

STRUCTURAL DESIGN

FOR

7545 E MERCER WAY REMODEL



Submitted to: Liang Du

Date: 6/3/2022

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Job Number: 2022004

Job Name: 7545 E Mercer Way Remodel

Location: 7545 E Mercer Way, Mercer Island, WA

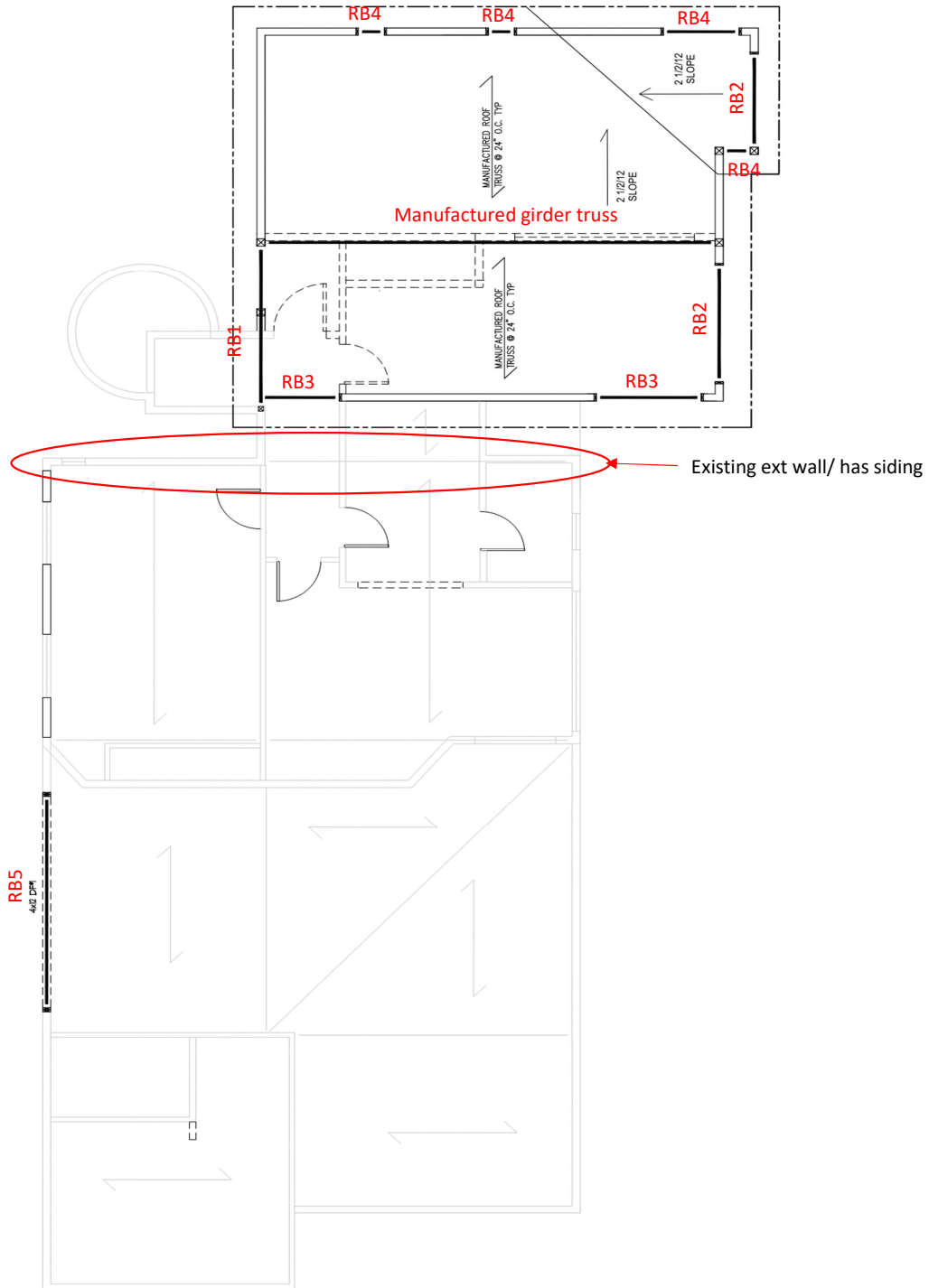
Engineer: Frankie Tsui

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1.0 OBJECTIVE

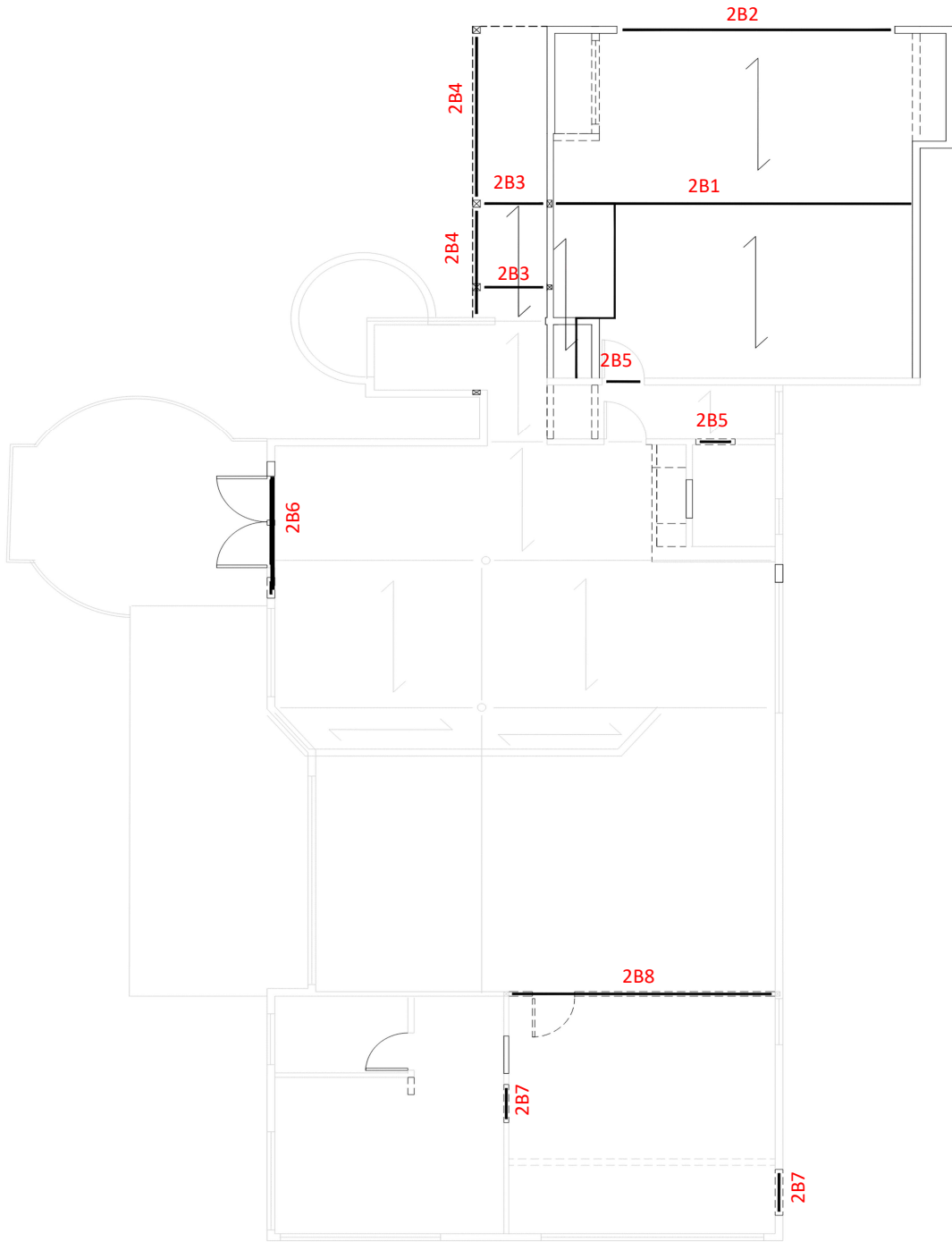
The analysis is performed for 7545 E Mercer Way Remodel project. New 3xx sqft will be added on top of the existing garage. Since the existing garage is very stand alone itself. Wind and seismic analysis will be only perform for the garage area.



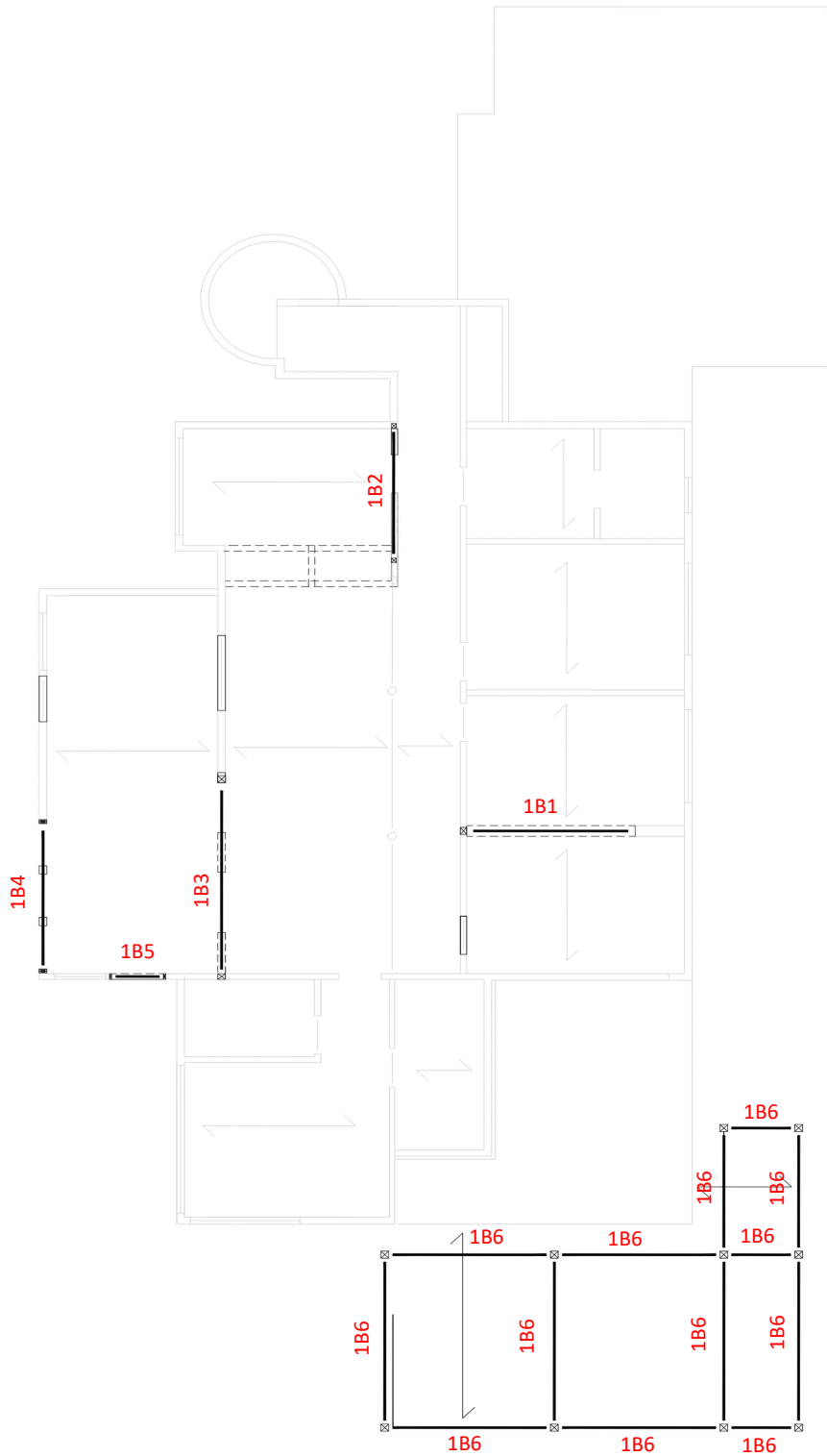
ROOF PLAN

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2ND FLOOR PLAN



1ST FLOOR PLAN

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2.0 LOAD

Roof Live Load = 20 PSF
Deck live load = 60 psf

Snow Load, $P_f = 0.7C_eC_tI_sP_g$

$C_e = 1$

$C_t = 1$

$I_s = 1$

$P_g = 25$

$P_f = 17.5$

Use = 25 psf

Floor Dead Load = 15 psf

Roof Dead Load = 25 psf

Wind Design :

Design Wind speed = 110 mph

Exp = C

Seismic Design :

$S_{ds} = 1.16$

$R = 6.5$

$\Omega = 2.5$

Soil Bearing Capacity :

Assumed Soil Bearing Capacity = 1500 psf

Frost Line Depth = 18 in

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3.0 Garvity Framing Design

RB1:4X10

Span =	6.00	ft					
Trib. Area =	4.00	ft (Roof)	0.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	Pll =	0	lbs
LL =	25.00	psf	40.00	psf	Ll =	0	ft
W =	200.00	plf	0.00	plf	Lr =	6	ft
Use W =	300.00	plf			RI =	0.00	lbs
V =	900.00	lb			Rr =	0.00	lbs
M =	1350.00	lb-ft			M =	0.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	9.25	in	Fv =	150	psi
	S =	49.91	in ³			
	A =	32.38	in ²			
	I =	230.84	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi
C _D =	1.15	
C _M =	1	
C _t =	1	
C _L =	0.99	
C _F =	1.2	
C _{fu} =	1	
C _i =	1	
C _r =	1	

