NRC·CNRC
Institute for Research in Construction

Evaluation Report
CCMC 12768-R

MASTERFORMAT: 06 17 33.01
Issued: 1996-09-09
Re-evaluated: 2009-09-08
Re-evaluation due: 2011-01-11
Re-Evaluation in Progress

IB 400, 600, 800, 900 Series I-Joists

1. Opinion

It is the opinion of the Canadian Construction MaterialsCentre (CCMC) that "IB 400, 600, 800, 900 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 2005:

- 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-O86-01, 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 4.1 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 2010-07-21) 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

"IB 400, 600, 800, 900 Series I-Joists" are prefabricated wood I−joists consisting of two finger-jointed lumber flanges. The flange sizes and grades are shown in Table 2.1.

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 withCAN/CSA-O325.0-92, "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 flange. The web material is installed in 1 219-mm lengths into the flanges. The V-shaped edge web segments, the web-to-flange, and the flange fingerjoints are bonded together using Isoset® UX-200/WD3-A300 (CCMC # 13267-R).

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 International Beams (IB) I-Joist flange sizes and grades

IB I-Joist	Depth (mm)	Grade	Flange Size (mm)	Web Thickness (mm)
IB 400	235-406	Proprietary(1) SPF no. 2 & Better	38 x 63.5	9.5
IB 600	235-508	Enhanced(2) MSR 2100f-1.8E	38 x 63.5	9.5
IB 800	235-508	Enhanced(2) MSR 2100f-1.8E	38 x 89	9.5
IB 900	302-610	Enhanced(2) MSR 2400f-2.0E	38 x 89	11.1

Notes to Table 2.1:

(1) The visually graded lumber flange is re-graded and a proprietary tension value has been qualified. The flange is subject to proprietary grading rules and on-going testing in accordance with the Manufacturing Standard.

(2) The MSR lumber flange is enhanced with a proprietary tension value, which has been qualified. The flange is subject to on-going testing in accordance with the Manufacturing Standard.

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "IB 400, 600, 800, 900 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.

  (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 2005.

- The following pre-engineering has been provided to CCMC by International Beams Inc. to demonstrate compliance to Part 9 buildings for acceptance by the local authority having jurisdiction (AHJ):

  i) International Beams Inc.'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 2005 Code-specified vibration criteria[1]) found in the following documents, in Limit States Design for Canada, entitled:

  1. International Beams Series Spans, dated 06-03-05;
  2. International Beams Product Guide, dated February 2007;
  3. International Beams I-Joist Installation Guide, dated April 2007;
  4. APA EWS, I-Joist Construction Details, Canadian Limit States Design, March 2008.

  The product shall be installed in accordance with APA EWS 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 shall require engineering on a case-by-case basis.

  (1) 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. International Beams Inc. should therefore be consulted for span adjustments, if necessary, in these types of installations.

  ii) APA EWS's Pre-engineered Installation Details

  The products are to be installed in accordance with International Beams and the APA EWS specified installation document outlined in 3(i). Installation of the products are limited in scope to building designs where the anticipated loads on the following structural details are not exceeded (page references from document 4):

  - rim joist and blocking resistance (page 3)
  - rim board resistance (page 3)
  - squash blocks (page 4)
  - backer block (page 5)
  - filler block for double I-joists (page 7)
  - web stiffener requirements (page 8)
  - loadbearing cantilever details and tables (pages 9 to 11)
  - web hole tables (pages 12 to 16)
  - roof installation details (pages 17 to 22)

  iii) Engineering Required

  When required by the AHJ or for structural applications beyond the scope/limitations of those referenced in Section (i), 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
  - roof spans
  - design of supporting wall studs/beams when total load exceeds the NBC 2005 pre-engineered floor/roof joist tables
  - design of supporting foundation footings when total load exceeds the NBC 2005 pre-engineered floor/roof joist tables.

The engineer must design in accordance with CAN/CSA-O86, "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 Provided by Manufacturer

APA EWS provides engineering and product support in conjunction with International Beams Inc. via the following methods:

International Beams Inc.: 1-514-849-4849, ext. 101

APA EWS: 1-253-620-7400

APA EWS e-mail: help@apawood.org

This product 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.

