

Cross Laminated Timber Market Profile

Overview

Mass timber is a category of framing styles typically characterized by the use of large solid wood panels for wall, floor, and roof construction. The strength and dimensional stability of mass timber offers a low-carbon alternative to steel, concrete, and masonry for many applications. Cross-laminated timber is a key mass timber product.

Cross-laminated timber (CLT) is a strong-engineered product to be used for exterior walls, floors, and roofs in tall building construction. It is manufactured by gluing three to seven layers of wood together which is then fed into a pneumatic press that uses hydraulic air pressure to squeeze the boards tightly together.

CLT panels tend to be cost effective for multistory and large building applications. CLT can be manufactured in custom dimensions, with panel sizes varying by manufacturer.¹

National Industry Trends

Construction

Construction sectors are cyclical and heavily influenced by interest rates. The ability to repay is the primary demand determinant for individuals and companies undertaking both residential and nonresidential projects. Construction activity, in turn, bolsters demand for lumber and other wood products. Over the five years to 2021, interest rates have declined, thus increasing the affordability of construction investments. Moreover, the industry is expected to grow substantially following the coronavirus outbreak. The pandemic has caused individuals to prioritize their spending on housing, as large swaths of the economy have been working from home. Consequently, industry profit increased over the past five years, boosted further by rising lumber prices. While domestic demand remained strong, the industry's exports were hurt by

¹ *Mass Timber in North America: Expanding the Possibilities of Wood Building Design.* reThink Wood.

the pandemic and rising trade tensions with China in 2019. Conversely, imports surged during the period, hurting domestic operators.²

Timber/Lumber

Operators in the Sawmills and Wood Production industry manufacture lumber, boards, beams and other wood products. The industry's main activities include sawing hardwood and softwood logs and applying chemicals to them to prevent mold. As the industry's performance relies heavily on overall construction activity, rising housing starts and the value of nonresidential construction caused industry revenue to grow strongly over the five years to 2021, especially during the COVID-19 (coronavirus) pandemic as consumers spent far more time at home due to social distancing measures. Conversely, nonresidential construction declined during the same period, as the pandemic caused demand for commercial office space to collapse.³

Mass timber is also an efficient construction solution. The prefabricated panels of mass timber means that construction is approximately 25% faster than with concrete. Interest is growing in mass timber for midrise buildings such as hotels and high-end offices that would have typically used concrete or steel. For offices, the aesthetic of mass timber can be a draw for tenants.

Major Products

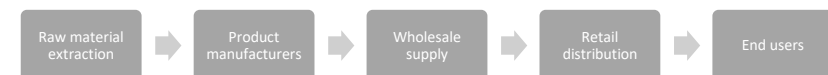
In addition to CLT, the focus of this profile, there are several other products that fall under the category of mass timber.⁴

- ◆ **Nail-Laminated Timber (NLT):** NLT is created by stacking individual pieces of lumber on edge and fastening with nails or screws to create a larger structural element. NLT is undergoing a resurgence as part of the modern mass timber movement. It is commonly used in floors, decks, and roofs, and has been used to create elevator and stair shafts. NLT doesn't require specialized equipment to produce.

- ◆ **Glued-Laminated Timber (glulam):** Glulam is composed of individual wood laminations that are selected and positioned based on their performance characteristics, and then bonded together with durable, moisture-resistant adhesives. Glulam has excellent strength and stiffness properties, is typically used as beams and columns, but can also be used for floor or roof decking.
- ◆ **Dowel-Laminated Timber (DLT):** DLT panels are a next-generation mass timber product commonly used in Europe. Panels are made from softwood lumber boards stacked like the boards of NLT and friction-fit together with dowels. A key advantage of DLT is the ability to integrate acoustic strips directly into the bottom surface of a panel.
- ◆ **Structural Composite Lumber (SCL):** SCL is a family of wood products created by layering dried and graded wood veneers, strands, or flakes with moisture-resistant adhesive into blocks of material which are subsequently re-sawn into specified sizes.

Supply and Demand

At its most basic, the supply chain for building materials, including mass timber, starts with raw material extraction and moves through product manufacturers, wholesale supply and retail distribution before reaching the end users. The major raw materials used in the manufacturing of CLT includes softwood spruce, larch, Douglas fir, pine, and other timber.⁵



² IBISWorld.

³ IBISWorld.

