipe Piles (4" diameter)	20 K
Minimum Footing Width	Continuous: 18" min., Isolated: 24" min.
Frost Depth	18" min.
Soils Consultant	Nelson Geotechnical Associates, Inc.
Soils Report Number	#1276521
Soils Report Date	January 14, 2022
Active Soil Pressure (Restrained/Unrestrained)	60 PCF / 40 PCF
Seismic Surcharge Pressure	8H PSF
Passive Soil Pressure	150 PCF

Materials Criteria

Concrete (28 Day Strength):

Foundation/Slab on Grade	F'c= 4,000 PSI

Reinforcing Steel:

Grade 60 (#5 bar and larger)	Fy= 60,000 PSI
Grade 40 (#4 bar)	Fy= 40,000 PSI

Wood Framing:

2x, 3x & 4x Framing Members	HF#2 or DF#2
6x Framing Members	DF#1
Glulam Beams	24F-V4 (V8 @ Cont. and Cant. Members)
Parallam Beams	2.0 E PSL
LSL Members - Beams & Headers	1.55 E LSL
LSL Members - Studs & Columns	1.3 E LSL
LVL Members - Beams & Headers	1.9 E LVL
Wood Sheathing	APA RATED

Residential Building Loads

Snow Load	Roof	30 psf
Live Load	Residential	40 psf
	Residential exterior decks / balconies	60 psf

Floor Loads

Roof Loads		Comments
Standard Roofing	2.0 psf	
1/2” Plywood Shtg	1.8 psf	
Joists @ 16” o.c.	2.5 psf	
R38 Insulation	1.0 psf	
Lights, ducts	0.5 psf	
5/8" GWB	2.8 psf	
PV Allowance	4.0 psf	INCL W/ MISC
Miscellaneous	1.4 psf	FOR SEISMIC
Total:	**16.0 psf**	SL=30 PSF

Typical Floor Loads		Comments
Flooring	3.0 psf	
3/4” Plywood Shtg	2.3 psf	
Floor Joists @ 16" o.c.	2.5 psf	
Lights, ducts	0.5 psf	
5/8" GWB	2.8 psf	
Miscellaneous	0.9 psf	
Total:	**12.0 psf**	LL=40 PSF

Deck Loads

	Gravity:	Comments
Decking	3.0 psf	
Membrane Roofing	2.3 psf	
3/4” Plywood Shtg	2.3 psf	
2x Joists @ 16” o.c.	2.5 psf	
R38 Insulation	1.0 psf	
Lights, ducts	0.5 psf	
5/8” GWB	2.8 psf	
Miscellaneous	0.6 psf	
Total:	15.0 psf	LL=60 PSF

Deflection Criteria

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

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

ROOF SNOW LOAD [a] (psf)	WIND DESIGN				SEISMIC DESIGN CATEGORY	SUBJECT TO DAMAGE FROM			OUTDOOR DESIGN TEMP (F) - Heat/Cool	ICE BARRIER UNDERLAYMENT REQUIRED	FLOOD HAZARD[e]	AIR FREZING INDEX	MEAN ANNUAL TEMP
	Speed [b] (mph)	Topographic effects[c]	Special wind region	Windborne debris zone		Weathering[d]	Frost line depth	Termite					
25	110	Yes	No	No	D2	Moderate	12”	Slight to Moderate	83/24	No	N.A.	113	53

MANUAL J DESIGN CRITERIA							
Elevation	Latitude	Winter heating	Summer cooling	Altitude correction factor	Indoor design temperature	Design temperature cooling	Heating temperature difference
338 feet	47º34’39’’	72ºF max	75ºF min	0.99	72ºF	75ºF	48ºF
Cooling temperature difference	Wind velocity heating	Wind velocity cooling	Coincident wet bulb	Daily range	Winter humidity	Summer humidity	
8ºF	N.A.	N.A.	66	Medium	75%	68%	

a. This is the minimum roof snow load. When using this snow load it will be left to the engineer’s judgment whether to consider drift or sliding snow. However, rain on snow surcharge of 5 psf must be considered for roof slopes less than 5 degrees.

b. The 110 mph Ultimate Design Wind Speed (3-second gust) as adopted by the 2018 IRC/ASCE 7-10 (or if using the IBC for structural design, the 98 mph Basic Design Wind Speed as adopted by the 2018 IBC/ASCE 7-16 may be used).

c. Wind exposure category and Topographic effects (Wind Speed-up Kzt factor) shall be determined on a site-specific basis by the Engineer of Record (components and cladding need not consider topographic effects unless otherwise determined by the engineer of record).

d. Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652.

e. The City of Mercer Island participates in the National Flood Insurance Program (NFIP); Regular Program (No Special Flood Hazard Area). Further NFIP participation information: CID 530083, Initial FHBM Identified 06/28/74, Initial FIRM Identified 05/16/95, Current Effective Map Date (NSFHA), Reg-Emer Date 06/30/97, 53033C0654G effective 8/19/2020.

Hazards by Location

Search Information

Address: 7929 E Mercer Way, Mercer Island, WA 98040, USA

Coordinates: 47.531256, -122.2212357

Elevation: 192 ft

Timestamp: 2022-06-01T19:41:29.063Z

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

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 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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Hazards by Location

Search Information

Address: 7929 E Mercer Way, Mercer Island, WA 98040, USA

Coordinates: 47.531256, -122.2212357

Elevation: 192 ft

Timestamp: 2022-06-01T19:42:19.903Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D

Basic Parameters

Name	Value	Description
S_S	1.46	MCE_R ground motion (period=0.2s)
S_1	0.504	MCE_R ground motion (period=1.0s)
S_{MS}	1.46	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.974	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	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	0.624	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.687	Site modified peak ground acceleration

T_L	6	Long-period transition period (s)
SsRT	1.46	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.619	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	4.317	Factored deterministic acceleration value (0.2s)
S1RT	0.504	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.561	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.636	Factored deterministic acceleration value (1.0s)
PGAd	1.423	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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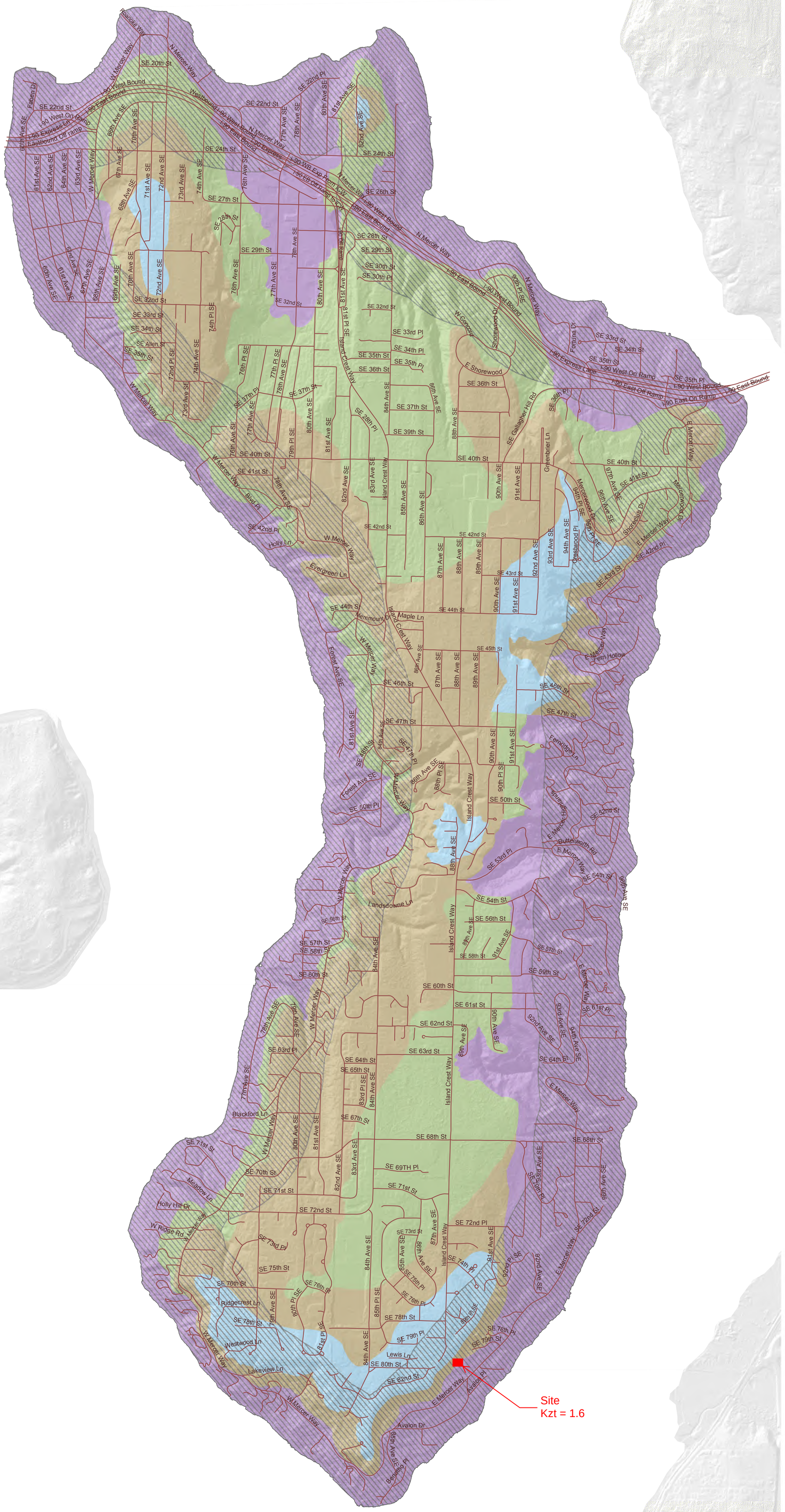
Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

by Development Services Group (DSG), City of Mercer Island
April 2009

0 0.5 1 Kilometers 1:12,000
0 0.5 1 Miles

N



WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS
(ICC Section 1609 & ASCE 7-05 Chapter 6)

It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the Kzt factor to be utilized for each specific project. The Kzt factors and wind exposure categories indicated on this map are the minimum values accepted by the City of Mercer Island without requiring the design professional to submit additional calculations and supporting topographic documentation (to verify the values utilized in their wind load determination).

Please note – The Kzt values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

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

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer island. This map shows the minimum wind exposure category and the minimum wind speed-up, "K_zt" factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically indentified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

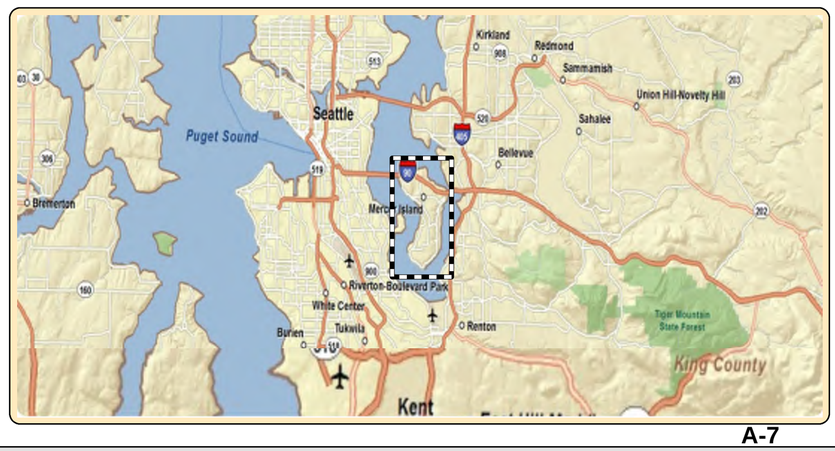
This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

DEFINITIONS:

K_zt factor:	The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.
Exposure B:	The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.
Exposure C:	The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.
Wind Speed:	Minimum 85 mph 3-second gust per IRC Figure R301.2(4)



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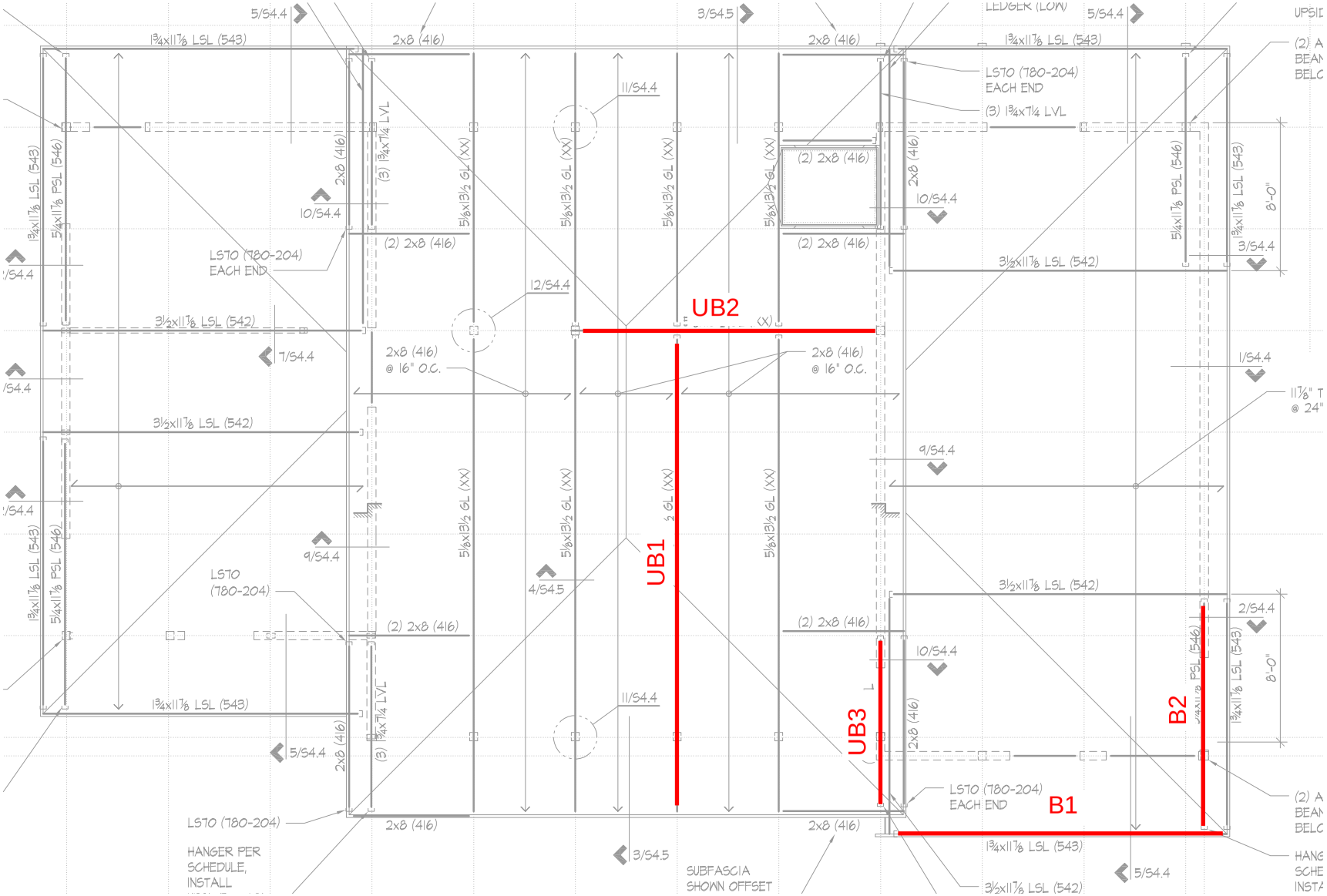
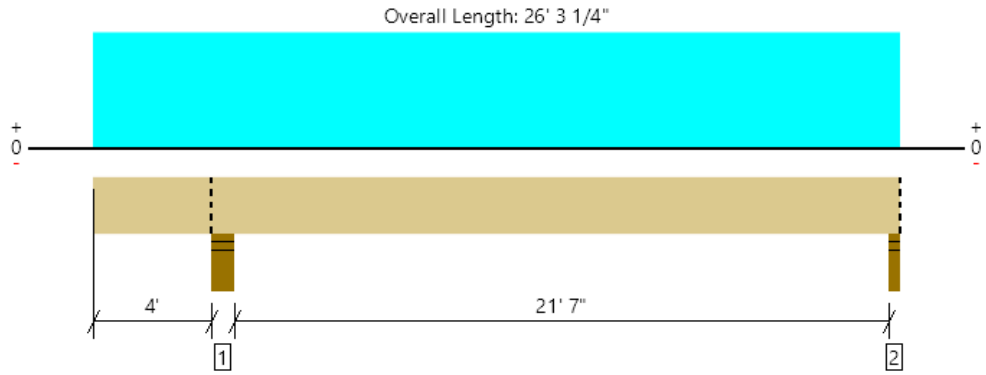
GRAVITY DESIGN



B-1

ROOF - BEAM KEY

Upper Roof, UB1 - Upper Roof Dropped Beam
1 piece(s) 5 1/8" x 13 1/2" 24F-V8 DF Glulam



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)	2911 @ 26' 2"	5990 (2.75")	Passed (49%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	2704 @ 5' 7"	14057	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	15405 @ 15' 5 3/4"	35323	Passed (44%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-2413 @ 4' 2 3/4"	35805	Passed (7%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.434 @ 15' 3 1/4"	1.097	Passed (L/606)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.697 @ 15' 3 9/16"	1.462	Passed (L/377)	--	1.0 D + 1.0 S (Alt Spans)

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

- Deflection criteria: LL (L/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.
- Critical positive moment adjusted by a volume/size factor of 0.99 that was calculated using length L = 21' 4 7/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 9/16".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	1.93"	1636	2575	4211	Blocking
2 - Stud wall - SPF	2.75"	2.75"	1.50"	1118	1793	2911	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)	26' 3" o/c	
Bottom Edge (Lu)	26' 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 26' 3 1/4"	N/A	16.8	--	
1 - Uniform (PSF)	0 to 26' 3 1/4" (Front)	5' 6"	16.0	30.0	Default Load

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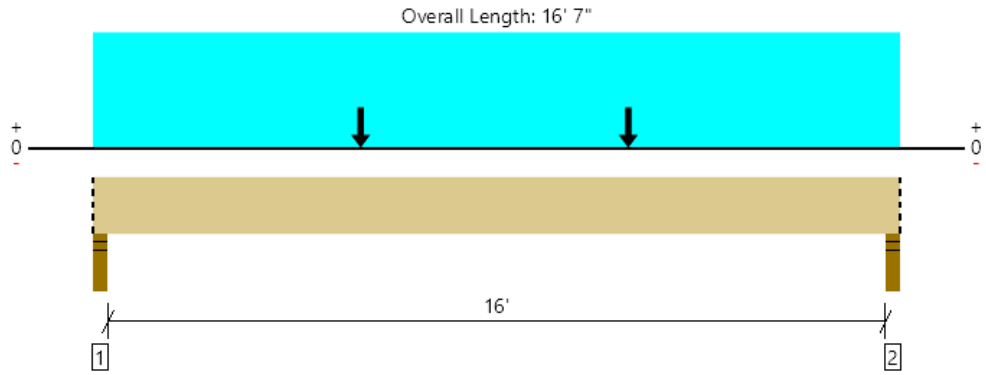
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Upper Roof, UB2 - Dropped Beam - Grid 5
1 piece(s) 5 1/8" x 13 1/2" 24F-V4 DF Glulam



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)	4420 @ 2"	7623 (3.50")	Passed (58%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	4375 @ 1' 5"	14057	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	23283 @ 8' 11 1/2"	35805	Passed (65%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.374 @ 8' 3 7/16"	0.813	Passed (L/522)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.599 @ 8' 3 7/16"	1.083	Passed (L/326)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 16' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	2.03"	1706	166	2714	4420	Blocking
2 - Stud wall - SPF	3.50"	3.50"	2.01"	1691	166	2686	4378	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)	16' 7" o/c	
Bottom Edge (Lu)	16' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16' 7"	N/A	16.8	--	--	
1 - Uniform (PSF)	0 to 16' 7" (Front)	1'	15.0	20.0	-	Default Load
2 - Point (lb)	5' 6" (Front)	N/A	1435	-	2700	
3 - Point (lb)	11' (Front)	N/A	1435	-	2700	

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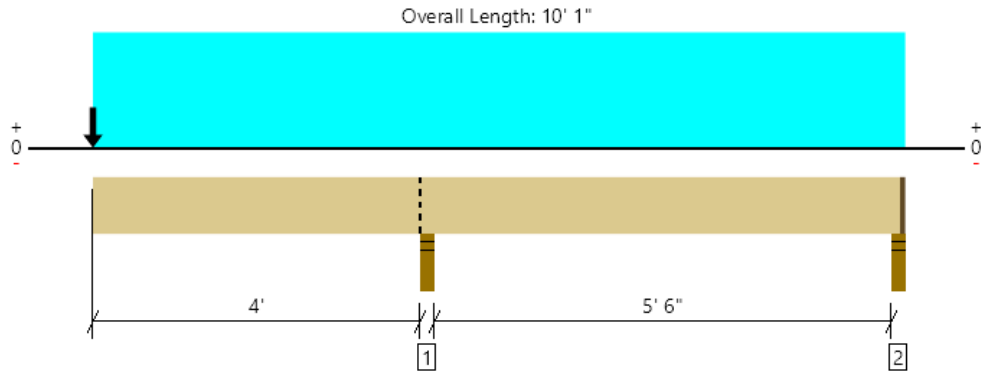
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Upper Roof, UB3 - Cantilever Beam

3 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)	2240 @ 4' 1 3/4"	7809 (3.50")	Passed (29%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	999 @ 3' 4 3/4"	8317	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-3070 @ 4' 1 3/4"	12273	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.122 @ 0	0.415	Passed (2L/818)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.192 @ 0	0.553	Passed (2L/520)	--	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/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	863	1376	2240	Blocking
2 - Stud wall - SPF	3.50"	2.25"	1.50"	23	203/-137	226/-114	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	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 9' 11 3/4"	N/A	11.1	--	
1 - Uniform (PSF)	0 to 10' 1" (Front)	4'	16.0	30.0	Default Load
2 - Point (lb)	0 (Front)	N/A	130	206	Linked from: Cantilever Rim, Support 1

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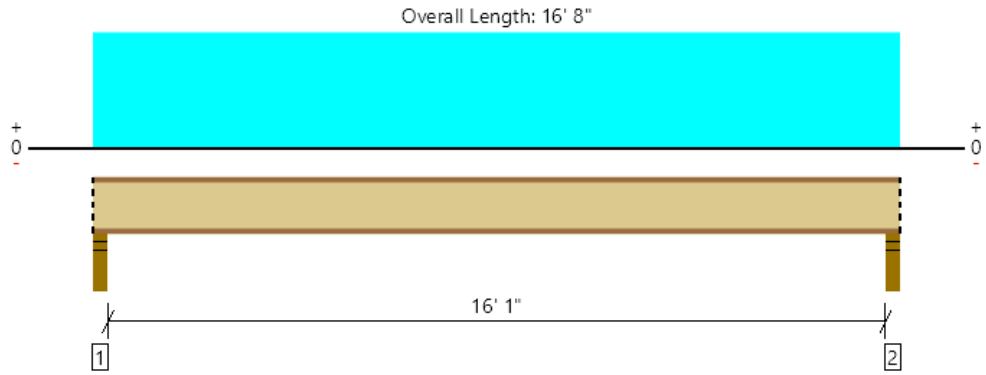
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Lower Roof, Typical Joists
1 piece(s) 11 7/8" TJI® 110 @ 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)	767 @ 2 1/2"	1581 (3.50")	Passed (48%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	740 @ 3 1/2"	1794	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3037 @ 8' 4"	3634	Passed (84%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.388 @ 8' 4"	0.813	Passed (L/502)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.595 @ 8' 4"	1.083	Passed (L/328)	--	1.0 D + 1.0 S (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.75"	267	500	767	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.75"	267	500	767	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 2" o/c	
Bottom Edge (Lu)	16' 8" o/c	

