STRUCTURAL DESIGN

FOR

7663 BEI NEW ADDITION

Submitted to: Mr. Bei

Date: *5/12/2024*

F.T. Engineering & Construction Management, LLC

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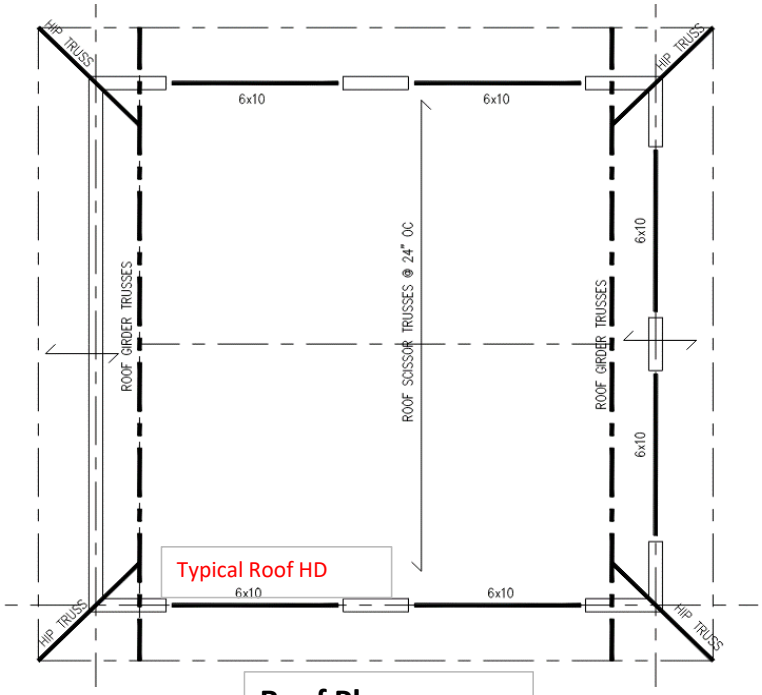
1.0 OBJECTIVE

The existing building is a one story structure. New additon will be on top of the existing garage with roof trusses.



Roof Plan

Lower Floor Plan

Job Number:	2024023	Engineer:	Frankie Tsui
Job Name:	7663 Bei New Addition	Date:	5/9/2024
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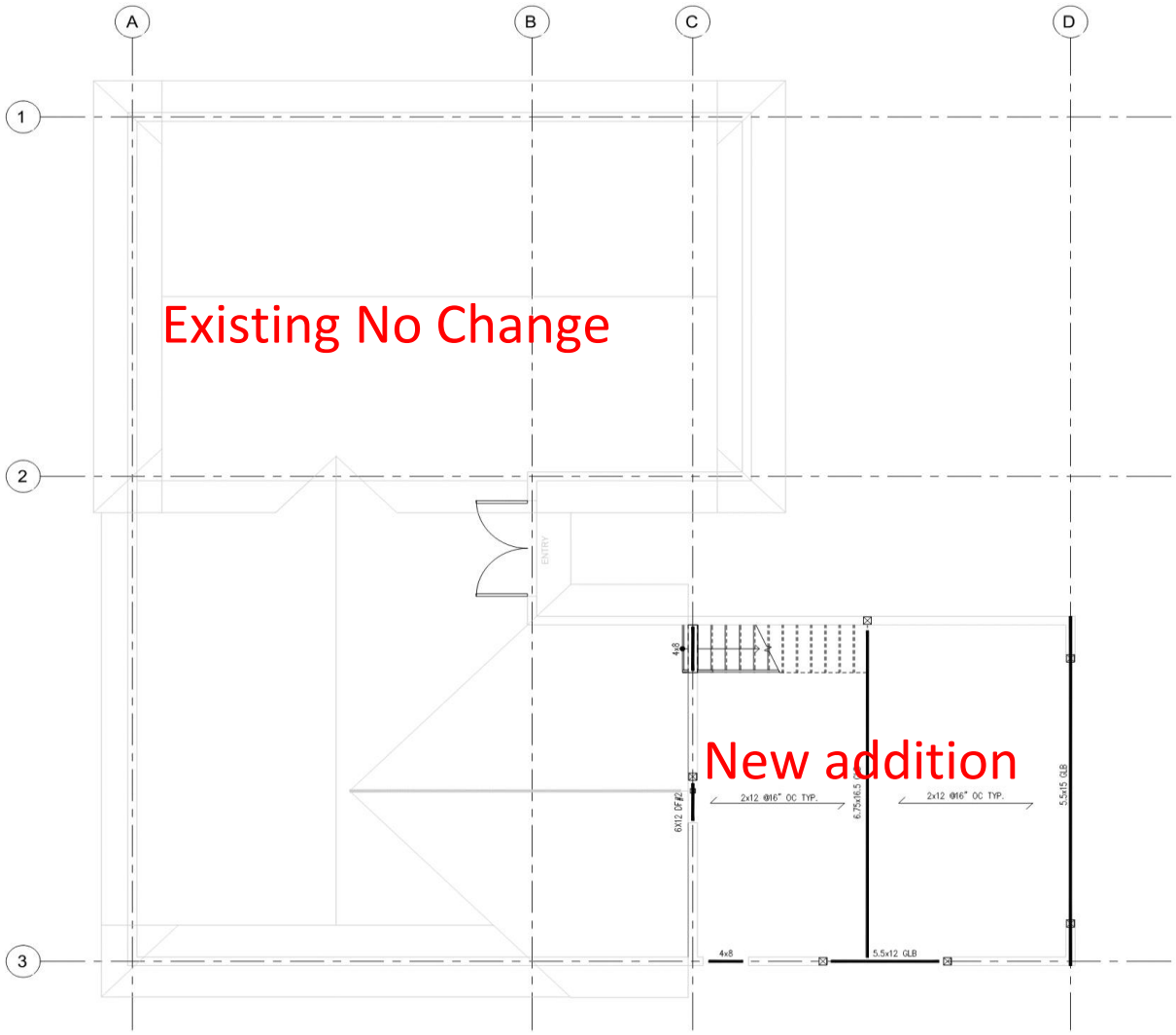

