Mass Timber and Tall Wood Buildings: An Update

Lead Author: Kathryn Fernholz
Co-Authors: Mark Jacobs, Gloria Erickson, Tamberly Conway, Ph.D., Sarah Harris, Jim Bowyer, Ph.D., Harry Groot, Ed Pepke, Ph.D.

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DOVETAIL PARTNERS

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Dovetail Partners

528 Hennepin Ave, Suite 303

Minneapolis, MN 55403

612-333-0430

info@dovetailinc.org

Executive Summary

In January 2016, Dovetail Partners released a report addressing modern tall wood buildings.[1] In the conclusion of that report we noted:

> *"The extent to which tall wood buildings will be developed in the U.S. remains to be seen, but there is little doubt that wood use will increase in high-rise structures. Wood has now re-entered the tall building discussion as one of many materials available to the design community. Its many attributes ensure a greater role in buildings of all kinds going forward."*

Nearly seven years later, this update report summarizes policy and code changes which have occurred in recent years and the trends in adoption of mass timber. We also look ahead to consider the challenges that mass timber may face. This report focuses on developments related to mass timber construction in the United States with some references to resources and information available globally

Key Takeaways from this Update on Mass Timber:

- Manufacturing of mass timber has increased to 11 companies in the U.S. and Canada since 2016, with 3 more planned;
- Mass timber construction in the U.S. and Canada has grown by 18.8% since 2019;
- As of March 2023, there are 1,753 mass timber projects in design, under construction or built in the U.S., with the tallest being 25-stories (19 stories of mass timber over a 6-story podium);
- Nineteen U.S. states have adopted code changes for tall mass timber provisions;
- Mass timber and other building innovations can reduce emissions impacts by 68% (based on whole life cycle analysis of a mass timber building over a 60 year life span);
- Even in the most aggressive mass timber demand scenario, forest growth in the U.S. continues to exceed harvest by 18%; and
- Continued innovation is needed for hybrid buildings, workforce development, and improved circularity and sustainability of materials.

[1]Modern Tall Wood Buildings: Opportunities for Innovation, January 2016, Dovetail Partners. Available at: https://dovetailinc.org/portfoliodetail.php?id=5e28c33f3e165

Terms and Definitions

Mass Timber: The term "mass timber" is used synonymously with "cross laminated timber" or CLT. Both terms refer to large structural panels made by assembling layers of dimension lumber, glued or nailed together, or connected by dowels, with the grain of alternate layers laid at right angles to one another, much like the veneers of plywood.

Tall Mass Timber: Associated with buildings that exceed the limits of previous codes for number of stories, height, and in some cases area (also referred to as "tall timber").

Mass timber construction
Mass timber construction: Construction in which mass timber panels are a dominant or major building material, typically in combination with other engineered wood beams or columns such as glulam, parallel strand lumber, and laminated veneer lumber.

Cross Laminated Timber (CLT): A panelized structural engineered wood product that can be used in all major building components (floors, interior and exterior walls, and roofs). (Other types include nail-laminated timber (NLT), dowel-laminated timber (DLT) and glulam beams.)

Mass Plywood (MPP): Refers to large structural panels made by gluing multiple layers of veneer with alternating grain directions to thicknesses of 4 to 20 inches (100-500mm). Can be made using logs as small as five inches (127mm) in diameter.

Circular Economy: A system of production and consumption, which minimizes waste, optimizes the resources used with minimal pollution, regenerates natural capital, creates opportunities for jobs and entrepreneurship, and reshapes production and consumption from a life-cycle and recycling perspective.

Type IV Construction: A type of construction where the exterior walls are of noncombustible material and the interior building elements are of solid or laminated wood without concealed spaces.

Sources: https://www.woodworks.org/learn/mass-timber-clt/tall-mass-timber/ , https://odfmasstimber.com/what-is-mass-timber/, https://www.thinkwood.com/mass-timber, https://www.apawood.org/cross-laminated-timber , https://dovetailinc.org/portfoliodetail.php?id=5e6f6fff64cb3 , https://codes.iccsafe.org/content/IBC2018P6/chapter-6-types-of-construction

Background

As noted in the 2016 report, mass timber buildings and modern tall wood construction were enabled by the European development of large wood panels known as cross laminated timber (CLT) (see sidebar for key terms and definitions). Canada was first in North America to experiment with the new construction material, including an 18-story wood building in British Columbia[2] and a 12-story building in Quebec in development and addressed in our prior report. In the 2016 report, we listed 29 tall wood building examples from around the world, including two proposed for construction in Portland, Oregon and one proposed for New York City. Twenty-three of the listed projects were in Europe and the earliest one on the list was an 8-story building in Sweden. The tallest wood building identified at that time was 24 stories, being constructed in Austria. Examples of tall wood buildings around the world are listed in Table 1.

