

**Structural Calculations**

for

**ADDITIONS & ALTERATIONS**

**Pierce Residence**

5635 84th Ave SE

Mercer Island, WA 98040

*1ST PLAN CHECK RESPONSE*

prepared by:

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Job No. 21031

Date: 7/5/22



NOT EXPLICITLY CALLED  
HEREIN

REVISED FRAMING

NOTE: ALL ELEMENTS WITH REVISED  
LOADING ESTIM HAVE DECREASED  
LOADING OR ALL OTHERWISE OK  
BY INSPECTION

(UF811) UPPER FLOOR BEAM

SPAN = 10'-6"

$$w = \frac{\text{ROOF}}{OC} \left( \frac{13+20+25}{2} \right) \left( \frac{11'}{2} \right) + \frac{\text{WALL}}{OC} (10') + \frac{\text{UF}}{OC} \left( \frac{13+10}{2} \right) \left( \frac{9'}{2} \right)$$

USE 5 1/4 x 9 1/4 GLB =  $\frac{210}{OC} + \frac{110}{MC} + \frac{140}{SC} + \frac{180}{U}$  #7A

(UF810) UPPER FLOOR BEAM

SPAN = 13'-6"

$$w_1 = \frac{\text{OD ext}}{OC} \left( \frac{13+20+25}{2} \right) \left( \frac{9'}{2} \right) = \frac{60}{OC} + \frac{90}{MC} + \frac{110}{SC} \#7A$$

USE 5 1/2 x 10 1/2 GLB

$$w_2 = \frac{\text{WALL}}{OC} (10') + \frac{\text{ATTIC}}{OC} \left( \frac{6+20}{2} \right) \left( \frac{10'}{2} \right) = \frac{130}{OC} + \frac{100}{U} \#7A \text{ (amped)}$$

$$P_2 = \frac{\text{ROOF}}{OC} \left( \frac{13+20+25}{2} \right) \left( \frac{12'}{2} \right) \left( \frac{11'}{2} \right) = \frac{430}{OC} + \frac{660}{MC} + \frac{830}{SC} \#8$$

$$P_1 = \frac{1100}{OC} + \frac{580}{MC} + \frac{740}{SC} + \frac{950}{U} \#8 \text{ ex} = 4'-3" \text{ (UF811)}$$

(UF809) UPPER FLOOR BEAM

SPAN = 5'-3"

$$P_1 = \frac{1100}{OC} + \frac{580}{MC} + \frac{740}{SC} + \frac{950}{U} \#8 \text{ ex} = 4'-0"$$

USE 3 1/2 x 9 1/4 GLB

$$P_2 = \frac{\text{ROOF}}{OC} \left( \frac{13+20+25}{2} \right) \left( \frac{36'}{2} \right) \left( \frac{11'}{2} \right) + \frac{\text{ATTIC}}{OC} \left( \frac{6+20}{2} \right) \left( \frac{25'}{2} \right) \left( \frac{9'}{2} \right)$$

$$= \frac{1620}{OC} + \frac{1480}{MC} + \frac{2480}{SC} + \frac{1130}{U} \#8 \text{ ex} = 4'-0"$$

**Multiple Simple Beam**

Project File: 21031\_Pierce.ec6

LIC#: KW-06018000, Build:20.22.5.16

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**Description :** PCR1 Revised Framing

**Wood Beam Design :** UFB11 - Upper Floor Beam

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

**BEAM Size :** 5.25x9.25, Parallam PSL, Fully Braced

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : Parallam PSL 2.2E

Fb - Tension 2,900.0 psi Fc - Prll 2,900.0 psi Fv 290.0 psi Ebend- xx 2,200.0 ksi Density 45.070 pcf  
 Fb - Compr 2,900.0 psi Fc - Perp 750.0 psi Ft 2,025.0 psi Eminbend - xx 1,118.19 ksi

**Applied Loads**

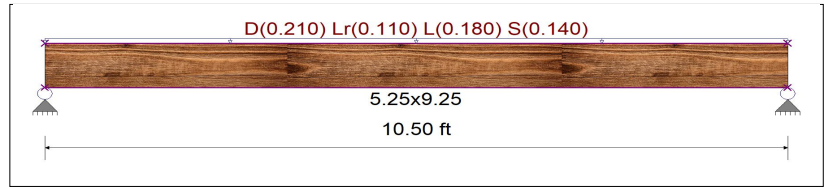
Unif Load: D = 0.210, Lr = 0.110, L = 0.180, S = 0.140 k/ft, Trib= 1.0 ft

**Design Summary**

Max fb/Fb Ratio = **0.298** : 1  
 fb : Actual : 994.01 psi at 5.250 ft in Span # 1  
 Fb : Allowable : 3,335.00 psi  
 Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.219** : 1  
 fv : Actual : 72.97 psi at 0.000 ft in Span # 1  
 Fv : Allowable : 333.50 psi  
 Load Comb : +D+0.750L+0.750S

