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Proceedings

Structural and Engineered Hardwood Materials and Applications Workshop

November 7, 2023

Madison, Wisconsin, USA



Abstract

Significant research has been conducted on the development and use of hardwood resources in engineered wood materials and products. This research focused on utilizing undervalued hardwoods for applications that take advantage of their excellent strength properties. Some of the results from this research have been implemented by industry, and additional research has been initiated and is on-going. To bring together industry leaders and scientists, Mississippi State University and the USDA Forest Service, Forest Products Laboratory, led a workshop on this topic in 2023. The objectives of the workshop were to (1) review recent research conducted on the development and use of engineered hardwood materials and products; (2) engage industry leaders to help guide our research programs, and (3) prepare a corresponding research needs assessment. This report summarizes the proceedings from that workshop. It includes the following: a summary of key findings, abstracts and/or copies of presentations made, a list of participating organizations and attendees, and the agenda for the workshop. It also includes several noteworthy industry publications on this important topic.

Keywords: wood, hardwoods, engineered wood materials

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Proceedings

Structural and Engineered Hardwood Materials and Applications Workshop

November 7, 2023, Madison, Wisconsin, USA

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Introduction

The hardwood industry is a key component of the forest products industry in several regions of the United States. High-grade lumber from hardwood species is very valuable, but finding higher value products for lower grade materials is a continual challenge faced by the industry.

Engineered wood products represent one of the fastest growing segments of the forest products industry. Most engineered wood products are manufactured from softwood species, such as Douglas-fir, the southern pines, or various softwood species mixes. Over the past several decades, significant research and development efforts have been devoted to the use of lower grade hardwood resources in engineered materials and components. The results of these efforts are summarized in Ross and Erickson (2005, 2020).

Some of the results have been implemented by industry, and hardwood markets have changed significantly since much of the research was completed. For example, the overall market for hardwood grade lumber today is approximately half of what it was 20 years ago. Consequently, we believed it would be beneficial for the research community to engage with the hardwood industry to assess what research has been utilized and ascertain what areas need further work.

Mississippi State University (MSU) and USDA Forest Service, Forest Product Laboratory (FPL), convened a workshop on the topic of structural and engineered hardwood materials and applications on November 7, 2023, at FPL. The objectives of the workshop were to (1) review research conducted on the development and use of engineered hardwood materials and products and (2) engage industry leaders to help guide our research programs.

This report is a summary of the workshop. It contains (1) a summary of key findings, (2) abstracts and/or copies of

presentations, (3) a list of participating organizations and attendees, and (4) the agenda for the workshop.

Importance of the Hardwood Industry, Recent Trends, and Direction

The *Hardwood Industry Economic Impact Study* published by the Hardwood Federation shows that the hardwood industry employs nearly 21 million people and contributes \$394 billion to the U.S. economy. The economic “ripple effects” of these hardwood products supports \$348.1 billion in economic output, \$156.9 billion in gross domestic product, and 1,834,670 jobs to the national economy.

The hardwood lumber industry produced about 6.5 billion board feet of grade lumber (flooring, millwork, cabinets, and furniture) in 1999. In 2022, under 2.0 billion board feet of hardwood grade lumber was produced.

The use of hardwood timber has had a long, significant impact on the history of the United States. It was a material of choice for many applications that today would be classified as structural. In 1843, Samuel Morse used chestnut to support his first telegraph lines. Originally built with white oak in 1860, the Bank Rock Bridge is a pedestrian bridge in Central Park, New York city, built from hardwoods. The most notable structural application of hardwoods is “Old Ironsides”—hard, heavy, straight-grained, and decay-resistant white oak contributed much to construction of the USS Constitution.

The increasing recognition of wood as a sustainable building material is driving a notable shift in the wood products industry. Efforts are intensifying to incorporate wood into residential and commercial structures, driven by a heightened awareness of the environmental advantages of wood over steel and concrete. This transition is marked by a

growing focus on engineered wood products, such as glued- and cross-laminated timber (glulam and CLT), laminated veneer lumber (LVL), and engineered trusses.

Opportunities for thermally modified hardwood materials are ongoing and growing. Its increased durability and low environmental impact make thermally modified hardwood a desirable product. Challenges related to reduction in some mechanical properties and ease of bonding to other materials present areas for research.

Two current trends are noteworthy: (1) There is a significant shift toward the use of optical scanning technologies to assist in the grading of lumber. (2) There is an increasing awareness of the positive environmental impact of using forest-based materials—forestry never looked so cool! However, the hardwood industry has some catching up to do in this area. The softwood industry has proactively promoting the environmental benefits of wood use, conducted the necessary background research, and secured the appropriate documentation for many softwood products.

Engineered Wood Materials

Although hardwoods are traditionally chosen for applications where appearance is crucial, many hardwood species exhibit wood properties comparable to or superior to softwood species currently prevalent in the industry. As summarized in *Wood Handbook* (FPL 2021), clear wood from hardwood species exhibits excellent mechanical properties. Ross and Erickson (2020) demonstrated that undervalued lumber and veneer from hardwood species can be used in common structural components that have performance characteristics similar to those produced from softwood species.

The utilization of hardwood lumber in engineered applications necessitates the adoption of appropriate lumber grading technologies. The Northeast Lumber Manufacturers Association (NeLMA) publishes design values for hardwood lumber. These design values are reliable but conservative. NeLMA provides grades for seven hardwood specie groupings—white oak, red oak, mixed oak, northern red oak, red maple, mixed maple, and beech/birch/hickory. Design values for additional hardwood species, such as alder, sweetgum, sycamore, honey locust, and yellow poplar, must be developed. The extent to which National Hardwood Lumber Association (NHLA, clear cutting basis) and NeLMA structural grades are related with respect to structural properties must be determined.

Research indicates that visual grading of hardwoods for structural purposes is ineffective in capturing their structural performance characteristics. Machine stress rating (MSR) is a common grading method for softwood structural lumber, involving a nondestructive stiffness measurement, visual evaluation, and quality assurance testing. The inaugural use of MSR for grading structural hardwood lumber occurred in 1993 at Spencer, West Virginia, with collaboration from USDA Forest Service, NeLMA, Southern Pine Inspection

Bureau (SPIB), and Burke–Parsons–Bowlby Corp. (Green and others 1994). Employing a mixed oak sample, results revealed a significant shift—only 1% qualified as Select Structural based on visual criteria, whereas 36% achieved an MSR grade with properties equal to or surpassing Select Structural grade. Subsequent university research, including studies by West Virginia University Appalachian Hardwood Center (AHC), affirms MSR value addition. Recent AHC studies indicate that visually grading lower grade mill run hardwood lumber yielded less than half the acceptable structural grades for CLT panel manufacturing; however, employing MSR-type grading on the same boards resulted in over 95% surpassing the ANSI/APA PRG 320-defined minimum MOE value of 1.2×10^6 lb/in².

Significant advancements in production equipment for MSR grading have emerged since the initial demonstration with hardwood lumber. Responding to global demand for in-mill grading equipment, innovations now enable handling random width lumber and operating at speeds aligned with hardwood lumber mills, and the equipment is commercially available at approximately \$200,000 installed cost.

Current Applications and Opportunities

Stair and Guard Systems

Wood based stair and guard systems are used throughout the United States, North America, and the world. Stair systems allow access to multilevel structures. Guard systems are design to prevent falls, particularly from elevated levels. Each has a long history of performance; in many cases, a system as served for centuries. Wood-based stair and guard systems are used in both interior (for transitioning between levels or stories of houses and buildings) and exterior (for access and egress from decks and for fall prevention). Stair and guard systems are subject to code-prescribed load and deflection criteria. Point, concentrated, and distributed loads are considered. Despite long and strong histories of practical in-service performance, there is a current and pressing need to develop engineering and design tools to accurately predict strength and deflection. Novel connection hardware and techniques, changes in code requirements, contemporary designs, rigorous inspection criteria, and other factors necessitate more sophisticated engineering design and analysis. These requirements apply to both factory and on-site built assemblies.

Hardwood Mass Timber

Research has been conducted on hardwood glulam and CLT. Efforts are ongoing to add yellow poplar to PRG 320, the design guide for CLT. There are hurdles related to utilizing ungraded material in glulam construction. For example, the use of visually graded 4/4 hardwood lumber may be a viable option for glulam. However various glulam production standards require structurally graded lamination material for glulam construction. ASTM 5456 seems to provide a legitimate alternative path to certification, based

on qualification and routine testing, but that standard is limited to laminations of 0.25 in. thickness or less.

Hardwood Timber Mats

Access matting is used throughout North America to facilitate rapid and safe infrastructure development and repair. Mats provide sound working platforms by spreading relatively large but concentrated loads (such as those from cranes, pipelayers, other equipment, and structures) over large areas, thereby reducing ground pressure. Mats can be made from a variety of materials, but timber and engineered wood composites are two of the most prominent materials of choice. A great variety of mats are designed and used for specific applications. For example, crane mats typically experience the heaviest loads and thus must be made from the thickest (often on the order of 12 in.), stiffest, and strongest material. Access mats that mainly facilitate low volume vehicular traffic are often thinner (3 to 6 in. deep). Pipeline mats usually fall between those values and if made with solid timbers are often 8 in. thick. With greater project oversight, particularly with federally funded infrastructure projects, heavier loads, more scrutiny with respect to environmental protection, and a desire for increased safety, the material properties of mats are increasingly important. Given the large volume of hardwood timber that goes into this industrial application, research related to material grading and mat performance is critical.

In support of more predictable mat performance, the North American Matting Association (NAMA) has developed a matting standard. This voluntary standard facilitates and allows interoperability of products from various producers. Essentially, the standard requires that producers document how they build their products, which species and grades they incorporate, and what quality control measures they employ to ensure product and performance uniformity over time. For structural mats, mechanical design properties are needed, and the NAMA matting standard has a provision for developing or assigning allowable properties. With documented and repeatable properties, engineers, specifiers, and lift planners can use analytical tools such as beam on elastic foundation and finite element modeling to check and verify mat strength, deflection, shear, and environmental impacts such as soil cutting, compaction, and rutting.

In support of this sector, in-grade allowable design properties from a greater number of hardwood species must be developed. There is a need for a timber mat structural design value guidance document that describes how one goes from basic small clear wood properties to full-scale, in-grade, timber design values. Preferably this would include testing of mats from structurally graded (Number 1 or 2 per NeLMA) timbers. There is also a need to develop mechanical condition assessments/nondestructive technologies for mats that have been in-service and may be damaged but still have residual service life.

Railroad Ties

The rail tie market requires a significant amount of material. According to the Rail Tie Association (RTA), the approximately 140,000 miles of railway track in the United States requires approximately 3,200 ties per mile. About 5% of this railway, about 7,000 miles, is operated by the Department of Defense. For maintenance, rebuilding, and new construction, the U.S. market requires approximately 20 million ties per year. Ties last from approximately 7 to 40 years. This variation results from several factors. Loading level, that is number, weight, and frequency of trains/cars influences tie longevity, is clearly important. Geographic region is influential because wood deteriorates more quickly in warmer and wetter climatic areas. Wood quality and species are important. Lower specific gravity and less refractory species may be able to absorb more wood preservatives, which boosts longevity. Higher specific gravity species perform better with respect to plate cutting and spike holding. Track curvature is also influential; in corners more weight is applied to the outer rail, thus wearing one end of the tie faster than the other. Given the increased needs of rail safety, and growing populations in urban areas, rail tie research is critically important.

Research needs include (1) development of new preservative treatments, of particular importance as creosote supplies come under pressure; (2) in-track, rapid nondestructive condition assessment methods; (3) grading technologies for ties during processing (an on-grade versus off-grade system); and (4) a nondestructive technology to differentiate oak/hickory from mixed hardwoods ties.

A significant body of data regarding production, consumption, supply, and economics has been gathered during the past 30 plus years. The RTA offers these data for analysis for potential development of better forecasting models.

Hardwood Utilization Research in Support of Department of Defense.

The Department of Defense (DoD) has a long-term interest in sustainable wood products. Engineers from the Construction Engineering Research Laboratory (CERL), part of the U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC), were in attendance. They specifically noted that the DoD would be a user, not a manufacturer or supplier, of wood products.

Ongoing research involves carbon-fiber-reinforced western hemlock CLT for contingency applications. A focal point of merit in this project is that it involves a partnership with a Native American tribe, which provides them with economic freedom in exchange for raw materials. Permanent military construction (MILCON) projects involving the need for standardization of criteria and specifications were also discussed. Additional DoD needs addressed were education and awareness, qualified labor, material selection and design tools, and strategic sourcing. Future hardwood applications

in MILCON include contingency construction, palletization, matting, railroad ties, and other engineering applications.

FPL has completed a series of tests to examine the blast resistance of CLT. Conducted at Tyndall Air Force Base, blast tests were conducted on structural systems constructed from three- and five-ply CLT panels. Follow-up tests are being conducted using reinforcing materials.

A significant success story is the recently completed research on the use of red maple lumber for pallets. The DoD will utilize a projected 1 to 3 thousand board feet of hardwood lumber over the next four years for pallets that are used for shipping small arms ammunition. Performance criteria for these pallets are well defined, stringent, and focused on engineering (mechanical) properties. Work completed at FPL has shown that red maple (excluding silver maple) lumber performs well in this application. Testing of pallets was conducted in conformance with MIL-STD-1660.

The use of hardwood lumber for decking and other structural applications encountered in the DoD is being investigated in a cooperative effort led by Michigan Technological University. To date, several undervalued hardwood species have been identified as excellent candidates for use in CLT and as replacements for tropical

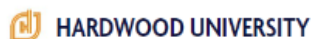
hardwoods currently used by the DoD. Ongoing work will focus on direct application of these results.

Funding Opportunities

The USDA Forest Service, through its Wood Innovations Program, provides funding opportunities for building wood utilization markets and expansion of forest products industry capacity. USDA recently announced the availability of nearly \$50 million to strengthen the forest products economy and create forest sector jobs as part of the Biden Administration's Investing in America agenda. Over \$23 million is devoted for grants in their Wood Products Infrastructure Assistance program, \$20 million for the Wood Innovations Program, and \$6 million in Community Wood Grants.

Noteworthy Publications

Reproduced on the following pages are four noteworthy articles (Shmulsky and others 2024, Brashaw 2023, Martin 2023, Brooks 2023) recently published in *Hardwood Matters*, the journal of the National Hardwood Lumber Association.



State and Federal Agencies Partner with Hardwood Lumber Industry for Research

By RUBIN SHMULSKY, PH.D., *Professor and Department Head, Mississippi State University*
BOB ROSS, PH.D., *USDA Forest Service, Forest Products Laboratory, Project Leader, Retired*
LAURICE SPINELLI, PH.D., *Post Doctoral Associate, Mississippi State University*

In response to a relatively flat market for graded lumber, there is much interest and activity toward developing structural markets for hardwoods. Significant research has been conducted recently on the development and use of hardwood resources in engineered materials and products, such as cross laminated timber (CLT), glued laminated timber, and laminated veneer products. To steer and coordinate future federal and state research priorities, the USDA Forest Products Laboratory and Mississippi State University co-hosted a structural hardwood needs assessment workshop in Madison, Wisconsin on November 7, 2023.

THE THREE MAIN OBJECTIVES OF THE WORKSHOP WERE:

- Create a forum for industry leadership to meet with state and federal researchers.
- Review recent research conducted on the development and use of lumber and engineered hardwood materials and products
- Develop a corresponding research needs assessment document to guide future research efforts.

Thirty-six individuals, including active scientists and research leaders, from the following organizations participated in this day-long event: USDA Forest Service Forest Products Laboratory (research); USDA Forest Service State, Private, and Tribal Forestry; U.S. Endowment for Forestry and Communities; National Hardwood Lumber Association; Timber Products Inspection Company; Railway Tie Association; North American Matting Association; Stairbuilders and Manufacturer's Association; Department of Defense Army Corps of Engineers, DEVCOM, and GVSC; Dearborn Companies; Anthony Hardwood Composites; and University researchers from Appalachian State University, Michigan Technical University, Mississippi State University, and West Virginia University

THE FOLLOWING INCLUDES THE DISCUSSION / RESEARCH TOPICS HIGHLIGHTED:

- Implementing and developing hardwood design values. There is a pressing need for developing allowable design values for additional species such as alder, honey locust, sweetgum, sycamore, and yellow poplar.
- Machine stress rating / nondestructive evaluation (NDE) of hardwoods for structural and engineered applications.



- Stair and guard system design/engineering software that can develop building code-compliant structures.
- Wood rail tie research needs include NDE of ties in track to identify maintenance / replacement needs, NDE of ties to assess on- versus off-grade, automated wood identification, and economics/supply.
- Hardwood timber mats. There is a need to develop and implement minimum standardization for grading and strength/stiffness evaluation.
- Hardwood mass timber. There is a current and pressing need for more species and grade layup performance.
- Increasing wood in Department of Defense applications. These include but are not limited to: permanent wood buildings and structures, modular housing, design for portability, domestic species for trailer, bridge, and container decking, alternative species for pallets and crating.
- Thermally modified wood for structural applications; retaining better performance.

Outcomes of meetings like this help guide future research priorities and expenditures at the state and federal levels. By coming together in forums like this we maximize the impacts of our research and minimize redundancy across research programs.

A larger and more broadly scoped follow up meeting hosted by NHLA is being scheduled for May 8-10, 2024.



Rubin Shmulsy, Ph.D.,
Professor and Department Head,
Mississippi State University



USFS: Supporting the Hardwood Industry with Research and Market Development



**FOREST PRODUCTS
LABORATORY**

By BRIAN BRASHAW, PHD

Assistant Director

*Forest Service, State, Private & Tribal Forestry
Cooperative Forestry
Wood Innovations*

The hardwood industry is important to me. My dad worked for a hardwood lumber company in Wisconsin when I was a kid, and I understood the critical connection between forestry and healthy forests. Trained as both a forester and wood products specialist, I joined the USDA Forest Service to continue supporting expanded wood product markets.

The Forest Service is actively engaged in hardwood product research through the Forest Products Laboratory, and this month's column will focus on the Wood Innovations program. Research and market development go hand-in-hand to supporting the wood products industry.

A healthy forest products industry is an indispensable tool for supporting the management of healthy forests, and robust markets for the full range of forest products are essential for having a healthy industry. Strong markets for forest products improve forest health and resilience and support key benefits that forests provide people, like clean water, clean air, wildlife habitat, and recreation opportunities. They also support jobs and rural economic development.

The Wood Innovations program focuses on building and expanding markets for wood products and renewable wood energy and building manufacturing capacity. Annually, we issue three grant programs to support these goals. The Wood Innovation, Community Wood, and Wood Products Infrastructure Assistance grant programs use funding from annual appropriations, the Bipartisan Infrastructure Law and the Inflation Reduction Act to support market development, fund the cost of installing thermally-led wood energy systems or innovative wood product manufacturing facilities, and support the ability to establish, reopen, retrofit, expand, or improve facilities to use materials removed from hazardous fuel treatments. You can find information on these programs and future funding opportunity announcements on our Wood Innovations | US Forest Service (usda.gov) website.

On June 26th, NHLA was awarded a \$500,000 matching grant from

the Forest Service Wood Innovations Program to support and expand markets for the United States hardwood industry. By strengthening and building new markets for products, our support will directly help improve the management and sustainability of hardwood forests. This investment builds on other Wood Innovations and Community Wood grants that were awarded to nine NHLA members to support their efforts to build markets, add innovative processing equipment and technology, and expand the use of wood energy. We were pleased to support Bingham & Son Lumber, BPM Lumber, Brownlee Lumber, Inc., Cumberland Cooperage, Dunaway Timber Company, Matson Lumber Company, Northwest Hardwoods, Inc., Northern Hardwoods Lumber, LLC, and Thompson Appalachian Hardwoods.

With the new NHLA partnership, we will work together to strengthen and recapture markets for decorative hardwood products but also work for new markets for lumber in thermally modified lumber and structural hardwoods, demonstrating the potential for use in industrial and structural cross-laminated timber (CLT). These commercial, institutional, and multi-family buildings are new market opportunities to use wood instead of other non-renewable materials like steel or concrete. We also invested in the first U.S. hardwood CLT plant and continue investing in education, engineering project assistance, and construction programs to support market expansion. New opportunities are also emerging for other innovations like wood energy, biochar, biofuels, and biochemicals.