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

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 8"	24"	16.0	30.0	Default Load

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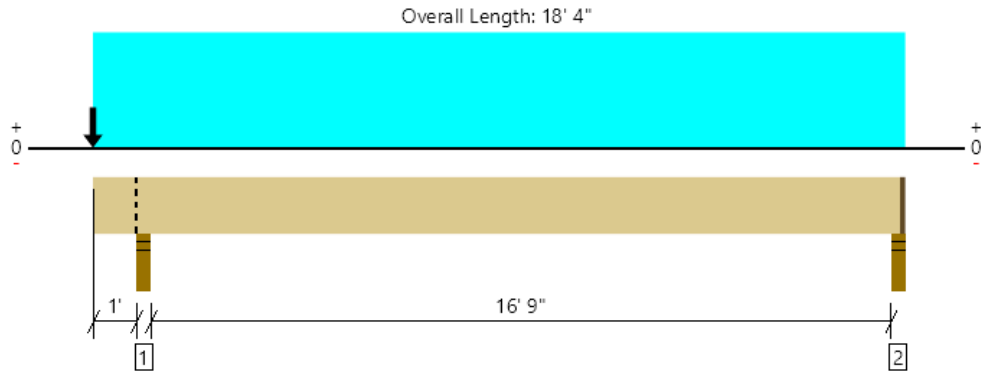
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Lower Roof, B1 - Cantilever Rim

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



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)	459 @ 18' 2"	1673 (2.25")	Passed (27%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	414 @ 2' 3 3/8"	4939	Passed (8%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1904 @ 9' 9 11/16"	9173	Passed (21%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.152 @ 9' 8 3/8"	0.851	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.274 @ 9' 8 1/2"	1.135	Passed (L/744)	--	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/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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	296	387	683	Blocking
2 - Stud wall - SPF	3.50"	2.25"	1.50"	207	257	464	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	18' 3" o/c	
Bottom Edge (Lu)	18' 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 18' 2 3/4"	N/A	6.5	--	
1 - Uniform (PSF)	0 to 18' 4" (Front)	1'	18.0	30.0	Default Load
2 - Point (lb)	0 (Front)	N/A	55	90	

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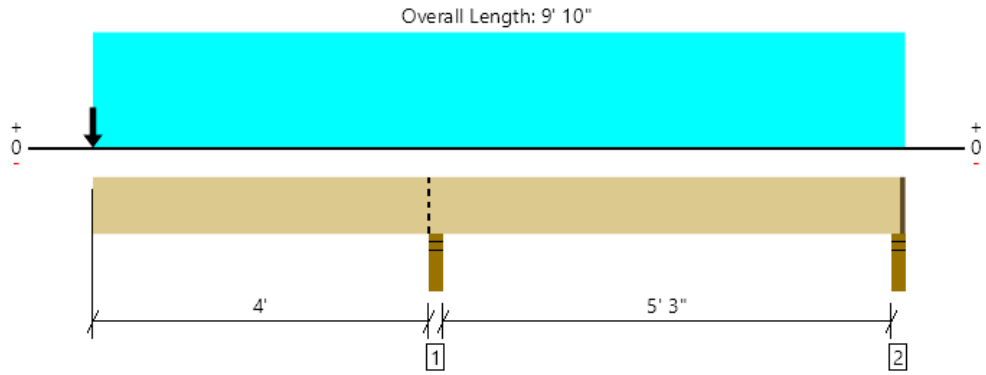
ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Lower Roof, B2 - Cantilever Beam
1 piece(s) 5 1/4" x 11 7/8" 2.0E 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)	5118 @ 4' 1 3/4"	7809 (3.50")	Passed (66%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2078 @ 3' 1/8"	13861	Passed (15%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-6815 @ 4' 1 3/4"	34332	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.061 @ 0	0.415	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.102 @ 0	0.553	Passed (2L/974)	--	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/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -271 lbs uplift at support located at 9' 8". Strapping or other restraint may be required.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	2.29"	2092	3026	5118	Blocking
2 - Stud wall - SPF	3.50"	2.25"	1.50"	31	451/-302	482/-271	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 9" o/c	
Bottom Edge (Lu)	9' 9" 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 9' 8 3/4"	N/A	19.5	--	
1 - Uniform (PSF)	0 to 9' 10" (Front)	9' 3"	18.0	30.0	Default Load
2 - Point (lb)	0 (Front)	N/A	296	387	Linked from: Cantilever Rim, Support 1

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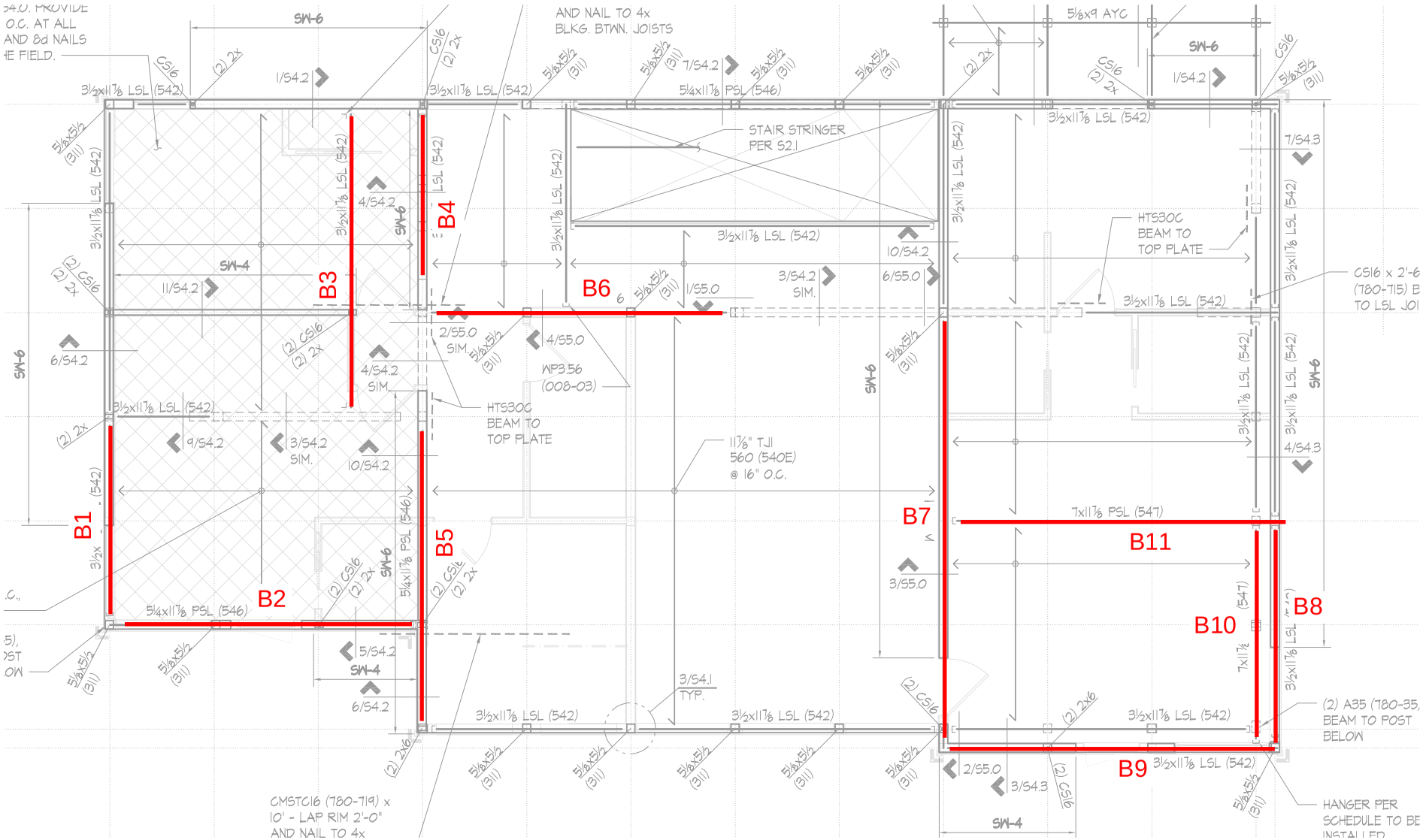
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

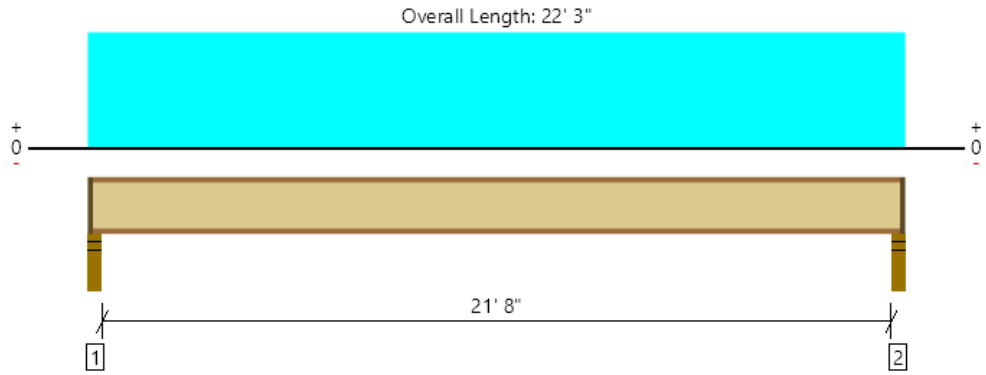
Weyerhaeuser



B-8

LEVEL 2 - BEAM KEY

Level 2, Joists - Family Room
1 piece(s) 11 7/8" TJI® 560 @ 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)	764 @ 2 1/2"	1396 (2.25")	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	751 @ 3 1/2"	2050	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4131 @ 11' 1 1/2"	9500	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.404 @ 11' 1 1/2"	0.546	Passed (L/648)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.526 @ 11' 1 1/2"	1.092	Passed (L/498)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	50	40	Passed	--	--

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	178	593	771	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	178	593	771	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 8" o/c	
Bottom Edge (Lu)	22' 1" o/c	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 22' 3"	16"	12.0	40.0	Default Load

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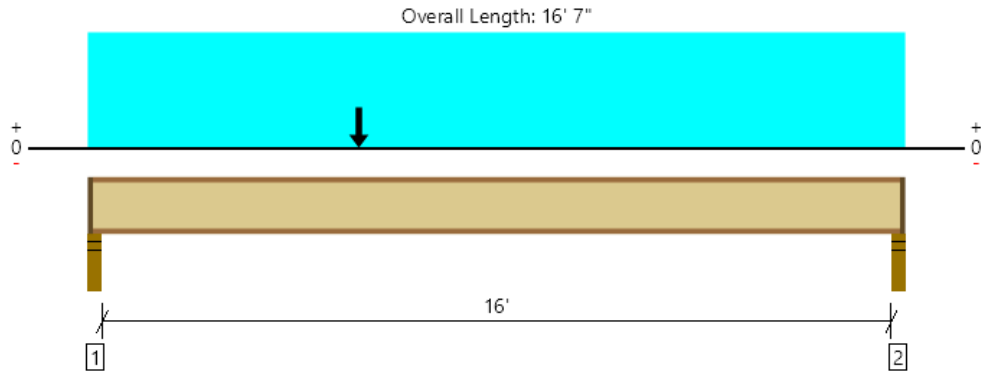
ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Level 2, Joists - Bed 2
1 piece(s) 11 7/8" TJI® 110 @ 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)	657 @ 2 1/2"	1041 (2.25")	Passed (63%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	644 @ 3 1/2"	1560	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2632 @ 7' 7 15/16"	3160	Passed (83%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.256 @ 8' 3 1/2"	0.404	Passed (L/757)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.386 @ 8' 2 5/16"	0.808	Passed (L/502)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	56	40	Passed	--	--

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

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	222	442	54	665	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	176	442	26	619	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 5" o/c	
Bottom Edge (Lu)	16' 5" o/c	

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

Vertical Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 7"	16"	12.0	40.0	-	Default Load
2 - Point (PLF)	5' 6"	16"	100.0	-	60.0	

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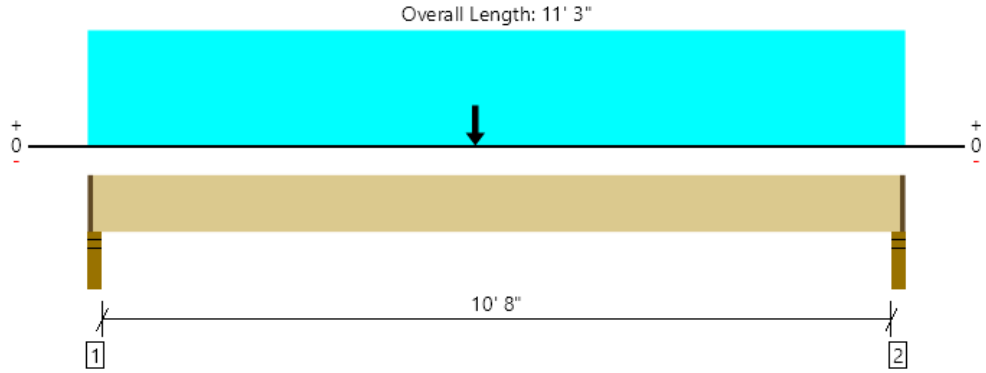
ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Level 2, B1 - Grid A

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



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)	1349 @ 2"	3347 (2.25")	Passed (40%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1320 @ 1' 3 3/8"	9878	Passed (13%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	6630 @ 5' 4"	18346	Passed (36%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.107 @ 5' 4"	0.273	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.176 @ 5' 4"	0.546	Passed (L/746)	--	1.0 D + 1.0 S (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	561	225	790	1351	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	518	225	710	1228	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 1" o/c	
Bottom Edge (Lu)	11' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 11' 1 3/4"	N/A	13.0	--	--	
1 - Uniform (PSF)	0 to 11' 3" (Front)	1'	12.0	40.0	-	Default Load
2 - Point (lb)	5' 4" (Front)	N/A	800	-	1500	

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ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

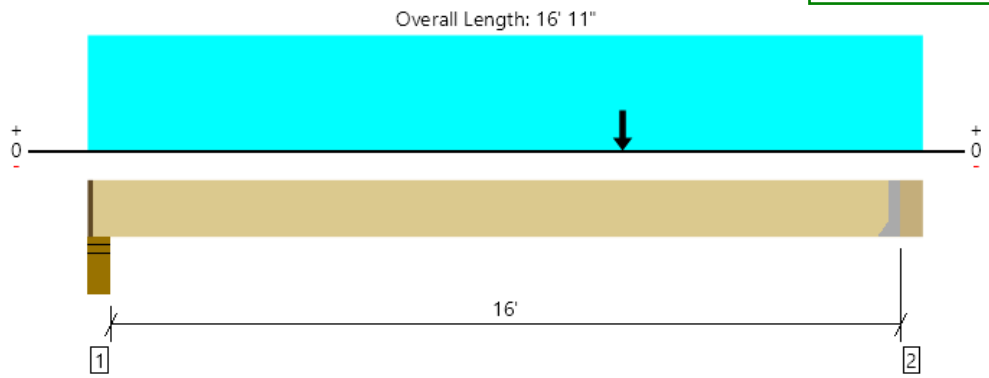
Level 2, B2 - Grid 8

1 piece(s) 5 1/4" x 11 7/8" 2.0E Parallam® PSL

An excessive uplift of -2371 lbs at support located at 4" failed this product.

An excessive uplift of -5193 lbs at support located at 16' 5 1/2" failed this product.

OK! HANGERS/STRAPS PROVIDED EACH END OF BEAM



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)	6982 @ 16' 5 1/2"	6982 (2.13")	Passed (100%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	6657 @ 15' 5 5/8"	19285	Passed (35%)	1.60	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	35014 @ 11'	47766	Passed (73%)	1.60	1.0 D + 0.7 E (All Spans)
Live Load Defl. (in)	0.319 @ 8' 7"	0.538	Passed (L/606)	--	1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.448 @ 8' 6 5/16"	0.806	Passed (L/432)	--	1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)						Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Wind	Seismic	Factored	
1 - Stud wall - SPF	5.50"	4.25"	2.21"	984	1847	504	711	4231/-4231	4969/-2371	1 1/4" Rim Board
2 - Hanger on 11 7/8" PSL beam	5.50"	Hanger[1]	2.13"	992	1875	511	1389	8269/-8269	7123/-5193	See note [1]

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

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

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	MGU5.50-SDS H=11.813	4.50"	N/A	24-SDS25212	16-SDS25212	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Wind (1.60)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	1 1/4" to 16' 5 1/2"	N/A	19.5	--	--	--	--	
1 - Uniform (PSF)	0 to 16' 11" (Front)	5' 6"	12.0	40.0	-	-	-	Default Load
2 - Uniform (PSF)	0 to 16' 11" (Front)	2'	16.0	-	30.0	-	-	Default Load
3 - Point (lb)	11' (Front)	N/A	-	-	-	2100	12500	HD Strap (seismic includes omega)

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

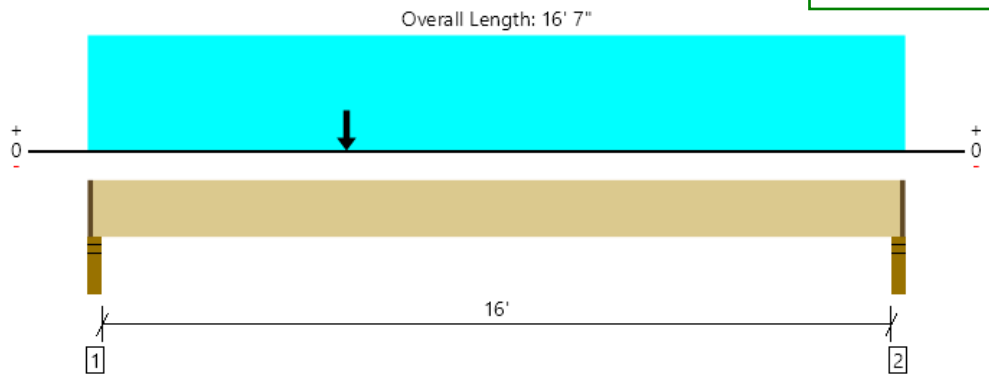
Weyerhaeuser

Level 2, B3 - Grid C.5

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

An excessive uplift of -2262 lbs at support located at 2" failed this product.

OK! STRAPS PROVIDED AT EACH END OF BEAM



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)	2643 @ 2"	3347 (2.25")	Passed (79%)	--	1.0 D + 0.7 E (All Spans)
Shear (lbs)	2608 @ 1' 3 3/8"	13743	Passed (19%)	1.60	1.0 D + 0.7 E (All Spans)
Moment (Ft-lbs)	13049 @ 5' 3"	25525	Passed (51%)	1.60	1.0 D + 0.7 E (All Spans)
Live Load Defl. (in)	0.135 @ 8' 1/4"	0.406	Passed (L/999+)	--	1.0 D + 0.45 W + 0.75 L + 0.75 Lr (All Spans)
Total Load Defl. (in)	0.199 @ 8' 1 1/4"	0.813	Passed (L/981)	--	1.0 D + 0.45 W + 0.75 L + 0.75 Lr (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -951 lbs uplift at support located at 16' 5". Strapping or other restraint may be required.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Wind	Seismic	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.78"	239	442	412	3436/-3436	2644/-2262	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	239	442	188	1564/-1564	1392/-951	1 1/4" Rim Board

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

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Wind (1.60)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	1 1/4" to 16' 5 3/4"	N/A	13.0	--	--	--	
1 - Uniform (PSF)	0 to 16' 7" (Front)	1' 4"	12.0	40.0	-	-	Default Load
2 - Point (lb)	5' 3" (Front)	N/A	-	-	600	5000	HD Strap (seismic includes omega)

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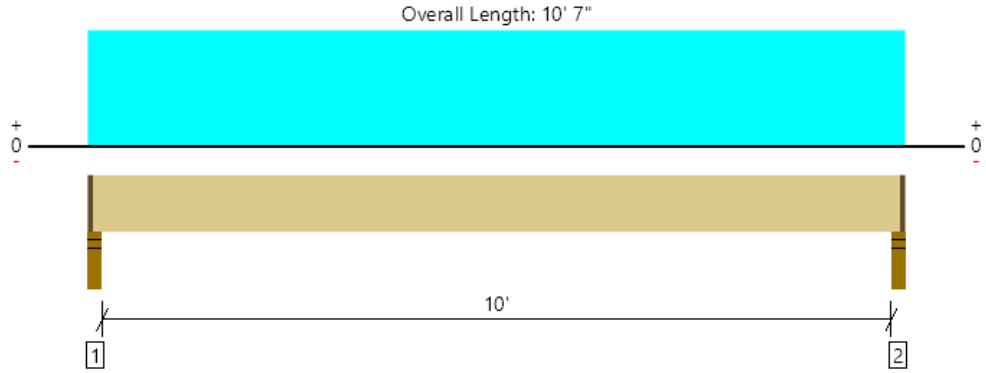
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Level 2, B4 - Grid D (North)
1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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)	2775 @ 2"	3347 (2.25")	Passed (83%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2146 @ 1' 3 3/8"	9878	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	7026 @ 5' 3 1/2"	18346	Passed (38%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.124 @ 5' 3 1/2"	0.256	Passed (L/994)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.201 @ 5' 3 1/2"	0.512	Passed (L/613)	--	1.0 D + 1.0 S (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.87"	1083	282	1746	2830	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.87"	1083	282	1746	2830	1 1/4" Rim Board

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

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 10' 5 3/4"	N/A	13.0	--	--	
1 - Uniform (PSF)	0 to 10' 7" (Front)	1' 4"	12.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 10' 7" (Front)	11'	16.0	-	30.0	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
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

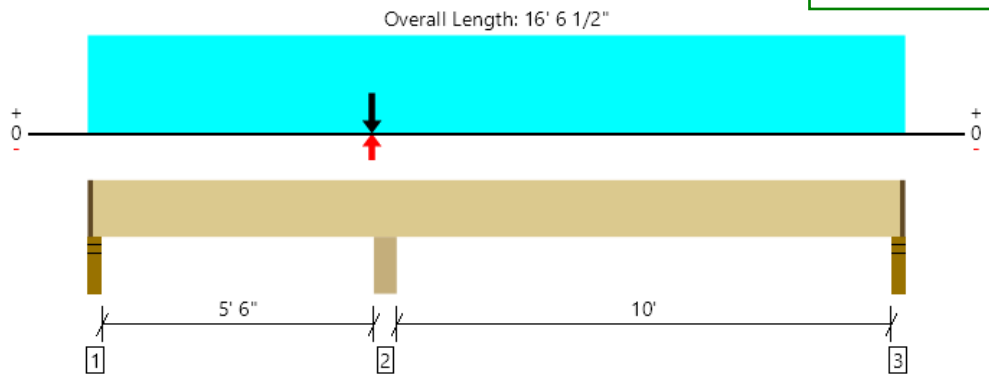
Weyerhaeuser

Level 2, B5 - Grid D (South)

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

An excessive uplift of -3750 lbs at support located at 6' 1/4" failed this product.

