There’s a Revolution Happening.
And Structurlam is Leading the Way.

North America and timber construction have histories that are inseparable. From our forestry practices and manufacturing infrastructure to our model building codes and standards, building with wood is more deeply rooted here in North America than anywhere else on the planet.

As our structures grew larger and taller, wood became limited to stick-built construction. Today, all of that is changing, as wood is now at the forefront of an exciting, new construction technology with mass timber construction.

With the power to lock away carbon through the life span of a building, timber provides a natural and innovative alternative to steel and concrete. Proven, cost-effective and renewable, it’s no wonder mass timber construction is quickly becoming the platform of choice for owners, architects, engineers and builders.

Structurlam is uniquely positioned to help make this revolution a reality. With nearly 60 years of experience as the industry’s leader in innovating with wood, we’re here to guide you to this next generation of building design and construction.

So, no matter what your project—whether you’re looking to make a statement of beauty, technical leadership, function or environmental responsibility—Structurlam’s mass timber building products are the answer.
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Note: Glulam is referenced throughout this guide as GlulamPLUS®. CLT is referenced as CrossLam® CLT.

This publication prepared by Structurlam Mass Timber Corporation is intended to serve as a technical guide only. The project designer and professional engineer of record are responsible for providing final documented design and engineering advice for any general or specific use or application where Structurlam CrossLam® CLT and GlulamPLUS® beams and columns are being used. Structurlam Mass timber Corporation will not be held liable for any direct or indirect use or reliance on information published herein.

Structurlam Mass Timber Corporation
Benefits of Mass Timber Construction

- Economically Viable and Competitive
- Code Approved
- Quality Assured
- Adhesives
- Architecturally Enabling
- Engineered Solutions
- Environmentally Superior
Mass Timber Construction Is:

Economically Viable and Competitive

Compared to traditional steel and concrete, mass timber construction compresses your project schedule by moving much of the on-site labour to the factory. Once on-site, it’s more about simple assembly rather than construction.

NOTE: With a portion of the reallocated cost of labour reflected in the mass timber cost of materials, it is important to compare the costs of the two systems at an installed-complete/structure stage of the project.

The cost benefits of mass timber construction can be summarized as follows:

**REDUCED CONSTRUCTION CYCLE TIME**

- As a fully integrated system supplier, Structurlam delivers your mass timber building system ready to assemble with all connecting hardware and accessories.
- When specified by the contractor, Structurlam components arrive on-site with all pick points identified, supporting a safe and efficient lift.
- When compared to traditional reinforced concrete construction practices where reinforcing steel is manually hand tied on-site, forms and falsework are constructed and concrete is poured and must be left to set to strengthen, mass timber solutions can accelerate production schedules by as much as 25%.

For a complete list of Structurlam Service Options, see page 22.

**REDUCTION IN SKILLED LABOUR REQUIRED**

- With more skilled labourers retiring from construction trades than entering, availability of skilled labour is one of the biggest challenges in the industry today.
- Mass timber construction repositions a significant portion of the on-site skilled labour to permanent positions in manufacturing, significantly reducing the cost of labour on the project.

**IMPROVED JOBSITE SAFETY PERFORMANCE**

- Fewer jobsite labourers and a compressed cycle time both contribute to improvements in jobsite safety performance. This often results in lowered insurance rates and incurred costs due to claims and recordable incident investigations.

**REDUCED FOUNDATION COSTS**

- As a building material, mass timber components are up to 75% lighter than traditional reinforced concrete components required for the same project.
- With this reduction in the total building weight, mass timber construction systems require smaller and lighter foundations. This results in the following benefits:
  - A cost savings to the project in reduced materials and labour required for footings and foundations
  - A solution for development in poor soil locations
  - More cost-effective seismic solutions

**IMPROVED PROJECT ROI**

- Cost of capital is materially reduced due to accelerated build schedule.

---

**Compressing the Typical Construction Schedule**

Look for these potential $$$ schedule savings with mass timber compared to steel and concrete.

- Earlier start for follow-up trades; no waiting for cure times
- MEP fully coordinated in design phase and therefore installed faster
- Less remediation with prefabricated modules
- Faster installation (prefabricated and precise)

**Figure 1:** Mass timber vs. Steel/concrete construction schedule. Mass timber cost and design optimization checklists.

**Figure 2:** Mass timber vs. Steel/concrete construction schedule. Mass timber cost and design optimization checklists.

WoodWorks – Wood Products Council
Mass Timber Construction Is:

The 2015 National Building Code of Canada (NBCC) permits cross laminated timber through CSA-O86 – Engineering Design in Wood when manufactured in accordance with the ANSI/APA PRG 320 Standard for Performance Rated Cross Laminated Timber, and structural glued laminated timber (when manufactured in accordance to the CSA O122 – Structural Glued Laminated Timber), along with mass timber construction building systems to be used in all buildings permitted to be of combustible construction.

Six storey buildings permitted to be of combustible construction (up from four storeys in the 2010 NBCC) were included into the 2015 NBCC for Group C (residential) and Group D (business and personal services) occupancies. See Table 1 below.

### TABLE 1: CANADIAN CODE REGULATIONS – UP TO 12 STOREYS

<table>
<thead>
<tr>
<th>CODE</th>
<th>GROUP C – ARTICLE 3.2.2.50</th>
<th>GROUP D – ARTICLE 3.2.2.58</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING HEIGHT</td>
<td>No more than six stories</td>
<td>No more than six stories</td>
</tr>
<tr>
<td>HEIGHT BETWEEN FIRST STOREY FLOOR AND UPPER MOST FLOOR LEVEL</td>
<td>No more than 18 m (59')</td>
<td></td>
</tr>
<tr>
<td>MAXIMUM BUILDING AREA PER BUILDING HEIGHT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOREY</td>
<td>BUILDING AREA</td>
<td>STORIES</td>
</tr>
<tr>
<td>6</td>
<td>9,000 m²</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>6,000 m²</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>4,500 m²</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>3,000 m²</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>2,150 m²</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>1,800 m²</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>1,500 m²</td>
<td>6</td>
</tr>
</tbody>
</table>

NOTE: Mixed uses, such as retail stores, shops and restaurants can be located on the first three storeys of these buildings.

### TABLE 2: CANADIAN CODE REGULATIONS – UP TO 12 STOREYS

<table>
<thead>
<tr>
<th>CODE</th>
<th>GROUP C</th>
<th>GROUP D</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING HEIGHT</td>
<td>No more than 12 stories</td>
<td>No more than 12 stories</td>
</tr>
<tr>
<td>HEIGHT BETWEEN FIRST STOREY FLOOR AND UPPER MOST FLOOR LEVEL</td>
<td>No more than 41 m (138’)</td>
<td></td>
</tr>
<tr>
<td>MAXIMUM BUILDING AREA PER BUILDING HEIGHT</td>
<td>6,000 m²</td>
<td>7,200 m²</td>
</tr>
<tr>
<td>FIRE RESISTANCE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Floor assemblies: fire separations with no less than one-hour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Roof assemblies: no less than one-hour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Load bearing walls, columns and arches: rating not less than required for the supported assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPOSED MASS TIMBER WALLS AND CEILINGS</td>
<td>Limited area allowed</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Mixed uses, such as retail stores, shops and restaurants can be located on the first through third storeys of these buildings.

When considering product manufactured outside of North America, it should be noted that a limited number of offshore suppliers are certified to North American standards. As a result, it is imperative to consider more than the conversion of design stress properties. Key considerations that are upheld to the North American design standards.

### TABLE 3: ADHESIVES FOR GLULAM AND CLT MASS TIMBER PRODUCTS

<table>
<thead>
<tr>
<th>ADHESIVE APPLICATION</th>
<th>ADHESIVE BRAND</th>
<th>ADHESIVE TYPE</th>
<th>EMISSIONS CERTIFICATION</th>
<th>FULL SCALE FIRE TEST</th>
<th>HEAT DELAMINATION</th>
<th>MOISTURE DURABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger Joint Glulam types</td>
<td>Hexen Cascon™</td>
<td>Melamine Formaldehyde (MF)</td>
<td>UL GREENGUARD Gold</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Crosslam CLT &amp; GlulamPLUS®</td>
<td>Hexen EcoBond™</td>
<td>Melamine Formaldehyde (MF)</td>
<td>UL GREENGUARD Gold</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Face Bond GlulamPLUS®</td>
<td>Henkel Locitite HB X PURBOND</td>
<td>Polyurethane (PUR)</td>
<td>UL GREENGUARD Gold</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>
### North American Glulam Standards to Be Met When Considering an Offshore Supplier

**Table 4: Glulam Standards**

<table>
<thead>
<tr>
<th>Differences</th>
<th>Affected Applications</th>
<th>Action Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Value Compatibility</td>
<td>All glulam applications designed in accordance with a recognized standard</td>
<td>Glulam design properties must be derived in accordance with the North American building codes and design standards.</td>
</tr>
<tr>
<td>Volume Effect Adjustment</td>
<td>All glulam beam applications that exceed 130 mm (5-1/8&quot;) in width, 610 mm (24&quot;) in depth and 9.1 m (30&quot;) in length</td>
<td>Glulam bending strength must be adjusted for the volume effect required by the North American building codes and design standards.</td>
</tr>
<tr>
<td>Adhesives</td>
<td>All glulam applications that depend on glue bond performance in elevated temperature events and high humidity</td>
<td>Glulam adhesives must meet CSA O112.9.</td>
</tr>
<tr>
<td>Fire Performance</td>
<td>All glulam applications that depend on glulam fire endurance</td>
<td>Glulam must be manufactured and certified to CSA O112 for fire performance.</td>
</tr>
<tr>
<td>Quality Assurance and Third-Party Certification</td>
<td>All glulam applications that depend on glulam quality</td>
<td>Glulam must be certified and inspected monthly by an accredited third-party certification or inspection agency.</td>
</tr>
<tr>
<td>Lower Bearing Capacity</td>
<td>All beam applications, such as:</td>
<td>Engineer must reconfigure design of supporting structure with:</td>
</tr>
<tr>
<td></td>
<td>- End and intermediate reactions</td>
<td>- More bearing support area</td>
</tr>
<tr>
<td></td>
<td>- Steel connections designed for Douglas Fir or Southern Pine bearing</td>
<td>- Larger posts</td>
</tr>
<tr>
<td></td>
<td>- Very high load in a short span</td>
<td>- Different connection details</td>
</tr>
<tr>
<td>Lower Shear Capacity</td>
<td>All shear-critical applications, such as:</td>
<td>Engineer must analyze shear-critical applications.</td>
</tr>
<tr>
<td></td>
<td>- Glulam supporting other beams on steel connections or point loads from the structure above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Centilevered or continuous span beam over intermediate support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Very high load in a short span</td>
<td></td>
</tr>
<tr>
<td>Lower Relative Density</td>
<td>When anything is connected to the beam, such as:</td>
<td>Engineer must consider:</td>
</tr>
<tr>
<td></td>
<td>- Floor and roof diaphragms with wood structural panels nailed directly to the beam</td>
<td>- Additional fasteners</td>
</tr>
<tr>
<td></td>
<td>- Steel connections designed for Douglas Fir or Southern Pine beams</td>
<td>- Larger or custom steel connections</td>
</tr>
<tr>
<td></td>
<td>- Lighting, sprinklers and HVAC</td>
<td>- Reduced steel connection capacity</td>
</tr>
<tr>
<td></td>
<td>Note: The relative density for European Spruce is 0.42 or less, while the specific gravity for Douglas Fir is 0.49, respectively.</td>
<td>- Redesigning all load-bearing connections—nails, bolts or screws—for reduced fastener capacity.</td>
</tr>
<tr>
<td>Different Field Drilling and Notching Recommendations</td>
<td>All beam applications that require field drilling and notching for structural or non-structural (plumbing or electrical wiring) applications</td>
<td>Engineer must consider the applicability of the industry recommendations and their compatibility with other structural elements.</td>
</tr>
</tbody>
</table>


### North American Cross Laminated Timber (CLT) Standards to Be Met When Considering an Offshore Supplier

**Table 5: CLT Standards**

<table>
<thead>
<tr>
<th>Differences</th>
<th>Affected Applications</th>
<th>Action Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI/APA PRG 320-2019</td>
<td>All CLT panel and applications</td>
<td>CLT design properties must be derived in accordance with North American building codes and standards.</td>
</tr>
<tr>
<td>Design Properties</td>
<td>ALL CLT panels and applications designed in accordance to North American codes and standards</td>
<td>Lumber used in the manufacture of CLT panels may have different design characteristics. ANSI/APA PRG 320-2019 has derived capacities for typical North American species used in CLT production. Only wood species and grades recognized by the Canadian Lumber Standards Accreditation Board (CSLAB) can be used in manufacturing CLT under ANSI/APA PRG 320-2019. Foreign species will differ in certain aspects, including stiffness, bending and shear strength, bearing capacity and specific gravity.</td>
</tr>
<tr>
<td>Full Scale CLT Qualification</td>
<td>All CLT panel and CLT applications that depend on glue bond performance in elevated temperature events</td>
<td>All CLT panels produced in North America must be produced using adhesives that have passed CSA O112.9. In addition, CLT panels must be qualified with a full-scale compartment fire test per ANSI/APA PRG 320-2019 Annex B. Other adhesives may not provide adequate bonding in high-heat incidents, raising life safety issues.</td>
</tr>
<tr>
<td>Moisture Durability</td>
<td>All CLT panel applications designed to withstand moisture durability conditions</td>
<td>CLT panels must be evaluated for stringent moisture durability per ANSI/APA PRG 320-2019 including evaluation of vacuum-pressure soak tests. Due to relative density differences between various wood species which can vary from 0.42 to 0.55, lateral load analysis must be evaluated in each specific case. This needs to occur whenever substituting alternate species for CLT panels to ensure the capacity of connectors and bearing capacity remains adequate for the structure in question. Lower relative density not only reduces connection properties, but can also significantly reduce the bearing capacity of the product. For these reasons, all of these evaluations must occur when considering alternate species.</td>
</tr>
<tr>
<td>Relative Density</td>
<td>Any lateral load analysis, bearing or connection design</td>
<td>ANSI/APA PRG 320-2019 requires regular inspection of manufacturing processes for CLT panels by an independent third-party inspection or product certification agency.</td>
</tr>
</tbody>
</table>

**Architecturally Enabling**

As humans, we have an inherent desire to be connected to nature and our environment. More and more, we’re seeing projects embrace this connection to the natural world. This is especially true in corporate offices, where creating an appealing workspace is both a benefit and a competitive advantage. Mass timber is the perfect structural material for this biophilic approach to design. Mass timber construction delivers the warmth and beauty of wood while still lending itself to inviting designs such as soaring ceilings, organic shapes and open spaces. And whether the mass timber components are encapsulated, or you opt to highlight the natural allure of the wood, you create environments people want to be in and return to time and time again.

**Environmentally Responsible**

The United Nations states that two of the most compelling issues in the world today are shelter and climate change. Mass timber construction speaks to both.

- Wood as a building material is a renewable resource that can be regenerated through sustainable forestry practices. Structurlam uses only wood that is sustainably harvested, including FSC and SFI chain-of-custody certified.
- Harvested timber retains its carbon through the life of the building, while reforestation through replanting increases the carbon capture rate by as much as a factor of two times over the same acreage.
- Located within the timberlands it draws upon, Structurlam minimizes the transportation footprint required to produce mass timber components. This is most compelling when compared to importing competitive mass timber products or steel from offshore producers.
- Less energy is consumed in the production of mass timber components. By some estimates, wood conversion is as much as five times more efficient than cement for concrete and up to 20 times more energy efficient than the production of steel. (See graphic below.)
- As a choice, mass timber construction enables a virtuous cycle of capturing carbon from the atmosphere while supporting the forestry practices of responsible harvesting techniques and reforestation practices.
- Both CrossLam® CLT and GlulamPLUS® beams and columns are ASTM certified with Environmental Product Declarations (EPD) to provide complete transparency of the materials used. EPDs are imperative for calculating building lifecycle costs.

*Figure 2: Normalized comparison of environmental impacts of wood, steel and concrete*
The Structurlam Advantage

The Structurlam Brand Promise

The Structurlam Advantage

Staggered Multiple Piece Lamination vs. Block Glued Layup

Service Options
The Structurlam Brand Promise

When you choose Structurlam, you have the assurance you’ll be working with:

• The North American industry leader in mass timber construction, Structurlam proudly supports and is certified to all North American building codes and manufacturing standards.

• A partner in your design. Structurlam utilizes 3D Building Information Modeling (BIM), including the design and specification of all related steel connections and hardware. We detail your vision down to the last screw, nut and bolt.

• A partner with your project. Structurlam plans the delivery of every component to maximize your construction schedule, right down to how each member is loaded on every truck.

