L2 ENGINEERS
17848 NE 198th Place
Woodinville, WA 98072

Structural Calculations
The Levella

2412 60th Ave SE
Mercer Island, WA 98040

Project # 21-120
October 22, 2021

10/22/2021

L2 ENGINEERS
17848 NE 198th Place
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	
	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	
	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
	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
	7.20

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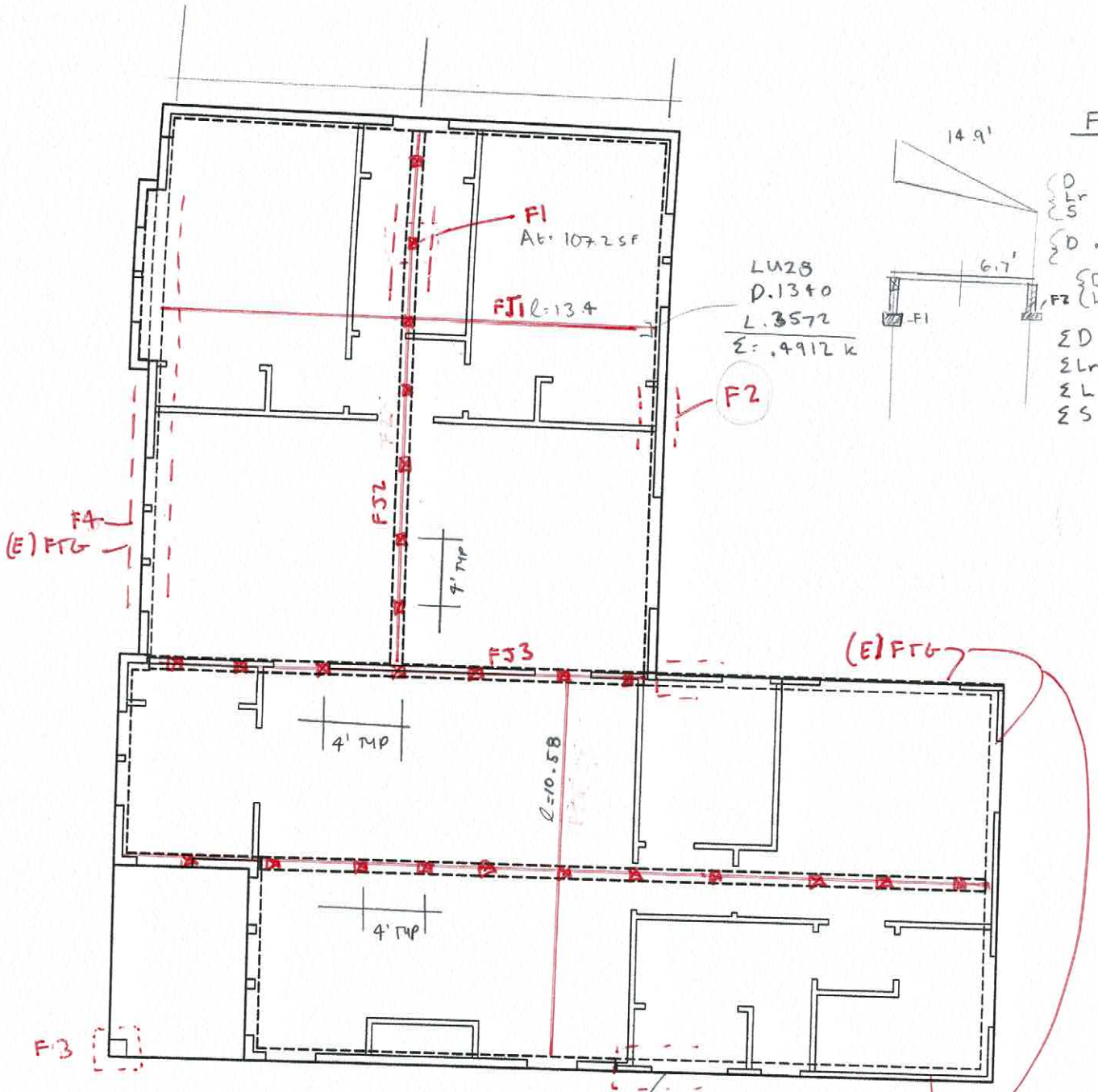
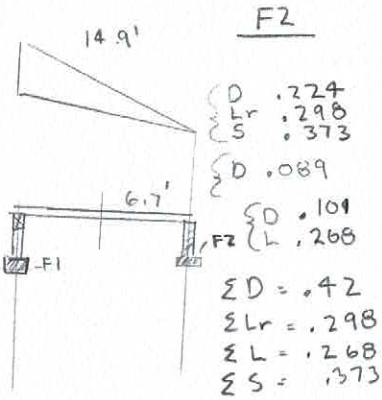
Gravity Analysis

1ST FLOOR
NT



FRAMING & FDN PLAN
NTS

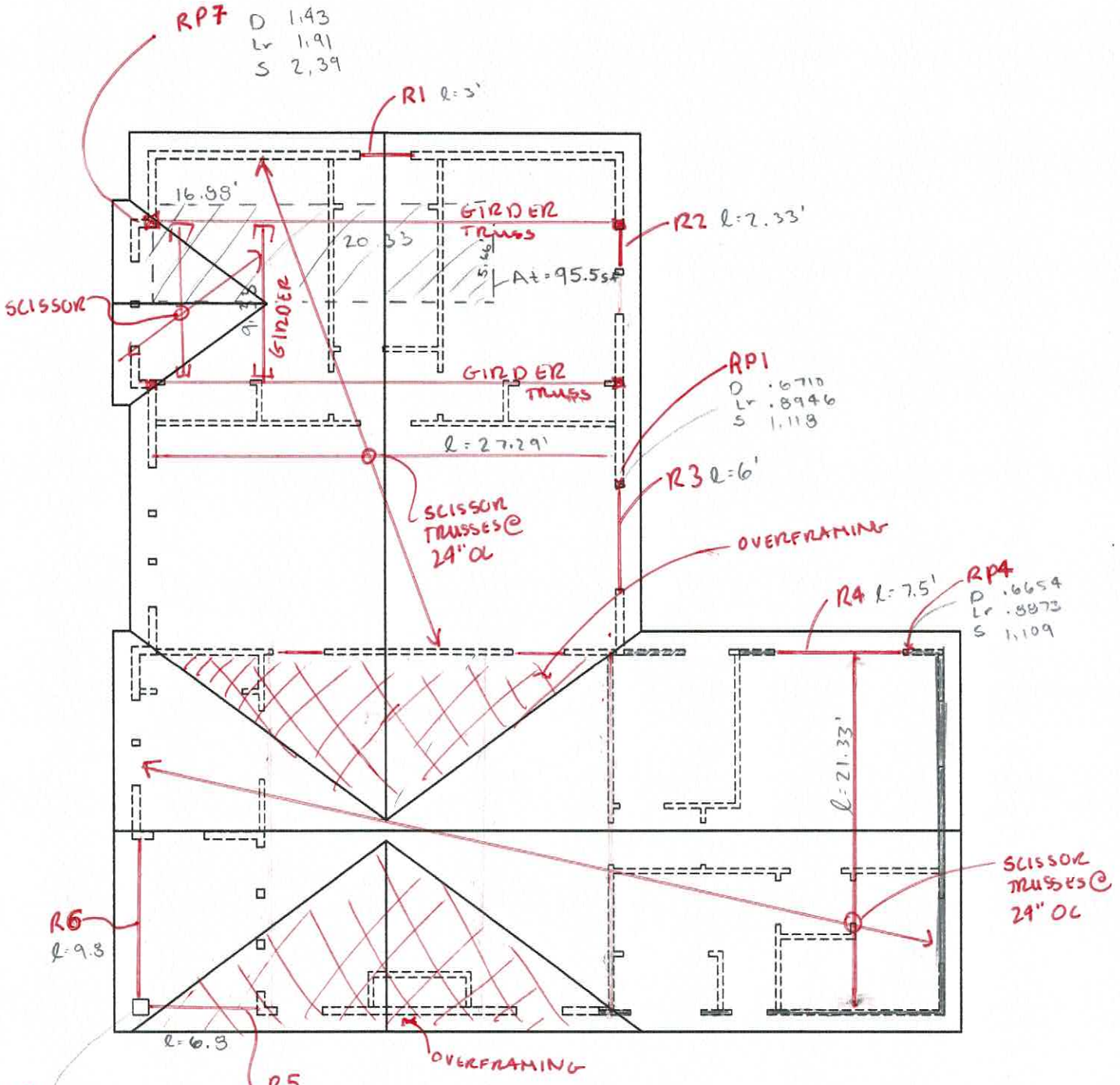


(E) 6" WALL W/ 6" DP FTG, 1'-4" WIDE

(N) OVEREXCAVATE & PLACE STRUCTURAL FILL

(E) SOIL IMBALANCE 24" TO 30"

ROOF PLAN
NTS



FRAMING PLAN

NTS

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Wood Beam

File: IEVELLA.ec6

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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
Load Combination : ASCE 7-10

