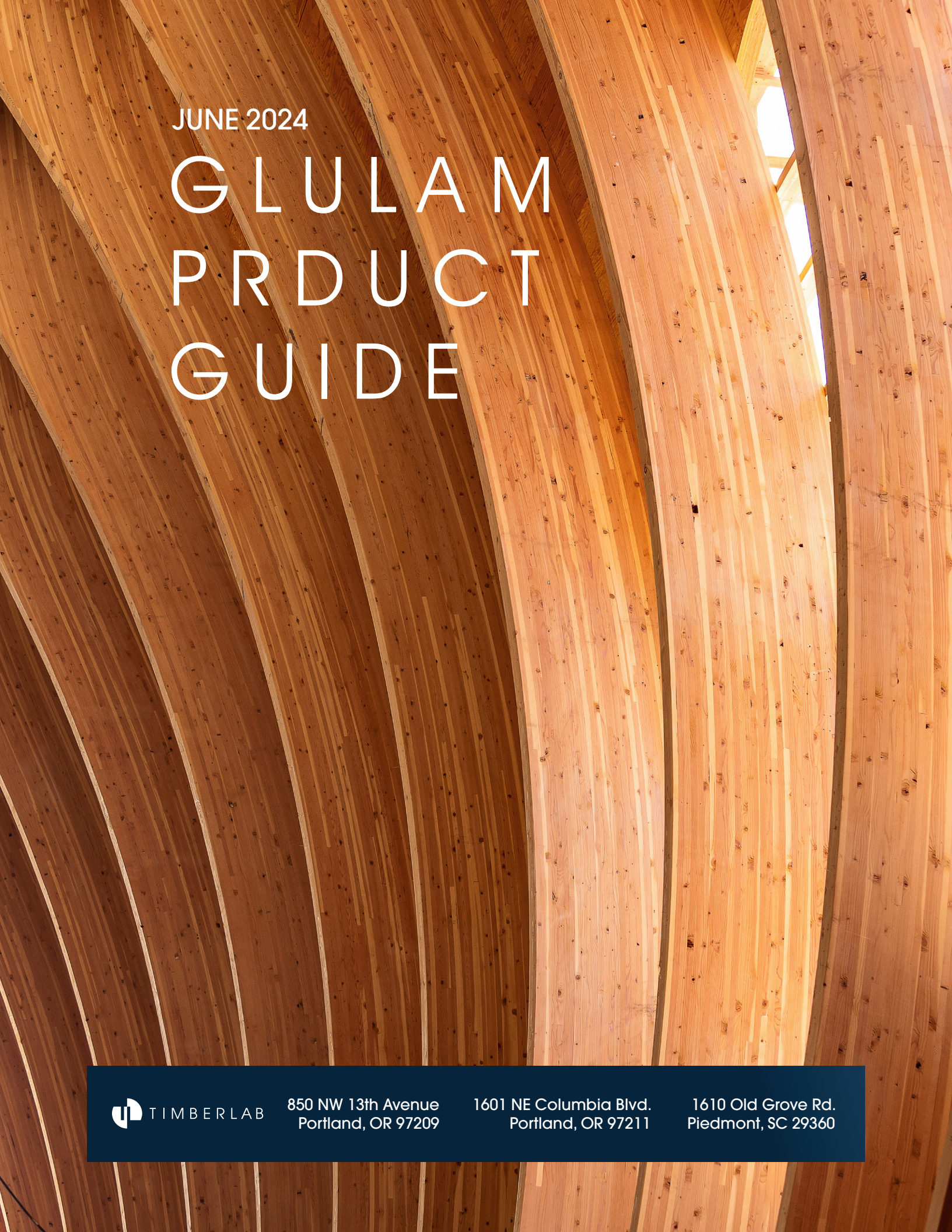

JUNE 2024

GLULAM PRDUCT GUIDE

TIMBERLAB

850 NW 13th Avenue
Portland, OR 97209

1601 NE Columbia Blvd.
Portland, OR 97211

1610 Old Grove Rd.
Piedmont, SC 29360

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1. INTRODUCTION

Thank you for picking up this guide! We invite you to keep it by your side as you develop, design, engineer, and prepare to build the next mass timber library, school, apartment building, office building, warehouse, hotel, laboratory, hospital, and beyond. Inside, you will find our current product offerings, ideas for system design, considerations for high-quality construction, and insights into how we operate.

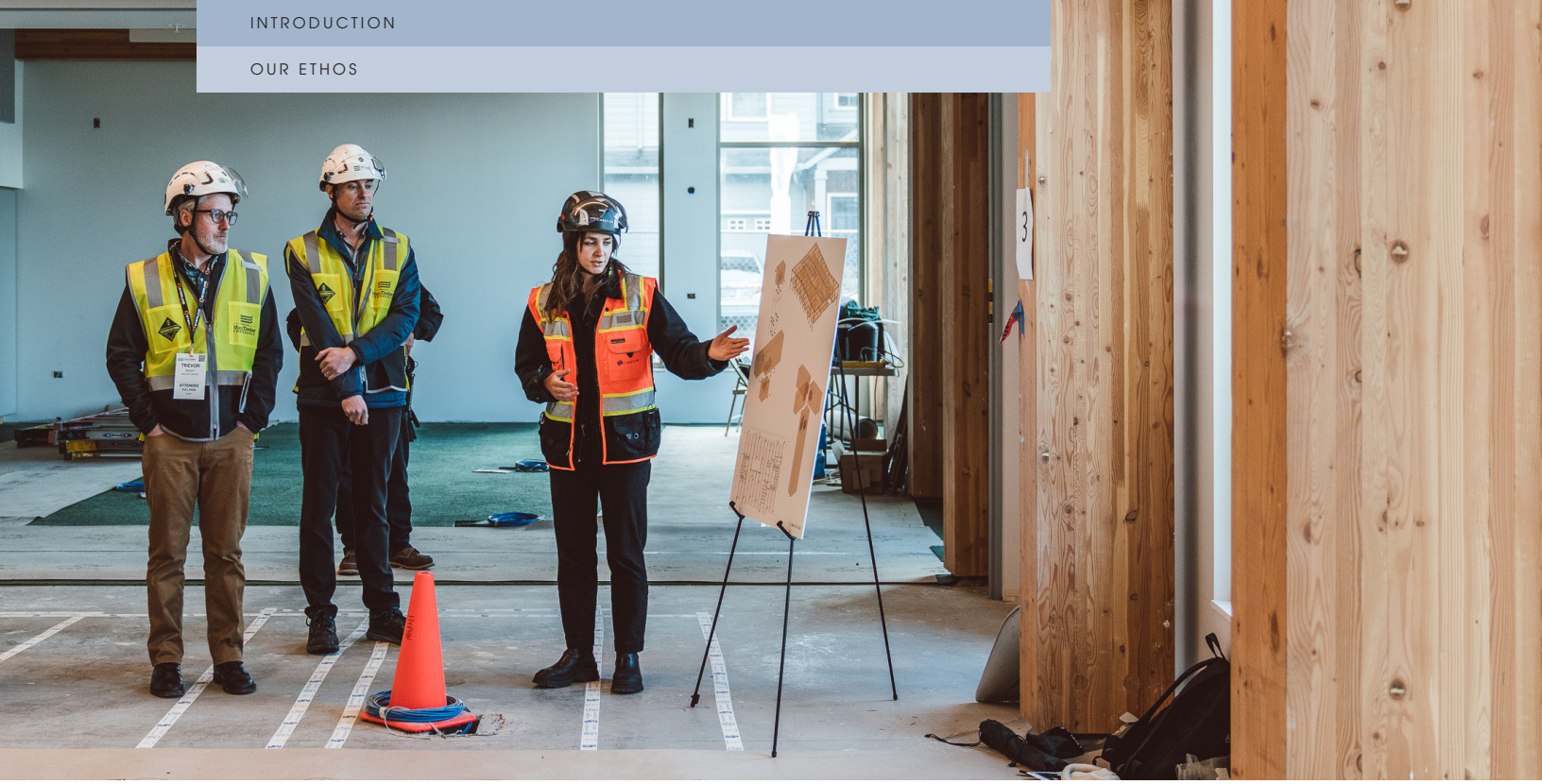
The guide is meant to be a tool for understanding both product and process. Whether this is your first experience with mass timber, or you are a seasoned expert, we offer our approach to decision-making in a sequential manner that mirrors the design and procurement phases of a project and will keep you on track toward achieving your project schedule. Read the guide cover-to-cover to comprehend the complete project development cycle, and then revisit specific sections as your work progresses.

