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Specific Gravity of Wood

-Scott Lyon, Forest Products Services Specialist

A commonly misunderstood term in the woodworking industry is "specific gravity." In many respects, specific gravity is an indicator of wood density, but it varies depending on the wood's moisture content. Therefore, specific gravity is often expressed in oven-dry (0% moisture content) terms so that relative comparisons can be drawn among wood species. The specific gravity of wood influences mechanical, machining, thermal, electrical, and dimensional properties. In addition, wood species with a higher specific gravity may shrink and swell more as the moisture content changes. Also, the strength and stiffness of wood is influenced by specific gravity. If producing wood composite products, a low specific gravity wood species is typically preferred (Bowyer et al. 2003).

Many factors contribute to variations in specific gravity within a wood species. Extractives located in and around wood cells, such as resins and gums, can cause a variation in specific gravity. Since these extractives are found within the heartwood, a variation is usually observed between sapwood and heartwood. In addition, the location of the wood sample within a tree (i.e., juvenile or reaction wood), location within the geographic range of the tree species, site conditions where the tree grew, and tree genetics can cause the specific gravity to vary.

There is no commonly accepted technique to calculate the specific gravity of wood. However, some may use specific gravity as the ratio of the oven-dry weight of wood to the mass of water displaced by the wood sample at a given moisture content. In the U.S., volume is typically measured at the green, oven-dry, or 12% moisture content stages. US Forest Services Forest Products Lab's Wood Handbook is a great tool to use to help you determine the specific gravity of different species.

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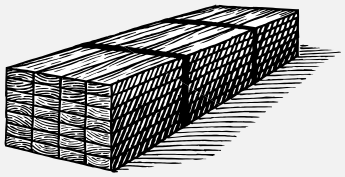


See page 6 for the latest Wisconsin forest economic data

Industry Headlines

Boxboard production is on the rise

The March 2016 U.S. Paperboard report provided by the American Forest and Paper Association states that boxboard production increased 6.6% from February and overall 1.8% from March 2015.

New website dedicated to Eastern White Pine

Easternwhitepine.org, which is sponsored by the Northeastern Lumber Manufacturers Association (NELMA), is a new resource providing ideas on products, technology, and markets for Eastern white pine. In addition, the website released a new video comparing Eastern white pine versus PVC trim.

March housing report

The US Census Bureau and Dept. of Housing and Urban Development released March's new home sales. Based on that housing market report, March 2016 new home sales increased 5.4% (±16.0%) over March 2015. Overall, March 2016 dropped 1.5% (±15.0%) from February 2016.

New LEED pathway to recognize forest certification systems

The US Green Building Council released a new alternative compliance path credit to help recognize legal and responsible wood and paper products from well-managed forests. These products can come from certified programs that include Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), Canadian Standards Association (CSA), and Programme for the Endorsement of Forest Certification (PEFC). Click here for detailed information.

April USFS Forest Products Marketing Unit Update

The Forest Service, Forest Products Marking Unit (FPMU) was established to help ensure healthy, sustainable forests that are more resilient to disturbances by creating high-value, high-volume wood markets .The program recently released its April newsletter that highlights the 2016 Mass Timber Conference and provides an update on the latest CLT projects in the US.

2015 Mass Timber Research Workshop Proceedings

This report summarizes the proceedings that evolved from the Mass Timber Research Workshop, which was held at the USDA Forest Products Laboratory (FPL), November 3-4, 2015. The purpose of the workshop was to bring design professionals, researchers, and industry leaders together to examine the state-of-the-art in mass timber construction, with an emphasis on cross-laminated timber, and to identify technical barriers to the broader use of wood in engineered structures that need to be addressed. Click here for more information.

Wisconsin space heating – Cost and fuels

How does the use of wood energy in Wisconsin compare with other fuels for space heating? County-level information on space heating costs and fuel types across the state have been provided in tabular and visual formats. These resources are available here on the Wisconsin Statewide Wood Energy Team website.