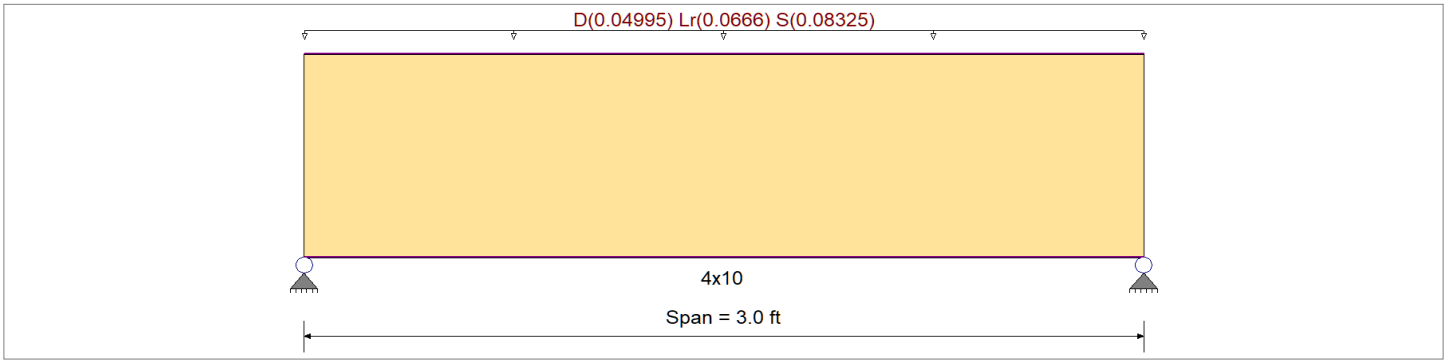
Wood Species : Hem Fir
Wood Grade : No.2

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

Fb +	850 psi
Fb -	850 psi
Fc - Prll	1300 psi
Fc - Perp	405 psi
Fv	150 psi
Ft	525 psi

E : Modulus of Elasticity

Ebend- xx	1300 ksi
Eminbend - xx	470 ksi
Density	26.84 pcf



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	=	36.03 psi	fv: Actual	=	4.53 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	=	1.500 ft	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

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		

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Wood Column

File: lEVELLA.ec6

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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
End Fixities : Top & Bottom Pinned
Overall Column Height : 10 ft
(Used for non-slender calculations)

Wood Species : Hem Fir
Wood Grade : No.2

Fb +	850.0 psi	Fv	150.0 psi
Fb -	850.0 psi	Ft	525.0 psi
Fc - Prll	1,300.0 psi	Density	26.840 pcf
Fc - Perp	405.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,300.0	1,300.0	1,300.0 ksi
Minimum	470.0	470.0	

Wood Section Name : **2-2x6**
Wood Grading/Manuf. : Graded Lumber
Wood Member Type : Sawn

Exact Width	**3.0**	in
Exact Depth	**5.50**	in
Area	16.50	in^2
Ix	41.594	in^4
Iy	12.375	in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.30
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 *NDS 15.3.2*
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 Forumla Comp Only, fc/Fc'
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

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

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

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

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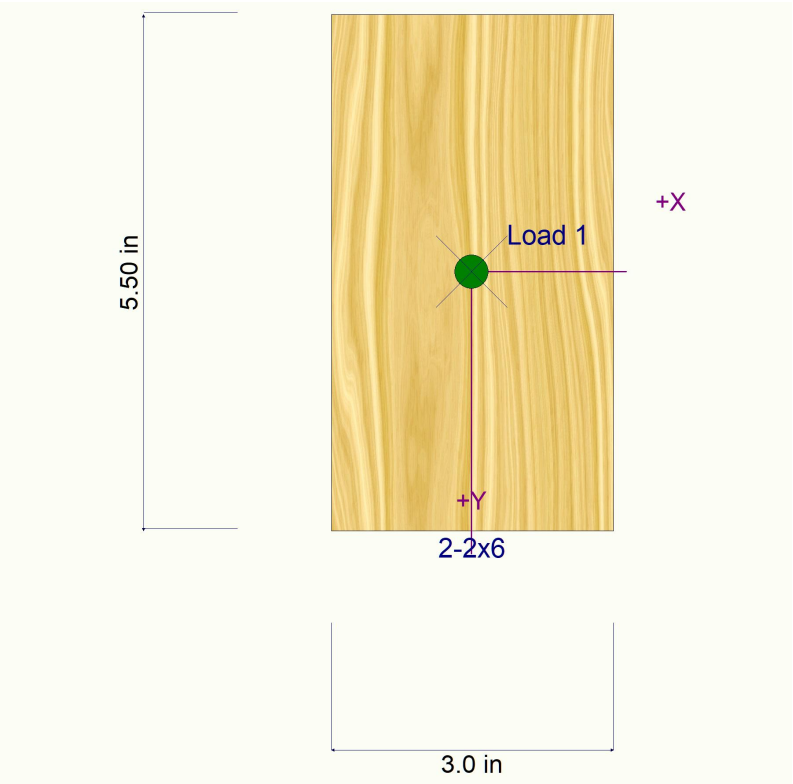
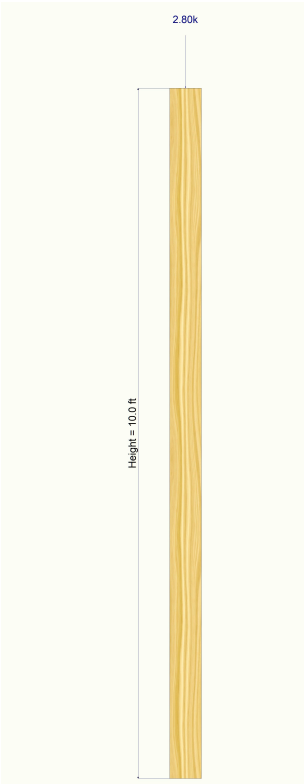
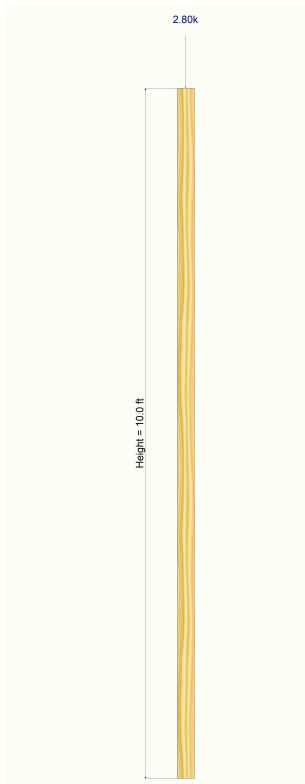
Wood Column

DESCRIPTION: RP1/RP4

Sketches







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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
Load Combination : ASCE 7-10

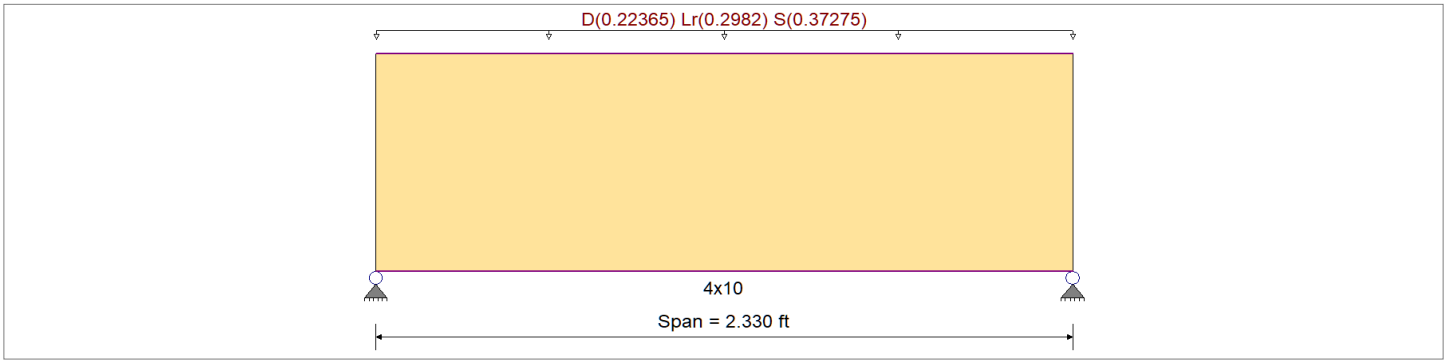
Wood Species : Hem Fir
Wood Grade : No.2

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf

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 = 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	=	1,173.00 psi	Fv: Allowable	=	172.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	1.165 ft	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

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		

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Wood Beam

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DESCRIPTION: R3

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
Load Combination : ASCE 7-10

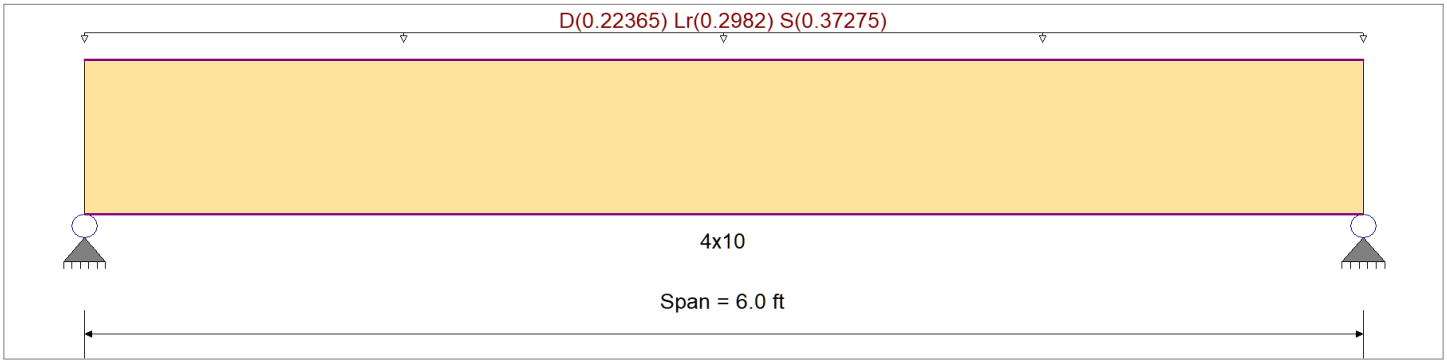
Wood Species : Hem Fir
Wood Grade : No.2