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2.0 LOAD

Roof live Load =	20	PSF
Floor live load =	40	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 =	20	psf
Wind Design :		
Design Wind speed =	110	mph
Exp =	B	
Seismic Design :		
Sds =	1.172	
R =	6.5	
Ω =	2.5	
Soil Bearing Capacity :		
Assumed Soil Bearing Capacity =	1500	psf

3.0 Garvity Framing Design

Typ 7 ft Roof Header

Span =	7.00	ft Max				Pdl =	0	lbs
Trib. Area =	13.00	ft (Roof)	0.00	ft (Floor)		Pll=	0	lbs
DL =	20.00	psf	15.00	psf		Ll=	0	ft
LL =	25.00	psf	40.00	psf		Lr =	7	ft
W =	585.00	plf	0.00	plf		Rl =	0.00	lbs
Use W =	600.00	plf				Rr =	0.00	lbs
V=	2100.00	lb				M =	0.00	lb-ft
M=	3675.00	lb-ft						

SIZE:	b=	5.5	in	E=	1100000 psi
	d=	9.5	in	Fv=	140 psi
	S=	82.73	in^3		
	A=	52.25	in^2		
	I=	392.96	in^4		

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

F_b=	675	psi
C_D=	1.15	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=	7.00	ft	
K=	1.8		
E_{MIN}'=	400000	psi	
Le=	151.2	in	
R_B=	6.89	<50	OK

F_{bE}=	10108.60	psi
F_b^*=	776.25	psi
F_{bE}/F_b^*=	13.02	
C_L=	1.00	

F_b'=	773.05	psi
f"b=	533.06	psi
f'b/F'b =	0.69	OK
F'v =	161.00	psi
f"v =	60.29	psi
f'v/F'v =	0.37	OK

ΔLL+DL =	5WL4/384EI	
=	0.07	in
L/240 =	0.35	in
ΔLL =	0.04	in
L/480 =	0.18	in

Garag dimension See Plan

Typical Floor Joist: 2X12

Span =	11.50	ft				Pdl =	233.33	lbs
Trib. Area =	0.00	ft (Roof)	1.33	ft (Floor)		Pll=	66.67	lbs
DL =	20.00	psf	15.00	psf		Ll=	2	ft
LL =	25.00	psf	40.00	psf		Lr =	9.50	ft
W =	0.00	plf	73.33	plf		Rl =	247.83	lbs
Use W =	80.00	plf				Rr =	52.17	lbs
V=	707.83	lb				M =	495.65	lb-ft
M=	1818.15	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=	0.79	BEAM STABILITY FACTOR
C_F=	1	SIZE FACTOR
C_{fu}=	1	FLAT USE FACTOR
C_i=	1	INCISING FACTOR
C_r=	1.15	REPETITIVE MEMBER FACTOR

L=	5.75	ft	
K=	1.8		
E_{MIN}'=	470000	psi	
Le=	124.2	in	
R_B=	24.92	<50	OK
F_{bE}=	908.21	psi	
F_b^*=	977.50	psi	
F_{bE}/F_b^*=	0.93		
C_L=	0.79		

F_b'=	767.73	psi
f"b=	689.55	psi
f'b/F'b =	0.90	OK
F'v =	150.00	psi
f"v =	62.92	psi
f'v/F'v =	0.42	OK

ΔLL+DL =	5WL4/384EI	
=	0.16	in
L/240 =	0.58	in
ΔLL =	0.10	in
L/480 =	0.29	in

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B1: 6.75 x 16.5 GLB

Span =	21.00	ft						
Trib. Area =	0.00	ft Roof	12.00	ft Floor		Pdl =	0	lbs
DL =	20.00	psf	15.00	psf		Pll=	0	lbs
LL =	25.00	psf	40.00	psf		Ll=	0	ft
W =	0.00	plf	660.00	plf		Lr =	21.00	ft
Use W =	700.00	plf				Rl =	0.00	lbs
V=	7350.00	lb				Rr =	0.00	lbs
M=	38587.50	lb-ft				M =	0.00	lb-ft

SIZE:	b=	6.75	in	E=	1800000 psi
	d=	16.5	in	Fv=	265 psi
	S=	306.28	in^3		
	A=	111.38	in^2		
	I=	2526.82	in^4		

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

F_b=	2400	psi	
C_D=	1		LOAD DURATION FACTOR
C_M=	1		WET SERVICE FACTOR
Cv=	0.88		Volumn
C_L=	0.97		BEAM STABILITY FACTOR

L=	21.00	ft	
K=	1.83		
E_{MIN}'=	950000	psi	
Le=	461.16	in	
R_B=	12.92	<50	OK
F_{bE}=	6826.17	psi	
F_b^*=	2400.00	psi	
F_{bE}/F_b^*=	2.84		
C_L=	0.97		

F_b'=	2056.57	psi
f"b=	1511.85	psi
f'b/F'b =	0.74	OK
F'v =	265.00	psi
f"v =	98.99	psi
f'v/F'v =	0.37	OK

ΔLL+DL =	5WL4/384EI	
=	0.67	in
L/240 =	1.05	in
ΔLL =	0.46	in
L/480 =	0.53	in

B2: 5.5 x 15 GLB

Span =	16.00	ft						
Trib. Area =	3.50	ft Roof	6.00	ft Floor		Pdl =	0	lbs
DL =	20.00	psf	15.00	psf		Pll=	0	lbs
LL =	25.00	psf	40.00	psf		Ll=	0	ft
W =	157.50	plf	330.00	plf		Lr =	16.00	ft
Use W =	620.00	plf				Rl =	0.00	lbs
V=	4960.00	lb				Rr =	0.00	lbs
M=	19840.00	lb-ft				M =	0.00	lb-ft

