

# Katerra CLT Product Definition

Updated July 2020



# Table of Contents

---

## Introduction

### 1. Katterra CLT Overview

- 1.1 Katterra CLT Definition
- 1.2 Katterra CLT Products

### 2. Katterra CLT Product Definition

- 2.1 CLT Flat Panel Applications
- 2.2 CLT Flat Panel Characteristics
- 2.3 CLT Flat Panel Layups
- 2.4 Appearance Classifications
- 2.5 Design and Mechanical Properties of Laminations
- 2.6 Fire Performance
- 2.7 Acoustic Performance
- 2.8 Thermal Performance
- 2.9 Water Vapor Transmission of Bare CLT
- 2.10 Environmental Certification
- 2.11 Typical Panel-to-Panel Connection Configurations

### 3. Katterra CLT Design Values

# Introduction

---

This document defines Katterra's cross-laminated timber (CLT) product line for use in commercial building projects in the United States and Canada. The document is intended for use by representatives of architecture, building engineering, and construction to properly design, specify, and construct buildings using Katterra CLT. The definition herein represents the product line currently available from the Katterra CLT Factory in Spokane Valley, WA.

# 1. Katterra CLT Overview

---

Katterra has built a world-class mass timber operation, spanning research, architecture, engineering, sourcing, manufacturing, logistics, and construction.

We control and optimize the entire building process, taking a technology-first approach and investing in R&D and continuous innovation at each step of the value chain. Katterra's team includes globally recognized leaders and best-in-class partners, and our production capacity and service capabilities are unmatched. The result is a portfolio of CLT structural products, assemblies, and solutions for full building systems that will continue to expand and add value over time.

## 1.1 Katerra CLT Definition

---

Katerra CLT is a premanufactured, prefabricated, engineered solid wood building material composed of Katerra-specified lumber (aka laminations) stacked crosswise at 90-degree angles in multiple layers (aka plies) and bonded together under high pressure using structural adhesives.

The large format size, cross-layer makeup, and high strength-to-weight ratio position Katerra CLT as a natural, high-performance substitute for conventional concrete, masonry, and steel, as well as wood truss and joist floors.

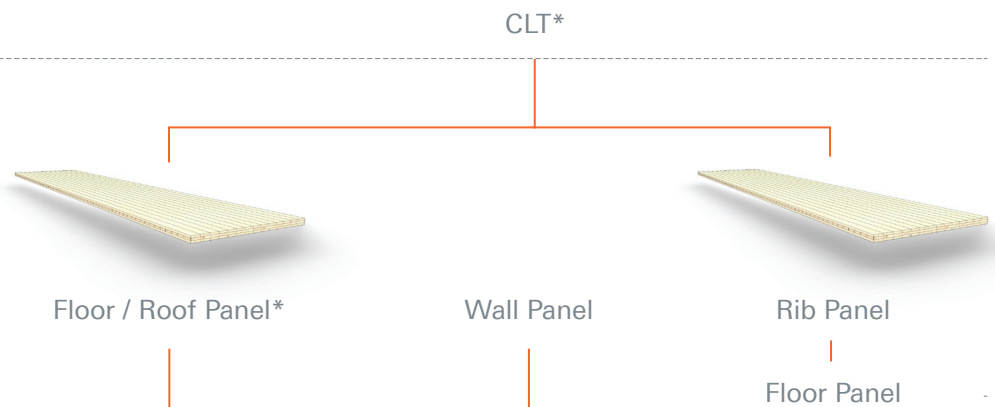
Produced at Katerra's Spokane Valley factory, Katerra CLT is manufactured and tested for its intended use in compliance with the 2018 International Building Code (IBC) and all relevant reference standards including ANSI/APA PRG 320 (2019) for ready use in the United States. Our product is also certified for use in Canada to meet the requirements of CSA O86 (2019).

## 1.2 Katerra CLT Products

Katerra offers a line of CLT and 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’s product-specific structural, fire, acoustics, and environmental performance requirements.

### Base Products



### Use Products

Acoustically Tested Floor Assembly  
Fire-Rated Floor and Roof Assemblies

Bearing  
or Shear Wall

### Finish Products

\*Defined in this document

## 2. Katterra CLT Product Definition

---

Katterra CLT Flat Panels offer maximum nominal dimensions of 12 ft width by 60 ft length and 9-ply, 12.4 in thickness. CLT Flat Panels are primarily intended for use as the structural substrate for floor and roof assemblies, but they are also suited for bearing or shear walls in the appropriate code-compliant application.

Further definition of our product is provided in our 3rd party product research reports:

US: [PFS-TECO RR0126](#)

Canada: [PFS-TECO RR0126-CAN](#)



## 2.1 CLT Flat Panel Applications

---

The Katterra CLT Flat panel is primarily intended for one-way slab span behavior in the panels strong direction for out-of-plane loads and acts as the floor/roof diaphragm without the addition of plywood sheathing. The bottom side of suitably-sized floor panels may be visually exposed to achieve a 1- or 2-hour fire resistance rating through charring of the wood.

The width of laminations (boards) in outer visible layers and inner layers of panels are nominally 6 in. Architectural and Industrial Appearance surface classifications are available, where Architectural Appearance surface classification may be specified on one, both, or neither of the broad surfaces of the panel. Our CLT is compatible with a number of different surface treatments (i.e., painted, stained, sealed, etc.), which should be evaluated on a project-by-project basis.

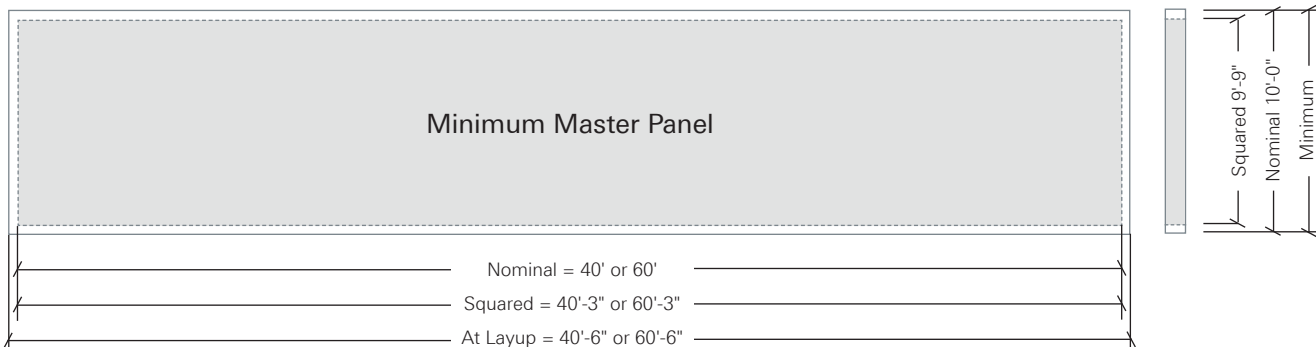
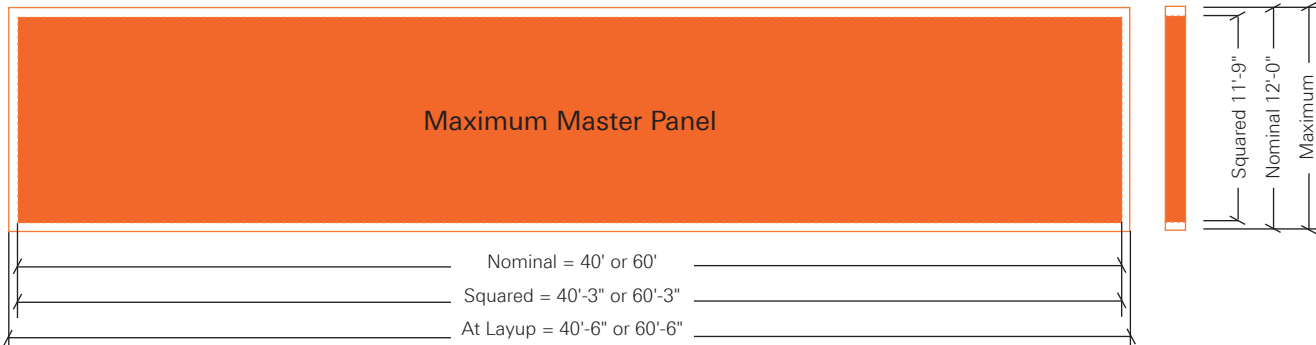
Longitudinal boards are end jointed (finger-jointed) at random lengths to create continuous boards from which the master panel is laid up. End joints are cut parallel to the wide face of laminations, thus the fingers will be visible on the narrow face of boards. Transverse boards are continuous and do not contain finger joints.

