MASS TIMBER CONSTRUCTION

WHAT IS MASS TIMBER CONSTRUCTION?

Mass timber construction is a carbon removal technique that involves using specialized wood products to construct buildings, including high-rise buildings. Manufacturers use products such as cross-laminated timber (CLT), laminated veneer lumber (LVL), and glue laminated timber ("glulam") to produce wood panels and beams, which can replace concrete, steel, and masonry as building materials. Because it displaces emissions-intensive steel and concrete, mass timber can significantly reduce the "embodied carbon" in buildings. Because the wood stores carbon dioxide (CO_2) that was captured from the atmosphere via photosynthesis, mass timber construction can function as a form of carbon removal when combined with sustainable timber production and building demolition practices. Other approaches to building with wood may be able to sequester carbon, as well, including in low-rise buildings.

CO-BENEFITS AND CONCERNS

+ **Lower cost:** mass timber construction is more cost-effective than alternative forms of construction for mid- and high-rise buildings.
+ **Energy efficiency:** building with mass timber is less energy intensive than building with steel and concrete.
+ **Faster construction:** by using prefabricated wood panels, mass timber construction is often faster than building with steel and concrete.
+ **Displaces steel and concrete:** by reducing demand for steel and cement, mass timber construction reduces emissions from those hard-to-abate sectors.
+ **Disaster resistant:** engineered mass timber products are fire-resistant, and mass timber buildings can handle earthquakes better than traditional high-rise construction.
+ **Renewable inputs:** wood is a renewable input, and it can be recycled, incinerated for energy, or converted to biochar at the end of its life as a construction material.
− **Saturation:** soils can only hold a finite amount of carbon; once they are saturated, societies will no longer be able to capture more carbon using soil carbon sequestration.
− **Reversibility:** the carbon captured via soil carbon sequestration can be released if the soils are disturbed; societies would need to maintain appropriate soil management practices indefinitely.
− **Difficulty of measurement:** monitoring and verifying carbon removal via soil carbon sequestration is currently difficult and costly.

POTENTIAL SCALE AND COSTS

It is currently difficult to quantify the cost and carbon removal potential of mass timber construction. Mass timber construction appears to be slightly less expensive than traditional steel and concrete construction. While costs are difficult to compare between the two approaches, one analysis of eighteen case studies found an average cost savings of about 4 percent. With respect to carbon removal potential, Skullestad and colleagues estimate that high-rise buildings provide carbon removal benefits equivalent to roughly 150–250 kilograms of CO_2 per square meter of floor space. For context, that would mean that building a city with as much floor space as Manhattan would sequester something on the order of 25–40 million metric tons of CO_2. This is in addition to the mitigation benefit from displacing steel and cement production. Estimates of the global potential for carbon sequestration via mass timber construction are not available at this time.

MASS TIMBER CONSTRUCTION

TECHNOLOGICAL READINESS

Mass timber construction is already practiced at commercial scales, but it remains tiny compared to conventional steel and reinforced concrete construction. Further research and development is still needed to extend the possibilities for mass timber construction and identify circumstances in which it would prove environmentally beneficial. More widespread expertise in and acceptance of mass timber construction would accelerate its adoption.

GOVERNANCE CONSIDERATIONS

- □ **Sustainable Timber Production:** good governance is critical to ensuring that the trees used for mass timber construction are grown and harvested sustainably, which is essential for making mass timber construction carbon-negative and environmentally sustainable.
- □ **Life Cycle Analysis:** standardizing best practices for life cycle analyses of embodied carbon would help ensure that mass timber construction is genuinely carbon-negative
- □ **Construction Regulations:** building codes and other regulations may need to be updated to promote appropriate forms of mass timber construction and appropriate handling of timber after demolition.
- □ **Incentivization:** incentives or regulations may be needed to accelerate adoption
- □ For **cross-cutting considerations**, see the What Is Carbon Removal? fact sheet on our website.

FURTHER READING

Skullestad, J. L., Bohne, R. A., & Lohne, J. (2016) High-rise Timber Buildings as a Climate Change Mitigation Measure – A Comparative LCA of Structural System Alternatives. *Energy Procedia* 96: 112–123. doi: 10.1016/j.egypro.2016.09.112

Smith, R.E., Griffin, G., Rice, T., and Hagehofer-Daniell, B. (2018) Mass timber: evaluating construction performance. *Architectural Engineering and Design Management* 14 (1–2): 127–38. doi: 10.1080/17452007.2016.1273089

Goubran, Sherif, Tristan Masson & Thomas Walker (2020) Diagnosing the local suitability of high-rise timber construction. *Building Research & Information* 48 (1): 101–23. doi: 10.1080/09613218.2019.1631700

For more fact sheets on carbon removal, visit https://carbonremoval.info/factsheets.

INSTITUTE *for* CARBON REMOVAL LAW AND POLICY

Copyright © 2020 by The Institute for Carbon Removal Law and Policy, an initiative of the School of International Service at American University. Visit www.american.edu/sis/carbonremoval

200520