Table 1. Examples of Tall Wood Buildings Globally, 2008-2019

Building Name	Location	Stories	Completion Date
Stadhaus at Murray Grove	London, UK	8-over-1	2008
Forté	Melbourne, Australia	8-over-1	2012
Via Cenni	Milan, Italy	9	2013
Treet	Bergen, Norway	14	2015
UBC Brock Commons	Vancouver, Canada	18	2016
Mjøstårnet	Norway	18	2019
HoHo Wien	Vienna, Austria	24	2019

As compared to our short list of less than 30 mass timber tall wood buildings globally as of 2016, the WoodWorks Innovation Network currently maps 434 mass timber projects in the U.S. and Canada alone, including 28 that are seven or more stories in height.[3] As of March 2023, there are 1,753 mass timber projects in design, under construction or built in the U.S., with the tallest being 25-stories (19 stories of mass timber over a 6-story podium).[3,5]

Note: 8-over-1 refers to 8 stories of timber structure over a concrete podium.
Source: WoodWorks, 2022. https://www.woodworks.org/wp-content/uploads/wood_solution_paper-tall-wood.pdf

The 2022 International Mass Timber Report indicated the number of publicly reported mass timber buildings constructed in the U.S. and Canada was 143 in 2019, 168 in 2020, and 170 in 2021 - an 18.8% increase over the three year period.[6] When we reported on mass timber in 2016, concerns about climate issues coupled with increasing recognition of the positive environmental attributes of wood – which include low carbon emissions in processing and massive carbon storage in use – were attracting interest in greater wood use in construction. Innovations in mass timber construction also were viewed as offering an opportunity to connect rural resources with suburban and urban communities in a manner that could support natural resource management to maintain, improve, and/or restore forest health, drive green building, and address carbon emission reduction objectives. Since that time, additional social benefits of wood construction have been identified in relation to meeting affordable housing needs,[7] supporting human mental and physical health,[8] and biophilic design opportunities.[9] In 2016, we concluded that the continued evaluation, testing, and reporting on tall-wood building research is a key component to ensure the continued safe and responsible realization of this innovation and its full suite of benefits.

[2] World's tallest hybrid wood building: Vancouver's 18-storey student residence https://www.nrcan.gc.ca/simply-science/worlds-tallest-hybrid-wood-building-vancouvers-18-storey-student-residence/20305

[3] https://www.woodworks.org/resources/mapping-mass-timber/ (accessed 21 June 2023); WoodWorks personal communication, 21 June 2023.

[4] http://softwoodlumberboard.org/wp-content/uploads/2022/07/SLB_Q1_June2022_11x17_English_Newsletter_WEB-1-3.pdf

[5] For more information about the Ascent project, see: https://www.woodworksinnovationnetwork.org/projects/ascent

[6] XXIV/2022 International Mass Timber Report. 2022. Forest Business Network. https://www.masstimberreport.com/

[7] https://elementfive.co/a-mass-timber-solution-for-rapid-affordable-housing/ ; https://www.toronto.ca/news/mayor-john-tory-announces-new-mass-timber-pilot-program-for-affordable-rental-housing/ ; https://www.opb.org/article/2022/09/02/oregon-mass-timber-industry-federal-grant-affordable-housing-developments/

[8] Behavior Changes in Older Persons Caused by Using Wood Products in Assisted Living, http://article.sapub.org/10.5923.j.phr.20120204.07.html

[9] Biophilic design—defined as an incorporation of natural materials, natural light, vegetation, views of nature and other experiences of the natural world into the built environment. See: https://www.thinkwood.com/blog/biophilic-design-a-boon-for-corporate-culture

Policy and Code Changes

Mass timber projects designed under the 2018 or earlier versions of the code were generally constrained by prescriptive building height limits of five to six stories depending on the occupancy group.[10] This was adding time and cost to mass timber construction under the existing code and limiting adoption and project success and competitiveness. It was also recognized that innovations in engineered wood products made it possible to safely and efficiently build taller buildings with these materials.

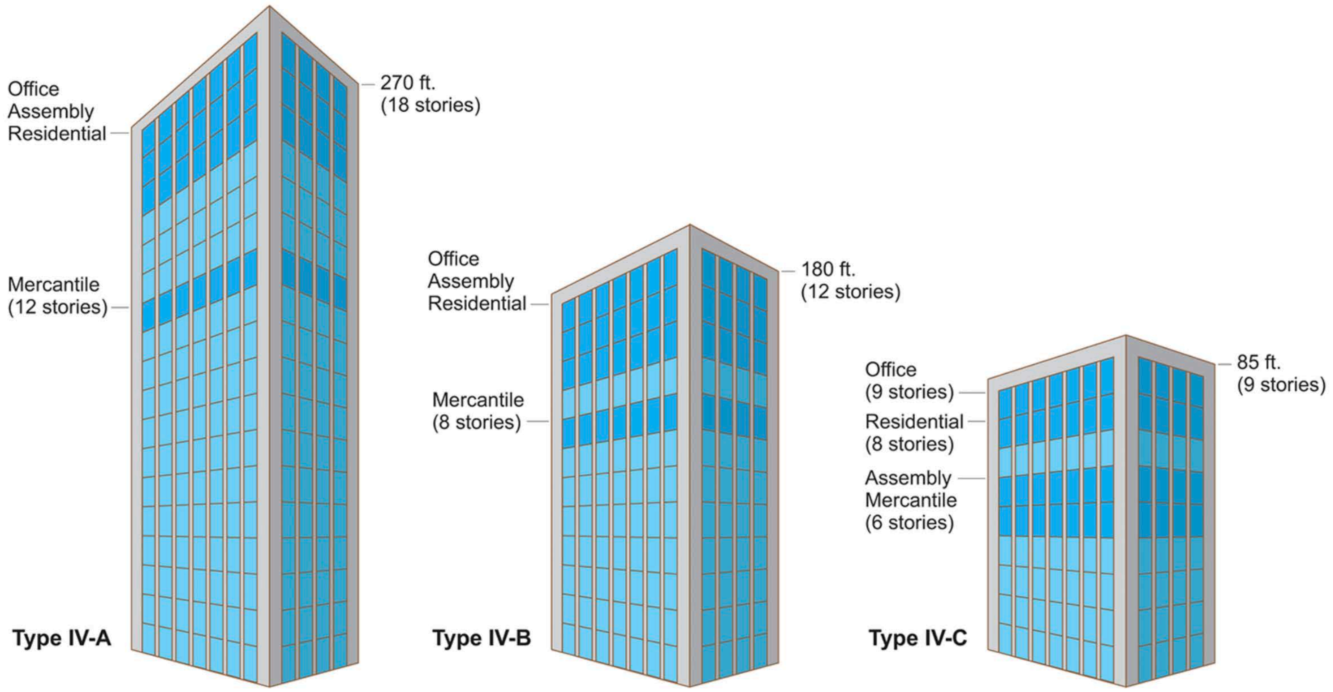
After several years of work, in January 2019, the International Code Council (ICC) approved a set of proposals to allow tall wood buildings as part of the 2021 International Building Code (IBC).

The 2021 International Building Code (IBC) includes three new construction types:

- Type IV-A – Maximum 18 stories, with noncombustible protection on all mass timber elements.
- Type IV-B – Maximum 12 stories, limited area of exposed mass timber walls and ceilings allowed.
- Type IV-C – Maximum 9 stories, all mass timber permitted to be exposed (with a few exceptions e.g. shafts) and designed for a 2-hour fire resistance.

These new types are based on the Heavy Timber construction type (renamed Type IV-HT) but with specified hourly fire-resistance ratings for building elements and added levels of noncombustible protection. The code includes provisions for up to 18 stories of Type IV-A construction for business and residential occupancies (Figure 1). Additional changes to be incorporated in the 2024 IBC have been voted on and results ratified by ICC. One significant change relative to construction Type IV-B is the allowance for exposure of mass timber ceilings and integral beams. The 2021 IBC permitted these areas to have 20% exposure while the 2024 IBC will permit 100% exposure.[11]

Figure 1. Height Limits for Building Types IV-A, IV-B, and IV-C in the 2021 International Building Code (IBC)



Source: http://www.woodworks.org/learn/mass-timber-clt/tall-mass-timber

[10] The term "tall timber" is associated with buildings that exceed the limits of previous codes for number of stories, height and in some cases area. (https://www.woodworks.org/learn/mass-timber-clt/tall-mass-timber/)
[11] https://www.woodworks.org/resources/status-of-building-code-allowances-for-tall-mass-timber-in-the-ibc/

Following approval of the IBC code changes, it is necessary for individual jurisdictions to adopt the changes and the tall wood code provisions.[12] As of July 2022, eight states, nine cities, and one county in the U.S. had adopted the tall mass timber provisions in the 2021 and/or 2024 IBC either in whole or with local amendments. As of December 2022, this number grew to 19 states, one city (Denver, CO), one county (in Maryland), and 10 jurisdictions in Texas. Other jurisdictions have made building code and policy changes to allow greater use of wood without adopting the IBC provisions (for example, see sidebar addressing New York City).

Given the design and engineering capacity of CLT and mass timber technologies, these innovations in the built environment can contribute to significant changes in material use, design, and green building. There is a business case for mass timber construction, including cost efficiencies and other project values.[13] There are also beneficial social and environmental attributes of mass timber, including support for forest management to maintain, improve and restore ecological health, green jobs, and improved resiliency that can reduce wildfire risk[14] as well as opportunities to improve affordable housing opportunities.[15] Although often associated with Type IV buildings, mass timber can be used in any construction type that allows for a wood structure.[16] In addition to needing to have more jurisdictions adopt the tall wood code provisions, there is other continuing code related work needed for mass timber. For example, the American Wood Council (AWC) has joined a new working group formed by California's Office of the State Fire Marshal to promote the adoption of the International Wildland-Urban Interface Code.[17]

New York approves use of cross-laminated timber for six-story buildings

Tom Ravenscroft | 13 October 2021 dezeen.com

The New York City Council has approved the use of mass timber for the construction of buildings of up to 85 feet tall in the city.

Included as part of a major update to the New York City Construction Codes, the new regulations mean that mass timber, including cross-laminated timber, can be used as a structural material for low and medium-rise buildings across the city.

The new regulations mean that buildings up to 85 feet (25.9 metres) tall can be built from the materials. This equates to structures of six or seven storeys.

Excerpted from: https://www.dezeen.com/2021/10/13/new-york-timber-buildings/

Also see: Inside New York's First Mass Timber Condo

https://www.woodworks.org/inside-new-yorks-first-mass-timber-condo/

[12]For the listing of jurisdictions that have adopted or are considering the tall mass timber code provisions, see: https://www.woodworks.org/resources/status-of-building-code-allowances-for-tall-mass-timber-in-the-ibc/ Also see: https://awc.org/codes-and-standards/code-adoption-map-2/

[13]https://www.woodworks.org/why-wood/business-case/

[14]https://www.woodworks.org/why-wood/forests-wildfire-rural-communities/

[15]Affordable Housing Opportunities for Mass Timber, March 2021, Dovetail Partners and Spiritos Properties, LLC. Available at: https://dovetailinc.org/portfoliodetail.php?id=60525fce7bf85

[16]For more information on the code changes, including design implications of the new construction types, see this WoodWorks paper and the ICC/American Wood Council document, Mass Timber Buildings and the IBC.

[17]https://www.iccsafe.org/products-and-services/wildland-urban-interface-code/

Mass Timber Research and Product Standardization

Closely related to the code changes are research efforts and other product standardization work that has been completed in recent years, examples include:

- **APA [18] Engineered Wood Construction Guide E30**

  Comprehensive guide to engineered wood construction systems for both residential and commercial/ industrial buildings. Includes information on plywood and oriented strand board (wood structural panels), glulam, I-joists, structural composite lumber, typical specifications and design recommendations for floor, wall and roof systems, diaphragms, shear walls, fire-rated systems and methods of finishing. Revised December 2019.

- **APA Engineered Wood Construction Guide Excerpt: Cross-Laminated Timber (CLT) Selection and Specification**

  Excerpt from the Engineered Wood Construction Guide, Form E30. A guide to selecting and specifying cross-laminated timber for various building applications. Only available as a downloadable pdf file. Revised December 2019.

- **ANSI/APA PRG 320-2019: Standard for Performance-Rated Cross-Laminated Timber[19]**

  Provides requirements and test methods for qualification and quality assurance for performance-rated CLT, which is manufactured from solid-sawn lumber or structural composite lumber. Issued January 2020.[20]

- **APA - The Mark of Quality for Wood Structural Panels X400**

  APA's quality assurance system includes review of mill quality procedures, independent third-party audits of the mill quality program and regular independent testing to verify the quality of panels bearing the APA trademark. Issued September 2021.