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf

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 = 14.910 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.550 : 1	Maximum Shear Stress Ratio	=	0.358 : 1
Section used for this span		4x10	Section used for this span		4x10
fb: Actual	=	645.25 psi	fv: Actual	=	61.72 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	=	3.000 ft	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	0.036 in	Ratio =	1976 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.058 in	Ratio =	1235 >=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	0.0583	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	1.789	1.789
Overall MINimum	1.118	1.118
+D+H	0.671	0.671
+D+L+H	0.671	0.671
+D+Lr+H	1.566	1.566
+D+S+H	1.789	1.789
+D+0.750Lr+0.750L+H	1.342	1.342
+D+0.750L+0.750S+H	1.510	1.510
+D+0.60W+H	0.671	0.671
+D+0.70E+H	0.671	0.671
+D+0.750Lr+0.750L+0.450W+H	1.342	1.342

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Wood Beam

DESCRIPTION: R3

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	1.510	1.510
+D+0.750L+0.750S+0.5250E+H	1.510	1.510
+0.60D+0.60W+0.60H	0.403	0.403
+0.60D+0.70E+0.60H	0.403	0.403
D Only	0.671	0.671
Lr Only	0.895	0.895
S Only	1.118	1.118
H Only		

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Wood Beam

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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
Load Combination : ASCE 7-10

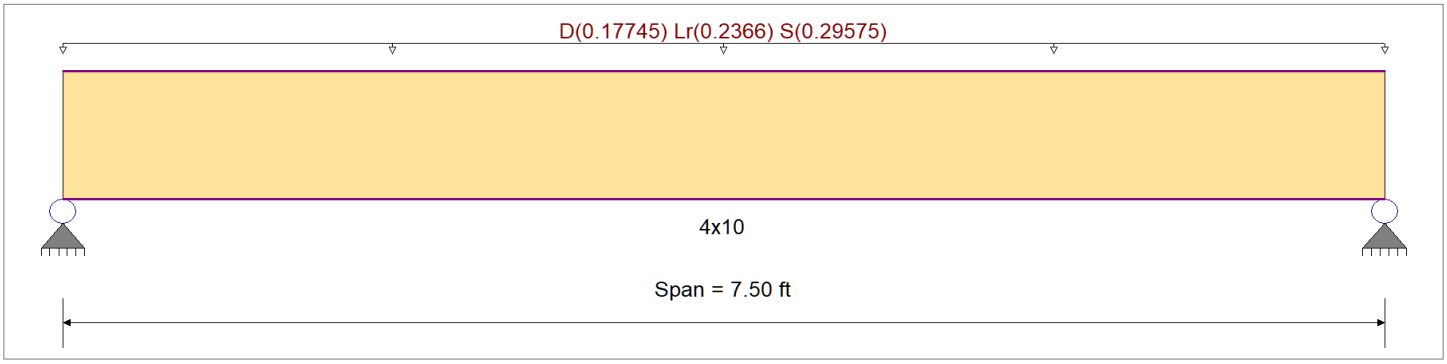
Wood Species : Hem Fir
Wood Grade : No.2

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

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf



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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Wood Beam

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		

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Wood Beam

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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
Load Combination : ASCE 7-10

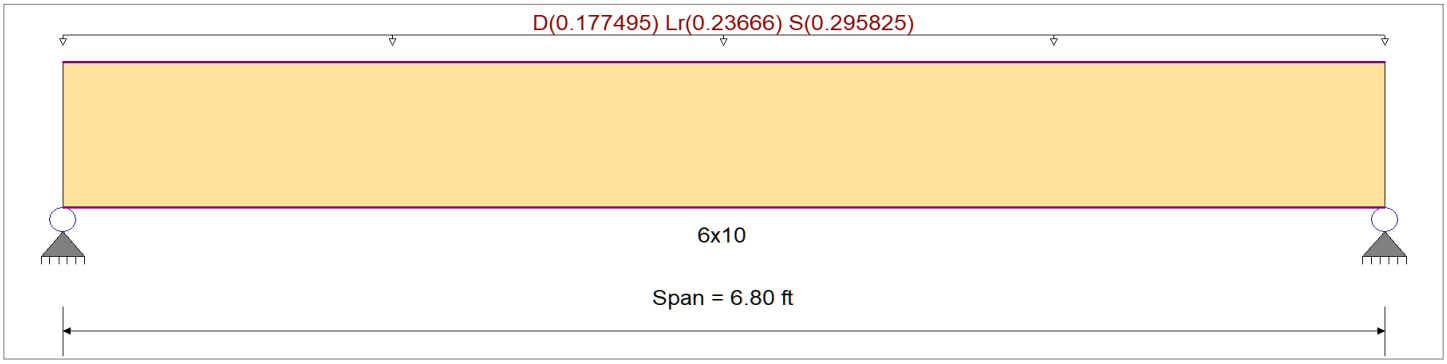
Wood Species : Hem Fir
Wood Grade : No.2

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

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf



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	=	396.83 psi	fv: Actual	=	35.75 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	=	3.400 ft	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

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		

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Wood Beam

File: IEVELLA.ec6

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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
Load Combination : ASCE 7-10

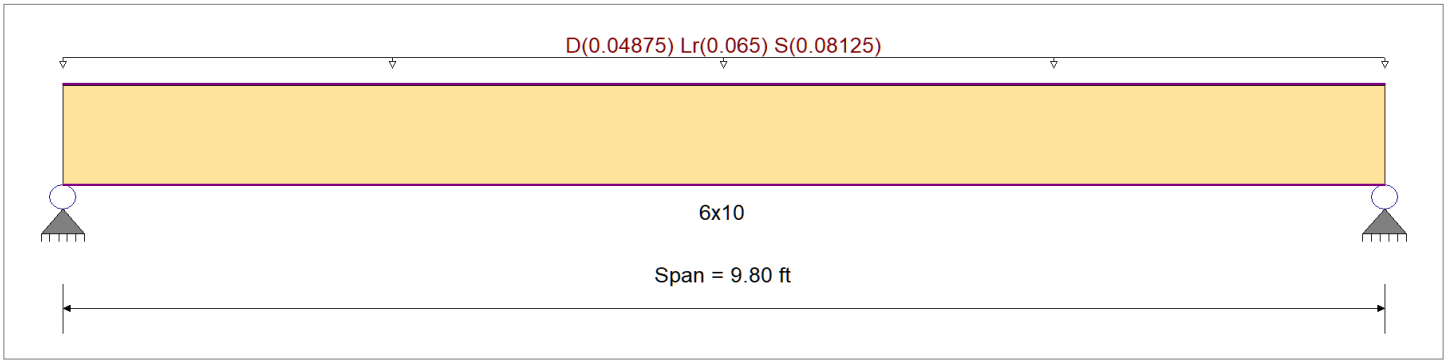
Wood Species : Hem Fir
Wood Grade : No.2

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

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf



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	=	4.900 ft	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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Wood Beam

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		

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Wood Column

File: lEVELLA.ec6

Lic. # : KW-06011909 — L2 Engineers

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		
End Fixities	Top & Bottom Pinned		
Overall Column Height	10 ft		
(Used for non-slender calculations)			
Wood Species	Hem Fir		
Wood Grade	No.2		
Fb +	575.0 psi	Fv	140.0 psi
Fb -	575.0 psi	Ft	375.0 psi
Fc - Prll	575.0 psi	Density	26.840 pcf
Fc - Perp	405.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,100.0	1,100.0	1,100.0 ksi
Minimum	400.0	400.0	

Wood Section Name	**6x6**		
Wood Grading/Manuf.	Graded Lumber		
Wood Member Type	Sawn		
Exact Width	**5.50** in	Allow Stress Modification Factors	
Exact Depth	**5.50** in	Cf or Cv for Bending	1.0
Area	30.250 in^2	Cf or Cv for Compression	1.0
Ix	76.255 in^4	Cf or Cv for Tension	1.0
Iy	76.255 in^4	Cm : Wet Use Factor	0.850
Incising Factors :		Ct : Temperature Factor	1.0
for Bending	0.80	Cfu : Flat Use Factor	1.0
for Elastic Modulus	0.95	Kf : Built-up columns	1.0 *NDS 15.3.2*
		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 Forumla Comp Only, fc/Fc'
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

