

ICC-ES Evaluation Report

ESR-5362

Reissued April 2026

Subject to renewal April 2027

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<p>DIVISION: 06 00 00 — WOOD, PLASTICS AND COMPOSITES</p> <p>Section: 06 18 13 — Glued-Laminated Beams</p>	<p>REPORT HOLDER: ARBOREAL SA</p>  <p>MASS TIMBER BUILDING SOLUTIONS</p>	<p>EVALUATION SUBJECT: GLUED-LAMINATED TIMBER</p>	
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1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2024, 2021 [International Building Code® \(IBC\)](#)
- 2024, 2021 [International Residential Code® \(IRC\)](#)

Property evaluated:

- Structural

2.0 USES

Arboreal glued-laminated timber (glulam) for use as beams manufactured to the combinations in [Table 2](#) are recognized as being in compliance with the design parameters indicated in Section 3.0 of this report.

3.0 DESCRIPTION

3.1 General:

Arboreal glulam described in this evaluation report complies with requirements noted in Section 2303.1.3 of the IBC, for allowable stress design (ASD) in accordance with IBC Section 2302.1(1) and load and resistance factor design (LRFD) in accordance with IBC Section 2302.1(2). Arboreal glulam is manufactured with mechanically graded lumber in accordance with layup combinations developed in accordance with the principle of ASTM D3737 in actual widths ranging from 5.71 inches (145 mm) to 7.72 inches (196 mm), a variety of depths, and lengths up to 38.7 feet (11,800 mm), as shown in [Table 1](#).

3.2 Adhesive:

Face and end-joint bonding adhesives comply with ANSI 405 for exterior or wet use.

3.3 End Joints:

End joints comply with ANSI A190.1.

3.4 Lumber:

Lumber having an actual thickness of 1.77 inches (45 mm) or less is glued-laminated into rectangular cross sections complying with industry standards for depth, width, and appearance. Sawn lumber is mechanically graded, complying with rules of applicable approved lumber grading agencies and the procedures set forth in the manufacturer's quality control documentation. Quality control for lumber grading and glulam fabrication is conducted under the supervision of an approved third-party inspection agency. Manufactured lumber and laminated lumber comply with the procedures set forth in the manufacturer's quality control documentation.

Grade specifications are included in rules of the applicable approved lumber grading agencies and follow industry classifications and nomenclature as provided in the applicable code.

3.5 Layup:

Arboreal glulam is fabricated in accordance with ANSI A190.1 and ASTM D3737 using the combinations noted in [Table 2](#) of this evaluation report.

4.0 DESIGN

The design requirements of Arboreal glulam must comply with Section 2306 (ASD) or 2307 (LRFD) of the IBC, or Sections R502.2 and R802.2 of the IRC, or *National Design Specification for Wood Construction*® (NDS®), as applicable.

The Allowable Stress Design (ASD) values for the Arboreal glulam beam combinations listed in [Table 2](#) are developed in accordance with ANSI 117 and ASTM D3737. The reference design values must be adjusted in accordance with Table 5.3.1 of the NDS® and the footnotes specified in the table. The design values used for the LRFD shall be obtained by multiplying the ASD design values by the factors specified in Table 5.3.1 of the NDS.

5.0 CONDITIONS OF USE

The combinations for the Arboreal glulam described in this evaluation report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Fabrication, design, and installation must comply with this evaluation report and the manufacturer's published design/installation instructions. In the event of a conflict between the manufacturer's published design/installation instructions and this evaluation report, the most restrictive one governs.
- 5.2 The manufacturer's design and/or installation instructions must be available at the jobsite at all times during installation.
- 5.3 Design stresses for the combinations noted in [Table 2](#) are for members with two or more laminations intended to be stressed primarily in bending due to loads applied perpendicular to the wide faces of the laminations. Design values are included, however, for axial stresses and stresses from bending due to loads applied parallel to the wide faces of the laminations.
- 5.4 The effects of checking of the members are outside the scope of this report.
- 5.5 Out of plane loads on the Y-Y axis is outside the scope of this report.
- 5.6 The dimensions of Arboreal beams shall follow those specified in [Table 1](#).
- 5.7 Arboreal glulam beams are manufactured under an approved quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with ANSI A190.1.
- 6.2 Data in accordance with ASTM D3737.
- 6.3 Data in accordance with ANSI 117.
- 6.4 Data in accordance with ANSI 405.
- 6.5 Quality documentation.

