Evaluation Report CCMC 12768-R
IB (WI) Series I-Joists

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "IB (WI) Series I-Joists", when used as joists in floor and roof applications in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2010:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Sentence 4.3.1.1.(1), Design Basis for Wood, CAN/CSA-O86-09, Engineering Design in Wood (i.e., Code-specified I-joist qualification)

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Sentence 9.23.4.2.(2), Spans for Joists, Rafters and Beams (i.e., alternative floor joist solution).

This opinion is based on CCMC's evaluation of the technical evidence in Section 4 provided by the Report Holder.

Ruling No. 04-01-105 (12768-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2004-02-13 (revised on 2014-03-20) pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

The products are prefabricated wood I-joists consisting of two finger-jointed lumber flanges. The flange sizes and grades are shown in Table 2.1. This evaluation covers all the I-joist series products described in this report that are manufactured at the Pohénégamook plant. This evaluation covers only the IB 400 (WI 40) and IB 600 (WI 60) I-joist series products manufactured at the Tillsonburg plant.

The flanges are finger-jointed at the plant and glued to a 9.5-mm- or 11-mm-thick oriented strandboard (OSB) web, which is manufactured in conformance with CAN/CSA-O325-07, "Construction Sheathing."

The web-flange connection is made by inserting the profiled OSB web into an 18.8-mm-deep tapered groove in the centre of the wide face of the top and bottom flanges. Consecutive web segments are end-spliced with a V-shaped joint to form a continuous web.

For the products manufactured at the:

- Pohénégamook plant: All the V-shaped edge web segments, the web-to-flange, and the flange finger joints are bonded together using a polyurethane adhesive (CCMC 13513-L).
- Tillsonburg plant: The flange finger joints are bonded together using a polyurethane adhesive (CCMC 13513-L), and the web-to-web and web-to-flange joints are bonded together using a phenol-resorcinol-formaldehyde (PRF) adhesive (CCMC 13054-L).

APA – The Engineered Wood Association (APA EWS trademark) conducts regular audits of the manufacturing plant and the quality assurance program as part of the product certification.

Table 2.1 I-Joist Flange Sizes and Grades

IB I-Joist	Depth (mm)	Grade	Flange Size (mm)	Web Thickness[1] (mm)
IB 400 (WI 40)	235-406	Proprietary[2] S-P-F No. 2 and better or enhanced[3] MSR 1650f-1.5E	38 x 63.5	9.5
IB 600 (WI 60)	235-508	Enhanced[3] MSR 2100f-1.8E	38 x 63.5	9.5
IB 800 (WI 80)	235-508	Enhanced[3] MSR 2100f-1.8E	38 x 89	9.5
IB 900	302-610	Enhanced[3] MSR 2550f-2.1E	38 x 89	11.1

Notes to Table 2.1:

1 Referenced dimensions are nominal. Tolerances are as specified in the manufacturing standard.

2 The visually graded lumber flange is regraded with a proprietary tension value that has been qualified. The flange is subject to proprietary grading rules and ongoing testing in accordance with the manufacturing standard.

3 The machine stress rated (MSR) lumber flange is enhanced with a proprietary tension value that has been qualified. The flange is subject to proprietary grading rules and ongoing testing in accordance with the manufacturing standard.

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "IB (WI) Series I-Joists" being used in accordance with the conditions and limitations set out below.

- The products are intended for use in structural applications, such as floor, ceiling or roof joists, and are intended for dry service use[1] applications only.
- The following pre-engineering information has been provided to CCMC by the manufacturer to demonstrate compliance with Part 9 of the NBC 2010 for acceptance by the local authority having jurisdiction (AHJ):

i. **Manufacturer's Pre-engineered Floor Span Charts**

When the products are used as floor joists in simple (single) span or continuous (multiple) span applications supporting uniform loads only, the installation must be in accordance with the vibration controlled floor span tables (including NBC 2010 specified vibration criteria[2]) found in the following documents, in Limit States Design for Canada, entitled:

For IB 400, IB 600, IB 800 and IB 900 products:

1. International Beams Residential Design Manual for I-joists (Canadian - LSD), dated December 2013;

For WI 40, WI 60 and WI 80 products:

2. Georgia-Pacific Residential Design Manual for I-joists (Canadian - LSD), dated January 2014.

The product must be installed in accordance with the manufacturer's installation guidelines noted in the above-mentioned documents for those applications falling within the scope of the documents. Applications outside the scope of these installation guidelines require engineering on a case-by-case basis.

ii. **APA EWS's Pre-engineered Installation Details**

The products must be installed in accordance with the applicable manufacturer's installation document outlined in 3(i). Installation of the products is limited in scope to building designs where the anticipated loads on the following structural details are not exceeded (page references from documents 1 and 2 above):

- floor span tables (pages 4-8 of (1) and pages 4-7 of (2));
- rim joist, rim board and blocking resistance (page 10 of (1) and page 9 of (2));
- squash blocks (page 10 of (1) and page 9 of (2));
- backer block (page 11 of (1) and page 10 of (2));
- web stiffener requirements (page 12 of (1) and page 11 of (2));
- filler block for double I-joists (page 14 of (1) and page 13 of (2));
- loadbearing cantilever tables (pages 13-16 of (1) and pages 12-15 of (2));
- web hole tables (page 17 of (1) and page 16 of (2)); and
- roof span tables (pages 21-23 of (1) and pages 20-22 of (2)).

iii. **Engineering Required**

When required by the AHJ or for structural applications beyond the scope/limitations of those referenced in Section 1, the drawings or related documents must bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.

Installations beyond the scope/limitations of 3(i) and 3(ii) imply, but are not limited to, the following:

- higher loads/longer spans than the manufacturer's pre-engineered details;
- concentrated loads;
- offset bearing walls;
- high wind and seismic areas;
- stair openings;
- design of supporting wall studs/beams when the total load exceeds the NBC 2010 pre-engineered floor/roof joist tables; and
- design of supporting foundation footings when the total load exceeds the NBC 2010 pre-engineered floor/roof joist tables.

The engineer must design in accordance with CAN/CSA-O86-09, "Engineering Design in Wood," and may use as a guide the *Engineering Guide for Wood-Frame Construction*, published by the Canadian Wood Council.

iv. **Engineering Support**

International Beams Inc. and Georgia-Pacific Wood Products LLC provide engineering and product support through the following contact information:

For the IB Series I-Joists, International Beams Inc.
Telephone: 1-941-552-9914
E-mail: sales@internationalbeams.com

For the WI Series I-Joists, Georgia-Pacific Wood Products LLC
Telephone: 1-877-437-9759
Web site: www.gp.com/build

- These products must be identified with the phrase "CCMC 12768-R" along the side of the flange. This CCMC number is only valid when it appears in conjunction with the APA EWS certification mark.
- Damaged or defective joists must not be used, unless repaired in accordance with written instructions from the manufacturer.

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1 *All lumber, wood-based panels and proprietary engineered wood products are intended for dry service conditions. "Dry service" is defined as the in-service environment under which the equilibrium moisture content (MC) of lumber is 15% or less over a year and does not exceed 19% at any time. Wood contained within the interior of dry, heated or unheated buildings has generally been found to have a MC between 6% and 14% according to season and location. During construction, all wood-based products should be protected from the weather to ensure that the 19% MC is not exceeded in accordance with Article 9.3.2.5., Moisture Content, of Division B of the NBC 2010.*

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2 *In cases where concrete topping is applied or bridging/blocking is used and joists are installed at the maximum spans, the current vibration criteria may not address all occupant performance expectations. The manufacturer should therefore be consulted for span adjustments, if necessary, in these types of installations.*

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

4.1 General

Table 4.1.1 Engineering Properties[1] (Limit States Design[2])

