
CROSS LAMINATED TIMBER: THE FUTURE OF MID-RISE CONSTRUCTION

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Cross laminated timber (CLT) is an established construction method that has the potential to revolutionize mid-rise construction in the United States, and revitalize the timber production industry in Oregon. CLT was originally created in Switzerland in the early 1990s. It consists of panels with multiple layers of wood oriented crosswise that are bonded with structural adhesives, and pressed to form a solid, straight, rectangular panel. Finished CLT panels are typically 2 feet to 10 feet wide, with lengths up to 60 feet and thickness up to 20 inches.¹ This allows it to be used for long spans in floors, walls, or roofing.

The prefabricated nature of CLT panels makes it fast and easy to install, generating almost no waste on the job site. CLT panels are prefabricated with pre-cut openings for doors, windows, stairs, service channels, and ducts, and shipped directly from the manufacture where they can quickly and efficiently lifted into place. The panels are shipped with preinstalled lifting straps to effectively utilize

¹ Evans, L. Cross laminated timber: Taking wood buildings to the next level. American Wood Council. MAT240-A – Cross Laminated Timber. 2013.

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just-in-time construction methods and provide substantial savings on construction timelines.

There are more than 500 CLT buildings in Europe. Due to more restrictive building codes and a lack of established production chains, there are only a handful in the United States. The Oregon Forest Resources Institute is aware of six to eight CLT projects under construction or complete in the U.S.²

The local advancement of CLT research and production has been encouraged by numerous local and national grant programs. Oregon is considered a national leader in CLT research, production, and construction. Oregon BEST and a newly established collaboration between Oregon State University and University of Oregon called the “Center for Advanced Wood Products Manufacturing and Design” are working to support expansion of Oregon’s manufacturing capacity to produce CLT. An innovative project from Portland-based LEVER Architecture in the Pearl District, was one of two teams to win a \$1.5 million dollar prize at the U.S. Tall Wood Building Prize Competition, a contest sponsored by the U.S. Department of Agriculture, the Softwood Lumber Board and the Binational Softwood Lumber Council.



D.R. Johnson Wood Innovations located in Riddle, OR recently became the first manufacturer in the United States to receive certification from the American Plywood Association (APA) to produce cross-laminated timber. Currently, the maximum panel size that can be produced at their facility is 10 feet × 32 feet × 3, 5,

² Andrews, G. Material differences: CLT becomes divisive. *Daily Journal of Commerce*. May 4, 2016.

or 7 feet layers. These extended lengths help to meet longer length construction requirements and increased specification.³

As of January, 2015, the State for Oregon Building Codes Divisions approved a statewide alternate method (No. 15-01) that will allow the use of CLT for Type IV, Heavy Timber buildings, a construction type that utilizes larger, exposed wood structural members that have minimum sizes for code required fire-resistive requirements. Currently, Oregon is the only US state to have formally adopted the use of CLT as a Heavy Timber component, however the 2015 IBC code update allowed for submittal of CLT materials as part of the “alternative designs sections of the IBC with allowing local amendments.”⁴ This will take substantial communication and coordination between regulating governments and project teams.

A 2014 CLT construction feasibility study by Mahlum Architecture, Walsh Construction and Coughlin Porter Lundeen found that CLT construction costs on an 8-story building with a two-story concrete platform would be four percent less than the costs of a 10-story concrete building. The study used a cast-in-place concrete frame structure with post-tensioned concrete floor decks as the base-line cost model. The study also highlighted the need for experienced CLT project engineers, which can a significant potential cost increase. As the Portland market adds CLT engineers, cost saving are expected to surpass the 4 percent baseline estimate.⁵

CLT has the potential to provide a catalyst for mid-rise structures taller than 7-story podium style development, while being more cost effective than high-rise steel construction. The Mahlum study identified that common assumptions for the Seattle market dictate that concrete is too expensive for building only slightly above midrise at heights above 75 feet and lower than around 125 feet. Often, non-high rise lots are built using 5-over-2 construction with 5 stories of light wood frame construction built on top of 2 stories of concrete. This construction method leaves development potential unrealized in high demand areas outside of central city cores that do not have market demand or supportive zoning for high-rise steel construction.

The recent update to the Portland Comprehensive Plan and Zoning Code, coupled with new challenges of impending inclusionary zoning laws and escalating development fees provide a unique opportunity to promote needed mid-rise construction. These large-scale planning code developments should anticipate the potential for allowing and even supporting this development type.

The Portland Planning Bureau is incorporating new mixed-use zones outside the central city core as part of the Comprehensive Plan Update. Although not a likely

³ Law, S. Grant will help develop Oregon's first cross-laminated timber plant. *Portland Tribune*. October 23, 2014.

⁴ State of Oregon, Building Codes Division. No. 15-01: Cross laminated timber provisions. January 15, 2015.

⁵ Mahlum, Walsh Construction, and Coughlin Porter Lundeen. CLT feasibility study: A study of alternative construction methods in the Pacific Northwest. May 14, 2014.

substitute to high-rise construction that is prevalent in the City’s Central Core, the proposed Urban Center Civic Corridor Mixed Use zones along designated corridors should be adjusted to allow mid-rise construction.

The proposed Mixed Use zones are scheduled for public hearings with City Council late 2016 and ultimate adoption in 2018. The Commercial/Mixed Use 3 (CM3) zone is a large-scale zone intended for sites in high-capacity transit station areas, in town centers, along streetcar alignments, along civic corridors, and in locations close to the Central City. Additionally, the CX Central Commercial and EX Central Employment zones located outside the Central City Plan provide potential for CLT mid-rise construction, and their maximum height are under discussion.

The public amenity of high-quality environments fostered by CLT construction in conjunction with promoting an Oregon-bred industry provides the potential to be incorporated into the density bonus program. Additionally, the limited waste and renewable materials of CLT have sustainability benefits that have public benefit standards that should be incorporated into the FAR Bonus system as part of the Planned Unit Developments allowed in the mixed-use zones.

As proposed, the maximum zone height under a Planned Unit Development on site over 2 acres in size are below. This bonus should be adjusted to allow height bonuses for sites less than 2 acres in size, and the public amenity benefits of CLT could be a factor in considering allowing height bonuses for projects that utilize this construction method.

In order to be eligible for the PUD bonuses, a portion of the development will need to provide affordable housing. Eligible projects can earn up to 100 percent of bonus floor area when 25 percent of floor area in excess of base floor area allowance is housing affordable to households earning less than 80 percent of the area median family income. The soon to be newly implemented inclusionary zoning standards will have a significant impact on project feasibility across all construction types spectrums, and should be considered in conjunction with allowing additional mid-rise construction.

	CM2	CM3	CE
Base Height Limit (Stories)	45'	65'	45'
PUD Maximum Height Limit	75'	120'	75'
Maximum PUD FAR	4 to 1	5 to 1	4 to 1

The increased popularity of this product stems from a multitude of advantages, such as mass production, prefabrication, customization, rapid construction, and reduced environmental impacts. Additionally, the lighter materials compared to concrete and steel will be advantageous on construction sites located on poor soil quality and lead to dramatic construction cost savings.

CLT has the potential to provide a transformative mid-rise construction type to the Portland market. The burgeoning Oregon market combined with the visual amenity enhancements compared to standard light wood or concrete building materials provide a potential political base to allow increased mid-rise heights along designated corridors and centers outside the downtown core. Portland should study during the Zoning Code updates the possibility of increased 75–120 feet development heights along corridors and locations not suitable to high-rise construction in order to promote this type of development. ■