

L2 ENGINEERS

17848 NE 198th Place
Woodinville, WA 98072



Structural Calculations

The Levella

2412 60th Ave SE
Mercer Island, WA 98040

Project # 21-120
February 10, 2022



02/10/2022

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Woodinville, WA 98072



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Loads and Design Criteria



Roof Dead Load	Weight (psf)	
SS Metal Roof	2.00	
5/8" Plywood	1.70	
Trusses	6.00	
Insulation	1.00	
R49 Batt Insulation - Assume 16"	0.62	
Miscellaneous	1.5	
	<hr/>	
	12.82	15 psf

Floor Assembly Weight	Weight (psf)	
Hardwood	4.00	
23/32" Plywood	2.40	
Floor Joists	5.50	
Insulation	1.00	
Miscellaneous	1.6	
Interior Light-Framed Partitions	0	
	<hr/>	
	14.50	15 psf

Exterior Wall Assembly	Weight (psf)
5/8" DensGlass	2.50
15/32 Plywood	1.70
2x6 Studs @ 16" OC	1.70
Batt Insulation	0.25
5/8" gypsum board	2.75
	<hr/>
	8.90

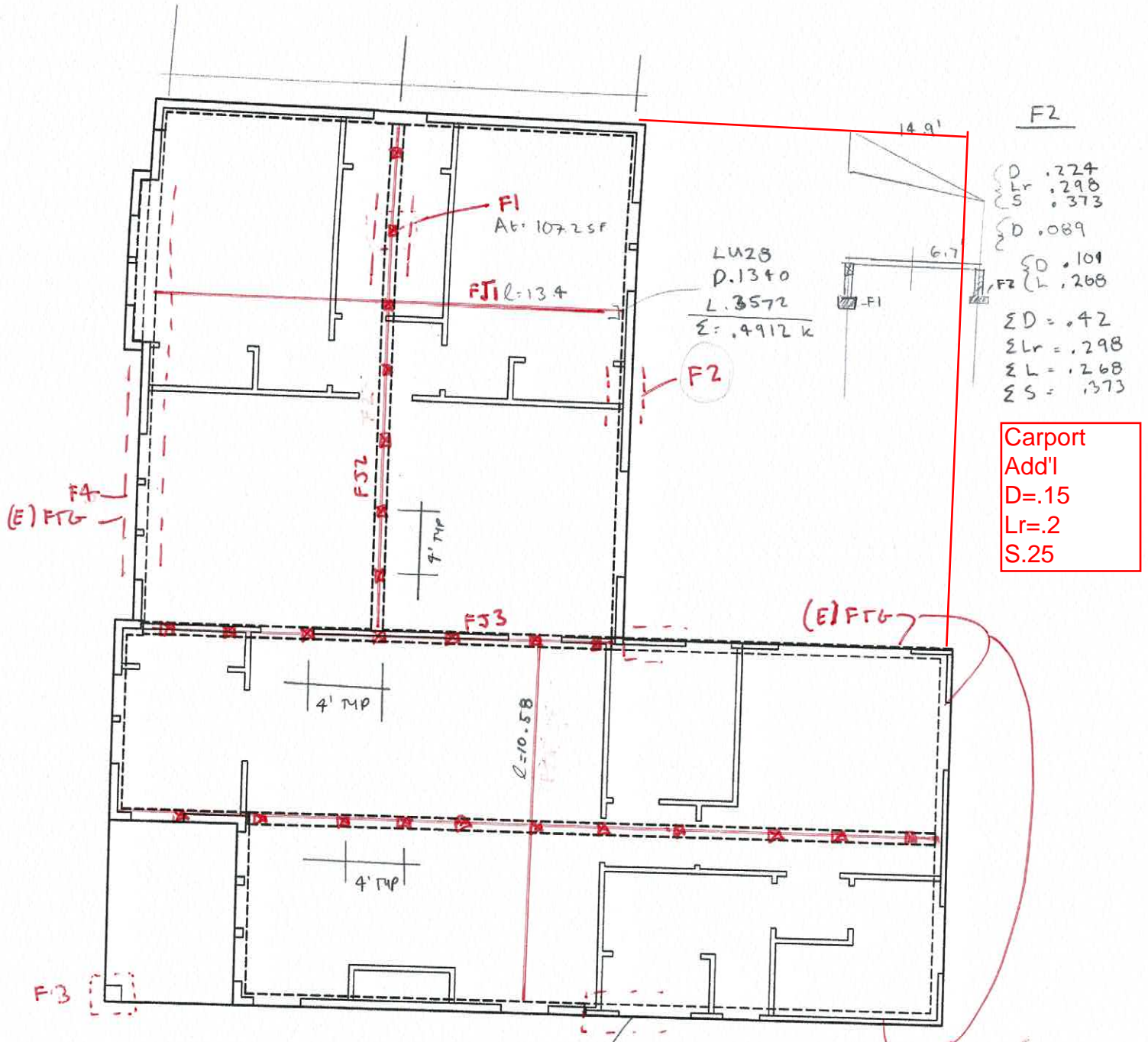
Interior Wall Assembly	Weight (psf)
5/8" Gypsum Wall Board	2.75
2x4 Studs @ 16" OC	1.70
5/8" Gypsum Wall Board	2.75
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	7.20

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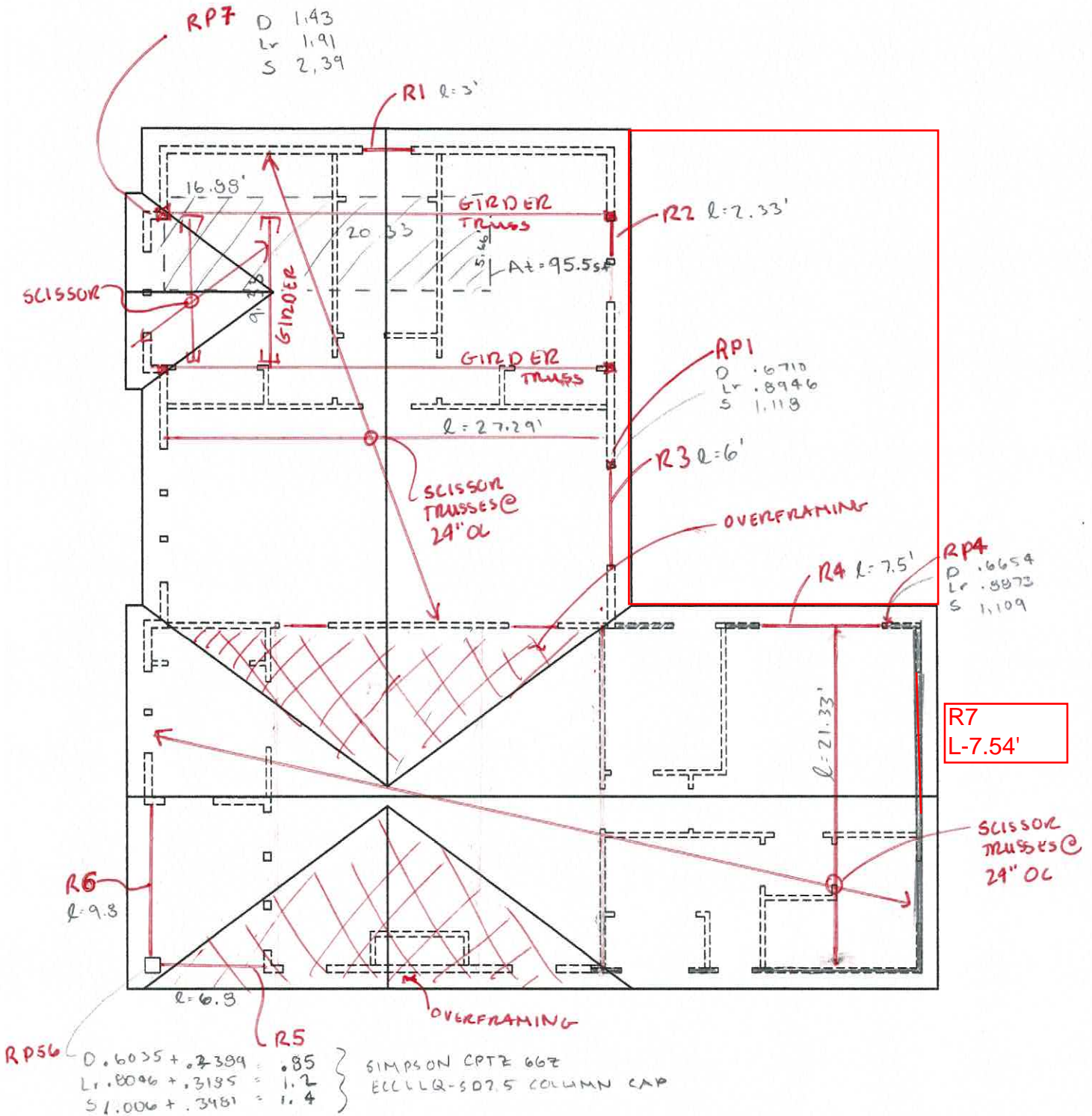


Gravity Analysis



- (E) 6" WALL W/ 6" DP FTG, 1'-4" WIDE
- (N) OVEREXCAVATE & PLACE STRUCTURAL FILL
- (E) SOIL IMBALANCE 24" TO 30"

ROOF PLAN
NT



FRAMING PLAN

NTS

Wood Beam

Lic. #: KW-06011909

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DESCRIPTION: R1

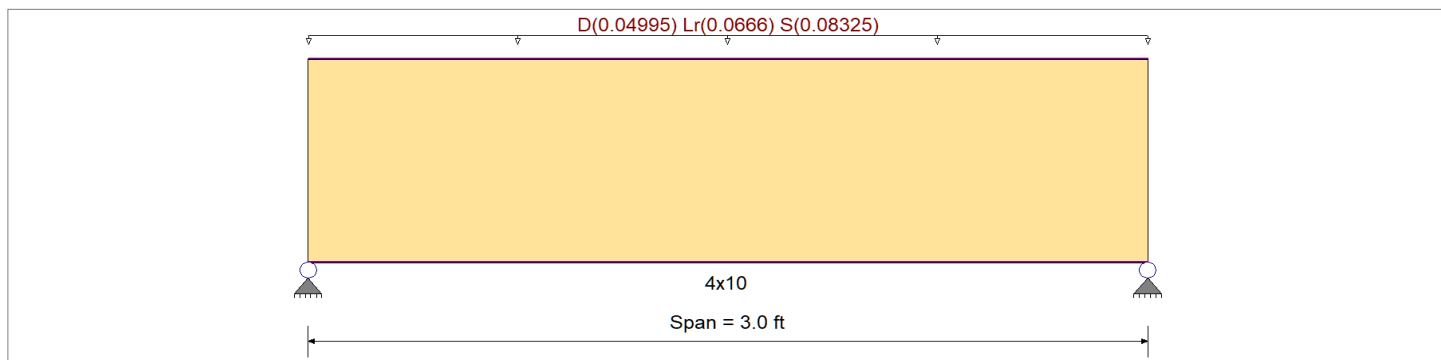
CODE REFERENCES

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

Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850 psi	E : Modulus of Elasticity	
Load Combination : ASCE 7-10	Fb -	850 psi	Ebend- xx	1300ksi
	Fc - Prll	1300 psi	Eminbend - xx	470ksi
Wood Species : Hem Fir	Fc - Perp	405 psi		
Wood Grade : No.2	Fv	150 psi		
	Ft	525 psi	Density	26.84pcf
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 = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 3.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.031 : 1	Maximum Shear Stress Ratio =	0.026 : 1
Section used for this span	4x10	Section used for this span	4x10
fb: Actual =	36.03psi	fv: Actual =	4.53 psi
Fb: Allowable =	1,173.00psi	Fv: Allowable =	172.50 psi
Load Combination	+D+S+H	Load Combination	+D+S+H
Location of maximum on span	1.500ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.000 in	Ratio =	0 < 360
Max Upward Transient Deflection	0.000 in	Ratio =	0 < 360
Max Downward Total Deflection	0.001 in	Ratio =	44244 > 240
Max Upward Total Deflection	0.000 in	Ratio =	0 < 240

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.0008	1.511		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.200	0.200
Overall MINimum	0.125	0.125
+D+H	0.075	0.075
+D+L+H	0.075	0.075
+D+Lr+H	0.175	0.175
+D+S+H	0.200	0.200
+D+0.750Lr+0.750L+H	0.150	0.150
+D+0.750L+0.750S+H	0.169	0.169
+D+0.60W+H	0.075	0.075
+D+0.70E+H	0.075	0.075
+D+0.750Lr+0.750L+0.450W+H	0.150	0.150



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Wood Beam

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Lic. #: KW-06011909

DESCRIPTION: R1

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	0.169	0.169
+D+0.750L+0.750S+0.5250E+H	0.169	0.169
+0.60D+0.60W+0.60H	0.045	0.045
+0.60D+0.70E+0.60H	0.045	0.045
D Only	0.075	0.075
Lr Only	0.100	0.100
S Only	0.125	0.125
H Only		

Wood Column

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DESCRIPTION: RP1/RP4

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-10

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	2-2x6	
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber	
Overall Column Height	10 ft			Wood Member Type	Sawn	
<i>(Used for non-slender calculations)</i>						
Wood Species	Hem Fir			Exact Width	3.0 in	
Wood Grade	No.2			Exact Depth	5.50 in	
Fb +	850.0 psi	Fv	150.0 psi	Area	16.50 in ²	
Fb -	850.0 psi	Ft	525.0 psi	Ix	41.594 in ⁴	
Fc - Prll	1,300.0 psi	Density	26.840 pcf	Iy	12.375 in ⁴	
Fc - Perp	405.0 psi					
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Allow Stress Modification Factors	
	Basic	1,300.0	1,300.0	1,300.0 ksi	Cf or Cv for Bending	1.30
	Minimum	470.0	470.0		Cf or Cv for Compression	1.10
					Cf or Cv for Tension	1.30
					Cm : Wet Use Factor	1.0
					Ct : Temperature Factor	1.0
					Cfu : Flat Use Factor	1.0
					Kf : Built-up columns	1.0 <small>NDS 15.3.2</small>
					Use Cr : Repetitive ?	No
					Brace condition for deflection (buckling) along columns :	
					X-X (width) axis :	Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0
					Y-Y (depth) axis :	Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0

Applied Loads

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

Column self weight included : 30.754 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 10.0 ft, D = 0.70, Lr = 0.90, S = 1.20 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.5007 : 1
Load Combination	+D+S+H
Governing NDS Formula	Comp Only, f_c/F_c'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	1.931 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	233.719 psi

Maximum SERVICE Lateral Load Reactions . .	
Top along Y-Y	0.0 k
Bottom along Y-Y	0.0 k
Top along X-X	0.0 k
Bottom along X-X	0.0 k

Maximum SERVICE Load Lateral Deflections . . .				
Along Y-Y	0.0 in	at	0.0 ft	above base
for load combination :	n/a			
Along X-X	0.0 in	at	0.0 ft	above base
for load combination :	n/a			

PASS Maximum Shear Stress Ratio =	0.0 : 1
Load Combination	+0.60D+0.70E+0.60H
Location of max.above base	10.0 ft
Applied Design Shear	0.0 psi
Allowable Shear	240.0 psi

Other Factors used to calculate allowable stresses . . .