7.0 IDENTIFICATION

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-5362) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.
- 7.2 Additionally, Arboreal Glulam presented in this evaluation report is identified with a label indicating the Standard A190.1, material code including type of product, strength grade configuration, visual classification and dimensions; dimensions external and useful; project identification number (ID); adhesive; species; and QC results.
- 7.3 The report holder's contact information is the following:

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TABLE 1—DIMENSIONS FOR ARBOREAL GLUED-LAMINATED BEAMS LAYUP

LAYUP	NUMBER OF LAMINATIONS	BEAM DEPTH	LAMINATION THICKNESS	BEAM WIDTH RANGE
		in (mm)	in (mm)	in (mm)
1	2	2,76 (70)	1,38 (35)	5.71 (145) - 7.72 (196)
2	2	3,15 (80)	1,57 (40)	5.71 (145) - 7.72 (196)
3	2	3,54 (90)	1,77 (45)	5.71 (145) - 7.72 (196)
4	3	4,13 (105)	1,38 (35)	5.71 (145) - 7.72 (196)
5	3	4,72 (120)	1,57 (40)	5.71 (145) - 7.72 (196)
6	3	5,31 (135)	1,77 (45)	5.71 (145) - 7.72 (196)
7	4	5,51 (140)	1,38 (35)	5.71 (145) - 7.72 (196)
8	4	6,30 (160)	1,57 (40)	5.71 (145) - 7.72 (196)
9	5	6,89 (175)	1,38 (35)	5.71 (145) - 7.72 (196)
10	4	7,09 (180)	1,77 (45)	5.71 (145) - 7.72 (196)
11	5	7,87 (200)	1,57 (40)	5.71 (145) - 7.72 (196)
12	6	8,27 (210)	1,38 (35)	5.71 (145) - 7.72 (196)
13	5	8,86 (225)	1,77 (45)	5.71 (145) - 7.72 (196)
14	6	9,45 (240)	1,57 (40)	5.71 (145) - 7.72 (196)
15	7	9,65 (245)	1,38 (35)	5.71 (145) - 7.72 (196)
16	6	10,63 (270)	1,77 (45)	5.71 (145) - 7.72 (196)
17	7	11,02 (280)	1,57 (40)	5.71 (145) - 7.72 (196)
18	7	12,40 (315)	1,77 (45)	5.71 (145) - 7.72 (196)
19	8	12,60 (320)	1,57 (40)	5.71 (145) - 7.72 (196)
20	10	13,78 (350)	1,38 (35)	5.71 (145) - 7.72 (196)
21	8	14,17 (360)	1,77 (45)	5.71 (145) - 7.72 (196)
22	11	15,16 (385)	1,38 (35)	5.71 (145) - 7.72 (196)
23	10	15,75 (400)	1,57 (40)	5.71 (145) - 7.72 (196)
24	9	15,94 (405)	1,77 (45)	5.71 (145) - 7.72 (196)
25	12	16,54 (420)	1,38 (35)	5.71 (145) - 7.72 (196)
26	11	17,32 (440)	1,57 (40)	5.71 (145) - 7.72 (196)
27	10	17,72 (450)	1,77 (45)	5.71 (145) - 7.72 (196)
28	13	17,91 (455)	1,38 (35)	5.71 (145) - 7.72 (196)
29	12	18,90 (480)	1,57 (40)	5.71 (145) - 7.72 (196)
30	14	19,29 (490)	1,38 (35)	5.71 (145) - 7.72 (196)
31	11	19,49 (495)	1,77 (45)	5.71 (145) - 7.72 (196)
32	13	20,47 (520)	1,57 (40)	5.71 (145) - 7.72 (196)
33	15	20,67 (525)	1,38 (35)	5.71 (145) - 7.72 (196)
34	12	21,26 (540)	1,77 (45)	5.71 (145) - 7.72 (196)
35	14	22,05 (560)	1,57 (40)	5.71 (145) - 7.72 (196)
36	13	23,03 (585)	1,77 (45)	5.71 (145) - 7.72 (196)
37	17	23,43 (595)	1,38 (35)	5.71 (145) - 7.72 (196)
38	15	23,62 (600)	1,57 (40)	5.71 (145) - 7.72 (196)
39	14	24,80 (630)	1,77 (45)	5.71 (145) - 7.72 (196)
40	16	25,20 (640)	1,57 (40)	5.71 (145) - 7.72 (196)
41	19	26,18 (665)	1,38 (35)	5.71 (145) - 7.72 (196)
42	15	26,57 (675)	1,77 (45)	5.71 (145) - 7.72 (196)
43	17	26,77 (680)	1,57 (40)	5.71 (145) - 7.72 (196)
44	20	27,56 (700)	1,38 (35)	5.71 (145) - 7.72 (196)
45	16	28,35 (720)	1,77 (45)	5.71 (145) - 7.72 (196)
46	21	28,94 (735)	1,38 (35)	5.71 (145) - 7.72 (196)
47	19	29,92 (760)	1,57 (40)	5.71 (145) - 7.72 (196)
48	17	30,12 (765)	1,77 (45)	5.71 (145) - 7.72 (196)
49	22	30,31 (770)	1,38 (35)	5.71 (145) - 7.72 (196)
50	20	31,50 (800)	1,57 (40)	5.71 (145) - 7.72 (196)
51	23	31,69 (805)	1,38 (35)	5.71 (145) - 7.72 (196)
52	18	31,89 (810)	1,77 (45)	5.71 (145) - 7.72 (196)
53	21	33,07 (840)	1,57 (40)	5.71 (145) - 7.72 (196)
54	19	33,66 (855)	1,77 (45)	5.71 (145) - 7.72 (196)
55	25	34,45 (875)	1,38 (35)	5.71 (145) - 7.72 (196)
56	22	34,65 (880)	1,57 (40)	5.71 (145) - 7.72 (196)
57	20	35,43 (900)	1,77 (45)	5.71 (145) - 7.72 (196)
58	26	35,83 (910)	1,38 (35)	5.71 (145) - 7.72 (196)
59	23	36,22 (920)	1,57 (40)	5.71 (145) - 7.72 (196)
60	21	37,20 (945)	1,77 (45)	5.71 (145) - 7.72 (196)
61	24	37,80 (960)	1,57 (40)	5.71 (145) - 7.72 (196)
62	28	38,58 (980)	1,38 (35)	5.71 (145) - 7.72 (196)
63	22	38,98 (990)	1,77 (45)	5.71 (145) - 7.72 (196)
64	25	39,37 (1000)	1,57 (40)	5.71 (145) - 7.72 (196)

