BYKONEN
CARTER
QUINN

STRUCTURAL
ENGINEERING

STRUCTURAL CALCULATIONS

Vaney Shinde Residence
4207 W Mercer Way,
Mercer Island, WA 98040

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4212 W Mercer Way,
Mercer Island, WA 98040

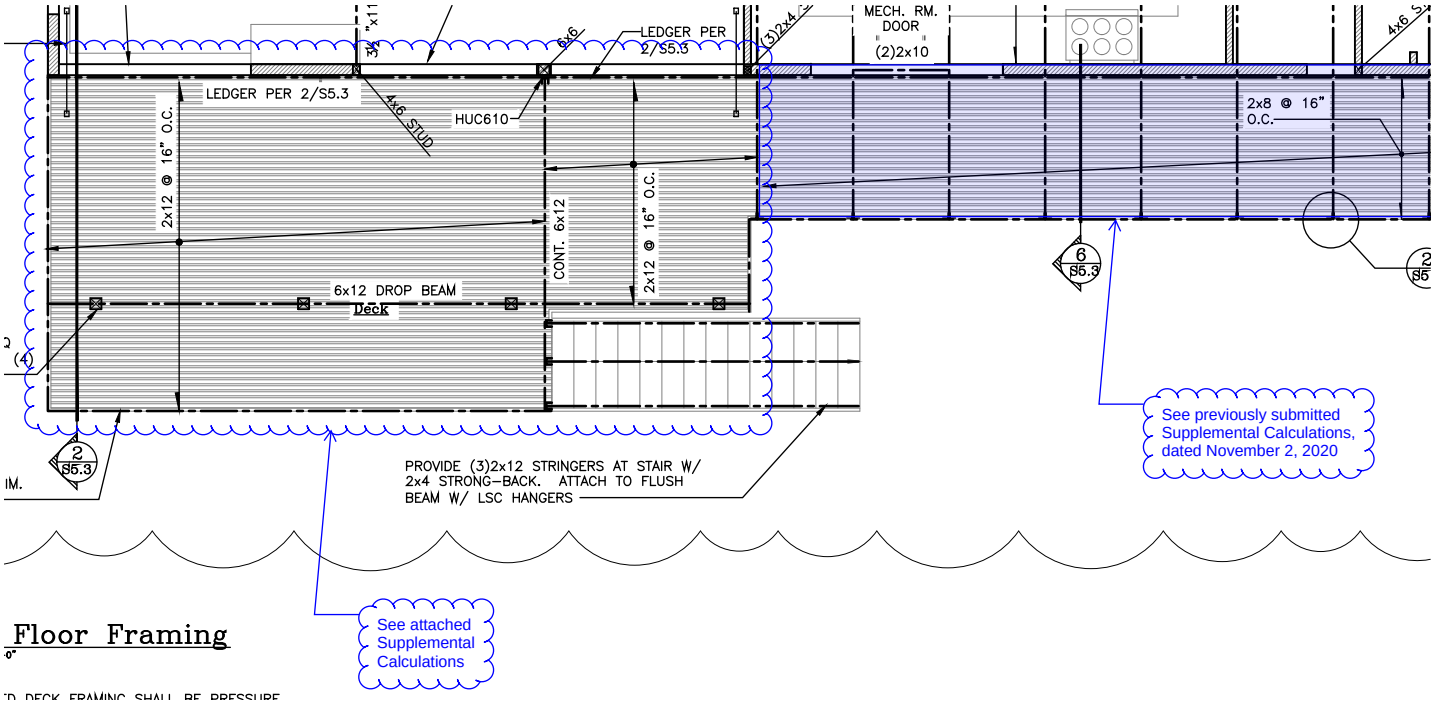
February 8, 2021

Supplemental Calculations – Deck and exterior window revisions

2033 Sixth Avenue #995 Seattle, WA 98121 206-264-7784 www.BCQ-SE.com

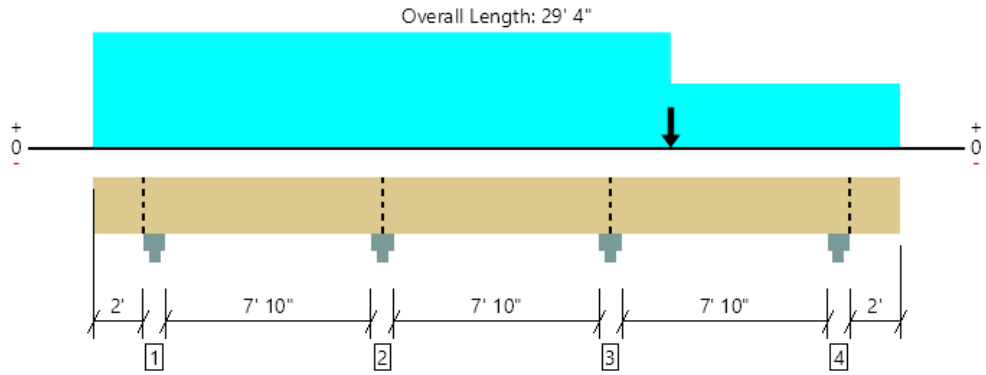
Deck Framing

Deck loads:
DL=15 psf
LL=60 psf



Main, Deck drop beam

1 piece(s) 6 x 12 Douglas Fir-Larch No. 1



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	9420 @ 18' 9 3/4"	18906 (5.50")	Passed (50%)	--	1.0 D + 1.0 L (Adj Spans)
Shear (lbs)	5034 @ 20'	7168	Passed (70%)	1.00	1.0 D + 1.0 L (Adj Spans)
Moment (Ft-lbs)	-7197 @ 18' 9 3/4"	13638	Passed (53%)	1.00	1.0 D + 1.0 L (Adj Spans)
Live Load Defl. (in)	0.056 @ 22' 9 15/16"	0.276	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.067 @ 22' 10 1/16"	0.415	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column Cap - steel	5.50"	5.50"	1.50"	907	3463	4370	Blocking