Max Reactions (k) D Lr L S W E H  
 Left Support 1.10 0.58 0.95 0.74  
 Right Support 1.10 0.58 0.95 0.74



**Max Deflections**

Transient Downward	0.065 in	Total Downward	0.141 in
Ratio	1939	Ratio	895
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

**Wood Beam Design :** UFB10 - Upper Floor Beam

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

**BEAM Size :** 5.5x10.5, GLB, Fully Braced

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : DF/DF

Wood Grade : 24F-V8

Fb - Tension 2400 psi Fc - Prll 1650 psi Fv 265 psi Ebend- xx 1800 ksi Density 31.21 pcf  
 Fb - Compr 2400 psi Fc - Perp 650 psi Ft 1100 psi Eminbend - xx 950 ksi

**Applied Loads**

Unif Load: D = 0.060, Lr = 0.090, S = 0.110 k/ft, Trib= 1.0 ft

Unif Load: D = 0.130, L = 0.10 k/ft, 0.0 to 9.250 ft, Trib= 1.0 ft

1Point: D = 1.10, Lr = 0.580, L = 0.950, S = 0.740 k @ 9.250 ft

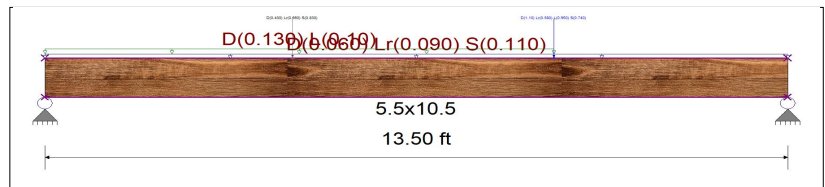
2Point: D = 0.430, Lr = 0.660, S = 0.830 k @ 4.50 ft

**Design Summary**

Max fb/Fb Ratio = **0.623** : 1  
 fb : Actual : 1,719.93 psi at 7.470 ft in Span # 1  
 Fb : Allowable : 2,760.00 psi  
 Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.312** : 1  
 fv : Actual : 94.95 psi at 0.000 ft in Span # 1  
 Fv : Allowable : 304.75 psi  
 Load Comb : +D+0.750L+0.750S

Max Reactions (k) D Lr L S W E H  
 Left Support 1.83 1.23 0.91 1.53  
 Right Support 1.71 1.22 0.97 1.53



**Max Deflections**

Transient Downward	0.209 in	Total Downward	0.454 in
Ratio	775	Ratio	356
LC: S Only		LC: +D+S	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

**Multiple Simple Beam**

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**Wood Beam Design : UFB9 - Upper Floor Beam**

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

BEAM Size : **3.5x9.25, Parallam PSL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : Parallam PSL 2.2E

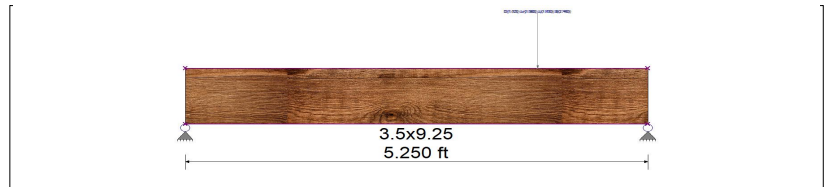
Fb - Tension	2900 psi	Fc - Prll	2900 psi	Fv	290 psi	Ebend- xx	2200 ksi	Density	45.07 pcf
Fb - Compr	2900 psi	Fc - Perp	750 psi	Ft	2025 psi	Eminbend - xx	1118.19 ksi		

Applied Loads

1Point: D = 1.10, Lr = 0.580, L = 0.950, S = 0.740 k @ 4.0 ft  
 2Point: D = 1.620, Lr = 1.980, L = 1.130, S = 2.480 k @ 4.0 ft

Design Summary

Max fb/Fb Ratio = **0.459** : 1  
 fb : Actual : 1,529.17 psi at 3.990 ft in Span # 1  
 Fb : Allowable : 3,335.00 psi  
 Load Comb : +D+0.750L+0.750S  
 Max fv/FvRatio = **0.709** : 1  
 fv : Actual : 236.34 psi at 4.008 ft in Span # 1  
 Fv : Allowable : 333.50 psi  
 Load Comb : +D+0.750L+0.750S



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.65	0.61	0.50	0.77			
Right Support	2.07	1.95	1.58	2.45			

Max Deflections

Transient Downward	0.022 in	Total Downward	0.041 in
Ratio	2827	Ratio	1532
	LC: S Only		LC: +D+S
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC: