BYKONEN
CARTER
QUINN

STRUCTURAL
ENGINEERING

STRUCTURAL CALCULATIONS

Leung Residence
9102 SE 78th Place
Mercer Island, WA 98040

Board & Vellum
115 15th Ave Suite 100
Seattle, WA 98112

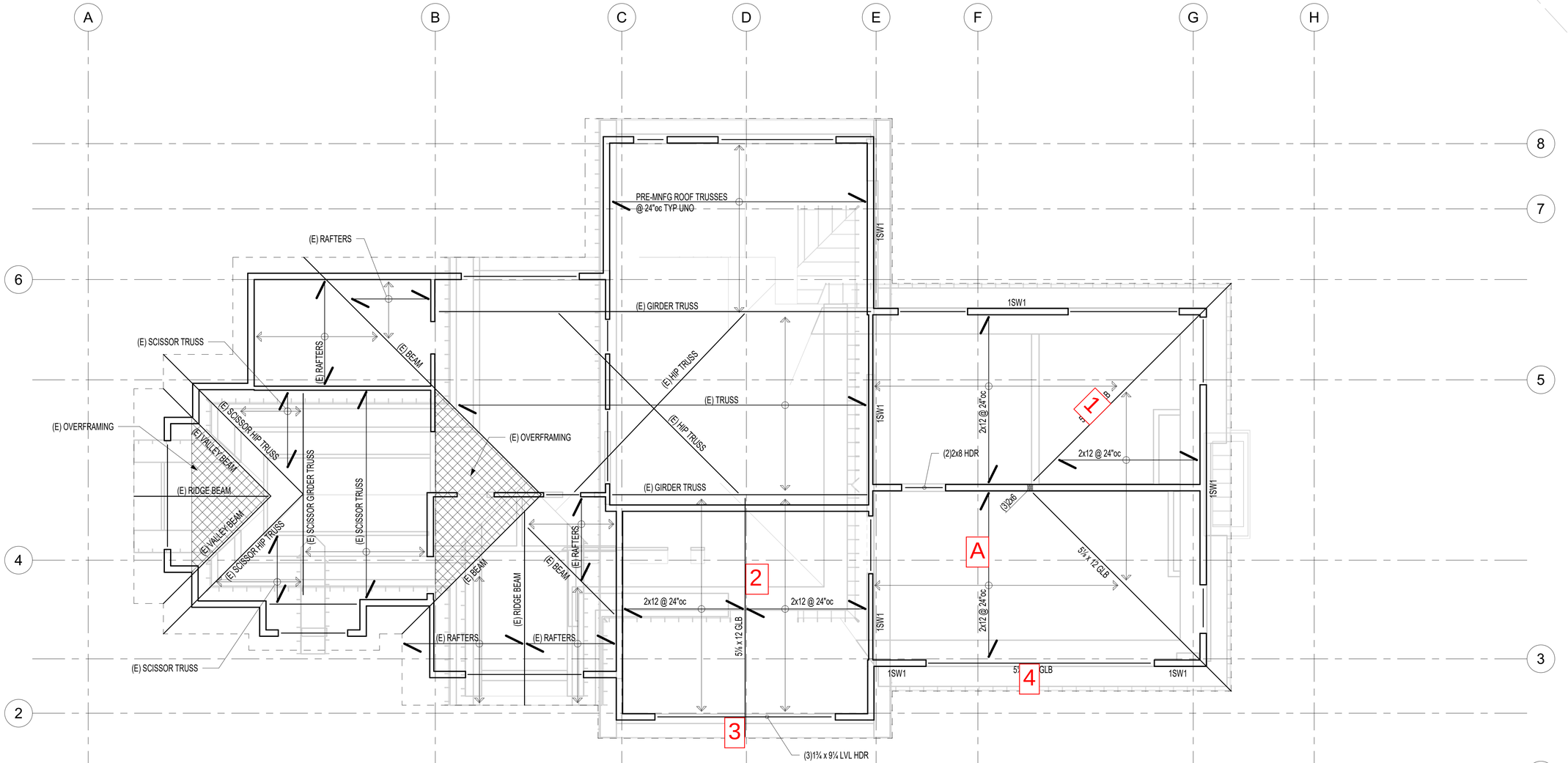
July 26, 2022

FRAMING PLAN NOTES (TYPICAL UNLESS NOTED OTHERWISE)

1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
2. FLOOR SHEATHING SHALL BE 23/32" TONGUE AND GROOVE APA RATED SHEATHING (SPAN RATING 40/20). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEAR WALLS w/ 10d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING
3. ROOF SHEATHING SHALL BE 15/32" APA RATED SHEATHING (SPAN RATING 24/0). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEARWALLS w/ 8d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING.
4. 1SWX INDICATES SINGLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
5. 2SWX INDICATES DOUBLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
6. ALL HEADERS SHALL BE (2)2x8 U.N.O. REFER TO NOTE 5 FOR SUPPORT REQUIREMENTS.
7. COLUMNS SHALL BE DOUBLE STUDS MINIMUM, U.N.O., WITH BEAM OR HEADER BEARING FULLY ON COLUMN.

FRAMING PLAN LEGEND

- WALLS BELOW
- WALLS ABOVE
- COLUMNS BELOW
- COLUMNS ABOVE
- HANGER
- ABRUPT CHANGE IN SLAB/FRAMING ELEVATION
- FB — INDICATES FLUSH BEAM
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- FRAMING SPAN AND EXTENTS
- HDUX — INDICATES SIMPSON HOLDOWN. REFER TO HOLDOWN SCHEDULE (8/S3.00) FOR THREADED ROD CALLOUT & EMBEDMENT INTO CONCRETE
- MSTCXX — INDICATES SIMPSON STRAP HOLDOWN



1 ROOF FRAMING PLAN
1/4" = 1'-0"

0' 2' 4' 8' 16'

NORTH

Board & Vellum
ARCHITECTURE AND DESIGN
115 15th Ave E. Suite 100 Seattle, WA 98112
info@boardandvellum.com | 206.707.8895

BYKONEN CARTER QUINN
STRUCTURAL ENGINEERING

NICHOLAS VH CARTER
STATE OF WASHINGTON
37270
STRUCTURAL
PROFESSIONAL ENGINEER
SDCI STAMP AREA

LEUNG RESIDENCE

PROJECT ADDRESS:
9107 SE 78TH PLACE
MERCER ISLAND, WA 98040

OWNER:
KEVIN & NANCY LEUNG

REVISION	DATE	DESCRIPTION

ISSUANCES

DATE	DESCRIPTION

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ORIGINAL SHEET SIZE IS 22"x34"

BOARD & VELLUM PROJECT #: 2021054.00
SDCI PROJECT #:
PLOT DATE: 05.24.22

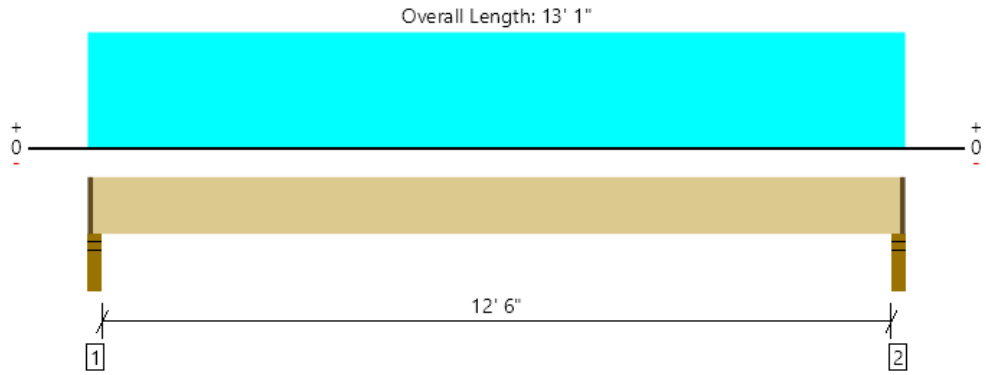
ROOF FRAMING PLAN

SHEET NO.:

S2.03

Roof Framing, Joist A

1 piece(s) 2 x 12 HF No.2 @ 24" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	579 @ 2 1/2"	1367 (2.25")	Passed (42%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	478 @ 1' 2 3/4"	1941	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1805 @ 6' 6 1/2"	2964	Passed (61%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.125 @ 6' 6 1/2"	0.422	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.225 @ 6' 6 1/2"	0.633	Passed (L/675)	--	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/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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	262	327	589	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.50"	262	327	589	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)	6' 2" o/c	
Bottom Edge (Lu)	12' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 13' 1"	24"	20.0	25.0	Default Load

Weyerhaeuser Notes

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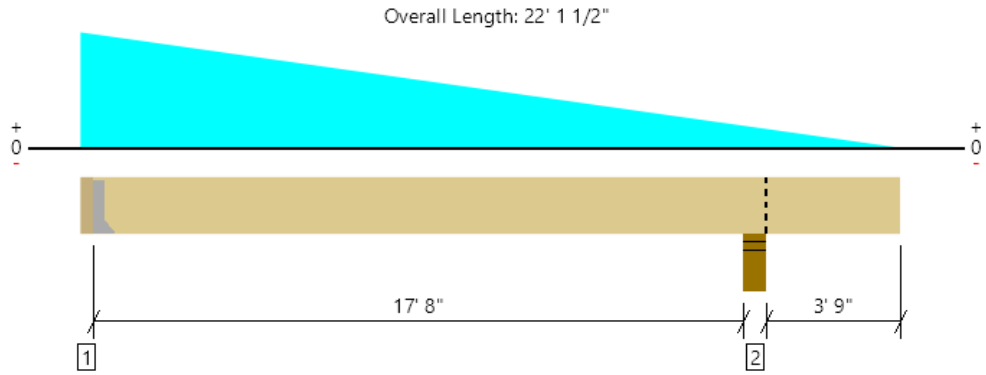
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Roof Framing, Beam 1

1 piece(s) 5 1/8" x 12" 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)	3663 @ 3"	4997 (1.50")	Passed (73%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	3116 @ 1' 3"	12495	Passed (25%)	1.15	1.0 D + 1.0 S (Alt Spans)
Pos Moment (Ft-lbs)	13515 @ 8' 2 3/8"	28290	Passed (48%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-380 @ 18' 1 3/4"	27295	Passed (1%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.309 @ 8' 11 7/16"	0.597	Passed (L/694)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.578 @ 8' 11 3/8"	0.895	Passed (L/372)	--	1.0 D + 1.0 S (Alt Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 17' 9 3/16".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 4' 1 11/16".
- 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 - Hanger on 12" DF beam	3.00"	Hanger[1]	1.50"	1759	2043	3802	See note [1]
2 - Stud wall - HF	5.50"	5.50"	1.50"	1279	1349	2629	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	Continuous	
Bottom Edge (Lu)	All Bearing Points	

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HU5.125/12	2.50"	N/A	22-16d	8-16d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3" to 22' 1 1/2"	N/A	14.9	--	
1 - Tapered (PSF)	0 to 22' 1 1/2" (Front)	12' 3" to 0	20.0	25.0	Default Load

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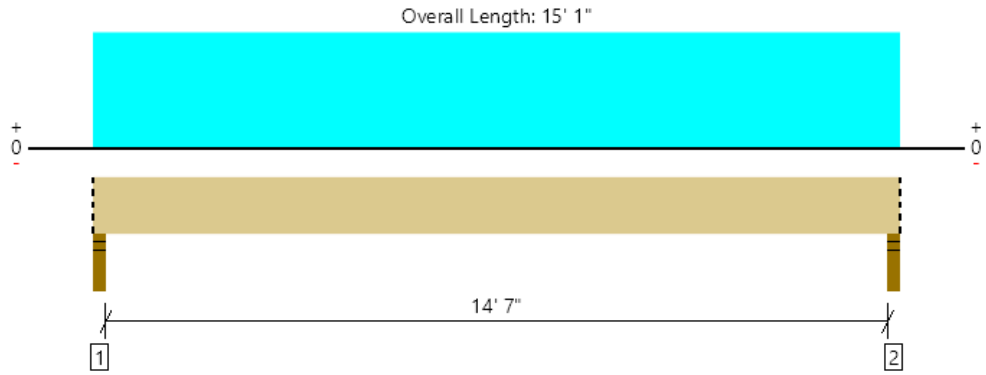
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Roof Framing, Beam 2

1 piece(s) 5 1/8" x 10 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)	3096 @ 1 1/2"	6227 (3.00")	Passed (50%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2635 @ 1' 1 1/2"	10933	Passed (24%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	11292 @ 7' 6 1/2"	21660	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.270 @ 7' 6 1/2"	0.494	Passed (L/659)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.503 @ 7' 6 1/2"	0.742	Passed (L/354)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 14' 10".
- 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 - HF	3.00"	3.00"	1.50"	1431	1665	3096	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	1431	1665	3096	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)	All Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 15' 1"	N/A	13.1	--	
1 - Uniform (PSF)	0 to 15' 1" (Front)	8' 10"	20.0	25.0	Default Load

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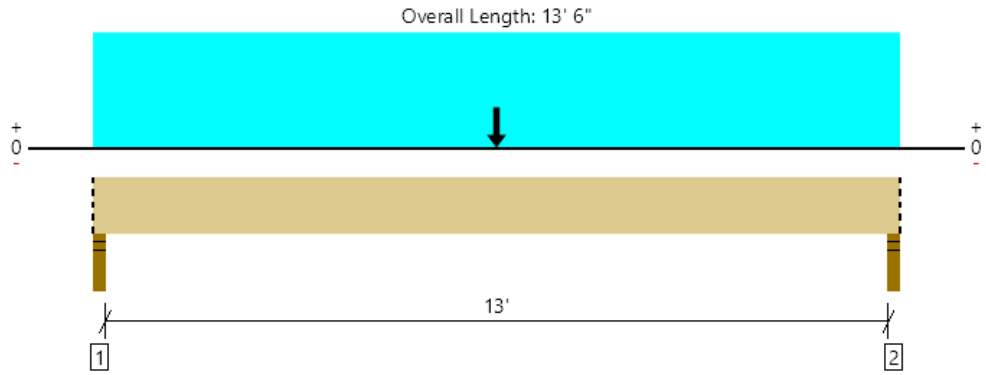
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Roof Framing, Beam 3

3 piece(s) 1 3/4" x 9 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)	2184 @ 1 1/2"	9844 (3.00")	Passed (22%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2087 @ 1' 1/4"	10611	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	12322 @ 6' 9"	19327	Passed (64%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.267 @ 6' 9"	0.442	Passed (L/595)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.498 @ 6' 9"	0.663	Passed (L/319)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - DF	3.00"	3.00"	1.50"	1014	1170	2184	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	1014	1170	2184	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)	All Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 13' 6"	N/A	14.2	--	
1 - Uniform (PSF)	0 to 13' 6" (Front)	2'	15.0	25.0	Default Load
2 - Point (lb)	6' 9" (Front)	N/A	1431	1665	Linked from: Beam 2, Support 1

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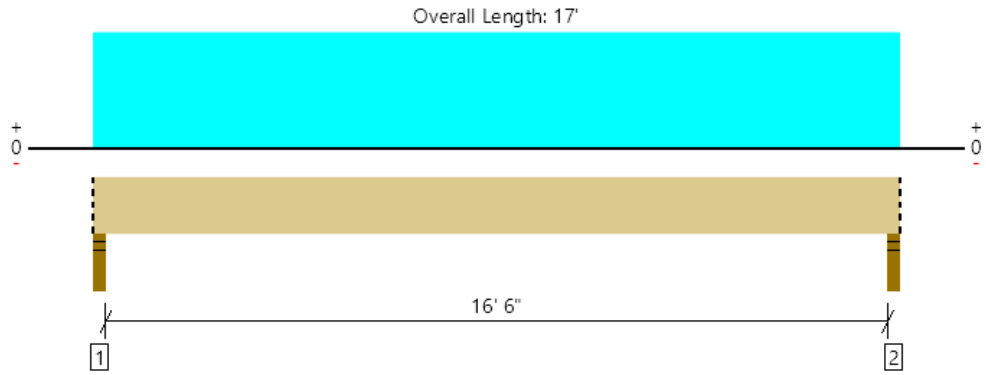
Roof Framing, Beam 4

1 piece(s) 5 1/8" x 12" 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)	3187 @ 1 1/2"	6227 (3.00")	Passed (51%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2718 @ 1' 3"	12495	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	13150 @ 8' 6"	28290	Passed (46%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.267 @ 8' 6"	0.558	Passed (L/754)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.500 @ 8' 6"	0.837	Passed (L/402)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 16' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.54"	1487	1700	3187	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.54"	1487	1700	3187	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)	All Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 17'	N/A	14.9	--	
1 - Uniform (PSF)	0 to 17' (Front)	8'	20.0	25.0	Default Load

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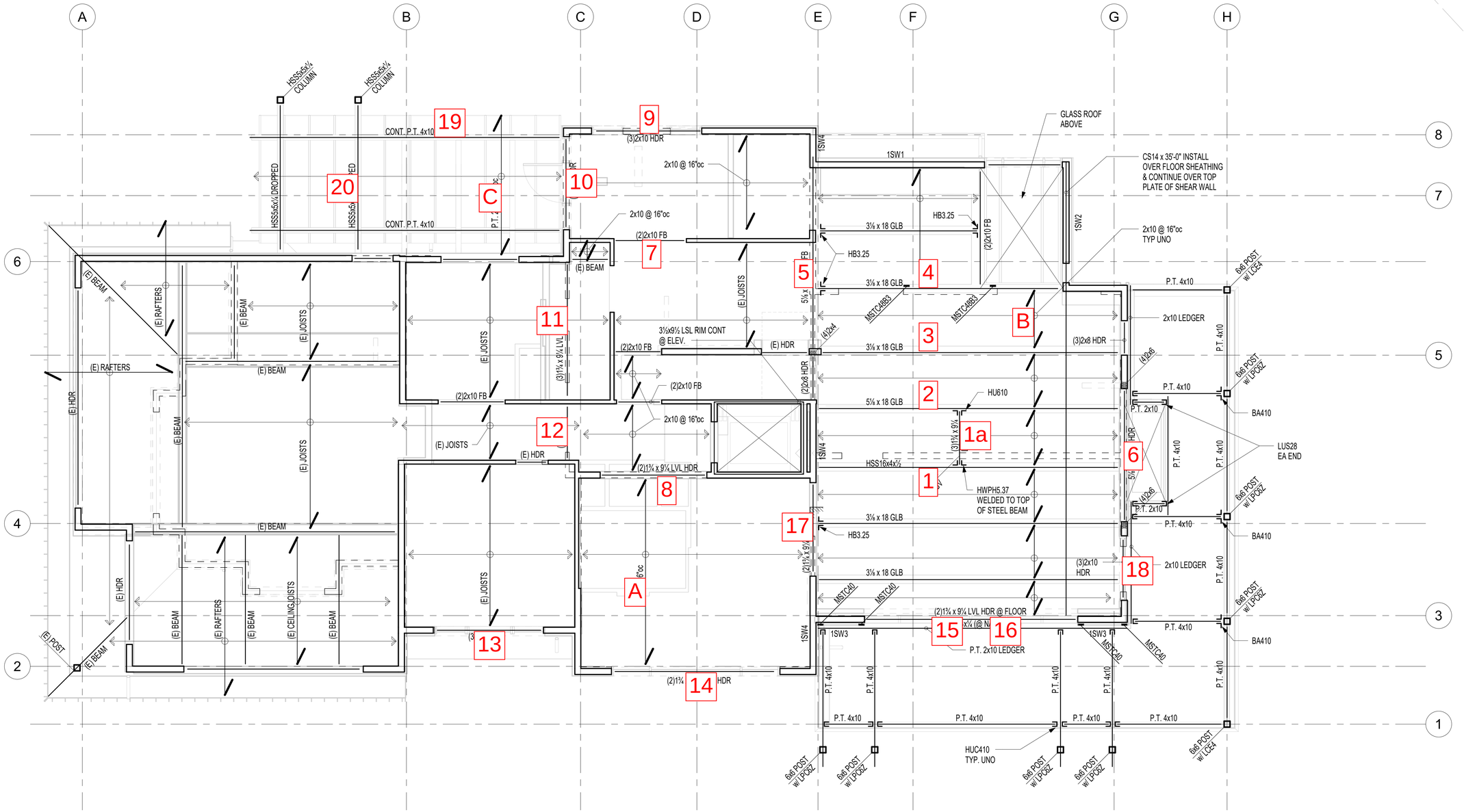
5. 2SWX INDICATES DOUBLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
6. ALL HEADERS SHALL BE (2)2x8 U.N.O. REFER TO NOTE 5 FOR SUPPORT REQUIREMENTS.
7. COLUMNS SHALL BE DOUBLE STUDS MINIMUM, U.N.O., WITH BEAM OR HEADER BEARING FULLY ON COLUMN.

FRAMING PLAN LEGEND

- WALLS BELOW
- WALLS ABOVE
- COLUMNS BELOW
- COLUMNS ABOVE
- HANGER
- ABRUPT CHANGE IN SLAB/FRAMING ELEVATION
- FB — INDICATES FLUSH BEAM
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- FRAMING SPAN AND EXTENTS
- HDUX — INDICATES SIMPSON HOLDOWN. REFER TO HOLDOWN SCHEDULE (8/S3.00) FOR THREADED ROD CALLOUT & EMBEDMENT INTO CONCRETE
- MSTCXX — INDICATES SIMPSON STRAP HOLDOWN



Board & Vellum
ARCHITECTURE AND DESIGN
115 15th Ave E. Suite 100 Seattle, WA 98112
info@boardandvellum.com | 206.707.8895

BYKONEN CARTER QUINN
STRUCTURAL ENGINEERING

NICHOLAS VH CARTER — STATE OF WASHINGTON — 37270 — STRUCTURAL — PROFESSIONAL ENGINEER
SDCI STAMP AREA

LEUNG RESIDENCE

PROJECT ADDRESS:
9102 SE 78TH PLACE
MERCER ISLAND, WA 98040

OWNER:
KEVIN & NANCY LEUNG

REVISION	DATE	DESCRIPTION

ISSUANCES

DATE	DESCRIPTION

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ORIGINAL SHEET SIZE IS 22"x34"

BOARD & VELLUM PROJECT #: 2021054.00
SDCI PROJECT #:
PLOT DATE: 05.24.22

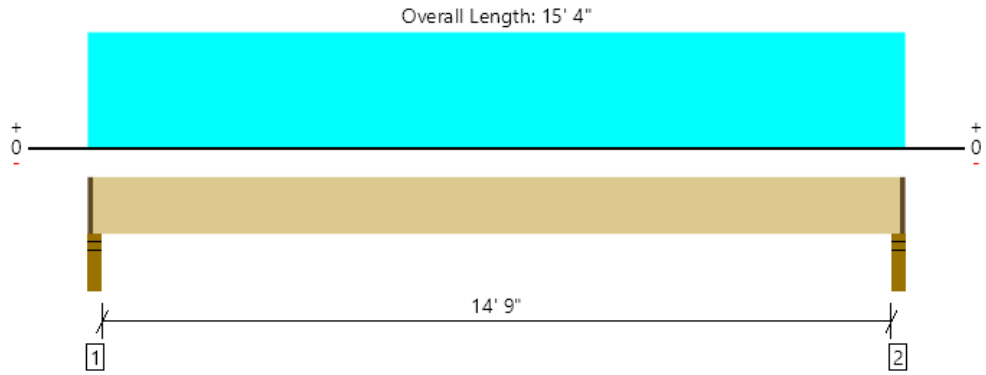
LEVEL 2 FRAMING PLAN

SHEET NO.:

S2.02

Level 2 Framing, Joist A

1 piece(s) 2 x 12 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	555 @ 2 1/2"	1367 (2.25")	Passed (41%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	472 @ 1' 2 3/4"	1688	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2040 @ 7' 8"	2577	Passed (79%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.257 @ 7' 8"	0.373	Passed (L/697)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.353 @ 7' 8"	0.746	Passed (L/507)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	153	409	562	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.50"	153	409	562	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)	5' o/c	
Bottom Edge (Lu)	15' 2" 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 15' 4"	16"	15.0	40.0	Default Load

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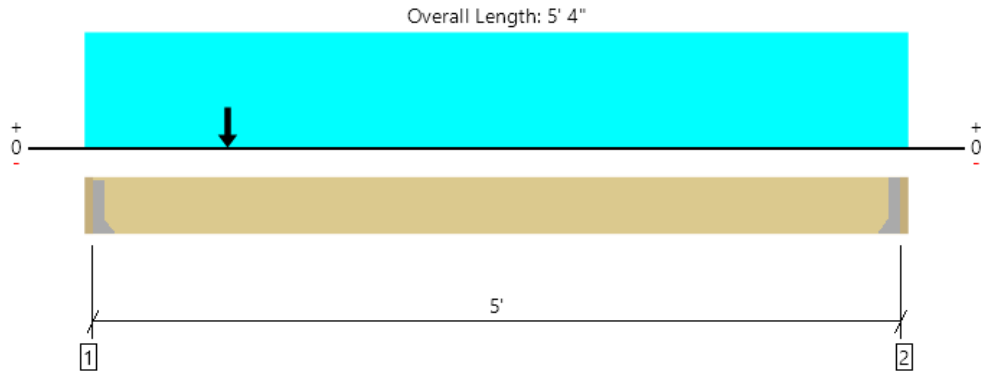
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Joist B

1 piece(s) 2 x 10 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	690 @ 2"	911 (1.50")	Passed (76%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	662 @ 11 1/4"	1596	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	558 @ 1'	2204	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.010 @ 2' 5 15/16"	0.125	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.018 @ 2' 5 9/16"	0.250	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Hanger on 9 1/4" HF beam	2.00"	Hanger[1]	1.50"	331	142	350	700	See note [1]
2 - Hanger on 9 1/4" HF beam	2.00"	Hanger[1]	1.50"	109	142	70	268	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

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

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	
2 - Face Mount Hanger	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

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

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 5' 4"	16"	15.0	40.0	-	Default Load
2 - Point (PLF)	1'	16"	250.0	-	315.0	

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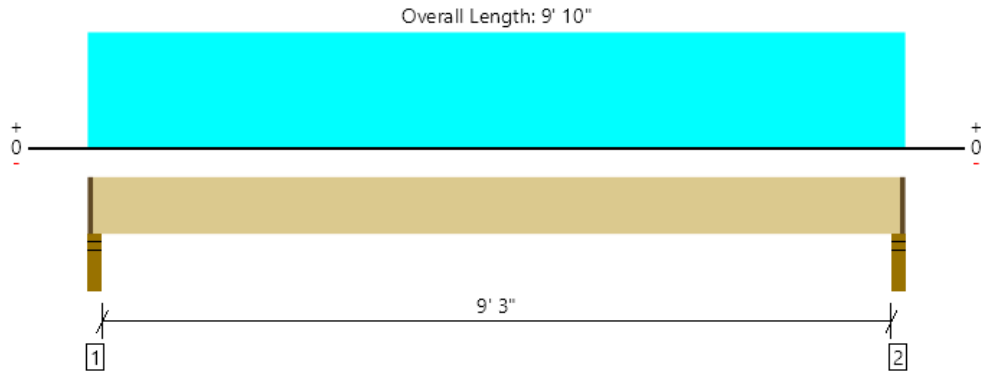
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 2 Framing, Joist C

1 piece(s) 2 x 6 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	225 @ 2 1/2"	1367 (2.25")	Passed (16%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	194 @ 9"	949	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	517 @ 4' 11"	921	Passed (56%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.218 @ 4' 11"	0.314	Passed (L/518)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.305 @ 4' 11"	0.471	Passed (L/370)	--	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/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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	66	164	229	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.50"	66	164	229	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)	9' 8" o/c	
Bottom Edge (Lu)	9' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 9' 10"	16"	10.0	25.0	Default Load

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

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Leung Residence - Framing.ec6

LIC# : KW-06015393, Build:20.22.3.16 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

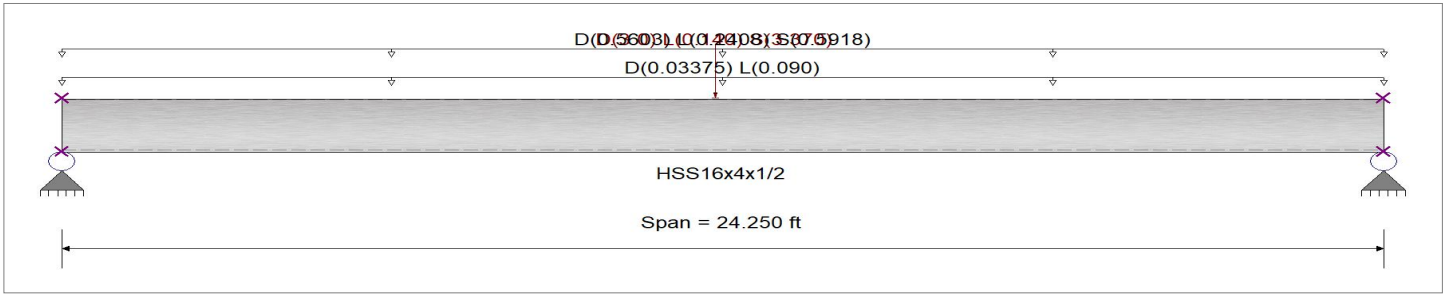
DESCRIPTION: Level 2 Framing - Beam 1

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 2.250 ft

Uniform Load : D = 0.2490, L = 0.1070, S = 0.2630 ksf, Tributary Width = 2.250 ft

