

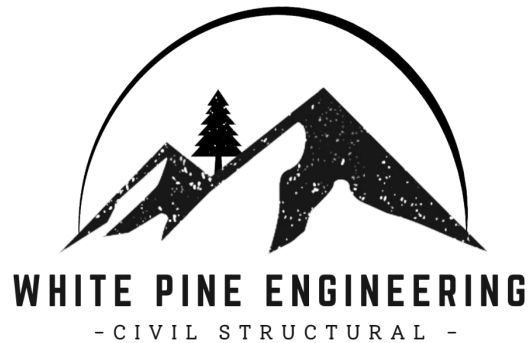
## Residential Structural Engineering Calculations

Luradiance Bennett Taylor  
Residential Plan  
2750 S 4300 W  
Ogden, Utah

Prepared for:

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Date: 9/21/2023



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Design Criteria

Codes

IBC 2021  
 ASCE7-16

Risk Category **II** ASCE 7-16 Table 1.5-1

Is	<b>1.0</b>	ASCE 7-16 Table 1.5-2
Ie	<b>1.0</b>	ASCE 7-16 Table 1.5-2

Seismic Loads

S1	<b>0.46</b>	ASCE 7 Hazard Tool
SM1	<b>0.97</b>	ASCE 7 Hazard Tool
SMS	<b>1.41</b>	ASCE 7 Hazard Tool
TL	<b>8</b>	ASCE 7 Hazard Tool

Site Class	<b>D</b>	Assumed
SDC	<b>D</b>	ASCE 7 Hazard Tool

R	<b>6.5</b>	ASCE7-16 table 12.2-1
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Wind Loads

V	<b>120</b>	mph 3 Sec Gust
Category	<b>C</b>	
Elevation	<b>4256</b>	ft USU Snow Load Map

Snow Loads

Pg	<b>43</b>	psf USU Snow Load Map
Ws	<b>0</b>	psf

Ce	<b>1.0</b>	ASCE7-16 Table 7.3-1
Ct	<b>1.0</b>	ASCE7-16 Table 7.3-2
Cs	<b>1.0</b>	ASCE7-16 Figure 7.4-1

Pf	<b>30</b>	ASCE7-16 Eq 7.3-1
Ps	<b>30</b>	ASCE7-16 Eq 7.4-1

Dead Loads

Roof	<b>15</b>	psf
Floor	<b>15</b>	psf
Walls	<b>10</b>	psf
Decks	<b>10</b>	psf
Concrete	<b>145</b>	pcf

Live Loads

Roof	<b>20</b>	psf	ASCE7-16 Table 4.3-1
Floor	<b>40</b>	psf	ASCE7-16 Table 4.3-1
Bedroom	<b>30</b>	psf	ASCE7-16 Table 4.3-1
Deck	<b>60</b>	psf	ASCE7-16 Table 4.3-1
Garage	<b>40</b>	psf	ASCE7-16 Table 4.3-1

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#### Soil Properties

Geotechnical Report by N/A  
Report Number N/A  
Date of Report N/A

If no report is listed above, the follow values are assumed

Unified Soil Classification Assumed to be GW, GP, SW, or SP IBC Table 1610.1

Bearing Pressure 1500 psf

Active Pressure 35 pcf

At Rest Presssure 60 pcf

Passive Pressure 250 pcf

Coefficient of Friction 0.3

\*\*Engineer assumes stable soil conditions.

If there are any global stability concerns, a geotechnical report is required.

#### Deflection Criteria

##### Roof

Live Load L/240 Table 1604.3

Total Load L/180 Table 1604.3

##### Floor

Live Load L/360 Table 1604.3

Total Load L/240 Table 1604.3

##### Wall

Live Load L/360 Table 1604.3 W/ Stucco

Live Load L/240 Table 1604.3 W/ Other Brittle Finishes

Live Load L/120 Table 1604.3 W/ Flexible Finishes

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	Span/Height (ft)	Live Load (psf)	Dead Load (psf)	Total Load (plf)	LL Factor
Roof	54	30	15	1217.7	1
Top Wall	0	0	10	0	N/A
Upper Floor	0	40	15	0	1
Middle Wall	8	0	10	80	N/A
Main Floor	14	40	15	385	1
Bottom Wall	0	0	10	0	N/A
Deck 1	0	60	10	0	1
Deck 2	0	60	10	0	1
Suspended Slab	0	40	150	0	1
Foundation	4	0	100	400	N/A
				2082.7	

