NORTH AMERICAN BIM DATA STANDARDS FOR CLT (A PROPOSAL)

CAN CANADIAN PRODUCERS LEAD WITH CONSENSUS, OR DO WE WAIT?

Closing the Gaps in North American Mass Timber Material Data & Visualization

MTC - MASS TIMBER CONSULTING

MASS TIMBER CONSULTING

KEY IDEAS

- INTRODUCTION
- REVIT LIMITATIONS
- FLOOR FAMILY – CLT FLOOR PANEL
- DETAIL FAMILY – CLT HATCH
- GLT & NLT PANELS

INTRODUCTION

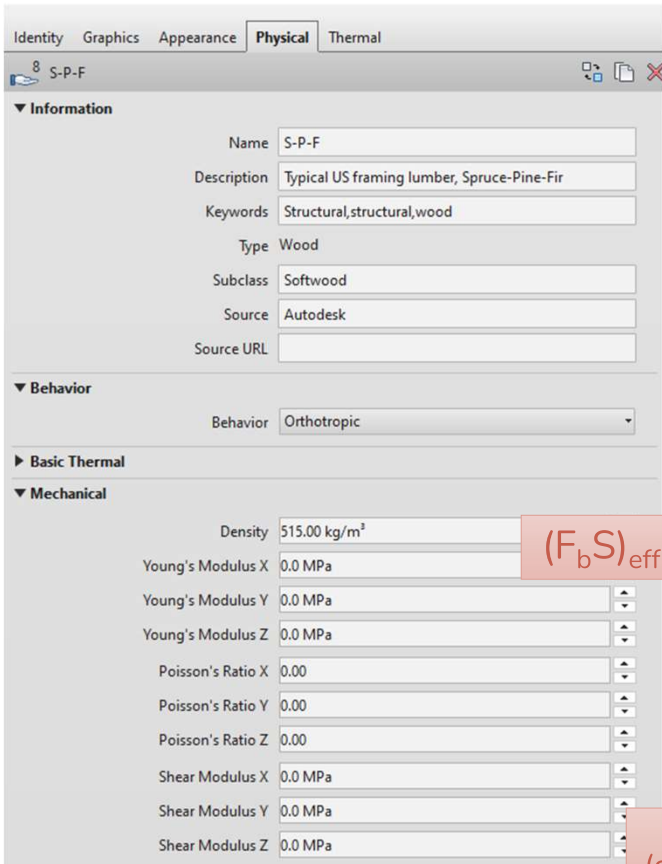
RVT Limitations

Young Industry

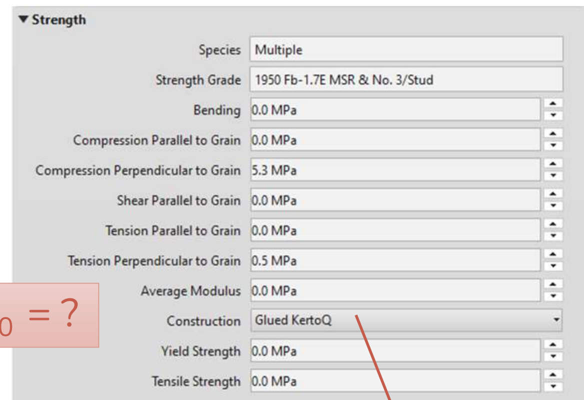
No clear North American Standard

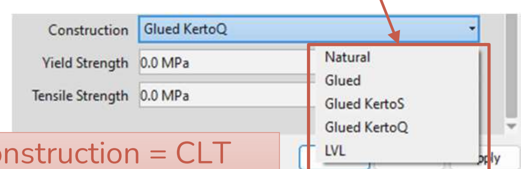
Canadian Mass Timber container file

CLT PERFORMANCE CHARACTERISTICS - PHYSICAL

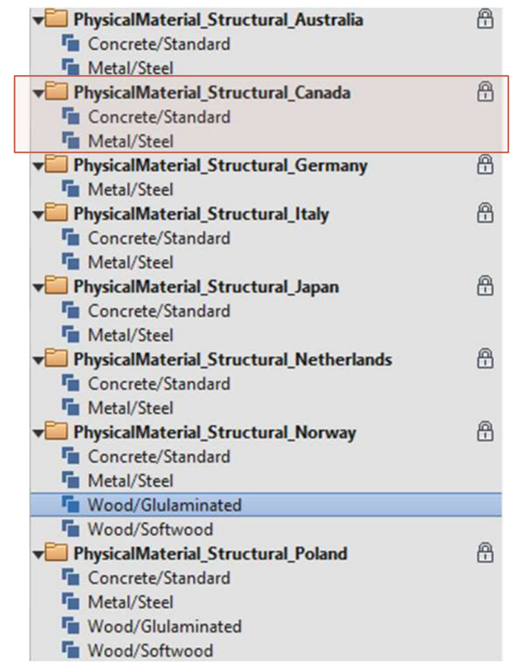


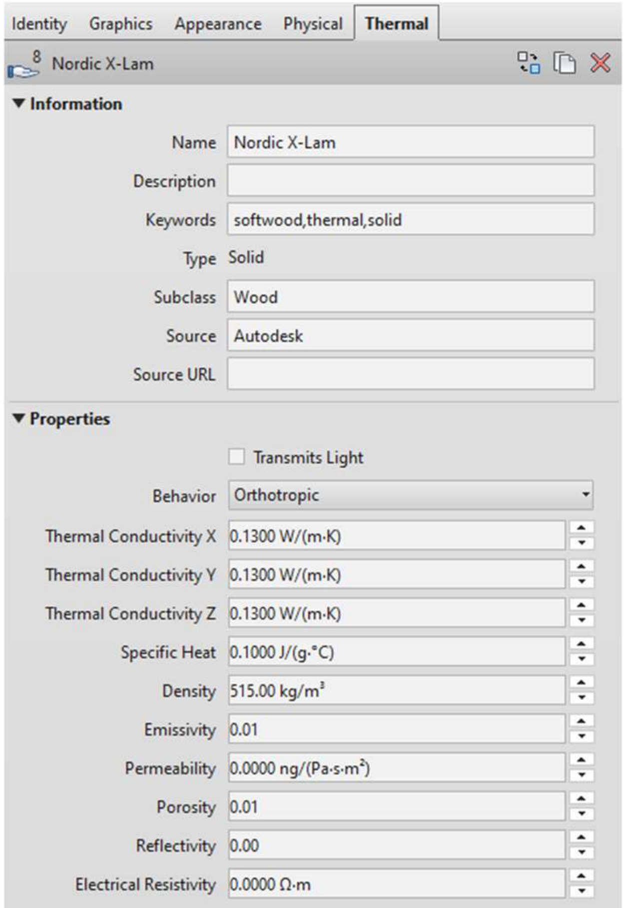
$(F_b S)_{eff,f,0} = ?$





Construction = CLT
(currently not available)