SIZE:

b=	5.5	in	E=	1800000	psi
d=	15	in	Fv=	265	psi
S=	206.25	in^3			
A=	82.50	in^2			
I=	1546.88	in^4			

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

F_b=	2400	psi
C_D=	1	LOAD DURATION FACTOR
C_M=	1	WET SERVICE FACTOR
Cv=	0.93	Volumn
C_L=	0.97	BEAM STABILITY FACTOR

L=	16.00	ft	
K=	1.83		
E_{MIN}'=	950000	psi	
Le=	351.36	in	
R_B=	13.20	<50	OK

F_{bE}=	6543.15	psi
F_b*=	2400.00	psi
F_{bE}/F_b*=	2.73	
C_L=	0.97	

F_b'=	2174.07	psi
f"b=	1154.33	psi
f'b/F'b =	0.53	OK
F'v =	265.00	psi
f"v =	90.18	psi
f'v/F'v =	0.34	OK

ΔLL+DL =	5WL4/384EI	
=	0.33	in
L/240 =	0.80	in
ΔLL =	0.17	in
L/480 =	0.40	in

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HD: 4x8

Span =	3.00	ft						
Trib. Area =	3.00	ft Roof	6.00	ft Floor		Pdl =	0	lbs
DL =	20.00	psf	15.00	psf		Pll=	0	lbs
LL =	25.00	psf	40.00	psf		Ll=	0	ft
W =	135.00	plf	330.00	plf		Lr =	3.00	ft
Use W =	600.00	plf				Rl =	0.00	lbs
V=	900.00	lb				Rr =	0.00	lbs
M=	675.00	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	SIZE FACTOR
C_{fu}=	1	FLAT USE FACTOR
C_i=	1	INCISING FACTOR
C_r=	1	REPETITIVE MEMBER FACTOR

L=	3.00	ft	
K=	1.8		
E_{MIN}'=	470000	psi	
Le=	64.8	in	
R_B=	6.19	<50	OK

F_{bE}=	14706.26	psi
F_b*=	850.00	psi
F_{bE}/F_b*=	17.30	
C_L=	1.00	

F_b'=	847.41	psi
f"b=	264.18	psi
f'b/F'b =	0.31	OK
F'v =	150.00	psi
f"v =	53.20	psi
f'v/F'v =	0.35	OK

ΔLL+DL =	5WL4/384EI	
=	0.01	in
L/240 =	0.15	in
ΔLL =	0.00	in
L/480 =	0.08	in

HD 1: 4x12 or 6x12 DF#2

Span =	3.00	ft						
Trib. Area =	3.00	ft Roof	6.00	ft Floor		Pdl =	2600	lbs
DL =	20.00	psf	15.00	psf		Pll=	3250	lbs
LL =	25.00	psf	40.00	psf		Ll=	1	ft
W =	135.00	plf	330.00	plf		Lr =	2.00	ft
Use W =	600.00	plf				Rl =	3900.00	lbs
V=	4800.00	lb				Rr =	1950.00	lbs
M=	4575.00	lb-ft				M =	3900.00	lb-ft

SIZE:	b=	3.5	in	E=	1600000 psi
	d=	11.25	in	Fv=	180 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=	900	psi	
C_D=	1.15		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=	3.00	ft	
K=	1.8		
E_{MIN}'=	580000	psi	
Le=	64.8	in	
R_B=	7.71	<50	OK

F_{bE}=	11695.47	psi
F_b^*=	1035.00	psi
F_{bE}/F_b^*=	11.30	
C_L=	1.00	

F_b'=	1030.03	psi
f"b=	743.62	psi
f'b/F'b =	0.72	OK
F'v =	207.00	psi
f"v =	182.86	psi
f'v/F'v =	0.88	OK

ΔLL+DL =	5WL4/384EI	
=	0.01	in
L/240 =	0.15	in
ΔLL =	0.00	in
L/480 =	0.08	in

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Floor HD 2: 5.5x12 GLB

Span =	7.00	ft				Pdl =	1815	lbs
Trib. Area =	13.00	ft Roof	2.00	ft Floor		Pll=	4840	lbs
DL =	20.00	psf	15.00	psf		Ll=	2.5	ft
LL =	25.00	psf	40.00	psf		Lr =	4.50	ft
W =	585.00	plf	110.00	plf		Rl =	4278.21	lbs
Use W =	850.00	plf				Rr =	2376.79	lbs
V=	7253.21	lb				M =	10695.54	lb-ft
M=	15901.79	lb-ft						

SIZE:	b=	5.5	in	E=	1800000 psi
	d=	12	in	Fv=	265 psi
	S=	132.00	in^3		
	A=	66.00	in^2		
	I=	792.00	in^4		

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

F_b=	2400	psi	
C_D=	1		LOAD DURATION FACTOR
C_M=	1		WET SERVICE FACTOR
Cv=	1.03		Volumn
C_L=	0.99		BEAM STABILITY FACTOR

L=	7.00	ft	
K=	1.83		
E_{MIN}'=	950000	psi	
Le=	153.72	in	
R_B=	7.81	<50	OK

F_{bE}=	18694.70	psi
F_b*=	2400.00	psi
F_{bE}/F_b*=	7.79	
C_L=	0.99	

F_b'=	2463.73	psi
f"b=	1445.62	psi
f'b/F'b =	0.59	OK
F'v =	265.00	psi
f"v =	164.85	psi
f'v/F'v =	0.62	OK