Allowable Soil Bearing Pressure 1500 psf  
 Required Continuous Footing Width 16.7 Inches



Description Main

ELF		
SD1	0.65	Eq 11.4-4
SDS	0.94	Eq 11.4-3
Cs	0.14	Eq 12.8-2
Ta	0.15	Eq 12.8-7
Ct	0.02	table 12.8-2
x	0.75	table 12.8-2
hn	15	
Cs Max	0.65	Eq 12.8-3
Cs Max	N/A	Eq 12.8-4
Cs Min	0.04	Eq 12.8-5
Cs Min	0.01	Eq 12.8-5
Cs Min	N/A	Eq 12.8-6
Cs Max	0.65	
Cs Min	0.04	
Cs	0.14	
V (lbs)	12191	Eq 12.8-1

Building Info

Z (ft)	Area (ft^2)	Weight (psf)	Weight (lbs)	Wx (lbs)	Cvx	Fx (lbs)	Shear (lbs)
Roof	21	4212	15	63180			
Top Wall	9	2112	10	21120	73740	1.000	12191
Upper Floor	0	4212	0	0			
Middle Wall	0	-264	0	0	10560	0.000	0
Main Floor	0	4212	0	0			
Bottom Wall	0	0	0	0	0	0.000	0
				84300			12191

k=1 for T<=5

Width	54
Length	78
Roof Pitch F-B	5 :12 Pitch
Roof Pitch L-R	9999999 :12 Pitch

Simplified Seismic

V	12191.077	Eq 12.14-12
F	1	1 1 story 1.1 2 story 1.2 3 story

Wx (lbs)	Fx (lbs)	Shear (lbs)
73740	10664	10664
10560	1527	12191
0	0	12191

Directional

hn	15		V	120 mph 3 Sec Gust
G	0.85	(26.11.4,26.11.2)	Category	C
ke	0.857214	table 26.9-1		
kzt	1	26.8.2		
kd	0.85	table 26.6-1		
kh	0.85	table 26.10-1		

Surface	Cp	L/B or h/L	z or h	kz or kh	Theta	q (psf)	p (psf)	Area (ft^2)	Force (lbs)
Top Front Wall	0.8	0.69230769	9	0.85	0.00	22.83	15.53	702	10899
Middle Front Wall	0.8	0.69230769	0	0.85	0.00	22.83	15.53	0	0
Bottom Front Wall	0.8	0.69230769	0	0.85	0.00	22.83	15.53	0	0
Front Roof Plane	0.24	0.27777778	15	0.85	22.62	22.83	4.58	935.9998272	4287
Top Rear Wall	-0.5	0.69230769	15	0.85	0.00	22.83	-9.70	702	-6812
Middle Rear Wall	-0.5	0.69230769	15	0.85	0.00	22.83	-9.70	0	0
Bottom Rear Wall	-0.5	0.69230769	15	0.85	0.00	22.83	-9.70	0	0
Rear Roof Plane	-0.6	0.27777778	15	0.85	22.62	22.83	-11.64	935.9998272	-10899
Top Left Wall	0.8	1.44444444	9	0.85	0.00	22.83	15.53	486	7545
Middle Left Wall	0.8	1.44444444	0	0.85	0.00	22.83	15.53	0	0
Bottom Left Wall	0.8	1.44444444	0	0.85	0.00	22.83	15.53	0	0
Left Roof Plane	0.80	0.19230769	15	0.85	90.00	22.83	15.53	302.4	4695
Top Right Wall	-0.41111	1.44444444	15	0.85	0.00	22.83	-7.98	486	-3877
Middle Right Wall	-0.41111	1.44444444	15	0.85	0.00	22.83	-7.98	0	0
Bottom Right Wall	-0.41111	1.44444444	15	0.85	0.00	22.83	-7.98	0	0
Right Roof Plane	-0.6	0.19230769	15	0.85	90.00	22.83	-11.64	302.4	-3521

L/R Walls	Shear (lbs)
Top	24041
Middle	32896
Bottom	32896

F/B Walls	Shear (lbs)
Top	13927
Middle	19639
Bottom	19639

Simplified Wind

Case A	A	B	C	D
Ps30	30.03	0.00	20.89	0.27
Ps	36.33	0.00	25.28	0.33

Case B	A	C
Ps30	22.80	15.10
Ps	27.59	18.27

a 5.4 Lambda 1.21

	C&D (lbs)	C&D/2 (lbs)	A&B (lbs)	L/R Shear (lbs)		C&D (lbs)	C&D/2 (lbs)	AA&BA (lbs)	AB (lbs)	A&B (lbs)	F/B Shear (lbs)
Top	9181	4591	495	5085		9965	4983	495	226	226	5209
Middle	18054	9027	1032	10059		14405	7202	1032	453	453	7655
Bottom	18054	9027	1032	10059		14405	7202	1032	453	453	7655