We have included a decision checklist at the end of each design phase section to help your team make decisions in the appropriate timeframe. Decisions fall under the categories of team formation, architectural planning, structural design, and procurement. You will notice we focus first on the big picture building blocks, and then gradually build specificity with the design.

This guide offers common applications that will apply to most projects. It is not meant to be a substitute for conversation, as we know every project has unique qualities and conditions. We are passionate about serving our customers and encourage you to contact us with general questions and project-specific inquiries.

Enjoy the process and know that our team is here to assist at every step.

In gratitude,
The Timberlab team



OUR ETHOS

We are experienced builders on a bold mission: to innovate, produce, and deliver mass timber solutions like no other — transforming the built environment and changing the planet's future.

With a deep understanding of how buildings are constructed and where there is room for improvement and innovation, Timberlab works at the forefront of a movement rooted in sustainability through renewable materials, quality through precision manufacturing, and cost certainty through prefabrication.

As a team of architects, engineers, and builders, we see every project from multiple vantage points. We provide solutions that result in the highest value for the owner and occupant and offer services to support your team throughout the project life cycle. We're driven to test new ideas and reach new heights through transparency, collaboration, and creativity – breaking boundaries and pushing forward with inspired motivation.

We view our work as a practical and scientific endeavor constantly evolving to respond to ever-changing climate, societal pressures, and mass timber supply chain landscape. With curiosity and passion, we are alert to the needs of our partners in the architecture, engineering, and construction community and the owners, developers, and facility managers responsible for real estate investments, and we work to provide durable, high-quality solutions at the cusp of possibility.

OUR ROOTS

Timberlab was born out of and is a subsidiary of Swinerton, a company known for excellence and innovation for over 135 years. With a history and culture of entrepreneurship and innovation, Swinerton is no stranger to working on the frontier – pioneering steel-reinforced concrete following the 1906 San Francisco earthquake, and one hundred years later, incubating one of the top industrial solar contractors in the United States (now SOLV Energy).

As the first mass timber buildings were being built in the Pacific Northwest, Swinerton's Portland office recognized the opportunity to reduce their impact on the natural environment, deliver projects with improved quality and safety outcomes, support rural economies, and create beautiful spaces by bringing the outside in.

Swinerton Mass Timber, an operating group within Swinerton, was formed in 2018 to provide turnkey mass timber systems to general contractors across the country. In January of 2021, Timberlab was launched as a separate business entity within the Swinerton Incorporated family of companies.

To this day, our foundation as a general contractor enables us to support projects holistically, focusing not only on the mass timber, but on the harmonious integration of the structure with all other building systems. Through proactive problem solving, we offer solutions that result in the highest value for the owner and occupant and are committed to being a partner in the success of the entire project.

OUR EVOLUTION

From our early days of providing mass timber installation services to the commercial construction market, to our latest step into manufacturing, we have endeavored to close the gaps in the supply chain. We focused first on providing installation services, and then layered on fabrication modeling, CNC machining, and timber engineering. As the demand for mass timber continues to rapidly increase, we hope that the manufacturing branch of our business will augment the existing production capacity in the United States and give owners and developers further confidence that the supply chain can support their vision – at any scale.

2017	FIRST TECH FEDERAL CREDIT UNION
2019	HIDDEN CREEK COMMUNITY CENTER
2021	ASCENT
2023	HEARTWOOD
2023	LIVE OAK BANK
2024	PDX TCORE

FIRST TECH FEDERAL CREDIT UNION

Hillsboro, OR

We take our first step to expand the market for installation of mass timber commercial buildings, erecting a beautifully engineered and coordinated structure provided by Structurlam.

HIDDEN CREEK COMMUNITY CENTER

Hillsboro, OR

Supported by the expertise and experience of KLH, and inspired by the fabrication business of CutMyTimber, we invite long-standing regional manufacturers Calvert and American Laminators into the burgeoning mass timber industry by connecting them with new CNC fabrication capacity at Vaagen Timbers.

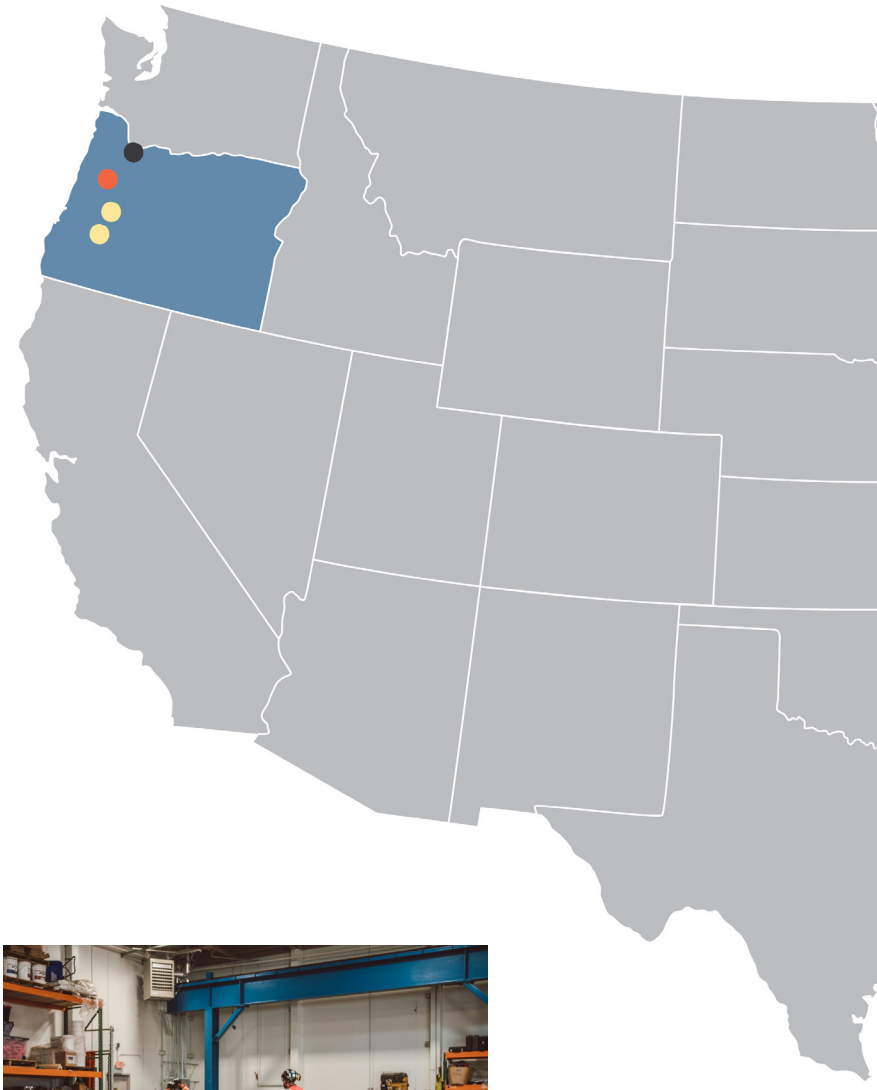
ASCENT

Milwaukee, WI

We deliver this record-breaking timber tower with the excellence and expertise of our Austrian partners, KLH and Wiehag. We become aware of the need for 2-hour rated glulam connections, and continued automation and innovation in US manufacturing, especially as it pertains to larger members required for high-rise construction.

PORTLAND, OREGON
MASS TIMBER FABRICATION

Our Portland, Oregon facility provides custom fabrication services for glulam, with state-of-the-art CNC machining, finishing, and connection hardware installation to provide a holistic kit of parts.