Finished panels are accurately fabricated from full master panels to the user-specified size, shape, and level of detail by state-of-the-art CNC machines to provide precise field fit. Section 2.10 presents a summary of representative subtractive fabrication capabilities in the factory for edge connections. Consult with Katterra on a project basis to review the manufacturability of the proposed CLT panelization, holes, and edge cut fabrication at early design stages.

## 2.2 CLT Flat Panel Characteristics

Characteristics	Features	
Master Panel Format Size	Length Width	Actual max/min 60'-3" (60 ft nominal) or 40'-3" (40 ft nominal)  Actual max 11'-9" (12 ft nominal)  Actual min 9'-9" (10 ft nominal)  Notes: 1. The maximum and minimum widths presented above are based on the use of 10 ft and 12 ft long laminations at layup and trimming the master panel to square after pressing.  2. Consult with Katerra for custom master panel widths and lengths between the stated maximum and minimum stated.

### Actual Size versus Nominal Size of Master Panel



## 2.2 CLT Flat Panel Characteristics (Continued)

Standard Finished Panel Format Lengths and Widths Cut from Master Panel	Lengths	60'-0" 40'-0" 30'-0" 20'-0" 15'-0" 10'-0" 8'-0"	Notes:  1. The subdivisions presented at left 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.  2. Selection of finished panel width and length to be informed by logistics, erection, design, etc.
	Widths (12 ft)	11'-9" 5'-9"	
	Widths (10 ft)	9'-9" 4'-9"	
Panel Thickness	(See layups in Section 2.3)		
Laminations	Layers (plies) Orientation Thickness Width	3, 5, 7, and 9 Adjacent layers are perpendicular Post-planed: approx. 1.08–1.38 in (see layups below) Post-planed: approx. 5.25 in	
Species / Species Combination	Spruce-Pine-Fir (SPF) and Douglas-fir Larch (DF-L). Contact Katterra for additional information.		
Adhesives	Face bonding End joints	1-component polyurethane (formaldehyde-free) 2-component melamine formaldehyde with RF curing	

### Examples of Finished Panels Cut from a Master Panel



Master Panel



Master Panel



4-Symmetric Finished Panels







4-Asymmetric Finished Panels

## 2.2 CLT Flat Panel Characteristics (Continued)

Master Panel Tolerances at the Time of Manufacturing	Thickness	+/- 1/16" or 2% of panel thickness, whichever is greater	
	Width	+/- 1/8"	
	Length	+/- 1/8"	
	Squareness	1/8" max – (difference in length two panel face diagonals measured between corners)	
	Straightness	1/8" max – (deviation of edges from a straight line between adjacent panel corners)	
Finish Panel CNC Tolerances	Fabrication tolerances using factory CNC equipment will generally be +/- 3/32"		
Moisture Content	12% +/- 3% (at the time of manufacture)		
Surface Classification Options	Industrial Appearance (IA)	Architectural Appearance (AA)	
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 layup (LL) and Transverse layup (TL) panels are available in the 3- and 5-ply while our 7- and 9-ply are LL only. Contact Katterra for more information related to TL panels.		
Edge Sealer	Upon request panel edges and cutouts with exposed lamination end grain can be coated with a clear factory applied end-grain sealer.		
Design Values	Refer to Section 3 and 3rd Party Katterra CLT Research Reports 0126 and 0126CAN.		