• A fully integrated supplier. We supply CrossLam® cross laminated timber and GlulamPLUS® beams and columns mass timber building products, as well as custom steel connectors and related hardware.

• A steward of the environment. Structurlam uses wood that is sustainably harvested, including SFI and FSC chain-of-custody certified. Certificates for your project are available upon request.

The Structurlam Advantage

For nearly 60 years, our experience as a world-renowned fabricator of complex mass timber components has given us the deep knowledge and expertise to create beautifully designed systems of the highest quality. Our work process is designed to ensure 100% accountability through every step of your project, including:

**Mass Timber Design Support**

Our Mass Timber Specialists, supported by our internal customer and technical services teams, have amassed the experience of every project we have supplied. As a resource to your project design team, we will share our best practices with you to deliver the most cost-effective and creative solutions that meet or exceed the requirements of the U.S. building codes, as well as your own high expectations.

**Budgeting**

Our estimators and senior designers possess deep knowledge of mass timber design and engineering, including hardware and connections to provide you with accurate and timely SD-, DD- and CD-level budgets and quotations for your project.

**Project Management**

A dedicated project manager guides each Structurlam project through design, fabrication, delivery and installation, providing each customer with a single point of contact and the utmost in customer service.

**Lumber Procurement**

Through our strategic supply relationships, Structurlam has dedicated personnel to procure a wide range of commodity lumber and raw materials, as well as the related steel and system accessories, to protect against raw material price volatility. This mitigates the risk of price escalation for projects that have deferred production windows or prolonged production cycles.

**Sustainability**

Structurlam is a fully certified FSC manufacturer of mass timber building products and is committed to achieving the highest standards of sustainable construction requirements. Our mass timber building products can be supplied with SFI and FSC certification.

**Fabrication Design and 3D Modeling**

Following the building design process, our fabrication design team will create an exact 3D model of your project including all mass timber components with all steel and hardware connectors, right down to every nut, bolt and screw, including vital details such as holes, slots, slots, counter bores and chamfers. This process allows us to envision potential construction issues long before arriving on the jobsite. Individual component shop drawings are then produced with exacting specifications as part of our quality control best practices.

**Fabrication**

From the 3D model, data is transferred electronically, directly to our state-of-the-art CNC fabrication machinery where components are reproduced to extreme precision (less than 3 mm (1/8”)). No other manufacturer in North America can match our quality and precision on CLT and glulam building products.

**Quality and Application Assurance**

Structurlam maintains a rigorous Quality and Application Assurance program that meets or exceeds the standards set forth in the North American model building codes, throughout our process. Third-party inspected and verified, Structurlam delivers defect-free quality, the first time.

**Codes and Standards Compliant**

Structurlam CrossLam® CLT and GlulamPLUS® beams and columns meet the requirements set forth in the 2015 National Building Code of Canada (NBCC) and CSA O86:19 for Cross Laminated and Glued Laminated Timber and are manufactured in accordance with CSA G122 – Structural Glued-Laminated Timber.

**Options – Adhesives, Finishes and Coatings**

We offer a variety of options to enhance the aesthetic appeal of your GlulamPLUS® beams and columns, including two adhesives, three smooth finishes, three rustic finishes and a wide array of factory-applied coatings.

**Packaging and Delivery**

Secure arrival to the jobsite is the cornerstone of our delivery system. Depending on the job requirements, we factory install connectors and test-fit pieces to ensure smooth on-site assembly. GlulamPLUS® beams and columns are individually wrapped and sealed, corners are protected and additional packaging such as plywood sheathing is added when necessary. Please refer to page 92 for additional Care and Handling recommendations.

**Coordinated Installation**

Structurlam’s experienced project management team will coordinate with the project installers to ensure safe and efficient on-site installation. The result is a building with optimized structural performance, rapid assembly and superior aesthetic appeal.

**Fabrication**

From the 3D model, data is transferred electronically, directly to our state-of-the-art CNC fabrication machinery where components are reproduced to extreme precision (less than 3 mm (1/8”)). No other manufacturer in North America can match our quality and precision on CLT and glulam building products.

**Quality and Application Assurance**

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**Coordinated Installation**

Structurlam’s experienced project management team will coordinate with the project installers to ensure safe and efficient on-site installation. The result is a building with optimized structural performance, rapid assembly and superior aesthetic appeal.

Our team takes pride in every project, from preliminary consultation and design through manufacturing, shipment and installation. We understand the many challenges of both design and construction and make it our primary goal to ensure that all processes run as smoothly as possible.
Superior Engineering for Superior Performance

**STAGGERED MULTIPLE PIECE LAMINATION VS. BLOCK GLUED LAYUP METHODOLOGY**

When manufacturing wide-section members, Structurlam utilizes a staggered multiple piece lamination technique as described in CSA O122, section 6.4.4.

In contrast, the block glued methodology, commonly used by foreign manufacturers, allows for narrower single-lamination components to be edge-glued along the face of the two beams to produce built-up wide-section components. These edge-laminated blocks create a continuous, vertical shear plane between the two edge-glued narrow beams and are not permitted in CSA O122.

The multiple piece layup where edge laminations are both staggered and face glued is a preferred methodology because it creates a continuous vertical shear plane through the components.

**Diffused Shear Planes**

Foreign manufacturers commonly use a block glued methodology where narrower single-lamination components are edge-glued to produce built-up wide components. This creates a continuous vertical shear plane between the two edge-glued components. In contrast, the multiple piece lamination technique creates a noncontiguous vertical glue-line shear plane through the components.

**Dimensional Stability**

Based upon the same principle of an increased number of elements within the component, a staggered multiple piece lamination method reduces the dimensional tendencies of any one element and can potentially increase the overall stability of the component. This can be most prominently realized in wider and deeper sections.

**Increased Homogenization**

Glulam beams and columns constructed through the staggered multiple piece lamination technique are composed of more individual elements than through a single lamination layup technique. This increased number of elements acts to further diffuse the impact of any one element on the resulting component and creates a more homogenous construction.

**STAGGERED MULTIPLE PIECE LAMINATION**

- The staggered multiple piece lamination method creates a noncontiguous shear plane in the glulam member.
- This staggered layup does not rely on the glue line integrity to the same degree as the forces can be resisted by the overlapping laminations in shear.
- This staggered gluelam composition method is implicitly safer, more robust and does not demand the same degree of quality control over the glue line integrity as the block glued lamination method.

**BLOCK GLUED GLULAM**

- The block glued glulam lamination method creates a contiguous vertical shear plane that relies on the glue-bond line integrity to transfer loads through the glulam member.
- In an asymmetric loading application, the load component must transfer across the glue line in shear to allow the glulam member to act as a compound unit.

**Get It Built to Order, Not Built to Ship**

We don’t live in a world of cookie-cutter buildings. Every project is unique, which may call for unique sizes of panels and unique shapes and lengths of beams. Working with Structurlam gives you tremendous control over the custom nature of your project.

Our advanced 3D modeling and precision machining create exactly the piece of engineered wood you need. Perhaps just as important is the fact that, because we’re the local source for mass timber, we can deliver custom and oversized pieces much more readily than overseas manufacturers.

Nearly 60 years of North American Mass Timber Expertise

When you choose Structurlam, you’ll be working with the North American industry leader in mass timber manufacturing and project delivery, a company at the forefront of the mass timber revolution. We proudly support and are certified to all North American building codes and manufacturing standards. Compared with the costs and logistics of working with overseas manufacturers, Structurlam is the right choice for simplified construction and sustainability.

We are also your partner in the process. We use 3D Building Information Modeling (BIM) to detail your vision down to the last screw, nut and bolt. Our sophisticated CNC machinery ensures extreme precision (less than 0.175 mm (1/8’)) in all our fabrication. No other manufacturer in North America can match our quality and precision on CLT and glulam building products. We plan the delivery of every component to maximize your construction schedule, right down to how each member is loaded on every truck.

We work closely with you every step of the way. That’s an advantage that overseas companies simply cannot achieve.

Foreign companies have to overcome the additional logistical burden of shipping large pieces overseas. This means that pieces need to fit in 2.44 m x 12.19 m (8’ x 40’) containers, compromising the scope of projects.

The cost of this shipping is obvious, but there are hidden costs as well. Chopping panels, beams and columns into sea container sizes often leads to increased installation costs. With Structurlam, we deliver products ready to install, loaded in order of assembly to speed things along.

It’s one more way that makes local sourcing a smart choice.

Structurlam Manufacturing Facility, Okanagan Falls, BC, Canada

*Structurlam Mass Timber Technical Guide | MASS TIMBER CONSTRUCTION BENEFITS  2120  MASS TIMBER CONSTRUCTION BENEFITS | Mass Timber Expertise*
As a Manufacturer, Structurlam Delivers

Defect-free quality, the first time, every time. Structurlam utilizes state-of-the-art CNC robotics, along with a rigorous Quality and Product Application Assurance program throughout our process, from 3D modeling and inline lumber testing to test-fitting all component connections, ensuring what is delivered to the jobsite matches precisely.

Service Options

Our customers are at the heart of our business. Structurlam offers a range of design and fabrication service levels, each incorporating various elements of The Structurlam Advantage. The service options range from fabrication only of your approved shop drawings, to traditional supply with our technical services, to consulting on cost efficiency through an engagement of design for manufacturing and assembly. We will work with you to understand your needs, preferences and budget to select the right service level for your project.

Our service options include:

**FABRICATION ONLY**
- Supply of mass timber components per your approved single-piece shop drawings on fully detailed 3D model

**TRADITIONAL SUPPLY**
- Complete detailing and supply of mass timber kit-of-parts including site evaluation and hardware
- Project management and scheduling services, ensuring your mass timber kit-of-parts arrives on-site, on-time, in full and on spec, to meet your construction schedule
- Installation services available as an added service

**DESIGN FOR MANUFACTURE AND ASSEMBLY (DfMA)**
- Collaborate with the AEC team to achieve design cost optimization through efficiencies in manufacture and on-site installation of the mass timber kit-of-parts
- Complete detailing and supply of mass timber kit-of-parts (including site evaluation and hardware) per Structurlam single-piece shop drawings, as approved by the AEC team
- Project management and scheduling services, ensuring your mass timber kit-of-parts arrives on-site, on-time, in full and on spec, to meet your construction schedule
- Installation services available as an added service

**MASS TIMBER SPECIALTY ENGINEERING DESIGN AND SUPPLY**
- Provide mass timber specialty engineering design services with consent and collaboration with the EOR and with respect to the architect’s design intent
- Complete detailing and supply of mass timber kit-of-parts (including site evaluation and hardware) per Structurlam single-piece shop drawings, as approved by the AEC team
- Project management and scheduling services, ensuring your mass timber kit-of-parts arrives on-site, on-time, in full and on spec, to meet your construction schedule
- Installation services available as an added service

We believe that Structurlam is uniquely positioned to meet even the most challenging project requirements. We are confident that you will find our decades of North American experience and expertise worthy of further discussion.
Mass Timber Design Process

Once you’ve determined mass timber construction is your building approach and chosen Structurlam as your supply partner, we recommend the following series of steps and decisions to help guide your progression forward.

1. Determine standard grid pattern(s) for your design (recommended grid patterns for each mass timber system can be found on pages 28, 33 and 36 of this guide).

2. Select a mass timber building system for your project (see Mass Timber Building Systems starting on page 25 for a description of popular mass timber systems and recommendations for building typology).

3. Consider each design element (fire performance, acoustics and sound transmission, vibration control, etc.) through the Design Considerations section in the guide (pages 41–60) and the effect each consideration may have on member sizing.

4. Using the engineering design properties provided in the guide for CrossLam® CLT (see pages 61-76) and GlulamPLUS® beams and columns (see pages 77-91), determine preliminary member sizing for individual grid assemblies for the load and applicable code requirements of your project.

5. As you develop a working design solution, your Structurlam Mass Timber Specialist will work with you to complete your design, including grid layout and member sizing and positioning, as well as to develop a preliminary budget for your project. Feel free to contact your Structurlam Mass Timber Specialist at any time during the process.

As always, we’re here to assist. Regardless of what level you ultimately work with us—whether Design, Supply, Fabrication Only or any stage in between—we recommend you engage one of our team of Mass Timber Specialists as early in the process as possible.

Mass Timber Building Systems

Post and Panel
Post-Beam-Panel
Hybrid Light-Frame

Mass Timber System Selection Chart
Post and Panel is a common type of mass timber structural system made up of CrossLam® CLT floor panels resting directly above GlulamPLUS® columns. This system does not use any beams or secondary supporting members for the CrossLam® CLT panels. The panels are designed to work in a full two-way span system point-supported on bearing columns. This system is made up of a series of typical grids, allowing for the simple design of open concept living and workspaces. It’s ideal for building types in which a regularly repeating grid pattern can be established throughout the structure. These structures include hotels, dormitories or micro apartments and can be used effectively in both hybrid material systems as well as full timber-based structures.

**Benefits**

- The open and clear head heights of the Post and Panel System allow easy routing of mechanical, electrical and plumbing (MEP) systems.
- Connection design is typically less complex than other systems, making it ideal for fast, efficient and safe mass timber construction (see “Connections” on pages 42–53 under “Mass Timber Design Considerations” for additional information).
System Components

The Post and Panel System is made up of the following components:

- A GlulamPLUS® Columns
- B CrossLam® CLT Panels
- C Steel Connectors/Fasteners (screws, caps, etc.)

Grid Patterns

Figure 5 shows the typical grid sizes used for Post and Panel mass timber building systems. The optimal grid sizes for this type of system are 2.4-3 m (7’-10.5”-9’-10.5”) wide since this maximizes the utilization of CrossLam® CLT by reducing material costs and waste. Other sizes can be used; please consult with your Structurlam Mass Timber Specialist on efficiencies related to alternative patterns. Due to the nature of pressing CrossLam® CLT, the maximum length of panel that can be pressed is 12.19 m (40’), and the maximum width that can be pressed is 2.4 m (7’-10.5”) and 3 m (9’-10.5”). This results in grid layouts that are ideal for hotels, multifamily and student- or senior-living housing and facilities.

MEP Routing

As a result of the open and clear head heights of the Post and Panel system, routing mechanical, electrical and plumbing (MEP) systems along ceiling lines is recommended. This is particularly convenient where drop ceilings will be incorporated in the design where MEP systems can be concealed above the finished ceiling.

Building Typology

IDEAL FOR
- Hotels
- Dormitories
- Multifamily Residential
- Senior Housing
- Industrial
The Post-Beam-Panel System is composed of CrossLam® CLT floor panels bearing on a system of GlulamPLUS® beams and columns. The beams and columns form the vertical load-bearing structure of the building. Connecting the CrossLam® CLT panels completes the structural system and creates the platform for subsequent floors. Its principles can be used in both hybrid material and full timber-based structures.

The Post-Beam-Panel System allows for more flexibility in the grid pattern of the design, making the system well suited for projects that feature open floor plans and work concepts, such as corporate offices, high-end residential, multifamily and commercial buildings, government and other public access structures.

Benefits

- Allows for open floor plans and design concepts.
- Left exposed, GlulamPLUS® beams and columns and CrossLam® CLT panels add high architectural appeal.
- No additional timber construction education required.
Grid Patterns

TYPICAL GRIDS

Figure 6 shows typical grid sizes used for Post-Beam-Panel mass timber building systems. Due to the nature of pressing CrossLam® CLT, the maximum length of panel that can be pressed is 12.19 m (40’), and the maximum width that can be pressed is 2.4 m (7’-10.5”) and 3 m (9’-10.5”).

The use of augmented grids can create impressive structural efficiencies. An example would be a 9.1 m (30’) primary beam span in the Y direction and 4.5 m (15’) bay spacing in the X direction. Located on exterior bays of the building, this produces large functional spaces.

MEP Routing

Depending on the degree of encapsulation of the mass timber components as required by code (often determined by fire performance considerations) or by architectural preference, routing for mechanical, electrical and plumbing (MEP) systems can be located within false ceilings, walls or floors; or in the case where the mass timber components will be left exposed for architectural effect, incorporated into the design as the designer best determines.

Building Typology

IDEAL FOR

- Multi-story Residential
- Office Buildings
- Corporate Headquarters and Campuses
- Industrial Buildings
- Large Assembly Halls

System Components

This system is made up of the following components:

A GlulamPLUS® Beams
B GlulamPLUS® Columns
C CrossLam® CLT Panels
D Steel Connectors/Fasteners (screws, caps, etc.)

All are prefabricated to provide the highest degree of accuracy and to simplify and accelerate construction on-site.
This system is a hybrid between typical light-frame (wood or steel) and mass timber construction. Commonly, only the shear walls and horizontal structure (floor and roof) are constructed using CrossLam® CLT, while the rest of the structure utilizes traditional light-frame construction principles. This system is generally used for multifamily residential structures. When off-site prefabricated wall panel systems are used, benefits of an accelerated construction schedule can be realized. This system also allows for added flexibility in floor plan design and layout.

Benefits

• The Hybrid Light-Frame System delivers improved construction cycle time over conventional light-frame systems.
• As a hybrid system, it’s also a popular transitional system for builders more familiar with traditional building techniques.
• MEP infrastructure can be installed within the wall assembly.
• CrossLam® CLT horizontal panels improve lateral (seismic and wind) capacity and design performance as compared to traditional light-frame construction.
• Downstream trades for MEP can adhere directly to the underside of CLT, accelerating installation timelines.
• Solid CLT floor plates create a fire block between levels, enhancing fire safety from traditional light-frame systems.
System Components

The Hybrid Light-Frame System is made up of the following components:

A CrossLam® CLT (floor, shaft walls or roof)
B Light-frame walls (wood or steel)

Grid Patterns

While utilizing traditional light-framing materials for walls allows for greater flexibility in vertical load transfer, designers should still consider a CLT floor panel size that is optimal to the manufacturers’ production capabilities. Standard hybrid light-frame projects vary in open spans from 3.0 m-4.3 m (10’-14’). Large spans often require a dropped beam to remain economically competitive with light-frame systems.

MEP Routing

With traditional light-framed walls, designers often choose to incorporate mechanical, electrical and plumbing (MEP) systems within walls. MEP can also be attached directly to the underside of the CLT panels, simplifying routing installation.

Building Typology

- Multifamily residential
- Conventional non-residential up to six storeys (offices, hotels, motels, dormitories)
## Mass Timber System Selection Chart

**TABLE 8: Cullamplus® Beams and Columns**

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>DESCRIPTION</th>
<th>TYPICAL OCCUPANCIES</th>
<th>TOF BUILDING STOREYS</th>
<th>MIN SPAN CLT</th>
<th>MAX SPAN CLT</th>
<th>TYPICAL PANEL THICKNESS mm (in)</th>
<th>RECOMMENDED GRID X (beams) mm (in)</th>
<th>RECOMMENDED GRID Y (purlins) mm (in)</th>
<th>FIRE RESISTANCE</th>
<th>MEP</th>
<th>ACOUSTICS</th>
<th>VALUE PROPOSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST AND PANEL</td>
<td>Supported CLT panel on glulam columns similar to a concrete slab building. Limited to CLT production sizes and panel strength limitations. Best used in encapsulated scenarios.</td>
<td>Hotel Dormitories Micro Apartments</td>
<td>6 to 18</td>
<td>2.4 m (8')</td>
<td>4.2 m (14')</td>
<td>175 (6.88)</td>
<td>245 (9.72)</td>
<td>2+ hr encapsulated</td>
<td>Requires additional floor system or dropped ceiling</td>
<td>Quick speed of installation and MEP simple layout fastening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POST-BEAM-PANEL</td>
<td>Most common and generic system similar to traditional timber frame construction augments with mass timber panel systems and modern connections for a smooth and reliable performance.</td>
<td>Office Residential</td>
<td>1 to 6</td>
<td>3.6 m (12')</td>
<td>12.1 m (20')</td>
<td>119 (5.5)</td>
<td>175 (6.88)</td>
<td>191 (7.58)</td>
<td>2+ hr encapsulated</td>
<td>Requires additional floor system or dropped ceiling</td>
<td>Mass timber kits of parts, quick install, amazing performance and aesthetics, cost competitive</td>
<td></td>
</tr>
<tr>
<td>POST, BEAM, PANEL, PANEL</td>
<td>Similar to a Post-Beam-Panel System; however, it includes an extra set of purflins to further break up the span. The system works well with large grid sizes or one-hour fire ratings and thin panels.</td>
<td>Office Residential</td>
<td>1 to 6</td>
<td>2.4 m (8')</td>
<td>4.8 m (16')</td>
<td>87 (3.43)</td>
<td>105 (4.13)</td>
<td>139 (5.5)</td>
<td>5 m (15')</td>
<td>175 (6.88)</td>
<td>191 (7.58)</td>
<td>2+ hr encapsulated</td>
</tr>
<tr>
<td>HYBRID LIGHT-FRAME CLT</td>
<td>Traditional light-frame wood walls are used with 2x4s, 2x6s or steel studs in the wall layout. CLT floor panels are placed on top of the wall stud systems in a platform framing approach. This yields significant installation time savings for the project. Downstream trades also realize a faster installation process with CLT floor plates as opposed to traditional methods.</td>
<td>Multifamily Residential</td>
<td>1 to 6</td>
<td>4 m (13')</td>
<td>5 m (15')</td>
<td>87 (3.43)</td>
<td>105 (4.13)</td>
<td>139 (5.5)</td>
<td>175 (6.88)</td>
<td>2+ hr encapsulated</td>
<td>Requires additional floor system or dropped ceiling</td>
<td>Speed of installation of higher-quality performance product, can create overall cost savings in tight labour markets</td>
</tr>
<tr>
<td>HYBRID STEEL FRAME CLT</td>
<td>Structural steel gravity and lateral frames are covered with CLT decking solutions. Not only does this greatly reduce the project’s carbon footprint, but it can also lead to beautiful aesthetic finishes and installation time savings on-site.</td>
<td>Office Public Buildings Post Disaster Status</td>
<td>1 to 18</td>
<td>2.4 m (8')</td>
<td>6 m (20')</td>
<td>87 (3.43)</td>
<td>105 (4.13)</td>
<td>139 (5.5)</td>
<td>175 (6.88)</td>
<td>191 (7.58)</td>
<td>245 (9.72)</td>
<td>2+ hr encapsulated</td>
</tr>
<tr>
<td>CLT TILT-UP</td>
<td>These projects use CLT as a simple, quick kit of parts. CLT is used for gravity load, lateral and floor plate systems. By using a one-stop supplier, the project is quickly coordinated and installed for the perfect fit on-site. These projects can quickly be designed and delivered.</td>
<td>Industrial Tilt-Up Remote Location Post Disaster Status</td>
<td>1 to 4</td>
<td>6 m (20')</td>
<td>105 (4.13)</td>
<td>139 (5.5)</td>
<td>175 (6.88)</td>
<td>191 (7.58)</td>
<td>245 (9.72)</td>
<td>2+ hr encapsulated</td>
<td>Requires additional floor system or dropped ceiling</td>
<td>Quick installation, single supplier, coordinated kit of parts easy for remote installation</td>
</tr>
<tr>
<td>BOUTIQUE BUILDING</td>
<td>Unique structures with free-form systems and dynamic components. No two parts are the same, and the architecturally exposed mass timber often results in award-winning designs.</td>
<td>Public Buildings</td>
<td>1 to 4</td>
<td>6 m (20')</td>
<td>87 (3.43)</td>
<td>105 (4.13)</td>
<td>139 (5.5)</td>
<td>175 (6.88)</td>
<td>191 (7.58)</td>
<td>245 (9.72)</td>
<td>315 (12.5)</td>
<td>2+ hr encapsulated</td>
</tr>
</tbody>
</table>

**NOTE:**
- MEP: Mechanical, Electrical, Plumbing; MEP simple installation and installation and MEP easy.
- Fire resistance: Surface Mounted MEP collides with nothing.
- Aesthetics: Competitive aesthetics, cost competitive.
Mass Timber Design Considerations

Connections
Fire Performance
Acoustic Performance
Thermal and Energy Performance
Deflection
Design Layout
Vibration Control
Mass Timber Construction Connection Details

Structurlam can supply all connecting steel components and related hardware. All notches, slots, grooves, holes and connecting details are prefabricated by Structurlam. All members are either preassembled or test-fit prior to delivery to minimize erection issues in the field and maximize the efficiency gains from Structurlam mass timber systems.

Cross Laminated Timber (CLT) Connections

CLT Panel to Panel Connecting System

TABLE 9: FACTORED LATERAL RESISTANCES FOR CLT BUTT JOINTS LOADED IN SHEAR

<table>
<thead>
<tr>
<th>LOADING</th>
<th>PANEL SERIES THICKNESS (mm)</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED RESISTANCES (N)</th>
<th>MINIMUM SPACING IN A ROW (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z1</td>
<td>105</td>
<td>VG Cyl 8 x 140</td>
<td>660</td>
<td>25</td>
</tr>
<tr>
<td>Z2</td>
<td>175</td>
<td>VG Cyl 10 x 220</td>
<td>1,720</td>
<td>32</td>
</tr>
<tr>
<td>Z3</td>
<td>175</td>
<td>VG Cyl 10 x 220</td>
<td>820</td>
<td>32</td>
</tr>
<tr>
<td>Z4</td>
<td>175</td>
<td>VG Cyl 8 x 140</td>
<td>1,160</td>
<td>40</td>
</tr>
</tbody>
</table>

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CAN/CSA-O86-19.
3. The table contains factored lateral resistances (Z) for a single ASSY fastener conforming to the connection geometry and loading conditions described.
4. Listed factored resistances are valid for dry service conditions only, where k_{sf} = 1.

Source: MTC Solutions, mtcsolutions.com

TABLE 10: FACTORED LATERAL RESISTANCES FOR CLT SURFACE SPLINE JOINTS LOADED IN SHEAR

<table>
<thead>
<tr>
<th>PANEL &amp; JOINT CONFIGURATION</th>
<th>SPLINE THICKNESS (mm)</th>
<th>PANEL SERIES THICKNESS (mm)</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED RESISTANCES (N)</th>
<th>MINIMUM SPACING IN A ROW (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z1</td>
<td>19.05</td>
<td>Eco 6 x 70</td>
<td>630</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Z2</td>
<td>105</td>
<td>Eco 8 x 90</td>
<td>1,040</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Z3</td>
<td>25.4</td>
<td>Eco 10 x 120</td>
<td>1,610</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CAN/CSA-O86-19.
3. The table contains factored lateral resistances (Z) for a single ASSY fastener conforming to the connection geometry and loading conditions described.
4. Listed factored resistances are valid for dry service conditions only, where k_{sf} = 1.
5. Fasteners are installed at a 45° angle intersecting the shear plane at half the panel thickness.
6. The angle between force and fastener axis is 90°.
7. Factored lateral resistance may be applied to parallel and perpendicular loading toward the panel joint considering grain directions and minimum end and edge distance requirements.
8. Z_{II} angle between loading direction and wood grain in the shear plane ϴ = 0°.

Source: MTC Solutions, mtcsolutions.com

Figure 8: CLT butt joint connection in shear

Figure 9: CLT spline connection in shear
DESIGN CONSIDERATIONS

REINFORCEMENT ONLY
SCREW FOR SHEAR
FULLY THREADED TIMBER

Notes:
1. Fasteners are installed at an angle intersecting the shear plane at half the panel thickness.
2. The angle between force and fastener axis is 90°.
3. Fastened lateral resistances may be applied to parallel and perpendicular loading toward the panel joint considering grain direction and minimum end and edge distance requirements.
4. Tolerance Gap = 2 mm
5. Fasteners are installed at an angle intersecting the shear plane at half the panel thickness.
6. The angle between force and fastener axis is 90°.
7. Angle between loading direction and wood grain in the shear plane

Source: MTC Solutions, mtcsolutions.com

**TABLE 11: FACTORED LATERAL RESISTANCES FOR CLT LAP JOINTS LOADED IN SHEAR**

<table>
<thead>
<tr>
<th>PANEL &amp; JOINT CONFIGURATION</th>
<th>PANEL SERIES THICKNESS (mm)</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED RESISTANCES (N)</th>
<th>MINIMUM SPACING IN A ROW (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ụ</td>
<td>Eco 6 x 80</td>
<td>610</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>Eco 8 x 100</td>
<td>970</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>Eco 6 x 80</td>
<td>300</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>Eco 8 x 100</td>
<td>350</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>Eco 8 x 100</td>
<td>480</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>139</td>
<td>Eco 6 x 120</td>
<td>870</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>175</td>
<td>Eco 6 x 160</td>
<td>1,570</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>175</td>
<td>Eco 10 x 160</td>
<td>2,110</td>
<td>40</td>
<td></td>
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</tbody>
</table>

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (Z) for a single ASSY fastener conforming to the connection geometry and loading conditions described.
4. Listed factored resistances are valid for dry service conditions only, where Z = Zm + Zs.
5. Fasteners are installed at an angle intersecting the shear plane at half the panel thickness.
6. The angle between force and fastener axis is 90°.
7. Fastened lateral resistances may be applied to parallel and perpendicular loading toward the panel joint considering grain direction and minimum end and edge distance requirements.

Source: MTC Solutions, mtcsolutions.com

**TABLE 12: FACTORED LATERAL RESISTANCES FOR CLT PANEL TO BEAM CONNECTIONS IN SHEAR**

<table>
<thead>
<tr>
<th>CLT PANEL &amp; BEAM CONFIGURATION</th>
<th>PANEL SERIES THICKNESS (mm)</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED RESISTANCES (N)</th>
<th>MINIMUM SPACING IN A ROW (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ụ</td>
<td>Eco 6 x 160</td>
<td>940</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>Eco 8 x 200</td>
<td>1,660</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td></td>
</tr>
<tr>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td></td>
</tr>
<tr>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td></td>
</tr>
<tr>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td>ụ</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (Z) for a single ASSY fastener conforming to the connection geometry and loading conditions described.
4. Listed factored resistances are valid for dry service conditions only, where Z = Zm + Zs.
5. Fasteners are installed at an angle intersecting the shear plane at half the panel thickness.
6. The angle between force and fastener axis is 90°.
7. Fastened lateral resistances may be applied to parallel and perpendicular loading toward the panel joint considering grain direction and minimum end and edge distance requirements.
8. Angle between loading direction and wood grain in the shear plane

Source: MTC Solutions, mtcsolutions.com
CLT Panel to Beam Connecting System

TABLE 12: FACTORED RESISTANCES FOR CLT PANEL TO BEAM CONNECTION INCLINED SCREWS

<table>
<thead>
<tr>
<th>BEAM TYPE (in)</th>
<th>LOADING</th>
<th>PANEL SERIES THICKNESS (mm)</th>
<th>ASSY FASTENER OPTIONS WITH INCLINED SCREWS</th>
<th>FACTORED RESISTANCES PER SCREW CROSS (N)</th>
<th>MINIMUM SPACING IN A ROW (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 3-PLY</td>
<td>Dfr (p.50)</td>
<td>87</td>
<td>VG CSK 8 x 240</td>
<td>7,780</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>105</td>
<td>VG CSK 8 x 300</td>
<td>9,710</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>105</td>
<td>VG CSK 10 x 300</td>
<td>12,100</td>
<td>143</td>
</tr>
<tr>
<td>S 5-PLY</td>
<td>Dfr (p.50)</td>
<td>87</td>
<td>VG CSK 8 x 240</td>
<td>8,650</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>105</td>
<td>VG CSK 8 x 300</td>
<td>10,220</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td></td>
<td>105</td>
<td>VG CSK 10 x 300</td>
<td>12,740</td>
<td>143</td>
</tr>
</tbody>
</table>

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (N) for 2 ASSY fasteners installed in a screw cross configuration conforming to the connection geometry and loading conditions described.
4. The angle between force and fastener axis is 45°.
5. Fasteners are installed at an angle intersecting the shear plane at the interface of the CLT panel and supporting beam.
6. The angle between force and fastener axis is 45°.
7. Factored lateral resistances only apply to parallel loading along the span direction of the glulam.
8. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-19 clause 12.6.5.2.
9. For complete data on each beam hanger system, please refer to the MTC solutions’ “Beam Hanger Design Guide,” downloadable on MTC solutions’ website.

Source: MTC Solutions, mtcsolutions.com

Figure 12: CLT panel to beam connection with inclined screws

Figure 13: Pre-engineered connectors

Figure 14: Ricon S VS

Figure 15: Megant

Figure 16: Product kit details

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (N) for 2 ASSY fasteners installed in a screw cross configuration conforming to the connection geometry and loading conditions described.
4. The angle between force and fastener axis is 45°.
5. Factored lateral resistances only apply to parallel loading along the span direction of the glulam.
6. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-19 clause 12.6.5.2.

Source: MTC Solutions, mtcsolutions.com

Figure 12: CLT panel to beam connection with inclined screws

Figure 13: Pre-engineered connectors

Figure 14: Ricon S VS

Figure 15: Megant

Figure 16: Product kit details

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (N) for 2 ASSY fasteners installed in a screw cross configuration conforming to the connection geometry and loading conditions described.
4. The angle between force and fastener axis is 45°.
5. Factored lateral resistances only apply to parallel loading along the span direction of the glulam.
6. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-19 clause 12.6.5.2.

Source: MTC Solutions, mtcsolutions.com

Figure 12: CLT panel to beam connection with inclined screws

Figure 13: Pre-engineered connectors

Figure 14: Ricon S VS

Figure 15: Megant

Figure 16: Product kit details

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (N) for 2 ASSY fasteners installed in a screw cross configuration conforming to the connection geometry and loading conditions described.
4. The angle between force and fastener axis is 45°.
5. Factored lateral resistances only apply to parallel loading along the span direction of the glulam.
6. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-19 clause 12.6.5.2.

Source: MTC Solutions, mtcsolutions.com

Figure 12: CLT panel to beam connection with inclined screws

Figure 13: Pre-engineered connectors

Figure 14: Ricon S VS

Figure 15: Megant

Figure 16: Product kit details

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (N) for 2 ASSY fasteners installed in a screw cross configuration conforming to the connection geometry and loading conditions described.
4. The angle between force and fastener axis is 45°.
5. Factored lateral resistances only apply to parallel loading along the span direction of the glulam.
6. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-19 clause 12.6.5.2.

Source: MTC Solutions, mtcsolutions.com

Figure 12: CLT panel to beam connection with inclined screws

Figure 13: Pre-engineered connectors

Figure 14: Ricon S VS

Figure 15: Megant

Figure 16: Product kit details

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (N) for 2 ASSY fasteners installed in a screw cross configuration conforming to the connection geometry and loading conditions described.
4. The angle between force and fastener axis is 45°.
5. Factored lateral resistances only apply to parallel loading along the span direction of the glulam.
6. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-19 clause 12.6.5.2.

Source: MTC Solutions, mtcsolutions.com

Figure 12: CLT panel to beam connection with inclined screws

Figure 13: Pre-engineered connectors

Figure 14: Ricon S VS

Figure 15: Megant

Figure 16: Product kit details

Notes:
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and the CSA O86:19.
3. The table contains factored lateral resistances (N) for 2 ASSY fasteners installed in a screw cross configuration conforming to the connection geometry and loading conditions described.
4. The angle between force and fastener axis is 45°.
5. Factored lateral resistances only apply to parallel loading along the span direction of the glulam.
6. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-19 clause 12.6.5.2.

Source: MTC Solutions, mtcsolutions.com
1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.

2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and CSA O86:19.

3. The table contains factored resistances for a single ASSY fastener conforming to the connection geometry and loading conditions described.

4. Listed factored resistances are valid for dry service conditions only, where $K_{sf} = 1$.

5. Factored uplift resistances ($Z_{UP}$) shall not exceed factored downward resistances load capacity ($Z_{DOWN}$) for continuous load path.

6. Factored downward resistances ($Z_{DOWN}$) apply only to parallel (gravity shear) loading.

7. Engineered Wood Products must have an Equivalent Specific Gravity (ESG) of 0.50 as per their respective evaluation reports for the loading condition shown above.

8. Adjustment for panel edge loading of CLT shall be considered, following CSA O86-14 clause 12.6.6.3

Source: MTC Solutions, mtcsolutions.com

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**TABLE 14: FACTORED RESISTANCES FOR WALL TO CLT FLOOR CONNECTION (ledger board)**

<table>
<thead>
<tr>
<th>PANEL &amp; LEDGER CONFIGURATION</th>
<th>ASSY SCREW</th>
<th>STUD TYPE</th>
<th>LEDGER THICKNESS (mm)</th>
<th>PANEL SERIES THICKNESS (mm)</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED RESISTANCES (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 MM STUD</td>
<td>Z_{UP}</td>
<td>50 mm Lumber</td>
<td>38</td>
<td>-</td>
<td>Eco 6 x 120</td>
<td>599</td>
</tr>
<tr>
<td>50 MM STUD</td>
<td>Z_{DOWN}</td>
<td>50 mm Lumber</td>
<td>38</td>
<td>87</td>
<td>Eco 6 x 200</td>
<td>1,210</td>
</tr>
</tbody>
</table>

Notes:

1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.

2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and CSA O86:19.

3. The table contains factored resistances for a single ASSY fastener conforming to the connection geometry and loading conditions described.

4. Listed factored resistances are valid for dry service conditions only, where $K_{sf} = 1$.

5. The side member is assumed as ASTM A36 grade steel or higher. In accordance with CSA O86:19, a dowel bearing strength of 400 MPa for steel is used in the yield limit equations.

6. Fasteners are installed at a 90° angle intersecting the shear plane at the interface of steel side member and CLT.

7. The angle between force and fastener axis is 90°.

8. ASSY Ecofast may be used in lieu of ASSY Kombi fasteners if proper head bearing is assured.

9. ZII Main member loaded parallel to grain ($\theta = 0^\circ$)

10. ZII Main member loaded perpendicular to grain ($\theta = 90^\circ$)

W Steel plate loaded in withdrawal.

Source: MTC Solutions, mtcsolutions.com

---

**TABLE 15: FACTORED RESISTANCES FOR CLT STEEL SIDE PLATE CONNECTIONS IN SHEAR**

<table>
<thead>
<tr>
<th>PANEL &amp; JOINT CONFIGURATION</th>
<th>LOADING</th>
<th>PANEL SERIES THICKNESS (mm)</th>
<th>STEEL THICKNESS (mm)</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED LATERAL RESISTANCES (N)</th>
<th>FACTORED WITHDRAWAL RESISTANCES (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>87 to 105</td>
<td>Z_{UP}</td>
<td>4.75</td>
<td>6.35</td>
<td>Kombi 8 x 80</td>
<td>2,205</td>
<td>3,100</td>
</tr>
<tr>
<td>87 to 105</td>
<td>Z_{DOWN}</td>
<td>4.76</td>
<td>6.35</td>
<td>Kombi 8 x 80</td>
<td>1,545</td>
<td></td>
</tr>
<tr>
<td>87 to 105</td>
<td>Z_{DOWN}</td>
<td>12.7</td>
<td>6.35</td>
<td>Kombi 8 x 80</td>
<td>12.7</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.

2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and CSA O86:19.

3. The table contains factored resistances for a single ASSY fastener conforming to the connection geometry and loading conditions described.

4. Listed factored resistances are valid for dry service conditions only, where $K_{sf} = 1$.

5. Fasteners are installed at a 90° angle intersecting the shear plane at the interface of steel side member and CLT.

6. The angle between force and fastener axis is 90°.

7. ASSY Ecofast may be used in lieu of ASSY Kombi fasteners if proper head bearing is assured.

8. ZII Main member loaded parallel to grain ($\theta = 0^\circ$)

9. ASSY Ecofast may be used in lieu of ASSY Kombi fasteners if proper head bearing is assured.

10. ZII Main member loaded perpendicular to grain ($\theta = 90^\circ$)

W Steel plate loaded in withdrawal.

Source: MTC Solutions, mtcsolutions.com
CLT Panel to Steel Connecting System

CLT PANEL WITH STEEL SIDE PLATE IN SHEAR

### DESIGN CONSIDERATIONS

#### CLT Panel to Steel Side Plate connections in Shear

**5. The side member is assumed as ASTM A36 grade steel or higher.** In accordance with CSA O86:19, 

**Source:** MTC Solutions, mtcsolutions.com

**Notes:**

1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and CSA O86:19.
3. The table contains factored lateral resistances (Z) for a single ASSY fastener conforming to the connection geometry and loading conditions described.
4. Listed factored resistances are valid for dry service conditions only, where \( K_{sf} = 1 \).
5. The side member is assumed as ASTM A36 grade steel or higher in accordance with CSA O86:19, a shear bearing strength of 400 MPa for steel is used in the yield limit equations.
6. Fasteners are installed at a 45° angle intersecting the shear plane at the interface of steel side member and CLT.
7. The angle between force and fastener axis is 45°.
8. ASSY Ecofast may be used in lieu of ASSY Kombi fasteners if proper head bearing is assured.
9. ZII Main member loaded parallel to grain (\( \theta = 90° \)).
10. ZI Main member loaded perpendicular to grain (\( \theta = 0° \)).
11. ZI Main member loaded perpendicular to grain (\( \theta = 90° \)).
12. ZII Main member loaded perpendicular to grain (\( \theta = 0° \)).
13. Steel plate loaded in withdrawal.

**TABLE 16: FACTORED RESISTANCES FOR CLT STEEL SIDE PLATE CONNECTIONS IN SHEAR**

<table>
<thead>
<tr>
<th>PANEL &amp; JOINT CONFIGURATION</th>
<th>MTC PANEL SERIES</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED LATERAL RESISTANCES (N)</th>
<th>FACTORED WITHDRAWAL RESISTANCES (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOADING</td>
<td>Panel Series Thickness (mm)</td>
<td>Steel Thickness (mm)</td>
<td>4.75</td>
<td>6.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kombi 8 x 80</td>
<td>3,241</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kombi 10 x 120</td>
<td>6,030</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kombi 12 x 120</td>
<td>7,220</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kombi 12 x 140</td>
<td>7,220</td>
</tr>
</tbody>
</table>

**TABLE 17: FACTORED LATERAL RESISTANCES FOR CLT STEEL SIDE PLATE CONNECTIONS WITH INCLINED SCREWS**

<table>
<thead>
<tr>
<th>PANEL &amp; JOINT CONFIGURATION</th>
<th>MTC PANEL SERIES</th>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED RESISTANCES (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOADING</td>
<td>Panel Series Thickness (mm)</td>
<td>Steel Thickness (mm)</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4-15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VG CSK 8 x 160</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4,069</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VG CSK 8 x 240</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8,274</td>
</tr>
</tbody>
</table>

**Notes:**

1. For complete data, please refer to the MTC Solutions’ “Mass Timber Connections Design Guide,” downloadable on MTC Solutions’ website.
2. Connections must respect the minimum spacing, edge and end distance requirements for ASSY screws in CLT and meet all relevant requirements of the “Notes to the Designer” section, as specified in the MTC Solutions’ “Mass Timber Connections Design Guide” and CSA O86:19.
3. The table contains factored lateral resistances (Z) for a single ASSY fastener conforming to the connection geometry and loading conditions described.
4. Listed factored resistances are valid for dry service conditions only, where \( K_{sf} = 1 \).
5. The side member is assumed as ASTM A36 grade steel or higher in accordance with CSA O86:19, a shear bearing strength of 400 MPa for steel is used in the yield limit equations.

**Source:** MTC Solutions, mtcsolutions.com

---

Figure 19: CLT and Steel Plate hold down connectors with Inclined Screws

<table>
<thead>
<tr>
<th>ASSY FASTENER OPTIONS</th>
<th>FACTORED RESISTANCES (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-15</td>
<td>9,182</td>
</tr>
<tr>
<td>6-20</td>
<td>10 x 240</td>
</tr>
<tr>
<td>8-240</td>
<td>VG CSK 8 x 160</td>
</tr>
<tr>
<td>9,140</td>
<td>VG CSK 10 x 240</td>
</tr>
<tr>
<td>1,452</td>
<td>8 x 140</td>
</tr>
<tr>
<td>7,759</td>
<td>8 x 240</td>
</tr>
<tr>
<td>4,069</td>
<td>4-15</td>
</tr>
<tr>
<td>4,152</td>
<td>6-20</td>
</tr>
<tr>
<td>4,069</td>
<td>6-20</td>
</tr>
<tr>
<td>9,140</td>
<td>4-15</td>
</tr>
<tr>
<td>8,274</td>
<td>6-20</td>
</tr>
<tr>
<td>7,759</td>
<td>4-15</td>
</tr>
<tr>
<td>9,182</td>
<td>6-20</td>
</tr>
</tbody>
</table>

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GlulamPLUS® Connections

Mass timber projects typically feature multiple beam-to-beam and beam-to-column connections, with connections available from Structurlam in any of four main categories, as follows:

**CUT-TO-LENGTH**
Beams and columns are provided, square-cut to length for field assembly. For a precision fit, in some cases, beams and columns may need to be undersized by 3mm (1/8") to 5mm (3/16").

**TRADITIONAL WOOD JOINERY**
Traditional, wood-to-wood joinery of mortise and tenon, dovetail and rabbet connections are available and can be provided with tight-tolerance accuracy.

**PRE-ENGINEERED CONNECTORS**
Pre-engineered connectors are a preferred and typical connector system in mass timber projects. Straightforward to specify using available design values and tables, the connectors can be factory installed and test-fit prior to delivery, ensuring smooth, time-saving installation. Pre-engineered connectors are not recommended to be installed on cambered beams due to significant installation challenges.

**CUSTOM STEEL**
In certain applications where pre-engineered connectors may not be feasible, typically as a result of irregular component shapes or geometries or where a particular aesthetic result is desired, custom steel connectors are typically used. Custom steel connectors typically fall into one of two categories:
- **Concealed**: where the performance of steel connectors is desired with the visual appearance of a wood-to-wood connection
- **Exposed**: where the visual impact of large, heavy steel connectors is part of the architectural design

Consult with your Structurlam Mass Timber Specialist for more information and cost estimates for each. For more information on GlulamPLUS® connections refer to page 53.

**SELECTION TOOL FOR BEAM HANGER SYSTEMS**
The following pre-selection table helps the designer in choosing the right beam hanger system. The table lists the allowable loads for each system based on the minimum beam width and minimum beam depth.

<table>
<thead>
<tr>
<th>MINIMUM BEAM WIDTH</th>
<th>MINIMUM BEAM DEPTH</th>
<th>FACTORED RESISTANCES (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>180</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>520</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>640</td>
<td>125</td>
</tr>
<tr>
<td>120</td>
<td>240</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>330</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>430</td>
<td>131</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>77</td>
</tr>
<tr>
<td>140</td>
<td>530</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>650</td>
<td>166</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>520</td>
<td>166</td>
</tr>
<tr>
<td></td>
<td>640</td>
<td>232</td>
</tr>
<tr>
<td></td>
<td>830</td>
<td>318</td>
</tr>
</tbody>
</table>

**Notes:**
1. Factored resistances listed are only valid for Limit State Design in Canada.
2. This table is a pre-selection tool. For complete design guidelines, please refer to the MTC Solutions’ Beam Hanger Design Guide, downloadable at mtcsolutions.com.
3. Factored resistances listed here are only valid for use in ULF standard term (B = 0.5). Please refer to each respective connector section for more values.
4. In the table:
   - Single connector factored resistance.
   - Double connectors factored resistance, the minimum beam width is larger than the listed value, refer to respective connector sections.
5. Development of loads and design of connections are the responsibility of the design professional of record.

Source: MTC Solutions, mtcsolutions.com
**Fire Performance**

Mass timber performs exceptionally well in fire events due to its slow-charring and self-insulating properties, providing effective fire protection.

Fire resistance is the ability of a material to continue to provide structural strength and resistance to heat or vapor transfer during a fire event. A fire resistance rating (FRR) refers to the time that a building component can withstand fire or heat and integrity failure. It’s important to note that requirements regarding fire safety vary depending on building occupancy type and location; therefore, the specific requirements must be confirmed when designing the system. Mass timber systems can be designed using various performance principles to meet the required criteria, including the following two methods:

**THE ENCAPSULATION METHOD**

This method encapsulates all structural mass timber components using Type X Gypsum Board and is the more conservative option between the two. Each additional board of 16 mm (5/8") gypsum board adds approximately 25 minutes of fire resistance to the timber components. Each layer of 1/2" (13 mm) gypsum board adds approximately 40 minutes of protection. This system maintains the integrity of the full load-bearing cross-section of the structural component.

**THE CHAR METHOD**

The char method allows mass timber to be directly exposed to fire. Since the timber is fully exposed, extra lumber is added during the design phase to meet the fire resistance rating (FRR). This system is designed by determining the approximate depth to which the fire would penetrate and the remaining structural strength of the member after a certain exposure time.

CrossLam® CLT and GlulamPLUS® behave as mass timber and have a predictable charring rate of approximately 0.65 mm/min (0.025")/h. The char layer, which is formed during combustion, acts as an insulating layer for the inner layers, thus protecting the structural members from a further loss of strength. The FRR of CrossLam® CLT and GlulamPLUS® is dependent on several factors, including the member depth, span, applied loading and exposure. The most vulnerable components of this type of system tend to be the steel connectors due to the rapid reduction in steel’s strength at high temperatures. To counteract this, it is required that all connectors be covered by a layer of timber or intumescent paint to protect the steel.

**FIRE RESISTANCE RATING (FRR)**

Fire Resistance Rating (FRR) performance can be designed either generically, according to the National Building Code of Canada (NBCC), or using an alternative methodology described in Annex B – Fire resistance of large cross-section wood elements of CSA 086. Extensive testing has been completed to allow either the codified generic approach or the engineering approach in CSA 086 to cover a variety of use scenarios.

Glulam beams and columns can be designed using the current 2015 NBCC. For other mass timber elements (solid sawn, glulam, structural composite lumber and CLT), they can be designed using the methodology from Annex B within CSA 086.

Reduced cross-section method of CSA 086: The Annex B methodology uses wood-engineering-based mechanics to calculate the fire resistance of wood members and will be referenced in Appendix D of the 2020 NBCC.

Execution of proprietary CAN/ULC-S101 testing that is specific to the project assemblies: Standard Methods of Fire Endurance Tests of Building Construction and Materials evaluate the duration for which CLT will contain a fire and maintain its structural integrity during exposure to fire.

For additional test documentation, visit https://www.structurlam.com/resources/testing/

**FIRE PROTECTION SYSTEMS**

A number of commercially available fire-rated joint systems for concrete can achieve the same fire test ratings when used in mass timber for up to two hours. Detailing and fire caulking need to be applied appropriately around the fire sleeve. This allows solid mass timber panels such as CrossLam® CLT to be a superior part of your fire protection system.
Acoustic Performance

When using CLT walls and floors, and in order to achieve the desired STC and IIC ratings for your building project, refer to Table 19 on page 58. These assemblies contribute to the overall sound isolation and acoustic performance of your completed building.

Sound transmission is also affected by the components in wall and floor assemblies. Airtight construction and specifically engineered connections can help mitigate flanking sound transmission, further improving acoustic performance.

ACOUSTIC DESIGN PRINCIPLES

Sound and vibration control are directly associated with the comfort of building occupants. There are several different types of sound, including airborne sound, impact sound and flanking sound that must be minimized and optimized to provide maximum comfort and livability. Reverberation sound affects sound quality in a room but not rating values.

AIRBORNE SOUND (STC RATING)

Airborne sound is transmitted by various means, including speech, televisions and stereos. These airborne waves cause the structural components to vibrate and therefore transmit sound to adjacent spaces.

Airborne Sound Mitigation:

To mitigate the intensity of airborne sound from being transmitted into adjacent building spaces, architectural outfitting can be used. Fire, thermal and acoustic insulation can be combined where appropriate for walls, doors and windows. Techniques to reduce airborne sound often include the use of dense materials, which tend to attenuate sound waves effectively, for instance:

- Floor – using acoustic mat floor underlays or dropped ceilings
- Walls – using dense wall insulation, such as rock mineral wool

IMPACT SOUND (IIC RATING)

Impact sound is a structure-borne sound transmitted through a direct impact on solid elements such as through the walls and floors of a building. Examples of impact sound in a building include footsteps, falling objects and other sounds from your upstairs neighbors.

Impact Sound Mitigation:

To reduce the transmission of impact sound between building areas, install damping materials on the impact surface such as:

- Carpet flooring
- Resilient underlay beneath flooring surface
- Suspended ceiling or raised floors

SOUND REVERBERATION

Reverberation is a longer-lasting and degrading sound caused by the reflection from surfaces inside of a building. Varied surface shapes such as fluting or soft absorbing surfaces can help change the sound quality of a room and mitigate reverberation. This should not be confused with IIC (Impact) or STC (Sound Transmission) ratings.

FLANKING SOUND (STC AND IIC RATING)

Flanking sound occurs due to the transmission of both airborne and impact sound or vibration through building components into other non-intended portions of the building via uninsulated and indirect sound paths. For example, flanking sound transmission paths include windows and doors, ducts and shared structural building components such as floor panels. Conventional flanking sound mitigation techniques commonly see a 2–5 dB increase in field STC/IIC ratings.

FLANKING SOUND MITIGATION

Flanking sound must be mitigated on a project-specific basis and is minimized using sound insulation techniques such as window placement and building component insulation developed during the design stage. A certain degree of flanking sound can typically not be avoided; however, it can be minimized through:

- Design of less direct (i.e., longer and more complex) sound transmission paths
- Prioritization of discontinuity between units and building elements (i.e., avoid using one panel for more than one living unit without adding acoustic barriers)
- The buildup of multiple layers in the structural component cross-section
- Sound encapsulation techniques to remove direct structural paths (i.e., dropped ceilings)

For more information on flanking sound transmission, refer to 2019 Canadian CLT Handbook - Chapter 9.
### TABLE 19: ACOUSTIC RATINGS FOR FLOOR AND CEILING ASSEMBLIES

<table>
<thead>
<tr>
<th>CLOTH FLOOR 5-PLY</th>
<th>BARE</th>
<th>GYPSUM BOARD CEILING</th>
<th>2 LAYERS 1.27 mm (1/2&quot;) THICK TYPE X GYPSUM BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOUND TRANSMISSION CLASS (STC)</td>
<td>Predicted ratings based on the measured ratings.</td>
<td>Measured sound transmission class ratings.</td>
<td></td>
</tr>
<tr>
<td>IMPACT INSULATION CLASS (IIC)</td>
<td>Predicted ratings based on the measured ratings.</td>
<td>Measured impact insulation class ratings.</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Predicted ratings based on the measured ratings.
- Numbers in brackets are the IIC ratings.
- Measured sound transmission class ratings.
- Measured impact insulation class ratings.

**Reference:**
- CLOTH Handbook, Chapter 8, Canada, 2010

#### Design Layout

Multi-story mass timber buildings typically require that all loading paths are vertically and uniformly aligned throughout all stories. Any walls and columns that remain aligned in the same vertical plane throughout the building can be used to brace the building. This is important to consider in all mass timber building systems described in this guide, including Post and Panel, Post-Beam-Panel and Hybrid Light-Frame. Structures with load paths that do not align will require transfer slabs and transfer beams. While possible, this approach is not cost-effective and can add complexity to the overall design. Base designs and concepts should avoid these types of design situations.

#### Vibration

Maximum floor vibrations for CLT slab elements must be carefully analyzed. Research in this area is ongoing. However, the proposed design method for controlling vibrations in CLT floors is outlined in CSA O86:19 clause A.8.5.3. Experience has shown that for panels supported on load-bearing walls, the method in the CLT Handbook generally produces well-behaving floors to typical walking excitations. Where floor panels are supported on long span beams, additional considerations should be given to the vibration performance of the entire framing system.

#### FLOOR VIBRATION CONTROL COMPARISON

Floor vibration performance depends on the application and the expectations of the user. Because of this, floor vibration should be designed accordingly. The preferred design method to controlling vibrations in CLT floors is found in CSA O86:19 - A.8.5.3 and the 2019 Canadian CLT Handbook. The chart below compares the thickness of CLT floors against concrete and at what level we are able to better control our vibration with CLT versus concrete. See table below for CrossLam® CLT floor vibration performance.

#### MEP Penetrations

Building penetrations for mechanical, electrical and plumbing (MEP) services are easier and more economical to install if their locations can be included in the design of the CLT panel. Penetrations can be cut in the factory, saving installation time and expense. MEP services not included before the manufacture of the panel can still be easily incorporated on-site using standard construction tools.

#### Thermal and Energy Performance

The material properties of mass timber help to manage the transfer of thermal energy through the building envelope by resisting air transfer, creating a highly insulated space. Due to the tight tolerances and precision of prefabrication in our state-of-the-art manufacturing facility, joints between panels and members tend to fit together tighter, resulting in the improved energy efficiency of your building. The mass in the timber mass also acts as a thermal battery, helping the structure better regulate internal environmental conditions. For more information, refer to CLT panel properties on page 70.
CrossLam® CLT

CrossLam® CLT Product Applications
Code Acceptance and Quality Assurance Standards
Adhesives
Product Characteristics and Panel Layups
Finishes and Appearance Classification
The CrossLam® CLT Series
Allowable Design and Structural Panel Properties
Load Span Tables
CrossLam® CLT

As a North American manufacturer with deep roots in wood construction, we understand building codes and the construction process. Our history is also what makes us uniquely suited to deliver solutions that serve the construction industry. So, we used our decades of heavy timber manufacturing experience to develop a revolutionary new CLT panel for the North American market.

The result of that work is CrossLam® CLT, our proprietary CLT panel built specifically for North America using native species softwood lumber, sourced from sustainably managed forests.

Significantly lighter, CrossLam® CLT is engineered to be a direct replacement for concrete and can be used for floors, walls, roofs, shear walls and diaphragms and cores and shafts. CrossLam® CLT spans in two directions with precision and accuracy, is carbon negative and opens the door to a new way to construct buildings in the 21st century.

The technical information in this guide is compiled to support you in developing designs that specify CrossLam® CLT panels. If you have questions and need help, let our qualified team of Mass Timber Specialists and technical support representatives help you specify the right solution for your project.

CrossLam® CLT Product Applications

FLOORS
CrossLam® CLT panels are ideally suited for modern floor systems because they are two-way span capable and ship site as ready-to-install components, greatly simplifying building construction and increasing job-site productivity. CrossLam® CLT products help ensure an optimized structural solution that allows you to install up to 37.16 square metres (400 square feet) per lift.

ROOFS
CrossLam® CLT panels provide overhanging eaves and span a variety of roof layouts. Their thermal properties contribute to a more efficient envelope assembly. Panels can be as thin as 87 mm (3.43") and as thick as 315 mm (12.42"), resulting in a maximum roof span of 12.19 m (40') with appropriate loading. CrossLam® CLT roofs are installed quickly, allowing projects to approach lockup and a watertight state in a short amount of time.

WALLS
CrossLam® CLT wall panels are a lighter, cost-competitive alternative to precast concrete systems. When used as a system, CrossLam® CLT wall and roof panels allow more flexibility and efficiency in building design. As vertical and horizontal load-bearing elements, CrossLam® CLT panels extend the design envelope for industrial projects and allow the use of one structural system for an entire project.

SHEAR WALLS AND DIAPHRAGMS
CrossLam® CLT panels may be used as lateral force-resisting systems for both wind and seismic loads. The Horizontal Diaphragm Design Example white paper provides a design method to determine the strength of CLT horizontal diaphragm and deflection due to lateral wind or seismic loads. See https://www.structurlam.com/wp-content/uploads/2016/10/White-paper-Rv12-June-2017.pdf.

CORES AND SHAFTS
CrossLam® CLT panel cores and shafts erect quicker and easier than comparable steel and concrete designs while still providing lateral bracing. Elevator and stair shafts can achieve two-hour fire resistance ratings.

CROSSLAM® CLT ADVANTAGES:
• North American code approved
• Superior wood fibre and appearance
• CNC fabricated to exacting tolerances
• Delivered in coordinated sequence to installation schedule
• Steel and connecting hardware included
• All required holes, daps, slots, counterbores and chamfers included
• Rigorous quality control process
• BIM modeling options
In the 2015 NBCC, CLT can be used in exterior/interior walls, floors and roofs of buildings permitted to be of combustible construction. Buildings of combustible construction can be up to six storeys for Group C (residential) and Group D (business and personal services) occupancies. See Table 21 below.

### TABLE 21: CANADIAN CODE REGULATIONS – UP TO 6 STOREYS

<table>
<thead>
<tr>
<th>CODE</th>
<th>GROUP C – ARTICLE 131.53D</th>
<th>GROUP D – ARTICLE 131.58</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING HEIGHT</td>
<td>No more than six storeys</td>
<td>No more than 18 m (6F)</td>
</tr>
<tr>
<td>MAXIMUM BUILDING AREA PER BUILDING HEIGHT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOREYS</td>
<td>BUILDING AREA</td>
<td>STOREYS</td>
</tr>
<tr>
<td>1</td>
<td>9,000 m²</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4,500 m²</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>3,000 m²</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>1,800 m²</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>1,500 m²</td>
<td>6</td>
</tr>
</tbody>
</table>

- Floor assemblies: fire separations with no less than one-hour
- Roof assemblies: no less than one-hour
- Load-bearing wall, columns and arches: rating not less than required for the supported assembly

**NOTE:** Mixed uses, such as retail stores, shops and restaurants can be located on the first two storeys of these buildings.

In the 2020 NBCC, CLT can be used in exterior/interior walls, floors and roofs of buildings permitted to be of combustible construction or new construction type called encapsulated mass timber construction (EMTC). Buildings constructed of encapsulated mass timber will be permitted to be up to 12 storeys for Group C and Group D occupancies. See Table 22 above. Manufacturers of mass timber components of cross laminated timber, certified in North America, adhere to the standards set forth as described above.

When considering product manufactured outside of North America, all offshore manufacturers need to adhere to the North American Cross Laminated Timber (CLT) standards referenced throughout this guide. Crosslam® CLT is certified to meet the requirements of the North American testing and manufacturing standards. For more information on destructive testing performance, see Table 24 below.

### TABLE 22: CANADIAN CODE REGULATIONS – UP TO 12 STOREYS

<table>
<thead>
<tr>
<th>CODE</th>
<th>GROUP C</th>
<th>GROUP D</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING HEIGHT</td>
<td>No more than 12 storeys</td>
<td>No more than 42 m (118’)</td>
</tr>
<tr>
<td>MAXIMUM BUILDING AREA PER BUILDING HEIGHT</td>
<td>6,000 m²</td>
<td>7,200 m²</td>
</tr>
<tr>
<td>EXPOSED MASS TIMBER WALLS AND CEILINGS</td>
<td>Limited area allowed</td>
<td></td>
</tr>
</tbody>
</table>

- Floor assemblies: fire separations with no less than two-hours
- Load-bearing wall, columns and arches: rating not less than required for the supported assembly

**NOTE:** Mixed uses, such as retail stores, shops and restaurants can be located on the first through third storeys of these buildings.

### DESIGN PROPERTY COMPATIBILITY

The design capacities published in ANSI/APA PRG 320-2019 were derived analytically using the Canadian lumber properties published in CSA O86 – Engineering Design in Wood. Lumber from outside of North America has different properties published in CSA O86 – Engineering Design in Wood. From outside of North America, may not be recognized by ANSI O86 and has published design values that are incompatible with those of North American lumber. As a result, the design properties for mass timber products manufactured with foreign species lumber should be carefully examined for compatibility with the North American design standards.

### Adhesives

**STRUCTURALM ADHESIVE SYSTEMS**

The manufacturing of all code approved mass timber products to produce long length lamellas requires adhesives approved for face bond lamina and end to end finger jointing. Structurlam uses adhesives specific to our manufacturing processes that are certified to North American testing and manufacturing standards.

All adhesives must conform to CSA O122 and ASTM D7247 testing methods for fire, heat and moisture and must support ANSI manufacturing standards – see Table 23 below.

### TABLE 23: ADHESIVES FOR CLT MASS TIMBER PRODUCTS

<table>
<thead>
<tr>
<th>ADHESIVE APPLICATION</th>
<th>ADHESIVE BRAND</th>
<th>ADHESIVE TYPE</th>
<th>EMISSIONS CERTIFICATION</th>
<th>ADHESIVE PERFORMANCE TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger Joint</td>
<td>Hexon Cascomel™</td>
<td>Melamine: Formaldehyde (MF)</td>
<td>LA GREENGUARD Gold</td>
<td>Heat Delamination ✔️ Moisture Durability ✔️</td>
</tr>
<tr>
<td>Crosslam CLT®</td>
<td>Henkel Locite HB 18 PURBOND</td>
<td>Polyurethane (PUR)</td>
<td>LA GREENGUARD Gold</td>
<td>✔️ ✔️</td>
</tr>
<tr>
<td>Face Bond</td>
<td>Crosslam CLT®</td>
<td>Henkel Locite HB 18 PURBOND</td>
<td>✔️ ✔️</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** As a standard procedure each test result is documented and used to certify Structurlam products prior to shipment.

### Product Quality Assured

We are proud of our ongoing certification and adherence to the North American cross laminated timber and glued laminated timber standards referenced throughout this guide. Crosslam® CLT is certified to meet the requirements of Standard for Wood Products – Structural Glued Laminated Timber and Cross Laminated Timber (CLT) as described in CSA O122 and ANSI/APA PRG 320-2019. These standards outline the quality control requirements required by CSA/ANSI and are verified by the APA – The Engineered Wood Association (www.apawood.org) through ongoing and monthly independent third party inspection visits to Structurlam's manufacturing operations. For more information on destructive performance testing, see Table 24 below.

### FIRE PERFORMANCE

The fire resistance of cross laminated timber and structural glued laminated timber is based on the certification requirements of the North American testing and manufacturing mass timber standards. These standards require rigorous adhesive heat durability testing to ensure mass timber product structural integrity under the most severe fire conditions.

### EMISSIONS

Both Henkel and Hexon adhesives used by Structurlam for manufacturing our mass timber products are certified to UL GREENGUARD Gold. GREENGUARD Gold certified products are qualified to meet UL GREENGUARD standards for low chemical emissions into indoor air during product usage. These adhesives are formulated to meet or exceed all global emissions standards.