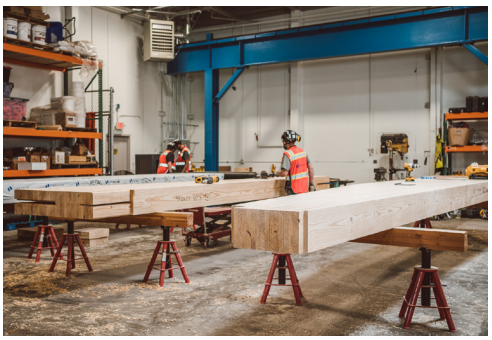


MILLERSBURG, OREGON
CLT MANUFACTURING (2027)

Full-service manufacturing of CLT and glulam takes place in Corvallis, Oregon. Our primary manufacturing facility is highly automated and climate controlled, ensuring a consistently high-quality product. This facility leads North American CLT and glulam manufacturing both with the volume of production and process control to ensure thorough adhesive bonding is achieved. The facility is on a rail spur, enabling rail transport of products across the country, resulting in lower shipping costs and embodied carbon related to transportation emissions.

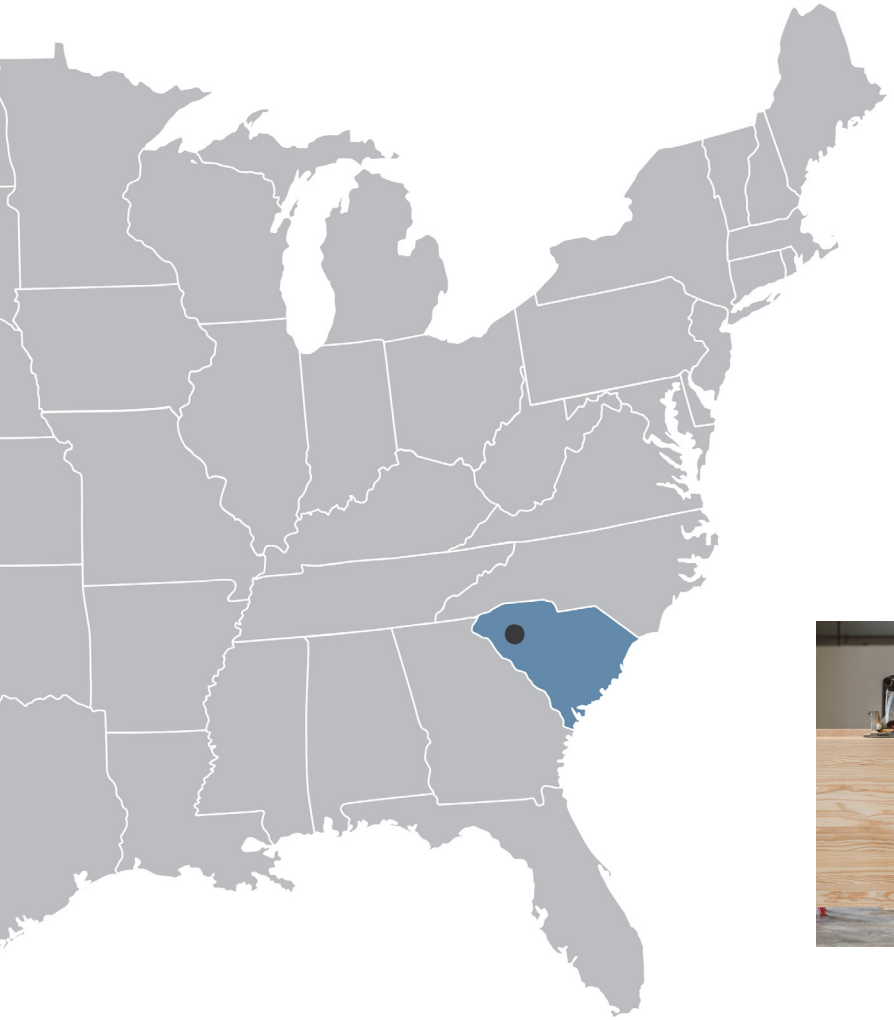
DRAIN + SWISSHOME, OREGON
GLULAM PRODUCTION

Our Portland, Oregon facility provides custom fabrication services for glulam, with state-of-the-art CNC machining, finishing, and connection hardware installation to provide a holistic kit of parts.



MASS TIMBER FACILITIES

Timberlab maintains production facilities in both the western and eastern United States to service our clients across the country.



GREENVILLE, SOUTH CAROLINA MASS TIMBER FABRICATION

Our Greenville, South Carolina facility provides custom fabrication services for glulam, with state-of-the-art CNC machining, hand fabrication, and connection hardware installation. The Greenville facility fabricates material from our Corvallis facility and from other regional manufacturers. The Greenville facility is near a rail spur, able to receive manufactured products by rail transport and deliver fully fabricated products by rail closer to your project site.

2. WOOD SOURCING

Timberlab is committed to responsible wood sourcing for our projects and offers creative solutions to meet sustainability and wood procurement goals. We prioritize working with suppliers who adhere to rigorous environmental standards and promote responsible forest management practices. By carefully selecting our timber sources, we aim to minimize our ecological footprint and contribute to the preservation of our planet's precious resources. Through our dedication to sustainable timber procurement, we strive to create a positive impact, not only in the construction industry but also in the preservation of forests for future generations.

STRONG INDUSTRY PARTNERSHIPS:

Through a deep understanding of and strong relationships with the mass timber industry, we create strategic procurement plans for each project to meet project design, cost, schedule, and sustainability goals. As part of our overarching effort to expand the mass timber supply chain, we source each mass timber structure from multiple suppliers – coordinating the highest value package for our clients.

STRATEGIC TIMBER SOURCING:

We are committed to responsible wood sourcing for our projects and offer creative solutions to meet sustainability and wood procurement goals. We maintain chain of custody certification for FSC®, SFI®, and PEFC forest management standards. We also offer more targeted and transparent sourcing opportunities for clients who desire to tell a specific story about where the wood comes from on their project.

KNOWING WHEN TO BUY:

Keenly aware of fluctuating lumber prices and exchange rates, as well as manufacturer capacity and product availability, we advise our clients on the most advantageous time to make commitments and set expectations early on when significant deposits must be made.

Opposite:
Thesis HQ
Portland, OR, 2022.

SPECIES OFFERINGS

DOUGLAS FIR-LARCH

Species	Douglas fir (Pseudotsuga menziesii var. menziesii) Western larch (Larix occidentalis)
Bioregion	Central British Columbia south along Pacific Coast to central California, central Mexico, also Rocky Mountains to Arizona, Texas
Appearance	Sapwood is generally a light straw color. Heartwood is a deep russet brown. Grain is straight or slightly wavy.
Density	32 - 35 lb/ft^3 (at 15% moisture content) 510 - 560 kg/m^3 (at 15% moisture content)
Notable Characteristics	Stiff and strong for its weight, among the most dense softwoods in North America. Dimensionally stable, glues well, and machines well.
Durability	Requires preservative treatment for wet service conditions. Coastal Douglas fir, with its slightly lower density, can be easily incised for maximum preservative penetration.
Availability	Douglas-fir accounts for 37% of forest land in Oregon, with 10.9 million acres of cover. While Douglas fir populations are sensitive to increasing temperatures that produce drought events and higher pest infestations, it is the most prevalent tree species in the Pacific Northwest.

SUSTAINABLE FORESTRY INITIATIVE

We maintain chain of custody certification for SFI® forest management standards. Please let us know early if you are interested in sourcing wood for your project with any of these certifications, as species can impact availability of material. There may be cost premiums for certified products due to supply chain limitations .

SOUTHERN PINE

Species	Longleaf pine (Pinus palustris) Shortleaf pine (Pinus echinata) Loblolly pine (Pinus taeda) Slash pine (Pinus elliotti)
Bioregion	Southeastern United States
Appearance	Sapwood ranges from white to yellow or golden. Heartwood from yellow to reddish-brown. Distinct grain pattern.
Density	33 - 39 lb/ft^3 530 - 625 kg/ m^3
Notable Characteristics	Highest specific gravity of all common softwoods.
Durability	Requires preservative treatment for wet service conditions. Highly accepting of preservative treatments due to its molecular structure.
Availability	Widely available, Southern Pine forests are some of the most productive in the world. Grown in a vast band in the southern United States, near sawmills.

