Virginia Wood Products Update
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Is the Cross-laminated timber (CLT) market an option for the hardwood industry?

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Cross laminated timber (CLT) has been in the market since 2000 when it was launched in Austria by a company called KHL. A CLT panel is usually composed of 3, 5, or 7 layers of lumber. Each layer is glued perpendicularly to each other. Today almost 100% of the CLT panels being produced are made from softwood species and it is estimated that the current CLT production in Europe is around 1 million cubic meters.

In the United States, production of CLT started about 5 years ago. There are currently three companies producing CLT panels in the USA: DR Johnson (OR), Smartlam (MT) and Sterling (IL). DR Johnson uses Douglas Fir (DF) as the main raw material while Smartlam uses Spruce-Pine-Fir (SPF) and Sterling uses Southern Yellow Pine (SYP). It has been announced that over the next two years the following 4 CLT production facilities will start production: Katerra in Washington, a second plant by Smartlam in Maine, LignaCLT Maine, and International Beams in Alabama. All of the upcoming facilities will be using softwoods as raw material.

The CLT standard, ANSI/APA PRG-320, does not admit hardwood lumber yet; a major hurdle for hardwood lumber to become an accepted CLT raw material. The current and planned CLT plants must be certified in the PRG-320 standard unless they produced non-structural elements such as the case of Sterling that manufactures CLT crane matts. Any softwood species as described in the ALCS under PS 20 with specific gravity higher than 0.35 should be an acceptable raw material for CLT, according to ANSI/APA PRG-320. In most of the cases, hardwood species have higher specific gravity than softwood, so this should not be a problem.

In addition, lumber for CLT should be dried to a moisture content (MC) of 12%+-3%. This is also not an issue for hardwood lumber as most of it is dried to 8% MC.

A key requirement for lumber going into CLT is that the minimum thickness in the PRG-320 is 5/8. As we know, most of hardwood lumber is produced in 4/4 thickness. In addition, the board width should exceed its thickness by 1.5 times (in the major strength direction of the CLT panel) and by 3.5 times in minor strength direction of the panel. Currently, most hardwood mills produce random widths that definitely need to be sorted out to comply with this requirement.

Glue-line performance should be considered too. Hardwood lumber has a more complicated cellular structure than softwood lumber that could present challenges with adhesion. For example, some hardwoods are stiffer than softwoods and this might require additional pressure or pressing time. Also, chemicals in the hardwood lumber could also prevent an acceptable glue-line interface between the laminations.

Hardwoods have a different structure than softwoods that could require different tooling and energy requirements. For example, some hardwoods present crystals and other hard structures that could wear tools faster than softwood lumber. These issues ultimately will impact cost and productivity of the planer, finger joint, and computer numerical control (CNC) equipment of the CLT production line.

There is also the question about the supply of hardwood lumber for CLT. A medium size CLT plant could process about 50,000 cubic meters per year which translate to roughly 21 million board feet. It is estimated that CLT demand in the US would be very similar to Europe or around 1 million cubic meters (424 million bf). The current structure of hardwood industry is fragmented so it would be very difficult for a major CLT plant to establish a steady and consistent supply of hardwood lumber under these market conditions.

Hardwood sawmills that wish to become suppliers of a CLT panel plant might need to adjust their production mix. For example, Virginia Tech researchers recently conducted a mill study where 6/8 Yellow Poplar lumber that was initially graded as 2 Common and lower was also graded as #2 and #3 using structural rule grades. An economic analysis indicated that a mill using this production mix strategy could get similar or higher revenue if 2 Common and lower grade YP lumber was sold as structural lumber for CLT panels. Ultimately, hardwood sawmills would need to train their personnel to learn how to grade hardwood lumber under structural grading rules.

Other issue that should be considered for hardwood CLT panels is the weight of panels. It has been estimated that for some hardwood species, a hardwood CLT panels could weigh up to 30% more than a softwood CLT panel. In terms of logistics and transportation arrangements, this could increase the overall cost and time of the project as additional trips are required to move the completed hardwood CLT panels to the construction site.

Finally, there is also the question of sustainability. The US Forest Service has indicated that the growth of hardwood forest doubles its harvesting rates. However, it should be considered that growing hardwoods might take twice the time of growing softwood timber. In addition, softwood timber is usually grown in plantations where productivity metrics could he higher than the natural forest.

As we just pointed out, it seems that there are opportunities for hardwood lumber to participate in the CLT market. However, there are some critical hurdles that need to be resolved before this could happen. At Virginia Tech and other universities, we continue to generate research in technical, manufacturing, and marketing aspects of the potential use of hardwood lumber in the CLT market. If you have questions, please let us know at your earliest convenience.