CLT PERFORMANCE CHARACTERISTICS - THERMAL

λ – thermal conductivity → insulation performance

λ = 0.13 W/mk

Density → thermal mass

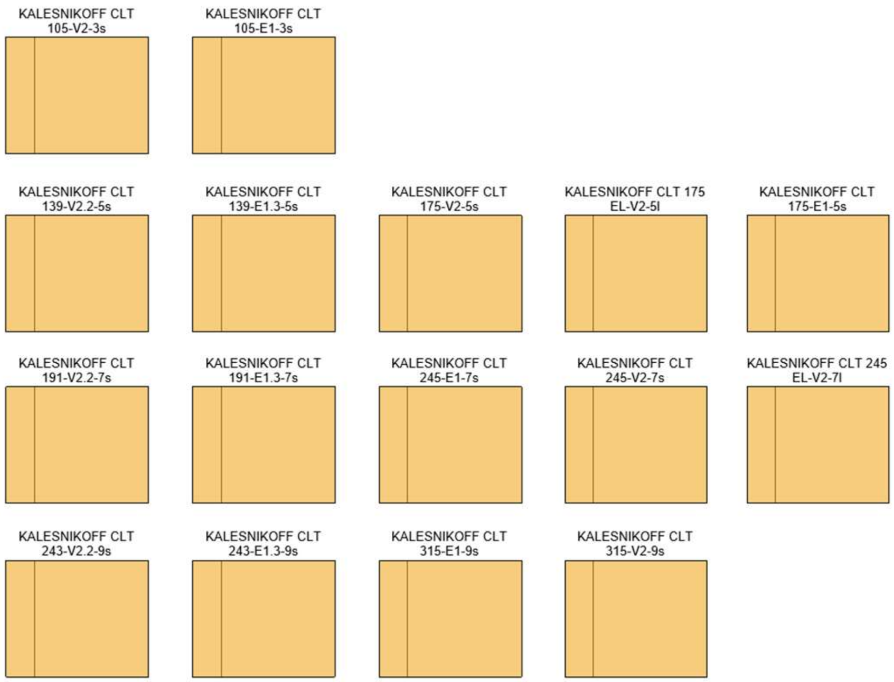
480-500kg/m^3

High specific heat capacity → thermal inertia

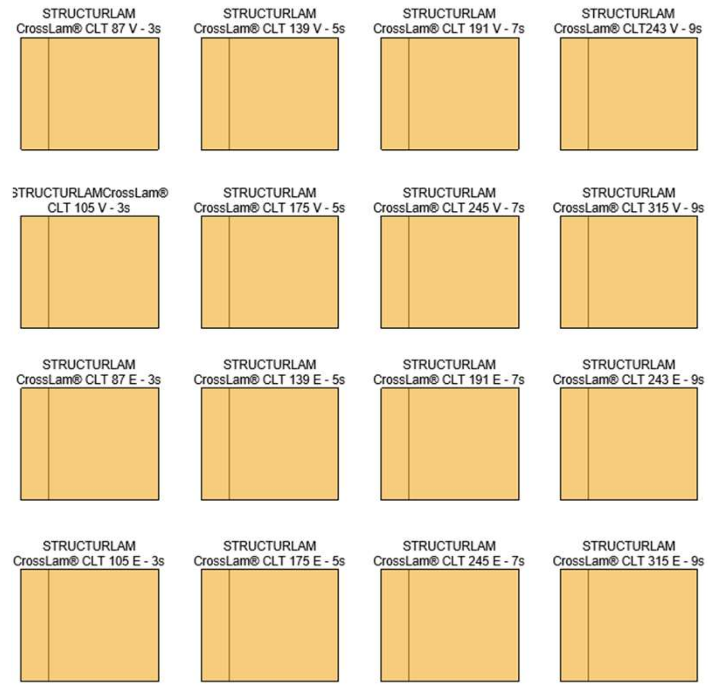
1 300J/kg°C

FLOOR FAMILIES

KALESNIKOFF CLT



STRUCTURLAM - CrossLam® CLT



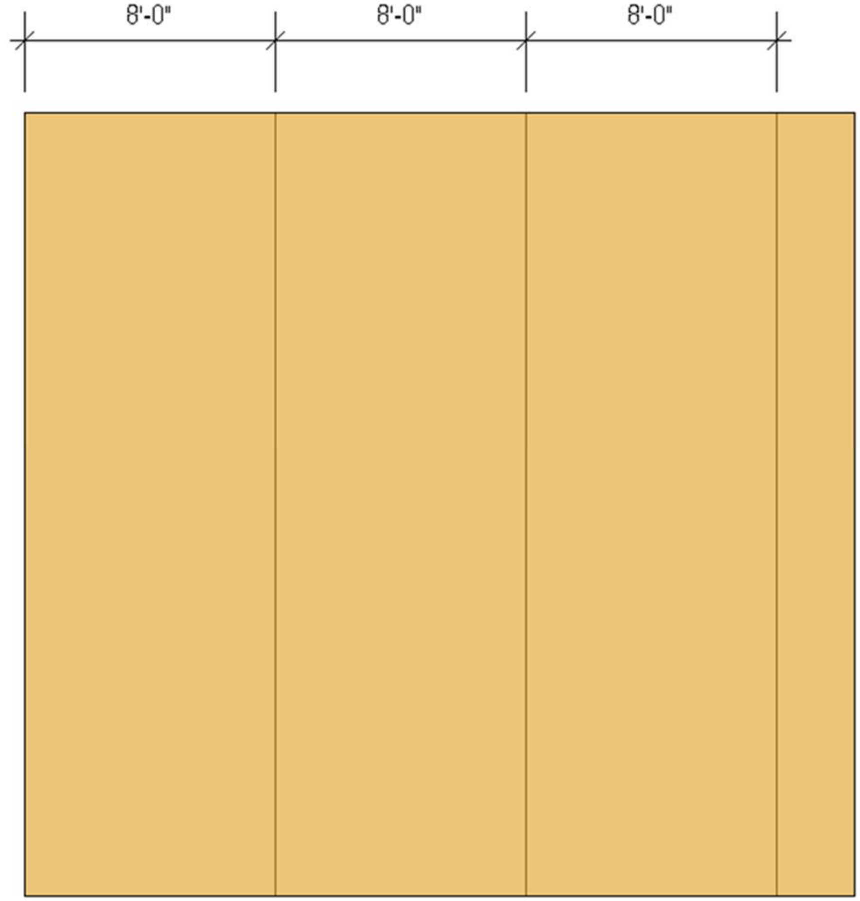
FLOOR FAMILIES

NORDIC STRUCTURES – Nordic X-Lam

- Taking our proposal to all Canadian manufacturers who have an ANSI/APA PRG-320 product.
- Manufacturer consent and consensus is important.

