



## Evaluation Report CCMC 13470-R

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### ***PWI Joists***

#### **1. Opinion**

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “PWI Joists” when used as floor joists and roof rafters or joists 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.

#### **2. Description**

The products are prefabricated wood I-joists that are available in eleven different series. Nine series are manufactured with continuous laminated veneer lumber (LVL) flanges and two series are manufactured with finger-jointed MSR lumber flange.

The LVL flanges are manufactured by Pacific Woodtech Corporation (the designated flange material fall within the scope of the manufacturing process and quality control system of CCMC # 13006-R). The flange widths and depths are listed in Table 2.1.

The web material for all series is oriented strandboard (OSB) that is manufactured in conformance with CAN/CSA-O325.0-92, “Construction Sheathing.”

The web-to-web joints are bonded with a polyurethane emulsion polymer (PEP) and the web-to-flange joints are bonded with an emulsion polymer isocyanate (EPI) adhesive (see 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 “PWI Joists”**

I-Joist Series	Flange		Web Material	Joist Depth Range (mm)
	Material	Depth x Width (mm)		
PWI-20	PW LVL <sup>(1)</sup>	35 x 44	9.5-mm-thick OSB	241 to 356
PWI-30	PW LVL	38 x 38	9.5-mm-thick OSB	241 to 302
PWI-40	PW LVL	35 x 59	9.5-mm-thick OSB	241 to 406
PWI-40s	MSR <sup>(2)</sup>	38 x 64	9.5-mm-thick OSB	241 to 406
PWI-50	PW LVL	38 x 44	9.5-mm-thick OSB	241 to 406
PWI-60	PW LVL	35 x 59	9.5-mm-thick OSB	241 to 406
PWI-60s	MSR	38 x 64	9.5-mm-thick OSB	241 to 406
PWI-70	PW LVL	38 x 59	9.5-mm-thick OSB	302 to 508
PWI-77	PW LVL	38 x 59	11.5-mm-thick OSB	241 to 610
PWI-90	PW LVL	38 x 89	11.5-mm-thick OSB	241 to 610
PWI-93	PW LVL	38 x 89	9.5-mm-thick OSB	302 to 406

**Notes to Table 2.1:**

(1) PW LVL - Pacific Woodtech Laminated Veneer Lumber

(2) MSR - machine stress rated lumber

**3. Conditions and Limitations**

CCMC's compliance opinion in Section 1 is bound by the “PWI 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 is intended for dry service use<sup>(1)</sup> 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 Pacific Woodtech Corporation to demonstrate compliance to Part 9 buildings for acceptance by the local authority having jurisdiction (AHJ):

i) Pacific Woodtech Corporation 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<sup>(2)</sup>) found in the document, in Limit States Design for Canada, entitled, “PWI-Joist

Limit States Design User's Guide," dated 20 November 2008.

The product shall be installed in accordance with Pacific Woodtech Corporation's installation guidelines noted in the above-mentioned document 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.

*(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. Pacific Woodtech Corporation should therefore be consulted for span adjustments, if necessary, in these types of installations.*

ii) Pacific Woodtech Corporation's Pre-engineered Installation Details

The products are to be installed in accordance with Pacific Woodtech Corporation's pre-engineered details within the document mentioned in 3i) of this Guide. Installation of the products are limited in scope to building designs where the anticipated loads on the following structural details are not exceeded:

- o rim joist max. vertical load (page 44);
- o blocking panel max. vertical load (page 44);
- o squash blocks max. vertical load (page 45);
- o loadbearing cantilever tables (pages 48 and 49);
- o cantilever balcony (pages 47 and 48);
- o web stiffener requirements (page 50);
- o web hole tables (pages 51 and 52); and
- o roof joist details (pages 53 to 57).

iii) Engineering Required

When required by the AHJ or for structural applications beyond the scope and limitations of the Pacific Woodtech Corporation publication mentioned in 3i) of this Guide, 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:

- o higher loads/longer spans than the manufacturer's pre-engineered details;
- o concentrated loads;
- o offset bearing walls;
- o high wind and seismic areas;
- o stair openings;
- o design of supporting wall studs/beams when the total load exceeds the NBC 2005 pre-engineered floor/roof joist tables; and
- o design of supporting foundation footings when the 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

Pacific Woodtech Corporation provides engineering support and may also be consulted in the use of this product at the following numbers:

Tel.: (360) 707-2200

Fax: (360) 707-2211

This product must be identified with the phrase "CCMC 13470-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 EWS.

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 "PWI 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 "PWI Joists" are summarized below.

### 4.1 NBC 2005 Compliance Data for "PWI Joists" on which CCMC Based its Opinion in Section 1

#### 4.1.1 Design Requirements

Table 4.1.1 Engineering Properties of "PWI Joists" (Limit States Design)<sup>(1)</sup>

-Joist Series	Joist Depth (mm)	EI <sup>(2)</sup> (x 10 <sup>6</sup> kN·mm <sup>2</sup> )	K <sup>(3)</sup> (x 10 <sup>6</sup> N)	M <sub>r</sub> <sup>(4)</sup> (N·m)	V <sub>r</sub> <sup>(5)</sup> (N)	Factored End Reactions (N)					Factored Intermediate Reactions (N)				
						44 mm		89 mm		WS Nails <sup>(7)</sup>	89 mm		133 mm		WS Nails
						No WS <sup>(6)</sup>	WS	No WS	WS		No WS	WS	No WS	WS	
PWI-20	241	416	22.0	5 682	7 863	6 424	7 863	7 863	7 863	4 x 63.5	13 971	15 727	15 727	15 727	4 x 63.5
	302	726	27.5	7 362	9 970	6 424	9 970	9 162	9 970	4 x 63.5	13 971	15 972	16 990	18 570	4 x 63.5
	356	1 070	32.4	8 771	12 006	6 424	10 812	9 162	12 006	4 x 63.5	13 971	15 972	16 990	18 570	4 x 63.5
PWI-30	241	462	22.0	7 272	7 863	6 635	6 635	7 590	7 590	4 x 63.5	13 375	13 375	13 375	13 375	4 x 63.5
	302	804	27.5	9 403	9 970	6 635	6 635	9 228	9 228	4 x 63.5	13 375	13 375	13 375	13 375	4 x 63.5
PWI-40	241	554	22.0	6 167	7 863	7 582	7 582	7 801	7 801	4 x 63.5	15 165	15 165	15 165	15 165	4 x 63.5
	302	947	27.5	7 994	9 970	8 425	8 425	9 626	9 626	4 x 63.5	17 552	17 552	17 552	17 552	4 x 63.5
	356	1 383	32.4	9 628	12 006	8 425	8 425	10 336	11 210	4 x 63.5	17 552	17 552	17 552	17 552	4 x 63.5
	406	1 885	37.0	11 162	13 831	8 425	8 425	10 336	12 630	4 x 63.5	17 552	17 552	17 552	17 552	4 x 63.5
PWI-50	241	534	22.0	8 569	7 863	7 126	7 126	7 699	7 699	4 x 63.5	14 322	14 322	14 322	14 322	4 x 63.5
	302	924	27.5	11 083	9 970	7 126	7 126	9 338	9 338	4 x 63.5	14 322	14 322	14 322	14 322	4 x 63.5
	356	1 377	32.4	13 214	12 006	7 126	7 126	9 149	9 754	4 x 63.5	14 322	14 322	14 322	14 322	4 x 63.5
	406	1 903	37.0	15 142	13 831	7 126	7 126	9 149	10 736	4 x 63.5	14 322	14 322	14 322	14 322	4 x 63.5
PWI-60	241	663	22.0	8 523	7 863	7 582	7 582	7 801	7 801	4 x 63.5	15 165	15 165	15 165	15 165	4 x 63.5
	302	1 136	27.5	11 049	9 970	8 425	8 425	9 626	9 626	4 x 63.5	17 552	17 552	17 552	17 552	4 x 63.5
	356	1 676	32.4	13 293	12 006	8 425	8 425	10 336	11 210	4 x 63.5	17 552	17 552	17 552	17 552	4 x 63.5
	406	2 293	37.0	15 412	13 831	8 425	8 425	10 336	12 630	4 x 63.5	17 522	17 552	17 552	17 552	4 x 63.5

