Evaluation Report CCMC 13323-R
RFPI®-Joists

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "RFPI®-Joists", when used as floor and roof joists 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 (CSA O86-09)
- 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

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

Ruling No. 09-13-211 (13323-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 2009-08-05 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 product is a pre-fabricated wood I-joist available in ten (10) series. The I-joists are made with either laminated veneer lumber (LVL) or lumber flanges with an oriented strandboard (OSB) web. The LVL flanges are manufactured by Roseburg Forest Product Co. (the designated LVL flange material falls within the scope of the manufacturing process and quality control system of CCMC 13310-R). The top and bottom flanges range in thicknesses from 35 mm to 38 mm and in widths from 44 mm to 89 mm. The web consists of 9.5-mm- or 11-mm-thick OSB. The web sections are end-jointed to form a continuous web. The flange width, depth and material are listed in Table 2.1.

The web-flange connection is made by inserting the profiled OSB web into a profiled groove in the centre of the wide face of the flange (both top and bottom flanges.) The web-to-web and web-to-flange joints are bonded with phenol resorcinol formaldehyde adhesive (PRF) (see CCMC 13522-L). The LVL is manufactured with a high-temperature cure phenol resorcinol (PF) (see CCMC 13533-L). The fingerjoint adhesive for the lumber flanges is a melamine-formaldehyde adhesive (see CCMC 13252-L).

Table 2.1 "RFPI®-Joist" Series

I-Joist Series	Flange		Web Material	Joist Depth Range (mm)
	Material	Depth × Width (mm)		
RFPI 20	Roseburg 1.88E LVL	35 × 44	9.5-mm-thick OSB	241 to 356
RFPI 40S	1.5E Solid sawn lumber	38 × 64	9.5-mm-thick OSB	241 to 406
RFPI 400	Roseburg 1.88E LVL	35 × 52	9.5-mm-thick OSB	241 to 406
RFPI 40	Roseburg 1.88E LVL	35 × 59	9.5-mm-thick OSB	241 to 406

I-Joist Series	Flange		Web Material	Joist Depth Range (mm)
	Material	Depth × Width (mm)		
RFPI 60S	1.8E Solid sawn lumber	38 × 64	9.5-mm-thick OSB	241 to 406
RFPI 70	Roseburg 2.21E LVL	38 × 59	9.5-mm-thick OSB	241 to 406
RFPI 80S	1.8E Solid sawn lumber	38 × 89	9.5-mm-thick OSB	302 to 406
RFPI 90	Roseburg 2.21E LVL	38 × 89	11-mm-thick OSB	302 to 406
RFPI 700	Roseburg 2.41E LVL	38 × 59	11-mm-thick OSB	457 to 610
RFPI 900	Roseburg 2.41E LVL	38 × 89	11-mm-thick OSB	457 to 610

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "RFPI®-Joist" being used in accordance with the conditions and limitations set out below.

The product is intended for structural applications, such as floor joists and is intended for dry use in-service applications only.[1]

The following pre-engineering has been provided to CCMC by Roseburg Forest Products Co. to demonstrate compliance with Part 9 buildings for acceptance by the local authority having jurisdiction (AHJ):

i. **Roseburg Forest Products Co. Pre-engineered Floor and Roof Span Charts**
When the RFPI®20, 40S, 400, 40, 60S, 70, 80S or 90 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 span tables (including vibration criteria[2]) found in the document entitled, "Roseburg Design Guide – Residential – Engineered Wood Products, Limit States Design," October 2015.

When the RFPI®700 or 900 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 span tables (including vibration criteria[2]) found in the document entitled, "Roseburg Design Guide – Commercial – Engineered Wood Products, Limit States Design," October 2015.

The joists must be installed in accordance with Roseburg Forest Products Co.'s installation guidelines noted in this document for those applications falling within the scope of the document. Applications outside the scope of these installation guidelines require engineering on a case-by-case basis.

ii. **Roseburg Forest Products Co.'s Pre-engineered Installation Details**
Roseburg Forest Products Co.'s pre-engineered details within the document entitled, "Roseburg Framing System – Installation Guide for Canada," dated December 2014 includes:

- rim board maximum vertical load;
- squash blocks maximum vertical load;
- blocking panel maximum vertical load;
- web stiffener requirements;
- loadbearing cantilever tables;
- cantilever balcony;
- web hole tables; and
- roof joist details.

iii. **Engineering Requirements**
For structural applications beyond the scope and limitations of the Roseburg Forest Products Co.'s publication listed in 3(i) or when required by the AHJ, 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 and 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 CSA O86-09 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

Roseburg Forest Products Co. provides engineering support and may also be consulted in the use of this proprietary pre-fabricated I-joist at the following numbers:
Tel.: (541) 679-3311
Fax: (541) 679-2540

This product must be identified with the phrase "CCMC 13323-R" along the side of the web or flange of the product. The CCMC number is only valid when it appears in conjunction with the certification mark of APA – The Engineered Wood Association.

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.