Vietnam Wood Products Market and Trade Mission

-Sabina Dhungana, Forest Products Services Specialist

In cooperation with the Department of Agriculture Trade and Consumer Protection (DATCP) the Wisconsin Department of Natural Resources (WDNR) Forestry Division, Forest Products Services Program participated in an international business trade mission to Vietnam from October 11, 2015 to October 21, 2015. The purpose of the mission was to provide Wisconsin forest products companies the opportunity to see Vietnamese wood market segments and to develop possible business contacts for expanded export opportunities.

Why Vietnam?

Vietnam's rapidly increasing population (93 million, 2015), growing household income, growing domestic use of US hardwoods, and booming furniture export markets are the main reasons why Vietnam was selected for the wood products business expansion trade mission in 2015. With improving Vietnamese living standards and increasing annual disposable income per household, targeting Vietnamese wood products markets may help diversify market outlets for Wisconsin's wood products. Vietnam's booming wood furniture exports grew from $2 billion in 2006 to more than $6 billion in 2015 as indicated in Figure 1. Vietnam relies heavily on wood imports to meet the demand of their growing furniture sector.

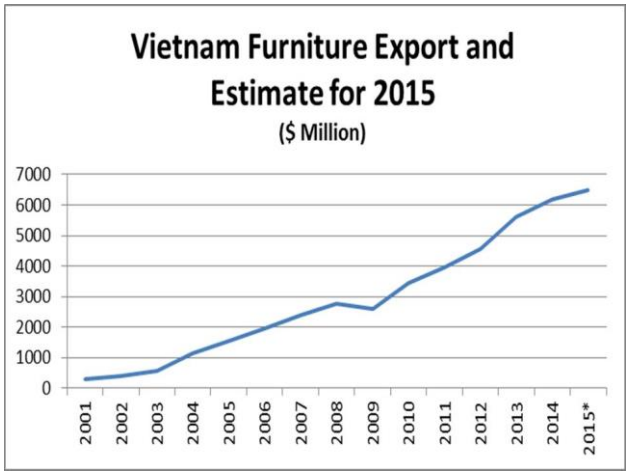
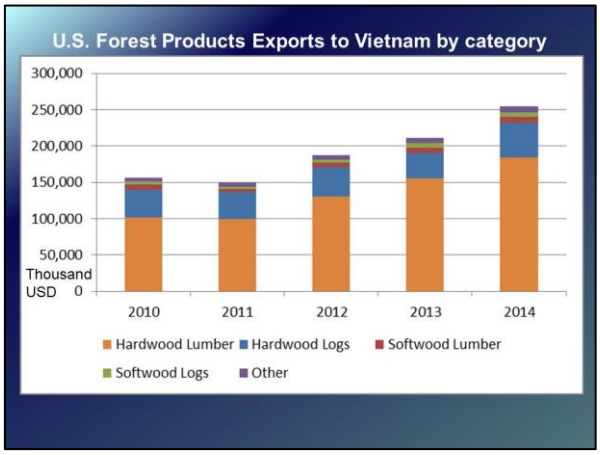


Figure 1: Trend in furniture exports shipped from Vietnam (Source: USDA FAS Vietnam, Hanoi Office)

Forest product imports have grown from $161 million in 2001 to over $2.2 billion in 2014. The USA remains the top supplier of solid wood to Vietnam with a record of $255 million in 2014. Vietnam is the biggest market for US wood in South East Asia. Currently, 80% of the wood furniture industry's raw materials in Vietnam are imported. In 2010, Vietnam spent around $1.1 billion US dollars on imported timber and timber products which is approximately 32% of the country's export revenue. Demand for Wisconsin's wood products seems even stronger because of the demand for sustainably harvested wood products in international wood products markets. Top export destinations of Vietnamese furniture products are the USA, Europe, and China. Figure 2 shows US wood products export trends to Vietnam in different years (cont'd on page 4).