My team and I look forward to working with NHLA to build a great future for hardwood markets.

*Brian Brashaw, Assistant Director,
Forest Service, State, Private & Tribal Forestry
Cooperative Forestry
Wood Innovations*



USFS: Supporting the Hardwood Industry with Research and Market Development



**FOREST PRODUCTS
LABORATORY**

By ANDY MARTIN, PHD, PE, FASCE,
Assistant Director, Wood Products Research

I had the pleasure of representing the USDA Forest Service at the National Hardwood Lumber Association's (NHLA's) Open House and 125th Anniversary Celebration in April of this year. As I walked onto the NHLA campus, planned years ago by NHLA leaders and members, in the middle of suburban Memphis, I was taken aback by the beauty of the surrounding grounds and the use of wood products. The USDA Forest Service has a long history of caring for our lands and serving people. Through the Forest Products Laboratory and the Cooperative Forestry Wood Innovations program, our Agency has worked to support the hardwood industry with research and market development. This month's column will focus on the Forest Products Laboratory, and next month's column will focus on the market efforts in the Wood Innovations program.

The Forest Service has embarked on a critical mission to curtail the wildland fire crisis in the western landscapes through active forest management; biomass harvesting and utilization; linkages to state, private, and tribal forestry engagement; and research and development. Recently we have partnered with the U.S. Endowment for Forestry and Communities (aka the Endowment) and Resources for the Future (RFF) to conduct regional roundtables to identify critical barriers and opportunities that use biomass removed from the high fire risk landscapes. Information gathered from the regional roundtables will be consolidated with common themes addressed at the national level. The Forest Service is also working closely across business lines to develop and successfully transition technologies across the industry.

We see a growing interest in the use and development of the hardwood products industry. Enhanced durability research and studies of wood railroad ties date back to the beginning of the Forest Products Laboratory. Over the years, we have taken lessons learned from past research on wood products and evolved our research direction

and projects to support the current and future needs of the industry. Currently, the Forest Products Laboratory has several active hardwood research projects where we are working to expand the use of hardwoods for value-added engineered materials and components. For example, scientists are evaluating the durability of multiple hardwood species as trailer decking material and for use in specialized shipping pallets to support government and industry needs. Also, the life cycle assessment of hardwood lumber production as a viable means to sequester carbon is being investigated and evaluated to provide valuable data and metrics that support industry life cycle assessments and environmental product declarations. We continue to reach out and engage with organizations like NHLA to provide the best research possible to the nation and industry.

We look forward to future engagements to share what we know and learn from each other, engage in projects to develop a deeper understanding of hardwood timber resources and identify future needs for the research community and the industry we support. As I mentioned at the NHLA 125th Anniversary Celebration, I look forward to what the next 125 years have to offer!

*Andy Martin, PhD, PE, FASCE
Assistant Director,
Wood Products Research*





STRUCTURAL AND APPEARANCE-BASED GRADING



Change is coming, and it is time the hardwood industry changes too. I have seen the graded hardwood lumber consumption slides from HMR, AHEC, and RAHC that paint the picture of the industry's current struggles. We are the world's greatest producer of sawn hardwoods, we have worked hard to be sustainable and grow more hardwood than we harvest, but the consumption of graded hardwood lumber in the USA dropped from 6.5 billion board feet in 1999 to 2 billion in 2009 and remains there 14 years later, even though the GDP and economy have bounced back. The result means that an uncut 56 billion board feet of hardwood lumber has continued to grow and will continue into the foreseeable future.

Stupidity isn't sustainability.

We would be sustainable even if we cut another 4.5 billion board feet of lumber a year. That isn't the problem; the problem is we have watched our market go away and have done nothing to adapt. We are jeopardizing our future forests by allowing current forests to be undervalued for lumber and more valued for log exports or carbon sequestration credits. The northern, eastern, and southern forests have experienced many diseases, infestations, and rot degradation. Dutch elm disease, the emerald ash borer, birch dieback, and oak wilt, to name a few. We have fewer loggers and truckers than ever before. I have yet to meet a logger or woodlot owner who feels compensated when prices increase. They tell me, "We are the only industry that loses more money when we get more efficient."

It's time to relinquish the status quo and go after the next item. Maybe it's pallets, HCLT, or structural lumber and guardrail posts. It could be flooring and cabinets. Or perhaps it's all the above. As an industry, we must diversify, and NHLA can take the lead. Did you know that Mississippi, Alabama, and Arkansas all have Department of Transportation rules that specify SYP only? I am sure many other state agencies have this restriction too. Why? Because we never bothered to ask, complain, and tell them what hardwoods can do because hardwoods are worth more than softwoods.

Well, that might be true for FAS boards, but it isn't true for the lower grades, and we have to make a lot more of them to get the FAS. We must embrace structural grades for hardwoods because hardwoods are stronger than softwoods.

We must determine why we are excluded from any option or scenario where wood is used. There are several reasons that softwood has been the standard for structural lumber.

- 1. Abundance:** Softwood mills are production oriented and produce more lumber in one day than most hardwood mills do in a week.
- 2. Research:** The softwood industry has spent much time and money on preservative treatments, fire-retardant treatments, glues, stains, LCA, EPDs, PCRs, and more to tell their story. Hardwoods can also be treated, but do we discuss it for anything other than ties?
- 3. Ease of Use:** In most cases, softwoods are somewhat lighter and easier to work with, but some species of hardwoods are just as light and structurally strong.
- 4. Perception:** The term "hardwood" makes people think it is hard to work with or drive a nail into. This is not true, except for Hickory and Pecan.
- 5. Promotion:** The softwood industry has done a better job of marketing its lumber to the structural markets.
- 6. Products:** Softwood producers give their customers exactly what they want, not what they cut with random widths, lengths, and thicknesses.

There are a lot of misconceptions, and our industry has not done a good job of dispelling them. We have an untapped market just waiting for us to sell to, but we can only do it if we do it together and adapt to what the customer wants.

Our One Common Ground should be in structural and appearance-based grading.

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Abstracts and Presentations

Hardwood Matters

Dallin Brooks, Executive Director

Dana Spessert, Chief Inspector

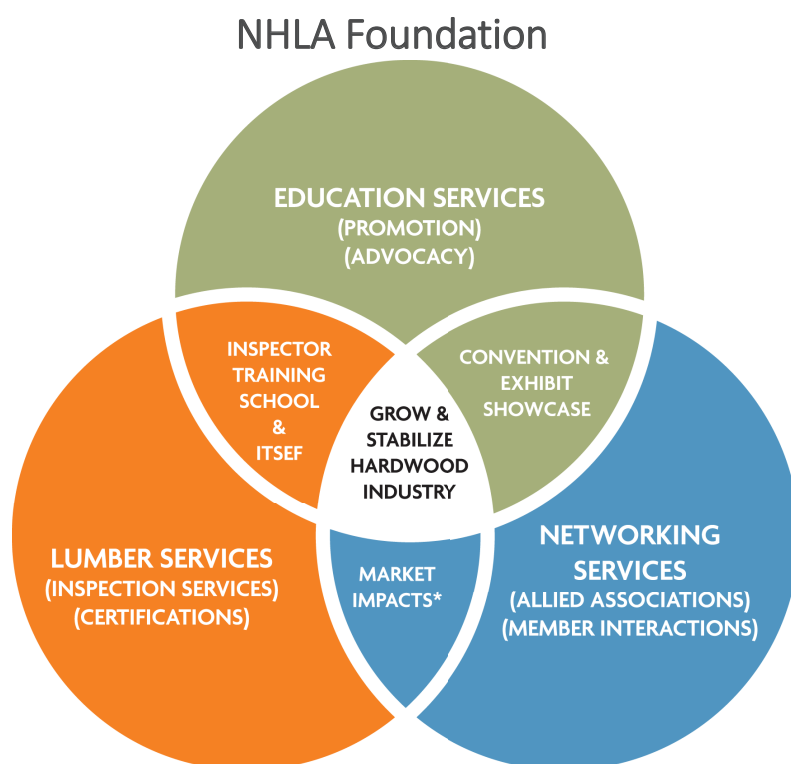
National Hardwood Lumber Association, Memphis, Tennessee, USA

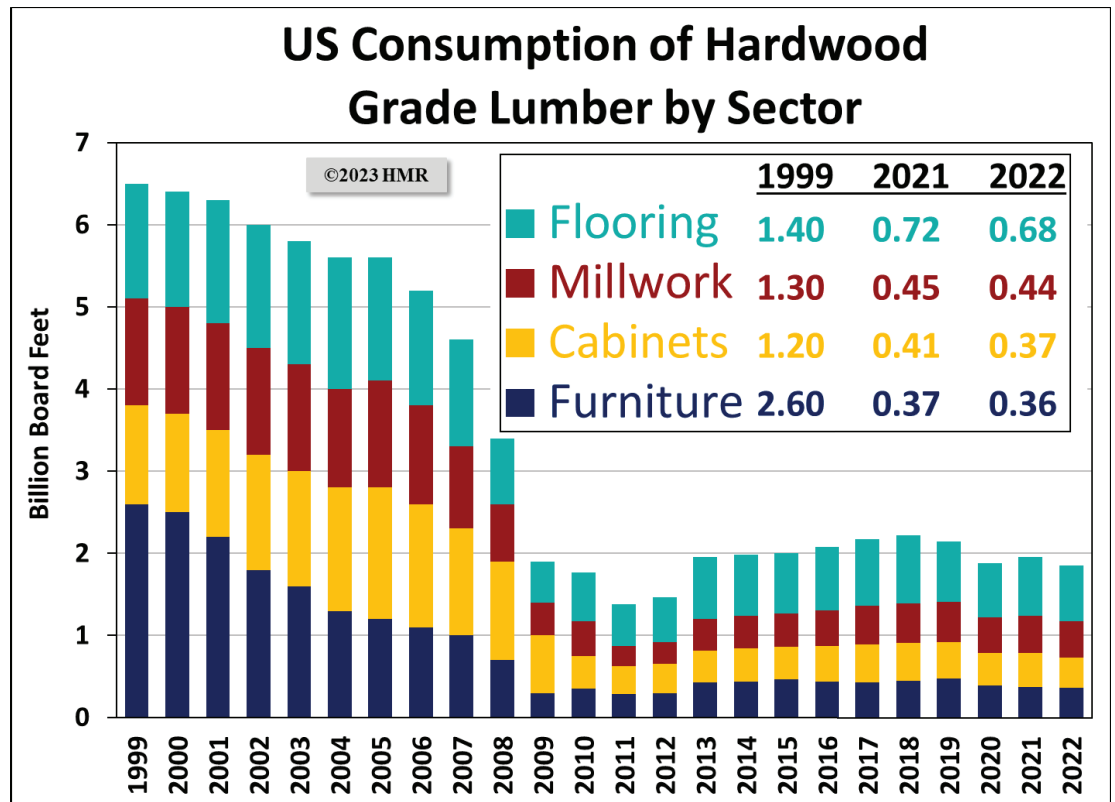
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Grow and Stabilize
the Hardwood
Industry