ΔLL+DL =	5WL4/384EI	
=	0.08	in
L/240 =	0.35	in
ΔLL =	0.05	in
L/480 =	0.18	in

4.0 Column and Foundation Design

Column: 6x6

SIZE: b= 5.5 in
d= 5.5 in

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

F_C=	575	psi	COMPRESSION PARALLEL TO GAIN
C_D=	1		LOAD DURATION FACTOR
C_M=	1		WET SERVICE FACTOR
C_t=	1		TEMP. FACTOR
C_F=	1		SIZE FACTOR
C_i=	1		INCISING FACTOR
C_P=	0.856		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*=	575
F_{CE}/FC*=	1.876925
C_P=	0.856

Fc'= 492.38 psi

Allowable P= F'c X A

= 14894 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 GAIN
C_D=	1		LOAD DURATION FACTOR
C_M=	1		WET SERVICE FACTOR
C_t=	1		TEMP. FACTOR
C_F=	1		SIZE FACTOR
C_i=	1		INCISING FACTOR
C_P=	0.356		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*=	1300
F_{CE}/FC^*=	0.395021
C_P=	0.356

Fc'= 462.46 psi

Allowable P= F'c X A

= 5665 lb

Column: 4x6

SIZE: b= 3.5 in
d= 5.5 in

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

F_C=	1300	psi	COMPRESSION PARALLEL TO GAIN
C_D=	1		LOAD DURATION FACTOR
C_M=	1		WET SERVICE FACTOR
C_t=	1		TEMP. FACTOR
C_F=	1		SIZE FACTOR
C_i=	1		INCISING FACTOR
C_P=	0.356		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*=	1300
F_{CE}/FC*=	0.395021
C_P=	0.356

Fc'= 462.46 psi

Allowable P= F'c X A

= 8902 lb

Stud: 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 GAIN
C_D=	1		LOAD DURATION FACTOR
C_M=	1		WET SERVICE FACTOR
C_t=	1		TEMP. FACTOR
C_F=	1		SIZE FACTOR
C_i=	1		INCISING FACTOR
C_P=	0.807		COLUMN STABILITY FACTOR

L=	8.00	ft	
d=	5.5	in	
K=	1		
E_{MIN}'=	440000	psi	
c=	0.8		
Le=	96	in	
Le/d=	17.45	<50	OK

F_{CE}=	1187.155
F_C*=	800
F_{CE}/FC*=	1.483944
C_P=	0.807

Fc'= 645.87 psi

Allowable P= F'c X A

= 3390.81 lb

Stud: 2x6

SIZE: b= 1.5 in
d= 5.5 in

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

F_C=	800	psi	COMPRESSION PARALLEL TO GAIN
C_D=	1		LOAD DURATION FACTOR
C_M=	1		WET SERVICE FACTOR
C_t=	1		TEMP. FACTOR
C_F=	1		SIZE FACTOR
C_i=	1		INCISING FACTOR
C_P=	0.807		COLUMN STABILITY FACTOR

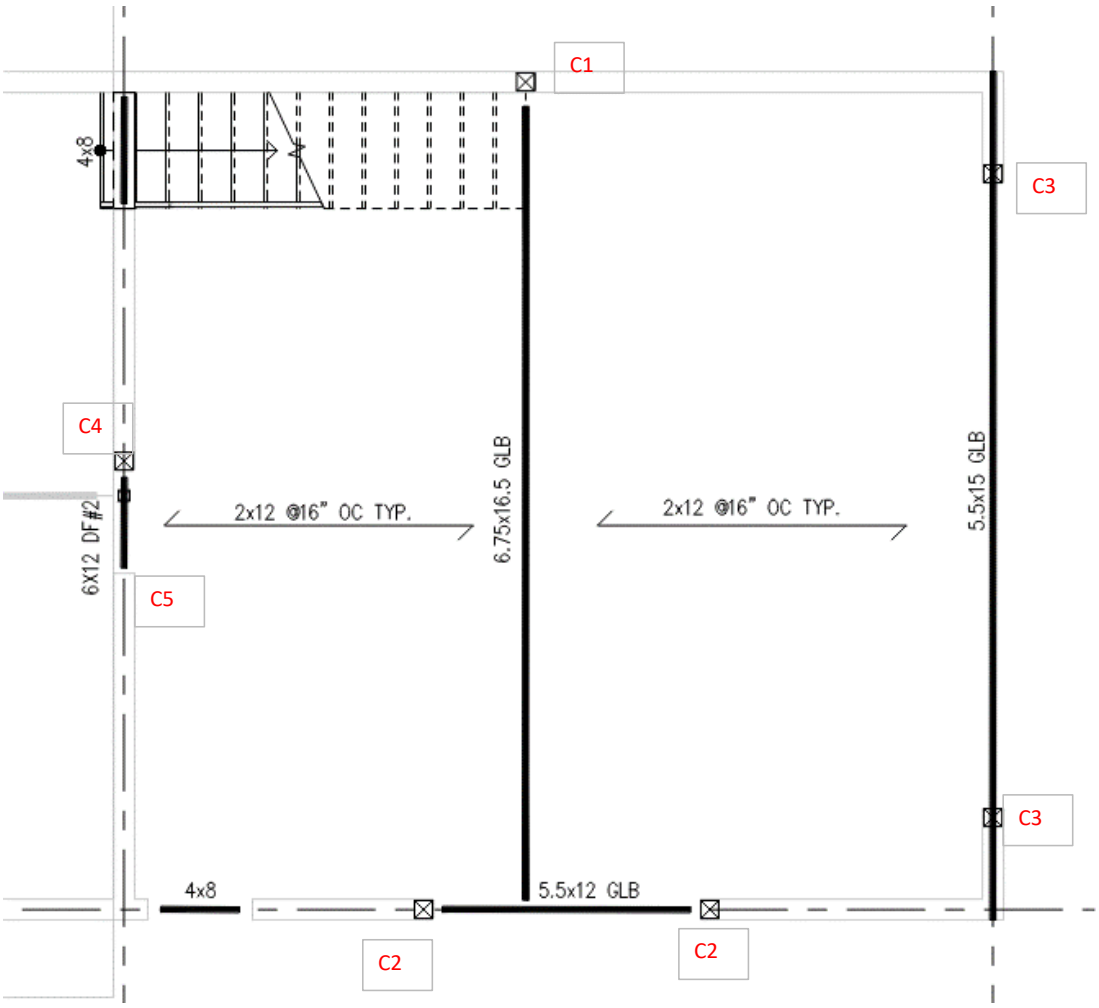
L=	8.00	ft	
d=	5.5	in	
K=	1		
E_{MIN}'=	440000	psi	
c=	0.8		
Le=	96	in	
Le/d=	17.45	<50	OK