Point Load : D = 3.0, L = 0.140, S = 3.370 k @ 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.751 : 1	Maximum Shear Stress Ratio =	0.086 : 1
Section used for this span	HSS16x4x1/2	Section used for this span	HSS16x4x1/2
Ma : Applied	133.205 k-ft	Va : Applied	19.194 k
Mn / Omega : Allowable	177.435 k-ft	Vn/Omega : Allowable	224.480 k
Load Combination	+D+0.750L+0.750S	Load Combination	+D+0.750L+0.750S
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.482 in	Ratio =	603	>=480.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<480.0	Span: 1 : S Only
Max Downward Total Deflection	1.019 in	Ratio =	286	>=240.	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection	0.000 in	Ratio =	0	<240.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 24.25 ft	1	0.374	0.042	66.41		66.41	296.32	177.44	1.18	1.00	9.48	374.88	224.48
+D+L													
Dsgn. L = 24.25 ft	1	0.516	0.060	91.57		91.57	296.32	177.44	1.17	1.00	13.56	374.88	224.48
+D+S													
Dsgn. L = 24.25 ft	1	0.734	0.082	130.31		130.31	296.32	177.44	1.19	1.00	18.35	374.88	224.48
+D+0.750L													
Dsgn. L = 24.25 ft	1	0.481	0.056	85.28		85.28	296.32	177.44	1.17	1.00	12.54	374.88	224.48
+D+0.750L+0.750S													
Dsgn. L = 24.25 ft	1	0.751	0.086	133.20		133.20	296.32	177.44	1.18	1.00	19.19	374.88	224.48
+0.60D													
Dsgn. L = 24.25 ft	1	0.225	0.025	39.85		39.85	296.32	177.44	1.18	1.00	5.69	374.88	224.48

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S	1	1.0188	12.125		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Leung Residence - Framing.ec6

LIC# : KW-06015393, Build:20.22.3.16 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Level 2 Framing - Beam 1

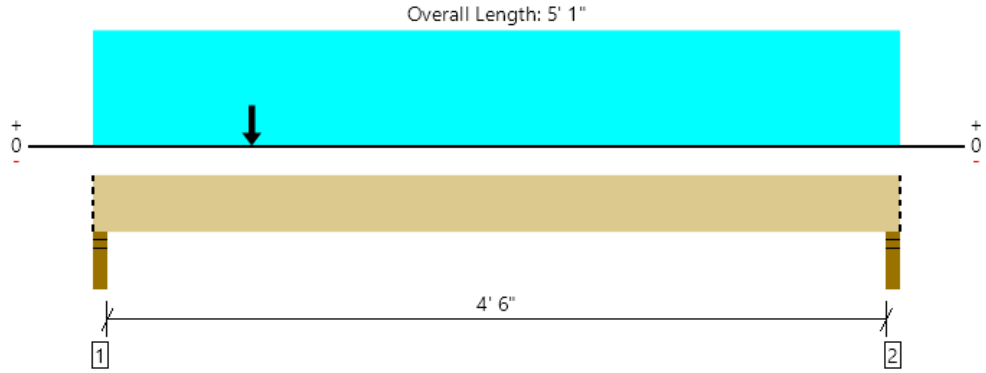
Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	19.194	19.136
Overall MINimum	4.081	4.080
D Only	9.475	9.444
+D+L	13.556	13.524
+D+S	18.352	18.287
+D+0.750L	12.536	12.504
+D+0.750L+0.750S	19.194	19.136
+0.60D	5.685	5.666
L Only	4.081	4.080
S Only	8.877	8.843

Level 2 Framing, Beam 1a

3 piece(s) 1 3/4" x 9 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)	6357 @ 2"	7442 (3.50")	Passed (85%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	5704 @ 1' 3/4"	10611	Passed (54%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5281 @ 1'	19327	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.016 @ 2' 2 13/16"	0.119	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.031 @ 2' 2 7/8"	0.237	Passed (L/999+)	--	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).

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.99"	2988	136	3369	6357	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	704	136	717	1421	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 5' 1"	N/A	14.2	--	--	
1 - Uniform (PSF)	0 to 5' 1" (Front)	1' 4"	15.0	40.0	-	Default Load
2 - Point (lb)	1' (Front)	N/A	1759	-	2043	Linked from: Beam 1, Support 1
3 - Point (lb)	1' (Front)	N/A	1759	-	2043	Linked from: Beam 1, Support 1

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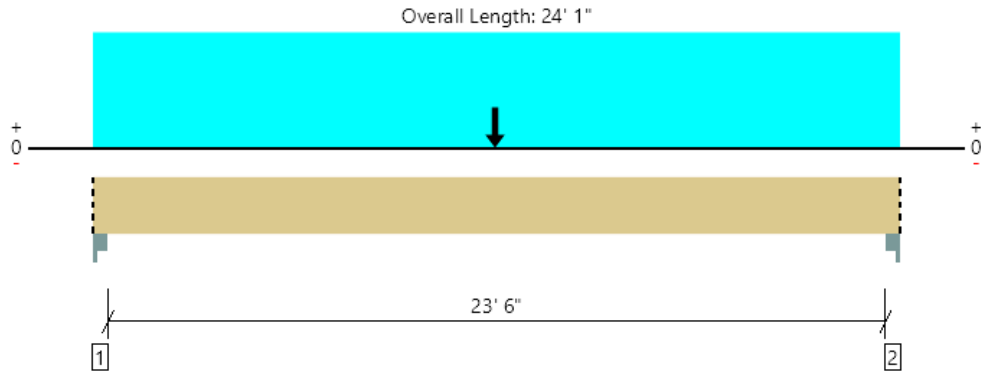
Level 2 Framing, Beam 1

1 piece(s) 6 3/4" x 19 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)	10745 @ 2"	15356 (3.50")	Passed (70%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	9483 @ 1' 11"	26742	Passed (35%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	79760 @ 12'	90066	Passed (89%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.497 @ 12' 7/16"	0.594	Passed (L/573)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.988 @ 12' 7/16"	1.188	Passed (L/288)	--	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).
- A 8.5% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 0.92 that was calculated using length L = 23' 9".
- 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 - Column Cap - steel	3.50"	3.50"	2.45"	5280	2434	4851	10745	Blocking
2 - Column Cap - steel	3.50"	3.50"	2.44"	5270	2434	4840	10725	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 24' 1"	N/A	32.0	--	--	
1 - Uniform (PSF)	0 to 24' 1" (Front)	2' 3"	15.0	40.0	-	Default Load
2 - Uniform (PLF)	0 to 24' 1" (Front)	N/A	248.3	106.5	262.5	Linked from: Joist B, Support 1
3 - Point (lb)	12' (Front)	N/A	2988	136	3369	Linked from: Beam 1a, Support 1

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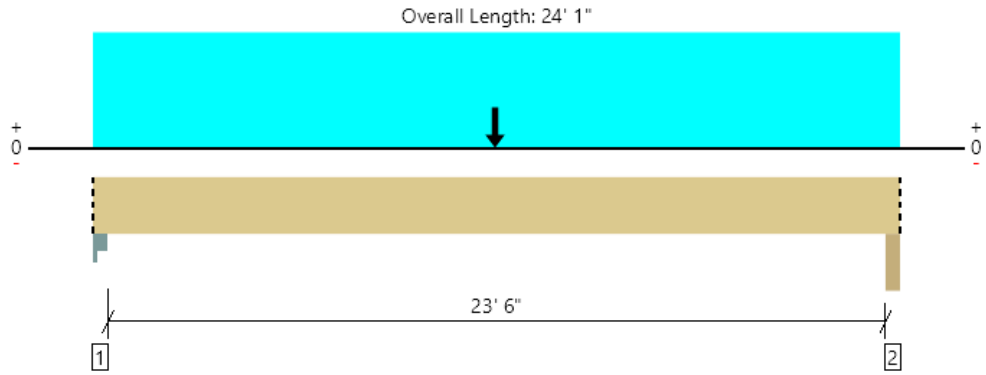
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 2

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)	4584 @ 2"	11659 (3.50")	Passed (39%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	3849 @ 1' 9 1/2"	16298	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	28567 @ 12'	52501	Passed (54%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.367 @ 12' 1/2"	0.594	Passed (L/777)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.663 @ 12' 7/16"	1.188	Passed (L/430)	--	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).
- A 5.1% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 0.95 that was calculated using length L = 23' 9".
- 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 - Column Cap - steel	3.50"	3.50"	1.50"	2014	2434	992	4584	Blocking
2 - Beam - GLB	3.50"	3.50"	1.50"	2012	2434	989	4579	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 24' 1"	N/A	22.4	--	--	
1 - Uniform (PSF)	0 to 24' 1" (Front)	2' 3"	15.0	40.0	-	Default Load
2 - Uniform (PLF)	0 to 24' 1" (Front)	N/A	81.8	106.5	52.5	Linked from: Joist B, Support 2
3 - Point (lb)	12' (Front)	N/A	704	136	717	Linked from: Beam 1a, Support 2

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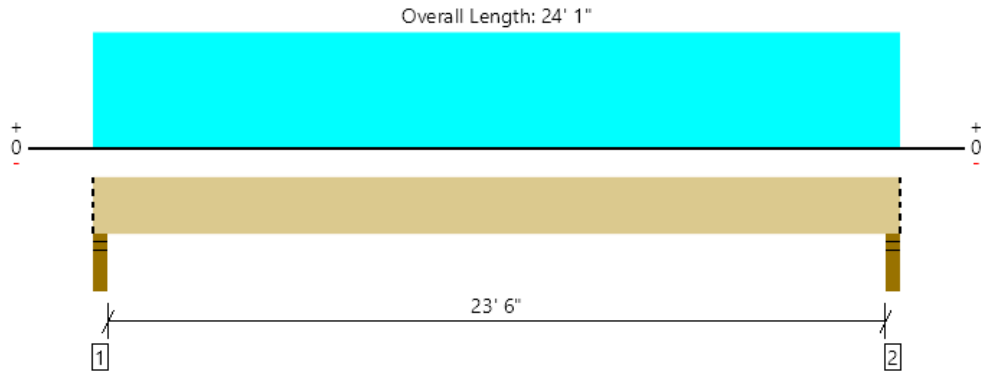
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 3

1 piece(s) 3 1/8" x 18" 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)	3145 @ 2"	4430 (3.50")	Passed (71%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2677 @ 1' 9 1/2"	9938	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	18415 @ 12' 1/2"	33636	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.471 @ 12' 1/2"	0.594	Passed (L/605)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.684 @ 12' 1/2"	1.188	Passed (L/417)	--	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).
- A 0.3% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 23' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.48"	977	2168	3145	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.48"	977	2168	3145	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)	Comments
0 - Self Weight (PLF)	0 to 24' 1"	N/A	13.7	--	
1 - Uniform (PSF)	0 to 24' 1" (Front)	4' 6"	15.0	40.0	Default Load

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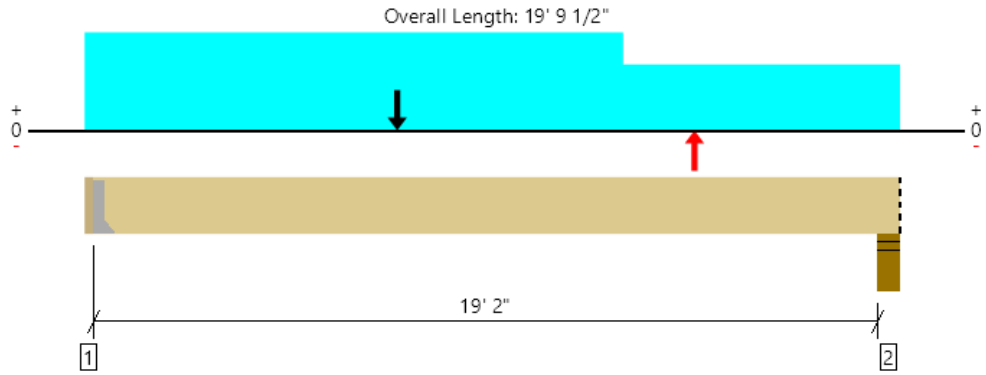
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 4 (w/ overstrength)
1 piece(s) 3 1/8" x 18" 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)	5275 @ 2"	5275 (2.60")	Passed (100%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	3886 @ 1' 8"	11428	Passed (34%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	21543 @ 9' 5 9/16"	38813	Passed (56%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Neg Moment (Ft-lbs)	-889 @ 7' 6"	41625	Passed (2%)	1.60	0.6 D - 0.7 E (All Spans)
Live Load Defl. (in)	0.337 @ 9' 1 1/2"	0.482	Passed (L/687)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.564 @ 9' 4 1/4"	0.965	Passed (L/410)	--	1.0 D + 0.525 E + 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).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 19' 3 1/2".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 2' 4 13/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Seismic	Factored	
1 - Hanger on 18" HF beam	2.00"	Hanger[1]	2.60"	2054	916	2631	1221/-1221	5356	See note [1]
2 - Stud wall - HF	5.50"	5.50"	3.71"	1763	931	2129	1221/-1221	4699	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	Continuous	
Bottom Edge (Lu)	Continuous	

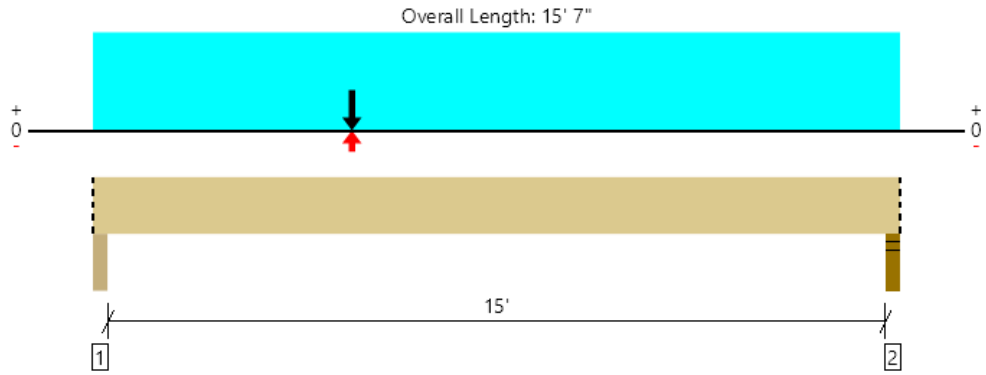
Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	2" to 19' 9 1/2"	N/A	13.7	--	--	--	
1 - Uniform (PSF)	0 to 19' 9 1/2" (Front)	2' 4"	15.0	40.0	-	-	Default Load
2 - Uniform (PSF)	0 to 13' (Front)	4' 9"	15.0	-	25.0	-	Default Load
3 - Uniform (PSF)	0 to 19' 9 1/2" (Front)	6' 6"	15.0	-	25.0	-	Default Load
4 - Point (lb)	7' 6" (Front)	N/A	-	-	-	3250	
5 - Point (lb)	14' 9" (Front)	N/A	-	-	-	-3250	

Level 2 Framing, Beam 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) [Group]
Member Reaction (lbs)	6292 @ 2"	7265 (3.50")	Passed (87%)	--	1.0 D + 1.0 S (All Spans) [1]
Shear (lbs)	5730 @ 1' 5"	14057	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans) [1]
Pos Moment (Ft-lbs)	25457 @ 5'	35805	Passed (71%)	1.15	1.0 D + 1.0 S (All Spans) [1]
Live Load Defl. (in)	0.300 @ 7' 5 7/16"	0.381	Passed (L/610)	--	1.0 D + 1.0 S (All Spans) [1]
Total Load Defl. (in)	0.517 @ 7' 5 5/16"	0.762	Passed (L/354)	--	1.0 D + 1.0 S (All 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).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 15' 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	Floor Live	Snow	Seismic	Factored	
1 - Beam - HF	3.50"	3.50"	3.03"	2644	626	3648	834/-834	6292	Blocking
2 - Stud wall - HF	3.50"	3.50"	2.20"	1892	290	2684	387/-387	4577	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)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	0 to 15' 7"	N/A	16.8	--	--	--	
1 - Uniform (PSF)	0 to 15' 7" (Front)	9' 6"	15.0	-	25.0	-	Default Load
2 - Point (lb)	5' (Front)	N/A	2054	916	2631	1221/-1221	Linked from: Beam 4, Support 1

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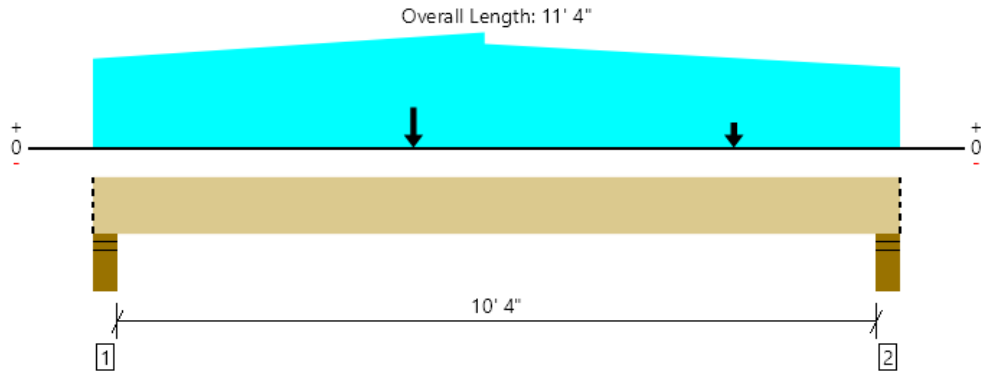
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 6

1 piece(s) 5 1/8" x 15" 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)	9571 @ 10' 11 1/2"	12454 (6.00")	Passed (77%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	9113 @ 9' 7"	15618	Passed (58%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	34727 @ 4' 6"	44203	Passed (79%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.123 @ 5' 6 9/16"	0.265	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.239 @ 5' 6 3/8"	0.529	Passed (L/532)	--	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).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 10' 7".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - HF	6.00"	6.00"	4.41"	4493	2087	4130	9156	Blocking
2 - Stud wall - HF	6.00"	6.00"	4.61"	4496	3083	3683	9571	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 11' 4"	N/A	18.7	--	--	
1 - Tapered (PSF)	0 to 5' 6" (Front)	6' to 8'	20.0	-	25.0	Default Load
2 - Tapered (PSF)	5' 6" to 11' 4" (Front)	8' to 6'	15.0	-	25.0	Default Load
3 - Uniform (PSF)	0 to 11' 4" (Front)	8"	15.0	40.0	-	Default Load
4 - Point (lb)	4' 6" (Front)	N/A	5270	2434	4840	Linked from: Beam 1, Support 2
5 - Point (lb)	9' (Front)	N/A	2012	2434	989	Linked from: Beam 2, Support 2

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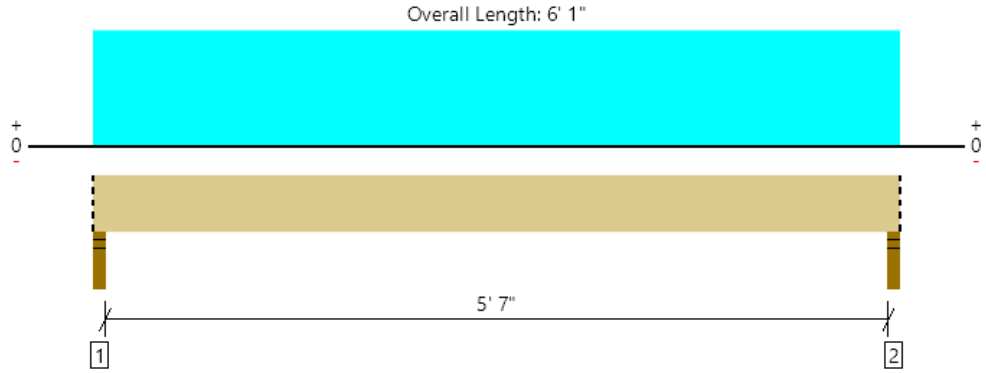
Level 2 Framing, Beam 7
2 piece(s) 2 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1443 @ 1 1/2"	3645 (3.00")	Passed (40%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	959 @ 1' 1/4"	2775	Passed (35%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2018 @ 3' 1/2"	3333	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.034 @ 3' 1/2"	0.146	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.048 @ 3' 1/2"	0.292	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	409	1034	1443	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	409	1034	1443	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)	Comments
0 - Self Weight (PLF)	0 to 6' 1"	N/A	7.0	--	
1 - Uniform (PSF)	0 to 6' 1" (Front)	8' 6"	15.0	40.0	Default Load

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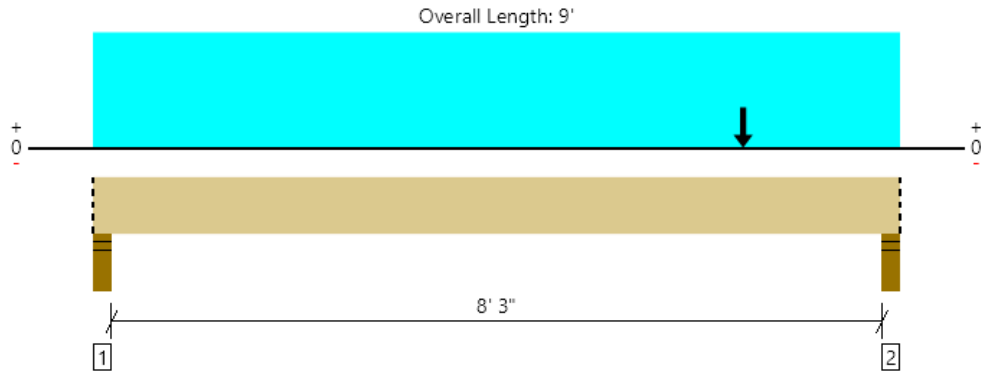
Level 2 Framing, Beam 8

2 piece(s) 1 3/4" x 9 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)	4325 @ 8' 9"	6379 (4.50")	Passed (68%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	3786 @ 7' 10 1/4"	7074	Passed (54%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	6306 @ 4' 11 5/16"	11204	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.122 @ 4' 7 5/8"	0.213	Passed (L/836)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.208 @ 4' 8 1/16"	0.425	Passed (L/491)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - HF	4.50"	4.50"	2.00"	987	1845	294	2832	Blocking
2 - Stud wall - HF	4.50"	4.50"	3.05"	1913	1845	1371	4325	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 9'	N/A	9.4	--	--	
1 - Uniform (PSF)	0 to 9' (Front)	10' 3"	15.0	40.0	-	Default Load
2 - Point (lb)	7' 3" (Front)	N/A	1431	-	1665	Linked from: Beam 2, Support 2

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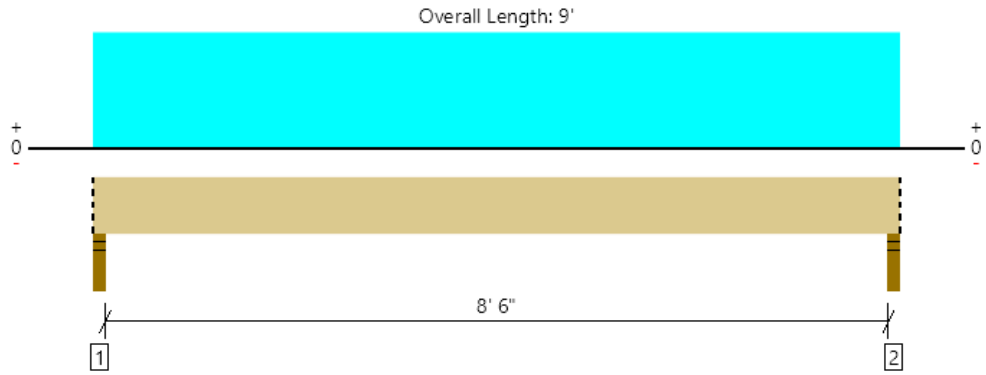
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 2 Framing, Beam 9

3 piece(s) 2 x 8 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1162 @ 1 1/2"	5468 (3.00")	Passed (21%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	942 @ 10 1/4"	3263	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2472 @ 4' 6"	3351	Passed (74%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.114 @ 4' 6"	0.219	Passed (L/924)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.183 @ 4' 6"	0.438	Passed (L/573)	--	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).
- 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 - HF	3.00"	3.00"	1.50"	442	720	225	1162	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	442	720	225	1162	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 9'	N/A	8.3	--	--	
1 - Uniform (PSF)	0 to 9' (Front)	4'	15.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 9' (Front)	2'	15.0	-	25.0	Default Load

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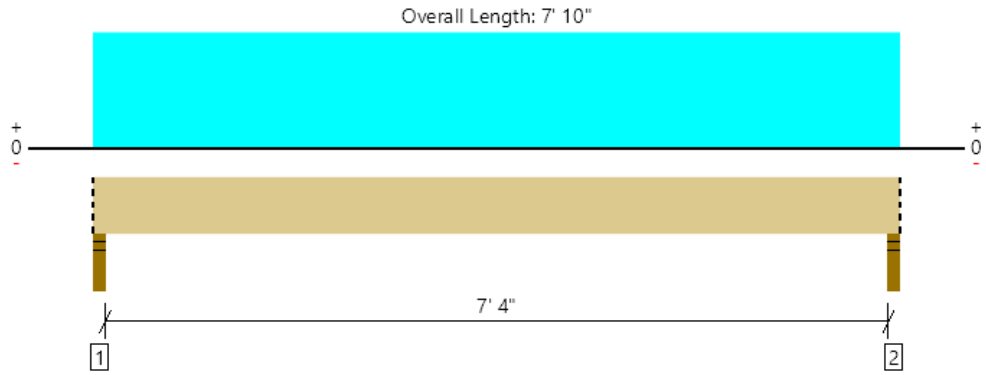
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 10
3 piece(s) 2 x 8 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1579 @ 1 1/2"	5468 (3.00")	Passed (29%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1235 @ 10 1/4"	3752	Passed (33%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2899 @ 3' 11"	3853	Passed (75%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.095 @ 3' 11"	0.190	Passed (L/957)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.162 @ 3' 11"	0.379	Passed (L/563)	--	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).
- 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 - HF	3.00"	3.00"	1.50"	649	157	930	1579	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	649	157	930	1579	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 7' 10"	N/A	8.3	--	--	
1 - Uniform (PSF)	0 to 7' 10" (Front)	1'	15.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 7' 10" (Front)	9' 6"	15.0	-	25.0	Default Load

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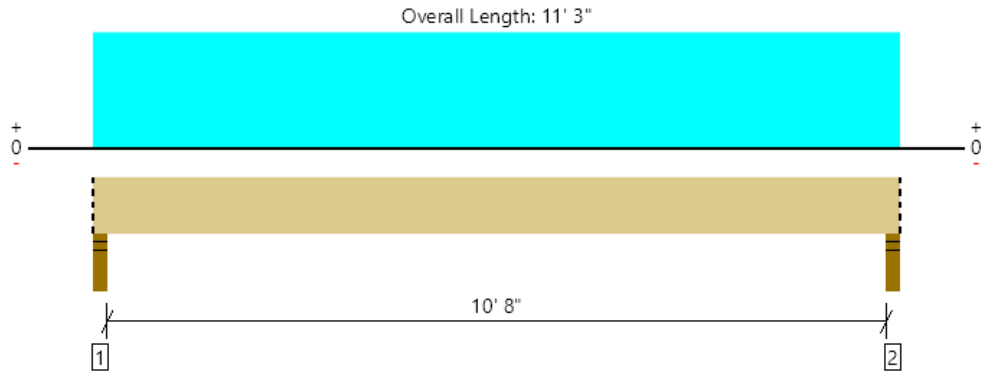
Level 2 Framing, Beam 11

3 piece(s) 1 3/4" x 9 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)	3708 @ 2"	7442 (3.50")	Passed (50%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3007 @ 1' 3/4"	10611	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	9819 @ 5' 7 1/2"	19327	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.194 @ 5' 7 1/2"	0.273	Passed (L/675)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.327 @ 5' 7 1/2"	0.546	Passed (L/400)	--	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).