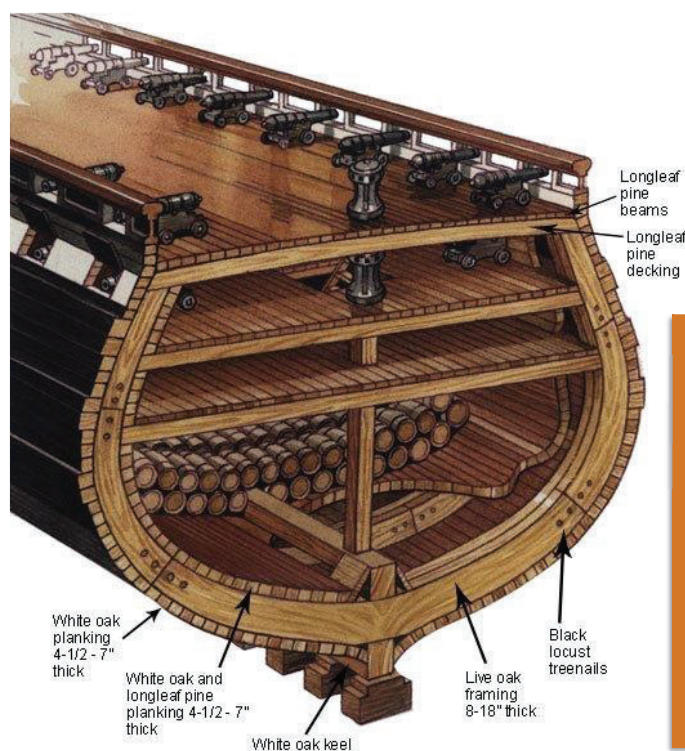
125 Years Ago
You Would Have Found Hardwood
Everywhere

Today it is almost Nowhere



Completed in 1797, the USS Constitution was one of six ships constructed of Wood

www.nhla.com



A cross-section showing how white oak was used in the construction of the USS Constitution. Hard, heavy, straight-grained, and decay-resistant, white oak contributed much to the USS Constitution.

www.nhla.com



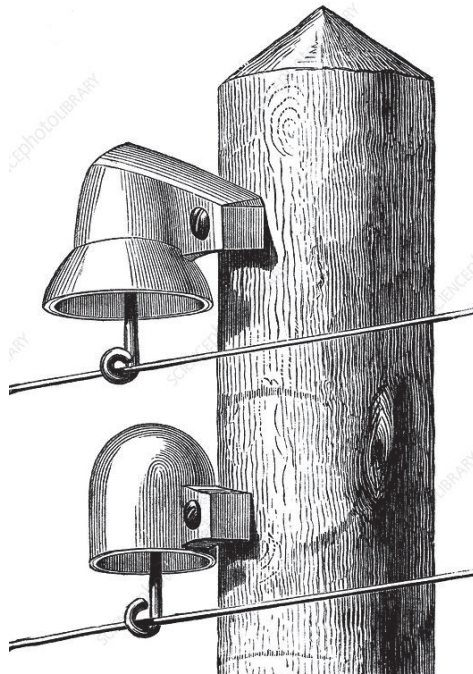
Bourbon, Whiskey
Barrels
And Wagons

www.nhla.com



19th-century
hardwood floors
and furniture.

www.nhla.com



1843, Samuel Morse used chestnut for his first telegraph lines.

www.nhla.com



Originally built with white oak in 1860, the Bank Rock Bridge is a pedestrian bridge in Central Park, NYC.

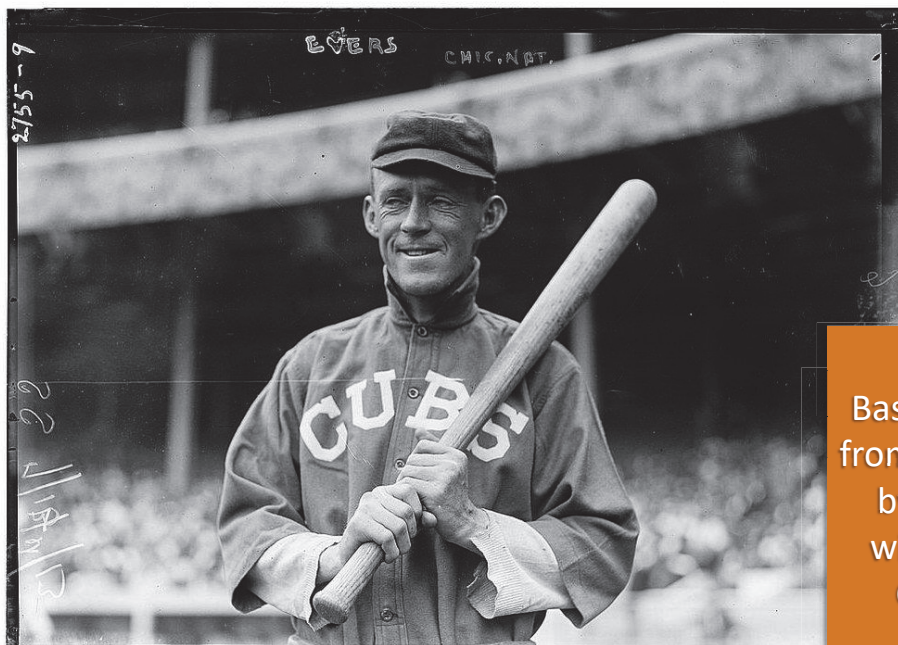


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Golden Spike on May 10, 1869 connected the continent from coast to coast.

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Baseball bat (made from ash) being held by Johnny Evers with the Chicago Cubs in 1913.

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A B-17G WWII Flying Fortress with propellers made from beech.

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What Did the Hardwood Industry Do Wrong?

Accepted the Fact That it Was More Expensive Than Softwood



Hardwood pallets are naturally stronger than their softwood counterparts. Wood pallets are an \$11.5 billion industry in the USA.

www.nhla.com



An oak tree produces about four rail ties. Other species that are used include chestnut, elm, and Saggum.

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The sitting room at NHLA Headquarters is a hardwood heaven, with hardwood chairs, floors, countertops and wall and ceiling paneling.



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What Does Hardwood Industry Do

Structural Applications
Process Improvements
Environmental Work



Where NHLA Needs To Catch Up

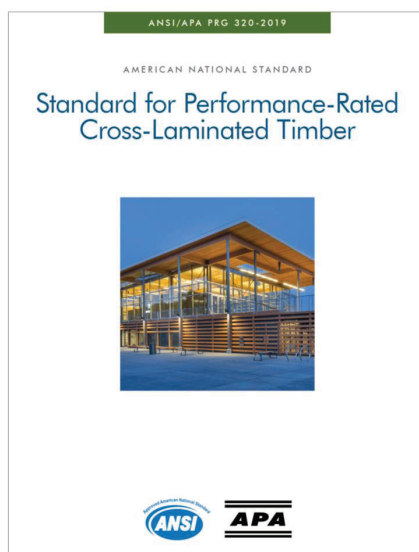
Hardwood Lumber Behind on Issues

- Softwood Lumber Is Ahead
 - Cross Laminated Timber (CLT)
 - Environmental Proof
- Laminates Are Ahead
 - Wood Look
 - Maintenance Free
 - Low Cost
- What don't you want to be doing 50 years from now?
- Start today what you want to change tomorrow.



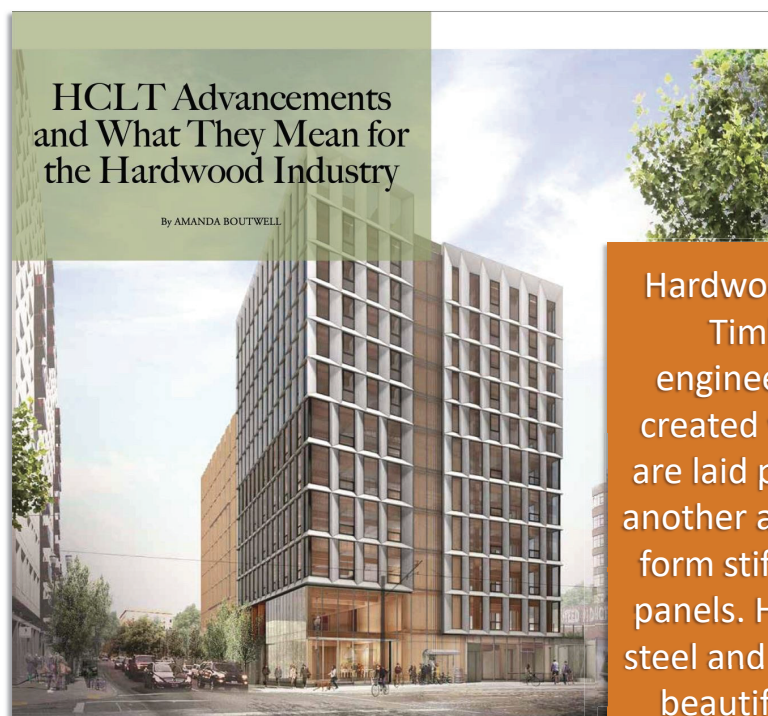
Structural Applications





Hardwood CLT

- AHMI on PRG 320 committee
- NHLA an observer
- Use NELMA structural grades
 - Poplar
 - Maple
 - ...



