APEX
ENGINEERS, INC.

September 8, 2020

D&D Builders

Re: 1709 SW 27th St
Lot, 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 north.

1. *Address missing steel columns per plans throughout.*

- After computations, our firm recommends the following:
  - Install 3'' SCH. 40 steel columns in the locations shown on the attached marked-up plans.
    - Fasten each column base plate to the basement slab with (4) ½''x4'' wedge anchors.
    - Columns to bear directly on concrete pier pads or to bear on basement slab with properly installed isolation ring (see detail attached to this report, 5/S2.0).
  - For the column between the storage room and the family room, a built-up wood column consisting of (5)-2x4 studs is adequate for resisting the applied loads.
    - Fasten plies of the built-up wood column as shown in 1/S3.1, attached to this report for reference.

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
2020.09.09
PROFESSIONAL ENGINEER

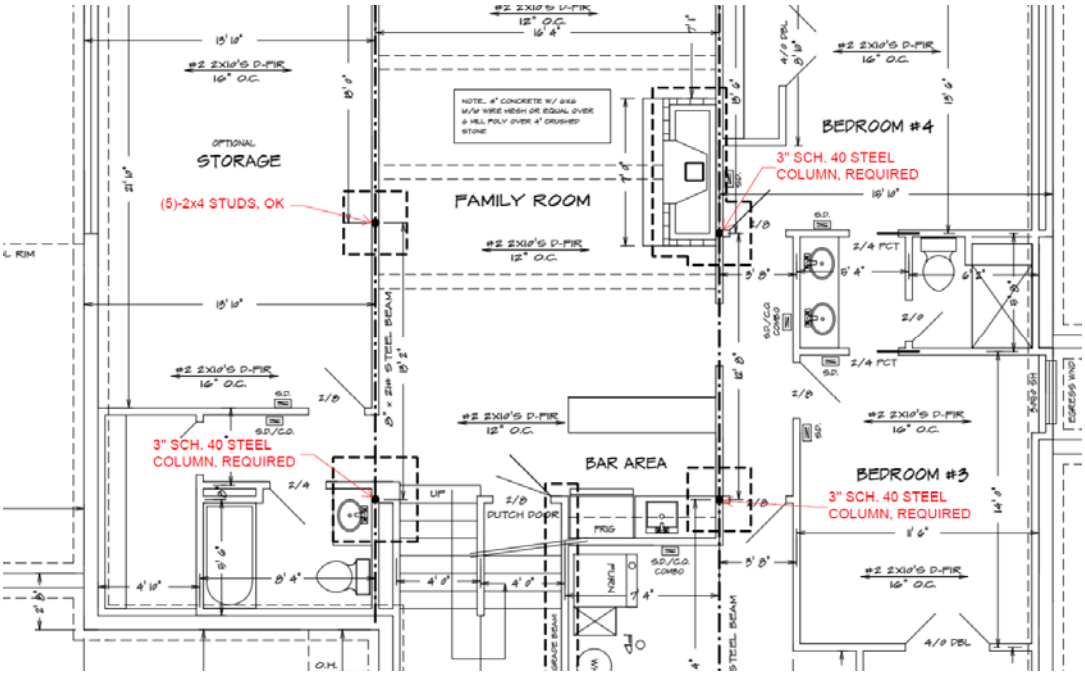
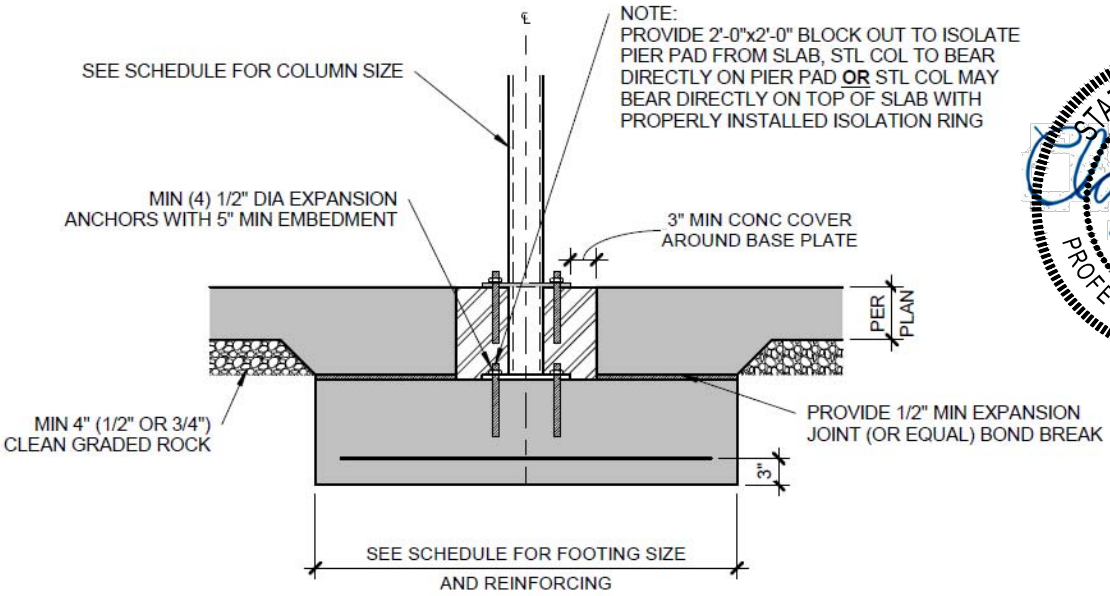
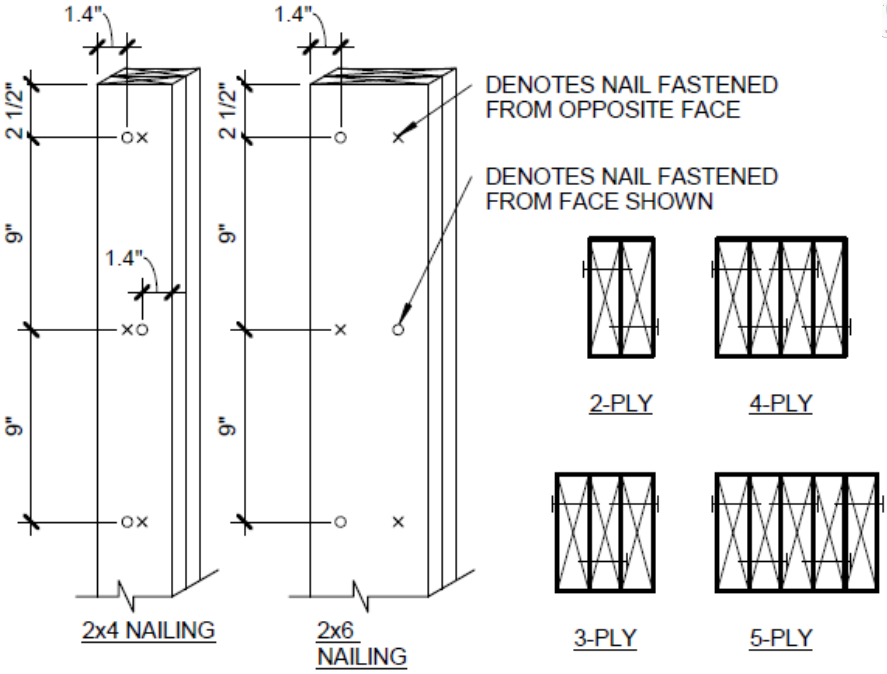


Fig. 1 – Marked-Up Lower Level Plan. Reference for column locations.



5 COLUMN PAD DETAIL
S2.0 3/4" = 1'-0"

Fig. 2 – Column Pad Detail. Not To Scale.