US Forest Products Exports to Vietnam
(Source: *USDA FAS Vietnam, Hanoi Office)*

Mission Participants at the VETWOOD show 2015

(cont'd from page 3)

Conclusion and Observation

Good demand for most Wisconsin wood species can be seen in Vietnam. Demand is strong for white oak and ash species. White oak is popular in European markets and ash is a popular species in Asian markets. Marketing opportunities exist for other wood species because most people we met during the mission were not aware of other valuable species from Wisconsin. Two kinds of market distribution channels exist for wood product supply for Wisconsin companies. One is to do direct business with wood manufacturing companies and the other is to do business with a wholesale lumber distributer who supplies lumber to the manufacturing companies. USDA Foreign Agricultural Service (FAS) staff and local wood industry professionals shared Vietnam import and export issues such as underdeveloped infrastructures, cumbersome import procedures, exchange rates and currency (difference between US and Vietnamese currency) as potential hardships. They also shared useful business tips which need to be considered before considering business in Vietnam; simple things such as wood measurement units (cubic meters in Vietnam), people's value for personal meetings and face-to-face interaction, and conducting due diligence of a customer or a company before doing business. Wood products transportation, as usual, is a challenge for Wisconsin companies to compete in the price-sensitive Vietnamese wood products market because of the physical proximity to sea ports. Species demand is primarily driven by the end market destination and consumer preference. Because of the price -sensitive market, Vietnamese prefer medium to low grade wood products materials.

The Basics of Cross-Laminated Timber (CLT)

-Sabina Dhungana & Collin Buntrock, Forest Products Services Specialists

Cross-Laminated Timber (CLT) is a prefabricated solid engineered wood product made of at least three orthogonally bonded layers of solid-sawn lumber or structural composite lumber, such as laminated veneer lumber (LVL), laminated strand lumber (LSL), or oriented strand lumber (OSL). Cross lamination provides dimensional stability, strength and rigidity, which makes it a viable alternative to concrete, masonry and steel in many applications. It can be used in construction of an entire building, as a lateral and vertical load resisting system, or for select elements such as the roof, floors or walls. To expand on the aesthetic appeal, the interior wall and floor panels can be left uncovered or fitted with appearance-grade hardwood lumber. The panels are used as prefabricated building components which can speed up construction practices or allow for off-site construction. The product was first developed in the early 1990s in Austria and Germany. Recently it has been gaining popularity in residential and non-residential applications, both in North America and Europe.

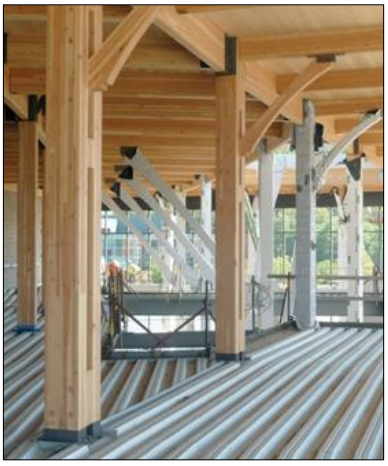


Figure 3: The first large-scale commercial installation of Cross Laminated Timber (CLT) in the United States (using CLT manufactured in North America) was done right in Madison, Wisconsin, for Promega Corporation. Promega used an innovative mix of Cross Laminated Timber and Glulam for their new facility. *Photo Curtesy of Architect: Uihlein/Wilson Architects, Inc.*

Manufacturing

CLT panels are manufactured with three or more layers of dimension lumber where the layers are oriented in a 90 degree cross pattern. The process of manufacturing CLT includes: lumber selection, lumber grouping and planing, adhesive application, panel lay-up and pressing, product (cont'd on page 5)