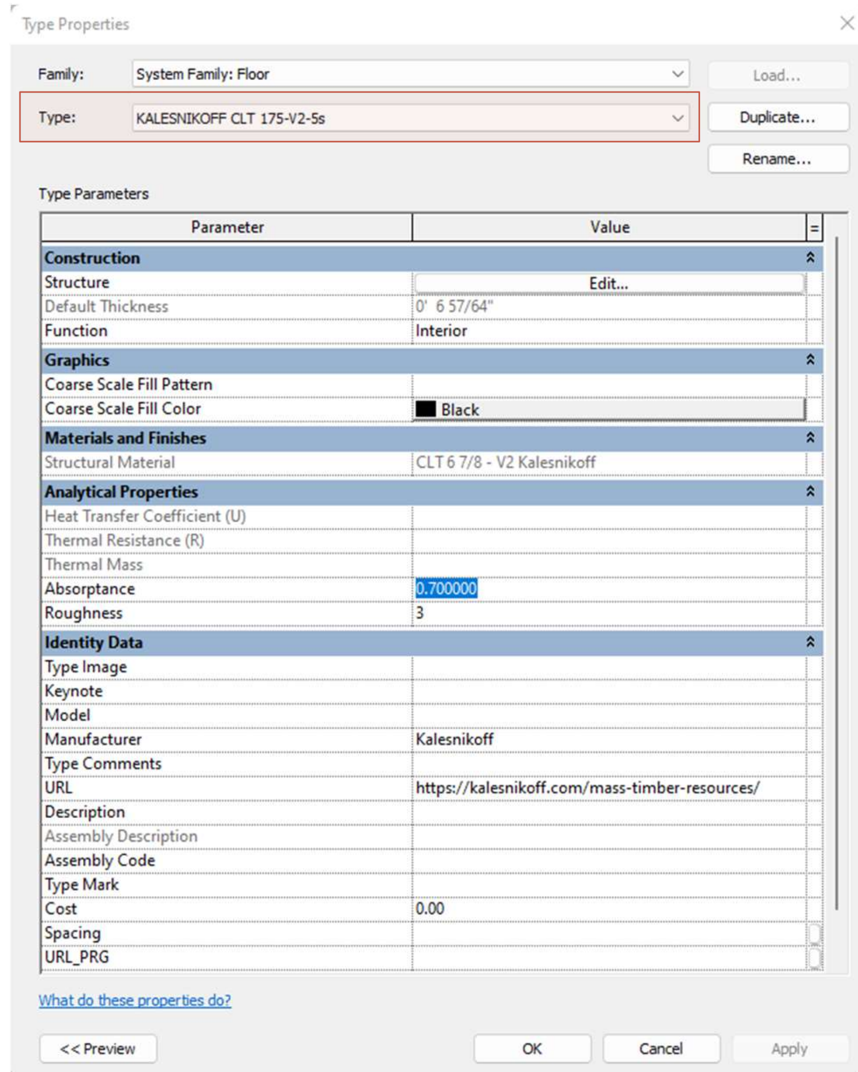
SURFACE PATTERN

- To be used as reference!
- Manufacturers may offer other widths.



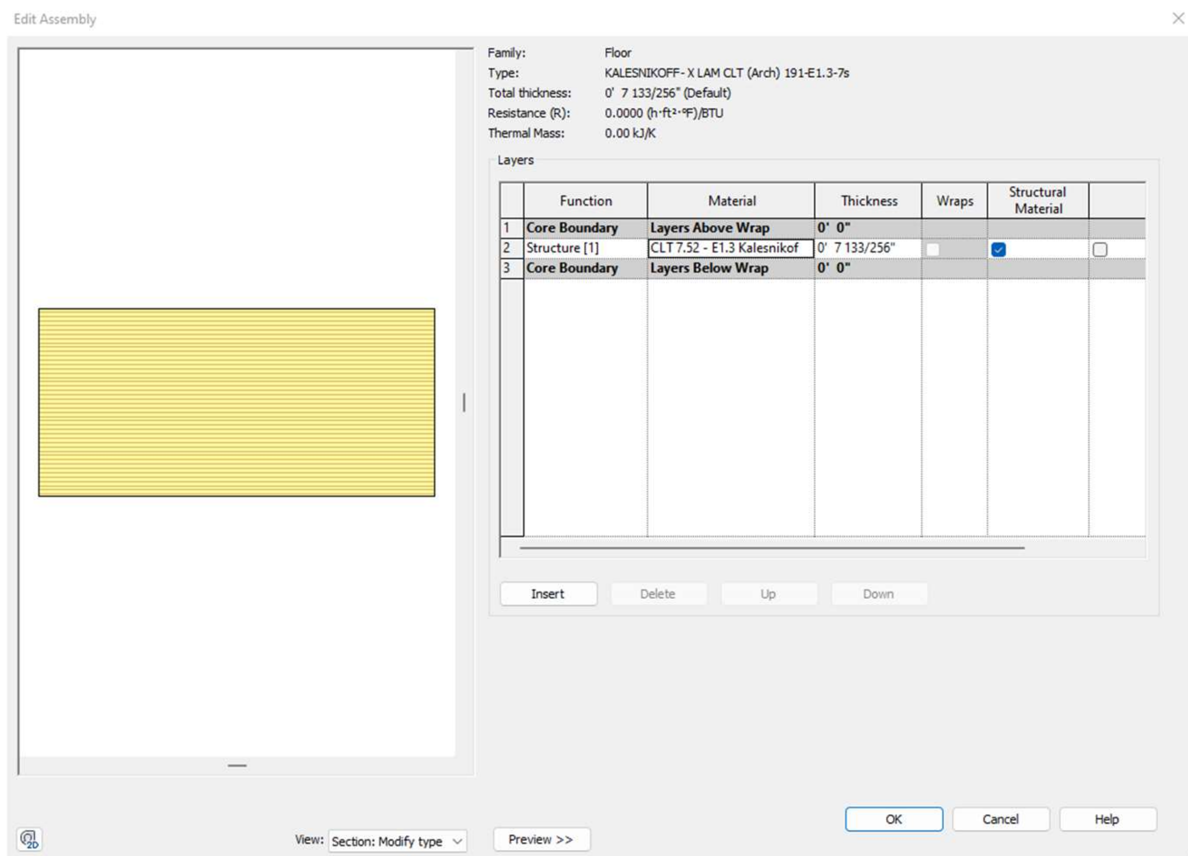
FLOOR TYPES

- Floor types are available for each CLT product offered by the manufacturer.



FLOOR ASSEMBLY

- The floor structure is customizable and different layers can be added to suit the design.

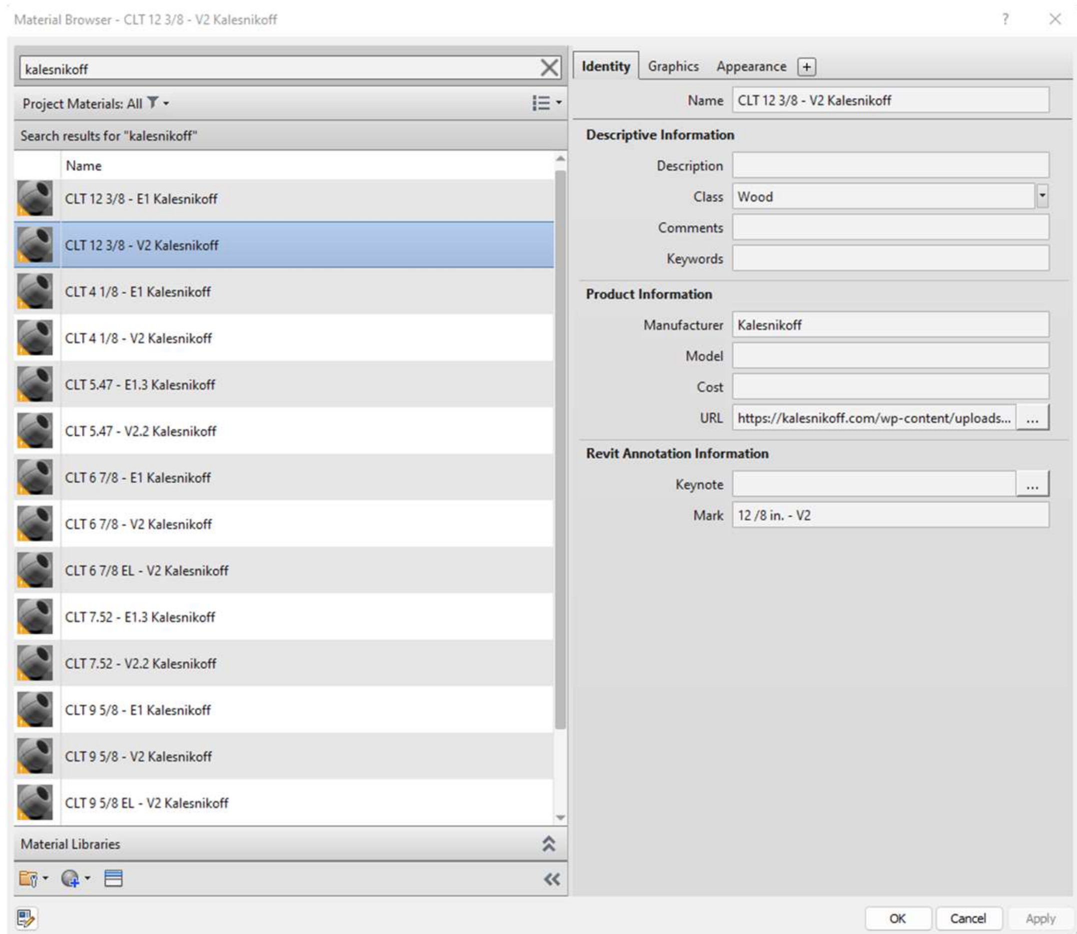


MATERIAL PARAMETERS

- Custom material related to manufacturer product.
- Material name :