<u>Bending</u>	<u>Compression</u>	<u>Tension</u>
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Wood Column

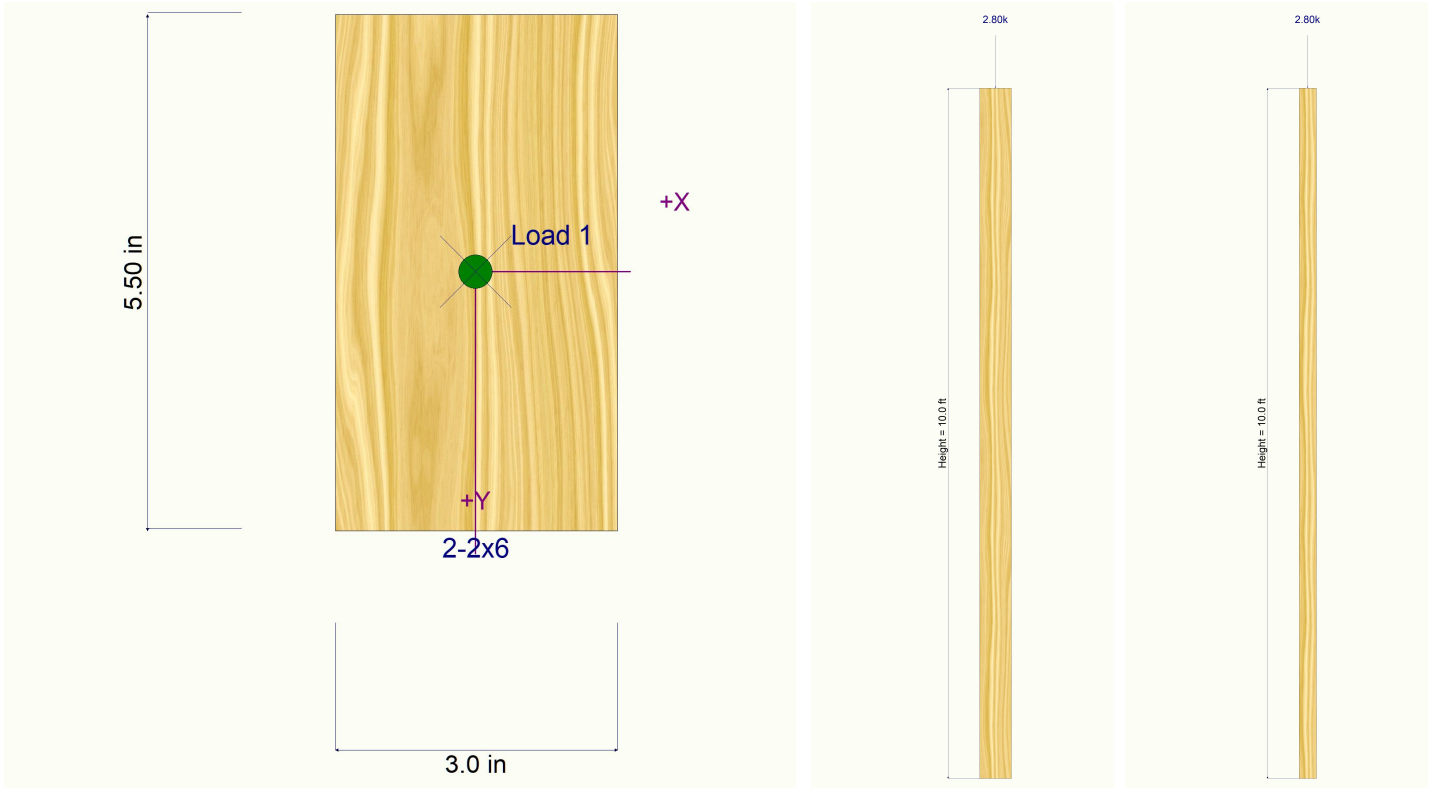
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DESCRIPTION: RP1/RP4

Sketches



Wood Beam

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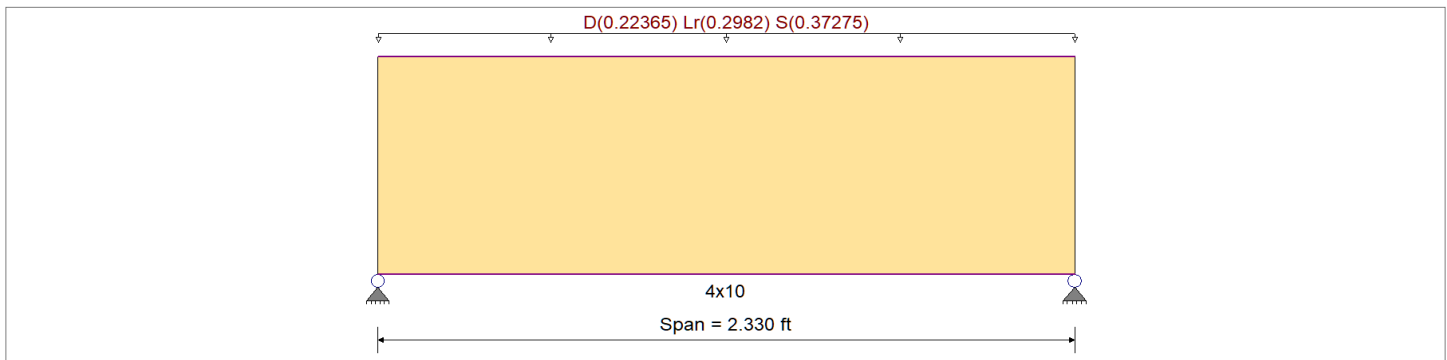
DESCRIPTION: R2

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	E : Modulus of Elasticity
Load Combination ASCE 7-10	Fb -	850.0 psi	Ebend- xx
	Fc - Prll	1,300.0 psi	Eminbend - xx
Wood Species : Hem Fir	Fc - Perp	405.0 psi	
Wood Grade : No.2	Fv	150.0 psi	
	Ft	525.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			26.840pcf



Applied Loads

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

Uniform Load : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 14.910 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.083 1	Maximum Shear Stress Ratio	=	0.064 : 1
Section used for this span		4x10	Section used for this span		4x10
fb: Actual	=	97.31 psi	fv: Actual	=	11.04 psi
Fb: Allowable	=	1,173.00psi	Fv: Allowable	=	172.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	1.165ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection		0.000 in	Ratio =		0 < 360
Max Upward Transient Deflection		0.000 in	Ratio =		0 < 360
Max Downward Total Deflection		0.001 in	Ratio =		21092 >= 240
Max Upward Total Deflection		0.000 in	Ratio =		0 < 240

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.0013	1.174		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.695	0.695
Overall MINimum	0.434	0.434
+D+H	0.261	0.261
+D+L+H	0.261	0.261
+D+Lr+H	0.608	0.608
+D+S+H	0.695	0.695
+D+0.750Lr+0.750L+H	0.521	0.521
+D+0.750L+0.750S+H	0.586	0.586
+D+0.60W+H	0.261	0.261
+D+0.70E+H	0.261	0.261
+D+0.750Lr+0.750L+0.450W+H	0.521	0.521



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Wood Beam

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DESCRIPTION: R2

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	0.586	0.586
+D+0.750L+0.750S+0.5250E+H	0.586	0.586
+0.60D+0.60W+0.60H	0.156	0.156
+0.60D+0.70E+0.60H	0.156	0.156
D Only	0.261	0.261
Lr Only	0.347	0.347
S Only	0.434	0.434
H Only		

Wood Beam

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

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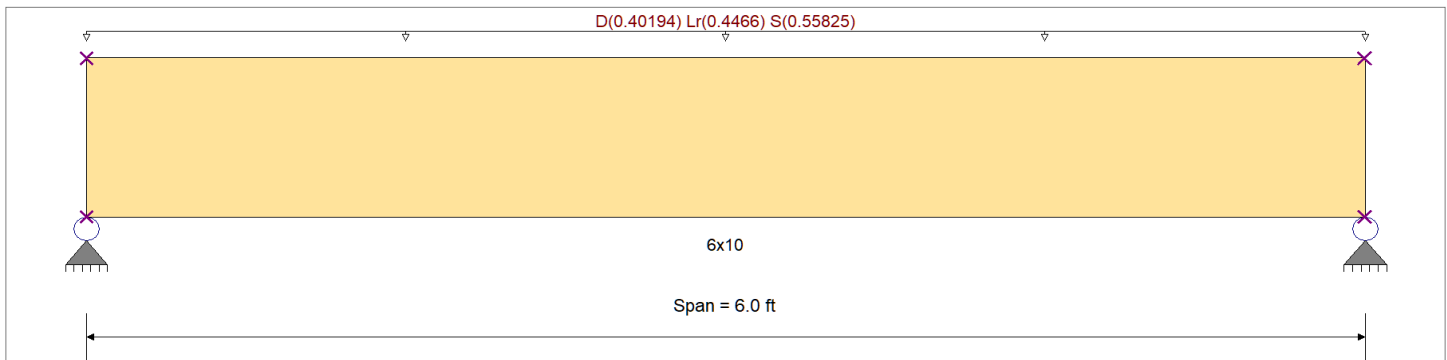
DESCRIPTION: R3

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : ASCE 7-16	Fb -	850 psi	Ebend- xx	1300ksi
	Fc - Prll	1300 psi	Eminbend - xx	470ksi
Wood Species : Hem-Fir	Fc - Perp	405 psi		
Wood Grade : No.2	Fv	150 psi		
	Ft	525 psi	Density	26.84pcf
Beam Bracing : Completely Unbraced				



Applied Loads

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

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.0180, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 22.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.644 : 1	Maximum Shear Stress Ratio	=	0.353 : 1
Section used for this span		6x10	Section used for this span		6x10
fb: Actual	=	626.75psi	fv: Actual	=	60.97 psi
Fb: Allowable	=	973.32psi	Fv: Allowable	=	172.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.000ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection	0.032 in	Ratio = 2246 >=360	Span: 1 : S Only		
Max Upward Transient Deflection	0 in	Ratio = 0 <360	n/a		
Max Downward Total Deflection	0.055 in	Ratio = 1306 >=240	Span: 1 : +D+S		
Max Upward Total Deflection	0 in	Ratio = 0 <240	n/a		

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values								
			M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v						
D Only	Length = 6.0 ft	1	0.344	0.189	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.81	262.36	762.48	0.00	0.00	0.00	0.89	25.52	135.00
+D+Lr	Length = 6.0 ft	1	0.524	0.287	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.82	553.87	1057.53	0.00	0.00	0.00	1.88	53.88	187.50
+D+S	Length = 6.0 ft	1	0.644	0.353	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.32	626.75	973.32	0.00	0.00	0.00	2.12	60.97	172.50
+D+0.750Lr	Length = 6.0 ft	1	0.455	0.250	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.32	480.99	1057.53	0.00	0.00	0.00	1.63	46.79	187.50
+D+0.750S	Length = 6.0 ft	1	0.550	0.302	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.69	535.65	973.32	0.00	0.00	0.00	1.81	52.10	172.50
+0.60D	Length = 6.0 ft	1	0.116	0.064	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.09	157.42	1351.67	0.00	0.00	0.00	0.53	15.31	240.00	

Wood Beam

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

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DESCRIPTION: R3

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0551	3.022		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.881	2.881
Overall MINimum	1.675	1.675
D Only	1.206	1.206
+D+Lr	2.546	2.546
+D+S	2.881	2.881
+D+0.750Lr	2.211	2.211
+D+0.750S	2.462	2.462
+0.60D	0.723	0.723
Lr Only	1.340	1.340
S Only	1.675	1.675

Wood Beam

Lic. # : KW-06011909

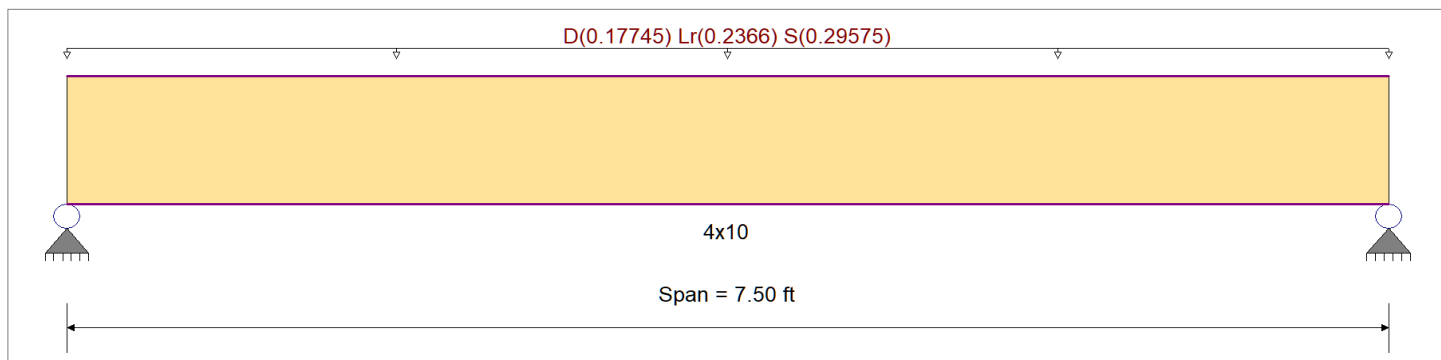
DESCRIPTION: R4

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	E : Modulus of Elasticity	
Load Combination ASCE 7-10	Fb -	850.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	1,300.0 psi	Eminbend - xx	470.0ksi
Wood Species : Hem Fir	Fc - Perp	405.0 psi		
Wood Grade : No.2	Fv	150.0 psi		
	Ft	525.0 psi	Density	26.840pcf
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 = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 11.830 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.682	1	Maximum Shear Stress Ratio =	0.379	: 1
Section used for this span	4x10		Section used for this span	4x10	
fb: Actual =	799.94	psi	fv: Actual =	65.41	psi
Fb: Allowable =	1,173.00	psi	Fv: Allowable =	172.50	psi
Load Combination	+D+S+H		Load Combination	+D+S+H	
Location of maximum on span =	3.750	ft	Location of maximum on span =	6.734	ft
Span # where maximum occurs =	Span # 1		Span # where maximum occurs =	Span # 1	
Maximum Deflection					
Max Downward Transient Deflection	0.071	in	Ratio =	1275	>=360
Max Upward Transient Deflection	0.000	in	Ratio =	0	<360
Max Downward Total Deflection	0.113	in	Ratio =	797	>=240
Max Upward Total Deflection	0.000	in	Ratio =	0	<240

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.1129	3.777		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.775	1.775
Overall MINimum	1.109	1.109
+D+H	0.665	0.665
+D+L+H	0.665	0.665
+D+Lr+H	1.553	1.553
+D+S+H	1.775	1.775
+D+0.750Lr+0.750L+H	1.331	1.331
+D+0.750L+0.750S+H	1.497	1.497
+D+0.60W+H	0.665	0.665
+D+0.70E+H	0.665	0.665
+D+0.750Lr+0.750L+0.450W+H	1.331	1.331



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DESCRIPTION: R4

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	1.497	1.497
+D+0.750L+0.750S+0.5250E+H	1.497	1.497
+0.60D+0.60W+0.60H	0.399	0.399
+0.60D+0.70E+0.60H	0.399	0.399
D Only	0.665	0.665
Lr Only	0.887	0.887
S Only	1.109	1.109
H Only		

Wood Beam

Lic. # : KW-06011909

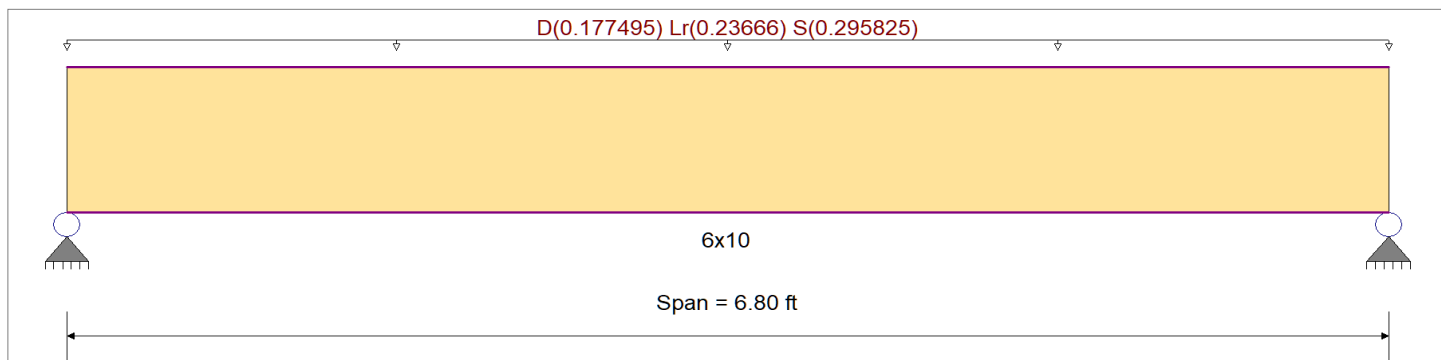
DESCRIPTION: R5

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	E : Modulus of Elasticity	
Load Combination ASCE 7-10	Fb -	850.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	1,300.0 psi	Eminbend - xx	470.0ksi
Wood Species : Hem Fir	Fc - Perp	405.0 psi		
Wood Grade : No.2	Fv	150.0 psi		
	Ft	525.0 psi	Density	26.840pcf
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 = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 11.833 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.597 : 1	Maximum Shear Stress Ratio =	0.267 : 1
Section used for this span	6x10	Section used for this span	6x10
fb: Actual =	396.83psi	fv: Actual =	35.75 psi
Fb: Allowable =	664.70psi	Fv: Allowable =	133.86 psi
Load Combination	+D+S+H	Load Combination	+D+S+H
Location of maximum on span =	3.400ft	Location of maximum on span =	0.000 ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.033 in	Ratio =	2489 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.052 in	Ratio =	1556 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.0524	3.425		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.609	1.609
Overall MINimum	1.006	1.006
+D+H	0.603	0.603
+D+L+H	0.603	0.603
+D+Lr+H	1.408	1.408
+D+S+H	1.609	1.609
+D+0.750Lr+0.750L+H	1.207	1.207
+D+0.750L+0.750S+H	1.358	1.358
+D+0.60W+H	0.603	0.603
+D+0.70E+H	0.603	0.603
+D+0.750Lr+0.750L+0.450W+H	1.207	1.207



