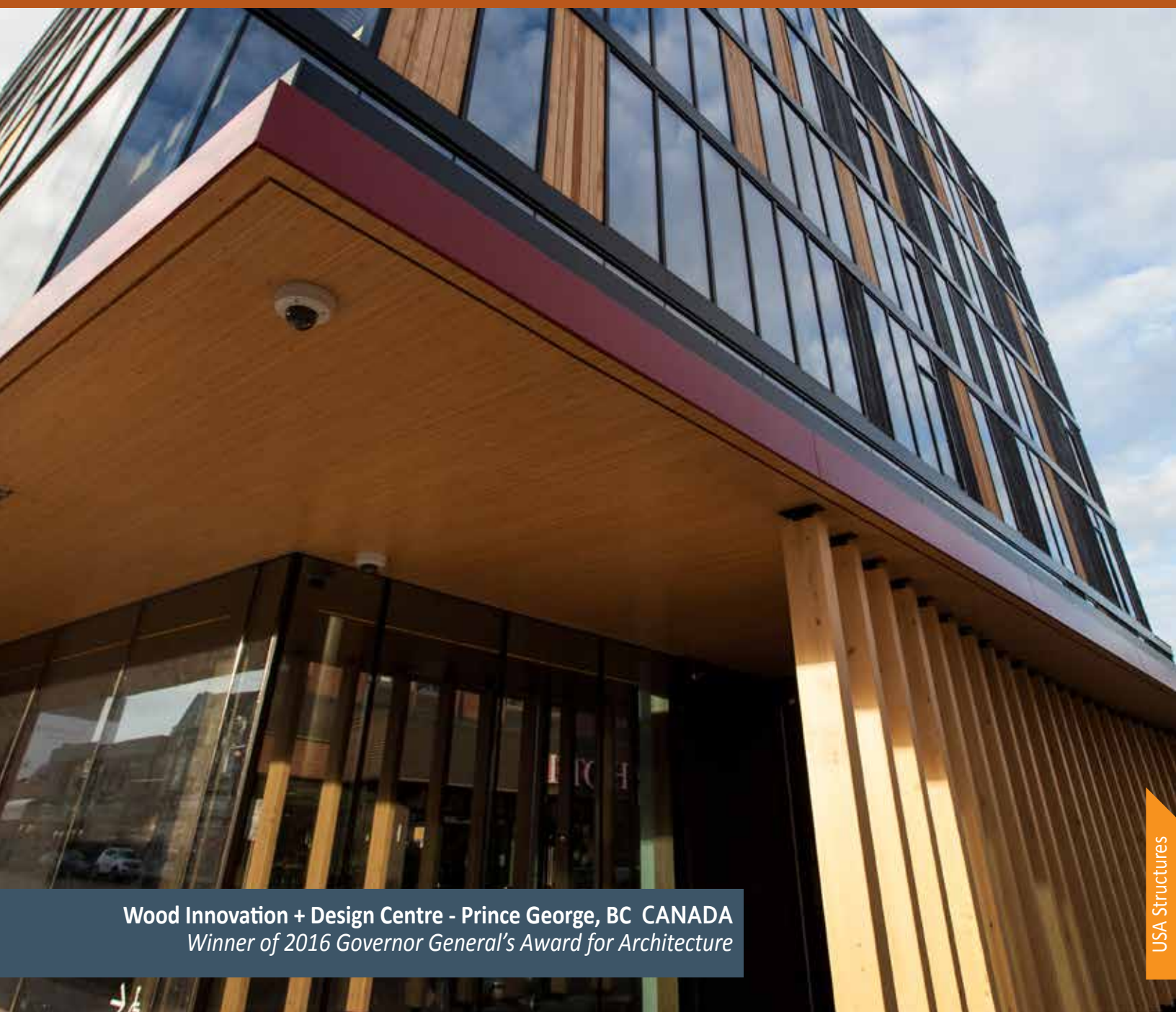
STRUCTURLAM
Intelligence In Wood

CROSSLAM®CLT
Technical Design Guide



Wood Innovation + Design Centre - Prince George, BC CANADA
Winner of 2016 Governor General's Award for Architecture

USA Structures

Shoreline Medical Center - Seattle WA USA

Introduction - CrossLam® CLT

Structurlam was founded in 1962. In that year, the earth's population was less than half of what it is today. Sustainability was an unknown concept and wood construction had been replaced by concrete and steel everywhere except single family homes. The team at Structurlam had a different idea. We understood the advantages of building with wood and of laminating lumber into beams that could be used in larger structures. We embraced new technology, such as 3D modeling and robotic machinery, to fabricate complete mass timber packages. This allowed us to introduce wood into buildings where it was never considered in the past.

Fast forward to 2011. The population of the world reached seven billion and sustainability was now universally understood. As the only renewable structural material available, wood use in construction began to increase. It was in this environment that Structurlam opened the first cross laminated timber (CLT) plant in North America and introduced our product CrossLam® CLT to the market. Commercial construction was changed forever.

CrossLam® CLT, as we call our proprietary CLT panel, is a revolutionary product. It can be used for floors, walls and roofs. CrossLam® CLT is a direct replacement for concrete but is significantly lighter. It spans two directions with precision accuracy, is carbon negative and uses wood from only sustainably managed forests. CrossLam® CLT opens the door to a new, ecological way to construct the buildings of the twenty-first century.

The technical information in this guide supports efficient and affordable design when specifying CrossLam® CLT. A truly efficient structure is conceived of and designed with CLT panels from the start. If you have questions and need help, let our qualified team of technical representatives and support staff help you specify the right panel for your project.

Rocky Ridge Recreation Centre

Ronald McDonald House - Vancouver, BC CANADA
Winner of 2016 Governor General's Award for Architecture

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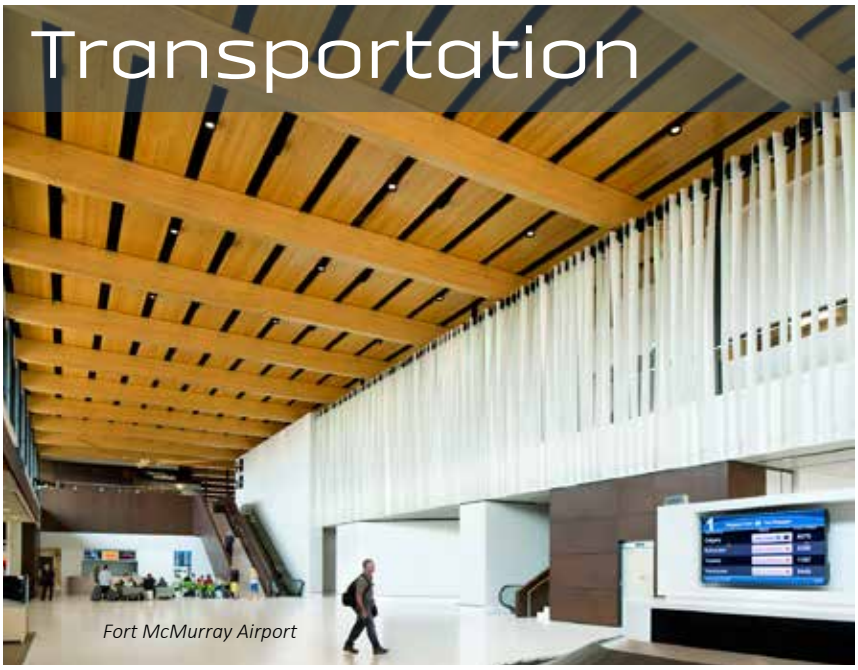
Brock Commons - University of British Columbia, CANADA
2016 - The World's Tallest Mass Timber Building

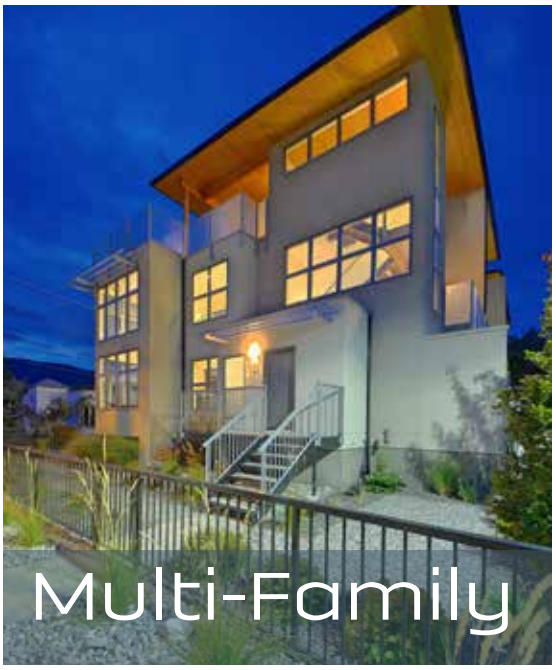
The Structurlam Advantage

Structurlam is more than a fabricator of the highest quality engineered wood products. We operate at the front lines of innovation in mass timber design, engineering, 3D modeling, and precision manufacturing. One of the biggest benefits with mass timber buildings as compared to other types of structures is the ability to prefabricate the entire project. This saves precious time and money on-site because the installation process becomes more efficient. Since the 1990's, Structurlam has been leveraging state-of-the-art 3D modeling software to virtually construct each building before it is produced. Our team begins with the two-dimensional drawings and creates a 3D model. This model includes all of our components; glulam, CrossLam® CLT, steel connections, and associated hardware. Virtual construction allows our highly-trained detailers to detect potential problems and prevent issues in the field. The work to build the model often takes three times longer than the actual time to produce the components, but it's necessary for a smooth assembly process on-site.

Once the design work is complete, the model is used to create manufacturing lists for CrossLam® CLT and glulam. Shop drawings for panels and steel connectors are generated from the 3D model, and digital files are sent to our



Fort McMurray Airport

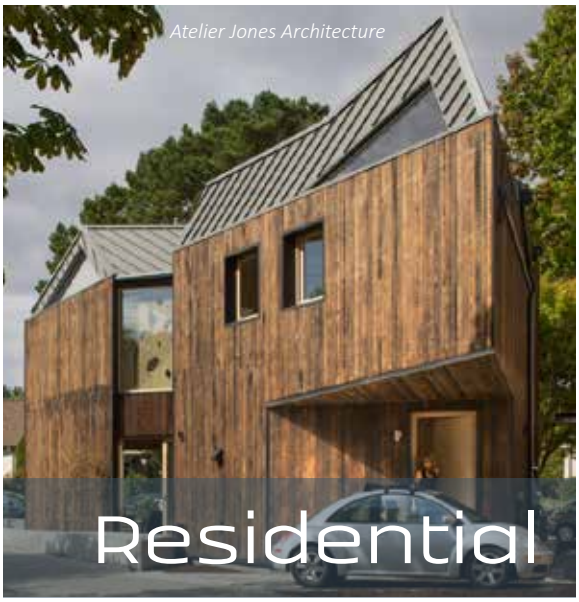


Ronald McDonald House

CNC machines for fabrication. Finally, our 3D model is used to develop a material list for efficient purchasing of steel and hardware components. Loading diagrams are then created to optimize freight and assembly drawings are produced to provide instruction for quick and efficient installation.

