



Evaluation Report

CCMC 13053-R

MASTERFORMAT DIVISION

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	2011-03-06

Power JoIst™ ADI-40, ADI-60, ADI-80 I-joists

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “Power JoIst™ ADI-40, ADI-60 and ADI-80 I—joists,” when used as joists in accordance with the conditions and limitations stated in Section 3 of this Report, comply with the National Building Code of Canada (NBC) 2005:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solution (i.e. CAN/CSA-O86-01 [including Supplement CAN/CSA-O86S1-05], “Engineering Design in Wood,” for I-joist qualification) from Division B:
 - Sentence 4.3.1.1.(1); and
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution (i.e. floor joists) 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 solution:
 - Sentence 9.23.4.2.(2).

This opinion is based on CCMC’s evaluation of the technical evidence in Section 4.1 provided by the Report holder.

Ruling No. 07-16-174 (13053-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 May 29, 2007 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

“Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” are prefabricated, wood I-joists consisting of two continuous proprietary grade S-P-F flanges glued to a 9.5-mm-thick OSB web. The flange sizes and grades are listed in Table 1 below.

The web-flange connection is made by inserting the profiled OSB web into a tapered groove in the centre of the wide face of the flange at various depths. The OSB web material is manufactured in 2 743-mm lengths and end-jointed by gluing a full thickness vee-joint. The flange fingerjoints are bonded with a polyurethane adhesive (see CCMC 13267-R) and the web-to-web and web-to-flange joints are bonded with a phenol-resorcinol waterproof adhesive (see CCMC 13054-L).

APA-The Engineered Wood Association (APA EWS trademark) conducts regular audits of the manufacturing plant and the quality assurance program.

The engineering properties of “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” are listed in Table 2.

Table 1. “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” Flange Sizes and Grades

I-joist	Width (mm)	Thickness (mm)	Grade
ADI-40	63.5	38.0	Enhanced 1 650f-1.5E
ADI-60	63.5	38.0	2 100f-1.8E
ADI-80	89.0	38.0	2 100f-1.8E

3. Conditions and Limitations

CCMC’s compliance opinion in Section 1 is bound by the “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” being used in accordance with the conditions and limitations set out below.

“Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” are intended for structural applications, such as floor 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 the NBC 2005, Article 9.3.2.5.

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

i) Anthony-Domtar Inc. Pre-engineered Floor Span Charts

When “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” 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*) found in the document entitled

- “Power JoIst® - Canadian Limit States Design (LSD) CCMC 13053-R – User Guide,” dated 2008.

They shall be installed in accordance with Anthony-Domtar Inc.’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 shall require engineering on a case-by-case basis.

** 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. Anthony-Domtar Inc. should therefore be consulted for span adjustments, if necessary, in these types of installations.*

ii) Anthony-Domtar Inc.'s Pre-engineered Installation Details

The product is to be installed in accordance with Anthony-Domtar Inc.'s pre-engineered details outlined in the document specified in 3(i) above, where the following details are not exceeded:

- rim board maximum vertical load;
- squash blocks maximum vertical load;
- blocking panel maximum vertical load;
- web stiffeners requirements;
- stair opening header;
- load-bearing cantilever load table;
- cantilever balcony;
- web hole tables;
- roof joist details; and
- roof uniform load tables.

iii) Engineering Required

For structural applications beyond the scope/limitations of the above-referenced Anthony-Domtar Inc.'s publication or when required by the AHJ, the drawings or related documents shall 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 manufacturer's pre-engineered details;
- concentrated loads;
- offset bearing walls;
- areas of high wind or high seismicity;
- stair openings;
- design of supporting wall studs/beams when the total load exceeds the NBC 2005 pre-engineered floor/roof joist tables; and
- design of supporting foundation footings when the total load exceeds the NBC 2005 pre-engineered floor/roof joist tables.

The engineer shall design in accordance with CAN/CSA-O86-01 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 does provide engineering support in conjunction with Anthony-Domtar Inc. product support. Anthony-Domtar Inc. and APA EWS offer the following support contact numbers:

APA EWS help line: 1-253-620-7400

APA EWS e-mail: help@apawood.org

This product must be identified with the phrase "CCMC 13053-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 shall not be used, unless repaired in accordance with written instructions from the manufacturer.

4. Technical Evidence

CCMC’s Technical Guide for “Prefabricated Wood 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 test results for CCMC’s evaluation. Testing was conducted by various independent testing agencies recognized by CCMC. The corresponding test results for “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” are summarized below.

