APEX
ENGINEERS, INC.

April 10, 2019

LandRock Signature Homes, LLC
4335 McGee St
Kansas City, MO 64111

Re: 4509 SW Nautilus Pl
          Lot 15 Creekside at Raintree
          Lee's Summit, MO

Apex Engineers, Inc. has been asked to address comments from the city rough-in inspection for the house at the address above. For the purpose of this report, the house will be referred to as facing west.

1. *11 7/8'' BCI 5000 floor joists over garage headered off for plumbing. Holes have been drilled in the LVL headers and the floor joists.*
   - The existing 11 7/8'' BCI 5000 joists are adequate for supporting the applied loads, including the additional load from the adjacent 1 ¾''x11 7/8'' LVL header.
     i. The 11 7/8'' BCI floor joists that have been headered off shall be connected to the LVL header with a Simpson Strong-Tie IUS2.06/11.88 face mount joist hanger or equivalent. Fasten the hanger with (10) 10d common nails (0.148''x3'') through the joist and (10) 10d common nails (0.148''x3'') through the LVL header.
     ii. The 1 ¾''x11 7/8'' LVL shall be connected to the adjacent BCI 5000 floor joists with Simpson Strong-Tie HUS1.81/10 face mount hangers with (30) 16d common nails through the joist and (10) 16d common nails (0.162''x3 ½'') through the LVL.
     iii. Install ¾'' thick, 12'' long backer blocks on both sides of BCI 5000 joist web, as recommended by BCI (see attached document). Backer blocks shall be tight to the top of the bottom flange with ¼'' to 2'' gap between bottom of top flange and top of block.
     iv. Install lateral support where floor joists bear over steel beam. Lateral support may be provided in the form of blocking or 2x4 cross bracing.
     v. 4'' round holes in BCI floor joists are acceptable, based on their size and location relative to the supports.

Please call if Apex Engineers, Inc. can be of further assistance.

LIMITATIONS
The scope of our services includes only those items specifically addressed herein. No attempt was made to design or check the design of any structural members other than those specifically addressed herein. All other items are outside the scope of this inspection; including but not limited to, any environmental assessment (such as, but not limited to mold, mildew, presence of hazardous or toxic materials in the soil, surface water, ground water, etc.).

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In addition, the scope of 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.

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
2019.04.10
PROFESSIONAL ENGINEER
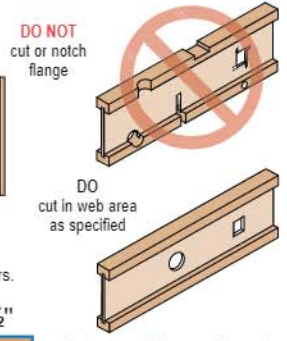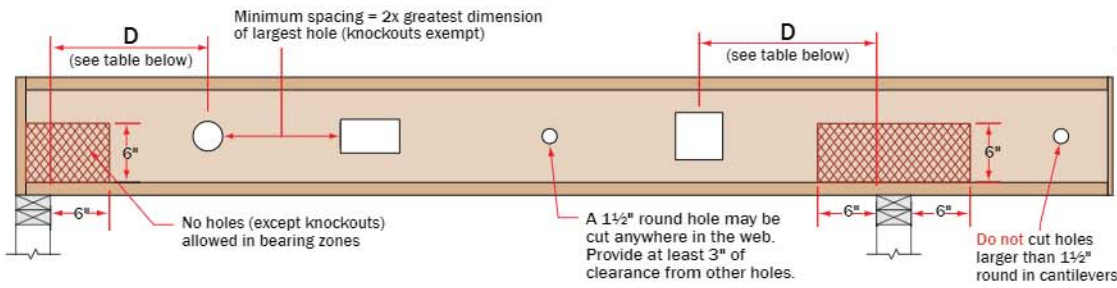
Floor Bracing for Endwall

Block spacing per governing code and diaphragm nailing per engineer of record. Intent of blocking is to resist external lateral forces acting perpendicular to wall.

BCI® Joist

Boise Cacade Rimboard

BCI® Blocking

Sill Plate

BCI® Joist Blocking

(2) 8d nails or #8 wood screws per web
2x4 lumber

Apply construction adhesive to contact surfaces to limit floor squeaks.