F_{CE}=	1187.155
F_C*=	800
F_{CE}/FC*=	1.483944
C_P=	0.807

Fc'= 645.87 psi

Allowable P= F'c X A

= 5328.42 lb



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Column Load:

Roof:	psf	Floor:	psf
DL=	20	DL =	15
LL =	25	LL =	40
Sum =	45		55

Assumed allowable Soil Bearing = 1500 psf

C1	Roof load =	2048	lbs	
	Floor Load =	7260	lbs	
	Total Load =	9308	lbs	
	Req'd FTG size =	6.2	sqft	
	Use sq FTG =	3.0	ft	
	FTG area =	9.0	sqft	
	use Col =	6x6		
C2	Beam Load =	7253	lbs	Floor HD 2: 5.5x12 GLB
	Additional Load =	0	lbs	
	Total Load =	7253	lbs	
	Req'd FTG size =	4.8	sqft	
	Use sq FTG =	2.5	ft	
	FTG area =	6.3	sqft	
	use Col =	4x6 col or 6x6 or (2) 2x6		
C3	Beam Load =	4960	lbs	B2: 5.5 x 15 GLB
	Additional Load =	0	lbs	
	Total Load =	4960	lbs	
	Req'd FTG size =	3.3	sqft	
	Use sq FTG =	2.5	ft	
	FTG area =	6.3	sqft	
	use Col =	(2) 2x		
C4	Beam Load =	4800	lbs	HD 1: 4x12 or 6x12 DF#2
	Additional Load =	0	lbs	
	Total Load =	4800	lbs	
	Req'd FTG size =	3.2	sqft	
	Use sq FTG =	2.0	ft	
	FTG area =	4.0	sqft	
	use Col =	4x6 col or 6x6		
C5	Beam Load =	2850	lbs	HD 1: 4x12 or 6x12 DF#2
	Additional Load =	0	lbs	
	Total Load =	2850	lbs	
	Req'd FTG size =	1.9	sqft	
	Use sq FTG =	Existing Wall FTG		
	FTG area =	2.2	sqft	
	use Col =	(1) 2x		

5.0 Lateral Analysis

Dead Load: (only at the timber framing Area)

Roof DL	**20.00**	**PSF**
Floor DL	**15.00**	**PSF**
IntWall	**10.00**	**PSF**
Ext Wall	**15.00**	**PSF**

Roof

Diaphragm Area:		690.00	sq. ft.
Height of Diaphragm:		9.00	ft
	Weight of Diaphragm:	13800.00	lbs
Wall Weights Below:			
Wall Height:		8.00	ft
Concrete Wall Lengths:		0.00	lf
Int wall Wall Lengths:		0.00	lf
Ext Wall Perimeter:		88.00	lf
Concrete Wall Weight:		150.00	psf
Int Wall Weight:		10.00	psf
Ext Wall Wall Weight:		15.00	psf
	Weight of Walls Below:	5280.00	lbs
	Seismic Weight at Roof:	**19080.00**	**lbs**

Main Floor

Diaphragm Area:		500.00	sq. ft.
Height of Diaphragm:		9.00	ft
	Weight of Diaphragm:	7500.00	lbs
Wall Weights Below:			
Wall Height:		8.00	ft
Concrete Wall Lengths:		0.00	lf
Int wall Wall Lengths:		8.00	lf
Ext Wall Perimeter:		88.00	lf
Concrete Wall Weight:		150.00	psf
Int Wall Weight:		10.00	psf
Ext Wall Wall Weight:		15.00	psf
	Weight of Walls Below:	5600.00	lbs
	Seismic Weight at Floor:	**18380.00**	**lbs**

Base Shear:

V= CS*w
CS = SDS / (R/Ie)
SDS = 1.172
R(N-S) = 6.5
R(E-W) = 6.5
V = 6.75 kips
$0.7V_E$ = 4.73 kips

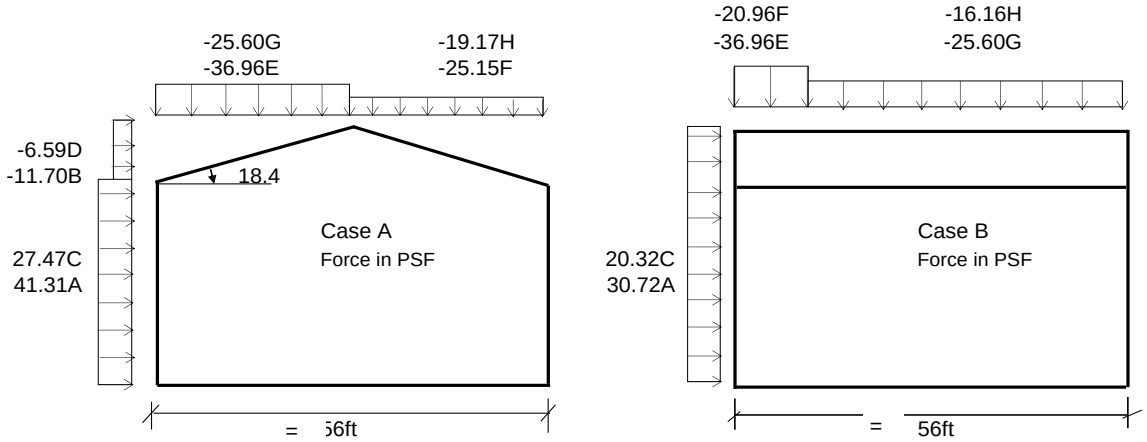
Seismic Loads

Floor	Seismic Weight	Height	W*h	w*h/Σw*h	V
Roof	19.08 kips	21.50 ft	410.22	0.64	**4.33 kips**
Main	18.38 kips	12.50 ft	229.75	0.36	**2.42 kips**
	37.46 kips		639.97		