## 2.3 CLT Flat Panel Layups

	CLT Layup Designation	CLT Thickness (in)	Lamination Thicknesses in CLT Layup (in)								
			=	⊥	=	⊥	=	⊥	=	⊥	=
3-ply 	K3-0320	3.24	1.08	1.08	1.08						
	K3-0350	3.54	1.08	1.38	1.08						
	K3-0380	3.84	1.38	1.08	1.38						
	K3-0410	4.14	1.38	1.38	1.38						
5-ply 	K5-0540	5.40	1.08	1.08	1.08	1.08	1.08				
	K5-0600	6.00	1.08	1.38	1.08	1.38	1.08				
	K5-0630	6.30	1.38	1.08	1.38	1.08	1.38				
	K5-0690	6.90	1.38	1.38	1.38	1.38	1.38				
7-ply 	K7-0970	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38		
9-ply 	K9-1120	11.22	1.38	1.08	1.38	1.08	1.38	1.08	1.38		
	K9-1240	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38

Layup Availability:   Estimated for release Q3 2020

## 2.4 Appearance Classifications

Katerra produces two appearance classifications for its CLT floor/roof product line to achieve the project's visual appearance requirements. An Architectural Appearance (AA) surface classification may be specified for the broad faces of a panel on a single face, both faces, or no faces. Unless otherwise specified, the top side of all Katerra CLT floor/roof panels have an Industrial Appearance (IA) classification, and the bottom side of all panels have an Architectural Appearance (AA), where top side is defined by the orientation of the panel as installed in the field. The following table presents the visual characteristics of each surface classification.<sup>1,2</sup>

Characteristic	Industrial Appearance (IA)	Architectural Appearance (AA)
Surface finish	Sanded, 80-100 grit	Sanded, 80-100 grit
Color and texture	Not specified	Well-balanced color and texture
Blue/Brown stain	Permitted	Up to 5% of area max permitted
Knots (i.e., intergrown, spike, loose)	At edge: 1-7/8" max dia At centerline: 2-7/8" max dia	At edge: 1-7/8" max dia At centerline: 2-7/8" max dia
Knot holes	1-1/2" max dia	At centerline: 1" max dia
Resin (Pitch) pockets	Permitted	3/4" max dia.
Pith	Permitted	Occasionally permitted, 3/8" x 3" max, or the equivalent in square inches
Bark ingrowth	Permitted	Occasional pith up to a length of 36" permitted
Wane	1/3 the thickness and 1/3 the width full length, or equivalent on each face, provided wane does not exceed 2/3 the thickness or 1/2 the width for up to 1/4 the length.	Not permitted
Compression wood	Permitted	Permitted

## 2.4 Appearance Classifications (Continued)

Characteristic	Industrial Appearance (IA)	Architectural Appearance (AA)
Insect damage	Occasionally permitted	Not permitted
Decay (unsound wood)	Honeycomb or peck are limited to $\frac{1}{6}$ the width. Any other unsound wood is limited to a spot $\frac{1}{12}$ the width and 2" in length or smaller.	Not permitted
Wood shake, splits, checks (at manufactured MC reference)	Permitted	Occasional surface cracks permitted, occasional end shakes, up to 2" length
Sapwood	Permitted	Permitted
Edge joint gaps	Less than $\frac{1}{8}$ "	Less than $\frac{1}{16}$ "

<sup>1</sup> The specified surface qualities are only valid for the outer layer(s) at the time of manufacturing, and therefore are not applicable to the end grain (narrow faces) of the panel.

<sup>2</sup> Like all wood products, the above stated qualities are at the time of manufacturing and subject to crack and joint formation as a result of normal drying to the equilibrium moisture content of the location and conditions wherein the product is finally installed. Refer to the Katterra CLT Product Care Manual for recommendations for protection during transportation, site storage, and installation.

## 2.5 Design and Mechanical Properties of Laminations<sup>1</sup>

CLT Grade <sup>2</sup>		V2 (SPF)	
Orientation	—	Longitudinal layers	Transverse layers
Species	—	SPF <sup>3</sup>	SPF <sup>3</sup>
Stress classes	Visually graded <sup>2</sup>	No. 2 or Better	No. 3 or Better
Specific gravity	SG	0.42	0.42
Bending at extreme fiber	Fb (psi)	875	500
Shear parallel to grain	Fv (psi)	135	135
Rolling shear	Fs (psi)	45	45
Compression parallel to grain	Fc (psi)	1,150	650
Compression perpendicular to grain	Fcp (psi)	425	425
Tension parallel to grain	Ft (psi)	450	250
Modulus of elasticity	E (psi)	1,400,000	1,200,000

<sup>1</sup> All values are NDS Reference Design Values and minimum requirements for Katerra CLT

<sup>2</sup> Visual grading rules as established by National Lumber Grades Authority (NLGA).

<sup>3</sup> Species combination Spruce-Pine-Fir (SPF)

## 2.6 Fire Performance

Characteristic	Standard	Value <sup>1</sup>
Fire resistance rating	ASTM E119	Floor and Roof 1-hr, Floor 2-hr
Char rate	—	1.3 in/hr <sup>2</sup>
Spread of flame and smoke index rating	ASTM E84	Class B
Through-penetration fire stopping	ASTM E814	1- and 2-hour

<sup>1</sup> CLT product has been tested per the reference standards in third-party accredited laboratories. Consult Katerra for specific products tested and performance requirements that have been met.

<sup>2</sup> Average one dimensional char rate substantiated through ASTM E119 testing. Contact Katerra for additional information.



## 2.7 Acoustic Performance of Bare CLT<sup>1</sup>

Characteristic	Standard	Value
Airborne Sound Transmission Class (STC)	ASTM E90	K5-0540: STC = 41
Impact Insulation Class (IIC)	ASTM E492	K5-0540: IIC = 27

<sup>1</sup> CLT may need to be integrated into an assembly with supplemental materials to achieve desired acoustic performance.

<sup>2</sup> CLT product has been tested per the reference standards in third-party accredited laboratories. Consult Kattera for specific products tested and performance requirements that have been met.

## 2.8 Thermal Performance

Characteristic	Standard	Value
Thermal conductivity (U)	TBD	TBD
Thermal resistance (R)	TBD	TBD
Airtightness	TBD	TBD

## 2.9 Water Vapor Transmission of Bare CLT

Characteristic	Standard	Value
Permeance, desiccant method	ASTM E96, Dry Cup	TBD
Permeance, water method	ASTM E96, Wet Cup	TBD

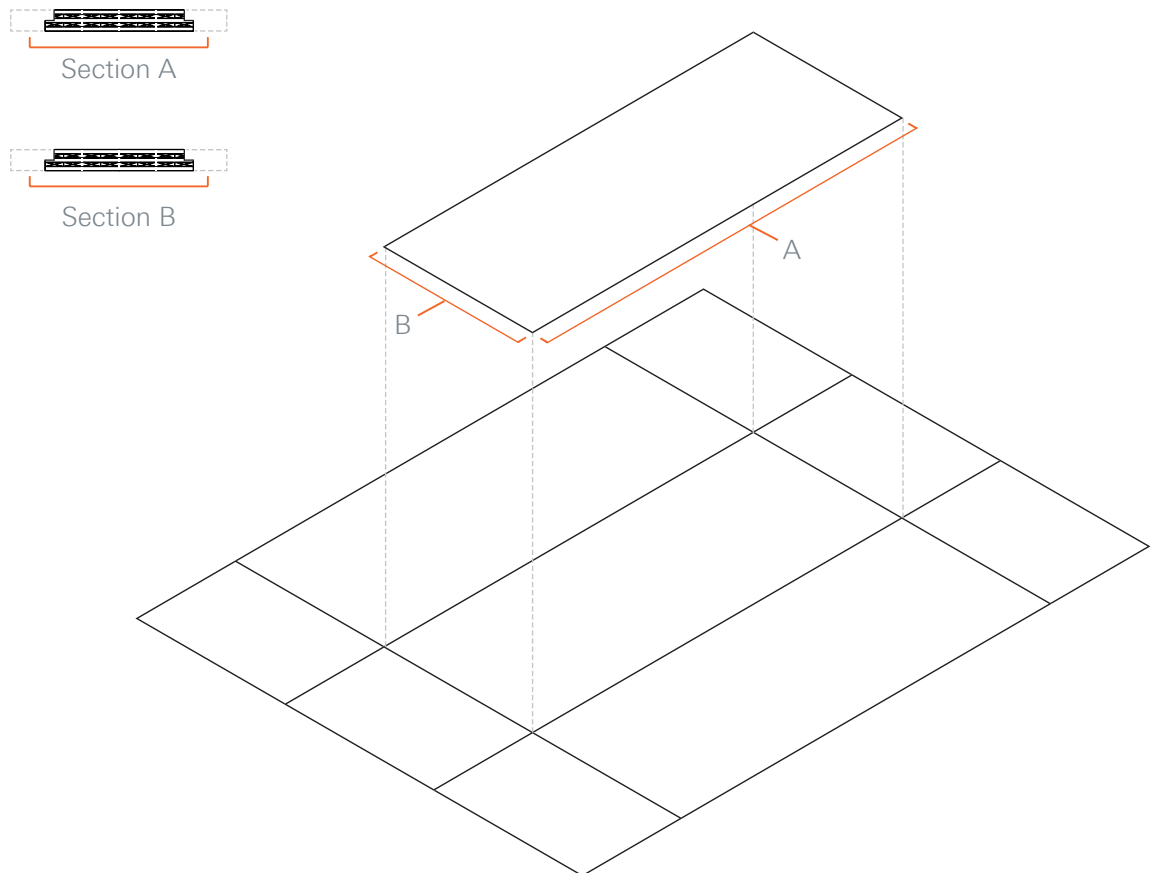
## 2.10 Environmental Certifications

Agency	Standard
International Living Future Institute	Declare Label - Red List Approved
SFI, FSC, PEFC	Factory Chain of Custody <sup>1</sup>

<sup>1</sup> Chain of custody certification provided upon project request for the forest stewardship program specified.

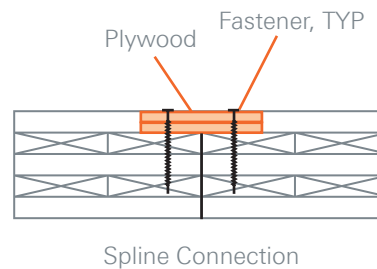
## 2.11 Typical Panel-to-Panel Connection Configurations

Katerra has the capabilities to pre-fabricate CLT Flat Panels for quick and accurate onsite installation using state-of-the-art CNC equipment located in its Spokane Valley manufacturing facility. Used as floor or roof panels, we recommend the following panel-to-panel connections configurations to ensure strength, stiffness, fire, vibration, and acoustic performance requirements of the application are met.



Note:

1. Sketches are not to scale.
2. The detailed specifics and design of the connections is subject to coordination and may vary depending on the application.



# 3. Kattera CLT Design Values

---

Table 1:

Allowable Design Properties for Lumber Laminations Used in Katerra CLT											
Major Strength Direction						Minor Strength Direction					
$f_{b,0}$ (psi)	E(10 <sup>6</sup> psi)	$f_{t,0}$ (psi)	$f_{c,0}$ (psi)	$f_{v,0}$ (psi)	$f_{s,0}$ (psi)	$f_{b,90}$ (psi)	E(10 <sup>6</sup> psi)	$f_{t,90}$ (psi)	$f_{c,90}$ (psi)	$f_{v,90}$ (psi)	$f_{s,90}$ (psi)
875	1.4	450	1150	135	45	500	1.2	250	650	135	45

Note: Properties are based on visual grade SPF No. 1/No. 2 or better, and No. 3 or better for major and minor strength directions, respectively.

Table 2 – Part 1: Allowable Design Values<sup>1</sup> for Katerra CLT










	CLT Layup Designation	CLT Thickness (in)	Lamination Thicknesses in CLT Layup (in)								
			=	⊥	=	⊥	=	⊥	=	⊥	=
3-ply 	K3-0320	3.24	1.08	1.08	1.08						
	K3-0350	3.54	1.08	1.38	1.08						
	K3-0380	3.84	1.38	1.08	1.38						
	K3-0410	4.14	1.38	1.38	1.38						
5-ply 	K5-0540	5.40	1.08	1.08	1.08	1.08	1.08				
	K5-0600	6.00	1.08	1.38	1.08	1.38	1.08				
	K5-0630	6.30	1.38	1.08	1.38	1.08	1.38				
	K5-0690	6.90	1.38	1.38	1.38	1.38	1.38				
7-ply 	K7-0970	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38		
9-ply 	K9-1120	11.22	1.38	1.08	1.38	1.08	1.38	1.08	1.38		
	K9-1240	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38

Table 2 – Part 2: Allowable Design Values<sup>1</sup> for Katerra CLT

	CLT Layup Designation	CLT Thickness (in)	Major Strength Direction				Minor Strength Direction			
			$F_{b,eff,0}$ (lb-ft/ft)	$EI_{eff,0}$ (10 <sup>6</sup> lb-in <sup>2</sup> /ft)	$GA_{eff,0}$ (10 <sup>6</sup> lb/ft)	$V_{s,0}$ (lb/ft)	$F_{b,eff,90}$ (lb-ft/ft)	$EI_{eff,90}$ (10 <sup>6</sup> lb-in <sup>2</sup> /ft)	$GA_{eff,90}$ (10 <sup>6</sup> lb/ft)	$V_{s,90}$ (lb/ft)
3-ply 	K3-0320	3.24	1250	46	0.36	1170	95	1.50	0.41	390
	K3-0350	3.54	1460	59	0.37	1270	160	3.20	0.51	495
	K3-0380	3.84	1790	78	0.45	1380	95	1.50	0.42	390
	K3-0410	4.14	2050	96	0.46	1490	160	3.20	0.52	495
5-ply 	K5-0540	5.40	2875	176	0.72	1940	845	39	0.81	1170
	K5-0600	6.00	3350	227	0.74	2160	1200	66	1.00	1380
	K5-0630	6.30	4125	293	0.91	2270	985	50	0.84	1270
	K5-0690	6.90	4700	367	0.92	2480	1380	82	1.00	1490
7-ply 	K7-0970	9.66	8325	908	1.40	3475	3175	315	1.60	2480
9-ply 	K9-1120	11.22	11350	1437	1.80	4050	4000	486	1.70	3050
	K9-1240	12.42	12900	1810	1.80	4475	5625	782	2.10	3475

<sup>1</sup> Tabulated values are allowable design values and not permitted to be increased for the flat use or size adjustment factor in accordance with the NDS.

Table 3: Allowable Design Values for Edgewise Shear of Katerra CLT

	CLT Layup Designation	CLT Thickness (in)	Edgewise Shear Stress <sup>1</sup>	
			F <sub>v,e,0</sub> (psi)	F <sub>v,e,90</sub> (psi)
3-ply 	K3-0320	3.24	190	215
	K3-0350	3.54	190 <sup>(2)</sup>	215 <sup>(2)</sup>
	K3-0380	3.84	190 <sup>(2)</sup>	215 <sup>(2)</sup>
	K3-0410	4.14	190 <sup>(2)</sup>	215 <sup>(2)</sup>
5-ply 	K5-0540	5.40	240	235
	K5-0600	6.00	240 <sup>(3)</sup>	235 <sup>(3)</sup>
	K5-0630	6.30	240 <sup>(3)</sup>	235 <sup>(3)</sup>
	K5-0690	6.90	240 <sup>(3)</sup>	235 <sup>(3)</sup>
7-ply 	K7-0970	9.66	240 <sup>(3)</sup>	235 <sup>(3)</sup>
9-ply 	K9-1120	11.22	240 <sup>(3)</sup>	235 <sup>(3)</sup>
	K9-1240	12.42	240 <sup>(3)</sup>	235 <sup>(3)</sup>

<sup>1</sup> The tabulated values shall be multiplied by the gross area (full thickness of the CLT x Length) to attain an allowable shear force for the element and direction of loading under consideration.

<sup>2</sup> Based on test results for K3-0320

<sup>3</sup> Based on test results for K5-0540