BCI® Joist Fire Cut

DO NOT bevel cut beyond inside face of wall

Masonry or concrete wall

Bond beam

Bearing plate shall be properly fastened to bond beam

1) Joists shall be restrained from rotation at end bearing by installing blocking panels or cross-bridging between joists (not shown for clarity).
2) Joists shall not be in direct contact with masonry or concrete.
A minimum of ½" of air space or an adequate moisture barrier shall be provided between joists and wall pocket.
3) Joists are to be installed in dry-use conditions only.

Blocked Diaphragm Nailing Detail

Simpson Strong-Tie Z2 blocking clip

Apply construction adhesive to contact surfaces to limit floor squeaks.

Flat 2x4's at panel edges for diaphragm nailing

Hanger Connections to BCI® Headers

- Backer blocks shall be at least 12" long per hanger.
- Nails shall be clinched when possible.
- Verify capacity and fastening requirements of hangers and connectors.

Backer Block

¼" to 2" gap

"Top Mount"
Backer block shall be tight to bottom of top flange with ¼" to 2" gap at top of bottom flange.

"Face Mount"
Backer block shall be tight to bottom of top flange with ¼" to 2" gap at top of bottom flange.

Connection on Steel Beam

F15D

Sill plate to be properly anchored to steel beam

Steel beam

Connection on Hanger with Steel Beam

F15E

Sill plate to be properly anchored to steel beam

Steel beam

Backer block optional

1 of 4

BCI® Joist Hole Location & Sizing

BCI® Joists are manufactured with 1½" round perforated knockouts in the web at approximately 12" on center

Minimum spacing = 2x greatest dimension of largest hole (knockouts exempt)

D (see table below)

D (see table below)

No holes (except knockouts) allowed in bearing zones

A 1½" round hole may be cut anywhere in the web. Provide at least 3" of clearance from other holes.

DO NOT cut or notch flange

DO cut in web area as specified

Do not cut holes larger than 1½" round in cantilevers.

Minimum distance from support, listed in table below, is required for all holes greater than 1½"

MINIMUM DISTANCE (D) FROM ANY SUPPORT TO THE CENTERLINE OF THE HOLE														
Round Hole Diameter [in]		2	3	4	5	6	6½	7	8	8⅞	9	10	11	12	13
Rectangular Hole Side [in]		-	-	-	3	5	6	7	-	-	-	-	-	-	-
Any 9½" Joist	Span [ft] 8	1'-0"	1'-1"	1'-5"	2'-1"	2'-9"	3'-1"	3'-5"							
	12	1'-0"	1'-2"	2'-2"	3'-2"	4'-2"	4'-8"	5'-2"							
	16	1'-0"	1'-7"	2'-11"	4'-3"	5'-7"	6'-3"	6'-11"							
Round Hole Diameter [in]		2	3	4	5	6	6½	7	8	8⅞	9	10	11	12	13
Rectangular Hole Side [in]		-	-	-	2	3	4	5	7	8	-	-	-	-	-
Any 11⅞" Joist	Span [ft] 8	1'-0"	1'-1"	1'-5"	1'-10"	2'-4"	2'-7"	2'-10"	3'-4"	3'-9"					
	12	1'-0"	1'-4"	2'-1"	2'-10"	3'-7"	3'-11"	4'-3"	5'-0"	5'-8"					
	16	1'-0"	1'-10"	2'-10"	3'-9"	4'-9"	5'-3"	5'-9"	6'-9"	7'-7"					
	20	1'-1"	2'-3"	3'-6"	4'-9"	5'-11"	6'-7"	7'-2"	8'-5"	9'-6"					
Round Hole Diameter [in]		2	3	4	5	6	6½	7	8	8⅞	9	10	11	12	13
Rectangular Hole Side [in]		-	-	-	-	2	3	3	5	6	6	8	9	-	-
Any 14" Joist	Span [ft] 8	1'-0"	1'-1"	1'-2"	1'-3"	1'-8"	1'-10"	2'-1"	2'-6"	2'-10"	2'-11"	3'-4"	3'-8"		
	12	1'-0"	1'-1"	1'-3"	1'-10"	2'-6"	2'-10"	3'-1"	3'-9"	4'-3"	4'-4"	5'-0"	5'-7"		
	16	1'-0"	1'-1"	1'-8"	2'-6"	3'-4"	3'-9"	4'-2"	5'-0"	5'-8"	5'-10"	6'-8"	7'-5"		
	20	1'-0"	1'-1"	2'-1"	3'-2"	4'-2"	4'-8"	5'-2"	6'-3"	7'-2"	7'-3"	8'-4"	9'-4"		
	24	1'-0"	1'-4"	2'-6"	3'-9"	5'-0"	5'-8"	6'-3"	7'-6"	8'-7"	8'-9"	10'-0"	11'-2"		
Round Hole Diameter [in]		2	3	4	5	6	6½	7	8	8⅞	9	10	11	12	13
Rectangular Hole Side [in]		-	-	-	-	-	-	2	3	5	5	6	8	9	10
Any 16" Joist	Span [ft] 8	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-3"	1'-3"	1'-7"	1'-11"	2'-0"	2'-5"	2'-9"	3'-2"	3'-7"
	12	1'-0"	1'-1"	1'-2"	1'-2"	1'-3"	1'-6"	1'-10"	2'-5"	2'-11"	3'-0"	3'-7"	4'-2"	4'-9"	5'-4"
	16	1'-0"	1'-1"	1'-2"	1'-2"	1'-8"	2'-1"	2'-6"	3'-3"	3'-11"	4'-0"	4'-10"	5'-7"	6'-4"	7'-2"
	20	1'-0"	1'-1"	1'-2"	1'-2"	2'-1"	2'-7"	3'-1"	4'-1"	4'-11"	5'-1"	6'-0"	7'-0"	8'-0"	8'-11"
	24	1'-0"	1'-1"	1'-2"	1'-4"	2'-6"	3'-1"	3'-9"	4'-11"	5'-11"	6'-1"	7'-3"	8'-5"	9'-7"	10'-9"

- Select a table row based on joist depth and the actual joist span rounded up to the nearest table span. Scan across the row to the column headed by the appropriate round hole diameter or rectangular hole side. Use the longest side of a rectangular hole. The table value is the closest that the centerline of the hole may be to the centerline of the nearest support.

- The entire web may be cut out. DO NOT cut the flanges. Holes apply to either single or multiple joists in repetitive member conditions.

- For multiple holes, the amount of uncut web between holes must equal at least twice the diameter (or longest side) of the largest hole.

- 1½" round knockouts in the web may be removed by using a short piece of metal pipe and hammer.

- Holes may be positioned vertically anywhere in the web. The joist may be set with the 1½" knockout holes turned either up or down.

- This table was designed to apply to the design conditions covered by tables elsewhere in this publication. Use the BC CALC® software to check other hole sizes or holes under other design conditions. It may be possible to exceed the limitations of this table by analyzing a specific application with the BC CALC® software.

Large Rectangular Holes in BCI® Joists

Hole size table based on maximum uniform load of 40 psf live load and 25 psf dead load, at maximum spacing of 24" on-center.
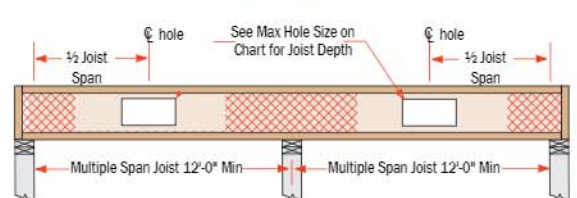
Single Span Joist

½ Joist Span

See Max Hole Size on Chart for Joist Depth

Minimum 2x diameter/ width of largest hole

Simple Span Joist 6'-0" Min

Multiple Span Joist

See Max Hole Size on Chart for Joist Depth

½ Joist Span

½ Joist Span

Multiple Span Joist 12'-0" Min

Multiple Span Joist 12'-0" Min

Joist Depth	Maximum Hole Size	
	Simple Span	Multiple Span
9½"	6" x 14"	6" x 10"
11⅞"	8" x 16"	8" x 10"
14"	9" x 18" 10" x 17"	8" x 14" 10" x 10"
16"	11" x 18" 12" x 16"	10" x 14"

Notes:

Additional holes may be cut in the web provided they meet the specifications as shown in the hole distance chart shown above or as allowed using BC CALC® sizing software.

Larger holes may be possible for either Single or Multiple span joists; use BC CALC® sizing software for specific analysis.