**Table 4.1.1 Engineering Properties of "PWI Joists" (Limit States Design)<sup>(1)</sup> (cont'd)**

-Joist Series	Joist Depth (mm)	EI <sup>(2)</sup> (x 10 <sup>6</sup> kN·mm <sup>2</sup> )	K <sup>(3)</sup> (x 10 <sup>6</sup> N)	M <sub>r</sub> <sup>(4)</sup> (N·m)	V <sub>r</sub> <sup>(5)</sup> (N)	Factored End Reactions (N)					Factored Intermediate Reactions (N)				
						44 mm		89 mm		WS Nails <sup>(7)</sup>	89 mm		133 mm		WS Nails
						No WS <sup>(6)</sup>	WS	No WS	WS		No WS	WS	No WS	WS	
PWI-70	302	1 263	27.5	15 175	9 970	8 144	9 970	9 970	9 970	4 x 63.5	16 394	19 427	19 939	19 939	4 x 63.5
	356	1 848	32.6	18 107	12 006	8 144	11 177	11 339	12 006	4 x 63.5	16 394	19 427	20 150	23 183	4 x 63.5
	406	2 505	37.5	20 745	13 831	8 144	11 177	11 339	13 831	4 x 63.5	16 394	19 427	20 150	23 183	4 x 63.5
	457	3 274	42.4	23 349	15 720	8 144	12 694	11 339	15 720	6 x 63.5	16 394	22 460	20 150	26 216	8 x 63.5
	508	4 152	47.3	25 920	17 594	8 144	12 694	11 339	15 888	6 x 63.5	16 394	22 460	20 150	26 216	8 x 63.5
PWI-77	241	749	24.8	11 624	10 040	9 022	10 040	10 040	10 040	4 x 63.5	18 921	20 080	20 080	20 080	4 x 63.5
	302	1 268	30.8	15 051	13 515	9 022	13 269	12 357	13 515	4 x 63.5	18 921	21 273	22 116	25 521	4 x 63.5
	356	1 860	36.3	17 949	14 919	9 022	13 269	12 357	14 919	4 x 63.5	18 921	21 273	22 116	25 521	4 x 63.5
	406	2 528	41.6	20 565	16 358	9 022	13 269	12 357	16 358	4 x 63.5	18 921	21 273	22 116	25 521	4 x 63.5
	457	3 306	46.9	23 146	17 798	9 022	15 025	12 357	17 798	6 x 63.5	18 921	26 468	22 116	28 856	8 x 63.5
	508	4 198	52.3	25 694	19 237	9 022	15 025	12 357	18 605	6 x 63.5	18 921	26 468	22 116	28 856	8 x 63.5
	559	5 208	57.7	28 231	20 606	n/a	16 780	n/a	20 360	8 x 63.5	n/a	28 961	n/a	31 067	10 x 63.5
	610	6 339	63.1	30 734	21 484	n/a	16 780	n/a	20 360	8 x 63.5	n/a	28 961	n/a	31 067	10 x 63.5
PWI-90	241	1 125	24.8	17 847	10 040	9 829	10 040	10 040	10 040	4 x 88.9	20 080	20 080	20 080	20 080	4 x 88.9
	302	1 897	30.8	23 124	13 515	9 829	13 340	13 340	13 515	4 x 88.9	23 555	27 030	27 030	27 030	4 x 88.9
	356	2 769	36.3	27 589	14 919	9 829	13 340	13 340	14 919	4 x 88.9	23 555	27 065	27 873	29 838	4 x 88.9
	406	3 748	41.6	31 613	16 358	9 829	13 340	13 340	16 358	4 x 88.9	23 555	27 065	27 873	31 383	4 x 88.9
	457	4 887	46.9	35 582	17 798	9 829	15 095	13 340	17 798	6 x 88.9	23 555	30 576	27 873	34 893	8 x 88.9
	508	6 184	52.3	39 506	19 237	9 829	15 095	13 340	18 605	6 x 88.9	23 555	30 576	27 873	34 893	8 x 88.9
	559	7 645	57.7	43 395	20 606	n/a	16 850	n/a	20 360	8 x 88.9	n/a	32 331	n/a	36 649	10 x 88.9
	610	9 275	63.1	47 251	21 484	n/a	16 850	n/a	20 360	8 x 88.9	n/a	32 331	n/a	36 649	10 x 88.9
PWI-93	302	1 891	27.5	23 259	9 970	8 987	8 987	9 751	9 751	4 x 63.5	19 377	19 377	19 377	19 377	4 x 63.5
	356	2 758	32.4	27 746	12 006	8 987	8 987	10 461	11 335	4 x 63.5	21 203	21 203	21 203	21 203	4 x 63.5
	406	3 733	37.0	31 783	13 831	8 987	8 987	10 461	12 754	4 x 63.5	21 203	21 203	21 203	21 203	4 x 63.5