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. Roseburg Forest Products Co. should therefore be consulted for span adjustments, if necessary, in these types of installations.

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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 Material Requirements

Table 4.1.1 Engineering Properties of the Product Series[1] for Limit States Design

I-Joist Series	Joist Depth (mm)	M_r [2] (N-m)	EI ($\times 10^9$ N-mm^2)	K ($\times 10^6$ N)	V_r [3] (N)
RFPI®20	241	6 360	473	22.0	8 565
	302	8 210	812	27.5	9 970
	356	9 765	1 205	32.4	11 305
RFPI®40S	241	6 000	554	22.0	7 865
	302	7 710	947	27.5	9 970
	356	9 630	1 383	32.4	12 005
	406	11 160	1 885	37.0	13 830
RFPI®400	241	7 545	554	22.0	8 565
	302	9 730	947	27.5	10 390
	356	11 590	1 395	32.4	12 005
	406	13 260	1 908	37.0	13 830
RFPI®40	241	8 480	617	22.0	9 340
	302	10 950	1 050	27.5	10 880
	356	13 045	1 550	32.4	12 425
	406	14 915	2 115	37.0	13 830
RFPI®60S	241	7 650	663	22.0	7 865
	302	9 910	1 136	27.5	9 970
	356	11 935	1 676	32.4	12 005
	406	13 840	2 293	37.0	13 830

I-Joist Series	Joist Depth (mm)	M_r [2] (N-m)	EI ($\times 10^9$ N-mm^2)	K ($\times 10^6$ N)	V_r [3] (N)
RFPI®70	241	11 570	763	22.0	9 340
	302	14 985	1 306	27.5	10 880
	356	17 870	1 928	32.4	12 425
	406	20 475	2 634	37.0	13 830
RFPI®80S	302	15 715	1 570	27.5	11 165
	356	18 920	2 301	32.4	12 885
	406	21 940	3 134	37.0	14 535
RFPI®90	302	22 875	1 940	27.5	14 395
	356	27 285	2 847	32.4	15 410
	406	31 265	3 874	37.0	16 360
RFPI®700	457	23 565	3 573	50.4	18 080
	508	26 160	4 531	56.0	19 235
	559	28 730	5 610	61.6	20 605
	610	31 275	6 815	67.3	21 485
RFPI®900	457	36 260	5 306	50.4	20 255
	508	40 265	6 706	56.0	20 675
	559	44 230	8 282	61.6	21 135
	610	48 155	10 032	67.3	21 485

Notes to Table 4.1.1:

1 M_r – factored moment resistance; EI – stiffness; K – shear coefficient; and V_r – factored shear resistance.

2 The M_r must not be increased by any Code-allowed repetitive member factor.

3 Minimum 102-mm bearing required for shear resistance.

Table 4.1.2 Factored Reaction Resistances[1]

I-Joist Series	Joist Depth (mm)	Factored End Reaction Resistance (N)				Factored Intermediate Reaction Resistance (N)			
		45-mm bearing		102-mm bearing		89-mm bearing		133-mm bearing	
		w/o stiff.	w/ stiff.	w/o stiff.	w/ stiff.	w/o stiff.	w/ stiff.	w/o stiff.	w/ stiff.
RFPI®20	241	6 390	8 075	8 565	8 565	12 460	13 165	14 040	16 150
	302	6 670	8 600	9 970	9 970	13 585	14 285	14 990	17 095
	356	6 670	9 055	10 880	11 305	13 585	14 285	14 990	17 095
RFPI®40S	241	7 580	7 865	7 865	7 865	15 165	15 725	15 725	15 725
	302	8 425	9 410	9 970	9 970	17 550	18 430	18 675	19 940
	356	8 425	10 740	10 880	12 005	17 550	19 235	19 340	21 415
	406	8 425	12 005	10 880	13 830	17 550	20 010	20 010	22 820
RFPI®400	241	7 195	8 565	8 565	8 565	15 095	15 795	16 150	17 130
	302	7 370	8 880	10 390	10 390	15 795	16 500	16 500	18 605
	356	7 370	9 160	10 880	12 005	15 795	16 500	16 500	18 605
	406	7 370	9 410	10 880	13 830	15 795	16 500	16 500	18 605
RFPI®40	241	7 580	8 565	9 340	9 340	15 795	17 550	17 905	18 605
	302	8 425	9 830	10 880	10 880	17 475	18 430	18 675	20 150
	356	8 425	10 950	10 880	12 425	17 550	19 235	19 340	21 520
	406	8 425	12 005	10 880	13 830	17 550	20 010	20 010	22 820