Design teams who leverage our fabrication services receive aesthetically appealing buildings with optimized structural performance and rapid assembly; where every piece fits and no detail is missed. Because mass timber structures are relatively new, many of our first-time customers come to us with a concrete building already designed and ask us to offer an option in CrossLam® CLT. While this is possible, it is always better to design with the structural system of choice. With CrossLam® CLT, optimum sizes are 7'10.5" x 40' and 9'10.5" x 40'. This is the best way to ensure an efficient design, optimal panel spans and layout, and the most cost effective structure.

Structurlam brings cohesion and coordination to project teams, facilitating success from design to installation.



Strengths of the CrossLam® CLT System

Prefabrication

CrossLam® CLT is manufactured with CNC machines in a factory environment where close tolerances and rigorous quality control are easily achieved. Our efficient CAD workflow ensures complete coordination between design, manufacturing, and on-site construction.

Standardized Sizing

Building efficiencies are achieved when the project is designed from the beginning with standard CrossLam® CLT panel sizes such as 7'10.5" or 9'10.5" by 40'. This maximizes the utilization of CrossLam® CLT by reducing material costs and waste.

Structural Strength + Stability

The CrossLam® CLT system is structurally comparable to steel and concrete but lighter. Projects utilizing the CrossLam® CLT system can have smaller, less expensive foundations, and are ideally suited for poor soil conditions.

Cost Efficiency

Construction projects that leverage the CrossLam® CLT system achieve cost efficiencies through the combination of material and installation costs, and the associated benefits of using a prefabricated system that is structural and architectural. The compressed construction schedule of a well-designed Crosslam® CLT system provides a less expensive option to steel and concrete. CrossLam® CLT can also be competitive with standard light wood framing systems in specific applications.

Reduced Construction Time

In comparison to concrete structures, CrossLam® CLT projects are installed in a shorter period of time due to the nature of prefabrication and dry materials. Mass timber components arrive on-site as a kit of parts, require less storage, and can be shipped for just-in-time scheduling to facilitate quick assembly in dense urban areas.

Architects and Designers can design with freedom.

Engineers receive a strong, stable building.

General Contractors receive a predictable experience on-site.

Owners receive a green building that is on budget and on time.

Strengths of the CrossLam® CLT System

Light Environmental Impact

Life Cycle Assessment studies show that CrossLam® CLT has a lighter overall environmental footprint than other building materials. CrossLam® CLT also stores carbon and produces fewer greenhouse gas emissions during manufacture. The wood fiber used in CrossLam® CLT is traceable from certified forests to the consumer. FSC and FSI Chain of Custody Certification are available from Structurlam should your project have this requirement.

Code Acceptance

The 2015 International Building Code (IBC) and 2015 National Design Specification (NDS) recognize CLT as a structural system however, it must be manufactured according to the ANSI/APA PRG-320:2012 Standard for Performance Rated Cross-Laminated Timber. The IBC approves the use of CLT in exterior/interior walls, floors, and roofs for Type IV Construction and Chapter 10 of the NDS references design values, design equations and overall engineering design specific to the use of CLT. The Structurlam ICC-ES Report affirms *"CrossLam® CLT panels comply with requirements noted in Section 2303.1.4 of the 2015 IBC for allowable stress design in accordance with IBC Section 2301.2(1) and Chapter 10 of the 2015 NDS."*

Standards

CrossLam® CLT is certified to meet the requirements of the Standard for Performance Rated CLT ANSI/APA PRG 320 and the APA Product Report PR-L314. These standards outline the requirements and test methods for qualification and quality assurance for CLT and are the same across North America.

Design Development + Service Options

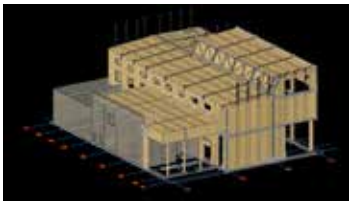
Structurlam is a world-renowned fabricator of complex structural timber components. Our team of design and manufacturing professionals carefully integrates 3D computer models with CNC controlled milling machines to produce world leading projects. Our goal is to help design teams make the most of their projects by leveraging the cost saving and structural advantages of CrossLam® CLT construction. We offer design and fabrication services at a variety of levels.

DESIGN SUPPLY	MANUFACTURING DESIGN ASSIST	TRADITIONAL BID	FABRICATION
Full Engineering	Assist the EOR and Architect with achieving cost optimization	Complete detailing & drafting services (steel connections & hardware)	Supply of mass timber members per single piece shop drawing or fully detailed 3D model
Partner with Architect to retain original design intent	Design to construction schedule	Supply of mass timber members per Structurlam shop drawings	
Complete detailing & drafting services (steel connections & hardware)	Complete detailing & drafting services (steel connections & hardware)		
Supply of mass timber members per Structurlam shop drawings	Supply of mass timber members per Structurlam shop drawings		

CrossLam® CLT Fabrication

Structurlam's CrossLam® CLT is fabricated using the latest 3D modeling software. Data is transferred directly to our CNC machines - the most sophisticated milling machinery in North America, allowing us to achieve very tight tolerances.

CrossLam® CLT projects begin with your drawings from which we develop a 3D model that is used to design panels and connectors. Our model also allows our experts to identify optimized design alternatives to increase constructability and reduce overall costs. Shop drawings for panels and steel connectors are generated from the 3D model and digital files are sent to our CNC machines for fabrication. Finally, our 3D model is used to develop a material list for efficient purchasing, loading diagrams to optimize freight, and assembly drawings for quick and efficient installation.



CrossLam® CLT Delivery, Storage + Handling

Structurlam has taken every reasonable precaution to protect your CrossLam® CLT during shipment by individually wrapping panels in 100% recyclable plastic. However, when not properly handled and protected, panels are subject to surface marring and damage, water staining, sun damage, and checking. We recommend you follow the guidelines outlined in our CrossLam® CLT Storage and Handling Guide available on our website or through our office.

CrossLam® CLT Installation

Detailed pre-construction planning can help to ensure installation of CrossLam® CLT 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;
- If required, apply treatments; and
- If required, add on-site hardware.

Truckload sequencing is a service offered by Structurlam for projects without a staging area. However, it must be requested during the shop drawing process. Please contact our office to learn more about truckload sequencing and lifting hardware. All rigging and hoisting of panels should be done in a safe manner and the lifting device should have the capacity to unload panels from the truck and place them in the desired location.

Shoreline Medical Center

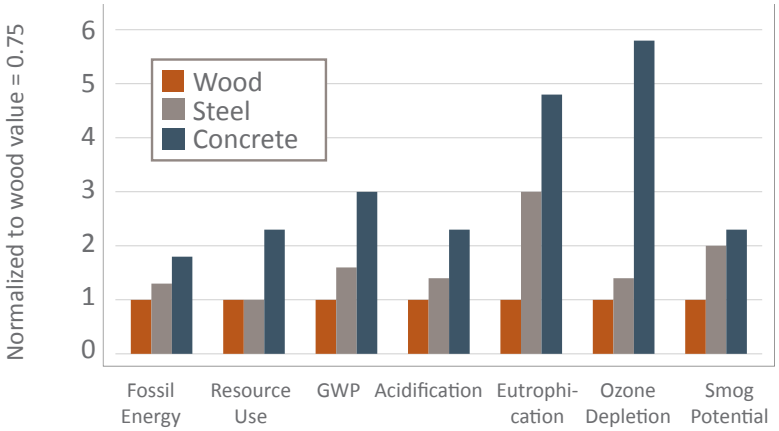
CrossLam® CLT vs. Concrete

Mass timber systems produce a lighter-weight structure and a lighter carbon footprint than concrete. CrossLam® CLT is up to five times lighter than concrete and can be installed three times faster than cast-in-place concrete, with many erectors installing up to 15,000 sq ft per day with a team of 4-6 people. CrossLam® CLT is also cost comparative to concrete and allows for construction in areas with poor soil conditions. As CLT replaces concrete in buildings, the overall weight of the structure is reduced, allowing for smaller foundations and lower total cost.

CrossLam® CLT sequesters CO_2 and allows a building to serve as a carbon sink over its lifetime. Life Cycle Assessments (LCA) of building materials show the carbon footprint of wood is lower than steel or concrete when compared with seven key environmental measures (see chart "Environmental Impact of a Wood, Steel and Concrete").

To learn more about the environmental footprint of Structurlam products, contact us for a copy of our Life Cycle Assessment and Environmental Product Declaration documents. You can read more about the LCA of wood by visiting http://www.naturallywood.com/wood-design/responsible-choice/life-cycle-assessment.

Environmental Impact of Wood, Steel and Concrete



Source: Dovetail Partners using the Athena Eco-Calculator (2014)

Three hypothetical buildings (wood, steel, and concrete) of identical size and configuration are compared. In all cases, impacts are lower for the wood design.

Floor Vibration Control Comparison

Floor vibration performance depends on the application and the expectations of the user. As such, floor vibration should be designed accordingly. The preferred design method to controlling vibrations in CLT floors is found in NDS 2015 and the US CLT Handbook. The chart below compares the thickness of CrossLam® CLT floors against concrete and at what level we are able to better control our vibration with CrossLam® CLT versus concrete.

CrossLam® CLT Series	CLT Panel (in)	Concrete Slab (in)	Vibration Controlled Span (ft)
87 V	3.43	5.31	10.5
105 V	4.14	5.91	12.1
139 V	5.48	7.48	14.8
175 V	6.90	8.46	16.7
191 V	7.53	9.25	18.4
243 V	9.58	10.24	21.0
245 V	9.66	10.83	21.6
315 V	12.42	12.40	24.9

50 psf live load plus self weight plus 21 psf miscellaneous dead load

Indicates CrossLam® CLT thickness advantage

CrossLam® CLT Applications

Floors

CrossLam® CLT panels are ideally suited for modern floor systems because they are two-way span capable and ship to site as ready-to-install components, greatly simplifying building construction and increasing job site productivity. Our expanded array of CrossLam® CLT products helps to ensure an optimized structural solution that allows you to install up to 400 sq ft per lift.


Faction Projects Building

Roofs

CrossLam® CLT panels easily provide overhanging eaves while efficiently spanning a variety of roof layouts. The enhanced thermal properties of CLT contribute to a much more efficient envelope assembly. Panels can be as thin as 3.43" and as thick as 12.42" resulting in a maximum possible roof span of 40' with appropriate loading. CrossLam® CLT roofs are quickly installed allowing projects to approach lockup and a water tight state in a short amount of time.


