

BCI Series I-Joists Boise Cascade Wood Products, LLC

Products: BCI[®] Series I-Joists

Boise Cascade Wood Products, LLC, 1000 North Park Drive, Roxboro, North Carolina 27573

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- 1. Basis of the product report:
 - 2018, 2015, and 2012 International Building Code (IBC): Sections 104.11 Alternative materials and 2303.1.2 Prefabricated wood I-joists
 - 2018 and 2015 International Residential Code (IRC): Sections R104.11 Alternative materials, and R502.1.2 and R802.1.8 (2018 IRC only) Prefabricated wood I-joists
 - 2012 IRC: Sections R104.11 Alternative materials and R502.1.4 Prefabricated wood I-joists
 - ASTM D5055-13e1, D5055-13, and D5055-09 recognized by the 2018 IBC and IRC, 2015 IBC and IRC, and 2012 IBC and IRC, respectively
 - APA Reports T2017P-43, T2018P-16, T2019P-33, and T2019P-36, and other qualification data
- 2. Product description:

The BCI Series I-joists covered by this report, as described in Table 1, are made with VERSA-LAM[®] LVL flanges and OSB webs in accordance with the in-plant manufacturing standard approved by APA. BCI 60S and BCI 90S shall be permitted to be manufactured with proprietary Thermax[™] as described in APA Product Report PR-S201.

3. Design properties:

Tables 2a and 2b list the design properties for BCI Series I-joists covered by this report. The allowable spans for BCI Series I-joists covered in this report shall be in accordance with the recommendations provided by the manufacturer (<u>www.bc.com</u>). For connection design, the specific gravity for the BCI flanges shall be limited to 0.43 for edge nail withdrawal, and 0.50 for face nail withdrawal, nail lateral, and bolt lateral.

Allowable shear values with web holes (V_{hole}) can be calculated based on the tabulated allowable shear values (V_r), hole size, and hole type using the following equations:

Circular holes

$$V_{hole} = V_r \left[0.88 - 0.7 \left(\frac{hole \ diameter}{joist \ depth - 2 \ x \ flange \ depth} \right) \right]$$

Square, rectangular or obround holes

$$V_{hole} = V_r \left[0.5 - 0.25 \left(\frac{hole \; depth}{joist \; depth - 2 \; x \; flange \; depth} \right) - 0.25 \left(\frac{hole \; length}{18} \right) \right]$$

where:

 V_r = Allowable shear value from Table 2a

4. Product installation:

BCI Series I-joists shall be installed in accordance with the recommendations provided by the manufacturer (see link above). Permissible web holes and cantilever reinforcements shall be in accordance with the recommendations provided by the manufacturer.

5. Fire-rated assemblies:

Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer (see link above), or as shown in APA Product Report PR-S201 (www.apawood.org/resource-library).

- 6. Limitations:
 - a) BCI Series I-joists covered by this report shall be designed in accordance with the code using the design properties specified in this report.
 - b) BCI Series I-joists covered by this report are limited to dry service conditions where the average equilibrium moisture content of sawn lumber is less than 16 percent.
 - c) BCI Series I-joists are produced at the Boise Cascade Wood Products, LLC facility in Roxboro, North Carolina under a quality program audited by APA.
 - d) This report is subject to re-examination in one year.
- 7. Identification:

The BCI Series prefabricated wood I-joists described in this report are identified by a label bearing the manufacturer's name (Boise Cascade or Boise Cascade Wood Products, LLC) and/or trademark (BCI), the APA assigned plant number (1027), the I-joist depth and series, the APA logo, the report number PR-L323, and a means of identifying the date of manufacture.

Joist Series		Flanç	Web			
	Joist Depths		Dime	nsion		Thickness (in.)
	(In.)	Material	Depth (in.)	Width (in.)	Material	
4500S-1.8	9-1/2 - 16	1.8 2500 VERSA-LAM	1.125	1.75	OSB	3/8
5000S-1.8	9-1/2 - 16	1.8 2500 VERSA-LAM	1.125	2.00	OSB	3/8
6000S-1.8	9-1/2 - 16	1.8 2500 VERSA-LAM	1.125	2.31	OSB	3/8
6500S-1.8	9-1/2 - 16	1.8 2500 VERSA-LAM	1.125	2.55	OSB	3/8
60S-2.0	9-1/2 - 20	2.0 3100 VERSA-LAM	1.500	2.31	OSB	3/8
90S-2.0	9-1/2 - 20	2.0 3100 VERSA-LAM	1.500	3.50	OSB	3/8

Table 1. Description of BCI Series I-Joists^(a)

^(a) Referenced dimensions are nominal. Tolerances are as specified in the plant quality manual.