(cont'd from page 4) cutting, surface machining, and marking and packaging. Lumber used in CLT manufacturing is kiln dried to a moisture content of 12% ± 3%. Trimming and finger jointing are used to obtain the desired lengths and quality of lumber. In North America adhesives used must meet the same requirements as those used in glued laminated timber and include qualified polyurethane, melamine and phenolic-based adhesives. Once the adhesive is applied, the assembly is pressed using hydraulic or vacuum presses and compressed air depending on panel thickness and adhesive used. The assembled panels are usually planed or sanded at the end of the process. Panels are then cut to size while any openings (e.g. windows, doors, service channels, connections, and ducts) are made using CNC routers. There are currently two CLT manufacturers in the US: DR Johnson Lumber Co. in Oregon and SMARTLAM, LLC in Montana.

Figure 4: Cross Laminated Timber *Photo Courtesy of FPInnovations*

Benefits of CLT in Construction

- **Speed and Efficiency of Installation.** CLT panels are manufactured for specific applications. They are prefabricated, complete with pre-cut openings for doors, windows, stairs, service channels and ducts, and shipped directly from the manufacturer to the job site, where they can be quickly and efficiently lifted into place. This can save labor costs and time to finish the constriction project.
- **Design Flexibility.** CLT can be used for an entire building or any combination of wall, floor/ceiling and roof applications. Its light weight and other characteristics make it highly adaptable to different types of projects, designs and site conditions.
- **Cost Competitiveness.** Light wood-frame construction is still the most economical wood system for low-rise projects. However, CLT is competitive when compared to other materials in a variety of building types particularly in large, regularly shaped structures and in situations where fabrication is repetitive.
- **Fire Protection.** CLT's thick cross-section provides valuable fire resistance characteristics.
- **Seismic Performance.** Researchers have conducted extensive seismic testing on CLT and found panels to perform well with no residual deformation, particularly in multi-story applications.
- **Thermal Performance and Energy Efficiency:** Because the CLT panels are solid, there is little potential for airflow through the structure. As a result, an extremely tight building envelope can be achieved.
- **Environmental Performance:** Manufactured using wood from sustainably managed forests, CLT is a sustainable choice of building material.

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From the Field

Kenosha County Mechanized Logging Project

Sustainable Resources Institute, Kenosha County Parks Department, WDNR Division of Forestry, the USDA Forest Services' Forest Products Marketing Unit, and Wisconsin Urban Wood hosted a symposium on urban wood utilization at the Somers Town Hall in Kenosha County, WI on January 21, 2016. With the increased number of trees killed by invasive insects and disease, municipalities are trying to find the most economical way to remove trees, while also encouraging alternative uses for urban wood materials rather than disposal of them in a landfill.

This symposium provided the fifty-eight attendees the opportunity to learn about current urban wood utilization efforts, urban tree removal options, markets for urban wood, and to participate in a panel discussion on the Kenosha County Parks Tree Removal Project. In the afternoon, attendees visited four stations: mechanized tree felling, county on-site logistics, tour of sites where removal occurred, and wood product sorts and uses. This type of equipment has been used to remove large amounts of trees in several Wisconsin communities.

Mechanized removal is one of the safest and most efficient tree removal methods and offers a low cost option to remove a large number of urban trees under the right circumstances while also producing the volumes of wood needed to effectively market urban wood. A total of 4040 trees were removed. The project produced 166 MBF of saw logs, 320 cds of bolts, and 700 cds of pulpwood/firewood.