Notes to Table 4.1.1:

(1) Design values were developed in accordance with CAN/CSA-O86.

- (2) EI - stiffness.
- (3) K - shear coefficient.
- (4) Factored moment resistance ( $M_r$ ) shall not be increased by any Code-allowed system factor.
- (5)  $V_r$  - factored shear resistance.
- (6) No WS - without web stiffeners; WS - with web stiffeners.
- (7) 10 gauge common wire nails. Required number and length shown.

Report Holder: Pacific Woodtech Corporation  
P.O. Box 465  
1850 Park Lane  
Burlington, WA 98233  
U.S.A.  
Tel: 360-707-2200  
Fax: 360-707-2211

Plant(s): Burlington, WA, U.S.A.

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## APPENDIX A

The characteristic 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, “Engineering Design in Wood,” 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 “PWI Joists”**

Property	Test Information
Moment Capacity	The moment capacity qualification was carried out using the analytical method in accordance with ASTM D 5055. Quality control tests and 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.
Shear Capacity	The shear capacity of the “PWI Joists” series was established by testing in accordance with ASTM D 5055. Qualification and quality control 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	Stiffness capacity was tested in accordance with Section 6.5.2 of ASTM D 5055. The following formula was used to predict mid-span deflection: $\Delta \text{ deflection} = \frac{5wL^4}{384EI} + \frac{wL^2}{K}$ where $w$ = unfactored uniform load (kN/mm), $L$ = clear span (mm), $EI$ = ( $\text{kN}\cdot\text{mm}^2$ ), $K$ = (kN) from Table 4.1.1.
Creep	Product specimens were tested for creep performance as per ASTM D 5055, whereby two specimens in each I-joist series group are loaded to 1.5 times the design resistive moment capacity. The average deflection recovery must exceed 90% of the deflection between 1.5 times total load and the basic dead load deflection (20% design).
Bearing Length	Tests were conducted to qualify a minimum end bearing of 44 mm and 89 mm as well as interior bearing lengths of 89 mm and 133 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	The web-to-web joints are bonded with a polyurethane emulsion polymer (PEP) adhesive and the web-to-flange joints are bonded with an emulsion polymer isocyanate (EPI) adhesive (see CCMC 13267-R.)
Web stock	The web stock complies with CAN/CSA O325.0-92, “Construction Sheathing.”