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

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

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

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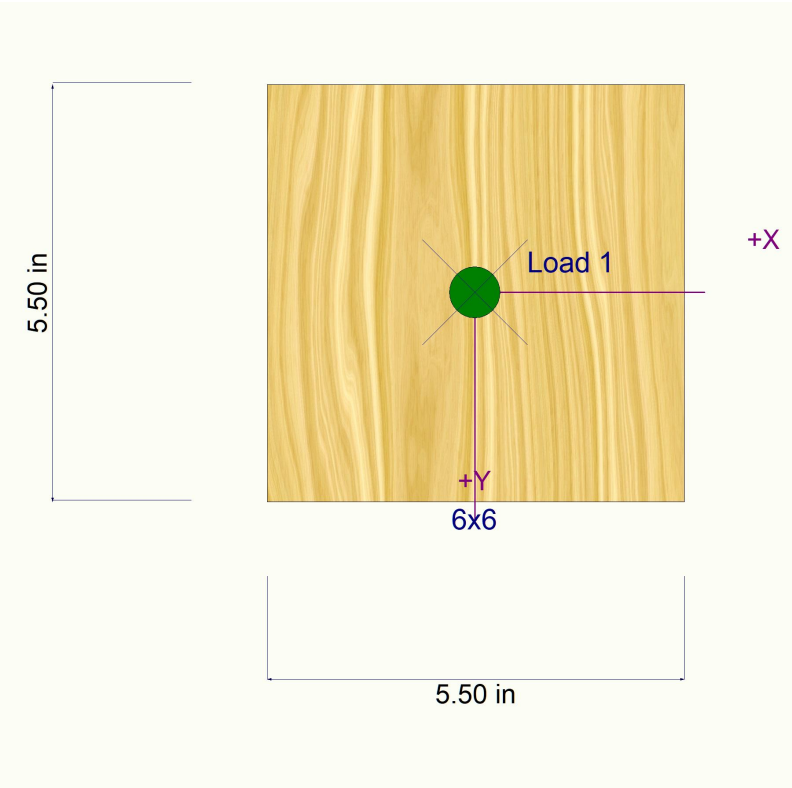
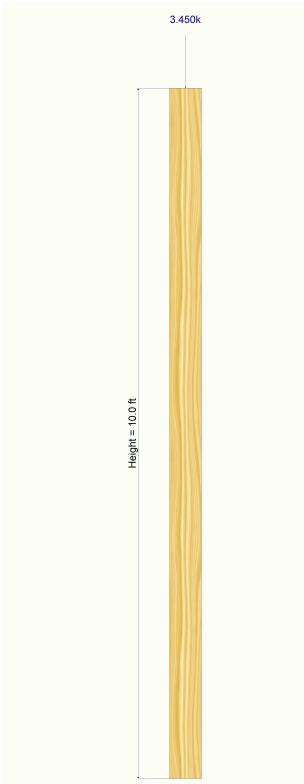
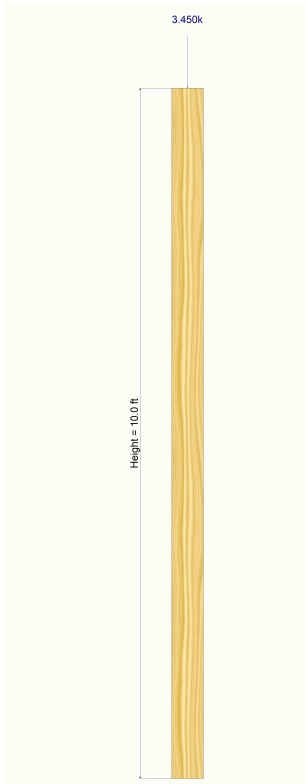
Wood Column

DESCRIPTION: RP56

Sketches







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Wood Beam

File: IEVELLA.ec6

Lic. # : KW-06011909 L2 Engineers

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
Load Combination : ASCE 7-10

Wood Species : Hem Fir
Wood Grade : No.2

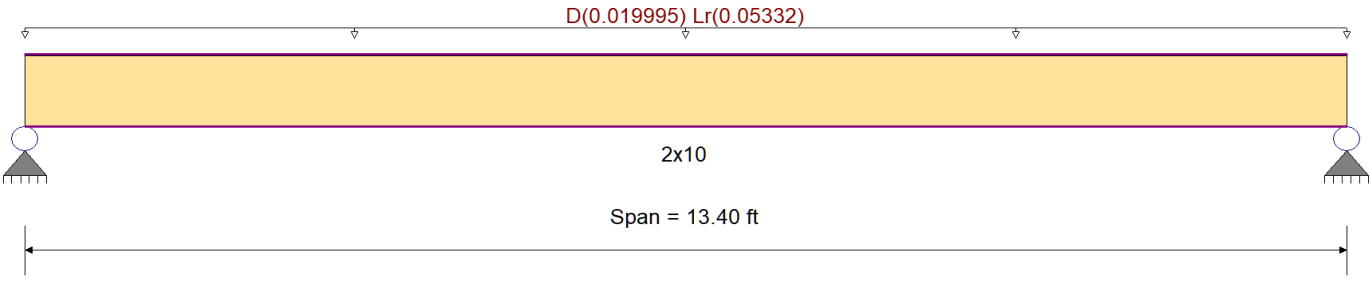
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf

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	=	6.700 ft	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	0.303 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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Wood Beam

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		

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Wood Beam

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
Load Combination : ASCE 7-10

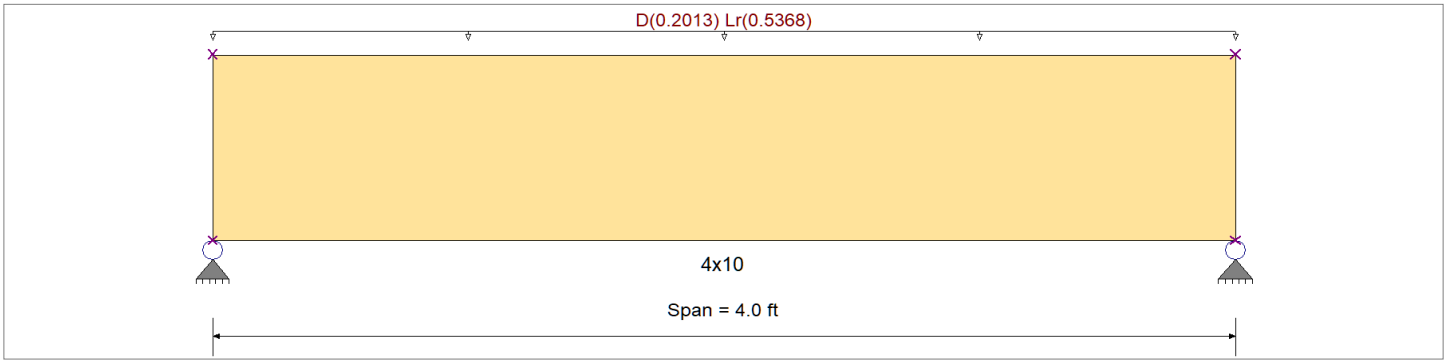
Wood Species : Hem Fir
Wood Grade : No.2

Beam Bracing : Completely Unbraced

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf



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	=	354.92 psi	fv: Actual	=	42.44 psi
Fb: Allowable	=	1,262.34 psi	Fv: Allowable	=	187.50 psi
Load Combination		+D+Lr+H	Load Combination		+D+Lr+H
Location of maximum on span	=	2.000 ft	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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Wood Beam

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		

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Wood Beam

File: IEVELLA.ec6

Lic. # : KW-06011909 L2 Engineers

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
Load Combination : ASCE 7-10

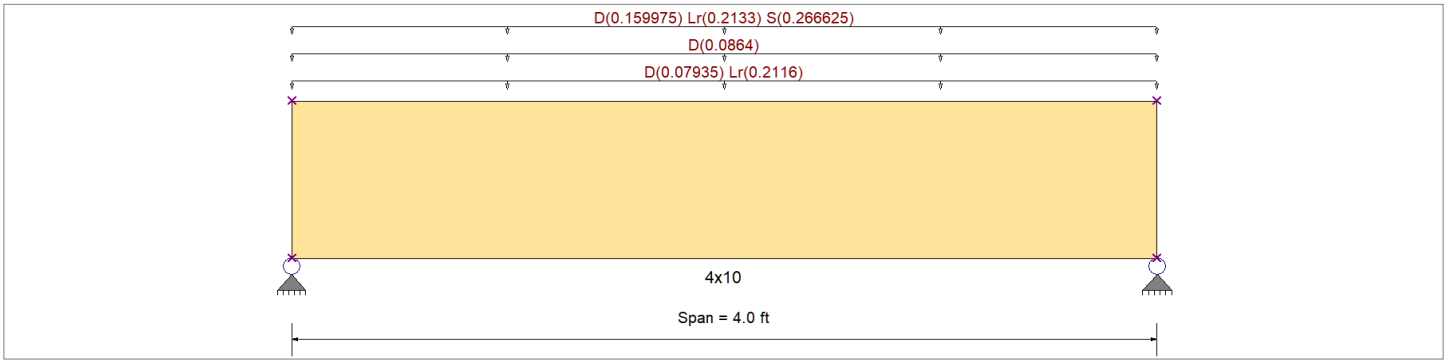
Wood Species : Hem Fir
Wood Grade : No.2

Beam Bracing : Completely Unbraced

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf



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	=	360.94 psi	fv: Actual	=	43.16 psi
Fb: Allowable	=	1,262.34 psi	Fv: Allowable	=	187.50 psi
Load Combination		+D+Lr+H	Load Combination		+D+Lr+H
Location of maximum on span	=	2.000 ft	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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Wood Beam

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		

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Wood Column

File: lEVELLA.ec6

Lic. # : KW-06011909 — L2 Engineers

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		
End Fixities	Top & Bottom Pinned		
Overall Column Height	10 ft		
(Used for non-slender calculations)			
Wood Species	Hem Fir		
Wood Grade	No.2		
Fb +	850.0 psi	Fv	150.0 psi
Fb -	850.0 psi	Ft	525.0 psi
Fc - Prll	1,300.0 psi	Density	26.840 pcf
Fc - Perp	405.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,300.0	1,300.0	1,300.0 ksi
Minimum	470.0	470.0	

Wood Section Name	**6x6**		
Wood Grading/Manuf.	Graded Lumber		
Wood Member Type	Sawn		
Exact Width	**5.50** in	Allow Stress Modification Factors	
Exact Depth	**5.50** in	Cf or Cv for Bending	1.0
Area	30.250 in^2	Cf or Cv for Compression	1.0
Ix	76.255 in^4	Cf or Cv for Tension	1.0
Iy	76.255 in^4	Cm : Wet Use Factor	1.0
		Ct : Temperature Factor	1.0
		Cfu : Flat Use Factor	1.0
		Kf : Built-up columns	1.0 *NDS 15.3.2*
		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
	Load Combination	+D+S+H
	Governing NDS Forumla	Comp Only, fc/Fc'
	Location of max.above base	0.0 ft
	At maximum location values are . . .	
	Applied Axial	3.876 k
	Applied Mx	0.0 k-ft
	Applied My	0.0 k-ft
	Fc : Allowable	692.21 psi
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