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 TEMP. FACTOR
 BEAM STABILITY FACTOR
 SIZE FACTOR
 FLAT USE FACTOR
 INCISING FACTOR
 REPETITIVE MEMBER FACTOR

L =	6.00	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	129.6	in
R _B =	9.89	<50

OK

F _{bE} ' =	5763.26	psi
F _b * =	1173.00	psi
F _{bE} ' / F _b * =	4.91	
C _L =	0.99	

F _b ' =	1158.43	psi
f'' _b =	324.57	psi
f'' _b / F _b ' =	0.28	OK

F' _v =	172.50	psi
f' _v =	41.70	psi
f' _v / F' _v =	0.24	OK

ΔLL + DL =	5WL ⁴ / 384EI
=	0.03 in
L / 240 =	0.30 in
ΔLL =	0.01 in
L / 480 =	0.15 in

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RB2:4X8

Span =	7.50	ft					
Trib. Area =	4.00	ft (Roof)	0.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PlI =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	0	ft
W =	200.00	plf	0.00	plf	Lr =	7.5	ft
Use W =	300.00	plf			RI =	0.00	lbs
V =	1125.00	lb			Rr =	0.00	lbs
M =	2109.38	lb-ft			M =	0.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	7.25	in	Fv =	150	psi
	S =	30.66	in ³			
	A =	25.38	in ²			
	I =	111.15	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1.15		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	0.99		BEAM STABILITY FACTOR
C _F ' =	1.3		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	7.50	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	162	in
R _B ' =	9.79	<50

OK

F _{bE} ' =	5882.50	psi
F _b * =	1270.75	psi
F _{bE} '/F _b * =	4.63	
C _L ' =	0.99	

F _b ' =	1253.77	psi
f''b =	825.55	psi
f'b/F'b =	0.66	OK

F'v =	172.50	psi
f'v =	66.50	psi
fv/F'v =	0.39	OK

ΔLL+DL =	5WL4/384EI
=	0.15 in
L/240 =	0.38 in
ΔLL =	0.05 in
L/480 =	0.19 in

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RB3.4X10

Span =	6.00	ft					
Trib. Area =	12.00	ft (Roof)	0.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PlI =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	0	ft
W =	600.00	plf	0.00	plf	Lr =	6	ft
Use W =	700.00	plf			RI =	0.00	lbs
V =	2100.00	lb			Rr =	0.00	lbs
M =	3150.00	lb-ft			M =	0.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	9.25	in	Fv =	150	psi
	S =	49.91	in ³			
	A =	32.38	in ²			
	I =	230.84	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1.15		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	0.99		BEAM STABILITY FACTOR
C _F ' =	1.2		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	6.00	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	129.6	in
R _B ' =	9.89	<50

OK

F _{bE} ' =	5763.26	psi
F _b * =	1173.00	psi
F _{bE} '/F _b * =	4.91	
C _L ' =	0.99	

F _b ' =	1158.43	psi
f''b =	757.34	psi
f''b/F''b =	0.65	OK

F'v =	172.50	psi
f'v =	97.30	psi
f'v/F'v =	0.56	OK

ΔLL+DL =	5WL ⁴ /384EI
=	0.07 in
L/240 =	0.30 in
ΔLL =	0.03 in
L/480 =	0.15 in

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Span =	4.50	ft					
Trib. Area =	15.00	ft (Roof)	0.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PlI =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	0	ft
W =	750.00	plf	0.00	plf	Lr =	4.5	ft
Use W =	850.00	plf			RI =	0.00	lbs
V =	1912.50	lb			Rr =	0.00	lbs
M =	2151.56	lb-ft			M =	0.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	7.25	in	Fv =	150	psi
	S =	30.66	in ³			
	A =	25.38	in ²			
	I =	111.15	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1.15		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	0.99		BEAM STABILITY FACTOR
C _F ' =	1.3		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	4.50	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	97.2	in
R _B ' =	7.58	<50

OK

F _{bE} ' =	9804.17	psi
F _b * =	1270.75	psi
F _{bE} ' / F _b * =	7.72	
C _L ' =	0.99	

F _b ' =	1261.44	psi
f'' _b ' =	842.06	psi
f'' _b ' / F _b ' =	0.67	OK

F' _v ' =	172.50	psi
f'' _v ' =	113.05	psi
f'' _v ' / F' _v ' =	0.66	OK

ΔLL+DL = 5WL⁴/384EI

=	0.05	in
L/240 =	0.23	in
ΔLL =	0.02	in
L/480 =	0.11	in

Span = 13.50 ft
 Trib. Area = 4.00 ft (Roof) 0.00 ft (Floor)
 DL = 25.00 psf 15.00 psf
 LL = 25.00 psf 40.00 psf
 W = 200.00 plf 0.00 plf
 Use W = 250.00 plf
 V = 1687.50 lb
 M = 5695.31 lb-ft
 Pdl = 0 lbs
 Pll = 0 lbs
 Lll = 0 ft
 Lr = 13.5 ft
 RI = 0.00 lbs
 Rr = 0.00 lbs
 M = 0.00 lb-ft

SIZE: b = 3.5 in E = 1700000 psi
 d = 11.25 in Fv = 180 psi
 S = 73.83 in³
 A = 39.38 in²
 I = 415.28 in⁴

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F_b = 1000 psi
 C_D = 1.15
 C_M = 1
 C_t = 1
 C_L = 0.96
 C_F = 1.1
 C_{fu} = 1
 C_i = 1
 C_r = 1

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 TEMP. FACTOR
 BEAM STABILITY FACTOR
 SIZE FACTOR
 FLAT USE FACTOR
 INCISING FACTOR
 REPETITIVE MEMBER FACTOR

L = 13.50 ft
 K = 1.8
 E_{MIN}' = 620000 psi
 Le = 291.6 in
 R_B = 16.36 <50 OK

F_{bE} = 2778.24 psi
 F_b* = 1265.00 psi
 F_{bE}/F_b* = 2.20
 C_L = 0.96

F_b' = 1217.51 psi
 f''b = 925.71 psi
 f'b/F'b = 0.76 OK

F'v = 207.00 psi
 f'v = 64.29 psi
 fv/F'v = 0.31 OK

$\Delta LL + DL = 5WL^4/384EI$
 = 0.26 in
 L/240 = 0.68 in
 $\Delta LL = 0.11$ in
 L/480 = 0.34 in

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TYP FLOOR JOIST:2X12

Span =	13.50	ft					
Trib. Area =	0.00	ft (Roof)	1.33	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PlI =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	0	ft
W =	0.00	plf	73.33	plf	Lr =	13.5	ft
Use W =	85.00	plf			RI =	0.00	lbs
V =	573.75	lb			Rr =	0.00	lbs
M =	1936.41	lb-ft			M =	0.00	lb-ft

SIZE:	b =	1.5	in	E =	1300000	psi
	d =	11.25	in	Fv =	150	psi
	S =	31.64	in ³			
	A =	16.88	in ²			
	I =	177.98	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	0.93		BEAM STABILITY FACTOR
C _F ' =	1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	4.00	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	86.4	in
R _B ' =	20.78	<50

OK

F _{bE} ' =	1305.56	psi
F _b * =	850.00	psi
F _{bE} /F _b * =	1.54	
C _L ' =	0.93	

F _b ' =	789.59	psi
f'' _b ' =	734.40	psi
f'' _b /F _b ' =	0.93	OK

F' _v ' =	150.00	psi
f'' _v ' =	51.00	psi
f'' _v /F' _v ' =	0.34	OK

ΔLL+DL =	5WL ⁴ /384EI
=	0.27 in
L/240 =	0.68 in
ΔLL =	0.17 in
L/480 =	0.34 in

2B1: 5.5 x 19.5 GLB

Span = 21.85 ft
 Trib. Area = 0.00 ft Roof 12.00 ft Floor
 DL = 25.00 psf 15.00 psf
 LL = 25.00 psf 40.00 psf
 W = 0.00 plf 660.00 plf
 Use W = 760.00 plf
 V = 8303.00 lb
 M = 45355.14 lb-ft
 Pdl = 0 lbs
 Pll = 0 lbs
 Ll = 10 ft
 Lr = 11.85 ft
 Rl = 0.00 lbs
 Rr = 0.00 lbs
 M = 0.00 lb-ft

SIZE: b = 5.5 in E = 1800000 psi
 d = 19.5 in Fv = 265 psi
 S = 348.56 in³
 A = 107.25 in²
 I = 3398.48 in⁴

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_p$$

F_b = 2400 psi
 C_D = 1
 C_M = 1
 C_V = 0.88
 C_L = 0.93

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 Volumn
 BEAM STABILITY FACTOR

L = 21.85 ft
 K = 1.83
 E_{MIN}' = 950000 psi
 Le = 479.826 in
 R_B = 17.59 <50 OK

F_{bE} = 3685.63 psi
 F_b* = 2400.00 psi
 F_{bE}/F_b* = 1.54
 C_L = 0.93

F_b' = 1959.75 psi
 f''b = 1561.45 psi
 f'b/F'b = 0.80 OK

F'v = 265.00 psi
 f'v = 116.13 psi
 f'v/F'v = 0.44 OK

ΔLL+DL = 5WL/384EI
 = 0.64 in
 L/240 = 1.09 in
 ΔLL = 0.40 in
 L/480 = 0.55 in

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2B2: 5.5 x 21 GLB

Span = 17.00 ft
 Trib. Area = 15.00 ft Roof 12.00 ft Floor
 DL = 25.00 psf 15.00 psf
 LL = 25.00 psf 40.00 psf
 W = 750.00 plf 660.00 plf
 Use W = 1600.00 plf
 V = 13600.00 lb
 M = 57800.00 lb-ft
 Pdl = 0 lbs
 Pll = 0 lbs
 Ll = 10 ft
 Lr = 7.00 ft
 RI = 0.00 lbs
 Rr = 0.00 lbs
 M = 0.00 lb-ft

SIZE: b = 5.5 in E = 1800000 psi
 d = 21 in Fv = 265 psi
 S = 404.25 in³
 A = 115.50 in²
 I = 4244.63 in⁴

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F_b' = 2400 psi
 C_D' = 1
 C_M' = 1
 C_V' = 0.89
 C_L' = 0.95

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 Volumn
 BEAM STABILITY FACTOR

L = 17.00 ft
 K = 1.83
 E_{MIN}' = 950000 psi
 Le = 373.32 in
 R_B' = 16.10 <50 OK

F_{bE}' = 4398.75 psi
 F_b* = 2400.00 psi
 F_{bE}'/F_b* = 1.83
 C_L' = 0.95

F_b' = 2037.98 psi
 f''_b' = 1715.77 psi
 f''_b'/F_b' = 0.84 OK

F'_v = 265.00 psi
 f'_v = 176.62 psi
 f'_v/F'_v = 0.67 OK

ΔLL+DL = 5WL⁴/384EI
 = 0.39 in
 L/240 = 0.85 in
 ΔLL = 0.21 in
 L/480 = 0.43 in

2B3:6x8

Span =	4.50	ft					
Trib. Area =	0.00	ft (Roof)	12.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PlI =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	0	ft
W =	0.00	plf	660.00	plf	Lr =	4.5	ft
Use W =	750.00	plf			RI =	0.00	lbs
V =	1687.50	lb			Rr =	0.00	lbs
M =	1898.44	lb-ft			M =	0.00	lb-ft

SIZE:	b =	5.5	in	E =	1100000	psi
	d =	7.5	in	Fv =	150	psi
	S =	51.56	in ³			
	A =	41.25	in ²			
	I =	193.36	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	675	psi	
C _D ' =	1		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	1.00		BEAM STABILITY FACTOR
C _F ' =	1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	4.50	ft
K =	1.8	
E _{MIN} ' =	400000	psi
Le =	97.2	in
R _B ' =	4.91	<50

OK

F _{bE} ' =	19917.70	psi
F _b * =	675.00	psi
F _{bE} '/F _b * =	29.51	
C _L ' =	1.00	

F _b ' =	673.82	psi
f'' _b ' =	441.82	psi
f'' _b '/F _b ' =	0.66	OK

F' _v ' =	150.00	psi
f' _v ' =	61.36	psi
f' _v '/F' _v ' =	0.41	OK

ΔLL+DL =	5WL ⁴ /384EI
=	0.03 in
L/240 =	0.23 in
ΔLL =	0.02 in
L/480 =	0.11 in

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Span =	11.50	ft					
Trib. Area =	4.00	ft (Roof)	2.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PlI =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	0	ft
W =	200.00	plf	110.00	plf	Lr =	11.5	ft
Use W =	600.00	plf			RI =	0.00	lbs
V =	3450.00	lb			Rr =	0.00	lbs
M =	9918.75	lb-ft			M =	0.00	lb-ft

