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Introduction

We believe that Cross-Laminated Timber (CLT) will fundamentally change the way we design, manufacture and build. We also believe that CLT will become the backbone for future generations of high-performance, low carbon buildings.

Katerra’s goal is to develop world-class advanced building materials and systems, while making them both more widely available and higher quality than ever before. Katerra is uniquely qualified to be the supplier of choice to builder and developer partners due to our experience across the building value chain, from design to fabrication to construction and the quality and volume of our production capacity.

We invite you to learn more about CLT, Katerra’s approach to fabrication, and what makes our line of products unique.
Why CLT

Cross-Laminated Timber is a pre-fabricated, engineered wood building material with unique and often superior building, aesthetic, environmental and cost attributes.

Though introduced to the European market about thirty years ago, CLT is only now being adopted in North America. This expansion in usage is creating opportunities for developers, designers and builders to create structures that are sophisticated yet easily installed, rapidly assembled yet structurally sound, affordable yet attractive.

As access to high-quality CLT continues to expand in North America, we believe that it is the building material of the future and will become the product of choice across building types and geographies.
Design Benefits

Designers have enthusiastically embraced the inherent benefits of creating functional and beautiful spaces with CLT due to the following advantages:

- Potential for increased floor-to-ceiling height
- Thinner overall floor assembly comprised of fewer independent materials
- Reduced weight on footings, gravity load, and bracing requirements, due to lighter weight of CLT than concrete (a CLT wall weighs ~75% less than concrete for a similar strength level)

Beyond these functionally superior attributes, the aesthetic qualities of building with CLT are widely recognized. Exposed wood offers a natural beauty that can not be replicated with other fabricated materials. Moreover, recent studies demonstrate that simply being surrounded by wood triggers a positive effect on the brain, and leads to greater employee retention, productivity and health in work settings.

Cost

Katerra’s CLT product line is cost competitive, and in many cases, more affordable, than other building material options. Cost savings are driven by efficiency in materials production and by a reduction in manhours required to complete installation. CLT is particularly cost competitive in markets with high labor rates. Furthermore, faster build times equates to more attractive project ROI for developers, as assets can become revenue-generating on a faster timeline.

For most residential, student housing and hospitality projects of six to twelve stories, Katerra CLT will be cost neutral with concrete and steel. For commercial offices, Katerra CLT will also be competitive with concrete and steel and in some instances should generate project savings.

Residential, student housing and hospitality projects up to six stories that use only CLT floor panels may experience
a slight cost premium over traditional building materials. However, developers must consider the advantages of speed to market, brand differentiation and superior aesthetics when making the decision to use this material.

Environmental and Sustainability Impact

The environmental and sustainability advantages of building with CLT as compared with concrete and steel are derived from the inherent qualities of wood as a carbon capture material, the CLT production process and the efficiency of installation.

Material Attributes

- Wood is a renewable resource that can be regenerated through sustainable forestry
- Trees are 50% carbon by dry weight; when a tree is cut down, it sequesters carbon, and when a new tree is planted, the carbon-capture potential for that plot of land is doubled

Production Process

- The abundance of wood as a raw material in North America means that building materials need not be imported from overseas, reducing the transportation footprint generated by imported steel and concrete
- Less energy is consumed in the production of CLT than steel; by some estimates, wood production is estimated to be roughly five times more efficient than cement and roughly 20 times more efficient than steel
- Due to the close connection between design and production, there is very little waste material generated during the production process

Construction

- Less heavy machinery is required for shorter periods of time
- Given the relatively light weight of CLT, less concrete and steel is required to support the building structure – these two materials account for as much as 15% of global carbon emissions

Working with CLT offers an opportunity to develop a virtuous cycle of benefits – supporting healthy forests with responsible harvesting techniques, shrinking the environmental footprint of the building industry, while creating new jobs in rural communities.

Speed of Assembly

Logistical challenges normally associated with traditional construction are drastically minimized with just-in-time delivery made possible by the panelized CLT approach. Seamless coordination between trades has the potential to accelerate construction schedules up to 30%. This efficiency is driven by the unique qualities of CLT and the CLT planning process, which include:

- Pre-fabrication of CLT panels to meet building design and requirements
- Pre-determined logistics plans
- Coordination with the factory to load trucks in the sequence required on-site
- Pre-located pick locations to simplify and accelerate rigging in the field

Further efficiencies can be realized through effective coordination between the design team, manufacturing team and construction team, and the use of multiple cranes on the same site.

Labor Efficiency

Greater on-site efficiency is made possible by CLT’s inherent material and assembly attributes. Fewer workers are required onsite as compared with traditionally built structures – an average crew size is 15 people, as compared with 30 for a concrete build. This efficiency is driven by:

- Pre-installation of building features, including routing and passages for wiring and plumbing, waterproofing, insulation, flashing and cladding
- Simplified designs that facilitate easy installation
- Fewer panel picks due to large panel size
Construction Site Improvements

The pre-fabricated, easy-to-install nature of CLT lends itself to improvements on the construction site, including:

- Less construction site noise
- Fewer truck deliveries and less lay-down area required
- Smaller and potentially fewer cranes due to lighter weight of materials to hoist
- Reduced foot traffic onsite, due to reduced labor crews
- Decreased dependency on good weather conditions (compared to concrete)

Safety

Fewer people onsite and CLT installation sequencing lead to more effective field oversight and, therefore, fewer safety concerns. CLT crews experience fewer safety incidents for the following reasons:

- Prefabricated structural elements are safe to work above and below once installed
- Concurrent completion of walls and floors reduce incidence of falls
- Fewer power tools are required

Reduce Barriers to Entry

North America is currently experiencing a boom in CLT design and construction, driven by code revisions and increasing consumer and developer demand for mass timber building. Katerra seeks to fuel this expansion by introducing the highest quality CLT at the most efficient cost.

Developers and builders seeking to enter this market will benefit from expanded building code permissions:

- In December 2018, The International Code Council (ICC) released voting results on amendments to the 2021 International Building Code (which are already adopted in Washington State and Oregon), including:
  - **Type IV-A:** Maximum 18 stories, with gypsum wallboard on all mass timber elements
  - **Type IV-B:** Maximum 12 stories, limited-area of exposed mass timber walls and ceilings allowed
  - **Type IV-C:** Maximum nine stories, all exposed mass timber designed for a two-hour fire resistance

Beyond technical code changes, government support, public sentiment and demand for mass timber construction has spiked over the past few years. National press coverage has reported on the nearly 500 projects currently in design or construction in the US. As interest in this building material has grown, so has the ecosystem of support and service providers. Developer partners are increasingly responding to consumer and client demand for the aesthetic properties of CLT.

We welcome our developer and builder partners to engage with Katerra to optimize CLT building design and materials procurement.

CLT installation at the Postmark jobsite in Shoreline, WA.
Katerra’s unprecedented capital investment in CLT manufacturing, design, engineering and construction will dramatically accelerate the growth of mass timber markets in North America and beyond.

With the largest production capacity in the world and partnerships with leading technology, manufacturing, design, engineering and construction innovators, Katerra will supply and accelerate projects across markets, project types and geographies.
World-Class Manufacturing: Spokane Valley

CLT Factory
Katerra’s state-of-the-art, 250,000ft² mass timber manufacturing facility will scale the production of CLT in North America, driving growth across the industry. This facility optimizes core manufacturing processes in order to develop the highest quality CLT panels at the lowest possible cost by:

- Automating processes
- Integrating industry-leading technological solutions
- Operating at the highest level of standards and quality

With the ability to produce 185,000m³, which equates to 13,000,000ft² of 5-ply panels annually on a 2-shift, 5-day operation, Katerra’s Spokane Valley factory can easily scale to manufacture 1,500 master panels per month or 18,000 master panels per year. Our initial product offerings will include both 5-layer and 3-layer panels, used primarily for floors. We will quickly test and certify 7-layer and 9-layer panels including CLT shear wall panels to be used for lateral stability, providing even faster and cheaper construction. At full operation we will process the volume of lumber equivalent to 50 250,000ft² commercial office buildings per year, at a speed of 140 boards per minute running down our lines. Master panels will come out of our press with a format size of 12ft wide x 60ft long, creating the greatest possible production flexibility.