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			

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

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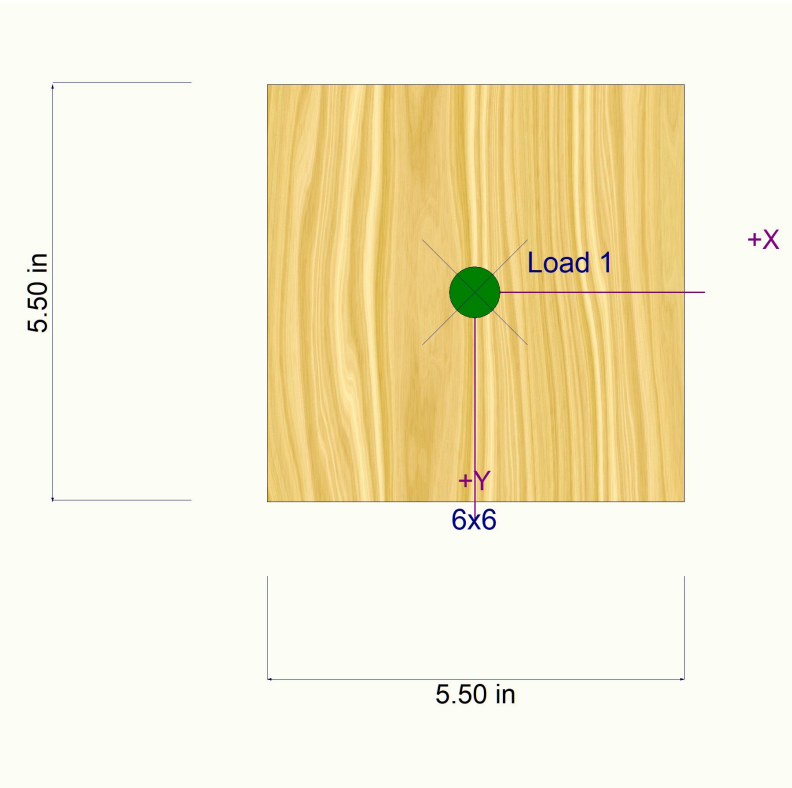
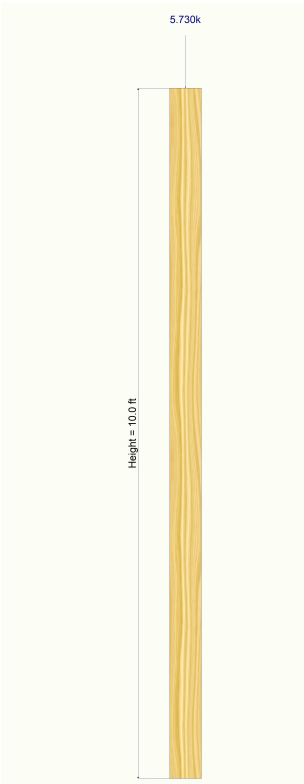
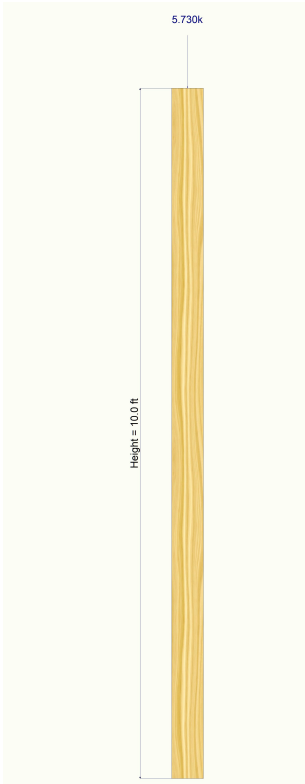
Wood Column

DESCRIPTION: RP7

Sketches







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General Footing

Lic. # : KW-06011909 — L2 Engineers

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
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
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

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

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

Increases based on footing plan dimension

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

Dimensions

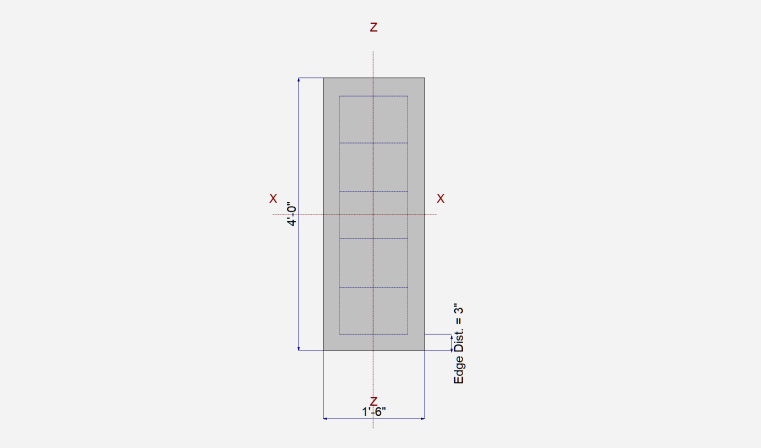
Width parallel to X-X Axis	=	1.50 ft
Length parallel to Z-Z Axis	=	4.0 ft
Footing Thickness	=	8 in

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



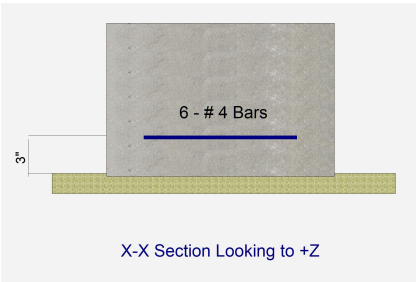
Reinforcing

Bars parallel to X-X Axis			
Number of Bars	=		6.0
Reinforcing Bar Size	=	#	4
Bars parallel to Z-Z Axis			
Number of Bars	=		3.0
Reinforcing Bar Size	=	#	4

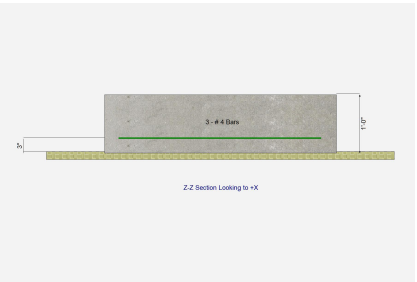
Bandwidth Distribution Check (ACI 15.4.4.2)
Direction Requiring Closer Separation

Bars along X-X Axis

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



X-X Section Looking to +Z



Applied Loads

		D	Lr	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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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	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	0.03510	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

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Wall Footing

File: lEVELLA.ec6

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DESCRIPTION: F2

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-10

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	=	ksf
when base footing is below	=	ft

Increases based on footing Width

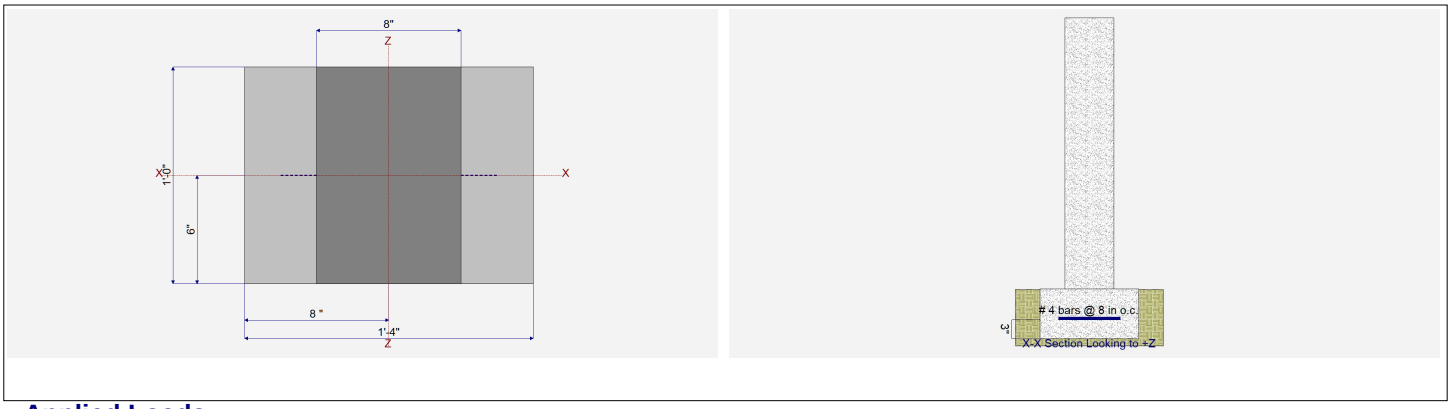
Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

Adjusted Allowable Bearing Pressure = 1.50 ksf

Dimensions

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

Reinforcing



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	0.420	0.2980	0.2680	0.3730				k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=								k-ft

Vx applied = in above top of footing

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Wall Footing

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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	0.5149	Soil Bearing	0.7724 ksf	1.50 ksf	+D+0.750L+0.750S+0.5
PASS	0.009024	Z Flexure (+X)	0.05784 k-ft	6.410 k-ft	+1.20D+0.50L+1.60S+1
PASS	0.003208	Z Flexure (-X)	0.02056 k-ft	6.410 k-ft	+0.90D+E+0.90H
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

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General Footing

Lic. # : KW-06011909 — 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
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
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

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

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

Increases based on footing plan dimension

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

Dimensions

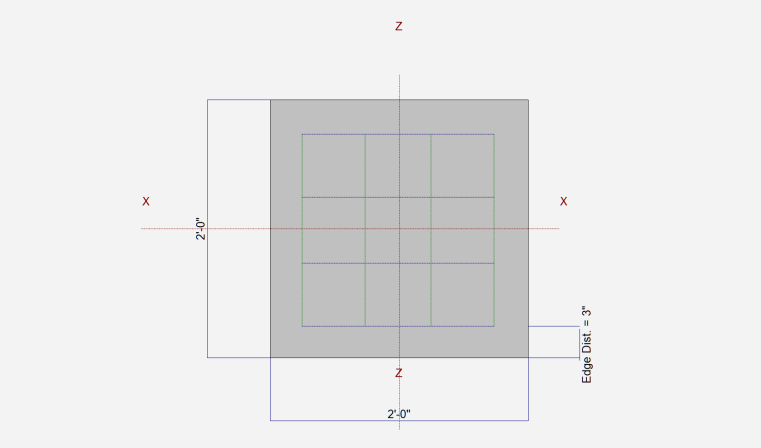
Width parallel to X-X Axis	=	2 ft
Length parallel to Z-Z Axis	=	2.0 ft
Footing Thickness	=	12.0 in