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Wood Beam

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DESCRIPTION: R5

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	1.358	1.358
+D+0.750L+0.750S+0.5250E+H	1.358	1.358
+0.60D+0.60W+0.60H	0.362	0.362
+0.60D+0.70E+0.60H	0.362	0.362
D Only	0.603	0.603
Lr Only	0.805	0.805
S Only	1.006	1.006
H Only		

Wood Beam

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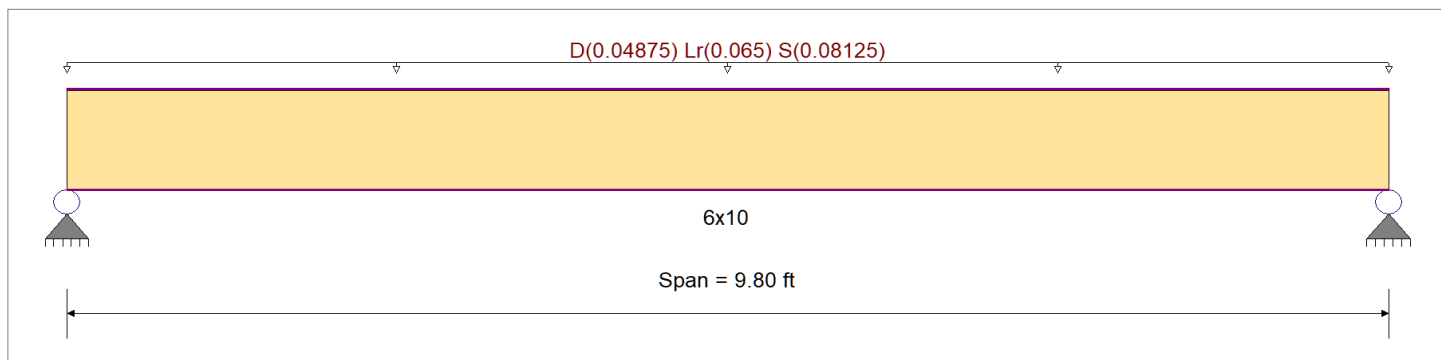
DESCRIPTION: R6

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	E : Modulus of Elasticity	
Load Combination : ASCE 7-10	Fb -	850.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	1,300.0 psi	Eminbend - xx	470.0ksi
Wood Species : Hem Fir	Fc - Perp	405.0 psi		
Wood Grade : No.2	Fv	150.0 psi		
	Ft	525.0 psi	Density	26.840pcf
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 = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 3.250 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.341 : 1	Maximum Shear Stress Ratio =	0.115 : 1
Section used for this span	6x10	Section used for this span	6x10
fb: Actual =	226.37 psi	fv: Actual =	15.35 psi
Fb: Allowable =	664.70 psi	Fv: Allowable =	133.86 psi
Load Combination	+D+S+H	Load Combination	+D+S+H
Location of maximum on span	4.900ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.039 in	Ratio =	3028 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.062 in	Ratio =	1892 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.0621	4.936		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.637	0.637
Overall MINimum	0.398	0.398
+D+H	0.239	0.239
+D+L+H	0.239	0.239
+D+Lr+H	0.557	0.557
+D+S+H	0.637	0.637
+D+0.750Lr+0.750L+H	0.478	0.478
+D+0.750L+0.750S+H	0.537	0.537
+D+0.60W+H	0.239	0.239
+D+0.70E+H	0.239	0.239
+D+0.750Lr+0.750L+0.450W+H	0.478	0.478



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DESCRIPTION: R6

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	0.537	0.537
+D+0.750L+0.750S+0.5250E+H	0.537	0.537
+0.60D+0.60W+0.60H	0.143	0.143
+0.60D+0.70E+0.60H	0.143	0.143
D Only	0.239	0.239
Lr Only	0.319	0.319
S Only	0.398	0.398
H Only		

Wood Column

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DESCRIPTION: RP56

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-10

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	6x6
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	10 ft			Wood Member Type	Sawn
<i>(Used for non-slender calculations)</i>					
Wood Species	Hem Fir			Exact Width	5.50 in
Wood Grade	No.2			Exact Depth	5.50 in
Fb +	575.0 psi	Fv	140.0 psi	Area	30.250 in ²
Fb -	575.0 psi	Ft	375.0 psi	Ix	76.255 in ⁴
Fc - Prll	575.0 psi	Density	26.840 pcf	Iy	76.255 in ⁴
Fc - Perp	405.0 psi			Incising Factors :	
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	for Bending	0.80
	Basic	1,100.0	1,100.0	for Elastic Modulus	0.95
	Minimum	400.0	400.0		
			1,100.0 ksi		
				Allow Stress Modification Factors	
				Cf or Cv for Bending	1.0
				Cf or Cv for Compression	1.0
				Cf or Cv for Tension	1.0
				Cm : Wet Use Factor	0.850
				Ct : Temperature Factor	1.0
				Cfu : Flat Use Factor	1.0
				Kf : Built-up columns	1.0 <small>NDS 15.3.2</small>
				Use Cr : Repetitive ?	No
				Brace condition for deflection (buckling) along columns :	
				X-X (width) axis :	Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0
				Y-Y (depth) axis :	Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0

Applied Loads

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

Column self weight included : 56.383 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 10.0 ft, D = 0.850, Lr = 1.20, S = 1.40 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.2238 : 1**
 Load Combination +D+S+H
 Governing NDS Formula **Comp Only, f_c/F_c'**
 Location of max.above base 0.0 ft
 At maximum location values are . . .
 Applied Axial 2.306 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 340.624 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.0 k Bottom along Y-Y 0.0 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.0 in at 0.0 ft above base
 for load combination : n/a
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

PASS Maximum Shear Stress Ratio = **0.0 : 1**
 Load Combination +0.60D+0.70E+0.60H
 Location of max.above base 10.0 ft
 Applied Design Shear 0.0 psi
 Allowable Shear 173.824 psi

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension



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Wood Column

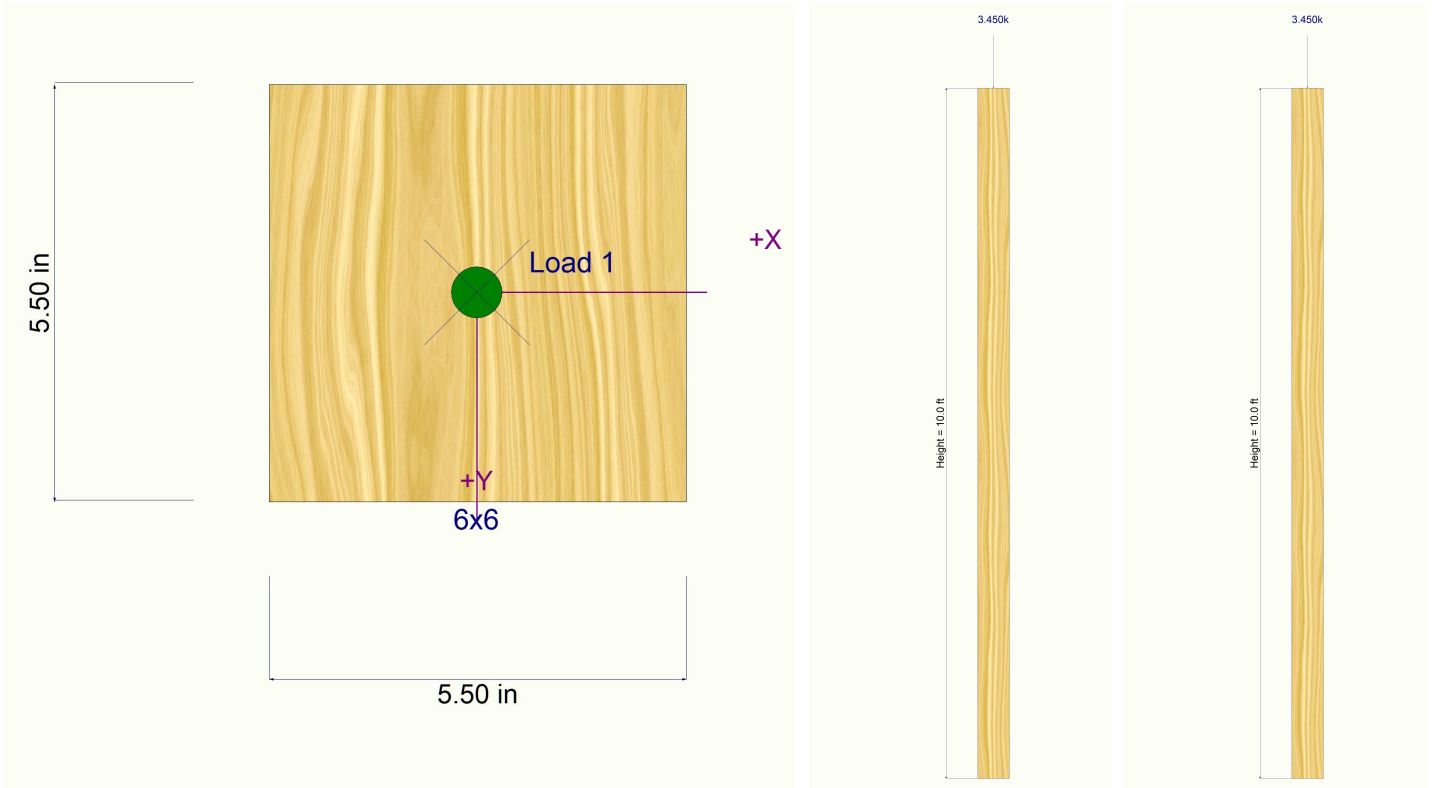
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DESCRIPTION: RP56

Sketches



Wood Beam

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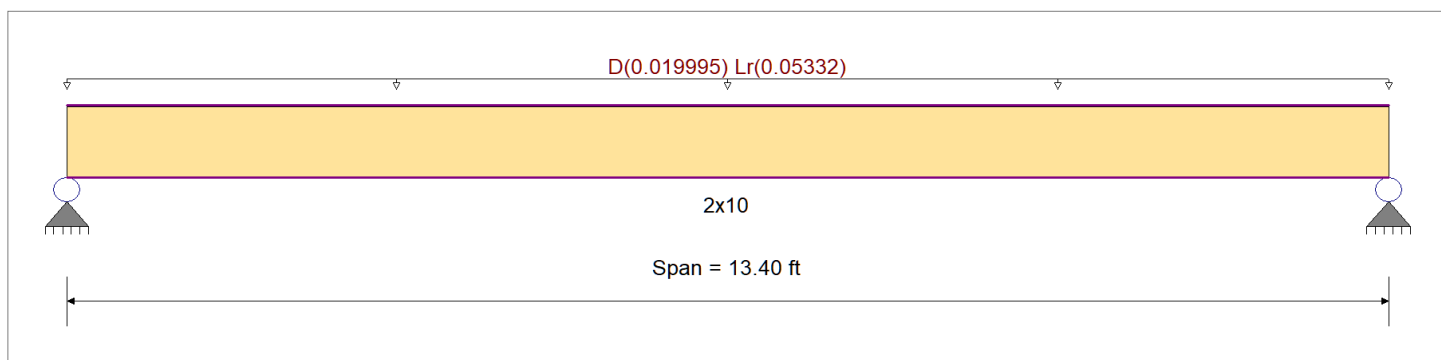
DESCRIPTION: FJ1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	E : Modulus of Elasticity
Load Combination ASCE 7-10	Fb -	850.0 psi	Ebend- xx
	Fc - Prll	1,300.0 psi	Eminbend - xx
Wood Species : Hem Fir	Fc - Perp	405.0 psi	
Wood Grade : No.2	Fv	150.0 psi	
	Ft	525.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			Repetitive Member Stress Increase



Applied Loads

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

Uniform Load : D = 0.0150, Lr = 0.040 ksf, Tributary Width = 1.333 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.687 : 1	Maximum Shear Stress Ratio =	0.252 : 1
Section used for this span	2x10	Section used for this span	2x10
fb: Actual =	923.15 psi	fv: Actual =	47.29 psi
Fb: Allowable =	1,344.06 psi	Fv: Allowable =	187.50 psi
Load Combination =	+D+Lr+H	Load Combination =	+D+Lr+H
Location of maximum on span =	6.700ft	Location of maximum on span =	0.000ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.303 in	Ratio =	531 >=480
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480
Max Downward Total Deflection	0.416 in	Ratio =	386 >=360
Max Upward Total Deflection	0.000 in	Ratio =	0 <360

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr+H	1	0.4160	6.749		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.491	0.491
Overall MINimum	0.357	0.357
+D+H	0.134	0.134
+D+L+H	0.134	0.134
+D+Lr+H	0.491	0.491
+D+S+H	0.134	0.134
+D+0.750Lr+0.750L+H	0.402	0.402
+D+0.750L+0.750S+H	0.134	0.134
+D+0.60W+H	0.134	0.134
+D+0.70E+H	0.134	0.134
+D+0.750Lr+0.750L+0.450W+H	0.402	0.402



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DESCRIPTION: FJ1

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	0.134	0.134
+D+0.750L+0.750S+0.5250E+H	0.134	0.134
+0.60D+0.60W+0.60H	0.080	0.080
+0.60D+0.70E+0.60H	0.080	0.080
D Only	0.134	0.134
Lr Only	0.357	0.357
H Only		

Wood Beam

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DESCRIPTION: FJ2

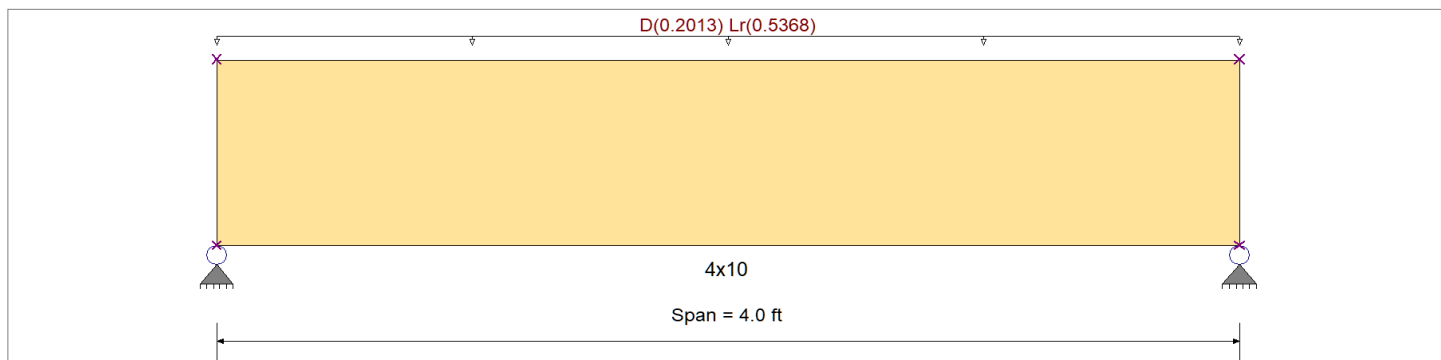
CODE REFERENCES

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

Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	E : Modulus of Elasticity	
Load Combination ASCE 7-10	Fb -	850.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	1,300.0 psi	Eminbend - xx	470.0ksi
Wood Species : Hem Fir	Fc - Perp	405.0 psi		
Wood Grade : No.2	Fv	150.0 psi		
	Ft	525.0 psi	Density	26.840pcf
Beam Bracing : Completely Unbraced				