The development of product standards and performance assurances for CLT and other mass timber products was an essential step for supporting code changes and their adoption. Additional information is available from the APA about on-going related research initiatives from the USDA Forest Service, Forest Products Lab and other partners.[21]

Growth in Mass Timber Manufacturing in the U.S. and Canada

Another change since the report in 2016 is the expansion of mass timber manufacturing in the U.S. and Canada (Table 2). Of the eleven manufacturers listed in Table 2, seven started producing mass timber products since 2016. As of 2021, an additional three mass timber plants were being planned for development in North America.[22]

[18] APA is a nonprofit trade association that has grown and evolved with the engineered wood industry. APA was founded in 1933 as the Douglas Fir Plywood Association and was later recognized as the American Plywood Association. In 1994, APA changed its name to APA – The Engineered Wood Association to better reflect the range of products manufactured by APA members and the international scope of the Association. https://www.apawood.org/apa-overview

[19] APA is accredited by the American National Standards Institute (ANSI) to develop national consensus standards for engineered wood products.

[20] Cross-laminated timber (CLT) manufactured in North America must meet stringent product standards and be certified to the ANSI/APA PRG 320 Standard for Performance-Rated Cross-Laminated Timber. CLT manufactured outside of North America may not meet these performance expectations. Revised February 2020. See: https://www.apawood.org/publication-search?q=s500

[21] USDA Forest Product Laboratory's research in progress: https://www.apawood.org/research-in-progress

[22] 2022 International Mass Timber Report

Table 2. CLT MANUFACTURERS in the United States and Canada, 2022

Manufacturer	Country	State/Province	Year Established	Plant Locations
Structurlam Mass Timber Corporation	Canada	British Columbia	1962 *(CLT started in Arkansas in 2021)*	Conway, Arkansas; Okanagan Falls, British Columbia; Penticton, British Columbia
Nordic Structures	Canada	Quebec	1961 *(CLT started in 2010)*	Chibougamau, Quebec
IB X-Lam USA, LLC*	USA	Alabama	2017	Dothan, Alabama
D.R. Johnson Wood Innovations	USA	Oregon	1967 *(CLT started in 2015)*	Riddle, Oregon
SmartLam, LLC	USA	Montana	2012	Columbia Falls, Montana
Freres Lumber Co., Inc.	USA	Oregon	1922 *(MPP started in 2017)*	Lyons, Oregon
Vaagen Timbers, LLC	USA	Washington	2017	Colville, Washington
Kalesnikoff Mass Timber, Inc.	Canada	British Columbia	1922 *(CLT started in 2019)*	Thrums, British Columbia
Element5 Limited Partnership	Canada	Ontario	2015	St. Thomas, Ontario Ripon, Quebec
Texas CLT	USA	Arkansas	2019	Magnolia, Arkansas
Sterling Lumber	USA	Texas	2019	Lufkin, Texas Phoenix, IL

Source: https://www.apawood.org/cross-laminated-timber ; 2022 International Mass Timber Report
* Facility was purchased by SmartLam LLC.

Sustainable Supply of Wood for Mass Timber Construction

In early 2022, a special issue of the journal *Sustainability* was published with twelve papers addressing original research articles, case studies, review articles, and methodological notes in the fields of mass timber-based building constructions and interaction between the built and the natural environments.[23]

Included in the papers was an analysis of sustainable timber supply for mass timber in the U.S.[24] The research concluded, *"In total, forest inventory growth in America exceeds timber harvests including incremental mass timber volumes. Even the most optimistic projections of mass timber growth will not exceed the lowest expected annual increases in the nation's harvestable coniferous timber inventory."*[25] The researchers determined that current U.S. wood consumption is 66% of growth. The forecasted demand for mass timber by 2035 represents a potential increase of 17% over what is harvested today. In the most aggressive scenario (highest estimated demand and lowest forest inventory estimate), forest growth in the U.S. continues to exceed harvest by 18%.[26]

An additional paper explored the global impacts of rising mass timber demand, and concluded: *"...the projected effect on global forest stock was relatively small based on the relatively fast projected biomass growth in stands assumed to be regenerated after harvest".*[27] The study suggested the development of market competition between the mass timber and traditional construction industries and evaluated the effects of three mass timber demand scenarios through the year 2060 within twelve selected countries in Asia, Europe, North America, and South America.[28]

[23]https://www.mdpi.com/journal/sustainability/special_issues/mass_timber_sus

[24]Comnick, Jeff, Luke Rogers, and Kent Wheiler. 2022. "Increasing Mass Timber Consumption in the U.S. and Sustainable Timber Supply" Sustainability 14, no. 1: 381. https://doi.org/10.3390/su14010381