### TABLE 24: DESTRUCTIVE PERFORMANCE TESTING

<table>
<thead>
<tr>
<th>TYPE</th>
<th>METHOD</th>
<th>TESTING TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Testing</td>
<td>Test blocks are sampled where the glue-bond lines are mechanically loaded to withstand failure</td>
<td></td>
</tr>
<tr>
<td>Cyclic – Delamination Test</td>
<td>Advanced wood aging process designed to simulate environmental trauma across 50 years of exterior service</td>
<td></td>
</tr>
<tr>
<td>End Joint Tension Testing</td>
<td>Destructive lot testing of manufactured finger joints to ensure that final products meet the prescribed strength ratings</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** A standard procedure each test result is documented and used to certify Structurlam products prior to shipment.
## CrossLam® CLT Product Characteristics

### Table 20

<table>
<thead>
<tr>
<th>MAXIMUM PANEL SIZE</th>
<th>Note: Panels with 17 mm cross layers restricted to 3,000 mm x 12,192 mm (10'-10.125&quot; x 40') due to manufacturing process</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,048 mm x 12,192 mm (10' x 40')</td>
<td></td>
</tr>
<tr>
<td>MAXIMUM THICKNESS</td>
<td>315 mm (12.42&quot;)</td>
</tr>
<tr>
<td>MINIMUM THICKNESS</td>
<td>87 mm (3.43&quot;)</td>
</tr>
<tr>
<td>PRODUCTION WIDTHS</td>
<td>2,438 mm and 3,048 mm (8' and 10')</td>
</tr>
<tr>
<td>MOISTURE CONTENT</td>
<td>12% (+/-3%) at time of manufacturing</td>
</tr>
<tr>
<td>FACE BOND GLUE SPECIFICATION</td>
<td>Henkel Loctite HB X PURBOND</td>
</tr>
<tr>
<td>FINGER JOINT GLUE SPECIFICATION</td>
<td>Hexen Cascomel® #270 Resin with Wonderbond™ Hardener 5025A</td>
</tr>
<tr>
<td>SPECIES</td>
<td>SPF, Douglas fir</td>
</tr>
<tr>
<td>LUMBER GRADES</td>
<td>SPF #2&amp;Btr, SPF MSR 2100, SPF #3, Dfir #2 &amp; Btr Square Edge</td>
</tr>
<tr>
<td>STRESS GRADES</td>
<td>V2M1.1, V2.1, E1M4, E1M5</td>
</tr>
<tr>
<td>MANUFACTURING CERTIFICATION</td>
<td>APA Product Report PR-L134</td>
</tr>
<tr>
<td>DENSITY</td>
<td>435 - 544 kg/m³ (23-34 lbs/ft³)</td>
</tr>
<tr>
<td>DIMENSIONAL STABILITY</td>
<td>Longitudinal and Transverse 0.10% per °Δ in MC, Thickness 0.1% per °Δ in MC</td>
</tr>
<tr>
<td>THERMAL CONDUCTIVITY</td>
<td>RSI Value: 0.84 per 100 mm (4&quot;)</td>
</tr>
<tr>
<td>CO₂ SEQUESTRATION</td>
<td>5.87 kN/m³ (37.4 lbs/cf) (subject to local manufacturing and distances)</td>
</tr>
</tbody>
</table>

### Table 26: Lumber Species and Thickness for CLT Panel Layups

<table>
<thead>
<tr>
<th>CrossLam® CLT SERIES</th>
<th>GRADE</th>
<th>FACE LAYERS</th>
<th>MAJOR LAYER (L)</th>
<th>MINOR LAYER (T)</th>
<th>LAYER THICKNESS (mm)</th>
<th>PANEL DEPTH (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>87 V</td>
<td>V2.1</td>
<td>SPF #2&amp;btr. Dfir</td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>87</td>
</tr>
<tr>
<td>139 V</td>
<td></td>
<td></td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>139</td>
</tr>
<tr>
<td>191 V</td>
<td></td>
<td></td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>191</td>
</tr>
<tr>
<td>243 V</td>
<td></td>
<td></td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>243</td>
</tr>
<tr>
<td>35 V</td>
<td>V2M1.1</td>
<td>SPF #2&amp;btr. Dfir</td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>105</td>
</tr>
<tr>
<td>79 V</td>
<td></td>
<td></td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>175</td>
</tr>
<tr>
<td>245 V</td>
<td></td>
<td></td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>245</td>
</tr>
<tr>
<td>315 V</td>
<td></td>
<td></td>
<td>SPF #2&amp;btr.</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>315</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CrossLam® CLT SERIES</th>
<th>GRADE</th>
<th>FACE LAYERS</th>
<th>MAJOR LAYER (L)</th>
<th>MINOR LAYER (T)</th>
<th>LAYER THICKNESS (mm)</th>
<th>PANEL DEPTH (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>87 E</td>
<td>E1M4</td>
<td>MSR 2100 1.8E SPF</td>
<td>MSR 2100 1.8E SPF</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>87</td>
</tr>
<tr>
<td>139 E</td>
<td></td>
<td></td>
<td>MSR 2100 1.8E SPF</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>139</td>
</tr>
<tr>
<td>191 E</td>
<td></td>
<td></td>
<td>MSR 2100 1.8E SPF</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>191</td>
</tr>
<tr>
<td>243 E</td>
<td></td>
<td></td>
<td>MSR 2100 1.8E SPF</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>243</td>
</tr>
<tr>
<td>315 E</td>
<td></td>
<td></td>
<td>MSR 2100 1.8E SPF</td>
<td>SPF #2&amp;btr.</td>
<td>35 17 35 35 17 35</td>
<td>315</td>
</tr>
</tbody>
</table>

### Notes
- Spandrel panels cannot be produced in any layups with 17 mm thick lamellas.
### CrossLam® CLT Finishes and Appearance Classification

**Table 27: CrossLam® CLT Finishes**

<table>
<thead>
<tr>
<th>Intended Use</th>
<th>Visual</th>
<th>Non-Visual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where one or both faces are left exposed</td>
<td>Where both faces are covered by another material</td>
<td></td>
</tr>
<tr>
<td><strong>Face Layer - V Series</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPF #2&amp;Btr Appearance Grade, Douglas Fir, Appearance Grade</td>
<td>SPF #2&amp;Btr</td>
<td></td>
</tr>
<tr>
<td><strong>Face Layer - E Series</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPF MSR 2100 Square Edge</td>
<td>SPF MSR 2100</td>
<td></td>
</tr>
<tr>
<td><strong>Sanded Face</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 grit Note: Final finishing prep work must be completed on-site, including cleaning and touch-up of panels</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**Allowable Fibre Characteristics**

<table>
<thead>
<tr>
<th>Shake and Checks</th>
<th>Visual</th>
<th>Non-Visual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Several up to 610 mm (24&quot;) long, none through</td>
<td>As per NLGA #2, SPF #2&amp;Btr</td>
<td></td>
</tr>
<tr>
<td>Stain</td>
<td>Visual</td>
<td>Non-Visual</td>
</tr>
<tr>
<td>Up to a max of 5% blue stain, heart stain allowed</td>
<td>Allowed, not limited</td>
<td></td>
</tr>
<tr>
<td>Knots</td>
<td>Visual</td>
<td>Non-Visual</td>
</tr>
<tr>
<td>Firm &amp; Tight (NLGA #2)</td>
<td>NLGA #2</td>
<td></td>
</tr>
<tr>
<td>Pitch Streaks</td>
<td>Visual</td>
<td>Non-Visual</td>
</tr>
<tr>
<td>Not limited</td>
<td>Not limited</td>
<td></td>
</tr>
<tr>
<td>Wane on Face</td>
<td>Visual</td>
<td>Non-Visual</td>
</tr>
<tr>
<td>None</td>
<td>Allowed</td>
<td></td>
</tr>
<tr>
<td>Side Pressure</td>
<td>Visual</td>
<td>Non-Visual</td>
</tr>
<tr>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

**Surface Quality**

- SPF Appearance Grade
- SPF Non-Visual - Example 1
- Douglas Fir
- SPF Non-Visual - Example 2

---

### The CrossLam® CLT Series

The V Series: Composed exclusively from #2 and BTR structural lumber.

The E Series: Contains MSR E-rated lumber for all major strength direction layers. The lumber for the E series panels does cost slightly more, but it allows a thinner panel to span further. This is more cost-effective in certain spans. However, it is important to note that E1 panels are not available with a visual grade or with a Dfir face layer. This panel is recommended for non-visual uses only.

### CrossLam® CLT Name Convention

- **Panel Series**: J-1: One Side SPF, Appearance Grade, D-1: One Side Dfir Lumber, Appearance Grade, D-2: Two Sides Dfir Lumber, Appearance Grade
- **Panel Finish**: V = V series: V2M1.1, V2.1, E = E series: E2M4, E1M5
- **Grade Indicator**: V = V series, D-2: Two Sides Dfir Lumber, Appearance Grade
- **No Label**: Non-Appearance Industrial Panel

### CrossLam® CLT Name Designations:

- EC - Elevator Core Panel
- RP - Roof Panel
- FP - Floor Panel
- WP - Wall Panel

---

#### Normal Panel Orientation

- Primary Span
- Secondary Span

#### Spandrel Panel Orientation

- (only available in 101, 175, 245 and 315 panels)
- Minor Strength Direction

---

No side pressure available and visual application not recommended.
TABLE 29: SPECIFIED STRENGTHS + MODULUS OF ELASTICITY

<table>
<thead>
<tr>
<th>CLT GRADE</th>
<th>CLT SERIES</th>
<th>MAJOR STRENGTH DIRECTION</th>
<th>MINOR STRENGTH DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1M4</td>
<td>87 V</td>
<td>V2M1.1</td>
<td>E1M4</td>
</tr>
<tr>
<td>11.8</td>
<td>4.4</td>
<td>5.1</td>
<td>11.8</td>
</tr>
<tr>
<td>9.5</td>
<td>5.5</td>
<td>5.3</td>
<td>9.5</td>
</tr>
<tr>
<td>11.9</td>
<td>5.3</td>
<td>5.3</td>
<td>11.9</td>
</tr>
<tr>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>3.3</td>
</tr>
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<tr>
<td>5.3</td>
<td>5.3</td>
<td>5.3</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Notes:
1. Values listed are based on thickness measurements and not permitted to be increased for panel thickness adjustment factor in accordance to CSA O86.
2. CLT grades are developed based on CSA O86-14 and ANSI/APA PRG 320. Please refer to specified grade layups for complete panel information.
3. Values are calculated per one metre wide section of panel.

TABLE 30: SPECIFIED STRENGTH + MODULUS OF ELASTICITY

<table>
<thead>
<tr>
<th>CLT GRADE</th>
<th>CLT SERIES</th>
<th>MAJOR STRENGTH DIRECTION</th>
<th>MINOR STRENGTH DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1M4</td>
<td>87 V</td>
<td>V2M1.1</td>
<td>E1M4</td>
</tr>
<tr>
<td>11.8</td>
<td>4.4</td>
<td>5.1</td>
<td>11.8</td>
</tr>
<tr>
<td>9.5</td>
<td>5.5</td>
<td>5.3</td>
<td>9.5</td>
</tr>
<tr>
<td>11.9</td>
<td>5.3</td>
<td>5.3</td>
<td>11.9</td>
</tr>
<tr>
<td>3.2</td>
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<td>3.2</td>
<td>3.3</td>
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<td>5.3</td>
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<td>5.3</td>
<td>5.3</td>
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<td>3.2</td>
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</tr>
<tr>
<td>5.3</td>
<td>5.3</td>
<td>5.3</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Notes:
1. Values listed are based on thickness measurements and not permitted to be increased for panel thickness adjustment factor in accordance to CSA O86.
2. CLT grades are developed based on CSA O86-14 and ANSI/APA PRG 320. Please refer to specified grade layups for complete panel information.
3. Values are calculated per one metre wide section of panel.
### TABLE 31: FLOOR SPAN TABLES WITH 50 MM CONCRETE Topping

<table>
<thead>
<tr>
<th>CROSSTALM® CIL SERIES</th>
<th>FLOOR LIVE LOAD (kPa)</th>
<th>MAXIMUM SPAN (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.9 RESIDENTIAL</td>
<td>2.4 OFFICE/CLASSROOM</td>
</tr>
<tr>
<td></td>
<td>VARIATION</td>
<td>VARIATION</td>
</tr>
<tr>
<td>87 V</td>
<td>3,240</td>
<td>3,250</td>
</tr>
<tr>
<td>87 E</td>
<td>3,470</td>
<td>3,500</td>
</tr>
<tr>
<td>105 V</td>
<td>3,750</td>
<td>3,770</td>
</tr>
<tr>
<td>105 E</td>
<td>3,960</td>
<td>3,960</td>
</tr>
<tr>
<td>119 V</td>
<td>4,480</td>
<td>4,480</td>
</tr>
<tr>
<td>119 E</td>
<td>4,780</td>
<td>4,780</td>
</tr>
<tr>
<td>175 V</td>
<td>5,150</td>
<td>5,150</td>
</tr>
<tr>
<td>175 E</td>
<td>5,580</td>
<td>5,580</td>
</tr>
<tr>
<td>191 V</td>
<td>5,970</td>
<td>5,970</td>
</tr>
<tr>
<td>191 E</td>
<td>6,430</td>
<td>6,430</td>
</tr>
<tr>
<td>245 V</td>
<td>6,680</td>
<td>6,880</td>
</tr>
<tr>
<td>245 E</td>
<td>6,640</td>
<td>6,640</td>
</tr>
<tr>
<td>243 E</td>
<td>7,070</td>
<td>7,070</td>
</tr>
<tr>
<td>315 V</td>
<td>7,620</td>
<td>7,620</td>
</tr>
<tr>
<td>315 E</td>
<td>8,160</td>
<td>8,160</td>
</tr>
</tbody>
</table>

Notes:
- V represents governing value; E represents governing value.

### TABLE 32: ROOF SPAN TABLES MAXIMUM SPAN (mm)

<table>
<thead>
<tr>
<th>CROSSTALM® CIL SERIES</th>
<th>ROOF SNOW LOAD (kPa)</th>
<th>MAXIMUM SPAN (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.1</td>
<td>1.6</td>
</tr>
<tr>
<td>87 V</td>
<td>4,250</td>
<td>4,000</td>
</tr>
<tr>
<td>87 E</td>
<td>4,600</td>
<td>4,350</td>
</tr>
<tr>
<td>105 V</td>
<td>4,950</td>
<td>4,700</td>
</tr>
<tr>
<td>105 E</td>
<td>5,350</td>
<td>5,100</td>
</tr>
<tr>
<td>119 V</td>
<td>6,250</td>
<td>6,000</td>
</tr>
<tr>
<td>119 E</td>
<td>6,750</td>
<td>6,450</td>
</tr>
<tr>
<td>175 V</td>
<td>7,150</td>
<td>6,900</td>
</tr>
<tr>
<td>175 E</td>
<td>7,500</td>
<td>7,200</td>
</tr>
<tr>
<td>179 V</td>
<td>8,100</td>
<td>7,750</td>
</tr>
<tr>
<td>191 V</td>
<td>8,700</td>
<td>8,350</td>
</tr>
<tr>
<td>245 V</td>
<td>9,400</td>
<td>9,100</td>
</tr>
<tr>
<td>245 E</td>
<td>10,150</td>
<td>9,800</td>
</tr>
<tr>
<td>243 V</td>
<td>9,800</td>
<td>9,450</td>
</tr>
<tr>
<td>243 E</td>
<td>10,500</td>
<td>10,150</td>
</tr>
<tr>
<td>315 V</td>
<td>11,350</td>
<td>11,000</td>
</tr>
<tr>
<td>315 E</td>
<td>12,150</td>
<td>11,850</td>
</tr>
</tbody>
</table>

Notes:
- V represents governing value; E represents governing value.

