January 7, 2021

Washam Homes

Re: 1801 SW River Run Dr
Lot 21, Whispering Woods
Lee's Summit, MO

Apex Engineers Inc. observed the house under construction at the above referenced address. Our firm has been retained to address comments from the city rough-in inspection. For the purposes of this report the house will be referred to as facing east.

1. *Load bearing 2x4 wall between stairs to basement and foundation wall is supporting two floors plus roof/ceiling assembly. Provide engineered solution for repair or comply with table R602.3(5).*
    - After computations, our firm recommends the following:
        - o Double each 2x4 stud in the wall of concern, so that there is (2)-2x4 studs at 16'' OC.
        - o The built-up wood column (stud pack) supporting the LVL spanning over the garage shall consist of a minimum of (4)-2x4 studs. The studs shall align above and below the wall plate line.

**Built-up wood column - Each 2x4 ply shall be fastened with 1 row of 10d nails at 9" on center alternating side to side, 1.4" min edge distance, and starting 2.5" from each end.

Contingent upon the repairs outline above, our firm recommends approval of these items.

Please call if our firm can of further assistance.

LIMITATIONS

The scope of our services includes only those items specifically addressed herein. All other items are outside the scope of this inspection; including any environmental assessment (such as, but not limited to mold, mildew, or presence of any other toxic substance or environmental risks).

In addition, the scope our services does not include any evaluation of the building or site for job-site safety and/or hazardous conditions. All construction shall be performed in compliance with IRC and OSHA standards at all times. Our firm has not been retained to examine the site or building for any of these conditions. In addition, the contractor shall retain sole responsibility for the quality of work, for adhering to plans, specifications, appropriate codes, and, for repairing defects, deficiencies or omission, regardless of when they are found. By the use of this report it is understood the above conditions are agreed to.

Best Regards,
Apex Engineers, Inc.

Joshua M. Jensen, P.E.
Project Engineer

Clayton J. Hess, P.E.
Principal

STATE OF MISSOURI
CLAYTON J. HESS
NUMBER PE-2003000003
2021.01.11
PROFESSIONAL ENGINEER

Apex Engineers, Inc
1625 Locust
Kansas City, MO 64108
www.apex-engineers.com

Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 8 JAN 2021, 10:36AM

Wood Column

File: 1801 SW River Run Dr Calcs.ec6

Lic. # : KW-06005244

APEX ENGINEERS INC

DESCRIPTION: Walls Studs in Basement

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		
End Fixities	Top & Bottom Pinned		
Overall Column Height	9.0 ft		
(Used for non-slender calculations)			
Wood Species	Douglas Fir - Larch		
Wood Grade	Stud		
Fb +	700.0 psi	Fv	180.0 psi
Fb -	700.0 psi	Ft	450.0 psi
Fc - Prll	850.0 psi	Density	31.210 pcf
Fc - Perp	625.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,400.0	1,400.0	1,400.0 ksi
Minimum	510.0	510.0	

Wood Section Name	**2-2x4**		
Wood Grading/Manuf.	Graded Lumber		
Wood Member Type	Sawn		
Exact Width	**3.0** in	Allow Stress Modification Factors	
Exact Depth	**3.50** in	Cf or Cv for Bending	1.10
Area	10.50 in^2	Cf or Cv for Compression	1.050
Ix	10.719 in^4	Cf or Cv for Tension	1.10
Iy	7.875 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 : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 9.0 ft, K = 1.0

Applied Loads

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

Column self weight included : 20.482 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.0 ft, D = 1.681 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.4324** : 1

Load Combination	+D+H
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	1.701 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	374.739 psi

PASS Maximum Shear Stress Ratio = **0.0** : 1

Load Combination	+0.60D+0.70E+H
Location of max.above base	9.0 ft
Applied Design Shear	0.0 psi
Allowable Shear	288.0 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

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.900	0.467	0.4324	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L+H	1.000	0.429	0.4233	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+Lr+H	1.250	0.355	0.4086	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+S+H	1.150	0.382	0.4135	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750Lr+0.750L+H	1.250	0.355	0.4086	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S+H	1.150	0.382	0.4135	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.60W+H	1.600	0.286	0.3975	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	0.286	0.3975	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S+0.450W+H	1.600	0.286	0.3975	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D+0.60W+0.60H	1.600	0.286	0.2385	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.70E+0.60H	1.600	0.286	0.3975	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S+0.5250E+H	1.600	0.286	0.3975	PASS	0.0 ft	0.0	PASS	9.0 ft

