

# Stephen Tapp

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## Additional Structural Calculations

for

### Petrie New Residence

2431 60<sup>th</sup> Avenue SE  
Mercer Island, Washington 98040



**Date: June 2021**  
**Project: T20B3**  
**Building Code Reference: 2015 IBC**

Shear Wall Analysis

Job : Petrie Residence  
 Architect: Leif Anderson  
 Job #: T20B3  
 Date: Feb-20

Wind Loading Only

House  
 Rev. 6.16.21

Level: Upper Roof Diaphragm  
 Direction: Side - Side  
 Vseismic @ Level=  
 Vseismic total=  
 Vseismic with redundancy=  
 Total Load to be resolved (#)= 8624.7

Grid	2.1	2.7	5					
Span(FT.)	19.9	21.17						
Wind load(#/LF)	210	210	210					
Seismic load(#/LF)	0	0	0	0	0	0	0	0

Load#1(LB)  
 Load#2(LB)  
 Load#3(LB)

P(wind+L1,L2,L3)=	2089.5	4312.35	2222.85	0	0	0	0	0
P(seismic+L1,L2,L3)=	0	0	0	0	0	0	0	0

Wall Length(FT.)	10.95	20.5	6.22					
Unit Shear(#/LF)	190.8219	210.3585	357.3714	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	<del>P1-8"</del>	P1-6"	P1-4"					

(USE P1-4")  
 ASPECT RATIO

Area Ab(sq.ft.)								
shear ratio r=	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Section Length(FT)	2.5	9.6	3.11					
Panel Height(FT)	8	9	9					
(M)from upper level	0	0	0					
OTM(#)	3816.438	18174.98	10002.83	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Panel Length(LF)	2.5	9.6	3.11					
Panel Wt.(#/LF)	135	135	135					
Wt. on Panel(#/LF)	100	100	100					
Reduction(%)	40	40	40	40	40	40	40	40
RM(#)	-440.625	-6497.28	-681.883	0	0	0	0	0

Resultant(#)	3375.813	11677.7	9599.052	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel Edge(#)	1350.325	1216.427	3086.512	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Simpson' Restraint	cmstc16 strap	cmstc16 strap	cmstc16 strap
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Shear Wall Analysis

Job : Petrie Residence  
 Architect: Leif Anderson  
 Job #: T20B3  
 Date: Feb-20

Wind Loading Only  
 House

Level: Upper Roof Diaphragm  
 Direction: Side - Side  
 Vseismic @ Level=  
 Vseismic total=  
 Vseismic with redundancy=  
 Total Load to be resolved (#)= 8624.7

Grid	2.1	2.7	5						
Span(FT.)	19.9	21.17							
Wind load(#/LF)	210	210	210						
Seismic load(#/LF)	0	0	0	0	0	0	0	0	0

Load#1(LB)  
 Load#2(LB)  
 Load#3(LB)

P(wind+L1,L2,L3)=	2089.5	4312.35	2222.85	0	0	0	0	0	0
P(seismic+L1,L2,L3)=	0	0	0	0	0	0	0	0	0

Wall Length(FT.)	10.95	20.5	6.22						
Unit Shear(#/LF)	190.8219	210.3585	357.3714	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-6"	P1-4"						

P1-4"

Area Ab(sq.ft.)									
shear ratio r=	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Section Length(FT)	2.78	9.6	3.11						
Panel Height(FT)	7	9	9						
(M)from upper level	0	0	0						
OTM(#)	3713.395	18174.98	10002.83	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Panel Length(LF)	2.78	9.6	3.11						
Panel Wt. (#/LF)	135	135	135						
Wt. on Panel(#/LF)	100	100	100						
Reduction(%)	40	40	40	40	40	40	40	40	40
RM(#)	-544.8522	-6497.28	-681.883	0	0	0	0	0	0

Resultant(#)	3168.542	11677.7	9599.052	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel Edge(#)	1139.763	1216.427	3086.512	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Simpson' cmstc16 cmstc16 cmstc16  
 Restraint strap strap strap

Shear Wall Analysis

Job : Petrie Residence  
 Architect: Leif Anderson  
 Job #: T20B3  
 Date: Feb-20