2 - Column Cap - steel	5.50"	5.50"	1.93"	1234	5409	6643	Blocking
3 - Column Cap - steel	5.50"	5.50"	2.74"	2004	7416	9420	Blocking
4 - Column Cap - steel	5.50"	5.50"	1.50"	687	2487	3174	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)	29' 4" o/c	
Bottom Edge (Lu)	29' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 29' 4"	N/A	16.0	--	
1 - Uniform (PSF)	0 to 21' (Front)	9'	15.0	60.0	Deck
2 - Uniform (PSF)	21' to 29' 4" (Front)	5'	15.0	60.0	Deck
3 - Point (lb)	21' (Top)	N/A	901	2934	Linked from: Cantilever beam at stair stringers, Support 1

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

ForteWEB Software Operator	Job Notes
Jane Johnson Bykonen Carter Quinn (206) 264-7784 jaj@bcq-se.com	

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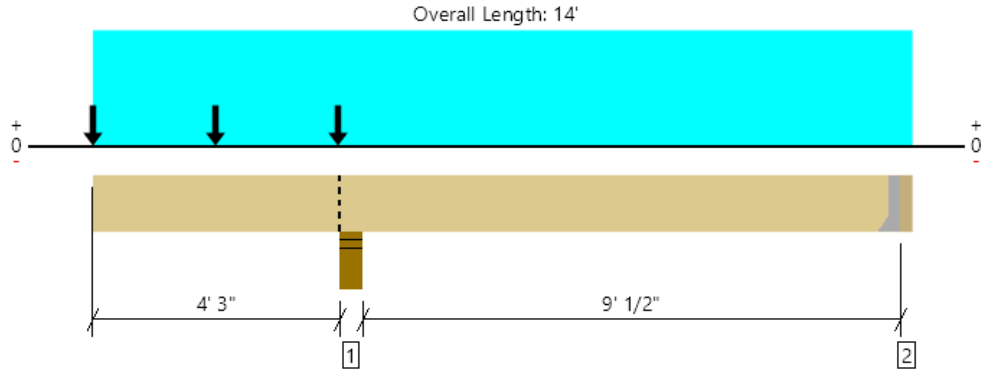
Main, Cantilever beam at stair stringers
1 piece(s) 6 x 12 Douglas Fir-Larch No. 1