Tall Tree Integrated Health

Walls

CrossLam® CLT wall panels are cost-competitive alternatives to pre-cast concrete systems. They are lighter than pre-cast concrete and can be handled with greater ease. When used as a system, CrossLam® CLT wall and roof panels allow more flexibility and efficiency for all types of building design. As vertical and horizontal load-bearing elements, CrossLam® CLT panels extend the design envelope for industrial projects and allow designers to use one structural system for their entire project.


BC Passive House

Shear Walls + Diaphragms

CrossLam® CLT panels may be utilized as the lateral force-resisting systems for both wind and seismic loads. The white paper, *Horizontal Diaphragm Design Example* by Spickler, K., Close, M., Line, P., & Pohll, M., provides a design method to determine the strength of a CLT horizontal diaphragm and deflection due to lateral wind or seismic loads. Visit www.structurlam.com to download a copy of this White Paper. More information about shear walls can also be found in the US CLT Handbook.

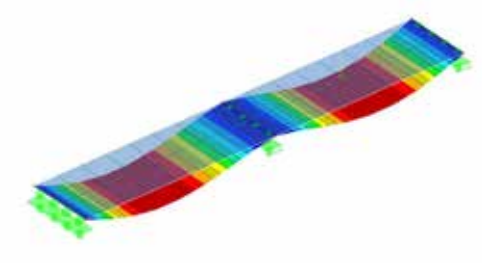
Cores + Shafts

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 2-hr fire resistance ratings.

CrossLam® CLT Design Considerations

Deflection

The deflection limits of CLT are specified in IBC Table 1604.3. Calculating deflection should conform to the US CLT Handbook, 2013 Chapter 2. Creep is a critical factor that should be accounted for in any structural design. Please see the approach outlined in Chapter 6 of the US CLT Handbook.



Service Integration

Building penetrations for mechanical, electrical, and plumbing services (MEP) 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 incorporated on-site using standard construction tools.

Wood Innovation + Design Centre Model
Courtesy of Michael Green Architects

Material Optimization

Involving Structurlam in the early stages of your project is the best way to ensure efficient utilization of CrossLam® CLT panels. To achieve material optimization, we suggest designing in full billet sizes, 9'10.5" x 40'. Incorporating standard panel sizes into your design will most certainly reduce your product waste.

Atelier Jones Architecture

Vibration

Maximum floor vibrations for CLT slab elements must be carefully analyzed when designing with CrossLam® CLT. Research in this area is ongoing; however, the proposed design method for controlling vibrations in CLT floors is outlined in Chapter 7 of the US CLT Handbook.

Acoustic Performance

CLT walls and floors contribute to the overall sound isolation characteristics of the completed building. Sound transmission is affected by the components in wall and floor assemblies. Airtight construction and specifically engineered connections can help reduce sound transmission by mitigating flanking transmission (sound energy that passes around, not through, panels). Chapter 9 of the US CLT Handbook addresses sound insulation in CLT construction.

Elkford Community Conference Centre

CrossLam® CLT Fire Performance

Fire Resistance

CLT has undergone regular scrutiny by research institutions and code officials, and results confirm that CLT panels provide excellent fire resistance. Fire testing results have shown mass timber panels exhibit unique properties when exposed to fire. The charring rate of 1.5 inches per hour, protects the structural integrity of the CLT system and restricts the ability of the fire to spread.

Wall assembly after testing showing the depth of charring on the exposed side. *NRC (2014) Fire Endurance of Cross-Laminated Timber Floor and Wall Assemblies for Tall Wood Buildings.*

Fire resistance testing such as ASTM E119, assess the fire performance of CLT and its ability to perform separating and/or loadbearing functions. CLT products that are used for loadbearing walls and floor assemblies, must comply with IBC fire-resistance rating requirements for the separating function and structural resistance. The fire-resistance requirements stipulated in the IBC depend on the structural elements, type of construction, use and occupancy classifications, distance from property line and other factors relevant to the project.

Fire Performance

CrossLam® CLT panels that conform to ANSI/APA PRG320 standards have been tested to meet the fire performance requirements of ASTM E119 and those found in the IBC and the 2015 NDS. Please contact us to learn more about our test results for various loads, times and assemblies.

To determine fire rating for CLT systems the three suggested methods are outlined below. Chapter 8 of the US CLT Handbook also provides a methodology for the fire resistance calculations of CLT assemblies.

1). Type IV Heavy Timber Construction of the 2015 IBC Chapter 6;
CLT is allowed in the IBC 2015 under Type IV Construction – 602.4 Type IV construction (Heavy Timber, HT). The hourly fire resistance rating requirements for walls, floors and roofs are shown at right. Further details are found in Table 601 of the IBC.

Building Element	TYPE IV HEAVY TIMBER
Bearing Walls • Exterior • Interior	 2 1/HT
Floor Construction	1/HT
Roof Construction	1/HT

Required Fire Resistance	Effective Charring Rate, β_{eff} (in./hr)	Visual Char Layer Thickness (in.)	Zero-strength Layer (in.)	Effective Char Layer Thickness a_{char} (in.)
45 min (¾-h)	1.90	1.19	0.24	1.42
60 min (1-h)	1.80	1.50	0.30	1.80
90 min (1½-h)	1.67	2.09	0.42	2.50
120 min (2-h)	1.58	2.64	0.53	3.16

2). Char calculation method of the 2015 NDS
The NDS methodology uses wood engineering based mechanics to calculate the fire resistance of wood members and is referenced in Section 721.1 of the IBC. Effective charring rates calculated using the NDS methodology are represented at left.

3). Execution of proprietary ASTM E-119 testing that is specific to the project assemblies.
Standard Test Methods for Fire Tests of Building Construction Materials or *UL 263, Standard for Fire 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.

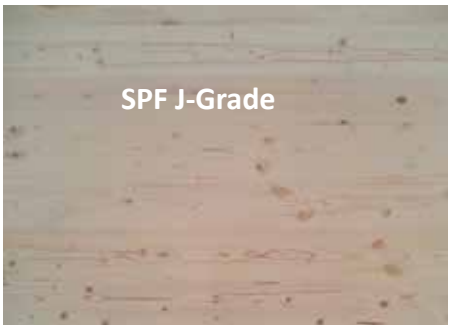
CrossLam® CLT Panel Characteristics

Maximum Panel Size:	9’10.5” x 40.0’
Maximum Thickness:	12.42”
Minimum Thickness:	3.43”
Production Widths:	7’10.5” & 9’10.5”
Moisture Content:	12% (+/-3%) at time of production
Glue Specifications:	Purbond polyurethane adhesive
Glue Type:	Weatherproof, formaldehyde free foaming PUR
Species:	SPF, Douglas-fir
Lumber Grades:	SPF #2& Btr, SPF #3, Dfir L3, MSR 2100
Stress Grades:	V2M1.1, V2.1, E1M4, E1M5
Manufacturing Certification:	APA PRG 320 Product Report PR-L314
Density:	30.3 lbs/ft^3 (shipping weight at time of manufacturing)
Dimensional Stability:	Longitudinal and Transverse 0.01% per % Δ in MC Thickness 0.2% per % Δ in MC
Thermal Conductivity:	R value: 1.2 per inch (h·ft2·°F /Btu)
CO_2 Sequestration:	13.7 lbs/ft^3

Dimensional Tolerances:

Thickness:	1/16” or 2% of CLT thickness, whichever is greater
Width:	1/8” of the CLT width
Length:	1/4” of the CLT length
Squareness:	Panel face diagonals shall not differ by more than 0.125”
Straightness:	Deviation of edges from a straight line between adjacent panel corners shall not exceed 1/16”

CrossLam® CLT Appearance Classification

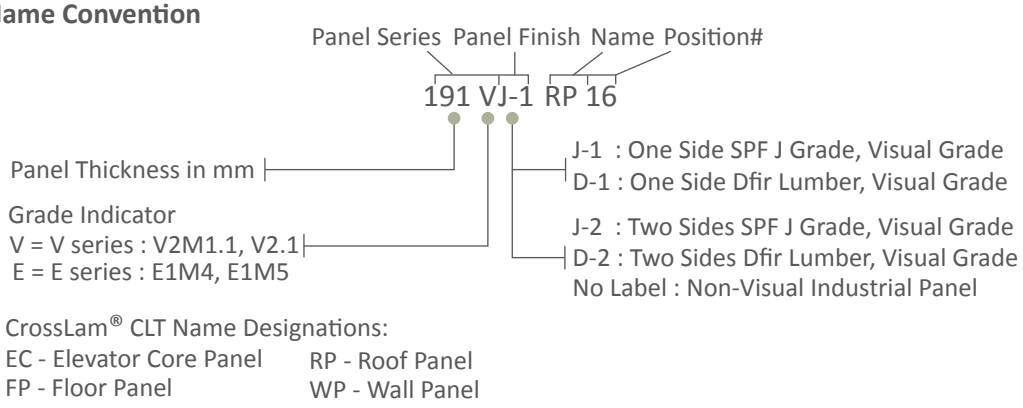
	VISUAL	NON-VISUAL
Intended Use	Where one or both faces are left exposed	Where both faces are covered by another material
Face Layer	SPF, "J" Grade (Japanese Grade), Douglas-fir (#2 Square Edge)	SPF #2& Btr, MSR 2100
Sanded Face	80 grit	N/A
	Allowable Fiber Characteristics	
Shake and Checks	Several up to 24" long, none through	As per NLGA #2, SPF #2& Btr
Stain	Up to a max of 5% blue stain, heart stain allowed	Allowed, not limited
Knots	Firm & Tight (NLGA #2)	NLGA #2
Pitch Streaks	Not limited	Not limited
Wane on Face	None	Allowed
Side Pressure	Yes	None
Surface Quality		
		

Introducing The New CrossLam® CLT Series

The V Series: Composed exclusively from #2& 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.