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.74"	1511	300	2197	3708	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.74"	1511	300	2197	3708	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 11' 3"	N/A	14.2	--	--	
1 - Uniform (PSF)	0 to 11' 3" (Front)	1' 4"	15.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 11' 3" (Front)	15' 7 1/2"	15.0	-	25.0	Default Load

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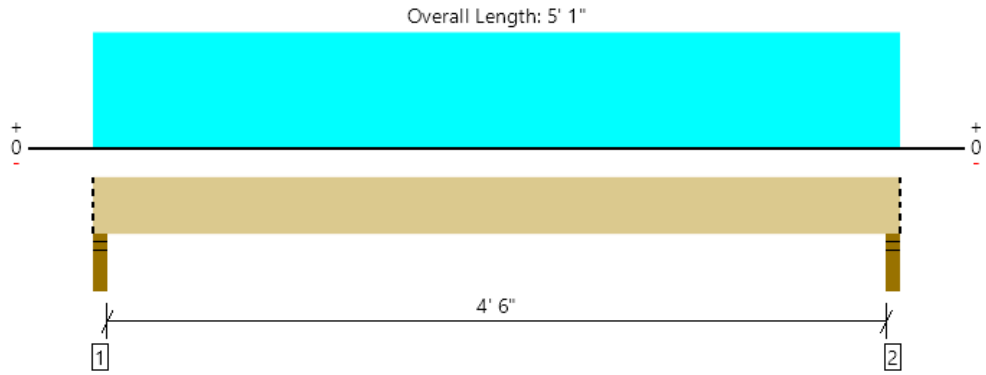
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 12
2 piece(s) 2 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1657 @ 2"	4253 (3.50")	Passed (39%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	964 @ 1' 3/4"	3191	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1839 @ 2' 6 1/2"	3833	Passed (48%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.017 @ 2' 6 1/2"	0.119	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.029 @ 2' 6 1/2"	0.237	Passed (L/999+)	--	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).
- 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 - HF	3.50"	3.50"	1.50"	664	136	993	1657	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	664	136	993	1657	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 5' 1"	N/A	7.0	--	--	
1 - Uniform (PSF)	0 to 5' 1" (Front)	1' 4"	15.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 5' 1" (Front)	15' 7 1/2"	15.0	-	25.0	Default Load

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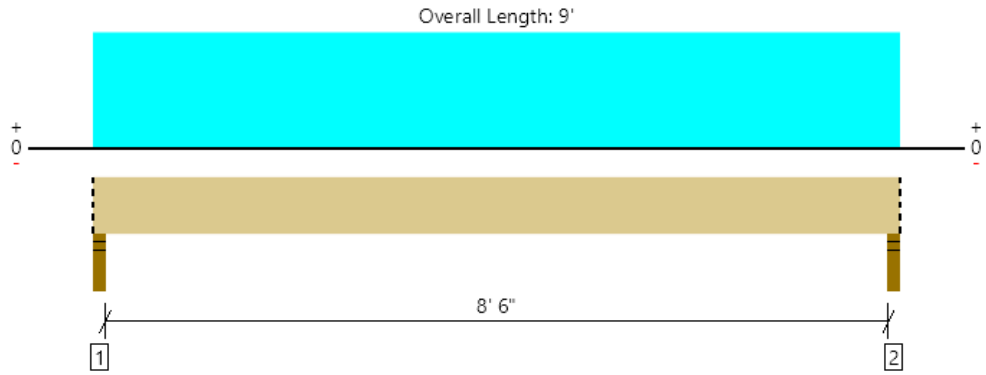
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 2 Framing, Beam 13
3 piece(s) 2 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1656 @ 1 1/2"	5468 (3.00")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1280 @ 1' 1/4"	4163	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3522 @ 4' 6"	5000	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.089 @ 4' 6"	0.219	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.126 @ 4' 6"	0.438	Passed (L/835)	--	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).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	486	1170	1656	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	486	1170	1656	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)	Comments
0 - Self Weight (PLF)	0 to 9'	N/A	10.6	--	
1 - Uniform (PSF)	0 to 9' (Front)	6' 6"	15.0	40.0	Default Load

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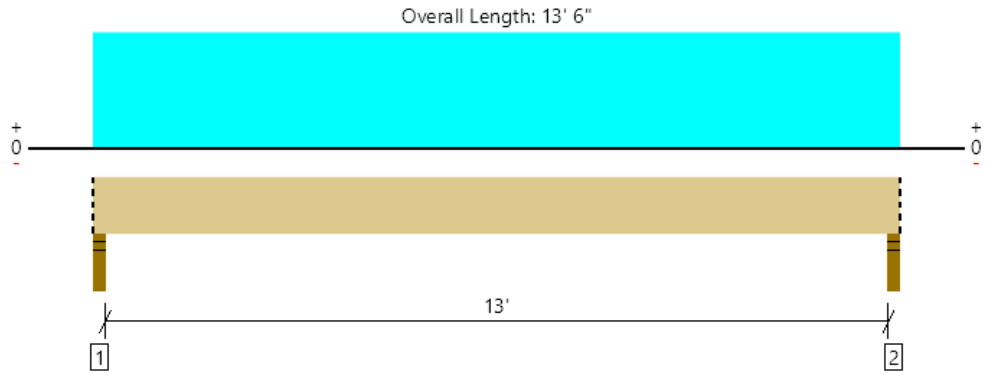
Level 2 Framing, Beam 14

2 piece(s) 1 3/4" x 11 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)	2862 @ 1 1/2"	4253 (3.00")	Passed (67%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2358 @ 1' 2 1/4"	7481	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	9304 @ 6' 9"	16137	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.270 @ 6' 9"	0.442	Passed (L/589)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.381 @ 6' 9"	0.663	Passed (L/417)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	2.02"	837	2025	2862	Blocking
2 - Stud wall - HF	3.00"	3.00"	2.02"	837	2025	2862	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)	All Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 13' 6"	N/A	11.5	--	
1 - Uniform (PSF)	0 to 13' 6" (Front)	7' 6"	15.0	40.0	Default Load

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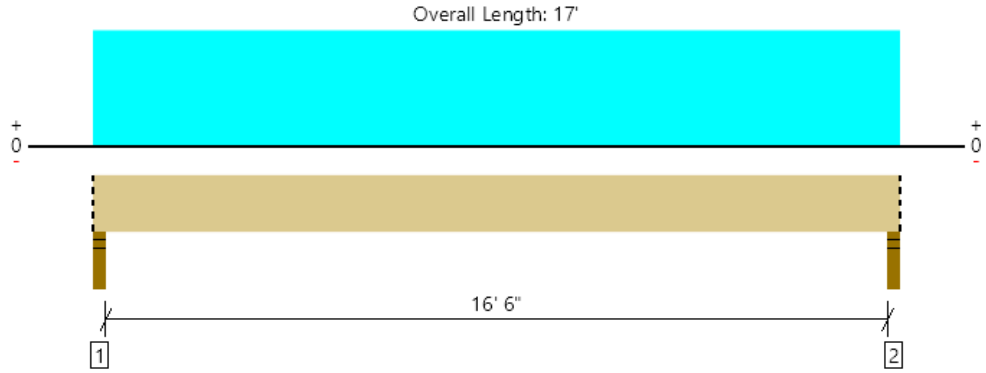
Level 2 Framing, Beam 15

2 piece(s) 1 3/4" x 9 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)	1015 @ 1 1/2"	4253 (3.00")	Passed (24%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	893 @ 1' 1/4"	6151	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4189 @ 8' 6"	11204	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.317 @ 8' 6"	0.558	Passed (L/634)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.473 @ 8' 6"	0.837	Passed (L/425)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	335	680	1015	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	335	680	1015	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)	All Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 17'	N/A	9.4	--	
1 - Uniform (PSF)	0 to 17' (Front)	2'	15.0	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

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Leung Residence - Framing.ec6

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

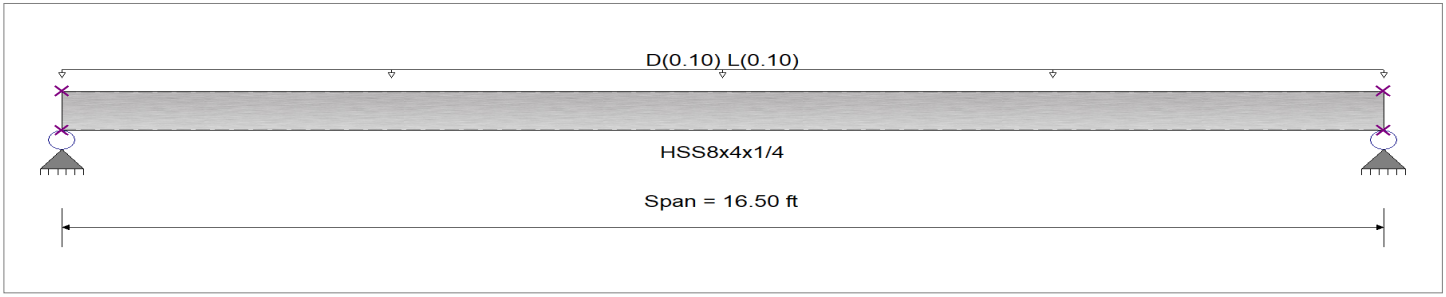
DESCRIPTION: Level 2 Framing - Beam 16

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.10, L = 0.10 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.223 : 1	Maximum Shear Stress Ratio =	0.029 : 1
Section used for this span	HSS8x4x1/4	Section used for this span	HSS8x4x1/4
Ma : Applied	6.806 k-ft	Va : Applied	1.650 k
Mn / Omega : Allowable	30.529 k-ft	Vn/Omega : Allowable	56.229 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.136 in	Ratio =	1,456	>=360	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	Span: 1 : L Only
Max Downward Total Deflection	0.272 in	Ratio =	728	>=180	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	VnxVnx/Omega
D Only												
Dsgn. L = 16.50 ft	1	0.111	0.015	3.40		3.40	50.98	30.53	1.14	1.00	0.83	93.90	56.23
+D+L												
Dsgn. L = 16.50 ft	1	0.223	0.029	6.81		6.81	50.98	30.53	1.14	1.00	1.65	93.90	56.23
+D+0.750L												
Dsgn. L = 16.50 ft	1	0.195	0.026	5.96		5.96	50.98	30.53	1.14	1.00	1.44	93.90	56.23
+0.60D												
Dsgn. L = 16.50 ft	1	0.067	0.009	2.04		2.04	50.98	30.53	1.14	1.00	0.50	93.90	56.23

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.2719	8.297		0.0000	0.000

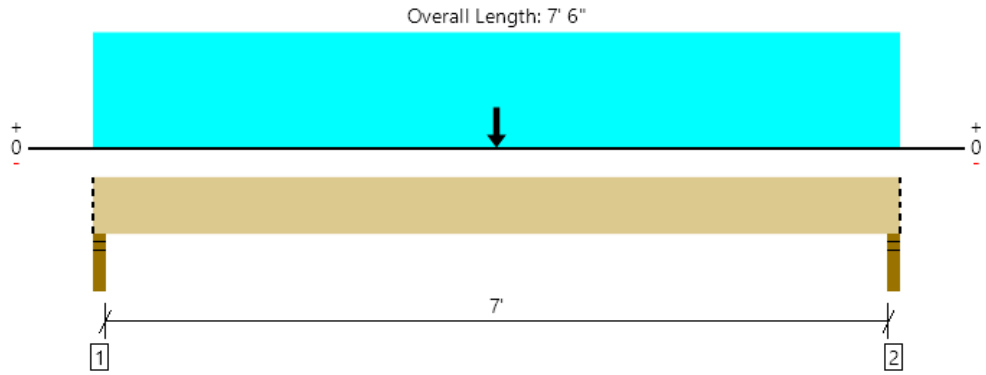
Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.650	1.650
Overall MINimum	0.495	0.495
D Only	0.825	0.825
+D+L	1.650	1.650
+D+0.750L	1.444	1.444
+0.60D	0.495	0.495
L Only	0.825	0.825

Level 2 Framing, Beam 17

2 piece(s) 1 3/4" x 9 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)	2020 @ 1 1/2"	4253 (3.00")	Passed (48%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1898 @ 1' 1/4"	6151	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	6485 @ 3' 9"	11204	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.091 @ 3' 9"	0.181	Passed (L/956)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.133 @ 3' 9"	0.363	Passed (L/656)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	636	1384	2020	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	636	1384	2020	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)	Comments
0 - Self Weight (PLF)	0 to 7' 6"	N/A	9.4	--	
1 - Uniform (PSF)	0 to 7' 6" (Front)	2'	15.0	40.0	Default Load
2 - Point (lb)	3' 9" (Front)	N/A	977	2168	Linked from: Beam 3, Support 1

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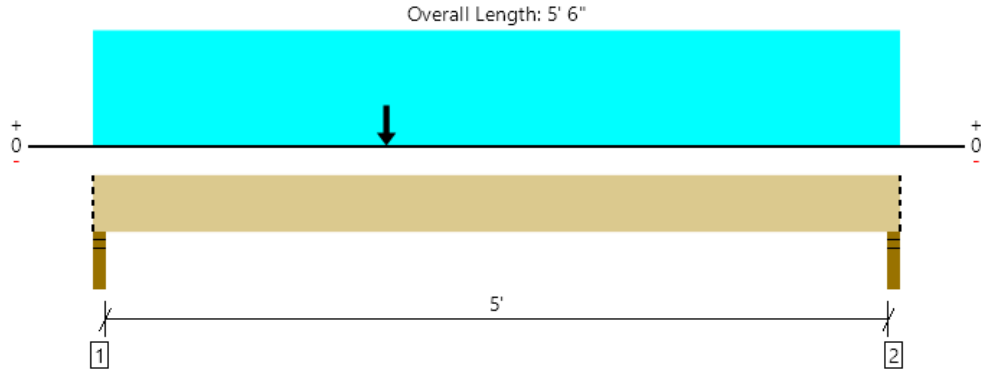
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 18
3 piece(s) 2 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2252 @ 1 1/2"	5468 (3.00")	Passed (41%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2167 @ 1' 1/4"	4163	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4056 @ 2'	5000	Passed (81%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.029 @ 2' 7 5/16"	0.131	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.042 @ 2' 7 5/16"	0.262	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	712	1540	2252	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	433	921	1354	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)	Comments
0 - Self Weight (PLF)	0 to 5' 6"	N/A	10.6	--	
1 - Uniform (PSF)	0 to 5' 6" (Front)	1' 4"	15.0	40.0	Default Load
2 - Point (lb)	2' (Front)	N/A	977	2168	Linked from: Beam 3, Support 2

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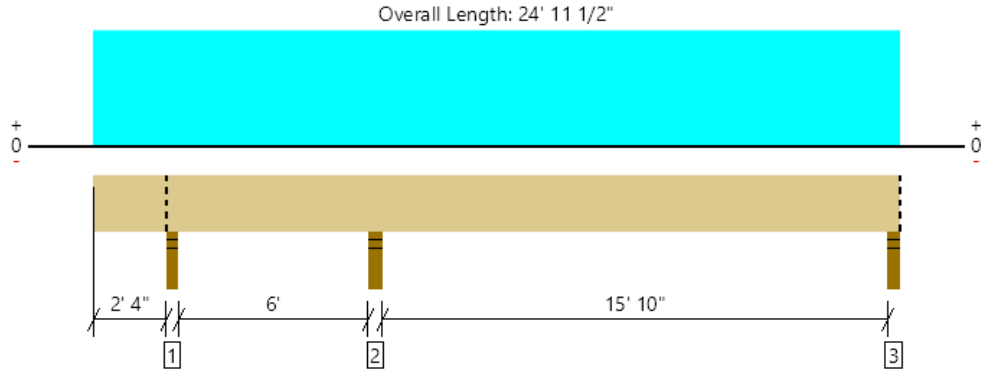
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 2 Framing, Beam 19
1 piece(s) 4 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2175 @ 8' 8 3/4"	4961 (3.50")	Passed (44%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	1156 @ 9' 7 3/4"	3723	Passed (31%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	-3264 @ 8' 8 3/4"	4879	Passed (67%)	1.15	1.0 D + 1.0 S (Adj Spans)
Live Load Defl. (in)	0.258 @ 17' 6 5/16"	0.403	Passed (L/750)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.381 @ 17' 6 7/16"	0.805	Passed (L/507)	--	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 (2L/480) and TL (2L/240).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	97	364	461	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.53"	708	1467	2175	None
3 - Stud wall - HF	3.00"	3.00"	1.50"	294	601	895	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)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 24' 11 1/2"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 24' 11 1/2" (Front)	3' 7"	10.0	25.0	Default Load

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

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Leung Residence - Framing.ec6

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

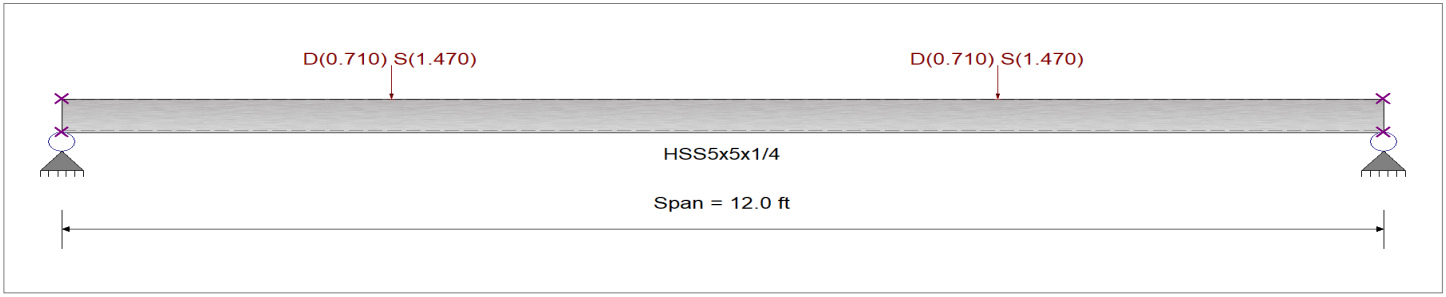
DESCRIPTION: Level 2 Framing - Beam 20

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Load(s) for Span Number 1
Point Load : D = 0.710, S = 1.470 k @ 3.0 ft

Point Load : D = 0.710, S = 1.470 k @ 8.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.432 : 1	Maximum Shear Stress Ratio =	0.071 : 1
Section used for this span	HSS5x5x1/4	Section used for this span	HSS5x5x1/4
Ma : Applied	7.543 k-ft	Va : Applied	2.365 k
Mn / Omega : Allowable	17.468 k-ft	Vn/Omega : Allowable	33.124 k
Load Combination	+D+S	Load Combination	+D+S
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.289 in	Ratio =	497	>=480.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<480.0	Span: 1 : S Only
Max Downward Total Deflection	0.445 in	Ratio =	323	>=240.	Span: 1 : +D+S
Max Upward Total Deflection	0.000 in	Ratio =	0	<240.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 12.00 ft	1	0.150	0.025	2.62		2.62	29.17	17.47	1.06	1.00	0.83	55.32	33.12
+D+S													
Dsgn. L = 12.00 ft	1	0.432	0.071	7.54		7.54	29.17	17.47	1.06	1.00	2.36	55.32	33.12
+D+0.750S													
Dsgn. L = 12.00 ft	1	0.361	0.060	6.31		6.31	29.17	17.47	1.06	1.00	1.98	55.32	33.12
+0.60D													
Dsgn. L = 12.00 ft	1	0.090	0.015	1.57		1.57	29.17	17.47	1.06	1.00	0.50	55.32	33.12

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.4454	6.034		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.365	2.183
Overall MINimum	0.500	0.464
D Only	0.833	0.774
+D+S	2.365	2.183

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Leung Residence - Framing.ec6

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Level 2 Framing - Beam 20

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750S	1.982	1.831
+0.60D	0.500	0.464
S Only	1.531	1.409

FOUNDATION PLAN NOTES

1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
2. SLABS ON GRADE SHALL BE 4" THICK WITH 6x6 W1.4xW1.4 WWM CENTERED, U.N.O. PREPARED SOILS AND PROVIDE MINIMUM 6-MIL VISQUEEN VAPOR BARRIER UNDER ALL SLABS.
3. SLABS ON GRADE SHALL BE SUPPORTED ON 12" COMPACTED STRUCTURAL FILL OVER RE-COMPACTED NATIVE SOIL PER GEOTECHNICAL REPORT.
4. REFER TO ARCHITECTURAL PLANS FOR DIMENSIONS AND TOP OF SLAB ELEVATIONS.

FRAMING PLAN NOTES (TYPICAL UNLESS NOTED OTHERWISE)

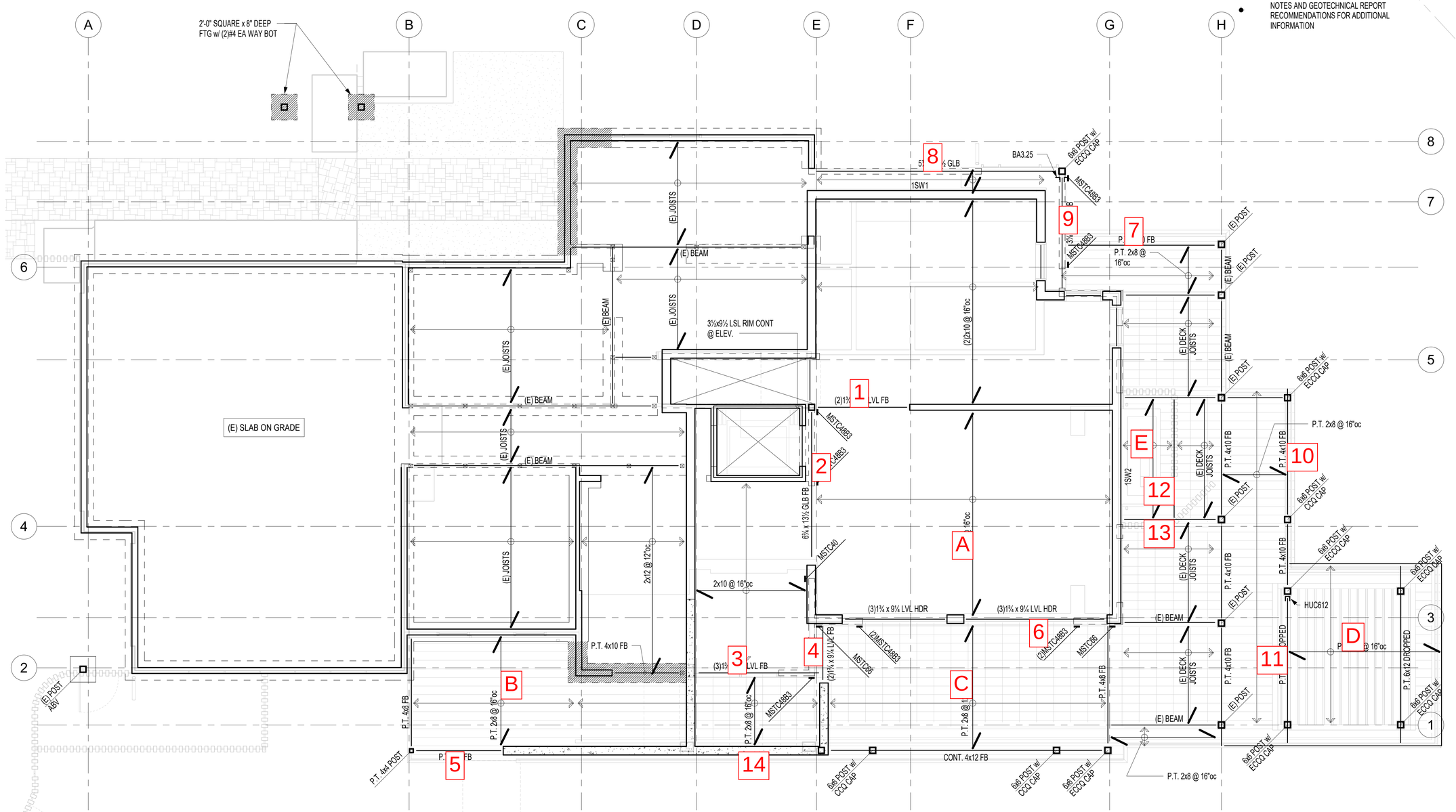
1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
2. FLOOR SHEATHING SHALL BE 23/32" TONGUE AND GROOVE APA RATED SHEATHING (SPAN RATING 40/20). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEAR WALLS w/ 10d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING
3. ROOF SHEATHING SHALL BE 15/32" APA RATED SHEATHING (SPAN RATING 24/0). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEARWALLS w/ 8d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING.
4. 1SWX INDICATES SINGLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
5. 2SWX INDICATES DOUBLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
6. ALL HEADERS SHALL BE (2)2x8 U.N.O. REFER TO NOTE 5 FOR SUPPORT REQUIREMENTS.
7. COLUMNS SHALL BE DOUBLE STUDS MINIMUM, U.N.O., WITH BEAM OR HEADER BEARING FULLY ON COLUMN.