SUSTAINABLE FORESTRY INITIATIVE

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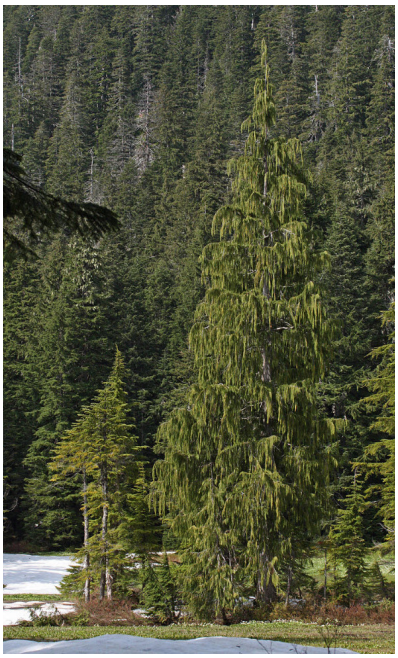
SPECIES OFFERINGS

ALASKAN CEDAR

Species	Alaskan Cedar (Chamaecyparis nootkatensis)
Bioregion	Coastal regions of Alaska, British Columbia, and the Pacific Northwest of the United States
Appearance	Lightest in color, with straight grain. Sapwood is whitish-yellow and not distinct from Heartwood. When left exposed outdoors, weathers to a uniform gray.
Density	26 - 31 lb/ft^3 (at 15% moisture content) 420 - 500 kg/ m^3 (at 15% moisture content)
Notable Characteristics	The heartwood is naturally durable due to natural extractives that also provide a pleasant aroma.
Durability	Naturally durable. Resistant to decay from water infiltration, insects, and fungi.
Common Applications	The heartwood can be used in exterior above ground applications that exposed to wetting.



SUSTAINABLE FORESTRY INITIATIVE

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Opposite:
Saddleback College
Mission Viejo, CA (2024)

ADDITIONAL OFFERINGS

Timberlab works closely with a diverse range of suppliers across the timber industry. With decades-long relationships with these providers, we ensure that we procure the highest-quality timber across all specie types. If you are looking for a unique aesthetic or an alternative material type, our team is here to help procure the right material for your next mass timber structure.

HEM FIR:

Western Hemlock (Tsuga heterophylla) provides exceptional structural integrity due to its high strength-to-weight ratio. Often used in large-span and load-bearing applications, Hemlock Fir is also known for offering a fine, even grain which ensures dimensional stability and surface finish.

SPRUCE-PINE-FIR:

Spruce-Pine-Fir (SPF) is a popular material choice for engineered wood products, comprised of established species like Lodgepole Pine and Engelmann Spruce. SPF is sourced from Canadian Forests and is used in many glulam products across the country for its impressive strenght-to-weight ratio. This material also lends itself for having a uniform texture, making it a great specie type for CNC machining and precise geometry. Additionally, SPF exhibits good nail and screw holding capabilities, which can ensure the durability of timber connections.

EUROPEAN SPRUCE:

European Spruce is a premier species for glulam mass timber products. Having moderate density allows this material type to be more easily handled and transported when compared to its counterparts. Timberlab works closely with our European Spruce suppliers and can ensure the procurement, fabrication, and delivery of this international specie.

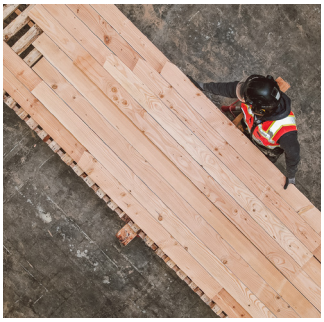
TARGETED SOURCING

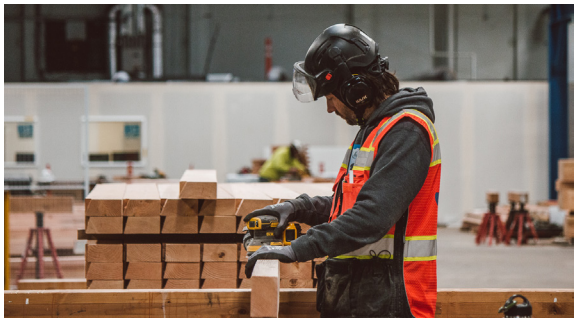
Our relationships with forest landowners and sawmills enable us to offer transparent and targeted wood sourcing in support of a variety of ecological and social equity values. While specific priorities may change over time, we remain committed to supporting our customers in selecting where their wood their wood comes from, if they so choose, and insofar as sourcing goals align with our product specifications. We are flexible in our procurement, capable of segregating lumber within our facility, and are a trusted partner in helping your team achieve its triple bottom line objectives.

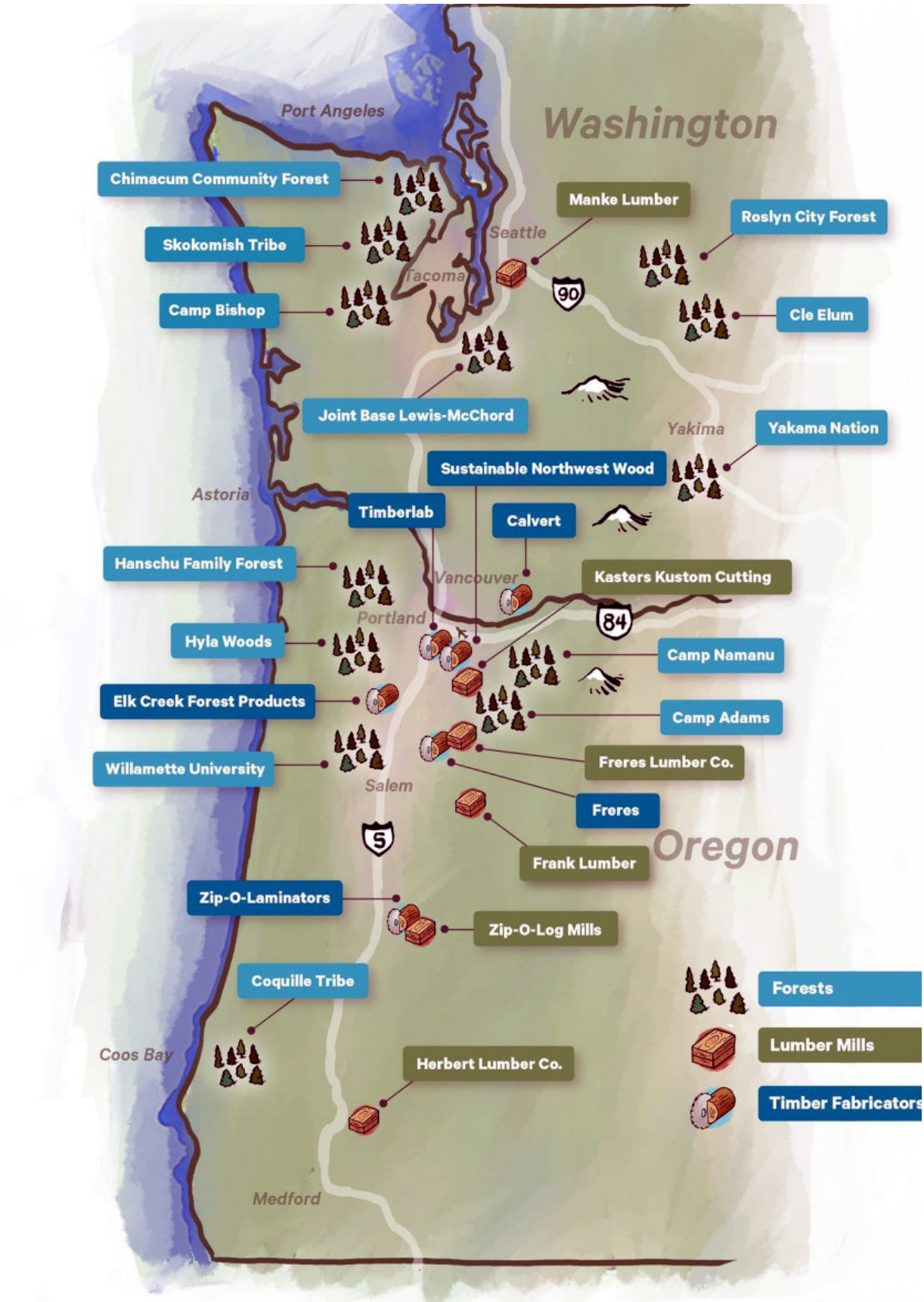
CASE STUDY

Portland International Airport - Portland, OR

The comprehensive scale of the timber sourcing for the PDX Airport is unprecedented—from the forest of origin to the mills, buyers and transport practices. Historically there were boundaries between interactions, from mill to forest, and another from mill to buyer. Through the thorough process, the project team was able to reduce the carbon footprint by 46% from an estimated 18%.