Single 11-7/8" BCI® 5000s-1.8
J01 (Joist)

BC CALC® Member Report	Dry | 1 span | No cant. | 16 OCS | Repetitive | Glued & nailed	April 10, 2019 11:58:49
Build 7133		

Job name:	4509 Nautilus Pl	File name:	
Address:		Description:	
City, State, Zip:	Lee's Summit, MO	Specifier:	
Customer:	LandRock Signature Homes	Designer:	
Code reports:	ESR-1336	Company:	

B1   11-00-00   B2
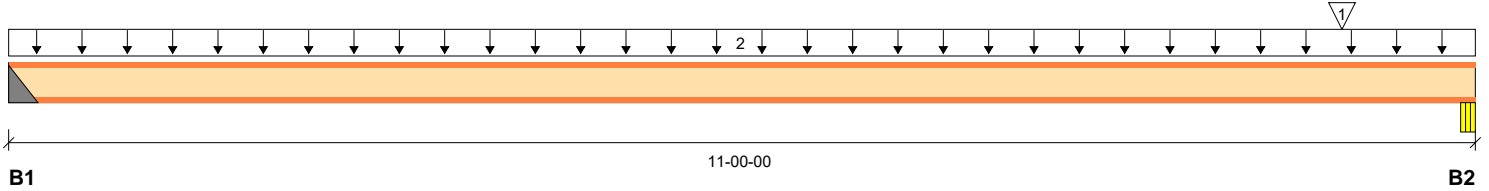
Total Horizontal Product Length = 11-00-00

Reaction Summary (Down / Uplift) (lbs)

Bearing	Live	Dead	Snow	Wind	Roof Live
B1, 2"	300 / 0	75 / 0			
B2, 3-1/2"	420 / 0	105 / 0			

Load Summary

Tag	Description	Load Type	Ref.	Start	End	Loc.	Live 100%	Dead 90%	Snow 115%	Wind 160%	Roof Live 125%	OCS
1	Point Load From LVL	Conc. Pt. (lbs)	L	10-00-00	10-00-00	Top	133	33				n\a
2	Floor Load	Unf. Area (lb/ft²)	L	00-00-00	11-00-00	Top	40	10				16

Controls Summary

	Value	% Allowable	Duration	Case	Location
Pos. Moment	1013 ft-lbs	29.1%	100%	1	05-06-14
End Reaction	525 lbs	36.9%	100%	1	11-00-00
End Shear	506 lbs	31.1%	100%	1	10-08-08
Total Load Deflection	L/999 (0.072")	n\a	n\a	1	05-06-14
Live Load Deflection	L/999 (0.058")	n\a	n\a	2	05-06-14
Max Defl.	0.072"	n\a	n\a	1	05-06-14
Span / Depth	10.8				

Bearing Supports

		Dim. (LxW)	Value	% Allow Support	% Allow Member	Material
B1	Hanger	2" x 2"	375 lbs	n\a	35.0%	Hanger
B2	Beam	3-1/2" x 2"	525 lbs	0.2%	36.9%	Steel

BC FloorValue® Summary

BC FloorValue®: ▮▮▮▮▮▮	Subfloor: 3/4" OSB, Glue + Nail
Minimum Enhanced Premium	Subfloor Rating: Premium

Controlling Location: 05-05-04

Notes

Design meets Code minimum (L/240) Total load deflection criteria.
Design meets User specified (L/480) Live load deflection criteria.
Design meets arbitrary (1") Maximum Total load deflection criteria.
Calculations assume member is fully braced.
Hanger Manufacturer: Simpson Strong-Tie, Inc.
BC CALC® analysis is based on IBC 2009.
Composite EI value based on 3/4" thick OSB sheathing glued and nailed to member.
Design based on Dry Service Condition.

Disclosure

Use of the Boise Cascade Software is subject to the terms of the End User License Agreement (EULA). Completeness and accuracy of input must be reviewed and verified by a qualified engineer or other appropriate expert to assure its adequacy, prior to anyone relying on such output as evidence of suitability for a particular application. The output here is based on building code-accepted design properties and analysis methods. Installation of Boise Cascade engineered wood products must be in accordance with current Installation Guide and applicable building codes. To obtain Installation Guide or ask questions, please call (800)232-0788 before installation.