⁴ (reThink Wood)

⁵ *Cross Laminated Timber Market Analysis, 2021*. Grand View Research, Inc.

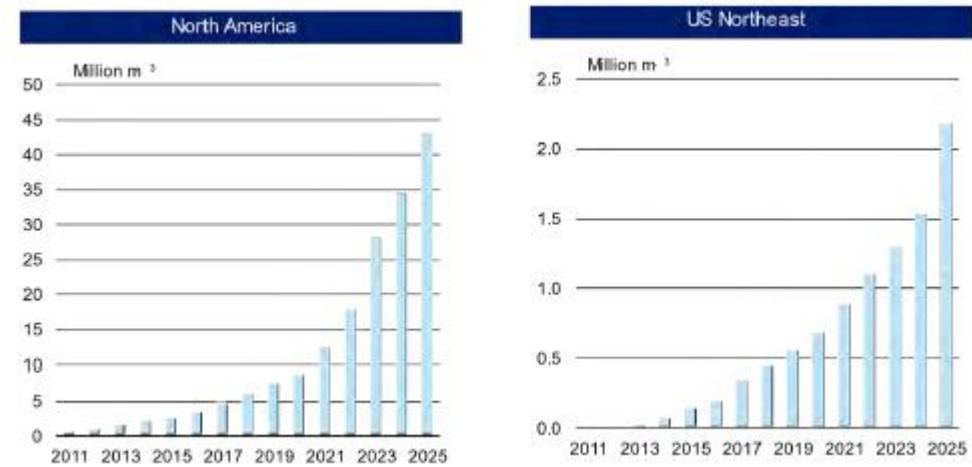
Global production capacity of CLT in 2020 was estimated to be 2.8 million cubic meters, of which 48% was in Europe, 43% was in North America, 6% was in Oceania and 3% was in Asia. Austria, Czechia, Germany, Italy and Switzerland are key producers, accounting for more than 80% of the estimated global production of CLT in 2019.⁶

Each square foot of building constructed with mass timber is estimated to consume 1 cubic foot of mass timber raw material. Each cubic foot of mass timber raw material is estimated to require 22.5 board feet of lumber to produce. Doubling the number of buildings made from mass timber every 2 years between 2020 and 2030 equates to an estimated increase in lumber demand of 3.25 billion board feet by 2030.⁷

Demand is significantly dependent on downstream construction activities, with residential and nonresidential constructors being the primary markets for industry products. The global CLT market is anticipated to be driven by the growing demand for lightweight, durable, and sustainable construction materials in the residential, institutional and commercial applications. In addition, growing awareness regarding energy conservation and sustainability is likely to drive growth.

Around the world there are now numerous timber buildings constructed above six stories tall. In the United States, such buildings have been constrained by a strong reliance on prescriptive building code limits and less willingness to use performance-based fire protection engineering. In January 2019, the International Code Council (ICC) approved a set of proposals to allow certain types of tall wood buildings as part of the 2021 International Building Code (IBC). The code will include provisions for up to 18 stories of Type IV-A construction for Business and Residential Occupancies. These code changes will be instrumental in increasing demand for mass timber products such as CLT.

Predicted North America and Northeast CLT Demand



Source: Poyry, 2017 via MMTCC

U.S. Markets

CLT is used in residential, commercial, institutional, and other applications. The product offers superior design flexibility, and the installation process is faster in comparison to other building materials. North America is an emerging market for CLT, with growth opportunities as awareness among consumers regarding the advantages over other alternative building materials are becoming more well known.

Growing environmental concerns regarding carbon emission has prompted an increase in popularity of CLT for commercial purposes. This, in addition to the cost advantages, has further promoted demand. The aesthetic appearance of mass timber is also driving growth of the market for residential construction. The use of CLT was dominated by residential applications in 2020, accounting for about 45.26% of

⁶ *Everything Your Wanted to Know About CLT*. Forest2Market, 15 March 2021.