Comprehensize regional timber sourcing for the Portland International Airport terminal redevelopment. The project team worked closely with local tribes, mills, and timber fabricators in order to trace material back to the forest of origin. (Credit: ZGF Architects)

3. GLULAM

Shevlin Crossing
Bend, OR, 2022

GLULAM PRODUCT CERTIFICATIONS

Timberlab Glulam is certified by APA - The Engineered Wood Association. We manufacture to the ANSI A190.1 (2022) Product Standard for Structural Glued Laminated Timber.

Timberlab produces glulam layup combinations with design values that conform to ANSI 117 (2020) Standard Specification for Structural Glued Laminated Timber of Softwood Species.

The information provided in this product guide applies to glulam designed to the National Design Specification for Wood Construction (2018) and Supplement developed by the American Wood Council. In addition our manufacturing facilities maintain a certification to manufacture glulam to the current edition of Canadian Standards - CSA O122 & CSAO177. Please contact Timberlab for additional information.

PRODUCT

Member finished dimensions	Straight and Cambered Members	Length: up to 130'-0" Width: 3⅛" to 30" Depth: 3"
	Arch Beams, & Custom	Length: up to 130'-0" Width: 3⅛" up to 31" (nominal 4" to 12") Depth: 8"
Lumber for Laminating	Species	Douglas fir-larch, Southern Pine, Alaskan Cedar
	Moisture Content	Not exceeding 16% at time of manufacturing.
Adhesives	Face Bond Adhesive	Clear MF standard. Brown PRF available when specified.
Finishing	Appearance Classifications	Framing, Industrial, Architectural, Premium in accordance with ANSI A190.1
	Special Surfacing	Rough saw texture upon request
	Standard Shop Sealer	Yes.
	Coatings	Available upon request.
Member Tolerances	Width	1/16" +/- (2mm)
	Depth	+⅛" +/- (3mm) per foot (305 mm) of depth. -3/16" (5 mm) or 1/16" (2 mm) per foot of depth, whichever is larger
	Length	Up to 20' (6.1 m), +/- 1/16" (2 mm). Over 20' (6.1 m), +/- 1/16" (2 mm) per 20' (6.1 m) of length or fraction thereof.
	Camber Or Straightness	Tolerances for camber are applicable at the time of manufacture without allowance for dead load deflection. Up to 20' (6.1 m), the tolerance is +/- ¼" (6 mm). Over 20' (6.1 m), the tolerance shall increase ⅛" (3 mm) per additional 20' (6.1 m) or fraction thereof, but not to exceed ¾" (19 mm). The tolerances are intended for use with straight or slightly cambered members and are not applicable to curved members such as arches.
	Squareness	The tolerance for squareness shall be within +/- ⅛" (3 mm) per foot (305 mm) of specified depth unless a specially shaped section is specified. Squareness shall be measured by placing one leg of a square across a top and/or bottom face and measuring the offset from the other leg of the square to the member at the opposite face of the beam.

STANDARD LAYUP COMBINATIONS

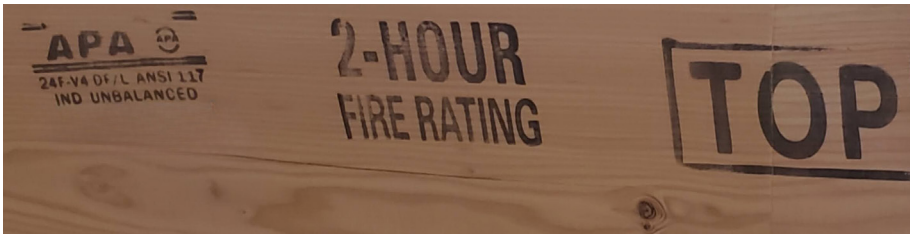
Timberlab provides glulam beam and columns in the most commonly specified stress classes and grades as provided in the table below. We are certified to manufacture glulam to other stress classes and grades provided in the NDS Supplement Tables 5A and 5B. Please contact us for additional information.

STANDARD GLULAM OPTIONS

Douglas Fir (DF)			
Stress Class / Grade	Combination Symbol	Layup	Typical Application
24F-1.8E	24F-V4	Unbalanced	Single span beam
	24F-V8	Balanced	Multi- supported beam, Cantilever beam
L2	2	Uniform	Column (standard)
L2D	3	Uniform	Column
L1	5	Uniform	Column
Southern Pine (SP)			
Stress Class / Grade	Combination Symbol	Layup	Typical Application
24F-1.8E	24F-V3	Unbalanced	Single spam beam
	24F-V8	Balanced	Multi-span beam, Cantilever beam
N2D12	48	Uniform	Columns, Truss member
N1D14	50	Uniform	Column, Truss member
Alaskan Cedar (AC)			
Stress Class / Grade	Combination Symbol	Layup	Typical Application
20F-1.5E	20F-V12	Unbalanced	Single spam beam
	20F-V13	Balanced	Multi-span beam, Cantilever beam
L2	70	Uniform	Column, Truss member

Note: See the NDS supplement Tables 5A and 5B for structural design values.

Opposite:
Northlake Commons
Seattle WA, 2023.



COLUMNS

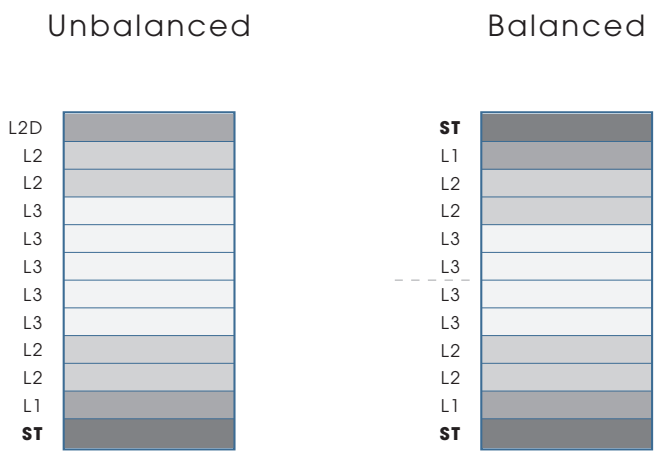
Glulam columns, either square or rectangular in cross-section, are subjected to stresses primarily in axial tension or compression and are most effectively manufactured with lumber of uniform grade. While we can produce glulam with many different grades of lumber, higher strength lumber intended to reduce the cross-sectional dimensions of the member will have a higher cost and may be subject to longer lead times to gather wood of this grade.

UNBALANCED BEAMS

Unbalanced beams are intended for use in simple-span applications loaded in positive bending, producing the greatest tension stress on the bottom of the beam. To resist such stresses, unbalanced beams are manufactured with the highest strength laminations on the bottom of the member. Importantly, the asymmetry of unbalanced beams results in a significantly reduced bending capacity if installed upside down – the top side of the beam is so indicated with a stamp.

BALANCED BEAMS

Balanced beams are intended for use in multi-span or cantilevered applications. As either the top or bottom of the member are stressed in tension due to applied loads, balanced beams are manufactured with high-strength tension laminations on both the top and bottom.



An example of different laminating lumber grades in an unbalanced and balanced glulam beam.

FIRE RATED BEAMS

In fire rated applications, it is critical that to specify and manufacture beams to maintain their structural capacity in the event of a fire. For beams that will be exposed to fire on three sides, this is accomplished by adding one tension lamination to the bottom of the beam for each hour of fire resistance required, and removing a corresponding number of inner laminations, so that the beam depth remains the same. For beams designed for fire exposure on four sides (as in the case of a beam without a CLT floor fastened to its top side), both the top and bottom of the layup shall be modified in accordance with ANSI A190.1. Fire-rated beams are marked with "1-hour fire rating" or "2-hour fire rating" for quality assurance.