[25]More information about the research: "Using U.S. Department of Agriculture U.S. Forest Service Forest Inventory and Analysis (FIA) data, incremental U.S. softwood (coniferous) timber harvests were projected to supply a high-volume estimate of mass timber and dimensional lumber consumption in 2035. Growth in reserve forests and riparian zones was excluded, and low confidence intervals were used for timber growth estimates, compared with high confidence intervals for harvest and consumption estimates. Results were considered for the U.S. in total and by three geographic regions (North, South, and West)." Comnick, Jeff, Luke Rogers, and Kent Wheiler. 2022. "Increasing Mass Timber Consumption in the U.S. and Sustainable Timber Supply" Sustainability 14, no. 1: 381. https://doi.org/10.3390/su14010381

[26]These percentages are for the U.S. as a whole. On a regional basis, the study found that growth exceeds consumption in the South and the North, but under the most aggressive scenario consumption could exceed growth in the West region by approximately 10%. For additional discussion, see: https://info.thinkwood.com/cintrafor-and-nrsig

[27]More information about the research: "Analyses were carried out by utilizing the Forest Resource Outlook Model, a partial market equilibrium model of the global forest sector. The findings suggest increases in global softwood lumber production of 8, 23, and 53 million m3 per year by 2060, under the Conservative, Optimistic, and Extreme scenarios, respectively, leading to world price increases of 2%, 7%, and 23%, respectively. An increase in softwood lumber prices due to increased mass timber demand would lead to the reduced consumption of softwood lumber for traditional end-use (e.g., light-frame construction), suggesting a likely strong market competition for softwood lumber between the mass timber and traditional construction industries." Nepal, Prakash, Craig M. T. Johnston, and Indroneil Ganguly. 2021. "Effects on Global Forests and Wood Product Markets of Increased Demand for Mass Timber" Sustainability 13, no. 24: 13943. https://doi.org/10.3390/su132413943

[28]For additional information, including global mapping of mass timber demand projections, see: https://www.cintrafor.org/mass-timber-demand.html

Other papers in the same special issue of *Sustainability* address climate-smart forestry, life cycle assessments, carbon and climate change impacts. There is growing interest in quantifying and incentivizing the carbon storage benefits of mass timber, including related policy developments (see sidebar related to legislation in California and Georgia). Private sector initiatives to develop mass timber carbon credit strategies have also recently been announced.[29]

One part of the sustainability benefit of mass timber is the reduction of greenhouse gas emissions associated with the construction phase of building development. Historically, the operational emissions of buildings (i.e., energy used for heating and cooling) have been a significant part of the carbon footprint of the built environment. However, as electricity production includes greater use of renewable energy and buildings are better insulated and energy-efficient, the emissions associated with building occupancy and operation have declined.[30] To make further reductions in the climate impact of buildings, it is increasingly important to look at the "upfront" emissions of construction. By designing with mass timber, these upfront emissions can be reduced by 30 to 44 percent.[31] A recent case study that further explored optimization of all material use and building design identified the potential for a 68% reduction in emissions impact from a whole life cycle analysis of a mass timber building with a 60 year life span.[32] The estimated savings were equivalent to avoiding the emissions of up to 20,000 barrels of oil.[33]

State Policy Support for the Carbon Benefits of Mass Timber

The *Carbon Intensity of Construction and Building Materials Act* (Assembly Bill No. 2446) in California creates a path towards a 40% reduction of embodied carbon in both residential and commercial building materials by the end of 2035. This may provide a replicable model of embodied carbon legislation for other states.

See: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB2446
For additional information: California Embodied Carbon Legislation: How to Prepare for AB 2446

The *Georgia Carbon Sequestration Registry* is a non-profit program established by Georgia Senate Bill 356 in 2004 to provide a mechanism for the development, documentation, and reporting of carbon sequestration projects undertaken in Georgia. In 2021, the registry was modernized and expanded to include building products and materials for carbon sequestration benefits. Participation in the Registry is completely voluntary.