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3835 @ 4' 5 3/4"	12251 (5.50")	Passed (31%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1909 @ 3' 3 1/2"	7168	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-6443 @ 4' 5 3/4"	13638	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.170 @ 0	0.224	Passed (2L/632)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.211 @ 0	0.448	Passed (2L/510)	--	1.0 D + 1.0 L (Alt Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
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.
- -562 lbs uplift at support located at 13' 9". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - HF	5.50"	5.50"	1.72"	901	2934	3835	Blocking
2 - Hanger on 11 1/2" HF beam	3.00"	Hanger[1]	1.50"	-30	195/-532	195/-562	See note [1]

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 9" o/c	
Bottom Edge (Lu)	13' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	HUC610	2.50"	N/A	14-10dx1.5	6-10d	

- 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)	0 to 13' 9"	N/A	16.0	--	
1 - Uniform (PSF)	0 to 14' (Front)	8"	15.0	60.0	Deck
2 - Point (lb)	0 (Front)	N/A	170	676	Stair, LL=60 psf
3 - Point (lb)	2' 1 1/2" (Front)	N/A	170	676	Stair, LL=60 psf
4 - Point (lb)	4' 3" (Front)	N/A	170	676	Stair, LL=60 psf

ForteWEB Software Operator	Job Notes
Jane Johnson Bykonen Carter Quinn (206) 264-7784 jaj@bcq-se.com	

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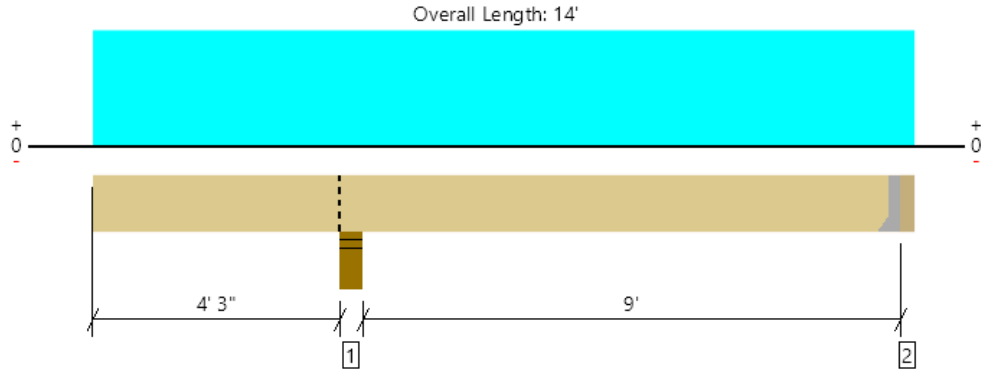
Main, Deck Joist, cantilevered
1 piece(s) 2 x 12 Hem-Fir No. 2 @ 16" OC



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)	440 @ 13' 8 1/2"	911 (1.50")	Passed (48%)	--	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	453 @ 5' 7 3/4"	1688	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1003 @ 4' 5 3/4"	2577	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.113 @ 0	0.299	Passed (2L/954)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.119 @ 0	0.448	Passed (2L/904)	--	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 2015
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	5.50"	5.50"	1.68"	204	814	1018	Blocking
2 - Hanger on 11 1/4" HF beam	3.50"	Hanger[1]	1.50"	76	393/-64	469/-64	See note [1]

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 6" o/c	
Bottom Edge (Lu)	13' o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	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 Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 14'	16"	15.0	60.0	Deck

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ForteWEB Software Operator	Job Notes
Jane Johnson Bykonen Carter Quinn (206) 264-7784 jaj@bcq-se.com	