I-Joist Series	Joist Depth (mm)	Factored End Reaction Resistance (N)				Factored Intermediate Reaction Resistance (N)			
		45-mm bearing		102-mm bearing		89-mm bearing		133-mm bearing	
		w/o stiff.	w/ stiff.	w/o stiff.	w/ stiff.	w/o stiff.	w/ stiff.	w/o stiff.	w/ stiff.
RFPI®60S	241	7 580	7 865	7 865	7 865	15 165	15 725	15 725	15 725
	302	8 425	9 410	9 970	9 970	17 550	18 430	18 675	19 940
	356	8 425	10 740	10 880	12 005	17 550	19 235	19 340	21 415
	406	8 425	12 005	10 880	13 830	17 550	20 010	20 010	22 820
RFPI®70	241	7 865	9 340	9 340	9 340	16 395	17 550	17 905	18 605
	302	8 425	10 320	10 880	10 880	17 550	18 430	18 675	20 150
	356	8 425	11 165	10 880	12 425	17 550	19 235	19 340	21 520
	406	8 425	12 005	10 880	13 830	17 550	20 010	20 010	22 820
RFPI®80S	302	8 985	11 165	10 880	11 165	19 730	22 325	21 765	22 325
	356	8 985	12 285	10 880	12 885	21 205	23 590	22 535	25 275
	406	8 985	13 340	10 880	14 535	21 205	24 750	23 240	28 085
RFPI®90	302	9 830	12 250	13 235	14 395	23 555	24 395	24 395	25 800
	356	9 830	13 235	13 235	15 410	23 555	24 575	24 575	27 030
	406	9 830	14 215	13 235	16 360	23 555	24 750	24 750	28 260
RFPI®700	457	7 900	15 445	12 635	18 080	19 270	28 435	21,240	31 420
	508	7 655	16 150	12 110	19 235	19 270	28 435	21 240	31 420
	559	N/A	16 850	N/A	20 605	N/A	29 135	N/A	32 330
	610	N/A	17 550	N/A	21 485	N/A	29 135	N/A	32 330
RFPI®900	457	10 355	18 045	12 990	20 255	21 060	35 875	24 395	40 090
	508	9 480	18 710	12 635	20 675	21 060	35 875	24 395	40 090
	559	N/A	19 340	N/A	21 135	N/A	37 945	N/A	42 265
	610	N/A	20 010	N/A	21 485	N/A	37 945	N/A	42 265

Note to Table 4.1.1:

1 For the floor or roof span design, the lesser of the reaction resistance or the compressive stress perpendicular to grain of the flange must be used. The Roseburg Design Guide specified in 3(i) above outlines the Table of compressive stress perpendicular to grain not to be exceeded.

This Evaluation Report is applicable only to the products labelled with the certification mark of the APA – The Engineered Wood Association and the phrase "CCMC 13323-R" on each I-joist member.

The manufacturing quality assurance program is evaluated for conformance to ASTM D 5055-8a, "Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists." The APA – The Engineered Wood Association (APA certification mark) is accredited by the Standards Council of Canada as a product and services certification body.

Report Holder

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Date modified:
2015-10-29

Appendix A

The design values obtained from testing to ASTM D 5055-08a as specified in CSA O86-09 are summarized below. The manufacturer's published pre-engineered joist spans were then designed in accordance with CSA O86-09.

Table A1. Additional Test Information

Property	Test Information
Shear capacity	The shear capacity of the "RFPI®-Joist" series was established by test as per ASTM D 5055-08a. Qualification and quality control tests were used to establish the applicable coefficient of variation, CVw, and the reliability normalization factor from Table 14.2.3.2 of CSA O86-09 was used to determine the specified strength.
Moment capacity	The moment capacity qualification was carried out using the analytical method in accordance with ASTM D 5055-08a. Quality control tests and qualification tests were used to establish the applicable coefficient of variation, CVw, and the reliability normalization factor from Table 14.2.3.2 of CSA O86-09 was used to determine the specified strength.
Stiffness	A bending test program of varying depths was used to confirm the stiffness capacity. The following formula should be used to predict mid-span deflection: $$\frac{5wL^4}{384EI \times 10^3} + \frac{wL^2}{K}$$ where EI = from Table 4.1.1 w = uniform load (kN/m) L = span (mm) K = shear deflection factor from Table 4.1.1.
Creep	The product specimens were tested for creep performance as per ASTM D 5055-08a, whereby two specimens in each I-joist series group are loaded to 1.5 times the design resistive moment capacity and the average deflection recovery must exceed 90% of the deflection between 1.5 times the total load and the basic dead load deflection (20% design).
Bearing length	Tests were conducted to qualify a minimum end bearing of 45 mm and 89 mm. Qualification tests were used to establish the applicable coefficient of variation, CVw, and the reliability normalization factor from Table 14.2.3.2 of CSA O86-09 was used to determine the specified strength.
Adhesive qualification	The web-to-web and web-to-flange joints are bonded with phenol resorcinol formaldehyde (PRF) adhesive conforming to CSA O112.9-10, "Evaluation of Adhesives for Structural Wood Products (Exterior Exposure)" (see CCMC 13522-L). The LVL flange is bonded with phenol formaldehyde (PF) adhesive conforming to CSA O112.10-08, "Evaluation of Adhesives for Structural Wood Products (Limit Moisture Exposure)" (see CCMC 13533-L). The lumber flange end joints are glued with a melamine formaldehyde adhesive conforming to CSA O112.9-04 (see CCMC 13252-L).