4. Technical Evidence

CCMC's Technical Guide for "IB 400, 600, 800, 900 Series I-Joists" sets out the nature of the technical evidence required by CCMC to enable it to evaluate a product as an acceptable or alternative solution in compliance with the NBC 2005. The Report Holder has submitted (i) the CCMC specified testing, summarized in the Appendix, and (ii) derived design values as outlined below, for CCMC's evaluation. Testing was conducted at independent laboratories recognized by CCMC. The corresponding test results for "IB 400, 600, 800, 900 Series I-Joists" are summarized below.

4.1 NBC 2005 Compliance Data for "IB 400, 600, 800, 900 Series I-Joists" on which CCMC Based its Opinion in Section 1

4.1.1 General

4.1.1.1 Design Values

Table 4.1.1.1 Engineering properties of "IB 400, 600, 800, 900 Series I-Joists" (Limit States Design)[1]

Series	Joist Depth (mm)	Factored Moment Resistance [2] M_r (N·m)	Factored Shear Resistance [3] V_r (N)	Factored ER[4] at 44 mm (N)	Factored IR[5] at 89 mm (N)	EI ($x10^6$) ($kN·mm^2$)	Shear Deflection 'K' Factor ($x10^6$) (N)
IB 400	235	6,122	8,109	7,582	15,165	531	21.40
	241	6,314	8,320	7,582	15,165	568	21.97
	292	7,689	9,864	8,425	17,552	849	26.02
	302	8,185	10,391	8,425	17,552	964	27.49
	356	9,854	12,286	8,425	17,552	1,418	32.38
	406	11,421	14,042	8,425	17,552	1,931	37.01
IB 600	235	8,433	9,478	7,582	15,165	631	21.40
	241	8,704	9,619	7,582	15,165	674	21.97
	292	10,598	10,637	8,425	17,552	1,022	26.02
	302	11,274	11,023	8,425	17,552	1,145	27.49
	356	13,574	12,286	9,057	17,552	1,679	32.38
	406	15,739	14,042	9,654	17,552	2,293	37.01
	457	17,802	15,797	10,285	17,552	3,002	41.63
	508	19,696	17,552	10,882	17,552	3,742	46.26
IB 800	235	11,940	9,759	7,582	16,218	881	21.40
	241	12,323	9,864	7,582	16,639	936	21.97
	292	15,006	10,812	8,425	19,728	1,415	26.02
	302	15,965	11,128	8,987	19,728	1,584	27.49
	356	19,234	12,286	9,057	21,203	2,316	32.38
	406	22,301	14,042	9,654	21,765	3,139	37.01
	457	25,108	16,148	10,285	21,765	4,147	41.63
	508	27,915	18,254	10,882	21,765	5,163	46.26
IB 900	302	19,899	13,515	9,829	23,555	1,733	27.49
	356	23,969	14,919	9,829	23,555	2,537	32.38
	406	28,490	16,358	9,829	23,555	3,441	37.01
	457	32,211	17,622	10,285	23,555	4,491	51.24
	508	35,650	18,921	10,882	23,555	5,693	56.93
	559	39,055	20,185	10,321	23,555	7,051	62.63
	610	42,414	21,484	10,321	23,555	8,566	68.32

Notes to Table 4.1.1.1:

(1) Design values were developed in accordance with CAN/CSA-086 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-086.

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

(3) Factored shear resistance (V_r) of the I-joist with a minimum end bearing of 102 mm with web stiffeners. I-Joists without web stiffeners and reaction-limited smaller bearings may have lower capacities. See Table 4.1.1.2 for web stiffener requirements which vary by depth and series.

(4) Factored end reaction (ER) is for a minimum end bearing of 44 mm without web stiffeners. Higher end reactions are permitted with increased bearing length and web stiffeners. See Table 4.1.1.2 for web stiffener requirements which vary by depth and series.

(5) Factored intermediate reaction (IR) is for a minimum bearing length of 89 mm without web stiffeners. Higher interior reactions are permitted with increased bearing length and web stiffeners. See Table 4.1.1.2 for web stiffener requirements which vary by depth and series.

(6) Additional engineering data and load/span tables are available from the manufacturer.