TOP OF BEAM NOT EXPOSED TO FIRE

UNBALANCED LAYUP

ONE HOUR	TWO HOUR
Outer Compression	Outer Compression
Inner Compression	Inner Compression
Inner Compression	Inner Compression
Core	Core
Core	Core
Core	Core
Core	Core
Core	Inner Tension
Inner Tension	Inner Tension
Inner Tension	Additional Outer Tension
Additional Outer Tension	Additional Outer Tension
Outer Tension	Outer Tension

BALANCED LAYUP

ONE HOUR	TWO HOUR
Outer Tension	Outer Tension
Inner Tension	Inner Tension
Inner Tension	Inner Tension
Core	Core
Core	Core
Core	Core
Core	Core
Core	Inner Tension
Inner Tension	Inner Tension
Inner Tension	Additional Outer Tension
Additional Outer Tension	Additional Outer Tension
Outer Tension	Outer Tension

TOP OF BEAM EXPOSED TO FIRE

UNBALANCED LAYUP

ONE HOUR	TWO HOUR
Outer Compression	Outer Compression
Additional Outer Compression	Additional Outer Compression
Inner Compression	Additional Outer Compression
Inner Compression	Inner Compression
Core	Inner Compression
Core	Core
Core	Core
Core	Inner Tension
Inner Tension	Inner Tension
Inner Tension	Additional Outer Tension
Additional Outer Tension	Additional Outer Tension
Outer Tension	Outer Tension

BALANCED LAYUP

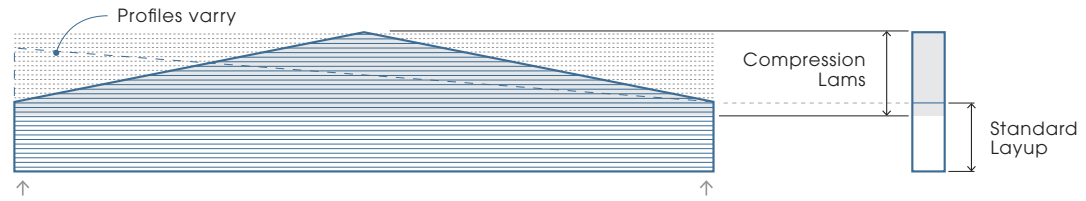
ONE HOUR	TWO HOUR
Outer Tension	Outer Tension
Additional Outer Tension	Additional Outer Tension
Inner Tension	Additional Outer Tension
Inner Tension	Inner Tension
Core	Inner Tension
Core	Core
Core	Core
Core	Inner Tension
Inner Tension	Inner Tension
Inner Tension	Additional Outer Tension
Additional Outer Tension	Additional Outer Tension
Outer Tension	Outer Tension

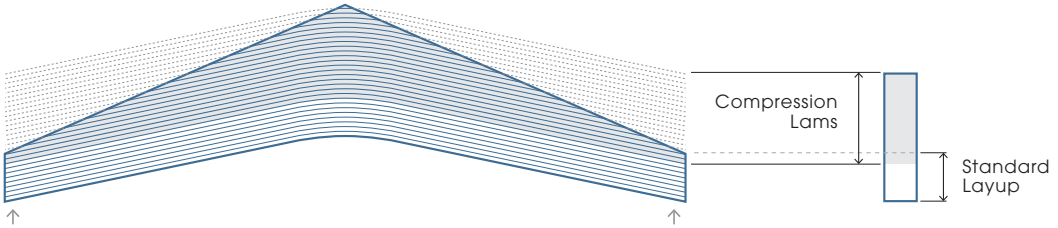
Note: Specifying a fire rated layup must be done in conjunction with engineering analysis, to ensure the beam will retain its required strength for the required fire exposure duration. Please reference APA Technical Note Y245 Calculating Fire Resistance of Glulam Beams and Columns, for additional guidance.

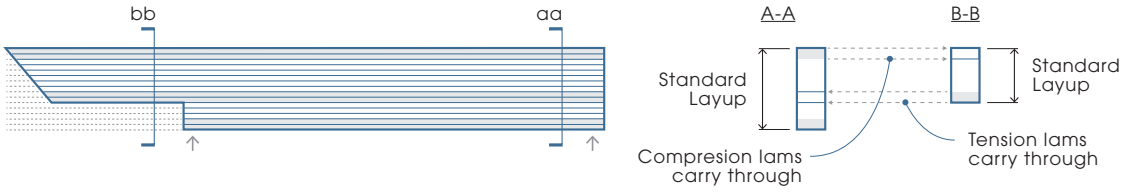
TAPERED BEAMS + COLUMNS

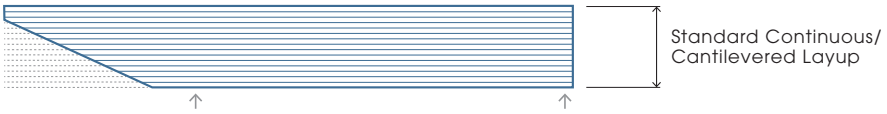
Tapered members are manufactured with lamination layups that meet the requirements of ANSI 117 Section 5.6 unless specific lamination layups are specified. In accordance with the standard, this allows tapered members to be designed to the requirements of the NDS, including the structural design values found in the NDS Supplement.

When a glulam beam is cut to a tapered shape during secondary manufacturing or fabrication by removing material from the compression face, reduced design values can be used in accordance with ANSI 117 Section 4.12.



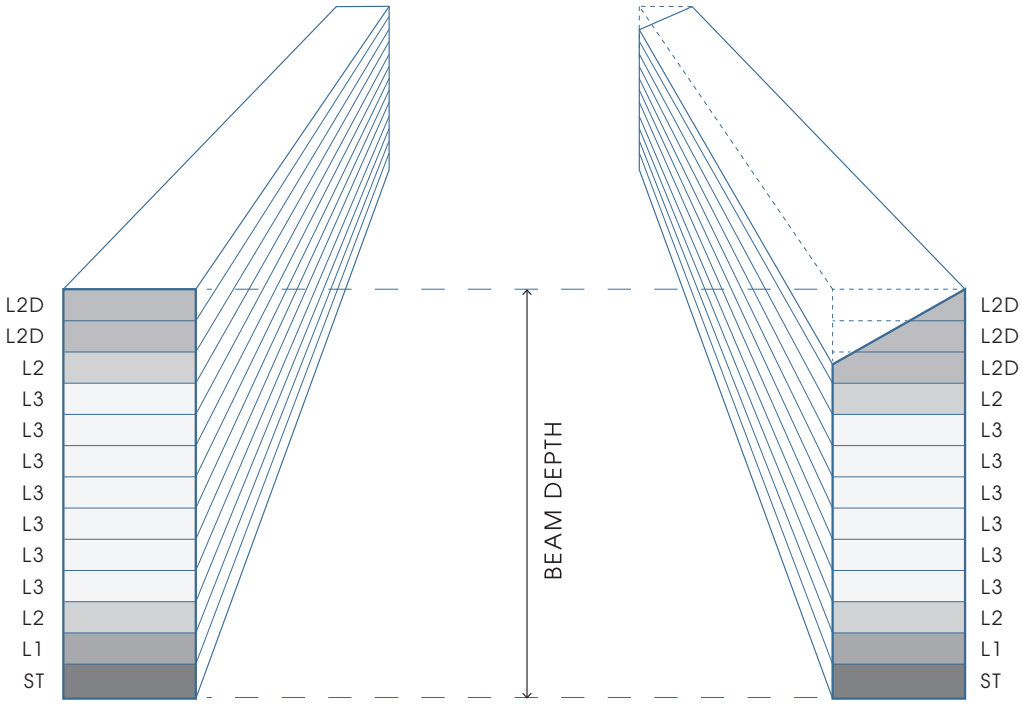


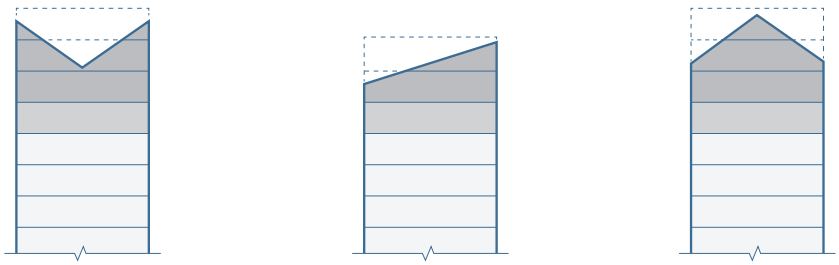




BEVELED BEAMS

Glulam beams can be bevel cut on their compression face to accommodate building design needs such as sloped roofs. Beveled beams are manufactured with lamination layups so that the grade of laminations in the outer compression zone is maintained throughout the entire depth of the bevel cut, meeting the requirements of ANSI 117 Section 5.8.