FRAMING PLAN LEGEND

- WALLS BELOW
- WALLS ABOVE
- COLUMNS BELOW
- COLUMNS ABOVE
- HANGER
- ABRUPT CHANGE IN SLAB/FRAMING ELEVATION
- FB — INDICATES FLUSH BEAM
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- FRAMING SPAN AND EXTENTS
- HDUX — INDICATES SIMPSON HOLDOWN. REFER TO HOLDOWN SCHEDULE (8/S3.00) FOR THREADED ROD CALLOUT & EMBEDMENT INTO CONCRETE
- MSTC/XX — INDICATES SIMPSON STRAP HOLDOWN

FRAMING PLAN LEGEND

- EXISTING FOOTING
- NEW FOOTING
- ABRUPT CHANGE IN SLAB/FRAMING ELEVATION
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- HDUX — INDICATES SIMPSON HOLDOWN. REFER TO HOLDOWN SCHEDULE (8/S3.00) FOR THREADED ROD CALLOUT & EMBEDMENT INTO CONCRETE
- INDICATES 3"Ø PIN PILE. REFER TO GENERAL NOTES AND GEOTECHNICAL REPORT RECOMMENDATIONS FOR ADDITIONAL INFORMATION



1 LEVEL 1 FRAMING PLAN
1/4" = 1'-0"

NORTH

0' 2' 4' 8' 16'

Board & Vellum
ARCHITECTURE AND DESIGN
115 15th Ave E. Suite 100 Seattle, WA 98112
info@boardandvellum.com | 206.707.8895

BYKONEN CARTER QUINN
STRUCTURAL ENGINEERING

NICHOLAS VH CARTER
STATE OF WASHINGTON
37270
STRUCTURAL
PROFESSIONAL ENGINEER
SDCI STAMP AREA

LEUNG RESIDENCE

PROJECT ADDRESS:
9102 SE 78TH PLACE
MERCER ISLAND, WA 98040

OWNER:
KEVIN & NANCY LEUNG

REVISION	DATE	DESCRIPTION

ISSUANCES

DATE	DESCRIPTION

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ORIGINAL SHEET SIZE IS 22"x34"

BOARD & VELLUM PROJECT #: 2021054.00
SDCI PROJECT #:

PLOT DATE: 05.24.22

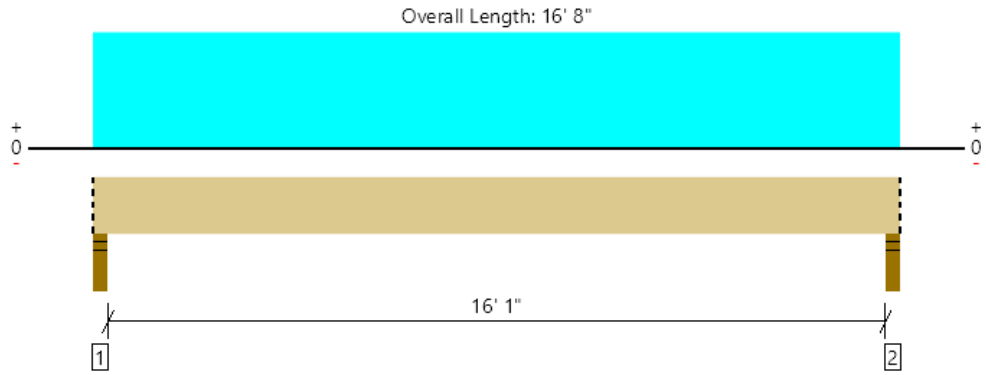
LEVEL 1 FRAMING PLAN

SHEET NO.:

S2.01

Level 1 Framing, Joist A

2 piece(s) 2 x 10 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	611 @ 2 1/2"	4253 (3.50")	Passed (14%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	533 @ 1' 3/4"	2775	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2421 @ 8' 4"	3833	Passed (63%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.325 @ 8' 4"	0.406	Passed (L/599)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.447 @ 8' 4"	0.813	Passed (L/436)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	167	444	611	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	167	444	611	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 5" o/c	
Bottom Edge (Lu)	16' 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 16' 8"	16"	15.0	40.0	Default Load

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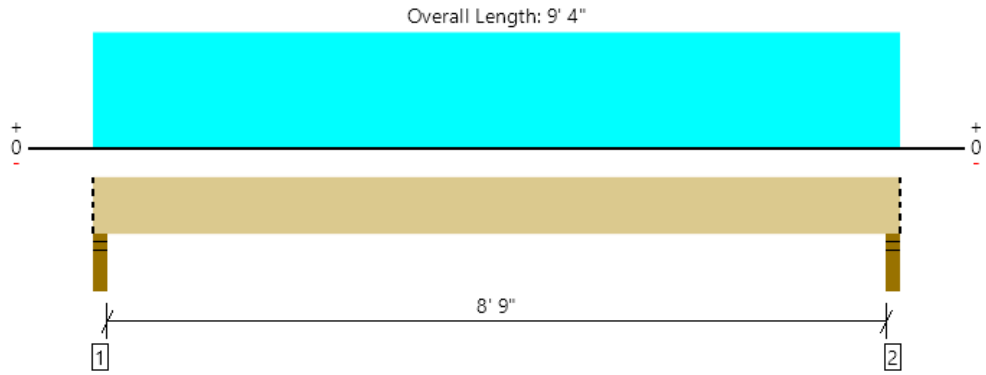
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Joist B

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	498 @ 2 1/2"	2126 (3.50")	Passed (23%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	402 @ 10 3/4"	1088	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1060 @ 4' 8"	1284	Passed (83%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.184 @ 4' 8"	0.223	Passed (L/582)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.245 @ 4' 8"	0.446	Passed (L/437)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	124	373	498	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	124	373	498	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 4" o/c	
Bottom Edge (Lu)	9' 4" 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 9' 4"	16"	20.0	60.0	Default Load

Weyerhaeuser Notes

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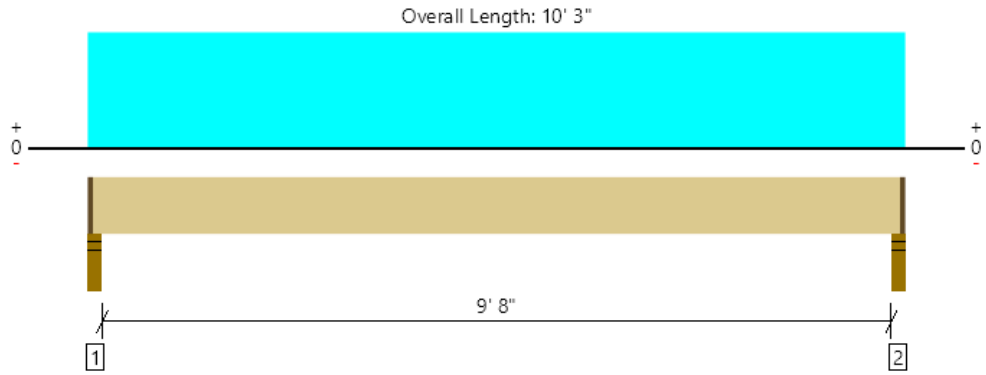
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 1 Framing, Joist C

1 piece(s) 2 x 8 HF No.2 @ 12" 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)	402 @ 2 1/2"	1367 (2.25")	Passed (29%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	338 @ 10 3/4"	1088	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	967 @ 5' 1 1/2"	1284	Passed (75%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.204 @ 5' 1 1/2"	0.246	Passed (L/579)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.272 @ 5' 1 1/2"	0.492	Passed (L/434)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	3.50"	2.25"	1.50"	102	308	410	1 1/4" Rim Board
2 - Stud wall - DF	3.50"	2.25"	1.50"	102	308	410	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 8" o/c	
Bottom Edge (Lu)	10' 1" 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' 3"	12"	20.0	60.0	Default Load

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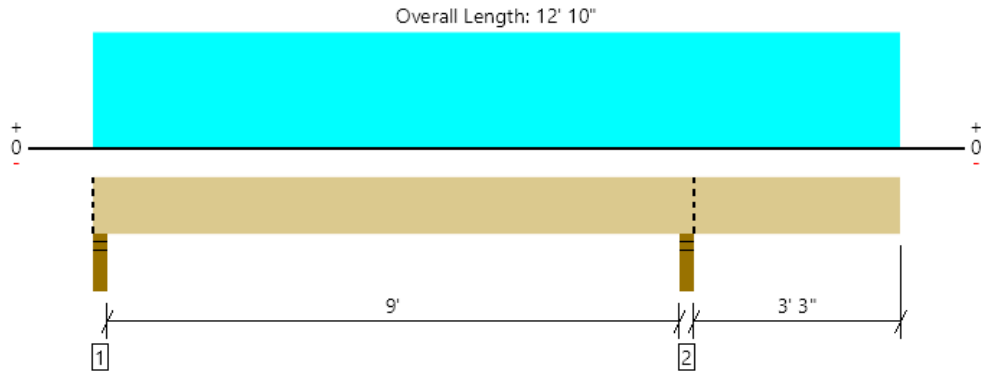
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 1 Framing, Joist D

1 piece(s) 2 x 10 HF No.2 @ 12" 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)	648 @ 9' 5 1/4"	2126 (3.50")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	324 @ 8' 6 1/4"	1388	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	756 @ 4' 8 3/8"	1917	Passed (39%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.076 @ 4' 9 7/8"	0.231	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.089 @ 4' 9 5/16"	0.461	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- 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 - HF	3.50"	3.50"	1.50"	63	289/-37	352	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	130	518	648	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)	12' 10" o/c	
Bottom Edge (Lu)	12' 10" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 12' 10"	12"	15.0	60.0	Default Load

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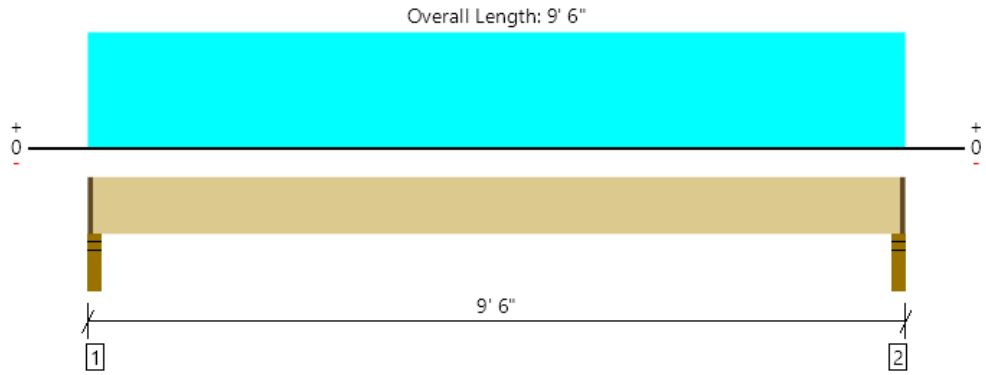
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 1 Framing, Joist E

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	124 @ 2 1/2"	1367 (2.25")	Passed (9%)	--	1.0 D (All Spans)
Shear (lbs)	103 @ 10 3/4"	979	Passed (11%)	0.90	1.0 D (All Spans)
Moment (Ft-lbs)	275 @ 4' 9"	1156	Passed (24%)	0.90	1.0 D (All Spans)
Live Load Defl. (in)	0.000 @ 1 1/4"	0.227	Passed (L/999+)	--	1.0 D (All Spans)
Total Load Defl. (in)	0.066 @ 4' 9"	0.454	Passed (L/999+)	--	1.0 D (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)		Accessories
	Total	Available	Required	Dead	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	127	127	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.50"	127	127	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)	9' 4" o/c	
Bottom Edge (Lu)	9' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Comments
1 - Uniform (PSF)	0 to 9' 6"	16"	20.0	Default Load

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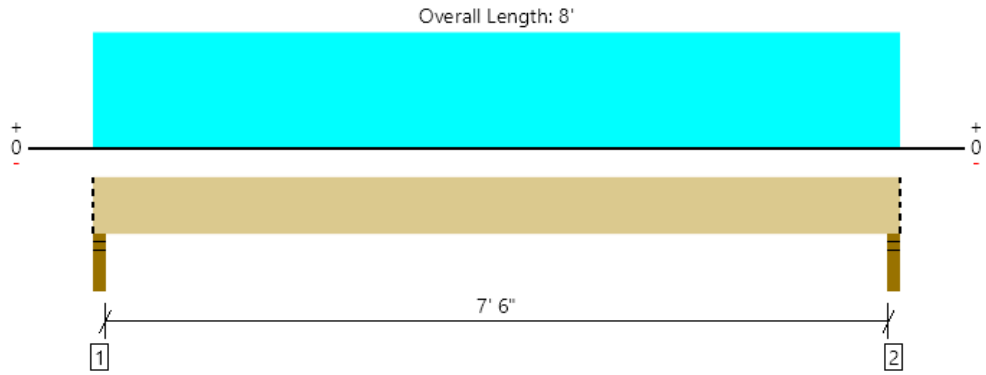
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 1 Framing, Beam 1

2 piece(s) 1 3/4" x 9 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)	3613 @ 1 1/2"	4253 (3.00")	Passed (85%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2691 @ 1' 1/4"	6151	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	6781 @ 4'	11204	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.132 @ 4'	0.194	Passed (L/706)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.183 @ 4'	0.387	Passed (L/508)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	2.55"	1013	2600	3613	Blocking
2 - Stud wall - HF	3.00"	3.00"	2.55"	1013	2600	3613	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)	Comments
0 - Self Weight (PLF)	0 to 8'	N/A	9.4	--	
1 - Uniform (PSF)	0 to 8' (Front)	16' 3"	15.0	40.0	Default Load

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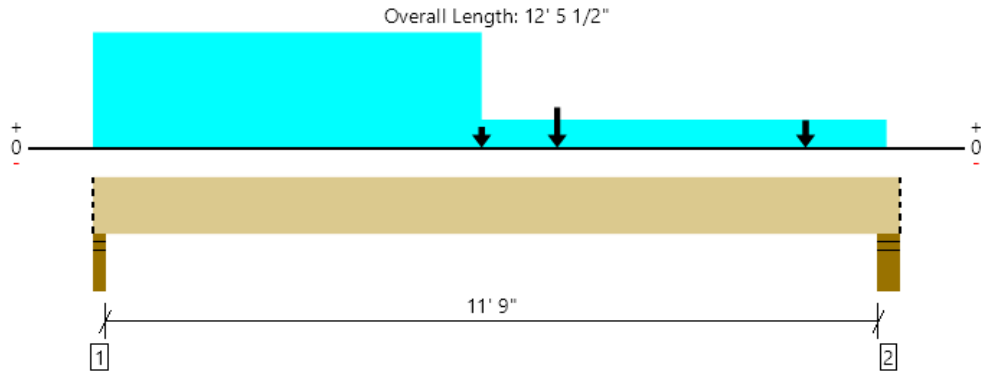
Level 1 Framing, Beam 2

1 piece(s) 6 3/4" 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)	7082 @ 1 1/2"	8201 (3.00")	Passed (86%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	11428 @ 10' 10 1/2"	18514	Passed (62%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	41120 @ 7' 2"	47157	Passed (87%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.194 @ 6' 4 7/16"	0.300	Passed (L/744)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.364 @ 6' 4 5/8"	0.600	Passed (L/396)	--	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).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 12'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - HF	3.00"	3.00"	2.59"	3238	3027	2097	7082	Blocking
2 - Stud wall - DF	5.50"	5.50"	2.86"	5588	4878	3746	12055	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 12' 5 1/2"	N/A	22.1	--	--	
1 - Uniform (PSF)	0 to 6' (Front)	5' 6"	15.0	40.0	-	Default Load
2 - Uniform (PSF)	6' to 12' 3" (Front)	1' 4"	15.0	40.0	-	Default Load
3 - Point (lb)	7' 2" (Front)	N/A	5280	2434	4851	Linked from: Beam 1, Support 1
4 - Point (lb)	11' (Front)	N/A	2014	2434	992	Linked from: Beam 2, Support 1
5 - Point (lb)	6' (Front)	N/A	636	1384	-	Linked from: Beam 20, Support 2

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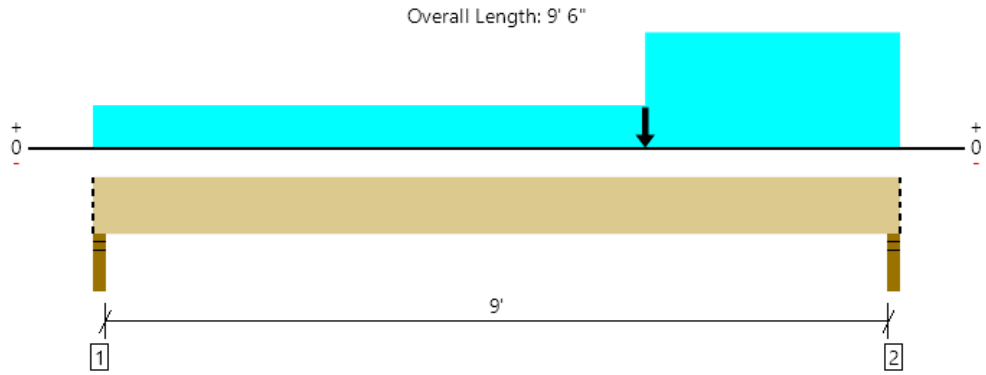
ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 3

3 piece(s) 1 3/4" x 9 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)	4932 @ 9' 4 1/2"	9844 (3.00")	Passed (50%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4251 @ 8' 5 3/4"	9227	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	11184 @ 6' 6"	16806	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.140 @ 5' 5/8"	0.231	Passed (L/792)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.235 @ 5' 7/8"	0.463	Passed (L/472)	--	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).

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - DF	3.00"	3.00"	1.50"	978	1618	364	2596	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	1915	3017	806	4932	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 9' 6"	N/A	14.2	--	--	
1 - Uniform (PSF)	0 to 9' 6" (Front)	3'	20.0	60.0	-	Default Load
2 - Uniform (PSF)	6' 6" to 9' 6" (Front)	7' 6"	15.0	40.0	-	Default Load
3 - Point (lb)	6' 6" (Front)	N/A	1014	-	1170	Linked from: Beam 4, Support 2
4 - Point (lb)	6' 6" (Front)	N/A	837	2025	-	Linked from: Beam 18, Support 2

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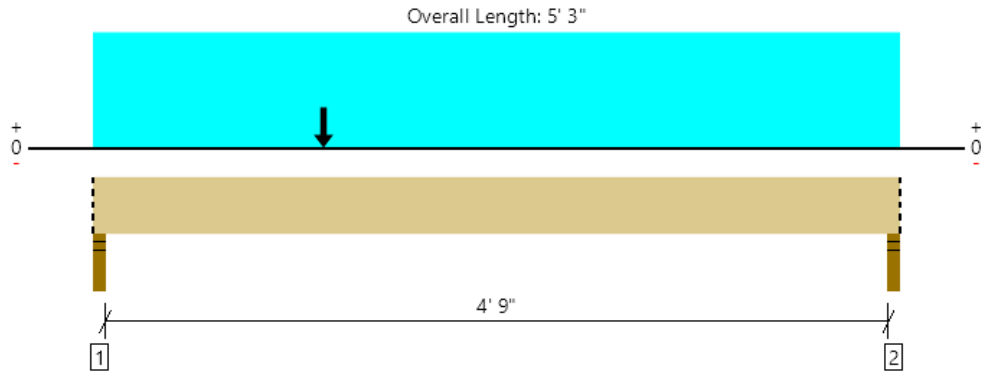
ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 4

2 piece(s) 1 3/4" x 9 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)	4530 @ 1 1/2"	6563 (3.00")	Passed (69%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4159 @ 1' 1/4"	6151	Passed (68%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5823 @ 1' 6"	11204	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.041 @ 2' 5 7/16"	0.125	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.064 @ 2' 5 5/16"	0.250	Passed (L/936)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - DF	3.00"	3.00"	2.07"	1660	2870	584	4530	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	799	1512	222	2311	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 5' 3"	N/A	9.4	--	--	
1 - Uniform (PSF)	0 to 5' 3" (Front)	4' 6"	15.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 5' 3" (Front)	1' 4"	20.0	60.0	-	Default Load
3 - Point (lb)	1' 6" (Front)	N/A	1915	3017	806	Linked from: Beam 3, Support 2

Weyerhaeuser Notes

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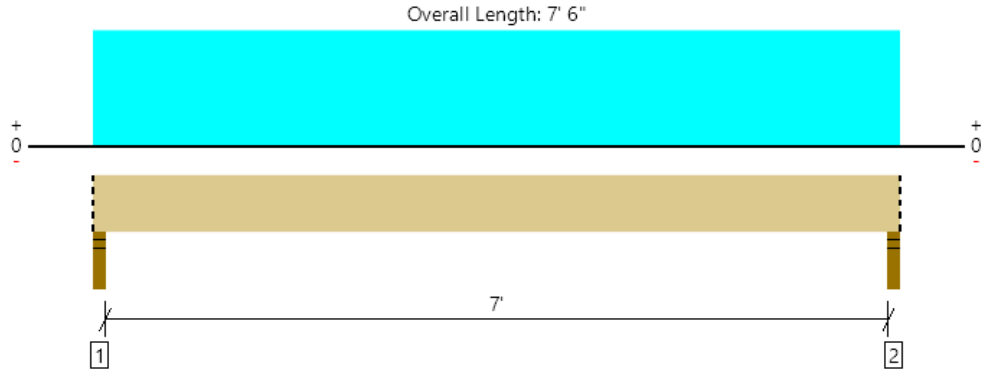
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 5
1 piece(s) 4 x 8 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1374 @ 1 1/2"	4253 (3.00")	Passed (32%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1061 @ 10 1/4"	2538	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2408 @ 3' 9"	2823	Passed (85%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.116 @ 3' 9"	0.181	Passed (L/749)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.158 @ 3' 9"	0.363	Passed (L/552)	--	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).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	3.00"	3.00"	1.50"	362	1013	1374	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	362	1013	1374	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)	Comments
0 - Self Weight (PLF)	0 to 7' 6"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 7' 6" (Front)	4' 6"	20.0	60.0	Default Load

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Level 1 Framing, Beam 6 (w/ overstrength)

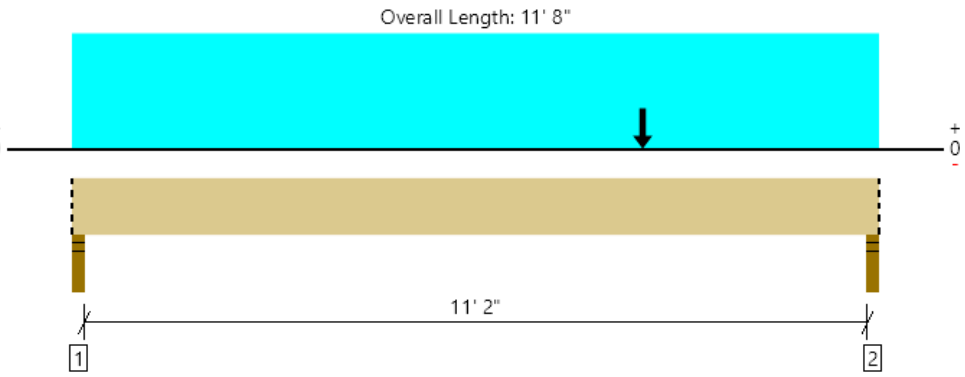
3 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL

Support 2 failed reaction check due to insufficient bearing capacity.

An excessive uplift of -1195 lbs at support located at 1 1/2" failed this product.

An excessive uplift of -4025 lbs at support located at 11' 6 1/2" failed this product.

BEARING AND DEFLECTION FAILURES ARE NOT CONSIDERED FOR BEAMS WITH OMEGA LEVEL HOLDOWN FORCES APPLIED



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)	6866 @ 11' 6 1/2"	6379 (3.00")	Failed (108%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	6289 @ 10' 7 3/4"	14763	Passed (43%)	1.60	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	19306 @ 8' 3"	26889	Passed (72%)	1.60	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.532 @ 6' 2 1/16"	0.285	Failed (L/258)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.655 @ 6' 1 5/16"	0.571	Failed (L/209)	--	1.0 D + 0.525 E + 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).

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Seismic	Factored	
1 - Stud wall - HF	3.00"	3.00"	2.23"	1220	2333	438	2753/-2753	4744/-1195	Blocking
2 - Stud wall - HF	3.00"	3.00"	3.23"	1220	2333	438	6797/-6797	6866/-4025	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)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	0 to 11' 8"	N/A	14.2	--	--	--	
1 - Uniform (PSF)	0 to 11' 8" (Front)	8'	15.0	40.0	-	-	Default Load
2 - Uniform (PSF)	0 to 11' 8" (Front)	2'	15.0	40.0	-	-	Default Load
3 - Uniform (PSF)	0 to 11' 8" (Front)	3'	15.0	-	25.0	-	Default Load
4 - Point (lb)	8' 3" (Front)	N/A	-	-	-	9550	3820 * 2.5

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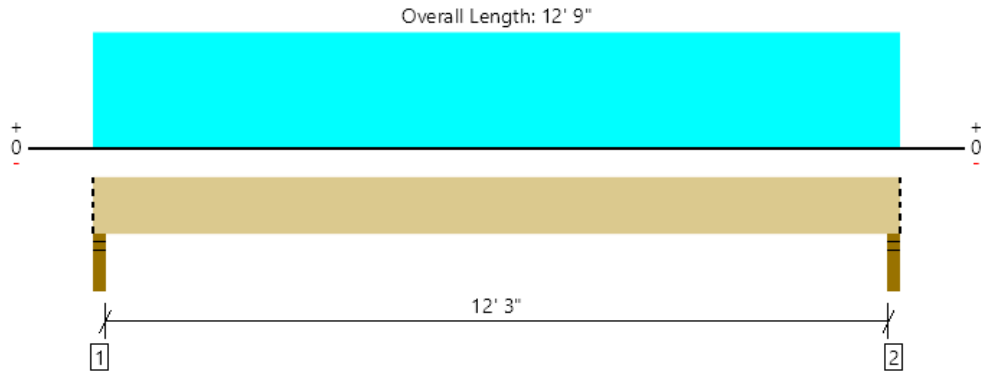
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 7
1 piece(s) 4 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1327 @ 1 1/2"	4253 (3.00")	Passed (31%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1115 @ 1' 1/4"	3238	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4066 @ 6' 4 1/2"	4242	Passed (96%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.275 @ 6' 4 1/2"	0.313	Passed (L/546)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.381 @ 6' 4 1/2"	0.625	Passed (L/394)	--	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).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	3.00"	3.00"	1.50"	371	956	1327	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	371	956	1327	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)	Comments
0 - Self Weight (PLF)	0 to 12' 9"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 12' 9" (Front)	2' 6"	20.0	60.0	Default Load

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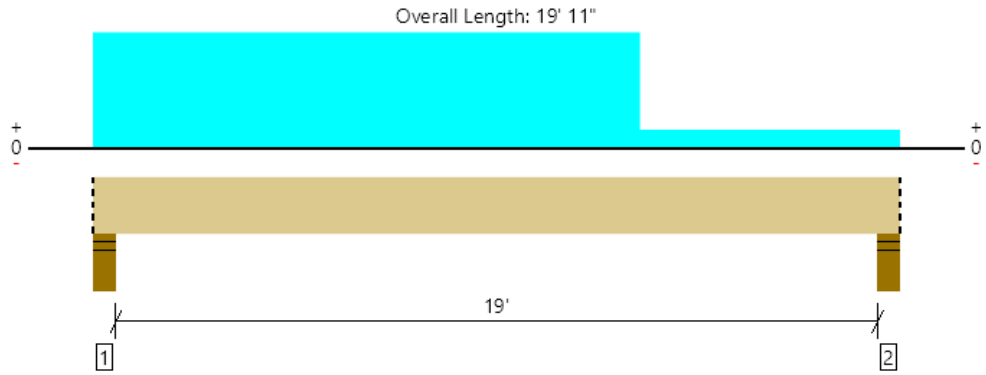
Level 1 Framing, Beam 8

1 piece(s) 5 1/8" x 12" 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)	3015 @ 4"	11416 (5.50")	Passed (26%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2536 @ 1' 5 1/2"	12495	Passed (20%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	12840 @ 9' 2 1/16"	28290	Passed (45%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.239 @ 9' 8 13/16"	0.481	Passed (L/966)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.625 @ 9' 8 1/2"	0.962	Passed (L/369)	--	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).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 19' 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	Floor Live	Snow	Factored	
1 - Stud wall - HF	5.50"	5.50"	1.50"	1873	398	1125	3015	Blocking
2 - Stud wall - HF	5.50"	5.50"	1.50"	1086	398	563	1807	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 19' 11"	N/A	14.9	--	--	
1 - Uniform (PSF)	0 to 19' 11" (Front)	1'	15.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 13' 6" (Front)	5'	15.0	-	25.0	Default Load
3 - Uniform (PSF)	0 to 13' 6" (Front)	10'	10.0	-	-	Default Load

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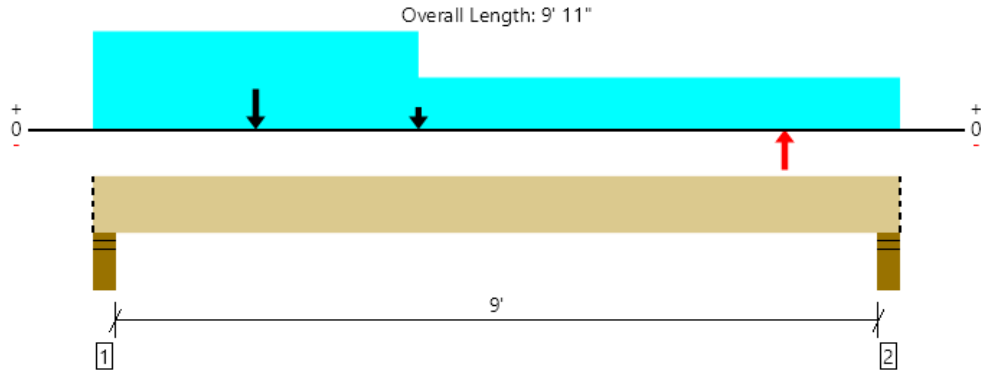
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 9
3 piece(s) 2 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3715 @ 4"	10024 (5.50")	Passed (37%)	--	1.0 D + 0.7 E (All Spans)
Shear (lbs)	3567 @ 1' 2 3/4"	6660	Passed (54%)	1.60	1.0 D + 0.7 E (All Spans)
Moment (Ft-lbs)	4291 @ 4'	5000	Passed (86%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.105 @ 3' 10 3/16"	0.231	Passed (L/999+)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.174 @ 4' 2 5/8"	0.463	Passed (L/637)	--	1.0 D + 0.525 E + 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 NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Seismic	Factored	
1 - Stud wall - HF	5.50"	5.50"	2.04"	788	773	4181/-4181	3715/-2454	Blocking
2 - Stud wall - HF	5.50"	5.50"	1.97"	660	423	4181/-4181	3587/-2531	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)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	0 to 9' 11"	N/A	10.6	--	--	
1 - Uniform (PSF)	0 to 9' 11" (Front)	9'	10.0	-	-	Default Load
2 - Uniform (PSF)	0 to 4' (Front)	1'	20.0	60.0	-	Default Load
3 - Point (lb)	2' (Front)	N/A	-	-	5950	2380 * 2.5
4 - Point (lb)	8' 6" (Front)	N/A	-	-	-5950	2380 * 2.5
5 - Point (lb)	4' (Front)	N/A	371	956	-	Linked from: Beam 7, Support 1

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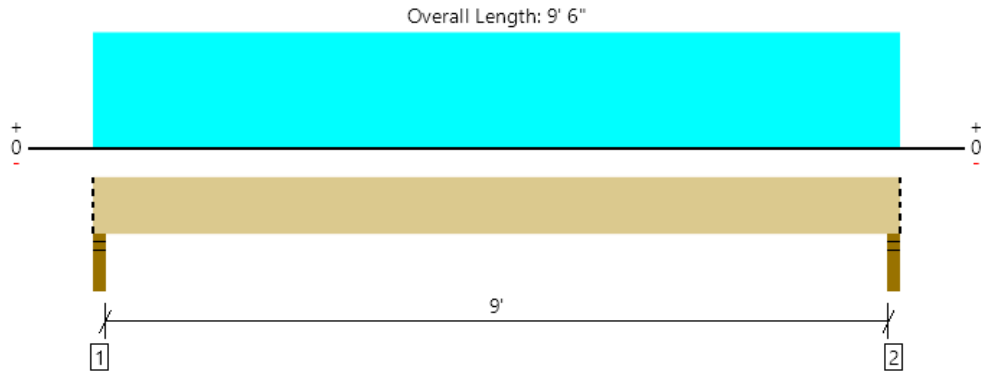
ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 10
1 piece(s) 4 x 10 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1108 @ 1 1/2"	4253 (3.00")	Passed (26%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	870 @ 1' 1/4"	3885	Passed (22%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2494 @ 4' 9"	4492	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.080 @ 4' 9"	0.231	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.104 @ 4' 9"	0.463	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	253	855	1108	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	253	855	1108	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)	Comments
0 - Self Weight (PLF)	0 to 9' 6"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 9' 6" (Front)	3'	15.0	60.0	Default Load