### Notes:
1. For span properties - see page 79. Span table assume dry service conditions.
2. The following factors were used for calculations: $k = 1.2, 1.5, 1.6, 2.0, 2.5, 3.0, 4.0$.
3. Spans show represent distances between the centers of supports and are to be used for preliminary design only.
4. Spans table above excludes panel self weight, 2.4 kPa for various topping, plus 0.35 mm moisture induced load.
5. Engineer to ensure that L/180 deflection limit is appropriate for intended use.
6. Spans are assumed to be equal for double span panels. When two spans are not equal, larger span goes for the design tabling.
7. Total panel length is limited to 12.19 m due to fabrication process.
8. ROOF SNOW LOAD corresponding to span governed by allowable bending stress, allowable shear stress or by vibration.
9. The new structural framing is assumed to provide an enhanced vibratory effect on the double spans. Values include 0.5% in snow.
10. CIL is NOT an isotropic material. Therefore the shown values must only be used for bending of panels in the longitudinal (y-z) axes.
11. For applications with deflection limits or loading different than what is included above, contact your CROSSTALM technical representative.
12. T indicates panel is strength governed and vibration control should not be used as a governing factor.
13. DOUB£ SPAN is governed by maximum panel length of 12.19 m and used max value of 6,095 or design as simple span using table values above.
### TABLE 33: CLT BEARING WALL TABLES ULTIMATE WALL AXIAL LOADS

<table>
<thead>
<tr>
<th>PANEL D (mm)</th>
<th>87 V</th>
<th>87 E</th>
<th>105 V</th>
<th>105 E</th>
<th>139 V</th>
<th>139 E</th>
<th>175 V</th>
<th>175 E</th>
<th>191 V</th>
<th>191 E</th>
<th>245 V</th>
<th>245 E</th>
<th>243 V</th>
<th>243 E</th>
<th>315 V</th>
<th>315 E</th>
</tr>
</thead>
<tbody>
<tr>
<td>L (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>394</td>
<td>662</td>
<td>450</td>
<td>767</td>
<td>702</td>
<td>1,203</td>
<td>712</td>
<td>1,227</td>
<td>949</td>
<td>1,636</td>
<td>933</td>
<td>1,612</td>
<td>1,172</td>
<td>1,203</td>
<td>1,052</td>
<td>1,779</td>
</tr>
<tr>
<td>2.5</td>
<td>307</td>
<td>508</td>
<td>388</td>
<td>655</td>
<td>633</td>
<td>1,079</td>
<td>670</td>
<td>1,150</td>
<td>894</td>
<td>1,536</td>
<td>895</td>
<td>1,544</td>
<td>1,011</td>
<td>1,034</td>
<td>1,032</td>
<td>1,718</td>
</tr>
<tr>
<td>3.0</td>
<td>213</td>
<td>382</td>
<td>326</td>
<td>544</td>
<td>561</td>
<td>947</td>
<td>547</td>
<td>976</td>
<td>858</td>
<td>1,431</td>
<td>857</td>
<td>1,476</td>
<td>1,071</td>
<td>1,071</td>
<td>1,065</td>
<td>1,839</td>
</tr>
<tr>
<td>3.5</td>
<td>175</td>
<td>283</td>
<td>268</td>
<td>443</td>
<td>487</td>
<td>816</td>
<td>578</td>
<td>983</td>
<td>775</td>
<td>1,319</td>
<td>821</td>
<td>1,410</td>
<td>1,014</td>
<td>1,019</td>
<td>1,032</td>
<td>1,779</td>
</tr>
<tr>
<td>4.0</td>
<td>132</td>
<td>212</td>
<td>218</td>
<td>356</td>
<td>417</td>
<td>692</td>
<td>528</td>
<td>894</td>
<td>711</td>
<td>1,203</td>
<td>949</td>
<td>1,636</td>
<td>933</td>
<td>1,612</td>
<td>1,172</td>
<td>2,025</td>
</tr>
<tr>
<td>4.5</td>
<td>176</td>
<td>281</td>
<td>354</td>
<td>582</td>
<td>804</td>
<td>1,086</td>
<td>741</td>
<td>1,266</td>
<td>909</td>
<td>1,547</td>
<td>964</td>
<td>1,656</td>
<td>1,101</td>
<td>1,043</td>
<td>1,065</td>
<td>1,839</td>
</tr>
<tr>
<td>5.0</td>
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<td>224</td>
<td>297</td>
<td>486</td>
<td>429</td>
<td>781</td>
<td>594</td>
<td>947</td>
<td>762</td>
<td>1,203</td>
<td>857</td>
<td>1,476</td>
<td>1,071</td>
<td>1,071</td>
<td>1,065</td>
<td>1,839</td>
</tr>
<tr>
<td>5.5</td>
<td>250</td>
<td>405</td>
<td>388</td>
<td>655</td>
<td>633</td>
<td>1,079</td>
<td>670</td>
<td>1,150</td>
<td>894</td>
<td>1,536</td>
<td>895</td>
<td>1,544</td>
<td>1,011</td>
<td>1,034</td>
<td>1,032</td>
<td>1,718</td>
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<tr>
<td>6.0</td>
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<td>338</td>
<td>319</td>
<td>558</td>
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<td>947</td>
<td>547</td>
<td>976</td>
<td>858</td>
<td>1,431</td>
<td>857</td>
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<td>176</td>
<td>283</td>
<td>268</td>
<td>443</td>
<td>487</td>
<td>816</td>
<td>578</td>
<td>983</td>
<td>775</td>
<td>1,319</td>
<td>821</td>
<td>1,410</td>
<td>1,014</td>
<td>1,019</td>
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<td>7.5</td>
<td>231</td>
<td>375</td>
<td>318</td>
<td>516</td>
<td>484</td>
<td>805</td>
<td>562</td>
<td>929</td>
<td>736</td>
<td>1,242</td>
<td>909</td>
<td>1,636</td>
<td>933</td>
<td>1,612</td>
<td>1,172</td>
<td>2,025</td>
</tr>
<tr>
<td>8.0</td>
<td>203</td>
<td>329</td>
<td>280</td>
<td>453</td>
<td>445</td>
<td>735</td>
<td>512</td>
<td>842</td>
<td>696</td>
<td>1,171</td>
<td>909</td>
<td>1,636</td>
<td>933</td>
<td>1,612</td>
<td>1,172</td>
<td>2,025</td>
</tr>
<tr>
<td>8.5</td>
<td>179</td>
<td>288</td>
<td>247</td>
<td>398</td>
<td>397</td>
<td>671</td>
<td>465</td>
<td>761</td>
<td>657</td>
<td>1,227</td>
<td>909</td>
<td>1,636</td>
<td>933</td>
<td>1,612</td>
<td>1,172</td>
<td>2,025</td>
</tr>
<tr>
<td>9.0</td>
<td>172</td>
<td>288</td>
<td>247</td>
<td>398</td>
<td>397</td>
<td>671</td>
<td>465</td>
<td>761</td>
<td>657</td>
<td>1,227</td>
<td>909</td>
<td>1,636</td>
<td>933</td>
<td>1,612</td>
<td>1,172</td>
<td>2,025</td>
</tr>
</tbody>
</table>

Notes:
1. For panel properties - see page 70.
2. Table assumes dry service conditions.
3. The following factors were used for calculations: \( k_D = 0.65 \); \( k_S = 1.0 \); \( k_T = 1.0 \); \( k_H = 1.0 \); \( k_E = 1.0 \).
4. Table values are to be used for preliminary design only.
5. Eccentricity of axial load and wind loading has not been included.
6. Axial load table assumes outer laminations to be vertical.
7. For applications with loading different that what is included above, contact your Structurlam technical representative.

### TABLE 34: IN-PLANE SHEAR LOADING

<table>
<thead>
<tr>
<th>PANEL D (mm)</th>
<th>87 V</th>
<th>87 E</th>
<th>105 V</th>
<th>105 E</th>
<th>139 V</th>
<th>139 E</th>
<th>175 V</th>
<th>175 E</th>
<th>191 V</th>
<th>191 E</th>
<th>245 V</th>
<th>245 E</th>
<th>243 V</th>
<th>243 E</th>
<th>315 V</th>
<th>315 E</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR (kN/m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. For panel properties - see page 70.
2. Table assumes dry service conditions.
3. The following factors were used for calculations: \( k_D = 0.8 \); \( k_S = 1.25 \).
4. Computed values based on “In-Plane Shear Capacity and Verification Methods” by Prof. G. Schickhofer, University of Graz.
5. Specified modulus of Strength: \( F_{V,CLT,K} = 5.0 \text{ MPa}; \ F_{T,CLT,K} = 2.5 \text{ MPa} \). Ref: “BSPhandbuch Holz-Massivbauweise in Brettsperrholz”, Technical University of Graz.
6. Minimum width of wood used in lay-up is 89 mm.
7. Values are for CrossLam® panel only, not for shear connectors.
8. Table values are to be used for preliminary design only.
9. For applications with loading different that what is included above, contact your Structurlam technical representative.
GlulamPLUS®
Beams and Columns

Code Acceptance and Quality Assurance Standards
Adhesives
Product Characteristics
Appearance Classifications
Camber Standards
Allowable Design Stress Properties
Layups Patterns
Beams and Columns

Structurlam GlulamPLUS® is manufactured using the highest-quality, sustainably harvested lumber, produced to exacting standards and finished to create North America’s most beautiful glulam beams and columns, allowing you to expose the structural elements of your building as a high-grade visual component.

Manufactured in a wide range of shapes, sizes and finish options to match the vision of your design, with options like factory-installed connections and factory-applied stain, GlulamPLUS® beams and columns stand above all others. When combined with CrossLam® CLT walls, floors and roof panels, GlulamPLUS® is a key component of beautiful, economically efficient structures.

The technical information in this guide is compiled to support you in developing designs that specify GlulamPLUS® beams and columns. If you have questions and need help, let our qualified team of Structurlam Mass Timber Specialists and technical support representatives help you specify the right solution for your project.

GLULAMPLUS® ADVANTAGES:

- North American code approved
- Range of shapes and sizes
- Superior wood fibre and appearance
- Available in sanded, high-quality finish
- Prefabricated kit of parts, CNC-fabricated to tight tolerances
- Top-notch project delivery experience
- BIM modeling options
- Shop-assembled steel connections
- Rigorous quality control process

Code-Approved to North American Standards


The NBCC permits the use of structural glued laminated timber as a structural member for combustible construction and the upcoming encapsulated mass timber construction and CSA O86 references design values, design equations and overall engineering design specification for structural glued laminated timber.

Manufacturers of glued laminated timber, certified in North America, adhere to the standards set forth as described above. When considering product manufactured outside of North America, it should be noted few offshore suppliers adhere to North American standards. As a result, when considering product supplied from producers outside of North America, it is imperative to consider more than the conversion of design stress properties. See page 12 for key considerations that are upheld in the North American standards.

DESIGN PROPERTY COMPATIBILITY

The design capacities published in CSA O112:16 were derived analytically using the lumber properties published in CSA O86:19 – Engineering design in wood. Lumber from outside of North America has different characteristics, may not be recognized in CSA O86:19 and has published design values that are incompatible with those of North American lumber. As a result, the design properties for mass timber products manufactured with foreign species lumber should be carefully examined for compatibility with the North American design standards.
Product Quality Assured

We are proud of our ongoing certification and adherence to the North American cross laminated timber and glued laminated timber standards referenced throughout this guide. GlulamPLUS® and Crosslam® CLT are certified to meet the requirements of Standard for Wood Products – Structural Glued Laminated Timber and Cross Laminated Timber (CLT) as described in CSA O122 and ANSI/APA PRG 320-2019. These standards outline the quality control requirements required by CSA and are verified by the APA – The Engineered Wood Association (www.apawood.org) through ongoing and monthly independent third-party inspection visits to Structurlam’s manufacturing operations. For more information on destructive performance testing, see Table 24 on page 65.

Further design considerations and local code approvals may be required when considering a foreign supply source, which can increase project timelines and cost. By adhering to these standards, Structurlam can assure a standard of quality to the professionals who specify our products. For more information, refer to pages 12 and 13.

Adhesives

**STRUCTURLAM ADHESIVE SYSTEMS**

The manufacturing of all code approved mass timber products to produce long length lamellas requires adhesives approved for face bond lamination and end to end finger jointing. Structurlam uses adhesives specific to our manufacturing processes that are certified to North American testing and manufacturing standards.

All adhesives must conform to CSA O122 and ASTM D7247 testing methods for fire, heat and moisture and must support ANSI manufacturing standards – see Table 35 below. The adhesive component is product thickness and depth dependent and comprises approximately 0.3% by weight of Structurlam’s mass timber building products.

**GLUE-BOND DURABILITY**

The structural integrity of mass timber components depends upon the integrity of the glue-bond between the component lumber elements. This is true for the entire service life of these mass timber components. Conditions that can impact the glue-bond integrity are exposure to elevated heat (such as a fire event) and exposure to high moisture conditions for extended periods.

**FIRE PERFORMANCE**

The fire resistance of cross laminated timber and structural glued laminated timber is based on the certification requirements of the North American testing and manufacturing mass timber standards. These standards require rigorous adhesive heat durability testing to ensure mass timber product structural integrity under the most severe fire conditions.

**EMISSIONS**

Both Henkel and Hexion adhesives used by Structurlam for manufacturing our mass timber products are certified to UL GREENGUARD Gold. GREENGUARD Gold certified products are qualified to meet UL GREENGUARD standards for low chemical emissions into indoor air during product usage. These adhesives are formulated to meet or exceed all global emissions standards.

**TABLE 35: ADHESIVES FOR GLULAM AND CLT MASS TIMBER PRODUCTS**

<table>
<thead>
<tr>
<th>ADHESIVE APPLICATION</th>
<th>ADHESIVE BRAND</th>
<th>ADHESIVE TYPE</th>
<th>EMISSIONS CERTIFICATION</th>
<th>ADHESIVE PERFORMANCE TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger Joints</td>
<td>Hexion Cascomel™</td>
<td>Melamine Formaldehyde (MF)</td>
<td>UL GREENGUARD Gold</td>
<td>✔</td>
</tr>
<tr>
<td>Face Bond</td>
<td>Hexion EcoBind™</td>
<td>Melamine Formaldehyde (MF)</td>
<td>UL GREENGUARD Gold</td>
<td>✔</td>
</tr>
</tbody>
</table>
TABLE 36: GLULAMPLUS® PRODUCT CHARACTERISTICS

<table>
<thead>
<tr>
<th>MANUFACTURING/FIBRE</th>
<th>FIBER</th>
<th>Interior Douglas fir (Pseudotsuga menziesii var. glauca). Other species available upon request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACE BOND GLUE SPECIFICATION</td>
<td>Hexeon Ecobind™, 6500, Hardener M 650Y</td>
<td></td>
</tr>
<tr>
<td>FINGER JOINT GLUE SPECIFICATION</td>
<td>Hexeon Cascomel™ 4720 Resin with Wonderbond™ Hardener 5025A</td>
<td></td>
</tr>
<tr>
<td>SFI/FSC CERTIFICATION</td>
<td>Available upon request</td>
<td></td>
</tr>
<tr>
<td>MOISTURE CONTENT</td>
<td>12% (+/-3%) at time of manufacturing, Available upon request</td>
<td></td>
</tr>
<tr>
<td>DENSITY</td>
<td>560 kg/m³ (14 lbs/ft³)</td>
<td></td>
</tr>
<tr>
<td>CERTIFICATIONS</td>
<td>CSA O122 and CSA O177</td>
<td></td>
</tr>
</tbody>
</table>

### DENSITY

- **560 kg/m³ (14 lbs/ft³)**

### MOISTURE CONTENT

- **12% (+/-3%)** at time of manufacturing, Available upon request

### CAMBER OR STRAIGHTNESS

- Tolerances for camber are applicable at the time of manufacture without allowance for dead load deflection. Up to 6.1 m (20'), the tolerance is +/- 6 mm (1/4”). Over 6.1 m (20'), the tolerance shall increase 3 mm (1/8") per each additional 6.1 m (20') or fraction thereof, but not to exceed 19 mm (3/4")

### SQUARENESS OF CROSS SECTION

- The tolerance for squareness shall be within +/- 3 mm (1/8") per 305 mm (1’) of specified depth unless a specialty shaped section is specified.

### CAMBER OR STRAIGHTNESS

- Up to 6.1 m (20’), +/- 2 mm (1/16’); Over 6.1 m (20’), +/- 2 mm (1/16’) per 6.1 m (20’) of length or fraction thereof.

### SQUARENESS OF CROSS SECTION

- The tolerance for squareness shall be within +/- 3 mm (1/8") per 305 mm (1’) of specified depth unless a specialty shaped section is specified.

### MIN MAX WIDTH

- **See page 84.**

### AVAILABLE SIZES METRIC IMPERIAL

<table>
<thead>
<tr>
<th>AVAILABLE SIZES</th>
<th>METRIC</th>
<th>IMPERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX LENGTH STANDARD</td>
<td>18.3 m</td>
<td>60'</td>
</tr>
<tr>
<td>MAX LENGTH SPECIALTY</td>
<td>33.5 m</td>
<td>110'</td>
</tr>
<tr>
<td>MAX DEPTH STANDARD</td>
<td>1,219 mm</td>
<td>48’</td>
</tr>
<tr>
<td>MAX DEPTH SPECIALTY</td>
<td>2,438 mm</td>
<td>96’</td>
</tr>
<tr>
<td>MINIMUM DEPTH</td>
<td>114 mm</td>
<td>4.5’</td>
</tr>
</tbody>
</table>

Shane Homes YMCA at Rocky Ridge, Calgary, AB, Canada

---

**Glulam Appearance Classifications**

Listed below are the CSA O122 appearance grades that glulam products must meet. At Structurlam, GlulamPLUS® exceeds visual standards set by CSA O122 (see Table 37 below). Lower-grade appearances are available by request.