Series	Joist Depth (mm)	Factored Moment Resistance[3] M_r (N·m)	Factored Shear Resistance[4] V_r		EI ($x10^6$) (kN·mm²)	Shear Deflection 'K' Factor ($x10^6$) (N)	Factored Vertical Load Resistance[5] (kN/m)
			No Stiffeners	With Stiffeners			
IB 400 (WI 40)	235	6 122	8 109	8 109	531	21.40	48.7
	241	6 314	8 320	8 320	568	21.97	
	286	7 689	9 864	9 864	849	26.02	
	302	8 185	10 391	10 391	964	27.49	
	356	9 854	10 882	12 286	1 418	32.38	
	406	11 421	10 882	14 042	1 931	37.01	
IB 600 (WI 60)	235	8 433	8 109	9 478	631	21.40	48.7
	241	8 704	8 320	9 619	674	21.97	
	286	10 598	9 864	10 637	1 022	26.02	
	302	11 274	10 391	11 023	1 145	27.49	
	356	13 574	10 882	12 286	1 679	32.38	
	406	15 739	10 882	14 042	2 293	37.01	
IB 600	457	17 802	10 882	15 797	3 002	41.63	42.6
	508	19 696	10 882	17 552	3 742	46.26	36.5
IB 800 (WI 80)	235	11 940	8 109	9 759	881	21.40	48.7
	241	12 323	8 320	9 864	936	21.97	
	286	15 006	9 864	10 812	1 415	26.02	
	302	15 965	10 391	11 128	1 584	27.49	
	356	19 234	10 882	12 286	2 316	32.38	
	406	22 301	10 882	14 042	3 139	37.01	
IB 800	457	25 108	11 233	16 148	4 147	41.63	44.1
	508	27 915	11 584	18 254	5 163	46.26	39.6

Table 4.1.1 Engineering Properties[1] (Limit States Design[2]) (cont.)

Series	Joist Depth (mm)	Factored Moment Resistance[3] M_r (N·m)	Factored Shear Resistance[4] V_r		EI ($x10^6$) (kN·mm²)	Shear Deflection 'K' Factor ($x10^6$) (N)	Factored Vertical Load Resistance[5] (kN/m)
			No Stiffeners	With Stiffeners			
IB 900	302	19 899	13 234	13 515	1 733	27.49	48.7
	356	23 969	13 234	14 919	2 537	32.38	
	406	28 490	13 234	16 358	3 441	37.01	
	457	32 211	13 234	17 622	4 491	51.24	44.1
	508	35 650	13 234	18 921	5 693	56.93	39.6
	559	39 055	13 234	20 185	7 051	62.63	30.4
	610	42 414	13 234	21 484	8 566	68.32	30.4

Notes to Table 4.1.1:

1 Additional engineering data and load/span tables are available from the manufacturer.

2 Design values were developed in accordance with CAN/CSA-O86 for standard term load duration (K_d = 1). All values, except EI and K, are permitted to be adjusted for other load durations as permitted by CAN/CSA-O86.

3 Factored moment resistance (M_r) shall **not** be increased by any Code-allowed system factor.

4 Factored shear resistance (V_r) of the I-joist with a minimum end bearing of 102 mm. Stiffeners must be designed as per specifications.

5 Factored vertical uniform load resistance of the I-joist when used as blocking (i.e., squash blocks).

Table 4.1.2 Additional Engineering Properties (Limit States Design)[1]

Series	Depth (mm)	Factored End Reactions[2] (N)							
		38-mm-Bearing		44-mm-Bearing		70-mm-Bearing		89-mm-Bearing	
		No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]
IB 400 (WI 40)	235	7 793	8 109	7 828	8 109	8 109	8 109	8 109	8 109
	241	7 863	8 320	7 934	8 320	8 320	8 320	8 320	8 320
	286	8 249	9 513	8 460	9 548	9 408	9 864	9 864	9 864
	302	8 425	9 970	8 636	10 040	9 619	10 391	10 285	10 391
	356	8 846	11 444	9 092	11 549	10 215	12 286	10 882	12 286
	406	9 303	12 813	9 513	12 953	10 215	14 042	10 882	14 042

Table 4.1.2 Additional Engineering Properties (Limit States Design)[1] (cont.)