Applied Loads

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

Uniform Load : D = 0.0150, Lr = 0.040 ksf, Tributary Width = 13.420 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.281 : 1	Maximum Shear Stress Ratio =	0.226 : 1
Section used for this span	4x10	Section used for this span	4x10
fb: Actual =	354.92psi	fv: Actual =	42.44 psi
Fb: Allowable =	1,262.34psi	Fv: Allowable =	187.50 psi
Load Combination	+D+Lr+H	Load Combination	+D+Lr+H
Location of maximum on span	2.000ft	Location of maximum on span	3.241 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.010 in	Ratio =	4631 >=480
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480
Max Downward Total Deflection	0.014 in	Ratio =	3368 >=360
Max Upward Total Deflection	0.000 in	Ratio =	0 <360

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr+H	1	0.0142	2.015		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.476	1.476
Overall MINimum	1.074	1.074
+D+H	0.403	0.403
+D+L+H	0.403	0.403
+D+Lr+H	1.476	1.476
+D+S+H	0.403	0.403
+D+0.750Lr+0.750L+H	1.208	1.208
+D+0.750L+0.750S+H	0.403	0.403
+D+0.60W+H	0.403	0.403
+D+0.70E+H	0.403	0.403
+D+0.750Lr+0.750L+0.450W+H	1.208	1.208



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DESCRIPTION: FJ2

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.450W+H	0.403	0.403
+D+0.750L+0.750S+0.5250E+H	0.403	0.403
+0.60D+0.60W+0.60H	0.242	0.242
+0.60D+0.70E+0.60H	0.242	0.242
D Only	0.403	0.403
Lr Only	1.074	1.074
H Only		

Wood Beam

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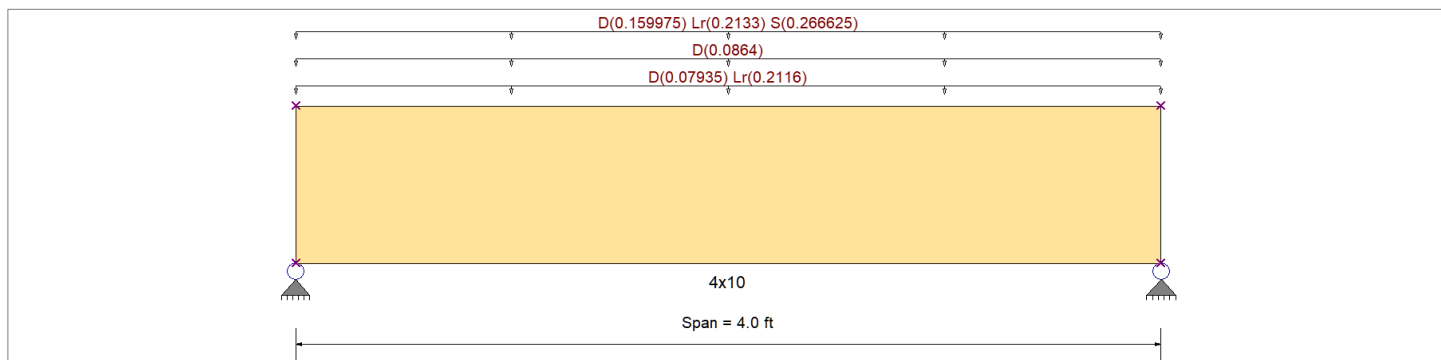
DESCRIPTION: FJ3

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	850.0 psi	E : Modulus of Elasticity	
Load Combination ASCE 7-10	Fb -	850.0 psi	Ebend- xx	1,300.0ksi
	Fc - Prll	1,300.0 psi	Eminbend - xx	470.0ksi
Wood Species : Hem Fir	Fc - Perp	405.0 psi		
Wood Grade : No.2	Fv	150.0 psi		
	Ft	525.0 psi	Density	26.840pcf
Beam Bracing : Completely Unbraced				



Applied Loads

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

- Uniform Load : D = 0.0150, Lr = 0.040 ksf, Tributary Width = 5.290 ft, (FLOOR)
- Uniform Load : D = 0.08640, Tributary Width = 1.0 ft, (Interior Wall)
- Uniform Load : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 10.665 ft, (Roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.286 1	Maximum Shear Stress Ratio =	0.230 : 1
Section used for this span	4x10	Section used for this span	4x10
fb: Actual =	360.94psi	fv: Actual =	43.16 psi
Fb: Allowable =	1,262.34psi	Fv: Allowable =	187.50 psi
Load Combination	+D+Lr+H	Load Combination	+D+Lr+H
Location of maximum on span =	2.000ft	Location of maximum on span =	3.241 ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.008 in	Ratio =	5851 >=480
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480
Max Downward Total Deflection	0.014 in	Ratio =	3312 >=360
Max Upward Total Deflection	0.000 in	Ratio =	0 <360

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr+H	1	0.0145	2.015		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.501	1.501
Overall MINimum	0.533	0.533
+D+H	0.651	0.651
+D+L+H	0.651	0.651
+D+Lr+H	1.501	1.501
+D+S+H	1.185	1.185
+D+0.750Lr+0.750L+H	1.289	1.289
+D+0.750L+0.750S+H	1.051	1.051
+D+0.60W+H	0.651	0.651



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DESCRIPTION: FJ3

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
+D+0.70E+H	0.651	0.651
+D+0.750Lr+0.750L+0.450W+H	1.289	1.289
+D+0.750L+0.750S+0.450W+H	1.051	1.051
+D+0.750L+0.750S+0.5250E+H	1.051	1.051
+0.60D+0.60W+0.60H	0.391	0.391
+0.60D+0.70E+0.60H	0.391	0.391
D Only	0.651	0.651
Lr Only	0.850	0.850
S Only	0.533	0.533
H Only		

Wood Column

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DESCRIPTION: RP7

Code References

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

Load Combinations Used : ASCE 7-10

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	6x6	
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber	
Overall Column Height	10 ft			Wood Member Type	Sawn	
<i>(Used for non-slender calculations)</i>						
Wood Species	Hem Fir			Exact Width	5.50 in	
Wood Grade	No.2			Exact Depth	5.50 in	
Fb +	850.0 psi	Fv	150.0 psi	Area	30.250 in ²	
Fb -	850.0 psi	Ft	525.0 psi	Ix	76.255 in ⁴	
Fc - Prll	1,300.0 psi	Density	26.840 pcf	Iy	76.255 in ⁴	
Fc - Perp	405.0 psi					
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Allow Stress Modification Factors	
	Basic	1,300.0	1,300.0	1,300.0 ksi	Cf or Cv for Bending	1.0
	Minimum	470.0	470.0		Cf or Cv for Compression	1.0
					Cf or Cv for Tension	1.0
					Cm : Wet Use Factor	1.0
					Ct : Temperature Factor	1.0
					Cfu : Flat Use Factor	1.0
					Kf : Built-up columns	1.0 <i>NDS 15.3.2</i>
					Use Cr : Repetitive ?	No
					Brace condition for deflection (buckling) along columns :	
					X-X (width) axis :	Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0
					Y-Y (depth) axis :	Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0

Applied Loads

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

Column self weight included : 56.383 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 10.0 ft, D = 1.430, Lr = 1.910, S = 2.390 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	0.1851 : 1	Maximum SERVICE Lateral Load Reactions . .	
	Load Combination	+D+S+H	Top along Y-Y	0.0 k
	Governing NDS Formula	Comp Only, f_c/F_c'	Bottom along Y-Y	0.0 k
	Location of max.above base	0.0 ft	Top along X-X	0.0 k
	Bottom along X-X		0.0 k	
	At maximum location values are . . .		Maximum SERVICE Load Lateral Deflections . . .	
	Applied Axial	3.876 k	Along Y-Y	0.0 in at 0.0 ft above base
	Applied Mx	0.0 k-ft	for load combination :	n/a
	Applied My	0.0 k-ft	Along X-X	0.0 in at 0.0 ft above base
	Fc : Allowable	692.21 psi	for load combination :	n/a
PASS	Maximum Shear Stress Ratio =	0.0 : 1	Other Factors used to calculate allowable stresses . . .	
	Load Combination	+0.60D+0.70E+0.60H	Bending	Compression
	Location of max.above base	10.0 ft	Tension	
	Applied Design Shear	0.0 psi		
	Allowable Shear	240.0 psi		



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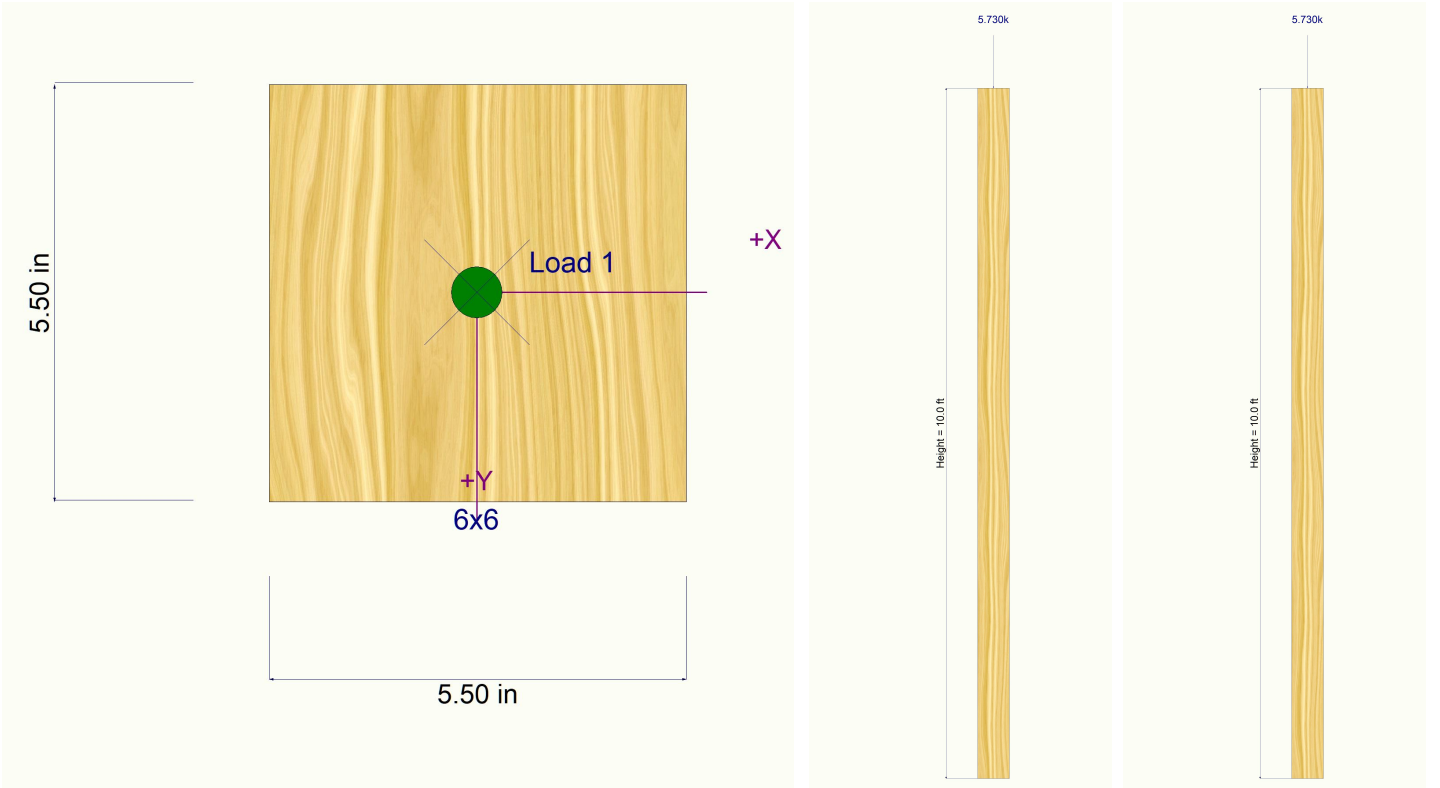
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DESCRIPTION: RP7

Sketches



General Footing

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DESCRIPTION: F1

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-10

General Information

Material Properties

f _c : Concrete 28 day strength	=	3.0 ksi
f _y : Rebar Yield	=	60.0 ksi
E _c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf
	=	ft

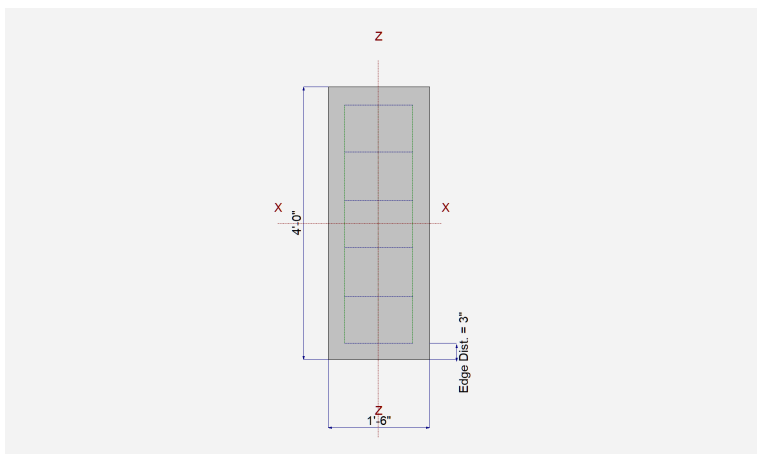
Increases based on footing plan dimension

Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf
	=	ft

Dimensions

Width parallel to X-X Axis	=	1.50 ft
Length parallel to Z-Z Axis	=	4.0 ft
Footing Thickness	=	8 in

Pedestal dimensions...		
px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in

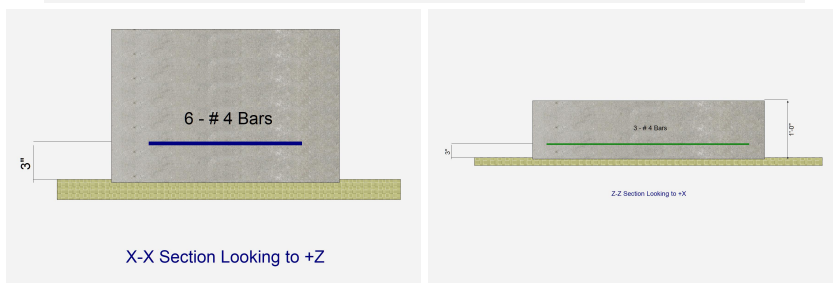


Reinforcing

Bars parallel to X-X Axis	=	6.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis	=	3.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4
Bandwidth Distribution Check (ACI 15.4.4.2)		
Direction Requiring Closer Separation		

Bars along X-X Axis

# Bars required within zone	54.5 %
# Bars required on each side of zone	45.5 %



Applied Loads

	D	L _r	L	S	W	E	H	
P : Column Load	=	1.60		4.30				k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k



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General Footing

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Lic. # : KW-06011909

DESCRIPTION: F1

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.7520	Soil Bearing	1.128 ksf	1.50 ksf	+D+L+H about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Overturing - Z-Z	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.03510	Z Flexure (+X)	0.4125 k-ft/ft	11.753 k-ft/ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.03510	Z Flexure (-X)	0.4125 k-ft/ft	11.753 k-ft/ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.1893	X Flexure (+Z)	2.933 k-ft/ft	15.494 k-ft/ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.1893	X Flexure (-Z)	2.933 k-ft/ft	15.494 k-ft/ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	n/a	1-way Shear (+X)	0.0 psi	82.158 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	0.2050	1-way Shear (+Z)	16.840 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.2050	1-way Shear (-Z)	16.840 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	n/a	2-way Punching	24.716 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H

Wall Footing

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

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DESCRIPTION: F2

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
 Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
AutoCalc Footing Weight as DL :	=	Yes

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Reference Depth below Surface	=	ft
Allow. Pressure Increase per foot of depth when base footing is below	=	ksf
	=	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width when footing is wider than	=	ksf
	=	ft