	$0.7V_E$ (Kips)
Roof	3.03
Main	1.70
	4.73

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

Roof Height h =	20	feet	
Roof Pitch =	4.00	:12	= 18.43 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} =	1.60		26.8, Figure 26.8-1
Exposure	B		
Height Adjustment factor λ =	1		Fig 28.6-1



Plus and minus signs signify pressures acting toward and away from projected surfaces, respectively.
For Case B use Θ = 0°
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 bot less than either 4% of least horizontal dimention or 3ft.

10 % of least dimension=	5.6 ft	⇐
40 % of the eave height =	8.0 ft	
4 % of least dimension or 3 ft=	3.0 ft	

	Section	Wind pressure	Area (sqft)	Wind force (kips)
	B	11.7	59.36	0.69
	D	6.6	47.64	0.31
	A	41.3	50.4	2.08
Roof	C	27.5	52.6	1.44
	A	41.3	106.4	4.40
Main	C	27.5	108.6	2.98
			Sum W =	11.91
			0.6W =	7.15

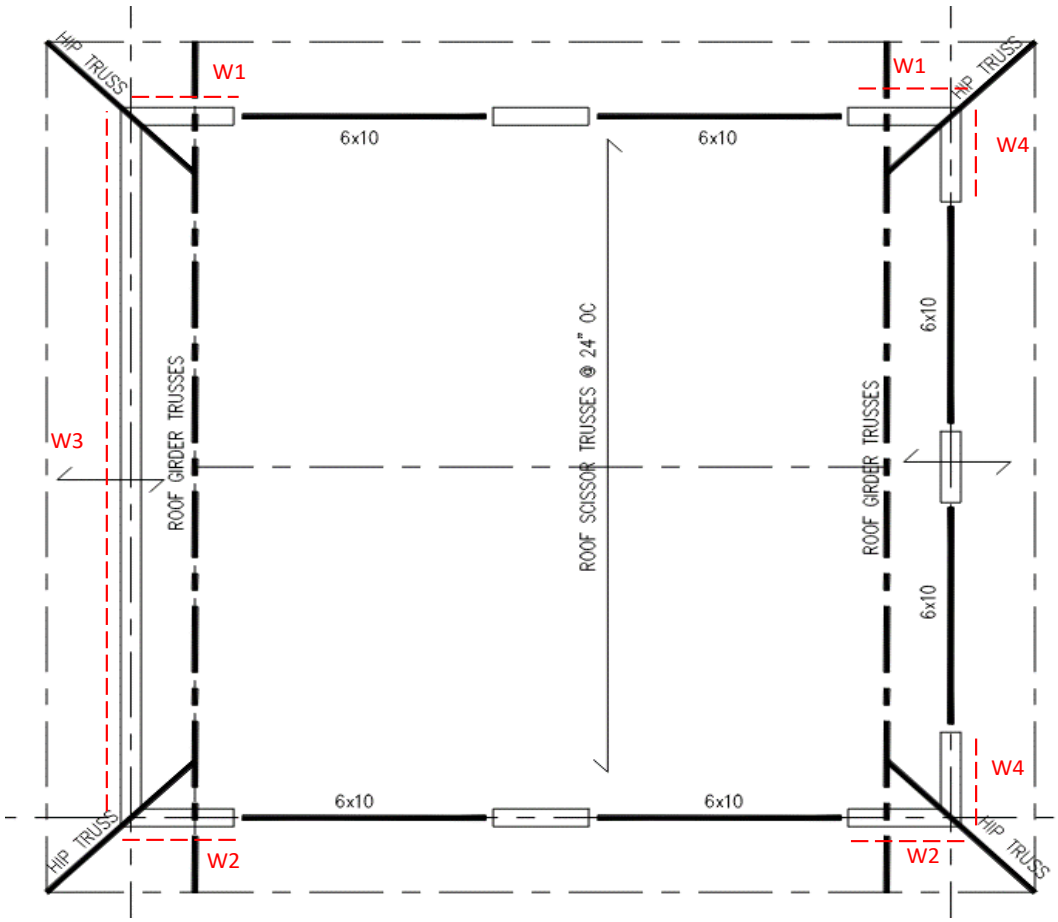
	$0.6V_w$ (Kips)
Roof	2.72
Main	4.43

Wind Area -CASE A

	Section	Wind pressure	Area (sqft)	Wind force (kips)
	A	30.7	109.2	3.35
Roof	C	20.3	57.8	1.17
	A	30.7	106.4	3.27
Main	C	20.3	103.6	2.11
			Sum W =	9.90
			0.6W =	5.94