Series	Depth (mm)	Factored End Reactions[2] (N)							
		38-mm-Bearing		44-mm-Bearing		70-mm-Bearing		89-mm-Bearing	
		No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]
IB 600 (WI 60)	235	7 793	8 109	7 934	9 478	8 109	9 478	8 109	9 478
	241	7 863	8 320	8 004	9 619	8 320	9 619	8 320	9 619
	286	8 249	9 513	8 530	10 637	9 408	10 637	9 864	10 637
	302	8 425	9 970	8 706	11 023	9 619	11 023	10 285	11 023
	356	8 846	11 444	9 373	12 286	10 250	12 286	10 882	12 286
	406	9 303	12 813	9 970	13 515	10 496	13 831	10 882	14 042
IB 600	457	n/a	n/a	10 566	14 709	10 742	15 340	10 882	15 797
	508	n/a	n/a	10 882	15 867	10 882	16 815	10 882	17 552
IB 800 (WI 80)	235	7 793	8 109	7 934	9 689	8 109	9 478	8 109	9 689
	241	7 863	8 320	8 004	9 864	8 320	9 619	8 320	9 684
	286	8 249	9 513	8 530	10 812	9 408	10 637	9 864	10 812
	302	8 425	9 970	9 022	11 128	9 619	11 023	10 285	11 128
	356	8 846	11 444	9 373	12 286	10 250	12 286	10 882	12 286
	406	9 303	12 813	9 970	14 042	10 496	13 831	10 882	14 042
IB 800	457	n/a	n/a	10 566	15 937	10 742	15 340	10 882	16 148
	508	n/a	n/a	10 882	17 271	10 882	16 815	10 882	18 254
IB 900	302	8 425	9 970	9 829	11 128	11 444	12 006	12 673	12 673
	356	8 846	11 444	9 829	12 286	11 444	13 129	12 673	13 761
	406	9 303	12 813	9 970	14 042	11 514	15 376	12 673	16 358
	457	n/a	n/a	10 566	15 937	11 233	16 885	11 760	17 622
	508	n/a	n/a	10 882	17 341	11 374	18 184	11 760	18 816
	559	n/a	n/a	10 321	18 219	11 128	19 132	11 760	19 799
	610	n/a	n/a	10 321	20 220	11 128	20 536	11 760	20 782

Notes to Table 4.1.2:

1 Design values were developed in accordance with CAN/CSA-O86 for standard term load duration (K_D = 1). All values, except EI and K, are permitted to be adjusted for other load durations as permitted by CAN/CSA-O86.

2 Interpolation of the factored end reaction resistances between tabulated values is permitted. For factored reactions for bearings 102 mm or longer, it is permitted to use the factored shear resistance in Table 4.1.1.

3 Stiffeners must be designed as per specifications.

Table 4.1.3 Additional Engineering Properties (Limit States Design)[1]

Series	Depth (mm)	Factored Interior Reactions[2] (N)			
		89-mm-Bearing		140-mm-Bearing	
		No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]
IB 400 (WI 40)	235	15 165	16 218	16 218	16 219
	241	15 165	16 639	16 639	16 639
	286	17 552	19 623	19 728	19 728
	302	17 552	19 623	19 728	20 782
	356	17 552	19 623	21 765	24 257
	406	17 552	19 623	21 765	25 626
IB 600 (WI 60)	235	15 165	18 956	16 218	18 965
	241	15 165	19 237	16 639	19 237
	286	17 552	21 273	19 728	21 273
	302	17 552	21 589	19 728	22 045
	356	17 552	22 572	21 765	24 257
	406	17 552	23 520	21 765	25 626
IB 600	457	17 552	24 046	21 765	26 223
	508	17 552	24 222	21 765	26 820
IB 800 (WI 80)	235	16 218	18 956	16 218	18 956
	241	17 341	19 237	17 341	19 237
	286	19 728	21 273	19 728	21 273
	302	19 728	22 045	19 728	22 045
	356	21 203	24 573	21 203	24 573
	406	21 765	28 083	21 765	28 083
IB 800	457	21 765	29 663	21 765	29 663
	508	21 765	30 541	21 765	30 541

Table 4.1.3 Additional Engineering Properties (Limit States Design)[1] (cont.)