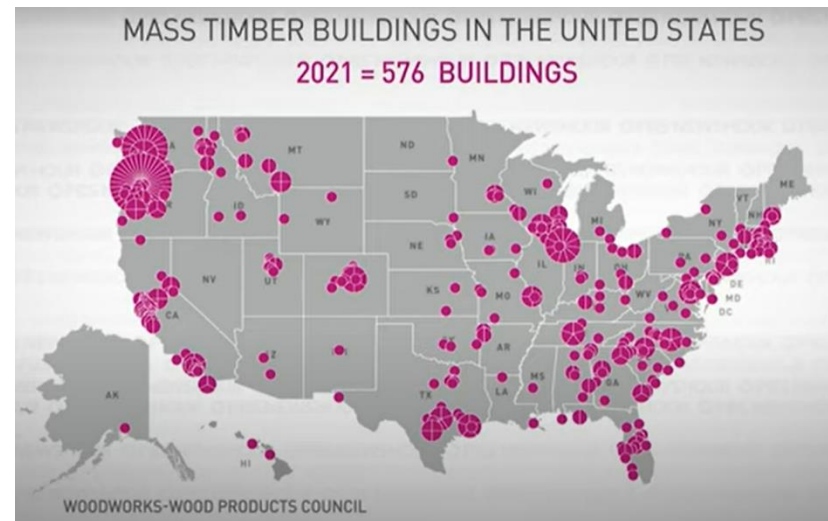
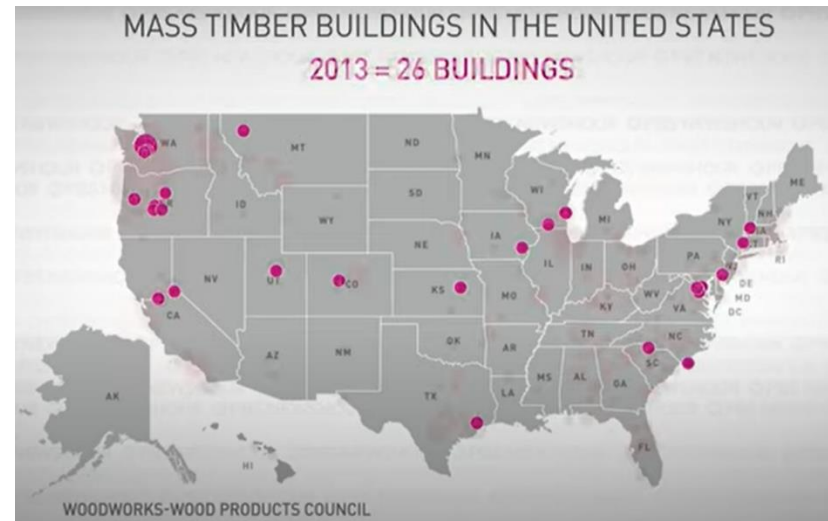
⁷ (Forest2Market)

revenue and 45.62% of volume.⁸ Residential use of CLT is expected to grow at a compounded annual growth rate of 14% through 2028.

The CLT market in North America is driven by demand from the U.S., however strong growth in application industries in Canada and Mexico are likely to provide growth opportunities for regional demand of CLT products. High disposable income, large market size, the ability of established players to mass-produce, and an extensive range of products are expected to boost market growth in the U.S.

Challenges to growth of CLT in the U.S. market are due to a strong reliance on prescriptive building code limits and less willingness to use performance-based fire protection engineering. Even with these challenges, mass timber construction has grown significantly.⁹ The adoption of the revised 2021 International Building Code standards, there are now clearly defined national specifications and criteria for implementing mass timber into a variety of construction types. This will serve to eliminate confusion and increase clarity to building code officials and architects in every state. This will create market opportunities throughout the United States as more code officials, architects, engineers, and builders gain familiarity with the technology.

According to data from Woodworks, in 2013 there were 26 mass timber buildings in the U.S. In 2020, that figure is now 576.



⁸ (Grand View Research, Inc.)

⁹ MMTCC

Industry Leaders

The CLT market is consolidated in Europe, with the region accounting for more than 60% of global CLT production. However, new production facilities in the U.S., Canada, and Australia are expected to create growth opportunities in these markets.