Wisconsin's Forest Economy at a Glance

Category	Employment	Output	Value-Added
Forestry and Logging	5,957 jobs	$435 million	$206 million
Pulp and Paper	31,372 jobs	$19.2 billion	$4.1 billion
Sawmills and Wood Products	27,568 jobs	$5.1 billion	$1.6 billion
Total	64,896 jobs	$24.7 billion	$5.9 billion

Output is the total value of the industry in the local economy. Value added is a measure of the industry's contribution to the local community; it includes wages, rents, interest, and profits. Direct impacts are jobs, revenue, and taxes for normal business operations. Indirect includes indirect and induced impacts. It refers to the dollars industry and households spend at other area businesses and the local jobs supported by the forest industry. *Data source: IMPLAN 2014*

Please contact DNR Forest Economist Julie Ballweg for further information

Team Updates

Statewide- *Sabina Dhungana*

I had a chance to participate in an industry roundtable meeting organized by Mary Ann Buenzow (Southern District Forestry Leader, Division of Forestry). Representatives from industry in the area, southern district DNR forestry staff, and forest products services specialists were invited to the meeting where participants shared their concerns about timber harvest restrictions, and logger shortage. I also attended Department of Transportation's freight advisory council meeting and shared issues and concerns related to transportation in the forest industries. The Forest Products Services Program is also coordinating inter-agency partnership meetings to discuss how different state agencies can work together in helping existing forest industry to sustain, expand, and grow their businesses. We are also working to attract new forestry businesses in the state. Not surprisingly, transportation and rail roads are important industry issues we are trying to assist with. I have been receiving requests for information and assistance on different wood utilization topics and primary and secondary company's contacts. I continue to provide responses to those requests.

Southeast District-*Scott Lyon*

Here in the Southeast, we are looking forward to summer after a winter that didn't seem to want to let spring come in. Recently, I have been working with a few organizations to increase production efficiency and quality of products they manufacture. Some of the inquiries related to quality included proper practices for air and kiln drying. Some helpful information I have passed along to these individuals is the US Forest Service's publication on Air Drying of Lumber, available online. I have fielded other requests for locating primary producers and utilization options for disease-killed trees. If you are having trouble finding a market or looking to acquire a particular species, please don't hesitate to contact us and we may be able to find you a supplier for your specific needs.

Northern District -*Collin Buntrock*

Our program has been busy assisting companies and partner groups with specific needs. At the end of March, I provided assistance in organizing a roundtable discussion among members of the forestry community in northwest Wisconsin. Industry representatives, county forest administrators, and Division of Forestry leadership were invited to the meeting. In addition, I assisted the Great Lakes Kiln Drying Association (GLKDA) with hosting a meeting and technical seminar for kiln operators and sawmill representatives this spring. The meeting featured an open forum to discuss dry kiln and boiler systems as well as special seminars on boiler maintenance and Cross-Laminated Timber construction in the US. Our program would be happy to assist your company with any specific forest product utilization and marketing concerns that you may have. Wishing you a safe and productive summer.

Event Calendar:

2016 GLKDA Kiln Drying Short Course

When: August 8th- 11th, 2016

Where: Northcentral Technical College- Antigo Campus
312 Forrest Avenue, Antigo, WI 54409

Cost: TBD

Registration: Coming soon on the website http://glkda.org/Courses.html

Heating the Midwest 2016 Conference and Expo

When: October 11th- 13th, 2016

Where: Island Resort & Casino
W 399 US-2, Harris, MI 49845

Cost: Pre-Conference Biomass Facilities Tour: $50 (limited availability)
Conference and Expo: $220 ($270 after Sept. 9, 2016)
Co-Host Registration: $220 for members of co-host organizations
Conference and Expo Student Rate: $75

Registration: http://heatingthemidwest.org/conferences/2016-conference-expo/attendee-registration-info-and-rates/

Wisconsin Local-Use Dimension Lumber Grading Short Course

When: August 22nd, 2016

Where: DNR Service Center in Rhinelander
107 Sutliff Ave Rhinelander, WI

Cost: FREE

Registration: Send an email with your full name, mailing address, and phone number to Tammy.Sykes@wisconsin.gov. Questions about the course can be directed to Collin Buntrock at Collin.Buntrock@wisconsin.gov. More information about the course can be found by clicking here.

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*During our vacancy please contact the Statewide Forest Products Specialist for assistance.

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