Shear Table

	Top		Middle		Bottom	
	F/B	L/R	F/B	L/R	F/B	L/R
ELF	6096	6096	6096	6096	6096	6096
Simplified S	5332	5332	6096	6096	6096	6096
Directional	6964	12020	9819	16448	9819	16448
Simplified W	5209	5085	7655	10059	7655	10059

Factored Shear Table (0.6W 0.7E)

	Top		Middle		Bottom	
	F/B	L/R	F/B	L/R	F/B	L/R
ELF	4267	4267	4267	4267	4267	4267
Simplified S	3732	3732	4267	4267	4267	4267
Directional	4178	7212	5892	9869	5892	9869
Simplified W	3125	3051	4593	6035	4593	6035

Factored Shear Table w/ Wind Converted to Seismic Equivalent Loading (W/1.4)

	Top		Middle		Bottom	
	F/B	L/R	F/B	L/R	F/B	L/R
ELF	4267	4267	4267	4267	4267	4267
Simplified S	3732	3732	4267	4267	4267	4267
Directional	2984	5152	4208	7049	4208	7049
Simplified W	2232	2179	3281	4311	3281	4311

Factored Shear Table w/ Wind Converted to Seismic Equivalent Loading (W/1.4)

	Top		Middle		Bottom	
	F/B	L/R	F/B	L/R	F/B	L/R
Simplified S	3732	3732	4267	4267	4267	4267
Simplified W	2232	2179	3281	4311	3281	4311

Factored Shear Table w/ Wind Converted to Seismic Equivalent Loading (W/1.4)

	Top		Middle		Bottom	
	F/B	L/R	F/B	L/R	F/B	L/R
Max Load	3732	3732	4267	4311	4267	4311







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Beam Calc #1

Span (ft)	6
Plys	2
Ref. #	102

	Live Loads	Dead Loads	Units	Location	
Distributed	810	405	plf		
Triangular	0	0	Max plf	Max @ Right	
Triangular	0	0	Max plf	Centered	
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left

Deflection Limits

Live load	L/	360
Total Load	L/	240

Factors	
CD	1.0
CM	1.0
Ct	1.0
CL	1.0
CF	1.0
Cfu	1.0
Cl	1.0
Cr	1.0
CV	1.0
Cc	1.0
Cj	1.0
CVR	1.0

Type	#	Size	Design
	2	1-3/4" X 9-1/2" LVL	OK

Fb	2600.00 psi	Max Moment	5,468 ft lbs	Flexure Check	Ratio
Fb'	2600.00 psi	Location	3.00 ft From Left	OK	0.479
Sx	52.65 In <sup>3</sup>	Req Sx	25.23 In <sup>3</sup>		

Fv	285.00 psi	L Reaction	3,645 lbs	Shear Check	Ratio
Fv'	285.00 psi	R Reaction	3,645 lbs	OK	0.577
Area	33.25 In <sup>2</sup>	Max Shear	3,645 lbs		
		Req Area	19.18 In <sup>2</sup>	Adj Shear Check	Ratio
	3.4.3.1	Adj Max Shear	2,697 lbs	OK	0.427
	(Non Hangered Loads)	Req Area	14.20 In <sup>2</sup>		

E	1,900,000 psi	Max LL Defl.	0.050 In	LL Deflection Check	Actual L/
E'	1,900,000 psi	Location	3.00 ft From Left	OK	1448
Ix	250.07 In <sup>4</sup>				

Deflection Limits		Max TL Defl.	0.075 In	TL Deflection Check	Actual L/
LL	0.200 In	Location	3.00 ft From Left	OK	966
TL	0.300 In				

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Beam Calc #2

Span (ft)	5
Plys	2
Ref. #	4

	Live Loads	Dead Loads	Units	Location	
Distributed	810	405	plf		
Triangular	0	0	Max plf	Max @ Right	
Triangular	0	0	Max plf	Centered	
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left

Deflection Limits

Live load	L/	360
Total Load	L/	240

Factors	
CD	1.15
CM	1.0
Ct	1.0
CL	1.0
CF	1.1
Cfu	1.0
Cl	1.0
Cr	1.0
CV	1.0
Cc	1.0
Cj	1.0
CVR	1.0