As of late 2018, ten mass timber panel manufacturing plants were in operation in North America (five in both Canada and the U.S.), with a combined annual production of about 400,000 cubic meters. At the end of 2019, 14 plants were producing mass timber panels in North America, and three new facilities were under construction.¹⁰

Some of the North American industry leaders include:

- ◆ **Structurlam:** Manufactures CrossLam CLT. Structurlam’s mass timber products have been used throughout North America and are produced in their British Columbia and Conway, Arkansas manufacturing facilities. Structurlam has worked on some of North America’s high-profile mass timber projects, including Vancouver’s UBC Brock Commons and Portland’s Carbon12.
- ◆ **Sterling:** Sterling is the matting industry’s leading CLT manufacturer of CLT access mats used on rights-of-way in the power transmission and distribution, oil, gas and chemical, and general construction industries. Sterling owns and operates two manufacturing facilities in Phoenix, IL and Lufkin, TX, in addition to satellite offices, and numerous remote inventory yards.
- ◆ **Western Structures, Inc.:** A premier supplier of custom glulam beams. Western Structures Inc. was founded in 1989 and leverages its proximity in Veneta, OR to Douglas fir timber.
- ◆ **DR Johnson Wood Innovations:** A subsidiary of DR Johnson, DR Johnson Wood Innovations specializes in the manufacture

of CLT and glulam beams from Douglas fir and Alaskan yellow cedar. The company is located in Riddle, OR.

- ◆ **SmartLam:** SmartLam is a CLT manufacturer with facilities located in Columbia Falls, MT and Dothan, AL. SmartLam had announced plans to open a facility in Maine, but this has yet to come to fruition.

Globally, other major players include:

- ◆ **Stora Enso:** Headquartered in Finland, Stora Enso is a global leader in the paper, biomaterials, wood products, and packing industries. Wood products include CLT and laminated veneer lumber (LVL). The company was founded in 1996.
- ◆ **XLam:** With locations in New Zealand and Australia, XLam aims to be the leading regional provider of sustainable solutions for commercial and residential construction. The company focuses on CLT and derivative products, and is the first manufacturer of CLT in the southern hemisphere.
- ◆ **Mayr-Melnhof Holz Holding AG:** Headquartered in Austria, Mayr-Melnhof Holz Holding AG is a leading European supplier of glulam.
- ◆ **Binderholz GmbH:** Also headquartered in Austria, Binderholz produces solid wood products and mass timber solutions. With additional locations in Germany, Finland, and the U.S., the company employs around 3,000 individuals.
- ◆ **Schilliger Holz AG:** Located in Switzerland and France, Schilliger Holz runs a high-capacity wood processing industry in addition to its sawmills. Glulam is a key product of the company.
- ◆ **Eugen Decker:** A leading producer of glulam and CLT, Eugen Decker is located in Germany.

¹⁰ *Everything You Wanted to Know about CLT*. Forest2Market, 15 March 2021.

Major Purchases

The following section summarizes recent examples of CLT/mass timber projects in Maine and throughout the northeast.

- ◆ **Bowdoin College** (Brunswick, ME): The framework of the new Barry Mills Hall and the John and Lile Gibbons Center for Arctic Studies at Bowdoin College is primarily made from mass timber, including CLT. This is the first complete mass timber commercial structure in Maine and the first commercial structure in Maine to utilize a mass timber wall system to resist wind and seismic loads. For Bowdoin, CLT's environmental sustainability properties and cost effectiveness made it a good choice.¹¹
- ◆ **Rock Row** (Westbrook, ME): The first CLT office building in Maine will be a part of the 100-acre, \$600 million Rock Row development in Westbrook, ME. The seven-story, 200,000 SF CLT office tower named 100 Rock Row will feature retail space on the street level and distinctive loft and class-A offices on upper levels. In addition to its aesthetic appeal, the CLT design of the office is expected to offer lower heating and cooling costs, air quality and moisture control, sound absorption and noise cancellation, and fire protection, among others.¹²
- ◆ **Wessex Woods** (Portland, ME): Wessex Woods, a 40-unit affordable senior housing development in Portland, Maine's Nason's Corner neighborhood, is the first building in Maine to feature stairwells and an elevator shaft constructed from CLT. While mass timber was not part of the building's original design, budget challenges prompted the team to seek alternate structural solutions, including CLT. Using CLT resulted in cost savings by

reducing the shaft's three-week construction time to one day, realizing cost savings related to reduced labor, heating and tenting requirements.¹³