SIZE:	b =	5.5	in	E =	1100000	psi
	d =	11.5	in	Fv =	150	psi
	S =	121.23	in ³			
	A =	63.25	in ²			
	I =	697.07	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	1350	psi	
C _D ' =	1.15		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	0.98		BEAM STABILITY FACTOR
C _F ' =	1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	11.50	ft
K =	1.8	
E _{MIN} ' =	400000	psi
Le =	248.4	in
R _B ' =	9.72	<50

OK

F _{bE} ' =	5082.97	psi
F _b * =	1552.50	psi
F _{bE} ' / F _b * =	3.27	
C _L ' =	0.98	

F _b ' =	1520.07	psi
f'' _b ' =	981.82	psi
f'' _b ' / F _b ' =	0.65	OK

F' _v ' =	172.50	psi
f' _v ' =	81.82	psi
f' _v ' / F' _v ' =	0.47	OK

ΔLL+DL =	5WL ⁴ /384EI
=	0.31 in
L/240 =	0.58 in
ΔLL =	0.09 in
L/480 =	0.29 in

2B5:4X10

Span =	2.50	ft					
Trib. Area =	15.00	ft (Roof)	12.00	ft (Floor)	Pdl =	240	lbs
DL =	25.00	psf	15.00	psf	PlI =	640	lbs
LL =	25.00	psf	40.00	psf	LI =	1.5	ft
W =	750.00	plf	660.00	plf	Lr =	1	ft
Use W =	1600.00	plf			RI =	352.00	lbs
V =	2528.00	lb			Rr =	528.00	lbs
M =	1778.00	lb-ft			M =	528.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	9.25	in	Fv =	150	psi
	S =	49.91	in ³			
	A =	32.38	in ²			
	I =	230.84	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	1.00		BEAM STABILITY FACTOR
C _F ' =	1.1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	2.50	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	54	in
R _B ' =	6.39	<50

OK

F _{bE} ' =	13831.83	psi
F _b * =	935.00	psi
F _{bE} ' / F _b * =	14.79	
C _L ' =	1.00	

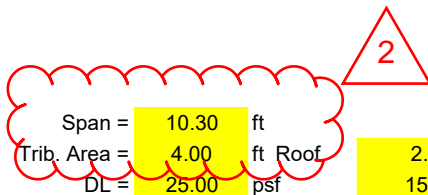
F _b ' =	931.64	psi
f'' _b ' =	427.48	psi
f'' _b ' / F _b ' =	0.46	OK

F' _v ' =	150.00	psi
f' _v ' =	117.13	psi
f' _v ' / F' _v ' =	0.78	OK

ΔLL + DL =	5WL ⁴ / 384EI
=	0.01 in
L/240 =	0.13 in
ΔLL =	0.00 in
L/480 =	0.06 in

Job Number: _____
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Span = 10.30 ft
 Trib. Area = 4.00 ft Roof
 DL = 25.00 psf
 LL = 25.00 psf
 W = 200.00 plf
 Use W = 500.00 plf
 V = 5477.28 lb
 M = 15337.47 lb-ft

2.00 ft Floor
 15.00 psf
 40.00 psf
 110.00 plf

Pdl = 1575 lbs
 Pll = 2520 lbs
 Ll = 3 ft
 Lr = 7.30 ft
 RI = 2902.28 lbs
 Rr = 1192.72 lbs
 M = 8706.84 lb-ft

SIZE: b = 3.5 in
 d = 12 in
 S = 84.00 in³
 A = 42.00 in²
 I = 504.00 in⁴

E = 1800000 psi
 Fv = 265 psi

$$F_b' = C_D * C_M * C_t * C_F * C_1 * C_P$$

F_b' = 2400 psi
 C_D' = 1.15
 C_M' = 1
 C_v' = 1.04
 C_L' = 0.95

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 Column
 BEAM STABILITY FACTOR

L = 10.30 ft
 K = 1.83
 E_{MIN}' = 950000 psi
 Le = 226.188 in
 R_B' = 14.89 < 50 **OK**

F_{bE}' = 5145.06 psi
 F_b* = 2760.00 psi
 F_{bE}'/F_b* = 1.86
 C_L' = 0.95

F_b' = 2730.75 psi
 f''_b' = 2191.07 psi
 f''_b'/F_b' = 0.80 **OK**

F'_v = 304.75 psi
 f'_v = 195.62 psi
 f'_v/F'_v = 0.64 **OK**

ΔLL+DL = 5WL⁴/384EI
 = 0.26 in
 L/240 = 0.52 in
 ΔLL = 0.12 in
 L/480 = 0.26 in

2B7:4X8

Span =	2.50	ft					
Trib. Area =	15.00	ft (Roof)	0.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PII =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	1.5	ft
W =	750.00	plf	0.00	plf	Lr =	1	ft
Use W =	800.00	plf			RI =	0.00	lbs
V =	1000.00	lb			Rr =	0.00	lbs
M =	625.00	lb-ft			M =	0.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	7.25	in	Fv =	150	psi
	S =	30.66	in ³			
	A =	25.38	in ²			
	I =	111.15	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	1.00		BEAM STABILITY FACTOR
C _F ' =	1.1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	2.50	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	54	in
R _B ' =	5.65	<50

OK

F _{bE} ' =	17647.51	psi
F _b * =	935.00	psi
F _{bE} ' / F _b * =	18.87	
C _L ' =	1.00	

F _b ' =	932.40	psi
f'' _b ' =	244.61	psi
f'' _b ' / F _b ' =	0.26	OK

F' _v ' =	150.00	psi
f' _v ' =	59.11	psi
f' _v ' / F' _v ' =	0.39	OK

ΔLL + DL =	5WL ⁴ / 384EI
=	0.00 in
L/240 =	0.13 in
ΔLL =	0.00 in
L/480 =	0.06 in

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2B8: 3.5 x 12 GLB

Span = 16.00 ft
 Trib. Area = 9.00 ft Roof 0.00 ft Floor
 DL = 25.00 psf 15.00 psf
 LL = 25.00 psf 40.00 psf
 W = 450.00 plf 0.00 plf
 Use W = 450.00 plf
 V = 3600.00 lb
 M = 14400.00 lb-ft
 Pdl = 0 lbs
 Pll = 0 lbs
 Ll = 6 ft
 Lr = 10.00 ft
 RI = 0.00 lbs
 Rr = 0.00 lbs
 M = 0.00 lb-ft

SIZE: b = 3.5 in E = 1800000 psi
 d = 12 in Fv = 265 psi
 S = 84.00 in³
 A = 42.00 in²
 I = 504.00 in⁴

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F_b' = 2400 psi
 C_D' = 1.15
 C_M' = 1
 C_v' = 1.00
 C_L' = 0.88

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 Column
 BEAM STABILITY FACTOR

L = 16.00 ft
 K = 1.83
 E_{MIN}' = 950000 psi
 Le = 351.36 in
 R_B' = 18.55 <50 OK

F_{bE}' = 3312.13 psi
 F_b* = 2760.00 psi
 F_{bE}/F_b* = 1.20
 C_L' = 0.88

F_b' = 2417.51 psi
 f''_b' = 2057.14 psi
 f''_b'/F_b' = 0.85 OK

F_v' = 304.75 psi
 f''_v' = 128.57 psi
 f''_v'/F_v' = 0.42 OK

$\Delta LL + DL = 5WL/384EI$
 = 0.73 in
 L/240 = 0.80 in
 ΔLL = 0.37 in
 L/480 = 0.40 in

Span = 10.00 ft
 Trib. Area = 0.00 ft Roof 10.00 ft Floor
 DL = 15.00 psf 15.00 psf
 LL = 25.00 psf 40.00 psf
 W = 0.00 plf 550.00 plf
 Use W = 650.00 plf
 V = 3250.00 lb
 M = 8125.00 lb-ft
 Pdl = 0 lbs
 Pll = 0 lbs
 Ll = 6 ft
 Lr = 4.00 ft
 RI = 0.00 lbs
 Rr = 0.00 lbs
 M = 0.00 lb-ft

SIZE: b = 3.5 in E = 1800000 psi
 d = 10.5 in Fv = 265 psi
 S = 64.31 in³
 A = 36.75 in²
 I = 337.64 in⁴

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F_b = 2400 psi
 C_D = 1
 C_M = 1
 C_V = 1.06
 C_L = 0.97

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 Volumn
 BEAM STABILITY FACTOR

L = 10.00 ft
 K = 1.83
 E_{MIN}' = 950000 psi
 Le = 219.6 in
 R_B = 13.72 <50 OK

F_{bE} = 6056.47 psi
 F_b* = 2400.00 psi
 F_{bE}/F_b* = 2.52
 C_L = 0.97

F_b' = 2462.33 psi
 f''b = 1516.03 psi
 f'b/F'b = 0.62 OK

F'v = 265.00 psi
 f'v = 132.65 psi
 fv/F'v = 0.50 OK

ΔLL+DL = 5WL⁴/384EI
 = 0.24 in
 L/240 = 0.50 in
 ΔLL = 0.15 in
 L/480 = 0.25 in

Span = 10.00 ft
 Trib. Area = 0.00 ft Roof 10.00 ft Floor
 DL = 15.00 psf 15.00 psf
 LL = 25.00 psf 40.00 psf
 W = 0.00 plf 550.00 plf
 Use W = 650.00 plf
 V = 3250.00 lb
 M = 8125.00 lb-ft
 Pdl = 0 lbs
 Pll = 0 lbs
 Ll = 6 ft
 Lr = 4.00 ft
 RI = 0.00 lbs
 Rr = 0.00 lbs
 M = 0.00 lb-ft

SIZE: b = 3.125 in E = 1800000 psi
 d = 10.5 in Fv = 265 psi
 S = 57.42 in³
 A = 32.81 in²
 I = 301.46 in⁴

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_p$$

F_b = 2400 psi
 C_D = 1
 C_M = 1
 C_v = 1.07
 C_L = 0.96

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 Column
 BEAM STABILITY FACTOR

L = 10.00 ft
 K = 1.83
 E_{MIN}' = 950000 psi
 Le = 219.6 in
 R_B = 15.37 <50 OK

F_{bE} = 4828.18 psi
 F_b* = 2400.00 psi
 F_{bE}/F_b* = 2.01
 C_L = 0.96

F_b' = 2456.74 psi
 f''_b = 1697.96 psi
 f''_b/F_b' = 0.69 OK

F'_v = 265.00 psi
 f'_v = 148.57 psi
 f'_v/F'_v = 0.56 OK

ΔLL+DL = 5WL⁴/384EI
 = 0.27 in
 L/240 = 0.50 in
 ΔLL = 0.17 in
 L/480 = 0.25 in

Span = 13.00 ft
 Trib. Area = 0.00 ft Roof 11.00 ft Floor
 DL = 15.00 psf 15.00 psf
 LL = 25.00 psf 40.00 psf
 W = 0.00 plf 605.00 plf
 Use W = 950.00 plf
 V = 6175.00 lb
 M = 20068.75 lb-ft
 Pdl = 0 lbs
 Pll = 0 lbs
 Ll = 6 ft
 Lr = 7.00 ft
 RI = 0.00 lbs
 Rr = 0.00 lbs
 M = 0.00 lb-ft

SIZE: b = 3.5 in E = 1800000 psi
 d = 15 in Fv = 265 psi
 S = 131.25 in³
 A = 52.50 in²
 I = 984.38 in⁴

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_p$$

F_b = 2400 psi
 C_D = 1
 C_M = 1
 C_v = 0.99
 C_L = 0.91

LOAD DURATION FACTOR
 WET SERVICE FACTOR
 Column
 BEAM STABILITY FACTOR

L = 13.00 ft
 K = 1.83
 E_{MIN}' = 950000 psi
 Le = 285.48 in
 R_B = 18.70 <50 OK

F_{bE} = 3261.17 psi
 F_b* = 2400.00 psi
 F_{bE}/F_b* = 1.36
 C_L = 0.91

F_b' = 2168.12 psi
 f''_b = 1834.86 psi
 f''_b/F_b' = 0.85 OK

F'_v = 265.00 psi
 f'_v = 176.43 psi
 f'_v/F'_v = 0.67 OK

ΔLL+DL = 5WL⁴/384EI
 = 0.34 in
 L/240 = 0.65 in
 ΔLL = 0.16 in
 L/480 = 0.33 in

1B4:4X12

Span =	10.00	ft					
Trib. Area =	6.00	ft (Roof)	0.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PII =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	1.5	ft
W =	300.00	plf	0.00	plf	Lr =	8.5	ft
Use W =	350.00	plf			RI =	0.00	lbs
V =	1750.00	lb			Rr =	0.00	lbs
M =	4375.00	lb-ft			M =	0.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	11.25	in	Fv =	150	psi
	S =	73.83	in ³			
	A =	39.38	in ²			
	I =	415.28	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	0.98		BEAM STABILITY FACTOR
C _F ' =	1.1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	10.00	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	216	in
R _B ' =	14.08	<50

OK

F _{bE} ' =	2843.21	psi
F _b * =	935.00	psi
F _{bE} '/F _b * =	3.04	
C _L ' =	0.98	