Thickness – Grade, Manufacturer

- Product Information – URL: PRG-320 or the company's technical guide



STRUCTURAL ANALYSIS

Structural Analysis	
MajorSD-Effective flatwise bending moment capacity (lbf-ft/ft)	12800.00
MajorSD-Effective flatwise bending stiffness (10^6 lbf-in.^2/ft)	1791.000000
MajorSD-Effective shear stiffness in flatwise bending (10^6 lbf/ft)	1.800000
MajorSD-Flatwise shear capacity (lbf/ft)	4450.00
MinorSD-Effective flatwise bending moment capacity (lbf-ft/ft)	5575.00
MinorSD-Effective flatwise bending stiffness (10^6 lbf-in.^2/ft)	773.000000
MinorSD-Effective shear stiffness in flatwise bending (10^6 lbf/ft)	2.100000
MinorSD-Flatwise shear capacity (lbf/ft)	3475.00
Weight	33.40 lb/ft^2

Table 2. ASD Reference Design Values[a, b] for Kalesnikoff CLT (for Use in the U.S.) (Continued)

CLT Grade[c]	Layup ID	Thickness, t_p (in.)	Lamination Thickness (in.) in CLT Layup									Major Strength Direction				Minor Strength Direction			
			=	⊥	=	⊥	=	⊥	=	⊥	=	$(F_bS)_{eff,f,0}$ (lbf-ft/ft)	$(EI)_{eff,f,0}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,0}$ (10^6 lbf/ft)	$V_{s,0}$ (lbf/ft)	$(F_bS)_{eff,f,90}$ (lbf-ft/ft)	$(EI)_{eff,f,90}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,90}$ (10^6 lbf/ft)	$V_{s,90}$ (lbf/ft)
E1.3	3-ply	3.42	1.38	0.67	1.38							3,200	68	0.49	1,230	40	0.36	0.36	240
	5-ply	5.47	1.38	0.67	1.38	0.67	1.38					7,400	249	0.98	1,970	540	21	0.73	980
	7-ply	7.52	1.38	0.67	1.38	0.67	1.38	0.67	1.38			13,150	608	1.5	2,700	1,230	84	1.1	1,720
	9-ply	9.56	1.38	0.67	1.38	0.67	1.38	0.67	1.38	0.67	1.38	20,450	1,204	2.0	3,450	2,170	212	1.5	2,450
E1M8	3-ply	4.13	1.38	1.38	1.38							4,525	115	0.64	1,490	615	4.4	0.64	495
	5-ply	6.88	1.38	1.38	1.38	1.38	1.38					10,425	441	1.3	2,480	5,325	115	1.3	1,490
	7-ply	9.63	1.38	1.38	1.38	1.38	1.38	1.38	1.38			18,450	1,093	1.9	3,475	12,275	441	1.9	2,480
	9-ply	12.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	28,625	2,179	2.6	4,450	21,700	1,093	2.6	3,475
E1M9	3-ply	4.13	1.38	1.38	1.38							4,525	115	0.53	1,490	275	3.6	0.63	495
	5-ply	6.88	1.38	1.38	1.38	1.38	1.38					10,425	441	1.1	2,480	2,390	95	1.3	1,490
	7-ply	9.63	1.38	1.38	1.38	1.38	1.38	1.38	1.38			18,400	1,090	1.6	3,475	5,525	364	1.9	2,480
	9-ply	12.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	28,525	2,173	2.1	4,450	9,775	903	2.5	3,475
E1M11	3-ply	4.13	1.38	1.38	1.38							3,825	101	0.46	1,490	160	3.1	0.55	495
	5-ply	6.88	1.38	1.38	1.38	1.38	1.38					8,800	389	0.92	2,480	1,370	81	1.1	1,490
	7-ply	9.63	1.38	1.38	1.38	1.38	1.38	1.38	1.38			15,575	962	1.4	3,475	3,150	312	1.7	2,480
	9-ply	12.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	24,125	1,917	1.8	4,450	5,575	774	2.2	3,475
V2	3-ply	4 1/8	1 3/8	1 3/8	1 3/8							2,030	95	0.46	1,490	160	3.1	0.52	495
	5-ply	6 7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8					4,675	363	0.91	2,480	1,370	81	1.0	1,490
	5-ply EL	6 7/8	1 3/8 x 2	1 3/8	1 3/8 x 2							5,825	451	0.95	2,480	160	3.1	0.61	495
	7-ply	9 5/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8			8,275	898	1.4	3,475	3,150	312	1.6	2,480
	7-ply EL	9 5/8	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8 x 2					10,650	1,156	1.4	3,475	1,370	81	1.1	1,490
	8-ply EL[d]	11	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8			11,000	1,463	1.6	3,950	3,150	312	1.6	2,480
	9-ply	12 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	12,800	1,791	1.8	4,450	5,575	773	2.1	3,475
	9-ply EL	12 3/8	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8 x 2			16,475	2,303	1.8	4,450	3,150	312	1.6	2,480
V2.2	3-ply	3.42	1.38	0.67	1.38							1,440	56	0.48	1,230	40	0.36	0.30	240
	5-ply	5.47	1.38	0.67	1.38	0.67	1.38					3,325	205	0.95	1,970	540	21	0.61	980
	5-ply EL	6.17	1.38 x 2	0.67	1.38 x 2							4,725	329	1.2	2,220	40	0.36	0.43	240
	7-ply	7.52	1.38	0.67	1.38	0.67	1.38	0.67	1.38			5,900	501	1.4	2,700	1,220	84	0.91	1,720
	7-ply EL	8.22	1.38 x 2	0.67	1.38	0.67	1.38 x 2					8,125	753	1.6	2,950	540	21	0.73	980
	9-ply	9.56	1.38	0.67	1.38	0.67	1.38	0.67	1.38	0.67	1.38	9,200	993	1.9	3,450	2,150	211	1.2	2,450
	9-ply EL	10.27	1.38 x 2	0.67	1.38	0.67	1.38	0.67	1.38 x 2			12,250	1,421	2.0	3,700	1,220	84	1.0	1,720

APAPR-L332KalesnikoffCLT-10_US PDF from Kalesnikoff

IDENTITY DATA

Identity Data	
Spec Material	
Number of layers	9
Thickness and orientation of layers	1 3/8L-1 3/8T-1 3/8L-1 3/8T-1 3/8L-1 3/8T-1 3/8L-1 3/8T-1 3/8L
Species	SPF
Stress Grade	V2
Finish	Architectural

KALESNIKOFF

Table 2. ASD Reference Design Values[a, b] for Kalesnikoff CLT (for Use in the U.S.) (Continued)