STANDARD SIZES

We understand that sometimes, a fraction of an inch can make the difference in the structural adequacy of a glulam beam or column. We also know that keeping standard dimensions straight, across a variety of species, is no easy task. We provide this cheat sheet below, so that there are no questions or surprises when it comes time to detail your project.

STANDARD SIZES

Nominal Width (In)	DF, SPF, AYC (in)	Southern Pine (in)	Alaskan Cedar (in)
4	3 ⅛	3 ⅛	3 ⅛
6	5 ⅛	5 ⅛	5 ⅛
8	6 ¾	6 ¾	6 ¾
10	8 ¾	8 ½	8 ½
10 ½ (split lamination)	-	-	-
12	10 ¾	10 ½	10 ½ (split lamination)
14	12 ¼ (split lamination)	12	12 ¼
16	14 ¼ (split lamination)	14	14 ¼
18	16 ¼ (split lamination)	16 ¼ (split lamination)	16 ¼
20	18 ¼ (split lamination)	18 ¼ (split lamination)	-
22	20 ¼ (split lamination)	20 ¼ (split lamination)	-

STANDARD DEPTHS

Standard depths are in multiples of the standard lamination thickness.

Douglas Fir, Alaskan Cedar 1-1/2 inches

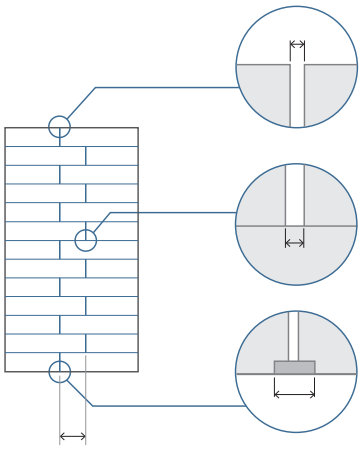
Southern Pine 1-3/8 inches

Note all premium finished beams are additionally undersized by ¼" in depth from full lamination depth provided above.

SPLIT LAMINATION LAYUPS

We offer staggered multiple piece lamination (split lamination) layups as a cost-effective and sustainable alternative for producing wide members. In this process, described in ANSI A190.1, section 10.3, we stagger adjacent laminations of two or more boards in a brick-like pattern to achieve larger widths, while avoiding the cost and schedule challenges of procuring wide boards. For members generally wider than 10¾, we provide split lamination layups.

As an option, Architectural and Premium classification glulam produced with the split laminations include a clear wood inlay on visual faces to disguise the joint. Inlays on exposed faces are required by code for all split laminated glulam used in exterior application.

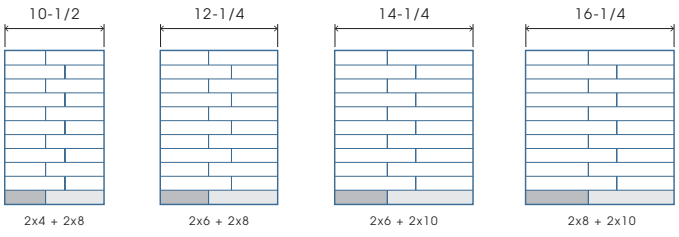


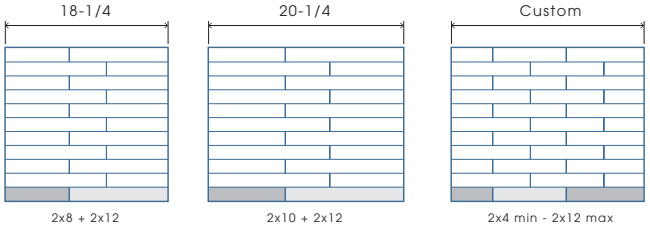
1/4" max at outer laminations. Occasional 3/8" permitted. Bottom detail shows inlays.

Nominal Board Width:	Max Int. Gap:
10" or less	3/8"
12"	1/2"
14"	5/8"
16" and wider	5/8"x (Nominal Width)/14

1/2" wide x 1/4-1/2" deep glued inlays of like material when specified. Top detail shows no inlays.

Minimum overlap = lamination thickness (1" min)





CAMBERING

For long span applications where design is controlled by deflection, a small amount of curvature can be built into a glulam to offset anticipated deflection. In many construction projects where the structure is rarely subjected to specified design live loads and the deflection due to dead loads is minimal, camber may result in unwanted crown and constructability challenges. Below, we offer our rules of thumb for incorporating camber into glulam design:

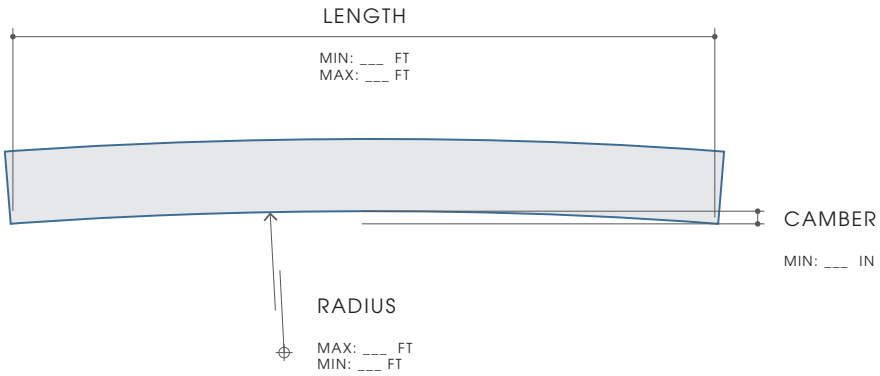
- Camber should be reserved for long-span members of at least 40 feet in length.
- Cambered beams are best paired with simple bucket or knife plate connections with slightly greater tolerance to allow for beam deflection over time and simple fabrication.
- Camber should not be used with proprietary concealed beam hangers or other systems that require tight tolerances for fit-up, such as large groups of bolts or drift pins.
- Camber is not recommended for beams with multiple connection points.
- Camber is not recommended for continuous span applications.

	Radius (ft)				
Span (ft)	1000	2000	3000	4000	5000
30	1.35	0.68	0.45	0.34	0.27
35	1.84	0.92	0.61	0.46	0.37
40	2.40	1.20	0.80	0.60	0.48
45	3.04	1.52	1.01	0.76	0.61
50	3.75	1.88	1.25	0.94	0.75
55	4.54	2.27	1.51	1.13	0.91
60	5.40	2.70	1.80	1.35	1.08
65	6.34	3.17	2.11	1.58	1.27
70	7.35	3.68	2.45	1.84	1.47
75	8.44	4.22	2.81	2.11	1.69
80	9.60	4.80	3.20	2.40	1.92
85	10.84	5.42	3.61	2.71	2.17
90	12.15	6.08	4.05	3.04	2.43
95	13.54	6.77	4.51	3.38	2.71
100	15.00	7.50	5.00	3.75	3.00
105	16.54	8.27	5.51	4.13	3.31
110	18.15	9.08	6.05	4.54	3.63
115	19.84	9.92	6.61	4.96	3.97
120	21.60	10.80	7.20	5.40	4.32
125	23.44	11.72	7.81	5.86	4.69
130	25.35	12.68	8.45	6.34	5.07

Reference APA Technical Note S550H Glulam Beam Camber, for additional guidance in determining beam camber requirements.

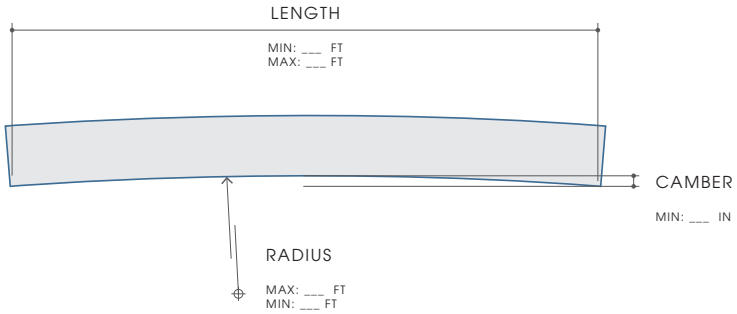
CALCULATING BEAM CAMBER

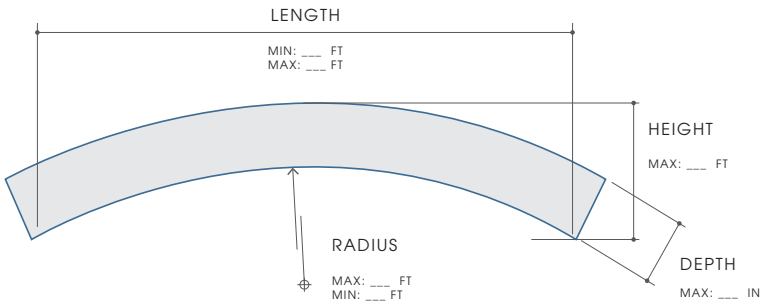
As an alternative to using the table above to specify camber, the following formula may be used to calculate the approximate radius of curvature given the beam span and camber desired.