OK! STRAPS CONTINUOUS AT SUPPORT



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern) [Group]
Member Reaction (lbs)	12289 @ 6' 1/4"	13956 (5.50")	Passed (88%)	--	1.0 D - 0.525 E + 0.75 L + 0.75 S (All Spans) [8]
Shear (lbs)	2653 @ 7' 2 7/8"	9878	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans) [1]
Moment (Ft-lbs)	-5545 @ 6' 1/4"	18346	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans) [1]
Live Load Defl. (in)	0.082 @ 11' 7 13/16"	0.259	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans) [1]
Total Load Defl. (in)	0.129 @ 11' 8 3/16"	0.518	Passed (L/964)	--	1.0 D + 1.0 S (Alt Spans) [1]

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

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

Supports	Bearing Length			Loads to Supports (lbs)						Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Wind	Seismic	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	309	208/-72	708	43	254/-254	1130	1 1/4" Rim Board
2 - Column - SPF	5.50"	5.50"	4.84"	3186	2410	4066	1359	8088/-8088	12289/-3750	None
3 - Stud wall - SPF	3.50"	2.25"	1.54"	885	241/-19	1464	-12	73/-73	2349	1 1/4" Rim Board

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

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Wind (1.60)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	1 1/4" to 16' 5 1/4"	N/A	13.0	--	--	--	--	
1 - Uniform (PSF)	0 to 16' 6 1/2" (Front)	1' 4"	12.0	40.0	-	-	-	Default Load
2 - Uniform (PSF)	0 to 16' 6 1/2" (Front)	11'	16.0	-	30.0	-	-	Default Load
3 - Point (lb)	5' 9" (Front)	N/A	992	1875	511	1389	8269/-8269	Linked from: Beam - Grid 8, 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
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

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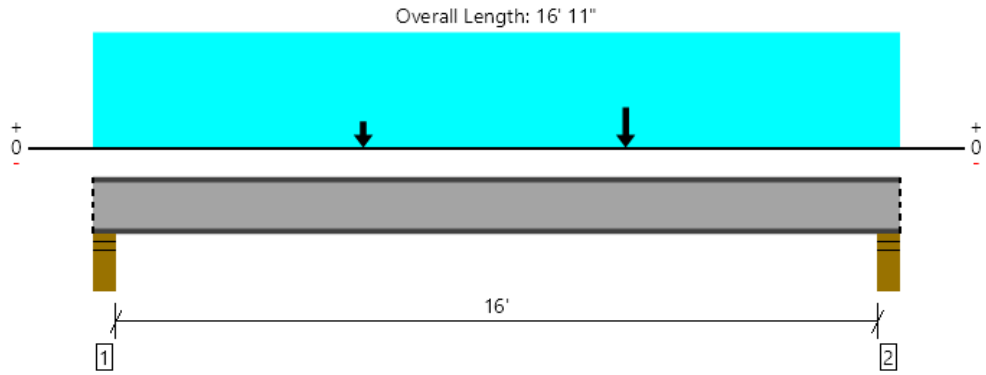
Level 2, B6 - Grid 5
1 piece(s) W10X26 (A992) ASTM Steel



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)	12018 @ 16' 7"	13487 (5.50")	Passed (89%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	11689 @ 16' 5 1/2"	53560	Passed (22%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	53576 @ 10' 2 5/8"	78094	Passed (69%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.377 @ 8' 7"	0.406	Passed (L/517)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.605 @ 8' 7 3/16"	0.813	Passed (L/322)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (Cb) of 1.0 has been assumed.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	5.50"	3906	5583	55	3619	10806	Blocking
2 - Stud wall - SPF	5.50"	5.50"	5.50"	4460	5583	111	4495	12018	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)	Continuous	
Bottom Edge (Lu)	Continuous	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16' 11"	N/A	26.0	--	--	--	
1 - Uniform (PSF)	0 to 16' 11"	16' 6"	12.0	40.0	-	-	Default Load
2 - Point (lb)	5' 8"	N/A	1435	-	-	2700	
3 - Point (lb)	11' 2"	N/A	1435	-	-	2700	
4 - Point (lb)	11' 2"	N/A	1706	-	166	2714	Linked from: UB2 - Dropped Beam - Grid 5, Support 1

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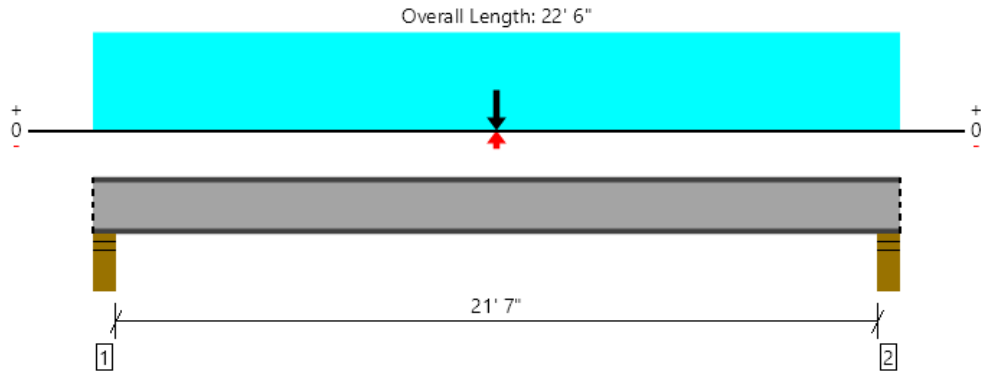
ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Level 2, B7 - Beam - Grid I

1 piece(s) W10X39 (A992) ASTM Steel



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)	8578 @ 4"	18677 (5.50")	Passed (46%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	8304 @ 5 1/2"	62496	Passed (13%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	55803 @ 11' 3"	116766	Passed (48%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.401 @ 11' 3"	0.546	Passed (L/654)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.733 @ 11' 3"	1.092	Passed (L/357)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (Cb) of 1.0 has been assumed.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	5.50"	4065	2436	3582	8578	Blocking
2 - Stud wall - SPF	5.50"	5.50"	5.50"	4065	2436	3582	8578	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)	Continuous	
Bottom Edge (Lu)	Continuous	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 22' 6"	N/A	39.0	--	--	
1 - Uniform (PSF)	0 to 22' 6"	1' 4"	12.0	40.0	-	Level 2
2 - Uniform (PSF)	0 to 22' 6"	8'	10.0	-	-	Wall
3 - Uniform (PSF)	0 to 22' 6"	11'	16.0	-	30.0	Roof
4 - Point (lb)	11' 3"	N/A	1133	3671	-262	Linked from: E/W Grid 7 Beam, Support 2

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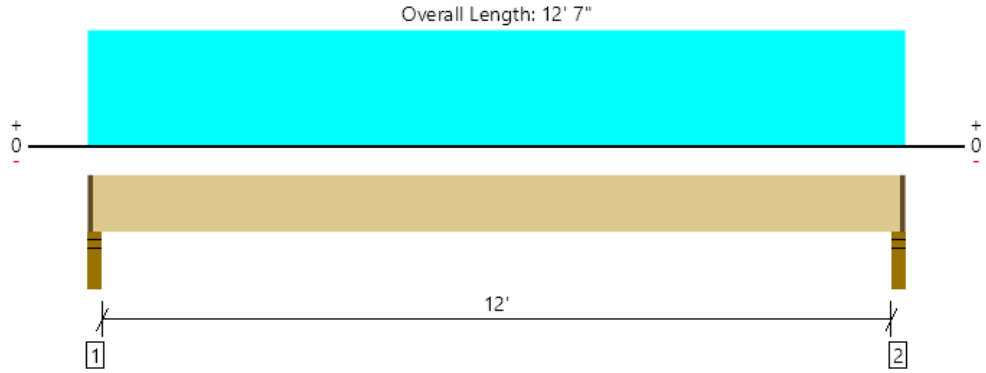
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Level 2, B8 - N/S Rim Beam
1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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)	2865 @ 2"	3347 (2.25")	Passed (86%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2320 @ 1' 3 3/8"	9878	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	8685 @ 6' 3 1/2"	18346	Passed (47%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.204 @ 6' 3 1/2"	0.306	Passed (L/719)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.341 @ 6' 3 1/2"	0.613	Passed (L/431)	--	1.0 D + 1.0 S (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.93"	1166	126	1746	2912	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.93"	1166	126	1746	2912	1 1/4" Rim Board

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

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 12' 5 3/4"	N/A	13.0	--	--	
1 - Uniform (PSF)	0 to 12' 7" (Front)	6"	12.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 12' 7" (Front)	9' 3"	18.0	-	30.0	Default Load

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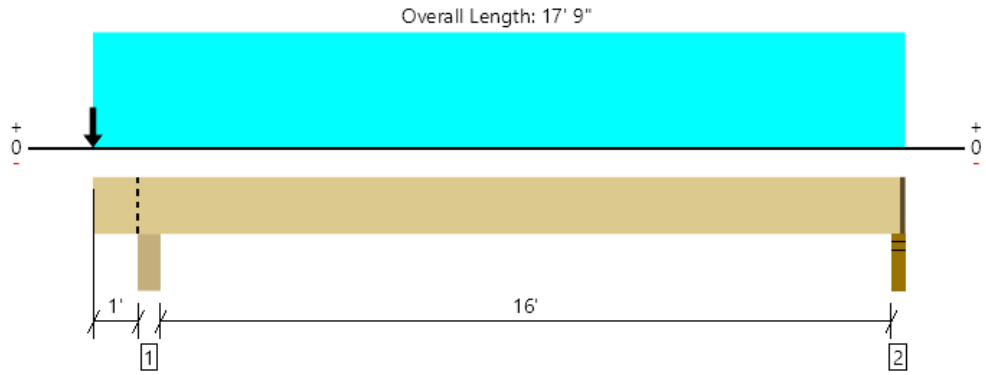
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Level 2, B9 - Cantilever Rim Beam

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



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)	10477 @ 1' 2 3/4"	12513 (5.50")	Passed (84%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	8032 @ 1/8"	9878	Passed (81%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-10018 @ 1' 2 3/4"	18346	Passed (55%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.103 @ 0	0.200	Passed (2L/286)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.116 @ 0	0.200	Passed (2L/254)	--	1.0 D + 1.0 S (Alt Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (0.2") and TL (0.2").
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Beam - GLB	5.50"	5.50"	4.61"	4779	325	5698	10477	Blocking
2 - Stud wall - SPF	3.50"	2.25"	1.50"	874	167/-8	320/-108	1239	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 8" o/c	
Bottom Edge (Lu)	17' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 17' 7 3/4"	N/A	13.0	--	--	
1 - Uniform (PSF)	0 to 17' 9" (Front)	6"	12.0	40.0	-	Floor
2 - Uniform (PSF)	0 to 17' 9" (Front)	2'	18.0	-	30.0	Roof
3 - Uniform (PSF)	0 to 17' 9" (Front)	8'	10.0	-	-	Wall
4 - Point (lb)	0 (Front)	N/A	2092	-	3026	Linked from: Cantilever Beam, Support 1
5 - Point (lb)	0 (Front)	N/A	1166	126	1746	Linked from: N/S Rim Beam, Support 1

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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
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

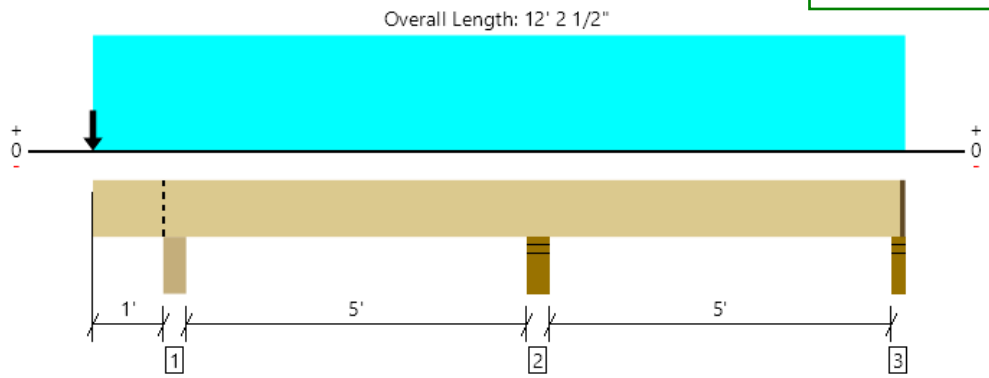
Weyerhaeuser

Level 2, B10 - N/S Cantilever Beam

1 piece(s) 7" x 11 7/8" 2.0E Parallam® PSL

An excessive uplift of -3287 lbs at support located at 6' 8 1/4" failed this product.

OK! HANGERS EACH END OF BEAM TAKE UPLIFT



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)	13577 @ 1' 2 3/4"	16363 (5.50")	Passed (83%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	10477 @ 1/8"	18481	Passed (57%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-12910 @ 1' 2 3/4"	45776	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.025 @ 0	0.200	Passed (2L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.046 @ 0	0.200	Passed (2L/644)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (0.2") and TL (0.2").
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Beam - SPF	5.50"	5.50"	4.56"	6272	619	7305	13577	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	-1350	360	-1937	-3287	None
3 - Stud wall - SPF	3.50"	2.25"	1.50"	367	155/-13	330	730	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 1" o/c	
Bottom Edge (Lu)	12' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12' 1 1/4"	N/A	26.0	--	--	
1 - Uniform (PSF)	0 to 12' 2 1/2" (Front)	1' 4"	12.0	40.0	-	Default Load
2 - Point (lb)	0 (Front)	N/A	4779	325	5698	Linked from: Cantilever Rim Beam, Support 1

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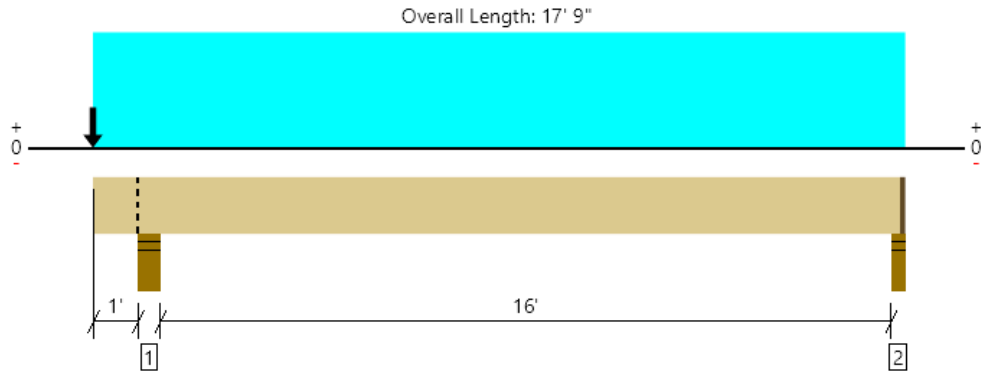
ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Level 2, B11 - E/W Grid 7 Beam
1 piece(s) 7" x 11 7/8" 2.0E 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)	4745 @ 17' 7"	6694 (2.25")	Passed (71%)	--	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	5826 @ 1/8"	18481	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	18528 @ 9' 8 9/16"	39805	Passed (47%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.383 @ 9' 4 7/8"	0.409	Passed (L/513)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.476 @ 9' 6 1/8"	0.818	Passed (L/412)	--	1.0 D + 1.0 L (Alt Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	3.41"	4001	4430	3754	10139	Blocking
2 - Stud wall - SPF	3.50"	2.25"	1.59"	1133	3671	-262	4804	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 8" o/c	
Bottom Edge (Lu)	17' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 17' 7 3/4"	N/A	26.0	--	--	
1 - Uniform (PSF)	0 to 17' 9" (Front)	11'	12.0	40.0	-	Default Load
2 - Point (lb)	0 (Front)	N/A	1166	126	1746	Linked from: N/S Rim Beam, Support 1
3 - Point (lb)	0 (Front)	N/A	1166	126	1746	Linked from: N/S Rim Beam, Support 1

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Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

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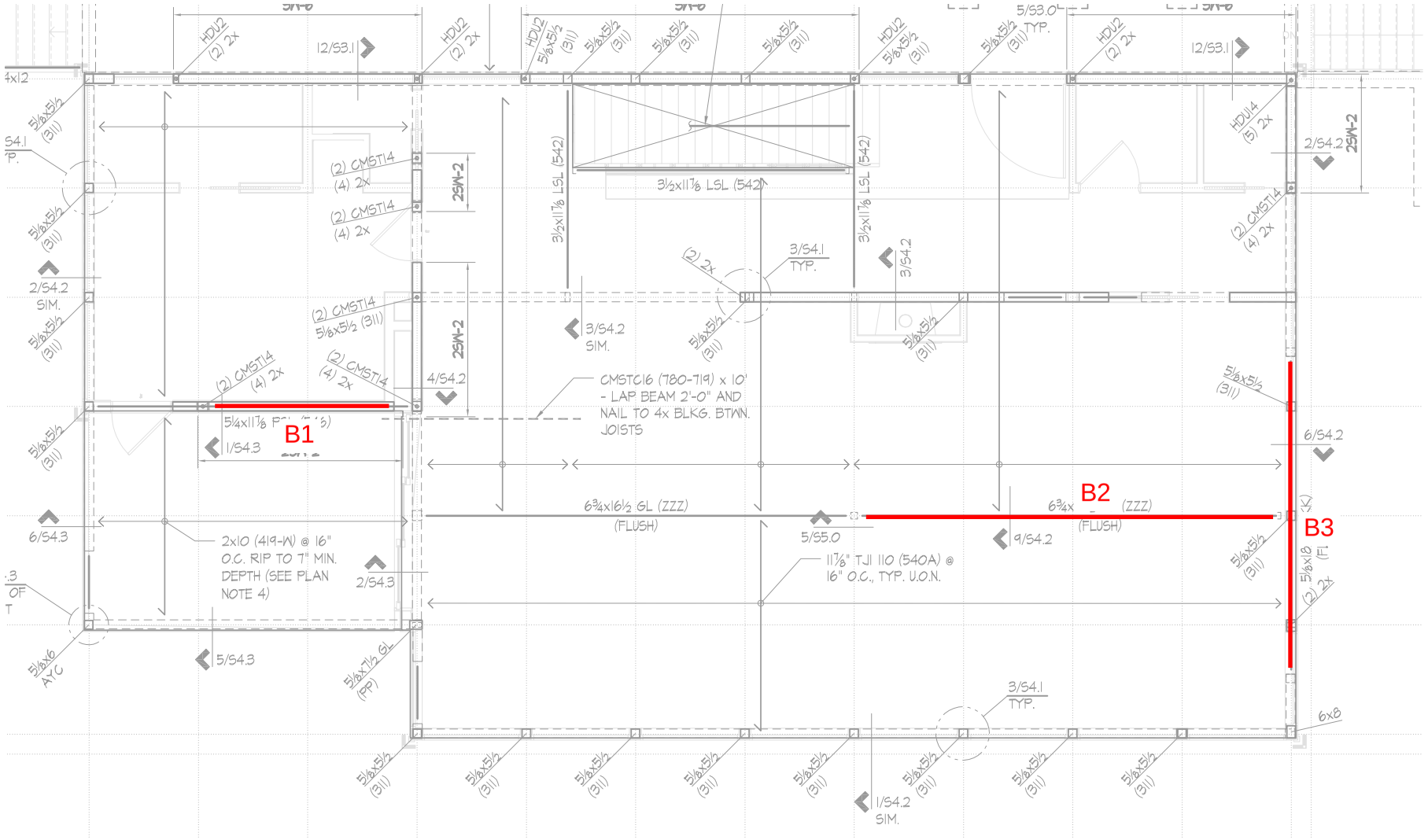
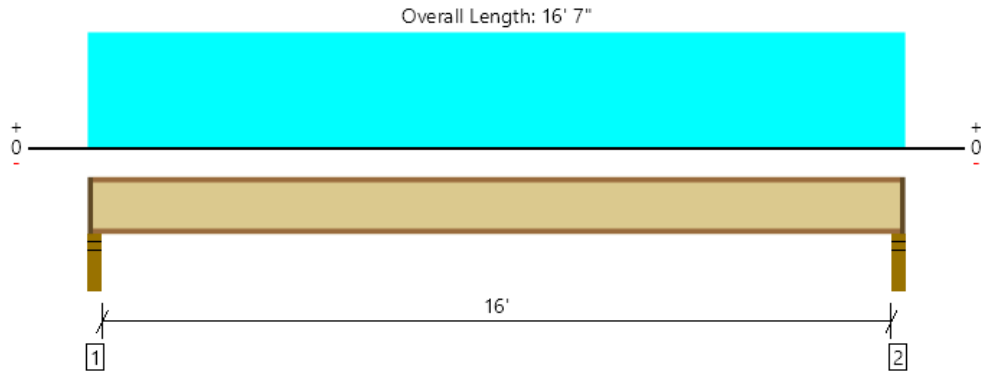


LEVEL 1 - BEAM KEY

Level 1, Joists
1 piece(s) 11 7/8" TJI® 110 @ 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)	568 @ 2 1/2"	1041 (2.25")	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	555 @ 3 1/2"	1560	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2265 @ 8' 3 1/2"	3160	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.275 @ 8' 3 1/2"	0.404	Passed (L/704)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.358 @ 8' 3 1/2"	0.808	Passed (L/542)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	43	40	Passed	--	--

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	133	442	575	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	133	442	575	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 8" o/c	
Bottom Edge (Lu)	16' 5" o/c	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 16' 7"	16"	12.0	40.0	Default Load

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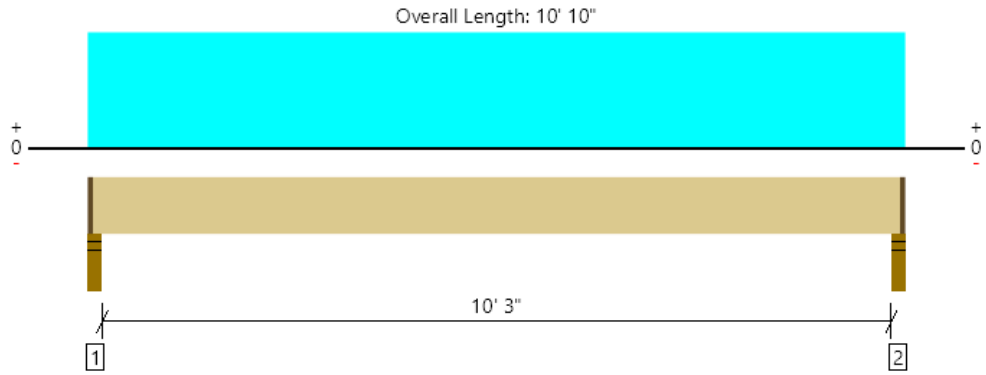
ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Level 1, Deck Joist
1 piece(s) 2 x 8 HF No.1 @ 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)	531 @ 2 1/2"	1367 (2.25")	Passed (39%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	452 @ 10 3/4"	1088	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1356 @ 5' 5"	1473	Passed (92%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.297 @ 5' 5"	0.347	Passed (L/421)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.371 @ 5' 5"	0.521	Passed (L/337)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	108	433	542	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	108	433	542	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 3" o/c	
Bottom Edge (Lu)	10' 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 10' 10"	16"	15.0	60.0	Default Load