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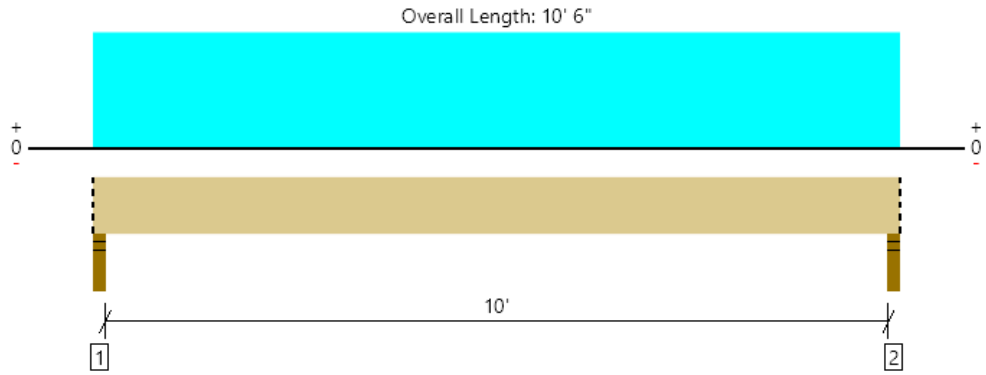
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 1 Framing, Beam 11
1 piece(s) 6 x 12 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2840 @ 1 1/2"	6683 (3.00")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2187 @ 1' 2 1/2"	7168	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	7105 @ 5' 3"	8840	Passed (80%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.115 @ 5' 3"	0.256	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.148 @ 5' 3"	0.512	Passed (L/830)	--	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).
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	635	2205	2840	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	635	2205	2840	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)	Comments
0 - Self Weight (PLF)	0 to 10' 6"	N/A	16.0	--	
1 - Uniform (PSF)	0 to 10' 6" (Front)	7'	15.0	60.0	Default Load

Weyerhaeuser Notes

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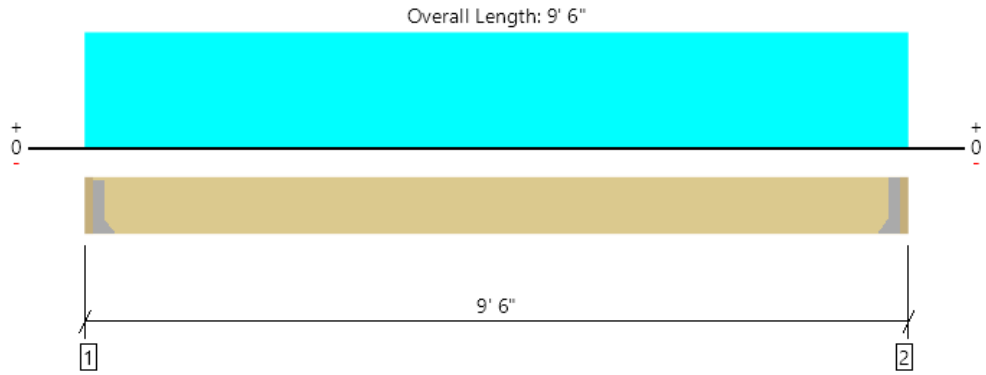
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 12

1 piece(s) 5 1/8" x 12" 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)	5703 @ 2"	5703 (1.71")	Passed (100%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4315 @ 1' 2"	9779	Passed (44%)	0.90	1.0 D (All Spans)
Pos Moment (Ft-lbs)	12649 @ 4' 9"	22140	Passed (57%)	0.90	1.0 D (All Spans)
Live Load Defl. (in)	0.005 @ 4' 9"	0.229	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.149 @ 4' 9"	0.458	Passed (L/739)	--	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).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 9' 2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 12" HF beam	2.00"	Hanger[1]	1.71"	5718	190	5908	See note [1]
2 - Hanger on 12" HF beam	2.00"	Hanger[1]	1.71"	5718	190	5908	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	Continuous	
Bottom Edge (Lu)	Continuous	

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HGUS5.25/10	4.00"	N/A	46-10d	16-10d	
2 - Face Mount Hanger	HGUS5.25/10	4.00"	N/A	46-10d	16-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	2" to 9' 4"	N/A	14.9	--	
1 - Uniform (PSF)	0 to 9' 6" (Front)	8"	20.0	60.0	Default Load
2 - Uniform (PSF)	0 to 9' 6" (Front)	24' 6"	48.0	-	Default Load

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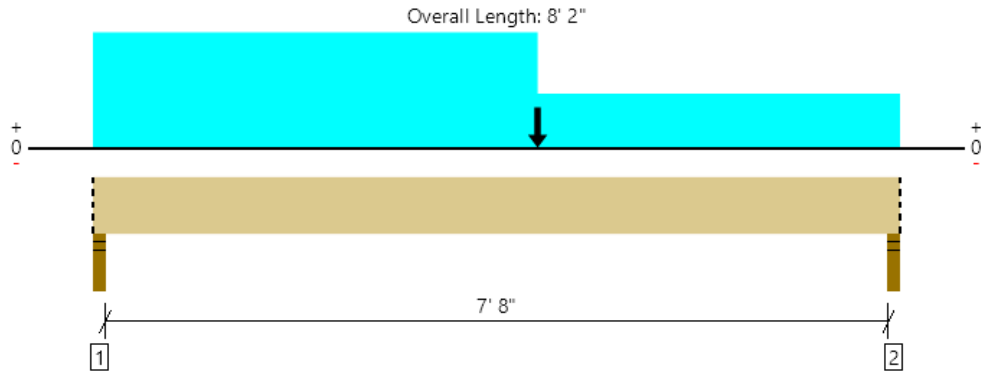
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Level 1 Framing, Beam 13

1 piece(s) 5 1/8" x 12" 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)	8182 @ 1 1/2"	9609 (3.00")	Passed (85%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	6293 @ 1' 3"	10865	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	20510 @ 4' 6"	24600	Passed (83%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.026 @ 4' 2 5/16"	0.198	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.157 @ 4' 15/16"	0.396	Passed (L/606)	--	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).
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 11".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	3.00"	3.00"	2.55"	6891	1291	8182	Blocking
2 - Stud wall - DF	3.00"	3.00"	2.23"	5242	1904	7147	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)	Comments
0 - Self Weight (PLF)	0 to 8' 2"	N/A	14.9	--	
1 - Uniform (PSF)	0 to 8' 2" (Front)	4'	20.0	60.0	Default Load
2 - Uniform (PSF)	0 to 4' 6" (Front)	24' 6"	48.0	-	Default Load
3 - Uniform (PSF)	4' 6" to 8' 2" (Front)	4' 9"	20.0	60.0	Default Load
4 - Point (lb)	4' 6" (Front)	N/A	5718	190	Linked from: Beam 12, Support 1

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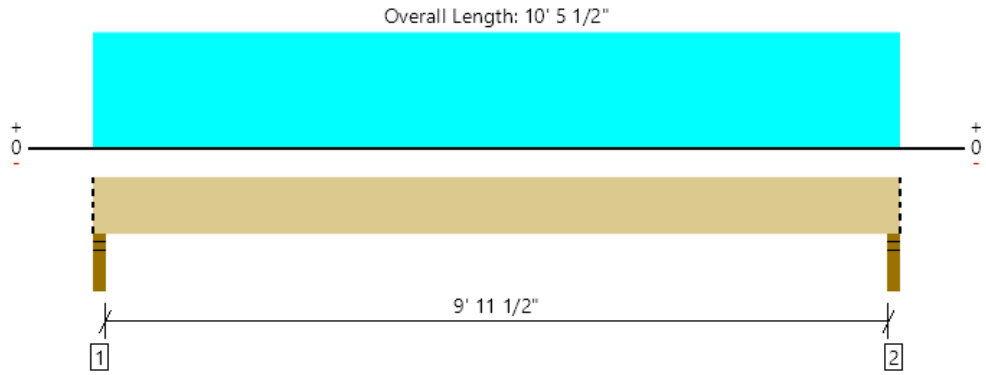
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Level 1 Framing, Beam 14
1 piece(s) 4 x 10 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1298 @ 1 1/2"	4253 (3.00")	Passed (31%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1045 @ 1' 1/4"	3238	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3233 @ 5' 2 3/4"	4242	Passed (76%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.147 @ 5' 2 3/4"	0.255	Passed (L/836)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.202 @ 5' 2 3/4"	0.510	Passed (L/606)	--	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).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	3.00"	3.00"	1.50"	357	941	1298	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	357	941	1298	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)	Comments
0 - Self Weight (PLF)	0 to 10' 5 1/2"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 10' 5 1/2" (Front)	3'	20.0	60.0	Default Load

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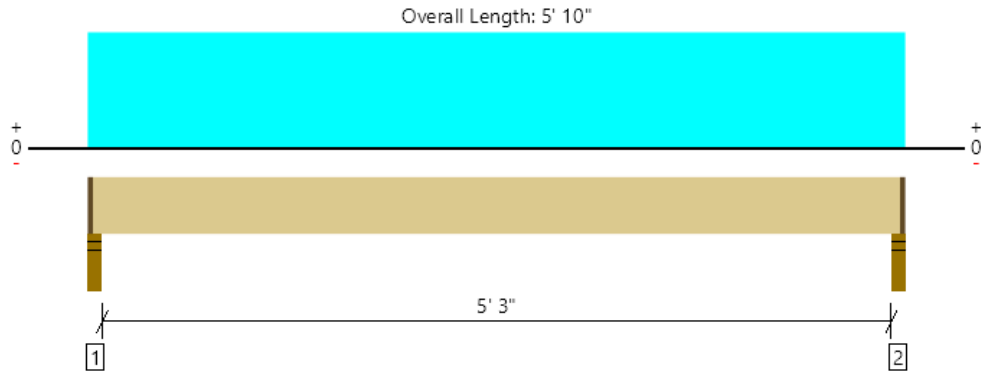
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Foundation Plan, Joists @ Hot Tub
1 piece(s) 2 x 8 HF No.2 @ 12" 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)	352 @ 2 1/2"	1367 (2.25")	Passed (26%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	253 @ 10 3/4"	1088	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	458 @ 2' 11"	1284	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.034 @ 2' 11"	0.135	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.039 @ 2' 11"	0.271	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	3.50"	2.25"	1.50"	44	321	365	1 1/4" Rim Board
2 - Stud wall - DF	3.50"	2.25"	1.50"	44	321	365	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)	5' 8" o/c	
Bottom Edge (Lu)	5' 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 5' 10"	12"	15.0	110.0	Default Load

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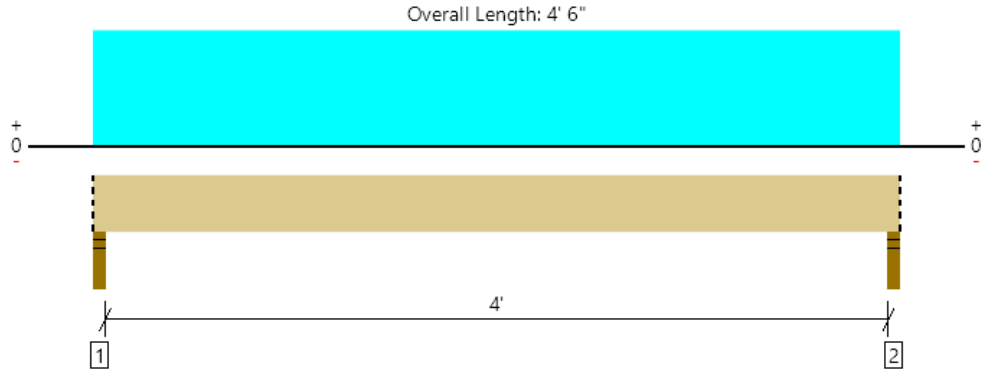
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Foundation Plan, Center Beam @ Hot Tub
1 piece(s) 4 x 8 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1479 @ 1 1/2"	4253 (3.00")	Passed (35%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	918 @ 10 1/4"	2538	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1484 @ 2' 3"	2823	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.029 @ 2' 3"	0.106	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.033 @ 2' 3"	0.213	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.00"	3.00"	1.50"	190	1289	1479	Blocking
2 - Stud wall - HF	3.00"	3.00"	1.50"	190	1289	1479	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)	Comments
0 - Self Weight (PLF)	0 to 4' 6"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 4' 6" (Front)	5' 2 1/2"	15.0	110.0	Default Load

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ForteWEB Software Operator	Job Notes
Steven Nickolas Bykonen Carter Quinn (206) 264-7784 ssn@bcq-se.com	

Weyerhaeuser

Hazards by Location

Search Information

Address: 9102 SE 78th Pl, Mercer Island, WA 98040, USA

Coordinates: 47.5331438, -122.2185708

Elevation: 177 ft

Timestamp: 2022-02-03T22:37:24.087Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D

Basic Parameters

Name	Value	Description
S_S	1.458	MCE_R ground motion (period=0.2s)
S_1	0.503	MCE_R ground motion (period=1.0s)
S_{MS}	1.458	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.972	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	0.623	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.686	Site modified peak ground acceleration

T_L	6	Long-period transition period (s)
SsRT	1.458	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.616	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	4.314	Factored deterministic acceleration value (0.2s)
S1RT	0.503	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.56	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.637	Factored deterministic acceleration value (1.0s)
PGAd	1.424	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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Hazards by Location

Search Information

Address: 9102 SE 78th Pl, Mercer Island, WA 98040, USA

Coordinates: 47.5331438, -122.2185708

Elevation: 177 ft

Timestamp: 2021-11-18T17:18:10.742Z

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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Seismic

Project: Leung Residence

Seismic Design Parameters		
Site Class	D	
Risk Category	II	*Table 1.5-1*
Importance Factor	1	*Table 1.5-2*
Ss	1.458	*From USGS*
S1	0.503	
Fa	1.000	*Table 11.4-1*
Fv	1.800	*Table 11.4-2*
Sms	1.458	*Eq. 11.4-1*
Sm1	0.905	*Eq. 11.4-2*
Sds	0.972	*Eq. 11.4-3*
Sd1	0.604	*Eq. 11.4-4*
R	6.5	*Table 12.2-1*
C_s	0.150	*Eq. 12.8-2*
k	1	*12.8.3*
ρ	1	
Seismic Design Category	D	*Table 11.6-1*

Seismic Weight

Areas (ft^2)	
Roof	2215
Upper Floor	2760
Main Floor	1315

Loads	
DL-Floor (psf)	25
DL-Roof (psf)	20
DL-Solar (psf)	5

Seismic Base Shear		
$V_{ultimate}$ (k)	23.5	*Eq. 12.8-1*
$V_{allowable}$ (k)	16.5	

Level	Weight (k)	Height (ft)	$w_x f_x^k$	C_{vx}	F_x (ult.)	F_x (allow.)
Roof	55.375	35.25	1952.0	0.53	12.4	8.7
Upper Floor	69	20.5	1414.5	0.38	9.0	6.3
Main Floor	32.875	10.5	345.2	0.09	2.2	1.5
TOTAL	157.3	-	3711.7	1	23.5	16.5

All references are from ASCE 7-16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

Project: Leung Residence

Wind Load Parameters

Chapter 28 - Envelope Procedure

Exposure	C	*Sec. 26.7*
Risk Category	II	*Table 1.5-1*
Mean Roof Height (ft)	35.25	
Roof Slope (X/12)	4	
Angle	18.4	
a (ft)	3.4	*Figure 28.3-1 Note "a"*
K_d	0.85	*Table 26.6-1*
K_{zt}	1.6	
V (mph)	97	
K_z	1.01	*Table 26.10-1*
q_h (psf)	33.14	*Eq. 26.10-1*
Minimum Wind Pressure on Walls (psf)	16	*Sec. 28.3.4*
Minimum Wind Pressure on Roof (psf)	8	

Building Geometry

Level	Height (ft)	Trib. Height (ft)	Load Case A Direction (ft)	Load Case B Direction (ft)
			Plan North/South	Plan East/West
Above Roof	6	6	42.75	44.5
Roof	9	4.5	42.75	44.5
Upper Floor	10	9.5	81.25	42.25
Main Floor	10.5	10.25	34	42.25
	Height below Level		"Long" Dimension	"Short" Dimension

GC_{pf} Values Summary (28.3-1)

Building Surface	Load Case A	Load Case B
Roof	0.22	-
Roof Corners	0.40	-
Wall	0.93	0.69
Wall Corners	1.40	1.04

Load Case A - Plan North/South

Level	A (ft^2)		$F = q_h*GC_{pf}*A$ (k)		Total Wind Load (Ultimate, k)	Minimum Load (Ultimate, k)	Total (allowable, k)
Roof - roof	216		1.50		2.01	2.05	1.23
Corners		41		0.51			
Roof - walls	162		5.00		6.41	3.08	3.85
Corners		31		1.42			
Upper Floor	707		21.84		24.83	12.35	14.90
Corners		65		2.99			
Main Floor	279		8.61		11.84	5.58	7.10
Corners		70		3.23			

Load Case B - Plan East/West

Level	A (ft^2)		$F = q_h*GC_{pf}*A$ (k)		Total Wind Load (Ultimate, k)	Minimum Load (Ultimate, k)	Total (allowable, k)
Roof - roof	247		5.64		6.34	2.14	3.80
Corners		20		0.70			
Roof - walls	185		4.23		4.76	3.20	2.85
Corners		15		0.53			
Upper Floor	369		8.44		9.55	6.42	5.73
Corners		32		1.11			
Main Floor	398		9.10		10.31	6.93	6.18
Corners		35		1.20			

Wind Loads Summary

Level	Plan North/South		Plan East/West	
	Wind Load (Ultimate, k)	Wind Load (Allowable, k)	Wind Load (Ultimate, k)	Wind Load (Allowable, k)
Roof	8.46	5.08	11.10	6.66
Upper Floor	24.83	14.90	9.55	5.73
Main Floor	11.84	7.10	10.31	6.18
Base Shear	45.13	27.08	30.95	18.57

FOUNDATION PLAN NOTES

1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
2. SLABS ON GRADE SHALL BE 4" THICK WITH 6x6 W1.4xW1.4 WWM CENTERED, U.N.O. PREPARED SOILS AND PROVIDE MINIMUM 6-MIL VISQUEEN VAPOR BARRIER UNDER ALL SLABS.
3. SLABS ON GRADE SHALL BE SUPPORTED ON 12" COMPACTED STRUCTURAL FILL OVER RE-COMPACTED NATIVE SOIL PER GEOTECHNICAL REPORT.
4. REFER TO ARCHITECTURAL PLANS FOR DIMENSIONS AND TOP OF SLAB ELEVATIONS.

FRAMING PLAN NOTES (TYPICAL UNLESS NOTED OTHERWISE)

1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
2. FLOOR SHEATHING SHALL BE 23/32" TONGUE AND GROOVE APA RATED SHEATHING (SPAN RATING 40/20). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEAR WALLS w/ 10d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING
3. ROOF SHEATHING SHALL BE 15/32" APA RATED SHEATHING (SPAN RATING 24/0). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEARWALLS w/ 8d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING.
4. 1SWX INDICATES SINGLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
5. 2SWX INDICATES DOUBLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
6. ALL HEADERS SHALL BE (2)2x8 U.N.O. REFER TO NOTE 5 FOR SUPPORT REQUIREMENTS.
7. COLUMNS SHALL BE DOUBLE STUDS MINIMUM, U.N.O., WITH BEAM OR HEADER BEARING FULLY ON COLUMN.

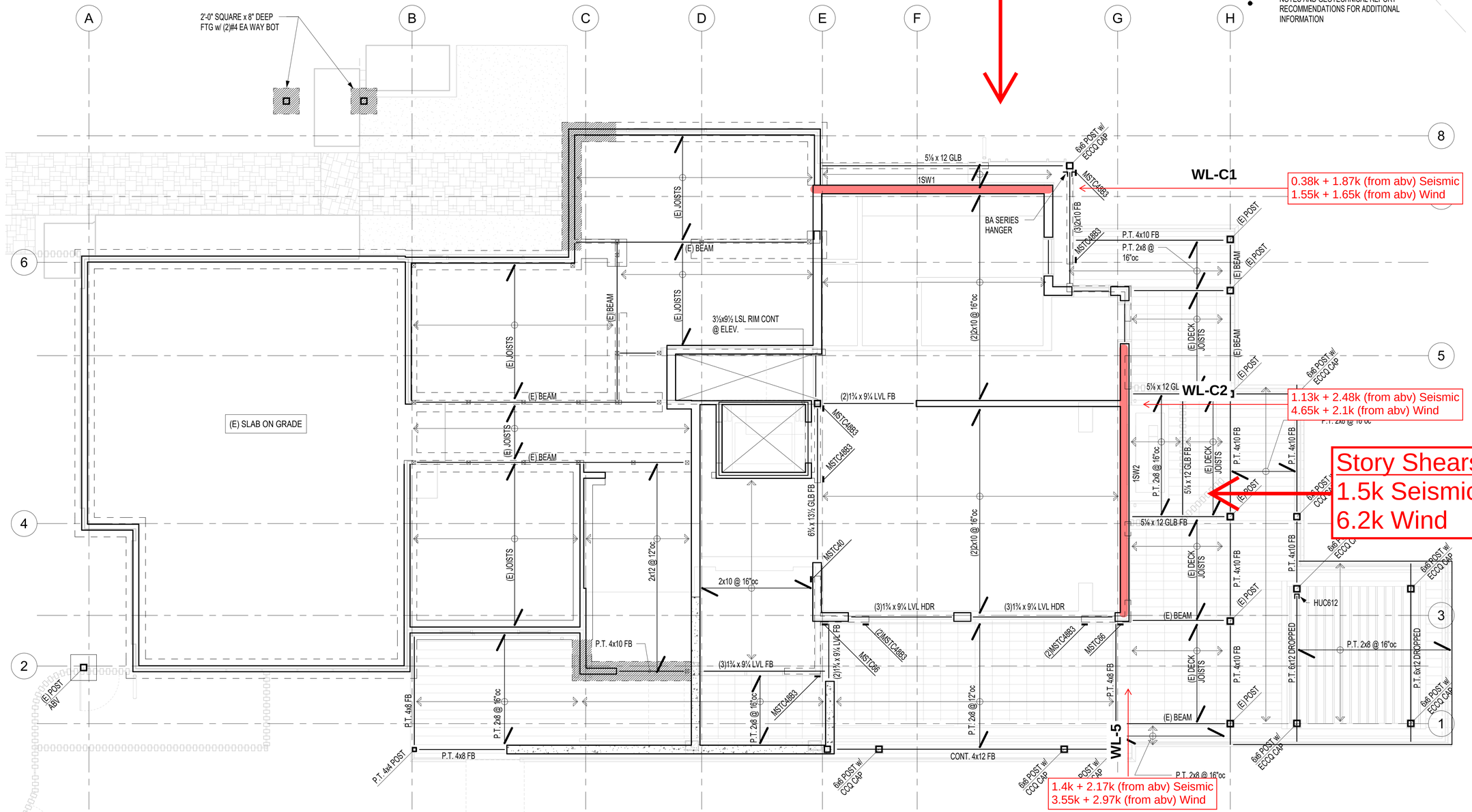
FRAMING PLAN LEGEND

- WALLS BELOW
- WALLS ABOVE
- COLUMNS BELOW
- COLUMNS ABOVE
- HANGER
- ABRUPT CHANGE IN SLAB/
- FB — INDICATES FLUSH BEAM
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- FRAMING SPAN AND EXTENTS
- MPSON HOLDOWN. REFER TO HEDULE (8/S3.00) FOR THREADED T & EMBEDMENT INTO CONCRETE
- MPSON STRAP HOLDOWN

FRAMING PLAN LEGEND

- EXISTING FOOTING
- NEW FOOTING
- ABRUPT CHANGE IN SLAB/FRAMING ELEVATION
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- HDUX — INDICATES SIMPSON HOLDOWN. REFER TO HOLDOWN SCHEDULE (8/S3.00) FOR THREADED ROD CALLOUT & EMBEDMENT INTO CONCRETE
- INDICATES 3"Ø PIN PILE. REFER TO GENERAL NOTES AND GEOTECHNICAL REPORT RECOMMENDATIONS FOR ADDITIONAL INFORMATION

Story Shears
1.5k Seismic
7.1k Wind



1 LEVEL 1 FRAMING PLAN
1/4" = 1'-0"

Board & Vellum
ARCHITECTURE AND DESIGN
115 15th Ave E. Suite 100 Seattle, WA 98112
info@boardandvellum.com | 206.707.8895

BYKONEN CARTER QUINN
STRUCTURAL ENGINEERING

NICHOLAS VH CARTER
STATE OF WASHINGTON
37270
STRUCTURAL
PROFESSIONAL ENGINEER
SDCI STAMP AREA

LEUNG RESIDENCE

PROJECT ADDRESS:
9102 SE 78TH PLACE
MERCER ISLAND, WA 98040

OWNER:
KEVIN & NANCY LEUNG

REVISION	DATE	DESCRIPTION

ISSUANCES

DATE	DESCRIPTION

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ORIGINAL SHEET SIZE IS 22"x34"

BOARD & VELLUM PROJECT #: 2021054.00
SDCI PROJECT #:
PLOT DATE: 05.24.22

LEVEL 1 FRAMING PLAN

SHEET NO.:

S2.01

FRAMING PLAN NOTES (TYPICAL UNLESS NOTED OTHERWISE)

1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
2. FLOOR SHEATHING SHALL BE 23/32" TONGUE AND GROOVE APA RATED SHEATHING (SPAN RATING 40/20). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEAR WALLS w/ 10d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING
3. ROOF SHEATHING SHALL BE 15/32" APA RATED SHEATHING (SPAN RATING 24/0). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEARWALLS w/ 8d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING.
4. "SW-X" INDICATES SINGLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00. "SW-X" INDICATES DOUBLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
5. ALL HEADERS SHALL BE (2)2x8 U.N.O. REFER TO NOTE 5 FOR SUPPORT REQUIREMENTS.
6. ALL COLUMNS SHALL BE DOUBLE STUDS MINIMUM, U.N.O., WITH BEAM OR HEADER BEARING FULLY ON COLUMN.

FRAMING PLAN LEGEND

- WALLS BELOW
- WALLS ABOVE
- COLUMNS BELOW
- COLUMNS ABOVE
- HANGER
- ABRUPT CHANGE IN SLAB/FRAMING ELEVATION
- FB — INDICATES FLUSH BEAM
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- FRAMING SPAN AND EXTENTS
- HDUX — INDICATES SIMPSON HOLDOWN. REFER TO HOLDOWN SCHEDULE (8/S3.00) FOR THREADED ROD CALLOUT & EMBEDMENT INTO CONCRETE
- MSTCXX — INDICATES SIMPSON STRAP HOLDOWN

Story Shears
6.3k Seismic
14.9k Wind

0.95k + 0.92k (from abv) Seismic
0.9k + 0.75k (from abv) Wind

0.95k + 1.22k (from abv) Seismic
2.24k + 0.73k (from abv) Wind

Story Shears
6.3k Seismic
5.8k Wind

0.95k + 1.53k (from abv) Seismic
0.90k + 1.2k (from abv) Wind

1.89k + 2.8k (from abv) Seismic
4.47k + 1.67k (from abv) Wind

Replace capacity of existing shear wall. Per existing drawings, current wall sheathing is 5/8" GWB with 5d cooler nails @ 7"oc

Capacity = 100 plf, Length = 21'-6"

New Length = 7'-6"
Shear Demand = (100 plf * 21.5ft) / 7.5 ft = 287 plf

Per shear wall schedule, SW-2 is adequate

Board & Vellum
ARCHITECTURE AND DESIGN
115 15th Ave E. Suite 100 Seattle, WA 98112
info@boardandvellum.com | 206.707.8895

BYKONEN CARTER QUINN
STRUCTURAL ENGINEERING

NICHOLAS VH CARTER — STATE OF WASHINGTON — 37270 — STRUCTURAL — PROFESSIONAL ENGINEER
SDCI STAMP AREA

LEUNG RESIDENCE

PROJECT ADDRESS:
9107 SE 78TH PLACE
MERCER ISLAND, WA 98040

OWNER:
KEVIN & NANCY LEUNG

REVISION	DATE	DESCRIPTION

ISSUANCES

DATE	DESCRIPTION

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BOARD & VELLUM PROJECT #: 2021054.00
SDCI PROJECT #:
PLOT DATE: 05.24.22

LEVEL 2 FRAMING PLAN

SHEET NO.:

S2.02

FRAMING PLAN NOTES (TYPICAL UNLESS NOTED OTHERWISE)

1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
2. FLOOR SHEATHING SHALL BE 23/32" TONGUE AND GROOVE APA RATED SHEATHING (SPAN RATING 40/20). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEAR WALLS w/ 10d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING
3. ROOF SHEATHING SHALL BE 15/32" APA RATED SHEATHING (SPAN RATING 24/0). NAIL AT ALL FRAMED PANEL EDGES AND OVER SHEARWALLS w/ 8d @ 6"oc AND 12"oc TO ALL INTERMEDIATE FRAMING.
4. XX INDICATES SINGLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
5. XX INDICATES DOUBLE-SIDED SHEAR WALL PER SCHEDULE 12/S6.00.
6. ALL HEADERS SHALL BE (2)2x8 U.N.O. REFER TO NOTE 5 FOR SUPPORT REQUIREMENTS.
7. ALL COLUMNS SHALL BE DOUBLE STUDS MINIMUM, U.N.O., WITH BEAM OR HEADER BEARING FULLY ON COLUMN.