F _b ' =	913.38	psi
f'' _b ' =	711.11	psi
f'' _b '/F _b ' =	0.78	OK

F' _v ' =	150.00	psi
f' _v ' =	66.67	psi
f' _v '/F' _v ' =	0.44	OK

ΔLL+DL =	5WL ⁴ /384EI
=	0.15 in
L/240 =	0.50 in
ΔLL =	0.06 in
L/480 =	0.25 in

1B5:4X6

Span =	3.25	ft					
Trib. Area =	4.00	ft (Roof)	0.00	ft (Floor)	Pdl =	0	lbs
DL =	25.00	psf	15.00	psf	PII =	0	lbs
LL =	25.00	psf	40.00	psf	LI =	1.5	ft
W =	200.00	plf	0.00	plf	Lr =	1.75	ft
Use W =	300.00	plf			RI =	0.00	lbs
V =	487.50	lb			Rr =	0.00	lbs
M =	396.09	lb-ft			M =	0.00	lb-ft

SIZE:	b =	3.5	in	E =	1300000	psi
	d =	5.5	in	Fv =	150	psi
	S =	17.65	in ³			
	A =	19.25	in ²			
	I =	48.53	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1		LOAD DURATION FACTOR
C _M ' =	1		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	1.00		BEAM STABILITY FACTOR
C _F ' =	1.1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	3.25	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	70.2	in
R _B ' =	5.61	<50

OK

F _{bE} ' =	17894.33	psi
F _b * =	935.00	psi
F _{bE} ' / F _b * =	19.14	
C _L ' =	1.00	

F _b ' =	932.44	psi
f''b =	269.36	psi
f''b / F _b ' =	0.29	OK

F _v ' =	150.00	psi
f''v =	37.99	psi
f''v / F _v ' =	0.25	OK

ΔLL + DL =	5WL ⁴ / 384EI
=	0.01 in
L / 240 =	0.16 in
ΔLL =	0.00 in
L / 480 =	0.08 in

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TYP DECK JOIST:2X12

Span =	11.25	ft					
Trib. Area =	0.00	ft (Roof)	1.33	ft (deck)	Pdl =	0	lbs
DL =	25.00	psf	12.00	psf	PlI =	0	lbs
LL =	25.00	psf	60.00	psf	LI =	0	ft
W =	0.00	plf	96.00	plf	Lr =	11.25	ft
Use W =	100.00	plf			RI =	0.00	lbs
V =	562.50	lb			Rr =	0.00	lbs
M =	1582.03	lb-ft			M =	0.00	lb-ft

SIZE:	b =	1.5	in	E =	1300000	psi
	d =	11.25	in	Fv =	150	psi
	S =	31.64	in ³			
	A =	16.88	in ²			
	I =	177.98	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b ' =	850	psi	
C _D ' =	1		LOAD DURATION FACTOR
C _M ' =	0.85		WET SERVICE FACTOR
C _t ' =	1		TEMP. FACTOR
C _L ' =	0.95		BEAM STABILITY FACTOR
C _F ' =	1		SIZE FACTOR
C _{fu} ' =	1		FLAT USE FACTOR
C _i ' =	1		INCISING FACTOR
C _r ' =	1		REPETITIVE MEMBER FACTOR

L =	4.00	ft
K =	1.8	
E _{MIN} ' =	470000	psi
Le =	86.4	in
R _B ' =	20.78	<50

OK

F _{bE} ' =	1305.56	psi
F _b * =	722.50	psi
F _{bE} ' / F _b * =	1.81	
C _L ' =	0.95	

F _b ' =	684.74	psi
f'' _b ' =	600.00	psi
f'' _b ' / F _b ' =	0.88	OK

F' _v ' =	127.50	psi
f' _v ' =	50.00	psi
f' _v ' / F' _v ' =	0.39	OK

ΔLL+DL =	5WL4/384EI
=	0.16 in
L/240 =	0.56 in
ΔLL =	0.12 in
L/480 =	0.28 in

Job Number: _____
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TYP DECK BEAM :6X12DF#1

Span =	11.25	ft MAX			
Trib. Area =	0.00	ft (Roof)	8.00	ft (deck)	Pdl = 0 lbs
DL =	25.00	psf	12.00	psf	PlI= 0 lbs
LL =	25.00	psf	60.00	psf	LI= 0 ft
W =	0.00	plf	576.00	plf	Lr = 11.25 ft
Use W =	600.00	plf			RI = 0.00 lbs
V =	3375.00	lb			Rr = 0.00 lbs
M =	9492.19	lb-ft			M = 0.00 lb-ft

SIZE:	b=	5.5	in	E=	1600000	psi
	d=	11.5	in	Fv=	170	psi
	S=	121.23	in ³			
	A=	63.25	in ²			
	I=	697.07	in ⁴			

$$F_b' = C_D * C_M * C_t * C_F * C_i * C_P$$

F _b '=	1300	psi	
C _D '=	1		LOAD DURATION FACTOR
C _M '=	0.85		WET SERVICE FACTOR
C _t '=	1		TEMP. FACTOR
C _L '=	1.00		BEAM STABILITY FACTOR
C _F '=	1		SIZE FACTOR
C _{fu} '=	1		FLAT USE FACTOR
C _i '=	1		INCISING FACTOR
C _r '=	1		REPETITIVE MEMBER FACTOR

L=	4.00	ft
K=	1.8	
E _{MIN} '=	580000	psi
Le=	86.4	in
R _B '=	5.73	<50

OK

F _{bE} '=	21189.61	psi
F _b *=	1105.00	psi
F _{bE} /F _b *=	19.18	
C _L '=	1.00	

F _b '=	1101.98	psi
f''b=	939.59	psi
f'b/F'b =	0.85	OK

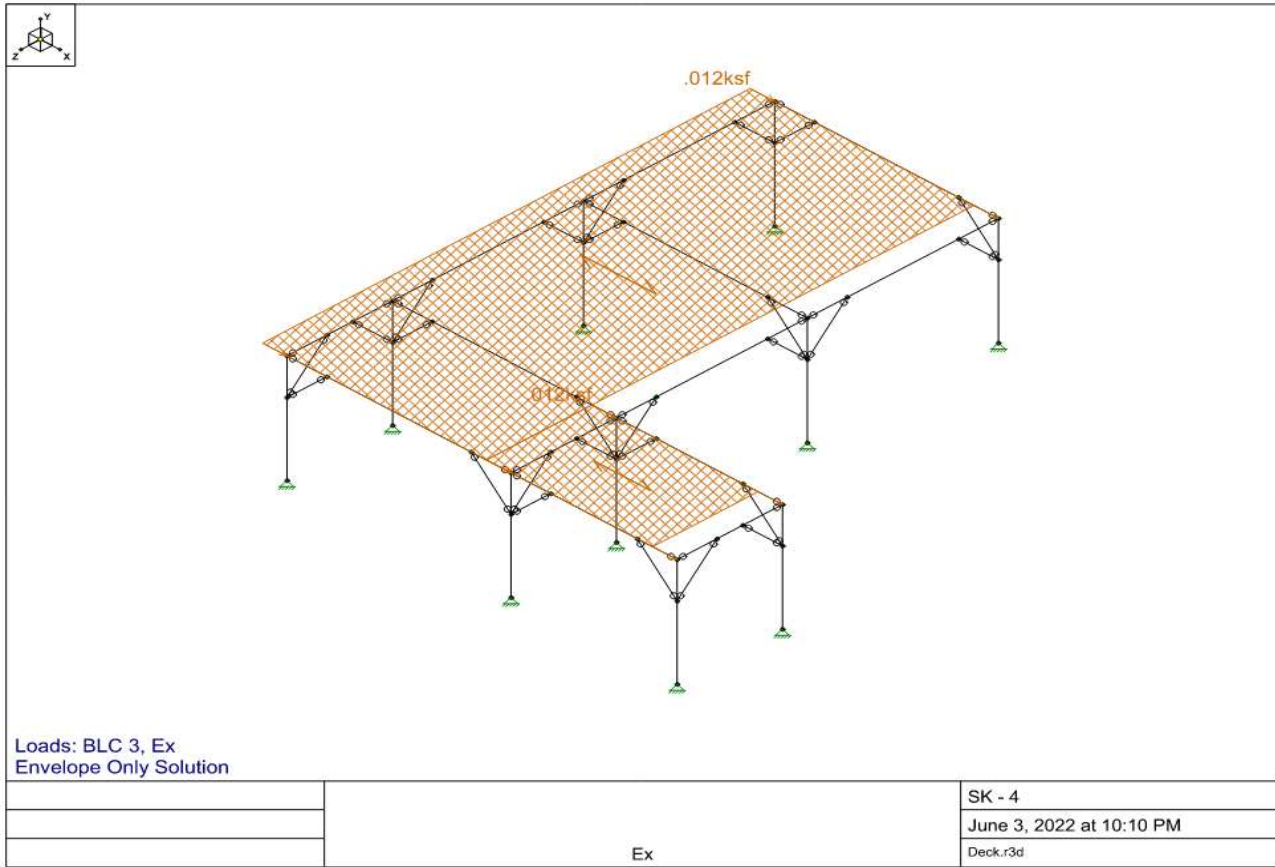
F'v =	144.50	psi
f'v =	80.04	psi
f'v/F'v =	0.55	OK

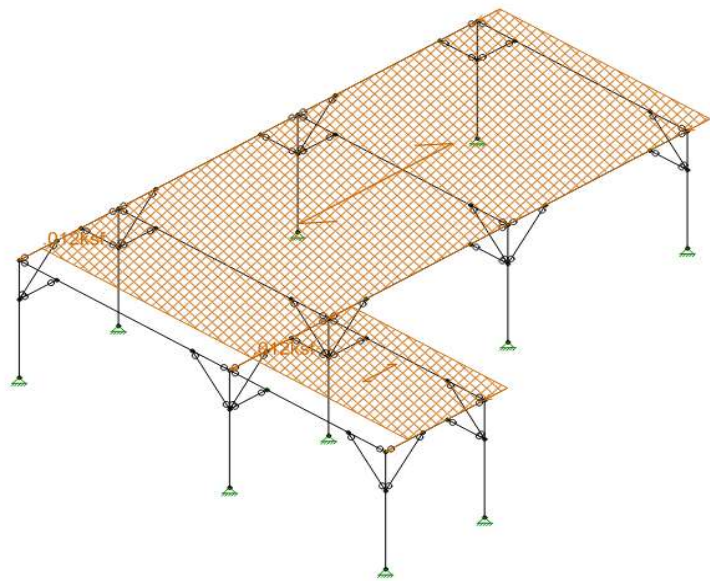
ΔLL+DL =	5WL4/384EI
=	0.19 in
L/240 =	0.56 in
ΔLL =	0.16 in
L/480 =	0.28 in

Deck Frame: RISA 3D

Seismic Design :

Sds = 1.16
 R = 1.5
 $\Omega = 1.5$
 Deck DL = 10 psf
 Deck DL W/ Column and Brace = 15 psf
 $Ex = Ez = DL \times Sds / R$
 11.6 psf
 Use 12 psf

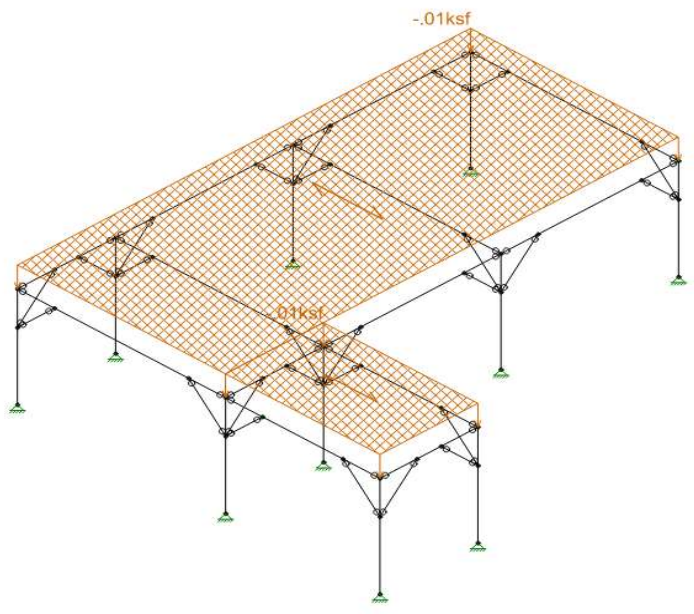




Loads: BLC 4, Ez
Envelope Only Solution

Ez

SK - 6
June 3, 2022 at 10:11 PM
Deck.r3d



Loads: BLC 1, DL
Envelope Only Solution

DL

SK - 5
June 3, 2022 at 10:11 PM
Deck.r3d

Job Number: _____
 Job Name: 7545 E Mercer Way Remodel
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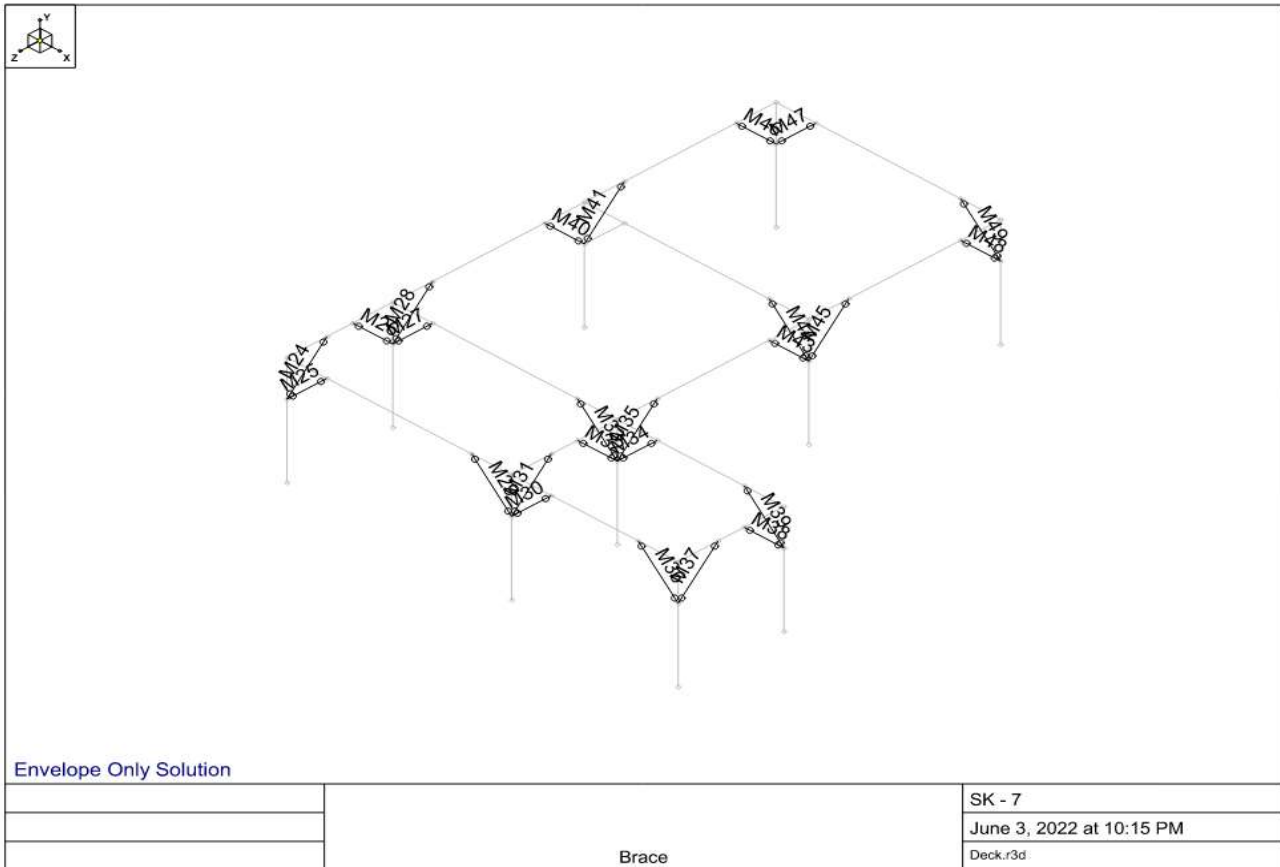
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Basic Load Cases

BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu..	Area(M..	Surface..
1 DL	DL			-1				2	
3 Ex	ELX							2	
4 Ez	ELZ							2	

Load Combinations

Description	Solve P...	S...	B...	Fa...	BLC Factor	BLC Factor	BLC Factor	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...
1 Ex			E...	1													
2 Ez			E...	1													
3 DL+0.7Ex	Yes		DL	1	ELX	.7											
4 DL + 0.7Ez	Yes		DL	1	ELZ	.7											
5 0.6DL+0.7Ex			DL	.6	ELX	.7											
6 0.6DL+0.7Ez			DL	.6	ELZ	.7											





Company :
 Designer :
 Job Number :
 Model Name :

June 3, 2022
 10:18 PM
 Checked By: _____

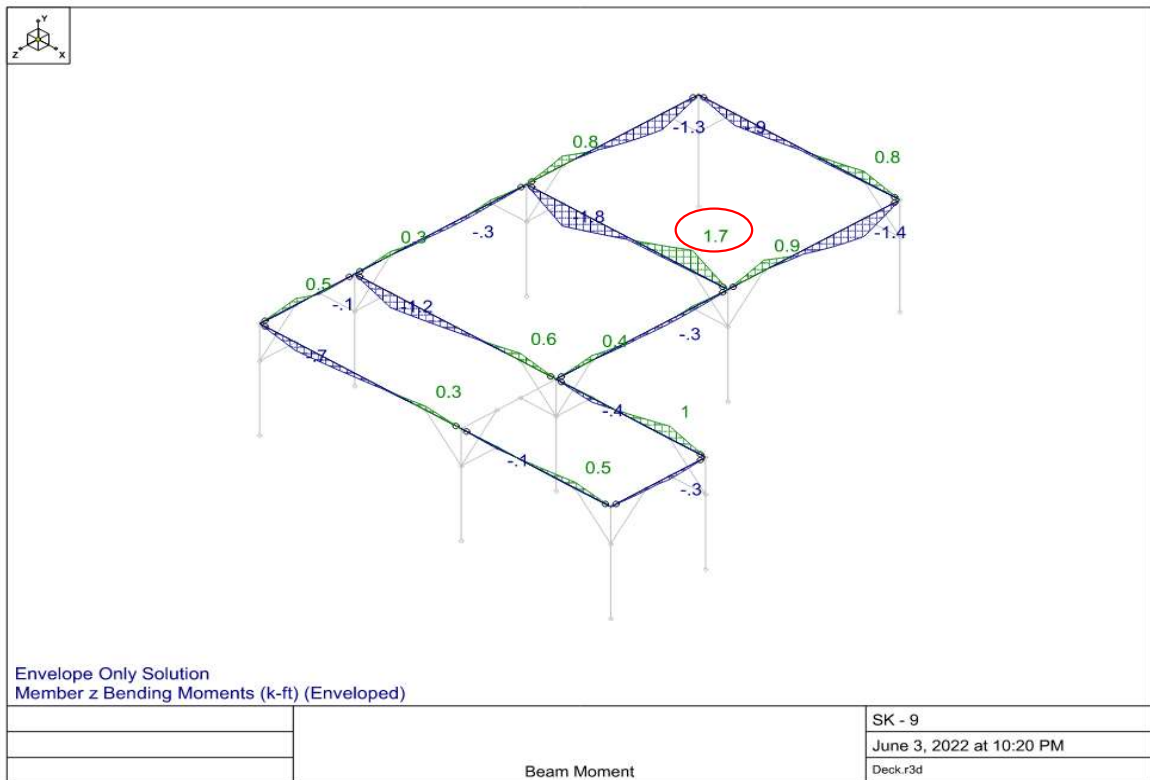
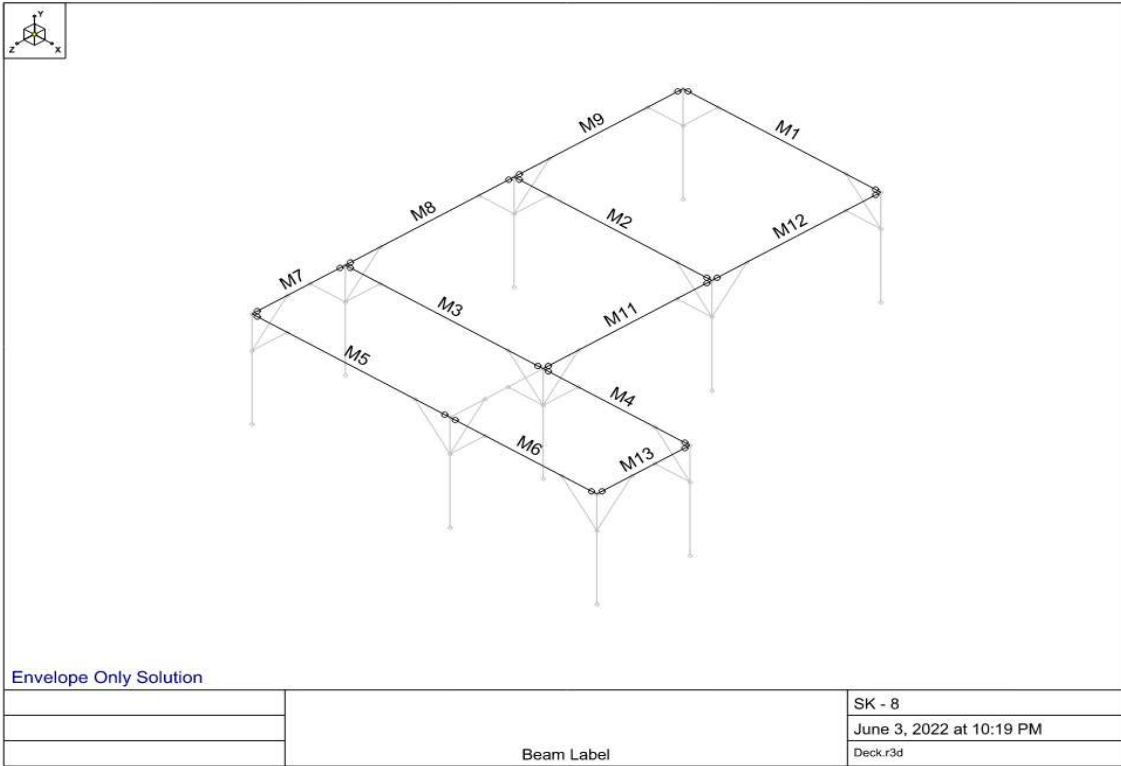
Envelope Maximum Member Section Forces

Member	Axial[k]	Loc[ft]	LC y Shear...	Locf...	LC z Shear...	Locf...	LC Torque[...	Locf...	LC y-y Mome...	Locf...	LC z-z Mome...	Locf...	LC						
1 M24	max	1.238	0	4	.005	0	4	0	0	4	.045	0	3	0	0	4	0	0	4
2	min	.018	2.828	3	-.005	2.828	3	0	0	3	-.056	0	4	0	0	3	-.003	1.414	3
3 M25	max	.024	0	4	.005	0	4	0	0	4	.056	0	4	0	0	4	0	0	4
4	min	-.555	2.828	3	-.005	2.828	3	0	0	3	-.045	0	3	0	0	3	-.003	1.414	3
5 M26	max	.347	0	3	.005	0	4	0	0	4	-.046	0	3	0	0	4	0	0	4
6	min	-.604	2.828	4	-.005	2.828	3	0	0	3	-.056	0	4	0	0	3	-.003	1.414	3
7 M27	max	.045	0	4	.005	0	4	0	0	4	.114	0	4	0	0	4	0	0	4
8	min	-1.094	2.828	3	-.005	2.828	3	0	0	3	-.045	0	3	0	0	3	-.003	1.414	3
9 M28	max	.731	0	4	.005	0	4	0	0	4	.091	0	3	0	0	4	0	0	4
10	min	.357	2.828	3	-.005	2.828	3	0	0	3	-.057	0	4	0	0	3	-.003	1.414	3
11 M29	max	.525	0	3	.005	0	4	0	0	4	-.039	0	3	0	0	4	0	0	4
12	min	.162	2.828	4	-.005	2.828	3	0	0	3	-.072	0	4	0	0	3	-.003	1.414	3
13 M30	max	.153	0	4	.005	0	4	0	0	4	.046	0	4	0	0	4	0	0	4
14	min	-.189	2.828	3	-.005	2.828	3	0	0	3	-.036	0	3	0	0	3	-.003	1.414	3
15 M31	max	1.477	0	4	.005	0	4	0	0	4	.075	0	3	0	0	4	0	0	4
16	min	.03	2.828	3	-.005	2.828	3	0	0	3	.026	0	4	0	0	3	-.003	1.414	3
17 M32	max	.394	0	3	.005	0	4	0	0	4	.033	0	4	0	0	4	0	0	4
18	min	-.736	2.828	4	-.005	2.828	3	0	0	3	-.044	0	3	0	0	3	-.003	1.414	3
19 M33	max	.873	0	3	.005	0	4	0	0	4	-.036	0	3	0	0	4	0	0	4
20	min	.163	2.828	4	-.005	2.828	3	0	0	3	-.122	0	4	0	0	3	-.003	1.414	3
21 M34	max	.171	0	4	.005	0	4	0	0	4	.051	0	4	0	0	4	0	0	4
22	min	-.611	2.828	3	-.005	2.828	3	0	0	3	-.033	0	3	0	0	3	-.003	1.414	3
23 M35	max	.836	0	4	.005	0	4	0	0	4	.113	0	3	0	0	4	0	0	4
24	min	.395	2.828	3	-.005	2.828	3	0	0	3	.037	0	4	0	0	3	-.003	1.414	3
25 M36	max	.606	0	3	.005	0	4	0	0	4	-.051	0	4	0	0	4	0	0	4
26	min	.011	2.828	4	-.005	2.828	3	0	0	3	-.052	0	3	0	0	3	-.003	1.414	3
27 M37	max	.405	0	4	.005	0	4	0	0	4	.052	0	3	0	0	4	0	0	4
28	min	.031	2.828	3	-.005	2.828	3	0	0	3	.051	0	4	0	0	3	-.003	1.414	3
29 M38	max	.02	0	3	.005	0	4	0	0	4	.05	0	4	0	0	4	0	0	4
30	min	-.339	2.828	4	-.005	2.828	3	0	0	3	-.003	0	3	0	0	3	-.003	1.414	3
31 M39	max	1.219	0	3	.005	0	4	0	0	4	.003	0	3	0	0	4	0	0	4
32	min	.011	2.828	4	-.005	2.828	3	0	0	3	-.05	0	4	0	0	3	-.003	1.414	3
33 M40	max	.629	0	3	.005	0	4	0	0	4	-.063	0	4	0	0	4	0	0	4
34	min	.16	2.828	4	-.005	2.828	3	0	0	3	-.089	0	3	0	0	3	-.003	1.414	3
35 M41	max	1.474	0	4	.005	0	4	0	0	4	.084	0	3	0	0	4	0	0	4
36	min	.652	2.828	3	-.005	2.828	3	0	0	3	-.068	0	4	0	0	3	-.003	1.414	3
37 M43	max	.538	0	3	.005	0	4	0	0	4	.06	0	4	0	0	4	0	0	4
38	min	.076	2.828	4	-.005	2.828	3	0	0	3	-.097	0	3	0	0	3	-.003	1.414	3
39 M44	max	1.973	0	3	.005	0	4	0	0	4	.004	0	3	0	0	4	0	0	4
40	min	.048	2.828	4	-.005	2.828	3	0	0	3	-.126	0	4	0	0	3	-.003	1.414	3
41 M45	max	1.597	0	4	.005	0	4	0	0	4	.093	0	3	0	0	4	0	0	4
42	min	.557	2.828	3	-.005	2.828	3	0	0	3	.066	0	4	0	0	3	-.003	1.414	3
43 M46	max	.082	0	3	.005	0	4	0	0	4	-.061	0	4	0	0	4	0	0	4
44	min	-1.047	2.828	4	-.005	2.828	3	0	0	3	-.069	0	3	0	0	3	-.003	1.414	3
45 M47	max	.063	0	4	.005	0	4	0	0	4	.069	0	3	0	0	4	0	0	4
46	min	-.909	2.828	3	-.005	2.828	3	0	0	3	.061	0	4	0	0	3	-.003	1.414	3
47 M48	max	.095	0	3	.005	0	4	0	0	4	.057	0	4	0	0	4	0	0	4
48	min	-1.219	2.828	4	-.005	2.828	3	0	0	3	-.076	0	3	0	0	3	-.003	1.414	3
49 M49	max	1.014	0	3	.005	0	4	0	0	4	.076	0	3	0	0	4	0	0	4
50	min	.055	2.828	4	-.005	2.828	3	0	0	3	-.057	0	4	0	0	3	-.003	1.414	3