Our Spokane Valley facility will open in June, with material available for third-party sales as early the third quarter of 2019. At full operation, this will be the largest producing by volume CLT plant in the world.

Technology-First Approach
Katerra is, above all else, a technology company. This informs our approach to design, construction, and manufacturing – and this holds true for our production of CLT. Our Spokane Valley factory leverages manufacturing innovation from across industries to optimize production speed, efficiency and quality, while remaining a low cost provider.
Our technology-first approach begins with our raw materials: we will deploy advanced geometric and biometric scanning of lamstock and high capacity sorting to accelerate raw materials intake. We will use advanced panel algorithms for layup and scanning technology to assess the aesthetic attributes of each board including knot sizes, pith and wane. These innovations will result in a consistent, high-quality product.

We are setting the industry standard for tracking and monitoring of panels as they progress throughout the product lifecycle. Every piece of lamstock will have a unique set of characteristics or “DNA” that can be tracked from beginning to end, providing transparency and quality control. This data will support rigorous testing and controls to help us achieve our aggressive output goals.

Quality Products and Processes

Our commitment to quality flows throughout our sourcing and manufacturing processes, and includes:

• Strategically sourcing spruce-pine-fir (SPF) species from the inland Pacific Northwest forests known for their tight grain structure, integrity and quality
• On-site scanning, sorting, and re-drying capabilities to ensure each board in our process meets our standards
• CLT press technology that squeezes panels during the curing of the adhesive in three directions to ensure consistent, quality bond and minimal gaps between boards
• Precision CNC equipment profiles that yields products to extremely tight tolerances
• Panel finishing, including a factory-applied surface treatment that provides protection from moisture and other environmental effects during transport, storage and installation

The factory itself has been designed and built to ensure consistent quality; we have invested in extensive mechanical systems and controls to maintain heat and humidity control.

Our quality assurance and quality control processes and procedures are governed by the requirements approved by our third party approval agency, with strict process control, product testing, reporting and document control, traceability and ongoing third party audits to ensure compliance with both our quality control manual and regulatory standards. We have invested the time and resources in the tools, equipment and processes necessary to consistently deliver a best-in-class CLT product.

Sustainability and Stewardship

Katerra is committed to creating a CLT product and process that reduce the environmental impact of buildings from manufacturing to construction to day-to-day building usage. This will be achieved through a number of industry-leading approaches:

• Katerra has adopted strict internal policies to govern procurement of lamstock from well-managed forests
• By supporting an integrated end-to-end building process that takes material usage into account at the design phase, we are decreasing waste at the manufacturing and construction phases
• Precise tracking of materials through the manufacturing and delivery process eliminates waste and overproduction

Katerra will attain a Environmental Product Declaration (EPD) specific to our product line after a minimum 12 months of production in our factory has occurred. The pursuit of an EPD aligns with our core value of transparency of our materials and manufacturing process, in addition to being good stewards of healthy buildings for thriving and vibrant communities.

End-to-End Services

By integrating traditionally fragmented steps in the design-build process, Katerra’s end-to-end model offers a unique value proposition: a fully integrated building partner with robust technology systems. Add the buying power of Katerra’s materials sourcing and procurement services,
it further eliminates the need of distributors and brokers, accelerating delivery time while reducing costs. Katerra offers services to support clients throughout the CLT development process, including:

**Design**
- Full design services (SD | DD | CD)
- Evaluation of building material options

**Estimating**
- Material take off and cost estimation
- Design option analysis

**Component Design**
- Translation of design elements into pre-fabricated building components, including CLT

**Sourcing**
- Sourcing of CLT hardware and connections
- Sourcing of glulam and other related mass timber building elements

**Manufacturing**
- Supply of completed, detailed CLT members per design specifications

**Logistics**
- Delivery planning
- Loading and shipment of all CLT building components to building site

**Construction**
- Construction management and oversight over labor and trades
- CLT erection

Katerra is currently offering developer and builder clients two avenues for partnership:

- **End-to-End Building Solution:** Katerra provides design, manufacturing, and construction services to completely serve the needs of the client
- **Materials Supply:** Katerra supplies CLT and related hardware and materials, derived from detailed specifications provided by the client

To learn more about these opportunities, contact CLT@katerra.com.

**A Best-in-Class Team**

Expanding our vision of a future in which quality and efficiency align with reducing costs and affordability, from initial design, through the life of the building, Katerra has partnered with the best in the CLT industry. With their unique strengths and expertise, we believe that our shared mission to transform the way buildings and spaces come to life will revolutionize the industry.

**Michael Green Architecture (MGA)**
MGA is a strategic design partner located in Vancouver, BC which is internationally renowned for their leadership in building with advanced wood products and technologies.

**Lord Aeck Sargent (LAS)**
LAS is a respected architectural and design firm with a focus on innovation across the spectrum of architecture, landscape architecture, planning, preservation, and interiors.

**Equilibrium**
Equilibrium is a full-service, award-winning engineering firm specialized in mass timber building structures.

**Washington State University**
Washington State University’s Composite Materials and Engineering Center is a leading interdisciplinary research organization focused on innovative, practical solutions for sustainable infrastructure solutions. Katerra has installed equipment and established process parameters onsite at WSU to test and certify processes and outputs.

Through our team and our partners, Katerra brings together technology, manufacturing, and design excellence to offer more sustainable, cost effective, and elegant architecture solutions to North American and global markets.
Technical Specifications
Katerra CLT Products

Katerra is developing an entire line of CLT-related products for manufacture, organized in the graphic below. This document focuses on defining the Katerra CLT Flat Panel base product and its derivative use products, CLT Flat Roof and Floor Panel.

Each Katerra CLT product includes a variety of thicknesses and layer combinations (layups) resulting in a catalog of sizes. End users may select the layup that best meets the building product-specific structural, fire, acoustics, and environmental performance requirements.
## CLT Flat Panel Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Features</th>
<th>Actual max/min 60'-3&quot; (60ft nominal)</th>
<th>Actual max 11'-9&quot; (12ft nominal)</th>
<th>Actual min 9'-9&quot; (10ft nominal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master Panel Format Size</td>
<td>Length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Width</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. The maximum and minimum widths presented above are based on the use of 10’ and 12’ long laminations at layup and trimming the master panel to square after pressing.
2. Consult with manufacturing for custom master panel widths between the stated maximum and minimum widths.

### Illustration sketch for 2.2 now 1 (Actual size versus Nominal size)

#### Actual Size versus Nominal Size of Master Panel
(ref. Section 2.2 Master Panel Format Size)

**Maximum Master Panel**
- 12' x 60' (Normal)
- 11'-9" x 60'-3" (Actual)
- Nominal = 60'
- Squared = 60'-3"
- At layup = 60'-6"

**Minimum Master Panel**
- 10' x 60' (Normal)
- 9'-9" x 60'-3" (Actual)
- Nominal = 60'
- Squared = 60'-3"
- At layup = 60'-6"
CLT Flat Panel Characteristics Continued

<table>
<thead>
<tr>
<th>Standard Finished Panel Format Lengths and Widths Cut from Master Panel</th>
<th>Lengths</th>
<th>Widths (12ft)</th>
<th>Widths (10ft)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60'-0&quot;</td>
<td>11'-9&quot;</td>
<td>9'-9&quot;</td>
<td>1. The subdivisions presented above are symmetric. Asymmetric subdivisions can be manufactured. The designer is cautioned to subdivide master panels in ways that result in a high rate of master panel utilization.</td>
</tr>
<tr>
<td></td>
<td>30'-0&quot;</td>
<td>5'-9&quot;</td>
<td>4'-9&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20'-0&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15'-0&quot;</td>
<td></td>
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<td></td>
<td>10'-0&quot;</td>
<td></td>
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<td></td>
<td>8'-0&quot;</td>
<td></td>
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<tr>
<td></td>
<td>11'-9&quot;</td>
<td></td>
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<tr>
<td></td>
<td>5'-9&quot;</td>
<td></td>
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<tr>
<td></td>
<td>9'-9&quot;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>4'-9&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel Thickness</th>
<th>See layups in section 2.3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Laminations</th>
<th>Layers (plies)</th>
<th>Orientation</th>
<th>Thickness</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3, 5, 7, and 9</td>
<td>Adjacent layers are perpendicular</td>
<td>Post-planed - approx. 1.08 - 1.38 inch (see layups below)</td>
<td>Post-planed - approx. 5.31 inch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species / Species Group</th>
<th>All panels are comprised of a single species / species combination</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Adhesives</th>
<th>Face bonding</th>
<th>1-component polyeurethane (formaldahyde-free)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>End joints</td>
<td>2-component polyeurethane with RF curing (formaldahyde-free)</td>
</tr>
</tbody>
</table>

