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Affordable Housing and Mass Timber: Where do Opportunities Lie for Oregon?

Report on Round Table Discussions, March 1st 2017

On March 1, 2017 at the University of Oregon's White Stag Block in Portland, Oregon, the TallWood Design Institute hosted a roundtable discussion on mass timber and its potential contributions to addressing the pressing need for affordable housing in Oregon and beyond. Participants represented the design, development and construction industries, along with academics:

Mike Andrews, Structure Development Advisors, LLC
Michael Fifield, Department of Architecture, University of Oregon
Isaac Johnson, Ankrom Moisan Architects, Inc.
Eric McDonnell, KPFF Consulting Engineers
Thomas Robinson, Lever Architecture
Dan Snow, Walsh Construction Co.
Moderator: Judith Sheine, Department of Architecture, University of Oregon

Introduction

While mass timber is used widely in Europe for housing projects ranging from single-family to multi-story, its use in North America is in the very early stages. Framework, a 12-story mixed-use project in Portland combining ground floor retail with office space and workforce housing, currently nearing its construction start date, will be a demonstration project. Framework, which won the USDA Tall Wood Building competition, will be the first tall mass timber building in the U.S. to include workforce housing. The team responsible for the project, which includes Andrews, McDonnell, Robinson and Snow, are pioneering a building that utilizes CLT and glulam construction and new lateral force-resisting systems. As the current building code does not allow for this type of construction, they have partnered with the TallWood Design Institute for some of the performance testing, which is needed to show that the systems meet the intent of the code to allow permitting. TDI is also partnering with the Oregon Building Codes Division so that the performance testing can be used for future buildings of this type. Their experience provides lessons for future affordable housing developments.

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In affordable housing, financial issues are key. There was general agreement among the panel that the least expensive way to build affordable housing in the U.S. currently is "stick" or light wood frame construction. The codes currently allow for this type of construction for up to five stories of wood frame over a one-story concrete podium. So, where is the market for mass timber in affordable housing and how can it be developed?

Building Codes

While current building codes incorporate some heavy timber systems, they do not provide for the use of CLT and other mass timber products in buildings over five stories (or six stories with a concrete base). Such buildings require specific third-party performance testing to demonstrate that proposed gravity and seismic force resisting systems meet the intent of the code and that floor and wall assemblies using mass timber can meet fire safety ratings. As noted above, this performance testing is nearly completed for the Framework project. Once it is done and made public, other projects will be able to use the results to support and justify their own building designs. This will allow mass timber housing in buildings six stories and above to be more competitive with concrete and steel framed construction. Additional demonstration projects will allow more testing and more mass timber building systems to be readily accepted by code officials.

But while we note the limitations of the building code, these regulations are constantly evolving and in some cases, will or already do favor mass timber. On sites with height restrictions, where CLT can replace framing systems for floors, this can substantially reduce the height of each floor construction and allow for additional floors to be built in the same envelope, which can maximize development potential and create more affordability. Similarly, when a site has poor soils, mass timber can allow a larger building volume than concrete and steel, which is substantially heavier.

Additionally, building codes are changing to recognize the need for resiliency, for buildings to protect life safety during seismic events and to be quickly made ready for rehabitation after a natural disaster. The new "rocking wall" seismic force resisting system, developed in New Zealand and being utilized for the first time in the U.S. in Framework and in Oregon State University's new Peavy Hall[1], will allow mass timber construction to both protect inhabitants during a seismic event and to allow the majority of the structural components to remain intact for continued use

Along with the evolving energy codes that are requiring buildings to become net-zero in the near future in places like California[2], codes are beginning to recognize the importance

[1] https://www.youtube.com/watch?v=dZWL8fscDYo
[2] http://www.californiaznehomes.com/framework

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of embodied energy in building material and processes[3]. Mass timber sequesters carbon and can be built with clean fabrication processes that minimize waste. Life cycle analyses clearly favor mass timber over concrete and steel.

Integrated Design and Construction Methods

Along with overcoming code barriers, increasing the volume of production and taking advantage of prefabrication techniques will likely lead to more competitive pricing for mass timber construction in the near future. Building Information Modeling, which allows architecture and engineering design teams to create a 3D model with embedded information, is already the industry norm. These models allow direct translation to CNC fabrication, which can create highly precise mass timber panels, posts and beams that can be quickly and cleanly assembled in the field. This can provide considerable cost savings in labor on site and minimizes material waste. Prefabrication can also reduce noise and pollution on construction sites, minimizing truck traffic and providing a quieter construction process than those for concrete and steel.