4.1 NBC 2005 Compliance Data for “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” on which CCMC Based its Opinion in Section 1

Table 4.1.A. Factored Resistances of “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists”⁽¹⁾

Basic Properties – Limit States Design					
Product	Joist Depth (mm)	Factored Resistance		EI x 10 ⁶ (kN·mm ²)	K x 10 ⁶ (N)
		Moment ⁽²⁾ (N·m)	Vertical Shear (N)		
ADI-40	241	6 167	7 860	554	21.97
	302	7 994	9 970	947	27.49
	356	9 629	12 010	1 383	32.38
	406	11 162	13 830	1 885	37.01
ADI-60	241	8 524	7 860	663	21.97
	302	11 049	9 970	1 136	27.49
	356	13 293	12 010	1 676	32.38
	406	15 413	13 830	2 293	37.01
ADI-80	302	15 650	9 970	1 570	27.49
	356	18 852	12 006	2 301	32.38
	406	21 851	13 830	3 134	37.01
	457	24 805	17 200	4 055	41.63
	508	27 466	17 760	5 137	46.26
	559	30 082	18 360	6 353	50.89
	610	32 675	18 920	7 711	55.51

Notes to Table 4.1.A.:

- (1) Design values were developed in accordance with CAN/CSA-O86-01, “Engineering Design in Wood,” for a standard term load duration (Kd=1). All values except EI and K are permitted to be adjusted for other load durations as permitted by CAN/CSA-O86-01.
- (2) The factored moment resistances listed in Table 4.1.A. shall not be increased by any Code-allowed repetitive member system factor.

Table 4.1.B. Engineering Properties of “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists”⁽¹⁾

Reaction Properties – Limit States Design									
Product	Joist Depth (mm)	Factored End Reaction (N)				Factored Intermediate Reaction (N)			
		44 mm Brg. Length		102 mm Brg. Length		89 mm Brg. Length		140 mm Brg. Length	
		Web Stiffeners		Web Stiffeners		Web Stiffeners		Web Stiffeners	
		No	Yes	No	Yes	No	Yes	No	Yes
ADI-40	241	7 582	7 863	7 863	7 863	19 342	20 360	22 783	22 783
	302	8 425	9 197	9 970	9 970	19 342	21 378	22 783	23 695
	356	8 425	10 391	10 882	12 006	19 342	22 291	22 783	24 468
	406	8 425	11 514	10 882	13 831	19 342	23 169	22 783	25 240
ADI-60	241	7 582	7 863	7 863	7 863	19 342	20 360	22 783	22 783
	302	8 425	9 197	9 970	9 970	19 342	21 378	22 783	23 695
	356	8 425	10 391	10 882	12 006	19 342	22 291	22 783	24 468
	406	8 425	11 514	10 882	13 831	19 342	23 169	22 783	25 240
ADI-80	302	8 987	9 970	9 970	9 970	19 377	23 169	22 853	25 170
	356	8 987	12 006	10 882	12 006	21 203	24 257	24 116	26 293
	406	8 987	12 953	10 882	13 831	22 923	25 275	25 275	27 381
	457	8 776	14 393	11 584	17 201	22 467	27 732	25 626	30 541
	508	8 776	14 393	11 584	17 763	22 467	27 732	25 626	30 541
	559	8 776	14 393	11 584	18 359	22 467	27 732	25 626	30 541
	610	8 776	14 393	11 584	18 921	22 467	27 732	25 626	30 541

Notes to Table 4.1.B.:

- (1) Design values were developed in accordance with CAN/CSA-O86-01, “Engineering Design in Wood,” for a standard term load duration (Kd=1). All values except EI and K are permitted to be adjusted for other load durations as permitted by CAN/CSA-O86-01.

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APPENDIX

The design values obtained from testing to ASTM D 5055-04, “Standard Specification for Establishing and Monitoring Structural Properties 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-O86-01.

Table A1. Additional Test Information for “Anthony-Domtar Inc.”

Property	Test Information
Shear capacity	The shear capacity of the “Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” was established by computing the shear capacity for each depth separately as per ASTM D 5055-04. Qualification tests were used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CAN/CSA-O86-01 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 5055-04. At least ten (10) specimens of each joist depth were tested to verify the actual capacity versus the design capacity. Qualification tests were used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CAN/CSA-O86-01 was used to determine the specified strength.
Stiffness	<p>A bending test program of varying depths was used to confirm the stiffness capacity. The following formula was used to predict mid-span deflection:</p> $\text{deflection} = \frac{5wL^4}{384EI \times 10^3} + \frac{wL^2}{K}$ <p>where EI = shear-free E-I from Table 4.1.A., w= uniform load (kN/m), L = span (mm), K = shear deflection factor from Table 4.1.A.</p>
End joints	End joints were qualified as part of the flange tension qualification. The flanges are in-plant finger-joined, and regular tension testing is conducted.
Creep	“Power JoIst™ ADI-40, ADI-60 and ADI-80 I-joists” series specimens were tested for creep performance as per ASTM D 5055-04, 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%.
Bearing length	The design values on end bearing and intermediate reaction were analyzed using a procedure that has been proposed for ASTM D 5055-04 whereby linear interpolation is used to establish reaction capacities within the tested bounds of depth and bearing length. A minimum of 10 specimens were tested for four bearing lengths at I-joist extreme depths. Qualification tests were used to establish the applicable coefficient of variation, CV_w , and the reliability normalization factor from CAN/CSA-O86 was used to determine the specified strength.
Adhesive qualification	The flange-to-flange fingerjoint is adhered with a polyurethane adhesive (see CCMC 13267-R); web-to-web and web-to-flange joints are bonded with a phenol-resorcinol formaldehyde adhesive complying with CSA O112.7-M1977, “Resorcinol and Phenol Resorcinol, Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing)” (see CCMC 13054-L).