Hardwood Cross Laminated Timber (HCLT) is an engineered wood product created when timber planks are laid perpendicular to one another and glued together to form stiff, strong, and stable panels. HCLT is stronger than steel and concrete but holds a beautiful wood aesthetic.



Hardwood Timber
for Crane matting

www.nhla.com



?

Hardwood or
Structural
Purposes

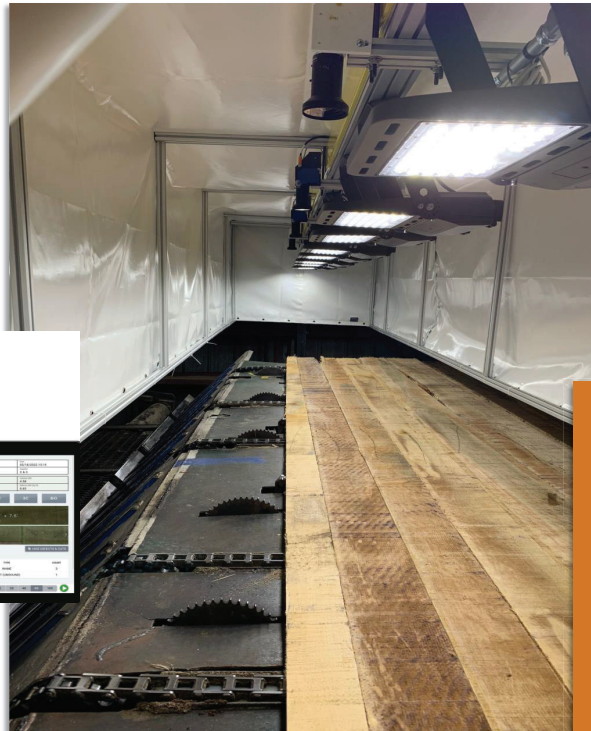
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Process Improvements



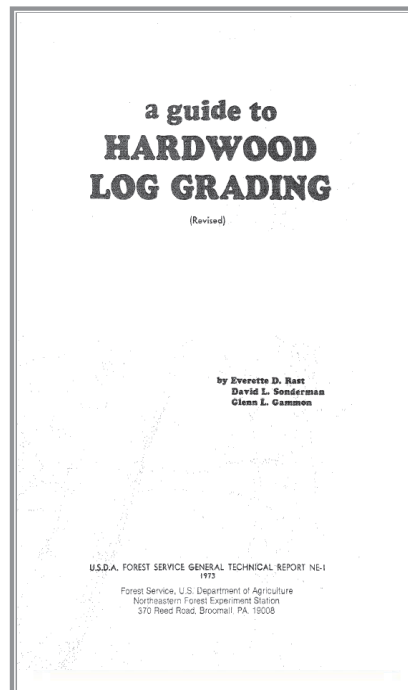
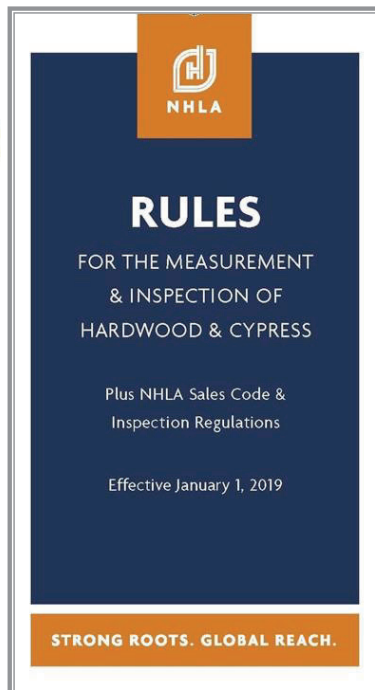
Thermally
Modified
red oak





Automatic Graders

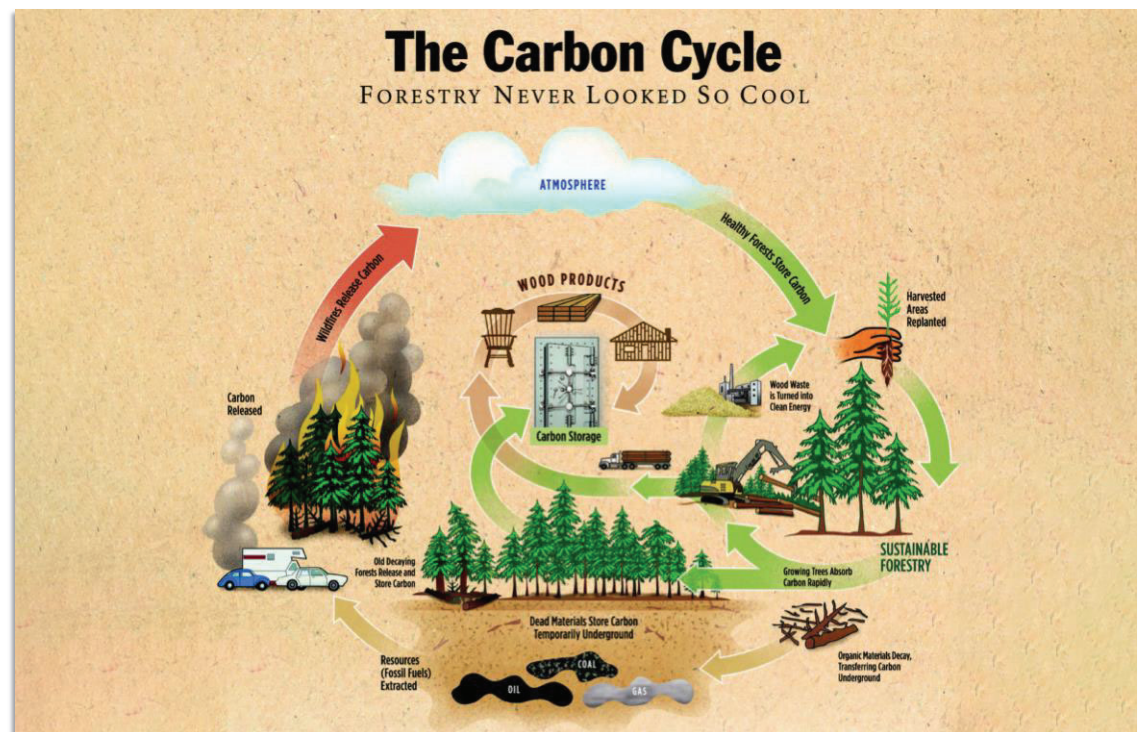
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Log Grading

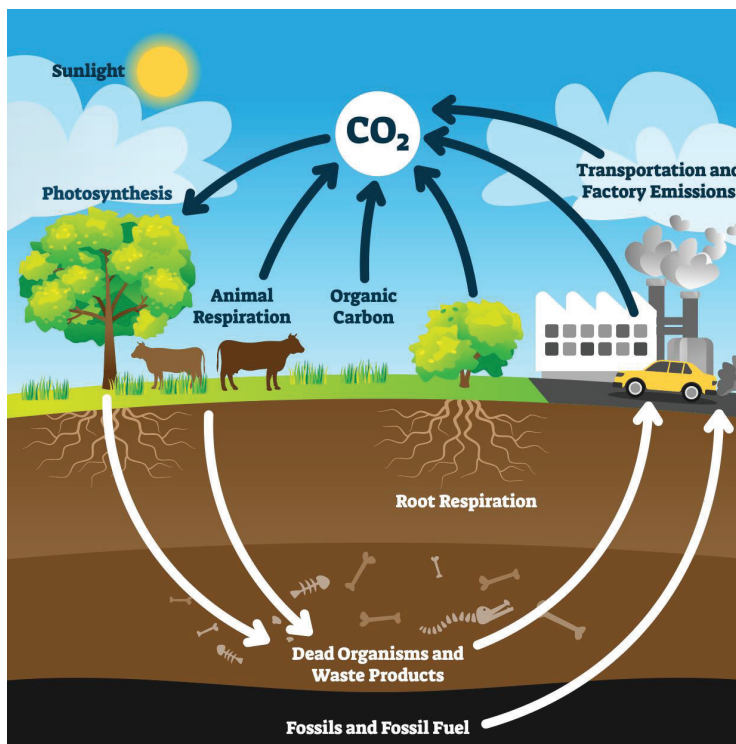
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Environmental Work





Trees are natural renewable resources. As trees grow, they store carbon dioxide from the atmosphere in their trunks, branches, stems, leaves, and roots. The carbon dioxide remains stored in the end product made of wood.



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Wood is the Greenest Building Material

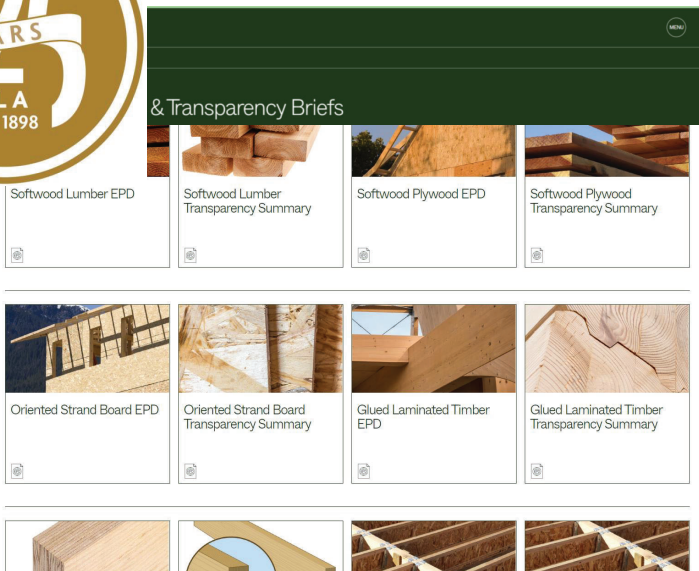
Carbon Emissions and Storage Compared to Lumber:

	Total Process Emissions*	Emissions + Carbon Storage*
Lumber	0.033	-0.457 carbon negative
Concrete	1.1x lumber	+0.034 carbon negative
Brick	2.6x lumber	+0.088 carbon negative
Glass	4.6x lumber	+0.154 carbon negative
Recycled Steel	6.6x lumber	+0.220 carbon negative
Cement	8.0x lumber	+0.265 carbon negative
Recycled Alum	9.4x lumber	+0.309 carbon negative
Steel	21.0x lumber	+0.694 carbon negative
Plastic	75.8x lumber	+1.500 carbon negative
Aluminum	137.2x lumber	+4.529 carbon negative

*Tons of CE/ton of product

Data Source: Dovetail Partners, Inc.