In order to maximize the prefabrication advantages of mass timber, production models in Europe and Canada are increasingly making use of integrated teams, where a product manufacturer is also a fabricator, does the engineering and installs the materials, or a construction company handles the engineering, fabrication and installation. Design professionals, with the use of BIM, have been moving in this direction for some years, with architects, engineers, fabricators and contractors working together from the early stages of design of projects. Increasing the number of teams with this experience in mass timber will be a key to making it more affordable.

Mass production of mass timber would make a significant difference in affordability. In the same way that IKEA has made modern furniture available to the public at low cost, mass timber could be made into a kit of parts that could even be cost competitive with stick built housing from single-family to low-rise multi-family. KLH produced 400,000 sq. ft. of refugee housing in a very short time, although that takes a large investment of capital to get to the point of efficiency. These kinds of kit-of-parts prefabricated projects can work particularly well when there is a need for quick construction, or in a remote location with a short building season and/or limited on-site labor.

Future Developments

More demonstration projects, greater integration within design and production teams, more mass timber design-and-build experience, a greater number of mass timber

[3] http://www.greenbuildingadvisor.com/blogs/dept/musings/all-about-embodied-energy

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manufacturers and more standard systems and connections will all help the evolution and affordability of the mass timber market.

Currently, there is promise in hybrid systems, such as the 18 story Brock Commons dormitory on the University of British Columbia campus, that combines CLT decking and glulam columns with steel connectors, a concrete core and podium, and prefabricated façade panels[4]. Other examples in Canada that combine CLT decking and prefabricated stick frame walls are the 6-story Virtuoso condominium in Vancouver[5] and a 70-room, six-story addition to the Penticton Lakeside Resort[6] in the picturesque Okanagan Valley. The Brock Commons project is coming in at the same cost as a concurrent concrete dormitory building at UBC, but is going up about 4 ½ months faster over an 18-20 month timeline, which is impressive. The timeline makes more of a difference when interest rates are high and prefabrication has advantages when on site labor costs are high, as in prevailing wage projects.

Clients are critical to promoting mass timber construction. Both the USDA and the Canadian government have sponsored mass timber building competitions to create demonstration projects to help jumpstart the industry in North America[7]. Civic organizations, interested in the economic development potentials in their regions, are also playing a part. The city of Springfield, Oregon has commissioned a mass timber parking structure as their contribution to the new Glenwood Development, a private/public partnership, and partnered with the University of Oregon Architecture Department to test its design feasibility[8]. Similarly, Lane County is partnering with UO Architecture on the design of their new Lane County Courthouse as a mass timber demonstration project. They see that the creation of this civic building as a sustainable project, showcasing the aesthetic as well as environmental advantages of advanced wood, can help both with public and legislative support of the project and aid in promoting new manufacturing of mass timber products in the county.

Client and political support is critical in these new developments. Framework's client, Beneficial State Bank, was driven by a mission that favored social good to build workforce housing using sustainable wood products. Government officials can advocate for the use of mass timber in civic and other demonstration projects, including affordable housing; the more that are built, the more affordable they will be. Affordability can also be enhanced

[4] http://www.naturallywood.com/emerging-trends/tall-wood/ubc-brock-commons
[5] http://adera.com/five-of-b-c-s-greenest-homes/
[6] http://www.bclocalnews.com/news/365709561.html
[7] https://www.usda.gov/media/press-releases/2015/09/17/us-tall-wood-building-prize-competition-winners-revealed
[8] https://architecture.uoregon.edu/news/mass-timber-design-wins-regional-award

with density bonuses for the incorporation of mass timber in developments. The U.S. military has already done blast testing of CLT walls and there could be a market for blast-resistant, resilient, quickly deployable and reusable construction for military and humanitarian uses if mass production systems, as noted above, can be developed.

In Oregon, D.R. Johnson pioneered the production of structural CLT panels in the United States. There is much more opportunity in the state for both production of new mass timber products, such as the new plywood mass timber panel that Freres Lumber is preparing to produce, and for affordable, sustainable mass timber construction. At the roundtable discussion, Valerie Johnson, of D.R. Johnson, noted that if there is opportunity then the private sector will jump in. Building codes may be slowing development, but testing and research is overcoming that. It is an organic development and there is no magic pill, but if there are clients willing to spend the energy to get this done then things could move ahead quickly.

The TallWood Design Institute is committed to helping this effort with applied research, performance testing, product development support, work on demonstration projects, education and training for students, professionals and the general public, and working with government officials to enable the potential of mass timber to create sustainable economic growth through sustainable building construction. The financial costs of peer review of project plans and testing, which often act as barriers to green-lighting of new projects, can currently be supported through the Institute. For more information please contact:

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