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

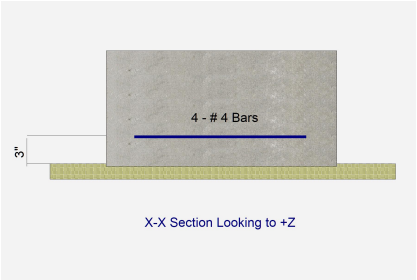


Reinforcing

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

Lic. # : KW-06011909 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	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	0.02678	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

LEDGER @ STEMWALL

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.
IIIm	1343 lbs.
IIIs	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 E: .491 2k 604/491 lbs = 1.23' O.C. , SAY 14" OC

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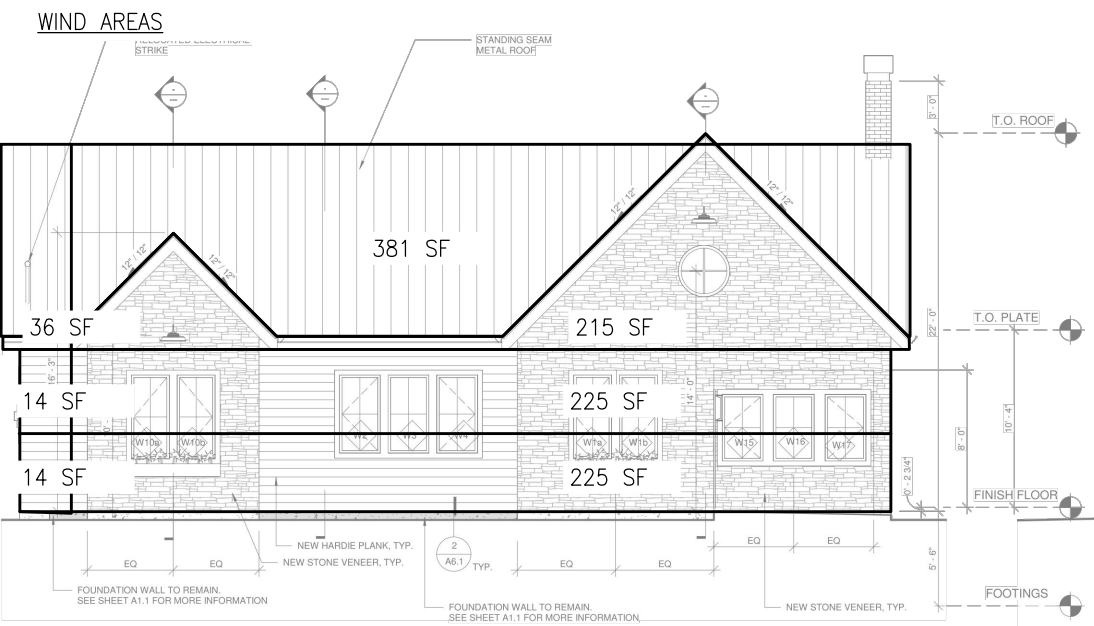
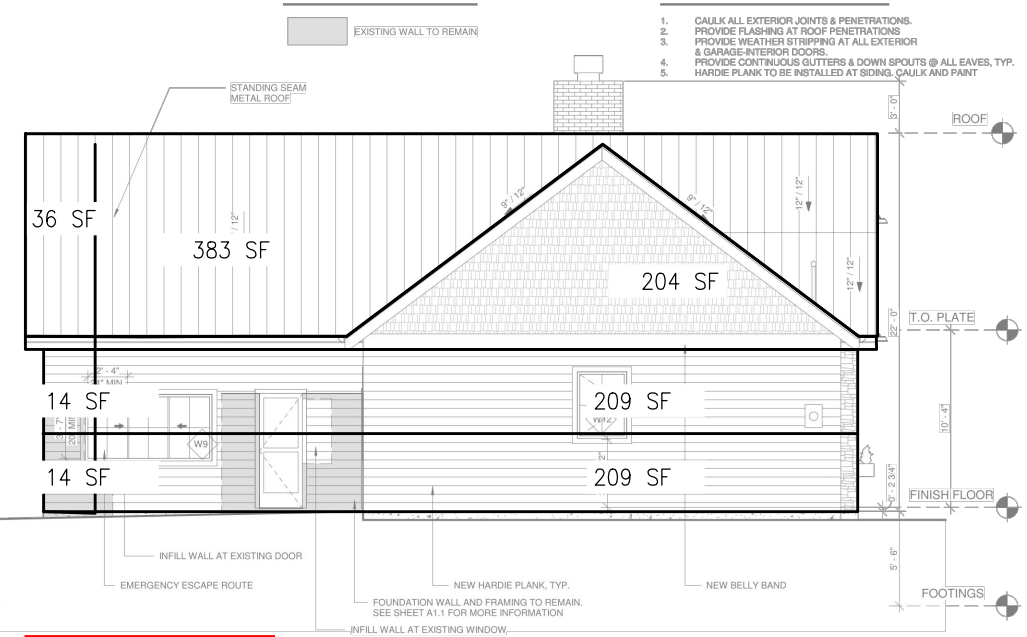
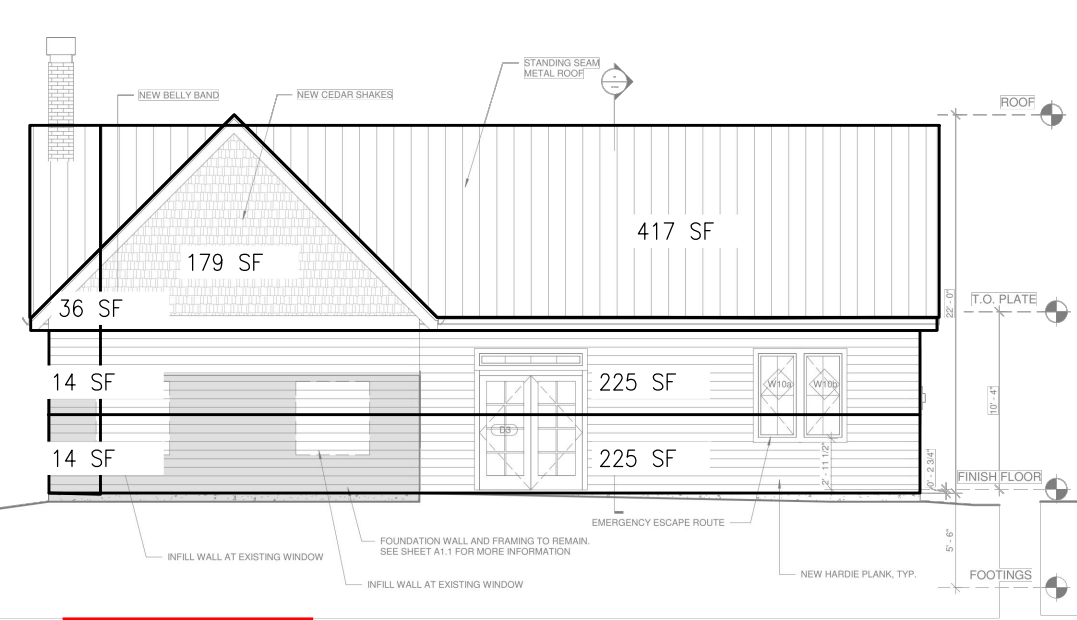
Lateral Analysis



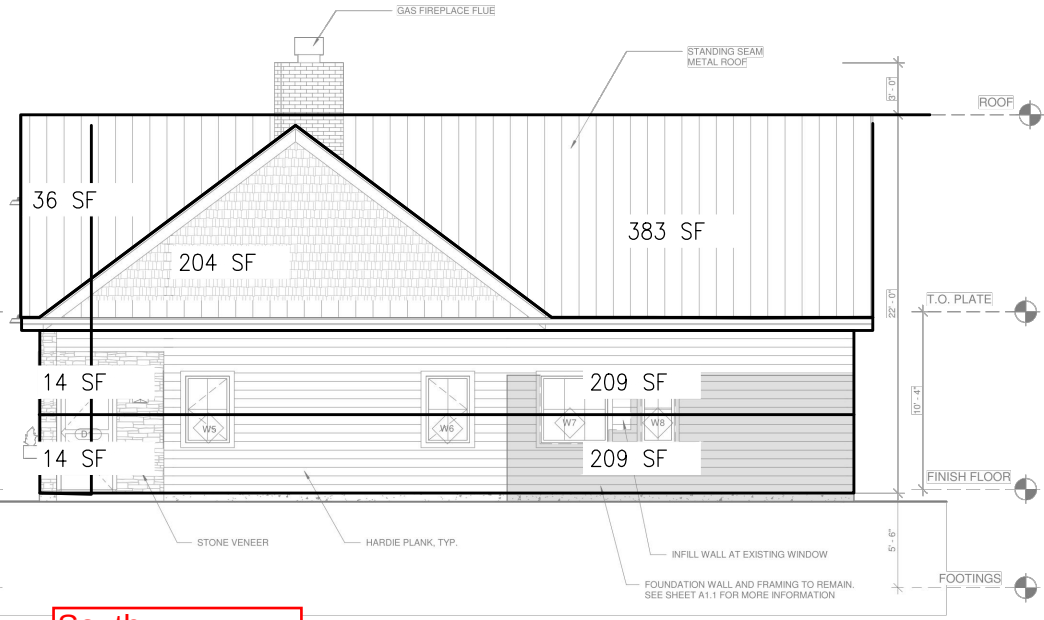
West



North



③ East

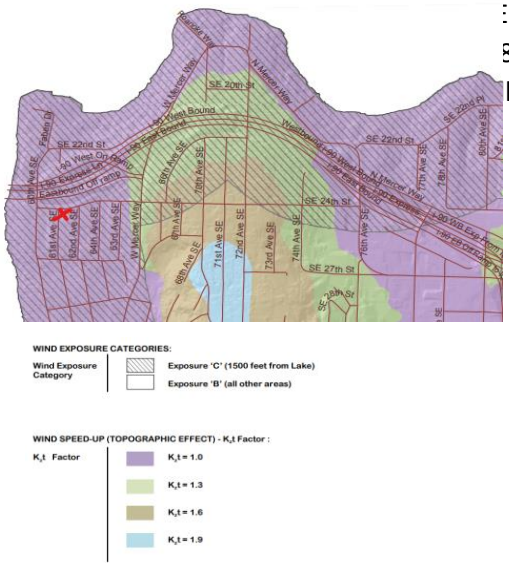


South

Project: 21-120 Levella

ngineers, LLC
3 NE 198th PL
le, WA 98072

Exposure:	C		
Risk Cat:	II		
z:	22	ft	
Kz:	0.916		*(Table 26.10-1)*
Kzt:	1		
Kd:	0.85		*(Table 26.6-1)*
Ke:	1		*(Table 26.9-1)*
v:	97		
End Zone:	3		
Roof Angle:	45		