See: http://www.gacarbon.org/GFCCSHome.aspx
For additional information: https://gatrees.org/forest-management-conservation/carbon-sequestration/

[29]September 29, 2022, Pioneering the First Mass Timber Carbon Removal Methodology; September 22, 2022, Aureus Earth and the University of Washington Execute Ground-Breaking Carbon Offset Transaction for a Mass Timber Building

[30]https://www.iamtc.org/carbon-equation-in-net-zero-mass-timber-buildings/

[31]Why Upfront Carbon Matters, The Promise of Mass Timber, Oregon Department of Forestry https://odfmasstimber.com/why-upfront-carbon-matters-more-today/#MassTimberNow

[32]Additional information: The case study assessed all design options over a typical 60-year life span, factoring in maintenance and equipment replacement schedules, refrigerant leakage rates, landscape sequestration and site maintenance. The Case Study achieves a 68% reduction, saving 4,458 Metric Tons of Carbon Dioxide equivalent emissions (CO_2e) over its lifespan compared to a baseline building situated in San Francisco. When moving to Atlanta, it achieves a 69% reduction, saving 8,967 Metric Tons of CO_2e. Source: Perkins&Will, 2021. https://masstimberhousing.com/whole-life-carbon

[33]https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

Challenges and Opportunities

Hybrid Buildings

Mass timber buildings are made not only of wood. Hybrid projects include the use of other materials and provide an opportunity to optimize the use of steel, concrete, and wood in the built environment, using each material so as to take advantage of the best properties of each. One of the challenges and opportunities for the continued growth and positive impact of mass timber is to seek innovative and collaborative opportunities across material sectors. An example of this is the research effort being led by the Council on Tall Buildings and Urban Habitat (CTBUH) with their project "The Future Potential of Steel-Timber Hybrid Buildings".[34] The work is supported by the World Steel Association and the Softwood Lumber Board (SLB). Past analysis by the SLB has indicated hybrid building systems will account for 470 million board feet in incremental lumber consumption by 2035.[35] Innovations with concrete could also impact mass timber construction demand, including concrete composites and 3D concrete printing technologies.[36]

Workforce, Labor, and Training

Mass timber requires less on-site labor compared to other construction types, but it requires new skills and additional training for working with mass timber materials and installation techniques. This challenge creates training development and delivery needs as well as opportunities to collaborate with construction trade organizations. For example, WoodWorks has collaborated with the Chicago Regional Council of Carpenters (CRCC) Apprentice & Training Program and the Northwest Carpenters' Institute of Washington. WoodWorks has partnerships with nine union training centers for installer training programs, and another five in development across the country.[37] The Installation Training component of the WoodWorks Construction Management Program plans to increase trained labor availability with 2,200 additional workers by 2027, which is sufficient to add and staff 75 installation crews per year, and will add installation crew capacity for over 400 additional projects annually thereafter. This rate of workforce development aligns with expected mass timber project growth across the United States.[37] The U.S. Mass Timber Construction Manual has also been developed to support the information needs of contractors and installers (see sidebar). Research is also identifying knowledge gaps for architects, engineers, designers, and others in the construction sector that many limit mass timber construction.[38]

U.S. Mass Timber Construction Manual

The U.S. Mass Timber Construction Manual gives contractors and installers a framework for the planning, procurement, and management of mass timber projects, and provides a bridge from their experience with other systems. Mass timber is unique in that it draws installation techniques from other construction types, so people with concrete, precast, tilt-up, and structural steel experience can readily adapt to these materials. However, understanding how mass timber differs from other building systems is key to cost effectiveness.

The manual was produced with primary funding from the U.S. Endowment for Forestry and Rural Communities, in collaboration with WoodWorks' mass timber manufacturing partners in the U.S. and Canada. While intended primarily for general contractors and installers, it is a useful reference for all members of a mass timber project team and anyone interested in the construction of mass timber buildings.

Source: https://www.woodworks.org/learn/mass-timber-clt/mass-timber-construction-management-program/

[34] https://www.ctbuh.org/research/projects/the-future-potential-of-steel-timber-hybrid-buildings#tab-overview; https://ctbuhsteeltimber.com/program/

[35] http://softwoodlumberboard.org/wp-content/uploads/2022/10/SLB_Q2_2022_English_Newsletter_WEB_FINAL.pdf

[36] For additional information, see: Concrete solutions: 9 innovations for a construction essential https://www.bdcnetwork.com/concrete-solutions-9-innovations-construction-essential and 3D Printed Concrete Buildings https://theconstructor.org/concrete/3d-printed-concrete-buildings-working-features/39027/

[37] For more information, see: WoodWorks Construction Management (https://www.woodworks.org/learn/mass-timber-clt/mass-timber-construction-management-program/) and SLB 2022 Q2 Quarterly Investment Update, http://softwoodlumberboard.org/wp-content/uploads/2022/12/SLB_Q2_Sept2022_11x17_English_Newsletter_WEB_UPDATED.pdf