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Softwood is Ready

- PCR
 - EPD
 - LCA



National Hardwood Lumber Association



How the Hardwood Industry Impacts the Economy

The Hardwood Industry Economic Impact Study published by the Hardwood Federation shows that the hardwood industry employs nearly 21 million people and contributes \$394 billion to the U.S. economy. The economic “ripple effects” of these hardwood products supports:

\$348.1 billion
in economic
output

\$156.9 billion
in gross
domestic
product

1,834,670
jobs in the
national
economy

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Hardwood lumber is
part of your daily life.

From cabinets to
furniture to flooring,
hardwood lumber
surrounds us and is
part of our daily lives.



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The hardwood industry
has to join with the
softwood industry, and
we all need to work
together.



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North American Matting Association

Jon Fiutak, President, Nominating Committee

Mike Walsh, Board of Directors, Technical Committee

North American Matting Association, Sheridan, Arkansas, USA

The North American Matting Association is a non-profit entity dedicated to advancing the matting industry through the adoption of voluntary mat standards with membership from producers, suppliers, users, specifiers, and general interest. Each year, incidents occur where matting fails under load, leading to unsafe conditions on site for workers as well as loss of or damage to equipment. In the matting industry, there are no current standards on matting. Years ago, there was one producer, one type and one species in matting. Today, innovations have ushered in timbers mats, three-ply bolted mats, composite mats, CLT mats, steel mats, bamboo mats, and beyond. The sheer diversity of mat types and dimensions poses a clear challenge. Determining the appropriate mat requirements and selecting the best matting solution can be daunting without specialized knowledge. NAMA bridges this knowledge gap by formulating clear standards rooted in recognized engineering principles.

The draft Timber Mat Production Standard was voted on and passed September 29, 2023. This voluntary mat standard is organized into structural and non-structural categories. An overview of these specifications can be seen in Figure 1 below. In all cases, any product that bears the NAMA certification mark shall also bear a conspicuous mark identifying the: manufacturer, mill, grade, and date of manufacture. You can read more on each specification in the draft standard that can be found at www.nama-assoc.org.

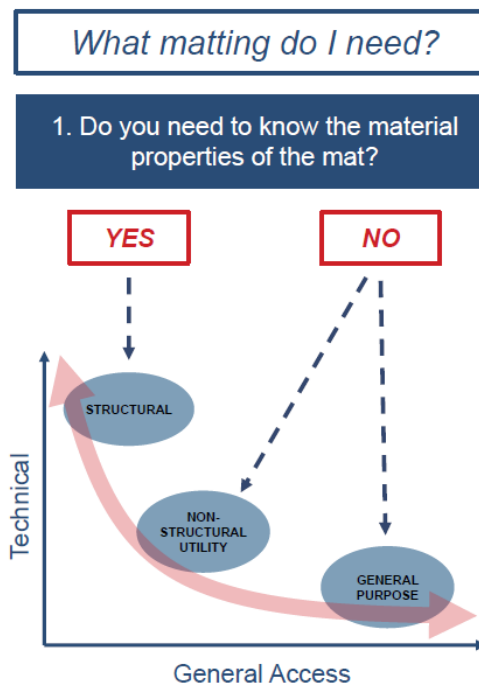


Figure 1: Conceptual diagram of where matting falls within categories defined by voluntary standard.

Analysis of Matting using Beam on Elastic Foundation Calculator

Sean Joyce, Project Engineer
Rhoen Fiutak, Technical Manager
 Anthony Hardwood Composites, Sheridan, Arkansas, USA

Beam on Elastic Foundation Methodology (BOEF) can be used to analyze the performance and impact of mats. BOEF considers the properties of the mat, the subgrade modulus of the foundation the mat sits upon and the loading conditions. From these inputs, the analysis provides distributions for mat deflection, bearing pressure, shear, and induced moment. Mat deflection is a good predictor of the extent of rutting present after removal of matting. The distribution for bearing pressure can be compared to limits on bearing capacity of the foundation to ensure matting will adequately distribute loads. Shear and induced moments can be compared to material properties to ensure that the mat does not undergo stresses beyond its allowable.

BOEF methodology is especially useful in analyzing hardwood mats due to the ability of hardwood to handle larger deflections without breaking under the same load as softwoods. Understanding this deflection profile is useful in distributing large loads in unimproved conditions with very low bearing capacity.

MACSUU is a free online calculator that makes the use of BOEF in matting applications more accessible to a wide variety of users in the industry. The calculator allows the user to analyze a variety of mats under various loading and site conditions. The material properties library for the list of available mats is maintained by Mississippi State University Department of Sustainable BioProducts. It should be noted that the tool is for design purposes only and values should be verified by a licensed engineering professional. MACSUU is made available to the public at www.macsuu.net.

Soil Deflection Under Foot (in)	SGM (subgrade modulus)
16.0	0.44 pci
Load Point(s) Configuration	2 Point Spacing (ft)
2	8
Load at Point(s) (kips)	Load Offset from Center (ft)
10	0
Width of Load Distribution (ft)	Length of Load Distribution (ft)
2.0	5.0
Matting	
CLT 3 ply, 8x24, SYPine (MSU)	
Layers	
1	
Print Results	
Bending Stress % of Allowable 1,2,3 MACSUU	Shear Stress % of Allowable MACSUU
83%	32%
Max Deflection MACSUU	Edge Deflection ⁴ MACSUU
-3.7"	-0.7"

Figure 1: Example of MACSUU calculator analyzing a single track on CLT mat for a 20 kip equipment load above soil with a 0.44 pci subgrade modulus.

Machine Stress Rating (Lumber) and Ultrasonic Veneer Grading

Robert J. Ross, Supervisory Research General Engineer (retired)
USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin, USA



U.S. DEPARTMENT OF AGRICULTURE

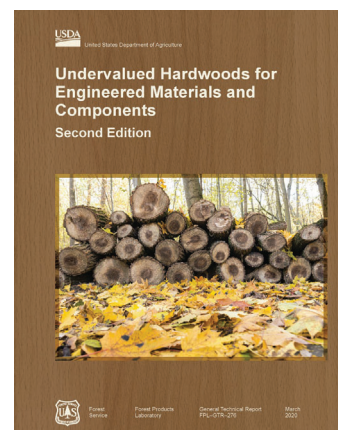
Machine Stress Rating (Lumber) and Ultrasonic Veneer Grading

Bob Ross

November 7, 2023

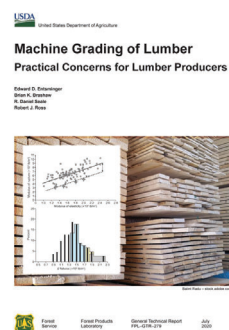


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Machine Stress Rating

- Mechanical grading, machine stress rated (MSR), machine evaluated lumber (MEL)
- Stress grading lumber with assistance of a machine
- “Machine Grading of Lumber—Practical Concerns for Lumber Producers”, General Technical Report, FPL-GTR-279, July 2020



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Machine Stress Rating

- Nondestructive test (modulus of elasticity)
- Foundation is relationship between strength and stiffness
- Visual (optical) assessment
- Quality control test(s)



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Mechanical Grading of Hardwoods (U.S.)

- “Undervalued Hardwoods for Engineered Materials and Components”, General Technical Report, FPL-GTR-276, March 2020
- First MSR grading of hardwood lumber
 - 1993, NELMA, SPIB, Burke-Parsons-Bowlby Corp. (Spencer, WV), FPL
 - Mixed oak, 2 by 8 lumber
 - Results-only 1% qualified as Select Structural (visual), 36% assigned to an MSR grade with allowable properties equal to or greater than Select Structural



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Ultrasonic Veneer Grading

- “Undervalued Hardwoods for Engineered Materials and Components”, General Technical Report, FPL-GTR-276, March 2020
- Relationship between ultrasound characteristics and strength
- Laminated veneer lumber (LVL) products



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FPL Hardwood Utilization Meeting USACE ERDC Summary

Peter B. Stynoski, Research Civil Engineer

Talbot B. Rueppel, Research Materials Engineer

U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory, Champaign, Illinois

Two engineers from the Construction Engineering Research Laboratory (CERL), part of the United States Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC), visited the Forest Products Laboratory (FPL) on November 7, 2023, to attend the Hardwood Utilization Meeting. CERL researchers presented ongoing research involving carbon-fiber reinforced Western hemlock CLT for contingency applications. A focal point of merit in this project is the fact that it involves a partnership with a native American tribe which provides them with economic freedom in exchange for raw materials. Permanent military construction (MILCON) projects involving the need for standardization of criteria and

specifications were also discussed. Additional DoD needs addressed were education and awareness, qualified labor, material selection and design tools, and strategic sourcing. Overall, the USACE engineers represented the DoD's long-term interest in sustainable wood products and their attendance served as a bridge for future hardwood applications in MILCON, contingency construction, palletization, matting, railroad ties, etc. DoD, FPL, and intra-government relationships were strengthened and trust was built with private organizations such as the NHLA and the RTA.