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

qz= 18.75 psf

Table 26.9-1 Ground Elevation Factor, K_e

Ground Elevation above Sea Level		Ground Elevation Factor
ft	m	K_e
<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
1. The conservative approximation $K_e = 1.00$ is permitted in all cases.
2. The factor K_e shall be determined from the above table using interpolation or from the following formula for all elevations:
   $K_e = e^{-0.0000362 z_g}$ (z_g = ground elevation above sea level in ft).
   $K_e = e^{-0.000119 z_g}$ (z_g = ground elevation above sea level in m).
3. 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)[a]	0.85	1.03
20	6.1	0.62 (0.70)[a]	0.90	1.08
25	7.6	0.66 (0.70)[a]	0.94	1.12
30	9.1	0.70	0.98	1.16

[a]Use 0.70 in Chapter 28, Exposure B, when $z < 30$ ft (9.1 m).

Notes
1. The velocity pressure exposure coefficient K_z may be determined from the following formula:
   For 15 ft (4.6 m) $\le z \le z_g$ $K_z = 2.01(z/z_g)^{2/\alpha}$
   For $z <$ 15 ft (4.6 m) $K_z = 2.01(15/z_g)^{2/\alpha}$
2. α and z_g are tabulated in Table 26.11-1.
3. Linear interpolation for intermediate values of height z is acceptable.
4. 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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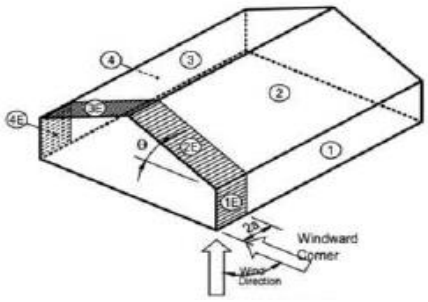
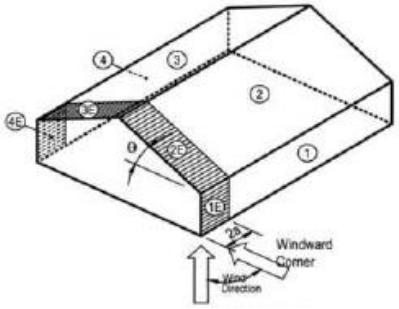
E/W DIRECTION

REGION	Gcpf	A(sf)	PRESSURE (psf)	SUM	
1	0.56	440	4621.03	4621.03	13135.05 ROOF
	0.56	225	2363.03	2363.03	4231.50 FDN
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	



N/S DIRECTION

REGION	Gcpf	A(sf)	PRESSURE (psf)	SUM	
1	0.56	413	4337.46	4337.46	12647.62
	0.56	209	2194.99	2194.99	3952.44
2	0.21	383	1508.40	1508.40	
3	-0.43	383	-3088.62	3088.62	
4	-0.37	413	-2865.82	2865.82	
	-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	



Hazards by Location

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

Ta= ct*hn^x (12.8.2.1)
= 0.20 *k = 1.0*

Cs= SDs/(R/Ie)
= 0.172

Csmin= .044*SDs*Ie
= 0.049

V= Cs*W (12.8-1)

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

V= 8,003 Reentrant Corner Irregularity
0.7E= 5,601.97 *1.25 7002.46

Wind Controls

Hazards by Location

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

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Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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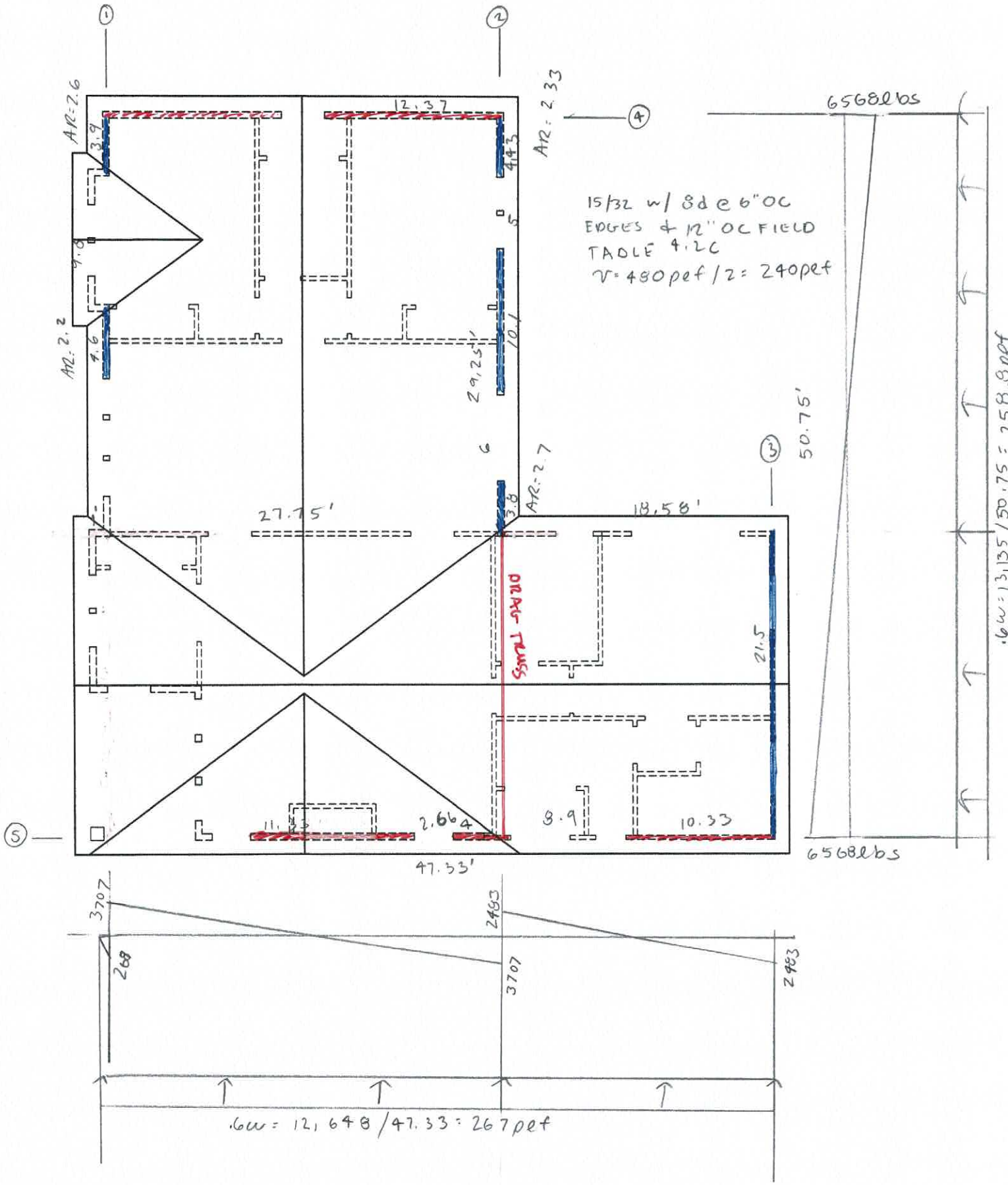
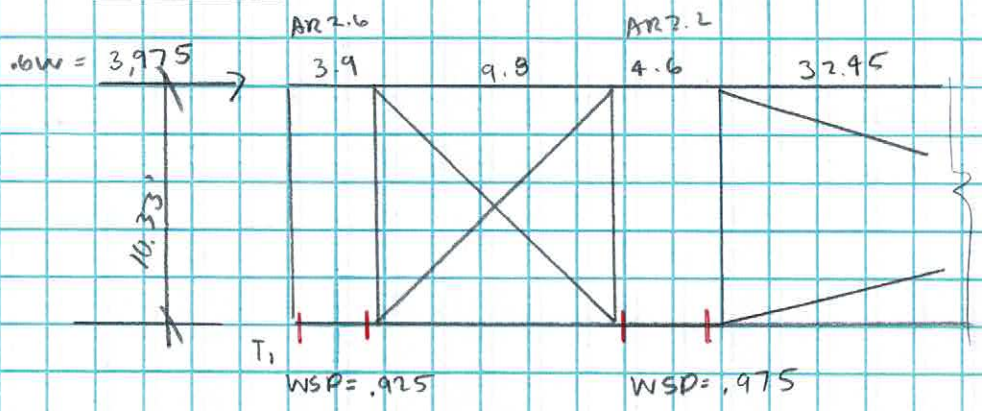
WIND CONTROLS N/S & E/W