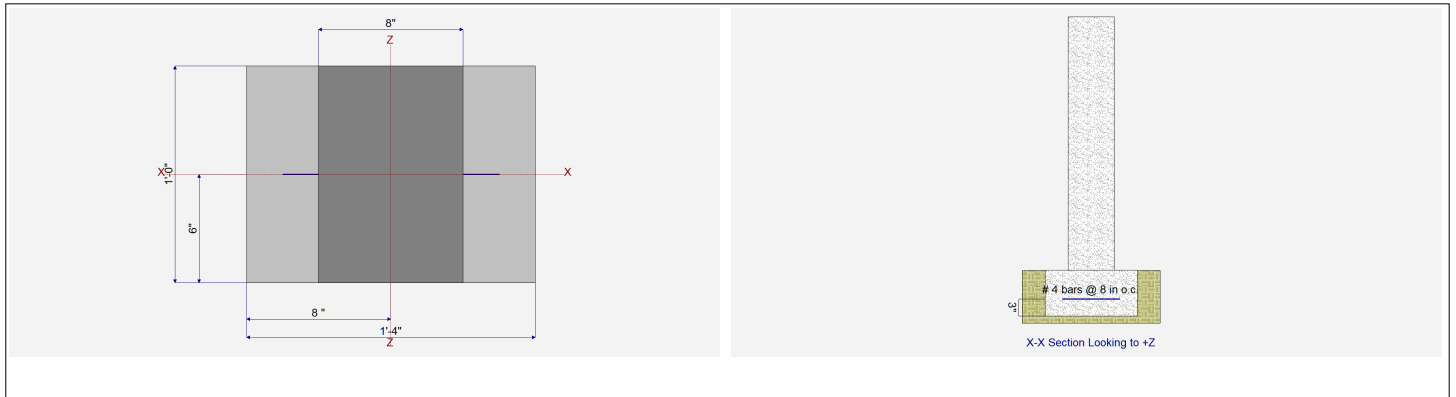
Adjusted Allowable Bearing Pressure

= 1.50 ksf

Dimensions

Reinforcing

Footing Width	=	1.333 ft	Footing Thickness	=	8.0 in	Bars along X-X Axis		
Wall Thickness	=	8.0 in	Rebar Centerline to Edge of Concrete...			Bar spacing	=	8.00
Wall center offset from center of footing	=	0 in	at Bottom of footing =	=	3.0 in	Reinforcing Bar Size	=	# 4



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.570	0.50	0.2680	0.630		k
OB : Overburden	=						ksf
V-x	=						k
M-zz	=						k-ft
Vx applied	=						in above top of footing

Wall Footing

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

L2 Engineers

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DESCRIPTION: F2

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination	
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

Utilization Ratio	Item	Applied	Capacity	Governing Load Combination	
PASS	0.6864	Soil Bearing	1.030 ksf	1.50 ksf	+D+0.750L+0.750S
PASS	0.01373	Z Flexure (+X)	0.08803 k-ft	6.410 k-ft	+1.20D+L+1.60S
PASS	0.008005	Z Flexure (-X)	0.05131 k-ft	6.410 k-ft	+1.20D+L+0.20S
PASS	n/a	1-way Shear (+X)	0.0 psi	88.741 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress		Actual / Allowable Ratio
			-X	+X	
, D Only	1.50 ksf	0.0 in	0.5243 ksf	0.5243 ksf	0.350
, +D+L	1.50 ksf	0.0 in	0.7253 ksf	0.7253 ksf	0.484
, +D+Lr	1.50 ksf	0.0 in	0.8994 ksf	0.8994 ksf	0.600
, +D+S	1.50 ksf	0.0 in	0.9969 ksf	0.9969 ksf	0.665
, +D+0.750Lr+0.750L	1.50 ksf	0.0 in	0.9564 ksf	0.9564 ksf	0.638
, +D+0.750L+0.750S	1.50 ksf	0.0 in	1.030 ksf	1.030 ksf	0.686
, +0.60D	1.50 ksf	0.0 in	0.3146 ksf	0.3146 ksf	0.210

Units : k-ft

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	0.04073	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.40D	0.04073	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+0.50Lr+1.60L	0.06317	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+0.50Lr+1.60L	0.06317	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60L+0.50S	0.06587	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60L+0.50S	0.06587	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60Lr+L	0.07937	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60Lr+L	0.07937	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60Lr	0.06821	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60Lr	0.06821	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+L+1.60S	0.08803	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+L+1.60S	0.08803	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60S	0.07687	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+1.60S	0.07687	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+0.50Lr+L	0.05647	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+0.50Lr+L	0.05647	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+L+0.50S	0.05918	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+L+0.50S	0.05918	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +0.90D	0.02618	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +0.90D	0.02618	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+L+0.20S	0.05131	-X	Bottom	0.1728	Min Temp %	0.3	6.41	OK
, +1.20D+L+0.20S	0.05131	+X	Bottom	0.1728	Min Temp %	0.3	6.41	OK

Wall Footing

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

L2 Engineers

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DESCRIPTION: F2

One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.50Lr+1.60L	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60L+0.50S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60Lr+L	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60Lr	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+L+1.60S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+1.60S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+0.50Lr+L	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+L+0.50S	0 psi	0 psi	0 psi	88.741 psi	0	OK
+0.90D	0 psi	0 psi	0 psi	88.741 psi	0	OK
+1.20D+L+0.20S	0 psi	0 psi	0 psi	88.741 psi	0	OK

General Footing

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L2 Engineers

DESCRIPTION: F3

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-10

General Information

Material Properties

f_c : Concrete 28 day strength	=	3.0 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
ϕ Values Flexure	=	0.90
Shear	=	0.750

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf
	=	ft

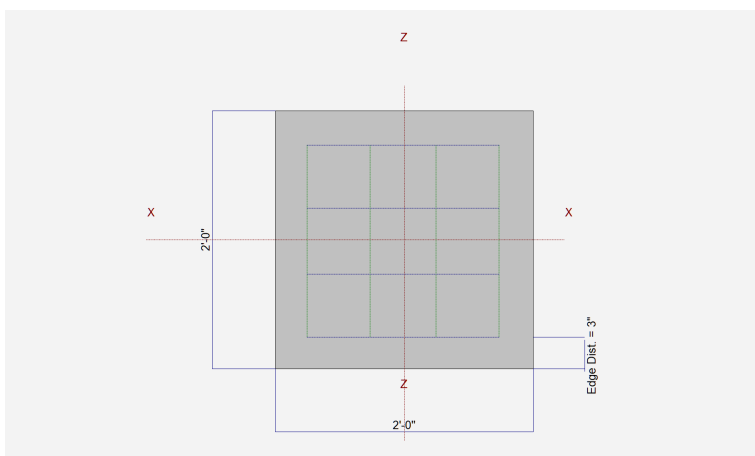
Increases based on footing plan dimension

Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf
	=	ft

Dimensions

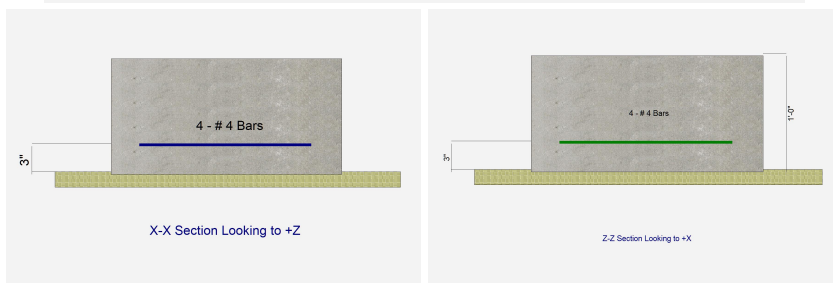
Width parallel to X-X Axis	=	2 ft
Length parallel to Z-Z Axis	=	2.0 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...		
px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	4.0
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis	=	
Number of Bars	=	4
Reinforcing Bar Size	=	# 4
Bandwidth Distribution Check (ACI 15.4.4.2)		
Direction Requiring Closer Separation		n/a
# Bars required within zone		n/a
# Bars required on each side of zone		n/a



Applied Loads

	D	Lr	L	S	W	E	H	
P : Column Load	=	.9	1.20		1.40			k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k



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General Footing

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 L2 Engineers

DESCRIPTION: F3

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.480	Soil Bearing	0.720 ksf	1.50 ksf	+D+S+H about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Overturing - Z-Z	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.02678	Z Flexure (+X)	0.4150 k-ft/ft	15.494 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	0.02678	Z Flexure (-X)	0.4150 k-ft/ft	15.494 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	0.02678	X Flexure (+Z)	0.4150 k-ft/ft	15.494 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	0.02678	X Flexure (-Z)	0.4150 k-ft/ft	15.494 k-ft/ft	+1.20D+0.50L+1.60S+1.60H
PASS	0.02245	1-way Shear (+X)	1.844 psi	82.158 psi	+1.20D+0.50L+1.60S+1.60H
PASS	0.02245	1-way Shear (-X)	1.844 psi	82.158 psi	+1.20D+0.50L+1.60S+1.60H
PASS	0.02245	1-way Shear (+Z)	1.844 psi	82.158 psi	+1.20D+0.50L+1.60S+1.60H
PASS	0.02245	1-way Shear (-Z)	1.844 psi	82.158 psi	+1.20D+0.50L+1.60S+1.60H
PASS	0.05336	2-way Punching	8.767 psi	164.317 psi	+1.20D+0.50L+1.60S+1.60H

Design Method	Allowable Stress Design (ASD)	▼
Connection Type	Lateral loading	▼
Fastener Type	Bolt	▼
Loading Scenario	Single Shear - Concrete Main Member	▼

Main Member Type	Concrete	▼
Bolt Embedment Depth in Concrete	4 in.	▼
Main Member: Angle of Load to Grain	0	
Side Member Type	Hem-Fir	▼
Side Member Thickness	1.5 in.	▼
Side Member: Angle of Load to Grain	0	
Fastener Diameter	5/8 in.	▼
Load Duration Factor	C _D = 1.0	▼
Wet Service Factor	C _M = 0.7	▼
Temperature Factor	C _t = 1.0	▼

Connection Yield Modes

Im	3281 lbs.
Is	788 lbs.
II	1123 lbs.
III _m	1343 lbs.
III _s	604 lbs.
IV	801 lbs.

Adjusted ASD Capacity	604 lbs.
------------------------------	-----------------

- Bolt bending yield strength of 45,000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for bolts with adequate end distance, edge distance and spacing per NDS chapter 11.

While every effort has been made to insure the accuracy of the information presented, and special effort has been made to assure that the information reflects the state-of-the-art, neither the American Wood Council nor its members assume any responsibility for any particular design prepared from this on-line Connection Calculator. Those using this on-line Connection Calculator assume all liability from its use.

The Connection Calculator was designed and created by Cameron Knudson, Michael Dodson and David Pollock at Washington State University. Support for development of the Connection Calculator was provided by [American Wood Council](#).

FJI TO STEMWALL $\Sigma: .4912k$ $604/491 \text{ lbs} = 1.23' \text{ O.C.}$, SAY 14" O.C.

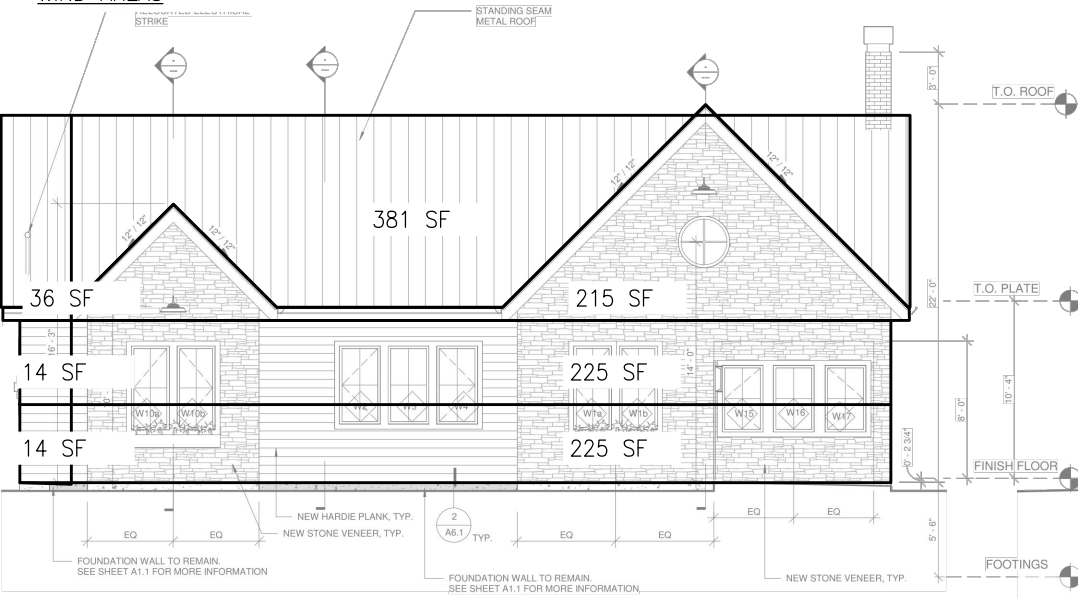
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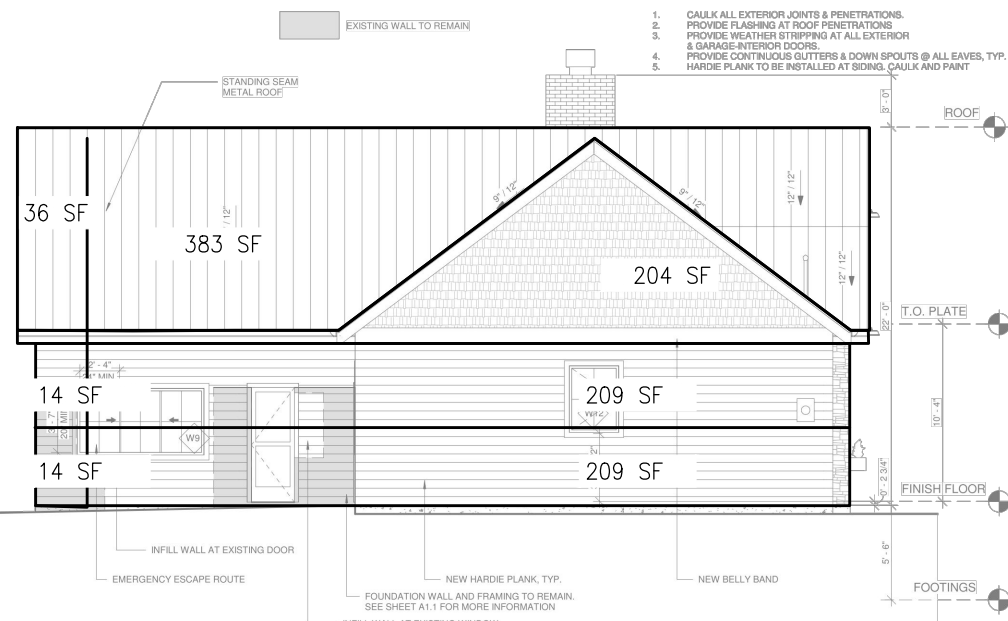


