

Mass Appeal: The Rise of the Mass Timber Construction

Balfour Beatty continuously invests in technology to make projects safer, faster and more cost-efficient while delivering the highest quality. However, what if the largest advancement in the built environment in the last one hundred years is based on one of the oldest construction materials—wood? Mass timber construction is on a trajectory for significant growth over the next ten years, and Balfour Beatty experts are collaborating with owners, architects, engineers and suppliers to maximize the advantages and opportunities of this expanding delivery type.

National and Global Growth of Mass Timber Construction

Invented in Europe in the 1990s, mass timber panels were first introduced in the U.S. in the 2010s. There are four types of mass timber panels:

- Cross-laminated timber (CLT) is made by stacking boards in alternating directions. The panels are very strong and capable of handling load transfer on all sides.
- Glue-laminated timber (Glulam or GLT) is used for long spans such as beams or columns. Frequently left exposed, it is the most visible form of mass timber.
- Nail-laminated timber (NLT) is commonly used for roofs and walls and has been around and allowed in code for decades.
- Dowel-laminated timber (DLT) is the only all-wood mass timber material without fasteners or adhesive. It is made by using the moisture difference in the type of woods used for the planks and dowels to shrink and swell forming a strong bonded material. DLT has its basis in heavy timber and is refined in today's use.

Each type involves a different fabrication process to compress smaller pieces of wood into large, finished mass timber panels. The panels can be produced in a variety of thicknesses for walls, floors, roofing and structural support.

The panel types have different purposes and are often used in tandem; however, CLT has emerged as the most popular and versatile of the panel types. According to an analysis by IMARC, the global market exceeded 1.8 cubic meters of CLT in 2021. Between 2010 to 2017, the European CLT grew 16% to a value of \$494 million. Of the more than 1,300 mass timber projects in

design or constructed in the U.S. since 2013, 53% have included CLT (Woodworks.org). The global demand for CLT is projected to increase by an impressive 12.4% between 2022 and 2027.

Benefits of Mass Timber Construction

Balfour Beatty has both national and global experience in mass timber construction in a variety of project types for mixed use, multifamily, municipal, commercial office and education clients. In the U.S., the company is currently constructing mass timber projects on both the east and west coasts. Known benefits of mass timber construction include:

- Growing acceptance within the construction industry
 - In 2015, CLT was incorporated into the International Building Code (IBC).
 - In 2021, the IBC introduced three new building types to accommodate variations allowable in mass timber construction—Type IV-A (maximum 18 stories), IV-B (maximum 12 stories) and IV-C (maximum 9 stories).
 - In fall 2021, Zurich American Insurance Company announced up to \$50 million in insurance for qualified mass timber clients.
 - In 2024, the IBC is planning further amendments to mass timber provisions allowing more exposure for wood ceilings in the various types of construction associated with mass timber.
- The US Forest Service and the military have fire tested and blast tested CLT, and the product meets fire safety codes for widespread use, including for stand-off distances for military facilities. Like a log on a fire, CLT has definable burn characteristics which produce a char externally and eventually will eliminate the

fuel source for the fire. Char characteristics of wood are easily calculated within provisions provided under code. The charring process of the exterior ensures the structural integrity of the wood inside.

- Mass timber products are strong and lightweight, which can help expedite construction. In addition, the lighter weight product may be used on sites with soil conditions that are not suitable for heavy concrete construction, such as brownfield sites. Lighter weight mass timber elements can also be used on projects to reduce foundation requirements.
- Prefabricated mass timber components mean fewer and less skilled workers are needed on-site, which results in lower project labor costs.
- Prefabricated mass timber provides added insulation through the natural massing effect of the material. Per inch, this thermal insulation is ten times greater in mass timber than in concrete.
- As a prefabricated product, mass timber reduces waste on-site.
- Even after it is manufactured, transported (the wood for mass timber products is usually locally sourced), and installed, mass timber still has a smaller carbon footprint than both concrete and steel.

Since mass timber is a relatively new delivery type, some critics are skeptical of the carbon storage projections of mass timber. These critics also express concern about the potential for increased clear cutting of old-growth forests to support the industry.

However, the success of mass timber is predicated on the investment into sustainable young-growth forests that can be continuously planted and harvested when the trees reach between 10 to 15 years old. Selective harvesting also leads to potentially healthier forests and lessens the risk of the forest fires that have increased in recent years.