Type	#	Size	Design
	2	2 X 10 DF-L#2	OK

Fb	900.00 psi	Max Moment	3,797 ft lbs	Flexure Check	Ratio
Fb'	1138.50 psi	Location	2.50 ft From Left	OK	0.935
Sx	42.78 In <sup>3</sup>	Req Sx	40.02 In <sup>3</sup>		

Fv	180.00 psi	L Reaction	3,038 lbs	Shear Check	Ratio
Fv'	207.00 psi	R Reaction	3,038 lbs	OK	0.793
Area	27.75 In <sup>2</sup>	Max Shear	3,038 lbs		
		Req Area	22.01 In <sup>2</sup>	Adj Shear Check	Ratio
	3.4.3.1	Adj Max Shear	2,126 lbs	OK	0.555
	(Non Hangered Loads)	Req Area	15.41 In <sup>2</sup>		

E	1,600,000 psi	Max LL Defl.	0.036 In	LL Deflection Check	Actual L/
E'	1,600,000 psi	Location	2.50 ft From Left	OK	1668
Ix	197.86 In <sup>4</sup>				

Deflection Limits		Max TL Defl.	0.054 In	TL Deflection Check	Actual L/
LL	0.167 In	Location	2.50 ft From Left	OK	1112
TL	0.250 In				

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Beam Calc #3

Span (ft)	11.5
Plys	2
Ref. #	102

	Live Loads	Dead Loads	Units	Location	
Distributed	240	120	plf		
Triangular	0	0	Max plf	Max @ Right	
Triangular	0	0	Max plf	Centered	
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left

Deflection Limits

Live load	L/	360
Total Load	L/	240

Factors	
CD	1.0
CM	1.0
Ct	1.0
CL	1.0
CF	1.0
Cfu	1.0
Cl	1.0
Cr	1.0
CV	1.0
Cc	1.0
Cj	1.0
CVR	1.0

Type	#	Size	Design
	2	1-3/4" X 9-1/2" LVL	OK

Fb	2600.00 psi	Max Moment	5,951 ft lbs	Flexure Check	Ratio
Fb'	2600.00 psi	Location	5.75 ft From Left	OK	0.522
Sx	52.65 In <sup>3</sup>	Req Sx	27.47 In <sup>3</sup>		

Fv	285.00 psi	L Reaction	2,070 lbs	Shear Check	Ratio
Fv'	285.00 psi	R Reaction	2,070 lbs	OK	0.328
Area	33.25 In <sup>2</sup>	Max Shear	2,070 lbs		
		Req Area	10.89 In <sup>2</sup>	Adj Shear Check	Ratio
	3.4.3.1	Adj Max Shear	1,822 lbs	OK	0.288
	(Non Hangered Loads)	Req Area	9.59 In <sup>2</sup>		

E	1,900,000 psi	Max LL Defl.	0.199 In	LL Deflection Check	Actual L/
E'	1,900,000 psi	Location	5.75 ft From Left	OK	694
Ix	250.07 In <sup>4</sup>				

Deflection Limits		Max TL Defl.	0.298 In	TL Deflection Check	Actual L/
LL	0.383 In	Location	5.75 ft From Left	OK	463
TL	0.575 In				

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Beam Calc #4

Span (ft)	5.5
Plys	2
Ref. #	4

	Live Loads	Dead Loads	Units	Location	
Distributed	330	165	plf		
Triangular	0	0	Max plf	Max @ Right	
Triangular	0	0	Max plf	Centered	
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left

Deflection Limits

Live load	L/	360
Total Load	L/	240

Factors	
CD	1.0
CM	1.0
Ct	1.0
CL	1.0
CF	1.1
Cfu	1.0
Cl	1.0
Cr	1.0
CV	1.0
Cc	1.0
Cj	1.0
CVR	1.0

Type	#	Size	Design
	2	2 X 10 DF-L#2	OK

Fb	900.00 psi	Max Moment	1,872 ft lbs	Flexure Check	Ratio
Fb'	990.00 psi	Location	2.75 ft From Left	OK	0.530
Sx	42.78 In <sup>3</sup>	Req Sx	22.69 In <sup>3</sup>		

Fv	180.00 psi	L Reaction	1,361 lbs	Shear Check	Ratio
Fv'	180.00 psi	R Reaction	1,361 lbs	OK	0.409
Area	27.75 In <sup>2</sup>	Max Shear	1,361 lbs		
		Req Area	11.34 In <sup>2</sup>	Adj Shear Check	Ratio
	3.4.3.1	Adj Max Shear	980 lbs	OK	0.294
	(Non Hangered Loads)	Req Area	8.17 In <sup>2</sup>		