- ◆ **Rhode Island School of Design – North Hall** (Providence, RI): For a new six-story residence hall at RISD, the design team used a hybrid system of CLT floor and ceiling panels supported by steel framing to achieve design goals, environmental sustainability, and an aggressive construction schedule. In addition to reducing the project's carbon footprint through the use of CLT, the new hall is expected to use a quarter less energy and less than half the water of a typical residential structure of similar size.¹⁴
- ◆ **UMass Amherst** (Amherst, MA): The John W. Olver Design Building at UMass Amherst is a four-story, 87,500 SF mass timber project. The structure includes a glulam beam-and-column frame, glulam base frame and CLT shear walls. Use of mass timber allowed the team to leverage key aspects of wood design, including fire resistance, acoustic control, energy efficiency and sustainability.¹⁵
- ◆ **State of Massachusetts Public-Use Airport Buildings** (Beverly, MA): The new Beverly airport in Massachusetts was constructed largely with mass timber. Glulam beams and CLT panels form a split roof sloped in two directions. Logistically, the glulam and CLT roof system simplified construction and installation of the Beverly airport was completed in days. The design is expected to lower heating costs and be an overall economically and environmentally sustainable design.¹⁶

¹¹ *Bowdoin Pioneers Maine's First Pure Mass Timber Commercial Structure, Signals Continued Commitment to Sustainability*. Bowdoin News, 20 Sept. 2021.

¹² *First Cross-Laminated-Timber Office Building in Maine to be Built at \$600 Million Rock Row Development*. New England Real Estate Journal, 2 July 2021.

¹³ *Wessex Woods: Affordable Housing Inspires New Possibilities in Wood Construction*. Think Wood.

¹⁴ Woodworks.

¹⁵ Woodworks.

¹⁶ Woodworks.

- ◆ **Jones Beach Energy & Nature Center** (Wantagh, NY): The 330-foot-long Jones Beach Energy Center, which was constructed with mass timber, houses offices and classrooms, exhibition space, and an outdoor amphitheater. The silhouette of the mass timber roof structure, framed with glulam beams and wood decking, was designed to look like a series of waves. Additionally, timber piles form a pier like deck surrounding the center, addressing the constraints of the building's location on a flood plain.¹⁷

Maine Performance

The Northeastern U.S. is known for its vast forestlands of commercial softwood timber. Maine, the most heavily forested state in the nation (as a percentage of land area) contains nearly 26 billion cubic feet of wood. At 16.7 million acres, Maine has the largest amount of timberland acres of any state in the Northeast. Unique to Maine, the majority of timberland is privately owned (94%) with large private corporations consisting of 60% of the private land holdings. The large population centers within the Northeastern U.S. (including New York and Boston) fall within 500 miles of the geographic center of Maine. This means that mass timber harvested and manufacturing in Maine and used in these areas is eligible for LEED regional materials status with the U.S. Green Building Council.¹⁸

Founded in 2017, the University of Maine's Mass Timber Commercialization Center (MMTCC) brings together industrial partners, trade organizations, construction firms, architects, and other stakeholders in the region to revitalize and diversify Maine's forest-based economy by bringing innovative mass timber manufacturing to the State of Maine. Through science-based research and development, the MMTCC is actively involved in exploring new applications and design practices for mass timber. Recent work completed by MMTCC includes:

- ◆ Expanding the organization to include code officials and consultants from critical research areas;
- ◆ Coordination and sponsorship of a road mapping conference to better identify research and policy needs affecting mass timber construction and manufacturing;
- ◆ Promotion of Maine's early adoption of the 2021 IBC Tall Wood Building code provisions;
- ◆ Creation of an attraction package laying out the business case for CLT manufacturing in Maine;
- ◆ Development of products to make Maine more competitive in the North American mass timber market; and
- ◆ Coordination of the execution of a life cycle analysis of CLT construction systems.

In addition to MMTCC, other organizations are involved in the promotion of the industry in Maine. The Northern Forest Center is promoting mass timber in construction for the benefits it can provide the Northern Forest region. They have partnered with architects and WoodWorks to provide educational sessions and materials on the benefits of mass timber, and are investing directly in projects that grow mass timber markets through their Future Forest Economy Initiative.

Similarly, the New England Forestry Foundation's Build It With Wood initiative helps speed the adoption of innovative, sustainable and long-lived wood products in construction and also documents, researches and provides information about their climate benefits. Additionally, with support from the USDA Forest Service, the foundation commissioned an analysis of the potential for a New England CLT mill.

¹⁷ Woodworks.

¹⁸ *The Case for CLT Manufacturing in Maine*. Maine Mass Timber Commercialization Center, University of Maine. 7 Jan. 2019/