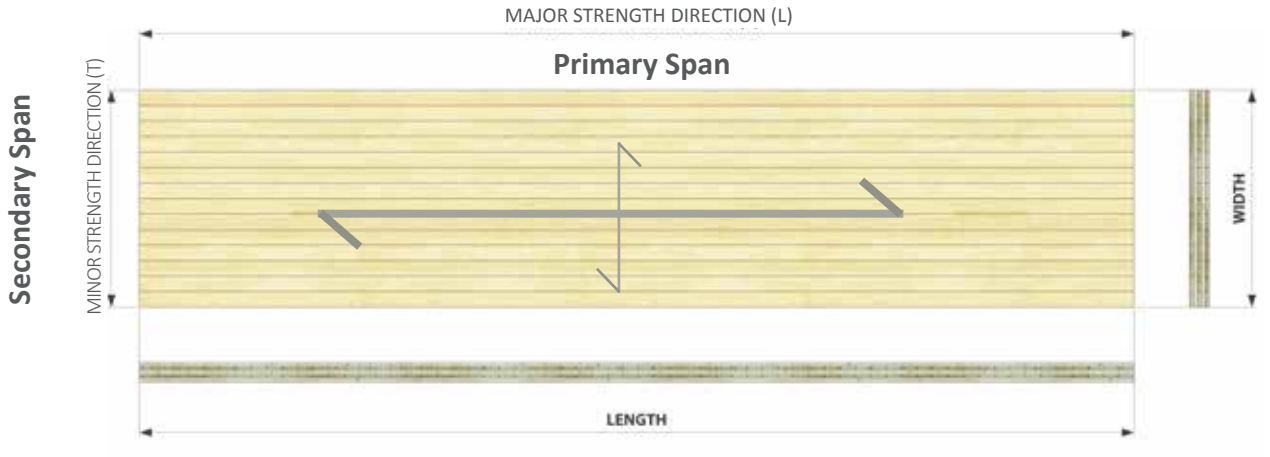
CrossLam® CLT Name Convention



CrossLam® CLT Name Designations:

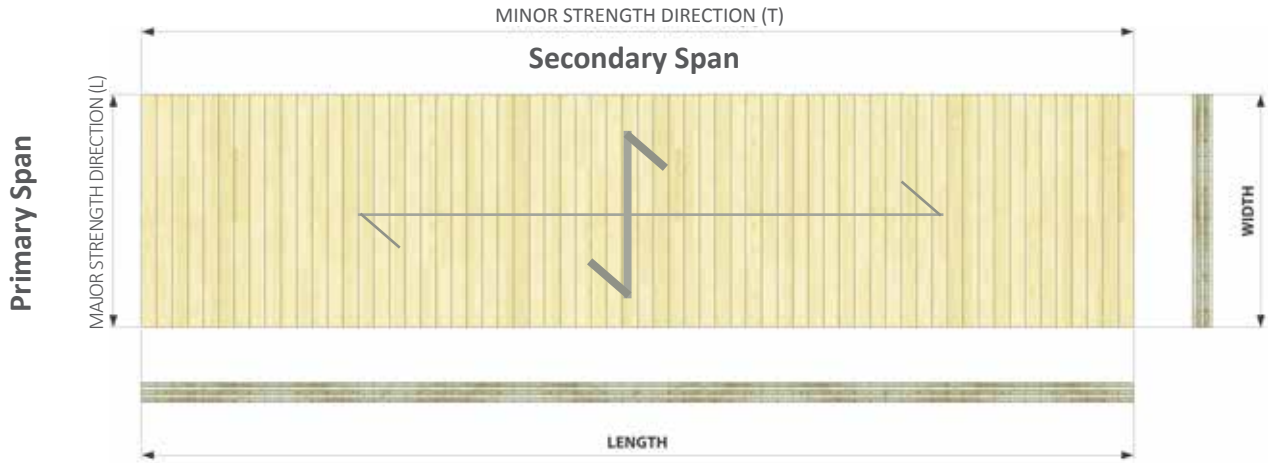
EC - Elevator Core Panel
FP - Floor Panel
RP - Roof Panel
WP - Wall Panel

Normal Panel Orientation



Spandrel Panel Orientation

(only available in 105, 175, 245, and 315 panels)



No side pressure available and visual application not recommended.

Table 1 - CrossLam® CLT Panel Layups

CrossLam® CLT Series	Grade	Face Layers	Major Layer (L)	Minor Layer (T)	Layer Thickness (in)									Panel Depth (in)
					L	T	L	T	L	T	L	T	L	
87 V	V2.1	SPF #2& Btr	SPF #2& Btr	SPF #3& Btr	1.38	**0.67**	1.38							3.43
139 V					1.38	**0.67**	1.38	**0.67**	1.38					5.48
191 V					1.38	**0.67**	1.38	**0.67**	1.38	**0.67**	1.38			7.53
243 V					1.38	**0.67**	1.38	**0.67**	1.38	**0.67**	1.38	**0.67**	1.38	9.58
105 V	V2M1.1	J-Grade Dfir L3		SPF #2& Btr	1.38	1.38	1.38							4.14
175 V					1.38	1.38	1.38	1.38	1.38					6.90
245 V					1.38	1.38	1.38	1.38	1.38	1.38	1.38			9.66
315 V					1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	12.42

87 E	E1M4	MSR 2100 1.8E SPF	MSR 2100 1.8E SPF	SPF #3& Btr	1.38	**0.67**	1.38							3.43
139 E					1.38	**0.67**	1.38	**0.67**	1.38					5.48
191 E					1.38	**0.67**	1.38	**0.67**	1.38	**0.67**	1.38			7.53
243 E					1.38	**0.67**	1.38	**0.67**	1.38	**0.67**	1.38	**0.67**	1.38	9.58
105 E	E1M5			SPF #2& Btr	1.38	1.38	1.38							4.14
175 E					1.38	1.38	1.38	1.38	1.38					6.90
245 E					1.38	1.38	1.38	1.38	1.38	1.38	1.38			9.66
315 E					1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	12.42

L = Longitudinal Layer (Major Layer)
T = Tangential Layer (Minor Layer)

Spandrel panels cannot be produced in any layups with 0.67” thick lamellas.

Ronald McDonald House

Structural Panel Properties

Table 2 - CrossLam® CLT Allowable Design Capacities [1]

CLT Grade	CLT Series	Weight lbs/ft²	Major Strength Direction					Minor Strength Direction				
			$F_b S_{eff,0}$ (lbs-ft/ft)	$EI_{eff,0}$ (10^6lbs-in²/ft)	$GA_{eff,0}$ (10^6lbs/ft)	$M_{allow,0}$ (lbs-ft/ft)	$V_{allowq,0}$ (lbs/ft)	$F_b S_{eff,0}$ (lbs-ft/ft)	$EI_{eff,90}$ (10^6lbs-in²/ft)	$GA_{eff,90}$ (10^6lbs/ft)	$M_{allow,90}$ (lbs-ft/ft)	$V_{allowq,90}$ (lbs/ft)
V2.1	87 V	7.5	1444	56	0.5	1444	1220	37	0.4	0.30	32	240
	139 V	11.9	3329	206	1.0	3329	1770	537	21	0.60	457	850
	191 V	16.3	5917	503	1.4	5917	2290	1216	83	0.91	1034	1080
	243 V	20.8	9212	995	1.9	9219	2800	2133	209	1.20	1814	1320
V2M1.1	105 V	9.0	2042	96	0.5	2042	1440	277	3.7	0.53	235	495
	175 V	15.0	4701	366	1.1	4701	1980	2403	96	1.10	2042	1440
	245 V	21.0	8315	906	1.6	8315	2500	5531	366	1.60	4701	1970
	315 V	27.0	12896	1806	2.1	12896	3025	9782	906	2.10	8315	2470
E1M4	87 E	8.2	3465	72	0.5	3465	1220	37	0.4	0.38	32	240
	139 E	13.0	7983	264	1.0	7983	1770	537	21	0.77	457	945
	191 E	17.8	14183	645	1.5	14183	2280	1216	83	1.10	1034	1200
	243 E	22.7	22075	1278	2.0	22075	2800	2133	209	1.50	1814	1460
E1M5	105 E	9.7	4900	123	0.5	4901	1430	277	3.7	0.66	235	495
	175 E	16.1	11261	469	1.1	11261	1980	2403	96	1.30	2042	1590
	245 E	22.5	19897	1161	1.6	19897	2500	5531	366	2.00	4701	2180
	315 E	28.8	30837	2314	2.1	30838	3000	9782	906	2.60	8315	2750

Table 3 - CrossLam® CLT Allowable Design Properties for Laminations [1]

CLT Grade	Major Strength Direction						Minor Strength Direction					
	$F_{b,0}$ (psi)	$E_{,0}$ (10^6 psi)	$F_{t,0}$ (psi)	$F_{c,0}$ (psi)	$F_{V,0}$ (psi)	$F_{s,0}$ (psi)	$F_{b,90}$ (psi)	E_{90} (10^6psi)	$F_{t,90}$ (psi)	$F_{c,90}$ (psi)	$F_{V,90}$ (psi)	$F_{s,90}$ (psi)
V2.1	875	1.4	450	1150	135	45	500	1.2	250	650	135	45
V2M1.1	875	1.4	450	1150	135	45	875	1.4	450	1150	135	45
E1M4	2100	1.8	1575	1875	160	50	500	1.2	250	650	135	45
E1M5	2100	1.8	1575	1875	160	50	875	1.4	450	1150	135	45

Notes:

1. Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment factor in accordance with the NDS.
2. The CLT grades are developed based on APA Product Report PR-L314. Please refer to specific grade layups for complete panel information.
3. The design values shall be used in conjunction with the section properties provided by the CLT manufacturer based on the actual layup used in manufacturing the CLT panel (see tables above).
4. Values are calculated per 1 foot wide section of panel.
5. The panel weight is based on SPF lumber values in the 2015 NDS.

Table 4 - CrossLam® CLT Floor Panel Load Table, maximum span (ft)

	CrossLam® CLT Series	FLOOR LIVE LOAD (psf)									
		40 RESIDENTIAL		50 OFFICE/ CLASSROOM		75 MECHANICAL ROOM		100 ASSEMBLY/ STORAGE		150 LIBRARY	
		Vibration	Deflection L/240	Vibration	Deflection L/240	Vibration	Deflection L/240	Vibration	Deflection L/240	Vibration	Deflection L/240
SINGLE SPAN	87 V	**10.58**	12.33	**10.58**	11.95	10.58	**10.56**	10.58	**9.71**[a]	10.58	**8.18**[a]
	87 E	**11.37**	13.33	**11.37**	12.67	**11.37**	11.43	11.37	**10.55**	11.37	**9.33**
	105 V	**12.04**	14.58	**12.04**	13.86	**12.04**	12.51	12.04	**11.48**[a]	12.04	**9.69**[a]
	105 E	**12.93**	15.77	**12.93**	15.00	**12.93**	13.54	12.93	**12.51**	12.93	**11.07**
	139 V	**14.65**	18.68	**14.65**	17.81	**14.65**	16.15	14.65	**14.49**[a]	14.65	**12.27**[a]
	139 E	**15.75**	20.17	**15.75**	19.24	**15.75**	17.47	**15.75**	16.19	15.75	**14.41**
	175 V	**16.78**	22.24	**16.78**	21.23	**16.78**	18.93[a]	**16.78**	17.01[a]	16.78	**14.45**[a]
	175 E	**18.01**	24.01	**18.01**	22.93	**18.01**	20.88	**18.01**	19.38	18.01	**17.28**
	191 V	**18.30**	24.65	**18.30**	23.56	**18.30**	21.10[a]	**18.30**	18.99[a]	18.30	**16.16**[a]
	191 E	**19.65**	26.58	**19.65**	25.43	**19.65**	23.21	**19.65**	21.58	19.65	**19.29**
	245 V	**20.98**	29.30	**20.98**	27.81[a]	**20.98**	24.48[a]	**20.98**	22.12[a]	20.98	**18.91**[a]
	245 E	**22.50**	31.57	**22.50**	30.27	**22.50**	27.74	**22.50**	25.85	**22.50**	23.16
	243 V	**21.68**	30.34	**21.68**	29.08	**21.68**	25.79	**21.68**	23.30	21.68	**19.92**
	243 E	**22.91**	32.67	**22.91**	31.33	**22.91**	28.73	**22.91**	26.80	**22.91**	24.04
	315 V	**24.86**	35.47[a]	**24.86**	33.49[a]	**24.86**	29.69[a]	**24.86**	26.95[a]	24.86	**23.18**[a]
	315 E	**26.66**	38.72	**26.66**	37.23	**26.66**	34.29	**26.66**	32.07	**26.66**	28.86

DOUBLE SPAN	87 V	**10.58**	13.59[a]	**10.58**	12.62[a]	**10.58**	10.88[a]	10.58	**9.71**[a]	10.58	**8.18**[a]
	87 E	**11.37**	18.23	**11.37**	17.16	**11.37**	15.51	**11.37**	14.35	**11.37**	12.65[a]
	105 V	**12.04**	15.98[a]	**12.04**	14.86[a]	**12.04**	12.85[a]	12.04	**11.48**	12.04	**9.69**
	105 E	**12.93**		**12.93**		**12.93**	18.42	**12.93**	17.04	**12.93**	14.98[a]
	139 V	**14.65**	19.96[a]	**14.65**	18.61[a]	**14.65**	16.17[a]	14.65	**14.49**[a]	14.65	**12.27**[a]
	139 E	**15.75**		**15.75**		**15.75**		**15.75**		**15.75**	17.43[b]
	175 V						**18.93**[a]		**17.01**[a]		**14.45**[a]
	175 E										
	191 V								**18.99**[a]		**16.16**[a]
	191 E										
	245 V										**18.91**[a]
	245 E										
	243 V										
	243 E										
	315 V										
	315 E										

Span is governed by maximum panel length of 40 ft - - > Use max value of 20 ft or design as simple span using table values above.

[a] *represents governing value Mr and* [b] *represents governing value Vr*

Notes:

1. For structural panel properties - see page 19. Span table assumes dry service conditions.
2. CLT is NOT an isotropic material. Presented values must only be used for bending of panels in the major strength axis.
3. Spans shown represent distance between the center lines of supports and are to be used for preliminary design only.
4. Span table above includes panel self weight, plus 15 psf miscellaneous dead load.
5. Engineer to ensure that L/240 deflection limit is appropriate for intended use.
6. Spans are assumed to be equal for double span panels.
7. Total panel length is limited to 40 ft due to fabrication process.
8. Values in **BOLD SHADING** correspond to a span governed by allowable bending stress, allowable shear stress or by vibration.
9. Table values are to be used for preliminary design only.
10. Values for double spans include a 20% increase based on CSA 086-14.
11. Deflection L/240 is considered for total load.

Table 5 - CrossLam® CLT Floor Panel Load Table, with 2 " concrete topping maximum span (ft)

	CrossLam® CLT Series	FLOOR LIVE LOAD (psf)									
		40 RESIDENTIAL		50 OFFICE/CLASSROOM		75 MECHANICAL ROOM		100 ASSEMBLY/STORAGE		150 LIBRARY	
		Vibration	Deflection L/240	Vibration	Deflection L/240	Vibration	Deflection L/240	Vibration	Deflection L/240	Vibration	Deflection L/240
SINGLE SPAN	87 V	**8.79**	11.19	**8.79**	10.75	**8.79**	9.88	**8.79**	9.00[a]	8.79	**7.75[a]**
	87 E	**9.44**	12.11	**9.44**	11.64	**9.44**	10.71	**9.44**	10.00	9.44	**8.97**
	105 V	**10.17**	13.26	**10.17**	12.74	**10.17**	11.72	**10.17**	10.65[a]	10.17	**9.18[a]**
	105 E	**10.91**	14.35	**10.91**	13.79	**10.91**	12.69	**10.91**	11.86	10.91	**10.64**
	139 V	**14.65**	17.06	**14.65**	16.43	**14.65**	14.78[a]	14.65	**13.46[a]**	14.65	**11.63[a]**
	139 E	**15.75**	18.45	**15.75**	17.77	**15.75**	16.42	15.75	**15.38**	15.75	**13.87**
	175 V	**16.78**	20.38	**16.78**	19.39[a]	**16.78**	17.35[a]	16.78	**15.83[a]**	16.78	**13.71[a]**
	175 E	**18.01**	22.02	**18.01**	21.24	**18.01**	19.65	**18.01**	18.43	18.01	**16.64**
	191 V	**18.30**	22.64	**18.30**	21.62[a]	**18.30**	19.36[a]	18.30	**17.69[a]**	18.30	**15.33[a]**
	191 E	**19.65**	24.44	**19.65**	23.59	**19.65**	21.87	**19.65**	20.55	19.65	**18.59**
	245 V	**20.98**	26.32[a]	**20.98**	25.05[a]	**20.98**	22.53[a]	20.98	**20.65[a]**	20.98	**17.97[a]**
	245 E	**22.50**	29.16	**22.50**	28.18	**22.50**	26.19	**22.50**	24.64	22.50	**22.34**
	243 V	**21.68**	27.74[a]	**21.68**	26.39[a]	**21.68**	23.74[a]	**21.68**	21.75[a]	21.68	**18.92[a]**
	243 E	**23.28**	30.19	**23.28**	29.19	**23.28**	27.14	**23.28**	25.56	23.28	**23.19**
	315 V	**24.86**	31.80[a]	**24.86**	30.35[a]	**24.86**	27.44[a]	**24.86**	25.24[a]	24.86	**22.06[a]**
	315 E	**26.66**	35.95	**26.66**	34.81	**26.66**	32.48	**26.66**	30.64	**26.66**	27.87
DOUBLE SPAN	87 V	**10.55**	11.83[a]	**10.55**	11.17[a]	10.55	**9.91[a]**	10.55	**9.00[a]**	10.55	**7.75[a]**
	87 E	**11.33**	16.42	**11.33**	15.80	**11.33**	14.55	**11.33**	13.41[a]	**11.33**	11.54[a]
	105 V	**12.20**	13.95[a]	**12.20**	13.18[a]	12.20	**11.72[a]**	12.20	**10.65[a]**	12.20	**9.18[a]**
	105 E	**13.09**	19.48	**13.09**	18.75	**13.09**	17.29	**13.09**	15.86[a]	**13.09**	13.67[a]
	139 V	17.58	**17.51[a]**	**17.58**	**16.58[a]**	17.58	**14.78[a]**	17.58	**13.46[a]**	17.58	**11.63[a]**
	139 E	**18.90**		**18.90**		**18.90**		**18.90**		18.90	**15.67[b]**
	175 V				**19.39[a]**		**17.35[a]**		**15.83[a]**		**13.71[a]**
	175 E										
	191 V						**19.36[a]**		**17.69[a]**		**15.33[a]**
	191 E										
	245 V										**17.97[a]**
	245 E										
	243 V										**18.92[a]**
	243 E										
	315 V										
	315 E										

Span is governed by maximum panel length of 40 ft - - > Use max value of 20 ft or design as simple span using table values above.

[a] *represents governing value Mr and* [b] *represents governing value Vr*

Notes:

1. For structural panel properties - see page 19. Span table assumes dry service conditions.
2. CLT is NOT an isotropic material. Presented values must only be used for bending panels in the major strength axis.
3. Spans shown represent distance between the center lines of supports and are to be used for preliminary design only.
4. Span table above includes panel self weight, 20 psf for concrete topping, plus 15 psf miscellaneous dead load.
5. Engineer to ensure that L/240 deflection limit is appropriate for intended use.
6. Spans are assumed to be equal for double span panels.
7. Total panel length is limited to 40 ft due to fabrication process.
8. Values in **BOLD SHADING** correspond to a span governed by allowable bending stress, allowable shear stress or by vibration.
9. Table values are to be used for preliminary design only.
10. The non-structural flooring is assumed to provide an enhanced vibration effect on double spans. Values include a 20% increase.
11. Deflection L/240 is considered for total load.
12. For floors with concrete topping, where the concrete is applied directly to the CLT panel, weight of concrete is ignored in the calculation of vibration-controlled span limit, provided the area density of the topping is not greater than twice the bare CLT floor area density.

Table 6 - CrossLam® CLT Roof Panel Load Table, maximum span (ft)

	CrossLam® CLT Series	ROOF SNOW LOAD (psf, unfactored)										125% NON-SNOW LOAD	
		20		30		40		55		100		20	
		L/180	L/240	L/180	L/240	L/180	L/240	L/180	L/240	L/180	L/240	L/180	L/240
SINGLE SPAN	87 V	16.21	14.69	14.95	13.55	14.01	12.68	12.62[a]	11.70	9.91[a]	9.88	16.21	14.69
	87 E	17.51	15.87	16.17	14.65	15.15	13.72	14.00	12.67	11.85	10.70	17.51	15.87
	105 V	19.10	17.31	17.66	16.00	16.57	15.00	14.86[a]	13.86	11.72[a]	11.72	19.10	17.31
	105 E	20.62	18.68	19.09	17.29	17.92	16.22	16.58	15.00	14.06	12.69	20.62	18.68
	139 V	24.18	21.92	22.48	20.38	20.74[a]	19.18	18.61[a]	17.80	14.78[a]	14.78[a]	24.18	21.92
	139 E	26.04	23.61	24.25	21.98	22.86	20.71	21.24	19.24	18.15	16.42	26.04	23.61
	175 V	28.56	25.89	26.15[a]	24.16	24.05[a]	22.81	21.68[a]	21.23	17.35[a]	17.35[a]	28.56	25.89
	175 E	30.76	27.87	28.76	26.05	27.19	24.62	25.34	22.93	21.74	19.65	30.76	27.87
	191 V	31.51	28.57	29.00[a]	26.73	26.72[a]	25.27	24.13[a]	23.56	19.36[a]	19.36[a]	31.51	28.57
	191 E	33.86	30.70	31.74	28.77	30.06	27.24	28.07	25.43	24.17	21.87	33.86	30.70
	245 V	36.12[a]	33.60	33.02[a]	31.60	30.61[a]	30.00	27.81[a]	27.81[a]	22.53[a]	22.53[a]	37.07	33.60
	245 E	39.84	36.11	37.54	34.01	35.67	32.31	33.44	30.27	28.96	26.19	39.84	36.11
	243 V	38.09[a]	34.79	34.81[a]	32.72	32.26[a]	31.06	29.31[a]	29.07	23.74[a]	23.74[a]	38.36	34.79
	243 E		37.32	38.79	35.16	36.88	33.42	34.59	31.33	30.00	27.14		37.32
	315 V			39.24[a]	38.55	36.60[a]	36.60[a]	33.49[a]	33.49[a]	27.44[a]	27.44[a]		
	315 E						39.55		37.23	35.91	32.48		
DOUBLE SPAN	87 V	17.55[a]	17.55[a]	15.59[a]	15.59[a]	14.17[a]	14.17[a]	12.62[a]	12.62[a]	9.91[a]	9.91[a]	18.30[a]	18.30[a]
	87 E				19.79		18.56	18.93	17.16	15.31[a]	14.57		
	105 V			18.26[a]	18.26[a]	16.64[a]	16.64[a]	14.86[a]	14.86[a]	11.72[a]	11.72[a]		
	105 E									18.10[a]	17.29		
	139 V							18.61[a]	18.61[a]	14.78[a]	14.78[a]		
	139 E												
	175 V									17.35[a]	17.35[a]		
	175 E												
	191 V									19.36[a]	19.36[a]		
	191 E												
	245 V												
	245 E												
	243 V												
	243 E												
	315 V												
	315 E												

Span is governed by maximum panel length of 40 ft - - > Use max value of 20 ft or design as simple span using table values above.

[a] *represents governing value Mr and* [b] *represents governing value Vr*

Notes:

1. For structural panel properties - see page 19. Span table assumes dry service conditions.
2. CLT is NOT an isotropic material. Presented values must only be used for bending panels in the major strength axis.
3. Spans shown represent distance between the center lines of supports and are to be used for preliminary design only.
4. Span table above considers panel self weight and 10psf for miscellaneous dead load. [Ref: International Building Code 2012 - art.1607.5].
5. Ponding or ceiling finishes may require higher deflection limits.
6. Engineer to ensure that deflection limit is appropriate for intended use.
7. Spans are assumed to be equal for double span panels.
8. Total panel length is limited to 40 ft due to the fabrication process.
9. Table values are to be used for preliminary design only.
10. L/180 is total load deflection limit; L/240 is snow load deflection limit.
11. For applications with deflection limits or loading different than what is indicated above, contact your Structurlam technical representative.

Table 7 - CrossLam® CLT Wall Panel Load Table (Axial Loading Only)

Pr (kips)		L (ft)														
PANEL NAME	PANEL SIZE (in)	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
87 V	3.43	36.80	35.13	30.69	23.28	16.77	12.32	9.34								
87 E	3.43	58.64	54.15	43.26	30.61	21.62	15.81	11.97								
105 V	4.14	37.07	36.24	34.36	30.52	24.81	19.31	15.06	11.95							
105 E	4.14	59.35	57.21	52.11	42.94	32.92	25.04	19.38	15.33							
139 V	5.48	55.94	55.17	53.58	50.51	45.09	37.78	30.63	24.79	20.26	16.79	14.10				
139 E	5.48	90.04	88.15	83.99	75.83	63.41	50.55	40.04	32.08	26.11	21.59	18.11				
175 V	6.90	56.13	55.73	54.98	53.72	51.65	48.36	43.64	38.03	32.52	27.69	23.66	20.35	17.64	15.41	
175 E	6.90	90.52	89.56	87.69	84.39	78.84	70.53	60.57	50.93	42.69	35.96	30.56	26.20	22.68	19.79	
191 V	7.53	74.88	74.36	73.40	71.80	69.18	65.02	59.00	51.69	44.37	37.86	32.39	27.88	24.18	21.13	18.60
191 E	7.53	120.83	119.61	117.24	113.09	106.11	95.53	82.51	69.64	58.48	49.33	41.94	35.98	31.14	27.18	23.91
245 V	9.66	75.05	74.78	74.30	73.56	72.47	70.90	68.66	65.50	61.27	56.13	50.54	45.06	40.02	35.57	31.69
245 E	9.66	121.26	120.62	119.48	117.65	114.87	110.73	104.73	96.66	87.07	77.11	67.74	59.43	52.26	46.15	40.96
243 V	9.58	93.76	93.37	92.68	91.59	89.96	87.55	84.05	79.12	72.72	65.41	58.01	51.16	45.10	39.86	35.38
243 E	9.58	151.48	150.57	148.90	146.19	142.00	135.62	126.42	114.50	101.28	88.42	76.91	67.02	58.66	51.62	45.69
315 V	12.42	93.93	93.73	93.37	92.84	92.10	91.09	89.75	87.95	85.57	82.46	78.50	73.73	68.39	62.82	51.62
315 E	12.42	151.90	151.42	150.58	149.31	147.49	144.95	141.45	136.69	130.35	122.36	113.06	103.14	93.34	84.16	75.84

Notes:

1. For panel properties - see page 19.
2. Tables assumes dry service conditions.
3. $P_r = F_c A_{parallel} C_D C_M C_T C_P$, where the P_r values are not given, the slenderness ratio exceeds 50.
4. The following factors were used for calculations: C_D=1.0, C_M=1.0, C_T=1.0.
5. Table values are to be used for preliminary design only.
6. Eccentricity of axial load and wind loading has not been included.
7. Axial load table assumes outer laminations to be vertical.
8. For applications with loading different than what is indicated above, contact your Structurlam technical representative.

Table 8 - CrossLam® CLT In-Plane Shear Loading

CrossLam® CLT Series															
87 V	87 E	105 V	105 E	139 V	139 E	175 V	175 E	191 V	191 E	245 V	245 E	243 V	243 E	315 V	315 E
Vr (lbs/ft)															
10656	10656	15869	15869	15869	15869	23428	23428	23428	23428	23428	23428	23428	23428	23428	23428

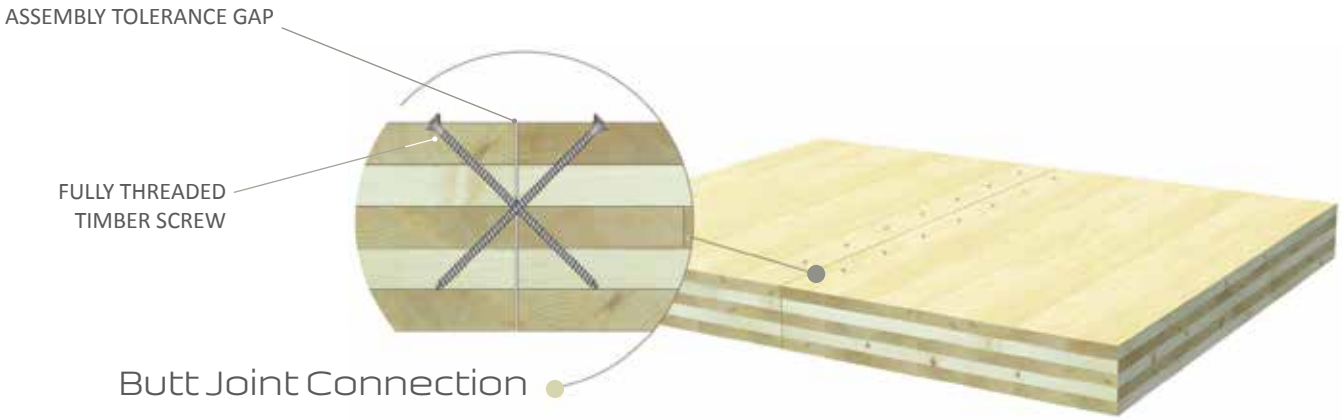
Notes:

1. For panel properties - see page 19.
2. Table values are to be used for preliminary design only.
3. Table values for 87 V and 87 E are computed based on "In- Plane Shear Capacity and Verification Methods" by Prof. G. Schickhofer, University of Graz.
4. Other table values are based on the in-plane shear resistance test conducted by the Advanced Building Sytems Department at FPInnovations. The panels were tested according to the test requirements of the ICC/ES AC455 acceptance criteria (Section 4.3) that refers to the method of ASTM D5456-14.
5. Values are for CrossLam® CLT panel only, not for shear connectors.
6. For applications with loading different than what is indicated above, contact your Structurlam technical representative.

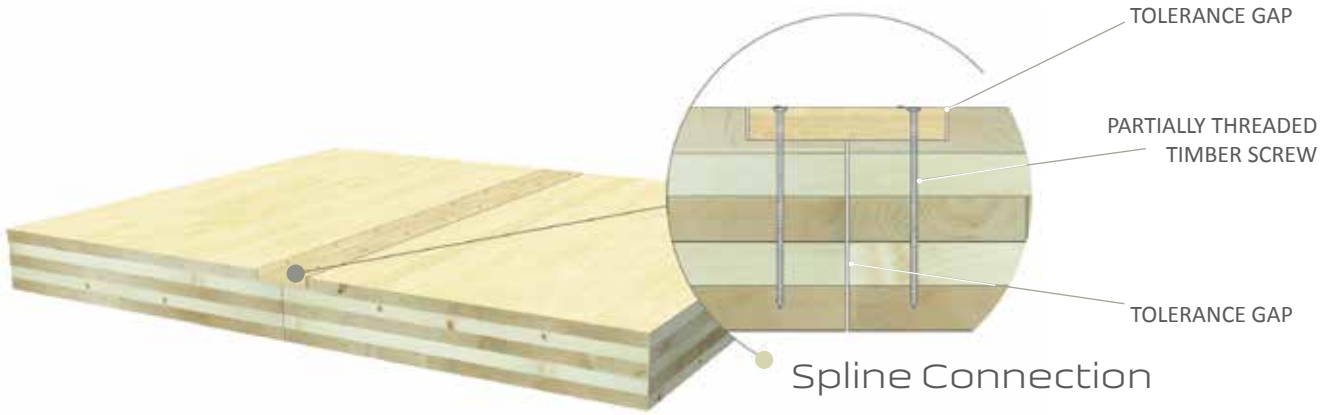
Wesbrook Community Centre - Vancouver, BC CANADA

CrossLam® CLT Connection Details - Floor to Roof Panel Joints

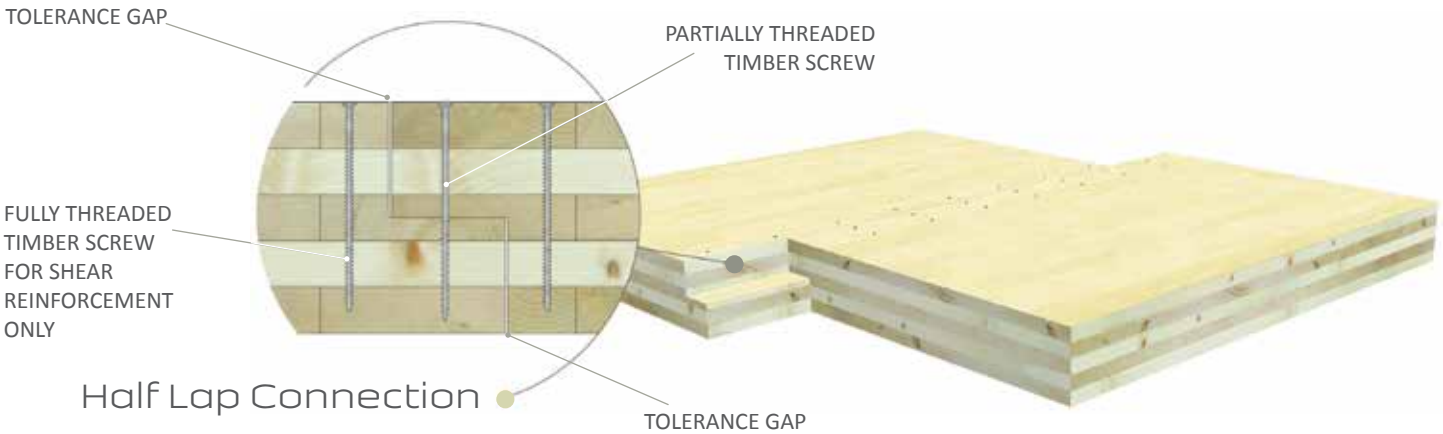
Structurlam will work with your team to identify the most cost-effective connection system for your structure. The following details show typical connection details used in CrossLam® CLT buildings.



Butt Joint Connection

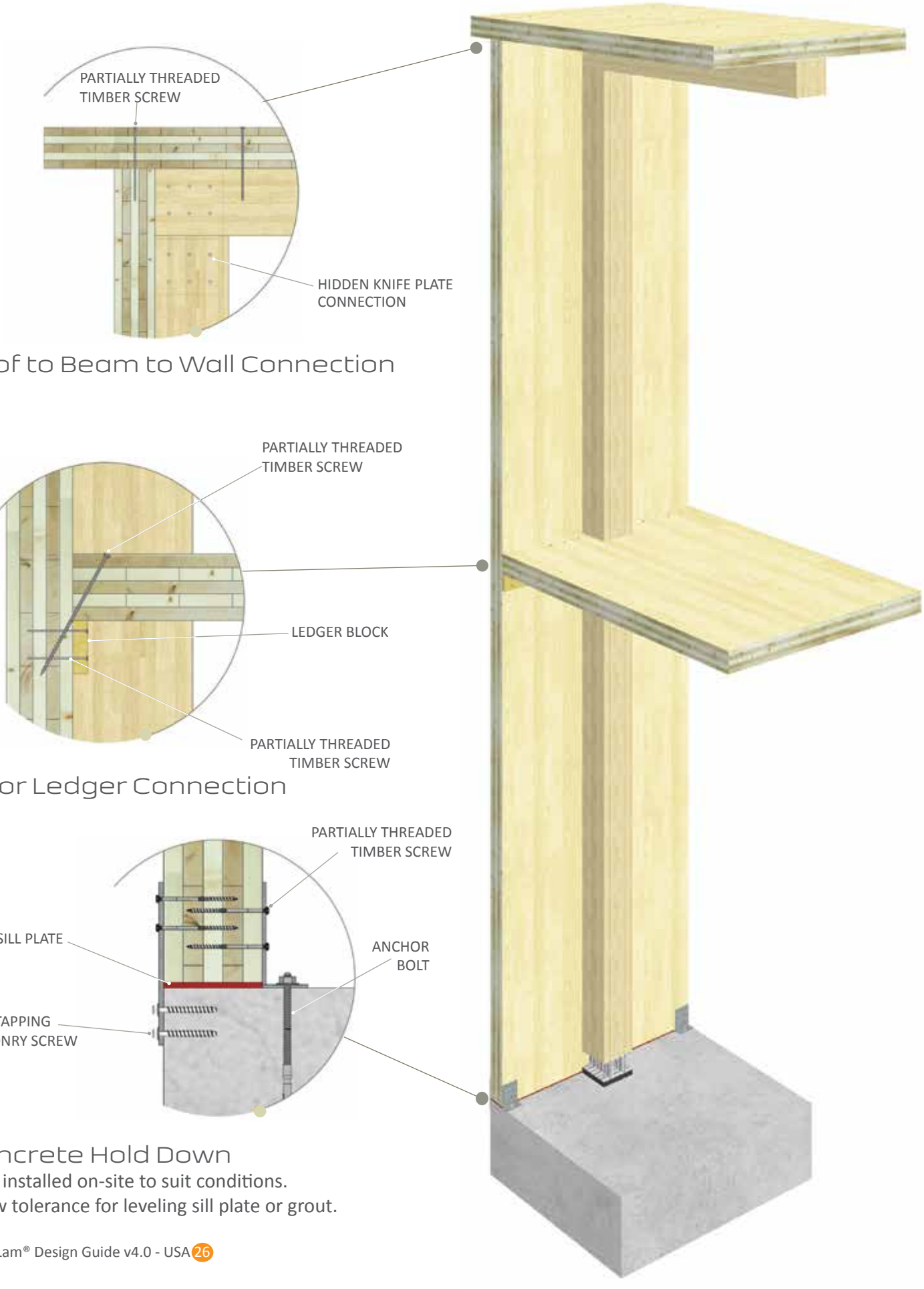


Spline Connection



Half Lap Connection

Flat Roof to Beam to Wall Connections



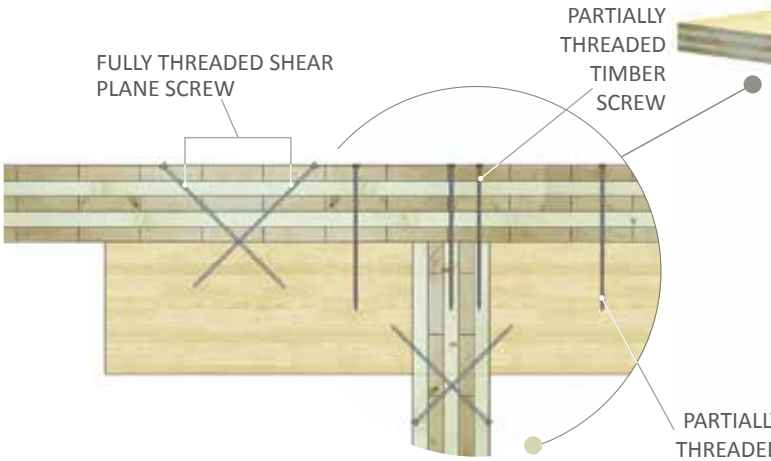
Roof to Beam to Wall Connection

Floor Ledger Connection

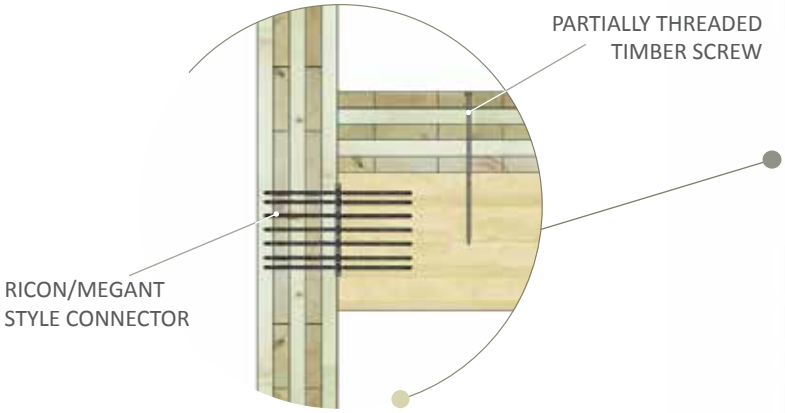
Concrete Hold Down

Post installed on-site to suit conditions.
Allow tolerance for leveling sill plate or grout.

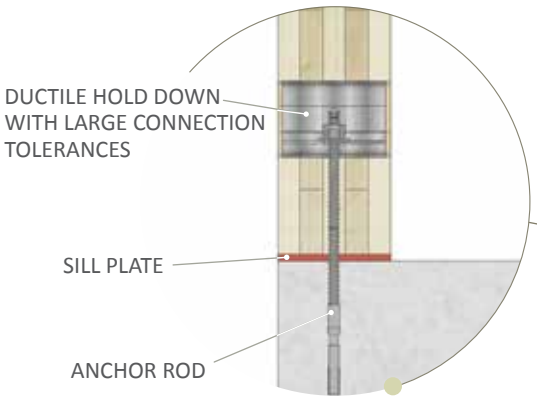
Flat Roof to Wall Connections



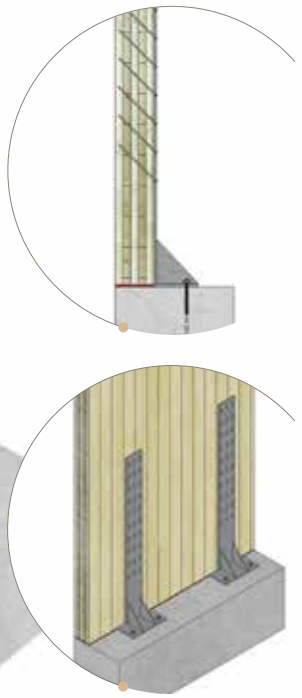
CLT Panel & Through Beam Roof Connection