Joist Series	Joist Depth	M ^(b)	$EI^{(c)}$	K ^(d)	V ^(e)	Uniform Vert (Ibf/ w/o Brg. Stiff 2300 2150 2000 1900 2300 2150 2000 1900 2300 2150 2000 1900 2300 2150 2000 1900 2300 2150 2000 1900 2300 2150 2000 1900 2650 2500 2400 2300 1600 1600 2650 2500	rtical Load ^(f) f/ft)
	(11.)	(101-11)	(10° 101-111)	(10-10)	(101)	w/o Brg. Stiff	w/Brg. Stiff ^(f,g)
	9 1/2	2360	155	5	1475	2300	N/A
45005 1 9	11 7/8	3025	260	6	1625	2150	N/A
45005-1.8	14	3585	380	8	1825	2000	N/A
	16	4090	515	9	1975	1900	2500
	9 1/2	2725	175	5	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	N/A	
50005-1.8	11 7/8	3485	295	6	1625	2150	N/A
50000-1.0	14	4130	430	8	1825	2000	N/A
	16	4715	580	9	1975	1900	Item (lbf/ft) 3rg. Stiff w/Brg. Stiff ^(f,g) 300 N/A 150 N/A 150 N/A 900 2500 300 N/A 150 N/A 900 2500 650 N/A 900 2500 650 N/A 300 2700 600 2700 650 N/A 2300 2700 600 2700 600 2700 <
6000S-1.8 6500S-1.8	9 1/2	3165	200	5	1575	2300	N/A
	11 7/8	4060	335	6	1675	2150	N/A
	14	4815	490	8	1925	2000	N/A
	16	5495	660	9	2175	1900	2500
6500S-1.8	9 1/2	3505	220	5	1575	2300	N/A
	11 7/8	4495	365	6	1675	2150	N/A
	14	5330	535	8	1925	2000	N/A
	16	6085	720	9	2175	1900	2500
	9 1/2	4815	265	6	1575	2650	N/A
	11 7/8	6235	450	7	1675	2500	N/A
605 2 0	14	7440	660	8	1925	2400	N/A
6500S-1.8 60S-2.0	16	8520	895	9	2175	2300	2700
	18	9590	1170	10	2375	1600	2700
	20	10650	1490	11	2450	1600	2700
	9 1/2	7370	400	6	1675	2650	N/A
	11 7/8	9550	675	7	2150	2500	N/A
905-2.0	14	11390	980	8	2350	2400	N/A
303-2.0	16	13050	1330	9	2550	2300	2700
	18	14690	1730	10	2750	1600	2700
	20	16310	2190	11	2850	1600	2700

Table 2a.	Desian	Properties	for Boise	Cascade BC	I Series I	Joists ^(a)
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For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lbf = 4.448 N.

^(a) The tabulated values are for normal duration of load. Values other than EI, K and uniform vertical load shall be permitted to be adjusted for other load durations as permitted by the code.

^(b) Moment capacity (M) of the I-joist, which shall not be increased by any repetitive member use factor.

- ^(c) Bending stiffness (EI) of the I-joist.
- ^(d) Coefficient of shear deflection (K). For calculating uniform load and center-point load deflections of the ljoist in a simple-span application, use Eqs. 1 and 2.

Uniform Load:
$$\delta = \frac{5w\ell^4}{384EI} + \frac{w\ell^2}{k}$$
[1]

Center-Point Load: $\delta = \frac{P\ell^3}{48EI} + \frac{2P\ell}{k}$

where:

- = calculated deflection (in.),
- w = uniform load (lbf/in.),
- ℓ = design span (in.),
- P = concentrated load (lbf),
- EI = bending stiffness of the I-joist (lbf-in.²), and
- K = coefficient of shear deflection (lbf).
- ^(e) Shear capacity (V) of the I-joist.

δ

- ^(f) Web stiffener required at each end.
- ^(g) Web stiffeners for blocking panels require three 8d box nails (0.113 in. x 2-1/2 in.), except three 16d box nails (0.135 in. x 3-1/2 in.) are required for BCI 90S-2.0.