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Engineer:
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Project Descr:

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Wood Column

File: 1801 SW River Run Dr Calcs.ec6

Lic. # : KW-06005244

APEX ENGINEERS INC

DESCRIPTION: Walls Studs in Basement

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+0.60D+0.70E+H	1.600	0.286	0.2385	PASS	0.0 ft	0.0	PASS	9.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction k @ Base	@ Top	Axial Reaction k @ Base	My - End Moments k-ft @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top
+D+H					1.701				
+D+L+H					1.701				
+D+Lr+H					1.701				
+D+S+H					1.701				
+D+0.750Lr+0.750L+H					1.701				
+D+0.750L+0.750S+H					1.701				
+D+0.60W+H					1.701				
+D+0.750Lr+0.750L+0.450W+H					1.701				
+D+0.750L+0.750S+0.450W+H					1.701				
+0.60D+0.60W+0.60H					1.021				
+D+0.70E+0.60H					1.701				
+D+0.750L+0.750S+0.5250E+H					1.701				
+0.60D+0.70E+H					1.021				
D Only					1.701				
Lr Only									
L Only									
S Only									
W Only									
E Only									
H Only									

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
+D+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+0.450W+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.450W+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.60W+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.70E+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.5250E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.70E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
D Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
Lr Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
S Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
W Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
E Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

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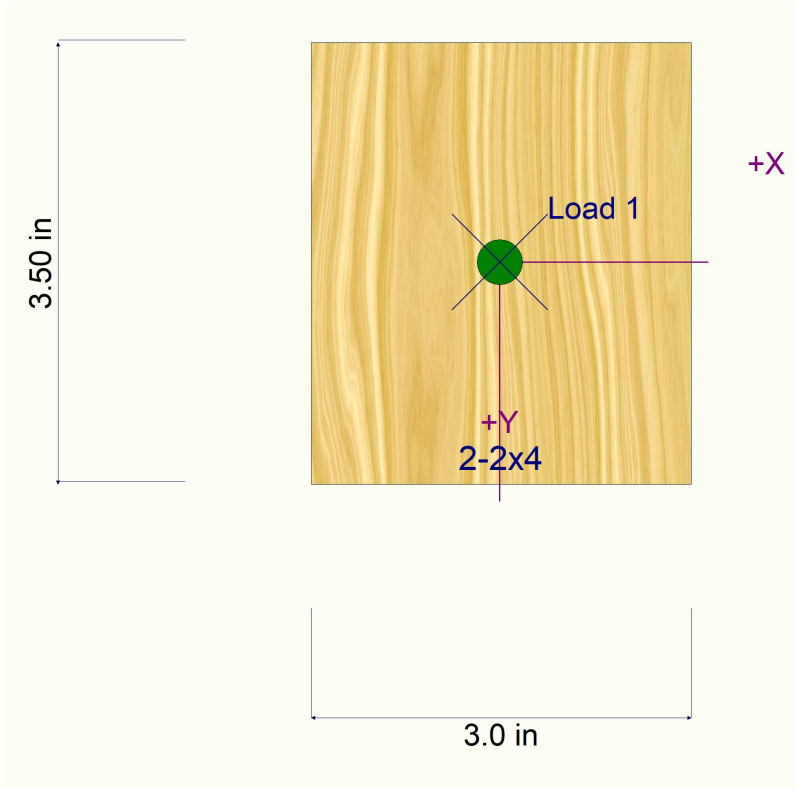
Wood Column

Lic. # : KW-06005244 APEX ENGINEERS INC

DESCRIPTION: Walls Studs in Basement

Sketches



Apex Engineers, Inc.
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Job Address: 1801 SW River Run Dr
Lee's Summit, MO

Sheet # _____ of _____

Engineer: JMJ

Date: 1/8/2021

Wall Uniform Loads

- Dead load of wall = 92 lbs/ft
- Second Floor Over Garage = 240 lbs/ft
- 1st to Lower Stair Landing = 225 lbs/ft

Wall Point Loads

- Ceiling Beam over Entry = 540 lbs
- LVL ridge = 1839 lbs
- Ceiling Beam over hallway = 600 lbs
- Second floor (4) 1 3/4" x 9 1/4" Beam = 1877 lbs
- 1st Floor

Total load Per Stud

(16/12) (92+240+225) + (1877 lbs/2) = 1681 lbs/STUD

See enercalc file for stud Capacity Calculations

STATE OF MISSOURI
CLAYTON J. JESS
NUMBER
PE-2003000003
2021.01.11
PROFESSIONAL ENGINEER