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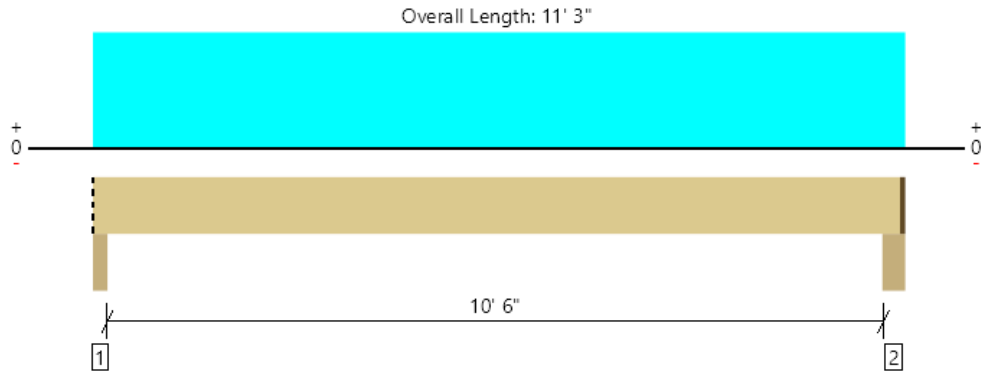
Level 1, B1 - Grid 6

1 piece(s) 5 1/4" x 11 7/8" 2.0E 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)	8382 @ 2"	11484 (3.50")	Passed (73%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	6444 @ 1' 3 3/8"	12053	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	21848 @ 5' 6 1/2"	29854	Passed (73%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.269 @ 5' 6 1/2"	0.269	Passed (L/480)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.351 @ 5' 6 1/2"	0.538	Passed (L/368)	--	1.0 D + 1.0 L (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Column - SPF	3.50"	3.50"	2.55"	1953	6428	8382	Blocking
2 - Column - SPF	5.50"	4.25"	2.58"	2010	6622	8632	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 2" o/c	
Bottom Edge (Lu)	11' 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 11' 1 3/4"	N/A	19.5	--	
1 - Uniform (PSF)	0 to 11' 3" (Front)	8'	12.0	40.0	Level 1 Floor
2 - Uniform (PSF)	0 to 11' 3" (Front)	5'	15.0	60.0	Level 1 Deck
3 - Uniform (PSF)	0 to 11' 3" (Front)	13' 6"	12.0	40.0	Level 2 Floor

Weyerhaeuser Notes

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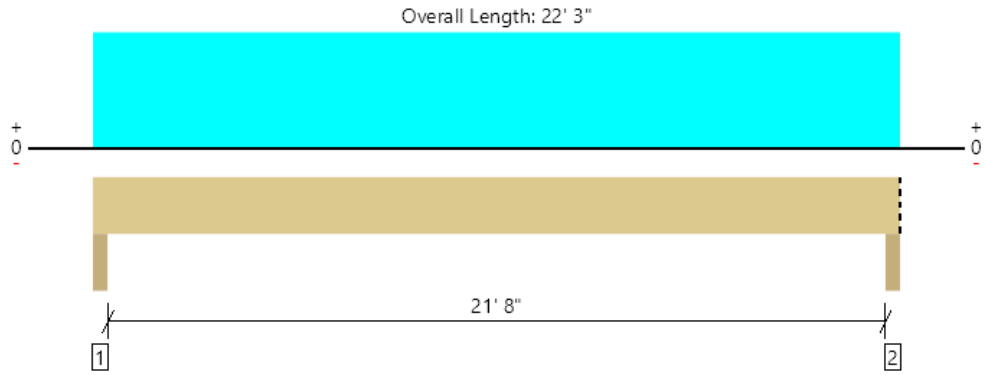
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

Level 1, B2 - Grid 7

1 piece(s) 6 3/4" x 16 1/2" 24F-V8 DF Glulam



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)	6665 @ 2"	15356 (3.50")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5666 @ 1' 8"	19676	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	35970 @ 11' 1 1/2"	57478	Passed (63%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.502 @ 11' 1 1/2"	0.548	Passed (L/524)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.684 @ 11' 1 1/2"	1.096	Passed (L/385)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.94 that was calculated using length L = 21' 11".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Column - SPF	3.50"	3.50"	1.52"	1770	4895	6665	None
2 - Column - SPF	3.50"	3.50"	1.52"	1770	4895	6665	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)	22' 3" o/c	
Bottom Edge (Lu)	22' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 22' 3"	N/A	27.1	--	
1 - Uniform (PSF)	0 to 22' 3" (Front)	11'	12.0	40.0	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
Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

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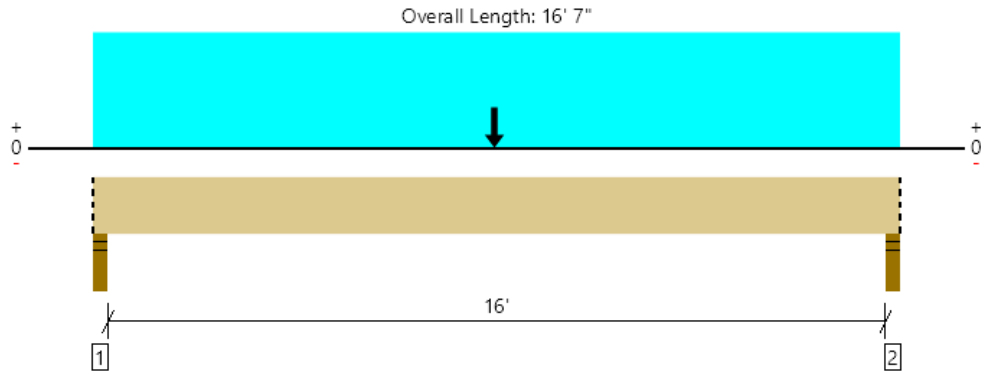
Level 1, B3 - Grid L
1 piece(s) 5 1/8" x 18" 24F-V8 DF Glulam



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)	6258 @ 2"	7623 (3.50")	Passed (82%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	4882 @ 1' 9 1/2"	16298	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	34857 @ 8' 3"	54531	Passed (64%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.211 @ 8' 3 7/16"	0.406	Passed (L/923)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.336 @ 8' 3 7/16"	0.813	Passed (L/580)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.99 that was calculated using length L = 16' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	2.87"	2402	2902	2239	6258	Blocking
2 - Stud wall - SPF	3.50"	3.50"	2.86"	2393	2877	2239	6230	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)	16' 7" o/c	
Bottom Edge (Lu)	16' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16' 7"	N/A	22.4	--	--	
1 - Uniform (PSF)	0 to 16' 7" (Front)	1' 4"	12.0	40.0	-	Floors
2 - Uniform (PSF)	0 to 16' 7" (Front)	9'	16.0	-	30.0	Roof
3 - Point (lb)	8' 3" (Front)	N/A	1770	4895	-	Linked from: Beam - Grid 7, Support 1

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Gerald Eggink Quantum Consulting Engineers LLC (206) 957-3900 geggink@quantumce.com	

Weyerhaeuser

GUARDRAIL DESIGN
MINIMUM ANCHORAGE

CHECK ANCHORAGE TO 6x STRINGER

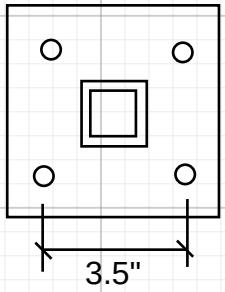
M = 7200 LB-IN

T=C = M/d = 7200 / 3.5"
T=C = 2060 LBS

C_d

1/4" x 6" SDS = 560 x 2.0 = 1120 LBS

(2) SDS = 2240 LBS > 2060 LBS



CHECK ANCHORAGE TO CONCRETE STAIR

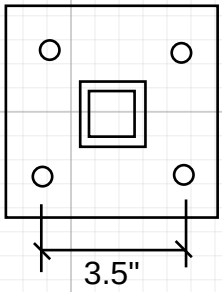
M = 7200 LB-IN

T=C = M/d = 7200 / 3.5"
T=C = 2060 LBS

1/4" TITEN ANCHOR (2" EMBED) = 1240 LBS

(2) TITENS = 2480 LBS > 2060 LBS

See next page(s) for Titen anchorage check



QUANTUM
CONSULTING ENGINEERS
1511 THIRD AVENUE
SUITE 323
SEATTLE, WA 98101
TEL 206.957.3900
FAX 206.957.3901
www.quantumce.com

INTRACHAT RESIDENCE — project
3/12/2024 — date
22252.01 — job no.
drawn by:
LINDAL — client
GAE — design by:

Company:		Date:	3/12/2024
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

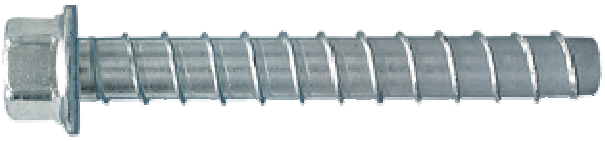
General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.250
Nominal Embedment depth (inch): 2.500
Effective Embedment depth, h_{ef} (inch): 1.940
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 3.50
c_{ac} (inch): 6.00
C_{min} (inch): 1.50
S_{min} (inch): 1.50

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 12.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: A tension, A shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 4.50 x 4.50 x 0.25

Recommended Anchor
Anchor Name: Titen HD® - 1/4"Ø Titen HD, hnom:2.5" (64mm)
Code Report: ICC-ES ESR-2713

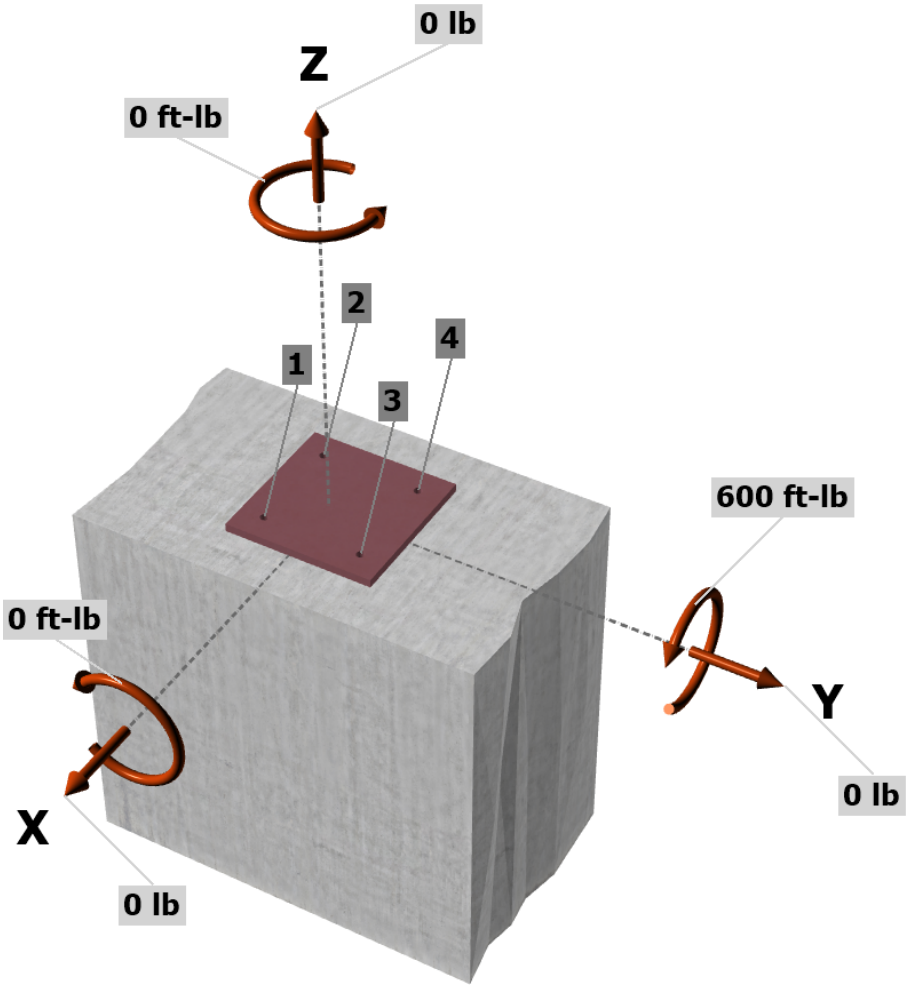


Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

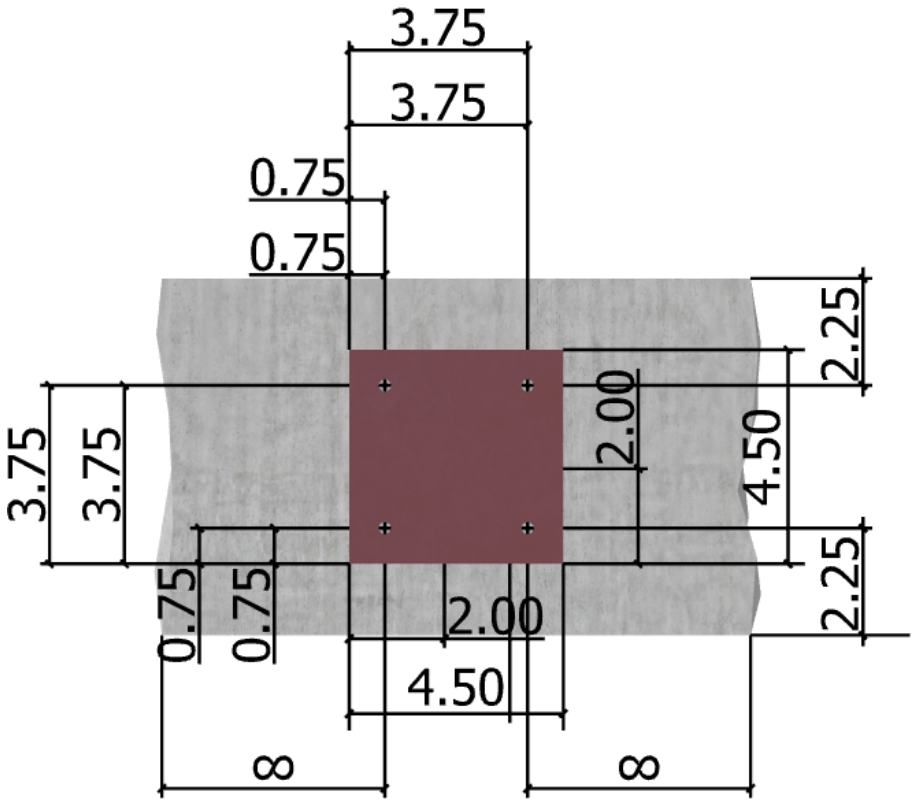
Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 0
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 600
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

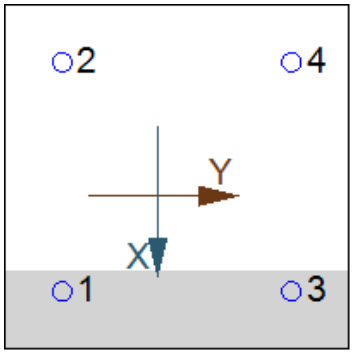


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	0.0	0.0	0.0
2	1055.5	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	1055.5	0.0	0.0	0.0
Sum	2110.9	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.21
Maximum concrete compression stress (psi): 921
Resultant tension force (lb): 2111
Resultant compression force (lb): 2111
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

<Figure 3>



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

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
5195	0.65	3377

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

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

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	1.940	2297

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

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
45.51	33.87	2.25	1.000	0.932	1.00	1.000	2297	0.75	2157

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

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

$\Psi_{c,P}$	λ_a	N_p (lb)	f'_c (psi)	n	ϕ	ϕN_{pn} (lb)
1.0	1.00	1905	2500	0.50	0.65	1238

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	1055	3377	0.31	Pass
Concrete breakout	**2111**	**2157**	**0.98**	**Pass (Governs)**
Pullout	1055	1238	0.85	Pass

1/4"Ø Titen HD, hnom:2.5" (64mm) meets the selected design criteria.

12. Warnings

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

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

INTRACHAT RESIDENCE
7929 East Mercer Way
Mercer Island, WA

Quantum Job Number: 22252.01

LATERAL DESIGN

QUANTUM | CONSULTING ENGINEERS

1511 Third Avenue, Suite 323 T. 206.957.3900
Seattle, WA 98101 F. 206.957.3901

Project	Intrachat Residence	Job #	22252.01	Page	
Client	Lindal	By	GAE	Date	09/15/23
Subject	Seismic Dead Load Calculations	Checked		Date	

SEISMIC DEAD LOAD VALUES

ROOF LEVEL

ELEMENT	AREA (FT^2)	UNIT WT. (PSF)	WEIGHT (LB)
ROOF FRAMING	2600	16	41600
WALLS BELOW	1400	10	13995
			0

NOTE:

4' Trib Height Used For Walls

TOTAL DL 55595 LB

Level 2

ELEMENT	AREA (FT^2)	UNIT WT. (PSF)	WEIGHT (LB)
FLOOR FRAMING	1950	12	23400
WALLS ABOVE	1400	10	13995
WALLS BELOW	1093	10	10925
			0
			0
			0

NOTE:

4' Trib Height Used For Walls Above
4.75' Trib Height Used For Walls Below

TOTAL DL 48320 LB

Level 1

ELEMENT	AREA (FT^2)	UNIT WT. (PSF)	WEIGHT (LB)
FLOOR FRAMING	1775	12	21300
DECK FRAMING	175	15	2625
WALLS ABOVE	1093	10	10925
WALLS BELOW	1000	10	10000

NOTE:

4.75' Trib Height Used For Walls Above
4' Trib Height Used For Walls Below

TOTAL DL 44850 LB

Seismic Base Shear for the Equivalent Lateral Force Procedure

Per IBC 2018 & ASCE 7-16

Structure: **Intrachat Residence**
Address: **7929 East Mercer Way**
Latitude: **47.5313** Longitude: **-122.2212**

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_o: **3** per ASCE Table 12.2-1
C_d: **4** per ASCE Table 12.2-1
h_n (ft): **30.00** height above the base to the highest level of the structure

Site Ground Motion

Reg. Structure/5 Stories Max: **Yes** **Sds (max) = 1.0** Per ASCE 12.8.1.3
S_1 (g-sec): **0.50** S_S (g-sec): **1.46**
Site Class: **D** **Per Geotechnical Report** per ASCE 11.4.3

F_v **1.80** F_a **1.00**

S_{M1} (g-sec): **0.90** S_{MS} (g-sec): **1.46** per ASCE 11.4.4
S_{D1} (g-sec): **0.60** S_{DS} (g-sec): **0.97** per ASCE 11.4.5
SDC: **D** per ASCE 11.6
I_E: **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_L (sec): **6.00** ASCE Figures 22-14 through 22-17
T_S: 0.62

Ta (sec): 0.26 Ct * hnx per ASCE Eq. 12.8-7

T_{use} (sec): **0.26** <= TL

Equivalent Lateral Force Procedure Design Base Shear per ASCE 12.8

C_s: 0.15 = S_{DS} / (R/I_E) per ASCE Eq. 12.8-2
$C_{s\text{-}max}$: 0.36 = S_{D1} / (T_a*R/I_E) for T <= T_L per ASCE Eq. 12.8-3
$C_{s\text{-}max}$: 8 = S_{D1}*T_L / (T_a^2*R/I_E) for T > T_L per ASCE Eq. 12.8-4
$C_{s\text{-}min}$: 0.04 per ASCE Eq. 12.8-5
$C_{s\text{-}min}$: -- = 0.5S_1 / (R/I_E) for S_1 => 0.6g per ASCE Eq. 12.8-6
$C_{s\text{-}use}$: 0.150

V : 0.150 W = $C_{S\text{-}use}$ * W per ASCE Eq. 12.8-1

Vert. Distribution of Seismic Forces for the Equiv. Lateral Force Procedure

Per IBC 2018 & ASCE 7-16

Structure: **Intrachat Residence**

Seismic Parameters

I_E:	1.00	per ASCE Table 1.5-2
S_{DS} (g-sec):	0.97	per ASCE 11.4.4
Period (Sec):	0.26	per ASCE 12.8.2.1
k:	1.00	per ASCE 12.8.3

Vertical Distribution of Seismic Forces per ASCE 12.8.3

$F_x = C_{vx}V$ per ASCE Eq. 12.8-11

$C_{vx} = (w_x h_x^k)/(\Sigma w_i h_i^k)$ per ASCE Eq. 12.8-12

Level	h_x (ft)	w_x (k)	% of W_{total}	$w_x * h_x^k$	C_{vx} (%)	F_x (k)	V_x (k)
Roof	30.00	55.60	37.4%	1667.9	55.3%	12.33	
Level 2	19.50	48.32	32.5%	942.2	31.3%	6.96	12.33
Level 1	9.00	44.85	30.1%	403.7	13.4%	2.98	19.29
							22.28

Total WT (k): 148.77 Sum: 3014

$C_{s\text{-}use}$: 0.150

V (k): 22.28 per ASCE 12.8.1

Vertical Distribution of Seismic Diaphragm Forces per ASCE 12.10.1.1

$F_{px} = (SF_i/Sw_i) * w_{px}$ per ASCE Eq 12.10-1

$F_{px\text{-}max} = 0.4*S_{DS}*I_E*w_{px}$ per per ASCE 12.10.1.1

$F_{px\text{-}min} = 0.2*S_{DS}*I_E*w_{px}$ per per ASCE 12.10.1.1

Level	w_{px} (k)	Σw_i (k)	F_x (k)	ΣF_i (k)	F_{px} (k)	Notes	Diaphragm/Story Force Ratio
Roof	55.60	55.60	12.33	12.33	12.33		1.000
Level 2	48.32	103.92	6.96	19.29	9.41	= Fp-min	1.351
Level 1	44.85	148.77	2.98	22.28	8.73	= Fp-min	2.926

Wind Loads Criteria

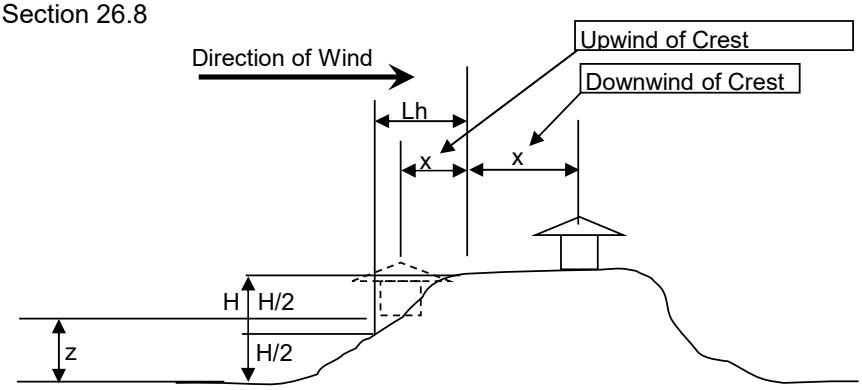
ASCE 7-16

Wind Load Criteria

Risk Category:	II	Table 1.5-1	Roof Type:	Flat	<=3deg
Basic Wind Speed:	98	Figure 26.5.1	Roof Slope:	0.0:12	0.0 DEG
Exposure Category:	C	Section 26.7.3	Mean Roof HT:	28.0 ft	UP TO 160FT
Ground Elevation:	190 ft		Parapet:	No	
Wall Ht:	25.0 ft				UP TO 160FT

Wind Topographic Factor, K_{zt}:

per Section 26.8



Terrain Type:	Per Local Jurisdiction
Direction:	Upwind of Crest

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

K_{zt}:	NA	*EQUATION 26.8-1*
K_{zt}:	1.60	*MANUALLY INPUT*

K_e: 0.993 ASCE 26.10.1

K_d: 0.85 ASCE 26.6

Wind Loads - Main Wind Force Resisting System

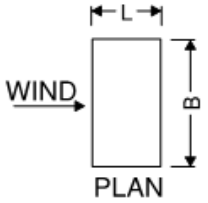
ASCE 7-16 Chapter 27.3 Part 1 - Enclosed Simple Diaphragm, h<160ft