CLT Grade[c]	Layup ID	Thick-ness, t_p (in.)	Lamination Thickness (in.) in CLT Layup									Major Strength Direction				Minor Strength Direction			
			=	⊥	=	⊥	=	⊥	=	⊥	=	$(F_bS)_{eff,f,0}$ (lbf-ft/ft)	$(EI)_{eff,f,0}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,0}$ (10^6 lbf/ft)	$V_{s,0}$ (lbf/ft)	$(F_bS)_{eff,f,90}$ (lbf-ft/ft)	$(EI)_{eff,f,90}$ (10^6 lbf-in.^{2}/ft)	$(GA)_{eff,f,90}$ (10^6 lbf/ft)	$V_{s,90}$ (lbf/ft)
E1.3	3-ply	3.42	1.38	0.67	1.38							3,200	68	0.49	1,230	40	0.36	0.36	240
	5-ply	5.47	1.38	0.67	1.38	0.67	1.38					7,400	249	0.98	1,970	540	21	0.73	980
	7-ply	7.52	1.38	0.67	1.38	0.67	1.38	0.67	1.38			13,150	608	1.5	2,700	1,230	84	1.1	1,720
	9-ply	9.56	1.38	0.67	1.38	0.67	1.38	0.67	1.38	0.67	1.38	20,450	1,204	2.0	3,450	2,170	212	1.5	2,450
E1M8	3-ply	4.13	1.38	1.38	1.38							4,525	115	0.64	1,490	615	4.4	0.64	495
	5-ply	6.88	1.38	1.38	1.38	1.38	1.38					10,425	441	1.3	2,480	5,325	115	1.3	1,490
	7-ply	9.63	1.38	1.38	1.38	1.38	1.38	1.38	1.38			18,450	1,093	1.9	3,475	12,275	441	1.9	2,480
	9-ply	12.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	28,625	2,179	2.6	4,450	21,700	1,093	2.6	3,475
E1M9	3-ply	4.13	1.38	1.38	1.38							4,525	115	0.53	1,490	275	3.6	0.63	495
	5-ply	6.88	1.38	1.38	1.38	1.38	1.38					10,425	441	1.1	2,480	2,390	95	1.3	1,490
	7-ply	9.63	1.38	1.38	1.38	1.38	1.38	1.38	1.38			18,400	1,090	1.6	3,475	5,525	364	1.9	2,480
	9-ply	12.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	28,525	2,173	2.1	4,450	9,775	903	2.5	3,475
E1M11	3-ply	4.13	1.38	1.38	1.38							3,825	101	0.46	1,490	160	3.1	0.55	495
	5-ply	6.88	1.38	1.38	1.38	1.38	1.38					8,800	389	0.92	2,480	1,370	81	1.1	1,490
	7-ply	9.63	1.38	1.38	1.38	1.38	1.38	1.38	1.38			15,575	962	1.4	3,475	3,150	312	1.7	2,480
	9-ply	12.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	24,125	1,917	1.8	4,450	5,575	774	2.2	3,475
V2	3-ply	4 1/8	1 3/8	1 3/8	1 3/8							2,030	95	0.46	1,490	160	3.1	0.52	495
	5-ply	6 7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8					4,675	363	0.91	2,480	1,370	81	1.0	1,490
	5-ply EL	6 7/8	1 3/8 x 2	1 3/8	1 3/8 x 2							5,825	451	0.95	2,480	160	3.1	0.61	495
	7-ply	9 5/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8			8,275	898	1.4	3,475	3,150	312	1.6	2,480
	7-ply EL	9 5/8	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8 x 2					10,650	1,156	1.4	3,475	1,370	81	1.1	1,490
	8-ply EL[d]	11	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8			11,000	1,463	1.6	3,950	3,150	312	1.6	2,480
	9-ply	12 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	12,800	1,791	1.8	4,450	5,575	773	2.1	3,475
	9-ply EL	12 3/8	1 3/8 x 2	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8 x 2			16,475	2,303	1.8	4,450	3,150	312	1.6	2,480
V2.2	3-ply	3.42	1.38	0.67	1.38							1,440	56	0.48	1,230	40	0.36	0.30	240
	5-ply	5.47	1.38	0.67	1.38	0.67	1.38					3,325	205	0.95	1,970	540	21	0.61	980
	5-ply EL	6.17	1.38 x 2	0.67	1.38 x 2							4,725	329	1.2	2,220	40	0.36	0.43	240
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	7-ply EL	8.22	1.38 x 2	0.67	1.38	0.67	1.38 x 2					8,125	753	1.6	2,950	540	21	0.73	980
	9-ply	9.56	1.38	0.67	1.38	0.67	1.38	0.67	1.38	0.67	1.38	9,200	993	1.9	3,450	2,150	211	1.2	2,450
	9-ply EL	10.27	1.38 x 2	0.67	1.38	0.67	1.38	0.67	1.38 x 2			12,250	1,421	2.0	3,700	1,220	84	1.0	1,720

https://kalesnikoff.com/wp-content/uploads/2022/09/APAPR-L332KalesnikoffCLT-10.pdf

CrossLam® CLT Panel Layups

TABLE 20: LUMBER SPECIES AND THICKNESS FOR SPRUCE-PINE-FIR (SPF) 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 Appearance Grade D. Fir #2SE	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			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					
191 E					1.38	**0.67**	1.38	**0.67**	1.38	**0.67**				
243 E					1.38	**0.67**	1.38	**0.67**	1.38	**0.67**				
105 E	E1M5			SPF #2&Btr	1.38	1.38	1.38							
175 E					1.38	1.38	1.38	1.38	1.38					
245 E					1.38	1.38	1.38	1.38	1.38	1.38				
315 E					1.38	1.38	1.38	1.38	1.38	1.38				

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

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

STRUC-13694-U.S.-Technical-Guide-3.0_92.0 PDF from Structurlam

CrossLam® CLT Structural Panel Properties

TABLE 23: ALLOWABLE DESIGN PROPERTIES FOR LAMINATIONS (SPF)

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	1,150	135	45	500	1.2	250	650	135	45
V2M1.1	875	1.4	450	1,150	135	45	875	1.4	450	1,150	135	45
E1M4	2,100	1.8	1,575	1,875	160	50	500	1.2	250	650	135	45
E1M5	2,100	1.8	1,575	1,875	160	50	875	1.4	450	1,150	135	45

Notes:

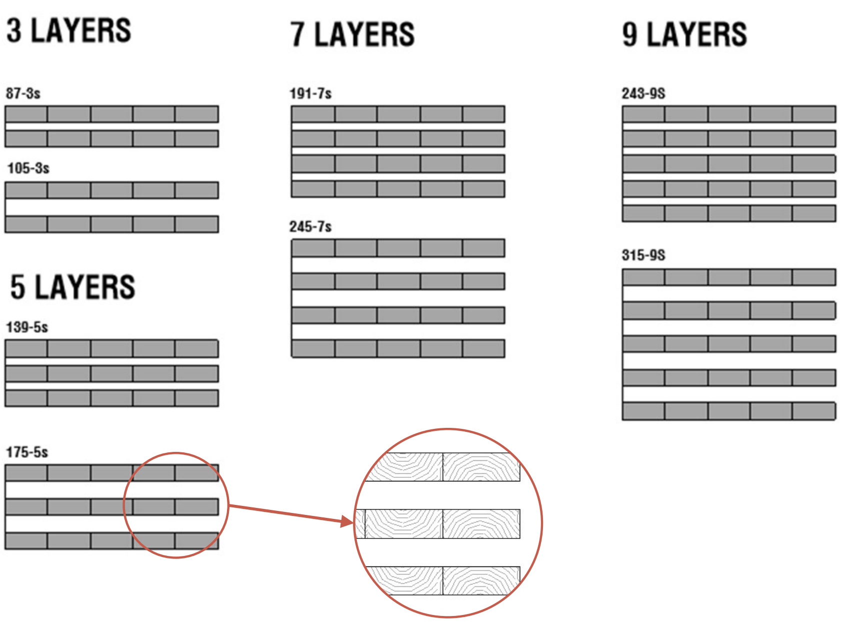
1. *Tabulated values are allowable design values and not permitted to be increased for the lumber size adjustment factor in accordance with the NDS.*
2. *The CLT grades are developed based on APA Product Report PR-L314. Please refer to specific grade layups for complete panel information.*
3. *The design 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 table above).*
4. *Values are calculated per one-foot-wide section of panel.*
5. *The panel weight is based on SPF lumber values in the 2015 NDS.*