Max Axil = 1900 lbs
 Ω = 1.5
 Design Axial and Conn, P = 2850 lbs
 Use 4x6 DF#2:
 A = 19.25 in2
 F'c = 1350 psi
 Cd = 1.6
 P allow = 41580 lbs > P
 Z = 780 lbs (3/4" Dia Bolt)
 Cd = 1.6
 (3) 3/4" Dia Bolt, Z = 3744 lbs > P OK

Job Number: _____
 Job Name: 7545 E Mercer Way Remodel
 Location: 7545 E Mercer Way, Mercer Island, WA

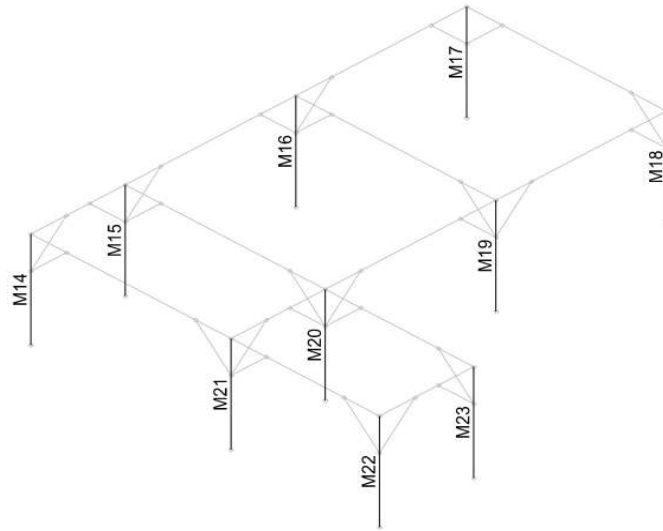
Engineer: Frankie Tsui
 Date: 5/23/2022
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Max Beam Moment = 1700 lb-ft < 9492.19 lb-ft TYP DECK BEAM :6X12DF#1
Ok

Job Number: _____
 Job Name: 7545 E Mercer Way Remodel
 Location: 7545 E Mercer Way, Mercer Island, WA

Engineer: Frankie Tsui
 Date: 5/23/2022
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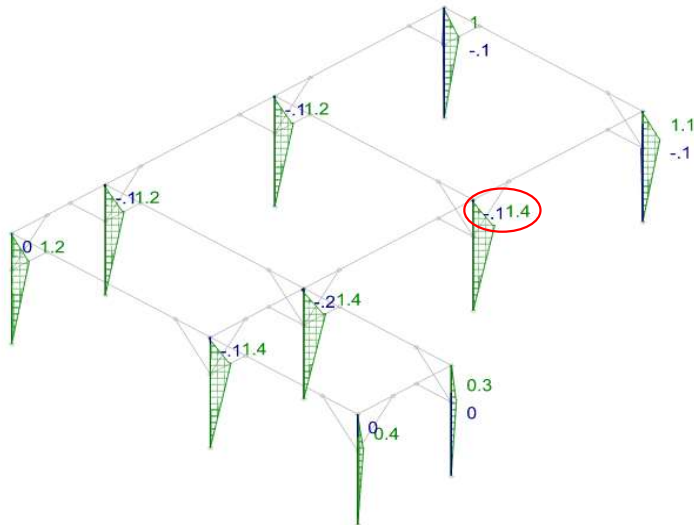
Envelope Only Solution

Column Label

SK - 12

June 3, 2022 at 10:22 PM

Deck.r3d



Envelope Only Solution
Member y Bending Moments (k-ft) (Enveloped)

Column My

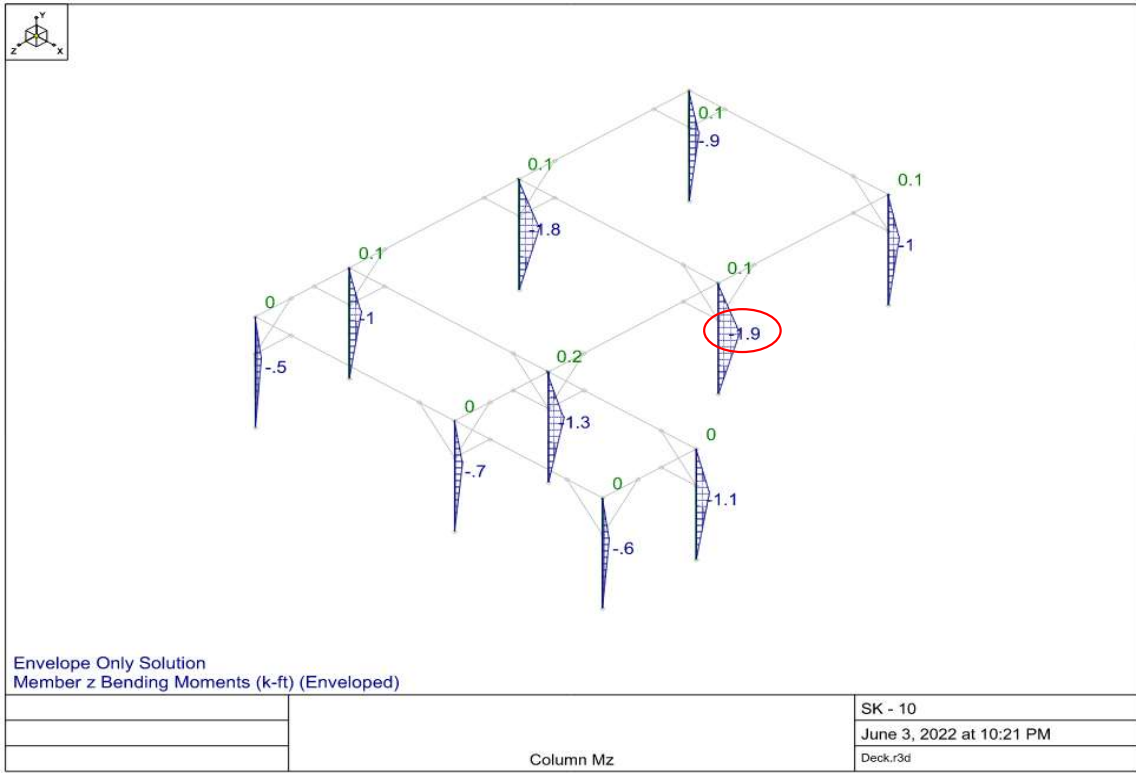
SK - 11

June 3, 2022 at 10:22 PM

Deck.r3d

Job Number: _____
 Job Name: 7545 E Mercer Way Remodel
 Location: 7545 E Mercer Way, Mercer Island, WA

Engineer: Frankie Tsui
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Max Moment = 1900 lbs-ft
 Use 6x6 Col
 A = 30.25 in²
 S = 27.73 in³
 Cd = 1.6
 Requ'd fb = 513.8993 psi
 Use DF#1
 fb = psi

Column Design:
Column: 6x6FD#1

SIZE: b= 5.5 in
 d= 5.5 in

$$F_c' = C_D * C_M * C_t * C_F * C_i * C_P$$

$F_C = 1000$ psi
 $C_D = 1$
 $C_M = 0.85$
 $C_t = 1$
 $C_F = 1$
 $C_i = 1$
 $C_P = 0.853$

COMPRESSION PARALLEL TO GRAIN
LOAD DURATION FACTOR
WET SERVICE FACTOR
TEMP. FACTOR
SIZE FACTOR
INCISING FACTOR
COLUMN STABILITY FACTOR

$L = 8.00$ ft
 $d = 5.5$ in
 $K = 1$
 $E_{MIN} = 580000$ psi
 $c = 0.8$
 $Le = 96$ in
 $Le/d = 17.45 < 50$ **OK**

$F_{CE} = 1564.886$
 $F_C^* = 850$
 $F_{CE}/F_C^* = 1.841042$
 $C_P = 0.853$

$F_c' = 724.89$ psi
Allowable P= $F_c' \times A$
= 21927.89 lb

Column: 6x6

SIZE: b= 5.5 in
 d= 5.5 in

$$F_c' = C_D * C_M * C_t * C_F * C_i * C_P$$

$F_c =$	575	psi	COMPRESSION PARALLEL TO GAIN
$C_D =$	1		LOAD DURATION FACTOR
$C_M =$	0.85		WET SERVICE FACTOR
$C_t =$	1		TEMP. FACTOR
$C_F =$	1		SIZE FACTOR
$C_i =$	1		INCISING FACTOR
$C_P =$	0.883		COLUMN STABILITY FACTOR

L=	8.00	ft
d=	5.5	in
K=	1	
$E_{MIN}' =$	400000	psi
c=	0.8	
Le=	96	in
Le/d=	17.45	<50 OK

$F_{CE} =$	1079.232
$F_c^* =$	488.75
$F_{CE}/F_c^* =$	2.208147
$C_P =$	0.883

$F_c' =$ 431.32 psi
Allowable P= $F_c' \times A$
 = 13047.51 lb

Column: 4x6

SIZE: b= 3.5 in
 d= 5.5 in

$$F_c' = C_D * C_M * C_t * C_F * C_i * C_P$$

$F_c = 1300$ psi
 $C_D = 1$
 $C_M = 1$
 $C_t = 1$
 $C_F = 1.1$
 $C_i = 1$
 $C_P = 0.327$

COMPRESSION PARALLEL TO GAIN
LOAD DURATION FACTOR
WET SERVICE FACTOR
TEMP. FACTOR
SIZE FACTOR
INCISING FACTOR
COLUMN STABILITY FACTOR

$L = 8.00$ ft
 $d = 3.5$ in
 $K = 1$
 $E_{MIN}' = 470000$ psi
 $c = 0.8$
 $Le = 96$ in
 $Le/d = 27.43 < 50$ **OK**

$F_{CE} = 513.527$
 $F_c^* = 1430$
 $F_{CE}/F_c^* = 0.35911$
 $C_P = 0.327$

$F_c' = 467.99$ psi
Allowable P= $F_c' \times A$
= 9008.87 lb

Column: 4x4

SIZE: b= 3.5 in
 d= 3.5 in

$$F_c' = C_D * C_M * C_t * C_F * C_i * C_P$$

$F_c =$	1300	psi	COMPRESSION PARALLEL TO GRAIN
$C_D =$	1		LOAD DURATION FACTOR
$C_M =$	1		WET SERVICE FACTOR
$C_t =$	1		TEMP. FACTOR
$C_F =$	1.15		SIZE FACTOR
$C_i =$	1		INCISING FACTOR
$C_P =$	0.315		COLUMN STABILITY FACTOR

$L =$	8.00	ft
$d =$	3.5	in
$K =$	1	
$E_{MIN}' =$	470000	psi
$c =$	0.8	
$Le =$	96	in
$Le/d =$	27.43	<50 OK