Wind Load Criteria

Risk Category:	**II**	Table 1.5-1	K_e:	**0.9931**	Section 26.10.1
Basic Wind Speed:	**98 mph**	Figure 26.5.1	K_d:	**0.85**	Section 26.6
Exposure Category:	**C**	Section 26.7.3	G:	**0.85**	Section 26.11
K_{zt}:	**1.60**	Section 26.8	Wall Height:	**25.0 ft**	

L/B Ratio:

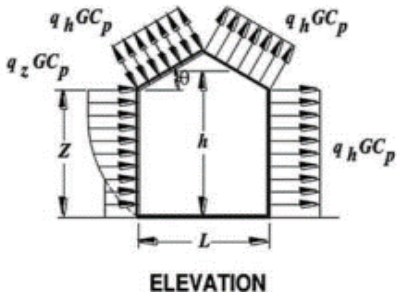
Short Dimension:	**33.0 ft**
Long Dimension:	**61.0 ft**
Transverse Wind L/B:	0.5409836
Longitudinal Wind L/B:	1.8



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

Wall Pressures:

K_h & K_z:	0.945	At Top of Wall
K_z:	0.85	0 ft to 15 ft



ELEVATION

	Transverse Wind Direction	Longitudinal Wind Direction	
Top of Wall:	**34.7 psf**	**30.2 psf**	ASCE EQ 27.3-1
0 ft to 15 ft Wall:	**32.5 psf**	**28.0 psf**	ASCE EQ 27.3-1

*Enveloped Leeward and Windward Pressure

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

Lateral Analysis

Base Shear

Wind

N/S Exposure

Roof:	5.5'(61') * 34.7 PSF =	11.64 kips	
Level 2	9.75'(61') * 34.7 PSF =	20.64 kips	
Level 1	9.75'(61') * 19.8PSF =	11.79 kips	Windward Only
		44.07 kips	

E/W Exposure

Roof:	5.5'(33') * 34.7 PSF =	6.30 kips	
Level 2	9.75'(33') * 34.7 PSF =	11.16 kips	
Level 1	9.75'(33') * 32.5 PSF =	10.46 kips	
		27.92 kips	

Seismic

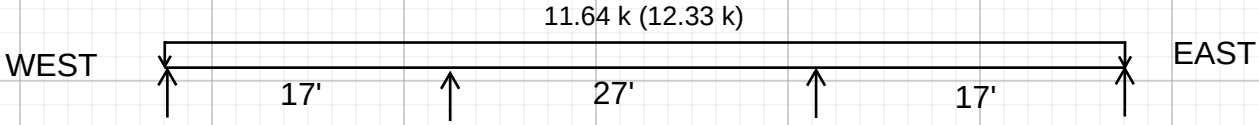
Roof:	12.33 kips	
Level 2	6.96 kips	
Level 1	2.98 kips	
	22.27 kips	

LATERAL ANALYSIS

(SEISMIC VALUES IN PARENTHESIS)

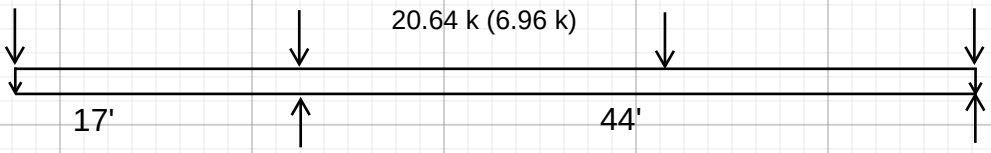
NORTH/SOUTH EXPOSURE

ROOF



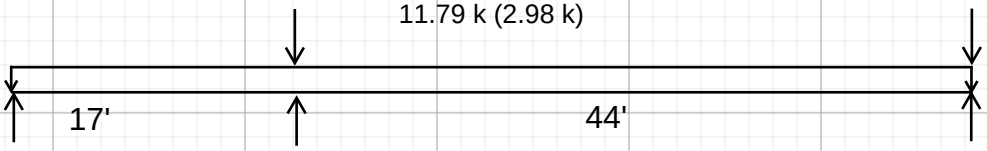
REACTION (KIPS)	1.62 (1.72)	4.20 (4.45)	4.20 (4.45)	1.62 (1.72)
GRIDLINE	A	D	I	L

LEVEL 2



REACTION (KIPS)		20.63 (12.34)	11.64 (6.96)
GRIDLINE		D	L

LEVEL 1



REACTION (KIPS)	1.64 (0.42)	26.52 (13.83)	15.89 (8.03)
GRIDLINE	A	D	L

QUANTUM CONSULTING ENGINEERS
1511 THIRD AVENUE
SUITE 323
SEATTLE, WA 98101
TEL 206.957.3900
FAX 206.957.3901
www.quantumce.com

INTRACHAT RESIDENCE	7/7/2023	22252.01
project	date	job no.
	drawn by:	
LINDAL	GAE	
client	design by:	sheet no. C-7

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Roof**

Sds = 0.97
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 15.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory of Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**A**	**17.50**	-	-	-	-	-	-	-	-	-
SW Segment	1.10	17.50	8.00	0.46	S-P-F #1/#2	0.42	Interstory	8.00	10.0	10.0	16.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID	**D**	**28.50**	-	-	-	-	-	-	-	-	-
SW Segment	2.10	18.00	8.00	0.44	S-P-F #1/#2	0.42	Interstory	8.00	10.0	10.0	16.0
SW Segment	2.20	10.50	8.00	0.76	S-P-F #1/#2	0.42	Interstory	8.00	10.0	10.0	16.0
SW Segment											
SW Segment											
SW Segment											
SW GRID	**I**	**29.00**	-	-	-	-	-	-	-	-	-
SW Segment	3.10	29.00	8.00	0.28	S-P-F #1/#2	0.42	Interstory	8.00	10.0	10.5	16.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID	**L**	**28.50**	-	-	-	-	-	-	-	-	-
SW Segment	4.10	28.50	8.00	0.28	S-P-F #1/#2	0.42	Interstory	8.00	10.0	10.0	16.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**A**	1720	1620	-	-	-	-	-	-
SW Segment	1.10	1720	1620	4200			**SW-6**	**2**	**No Strap**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID	**D**	4450	4200				-	-	-
SW Segment	2.10	2811	2653	4320			**SW-6**	**2**	**No Strap**
SW Segment	2.20	1639	1547	2520			**SW-6**	**2**	**No Strap**
SW Segment									
SW Segment									
SW Segment									
SW GRID	**I**	4450	4200				-	-	-
SW Segment	3.10	4450	4200	7192			**SW-6**	**2**	**No Strap**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID	**L**	1720	1620				-	-	-
SW Segment	4.10	1720	1620	6840			**SW-6**	**2**	**No Strap**
SW Segment									
SW Segment									
SW Segment									
SW Segment									

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Roof**

Shear Wall Schedule (LRFD) ϕ_D = 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

**See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
1.10	98	1.00	107	93	101	107	SW-6	416	OK	Seismic
2.10	156	1.00	170	147	160	170	SW-6	416	OK	Seismic
2.20	156	1.00	170	147	160	170	SW-6	416	OK	Seismic
3.10	153	1.00	167	145	157	167	SW-6	416	OK	Seismic
4.10	60	1.00	66	57	62	66	SW-6	416	OK	Seismic

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
1.10	17.50	17.29	1.20%	No	
2.10	18.00	17.79	1.17%	No	
2.20	10.50	10.29	2.02%	No	
3.10	29.00	28.79	0.72%	No	
4.10	28.50	28.29	0.74%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Roof**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
1.10	550		550	444		444	2100	2100
2.10	874		874	707		707	2160	2160
2.20	874		874	707		707	1260	1260
3.10	859		859	695		695	3596	3596
4.10	338		338	273		273	3420	3420

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
1.10	816	424	816	424	**424**	No Strap	**0**	**OK**
2.10	589	128	589	128	**128**	No Strap	**0**	**OK**
2.20	427	-289	427	-289	**-289**	No Strap	**0**	**OK**
3.10	1462	810	1462	810	**810**	No Strap	**0**	**OK**
4.10	1779	1250	1779	1250	**1250**	No Strap	**0**	**OK**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Level 2**

Sds = 0.97
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 15.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory of Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**D**	**11.00**	-	-	-	-	-	-	-	-	-
SW Segment	1.10	7.50	9.50	1.27	S-P-F #1/#2	0.42	Interstory	9.50	10.0	2.0	12.0
SW Segment	1.20	3.50	9.50	2.71	S-P-F #1/#2	0.42	Interstory	9.50	10.0	2.0	12.0
SW Segment											
SW Segment											
SW Segment											
SW GRID	**L**	**5.83**	-	-	-	-	-	-	-	-	-
SW Segment	2.10	5.83	9.50	1.63	S-P-F #1/#2	0.42	Base	9.50	10.0	1.0	12.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**D**	12340	20630	-	-	-	-	-	-
SW Segment	1.10	8414	14066	893			**2SW-2**	**2**	**(2) CMST14 (12950)**
SW Segment	1.20	3926	6564	417			**2SW-2**	**2**	**(2) CMST14 (12950)**
SW Segment									
SW Segment									
SW Segment									
SW GRID	**L**	6960	11640				-	-	-
SW Segment	2.10	6960	11640	624			**2SW-2**	**5**	**HDU14 (5) Studs (14390DF, 12375HF)**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID							-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID							-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Level 2**

Shear Wall Schedule (LRFD) ϕ_D = 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

**See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
1.10	1122	1.00	1219	1875	2039	2039	2SW-2	2864	OK	Wind
1.20	1122	0.91	1339	1875	2238	2238	2SW-2	2864	OK	Wind
2.10	1194	1.00	1298	1997	2170	2170	2SW-2	2864	OK	Wind

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
1.10	7.50	7.29	2.86%	No	
1.20	3.50	3.29	6.33%	No	
2.10	5.83	4.95	17.78%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Level 2**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
1.10	7460		7460	10690		10690	446	446
1.20	7460		7460	10690		10690	208	208
2.10	7939		7939	11380		11380	312	312

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
1.10	-10422	-7253	-10422	-7253	**-10422**	(2) CMST14 (12950)	**-12980**	**OK**
1.20	-10565	-7363	-10565	-7363	**-10565**	(2) CMST14 (12950)	**-12980**	**OK**
2.10	-11193	-7794	-11193	-7794	**-11193**	HDU14 (5) Studs (14390DF, 1237	**-12375**	**OK**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Level 1**

Sds = 0.97
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 15.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory of Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**A**	**27.00**	-	-	-	-	-	-	-	-	-
SW Segment	1.10	27.00	8.00	0.30	S-P-F #1/#2	0.42	Base	8.00	10.0	1.0	12.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID	**D**	**26.75**	-	-	-	-	-	-	-	-	-
SW Segment	2.10	26.75	8.00	0.30	S-P-F #1/#2	0.42	Base	8.00	10.0	2.0	12.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID	**L**	**13.50**	-	-	-	-	-	-	-	-	-
SW Segment	3.10	13.50	8.00	0.59	S-P-F #1/#2	0.42	Base	8.00	10.0	1.0	12.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**A**	420	1640	-	-	-	-	-	-
SW Segment	1.10	420	1640	2484			**SW-6**	**2**	**No HD**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID	**D**	13830	26520				-	-	-
SW Segment	2.10	13830	26520	2782			**SW-2**	**2**	**HDU8 (6765DF, 5820HF)**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID	**L**	8030	15890				-	-	-
SW Segment	3.10	8030	15890	1242			**SW-2**	**3**	**HDU8 (3) Studs (7870DF, 6580HF)**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID							-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Level 1**

Shear Wall Schedule (LRFD) ϕ_D = 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

**See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
1.10	16	1.00	17	61	66	66	SW-6	584	OK	Wind
2.10	517	1.00	562	991	1078	1078	SW-2	1432	OK	Wind
3.10	595	1.00	647	1177	1279	1279	SW-2	1432	OK	Wind

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
1.10	27.00	26.63	1.41%	No	
2.10	26.75	26.26	1.86%	No	
3.10	13.50	12.89	4.77%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **North/South Exposure**
Floor Level: **Level 1**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
1.10	87		87	292		292	1242	1242
2.10	2895		2895	4759		4759	1391	1391
3.10	3331		3331	5650		5650	621	621

Determine Required Holdown (ASD)

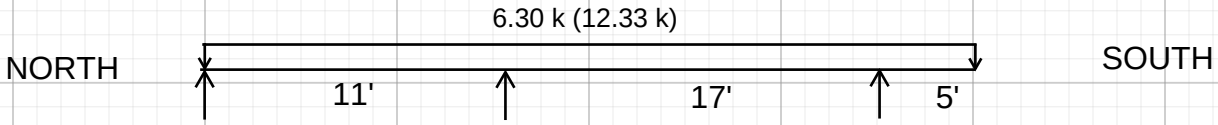
SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
1.10	454	489	454	489	**454**	No HD	**0**	**OK**
2.10	-3924	-2250	-3924	-2250	**-3924**	HDU8 (6765DF, 5820HF)	**-5820**	**OK**
3.10	-5277	-3043	-5277	-3043	**-5277**	HDU8 (3) Studs (7870DF, 6580HF	**-6580**	**OK**

LATERAL ANALYSIS

(SEISMIC VALUES IN PARENTHESIS)

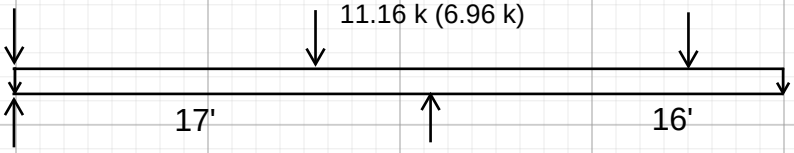
EAST/WEST EXPOSURE

ROOF



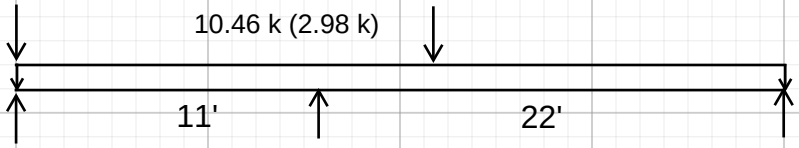
REACTION (KIPS)	1.05 (2.06)	2.67 (5.23)	2.58 (5.04)
GRIDLINE	3	5	8

LEVEL 2



REACTION (KIPS)	4.87 (5.70)	12.59 (13.59)
GRIDLINE	3	6

LEVEL 1



REACTION (KIPS)	6.61 (6.20)	14.39 (11.37)	6.92 (4.70)
GRIDLINE	3	5	6

TO CONCRETE FOUNDATION WALL

QUANTUM CONSULTING ENGINEERS
1511 THIRD AVENUE
SUITE 323
SEATTLE, WA 98101
TEL 206.957.3900
FAX 206.957.3901
www.quantumce.com

INTRACHAT RESIDENCE	7/7/2023	22252.01
project	date	job no.
	drawn by:	
LINDAL	GAE	
client	design by:	C-17 sheet no.

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Roof**

Sds = 0.97
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 15.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory of Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**3**	**18.00**	-	-	-	-	-	-	-	-	-
SW Segment	1.10	12.00	8.00	0.67	S-P-F #1/#2	0.42	Interstory	8.00	10.0	2.0	16.0
SW Segment	1.20	6.00	8.00	1.33	S-P-F #1/#2	0.42	Interstory	8.00	10.0	2.0	16.0
SW Segment											
SW Segment											
SW Segment											
SW GRID	**5**	**12.75**	-	-	-	-	-	-	-	-	-
SW Segment	2.10	12.75	8.00	0.63	S-P-F #1/#2	0.42	Interstory	8.00	10.0	2.0	16.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID	**8**	**11.25**	-	-	-	-	-	-	-	-	-
SW Segment	3.10	5.50	8.00	1.45	S-P-F #1/#2	0.42	Interstory	8.00	10.0	2.0	16.0
SW Segment	3.20	5.75	8.00	1.39	S-P-F #1/#2	0.42	Interstory	8.00	10.0	2.0	16.0
SW Segment											
SW Segment											
SW Segment											
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**3**	2060	1050	-	-	-	-	-	-
SW Segment	1.10	1373	700	1344			**SW-6**	**2**	**CS16 (1705)**
SW Segment	1.20	687	350	672			**SW-6**	**2**	**CS16 (1705)**
SW Segment									
SW Segment									
SW Segment									
SW GRID	**5**	5230	2670				-	-	-
SW Segment	2.10	5230	2670	1428			**SW-4**	**2**	**(2) CS16 (3410)**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID	**8**	5040	2580				-	-	-
SW Segment	3.10	2464	1261	616			**SW-4**	**2**	**(2) CS16 (3410)**
SW Segment	3.20	2576	1319	644			**SW-4**	**2**	**(2) CS16 (3410)**
SW Segment									
SW Segment									
SW Segment									
SW GRID							-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Roof**

Shear Wall Schedule (LRFD) ϕ_D = 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

**See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
1.10	114	1.00	124	58	63	124	SW-6	416	OK	Seismic
1.20	114	1.00	124	58	63	124	SW-6	416	OK	Seismic
2.10	410	1.00	446	209	228	446	SW-4	608	OK	Seismic
3.10	448	1.00	487	229	249	487	SW-4	608	OK	Seismic
3.20	448	1.00	487	229	249	487	SW-4	608	OK	Seismic

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
1.10	12.00	11.79	1.77%	No	
1.20	6.00	5.79	3.60%	No	
2.10	12.75	12.54	1.66%	No	
3.10	5.50	5.29	3.94%	No	
3.20	5.75	5.54	3.76%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Roof**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
1.10	641		641	280		280	672	672
1.20	641		641	280		280	336	336
2.10	2297		2297	1005		1005	714	714
3.10	2509		2509	1101		1101	308	308
3.20	2509		2509	1101		1101	322	322

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
1.10	123	-329	123	-329	**-329**	CS16 (1705)	**-1705**	**OK**
1.20	-78	-485	-78	-485	**-485**	CS16 (1705)	**-1705**	**OK**
2.10	-577	-1966	-577	-1966	**-1966**	(2) CS16 (3410)	**-3410**	**OK**
3.10	-916	-2366	-916	-2366	**-2366**	(2) CS16 (3410)	**-3410**	**OK**
3.20	-908	-2359	-908	-2359	**-2359**	(2) CS16 (3410)	**-3410**	**OK**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Level 2**

Sds = 0.97
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 15.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory of Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**3**	**40.00**	-	-	-	-	-	-	-	-	-
SW Segment	1.10	11.50	9.50	0.83	S-P-F #1/#2	0.42	Base	9.50	10.0	5.5	12.0
SW Segment	1.20	17.00	9.50	0.56	S-P-F #1/#2	0.42	Base	9.50	10.0	5.5	12.0
SW Segment	1.30	11.50	9.50	0.83	S-P-F #1/#2	0.42	Base	9.50	10.0	5.5	12.0
SW Segment											
SW Segment											
SW GRID	**6**	**10.33**	-	-	-	-	-	-	-	-	-
SW Segment	2.10	10.33	9.50	0.92	S-P-F #1/#2	0.42	Interstory	9.50	10.0	5.5	12.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**3**	5700	4870	-	-	-	-	-	-
SW Segment	1.10	1639	1400	1852			**SW-6**	**2**	**HDU2 (3075DF,2215HF)**
SW Segment	1.20	2423	2070	2737			**SW-6**	**2**	**HDU2 (3075DF,2215HF)**
SW Segment	1.30	1639	1400	1852			**SW-6**	**2**	**HDU2 (3075DF,2215HF)**
SW Segment									
SW Segment									
SW GRID	**6**	13590	12590				-	-	-
SW Segment	2.10	13590	12590	1663			**2SW-2**	**2**	**(2) CMST14 (12950)**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID							-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID							-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Level 2**

Shear Wall Schedule (LRFD) ϕ_D = 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

**See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
1.10	143	1.00	155	122	132	155	SW-6	416	OK	Seismic
1.20	143	1.00	155	122	132	155	SW-6	416	OK	Seismic
1.30	143	1.00	155	122	132	155	SW-6	416	OK	Seismic
2.10	1316	1.00	1430	1219	1325	1430	2SW-2	2048	OK	Seismic

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
1.10	11.50	11.02	4.40%	No	
1.20	17.00	16.52	2.93%	No	
1.30	11.50	11.02	4.40%	No	
2.10	10.33	10.12	2.06%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Level 2**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
1.10	948		948	694		694	926	926
1.20	948		948	694		694	1369	1369
1.30	948		948	694		694	926	926
2.10	8749		8749	6947		6947	832	832

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
1.10	-139	-518	-139	-518	**-518**	HDU2 (3075DF,2215HF)	**-2215**	**OK**
1.20	127	-312	127	-312	**-312**	HDU2 (3075DF,2215HF)	**-2215**	**OK**
1.30	-139	-518	-139	-518	**-518**	HDU2 (3075DF,2215HF)	**-2215**	**OK**
2.10	-6448	-8363	-6448	-8363	**-8363**	(2) CMST14 (12950)	**-12980**	**OK**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Level 1**

Sds =	0.97
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) =	15.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory of Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**5**	**29.25**	-	-	-	-	-	-	-	-	-
SW Segment	1.10	29.25	8.00	0.27	S-P-F #1/#2	0.42	Base	8.00	10.0	8.5	12.0
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID	**6**	**60.50**	-	-	-	-	-	-	-	-	-
SW Segment	2.10	44.50	8.00	0.18	S-P-F #1/#2	0.42	Base	8.00	10.0	5.5	12.0
SW Segment	2.30	16.00	8.00	0.50	S-P-F #1/#2	0.42	Base	8.00	10.0	5.5	12.0
SW Segment											
SW Segment											
SW Segment											
SW GRID	**6**	**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW Segment											
SW Segment											
SW Segment											
SW Segment											
SW Segment											

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**5**	11370	14390	-	-	-	-	-	-
SW Segment	1.10	11370	14390	5324			**SW-4**	**2**	**HDU2 (3075DF,2215HF)**
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID	**6**	4700	6920				-	-	-
SW Segment	2.10	3457	5090	6497			**SW-6**	**2**	**No HD**
SW Segment	2.30	1243	1830	2336			**SW-6**	**2**	**No HD**
SW Segment									
SW Segment									
SW Segment									
SW GRID	**6**						-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW GRID							-	-	-
SW Segment									
SW Segment									
SW Segment									
SW Segment									
SW Segment									

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Level 1**

Shear Wall Schedule (LRFD) ϕ_D = 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

**See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
1.10	389	1.00	423	492	535	423	SW-4	608	OK	Seismic
2.10	78	1.00	84	114	124	124	SW-6	584	OK	Wind
2.30	78	1.00	84	114	124	124	SW-6	584	OK	Wind

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
1.10	29.25	28.77	1.68%	No	
2.10	44.50	44.13	0.85%	No	
2.30	16.00	15.63	2.40%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **East/West Exposure**
Floor Level: **Level 1**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
1.10	2177		2177	2361		2361	2662	2662
2.10	435		435	549		549	3249	3249
2.30	435		435	549		549	1168	1168

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
1.10	-764	-941	-764	-941	**-941**	**HDU2 (3075DF,2215HF)**	**-2215**	**OK**
2.10	1400	1073	1400	1073	**1073**	**No HD**	**0**	**OK**
2.30	502	107	502	107	**107**	**No HD**	**0**	**OK**