ROOF PLAN NT



LINE ①

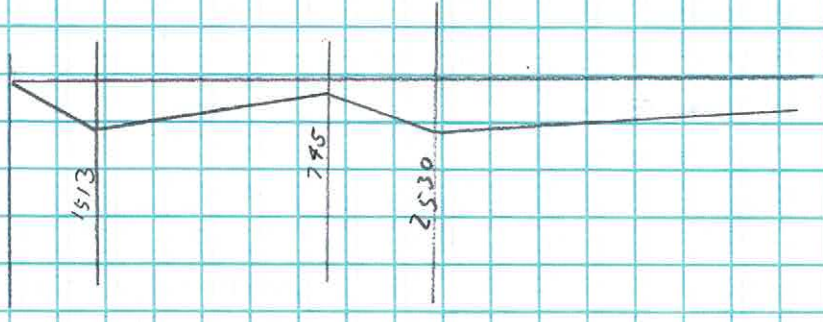


$$\frac{3975}{3.9(.925) + 4.6(.975)} = 491 \text{ pef}$$

∴ SW4

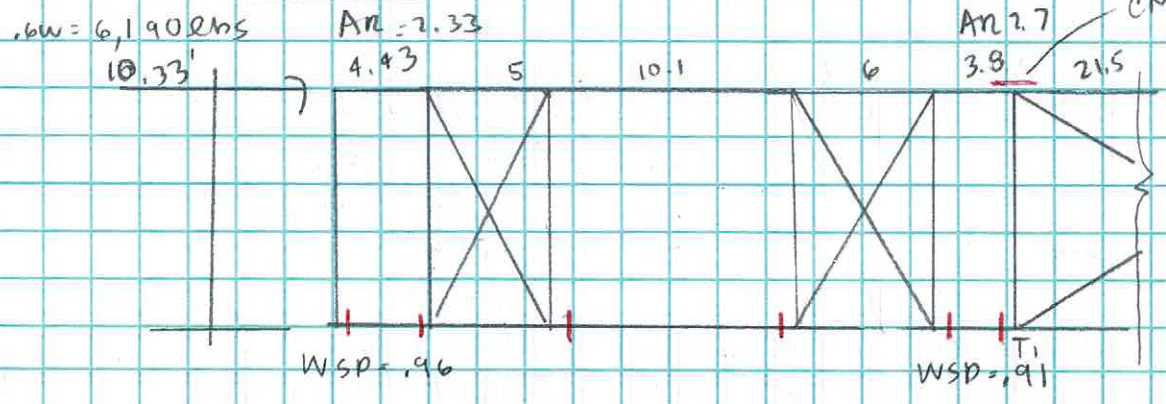
$$T_1 = [467.6(3.9)(10.33) - .6(3.9)(8.9)(10.33)(3.9/2)] / (3.9) = 4723 \text{ lbs}$$

∴ HDU8



v = 467 pef
r = 388 pef
V = 78.32 pef

LINE ②

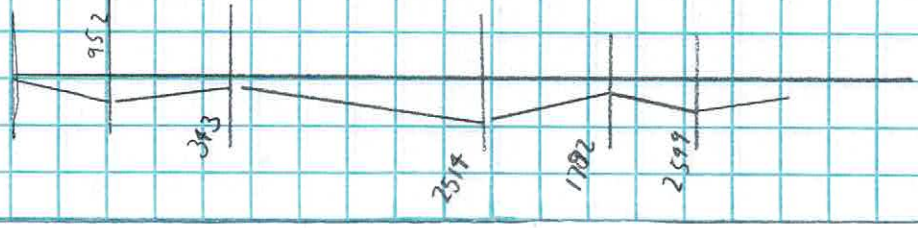


$$\frac{6190}{4.43(.96) + 10.1 + 3.8(.91)} = 347.5 \text{ pef}$$

∴ SW4

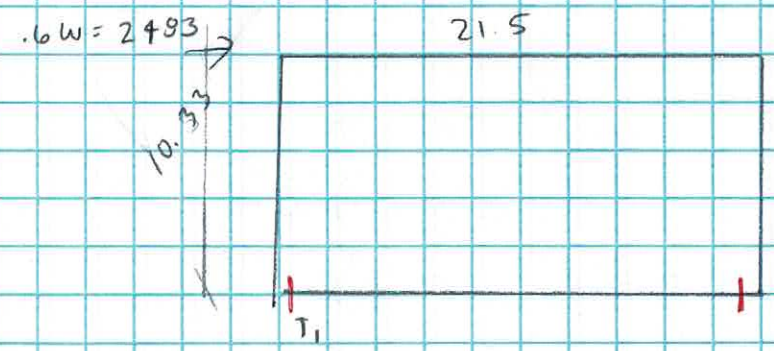
$$T_1 = [1283(10.33) - .6(3.9)(8.9)(10.33)(3.9/2)] / 3.8 = 3392 \text{ lbs}$$

∴ HDU5



v = 337
v = 215
V = 121.97

③

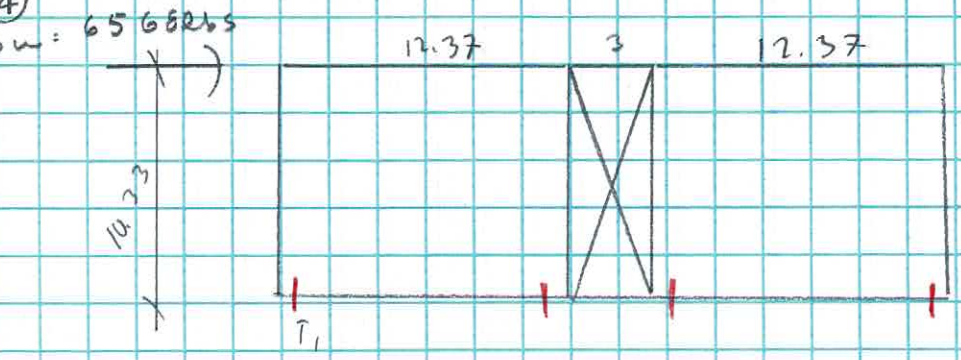


$v = 115$ plf ∴ SW6

$T_1 = [2493(10.33) - 21.5(10.33)(8.9)(21.5/2)(.6)]/21.5 = 600$ lbs

∴ HDU2

④

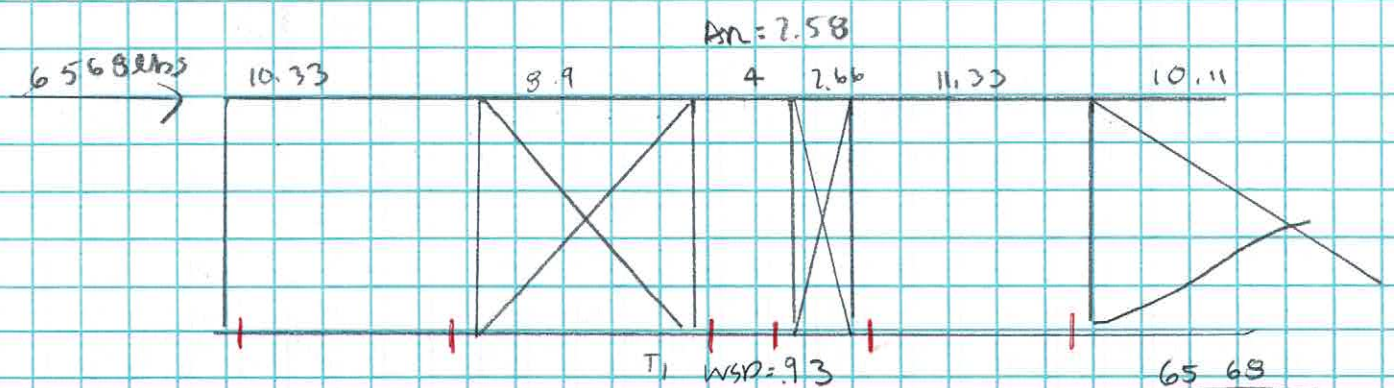


$v = 6568/(12.37(2)) =$
266 plf ∴ SW6

$T_1 = [\frac{6568}{2}(10.33) - 12.37(.6)(8.9)(10.33)(12.37/2)]/12.37 = 2401$ lbs

∴ HDU5

⑤



$T_1 = [1023(10.33) - 4(.6)(8.9)(10.33)(4/2)]/4 = 2531$ lbs

∴ HDU5

$v = \frac{6568}{10.33 + 11.33 + 4(.93)}$

$= 259$ plf

∴ SW6

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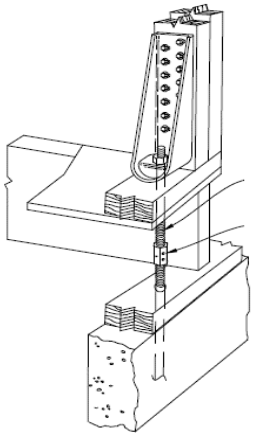

CONCRETE BREAKOUT STRENGTH IN TENSION

POST INSTALLED ANCHOR IN EXIST CONC

λa:	1	
kc:	17	*24 for cast-in, 17 for post installed*
f'c (psi):	3000	
s1 (in):	0	
hef (in):	6	
tstem(in):	6	
Ψed,n:	0.8	
Ψc,n:	1.4	
Ψcp,n:	1	*17.4.2.5b*
φ :	0.7	*.75 [supplimentary reinf provided],*
		.7 [supplimentary reinf not provided]

Nb= Kc*λa*(f'c)^(1/2)*hef^(1.5) *ACI 17.4.2.2a*
= 13,684.74

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

Anco (in^2)= 9*hef^2
= 324.00

Vcb= Anc/Anco*Ψed*Ψc,n*Ψcp,n*Nb *ACI 17.4.2.1a*
= 10,643.68
φVcb= 7,450.58