STRUCTURLAM DESIGN TABLE (US)

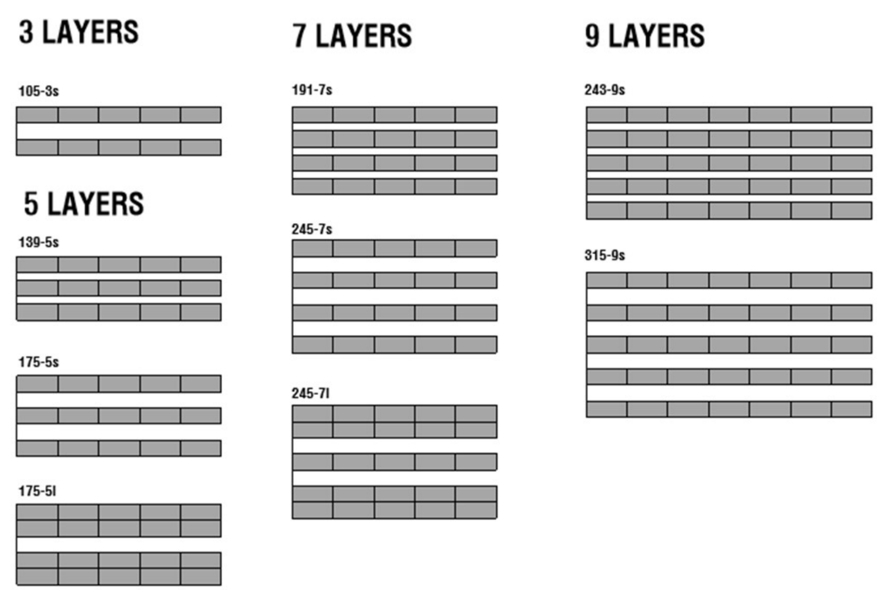
Structurlam Design Table - US									
Family and Type	MajorSD-Effective flatwise bending moment capacity (lbf-ft/ft)	MajorSD-Effective flatwise bending stiffness (10^6 lbf-in.^2/ft)	MajorSD-Effective shear stiffness in flatwise bending (10^6 lbf/ft)	MajorSD-Flatwise shear capacity (lbf/ft)	MinorSD-Effective flatwise bending moment capacity (lbf-ft/ft)	MinorSD-Effective flatwise bending stiffness (10^6 lbf-in.^2/ft)	MinorSD-Effective shear stiffness in flatwise bending (10^6 lbf/ft)	MinorSD-Flatwise shear capacity (lbf/ft)	Weight
Floor: STRUCTURLAM CrossLam CLT (Arch) 87 E - 3s	3475	72	0.5	1230	35	0.4	0.38	270	8.2 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 87 V - 3s	1440	56	0.5	1230	35	0.4	0.3	240	7.5 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 105 E - 3s	4900	123	0.5	1490	275	3.7	0.66	550	9.7 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 105 V - 3s	2050	96	0.5	1490	280	3.7	0.53	495	9 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 139 E - 5s	7975	264	1	1970	540	21	0.77	1090	13 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 139 V - 5s	3325	206	1	1970	540	21	0.6	980	11.9 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 175 E - 5s	11250	469	1.1	2480	2400	96	1.3	1650	16.1 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 175 V - 5s	4725	366	1.1	2480	2410	96	1.1	1490	15 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 191 E - 7s	14175	645	1.5	2700	1230	83	1.1	1910	17.8 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 191 V - 7s	5925	503	1.4	2700	1220	83	0.91	1710	16.3 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 243 E - 9s	22075	1278	2	3450	2160	209	1.5	2725	22.7 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 243 V - 9s	9200	995	1.9	3450	2140	209	1.2	2450	20.8 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 245 E - 7s	19900	1161	1.6	3475	5550	366	2	2750	22.5 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 245 V - 7s	8350	906	1.6	3475	5550	366	1.6	2480	21 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 315 E - 9s	30850	2314	2.1	4475	9825	906	2.6	3850	28.8 lb/ft²
Floor: STRUCTURLAM CrossLam CLT (Arch) 315 V - 9s	12925	1806	2.1	4475	9800	906	2.1	3475	27 lb/ft²