Holdown Anchorage into Grade Beam

ACI 318-14, IBC 2018

Material Properties:

Concrete:

f'c	3000	PSI
Slab Thickness	18	IN

Anchor Bolt:

Mat'l

d	1	IN
F	2	IN
fy	36000	PSI
fut	58000	PSI
Anchor Depth, hef	12	IN

Washer:

tw	0.5	IN
bw	3	IN

Anchor Edge Distances:

C1	12	IN
C2	12	IN
C3	12	IN
C4	12	IN

HDU11/HDU14

Tension Design Calculations (ACI 318-14)

17.4.1 - Steel Strength for Anchor in Tension:

nt	8	(number of threads per inch)
do	1	IN

Ase = pi/4*(do-0.9743/nt)^2

Ase	0.606	IN^2

Nsa = n*Ase*fut

Nsa	**35133**	**LBS**

17.4.2 - Concrete Breakout Strength of Anchor Only in Tension:

Ncb = Anc/Anco*Ψed,N*Ψc,N*Nb

Anco = 9*hef^2

Anco	1296.00	IN^2

Anc = (C1+C2)*(C3+C4)

Anc	576.00	IN^2

Ψed,N = 0.7+0.3*(cmin/1.5*hef); 1.0 MAX

Ψed,N	0.9000	
Ψc,N	1	[cracked]

Nb = k*sqrt(f'c)*hef^1.5

k	24	
Nb	54644	
Ncb	**21858**	**LBS**

17.4.3 - Anchor Pullout Strength (Initial Abrg for plate bearing for pullout)

Npn = Ψc,p*Np

Ψc,p	1	[cracked]
Np = Abrg*8*f'c		
Abrg = (pi*bw^2)/4-Area of Rod		
Abrg	4.249	IN^2
Npn	**101988**	**LBS**

17.4.4 - Concrete Side-Face Blowout Strength

Nsb = 160*ca1*sqrt(Abrg)*sqrt(f'c)

ca1	NOT REQ'D	IN
Nsb	**NOT REQ'D**	**LBS**

17.2.3.4.3(a) - Ductility Check (Required for SDC C-F)

Nsa	35133	LBS
1.2*Nsa	42160	LBS

Nominal Strength Summary:

1.2*Nsa =	**42160**	**LBS**	
Ncb =	**21858**	**LBS**	**NG Design Reinforcing**
Npn =	**101988**	**LBS**	**OK**
Nsb =	**NOT REQ'D**	**LBS**	**OK**

Anchor Reinforcement Estimate per 17.3.2.1 & 17.4.2.9

Nn = Ncb = Nn rebar , Where Nn rebar is the minimum of Nn, Npn, Nsb

Anchor Reinf. @ 45 deg.	#5	0.31	IN^2	
		60000	PSI	
# legs = 1.2*Nsa/(As*fy)				
# legs	2.27			
# legs act.	2			
Nn rebar	**26300**	**LBS**	<	**42160 LBS *NG Add More Bar***

LRFD Design Strength Summary:

ϕ = 0.7	For all concrete governed limit states
ϕ = 0.75	For anchor steel strength limit state
ϕ = 0.75	For anchor reinf. Per ACI 318-14 Chap. 21
SF = 0.75	Seismic Factor for use w/concrete limit states

ϕNsa	**26350**	1. ACI 318 anchor steel strength in tension
ϕNcb*SF	11475	2a. Concrete breakout strength of anchor reinf. System
ϕNn rebar	19725	2b. Anchor reinf. Contribution of system
Combined:	**31201**	2. Sum of conc. + anchor reinf.
ϕNpn*SF	**53544**	3. Pullout strength
ϕNsb*SF	**N/A**	4. Side-face blowout strength

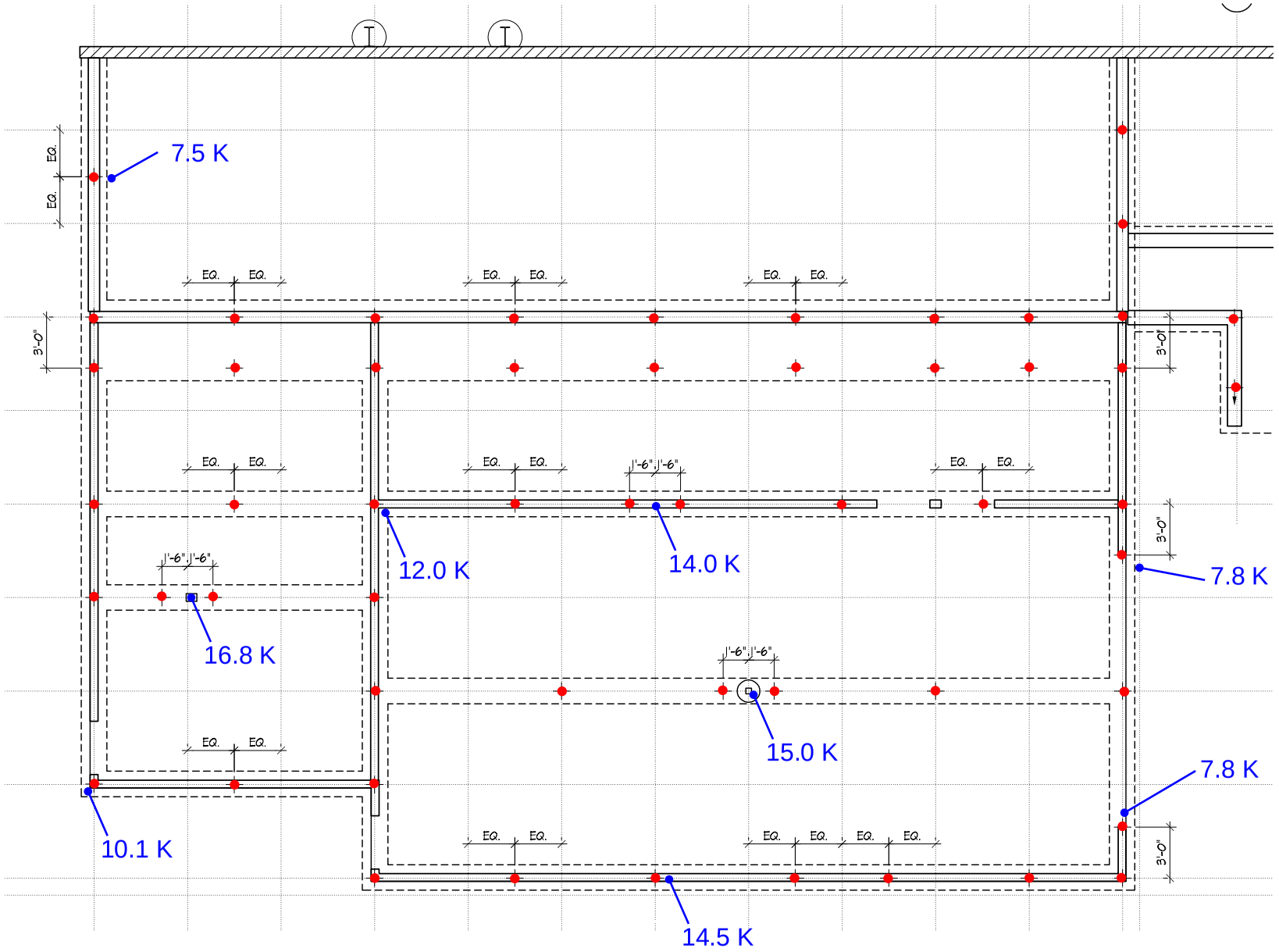
The anchor strength controls the design.

Calculation demonstrates that HDU11 & HDU14 holddowns
do not require additional reinforcing at any interior slab location.

INTRACHAT RESIDENCE
7929 East Mercer Way
Mercer Island, WA

Quantum Job Number: 22252.01

FOUNDATION DESIGN



LOADS INCLUDE POST LOADING +
SLAB/GRADE BEAM WEIGHTS

PIN PILE LOAD MAP
4" PILE CAPACITY = 16 KIPS

D-1

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2022

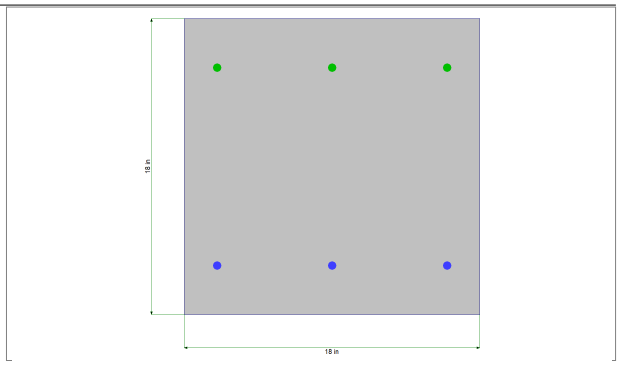
DESCRIPTION: Grade Beam - Grid 9

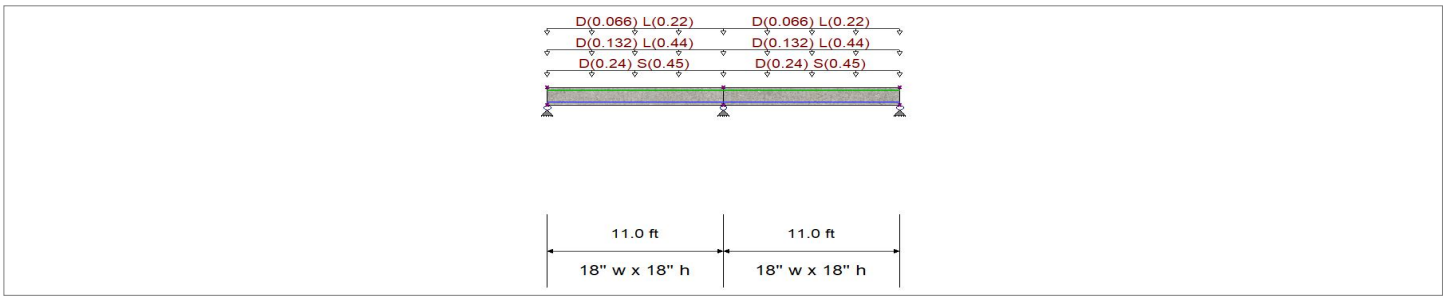
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

f'c	=	3.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c$^{1/2}$ * 7.50	=	410.792 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 18.0 in, Height = 18.0 in
Span #1 Reinforcing....
3-#4 at 3.0 in from Bottom, from 0.0 to 11.0 ft in this span
3-#4 at 3.0 in from Top, from 0.0 to 11.0 ft in this span
Span #2 Reinforcing....
3-#4 at 3.0 in from Bottom, from 0.0 to 11.0 ft in this span
3-#4 at 3.0 in from Top, from 0.0 to 11.0 ft in this span

Load for Span Number 1
Uniform Load : D = 0.0160, S = 0.030 ksf, Tributary Width = 15.0 ft, (Roof)
Uniform Load : D = 0.0120, L = 0.040 ksf, Tributary Width = 11.0 ft, (Level 2)
Uniform Load : D = 0.0120, L = 0.040 ksf, Tributary Width = 5.50 ft, (Level 1)

Load for Span Number 2
Uniform Load : D = 0.0160, S = 0.030 ksf, Tributary Width = 15.0 ft, (Roof)
Uniform Load : D = 0.0120, L = 0.040 ksf, Tributary Width = 11.0 ft, (Level 2)
Uniform Load : D = 0.0120, L = 0.040 ksf, Tributary Width = 5.50 ft, (Level 1)

DESIGN SUMMARY

Check As Min Limits!

Maximum Bending Stress Ratio =	**0.618** : 1	
Section used for this span	**Typical Section**	
Mu : Applied	-27.325	k-ft
Mn * Phi : Allowable	44.20	k-ft
Location of maximum on span	0.000	ft
Span # where maximum occurs	Span # 2	

Maximum Deflection

Max Downward Transient Deflection	0.003 in	Ratio =	39928	>=360.0	Span: 2 : S Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	Span: 2 : L Only
Max Downward Total Deflection	0.006 in	Ratio =	20742	>=180.0	Span: 2 : +D+0.750L+0.750S
Max Upward Total Deflection	0.000 in	Ratio =	0	<180.0	Span: 2 : +D+0.750L+0.750S

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Grade Beam - Grid 9

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	5.241	17.469	5.241
Overall MINimum	1.084	3.613	1.084
D Only	1.807	6.022	1.807
+D+L	4.529	15.097	4.529
+D+S	3.663	12.210	3.663
+D+0.750L	3.849	12.829	3.849
+D+0.750L+0.750S	5.241	17.469	5.241
+0.60D	1.084	3.613	1.084
L Only	2.723	9.075	2.723
S Only	1.856	6.187	1.856

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	11.000	-26.77	44.20	0.61
Span # 2	2	11.000	-27.32	44.20	0.62
+1.40D					
Span # 1	1	11.000	-9.09	44.20	0.21
Span # 2	2	11.000	-9.27	44.20	0.21
+1.20D+1.60L					
Span # 1	1	11.000	-23.44	44.20	0.53
Span # 2	2	11.000	-23.92	44.20	0.54
+1.20D+1.60L+0.50S					
Span # 1	1	11.000	-26.77	44.20	0.61
Span # 2	2	11.000	-27.32	44.20	0.62
+1.20D+0.50L					
Span # 1	1	11.000	-12.68	44.20	0.29
Span # 2	2	11.000	-12.94	44.20	0.29
+1.20D					
Span # 1	1	11.000	-7.79	44.20	0.18
Span # 2	2	11.000	-7.95	44.20	0.18
+1.20D+0.50L+1.60S					
Span # 1	1	11.000	-23.35	44.20	0.53
Span # 2	2	11.000	-23.83	44.20	0.54
+1.20D+1.60S					
Span # 1	1	11.000	-18.46	44.20	0.42
Span # 2	2	11.000	-18.84	44.20	0.43
+1.20D+0.50L+0.50S					
Span # 1	1	11.000	-16.01	44.20	0.36
Span # 2	2	11.000	-16.34	44.20	0.37
+1.20D+0.50L+0.70S					
Span # 1	1	11.000	-17.35	44.20	0.39
Span # 2	2	11.000	-17.71	44.20	0.40
+0.90D					
Span # 1	1	11.000	-5.84	44.20	0.13
Span # 2	2	11.000	-5.96	44.20	0.13

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft	Load Combination	Max. "+" Defl (in)	Location in Span (ft
+D+0.750L+0.750S	1	0.0064	4.557		0.0000	0.000
+D+0.750L+0.750S	2	0.0064	6.443		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2022

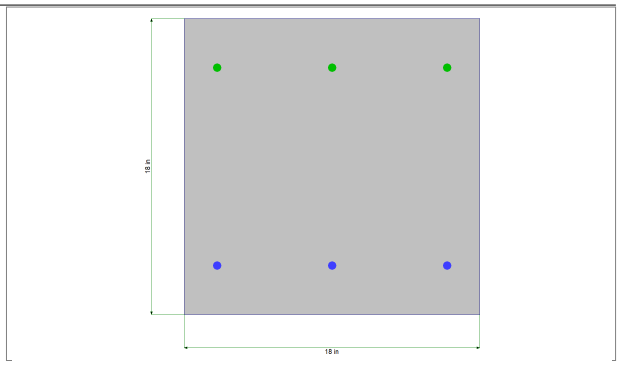
DESCRIPTION: Grade Beam - Grid 5

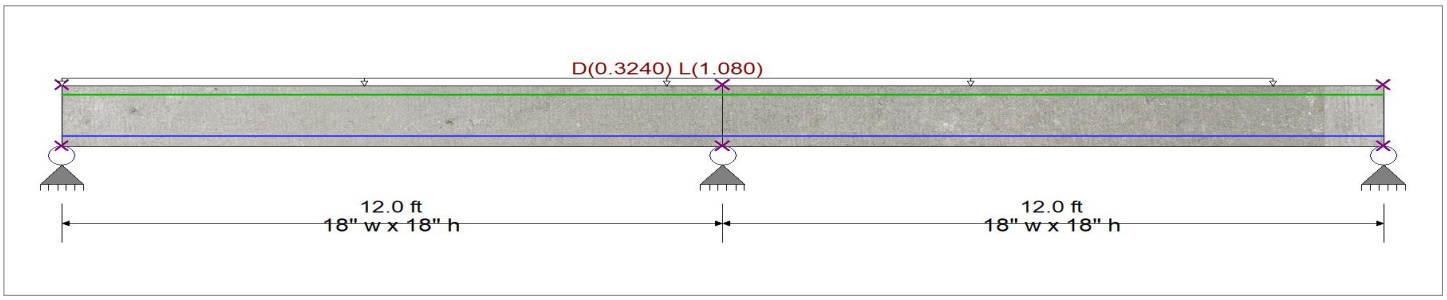
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

f'c	=	3.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = $f'c^{1/2}$ * 7.50	=	410.792 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 18.0 in, Height = 18.0 in
Span #1 Reinforcing....
3-#4 at 3.0 in from Bottom, from 0.0 to 12.0 ft in this span
3-#4 at 3.0 in from Top, from 0.0 to 12.0 ft in this span
Span #2 Reinforcing....
3-#4 at 3.0 in from Bottom, from 0.0 to 12.0 ft in this span
3-#4 at 3.0 in from Top, from 0.0 to 12.0 ft in this span

Loads on all spans...
Partial Length Uniform Load : D = 0.0120, L = 0.040 ksf, Extent = 0.0 -->> 22.0 ft, Tributary Width = 27.0 ft

DESIGN SUMMARY

Check As Min Limits!

Maximum Bending Stress Ratio =	**0.838**	: 1
Section used for this span	**Typical Section**	
Mu : Applied	-37.059	k-ft
Mn * Phi : Allowable	44.20	k-ft
Location of maximum on span	0.000	ft
Span # where maximum occurs	Span # 2	

Maximum Deflection

Max Downward Transient Deflection	0.008 in	Ratio =	18138	>=360.0	Span: 2 : L Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	Span: 2 : L Only
Max Downward Total Deflection	0.010 in	Ratio =	13952	>=180.0	Span: 2 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<180.0	Span: 2 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	6.376	20.711	3.802
Overall MINimum	0.883	2.868	0.526
D Only	1.471	4.779	0.877
+D+L	6.376	20.711	3.802
+D+0.750L	5.150	16.728	3.071

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Grade Beam - Grid 5

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2	Support 3
+0.60D	0.883	2.868	0.526
L Only	4.904	15.931	2.924

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	12.000	-36.29	44.20	0.82
Span # 2	2	12.000	-37.06	44.20	0.84
+1.40D					
Span # 1	1	12.000	-7.78	44.20	0.18
Span # 2	2	12.000	-7.94	44.20	0.18
+1.20D+1.60L					
Span # 1	1	12.000	-36.29	44.20	0.82
Span # 2	2	12.000	-37.06	44.20	0.84
+1.20D+0.50L					
Span # 1	1	12.000	-15.92	44.20	0.36
Span # 2	2	12.000	-16.26	44.20	0.37
+1.20D					
Span # 1	1	12.000	-6.67	44.20	0.15
Span # 2	2	12.000	-6.81	44.20	0.15
+0.90D					
Span # 1	1	12.000	-5.00	44.20	0.11
Span # 2	2	12.000	-5.11	44.20	0.12

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft	Load Combination	Max. "+" Defl (in)	Location in Span (ft
+D+L	1	0.0103	4.971		0.0000	0.000
+D+L	2	0.0087	7.029		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundation Calcs.ec6

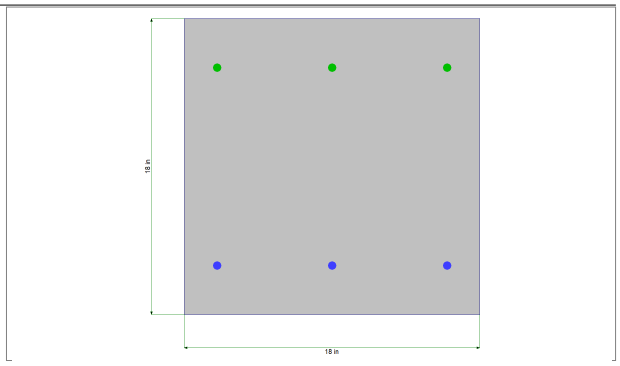
DESCRIPTION: Grade Beam - Grid D

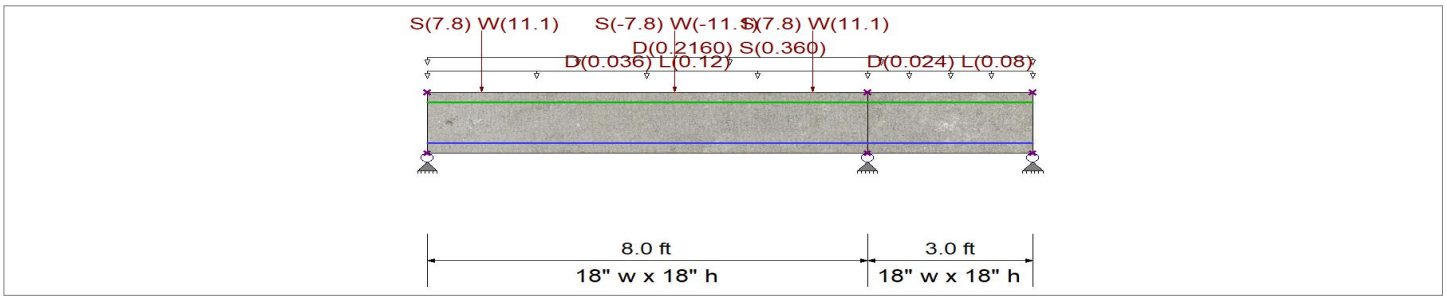
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

f'c	=	3.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c^1/2 * 7.50	=	410.792 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β 1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 18.0 in, Height = 18.0 in
Span #1 Reinforcing....
3-#4 at 3.0 in from Bottom, from 0.0 to 8.0 ft in this span
3-#4 at 3.0 in from Top, from 0.0 to 8.0 ft in this span
Span #2 Reinforcing....
3-#4 at 3.0 in from Bottom, from 0.0 to 3.0 ft in this span
3-#4 at 3.0 in from Top, from 0.0 to 3.0 ft in this span

Loads on all spans...
D = 0.0180, S = 0.030
Uniform Load on ALL spans : D = 0.0180, S = 0.030 ksf, Tributary Width = 12.0 ft

Load for Span Number 1
Uniform Load : D = 0.0120, L = 0.040 ksf, Tributary Width = 3.0 ft
Point Load : S = 7.80, W = 11.10 k @ 1.0 ft
Point Load : S = -7.80, W = -11.10 k @ 4.50 ft
Point Load : S = 7.80, W = 11.10 k @ 7.0 ft

Load for Span Number 2
Uniform Load : D = 0.0120, L = 0.040 ksf, Tributary Width = 2.0 ft

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Grade Beam - Grid D

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.291** : 1

Section used for this span	**Typical Section**
Mu : Applied	12.846 k-ft
Mn * Phi : Allowable	44.20 k-ft
Location of maximum on span	1.012 ft
Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0	<360.0	Span: 2 : L Only
Max Upward Transient Deflection	-0.001 in	Ratio =	69590	>=360.0	Span: 2 : Overall MAXimum Envelope
Max Downward Total Deflection	0.000 in	Ratio =	0	<180.0	Span: 2 : W Only
Max Upward Total Deflection	-0.001 in	Ratio =	69590	>=180.0	Span: 2 : +D+0.750L+0.750S