[2]

		End Reaction (lbf) ^(c,d)					Intermediate Reaction (lbf) ^(c,e)						
Joist	Joist Depth	1 1	∕"(b) 2	3	1/2"	5	1/4"	3 1⁄	∕"(b) 2	5	1/4"	7	
Series	(in.)	w/o Brg. Stiff	w/Brg. Stiff	w/o Brg. Stiff	w/Brg. Stiff	w/o Brg. Stiff	w/Brg. Stiff	w/o Brg. Stiff	w/Brg. Stiff	w/o Brg. Stiff	w/Brg. Stiff	w/o Brg. Stiff	w/Brg. Stiff
	9 1/2	950	1125	1125	1275	1275	1325	2100	2350	2525	2750	2525	2950
4500S	11 7/8	950	1425	1425	1475	1475	1525	2250	2850	2525	3000	2525	3250
-1.8	14	950	1525	1450	1725	1675	1775	2350	3050	2525	3200	2525	3650
	16	950	1625	1475	1975	1750	1975	2400	3200	2525	3350	2525	3750
	9 1/2	950	1125	1125	1275	1275	1325	2100	2350	2525	2750	2525	2950
5000S	11 7/8	950	1425	1425	1475	1475	1525	2250	2850	2525	3000	2525	3250
-1.8	14	950	1525	1475	1725	1675	1775	2350	3050	2525	3200	2525	3650
	16	950	1625	1500	1975	1750	1975	2400	3200	2525	3350	2525	3750
	9 1/2	1175	1375	1375	1425	1425	1475	2400	2650	2700	2750	3000	3150
6000S	11 7/8	1175	1425	1425	1475	1475	1675	2500	2850	2900	3000	3200	3250
-1.8	14	1175	1525	1525	1725	1725	1925	2600	3150	2925	3200	3400	3650
	16	1175	1625	1550	1975	1900	2175	2650	3350	2950	3350	3575	3750
	9 1/2	1175	1375	1375	1425	1425	1475	2400	2650	2700	2750	3000	3150
6500S	11 7/8	1175	1425	1425	1475	1475	1675	2500	2850	2900	3000	3200	3250
-1.8	14	1175	1525	1525	1725	1725	1925	2600	3150	2925	3200	3400	3650
	16	1175	1625	1550	1975	1900	2175	2650	3350	2950	3350	3575	3750
	9 1/2	1175	1375	1375	1425	NA	NA	2400	2650	2700	2750	NA	NA
	11 7/8	1175	1425	1425	1475	NA	NA	2750	2850	3200	3250	NA	NA
60S-	14	1175	1525	1525	1725	NA	NA	2750	3450	3200	3650	NA	NA
2.0	16	1175	1625	1550	1975	NA	NA	2750	3650	3200	3750	NA	NA
	18	1175	1750	1550	2175	NA	NA	2750	3950	3200	4550	NA	NA
	20	1175	1900	1550	2250	NA	NA	2750	4200	3200	4750	NA	NA
	9 1/2	1175	1425	1375	1450	NA	NA	3000	3150	3000	3150	NA	NA
	11 7/8	1425	1850	1800	1950	NA	NA	3375	3700	4000	4300	NA	NA
90S-	14	1450	1950	1850	2150	NA	NA	3400	3850	4100	4450	NA	NA
2.0	16	1475	2150	1900	2350	NA	NA	3425	4000	4200	4650	NA	NA
	18	1475	2300	1900	2550	NA	NA	3425	4150	4200	4750	NA	NA
	20	1475	2500	1900	2650	NA	NA	3425	4300	4200	4850	NA	NA

Table 2b. Design Properties for Boise Cascade BCI Series I-Joists^(a)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lbf = 4.448 N.

^(a) The tabulated values are design values for normal duration of load. All values shall be permitted to be adjusted for other load durations as permitted by the code.

^(b) Minimum bearing length required.

(c) Interpolation of the end reaction between 1-1/2-inch and 5-1/4-inch bearing (1-1/2 and 3-1/2 inch for BCI 60S & BCI 90S), with or without bearing stiffeners, respectively, shall be permitted.

(d) The tabulated *reference* design reaction values, *R_r*, are for normal duration of load and shall be permitted to be adjusted for other load durations in accordance with the NDS, provided the *adjusted* design reaction, *R_r*, does not exceed the flange bearing capacity, as calculated in accordance with Eq. 3.

$$P_{c\perp}' = F_{c\perp}' \ell_b (w_f - 0.15) \ge R_r'$$
 [3]

where: $P_{c\perp}$ = Flange bearing capacity (lbf),

F_{c⊥}' = 550 psi,

Note: The F_{cL} value listed above has included the bearing area factor (c_b in the NDS) and shall not be further adjusted for any load duration,

 ℓ_{b} = Bearing length (in.), and

 w_f = Nominal width of the flange (in.), as shown in Table 1.

^(e) Interpolation of the intermediate reaction between 3-1/2- and 7-inch bearing (3-1/2 and 5-1/4 inch for BCI 60S & BCI 90S), with or without bearing stiffeners, respectively, shall be permitted.

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