$F_{CE} =$	513.527
$F_c^* =$	1495
$F_{CE}/F_c^* =$	0.343496
$C_P =$	0.315

$F_c' = 470.35 \text{ psi}$
 Allowable P= $F_c' \times A$
 = 5761.74 lb

Column: 2x4

SIZE: b= 1.5 in
 d= 3.5 in

$$F_c' = C_D * C_M * C_t * C_F * C_i * C_P$$

$F_c =$	800	psi	COMPRESSION PARALLEL TO GRAIN
$C_D =$	1		LOAD DURATION FACTOR
$C_M =$	1		WET SERVICE FACTOR
$C_t =$	1		TEMP. FACTOR
$C_F =$	1.15		SIZE FACTOR
$C_i =$	1		INCISING FACTOR
$C_P =$	0.449		COLUMN STABILITY FACTOR

L=	8.00	ft
d=	3.5	in
K=	1	
$E_{MIN}' =$	440000	psi
c=	0.8	
Le=	96	in
Le/d=	27.43	<50 OK

$F_{CE} =$	480.7487
$F_c^* =$	920
$F_{CE}/F_c^* =$	0.522553
$C_P =$	0.449

$F_c' =$ 413.32 psi
Allowable P= $F_c' X A$
= 2169.92 lb

Job Number: _____
Job Name: 7545 E Mercer Way Remodel
Location: 7545 E Mercer Way, Mercer Island, WA

Engineer: Frankie Tsui
Date: 5/23/2022
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Column Load

Roof:	psf	Floor:	psf	Deck:	psf
DL=	25	DL =	15	DL =	10
LL =	25	LL =	40	LL =	60
Sum =	50		55		70

	Area Load (Lbs)	
C1: Roof:	173	8625
2nd:	127	6958
Main:		0
Deck:		0
Wall:		0
Total:		15583
C2: Roof:		0
2nd:	161	8855
Main:		0
Deck:		0
Wall:		0
Total:		8855
C3: Roof:	173	8625
2nd:	35	1898
Main:		0
Deck:		0
Wall:	120	1800
Total:		12323
C4: Roof:	68	3375
2nd:	54	2970
Main:		0
Deck:		0
Wall:	108	1620
Total:		7965
C5: Roof:	68	3375
2nd:	54	2970
Main:		0
Deck:		0
Wall:	108	1620
Total:		7965
C6: Roof:	30	1500
2nd:	24	1320
Main:		0
Deck:		0
Wall:	120	1800
Total:		4620

C7: Roof:	23	1125
2nd:	18	990
Main:		0
Deck:		0
Wall:	48	720
Total:		2835

C8: Roof:	17	825
2nd:	13	688
Main:		0
Deck:		0
Wall:	72	1080
Total:		2593

C9: Roof:		0
2nd:	13	688
Main:		0
Deck:		0
Wall:		0
Total:		688

C10: Roof:	32	1600
2nd:		0
Main:		0
Deck:		0
Wall:	48	720
Total:		2320

C11: Roof:	20	1000
2nd:	12	660
Main:		0
Deck:		0
Wall:	24	360
Total:		2020

C12: Roof:		0
2nd:		0
Main:	49	2671
Deck:		0
Wall:		0
Total:		2671

C13: Roof:	78	3900
2nd:		0
Main:	33	1788
Deck:		0
Wall:		0
Total:		5688

C14: Roof:	90	4500
2nd:	32	1760
Main:	45	2475
Deck:		0
Wall:		0
Total:		8735

C15: Roof:		0
Foundation 2nd:	120	6600
Main:	45	2475
Deck:		0
Wall:		0
Total:		9075

C15: Roof:		0
Col only 2nd:		0
Main:	45	2475
Deck:		0
Wall:		0
Total:		2475

C16: Roof:	24	1200
2nd:		0
Main:		0
Deck:		0
Wall:	36	540
Total:		1740

C17: Roof:	30	1500
2nd:		0
Main:		0
Deck:		0
Wall:	36	540
Total:		2040

C18: Roof:		0
2nd:		0
Main:		0
Deck:	80	5600
Wall:		0
Total:		5600

	Column Load (lbs)	Use Col	Allow load (lbs)	FTG WT lbs	Req'd size (ft)	Use FTG size (ft)	Use FTG THK (in)	#4 E.W. Rebars
C1:	15583	6x6DF	21927.89	2400	3.46	4	12	5
C2:	8855	6x6	13047.51	2400	2.74	4	12	5
C3:	12323	6x6DF	21927.89	2400	3.13	4	12	5
C4:	7965	6x6	13047.51	1125	2.46	3	10	4
C5:	7965	6x6	13047.51	1125	2.46	3	10	4
C6:	4620	6x6	13047.51	1125	1.96	3	10	4
C7:	2835	4x6	9008.87	375	1.46			
C8:	2593	6x6	13047.51	1125	1.57	3	10	4
C9:	688	4x6	9008.87	375	0.84			
C10:	2320	(2)2x4	4339.833	375	1.34			
C11:	2020	(2)2x4	4339.833	375	1.26			
C12:	2671	4X4	5761.74	375	1.43			
C13:	5688	4X6	9008.87	1125	2.13	3	10	4
C14:	8735	4X6	9008.87	2400	2.72	4	12	5
C15:	9075	4X6	9008.87	2400	2.77	4	12	5
C16:	1740	4X6	9008.87	375	1.19			
C17:	2040	(2)2x4	4339.833	375	1.27			
C18:	5600	6X6DF	21927.89	781	2.06	2.5	10	3

Column Load (lbs)	
C7:	2835
C9:	688
C10:	2320
C11:	2020
C12:	2671
C16:	1740
C17:	2040

On existing wall foundation or new wall foundation
The existitng wall foundation assumed min 16" width
With 12" depth total. Effecton bearing area = (12"+12") * 15"
area = 2.5 sqft. Allowable load = 2.5 x 1500 = 3750 lbs

4.0 FOUNDATION DESIGN

	Assumed Soil Bearing Capacity = 1500 psf			Min		Assumed LRFD (1.6)			
	Frost Line Depth = 18 in								
	Use FTG size (ft)	Use FTG THK (in)	Factor Vu (lbs)	Mu (lb-ft/ft)	Shear ϕV_c	Check	Moment ϕM_n /ft	Check	
C1:	4	12.00	24932	3117	112393	OK	7910	OK	
C2:	4	12.00	14168	1771	112411	OK	7910	OK	
C3:	4	12.00	19716	2465	112430	OK	7910	OK	
C4:	3	10.00	12744	1593	78254	OK	6128	OK	
C5:	3	10.00	12744	1593	78267	OK	6128	OK	
C6:	3	10.00	7392	924	78280	OK	6128	OK	
C7:									
C8:	3	10.00	4148	519	78306	OK	6128	OK	
C9:									
C10:									
C11:									
C12:									
C13:	3	10.00	9100	1138	78371	OK	6129	OK	
C14:	4	12.00	13976	1747	112636	OK	7910	OK	
C15:	4	12.00	14520	1815	112655	OK	7910	OK	
C16:									
C17:									
C18:	2.5	10.00	8960	1120	78436	OK	6117	OK	

	bo	d	f'c	Shear ϕV_c	Check	#4/ft As/ft	a (in)	Moment ϕM_n /ft	Check
	76	9	3000	112393	OK	0.20	0.10	7910	OK
	76	9	3001	112411	OK	0.20	0.10	7910	OK
	76	9	3002	112430	OK	0.20	0.10	7910	OK
	68	7	3003	78254	OK	0.20	0.13	6128	OK
	68	7	3004	78267	OK	0.20	0.13	6128	OK
	68	7	3005	78280	OK	0.20	0.13	6128	OK
	68	7	3007	78306	OK	0.20	0.13	6128	OK
	68	7	3012	78371	OK	0.20	0.13	6129	OK
	76	9	3013	112636	OK	0.20	0.10	7910	OK
	76	9	3014	112655	OK	0.20	0.10	7910	OK
	68	7	3017	78436	OK	0.20	0.15	6117	OK

Job Number: _____
 Job Name: 7545 E Mercer Way Remodel
 Location: 7545 E Mercer Way, Mercer Island, WA

Engineer: Frankie Tsui
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5.0 Lateral Analysis

New addition Roof:

Roof DL	25.00	PSF
2nd Floor DL	15.00	PSF
IntWall	10.00	PSF
Ext Wall	15.00	PSF

Roof

Diaphragm Area:	805.00	sq. ft.
Height of Diaphragm:	13.00	ft
Weight of Diaphragm:	20125.00	lbs

Wall Weights Below:

Wall Height:	10.30	ft
Concrete Wall Lengths:	0.00	lf
Int wall Wall Lengths:	77.00	lf
Ext Wall Perimeter:	106.00	lf
Concrete Wall Weight:	150.00	psf
Int Wall Weight:	10.00	psf
Ext Wall Wall Weight:	15.00	psf
Weight of Walls Below:	12154.00	lbs
Seismic Weight at Roof:	32279.00	lbs

2nd Floor

Diaphragm Area:	650.00	sq. ft.
Height of Diaphragm:	8.60	ft
Weight of Diaphragm:	9750.00	lbs

Wall Weights Below:

Wall Height:	7.70	ft
Concrete Wall Lengths:	0.00	lf
Int wall Wall Lengths:	24.00	lf
Ext Wall Perimeter:	92.00	lf
Concrete Wall Weight:	150.00	psf
Int Wall Weight:	10.00	psf
Ext Wall Wall Weight:	15.00	psf
Weight of Walls Below:	6237.00	lbs
Seismic Weight at Flor:	28141.00	lbs

Garage Base Shear:

$$V = CS * w$$

$$CS = SDS / (R/Ie)$$

$$SDS = 1.16$$

$$R(N-S) = 6.5$$

$$R(E-W) = 6.5$$

$$V = 11.93 \text{ kips}$$

$$0.7V_E = 8.35 \text{ kips}$$

Table 12.2-1 ASCE 7-10
Table 12.2-1 ASCE 7-10

Seismic Loads

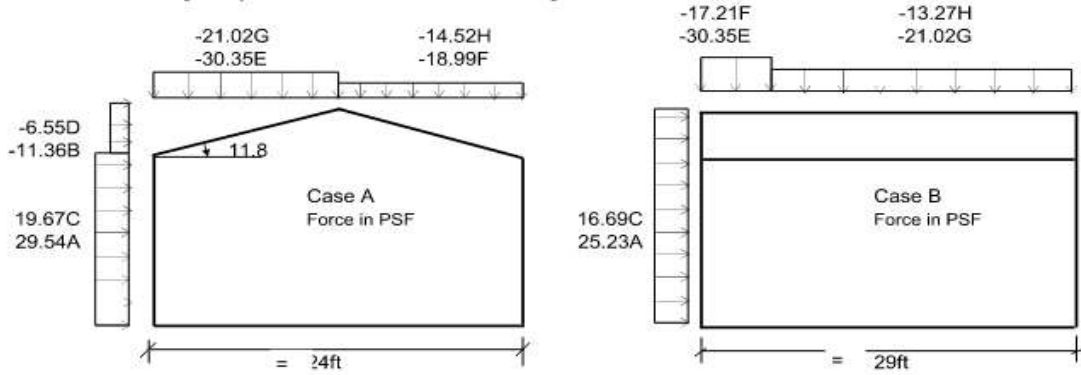
Floor	Seismic Weight	Height	W*h	w*h/Σw*h	V
Roof	32.28 kips	21.60 ft	697.23	0.74	8.85 kips
2nd	28.14 kips	8.60 ft	242.01	0.26	3.07 kips

	0.7V _E (Kips)
Roof	6.20
2nd	2.15

28.4 Envelope Procedure,

MWFRS For Low-Rise Building. Part 2: Enclosed Simple Diaphragm Building (≤ 60 ft)

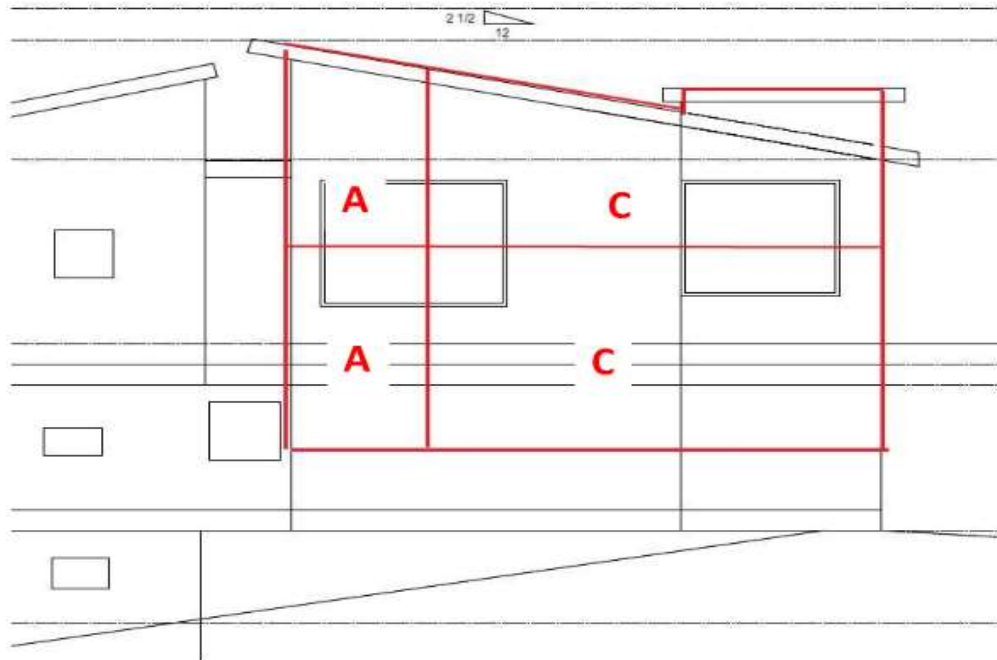
Roof Height $h = 22$ feet
 Roof Pitch = $2.50 : 12 = 11.77$ Degree
 Building & Structure Risk Category = **II, standard** IBC T-1604.5
 Wind Speed $V = 110$ MPH Fig. 26.5-1A, MRI = 700 yrs
 Topography factor $K_{zt} = 1.00$ 26.8, Figure 26.8-1
 Exposure **C**
 Height Adjustment factor $\lambda = 1.314$ Fig 28.6-1



*Plus and minus signs signify pressures acting toward and away from projected surfaces, respectively.
 For Case B use $\theta = 0^\circ$
 Total horizontal load shall not be less than that determined by assume $p_s = 0$ in zones B & D*

$a = 10\%$ of least horizontal dimension or $0.4h$, whichever smaller, but not less than either 4% of least horizontal dimension or $3ft$.