BC CALC®, BC FRAMER® , AJS™, ALLJOIST® , BC RIM BOARD™, BCI® , BOISE GLULAM™, BC FloorValue® , VERSA-LAM®, VERSA-RIM PLUS® ,

3 of 4

Apex Engineers
1625 Locust St
Kansas City, Missouri 64108
www.apex-engineers.com

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

**Lic. # : KW-06005244** | **Licensee : APEX ENGINEERS INC**

Description : LVL Headers

CODE REFERENCES

Calculations per NDS 2012, IBC 2012, CBC 2013, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Stress Design	Fb +	2600 psi	E : Modulus of Elasticity
Load Combination: ASCE 7-10	Fb -	2600 psi	Ebend- xx 1900 ksi
	Fc - Prll	2510 psi	Eminbend - xx 965.71 ksi
	Fc - Perp	750 psi	
Wood Species : Trus Joist	Fv	285 psi	
Wood Grade : MicroLam LVL 1.9 E	Ft	1555 psi	Density 42 pcf

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

D(0.06667) L(0.2666)

1.75x11.87
Span = 2.667 ft
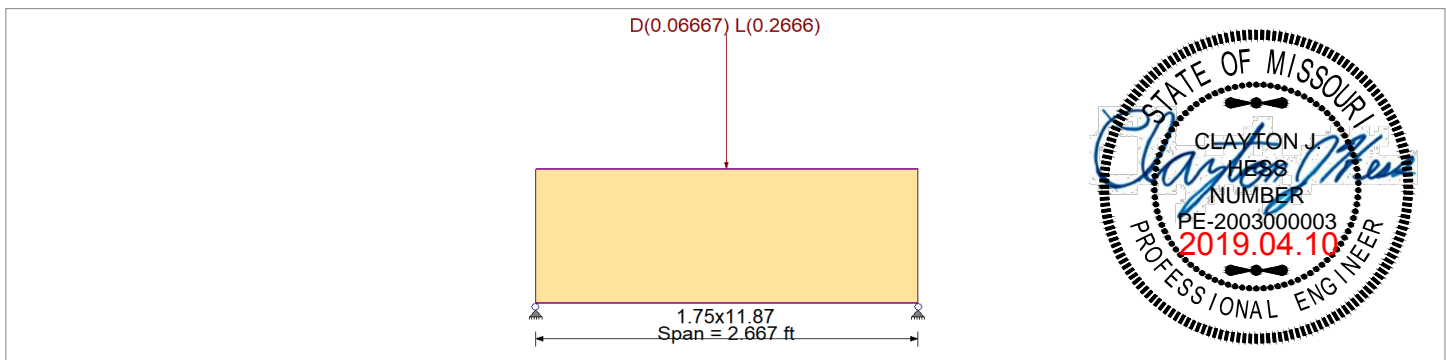
Applied Loads

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

Point Load : D = 0.06667, L = 0.2666 k @ 1.333 ft, (Load From BCI)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.025** : 1	Maximum Shear Stress Ratio	=	**0.042** : 1	
Section used for this span		**1.75x11.87**	Section used for this span		**1.75x11.87**	
fb : Actual	=	64.82 psi	fv : Actual	=	12.03 psi	
FB : Allowable	=	2,600.00 psi	Fv : Allowable	=	285.00 psi	
Load Combination		+D+L+H	Load Combination		+D+L+H	
Location of maximum on span	=	1.333 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	0.000 in	Ratio =	64906 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Maximum Forces & Stresses for Load Combinations

Load Combination Segment Length	Span #	Max Stress Ratios M	V	C_d	C_F/V	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H													0.00	0.00	0.00	0.00
Length = 2.667 ft	1	0.006	0.009	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.04	12.97	2340.00	0.03	2.41	256.50
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.667 ft	1	0.025	0.042	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.22	64.82	2600.00	0.17	12.03	285.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.667 ft	1	0.004	0.007	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.04	12.97	3250.00	0.03	2.41	356.25
+D+S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.667 ft	1	0.004	0.007	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.04	12.97	2990.00	0.03	2.41	327.75
+D+0.750Lr+0.750L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.667 ft	1	0.016	0.027	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.18	51.86	3250.00	0.13	9.62	356.25