FRAMING PLAN LEGEND

- WALLS BELOW
- WALLS ABOVE
- COLUMNS BELOW
- COLUMNS ABOVE
- HANGER
- ABRUPT CHANGE IN SLAB/FRAMING ELEVATION
- FB — INDICATES FLUSH BEAM
- X / SX.XX — INDICATES DETAIL X ON SHEET SX.XX
- FRAMING SPAN AND EXTENTS
- HDUX — INDICATES SIMPSON HOLDOWN. REFER TO HOLDOWN SCHEDULE (8/S3.00) FOR THREADED ROD CALLOUT & EMBEDMENT INTO CONCRETE
- MSTCXX — INDICATES SIMPSON STRAP HOLDOWN

Story Shears
8.7k Seismic
5.2k Wind

28% OF OVERALL ROOF MASS

WL-C1
1.22k Seismic
0.96k Wind

Story Shears
8.7k Seismic
6.8k Wind

WL-C2
1.22k Seismic
0.96k Wind

WL-5
1.22k Seismic
0.73k Wind

WL-4
2.8k Seismic
1.67k Wind

PRE-MNFG ROOF TRUSSES @ 24"oc TYP UNO
(E) RAFTERS
(E) GIRDER TRUSS
(E) SCISSOR TRUSS
(E) BEAM
(E) HIP TRUSS
(E) TRUSS
(E) OVERFRAMING
(E) SCISSOR HIP TRUSS
(E) VALLEY BEAM
(E) RIDGE BEAM
(E) SCISSOR GIRDER TRUSS
1SW1
2x12 @ 24"oc
5¼x12 GLB
(2)2x8 HDR
L5Z66
5¼ x 10½ GLB
5¼ x 12 GLB
(3)1¾ x 9¼ LVL HDR

A B C D E F G H
8 7 6 5 4 3 2 1

1 ROOF FRAMING PLAN
1/4" = 1'-0"

NORTH
0' 2' 4' 8' 16'

Board & Vellum
ARCHITECTURE AND DESIGN
115 15th Ave E. Suite 100 Seattle, WA 98112
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DATE	DESCRIPTION

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ORIGINAL SHEET SIZE IS 22"x34"

BOARD & VELLUM PROJECT #: 2021054.00
SDCI PROJECT #:
PLOT DATE: 05.24.22

ROOF FRAMING PLAN

SHEET NO.:

S2.03

WL-C1

Level	Total Wall Line Lengths (ft)	Seismic Forces (k)	Wind Forces (k)	Story Heights (ft)
Roof	7.25	1.22	0.96	9
Upper Floor	13	1.87	1.65	9
Main Floor	17.25	2.25	3.2	9

Max H/W Ratio [2] 3.5

ROOF

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
7.25	1.24	1.00	168	132	653	73	1.30	0.97
		Shear Wall	SW-1			Strap Tie	MSTC40	

UPPER FLOOR

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
13	0.69	1.00	144	127	1170	130	0.90	0.75
		Shear Wall	SW-1			Strap Tie	Strap Tie/Holdown Not Required	

MAIN FLOOR

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
17.25	0.52	1.00	130	186	1553	173	0.66	1.15
		Shear Wall	SW-1			Holdown	HDU2 w/ (2) 2x	

[1] Increase per 4.3.4.2 ANSI/AWC SDPWS-2015

[2] Per Table 4.3.4 ANSI/AWC SDPWS-2015

WL-C2

Level	Total Wall Line Lengths (ft)	Seismic Forces (k)	Wind Forces (k)	Story Heights (ft)
Roof	7.5	1.22	0.96	9
Upper Floor	7.5	2.48	2.1	12
Main Floor	15.75	3.61	6.75	9

Max H/W Ratio [2] 3.5

ROOF

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
3.75	2.40	1.05	171	128	338	38	1.35	1.04
3.75	2.40	1.05	171	128	338	38	1.35	1.04
		Shear Wall	SW-1			Strap Tie	MSTC40	

UPPER FLOOR

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
3.75	3.20	1.18	389	280	450	38	3.82	3.21
3.75	3.20	1.18	389	280	450	38	3.82	3.21
		Shear Wall	SW-3			Strap Tie	MSTC66	

MAIN FLOOR

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
15.75	0.57	1.00	229	429	1418	158	1.59	3.38
		Shear Wall	SW-2			Holdown	HDU5 w/ (2) 2x	

[1] Increase per 4.3.4.2 ANSI/AWC SDPWS-2015

[2] Per Table 4.3.4 ANSI/AWC SDPWS-2015

WL-4

Level	Total Wall Line Lengths (ft)	Seismic Forces (k)	Wind Forces (k)	Story Heights (ft)
Roof	37	2.8	1.67	9
Upper Floor	17.5	4.69	6.14	9

Max H/W Ratio [2] 3.5

ROOF

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
14.5	0.62	1.00	76	45	1305	145	0.25	-0.03
12	0.75	1.00	76	45	1080	120	0.32	0.05
10.5	0.86	1.00	76	45	945	105	0.37	0.09
		Shear Wall	SW-1			Strap Tie	Strap Tie/Holdown Not Required	

UPPER FLOOR

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
4	2.25	1.03	277	351	360	40	2.29	3.04
7.5	1.20	1.00	268	351	675	75	2.19	2.93
6	1.50	1.00	268	351	540	60	2.23	2.98
		Shear Wall	SW-2			Strap Tie	MSTC52	

[1] Increase per 4.3.4.2 ANSI/AWC SDPWS-2015

[2] Per Table 4.3.4 ANSI/AWC SDPWS-2015

WL-5

Level	Total Wall Line Lengths (ft)	Seismic Forces (k)	Wind Forces (k)	Story Heights (ft)
Roof	14.5	1.22	0.73	9
Upper Floor	7.5	2.17	2.97	9
Main Floor	21	3.57	6.52	9

Max H/W Ratio [2] 3.5

ROOF

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
14.5	0.62	1.00	84	50	1305	145	0.32	0.02
		Shear Wall	SW-1			Strap Tie	Strap Tie/Holdown Not Required	

UPPER FLOOR

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
7.5	1.20	1.00	289	396	675	75	2.38	3.34
		Shear Wall	SW-2			Strap Tie	MSTC52	

MAIN FLOOR

Length (ft)	H/W Ratio	Increase [1]	Force in Wall Elements		Dead Loads		Seismic Overturning (k)	Wind Overturning (k)
			Seismic Shear (plf)	Wind Shear (plf)	Wall (lb)	Floor (lb)		
21	0.43	1.00	170	310	1890	210	0.90	2.16
		Shear Wall	SW-1			Holdown	HDU2 w/ (2) 2x	

[1] Increase per 4.3.4.2 ANSI/AWC SDPWS-2015

[2] Per Table 4.3.4 ANSI/AWC SDPWS-2015

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0"

Code Reference

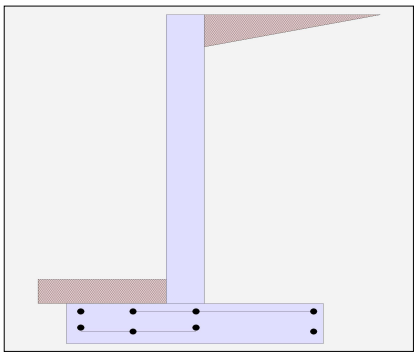
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	6.00 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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.525
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
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) (Strength 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: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0"

Design Summary

Wall Stability Ratios

Overturning	=	5.29	OK
Sliding	=	2.79	OK
Global Stability	=	2.12	
Total Bearing Load	=	3,834 lbs	
...resultant ecc.	=	1.98 in	
Soil Pressure @ Toe	=	1,039 psf	OK
Soil Pressure @ Heel	=	665 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,455 psf	
ACI Factored @ Heel	=	930 psf	
Footing Shear @ Toe	=	17.8 psi	OK
Footing Shear @ Heel	=	2.5 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	817.2 lbs	
less 100% Passive Force	-	266.7 lbs	
less 100% Friction Force	-	2,012.7 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

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	10.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.312**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,008.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	2,016.0		
Moment.....Allowable	=	6,444.1		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	13.4		
Shear.....Allowable	psi =	75.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	300.0		
Rebar Depth 'd'	in =	6.25		

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 =	2,500.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0"

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0755 in2/ft		
(4/3) * As :	0.1007 in2/ft	Min Stem T&S Reinf Area 1.152 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 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 :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.75 ft
Heel Width	=	2.75
Total Footing Width	=	4.50
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 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	=	1,455	930	psf
Mu' : Upward	=	2,124	2,195	ft-#
Mu' : Downward	=	331	2,044	ft-#
Mu: Design	=	1,793	-151	ft-#
phiMn	=	6,985	8,065	ft-#
Actual 1-Way Shear	=	17.76	2.54	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 10.00 in
Heel Reinforcing = # 4 @ 10.00 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 0.97 in2
Min footing T&S reinf Area per foot 0.22 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0"

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)	817.2	2.28	1,861.3			
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)				1,375.0	3.46	4,755.2
Soil Over HL (bel. water tbl)					3.46	4,755.2
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 =				96.3	0.88	84.2
Surcharge Over Toe =						
Stem Weight(s) =				1,800.0	2.08	3,750.0
Earth @ Stem Transitions =						
Footing Weight =				562.5	2.25	1,265.6
Key Weight =						
Vert. Component =						
Total =	817.2	**O.T.M.** =	1,861.3	**Total =** 3,833.8 lbs	**R.M.=**	9,855.1

Resisting/Overturning Ratio = **5.29**

Vertical Loads used for Soil Pressure = 3,833.8 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)	0.038	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

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0"

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 =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.05 in
As Provided =	0.2400 in2/ft
As Required =	0.1728 in2/ft

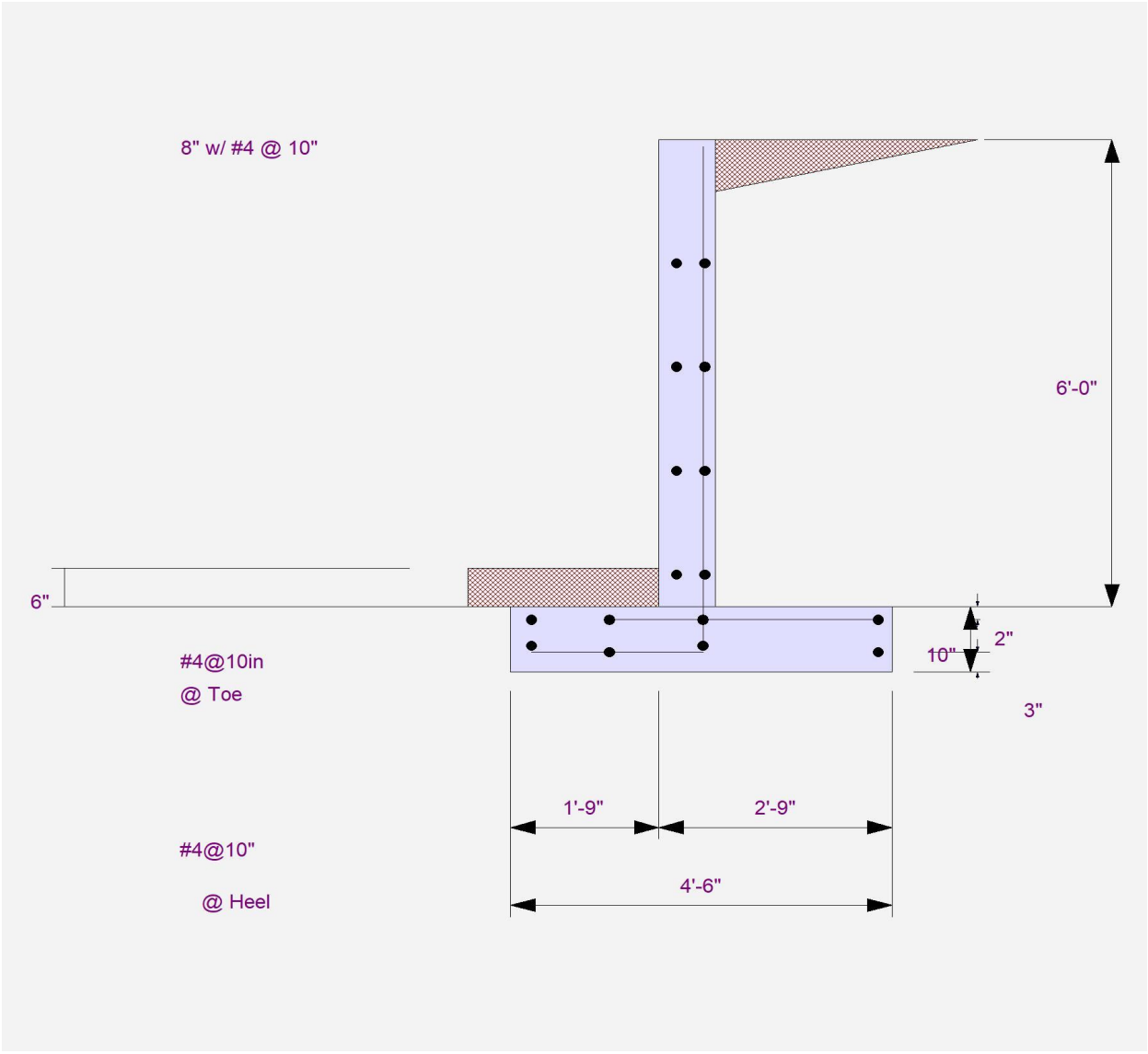
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0"



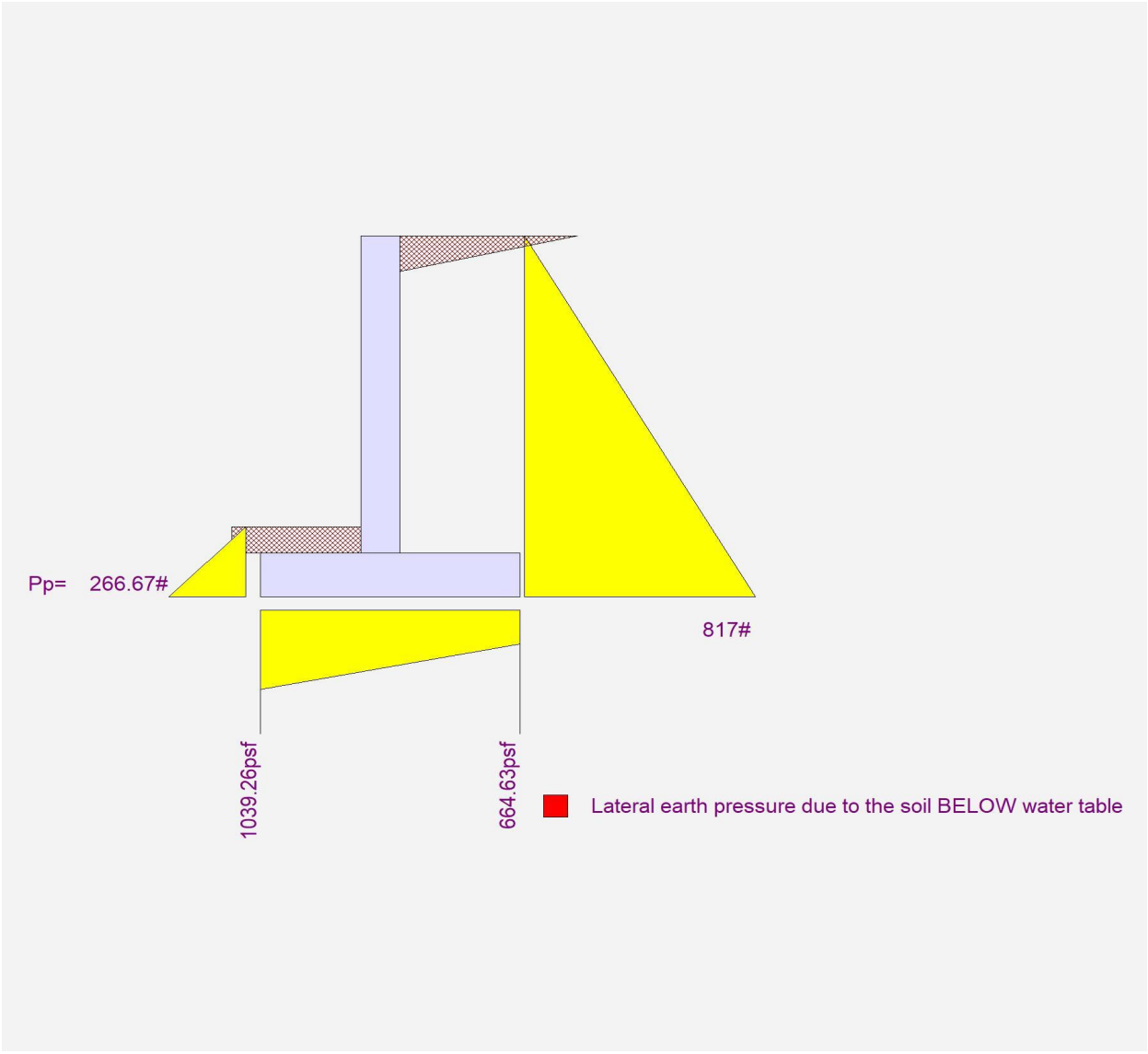
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0"



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0" (with Seismic)

Code Reference

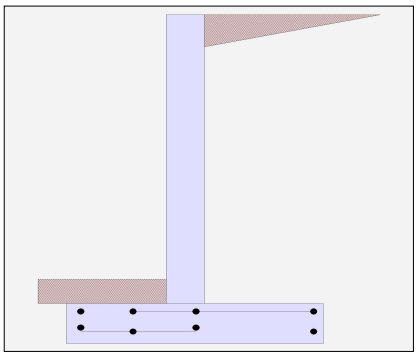
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	6.00 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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.525
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
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) (Strength 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

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	12.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	82.000
Total Seismic Force	=	560.333

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0" (with Seismic)

Design Summary

Wall Stability Ratios			
Overturning	=	3.08	OK
Sliding	=	1.88	OK
Global Stability	=	2.12	
Total Bearing Load	=	3,834 lbs	
...resultant ecc.	=	6.17 in	
Soil Pressure @ Toe	=	1,436 psf	OK
Soil Pressure @ Heel	=	268 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,011 psf	
ACI Factored @ Heel	=	375 psf	
Footing Shear @ Toe	=	24.1 psi	OK
Footing Shear @ Heel	=	4.4 psi	OK
Allowable	=	75.0 psi	
Sliding Calcs			
Lateral Sliding Force	=	1,209.4 lbs	
less 100% Passive Force	= -	266.7 lbs	
less 100% Friction Force	= -	2,012.7 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

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	10.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.541**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,500.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	3,492.0		
Moment.....Allowable	=	6,444.1		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	20.0		
Shear.....Allowable	psi =	75.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	300.0		
Rebar Depth 'd'	in =	6.25		

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 =	2,500.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0" (with Seismic)

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1308 in2/ft		
(4/3) * As :	0.1744 in2/ft	Min Stem T&S Reinf Area 1.152 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 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 :	0.1744 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 :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.75 ft
Heel Width	=	2.75
Total Footing Width	=	4.50
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 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	=	2,011	375	psf
Mu' : Upward	=	2,754	1,361	ft-#
Mu' : Downward	=	331	2,044	ft-#
Mu: Design	=	2,424	683	ft-#
phiMn	=	6,985	8,065	ft-#
Actual 1-Way Shear	=	24.06	4.37	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 10.00 in
Heel Reinforcing = # 4 @ 10.00 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 0.97 in2
Min footing T&S reinf Area per foot 0.22 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0" (with Seismic)

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)		817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	1,375.0	3.46	4,755.2
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.46	4,755.2
Hydrostatic Force					Watre 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	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	96.3	0.88	84.2
Seismic Earth Load	=	392.2	3.42	1,340.1	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	1,800.0	2.08	3,750.0
					Earth @ Stem Transitions	=			
					Footing Weight	=	562.5	2.25	1,265.6
					Key Weight	=			
					Vert. Component	=			
Total	=	1,209.4	**O.T.M.** =	3,201.4	**Total =**		3,833.8 lbs	**R.M.=**	9,855.1

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

Resisting/Overturning Ratio = **3.08**

Vertical Loads used for Soil Pressure = 3,833.8 lbs

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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)	0.053	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

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0" (with Seismic)

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 =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.11 in
As Provided =	0.2400 in2/ft
As Required =	0.1744 in2/ft

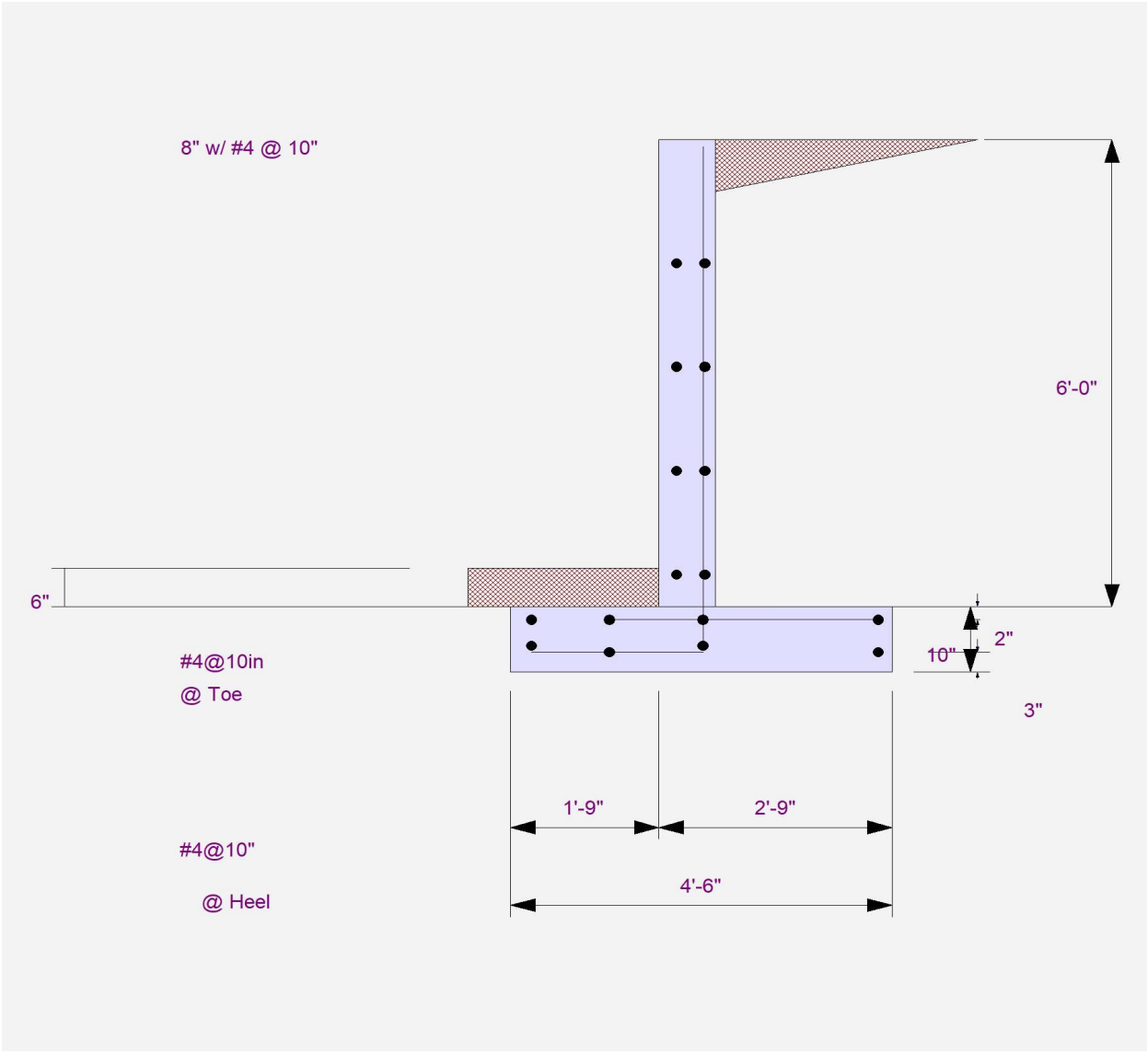
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0" (with Seismic)



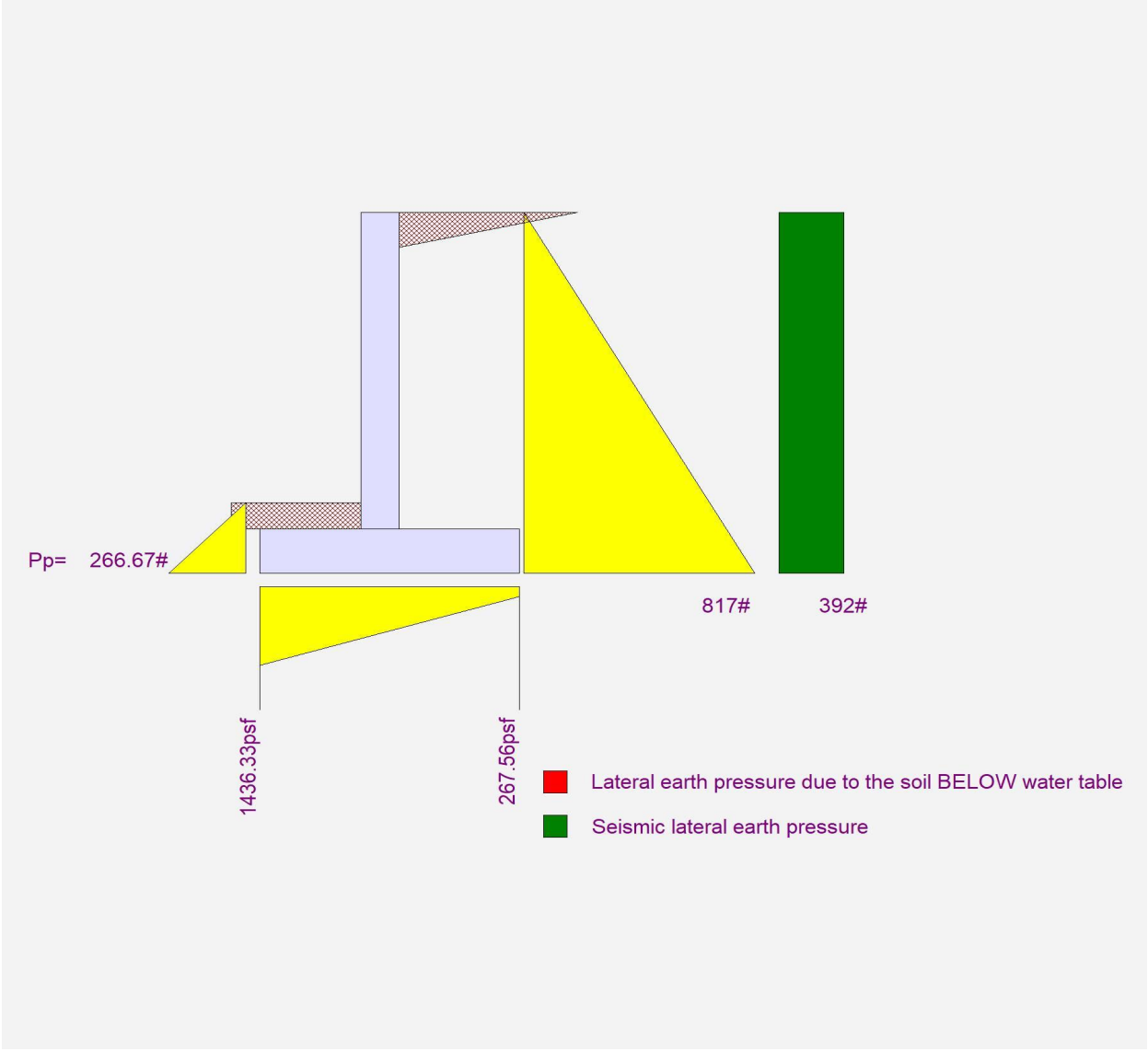
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 6'-0" (with Seismic)



