1. Basis of the product report:
   - 2012 IRC: Sections R502.1.5, R602.1.2, and R802.1.4 Structural glued laminated timber
   - ANSI 117-2020 and ANSI 117-2015 recognized in the 2021 IBC and IRC, and 2018 IBC and IRC, respectively
   - ASTM D3737-18e1, D3737-12, and D3737-08 recognized in the 2021 IBC and IRC, 2018 and 2015 IBC and IRC, and 2012 IBC and IRC, respectively
   - APA Report T2013P-06, AITC data (June 2010), and other qualification data

2. Product description:
   KING BEAM® 3000, BOISE GLULAM®, and VersaWorks™ Glulam are used as beams, headers, rafters, purlins, or columns. KING BEAM 3000 30F-E4 and 30F-E5 glulam beams are manufactured with a proprietary balanced and unbalanced layup combination, respectively, documented in the in-plant manufacturing standard and approved by APA. KING BEAM 3000 30F-E4 glulam beams use conventional laminating lumber grades of Douglas fir-Larch in the tension and compression zones, and Southern pine in the core with the exception that the outermost tension and outermost compression laminations are made of a proprietary Douglas fir-Larch manufactured lumber tension lamination, as permitted by ANSI A190.1. KING BEAM 3000 30F-E5 glulam beams use the same materials as 30F-E4 glulam beams except that outermost compression laminations are made of conventional 302-24 Douglas fir-Larch laminations. KING BEAM 3000 30F-E4 and 30F-E5 glulam beams have a minimum depth of 7-1/4 inches and a maximum depth of 54 inches.

   BOISE GLULAM and VersaWorks Glulam beams and columns are manufactured in accordance with ANSI A190.1 using layup combinations recognized in the National Design Specification (NDS) Supplement or ANSI 117. BOISE GLULAM and VersaWorks Glulam beams are manufactured in widths of 3-1/8, 3-1/2, 5-1/8, 5-1/2, 6-3/4, 8-3/4, 10-3/4, 12-1/4, and 14-1/4 inches with a minimum depth of 6 inches and lengths up to 66 feet. BOISE GLULAM and VersaWorks Glulam columns are manufactured in widths of 3-1/8 to 10-3/4 inches, depths of 5-1/8 to 12 inches, and lengths up to 30 feet.

3. Design properties:
   Tables 1 and 2 list the allowable design properties for KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam beams and columns. The allowable spans for KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam beams and columns shall be in accordance with the recommendations provided by the manufacturer (www.bc.com/ewp) and APA Data Files: Glued Laminated Beam Design Tables, Form S475 (www.apawood.org/resource-library),
and Design of Structural Glued Laminated Timber Columns, Form Y240 (see link above), as applicable.

4. Product installation:
   KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam beams and columns shall be installed in accordance with the recommendations provided by the manufacturer and APA Construction Guide: Glulam Connection Details, Form T300 (see link above). Permissible field notching and drilling shall be in accordance with the recommendations provided by the manufacturer, and APA Technical Notes: Field Notching and Drilling of Glued Laminated Timber Beams, Form S560, and Effect of Large Diameter Horizontal Holes on the Bending and Shear Properties of Structural Glued Laminated Timber, Form V700 (see link above).

5. Fire-rated assemblies:
   Design of fire-resistant exposed wood members in accordance with Chapter 16 of the NDS, Section 722.1 of the 2021, 2018, and 2015 IBC, or Section 722.6.3 of the 2012 IBC shall be applicable to KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam beams and columns. Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer, and APA Design/Construction Guide: Fire-Rated Systems, Form W305 (see link above).

6. Limitations:
   a) KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam beams and columns shall be designed in accordance with the code using the design properties specified in this report.
   b) KING BEAM 3000 glulam beams shall have a minimum depth of 7-1/4 inches and a maximum depth of 54 inches. BOISE GLULAM and VersaWorks Glulam beams and columns shall have a minimum depth of 6 inches.
   c) KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam beams and columns are produced at Boise Cascade’s Homedale, Idaho facilities under a quality assurance program audited by APA.
   d) This report is subject to re-examination in one year.

7. Identification:
   KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam beams and columns described in this report are identified by a label bearing the manufacturer's name (Boise Cascade) and/or trademark, the APA assigned plant number (1107), the product standard (ANSI A190.1), the APA logo, the combination symbol, the report number PR-L313, and a means of identifying the date of manufacture.
### Table 1. Allowable Design Values for KING BEAM 3000, BOISE GLULAM, and VersaWorks Glulam Beams for Normal Duration of Load¹⁺²⁺¹¹

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Species Outer/ Core (Bal or Unbal)</th>
<th>DF/SP (B)</th>
<th>DF/DF (B)</th>
<th>AC/AC (U)</th>
<th>POC/POC (B)</th>
<th>AC/AC (B)</th>
<th>POC/POC (U)</th>
<th>POC/POC (B)</th>
<th>DF/DF (U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E&lt;sub&gt;1&lt;/sub&gt; (psi)</td>
<td>E&lt;sub&gt;2&lt;/sub&gt; (psi)</td>
<td>E&lt;sub&gt;3&lt;/sub&gt; (psi)</td>
<td>E&lt;sub&gt;4&lt;/sub&gt; (psi)</td>
<td>E&lt;sub&gt;5&lt;/sub&gt; (psi)</td>
<td>F&lt;sub&gt;1&lt;/sub&gt; (psi)</td>
<td>F&lt;sub&gt;2&lt;/sub&gt; (psi)</td>
<td>F&lt;sub&gt;3&lt;/sub&gt; (psi)</td>
<td>F&lt;sub&gt;4&lt;/sub&gt; (psi)</td>
<td>F&lt;sub&gt;5&lt;/sub&gt; (psi)</td>
</tr>
<tr>
<td>KING BEAM 3000 30F-ES³⁹</td>
<td>DF/SP (U)</td>
<td>3,000</td>
<td>3,000</td>
<td>805</td>
<td>805</td>
<td>300</td>
<td>2.4</td>
<td>2.3</td>
<td>1.22</td>
</tr>
<tr>
<td>24F-V4</td>
<td>DF/DF (U)</td>
<td>2,400</td>
<td>1,850</td>
<td>650</td>
<td>650</td>
<td>265</td>
<td>1.9</td>
<td>1.8</td>
<td>0.95</td>
</tr>
<tr>
<td>24F-V8</td>
<td>DF/DF (B)</td>
<td>2,400</td>
<td>2,400</td>
<td>650</td>
<td>650</td>
<td>265</td>
<td>1.9</td>
<td>1.8</td>
<td>0.95</td>
</tr>
<tr>
<td>22F-V14</td>
<td>PO/POC (U)</td>
<td>2,200</td>
<td>1,650</td>
<td>560</td>
<td>560</td>
<td>265</td>
<td>1.8</td>
<td>1.7</td>
<td>0.90</td>
</tr>
<tr>
<td>22F-V15</td>
<td>PO/POC (B)</td>
<td>2,200</td>
<td>2,200</td>
<td>560</td>
<td>560</td>
<td>265</td>
<td>1.8</td>
<td>1.7</td>
<td>0.90</td>
</tr>
<tr>
<td>20F-V12</td>
<td>AC/AC (U)</td>
<td>2,000</td>
<td>1,400</td>
<td>560</td>
<td>560</td>
<td>265</td>
<td>1.6</td>
<td>1.5</td>
<td>0.79</td>
</tr>
<tr>
<td>20F-V13</td>
<td>AC/AC (B)</td>
<td>2,000</td>
<td>2,000</td>
<td>560</td>
<td>560</td>
<td>265</td>
<td>1.6</td>
<td>1.5</td>
<td>0.79</td>
</tr>
<tr>
<td>20F-V14</td>
<td>PO/POC (U)</td>
<td>2,000</td>
<td>1,450</td>
<td>560</td>
<td>560</td>
<td>265</td>
<td>1.6</td>
<td>1.5</td>
<td>0.79</td>
</tr>
<tr>
<td>20F-V15</td>
<td>PO/POC (B)</td>
<td>2,000</td>
<td>2,000</td>
<td>560</td>
<td>560</td>
<td>265</td>
<td>1.6</td>
<td>1.5</td>
<td>0.79</td>
</tr>
<tr>
<td>16F-V3</td>
<td>DF/DF (U)</td>
<td>1,600</td>
<td>1,250</td>
<td>560</td>
<td>560</td>
<td>265</td>
<td>1.6</td>
<td>1.5</td>
<td>0.79</td>
</tr>
</tbody>
</table>

- **Symbol**: The combination in this table is intended primarily for members stressed in bending due to loads applied perpendicular to the wide faces of the laminations. Allowable design values are tabulated, however, for loading both perpendicular and parallel to the wide faces of the laminations.
- **Species Outer/ Core (Bal or Unbal)**: The tabulated allowable design values are for normal duration of loading. For other durations of loading, see the applicable building code. The tabulated allowable design values are for dry conditions of use. For wet conditions of use, multiply the tabulated values by the wet-use factors shown at the bottom of the table.
- **DF/SP (B)***: AC = Alaska cedar, DF = Douglas fir-Larch, PO = Port Orford cedar, and SP = Southern pine in accordance with the manufacturing standard.
- **DF/DF (B)**: The balanced (B) layup is intended primarily for multiple-span or cantilevered beam applications, but may be used in simple-span applications. The unbalanced (U) layup is intended primarily for simple-span applications, but may be used in multiple-span or cantilevered beam applications.
- **AC/AC (U)**: The values of F<sub>1</sub> 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<sub>1</sub> shall be multiplied by a volume factor, C<sub>v</sub> = (5.125b)¹⁺(12d)²⁺(21L)³⁻, where b is the beam width (in.), d is the beam depth (in.), and L is the beam length between the points of zero moment (ft).
- **AC/AC (B)**: For non-prismatic members, members subject to impact or cyclic loading, or shear design of bending members at connections (NDS 3.4.3.3), the F<sub>1</sub> and F<sub>2</sub> values shall be multiplied by a factor of 0.72. The tabulated F<sub>1</sub> values are for timbers with laminations made from a single piece of lumber across the width or multiple pieces that have been edge bonded. For timber manufactured from multiple piece laminations (across width) that are not edge bonded, value shall be multiplied by 0.8 for members with 5, 7, or 9 laminations or by 0.9 for all other members.
- **POC/POC (U)**: The tabulated E values include true E (also known as "shear-free E"), apparent E, and E for beam stability calculation (NDS 3.3.3.8). For calculating beam deflections, the tabulated E<sub>app</sub> values shall be used except where the shear deflection is determined in addition to bending deflection based on the tabulated E<sub>base</sub>. The axial modulus of elasticity, E<sub>ax</sub>, and E<sub>ax</sub> = E<sub>base</sub> shall be equal to the tabulated E<sub>ax</sub> and E<sub>ax</sub> = E<sub>base</sub> values.
- **POC/POC (B)**: The values of F<sub>1</sub> are based on members 12 inches in depth. For depths less than 12 inches, F<sub>1</sub> shall be permitted to be increased by multiplying by the flat use factor, (12/d)¹⁻, where d is the beam depth in inches. When d is less than 3 inches, use the size adjustment factor for 3 inches.
- **DF/DF (U)**: The beam depths are limited to 2-1/4 to 54 inches.
- **POC/POC (B)**: The specific gravity shall be permitted to be increased to 0.55 when the fastener is installed in the outer 25% (top and bottom) and the center 40% of the beam depth.
- **VersaWorks Glulam Beams**: Vertically curved (horizontally laminated) beams utilizing all 302 Douglas fir tension laminations and with individual laminations planed down to a thickness, where 1-3/8 inches > thickness ≥ 5/8 inch, shall be permitted to be trademarked and designed as a Combination #2 glulam in accordance with Table 2.

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### Table 2. Allowable Design Values for BOISE GLULAM and VersaWorks Glulam for Normal Duration of Load<br>(1)

<table>
<thead>
<tr>
<th>Combination Symbol</th>
<th>Species(2)</th>
<th>Grade</th>
<th>All Loading</th>
<th>Axially Loaded</th>
<th>Bending about Y-Y Axis</th>
<th>Bending about X-X Axis</th>
<th>Fasteners</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Modulus of Elasticity(5)</td>
<td>Compression Perpendicular to Grain</td>
<td>Compression Parallel to Grain</td>
<td>Loaded Parallel to Wide Faces of Laminations</td>
<td>Loaded Perpendicular to Wide Faces of Laminations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E&lt;sub&gt;x&lt;/sub&gt;&lt;sup&gt;min&lt;/sup&gt;, E&lt;sub&gt;y&lt;/sub&gt;&lt;sup&gt;min&lt;/sup&gt; or E&lt;sub&gt;xy&lt;/sub&gt;&lt;sup&gt;min&lt;/sup&gt; (psi)</td>
<td>E&lt;sub&gt;x&lt;/sub&gt;&lt;sup&gt;app&lt;/sup&gt; or E&lt;sub&gt;y&lt;/sub&gt;&lt;sup&gt;app&lt;/sup&gt; (psi)</td>
<td>E&lt;sub&gt;x&lt;/sub&gt;&lt;sup&gt;min&lt;/sup&gt;, E&lt;sub&gt;y&lt;/sub&gt;&lt;sup&gt;min&lt;/sup&gt;, or E&lt;sub&gt;xy&lt;/sub&gt;&lt;sup&gt;min&lt;/sup&gt; (psi)</td>
<td>F&lt;sub&gt;L&lt;/sub&gt; (psi)</td>
<td>F&lt;sub&gt;C&lt;/sub&gt; (psi)</td>
<td>F&lt;sub&gt;v&lt;/sub&gt; (psi)</td>
</tr>
<tr>
<td>1</td>
<td>DF</td>
<td>L3</td>
<td>1.6</td>
<td>1.5</td>
<td>0.79</td>
<td>560</td>
<td>950</td>
<td>1,550</td>
</tr>
<tr>
<td>2(2)</td>
<td>DF</td>
<td>L2</td>
<td>1.7</td>
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<td>0.85</td>
<td>560</td>
<td>1,250</td>
<td>1,950</td>
</tr>
<tr>
<td>3</td>
<td>DF</td>
<td>L2D</td>
<td>2.0</td>
<td>1.9</td>
<td>1.00</td>
<td>650</td>
<td>1,450</td>
<td>2,300</td>
</tr>
<tr>
<td>5</td>
<td>DF</td>
<td>L1</td>
<td>2.1</td>
<td>2.0</td>
<td>1.06</td>
<td>650</td>
<td>1,650</td>
<td>2,400</td>
</tr>
<tr>
<td>70</td>
<td>AC</td>
<td>L2</td>
<td>1.4</td>
<td>1.3</td>
<td>0.69</td>
<td>470</td>
<td>975</td>
<td>1,450</td>
</tr>
<tr>
<td>74</td>
<td>POC</td>
<td>L2</td>
<td>1.5</td>
<td>1.4</td>
<td>0.74</td>
<td>470</td>
<td>1,050</td>
<td>1,900</td>
</tr>
</tbody>
</table>

Wet use factors: 0.833, 0.53, 0.8, 0.73, 0.8, 0.875, 0.875, see NDS.

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(1) The tabulated allowable design values are for normal duration of loading. For other durations of loading, see applicable building code. The tabulated allowable design values are for dry conditions of use. For wet conditions of use, multiply the tabulated values by the factors shown at the bottom of the table.

(2) AC = Alaska cedar, DF = Douglas fir-Larch, and POC = Port Orford cedar.

(3) The tabulated E values include shear-free (true) modulus of elasticity (E<sub>x</sub><sup>app</sup> and E<sub>y</sub><sup>app</sup>), apparent modulus of elasticity (E<sub>x</sub><sup>min</sup>, E<sub>y</sub><sup>min</sup>, and E<sub>xy</sub><sup>min</sup>), and 50th percentile modulus of elasticity (E<sub>x</sub><sup>app</sup>, E<sub>y</sub><sup>app</sup>, and E<sub>xy</sub><sup>app</sup>). For column stability calculation (NDS 3.7.1), E<sub>x</sub><sup>app</sup> or E<sub>y</sub><sup>app</sup> shall be used. For calculating the total deflection due to bending, the tabulated E<sub>x</sub><sup>app</sup> or E<sub>y</sub><sup>app</sup> values shall be used, or as an alternative, the true (shear-free) bending deflection shall be calculated using the tabulated E<sub>x</sub><sup>app</sup> or E<sub>y</sub><sup>app</sup>, which shall be added to the calculated shear deflection to determine the total deflection due to bending.

(4) The values of F<sub>v</sub> are based on members 12 inches in depth. For depths less than 12 inches, F<sub>v</sub> shall be permitted to be increased by multiplying by the size factor, (12/d)<sup>1/8</sup>, where d is the beam depth in inches. When d is less than 3 inches, use the size adjustment factor for 3 inches.

(5) For non-prismatic members, notched members, members subject to impact or cyclic loading, or shear design of bending members at connections (NDS 3.4.3.3), the tabulated F<sub>v</sub> and F<sub>y</sub> values shall be multiplied by 0.72.

(6) The tabulated F<sub>C</sub> values are for members of 4 or more lams. The tabulated F<sub>C</sub> values shall be multiplied by a factor of 0.95 for 3 lams and 0.84 for 2 lams. For members with 5, 7, or 9 lams manufactured from multiple-piece lams with unbonded edge joints, the tabulated F<sub>C</sub> values shall be multiplied by a factor of 0.4. For all other members manufactured from multiple-piece lams with unbonded edge joints, the tabulated F<sub>C</sub> values shall be multiplied by a factor of 0.5. This adjustment shall be cumulative with the adjustment specified in Footnote 5.

(7) The values of F<sub>x</sub> 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<sub>x</sub> shall be multiplied by a volume factor, C<sub>x</sub> = (5.125b)<sup>1/10</sup> (12/d)<sup>1/8</sup> (21L)<sup>1/10</sup>, where b is the beam breadth (in.), d is the beam depth (in.), and L is the beam length between the points of zero moment (ft).

(8) The tabulated F<sub>y</sub> values for members without special tension lams up to 15 inches in depth. If the member depth is greater than 15 inches without special tension lams, the tabulated F<sub>y</sub> values must be multiplied by a factor of 0.88. If special tension lams are used, the tabulated F<sub>y</sub> values are permitted to be increased by a factor of 1.18 regardless of the member depth provided that the increased F<sub>y</sub> value does not exceed 2,400 psi. This factor shall be cumulative with the volume factor, C<sub>y</sub> specified in Footnote 7.

(9) Vertically curved (horizontally laminated) beams utilizing all 302 Douglas fir tension lams and with individual laminations planed down to a thickness, where 1-3/8 inches > thickness ≥ 5/8 inch, shall be permitted to be trademarked and designed as a Combination #2 glulam.
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