REVIT DETAIL ITEM – CLT CROSS-SECTION PATTERN

STRUCTURLAM PANEL SIZES

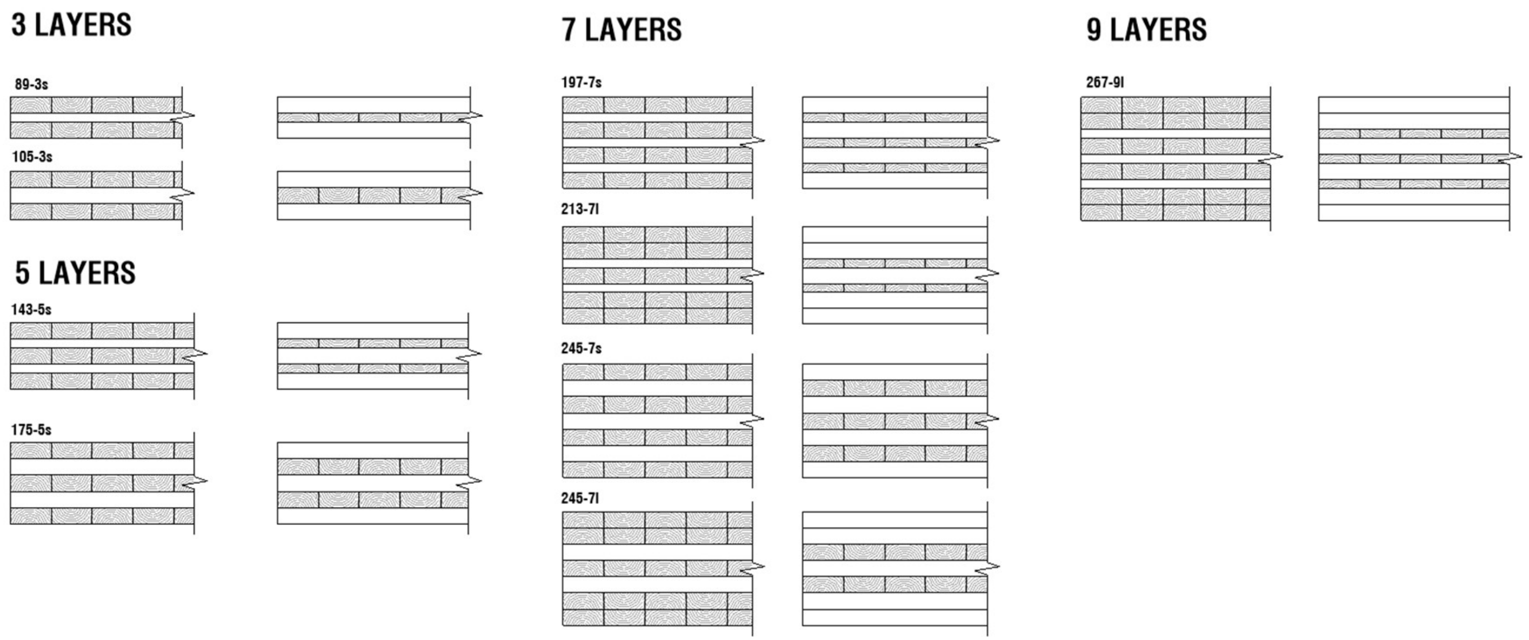


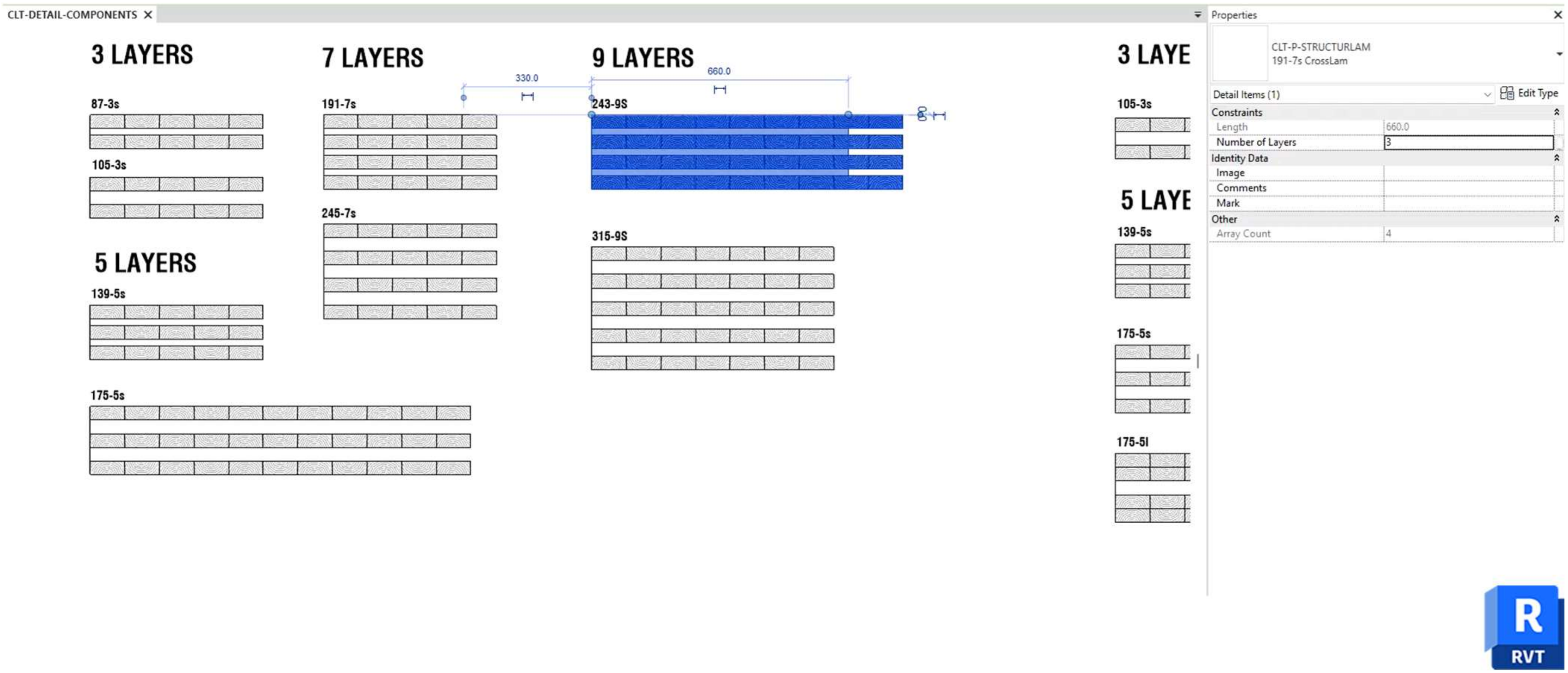
KALESNIKOFF PANEL SIZES



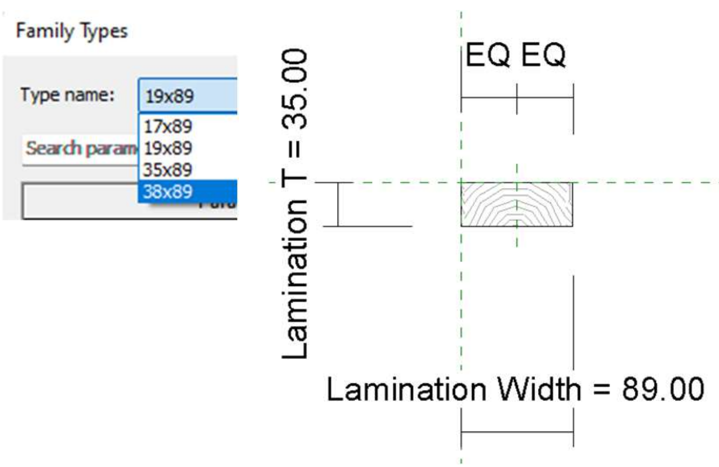
REVIT DETAIL ITEM – CLT CROSS-SECTION PATTERN

NORDIC STRUCTURES PANEL SIZES

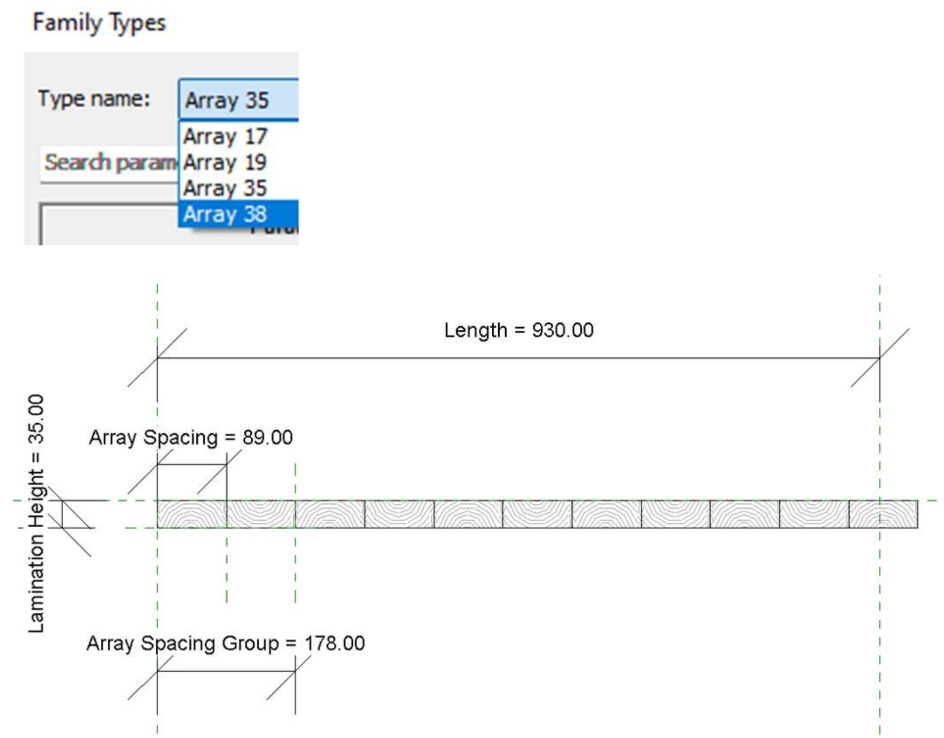



CLT-DETAIL-COMPONENTS
3 LAYERS
87-3s
105-3s
5 LAYERS
139-5s
175-5s
7 LAYERS
191-7s
245-7s
9 LAYERS
330.0
660.0
243-9S
315-9S
3 LAYE
105-3s
5 LAYE
139-5s
175-5s
175-5l
Properties
CLT-P-STRUCTURLAM
191-7s CrossLam
Detail Items (1)
Edit Type
Constraints
Length
660.0
Number of Layers
3
Identity Data
Image
Comments
Mark
Other
Array Count
4
R
RVT