Table 4.1.1.2 Additional engineering properties of"IB 400, 600, 800, 900 Series I-Joists" (Limit States Design)[1]

Series	Depth (mm)	Factored End Reactions[2] (N)					
		44 mm Bearing		89 mm Bearing		102 mm or Larger Bearing	
		No stiffeners	Stiffeners	No stiffeners	Stiffeners	No stiffeners	Stiffeners
IB 400	235	7,582	7,582	7,969	7,969	8,109	8,109
	241	7,582	7,582	8,144	8,144	8,320	8,320
	292	8,425	8,425	9,513	9,513	9,864	9,864
	302	8,425	8,425	9,934	9,934	10,391	10,391
	356	8,425	8,425	10,882	10,882	10,882	12,286
	406	8,425	8,425	10,882	10,882	10,882	14,042
IB 600	235	7,582	9,478	7,969	9,478	8,109	9,478
	241	7,582	9,619	8,144	9,619	8,320	9,619
	292	8,425	10,637	9,513	10,637	9,864	10,637
	302	8,425	11,023	9,934	11,023	10,391	11,023
	356	9,057	12,111	10,882	12,286	10,882	12,286
	406	9,654	12,111	10,882	14,042	10,882	14,042
	457	10,285	12,111	10,882	15,797	10,882	15,797
	508	10,882	12,111	10,882	17,552	10,882	17,552
IB 800	235	7,582	9,689	7,969	9,689	8,109	9,759
	241	7,582	9,864	8,144	9,864	8,320	9,864
	292	8,425	10,812	9,513	10,812	9,864	10,812
	302	8,987	11,238	9,934	11,128	10,391	11,128
	356	9,057	12,286	10,882	12,286	10,882	12,286
	406	9,654	14,042	10,882	14,042	10,882	14,042
	457	10,285	15,937	10,882	16,148	11,233	16,148
	508	10,882	17,271	10,882	18,254	11,584	18,254
IB 900	302	9,829	11,128	12,673	12,763	13,234	13,515
	356	9,829	12,286	12,673	13,761	13,234	14,919
	406	9,829	14,042	12,673	16,358	13,234	16,358
	457	10,285	15,937	11,760	17,622	13,234	17,622
	508	10,882	17,341	11,760	18,816	13,234	18,921
	559	10,321	18,219	11,760	19,799	13,234	20,185
	610	10,321	20,220	11,760	20,782	13,234	21,484

Notes to Table 4.1.1.2:

[1] Design values were developed in accordance with CAN/CSA-086 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-086.

(2) Interpolation of the factored end reaction resistances between 44 mm and 89 mm is permitted.

Table 4.1.1.3 Additional engineering properties of"IB 400, 600, 800, 900 Series I-Joists" (Limit States Design)[(1)]

Series	Depth (mm)	Factored Interior Reactions[(2)] (N)			
		89 mm Bearing		140 mm Bearing	
		No stiffeners	Stiffeners	No stiffeners	Stiffeners
IB 400	235	15,165	16,218	16,218	16,218
	241	15,165	16,639	16,218	16,639
	292	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	235	15,165	18,956	16,218	18,956
	241	15,165	19,237	16,639	19,237
	292	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
	457	17,552	24,046	21,765	26,223
	508	17,552	24,222	21,765	26,820
IB 800	235	16,218	18,956	16,218	18,956
	241	16,639	19,237	16,639	19,237
	292	19,728	21,273	19,728	21,273
	302	19,728	22,045	19,728	22,045
	356	21,203	24,573	21,765	24,573
	406	21,765	28,083	21,765	28,083
	457	21,765	29,663	21,765	29,663
	508	21,765	30,541	21,765	30,541
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 4.1.1.3:

(1) Design values were developed in accordance with CAN/CSA-086 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-086.

(2) Interpolation of the factored interior reaction resistances between 89 mm and 140 mm is permitted.

Report Holder: International Beams Inc.
418 St-Dizier Street
Montreal, QC H2Y 3P8
Tel: 1-866-457-4043
514-849-4849
Fax: 5147-849-1958

Plant(s): Pohénégamook, QC

APPENDIX A

The charateristic values obtained from testing to ASTM D 5055-08a, "Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists," as specified in CAN/CSA-O86-01, 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 were used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 13.2.3.2 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 quality control (QC) tests were used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from Table 13.2.3.2 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: $\text{deflection} = \frac{5wL^4}{384EI} + \frac{wL^2}{K}$ where deflection (in mm), w = unfactored uniform load (kN/mm), L = design span (mm), EI (kN·mm^2) and K (kN) from Table 4.1.1.1.
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 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 13.2.3.2 of CAN/CSA-O86 was used to determine the specified strength.
Adhesive qualification	All joints are bonded with a polyurethane adhesive Isoset® UX-200/WD3-A300 (CCMC # 13267-R).
Web stock	The web stock complies with CAN/CSA-O325.0-92, "Construction Sheathing."