Lateral Analysis

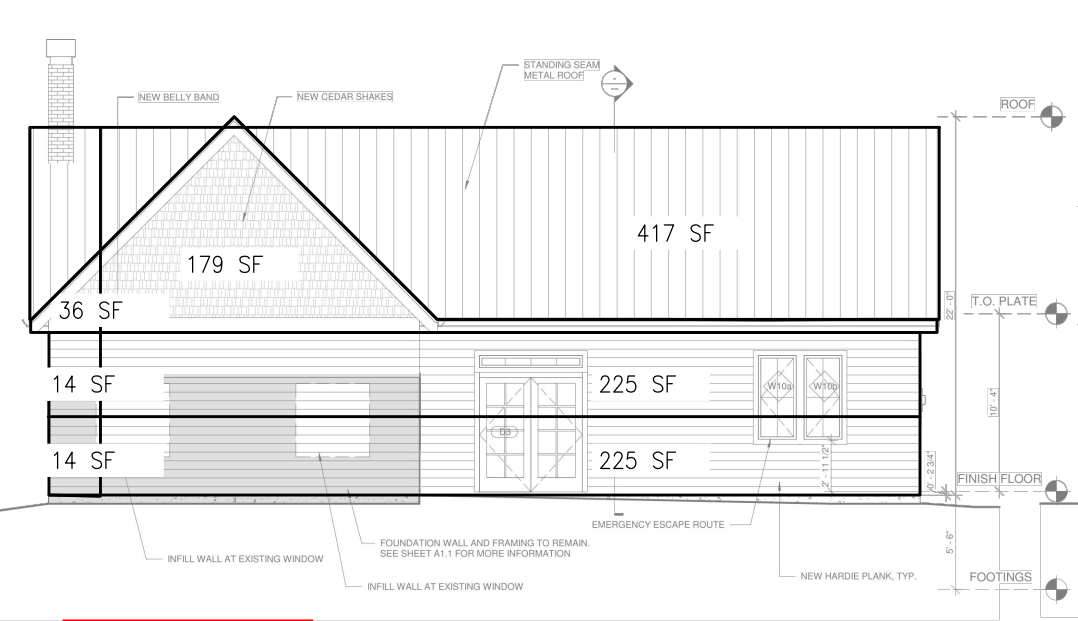
WIND AREAS



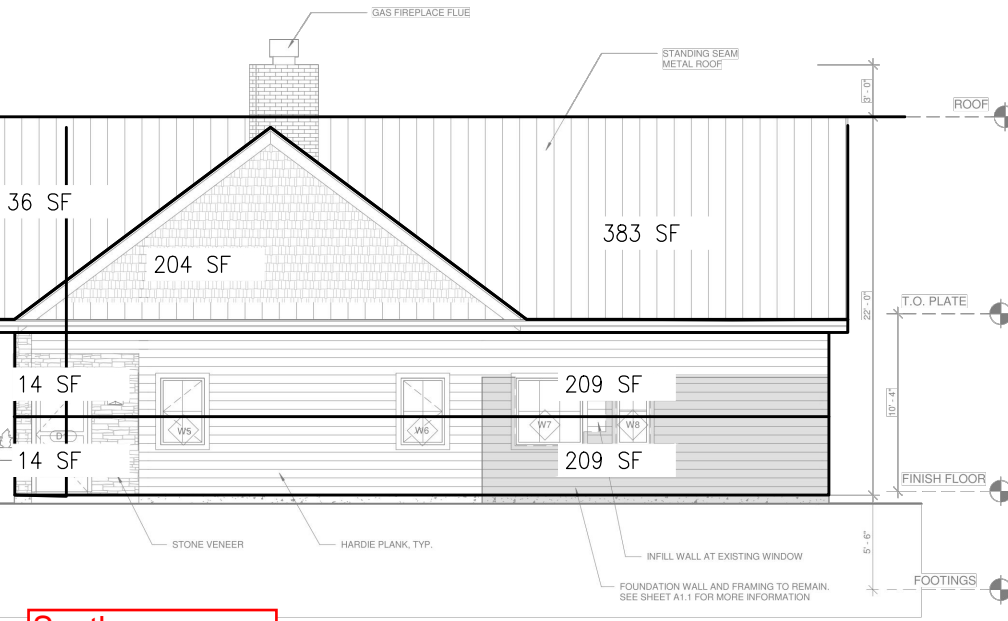
West



North



East



South

EXISTING WALL TO REMAIN

1. CAULK ALL EXTERIOR JOINTS & PENETRATIONS.
2. PROVIDE FLASHING AT ROOF PENETRATIONS
3. PROVIDE WEATHER STRIPPING AT ALL EXTERIOR & GARAGE-INTERIOR DOORS.
4. PROVIDE CONTINUOUS GUTTERS & DOWN SPOUTS @ ALL EAVES, TYP.
5. HARDIE PLANK TO BE INSTALLED AT SIDING, CAULK AND PAINT



Project: 21-120 Levella

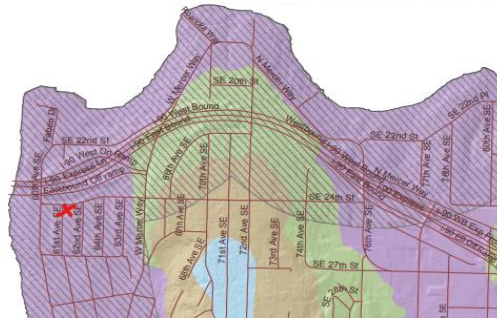
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 8 NE 198th PL
 Le, WA 98072

Exposure: C
 Risk Cat: II
 z: 22 ft
 Kz: 0.916
 Kzt: 1
 Kd: 0.85
 Ke: 1
 v: 97
 End Zone: 3
 Roof Angle: 45

(Table 26.10-1)

(Table 26.6-1)

(Table 26.9-1)



WIND EXPOSURE CATEGORIES:
 Wind Exposure Category: Exposure 'C' (1500 feet from Lake), Exposure 'B' (all other areas)

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_{t1} Factor:
 K_{t1} Factor: 1.0, 1.3, 1.6, 1.9

$$qz = .00256 * kz * kzt * kd * Ke * v^2 \quad (26.10-1)$$

$$qz = 18.75 \text{ psf}$$

Table 26.9-1 Ground Elevation Factor, K_e

Ground Elevation above Sea Level		Ground Elevation Factor K_e
ft	m	
<0	<0	See note 2
0	0	1.00
1,000	305	0.96
2,000	610	0.93
3,000	914	0.90
4,000	1,219	0.86
5,000	1,524	0.83
6,000	1,829	0.80
>6,000	>1,829	See note 2

Notes

- The conservative approximation $K_e = 1.00$ is permitted in all cases.
- The factor K_e shall be determined from the above table using interpolation or from the following formula for all elevations:
 $K_e = e^{-0.000362z_g}$ (z_g = ground elevation above sea level in ft).
 $K_e = e^{-0.000119z_g}$ (z_g = ground elevation above sea level in m).
- K_e is permitted to be take as 1.00 in all cases.

Table 26.6-1 Wind Directionality Factor, K_d

Structure Type	Directionality Factor K_d
Buildings	
Main Wind Force Resisting System	0.85
Components and Cladding	0.85

Table 26.10-1 Velocity Pressure Exposure Coefficients, K_h and K_z

Height above Ground Level, z	Exposure				
	ft	m	B	C	D
0-15	0-4.6	0.57 (0.70) ²	0.85	1.03	
20	6.1	0.62 (0.70) ²	0.90	1.08	
25	7.6	0.66 (0.70) ²	0.94	1.12	
30	9.1	0.70	0.98	1.16	

^aUse 0.70 in Chapter 28, Exposure B, when $z < 30$ ft (9.1 m).

Notes

- The velocity pressure exposure coefficient K_z may be determined from the following formula:
 For $15 \text{ ft (4.6 m)} \leq z \leq z_g$ $K_z = 2.01(z/z_g)^{2/\alpha}$
 For $z < 15 \text{ ft (4.6 m)}$ $K_z = 2.01(15/z_g)^{2/\alpha}$
- α and z_g are tabulated in Table 26.11-1.
- Linear interpolation for intermediate values of height z is acceptable.
- Exposure categories are defined in Section 26.7.

Roof Angle	Building Surface							
	1	2	3	4	1E	2E	3E	4E
0-5	0.4	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43
20	0.53	-0.69	-0.48	-0.43	0.8	-1.07	-0.69	-0.64
30-45	0.56	0.21	-0.43	-0.37	0.69	0.27	-0.53	-0.48
90	0.56	0.56	-0.37	-0.37	0.69	0.69	-0.48	-0.48

18.5 0.56 0.21 -0.43 -0.37 0.69 0.27 -0.53 -0.48



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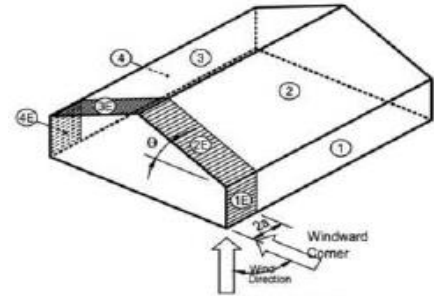
17848 NE 198th PL

Woodinville, WA 98072

E/W DIRECTION

REGION	Gcpf	A(sf)	PRESSURE (psf)	SUM
1	0.56	440	4621.03	4621.03
	0.56	225	2363.03	2363.03
2	0.21	381	1500.52	1500.52
3	-0.43	417	-3362.81	3362.81
4	-0.37	404	-2803.37	2803.37
	-0.37	225	-1561.28	1561.28
1E	0.69	14	181.17	181.17
	0.69	14	181.17	181.17
4E	-0.48	14	-126.03	126.03
	-0.48	14	-126.03	126.03
2E	0.27	36	182.29	182.29
3E	-0.53	36	-357.83	357.83
				17366.55
.6W=				10419.93

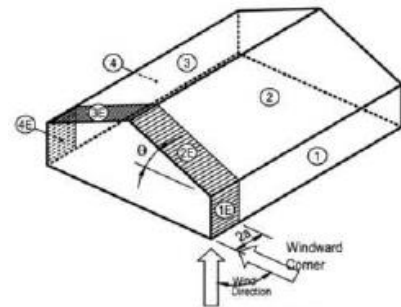
13135.05 ROOF
4231.50 FDN



N/S DIRECTION

REGION	Gcpf	A(sf)	PRESSURE (psf)	SUM
1	0.56	413	4337.46	4337.46
	0.56	209	2194.99	2194.99
2	0.21	383	1508.40	1508.40
3	-0.43	383	-3088.62	3088.62
	-0.37	413	-2865.82	2865.82
4	-0.37	209	-1450.26	1450.26
	-0.37	209	-1450.26	1450.26
1E	0.69	14	181.17	181.17
	0.69	14	181.17	181.17
4E	-0.48	14	-126.03	126.03
	-0.48	14	-126.03	126.03
2E	0.27	36	182.29	182.29
3E	-0.53	36	-357.83	357.83
				16600.07
.6W=				9960.04

12647.62
3952.44



Search Information

Address: 2412 60th Ave SE, Mercer Island, WA 98040, USA
Coordinates: 47.588654, -122.2526731
Elevation: 63 ft
Timestamp: 2021-10-21T20:24:02.816Z
Hazard Type: Wind



ASCE 7-16

MRI 10-Year 67 mph
 MRI 25-Year 73 mph
 MRI 50-Year 78 mph
 MRI 100-Year 83 mph
 Risk Category I 92 mph
 Risk Category II 97 mph
 Risk Category III 104 mph
 Risk Category IV 108 mph

ASCE 7-10

MRI 10-Year 72 mph
 MRI 25-Year 79 mph
 MRI 50-Year 85 mph
 MRI 100-Year 91 mph
 Risk Category I 100 mph
 Risk Category II 110 mph
 Risk Category III-IV 115 mph

ASCE 7-05

ASCE 7-05 Wind Speed 85 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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SEISMIC MASS, W

Item	Floor Area (SF) or Wall Length (LF)	Area Weight (psf) Wall Weight (plf)	Item Wt (lbs)
Roof	2,050	15	30,750
Exterior Walls	196	89	17,444
Interior Walls	196	72	14,112
			62,306

lbs

SEISMIC BASE SHEAR

Risk Cat: II
 SDs: 1.118
 R: 6.5
 Ie: 1
 ct: 0.02 (Table 12.8-2)
 x: 0.75 (Table 12.8-2)
 hn: 22 ft

$$T_a = ct \cdot hn^{\frac{1}{4}} \quad (12.8.2.1)$$

$$= 0.20 \quad k = 1.0$$

$$C_s = SDs / (R \cdot I_e)$$

$$= 0.172$$

$$C_{smin} = .044 \cdot SDs \cdot I_e$$

$$= 0.049$$

$$V = C_s \cdot W \quad (12.8-1)$$

	Weight, W	V
Roof	46,528	8,003
1st	15,778	2,714
Sum	62,306	10,717

$$V = 8,003 \text{ Reentrant Corner Irregularity}$$

$$0.7E = 5,601.97 \quad *1.25 \quad 7002.46$$

Wind Controls

Search Information

Address: 2412 60th Ave SE, Mercer Island, WA 98040, USA

Coordinates: 47.588654, -122.2526731

Elevation: 63 ft

Timestamp: 2021-10-21T20:24:51.146Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D-default



Basic Parameters

Name	Value	Description
S_S	1.397	MCE_R ground motion (period=0.2s)
S_1	0.487	MCE_R ground motion (period=1.0s)
S_{MS}	1.677	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.118	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

▼Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.902	Coefficient of risk (0.2s)
CR_1	0.896	Coefficient of risk (1.0s)
PGA	0.598	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.717	Site modified peak ground acceleration

T _L	6	Long-period transition period (s)
SsRT	1.397	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.549	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	3.156	Factored deterministic acceleration value (0.2s)
S1RT	0.487	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.543	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.292	Factored deterministic acceleration value (1.0s)
PGAd	1.092	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

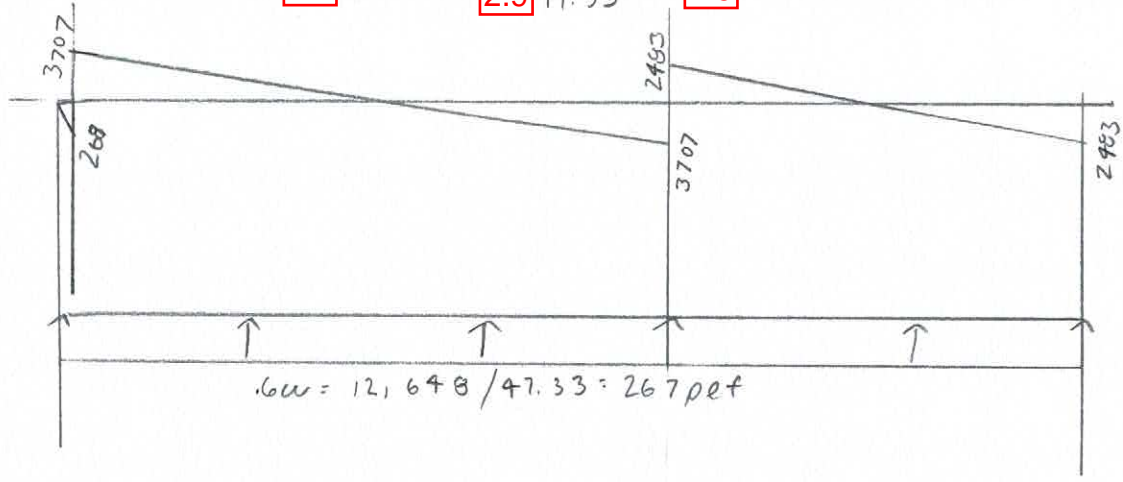
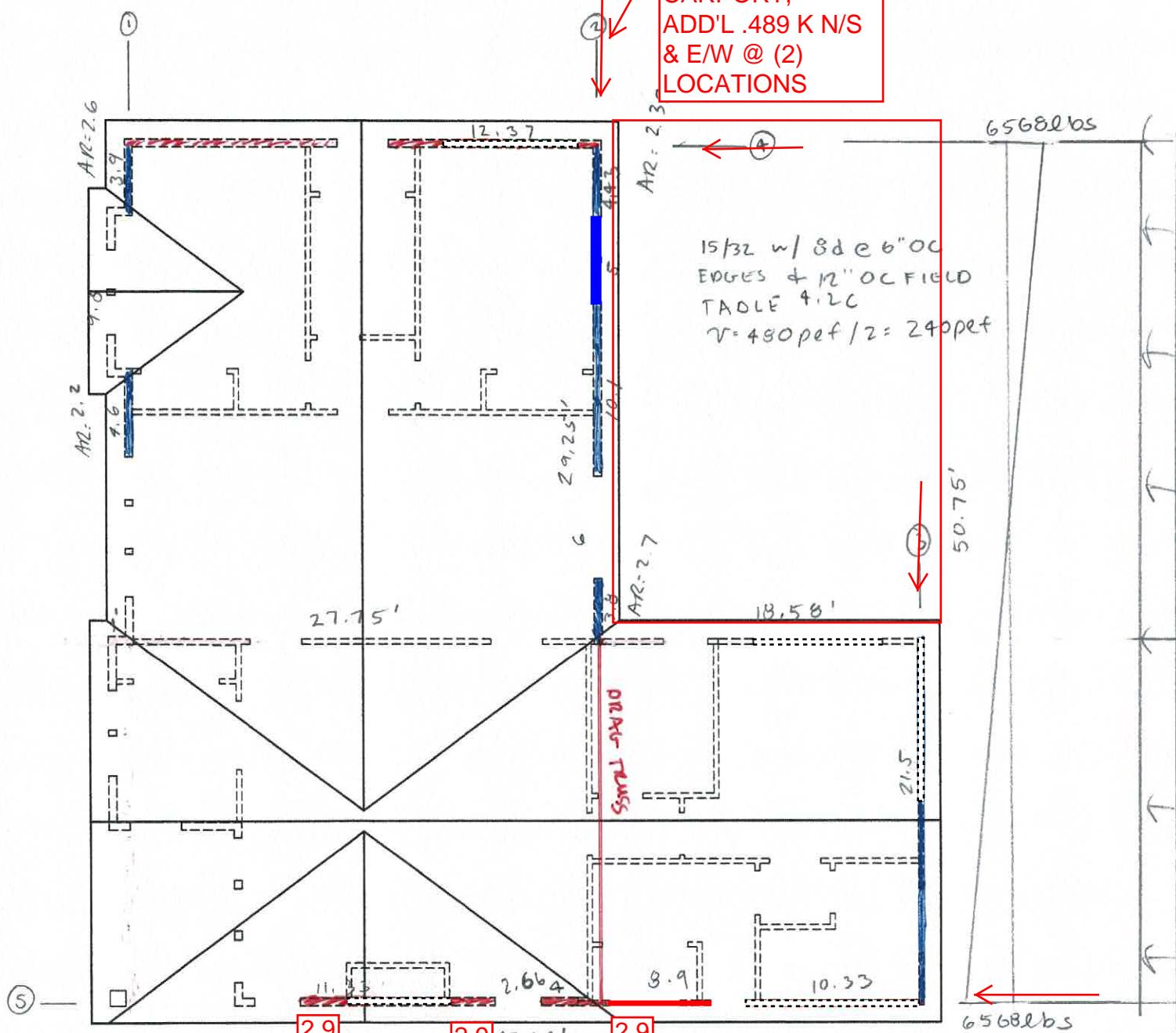
Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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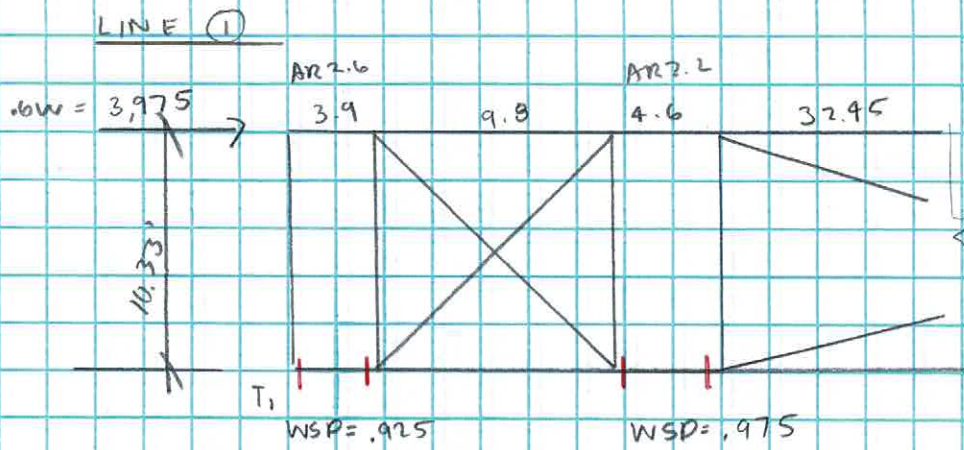
WIND CONTROLS N/S & E/W