NESTED PARAMETRIC FAMILIES



DIMENSIONAL SOFTWOOD
LUMBER FAMILY



LAYER OF LUMBER BOARD –
CUT PERPENDICULAR TO GRAIN

GLT PANELS - DESIGN PROPERTIES (US)

Art Massif & Western Archrib

GLT Art Massif US											
Type	Thickness	Stress Grade	Species	Finish	Bending Fb (psi)	Tension parallel to grain Ft (psi)	Shear parallel to grain Fv (psi)	Compression perpendicular to grain Fc⊥ (psi)	Compression parallel to grain Fc (psi)	Modulus of Elasticity E (psi)	Specific Gravity G (psi)
ArtMassif - GLT 2 3/8"	2 3/8"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	875	450	135	425	1150	1400000	510000
ArtMassif - GLT 3 1/8"	3 1/8"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	875	450	135	425	1150	1400000	510000
ArtMassif - GLT 5"	5"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	875	450	135	425	1150	1400000	510000
ArtMassif - GLT 1 1/2"	1 1/2"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	875	450	135		1150	1400000	510000

GLT Western Archrib US											
Family and Type	Thickness	Stress Grade	Species	Finish	Bending Fb (psi)	Tension parallel to grain Ft (psi)	Shear parallel to grain Fv (psi)	Compression perpendicular to grain Fc⊥ (psi)	Compression parallel to grain Fc (psi)	Modulus of Elasticity E (psi)	Specific Gravity G (psi)
Floor: WesternArchRib - GLT 3 1/8"	3 1/8"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	875	450	135	425	1150	1400000	510000
Floor: WesternArchRib - GLT 5 1/8"	5 1/8"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	875	450	135	425	1150	1400000	510000
Floor: WesternArchRib - GLT 6 7/8"	6 7/8"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	875	450	135	425	1150	1400000	510000
Floor: WesternArchRib - GLT 8 1/2"	8 1/2"	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	875	450	135	425	1150	1400000	510000
Floor: WesternArchRib - GLT 3 1/8" DF	3 1/8"	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	850	500	180	625	1400	1600000	580000
Floor: WesternArchRib - GLT 5 1/8" DF	5 1/8"	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	850	500	180	625	1400	1600000	580000
Floor: WesternArchRib - GLT 6 7/8" DF	6 7/8"	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	850	500	180	625	1400	1600000	580000
Floor: WesternArchRib - GLT 8 1/2" DF	8 1/2"	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	850	500	180	625	1400	1600000	580000

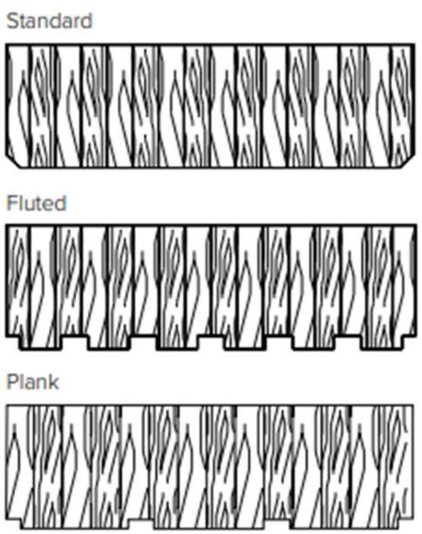
GLT PANELS - DESIGN PROPERTIES (CA)

Art Massif &
Western Archrib

GLT Art Massif										
Type	Thickness	Stress Grade	Species	Finish	Bending Moment	Longitudinal shear	Compression parallel to grain	Compression perpendicular to grain	Tension parallel to grain	Modulus of Elasticity
ArtMassif - GLT 38mm	38	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa
ArtMassif - GLT 60mm	60	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa
ArtMassif - GLT 80mm	80	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa
ArtMassif - GLT 130	127	structural light framing, Spruce-Pine-Fir, No.1/No.2	Black Spruce	Architectural	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa

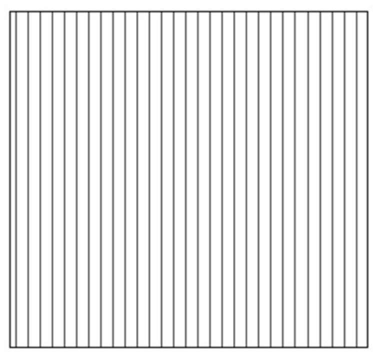
GLT Western Archrib										
Type	Thickness	Stress Grade	Species	Finish	Bending Moment	Longitudinal shear	Compression parallel to grain	Compression perpendicular to grain	Tension parallel to grain	Modulus of Elasticity
WesternArchRib - GLT 80mm DF	79	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	10 MPa	1.9 MPa	14 MPa	7 MPa	5.8 MPa	11000 MPa
WesternArchRib - GLT 130mm DF	130	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	10 MPa	1.9 MPa	14 MPa	7 MPa	5.8 MPa	11000 MPa
WesternArchRib - GLT 175mm DF	175	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	10 MPa	1.9 MPa	14 MPa	7 MPa	5.8 MPa	11000 MPa
WesternArchRib - GLT 215mm DF	216	structural light framing, D Fir-L, No.1/No.2	Douglas Fir	Sanded	10 MPa	1.9 MPa	14 MPa	7 MPa	5.8 MPa	11000 MPa
WesternArchRib - GLT 80mm	79	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa
WesternArchRib - GLT 130mm	130	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa
WesternArchRib - GLT 175mm	175	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa
WesternArchRib - GLT 215mm	216	structural light framing, Spruce-Pine-Fir, No.1/No.2	Spruce/Pine	Sanded	11.8 MPa	1.5 MPa	11.5 MPa	5.3 MPa	5.5 MPa	9500 MPa

SURFACE PATTERN OF GLT

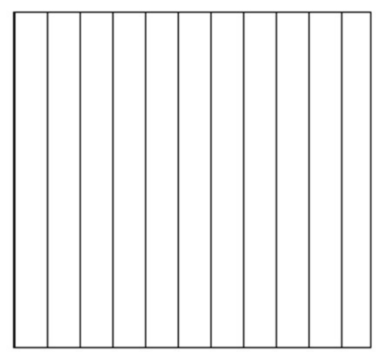


Example of billet profile

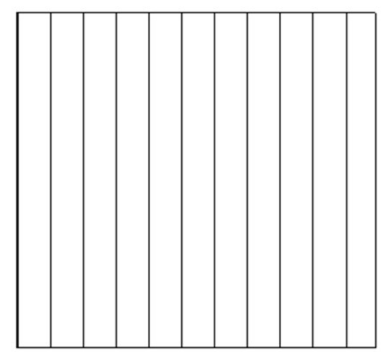
GLT Art Massif



GLT Spruce/Pine
Western Archrib



GLT Douglas Fir
Western Archrib



ARE DOWNSTREAM USERS LOOKING FOR DETAILED DATA IN REVIT?

CONCLUSION & CHALLENGES