[38] For more information, see: Mass timber 'knowledge gap' stunting sector's growth, 7 Nov 2022, Daily Commercial News https://canada.constructconnect.com/dcn/news/resource/2022/11/mass-timber-knowledge-gap-stunting-sectors-growth

Economic Competitiveness and Improved Circularity

There are also a number of multi-faceted economic constraints and potential concerns related to the future of mass timber. These include technical considerations related to insurance coverages and perceptions of insurance risk with a relatively new construction technique.[39] There are also needs for innovative financing for mass timber projects and related investments.[40] Lastly there are all of the basic challenges of forest product manufacturing and ever-changing market conditions.[41] Mass timber today is fundamentally a softwood lumber industry and is not immune to the established operating challenges that are inherent to this mature sector.

One of the operational challenges is related to waste handling and accessing markets for sawmill byproducts - bark, sawdust, and other materials. Sawmills and wood product manufacturers that are able to find markets for these materials are more economically viable as a result of reduced waste handling costs and the revenue gained by selling these materials as inputs to other product manufacturing systems, such as biofuels and wood pellets for renewable energy.

A recent study in Canada[42] concluded that the biomass industry:

- utilizes and creates value from sawmill residuals,
- creates an additional revenue stream for sawmills and other facilities,
- eliminates CO_2 emissions by using residuals that formerly were combusted (without energy capture) or landfilled, and
- utilizes low quality biomass that comes from natural disturbances and contributes to managing wildfire risks.

A related consideration is the efficient utilization of wood to support goals of greater sustainability and reduced waste.[43] The "cascading use of wood" is defined as *"the efficient utilization of resources by using residues and recycled materials for material use to extend total biomass availability within a given system"*.[44] Products ranging from engineered and solid wood products through fiber and biomass products create important opportunities for material use efficiencies and economic competitiveness. The circular economy concept is defined as *"a system of production and consumption, which minimizes waste, optimizes the resources used with minimal pollution, regenerates natural capital, creates opportunities for jobs and entrepreneurship, and reshapes production and consumption from a life-cycle and recycling perspective."* Examples of circularity in the forest sector include changes within pulp and paper manufacturing through development of pre- and post consumer recycling capacity and end-of-life alternatives that include composting and bioenergy. Improvements in construction/deconstruction debris recovery and recycling of solid wood products could further improve material use efficiencies, sustainability, and circularity in the forest sector.[45]

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[39] https://www.woodworks.org/learn/mass-timber-clt/mass-timber-building-insurance/

[40] For example, see: The Timber Finance Initiative https://timberfinance.ch/english/ , Sustainable Forestry Investor Club, Impact Finance Center https://investing.impactfinancecenter.org/sustainable-forestry ; Oregon Mass Timber Coalition https://www.masstimbercoalition.org/

[41] https://www.forest2market.com/blog/predictions-for-the-global-forest-industry-in-2022

[42] Additional conclusions are included in the full report, Wood Pellets in BC. 2022 https://www.pellet.org/wp-content/uploads/2022/09/WPACfibre_study_DESIGN_FINAL.pdf

[43] For further discussion, see: The Sustainable Development Goals (SDGs): An introduction to what they are and how they can be applied in the forest sector , Available at: https://dovetailinc.org/portfoliodetail.php?id=5e260bba17982

[44] https://europanels.org/issues/recycling-cascade-circular-economy/

[45] For further discussion, see: An Introduction to the Circular Economy Opportunities for Natural Resources and the Forest Sector, Available at: https://dovetailinc.org/portfoliodetail.php?id=5e6f6fff64cb3

The Bottom Line

As we stated in 2016, "tall wood buildings offer an opportunity to connect rural resources with [suburban and] urban communities in a manner that has the potential to support forest restoration, drive green building, and address carbon emission reduction objectives." Some of these opportunities are beginning to be realized and the adoption rate of mass timber has been enhanced by the results of research, product standardization, code provisions, expanded production capacities, and the leadership of many public and private sector organizations. It also remains true that: "The continued evaluation, testing, and reporting on tall-wood building research is a key component to ensure the safe and responsible realization of this innovation and its full suite of potential benefits." Mass timber partners and supporters, including federal, state, and local policy makers, will need to continue to advocate for adoption of innovation, collaboration across construction sectors, partnerships with labor and workforce interests, the valuation of the carbon storage benefits of wood, and wood's cascaded use across diverse biobased products to support netzero goals and greater circularity.

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Dovetail Partners' mission is to provide authoritative information about the impacts and trade-offs of environmental decisions, including consumption choices, land use and policy alternatives.

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