CURVED SHAPES

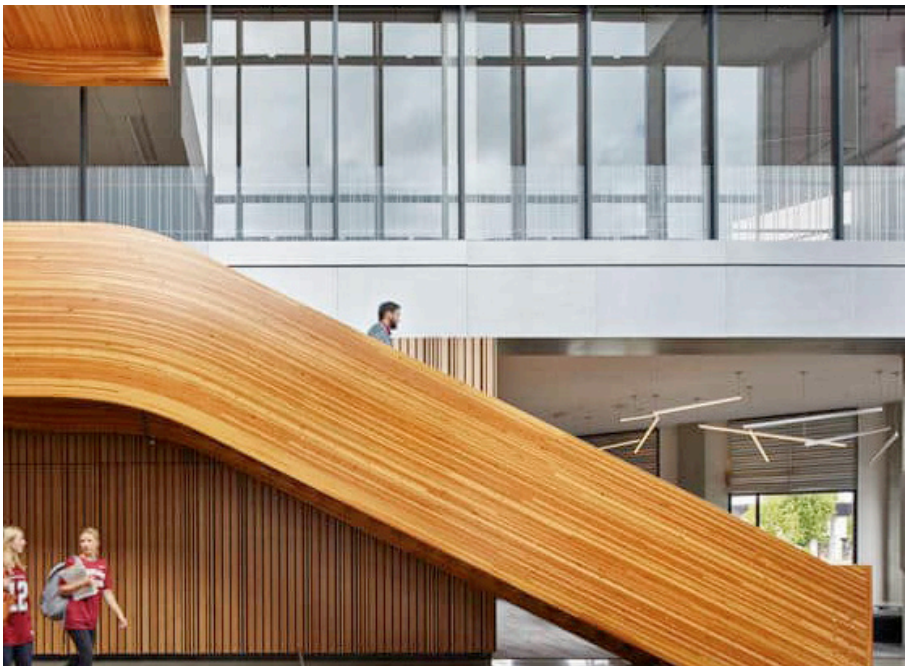
Timberlab is pleased to offer glulam in a wide range of shapes for unencumbered architectural creativity. Our arch line features multi-inflection capabilities, and our lumber supply partners afford us the opportunity to produce tightly curved members from thin laminations. In the diagrams below, we share parameters for our specialty glulam products.





Radial reinforcing (not shown) may be required.

Lamination Thickness	Minimum radius of curvature (at the inside face)	
	Douglas Fir, Alaskan Cedar	Southern Pine
1-½"	27'-6"	-
1-⅜"	8	18'-0"
3/4"	9'-4"	7'-0"



Reference APA Technical Note S550H Glulam Beam Camber, for additional guidance in determining beam camber requirements.

APPEARANCE CLASSIFICATIONS

Characteristic	Framing	Industrial	Architectural	Premium
Surface Finish	Surfaced on two sides, on which the cumulative depth of misses, low laminations, and wane shall not exceed 10% of beam width at any bond line. Maximum area of low laminations shall not exceed 25% of the surface area of a side. Surfaced to meet conventional framing sizes.	Surfaced on two sides, on which the cumulative depth of misses, low laminations, and wane shall not exceed 10% of beam width at any bond line. Maximum area of low laminations shall not exceed 5% of the surface area of a side, and no more than two low laminations shall be adjacent to one another.	Exposed faces shall be surfaced smooth . No misses, wane, low laminations permitted. Architectural glulam is not sanded but can be added for an additional cost.	Exposed faces shall be surfaced smooth . No misses, wane, low laminations permitted. Laminations shall be selected to minimize loose knots, unsound knots, knotholes, pencil wane, bark inclusions, and voids that will be visible after final surfacing.
			As an option, Architectural and Premium glulam produced with the split lamination technique can come with a clear wood inlay on visual faces to disguise the joint.	
Voids	Not filled	Not filled	Voids over ¾" long shall be filled with wood-tone colored filler or with wood inserts. A void can exceed ¾" in length if area does not exceed ½ in2.	In exposed surfaces, voids over ¾" long (or longer if its area does not exceed ½ in^2) shall be filled with a wood-tone colored filler or with clear wood inserts selected for similarity to the grain and color of the adjacent wood.
Knots			Wide face shall be free of loose knots, and open knots shall be filled.	On the wide face, knots shall be limited to 20% of the net face width of the lamination, and not over two maximum size knots or their equivalent shall occur in a 6 ft length.
Knot Holes		Loose knots and knot holes appearing on exposed face layers are not filled		
Wane	Pencil wane permitted, not limited in length, but limited to one in ten pieces of lumber used.	Pencil wane permitted, not limited in length, but limited to one in ten pieces of lumber used.	Pencil wane shall be repaired, regardless of length. Wane ≤ 8" to be filled. Wane > 8" to receive wood inserts.	Pencil wane shall be repaired, regardless of length. Wane ≤ 8" to be filled. Wane > 8" to receive wood inserts.
Edge Gaps			Edge voids over 1/16" in wide faces exposed to view shall be filled.	Edge voids over 1/16" in wide faces exposed to view shall be filled.
Eased Edges			The corners of the member exposed to view in the final structure shall be eased with a minimum radius of ⅛" or equivalent chamfer.	The corners of the member exposed to view in the final structure shall be eased with a minimum radius of ⅛" or equivalent chamfer.

ADHESIVES

While adhesives comprise only a small percentage of the total volume and weight of a glulam member, it is the advancement in this technology that enables the use of smaller-diameter trees to manufacture engineered wood products with superior strength, durability, and fire performance relative to solid-sawn timber. Adhesives are used in two distinct places within the glulam manufacturing process: (1) end-to-end finger-jointing of lumber, and (2) face bonding of laminations. All adhesives conform to ANSI manufacturing standards and ASTM testing methods for fire, creep, and moisture performance. These adhesives have been evaluated by APA as our certification agency.

STOCK BEAMS

For any given species, we can produce multiple grades of beam and column. The grade specified will define the cross-sectional area of the member – with higher grades corresponding to smaller cross-sections – while also impacting the cost of the member and the procurement timeline. Higher strength lumber is more expensive due to its limited availability, and in large quantities may require additional time to collect. In the table below, we provide a complete list of standard layups, annotated to highlight what we readily offer, and what we offer circumstantially. Please contact us to inquire about custom layups.

Beam Size	Width	Depth	Length Available
3-1/8" X 6"	3.125" (79mm)	6.0" (152mm)	Up to 66"
3-1/8" X 7.5"	3.125" (79mm)	7.5" (191mm)	Up to 66"
3-1/8" X 9"	3.125" (79mm)	9.0" (229mm)	Up to 66"
3-1/8" X10.5"	3.125" (79mm)	10.5" (267mm)	Up to 66"
3-1/8" X 12"	3.125" (79mm)	12.0" (305mm)	Up to 66"
3-1/8" X13.5"	3.125" (79mm)	13.5" (343mm)	Up to 66"
3-1/8" X 15"	3.125" (79mm)	15.0" (381mm)	Up to 66"
3-1/8" X 16.5"	3.125" (79mm)	16.5" (419mm)	Up to 66"
3-1/8" X 18"	3.125" (79mm)	18.0" (457mm)	Up to 66"
3-1/8" X 19.5"	3.125" (79mm)	19.5" (495mm)	Up to 66"
3-1/8" X 21"	3.125" (79mm)	21.0" (533mm)	Up to 66"
3-1/8" X 22.5"	3.125" (79mm)	22.5" (572mm)	Up to 66"
3-1/8" X 24"	3.125" (79mm)	24.0" (610mm)	Up to 66"

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