CLT Wall and Floor Connection



CLT Hold Down Connection

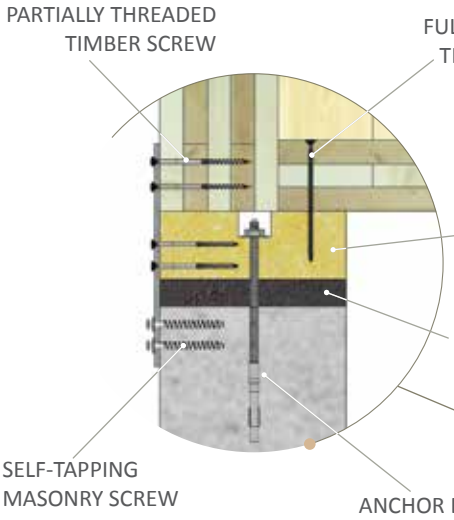


High Force Hold Down Connection

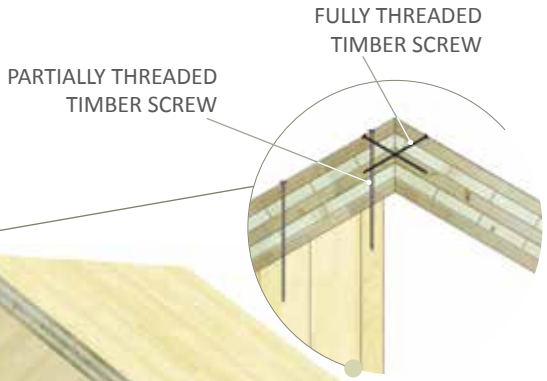
Angled Roof to Wall Connections

Angled Roof to Wall Connection

Platform Framed Wall & Floor Connection

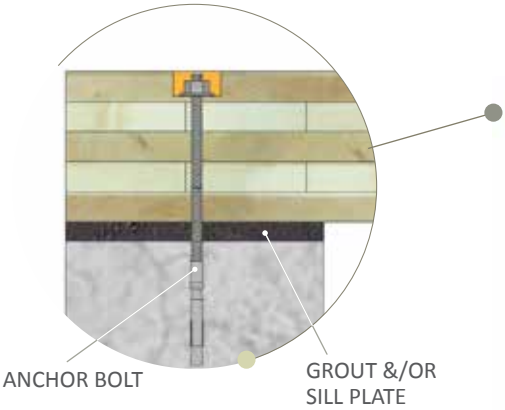


EWP SILL Levelling Plate

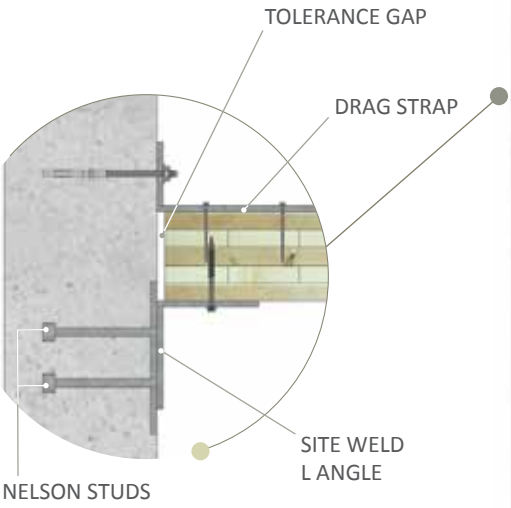


Nail Type Clip Connectors

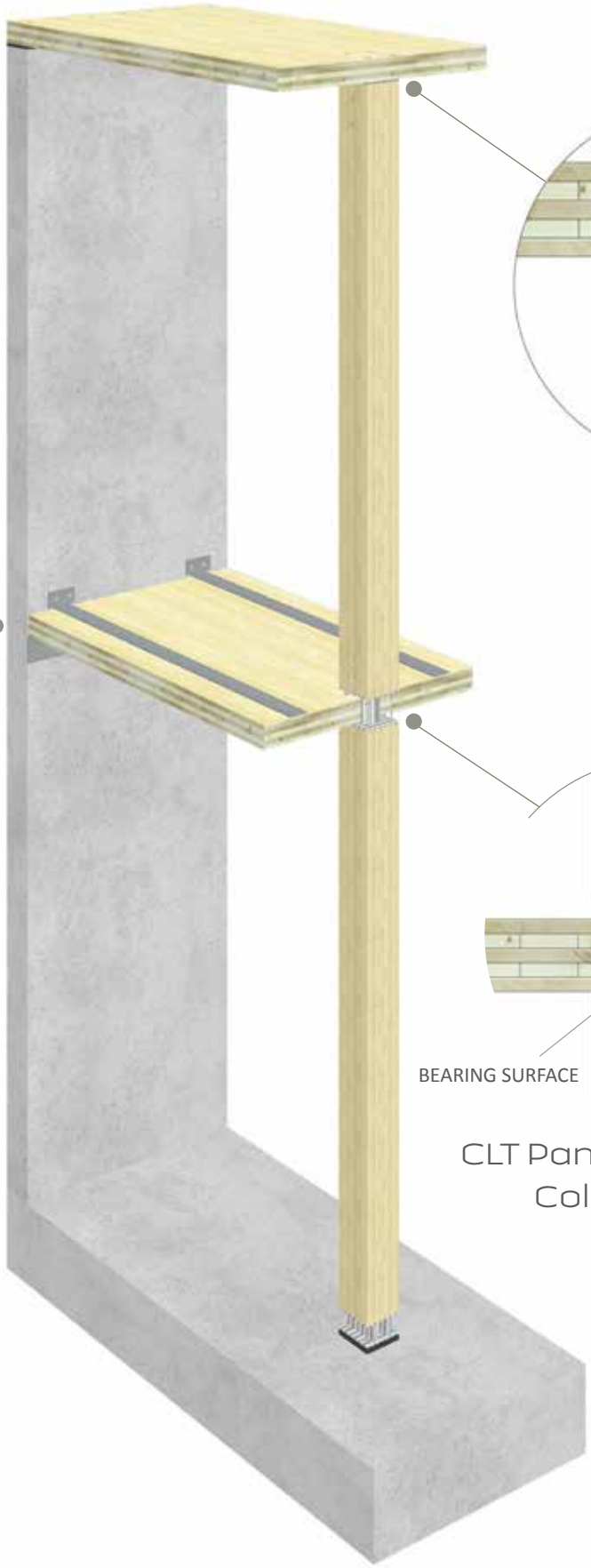
Wall to Concrete Connections

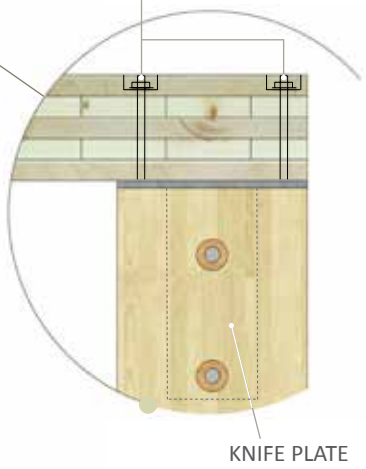


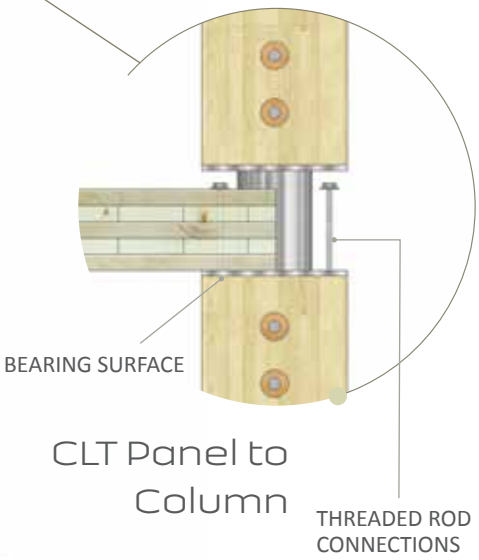
CLT to Concrete Bearing Connection



CLT to Concrete Walls or Core







CLT Panel to Column

f.a.q.
frequently asked questions

1. Where is CLT referenced in the building code?

CLT is now included as a structural system in both the 2015 International Building Code (IBC) for Type IV Construction (Heavy Timber) and the 2015 National Design Specification (NDS) for Wood Construction. Chapter 10 of the NDS applies to CLT manufactured to ANSI/APA standards which states "CLT shall be manufactured in accordance with ANSI/APA PRG 320-2012 Standard for Performance Related Cross Laminated Timber."

2. Can CLT span in two directions?

CLT is manufactured to span in two directions. The unique structural properties of CrossLam® CLT give it strength in both major and minor axis directions. The minor strength span direction needs to be calculated separately as CLT is not isotropic.

3. How are panels connected?

There are a variety of connection systems for CLT panels that provide excellent engineering solutions, and are fast and simple to use on the job site. Please refer to pages 25-29 in the CrossLam® CLT Design Guide for more connection information.

4. Can we run mechanical, electrical and plumbing (MEP) through the CLT panel?

Unlike concrete, the installation of MEP services is easy when building with CLT panels. Services can be field located on-site and cut with power tools by the installer. Should MEP services need factory prefabrication, locations must be determined during the shop drawing phase before manufacturing of CLT begins.

5. Can every CrossLam® CLT Panel be used in visual applications?

No. E1 panels are not available with a visual grade or with a Dfir face layer. They cannot be used in visual applications.

6. What is the insulation value of CLT?

The insulation value of CLT is as follows:

- R Value: 1.2 per inch ($h \cdot ft^2 \cdot °F/Btu$)

CLT also has significant thermal mass acting as a thermal battery for both heating and cooling loads.

7. Can we use CLT in exterior applications?

The 2015 NDS states that CLT must only be used in dry service conditions where the moisture content in service is less than 16%.

8. Can CLT be used in soffit applications?

A soffit application is considered to be a dry service application, so this is an acceptable detail for CrossLam® CLT. Be sure to detail the ends of the panels with protective fascia and metal flashing materials to protect CLT from the elements.

9. Can we expose the panel edge?

It is permissible to expose the CrossLam® CLT panel edge when used in an interior dry service application. It is not permissible to expose the panel edge in an exterior application detail. See FAQ #8.

f.a.q.
frequently asked questions

10. What are the Fire Resistance Ratings of CLT?

Please see Chapter 8 - Fire Performance of Cross Laminated Timber Assemblies in the US CLT Handbook published by the American Wood Council and FP Innovations.

11. What are the acoustic ratings - STC, IIC, FSTC, and FIIC for CLT?

Currently all assemblies are calculated according to the specific application. Please see Chapter 9 - Sound Insulation in the US CLT Handbook published by the American Wood Council and FP Innovations.

12. Can CLT be used in shear wall applications?

Yes. Shear walls and diaphragms must be designed in accordance with ANSI/AWC SDPWS-2015, *Special Design Provisions for Wind and Seismic.*

13. Can CLT panels be used as a vapor barrier?

The US CLT Handbook Chapter 10 states that CLT panels may meet requirements for both vapor retarders and vapor barriers. These findings are subject to the thickness of CLT, properly sealed connections, and lifelong movement of wood products.

14. Can other building materials be applied to CrossLam® CLT Panels?

Yes, but not during the CLT manufacturing process. Foam insulation, butyl peel and stick membranes (blue-skin), drywall, acoustic materials and many other building materials can be applied to CrossLam® CLT panels in a post-manufacturing environment.

15. Can coatings be applied to CrossLam® CLT?

Yes. Coatings are field applied. Coatings are NOT applied to CrossLam® CLT during manufacturing.

16. Do you apply sealer to the edge of the CrossLam® CLT panels to prevent checking?

Applying a sealer to the end of CrossLam® CLT panels is not a standard practice as it can affect other coating and finishing systems. However, if desired, Structurlam does offer this service at an additional cost.

17. Is your CrossLam® CLT panel edge-glued?

No. Structurlam does not edge-glue CrossLam® CLT panels. Our state-of-the-art press technology has an edge pressure system to minimize gaps between the lamellas. This system also controls face checking on CrossLam® CLT panels.

18. Can we do our own shop drawings?

Yes, you can do your own shop drawings. Structurlam can provide design standards that are compatible with our manufacturing requirements. We accept single piece shop drawings as well as the following file formats: IFC, STP, STL, or 3dz (CadWork).

19. Is truckload sequencing available before shipping to the job site?

Truckload sequencing is an added service that we offer. It is recommended for projects in urban areas where a staging area is not available. Load sequencing must be requested during the shop drawing process.

20. Does Structurlam offer a warranty on panels?

Yes, warranty information can be found in the Structurlam **Sales Terms & Conditions** document at www.structurlam.com/construction/services.

PHOTO CREDITS

Wood Innovation + Design - Brudder Productions
Shoreline Medical Center - Andrew Pogue
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Wood Innovation + Design - Ema Peter (Courtesy of Michael Green Architecture)
Tall Tree Integrated Health - Courtesy of AES Engineering Ltd.
Mica Heli-ski Lodge - Keri Knapp

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Intelligence In Wood

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