Series	Depth (mm)	Factored Interior Reactions[2] (N)			
		89-mm-Bearing		140-mm-Bearing	
		No Stiffeners	With Stiffeners[3]	No Stiffeners	With Stiffeners[3]
IB 900	302	23 555	23 555	23 555	23 555
	356	23 555	24 783	23 555	25 696
	406	23 555	27 522	23 555	28 715
	457	23 555	29 979	23 555	32 577
	508	23 555	32 296	23 555	35 104
	559	23 555	34 753	23 555	35 631
	610	23 555	36 157	23 555	36 157

Notes to Table 4.1.3:

1 Design values were developed in accordance with CAN/CSA-O86 for standard term load duration (K_D = 1). All values, except EI and K, are permitted to be adjusted for other load durations as permitted by CAN/CSA-O86.

2 Interpolation of the factored interior reaction resistances between tabulated values is permitted.

3 Stiffeners must be designed as per specifications.

Report Holder

International Beams Inc.
2010 Boul. St-Elzéar Ouest
Laval, QC H7L 3N4

Plant(s)

Pohénégamook, QC
Tillsonburg, ON

Disclaimer

Date modified:
2016-01-28

APPENDIX A

The charateristic values obtained from testing to ASTM D 5055-10, "Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists," as specified in CAN/CSA-O86-09, are summarized below. The manufacturer's published pre-engineered joist spans were designed in accordance with CAN/CSA-O86.

Table A1. Additional Testing Information for "IB 400, 600, 800, 900 Series I-Joists"

Property	Test Information
Shear capacity	The shear capacity of the specimens was established by combining data in accordance with ASTM D 5055. Data from quality control (QC) tests was used to establish the applicable coefficient of variation, CV_W, and the reliability normalization factor from Table 14.2.3.2 of CAN/CSA-O86 was used to determine the specified strength.
Moment capacity	The moment capacity qualification was carried out using the analytical method based on the characteristics of the flange material, with confirmatory testing in accordance with ASTM D 5055. Data from QC tests was used to establish the applicable coefficient of variation, CV_W, and the reliability normalization factor from Table 14.2.3.2 of CAN/CSA-O86 was used to determine the specified strength.
Stiffness	An appropriate test program was used to confirm the stiffness capacity. The following formula was used to predict mid-span deflection: deflection = $\frac{5wL^4}{384EI} + \frac{wL^2}{K}$ where deflection (in mm), w = unfactored uniform load (kN/mm), L = design span (mm), EI (kN·mm²) and K (kN) were taken from Table 4.1.1.
End joints	End joints were qualified as part of the flange tension qualification. The flanges are finger-joined at the plant, and regular tension testing is conducted.
Creep	Specimens were tested for creep performance in accordance with ASTM D 5055. The specimens recovered more than 90% of the basic dead load deflection.
Bearing length	Tests were conducted to qualify, with and without web stiffeners, minimum end-bearing lengths of 38 mm, 44 mm, 89 mm and 102 mm, as well as interior bearing lengths of 89 mm and 140 mm. Qualification tests were used to establish the applicable coefficient of variation, CV_W, and the reliability normalization factor from Table 14.2.3.2 of CAN/CSA-O86 was used to determine the specified strength.
Adhesive qualification	For the products manufactured at the Pohénégamook plant, all joints are bonded together using a polyurethane adhesive, UX-160/WD3-A322 (CCMC 13513-L). For the products manufactured at the Tillsonburg plant, the flange finger joints are bonded together using a polyurethane adhesive, UX-160/WD3-A322 (CCMC 13513-L), and the web-to-web and web-to-flange joints are bonded together using a PRF adhesive, PRF LT-5210Q/FM-7400 (CCMC 13054-L).
Web stock	The web stock complies with CAN/CSA-O325-07, "Construction Sheathing."