In addition, 11% of annual global CO2 emissions are attributed to building materials and construction (Architecture 2030). If the theory is proven that a cubic meter of cut wood used for the construction of a building will store a ton of CO2 throughout its useful life, this storage combined with the increased absorption of CO2 by sustainable forestry could significantly reduce the emissions contributing to climate change.

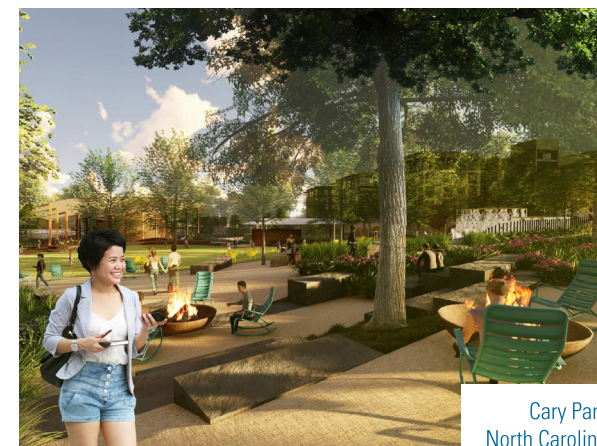
Opportunities for Local Economies and Communities

Due to the investments in forestry needed for the success of mass timber, there is an opportunity to create jobs in rural areas, increasing career opportunities in forestry management, harvesting, material production and transportation. As the only renewable structural building material, mass timber also has the potential to provide safe, affordable housing for the estimated global population growth over the next hundred years.

In addition, the aesthetic beauty of the wood in mass timber projects has become an attractive way for municipal clients to build central gathering places, such as libraries and other public spaces, which promote a sense of community. Known as biophilia, the tendency of humans to be drawn to natural elements was first identified by American biologist Edward. O.

Wilson and has been popularized in architectural design.

Balfour Beatty's Downtown Cary Park project in Cary, North Carolina embodies the principle of biophilia. The project features mass timber structures and will provide the local community with active performance spaces, a farmers' market, public art installations, botanical gardens, food and beverage concession spaces, a children's play area and an elevated skywalk.



Cary Park
North Carolina

Partnering to Achieve Project Goals

The variety of applications for mass timber has been well-established on low and mid-rise projects, and the benefits that can be reaped on taller buildings are steadily increasing. A 25-story multifamily/mixed-use project currently under construction in Milwaukee, Wisconsin will be the tallest mass timber structure in the world to date. Another project underway in Cleveland, Ohio is 20,000 square feet larger than the Milwaukee project. However, even with its many advantages, mass timber is not the right choice for every project.

To determine whether mass timber is right for our clients, Balfour Beatty experts ensure they understand and align on key project goals. By driving early collaboration, Balfour Beatty helps our clients identify the optimal construction type.

A popular approach to mass timber construction is a hybrid combination of mass timber panels and traditional materials such as steel, concrete or light wood framing. Based on the outcomes our clients are seeking and potential project constraints, this is often a viable selection. To empower and inform these early project decisions, our teams can provide a preliminary budget analysis, code compliance and permitting information, material selection options and labor force data.

An essential step in the success of a mass timber project is early coordination between major project team members before the development of construction drawings. These team members, including the owner, architect, engineer, construction professionals, manufacturers/ suppliers and major trade partners, will provide critical information on topics including:

- Material sourcing and cost
- Lateral load path strategy
- Structural spans
- Engineered, sequenced erection plans
- MEP distribution
- Slab composition
- Vibration control
- Acoustics
- Exposed finishes
- Material tolerances

According to Sean Mullen, senior project manager in Atlanta, Georgia, the collaboration between team members makes all the difference in the outcome of mass timber projects.

“Mass timber requires more upfront investigation and planning regarding finishes and penetrations. Early coordination between team members means necessary decisions are made, and the work is thoroughly planned for highly productive project execution and quality delivery.”



Sean Mullen

Balfour Beatty’s national experience and global collective mass timber knowledge include shared lessons learned, key business strategies and

relationships with quality manufacturers, suppliers and trade partners. We are on the leading edge of mass timber construction and provide our valued clients and partners with the expert advice needed to make informed and innovative project decisions.