Examples Finished Panels Cut from a Master Panel

Master Panel

(4) Symmetric Finished Panels

Master Panel

(4) Asymmetric Finished Panels
<table>
<thead>
<tr>
<th><strong>Master Panel Tolerances</strong></th>
<th><strong>Thickness</strong></th>
<th>+/- ( \frac{1}{16} )&quot; or 2% of panel thickness, whichever is greater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>+/(-\frac{1}{8})&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+/- ( \frac{1}{16} )&quot;</td>
</tr>
<tr>
<td></td>
<td>+/(-\frac{1}{8})&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1/16&quot; max</td>
<td>(difference in length two panel face diagonals measured between corners)</td>
</tr>
<tr>
<td></td>
<td>1/16&quot; max</td>
<td>(deviation of edges from a straight line between adjacent panel corners)</td>
</tr>
</tbody>
</table>

| **Finish Panel CNC Tolerances** | Fabrication tolerances using factory CNC equipment will generally be +/- \( \frac{1}{16} \)". |

| **Moisture Content** | 12% +/- 3% |

<table>
<thead>
<tr>
<th><strong>Surface Classification</strong></th>
<th><strong>Industrial Appearance</strong></th>
<th><strong>Architectural Appearance</strong></th>
</tr>
</thead>
</table>

| **Density** | Dependent on species used (Reference the National Design Specification (NDS) for Wood Construction). |

| **Use Conditions** | Dry (Ref PRG 320 – Section 1 – Scope). |

| **Panel Orientation** | Longitudinal layers (long boards) are parallel to the long dimension of the master panel. |

| **Factory Applied Treatment** | Temporary coating for moisture and organic growth control may be applied prior to leaving the factory for delivery. |
### Floor and Roof Panel Layups

<table>
<thead>
<tr>
<th>CLT Layup Designation</th>
<th>CLT Thickness (in)</th>
<th>Lamination Thicknesses in CLT Layup (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>=</td>
</tr>
<tr>
<td>K3-0320</td>
<td>3.24</td>
<td>1.08</td>
</tr>
<tr>
<td>K3-0350</td>
<td>3.54</td>
<td>1.08</td>
</tr>
<tr>
<td>K3-0380</td>
<td>3.84</td>
<td>1.38</td>
</tr>
<tr>
<td>K3-0410</td>
<td>4.14</td>
<td>1.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-ply</td>
</tr>
<tr>
<td>K5-0540</td>
<td>5.40</td>
<td>1.08</td>
</tr>
<tr>
<td>K5-0600</td>
<td>6.00</td>
<td>1.08</td>
</tr>
<tr>
<td>K5-0630</td>
<td>6.30</td>
<td>1.38</td>
</tr>
<tr>
<td>K5-0660</td>
<td>6.60</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-ply</td>
</tr>
<tr>
<td>K7-0760</td>
<td>7.56</td>
<td>1.08</td>
</tr>
<tr>
<td>K7-0970</td>
<td>9.66</td>
<td>1.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7-ply</td>
</tr>
<tr>
<td>K9-1120</td>
<td>11.22</td>
<td>1.38</td>
</tr>
<tr>
<td>K9-1240</td>
<td>12.42</td>
<td>1.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9-ply</td>
</tr>
</tbody>
</table>

**Note:**
1. Layup Availability
   - Estimate for release Q2 2019
   - Estimated for release Q3 2019
   - Estimated for release Q4 2019
2. “=” indicates laminates are parallel to the longitudinal axis of the panel,
3. “⊥” indicates laminates are perpendicular to the longitudinal axis of the panel,
4. “CLT Layup” is classified as a “CLT-Grade” in the PRG-320 standard
5. See appendix for associated structural design values for each CLT layup designation