Wind Loading Only

Garage

Level: Upper Roof Diaphragm  
 Direction: Side - Side  
 Vseismic @ Level=  
 Vseismic total=  
 Vseismic with redundancy=  
 Total Load to be resolved (#)= 4200

Grid ~~C~~ ~~A-1~~ ~~A-2~~  
 Span(FT.) 24  
 Wind load(#/LF) 175 175  
 Seismic load(#/LF) 0 0 0 0 0 0 0 0

Load#1(LB)  
 Load#2(LB)  
 Load#3(LB)

P(wind+L1,L2,L3)= 2100 2100 0 0 0 0 0 0  
 P(seismic+L1,L2,L3)= 0 0 0 0 0 0 0 0

Wall Length(FT.) 8.16 20  
 Unit Shear(#/LF) 257.3529 105 #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!  
 Wall Type P1-6" P1-6"

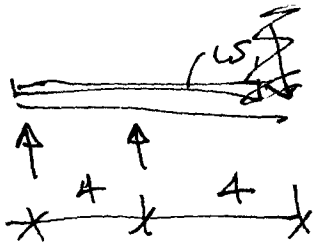
Area Ab(sq.ft.)  
 shear ratio r= #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!  
 Redundancy factor #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!

Section Length(FT) 2.11 10  
 Panel Height(FT) 6.7 9  
 (M)from upper level 0 0  
 OTM(#) 3638.199 9450 #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!

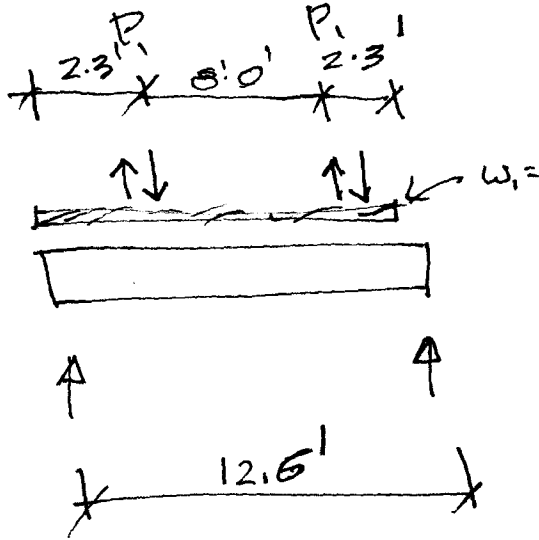
Panel Length(LF) 2.11 10  
 Panel Wt.(#/LF) 122 135  
 Wt. on Panel(#/LF) 100 100  
 Reduction(%) 40 40 40 40 40 40 40 40  
 RM(#) -296.5099 -7050 0 0 0 0 0 0

Resultant(#) 3341.689 2400 #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!  
 Uplift @ Panel 1583.739 240 #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!  
 Edge(#)

Simpson' cmstc16 n/a  
 Restraint strap



$$w_1 = \frac{DL}{.015} + \frac{LL}{.065}$$



	<u>DL</u>	<u>LL</u>	<u>W</u>
$w_1$	R .09	.15	
	W .12		
	<u>0.12 PLF</u>	<u>.24 PLF</u>	
	<u>.33 PLF</u>	<u>.41</u>	
$P_1$			1.6 ←

Petrie ADU

Mercer Island, Washington

0  
0  
0

Project Title: Petrie Residence

Engineer: STT

Project ID:

Project Descr: New Residence

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**Wood Beam**

Lic. #: KW-06011595

Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24

stephen tapp architect/pe

**DESCRIPTION** Transfer beam at garage

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

Load Combination Set : ASCE 7-05

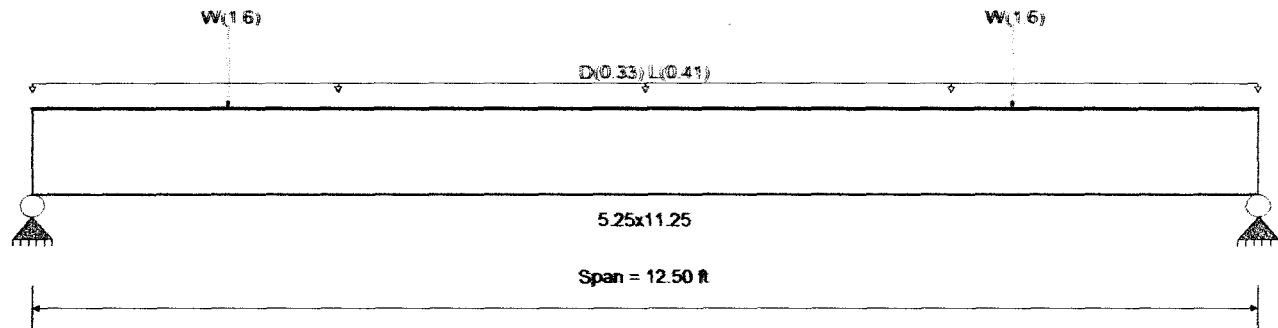
**Material Properties**

Analysis Method: Allowable Stress Design  
Load Combination: ASCE 7-05

Fb +	2900 psi	E : Modulus of Elasticity	
Fb -	2900 psi	Ebend- xx	2000 ksi
Fc - Prtl	2900 psi	Eminbend - x	1016.535 ksi
Fc - Perp	625 psi		
Fv	290 psi		
Ft	2025 psi	Density	45.07 pcf

Wood Species: Trus Joist  
Wood Grade: Parallam PSL 2.0E

Beam Bracing: Beam is Fully Braced against lateral-torsional buckling



**Applied Loads**

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

Uniform Load : D = 0.330, L = 0.410, Tributary Width = 1.0 ft

Point Load : W = 1.60 k @ 2.0 ft

Point Load : W = 1.60 k @ 10.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	0.540 : 1	Maximum Shear Stress Ratio =	0.346 : 1
Section used for this span	<b>5.25x11.25</b>	Section used for this span	<b>5.25x11.25</b>
fb: Actual =	1,566.14 psi	fv: Actual =	100.31 psi
Fb: Allowable =	2,900.00 psi	Fv: Allowable =	290.00 psi
Load Combination	+D+L+H	Load Combination	+D+L+H
Location of maximum on span =	6.250 ft	Location of maximum on span =	11.588 ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.182 in Ratio =	824 >= 360	
Max Upward Transient Deflection	0.000 in Ratio =	0 < 360	
Max Downward Total Deflection	0.353 in Ratio =	424 >= 180	
Max Upward Total Deflection	0.000 in Ratio =	0 < 180	

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>FN</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v	
D Only																		
Length = 12.50 ft	1	0.268	0.171	0.90	1.000	1.00	1.00	1.00	1.00	1.00	6.45	698.41	2610.00	0.00	0.00	0.00	0.00	0.00
+D+L+H																		
Length = 12.50 ft	1	0.540	0.346	1.00	1.000	1.00	1.00	1.00	1.00	1.00	14.45	1,566.14	2900.00	0.00	0.00	0.00	0.00	0.00
+D+Lr+H																		
Length = 12.50 ft	1	0.193	0.123	1.25	1.000	1.00	1.00	1.00	1.00	1.00	6.45	698.41	3625.00	0.00	0.00	0.00	0.00	0.00
+D+S+H																		
Length = 12.50 ft	1	0.209	0.134	1.15	1.000	1.00	1.00	1.00	1.00	1.00	6.45	698.41	3335.00	0.00	0.00	0.00	0.00	0.00
+D+0.750Lr+0.750L+H																		
Length = 12.50 ft	1	0.372	0.238	1.25	1.000	1.00	1.00	1.00	1.00	1.00	12.45	1,349.21	3625.00	0.00	0.00	0.00	0.00	0.00
+D+0.750L+0.750S+H																		
Length = 12.50 ft	1	0.405	0.259	1.15	1.000	1.00	1.00	1.00	1.00	1.00	12.45	1,349.21	3335.00	0.00	0.00	0.00	0.00	0.00

Petrie ADU  
 Mercer Island, Washington  
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 0  
 0

Project Title: Petrie Residence  
 Engineer: STT  
 Project ID:  
 Project Descr: New Residence