	$0.6V_w$ (Kips)
Roof	2.72
Main	3.22

Wind Area - CASE B



Roof: **Max diaph shear =** 75.77 plf

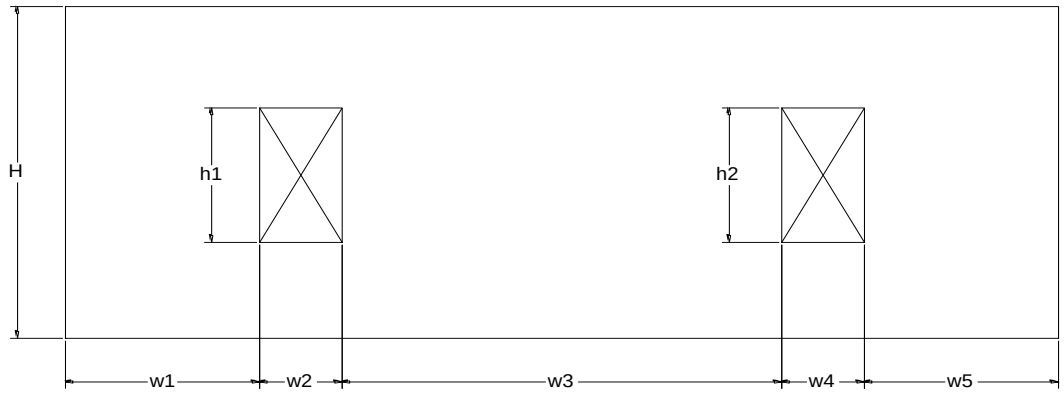
V = **3.03 kips**

v = **4.39 psf**

Shear Line	H(ft)	Trib (ft2)	Shear (lbs)	Wall	Wall Shear
W1	9	345	1515	**8.5 ft**	**178 plf**
W2	9	345	1515	**8.5 ft**	**178 plf**
W3	9	345	1515	**22.0 ft**	**69 plf**
W4	9	345	758	**2.8 ft**	**271 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	8.50 ft	195 plf	-349	492 plf	NA	D	560.0 plf	0.88
W2	8.50 ft	195 plf	-349	492 plf	NA	D	560.0 plf	0.88
W3	22.00 ft	195 plf	-667	69 plf	NA	A	230.0 plf	0.30
W4	2.80 ft	195 plf	2272	271 plf	MST48	B	380.0 plf	0.71



Inputs: W1 and W2 Roof

Load to Shear Line =	1515 lbs	
Controlling Load Case =	Seismic	
H =	9.00 ft	
h1 =	5.00 ft	
h2 =	5.00 ft	
Max Opening Height =	5.00 ft	
Full Height Sheathing =	38.05%	
C_o =	0.62	NDS Table 4.3.3.5

Wall Pier Inputs

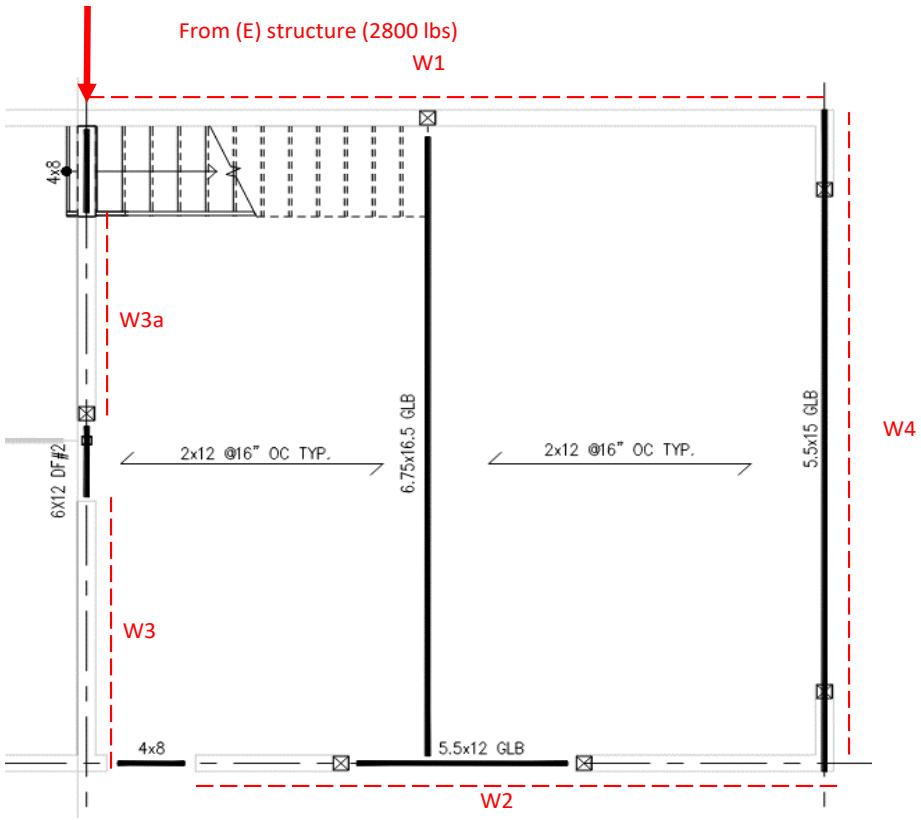
		Aspect Ratio	
w1 =	3.00 ft	3.00 : 1	***Pier 1***
w2 =	7.00 ft		
w3 =	2.60 ft	3.50 : 1	***Pier 2***
w4 =	7.00 ft		
w5 =	3.00 ft	3.00 : 1	***Pier 3***
TOTAL =	22.60 ft		

Results

Wall Pier	Aspect Ratio	Co	**Req'd Shear Strength**
Pier 1	0.67	0.62	**426 plf**
Pier 2	0.58	0.62	**492 plf**
Pier 3	0.67	0.62	**426 plf**

Results - Overturning

Uniform DL =	195 plf	
Overturning Moment =	13638 lbs-ft	
Resisting Moment (0.6D) =	29879 lbs-ft	
Tension =	-349 lbs	No HD Req'd
Use Type a Shear Wall allowable Shear =	492 plf	



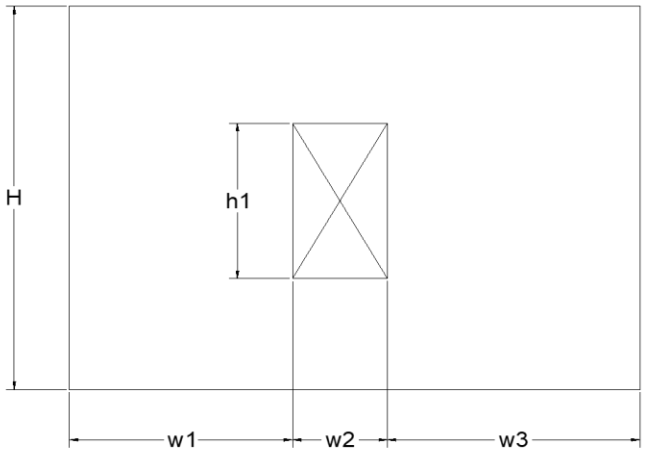
H		Roof	Main
7.75	Shear, V=	**3.03 kips**	**4.43 kips**
10		**3.03 kips**	**4.43 kips**
3.5			

Max Diaph Shear = 201 plf

		Roof		Main		
Shear Line	H(ft)	Shear (lbs)	H(ft)	Shear (lbs)	Wall L (ft)	Wall V (plf)
W1	9	1515	8	2213	20.0	**186.8**
W2	9	1515	8	2213	12.0	**311.4**
W3	9	758	8	2545	6.8	**490.5**
W4	9	1130	8	2213	5.6	**598.5**

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

Wall	Wall Length	W(DL)	Total Tension(0.6D)	Shear Strength	HD	Allowable Shear Wall	Allowable Shear	RATIO
W1	20.00 ft	545 plf	-1097	187 plf	NA	B	380.0 plf	0.49
W2	12.00 ft	545 plf	-350	374 plf	NA	B	380.0 plf	0.99
W3	6.75 ft	435 plf	4044	491 plf	HDU5	D	560.0 plf	0.88
W4	See Portal Frame							



Inputs: W2

Total Load to Shearwall =	3729 lbs		
Controlling Load Case =	Wind		
H =	8.00 ft		
h1 =	4.00 ft		
Full Height Sheathing =	63.16%		
C_o =	0.83		NDS Table 4.3.3.5

Wall Pier Inputs

		Aspect Ratio	
w1 =	4.50 ft	1.80 : 1	***Pier 1***
w2 =	7.00 ft		
w3 =	7.50 ft	1.10 : 1	***Pier 2***
TOTAL =	19.00 ft		

Results

Wall Pier	Aspect Ratio	C_o	**Req'd Shear Strength**
Pier 1	N/A	0.83	**374 plf**
Pier 2	N/A	0.83	**374 plf**

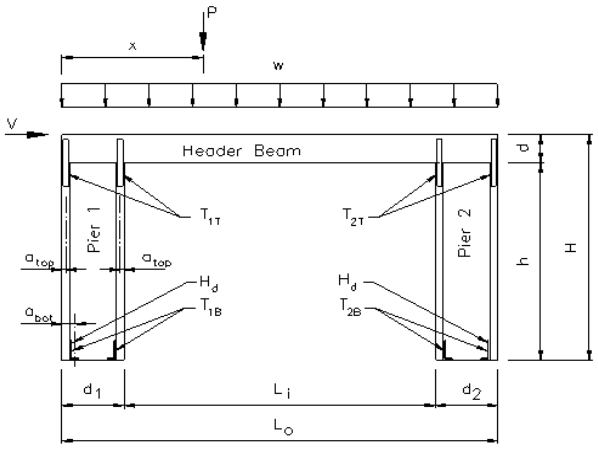
Results - Overturning

Uniform DL =	545 plf
Overturning Moment Above =	25761 lbs-ft
Total Overturning Moment =	43468 lbs-ft
Resisting Moment Above =	0 lb-ft
Total Resisting Moment (0.6D) =	59024 lbs-ft
Tension =	-350 lbs
Wall Shear =	374 plf

W4 PORTAL FRAME

V1 =	1130	lbs									
V2 =	2213	lbs	h =	6.75	ft	Tension Strap Forces					
Lateral load =	W	(E or W)	**v =**	**590**	plf	**T_{1t} =**	**4333**	lbs			
w =	0	plf	L_o =	21.6667	ft	**T_{2t} =**	**4333**	lbs			
P =	0	lbs	M_{ot} =	36916.3	lb-ft						
at x =	0	ft	Factor =	0.66667					Glulam Beam		
d_1 =	34	in	M_{res} =	4087.11	lb-ft	V_{1t} =	3029	lbs	SHEAR =	4333	
d_2 =	34	in	M_1 =	11283.9	lb-ft	M_{1t} =	7888	lb-ft	MOMENT =	11283	
L_i =	16	ft	M_2 =	11283.9	lb-ft	V_{2t} =	4333	lbs	b =	5.500	
H1 =	17	ft				M_{2t} =	11283	lb-ft	d =	15.00	
H2 =	8	ft	T_{1b} =	0	lbs				S =	206.25	
d =	15	in	T_{2b} =	0	lbs				I =	1546.88	
a_{top} =	2.75	in	R_1 =	3029.27	lbs	Holdown Required			A =	82.50	
a_{bot} =	8.5	in	R_2 =	5531.29	lbs	Hd =	1515.2	lbs	**fb =**	**656.47**	
Stud depth =	5.5	in	Pier thickness =	5.969	in				**fv =**	**78.78**	
Pier chord width =	5.5	in	Pier chord area =	30.25	in^2				C_F =	0.98	
Fixed bottom	N	(Y or N)	I_1 =	13973	in^4	Shearwalls			C_D =	1.60	
Plywood both sides =	N	(Y or N)	I_2 =	13973	in^4	v =	590	plf	Fb =	2400.00	
E of plywood =	1600	ksi	R =	0	lbs	Pier defl. =	0.255	in	Fv =	265.00	
Thickness of plywood =	0.469	in							**F'b =**	**3745.96**	**OK**
									F'v =	**424.00**	**OK**

The pier chord is the end element usually a double or triple 2x6 or a 4x6 or 6x6.
Pier deflection takes nail slippage into account based on UBC (Vol. 3), Section 23.223 **5.5 x 15 24F-V8 GLB**



GARAGE FRAME SECTION
NOT TO SCALE