NOTES:
1. EACH 2x PLY SHALL BE FASTENED WITH (1) ROW OF 10d NAILS AT 9" OC, ALTERNATING SIDE TO SIDE
2. 1.4" MIN EDGE DISTANCE, AND STARTING 2 1/2" FROM EACH END.
3. EXTEND FULL AREA OF COLUMN AS SOLID BLOCKING THROUGH JOIST BAYS AND WALLS TO LOAD-BERAING BEAM/WALL BELOW

1 BUILT-UP STUD COLUMN
S3.1 1 1/2" = 1'-0"

Fig. 3 – Built-Up Stud Column. Not To Scale.

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

Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 8 SEP 2020, 3:33PM

Wood Column

File: 1709 SW 27th St, Lee's Summit MO.ec6

Lic. # : KW-06005244

APEX ENGINEERS INC

DESCRIPTION: Columns in Basement

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 : 8.0 ft
(Used for non-slender calculations)

Wood Species : Douglas Fir - Larch
Wood Grade : Stud

Fb +	700 psi	Fv	180 psi
Fb -	700 psi	Ft	450 psi
Fc - Prll	850 psi	Density	31.21 pcf
Fc - Perp	625 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1400	1400	1400 ksi
Minimum	510	510	

Wood Section Name : **5-2x4**
Wood Grading/Manuf. : Graded Lumber
Wood Member Type : Sawn

Exact Width	**7.50**	in
Exact Depth	**3.50**	in
Area	26.250	in^2
Ix	26.797	in^4
Iy	123.047	in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.10
Cf or Cv for Compression	1.050
Cf or Cv for Tension	1.10
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 = 8.0 ft, K = 1.0

Applied Loads

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

AXIAL LOADS . . .
Axial Load at 8.0 ft, D = 4.0, L = 8.0 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.9946** : 1

Load Combination	+D+L+H
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	12.0 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	459.626 psi

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

Load Combination	+0.60D+0.70E+0.60H
Location of max.above base	8.0 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	0.555	0.3417	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+L+H	1.000	0.515	0.9946	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+Lr+H	1.250	0.433	0.3153	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+S+H	1.150	0.463	0.3206	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750Lr+0.750L+H	1.250	0.433	0.7882	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750L+0.750S+H	1.150	0.463	0.8016	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.60W+H	1.600	0.352	0.3032	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.70E+H	1.600	0.352	0.3032	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	0.352	0.7579	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750L+0.750S+0.450W+H	1.600	0.352	0.7579	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750L+0.750S+0.5250E+H	1.600	0.352	0.7579	PASS	0.0 ft	0.0	PASS	8.0 ft
+0.60D+0.60W+0.60H	1.600	0.352	0.1819	PASS	0.0 ft	0.0	PASS	8.0 ft
+0.60D+0.70E+0.60H	1.600	0.352	0.1819	PASS	0.0 ft	0.0	PASS	8.0 ft

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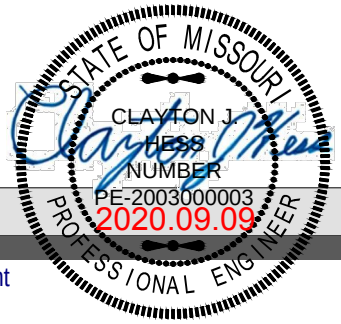

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Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	My - End Moments @ Base	My - End Moments @ Top	k-ft	Mx - End Moments @ Base	Mx - End Moments @ Top
+D+H						4.000					
+D+L+H						12.000					
+D+Lr+H						4.000					
+D+S+H						4.000					
+D+0.750Lr+0.750L+H						10.000					
+D+0.750L+0.750S+H						10.000					
+D+0.60W+H						4.000					
+D+0.70E+H						4.000					
+D+0.750Lr+0.750L+0.450W+H						10.000					
+D+0.750L+0.750S+0.450W+H						10.000					
+D+0.750L+0.750S+0.5250E+H						10.000					
+0.60D+0.60W+0.60H						2.400					
+0.60D+0.70E+0.60H						2.400					
D Only						4.000					
Lr Only											
L Only						8.000					
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+0.70E+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
+D+0.750L+0.750S+0.5250E+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
+0.60D+0.70E+0.60H	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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Sketches