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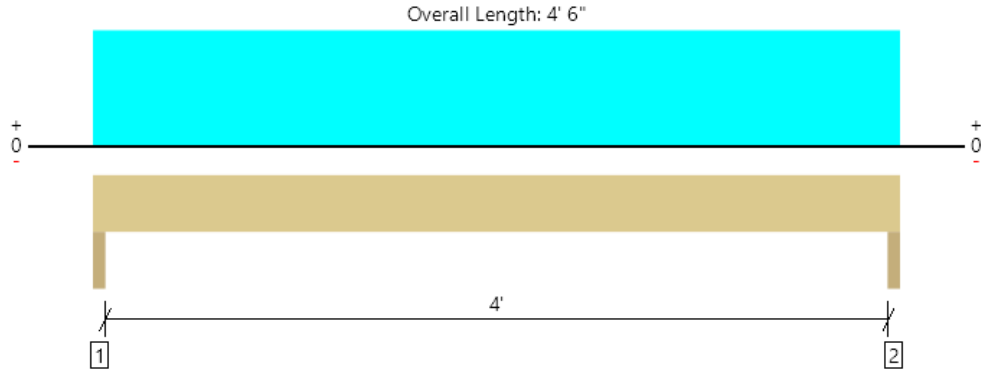
Main, Header at mech room opening
2 piece(s) 2 x 10 Hem-Fir No. 2



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)	2906 @ 1 1/2"	3645 (3.00")	Passed (80%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	1556 @ 1' 1/4"	2775	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2858 @ 2' 3"	3333	Passed (86%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.024 @ 2' 3"	0.142	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.037 @ 2' 3"	0.213	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Trimmer - DF	3.00"	3.00"	2.39"	1003	1845	692	3540	None
2 - Trimmer - DF	3.00"	3.00"	2.39"	1003	1845	692	3540	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 6" o/c	
Bottom Edge (Lu)	4' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 4' 6"	N/A	7.0	--	--	
1 - Uniform (PSF)	0 to 4' 6"	16'	15.0	40.0	-	Floor
2 - Uniform (PSF)	0 to 4' 6"	10' 3"	15.0	-	30.0	Snow
3 - Uniform (PSF)	0 to 4' 6"	3'	15.0	60.0	-	Deck

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Loads
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North & South elevation window/ shear wall length revision

MASSING

Uniform Loads (PSF)

ROOF	*Misc*	*Partitions*
	15	6.0

Uniform Loads (PSF)

FLOORS	*Misc*	*Partitions*
	15	12

Additional (PSF)

GARAGE ROOF	*Misc*	*Partitions*
	25	12

SEISMIC

DESIGN PARAMETERS

Site Class =	D	S_s =	1.380	
Risk Cat. =	II	S_1 =	0.531	
S_{DS} =	0.920	f_a =	1.00	
R =	6.50	f_v =	1.50	
Cs =	0.142	k =	1.0	

ASCE 7-10 Equivalent Lateral Force Prcedure, 18.5 — **ASD**

Level	Area (SF)	Unit DL (PSF)	w (k)	h^k (ft)	(w)(h^k)	C_{vx}	F_x (k)	0.7E (k)
ROOF	2085	21.0	43.8	24.5	1073	50%	8.3	5.8
UPPER	2540	27.0	73.1	14.5	1060	50%	8.2	5.8
Base Shear							**16.5**	

WIND

DESIGN PARAMETERS

V (mph) =	110	**G =**	0.85	**L/B =**	2.90		**L/B =**	0.35		
Exposure Cat. =	C	**Gcpi =**	0.18	**Cp =**	*Windward Wall*	0.80	**Cp =**	*Windward Wall*	0.80	
K_{zt} =	1.60	K_z=	0.98		*Leeward Wall*	-0.12		*Leeward Wall*	-0.50	
K_d =	0.85	q_z=	41.3		*Side Wall*	-0.70		*Side Wall*	-0.70	
Roof Slope (in/ft) =	5				*Roof*	-0.90		*Roof*	-0.90	