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0"

Code Reference

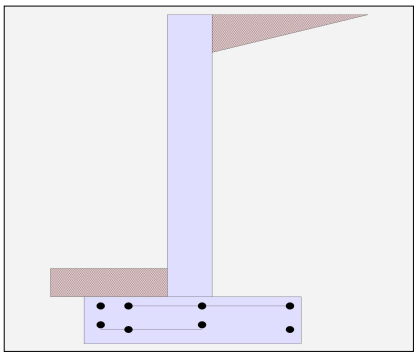
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.525
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
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) (Strength 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: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0"

Design Summary

Wall Stability Ratios

Overturning	=	4.29	OK
Sliding	=	2.84	OK
Global Stability	=	2.17	
Total Bearing Load	=	2,708 lbs	
...resultant ecc.	=	2.60 in	
Soil Pressure @ Toe	=	1,166 psf	OK
Soil Pressure @ Heel	=	500 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,633 psf	
ACI Factored @ Heel	=	700 psf	
Footing Shear @ Toe	=	11.7 psi	OK
Footing Shear @ Heel	=	1.2 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	595.5 lbs	
less 100% Passive Force	-	266.7 lbs	
less 100% Friction Force	= -	1,421.9 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

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	10.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.181**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	700.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,166.7		
Moment.....Allowable	=	6,444.1		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	9.3		
Shear.....Allowable	psi =	75.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	300.0		
Rebar Depth 'd'	in =	6.25		

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 =	2,500.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0"

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0437 in2/ft		
(4/3) * As :	0.0583 in2/ft	Min Stem T&S Reinf Area 0.960 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 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 :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.25 ft
Heel Width	=	2.00
Total Footing Width	=	3.25
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 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	=	1,633	700	psf
Mu' : Upward	=	1,182	736	ft-#
Mu' : Downward	=	169	720	ft-#
Mu: Design	=	1,014	-16	ft-#
phiMn	=	6,985	8,065	ft-#
Actual 1-Way Shear	=	11.75	1.21	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 10.00 in
Heel Reinforcing = # 4 @ 10.00 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 0.70 in2
Min footing T&S reinf Area per foot 0.22 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0"

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)		595.5	1.94	1,157.9	Soil Over HL (ab. water tbl)	733.3	2.58	1,894.4
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.58	1,894.4
Hydrostatic Force					Watre 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	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	68.8	0.63	43.0
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	1,500.0	1.58	2,375.0
					Earth @ Stem Transitions	=		
					Footing Weight	=	406.3	1.63	660.2
					Key Weight	=			
					Vert. Component	=			
Total	=	595.5	**O.T.M.** =	1,157.9	**Total =**		2,708.3 lbs	**R.M.=**	4,972.6

Resisting/Overturning Ratio = **4.29**

Vertical Loads used for Soil Pressure = 2,708.3 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 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)	0.050	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

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0"

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 =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.05 in
As Provided =	0.2400 in2/ft
As Required =	0.1728 in2/ft

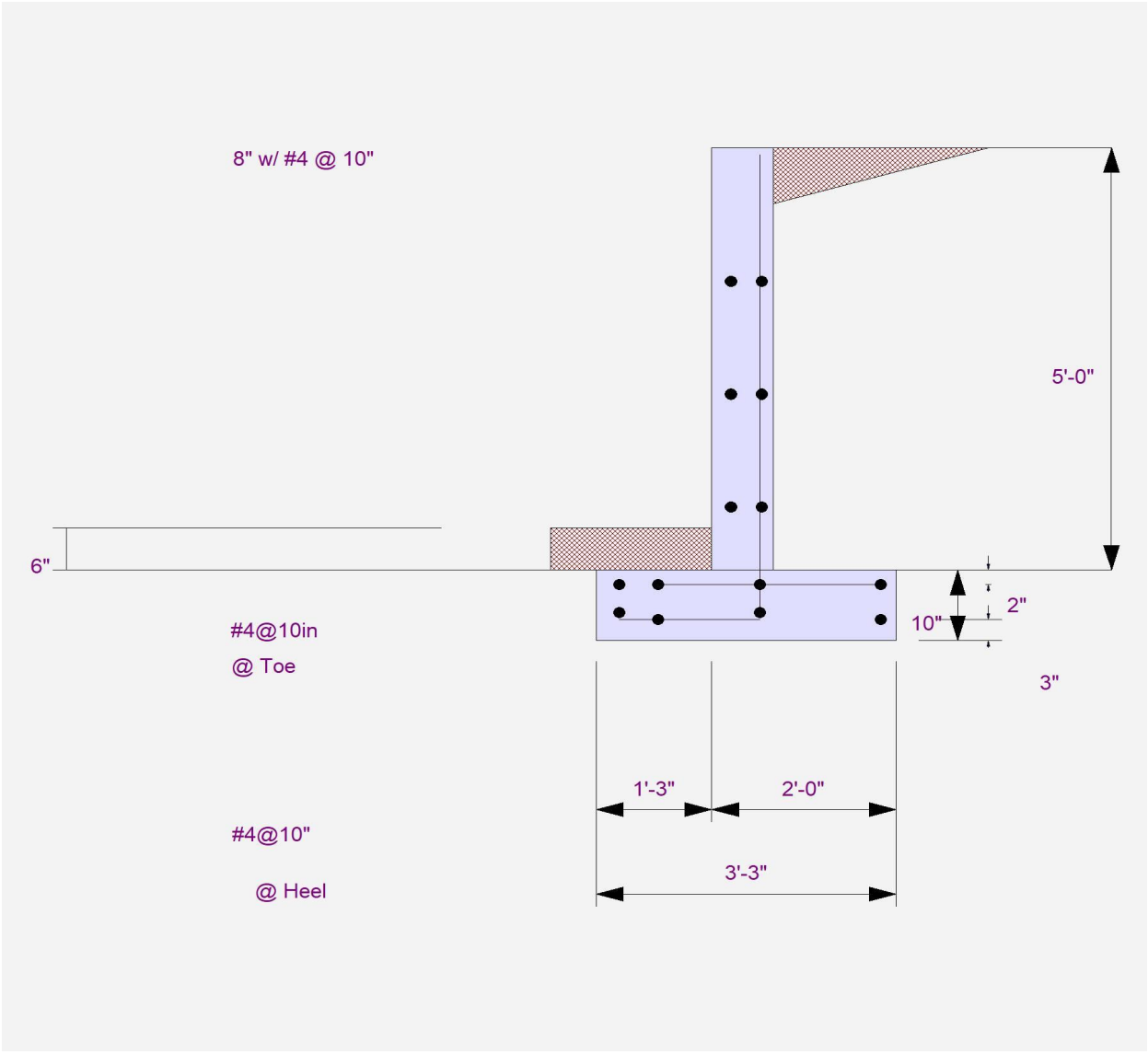
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0"



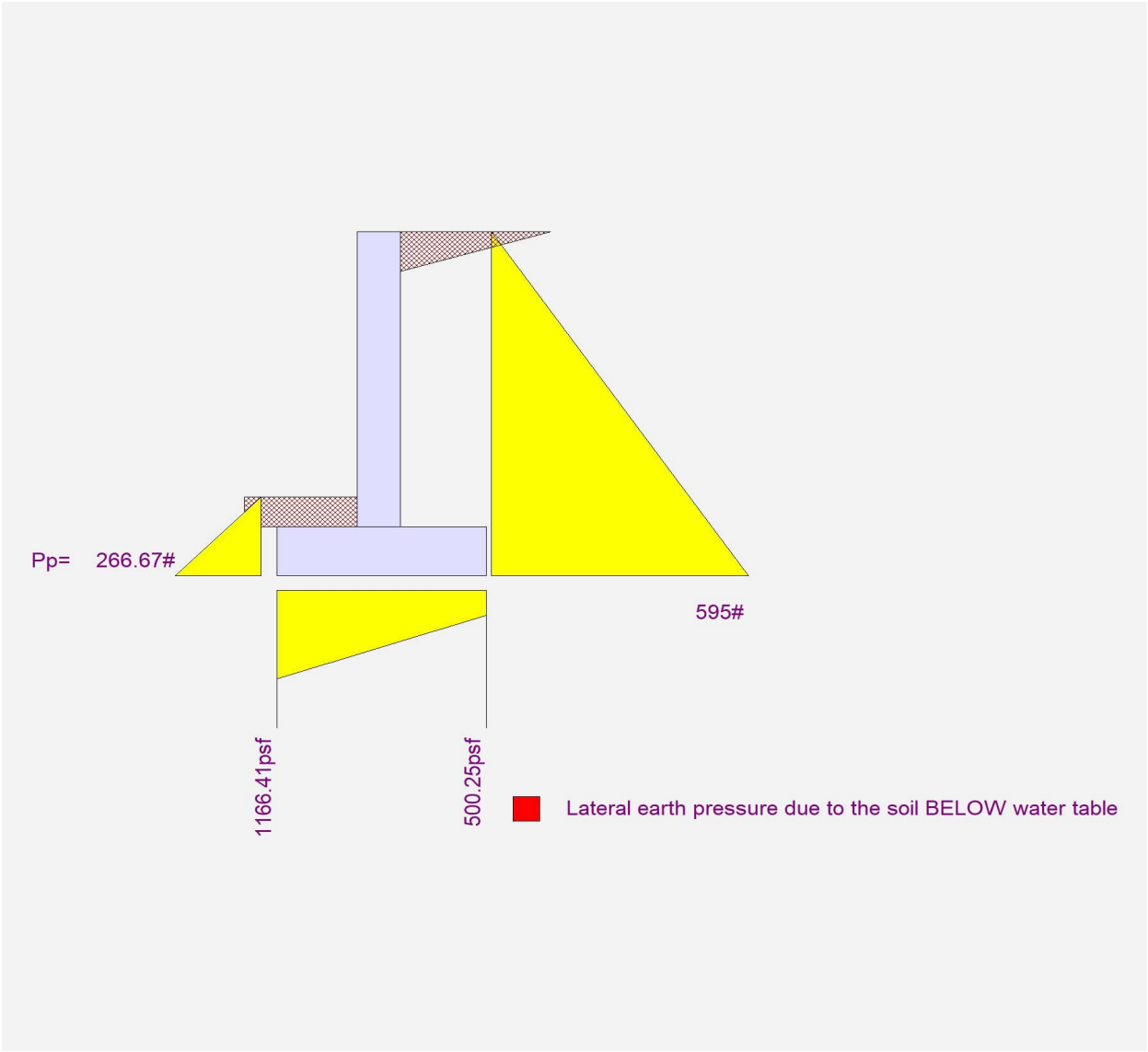
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0"



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0" (with Seismic)

Code Reference

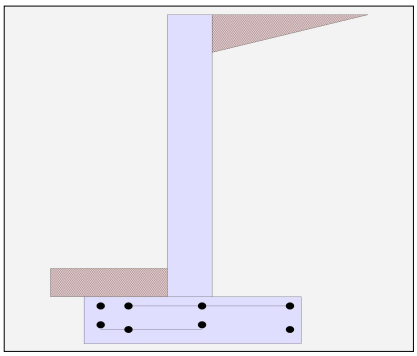
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.525
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
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) (Strength 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

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	12.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	70.000
Total Seismic Force	=	408.333

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0" (with Seismic)

Design Summary

Wall Stability Ratios

Overturning	=	2.50	OK
Sliding	=	1.92	OK
Global Stability	=	2.17	
Total Bearing Load	=	2,708 lbs	
...resultant ecc.	=	6.29 in	
Soil Pressure @ Toe	=	1,640 psf	NG
Soil Pressure @ Heel	=	27 psf	OK
Allowable	=	1,500 psf	

Soil Pressure Exceeds Allowable!

ACI Factored @ Toe	=	2,296 psf	
ACI Factored @ Heel	=	37 psf	
Footing Shear @ Toe	=	16.5 psi	OK
Footing Shear @ Heel	=	4.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	881.3 lbs	
less 100% Passive Force	-	266.7 lbs	
less 100% Friction Force	-	1,421.9 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

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	10.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.316**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,050.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	2,041.7		
Moment.....Allowable	=	6,444.1		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	14.0		
Shear.....Allowable	psi =	75.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	300.0		
Rebar Depth 'd'	in =	6.25		

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 =	2,500.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0" (with Seismic)

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0765 in2/ft		
(4/3) * As :	0.102 in2/ft	Min Stem T&S Reinf Area 0.960 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 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 :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.25 ft
Heel Width	=	2.00
Total Footing Width	=	3.25
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 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	=	2,296	37	psf
Mu' : Upward	=	1,568	308	ft-#
Mu' : Downward	=	169	720	ft-#
Mu: Design	=	1,399	412	ft-#
phiMn	=	6,985	8,065	ft-#
Actual 1-Way Shear	=	16.45	4.58	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 10.00 in
Heel Reinforcing = # 4 @ 10.00 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 0.70 in2
Min footing T&S reinf Area per foot 0.22 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0" (with Seismic)

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)		595.5	1.94	1,157.9	Soil Over HL (ab. water tbl)	733.3	2.58	1,894.4
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.58	1,894.4
Hydrostatic Force					Watre 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	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	68.8	0.63	43.0
Seismic Earth Load	=	285.8	2.92	833.7	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	1,500.0	1.58	2,375.0
					Earth @ Stem Transitions	=			
					Footing Weight	=	406.3	1.63	660.2
					Key Weight	=			
					Vert. Component	=			
Total	=	881.3	**O.T.M.** =	1,991.6	**Total =**		2,708.3 lbs	**R.M.=**	4,972.6

Resisting/Overturning Ratio = **2.50**

Vertical Loads used for Soil Pressure = 2,708.3 lbs

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

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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)	0.070	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

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0" (with Seismic)

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 =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.05 in
As Provided =	0.2400 in2/ft
As Required =	0.1728 in2/ft

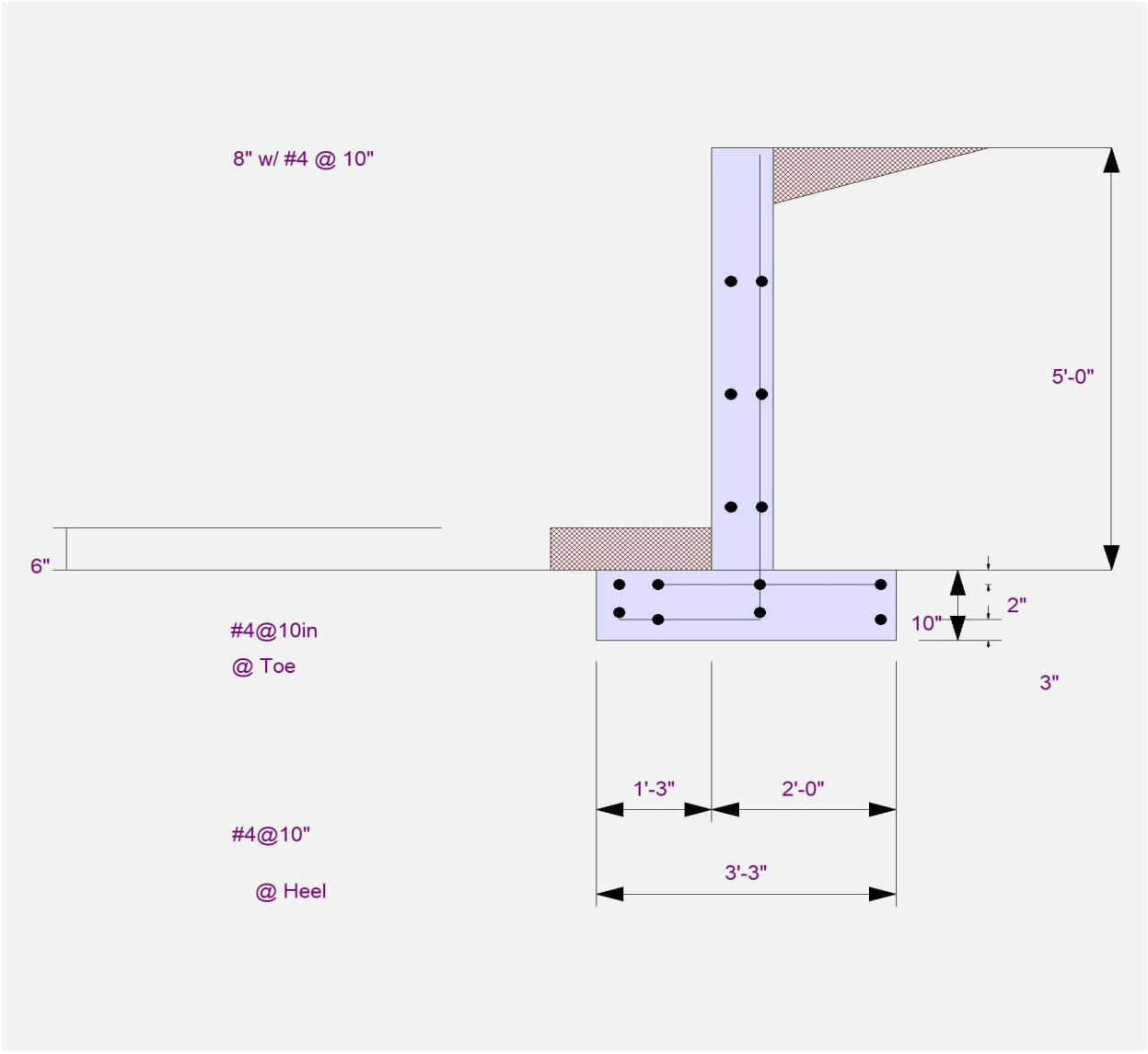
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0" (with Seismic)



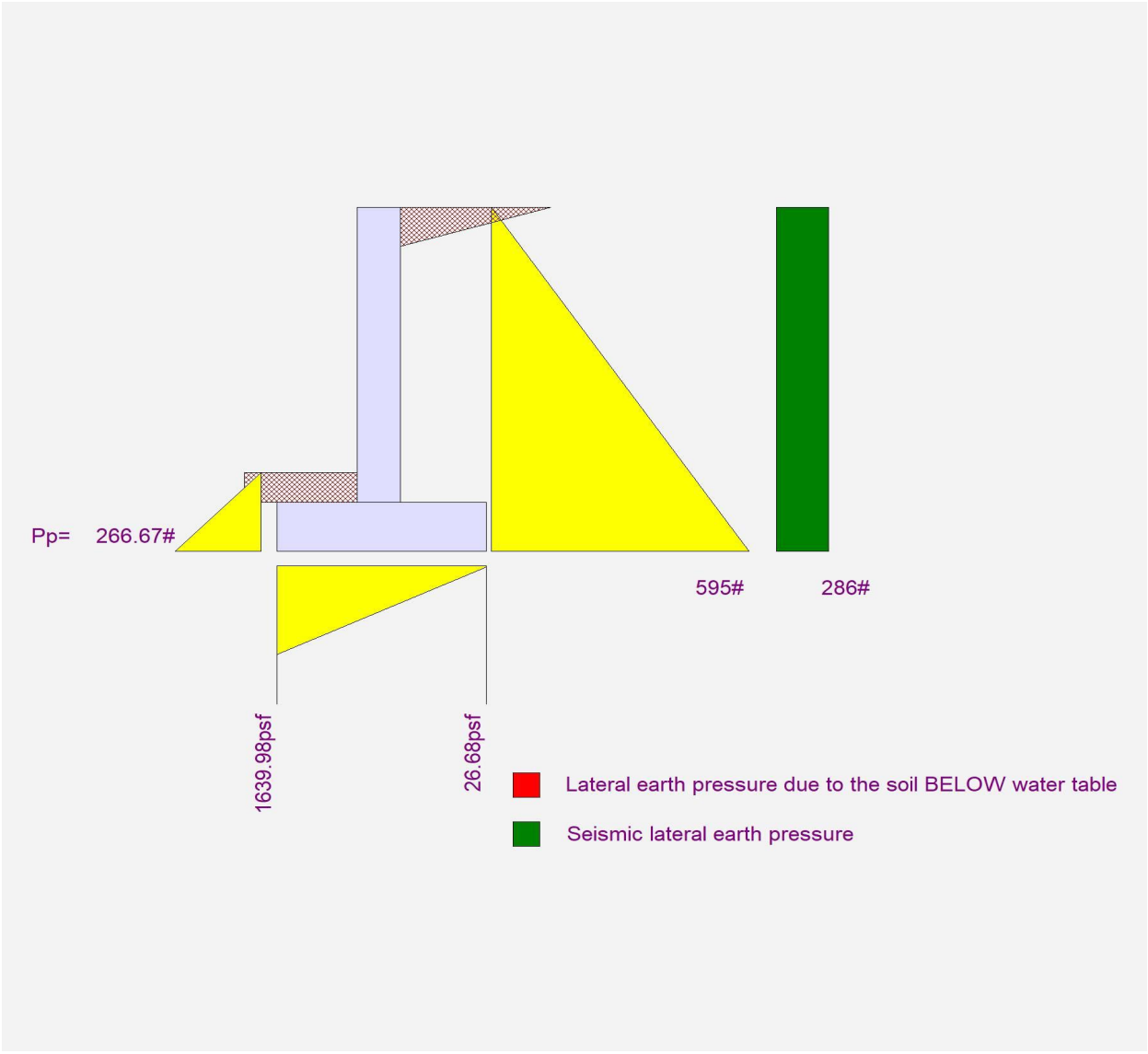
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 5'-0" (with Seismic)



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0"

Code Reference

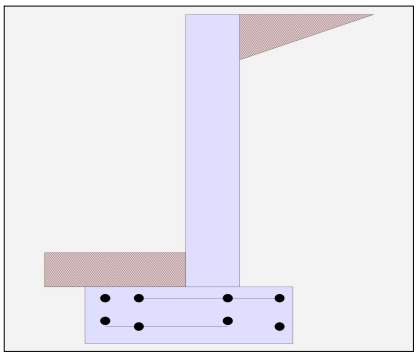
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	4.00 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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.525
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
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) (Strength 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: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0"

Design Summary

Wall Stability Ratios

Overturning	=	4.58	OK
Sliding	=	3.07	OK
Global Stability	=	2.28	
Total Bearing Load	=	1,883 lbs	
...resultant ecc.	=	0.46 in	
Soil Pressure @ Toe	=	795 psf	OK
Soil Pressure @ Heel	=	664 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,114 psf	
ACI Factored @ Heel	=	930 psf	
Footing Shear @ Toe	=	7.7 psi	OK
Footing Shear @ Heel	=	2.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	408.8 lbs	
less 100% Passive Force	-	266.7 lbs	
less 100% Friction Force	-	988.6 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

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	10.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.092**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	448.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	597.3		
Moment.....Allowable	=	6,444.1		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	6.0		
Shear.....Allowable	psi =	75.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	300.0		
Rebar Depth 'd'	in =	6.25		

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 =	2,500.0
Fy	psi =	60,000.0

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0"

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0224 in2/ft		
(4/3) * As :	0.0298 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 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 :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.25 ft
Heel Width	=	1.33
Total Footing Width	=	2.58
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 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	=	1,114	930	psf
Mu' : Upward	=	847	208	ft-#
Mu' : Downward	=	169	149	ft-#
Mu: Design	=	678	-59	ft-#
phiMn	=	6,985	8,065	ft-#
Actual 1-Way Shear	=	7.72	2.03	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 10.00 in
Heel Reinforcing = # 4 @ 10.00 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 0.56 in2
Min footing T&S reinf Area per foot 0.22 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0"

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)	408.8	1.61	658.7			
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)	291.9	2.25	656.2
				Soil Over HL (bel. water tbl)		2.25	656.2
				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 =	68.8	0.63	43.0
				Surcharge Over Toe =			
				Stem Weight(s) =	1,200.0	1.58	1,900.0
				Earth @ Stem Transitions =			
				Footing Weight =	322.5	1.29	416.0
				Key Weight =			
				Vert. Component =			
Total =	408.8	**O.T.M.** =	658.7	**Total =**	1,883.1 lbs	**R.M.=**	3,015.2

Resisting/Overturning Ratio = **4.58**

Vertical Loads used for Soil Pressure = 1,883.1 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)	0.034	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

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0"

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 =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.05 in
As Provided =	0.2400 in2/ft
As Required =	0.1728 in2/ft

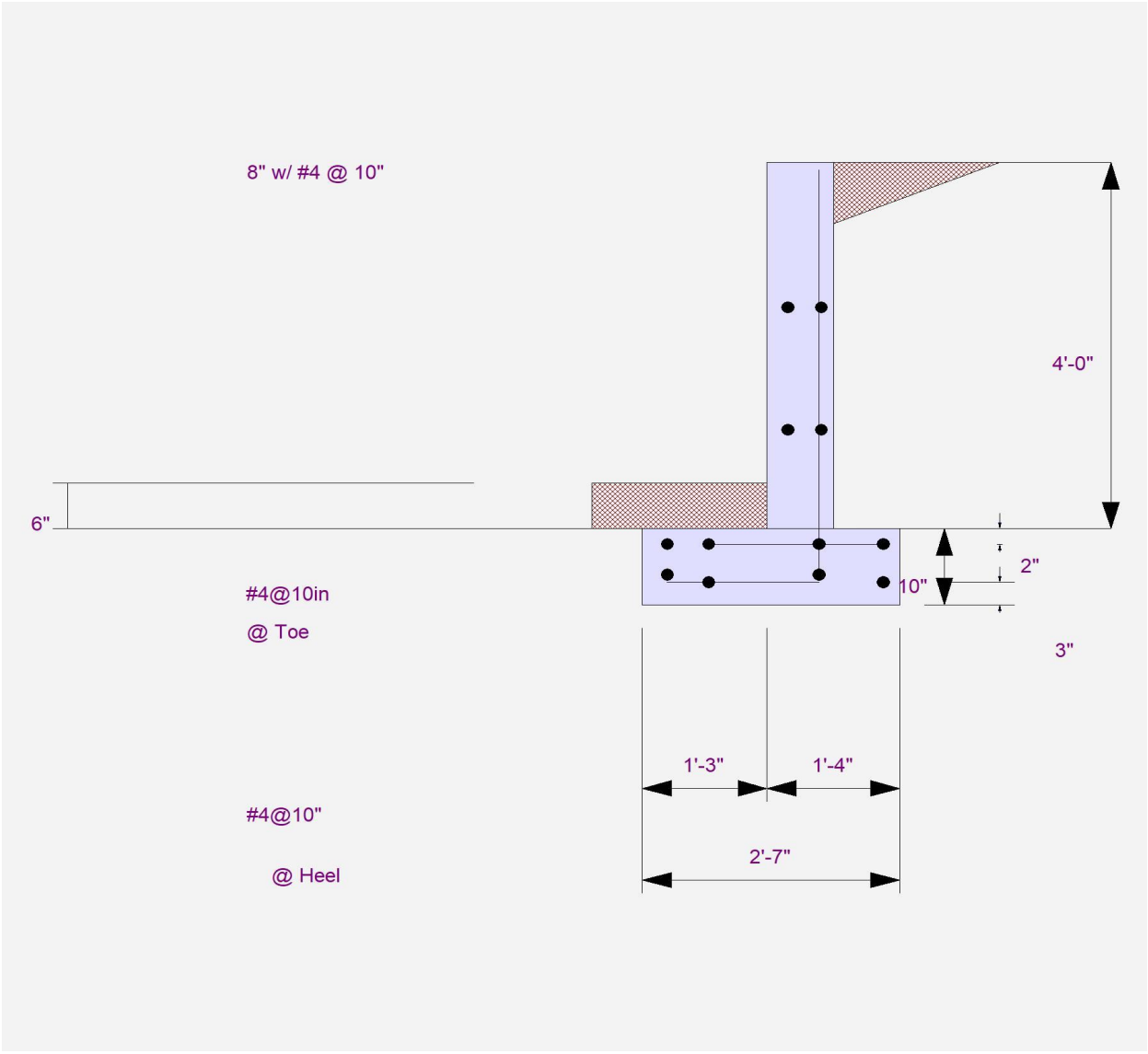
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0"