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	8.304	8.944	0.607
Overall MINimum	0.390	0.931	0.029
D Only	0.816	2.074	-0.153
+D+L	1.205	3.005	-0.274
+D+S	6.527	7.890	0.078
+D+0.750L	1.108	2.772	-0.244
+D+0.750L+0.750S	5.392	7.135	-0.070
+D+0.60W	4.698	4.487	0.211
+D+0.750L+0.450W	4.020	4.582	0.029
+D+0.750L+0.750S+0.450W	8.304	8.944	0.203
+0.60D+0.60W	4.372	3.657	0.272
+0.60D	0.489	1.244	-0.092
L Only	0.390	0.931	-0.121
S Only	5.712	5.817	0.232
W Only	6.471	4.022	0.607

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	8.000	12.85	44.20	0.29
Span # 2	2	3.000	-3.69	44.20	0.08
+1.40D					
Span # 1	1	8.000	-2.10	44.20	0.05
Span # 2	2	3.000	-2.16	44.20	0.05
+1.20D+1.60L					
Span # 1	1	8.000	-2.93	44.20	0.07
Span # 2	2	3.000	-3.00	44.20	0.07
+1.20D+1.60L+0.50S					
Span # 1	1	8.000	4.12	44.20	0.09
Span # 2	2	3.000	-3.47	44.20	0.08
+1.20D+0.50L					
Span # 1	1	8.000	-2.15	44.20	0.05
Span # 2	2	3.000	-2.21	44.20	0.05
+1.20D+0.50W					
Span # 1	1	8.000	4.04	44.20	0.09
Span # 2	2	3.000	-0.94	44.20	0.02
+1.20D+0.50L+1.60S					
Span # 1	1	8.000	9.81	44.20	0.22
Span # 2	2	3.000	-3.69	44.20	0.08
+1.20D+1.60S+0.50W					
Span # 1	1	8.000	12.85	44.20	0.29
Span # 2	2	3.000	-2.42	44.20	0.05
+1.20D+0.50L+W					
Span # 1	1	8.000	-8.08	44.20	0.18
Span # 2	2	3.000	-0.39	44.20	0.01
+1.20D+0.50L+0.50S+W					
Span # 1	1	8.000	-10.69	44.20	0.24
Span # 2	2	3.000	-0.85	44.20	0.02

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Grade Beam - Grid D

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
+1.20D+0.50L+0.70S					
Span # 1	1	8.000	4.85	44.20	0.11
Span # 2	2	3.000	-2.86	44.20	0.06
+0.90D+W					
Span # 1	1	8.000	-8.68	44.20	0.20
Span # 2	2	3.000	0.51	44.20	0.01
+0.90D					
Span # 1	1	8.000	-1.35	44.20	0.03
Span # 2	2	3.000	-1.39	44.20	0.03

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft	Load Combination	Max. "+" Defl (in)	Location in Span (ft
+D+0.750L+0.750S	1	0.0006	2.171	W Only	-0.0014	4.229
W Only	2	0.0001	1.243	+D+0.750L+0.750S	-0.0001	0.986

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Basement Wall - Grid 3 Detail 12/S3.1

Code Reference

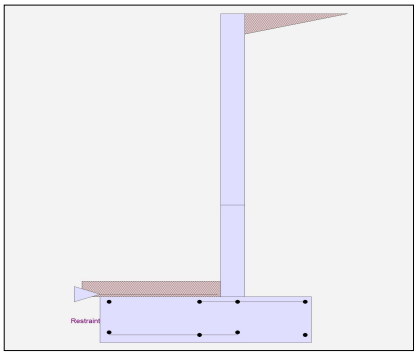
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	9.25 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	40.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	370.0 lbs
Axial Live Load	=	510.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

DESCRIPTION: Basement Wall - Grid 3 Detail 12/S3.1

Design Summary

Wall Stability Ratios

Overturning	=	2.28	OK
Slab Resists All Sliding !			
Global Stability	=	1.47	
Total Bearing Load	=	6,373 lbs	
...resultant ecc.	=	6.37 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	416 psf	OK
Soil Pressure @ Heel	=	1,419 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	583 psf	
ACI Factored @ Heel	=	1,987 psf	
Footing Shear @ Toe	=	5.8 psi	OK
Footing Shear @ Heel	=	1.6 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	2,311.3 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	3.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 4	# 6		
Rebar Spacing	=	10.00	10.00		
Rebar Placed at	=	Center	Edge		
Design Data					
fb/FB + fa/Fa	=	**0.640**	**0.695**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	1,250.0	2,738.0		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	2,604.2	8,442.2		
Moment.....Allowable	ft-# =	4,065.1	12,131.4		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	26.0	40.6		
Shear.....Allowable	psi =	82.2	82.2		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	4.00	5.63		

Masonry Data

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

Concrete Data

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Basement Wall - Grid 3 Detail 12/S3.1

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1572 in2/ft		
(4/3) * As :	0.2096 in2/ft	Min Stem T&S Reinf Area 1.200 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.16 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.6503 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3536 in2/ft		
(4/3) * As :	0.4714 in2/ft	Min Stem T&S Reinf Area 0.576 in2	
200bd/fy : 200(12)(5.625)/60000 :	0.225 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3536 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.528 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.9144 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	3.33 ft
Heel Width	=	2.50
Total Footing Width	=	5.83
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	583	1,987	psf
Mu' : Upward	=	4,715	3,496	ft-#
Mu' : Downward	=	1,896	2,692	ft-#
Mu: Design	=	2,818 OK	-804	ft-#
phiMn	=	33,519	26,800	ft-#
Actual 1-Way Shear	=	5.76	1.62	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 6 @ 10.00 in
Heel Reinforcing = # 5 @ 9.56 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.86 in, #10@ 39.19 in

Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.86 in, #10@ 39.19 in

Key: No key defined

Min footing T&S reinf Area 2.27 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Basement Wall - Grid 3 Detail 12/S3.1

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		2,311.3	3.58	8,282.0	Soil Over HL (ab. water tbl)	2,035.0	4.91	9,998.6
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.91	9,998.6
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=	370.0	3.66	1,355.4
Added Lateral Load	=				* Axial Live Load on Stem	=	510.0	3.66	1,868.3
Load @ Stem Above Soil	=				Soil Over Toe	=	199.8	1.67	332.7
	=				Surcharge Over Toe	=			
					Stem Weight(s)	=	925.0	3.66	3,388.6
					Earth @ Stem Transitions	=			
					Footing Weight	=	1,311.8	2.92	3,823.8
					Key Weight	=			
					Vert. Component	=			
Total	=	2,311.3	**O.T.M.** =	8,282.0	**Total =**		4,841.6 lbs	**R.M.=**	18,899.1

Resisting/Overturning Ratio = **2.28**

Vertical Loads used for Soil Pressure = 6,373.1 lbs

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.000	in

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

DESCRIPTION: Basement Wall - Grid 3 Detail 12/S3.1

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 3.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in

---

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

Lap Splice length for #6 bar specified in this stem design segment (25.4.2.3a) =	25.63 in
Development length for #6 bar specified in this stem design segment =	19.72 in
Hooked embedment length into footing for #6 bar specified in this stem design segment =	11.50 in
As Provided =	0.5280 in2/ft
As Required =	0.3536 in2/ft

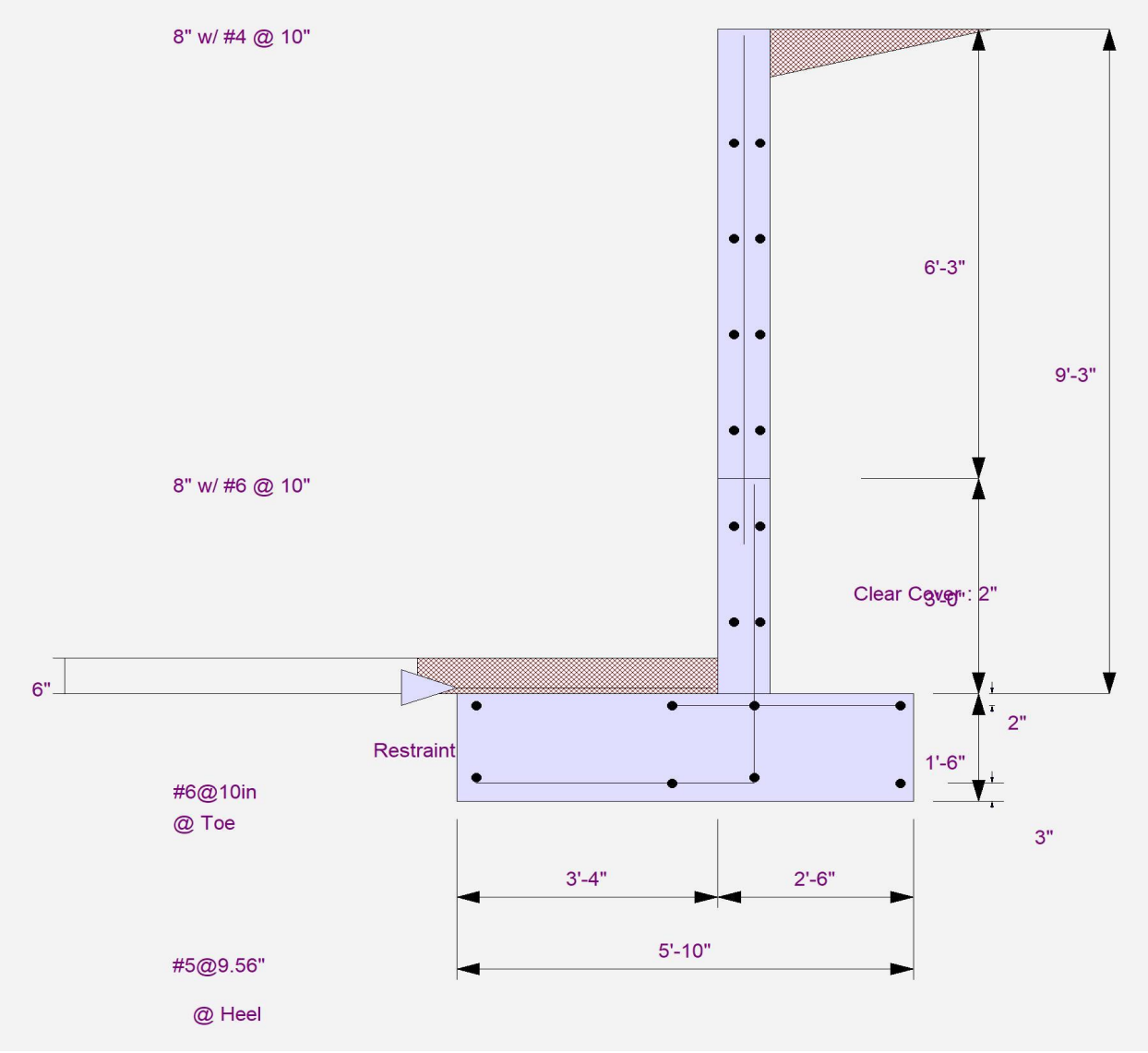
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

DESCRIPTION: Basement Wall - Grid 3 Detail 12/S3.1



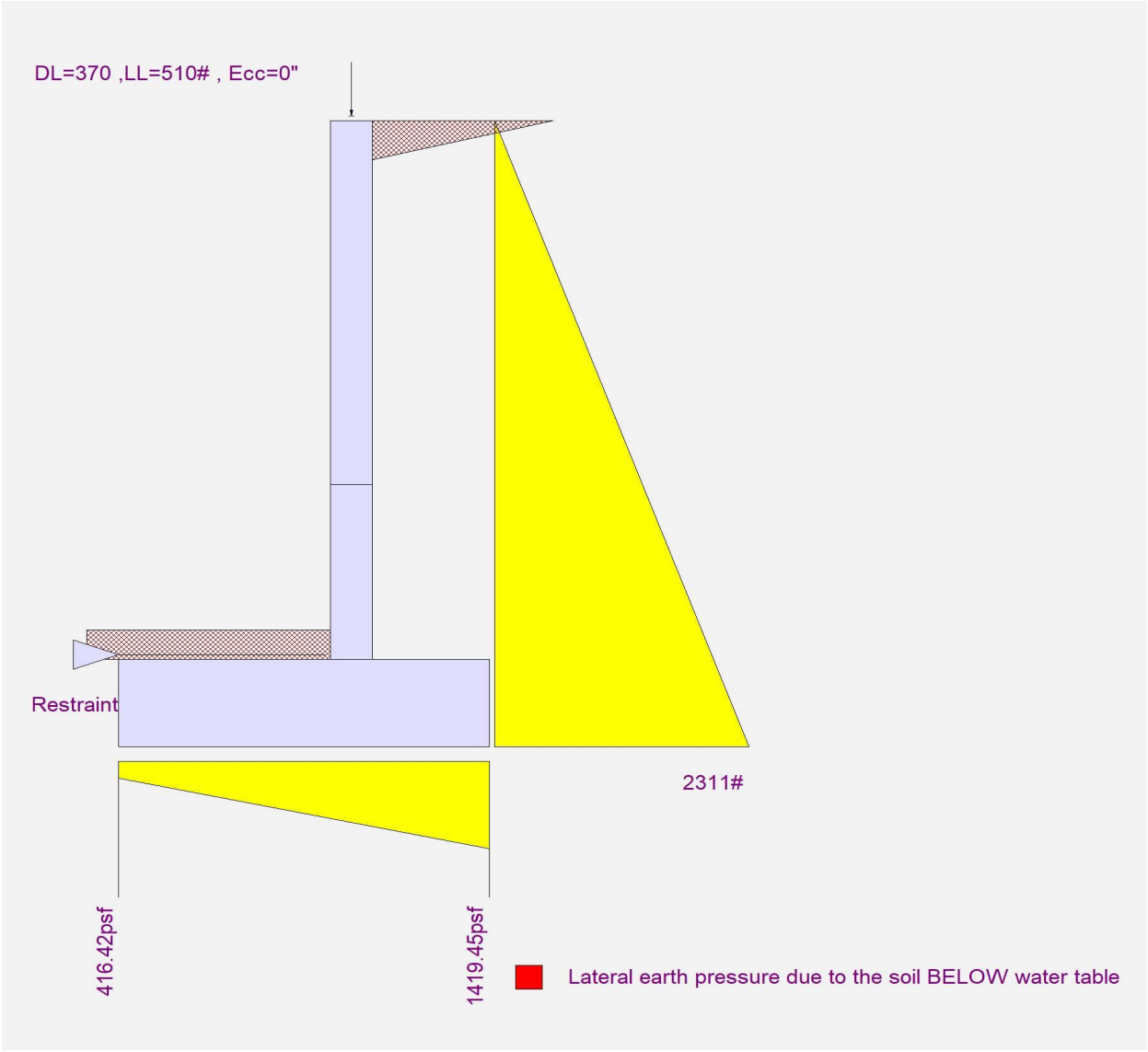
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

DESCRIPTION: Basement Wall - Grid 3 Detail 12/S3.1



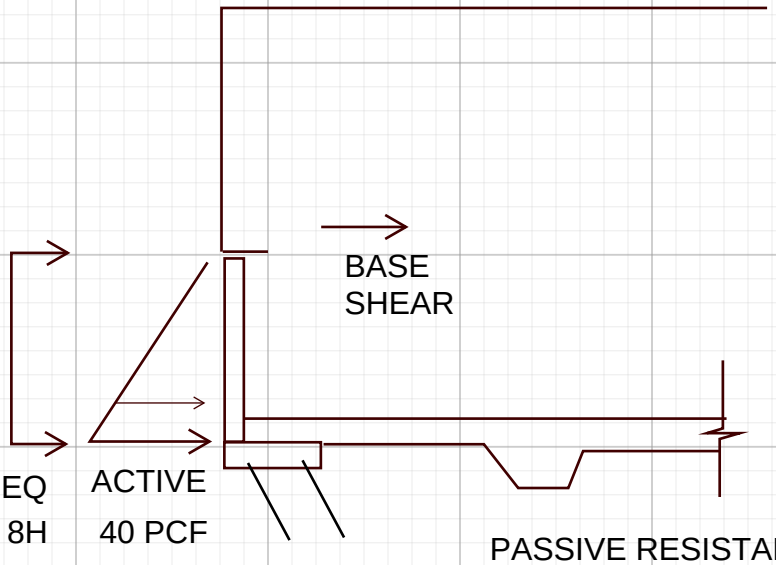
CHECK GLOBAL SLIDING

H = 10.5 FT

ACTIVE = 40 (10.5')^2 / 2
ACTIVE = 2205 PLF

EQ = 8 (10.5')^2 / 2
EQ = 440 PLF

BASE SHEAR = 22.3 K / 61'
BASE SHEAR = 370 PLF



PASSIVE RESISTANCE =
150 PSF

1:3 BATTERED PILE =
5333 LBS/PILE

TOTAL PRESSURE APPLIED (ASD):
= 2205 + (.7)440 + (.7)370
= 2770 PLF

PASSIVE RESISTANCE:

(4) 18" DEEP GRADE BEAMS
= (4) 150 PSF (2')^2 / 2
= 1200 PLF

(2) BATTERED PILES @ 5'-6" O.C.
= (2) 5333 / 5.5'
= 1940 PLF

TOTAL PASSIVE RESISTANCE
= 1200 + 1940 = 3140 PLF

3140 PLF > 2770 PLF OK!!!

QUANTUM
CONSULTING ENGINEERS
1511 THIRD AVENUE
SUITE 323
SEATTLE, WA 98101
TEL 206.957.3900
FAX 206.957.3901
www.quantumce.com

INTRACHAT RESIDENCE	2/4/24	22252.01
project	date	job no.
	drawn by:	
LINDAL	GAE	
client	design by:	sheet no. D-16

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Stair - Cantilever Wall Detail 5/S3.1

Code Reference

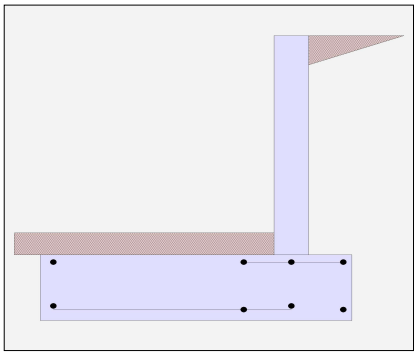
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	40.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Stair - Cantilever Wall Detail 5/S3.1

Design Summary

Wall Stability Ratios

Overturning	=	5.23	OK
Sliding	=	1.48	Ratio < 1.5!
Global Stability	=	2.02	
Total Bearing Load	=	2,556 lbs	
...resultant ecc.	=	0.40 in	
Soil Pressure @ Toe	=	412 psf	OK
Soil Pressure @ Heel	=	440 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	577 psf	
ACI Factored @ Heel	=	616 psf	
Footing Shear @ Toe	=	4.3 psi	OK
Footing Shear @ Heel	=	1.4 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	845.0 lbs	
less 100% Passive Force	-	225.0 lbs	
less 100% Friction Force	-	1,022.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	20.2 lbs	NG

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

Load Factors

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

Stem Construction

		Bottom			
		Stem OK			
Design Height Above Ftg	ft =	0.00			
Wall Material Above "Ht"	=	Concrete			
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00			
Rebar Size	=	# 4			
Rebar Spacing	=	12.00			
Rebar Placed at	=	Center			
Design Data					
fb/FB + fa/Fa	=	**0.370**			
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	800.0			
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	1,333.3			
Moment.....Allowable	=	3,598.2			
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	16.7			
Shear.....Allowable	psi =	821.6			
Anet (Masonry)	in2 =				
Rebar Depth 'd'	in =	4.00			
Masonry Data					
f'm	psi =				
Fs	psi =				
Solid Grouting	=				
Modular Ratio 'n'	=				
Wall Weight	psf =	100.0			
Short Term Factor	=				
Equiv. Solid Thick.	=				
Masonry Block Type	=				
Masonry Design Method	=	ASD			
Concrete Data					
f'c	psi =	300,000.0			
Fy	psi =	60,000.0			

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Stair - Cantilever Wall Detail 5/S3.1

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0789 in2/ft		
(4/3) * As :	0.1052 in2/ft	Min Stem T&S Reinf Area 0.960 in2	
3sqrt(f'c)bd/fy : 3sqrt(300000)(12)(4)/60000 :	1.3145 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	49.725 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	4.50 ft
Heel Width	=	1.50
Total Footing Width	=	6.00
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	577	616	psf
Mu' : Upward	=	5,939	219	ft-#
Mu' : Downward	=	3,402	323	ft-#
Mu: Design	=	2,537	104	ft-#
phiMin	=	37,731	40,431	ft-#
Actual 1-Way Shear	=	4.34	1.42	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 7 @ 12.00 in
Heel Reinforcing = # 7 @ 12.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe:
Heel:
Key:

Min footing T&S reinf Area 2.33 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Stair - Cantilever Wall Detail 5/S3.1

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	845.0	2.17	1,830.8			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
				Soil Over HL (ab. water tbl)	458.3	5.58	2,559.0
				Soil Over HL (bel. water tbl)		5.58	2,559.0
				Watre Table			
				Sloped Soil Over Heel =			
				Surcharge Over Heel =			
				Adjacent Footing Load =			
				Axial Dead Load on Stem =			
				* Axial Live Load on Stem =			
				Soil Over Toe =	247.5	2.25	556.9
				Surcharge Over Toe =			
				Stem Weight(s) =	500.0	4.83	2,416.7
				Earth @ Stem Transitions =			
				Footing Weight =	1,350.0	3.00	4,050.0
				Key Weight =			
				Vert. Component =			
Total =	845.0	**O.T.M.** =	1,830.8	**Total =**	2,555.8 lbs	**R.M.=**	9,582.6

Resisting/Overturning Ratio = **5.23**

Vertical Loads used for Soil Pressure = 2,555.8 lbs

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.000	in

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

Cantilevered Retaining Wall

DESCRIPTION: Stair - Cantilever Wall Detail 5/S3.1

Rebar Lap & Embedment Lengths Information

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

Lap Splice length for #4 bar specified in this stem design segment =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	7.67 in
As Provided =	0.2000 in2/ft
As Required =	0.1728 in2/ft