10 % of least dimension =	2.4 ft	
40 % of the eave height =	8.8 ft	
4 % of least dimension or 3 ft =	3.0 ft	←



	Section	Wind pressure	Area (sqft)	Wind force (kips)
Roof	A	29.5	50	1.48
	C	19.7	111	2.18
2nd	A	29.5	65	1.92
	C	19.7	190	3.74
Sum W =				9.32
0.6W =				5.59

	0.6V _w (Kips)
Roof	2.20
2nd	3.39

Wind Area - N-S

New Addition Lateral Summary

Lateral Loading N-S Direction

	0.7VE (Kips)	0.7VE (Kips)	0.6Vw (Kips)	0.6Vw (Kips)	Control Load
Roof	6.20	6.20	2.20	2.20	6.20
2nd	2.15	8.35	3.39	5.59	8.35

Lateral Loading E-W Direction

	0.7VE (Kips)	0.7VE (Kips)	0.6Vw (Kips)	0.6Vw (Kips)	Control Load
Roof	6.20	6.20	3.28	3.28	6.20
2nd	2.15	8.35	4.04	7.32	8.35

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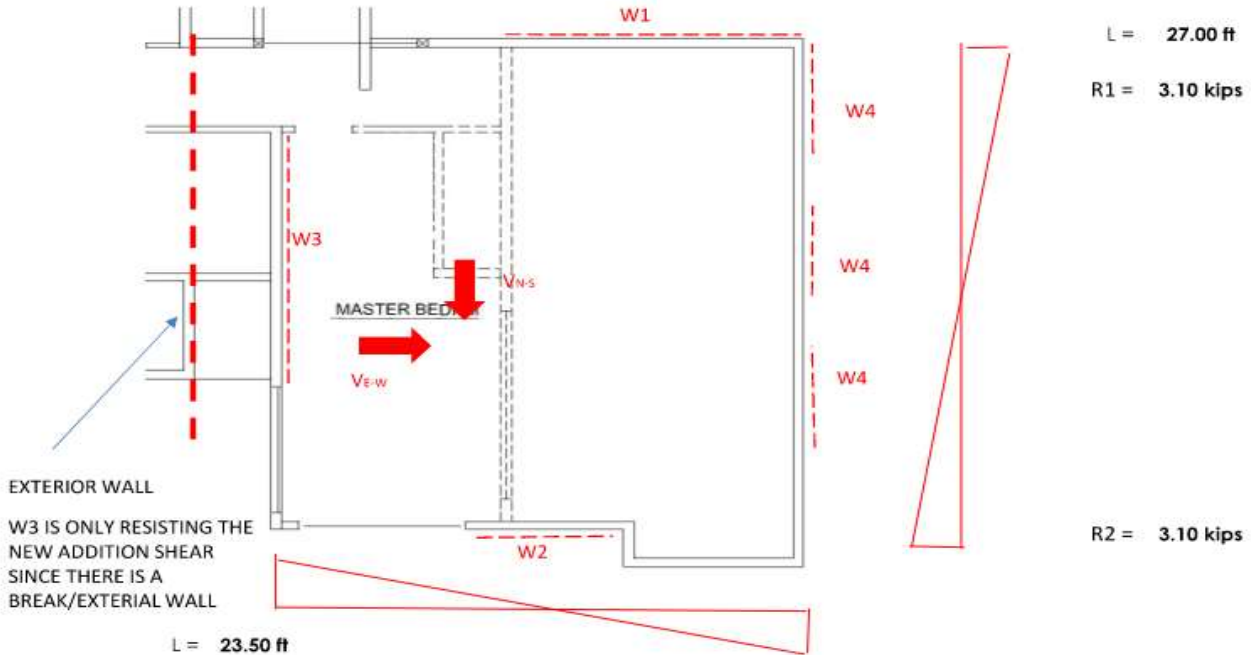
Location: 7545 E Mercer Way, Mercer Island, WA

Engineer: Frankie Tsui

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Floor layout



	Shear Line	H(ft)	Shear (lbs)	Wall	Wall Shear
E-W	W1	12.5	3099	13.8 ft	225 plf
	W2	12.5	3099	7.5 ft	413 plf
N-S	W3	12.5	3099	14.5 ft	214 plf
	W4	12.5	1033	5.0 ft	207 plf

Wall Pier Loading (Wall Reactions are Treated as Perforated Shearwalls)

Wall	Wall Length	W(DL)	Total Tension(0.6D)	Shear Strength	HD	Shear Wall	Allowable Shear	RATIO
W1	13.75 ft	238 plf	1837	225 plf	MST 48	B	380.0 plf	0.59
W2	7.50 ft	238 plf	4630	413 plf	MST 60	D	560.0 plf	0.74
W3	14.50 ft	338 plf	1203	214 plf	MST 48	c	420.0 plf	0.51
W4	5.00 ft	338 plf	2076	207 plf	MST 48	B	380.0 plf	0.54

Job Number: 2022004

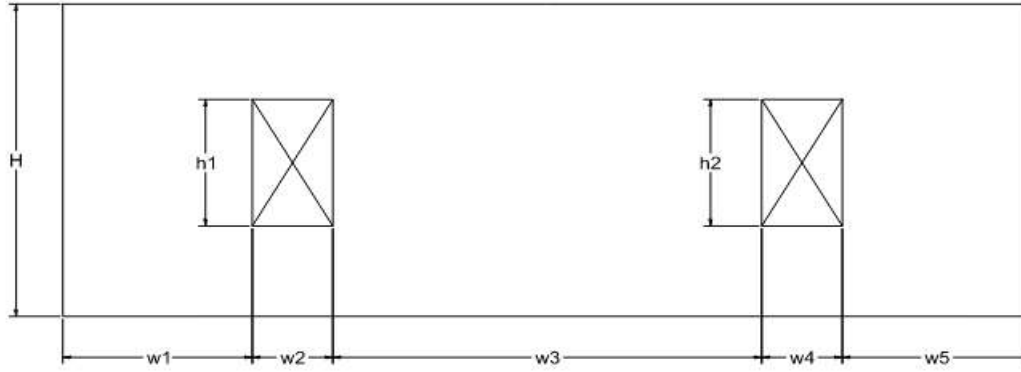
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Inputs: w4 Roof

Load to Shear Line = 3100 lbs
 Controlling Load Case = Seismic
 H = 10.00 ft
 h1 = 3.50 ft
 h2 = 3.5
 Max Opening Height = 3.50 ft
 Full Height Sheathing = 87.10%
 C_o = 0.95 NDS Table 4.3.3.5

Wall Pier Inputs

		<u>Aspect Ratio</u>	
w1 =	8.50 ft	1.20 : 1	Pier 1
w2 =	1.50 ft		
w3 =	6.00 ft	1.70 : 1	Pier 2
w4 =	1.50 ft		
w5 =	5.75 ft	1.70 : 1	Pier 3
TOTAL =	23.25 ft		

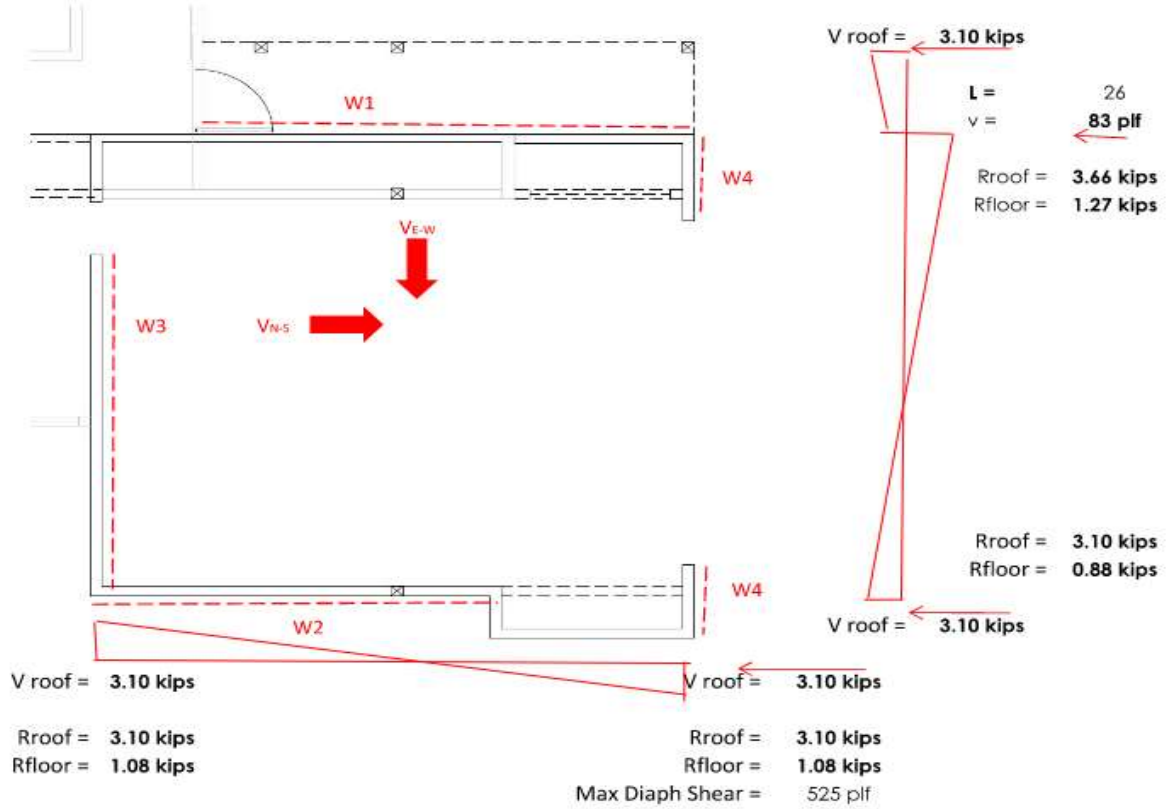
Results

Wall Pier	Aspect Ratio	C _o	Req'd Shear Strength
Pier 1	1	0.95	161 plf
Pier 2	1	0.95	161 plf
Pier 3	1	0.95	161 plf

Results - Overturning

Uniform DL = 338 plf
 Overturning Moment = 31000 lbs-ft
 Resisting Moment (0.6D) = 54732 lbs-ft
 Tension = -1021 lbs

Floor layout



H	Roof	2nd	Roof	2ndd	Wall L (ft)	Wall V (plf)	
12.5	$V_{E-W} = 6.20$ kips	2.15 kips					
9	$V_{N-S} = 6.20$ kips	2.15 kips					
Shear Line	H(ft)	Shear (lbs)	H(ft)	Shear (lbs)	Wall L (ft)	Wall V (plf)	
E-W	W1	12.5	3662 lbs	9	1271 lbs	19.0	259.6
	W2	12.5	3099 lbs	9	880 lbs	15.0	265.2
N-S	W3	12.5	3099 lbs	9	1076 lbs	16.0	260.9
	W4a	12.5	1684 lbs	9	585 lbs	4.2	544.5
	W4b	12.5	1415 lbs	9	491 lbs	3.5	544.5

Wall Pier Loading (Wall Reactions are Treated as Perforated Shearwalls)

Wall	Wall Length	W(DL)	Total Tension(0.6D)	Shear Strength	HD	Shear Wall	Allowable Shear	RATIO
W1	19.00 ft	323 plf	2908	260 plf	HDU2	B	380.0 plf	0.68
W2	15.00 ft	323 plf	3518	265 plf	HDU2 / HDU5	B	380.0 plf	0.70
W3	16.00 ft	398 plf	2861	261 plf	HDU2	B	380.0 plf	0.69
W4a	4.17 ft	398 plf	9456	544 plf	HHDQ14	D	560.0 plf	0.97
W4b	3.50 ft	398 plf	9535	544 plf	HHDQ14	D	560.0 plf	0.97

Job Number: 2022004

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