For SI: 1 inch = 25.4 mm

TABLE 2—ASD REFERENCE DESIGN VALUES FOR ARBOREAL GLUED-LAMINATED BEAMS SOFTWOOD TIMBER COMBINATIONS^(a)

Combination Symbol	Species ^(b) Outer/Core	Bending About X-X Axis (Loaded Perpendicular to Wide Faces of Laminations)								Axially Loaded		Fasteners	
		Extreme Fiber in Bending ^(c)		Compression Perpendicular to Grain		Shear Parallel to Grain	Modulus of Elasticity ^(e)			Tension Parallel to Grain	Compression Parallel to Grain	Specific Gravity for Fastener Design	
		Bottom of Beam Stressed in tension (Positive Bending)	Top of Beam Stressed in Tension (Negative Bending)	Tension Face	Compression Face							Top or Bottom Face	Side Face
		F_{bx+} (psi)	F_{bx-} (psi)	F_{cLx} (psi)		F_{vx} ^(d) (psi)	E_{xtrue} (10 ⁶ psi)	E_{xapp} (10 ⁸ psi)	E_{xmin} (10 ⁶ psi)	F_t (psi)	F_c (psi)	SG	
GL1	PET/PET (B)	1,500	1,500	445	445	165	1.4	1.3	0.7	900	1,525	0.41	0.41
GL2	PET/PET (B)	1,650	1,650	465	465	170	1.5	1.4	0.8	1,000	1,600	0.42	0.42
GL3	PET/PET (B)	1,950	1,950	555	555	170	1.7	1.6	0.9	1,300	1,825	0.46	0.46
GL4	PET/PET (B)	1,900	1,900	465	465	170	1.6	1.5	0.8	1,000	1,700	0.46	0.42
Wet-use factors, C_M		0.8		0.53		0.875	0.833			0.8	0.73	See Table 11.3.3 of NDS	

For SI: 1 psi = 6.895 Pa

- (a) The combinations in this table are applicable to members consisting of 2 or more laminations and are intended primarily for members stressed in bending due to loads applied perpendicular to the wide faces of the laminations. However, design values are tabulated for loading perpendicular to the wide face of the laminations as well as axial loading. The tabulated design values are for dry conditions of use. For use where the moisture content in lumber is 16 percent or greater, multiply the tabulated values by the wet-use factors shown at the bottom of the table. The tabulated design values are for normal duration of loading. For other durations of loading, see applicable building code.
- (b) The symbol used for species is PET = *Pinus taeda* and *Pinus elliotii* mix.
- (c) The tabulated design values in bending, F_{bx} , are based on members 5-1/8 inches in width by 12 inches in depth by 21 feet in length. For members with a larger volume, F_{bx} must be multiplied by a volume factor, C_v , determined in accordance with Section 5.3.6 of NDS.
- (d) The design values for shear, F_{vx} shall be decreased by multiplying by a factor of 0.72 for non-prismatic members, notched members, and for all members subject to impact or cyclic loading. The reduced design value shall be used for design of members at connections that transfer shear by mechanical fasteners. The reduced design value shall also be used for determination of design values for radial tension and torsion. F_{vx} values do not include adjustments for checking.
- (e) See Section 4.5 of ANSI 117-2020 for definitions of the E_{true} , E_{app} , and E_{min} terms.