ASCE 7-10 MWFRS Directional Procedure, 27.4-1 — **ASD**

ROOF	h (ft)	Direction	Wall Area	K_h	q_h	Wall (PSF)	Roof (k)	F_x (k)	06W (k)
HORIZONTAL PROJECTION	24.5	*PARALLEL TO WL-A*	348	0.98	41.3	32.3	0.0	11.2	6.7
		PARALLEL TO WL-1	120	0.98	41.3	45.6	0.0	5.5	3.3
UPPER	**h (ft)**	**Direction**	**Wall Area**		q_h	**Wall (PSF)**	**Roof (k)**	**F_x (k)**	**06W (k)**
HORIZONTAL PROJECTION	14.5	*PARALLEL TO WL-A*	897	0.90	37.9	32.0	0.0	28.7	17.2
		PARALLEL TO WL-1	234	0.90	37.9	44.2	0.0	10.3	6.2
Base Shear - Parallel to Grid A								**39.9**	
Base Shear - Parallel to Grid 1								**15.8**	

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BYKONEN CARTER QUINN STRUCTURAL ENGINEERING

Window/ shear wall length revision

WALL LINE 1

ROOF		**WIND TRIB =**	15%		**ΣL =**	29.42							
		0.6W (k) =	0.49										
		SEISMIC TRIB =	15%										
		0.7E (k) =	0.87										
Segment Count	HT (ft)	LENGTH (ft)	h/L	2/(h/L)[1]	0.6W (plf)	0.7E (plf)	SW	SW Cap (plf)	Tw (k, ASD)	Te (k, ASD)	Tension (k)	0.6 D (k)	Net T (k)
1	9.4	21.1	0.44	1.00	12	30	SW 1	240	0.16	0.28	0.28	1.19	0.00
1	9.4	8.3	1.13	1.00	12	30	SW 1	240	0.16	0.28	0.28	0.5	0.04
UPPER		**WIND TRIB =**	15%		**ΣL =**	28.52							
		0.6W (k) =	1.42										
		SEISMIC TRIB =	15%										
		0.7E (k) =	1.74										
Segment Count	HT (ft)	LENGTH (ft)	h/L	2/(h/L)[1]	0.6W (plf)	0.7E (plf)	SW	SW Cap (plf)	Tw (k, ASD)	Te (k, ASD)	Tension (k)	0.6 D (k)	Net T (k)
1	8.9	8.5	1.04	1.00	36	61	SW 1	240	0.44	0.54	0.54	0.45	0.31
1	8.9	8.4	1.06	1.00	36	61	SW 1	240	0.44	0.54	0.54	0.4	0.32
2	8.9	3.5	2.54	0.79	36	77	SW 1	240	0.44	0.54	0.54	0.2	0.45
1	8.9	4.7	1.90	1.00	36	61	SW 1	240	0.44	0.54	0.54	0.2	0.42

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BYKONEN CARTER QUINN STRUCTURAL ENGINEERING

Window/ shear wall length revision

WALL LINE 3

ROOF		**WIND TRIB =**	42%		**ΣL =**	20.50							
		0.6W (k) =	1.38										
		SEISMIC TRIB =	42%										
		0.7E (k) =	2.45										
Segment Count	HT (ft)	LENGTH (ft)	h/L	2/(h/L)[1]	0.6W (plf)	0.7E (plf)	SW	SW Cap (plf)	Tw (k, ASD)	Te (k, ASD)	Tension (k)	0.6 D (k)	Net T (k)
1	9.4	12.5	0.75	1.00	48	119	SW 1	240	0.63	1.12	1.12	0.70	0.77
2	9.4	4.0	2.34	0.85	48	140	SW 1	240	0.63	1.12	1.12	0.2	1.01
UPPER		**WIND TRIB =**	42%		**ΣL =**	34.50							
		0.6W (k) =	3.99										
		SEISMIC TRIB =	42%										
		0.7E (k) =	4.87										
Segment Count	HT (ft)	LENGTH (ft)	h/L	2/(h/L)[1]	0.6W (plf)	0.7E (plf)	SW	SW Cap (plf)	Tw (k, ASD)	Te (k, ASD)	Tension (k)	0.6 D (k)	Net T (k)
1	8.9	12.5	0.71	1.00	83	141	SW 2	355	1.60	1.96	1.96	0.67	1.62
1	8.9	22.0	0.40	1.00	83	141	SW 2	355	1.60	1.96	1.96	1.17	1.37