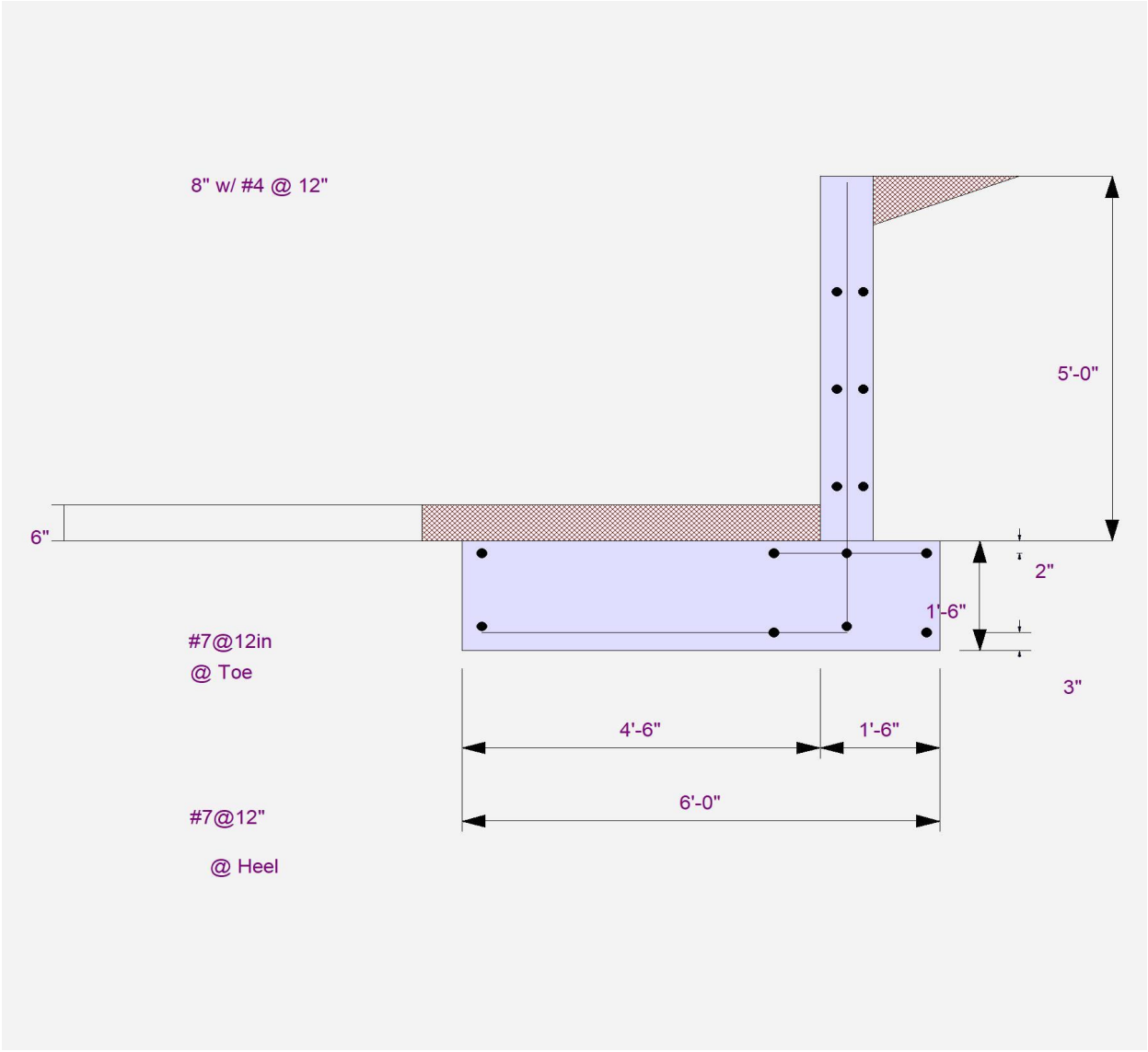
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Stair - Cantilever Wall Detail 5/S3.1



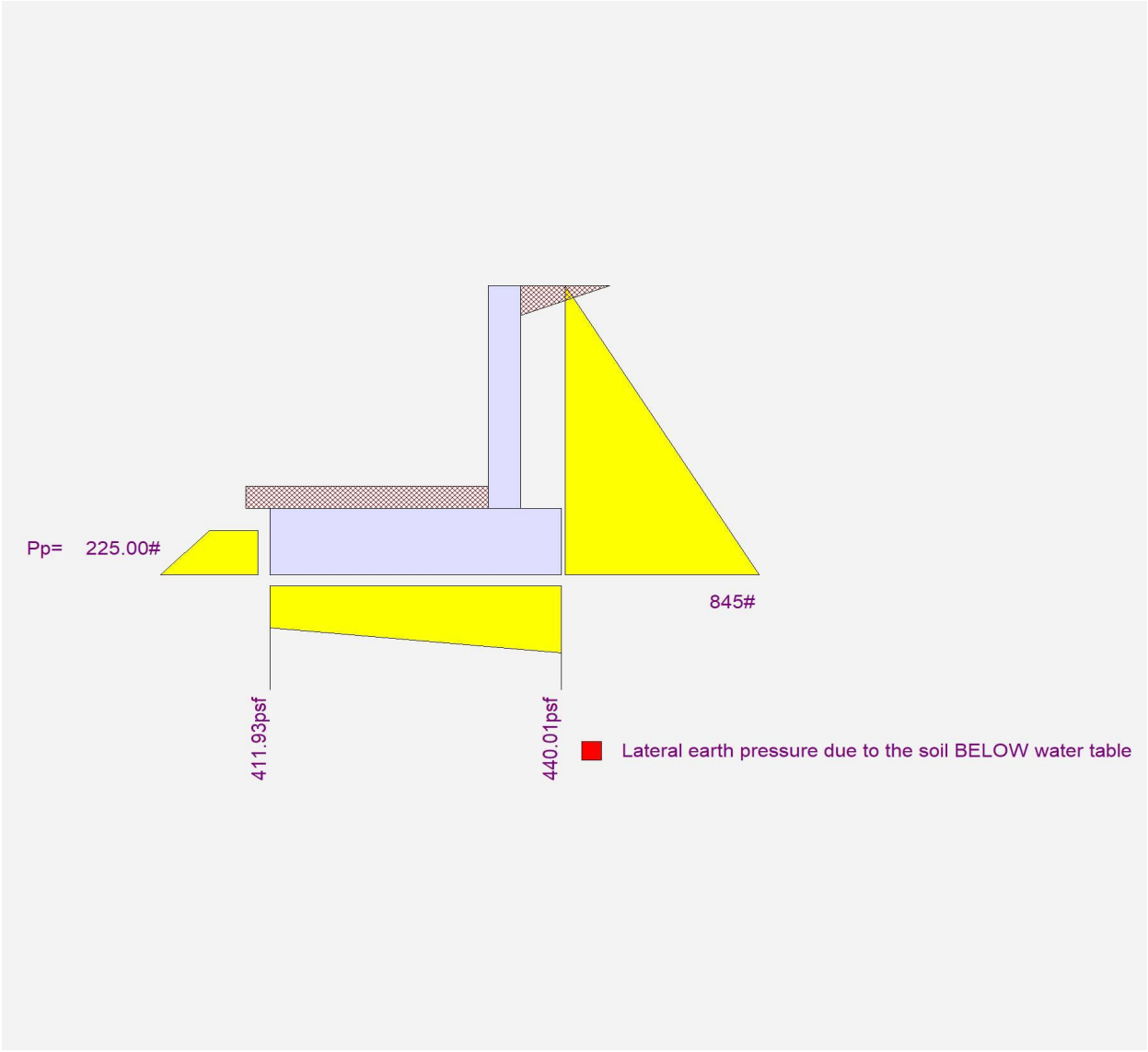
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.22.2.9 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Stair - Cantilever Wall Detail 5/S3.1



Basement Wall Design (PCA Rect. Conc. Tanks, 5th ED.)

IBC 2018 and ACI 318-14

Wall Location: Horizontal Spanning Retaining Wall - Grid L Detail 10/S3.1

Wall Thickness: 8 in

f'c: 4 ksi b= 15 ft b/a= 1.67

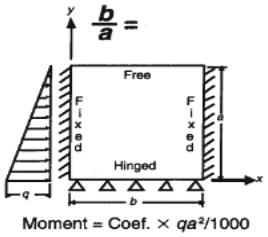
fy: 60 ksi a= 9 ft

Active Pressure

q (EFP): 60 lb/ft^3

Mu= 1.6 x C x EFP x a^3 x 12" / 1000^2

Mu= C(0.84) k-in/ft

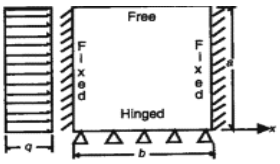


Earthquake Surcharge Pressure

q (EFP): 72 lb/ft^2

Mu= 1.0 x C x EFP x a^2 x 12" / 1000^2

Mu= C(0.07) k-in/ft



Horizontal Bending

Wall End	Mu$^-$=	-77.9	k-in/ft	C=	-72.3	Active	C=	-244.7	Surch.
Mid Wall	Mu$^+$=	36.3	k-in/ft	C=	34.0	Active	C=	110.3	Surch.
Corner Bar	d:	4	in	As$^-$=	**0.39**	in^2/ft	**#6 @ 12" O.C.**		
Horizontal Bar	d:	4	in	As$^+$=	**0.17**	in^2/ft	**#5 @ 12" O.C.**		

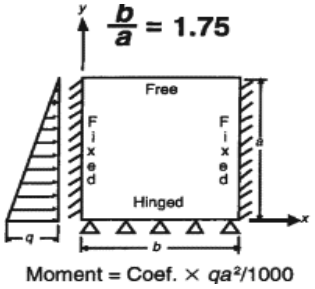
Vertical Bending

Mid Wall	Mu$^+$=	28.5	k-in/ft	C=	30.3	Active	C=	42.7	Surch.
Vertical Bar	d:	4	in	As$^-$=	**0.14**	in^2/ft	**#4 @ 16" O.C.**		

PCA Rectangular Concrete Tanks (Revised Fifth Edition)

Case 2

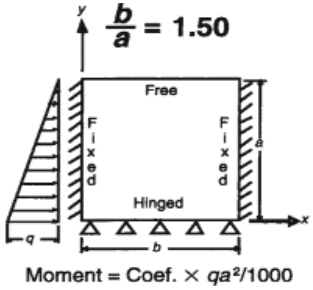
b/a=1.75



My	END	0.1b 0.9b	0.2b 0.8b	0.3b 0.7b	0.4b 0.6b	0.5b
Top	-58	-36	-4	19	33	37
0.9a	-75	-34	-3	19	32	36
0.8a	-75	-33	-1	20	32	36
0.7a	-77	-31	0	20	32	35
0.6a	-77	-29	2	21	31	34
0.5a	-77	-26	4	21	30	32
0.4a	-73	-21	6	20	27	29
0.3a	-65	-16	6	18	23	25
0.2a	-51	-10	6	14	17	18
0.1a	-30	-5	4	8	10	10
BOT.	0	0	0	0	0	0

Mx	END	0.1b 0.9b	0.2b 0.8b	0.3b 0.7b	0.4b 0.6b	0.5b
Top	-12	0	0	0	0	0
0.9a	-15	-5	0	2	4	4
0.8a	-15	-6	1	6	9	10
0.7a	-15	-5	4	11	15	16
0.6a	-15	-4	7	16	21	22
0.5a	-15	-2	11	20	26	28
0.4a	-15	0	14	24	30	32
0.3a	-13	2	16	25	30	32
0.2a	-10	4	16	23	27	28
0.1a	-6	4	11	15	17	18
BOT.	0	0	0	0	0	0

b/a=1.5



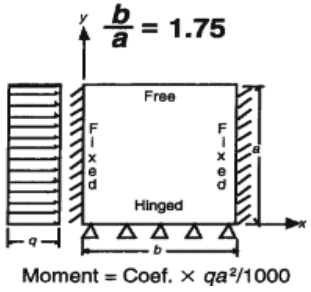
My	END	0.1b 0.9b	0.2b 0.8b	0.3b 0.7b	0.4b 0.6b	0.5b
Top	-37	-27	-4	13	24	27
0.9a	-53	-25	-3	14	24	27
0.8a	-56	-25	-2	15	24	28
0.7a	-59	-25	0	16	25	28
0.6a	-62	-24	1	17	26	28
0.5a	-63	-22	3	17	25	28
0.4a	-62	-19	4	17	24	26
0.3a	-56	-15	5	16	21	22
0.2a	-45	-10	5	12	16	17
0.1a	-27	-5	3	7	9	10
BOT.	0	0	0	0	0	0

Mx	END	0.1b 0.9b	0.2b 0.8b	0.3b 0.7b	0.4b 0.6b	0.5b
Top	-8	0	0	0	0	0
0.9a	-11	-4	-1	1	2	3
0.8a	-11	-5	0	4	6	7
0.7a	-12	-4	2	7	11	12
0.6a	-12	-3	5	12	16	17
0.5a	-13	-2	8	16	20	22
0.4a	-12	0	11	19	24	26
0.3a	-11	1	13	21	25	27
0.2a	-9	3	13	19	23	24
0.1a	-5	3	9	13	15	16
BOT.	0	0	0	0	0	0

PCA Rectangular Concrete Tanks (Revised Fifth Edition)

Case 7

b/a=1.75

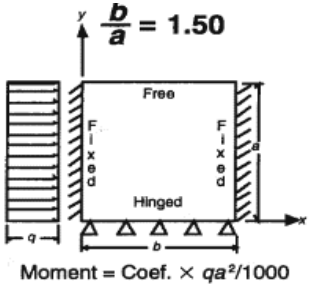


Moment = Coef. × $qa^2/1000$

My	END	0.1b	0.2b	0.3b	0.4b	
		0.9b	0.8b	0.7b	0.6b	0.5b
Top	-221	-114	-3	67	107	119
0.9a	-267	-105	-2	64	101	113
0.8a	-242	-99	-1	61	95	106
0.7a	-221	-91	0	58	89	99
0.6a	-202	-81	2	54	82	91
0.5a	-182	-70	4	49	73	81
0.4a	-158	-57	5	43	63	69
0.3a	-129	-43	6	35	50	55
0.2a	-94	-29	6	25	36	39
0.1a	-51	-14	4	14	19	20
BOT.	0	0	0	0	0	0

Mx	END	0.1b	0.2b	0.3b	0.4b	
		0.9b	0.8b	0.7b	0.6b	0.5b
Top	-44	0	0	0	0	0
0.9a	-53	-16	0	9	13	15
0.8a	-48	-19	2	16	23	26
0.7a	-44	-17	5	21	31	34
0.6a	-40	-14	9	27	37	41
0.5a	-36	-10	13	31	41	45
0.4a	-32	-6	16	33	43	46
0.3a	-26	-2	18	32	41	43
0.2a	-19	1	17	28	34	36
0.1a	-10	3	12	18	21	22
BOT.	0	0	0	0	0	0

b/a=1.5



Moment = Coef. × $qa^2/1000$

My	END	0.1b	0.2b	0.3b	0.4b	
		0.9b	0.8b	0.7b	0.6b	0.5b
Top	-182	-89	-5	51	83	93
0.9a	-200	-83	-4	49	79	89
0.8a	-184	-78	-3	47	75	84
0.7a	-171	-73	-2	45	71	79
0.6a	-159	-66	0	42	66	74
0.5a	-145	-58	2	39	60	66
0.4a	-128	-48	3	35	52	57
0.3a	-106	-37	4	29	42	46
0.2a	-79	-25	4	21	30	33
0.1a	-44	-12	5	12	16	18
BOT.	0	0	0	0	0	0

Mx	END	0.1b	0.2b	0.3b	0.4b	
		0.9b	0.8b	0.7b	0.6b	0.5b
Top	-37	0	0	0	0	0
0.9a	-40	-13	0	6	10	11
0.8a	-37	-16	1	11	17	19
0.7a	-34	-14	3	15	23	26
0.6a	-32	-11	6	20	28	31
0.5a	-29	-9	9	23	31	34
0.4a	-26	-6	12	25	33	36
0.3a	-21	-3	14	26	33	35
0.2a	-16	0	13	23	28	30
0.1a	-9	2	10	15	18	19
BOT.	0	0	0	0	0	0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

DESCRIPTION: Site Wall Detail 6/S3.1

Code Reference

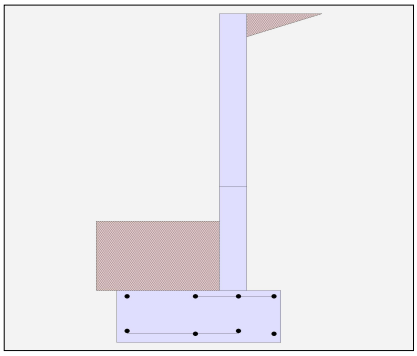
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	24.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	0.00 in



Surcharge Loads

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

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Axial Load Applied to Stem

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

DESCRIPTION: Site Wall Detail 6/S3.1

Design Summary

Wall Stability Ratios

Overturning	=	2.03	OK
Sliding	=	1.51	OK
Global Stability	=	2.03	

Total Bearing Load	=	2,983	lbs
...resultant ecc.	=	14.42	in
Eccentricity outside middle third			
Soil Pressure @ Toe	=	2,492	psf NG
Soil Pressure @ Heel	=	0	psf OK
Allowable	=	2,000	psf
Soil Pressure Exceeds Allowable!			
ACI Factored @ Toe	=	3,489	psf
ACI Factored @ Heel	=	0	psf
Footing Shear @ Toe	=	14.3	psi OK
Footing Shear @ Heel	=	11.9	psi OK
Allowable	=	82.2	psi

Sliding Calcs

Lateral Sliding Force	=	1,579.4	lbs
less 100% Passive Force	-	918.8	lbs
less 100% Friction Force	-	1,472.2	lbs
Added Force Req'd	=	0.0	lbs OK
....for 1.5 Stability	=	0.0	lbs OK

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

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	3.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 4	# 6		
Rebar Spacing	=	12.00	12.00		
Rebar Placed at	=	Center	Edge		
Design Data					
fb/FB + fa/Fa	=	**0.340**	**0.464**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	700.0	1,792.0		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	1,166.7	4,778.7		
Moment.....Allowable	ft-# =	3,423.0	10,280.8		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	14.6	26.5		
Shear.....Allowable	psi =	82.2	82.2		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	4.00	5.63		

PILE SUPPORTED - OKAY

Masonry Data

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

Concrete Data

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

DESCRIPTION: Site Wall Detail 6/S3.1

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0704 in2/ft		
(4/3) * As :	0.0939 in2/ft	Min Stem T&S Reinf Area 0.960 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.6503 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2001 in2/ft		
(4/3) * As :	0.2668 in2/ft	Min Stem T&S Reinf Area 0.576 in2	
200bd/fy : 200(12)(5.625)/60000 :	0.225 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.225 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.44 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.9144 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	2.50 ft
Heel Width	=	1.50
Total Footing Width	=	4.00
Footing Thickness	=	18.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	3,489	0	psf
Mu' : Upward	=	7,109	0	ft-#
Mu' : Downward	=	1,669	1,390	ft-#
Mu: Design	=	5,440 NG	1,390	ft-# OK
phiMn	=	20,065	26,800	ft-#
Actual 1-Way Shear	=	14.30	11.94	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 5 @ 9.56 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.86 in, #10@ 39.19 in

Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.86 in, #10@ 39.19 in

Key: No key defined

Min footing T&S reinf Area	1.56	in2
Min footing T&S reinf Area per foot	0.39	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

DESCRIPTION: Site Wall Detail 6/S3.1

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,579.4	3.17	5,001.4			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)				733.3	3.58	2,627.8
Soil Over HL (bel. water tbl)					3.58	2,627.8
Water Table						
Sloped Soil Over Heel =						
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =				550.0	1.25	687.5
Surcharge Over Toe =						
Stem Weight(s) =				800.0	2.83	2,266.7
Earth @ Stem Transitions =						
Footing Weight =				900.0	2.00	1,800.0
Key Weight =					0.50	
Vert. Component =				697.2	4.00	2,788.7
Total =	1,579.4	**O.T.M.** =	5,001.4	**Total =** 3,680.5 lbs	**R.M.=**	10,170.6

Resisting/Overturning Ratio = **2.03**

Vertical Loads used for Soil Pressure = 2,983.3 lbs

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

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	100.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.346	in

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

DESCRIPTION: Site Wall Detail 6/S3.1

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 3.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in

---

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

Lap Splice length for #6 bar specified in this stem design segment (25.4.2.3a) =	25.63 in
Development length for #6 bar specified in this stem design segment =	19.72 in
Hooked embedment length into footing for #6 bar specified in this stem design segment =	11.50 in
As Provided =	0.4400 in2/ft
As Required =	0.2250 in2/ft

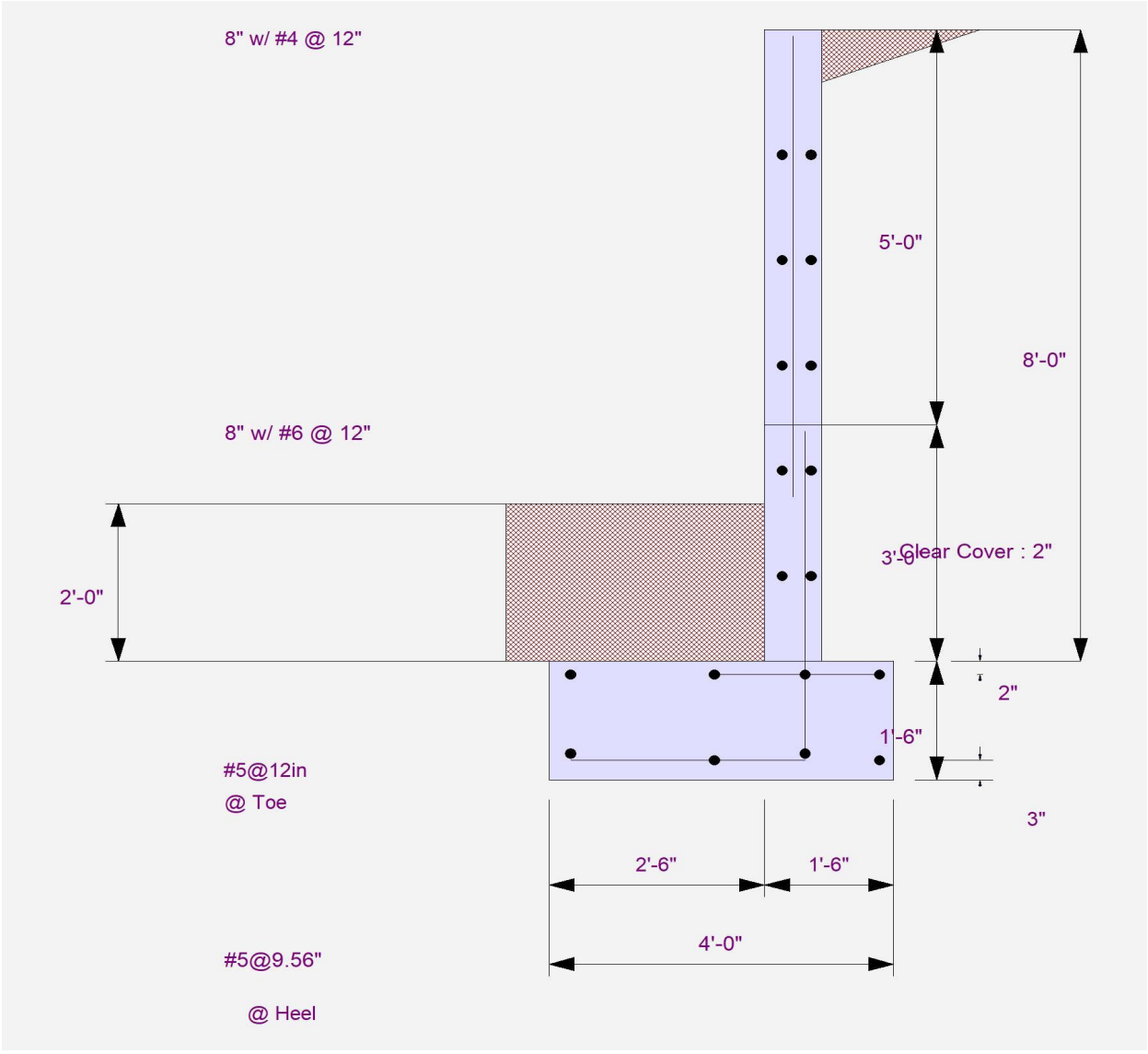
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

DESCRIPTION: Site Wall Detail 6/S3.1



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundation Calcs.ec6

LIC# : KW-06016450, Build:20.23.08.30 QUANTUM CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

DESCRIPTION: Site Wall Detail 6/S3.1