### INDUSTRIAL

- Laminations may contain natural growth characteristics in specified grades of laminating stock.
- Tight knots and stain may be present on exposed surfaces.
- Sides should be surfaced true to specified dimensions.

### COMMERCIAL

- Planer misses along individual laminations should be patched with replacement stock. Exposed surfaces should be sanded smooth and free of adhesive.

### QUALITY

- Loose knots, knot holes, and voids greater than 19 mm in diameter on exposed surfaces shall be replaced by wood inserts or non-shrinking, waterproof filling material.
- Loose knots, knot holes, and voids on exposed surfaces shall be replaced by wood inserts or non-shrinking, waterproof filling material.
- Slightly broken knots, slivers, torn grain, and checks shall be filled.

---

**FINISHES**

Wood finishes are a necessary component of preserving your products. Bare wood products highlight the natural beauty of wood but may check, swell and change color over time. GlulamPLUS® beams and columns are coated with a factory-applied temporary light-bodied sealer that provides some protection to the finished surface during shipping and through the construction phase. For more on GlulamPLUS® finishes, refer to page 92.

---

**TABLE 37: GLULAMPLUS® ADDITIONAL APPEARANCE STANDARD FEATURES**

<table>
<thead>
<tr>
<th>ADDITIONAL FEATURES FOR GLULAMPLUS® BEAMS AND COLUMNS INCLUDE:</th>
<th>INDUSTRIAL</th>
<th>COMMERCIAL</th>
<th>QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All Architectural and Premium GlulamPLUS® beams and columns exposed faces surfaces are sanded smooth to 80 grit.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2. Structurlam uses epoxy putty for correcting larger voids to assure adhesion.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3. For a staggered multi piece lamination layup, a full length wood spline insert is applied on the visible face to cover gaps of the adjacent boards.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4. GlulamPLUS® beams and columns are coated with a factory-applied temporary light-bodied sealer that provides some protection to the finished surface during shipping and through the construction phase.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5. For additional information on appearance classifications, refer to CSA O122.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

---

© 2016 Canadian Standards Association. With the permission of Canadian Standards Association (operating as “CSA Group”), 178 Rexdale Blvd., Toronto, ON, M9W 1R3, material is reproduced from CSA Group standard CSA O122. All structural glued-laminated timber. This material is not the complete and official version of CSA Group on the referenced subject. It is not the complete and official version of CSA Group on the referenced subject. It is not the complete and official version of CSA Group on the referenced subject. It is not the complete and official version of CSA Group on the referenced subject. For more information, visit store.csagroup.org or call 1-800-463-6727. No further reproduction is permitted. For more information, visit store.csagroup.org or call 1-800-463-6727. No further reproduction is permitted. For more information, visit store.csagroup.org or call 1-800-463-6727. No further reproduction is permitted. For more information, visit store.csagroup.org or call 1-800-463-6727. No further reproduction is permitted.
VERTICAL SHEAR PLANE

GLULAMPLUS® STANDARD WIDTH SECTIONAL DIAGRAMS

Figure 33: Single lamination beams

Figure 34: Staggered multiple piece lamination

NOTE: All quality finished beams used for either appearance grade or with tight tolerance connections are additional undersized by 6 mm (1/4") in depth from full lamination rounding:
Dfr: 38 mm x # of lams - 6 mm
SP: 35 mm x # of lams - 6 mm

TABLE 38: FINISHED WIDTHS OF GLULAMPLUS® BEAMS

<table>
<thead>
<tr>
<th>NOMINAL SIZE</th>
<th>FINISHED WIDTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INDUSTRIAL FINISH WIDTH</td>
</tr>
<tr>
<td></td>
<td>METRIC (mm)</td>
</tr>
<tr>
<td>2x4</td>
<td>79</td>
</tr>
<tr>
<td>2x6</td>
<td>130</td>
</tr>
<tr>
<td>2x8</td>
<td>175</td>
</tr>
<tr>
<td>2x12</td>
<td>216</td>
</tr>
<tr>
<td>2x14</td>
<td>260</td>
</tr>
<tr>
<td>2x16</td>
<td>314</td>
</tr>
<tr>
<td>2x18</td>
<td>365</td>
</tr>
<tr>
<td>2x20</td>
<td>406</td>
</tr>
</tbody>
</table>

*Other widths available from Structurlam

**Sectional Diagrams:**
- **2x4**
- **2x6**
- **2x8**
- **2x10**
- **2x12**
- **2x14**
- **2x16**
- **2x18**
- **2x20**

**Figure 35:** Staggered multi-piece lamination method

**Figure 36:** Block glued multi-piece lamination method

Staggered Multiple Piece Lamination: Structurlam utilizes a staggered multiple piece lamination layup technique as described in CSA O122, in the manufacture of wide-section members for GlulamPLUS® beams and columns. Structurlam analysis concludes staggered multiple piece lamination layup as a preferred methodology as follows:

Increased Homogenization: GlulamPLUS® beams and columns constructed through the staggered multiple piece lamination technique are composed of more individual elements than through a single lamination layup practice. This increased number of elements acts to further diffuse the impact of any one element on the resulting component and creates a more homogeneous construction.

Dimensional Stability: Based upon the same principle of an increased number of elements within the component, a staggered multiple piece lamination layup reduces the dimensional tendencies of any one element and can potentially increase the overall stability of the component. This can be most prominently realized in wider, deeper sections.

Diffused Shear Planes: In contrast to the block glulam layup methodology, commonly used by foreign manufacturers where narrower single-lam components are edge-glued to produce built-up wide components, the staggered multiple piece lamination technique creates noncontiguous vertical glue-line shear planes through the components. In contrast, the block laminating technique creates a continuous vertical shear plane between the two edge-glued components.

**STAGGERED MULTIPLE PIECE LAMINATION**
- The staggered multiple piece lamination method creates a noncontiguous shear plane in the glulam member.
- This staggered layup does not rely on the glue line integrity to transfer loads through the glulam member.
- In an asymmetric loading application, the load component must transfer across the glue line in shear to allow the glulam member to act as a composite unit.

**BLOCK GLUED GLULAM**
- The block glued glulam lamination method creates a continuous vertical shear plane that relies on the glue bond line integrity to transfer loads through the glulam member.

**Figure 33:** Single lamination beams

**Figure 34:** Staggered multiple piece lamination

**Figure 35:** Staggered multi-piece lamination method

**Figure 36:** Block glued multi-piece lamination method
TABLE 39: GLULAMPLUS® CAMBER STANDARDS

Four standard levels of camber are available. Camber falling outside these standards is custom processed and will carry additional fabrication costs as arches. Standard camber carry no additional costs. Camber cannot be used with complex multi-point connections or pre-engineered tight tolerance connections. Camber should only be used when simple bucket or knife plate connections are used on each end of the beam.

<table>
<thead>
<tr>
<th>CAMBER</th>
<th>CAMBER VALUES PER BEAM LENGTH</th>
<th>Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>m (ft)</td>
</tr>
<tr>
<td>6.1 m (20')</td>
<td>11.7 mm (0.46”) 26.16 mm (1.03”) 46.5 mm (1.83”) 72.65 mm (2.86”)</td>
<td>304.6 mm (11.2”) 104.6 mm (4.12”) 142.5 mm (5.61”) 309.3 mm (11.12”)</td>
</tr>
<tr>
<td>9.14 m (30’)</td>
<td>8.4 mm (0.33”) 18.8 mm (0.74”) 33.3 mm (1.31”) 52.1 mm (2.07”)</td>
<td>208.8 mm (8.2”) 101.85 mm (4.01”) 558.7 mm (2.20”)</td>
</tr>
<tr>
<td>12.2 m (40’)</td>
<td>5.8 mm (0.23”) 13.2 mm (0.52”) 25.4 mm (1.00”) 53.3 mm (2.09”)</td>
<td>156.4 mm (6.16”) 71.4 mm (2.81”) 798.6 mm (3.15”)</td>
</tr>
<tr>
<td>15.24 m (50’)</td>
<td>4.6 mm (0.18”) 10.4 mm (0.41”) 18.5 mm (0.72”) 41.9 mm (1.66”)</td>
<td>117.8 mm (4.61”) 41.9 mm (1.66”) 571.5 mm (22.5”)</td>
</tr>
</tbody>
</table>

Recommended Camber = 1.5 times dead load deflection for roof applications
1 time dead load deflection for floor applications

Camber is NOT recommended when using tight tolerance pre-engineered connections.
They are also not recommended when using beam systems with multiple interconnections as installation becomes difficult and deflection loads can cause dynamic stresses on connections.
Continuous beam applications will not have camber applied.

GLULAMPLUS® BEAM LAYUP PATTERNS

24F-E – Balanced Beam Layup
When dealing with a beam that is supported by multiple bearings or a beam that is cantilevered over a support, then an “EX” balanced layout is typically required.

24F-EX DOUGLAS FIR

24F E DOUGLAS FIR

Figure 37: Unbalanced Layup

Figure 38: Balanced Layup

BC Passive House Factory, Pemberton, BC, Canada
### Table 41: GLULAMPLUS® Column Limit State Design Properties for GLULAMPLUS® Columns

<table>
<thead>
<tr>
<th>Dimension (mm)</th>
<th>ALL UNITS (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.048 m (10 ft)</td>
<td>16c-E 14 14 2 30.2 30.2 7 20.4 15.3 0.85 12,400 0.50</td>
</tr>
</tbody>
</table>

The values listed in Table 39 and Table 40 on pages 86 and 87 are based on dry-service condition and standard-term load conditions.

Adjustment factors to be considered include:

- $K_D$: Load Duration Factor
- $K_S$: Service Condition Factor
- $K_H$: System Factor
- $K_T$: Treatment Factor
- $K_X$: Lateral Stability Factor
- $K_C$: Skewness Factor
- $K_E$: Effective Length Factor

### Table 42: GLULAMPLUS® Column Max Axial Load Based on Loading Eccentricity

<table>
<thead>
<tr>
<th>COLUMN DIMENSIONS (m)</th>
<th>COLUMN MAX AXIAL LOAD P_MAX (KN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W X D</td>
<td></td>
</tr>
<tr>
<td>3.048 m (10 ft)</td>
<td>3.658 m (12 ft)</td>
</tr>
<tr>
<td>4.267 m (14 ft)</td>
<td>4.877 m (16 ft)</td>
</tr>
<tr>
<td>5.486 m (18 ft)</td>
<td>6.096 m (20 ft)</td>
</tr>
</tbody>
</table>

### Table 43: GLULAMPLUS® Column Max Axial Resistance Based on Concentric Loading

<table>
<thead>
<tr>
<th>COLUMN DIMENSIONS (m)</th>
<th>COLUMN AXIAL RESISTANCE P_MAX (KN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W X D</td>
<td></td>
</tr>
<tr>
<td>3.048 m (10 ft)</td>
<td>3.658 m (12 ft)</td>
</tr>
<tr>
<td>4.267 m (14 ft)</td>
<td>4.877 m (16 ft)</td>
</tr>
<tr>
<td>5.486 m (18 ft)</td>
<td>6.096 m (20 ft)</td>
</tr>
</tbody>
</table>
TABLE 44: GLULAMPLUS® BEAM ENGINEERING PROPERTIES

<table>
<thead>
<tr>
<th>WEIGHT  (kg/m)</th>
<th>SHEAR CAPACITY V (kN)</th>
<th>MOMENT CAPACITY M (kNm)</th>
<th>AREA (mm²)</th>
<th>MAX UNSUPPORTED LENGTH (mm)</th>
<th>MAX UNSUPPORTED LENGTH (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>134,000</td>
<td>142,000</td>
<td>150,000</td>
<td>158,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>48</td>
<td>64</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>68</td>
<td>84</td>
<td>100</td>
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<td></td>
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<tr>
<td>60</td>
<td>76</td>
<td>92</td>
<td>110</td>
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<td>84</td>
<td>100</td>
<td>120</td>
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<td>76</td>
<td>92</td>
<td>108</td>
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<tr>
<td>84</td>
<td>100</td>
<td>116</td>
<td>160</td>
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<td>92</td>
<td>108</td>
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</tr>
<tr>
<td>130</td>
<td>140</td>
<td>160</td>
<td>400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Assumptions and notes:

1. Unfactored bending moment.
2. Normalized shears are based on the CEE Wood Design Manual tables; actual shears are uncorrected nominal depths (±15 mm) - no preservative treatment (Y = -1). The depth properties calculated are based on a timber factor (Y = 0.85).
3. Bending moments are intended as a rough guide of flexural and bending strengths. These properties are intended for use in Fire Engineering designs.
4. The beam span for bending moment calculations is assumed to be 3/4 of the actual depth.
5. Assumed allowable factors:
   - 1.00 for strength, 1.60 for stiffness, and 1.50 for deflection.
   - 0.85 for preservative treatment (Y = -1)
   - 0.90 for a preservative treatment (Y = -1)
   - 0.90 for a preservative treatment (Y = -1)
   - 0.90 for a preservative treatment (Y = -1)

Notes:

See page 88 for notes.
Detailed pre-construction planning can help to ensure installation of our mass timber systems is easy, safe and efficient. Depending on the project site, we recommend that sufficient space be available to:

- Prepare panels for installation
- Re-sort panels according to the install sequence
- Apply treatments if required
- Install on-site hardware if required

TRUCKLOAD SEQUENCING

Truckload sequencing is a standard feature of Structurlam mass timber packages. The exact sequencing is established during the shop drawing process. To the extent possible, CrossLam® CLT panels are sequenced for delivery to be erected in place, directly from the delivering truck. In order to maintain safe shipment, some panels may be delivered out of sequence in order to properly balance the load. Please contact Structurlam to learn more about truckload sequencing.

ASSEMBLY DRAWINGS

Assembly drawings are produced using our 3D modeling software to provide instruction for fast and efficient site installation.

REFERENCES

CLT Handbook - Chapter 12, Canada, 2019.

PACKAGING

All CrossLam® CLT and GlulamPLUS® beams and columns are wrapped and protected at the factory to ensure arrival on-site in the best possible condition.

DELIVERY SEQUENCING

As part of the Structurlam Advantage to maximize economic efficiency gains with mass timber construction, Structurlam will work with the project construction team to coordinate the delivery and construction schedules. In the event temporary site storage is required, please see “Storage” for recommendations.

HANDLING

Use care and caution when lifting, ensuring consideration of weights and following all appropriate site safety procedures. Do not drag, dump or drop mass timber building components to unload from truck. Always use wide nylon or fabric straps or slings with corner protectors when lifting CrossLam® CLT and GlulamPLUS® beams and columns to prevent surface damage or crushing of edges. Do not walk across panels or handle product with soiled or oily hands, tools or connecting hardware.

RIGGING

Prior to installation, CrossLam® CLT panels and GlulamPLUS® columns and beams need to be prepared for proper lifting and hoisting. All lifting equipment, rigging and hoisting devices are to be designed by the installer’s erection engineer.

STORAGE

Store CrossLam® CLT and GlulamPLUS® beams and columns on a flat surface, raised off ground contact by 152 mm-305 mm (6”-12”) using clean, wooden blocking spaced to ensure no product deflection. Separate courses with additional blocking, ensuring blocking is vertically aligned.

Cover product with good-quality, clean tarpaulin to protect from adverse weather conditions and UV exposure. Water will stain product. Prolonged exposure to sunlight will cause “tanning” and will discolor product.

For long-term storage, cut slits in the bottom of the wrapping to allow ventilation and drainage of any entrapped moisture. Structurlam recommends retaining factory-applied wrapping on product until fully installed and building is enclosed to best protect finished surfaces.

FINISHING

Final finish coating of visually exposed CrossLam® CLT and GlulamPLUS® beams and columns is recommended and should be applied prior to introducing heat in the building. Finish sanding with 80 grit sandpaper in the direction of the wood grain is recommended prior to application of finishing product to exposed surfaces. Follow all application directions of finishing product. Finishing a small, concealed test area to ensure satisfactory end results is always recommended.

CONDITIONING

In order to minimize adverse checking and/or dimensional movement in CrossLam® CLT and GlulamPLUS® beams and columns, it is critical that product is allowed to gradually adjust to final ambient moisture and temperature conditions over a period of several weeks.

Upon building closure, adjust building temperature and relative humidity slowly, over a series of weeks, allowing mass timber components equilibrium to adjust more naturally. (Remember, room temperatures near ceilings can be several degrees warmer than at floor level.) Do not expose CrossLam® CLT and GlulamPLUS® beams and columns directly to forced air during this period.

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Structurlam’s Family of Mass Timber Building Products

CrossLam® CLT: Cross laminated timber panels used in floor, wall and roof structures
GlulamPLUS®: Glued laminated timber beam and column systems
3D BIM Models
Steel Connections
Project Management
Logistics Management

Contact us to learn more.
structurlam.com