ROOF PLAN NT

ROOF DIAPHRAGM EXTENDED FOR CARPORT, ADD'L .489 K N/S & E/W @ (2) LOCATIONS



.6w = 13,135 / 50.75 = 258.8pef

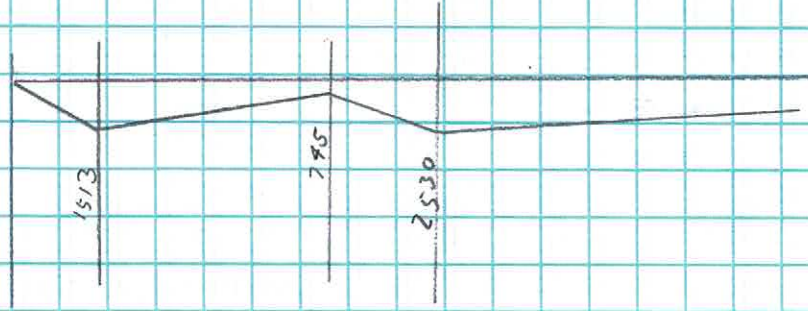


$$\frac{3975}{3.9(.925) + 4.6(.975)} = 491 \text{ pef}$$

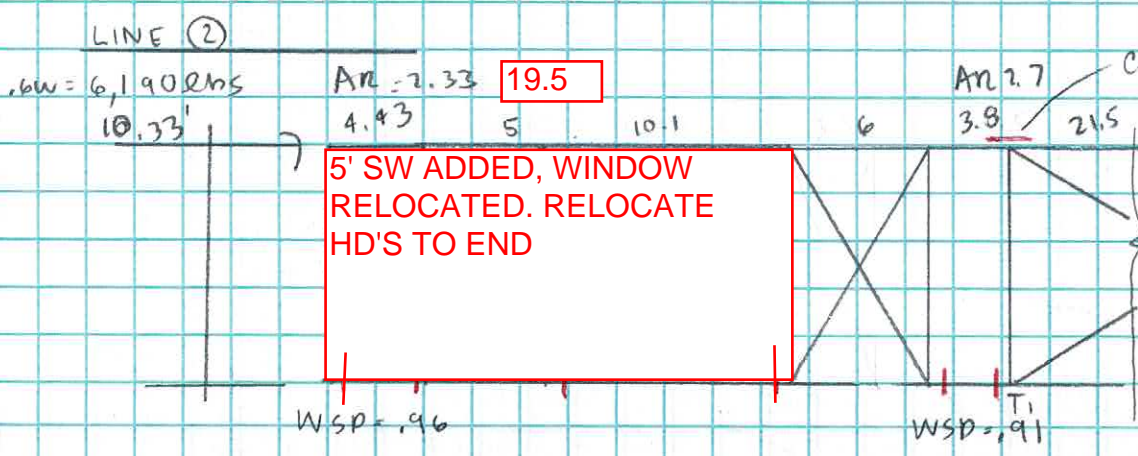
$\therefore SW4$

$$T_1 = \left[467.6(3.9)(10.33) - .6(3.9)(8.9)(10.33)(3.9/2) \right] / (3.9) = 4723 \text{ lbs}$$

$\therefore HDU8$

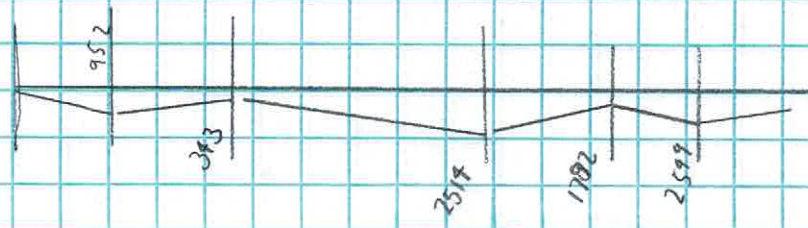


$v = 467 \text{ pef}$
 $v = 388 \text{ pef}$
 $v = 78.32 \text{ pef}$



$$T_1 = \left[1283(10.33) - .6(3.8)(8.9)(10.33)(3.8/2) \right] / 3.8 = 3392 \text{ lbs}$$

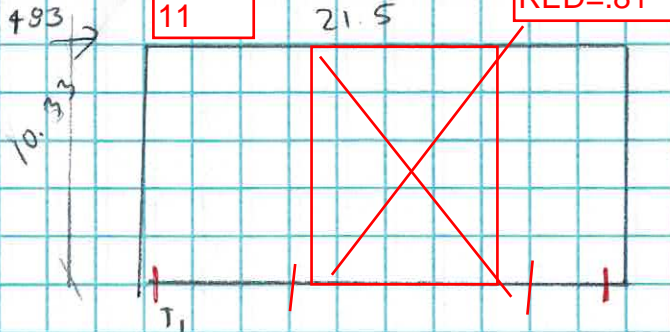
$\therefore HDU5$



$v = 337$
 $v = 215$
 $v = 121.97$

③

$.6W = 2493$



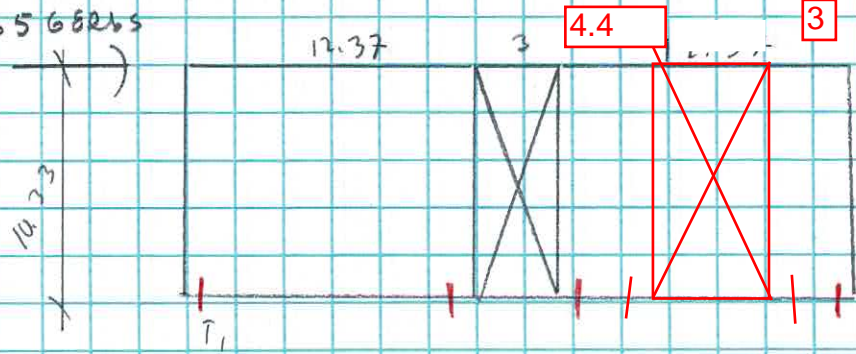
$2972/11=270\text{PFL}$
SW4

SW6

$T_1 = 270 * 10 = 2700\text{LBS, HUD5}$

④

$.6W = 6568\text{lbs}$

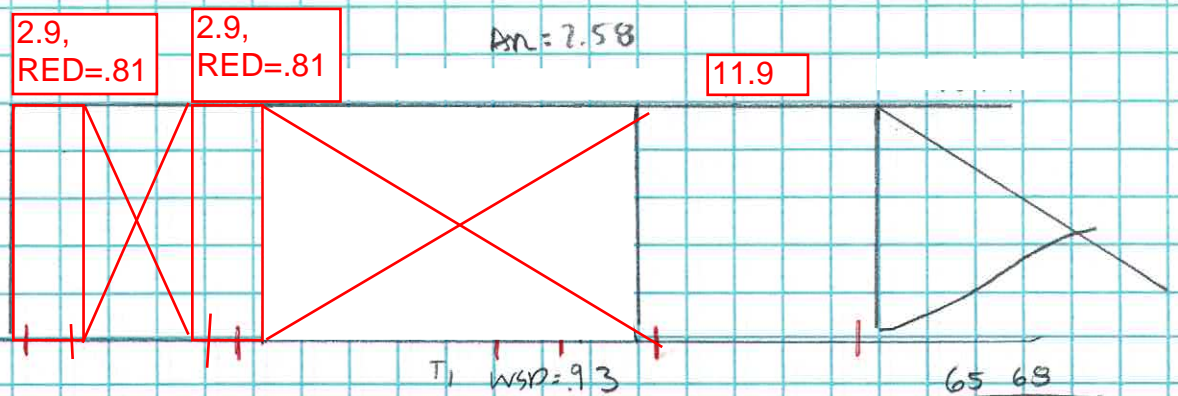


$6568/19.66=333\text{ PFL}$
SW6

$T_1 = 333 * 10 = 3330\text{LBS, HUD5}$

⑤

6568lbs



$6568/16.7=393\text{ PFL}$
SW4

$T_1 = 393 * 10 = 3930\text{LBS, HUD5}$



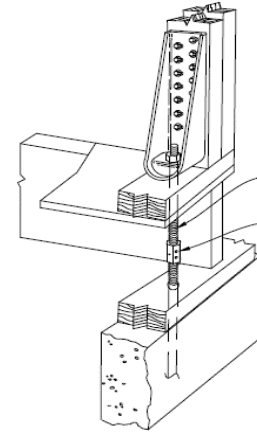
L2 Engineers, LLC
 17848 NE 198th PL
 Woodinville WA 98072

CONCRETE BREAKOUT STRENGTH IN TENSION

POST INSTALLED ANCHOR IN EXIST CONC

λa:	1
kc:	17
f'c (psi):	3000
s1 (in):	0
hef (in):	6
tstem(in):	6

24 for cast-in, 17 for post installed



Ψed,n:	0.8
Ψc,n:	1.4
Ψcp,n:	1
φ :	0.7

17.4.2.5b
.75 [supplimentary reinf provided],
.7 [supplimentary reinf not provided]

Nb= $Kc \cdot \lambda a \cdot (f'c)^{1/2} \cdot hef^{1.5}$ *ACI 17.4.2.2a*
 = 13,684.74

Anc (in²)= $t \cdot (1.5 \cdot hef^2)$ 108.00
 = 225 Use 3" square plate washer & 45Deg Angle of failure per 17.4.2.8

Anco (in²)= $9 \cdot hef^2$
 = 324.00

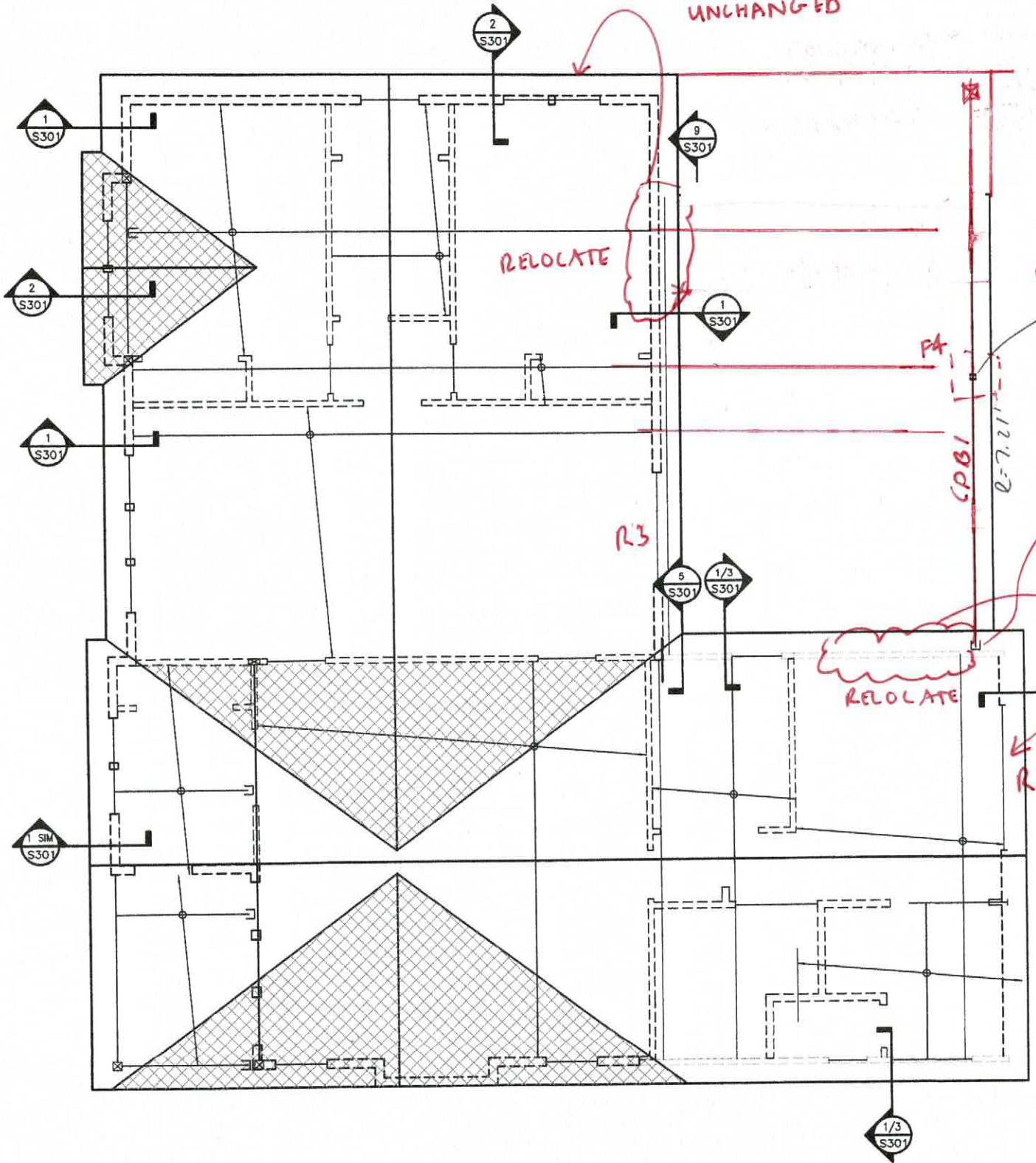
Vcb= $Anc / Anco \cdot \Psi ed \cdot \Psi c,n \cdot \Psi cp,n \cdot Nb$ *ACI 17.4.2.1a*
 = 10,643.68
 φVcb= 7,450.58

LEVELLA 2/19/2022

$$5685F \times 0.010 = 5.68K$$
$$V = 0.172(5.68) = .978/2$$
$$= .489K \text{ EA}$$

WALL LINE
ADD'D

WIND AREAS
UNCHANGED



PCPB1
D 2.31
Lr 2.0
S 3.6

D 1.19
Lr 1.45
S 1.81
HUC 6
G10-5

R7

Wood Beam

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

L2 Engineers

(c) ENERCALC INC 1983-2022

DESCRIPTION: R7

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0379	3.798		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.528	0.528
Overall MINimum	0.330	0.330
D Only	0.198	0.198
+D+Lr	0.462	0.462
+D+S	0.528	0.528
+D+0.750Lr	0.396	0.396
+D+0.750S	0.445	0.445
+0.60D	0.119	0.119
Lr Only	0.264	0.264
S Only	0.330	0.330