Hardwood Utilization Research in Support of Department of Defense—Blast Resistance Materials

C. Adam Senalik, Project Leader

USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin, USA



U.S. DEPARTMENT OF AGRICULTURE

Hardwood Utilization Research in Support of Department of Defense-Blast Resistance Materials

C. Adam Senalik, PhD, P.E.

November 7, 2023



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Advantages of Wood

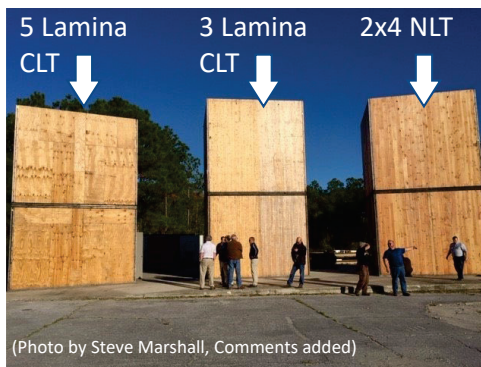
- Excellent strength/weight ratio
- Strong
- Abundant resource
- Rapid construction
- Flexible
 - Ability to dissipate kinetic energy



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Recent FPL Research

- Blast resistance of CLT structures

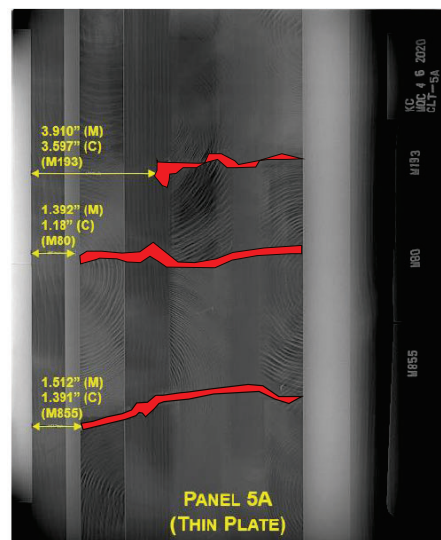
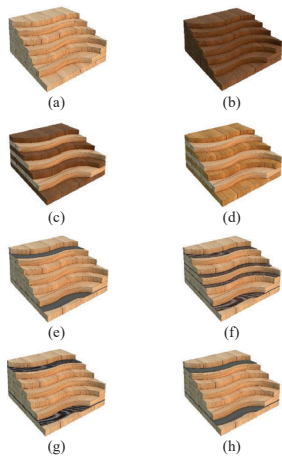


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3

Recent FPL Research

- Ballistic Resistant CLT panels

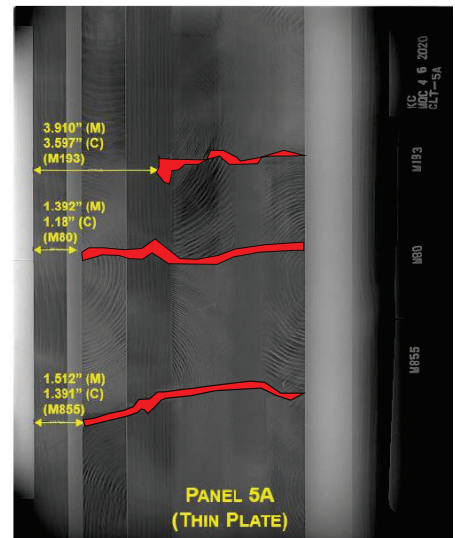
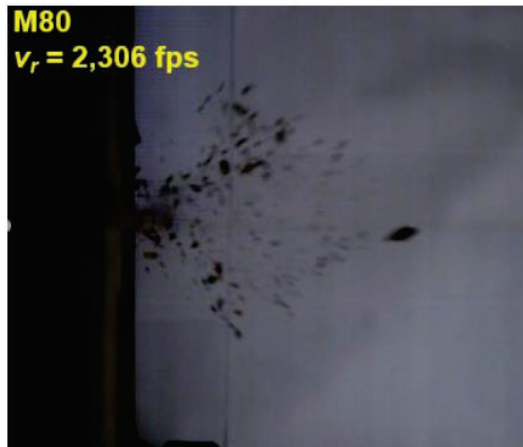
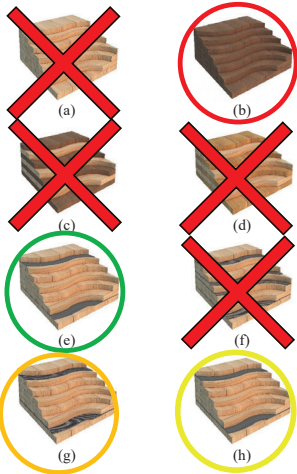


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4

Recent FPL Research

- Ballistic Resistant CLT panels



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5

Current FPL Research



- Blast Tested Reinforced CLT
 - Ballistic resistant panels
 - Tyndall AFB
 - Oct. 25, 2023
- Software tools for design



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6

Current FPL Research



- Blast Tested Reinforced CLT
 - Ballistic resistant panels
 - Tyndall AFB
 - Oct. 25, 2023
- Software tools for design



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MTU Research on Northern Hardwoods CLT

Xinfeng Xie, Associate Professor
Michigan Technological University, Houghton, Michigan, USA



Michigan
Technological
University

College of Forest Resources and Environmental Science

MTU Research on Northern Hardwoods CLT

Xinfeng Xie

Michigan Technological University

Hardwood Utilization Summit

Forest Products Laboratory, Madison, WI

November 7th, 2023



Outline

- Major characteristics of hardwood lumber (compared to softwoods) and challenges for using hardwood in CLT
- MTU research on northern wood CLT

Hardwood species for CLT

- U.S.: yellow poplar and hybrid poplar
- Canada: maple, poplar, beech, and birch

Major characteristics of hardwood lumber material

- Higher densities
- More complicated in anatomic features and wood chemistry.
- Sawn and graded not for structural applications
- Lower MC
- Less resistant to biological degradation
- Diverse species

Technical Challenges

- Potential bonding issues
- Lack of correlation between lumber grades and mechanical properties
- Modeling panel strength properties

MTU research on northern wood CLT

- Multiple species
 - Effects of wood species on the bonding performance in cross lamination
 - Evaluation and modeling of hardwood CLT panel mechanical properties

Effects of wood species on bonding performance

Wood species:

Common name (Scientific name)	Species code	Specific gravity	Pore distribution or early/latewood transition
Hard maple (<i>Acer Saccharum</i>)	HM	0.63	Diffuse porous
Red oak (<i>Quercus rubra</i>)	RO	0.63	Ring porous
Yellow birch (<i>Betula alleghaniensis</i>)	YB	0.62	Diffuse porous
White ash (<i>Fraxinus americana</i>)	WA	0.60	Ring porous
Red maple (<i>Acer rubrum</i>)	RM	0.54	Diffuse porous
Quaking aspen (<i>Populus tremuloides</i>)	ASP	0.38	Diffuse porous
Basswood (<i>Tilia americana</i>)	BW	0.37	Diffuse porous
Red pine (<i>Pinus resinosa</i>)	RP	0.46	Abrupt early/latewood trans.
White pine (<i>Pinus strobus</i>)	WP	0.35	Gradual early/latewood trans.

Adhesives: melamine formaldehyde and phenol-resorcinol formaldehyde @ 7.5 lbs per 1000 sqf

Pressing parameters: 8 hrs under 130 psi @ 70F

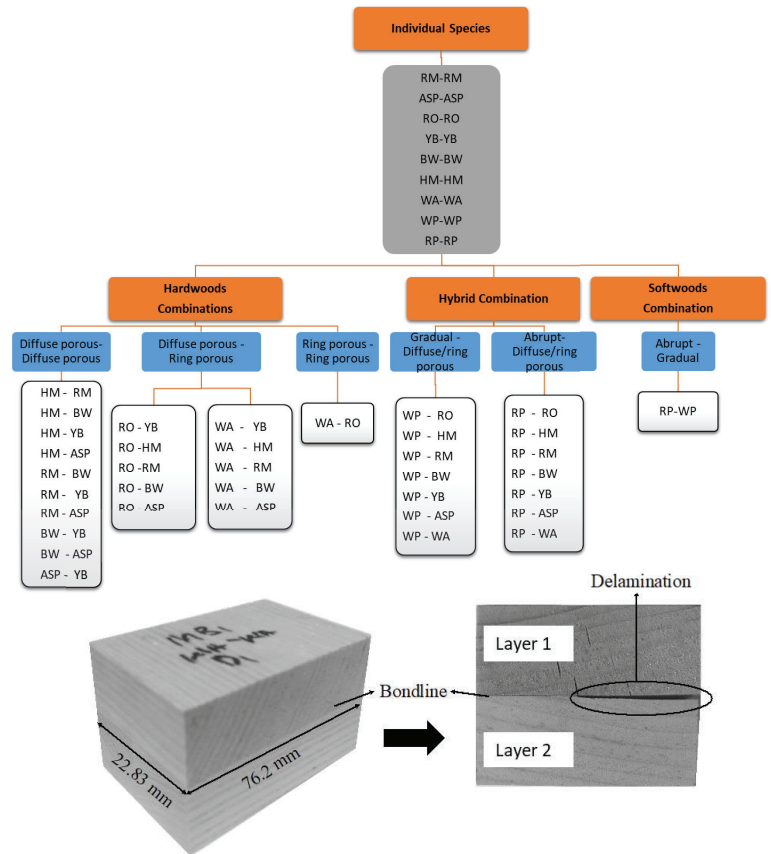
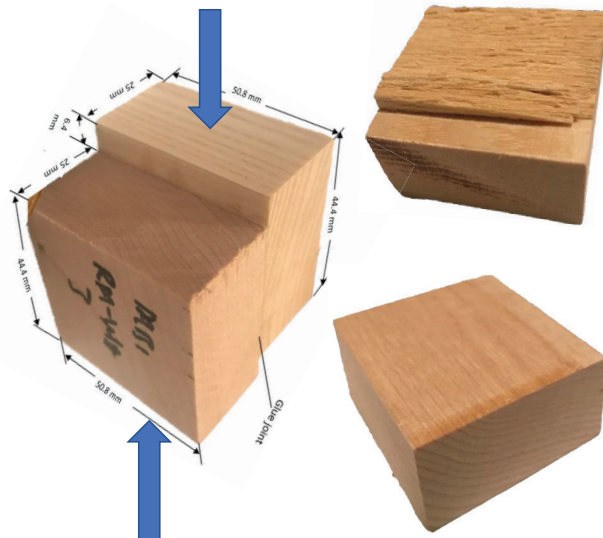
Bonding performance cont.