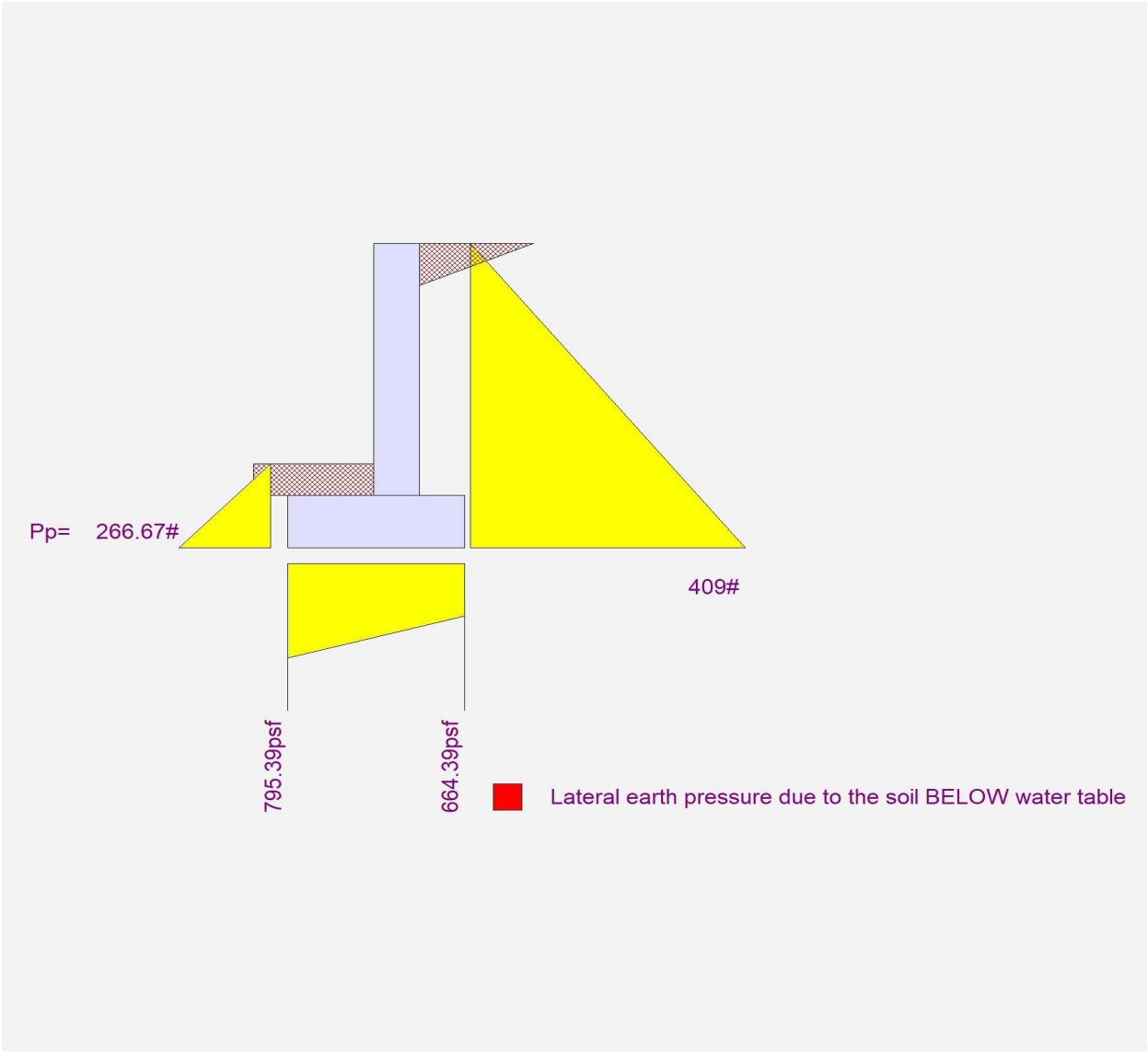
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0"



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0" (with Seismic)

Code Reference

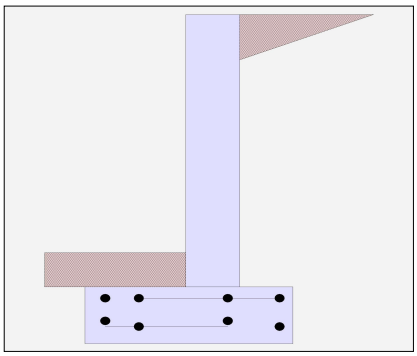
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	4.00 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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.525
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
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) (Strength 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

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	12.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	58.000
Total Seismic Force	=	280.333

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0" (with Seismic)

Design Summary

Wall Stability Ratios			
Overturning	=	2.66	OK
Sliding	=	2.07	OK
Global Stability	=	2.28	
Total Bearing Load	=	1,883 lbs	
...resultant ecc.	=	3.49 in	
Soil Pressure @ Toe	=	1,223 psf	OK
Soil Pressure @ Heel	=	237 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,712 psf	
ACI Factored @ Heel	=	332 psf	
Footing Shear @ Toe	=	11.7 psi	OK
Footing Shear @ Heel	=	1.2 psi	OK
Allowable	=	75.0 psi	
Sliding Calcs			
Lateral Sliding Force	=	605.1 lbs	
less 100% Passive Force	-	266.7 lbs	
less 100% Friction Force	-	988.6 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

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	10.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.164**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	680.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,061.3		
Moment.....Allowable	=	6,444.1		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	9.1		
Shear.....Allowable	psi =	75.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	300.0		
Rebar Depth 'd'	in =	6.25		
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 =	2,500.0		
Fy	psi =	60,000.0		

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0" (with Seismic)

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0398 in2/ft		
(4/3) * As :	0.053 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 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 :	0.24 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.25 ft
Heel Width	=	1.33
Total Footing Width	=	2.58
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 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	=	1,712	332	psf
Mu' : Upward	=	1,163	99	ft-#
Mu' : Downward	=	169	149	ft-#
Mu: Design	=	995	50	ft-#
phiMn	=	6,985	8,065	ft-#
Actual 1-Way Shear	=	11.66	1.24	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 10.00 in
Heel Reinforcing = # 4 @ 10.00 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 0.56 in2
Min footing T&S reinf Area per foot 0.22 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0" (with Seismic)

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)		408.8	1.61	658.7	Soil Over HL (ab. water tbl)	291.9	2.25	656.2
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.25	656.2
Hydrostatic Force					Watre 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	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	68.8	0.63	43.0
Seismic Earth Load	=	196.2	2.42	474.2	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	1,200.0	1.58	1,900.0
					Earth @ Stem Transitions	=			
					Footing Weight	=	322.5	1.29	416.0
					Key Weight	=			
					Vert. Component	=			
Total	=	605.1	**O.T.M.** =	1,132.9	**Total =**		1,883.1 lbs	**R.M.=**	3,015.2

Resisting/Overturning Ratio = **2.66**

Vertical Loads used for Soil Pressure = 1,883.1 lbs

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

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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)	0.053	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

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0" (with Seismic)

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 =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.05 in
As Provided =	0.2400 in2/ft
As Required =	0.1728 in2/ft

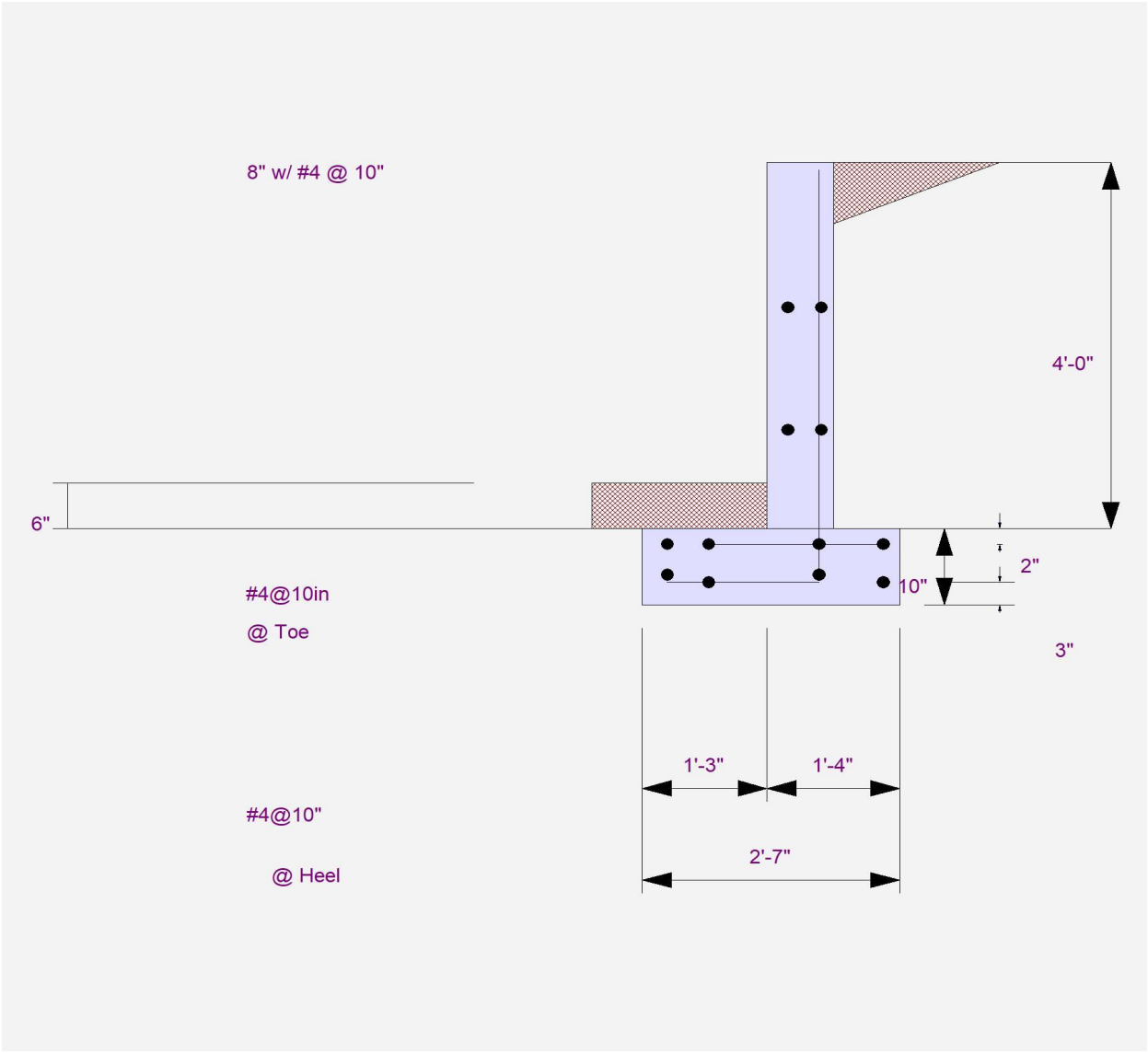
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0" (with Seismic)



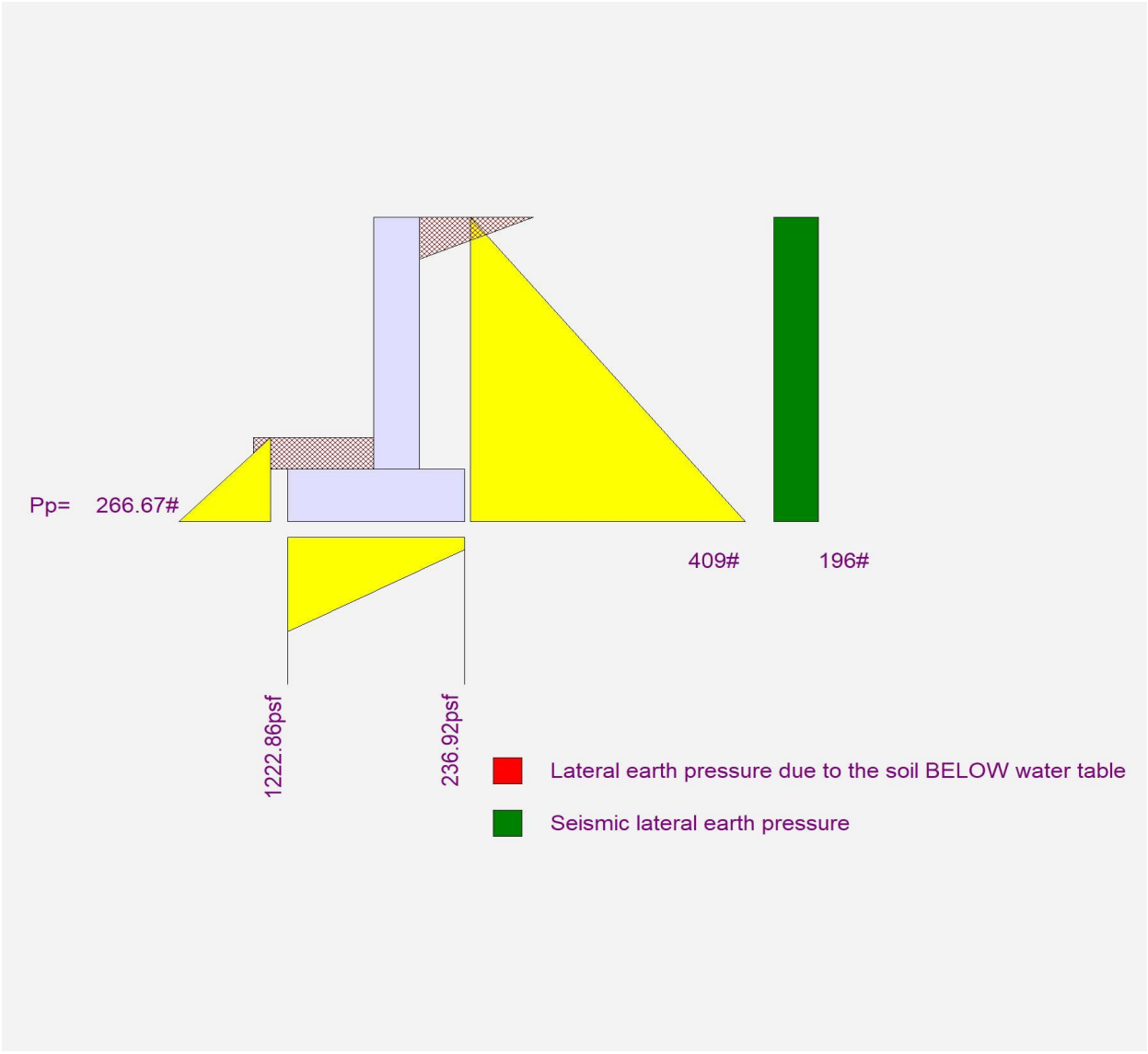
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Leung Residence - Retaining Walls.ec6

LIC# : KW-06015393, Build:20.22.3.31 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Site Retaining Wall 4'-0" (with Seismic)



Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: leung hot tub slab.ec6

LIC# : KW-06015393, Build:20.22.4.16 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

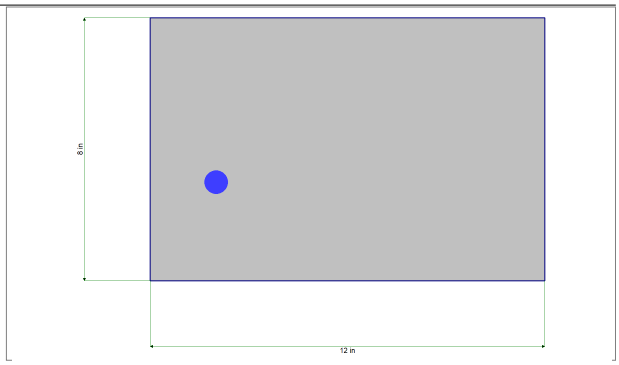
DESCRIPTION: Hot tub slab

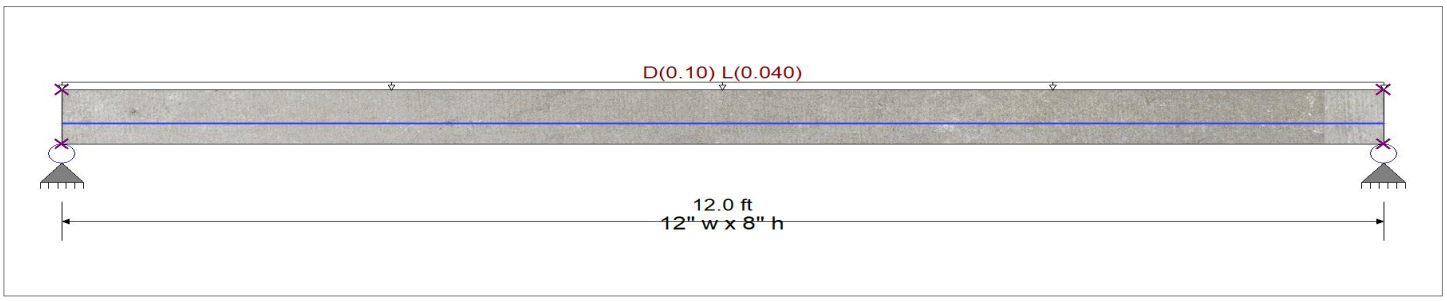
CODE REFERENCES

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

Material Properties

f'c	=	4.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c$^{1/2}$ * 7.50	=	474.342 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,605.0 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 = 12.0 in, Height = 8.0 in
Span #1 Reinforcing....
1-#6 at 3.0 in from Bottom, from 0.0 to 12.0 ft in this span

Beam self weight calculated and added to loads
Loads on all spans...
D = 0.10, L = 0.040
Uniform Load on ALL spans : D = 0.10, L = 0.040 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.583**	: 1
Section used for this span	**Typical Section**	
Mu : Applied	5.40	k-ft
Mn * Phi : Allowable	9.259	k-ft
Location of maximum on span	6.011	ft
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.010 in	Ratio =	14246	>=360.0	L Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	L Only
Max Downward Total Deflection	0.060 in	Ratio =	2407	>=180.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<180.0	Span: 1 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	1.420	1.420
Overall MINimum	0.240	0.240
D Only	1.180	1.180
+D+L	1.420	1.420
+D+0.750L	1.360	1.360
+0.60D	0.708	0.708

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: leung hot tub slab.ec6

LIC# : KW-06015393, Build:20.22.4.16 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Hot tub slab

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
L Only	0.240	0.240

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu Actual	(k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Suggest
+1.20D+1.60L	1	0.00	5.00	1.80	1.80	0.00	1.00	6.23	Vu < PhiVc/2	t Reqd 9.6	6.2	0.0	0.0
+1.20D+1.60L	1	0.13	5.00	1.76	1.76	0.23	1.00	6.23	Vu < PhiVc/2	t Reqd 9.6	6.2	0.0	0.0
+1.20D+1.60L	1	0.26	5.00	1.72	1.72	0.46	1.00	6.23	Vu < PhiVc/2	t Reqd 9.6	6.2	0.0	0.0
+1.20D+1.60L	1	0.39	5.00	1.68	1.68	0.68	1.00	6.23	Vu < PhiVc/2	t Reqd 9.6	6.2	0.0	0.0
+1.20D+1.60L	1	0.52	5.00	1.64	1.64	0.90	0.76	6.03	Vu < PhiVc/2	t Reqd 9.6	6.0	0.0	0.0
+1.20D+1.60L	1	0.66	5.00	1.60	1.60	1.12	0.60	5.90	Vu < PhiVc/2	t Reqd 9.6	5.9	0.0	0.0
+1.20D+1.60L	1	0.79	5.00	1.56	1.56	1.32	0.49	5.81	Vu < PhiVc/2	t Reqd 9.6	5.8	0.0	0.0
+1.20D+1.60L	1	0.92	5.00	1.52	1.52	1.53	0.42	5.75	Vu < PhiVc/2	t Reqd 9.6	5.8	0.0	0.0
+1.20D+1.60L	1	1.05	5.00	1.49	1.49	1.72	0.36	5.70	Vu < PhiVc/2	t Reqd 9.6	5.7	0.0	0.0
+1.20D+1.60L	1	1.18	5.00	1.45	1.45	1.92	0.31	5.67	Vu < PhiVc/2	t Reqd 9.6	5.7	0.0	0.0
+1.20D+1.60L	1	1.31	5.00	1.41	1.41	2.10	0.28	5.64	Vu < PhiVc/2	t Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	1.44	5.00	1.37	1.37	2.28	0.25	5.61	Vu < PhiVc/2	t Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	1.57	5.00	1.33	1.33	2.46	0.22	5.59	Vu < PhiVc/2	t Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	1.70	5.00	1.29	1.29	2.63	0.20	5.58	Vu < PhiVc/2	t Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	1.84	5.00	1.25	1.25	2.80	0.19	5.56	Vu < PhiVc/2	t Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	1.97	5.00	1.21	1.21	2.96	0.17	5.55	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	2.10	5.00	1.17	1.17	3.12	0.16	5.54	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	2.23	5.00	1.13	1.13	3.27	0.14	5.53	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	2.36	5.00	1.09	1.09	3.41	0.13	5.52	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	2.49	5.00	1.05	1.05	3.55	0.12	5.51	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	2.62	5.00	1.01	1.01	3.69	0.11	5.50	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	2.75	5.00	0.97	0.97	3.82	0.11	5.50	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	2.89	5.00	0.93	0.93	3.94	0.10	5.49	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.02	5.00	0.90	0.90	4.06	0.09	5.48	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.15	5.00	0.86	0.86	4.18	0.09	5.48	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.28	5.00	0.82	0.82	4.29	0.08	5.47	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.41	5.00	0.78	0.78	4.39	0.07	5.47	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.54	5.00	0.74	0.74	4.49	0.07	5.46	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.67	5.00	0.70	0.70	4.59	0.06	5.46	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.80	5.00	0.66	0.66	4.68	0.06	5.46	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	3.93	5.00	0.62	0.62	4.76	0.05	5.45	Vu < PhiVc/2	t Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	4.07	5.00	0.58	0.58	4.84	0.05	5.45	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	4.20	5.00	0.54	0.54	4.91	0.05	5.45	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	4.33	5.00	0.50	0.50	4.98	0.04	5.44	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	4.46	5.00	0.46	0.46	5.04	0.04	5.44	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	4.59	5.00	0.42	0.42	5.10	0.03	5.44	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	4.72	5.00	0.38	0.38	5.15	0.03	5.43	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	4.85	5.00	0.34	0.34	5.20	0.03	5.43	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	4.98	5.00	0.30	0.30	5.25	0.02	5.43	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	5.11	5.00	0.27	0.27	5.28	0.02	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	5.25	5.00	0.23	0.23	5.31	0.02	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	5.38	5.00	0.19	0.19	5.34	0.01	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	5.51	5.00	0.15	0.15	5.36	0.01	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	5.64	5.00	0.11	0.11	5.38	0.01	5.41	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	5.77	5.00	0.07	0.07	5.39	0.01	5.41	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	5.90	5.00	0.03	0.03	5.40	0.00	5.41	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.03	5.00	-0.01	0.01	5.40	0.00	5.41	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.16	5.00	-0.05	0.05	5.40	0.00	5.41	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.30	5.00	-0.09	0.09	5.39	0.01	5.41	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.43	5.00	-0.13	0.13	5.37	0.01	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.56	5.00	-0.17	0.17	5.35	0.01	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.69	5.00	-0.21	0.21	5.33	0.02	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.82	5.00	-0.25	0.25	5.30	0.02	5.42	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	6.95	5.00	-0.29	0.29	5.26	0.02	5.43	Vu < PhiVc/2	t Reqd 9.6	5.4	0.0	0.0

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: leung hot tub slab.ec6

LIC# : KW-06015393, Build:20.22.4.16 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Hot tub slab

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu Actual	(k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Suggest
+1.20D+1.60L	1	7.08	5.00	-0.32	0.32	5.22	0.03	5.43	Vu < PhiVc/2	ıt Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	7.21	5.00	-0.36	0.36	5.18	0.03	5.43	Vu < PhiVc/2	ıt Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	7.34	5.00	-0.40	0.40	5.13	0.03	5.43	Vu < PhiVc/2	ıt Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	7.48	5.00	-0.44	0.44	5.07	0.04	5.44	Vu < PhiVc/2	ıt Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	7.61	5.00	-0.48	0.48	5.01	0.04	5.44	Vu < PhiVc/2	ıt Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	7.74	5.00	-0.52	0.52	4.95	0.04	5.44	Vu < PhiVc/2	ıt Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	7.87	5.00	-0.56	0.56	4.88	0.05	5.45	Vu < PhiVc/2	ıt Reqd 9.6	5.4	0.0	0.0
+1.20D+1.60L	1	8.00	5.00	-0.60	0.60	4.80	0.05	5.45	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	8.13	5.00	-0.64	0.64	4.72	0.06	5.45	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	8.26	5.00	-0.68	0.68	4.63	0.06	5.46	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	8.39	5.00	-0.72	0.72	4.54	0.07	5.46	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	8.52	5.00	-0.76	0.76	4.44	0.07	5.47	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	8.66	5.00	-0.80	0.80	4.34	0.08	5.47	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	8.79	5.00	-0.84	0.84	4.23	0.08	5.48	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	8.92	5.00	-0.88	0.88	4.12	0.09	5.48	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.05	5.00	-0.91	0.91	4.01	0.10	5.49	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.18	5.00	-0.95	0.95	3.88	0.10	5.49	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.31	5.00	-0.99	0.99	3.76	0.11	5.50	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.44	5.00	-1.03	1.03	3.62	0.12	5.51	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.57	5.00	-1.07	1.07	3.48	0.13	5.51	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.70	5.00	-1.11	1.11	3.34	0.14	5.52	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.84	5.00	-1.15	1.15	3.19	0.15	5.53	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	9.97	5.00	-1.19	1.19	3.04	0.16	5.54	Vu < PhiVc/2	ıt Reqd 9.6	5.5	0.0	0.0
+1.20D+1.60L	1	10.10	5.00	-1.23	1.23	2.88	0.18	5.55	Vu < PhiVc/2	ıt Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	10.23	5.00	-1.27	1.27	2.72	0.19	5.57	Vu < PhiVc/2	ıt Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	10.36	5.00	-1.31	1.31	2.55	0.21	5.58	Vu < PhiVc/2	ıt Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	10.49	5.00	-1.35	1.35	2.37	0.24	5.60	Vu < PhiVc/2	ıt Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	10.62	5.00	-1.39	1.39	2.19	0.26	5.62	Vu < PhiVc/2	ıt Reqd 9.6	5.6	0.0	0.0
+1.20D+1.60L	1	10.75	5.00	-1.43	1.43	2.01	0.30	5.65	Vu < PhiVc/2	ıt Reqd 9.6	5.7	0.0	0.0
+1.20D+1.60L	1	10.89	5.00	-1.47	1.47	1.82	0.34	5.68	Vu < PhiVc/2	ıt Reqd 9.6	5.7	0.0	0.0
+1.20D+1.60L	1	11.02	5.00	-1.50	1.50	1.63	0.39	5.73	Vu < PhiVc/2	ıt Reqd 9.6	5.7	0.0	0.0
+1.20D+1.60L	1	11.15	5.00	-1.54	1.54	1.43	0.45	5.78	Vu < PhiVc/2	ıt Reqd 9.6	5.8	0.0	0.0
+1.20D+1.60L	1	11.28	5.00	-1.58	1.58	1.22	0.54	5.85	Vu < PhiVc/2	ıt Reqd 9.6	5.9	0.0	0.0
+1.20D+1.60L	1	11.41	5.00	-1.62	1.62	1.01	0.67	5.96	Vu < PhiVc/2	ıt Reqd 9.6	6.0	0.0	0.0
+1.20D+1.60L	1	11.54	5.00	-1.66	1.66	0.79	0.87	6.13	Vu < PhiVc/2	ıt Reqd 9.6	6.1	0.0	0.0
+1.20D+1.60L	1	11.67	5.00	-1.70	1.70	0.57	1.00	6.23	Vu < PhiVc/2	ıt Reqd 9.6	6.2	0.0	0.0
+1.20D+1.60L	1	11.80	5.00	-1.74	1.74	0.35	1.00	6.23	Vu < PhiVc/2	ıt Reqd 9.6	6.2	0.0	0.0
+1.20D+1.60L	1	11.93	5.00	-1.78	1.78	0.12	1.00	6.23	Vu < PhiVc/2	ıt Reqd 9.6	6.2	0.0	0.0

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	5.40	9.26	0.58
+1.40D					
Span # 1	1	12.000	4.96	9.26	0.54
+1.20D+1.60L					
Span # 1	1	12.000	5.40	9.26	0.58
+1.20D+L					
Span # 1	1	12.000	4.97	9.26	0.54
+1.20D					
Span # 1	1	12.000	4.25	9.26	0.46
+0.90D					
Span # 1	1	12.000	3.19	9.26	0.34

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	ocation in Span (ft	Load Combination	Max. "+" Defl (in)	ocation in Span (ft
+D+L	1	0.0598	6.000		0.0000	0.000