Wood Beam

Project File: levella.ec6

LIC#: KW-06016908, Build:20.22.1.30

L2 Engineers

(c) ENERCALC INC 1983-2022

DESCRIPTION: CPB1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-16

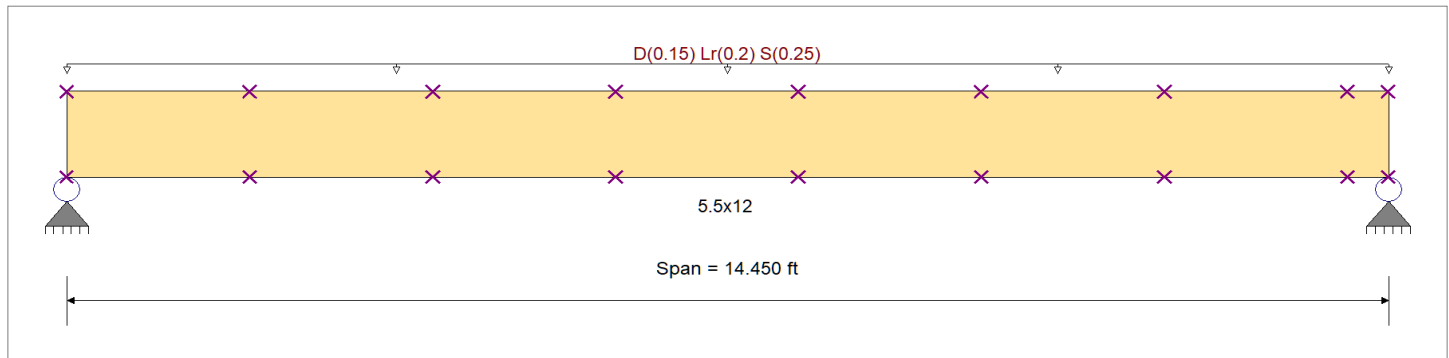
Material Properties

Analysis Method : Allowable Stress Design	Fb +	2400 psi	<i>E : Modulus of Elasticity</i>	
Load Combination : ASCE 7-16	Fb -	1850 psi	Ebend- xx	1800ksi
	Fc - Prll	1650 psi	Eminbend - xx	950ksi
Wood Species : DF/DF	Fc - Perp	650 psi	Ebend- yy	1600ksi
Wood Grade : 24F-V4	Fv	265 psi	Eminbend - yy	850ksi
	Ft	1100 psi	Density	31.21pcf

Beam Bracing : Beam bracing is defined as a set spacing over all spans

Unbraced Lengths

First Brace starts at 2.0 ft from Left-Most support
 Regular spacing of lateral supports on length of beam = 2.0 ft



Applied Loads

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

Beam self weight calculated and added to loading
 Uniform Load : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 10.0 ft, (ROOF)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.446	1	Maximum Shear Stress Ratio	=	0.222	: 1
Section used for this span		5.5x12		Section used for this span		5.5x12	
fb: Actual	=	983.04psi		fv: Actual	=	59.09 psi	
Fb: Allowable	=	2,202.74psi		Fv: Allowable	=	266.66 psi	
Load Combination		+D+S		Load Combination		+D+S	
Location of maximum on span	=	7.225ft		Location of maximum on span	=	13.501 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection	0.219 in	Ratio =	793	>=360	Span: 1 : S Only		
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a		
Max Downward Total Deflection	0.362 in	Ratio =	478	>=240	Span: 1 : +D+S		
Max Upward Total Deflection	0 in	Ratio =	0	<240	n/a		

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values			
			M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v	
D Only																		
	Length = 1.951 ft	1	0.106	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	2.00	182.14	1724.89	0.00	1.03	23.43	208.69
	Length = 2.004 ft	1	0.180	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	3.41	310.01	1724.81	0.87	23.43	208.69	
	Length = 2.004 ft	1	0.219	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	4.16	377.89	1724.81	0.54	23.43	208.69	
	Length = 2.004 ft	1	0.226	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	4.29	389.85	1724.81	0.21	23.43	208.69	
	Length = 2.004 ft	1	0.224	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	4.24	385.78	1724.81	0.45	23.43	208.69	
	Length = 2.004 ft	1	0.193	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	3.67	333.69	1724.81	0.78	23.43	208.69	
	Length = 2.004 ft	1	0.128	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	2.44	221.61	1724.81	1.03	23.43	208.69	
	Length = 0.4746 ft	1	0.029	0.112	0.90	1.000	1.00	1.00	0.80	1.00	1.00	0.54	49.54	1727.26	1.03	23.43	208.69	
+D+Lr						1.000	1.00	1.00	0.80	1.00	1.00			0.00	0.00	0.00	0.00	0.00

Wood Column

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

L2 Engineers

(c) ENERCALC INC 1983-2022

DESCRIPTION: PCPB1

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combinations Used : ASCE 7-16

General Information

Analysis Method	Allowable Stress Design			Wood Section Name	6x6
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	10 ft			Wood Member Type	Sawn
<i>(Used for non-slender calculations)</i>					
Wood Species	Hem Fir			Exact Width	5.50 in
Wood Grade	No.2			Exact Depth	5.50 in
Fb +	850.0 psi	Fv	150.0 psi	Area	30.250 in^2
Fb -	850.0 psi	Ft	525.0 psi	Ix	76.255 in^4
Fc - Prll	1,300.0 psi	Density	26.840 pcf	Iy	76.255 in^4
Fc - Perp	405.0 psi			Allow Stress Modification Factors	
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	Cf or Cv for Bending 1.0	
	Basic	1,300.0	1,300.0	1,300.0 ksi	Cf or Cv for Compression 1.0
	Minimum	470.0	470.0		Cf or Cv for Tension 1.0
					Cm : Wet Use Factor 1.0
					Ct : Temperature Fact 1.0
					Cfu : Flat Use Factor 1.0
					Kf : Built-up columns 1.0 <i>NDS 15.3.2</i>
					Use Cr : Repetitive ? No
Brace condition for deflection (buckling) along columns :					
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 10					
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 10					

Applied Loads

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

Column self weight included : 56.383 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 10.0 ft, D = 2.380, Lr = 2.90, S = 3.620 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.2892 : 1	Maximum SERVICE Lateral Load Reactions . .	
Load Combination	+D+S	Top along Y-Y	0.0 k
Governing NDS Formula	Comp Only, fc/Fc'	Bottom along Y-Y	0.0 k
Location of max.above base	0.0 ft	Top along X-X	0.0 k
At maximum location values are .		Bottom along X-X	0.0 k
Applied Axial	6.056 k	Maximum SERVICE Load Lateral Deflections . . .	
Applied Mx	0.0 k-ft	Along Y-Y	0.0 in at 0.0 ft above base
Applied My	0.0 k-ft	for load combination : n/a	
Fc : Allowable	692.21 psi	Along X-X	0.0 in at 0.0 ft above base
		for load combination : n/a	
PASS Maximum Shear Stress Ratio =	0.0 : 1	Other Factors used to calculate allowable stresses . . .	
Load Combination	+0.60D	Bending	Compression
Location of max.above base	10.0 ft	Tension	
Applied Design Shear	0.0 psi		
Allowable Shear	240.0 psi		

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.555	0.1240	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+Lr	1.250	0.433	0.2506	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+S	1.150	0.463	0.2892	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+0.750Lr	1.250	0.433	0.2165	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+0.750S	1.150	0.463	0.2460	PASS	0.0 ft	0.0	PASS	10.0 ft
+0.60D	1.600	0.352	0.06601	PASS	0.0 ft	0.0	PASS	10.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft		Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top		
D Only						2.436						

Wood Column

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

L2 Engineers

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DESCRIPTION: PCPB1

Maximum Reactions

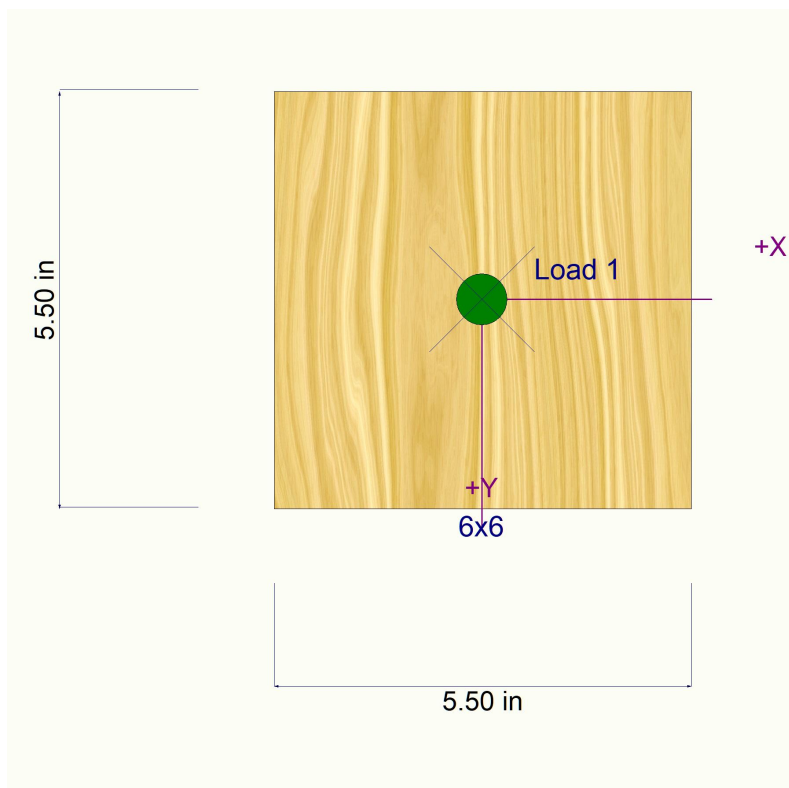
Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
+D+Lr						5.336				
+D+S						6.056				
+D+0.750Lr						4.611				
+D+0.750S						5.151				
+0.60D						1.462				
Lr Only						2.900				
S Only						3.620				

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Max. Y-Y Deflection	
	Distance	Distance	Distance	Distance
D Only	0.000 in	0.000ft	0.000 in	0.000 ft
+D+Lr	0.0000 in	0.000ft	0.000 in	0.000 ft
+D+S	0.0000 in	0.000ft	0.000 in	0.000 ft
+D+0.750Lr	0.0000 in	0.000ft	0.000 in	0.000 ft
+D+0.750S	0.0000 in	0.000ft	0.000 in	0.000 ft
+0.60D	0.0000 in	0.000ft	0.000 in	0.000 ft
Lr Only	0.0000 in	0.000ft	0.000 in	0.000 ft
S Only	0.0000 in	0.000ft	0.000 in	0.000 ft

Sketches



General Footing

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

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DESCRIPTION: F4

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
 Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

Increases based on footing plan dimension

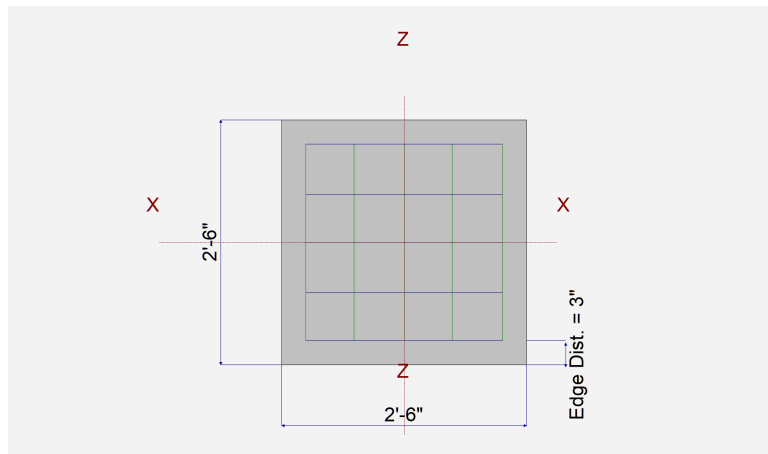
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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Dimensions

Width parallel to X-X Axis	=	2.50 ft
Length parallel to Z-Z Axis	=	2.50 ft
Footing Thickness	=	12.0 in

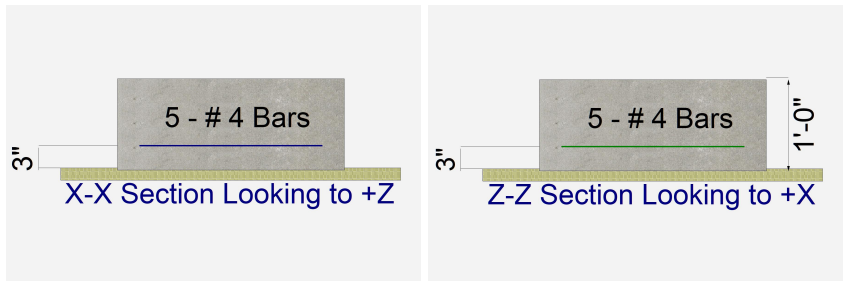
Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



Reinforcing

Bars parallel to X-X Axis		
Number of Bars	=	5
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis		
Number of Bars	=	5
Reinforcing Bar Size	=	# 4
Bandwidth Distribution Check (ACI 15.4.4.2)		
Direction Requiring Closer Separation		n/a
# Bars required within zone		n/a
# Bars required on each side of zone		n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	2.380	2.90	3.620			k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

General Footing

Project File: levella.ec6

LIC# : KW-06016908, Build:20.22.1.30

L2 Engineers

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DESCRIPTION: F4

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.7367	Soil Bearing	1.105 ksf	1.50 ksf	+D+S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.06977	Z Flexure (+X)	1.081 k-ft/ft	15.494 k-ft/ft	+1.20D+1.60S
PASS	0.06977	Z Flexure (-X)	1.081 k-ft/ft	15.494 k-ft/ft	+1.20D+1.60S
PASS	0.06977	X Flexure (+Z)	1.081 k-ft/ft	15.494 k-ft/ft	+1.20D+1.60S
PASS	0.06977	X Flexure (-Z)	1.081 k-ft/ft	15.494 k-ft/ft	+1.20D+1.60S
PASS	0.07797	1-way Shear (+X)	6.406 psi	82.158 psi	+1.20D+1.60S
PASS	0.07797	1-way Shear (-X)	6.406 psi	82.158 psi	+1.20D+1.60S
PASS	0.07797	1-way Shear (+Z)	6.406 psi	82.158 psi	+1.20D+1.60S
PASS	0.07797	1-way Shear (-Z)	6.406 psi	82.158 psi	+1.20D+1.60S
PASS	0.1478	2-way Punching	24.289 psi	164.317 psi	+1.20D+1.60S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
		Zecc (in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.5258	0.5258	n/a	n/a	0.351
X-X, +D+Lr	1.50	n/a	0.0	0.9898	0.9898	n/a	n/a	0.660
X-X, +D+S	1.50	n/a	0.0	1.105	1.105	n/a	n/a	0.737
X-X, +D+0.750Lr	1.50	n/a	0.0	0.8738	0.8738	n/a	n/a	0.583
X-X, +D+0.750S	1.50	n/a	0.0	0.9602	0.9602	n/a	n/a	0.640
X-X, +0.60D	1.50	n/a	0.0	0.3155	0.3155	n/a	n/a	0.210
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.5258	0.5258	0.351
Z-Z, +D+Lr	1.50	0.0	n/a	n/a	n/a	0.9898	0.9898	0.660
Z-Z, +D+S	1.50	0.0	n/a	n/a	n/a	1.105	1.105	0.737
Z-Z, +D+0.750Lr	1.50	0.0	n/a	n/a	n/a	0.8738	0.8738	0.583
Z-Z, +D+0.750S	1.50	0.0	n/a	n/a	n/a	0.9602	0.9602	0.640
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.3155	0.3155	0.210

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.4165	+Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.40D	0.4165	-Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+0.50Lr	0.5383	+Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+0.50Lr	0.5383	-Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+0.50S	0.5833	+Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+0.50S	0.5833	-Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+1.60Lr	0.9370	+Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+1.60Lr	0.9370	-Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+1.60S	1.081	+Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+1.60S	1.081	-Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +0.90D	0.2678	+Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +0.90D	0.2678	-Z	Bottom	0.2592	AsMin	0.40	15.494	OK
X-X, +1.20D+0.20S	0.4475	+Z	Bottom	0.2592	AsMin	0.40	15.494	OK