E	1,600,000 psi	Max LL Defl.	0.021 In	LL Deflection Check	Actual L/
E'	1,600,000 psi	Location	2.75 ft From Left	OK	3075
Ix	197.86 In <sup>4</sup>				

Deflection Limits		Max TL Defl.	0.032 In	TL Deflection Check	Actual L/
LL	0.183 In	Location	2.75 ft From Left	OK	2050
TL	0.275 In				

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Beam Calc #5

Span (ft)	9
Plys	2
Ref. #	103

	Live Loads	Dead Loads	Units	Location	
Distributed	780	390	plf		
Triangular	0	0	Max plf	Max @ Right	
Triangular	0	0	Max plf	Centered	
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left

Deflection Limits

Live load	L/	360
Total Load	L/	240

Factors	
CD	1.0
CM	1.0
Ct	1.0
CL	1.0
CF	1.0
Cfu	1.0
CI	1.0
Cr	1.0
CV	1.0
Cc	1.0
CJ	1.0
CVR	1.0

Type	#	Size	Design
	2	1-3/4" X 11-7/8" LVL	OK

Fb	2600.00 psi	Max Moment	11,846 ft lbs	Flexure Check	Ratio
Fb'	2600.00 psi	Location	4.50 ft From Left	OK	0.665
Sx	82.26 In <sup>3</sup>	Req Sx	54.68 In <sup>3</sup>		

Fv	285.00 psi	L Reaction	5,265 lbs	Shear Check	Ratio
Fv'	285.00 psi	R Reaction	5,265 lbs	OK	0.667
Area	41.56 In <sup>2</sup>	Max Shear	5,265 lbs		
		Req Area	27.71 In <sup>2</sup>	Adj Shear Check	Ratio
	3.4.3.1	Adj Max Shear	4,212 lbs	OK	0.533
	(Non Hangered Loads)	Req Area	22.17 In <sup>2</sup>		

E	1,900,000 psi	Max LL Defl.	0.124 In	LL Deflection Check	Actual L/
E'	1,900,000 psi	Location	4.50 ft From Left	OK	870
Ix	488.41 In <sup>4</sup>				

Deflection Limits		Max TL Defl.	0.186 In	TL Deflection Check	Actual L/
LL	0.300 In	Location	4.50 ft From Left	OK	580
TL	0.450 In				

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Beam Calc #6

Span (ft)	16
Plys	3
Ref. #	104

	Live Loads	Dead Loads	Units	Location	
Distributed	780	390	pif		
Triangular	0	0	Max plf	Max @ Right	
Triangular	0	0	Max plf	Centered	
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left
Point Load	0	0	lbs	0	ft From Left

Deflection Limits

Live load	L/	360
Total Load	L/	240

Factors	
CD	1.15
CM	1.0
Ct	1.0
CL	1.0
CF	1.0
Cfu	1.0
Cl	1.0
Cr	1.0
CV	1.0
Cc	1.0
Cj	1.0
CVR	1.0

Type	#	Size	Design
	3	1-3/4" X 14" LVL	OK

Fb	2600.00 psi	Max Moment	37,440 ft lbs	Flexure Check	Ratio
Fb'	2990.00 psi	Location	8.00 ft From Left	OK	0.876
Sx	171.50 In <sup>3</sup>	Req Sx	150.26 In <sup>3</sup>		

Fv	285.00 psi	L Reaction	9,360 lbs	Shear Check	Ratio
Fv'	327.75 psi	R Reaction	9,360 lbs	OK	0.583
Area	73.50 In <sup>2</sup>	Max Shear	9,360 lbs		
		Req Area	42.84 In <sup>2</sup>	Adj Shear Check	Ratio
	3.4.3.1	Adj Max Shear	8,050 lbs	OK	0.501
	(Non Hangered Loads)	Req Area	36.84 In <sup>2</sup>		

E	1,900,000 psi	Max LL Defl.	0.504 In	LL Deflection Check	Actual L/
E'	1,900,000 psi	Location	8.00 ft From Left	OK	381
Ix	1200.50 In <sup>4</sup>				

Deflection Limits		Max TL Defl.	0.756 In	TL Deflection Check	Actual L/
LL	0.533 In	Location	8.00 ft From Left	OK	254
TL	0.800 In				