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**Wood Beam**

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Lic. # KW-06011595

stephen tapp architect/pe

**DESCRIPTIO** Transfer beam at garage

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>FN</sub>	C <sub>i</sub>	C <sub>T</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
+D+W+H	Length = 12.50 ft	1	0.235	0.187	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10.05	1,089.18	4640.00	0.00	0.00	0.00	3.43	86.99	464.00
+D+0.70E+H	Length = 12.50 ft	1	0.151	0.096	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.45	698.41	4640.00	0.00	0.00	0.00	1.76	44.73	464.00
+D+0.750Lr+0.750L+0.750W-	Length = 12.50 ft	1	0.354	0.255	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	15.15	1,641.96	4640.00	0.00	0.00	0.00	4.65	118.11	464.00
+D+0.750L+0.750S+0.750W+	Length = 12.50 ft	1	0.354	0.255	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	15.15	1,641.96	4640.00	0.00	0.00	0.00	4.65	118.11	464.00
+D+0.750Lr+0.750L+0.5250E	Length = 12.50 ft	1	0.291	0.186	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.45	1,349.21	4640.00	0.00	0.00	0.00	3.40	86.42	464.00
+D+0.750L+0.750S+0.5250E-	Length = 12.50 ft	1	0.291	0.186	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.45	1,349.21	4640.00	0.00	0.00	0.00	3.40	86.42	464.00
+0.60D+W+H	Length = 12.50 ft	1	0.175	0.149	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.48	810.26	4640.00	0.00	0.00	0.00	2.72	69.10	464.00
+0.60D+0.70E+H	Length = 12.50 ft	1	0.090	0.058	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.87	419.05	4640.00	0.00	0.00	0.00	1.06	26.84	464.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.750W+H	1	0.3530	6.296		0.0000	0.000

**Maximum Deflections for Load Combinations**

Load Combination	Span	Max. Downward Defl	Location in Span	Max. Upward Defl	Location in Span
D Only	1	0.1464	in 6.296 ft	0.0000	in 0.000 ft
+D+L+H	1	0.3282	in 6.296 ft	0.0000	in 0.000 ft
+D+Lr+H	1	0.1464	in 6.296 ft	0.0000	in 0.000 ft
+D+S+H	1	0.1464	in 6.296 ft	0.0000	in 0.000 ft
+D+0.750Lr+0.750L+H	1	0.2827	in 6.296 ft	0.0000	in 0.000 ft
+D+0.750L+0.750S+H	1	0.2827	in 6.296 ft	0.0000	in 0.000 ft
+D+W+H	1	0.2401	in 6.296 ft	0.0000	in 0.000 ft
+D+0.70E+H	1	0.1464	in 6.296 ft	0.0000	in 0.000 ft
+D+0.750Lr+0.750L+0.750W+H	1	0.3530	in 6.296 ft	0.0000	in 0.000 ft
+D+0.750L+0.750S+0.750W+H	1	0.3530	in 6.296 ft	0.0000	in 0.000 ft
+D+0.750Lr+0.750L+0.5250E+H	1	0.2827	in 6.296 ft	0.0000	in 0.000 ft
+D+0.750L+0.750S+0.5250E+H	1	0.2827	in 6.296 ft	0.0000	in 0.000 ft
+0.60D+W+H	1	0.1816	in 6.296 ft	0.0000	in 0.000 ft
+0.60D+0.70E+H	1	0.0878	in 6.296 ft	0.0000	in 0.000 ft
D Only	1	0.1464	in 6.296 ft	0.0000	in 0.000 ft
L Only	1	0.1818	in 6.296 ft	0.0000	in 0.000 ft
W Only	1	0.0937	in 6.341 ft	0.0000	in 0.000 ft

**Vertical Reactions**

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	5.232	5.136
Overall MINimum	1.664	1.536
D Only	2.063	2.063
+D+L+H	4.625	4.625
+D+Lr+H	2.063	2.063
+D+S+H	2.063	2.063
+D+0.750Lr+0.750L+H	3.984	3.984
+D+0.750L+0.750S+H	3.984	3.984
+D+W+H	3.727	3.599
+D+0.70E+H	2.063	2.063
+D+0.750Lr+0.750L+0.750W+H	5.232	5.136
+D+0.750L+0.750S+0.750W+H	5.232	5.136
+D+0.750Lr+0.750L+0.5250E+H	3.984	3.984
+D+0.750L+0.750S+0.5250E+H	3.984	3.984
+0.60D+W+H	2.902	2.774
+0.60D+0.70E+H	1.238	1.238
D Only	2.063	2.063
L Only	2.563	2.563