Table 1. Percentage Composition of Hardwood Sawtimber Volume by Species Group for the Five Eastern Regions^a in the Current Period (Ending in 2017 or 2018 Depending on State, See Appendix 2)

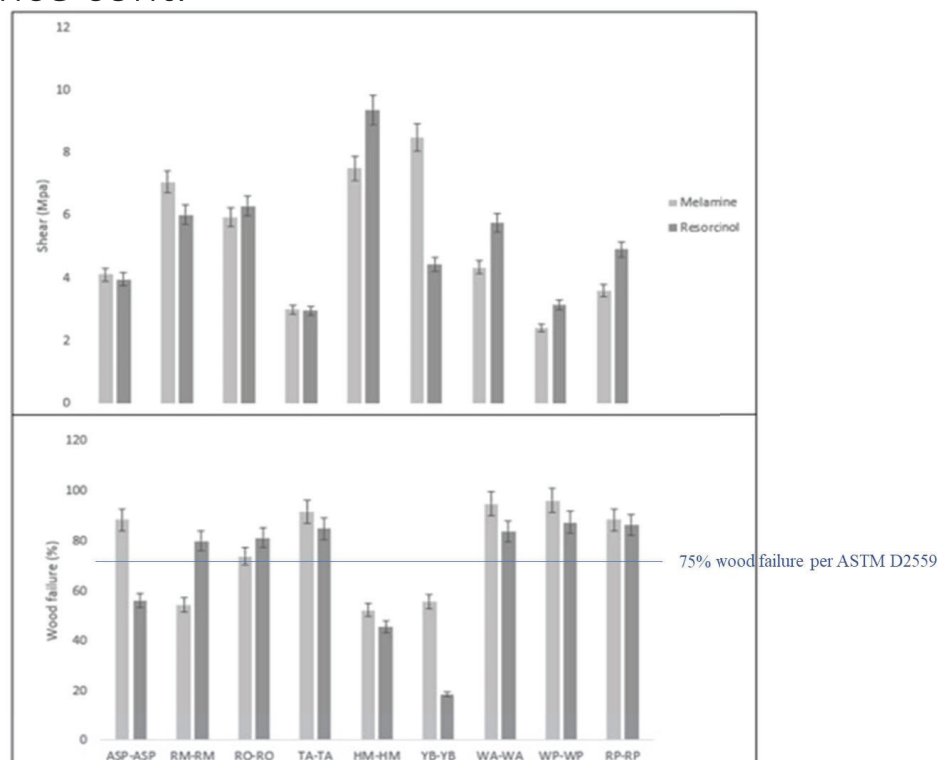
Species Group	Northeast	Lake States	Central	Mid-Atlantic	Southern
	(%)				
Select white oaks	4.2	7.5	14.6	11.9	11.4
Select red oaks	14.5	12.8	7.3	6.7	6.5
Other white oaks	3.7	t ^b	7.7	9.3	6.9
Other red oaks	5.1	5.6	11.9	11.3	25.0
Hickory	2.7	t	9.5	5.1	6.4
Yellow birch	3.7	t	t	t	t
Hard maple	13.7	16.3	5.1	t	t
Soft maple	19.8	16.2	6.6	7.0	2.1
Beech	3.4	t	2.4	2.0	t
Sweetgum	t	t	t	6.8	14.2
Tupelo/blackgum	t	t	t	3.6	8.1
Ash	6.6	6.1	3.7	2.1	2.9
Aspen/cottonwood	4.0	17.0	2.0	t	t
Basswood	t	7.1	t	t	t
Yellow-poplar	3.4	t	13.0	26.7	8.8
Walnut	t	t	2.1	t	t
Cherry	7.4	2.6	2.5	t	t
Total of region ^c	92.0	91.2	88.4	92.3	92.3
^a See Fig. 3 for description of regions;					
^b Trace (under 2% of composition);					
^c Total percentage volume of species examined in region					

Bonding performance cont.

- 45 types of combinations
- ASTM D905, bonding strength (shear) and percentage of wood failure
- AITC T110, cyclic delamination

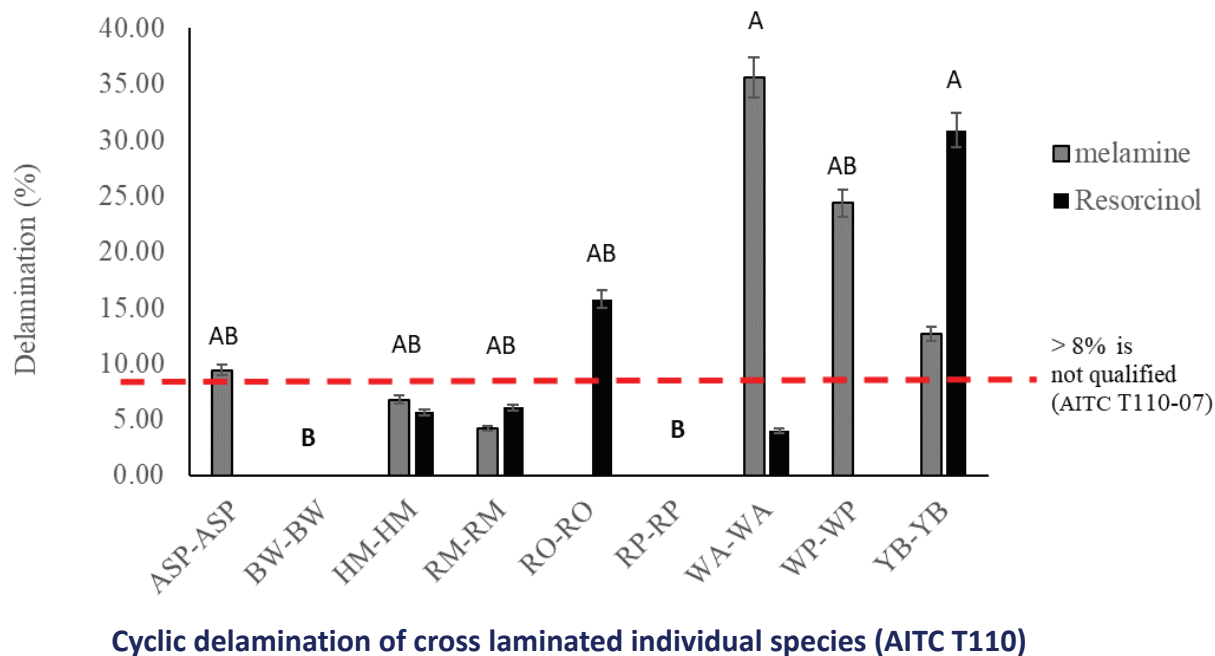


Bonding performance cont.



Average bonding strength and percentage wood failure of cross laminated individual species (ASTM D905)

Bonding performance cont.



Bonding performance cont.

Evaluation of the suitability of individual species for cross lamination

	ASTM D905		AITC T110		Remarks
	Melamine	Resorcinol	Melamine	Resorcinol	
HM	X	X	Y	Y	OK
RO	Y	Y	Y	X	Good
YB	X	X	X	X	Poor
WA	Y	Y	X	Y	Good
RM	X	Y	Y	Y	Good
ASP	Y	X	X	Y	OK
BW	Y	Y	Y	Y	Excellent
RP	Y	Y	Y	Y	Excellent
WP	Y	Y	X	Y	Good

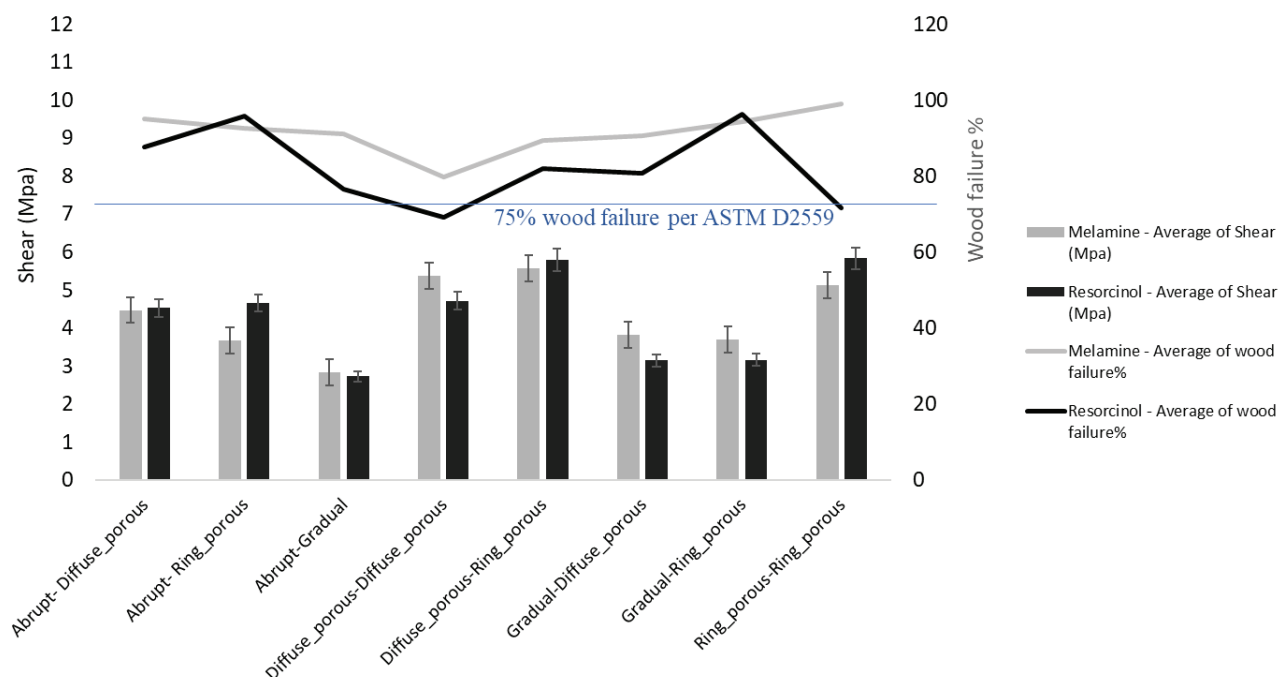
X: failed; Y: pass

BW, (RP) > RO, WA, RM, (WP) > HM, ASP >> YB

High
→
 Low

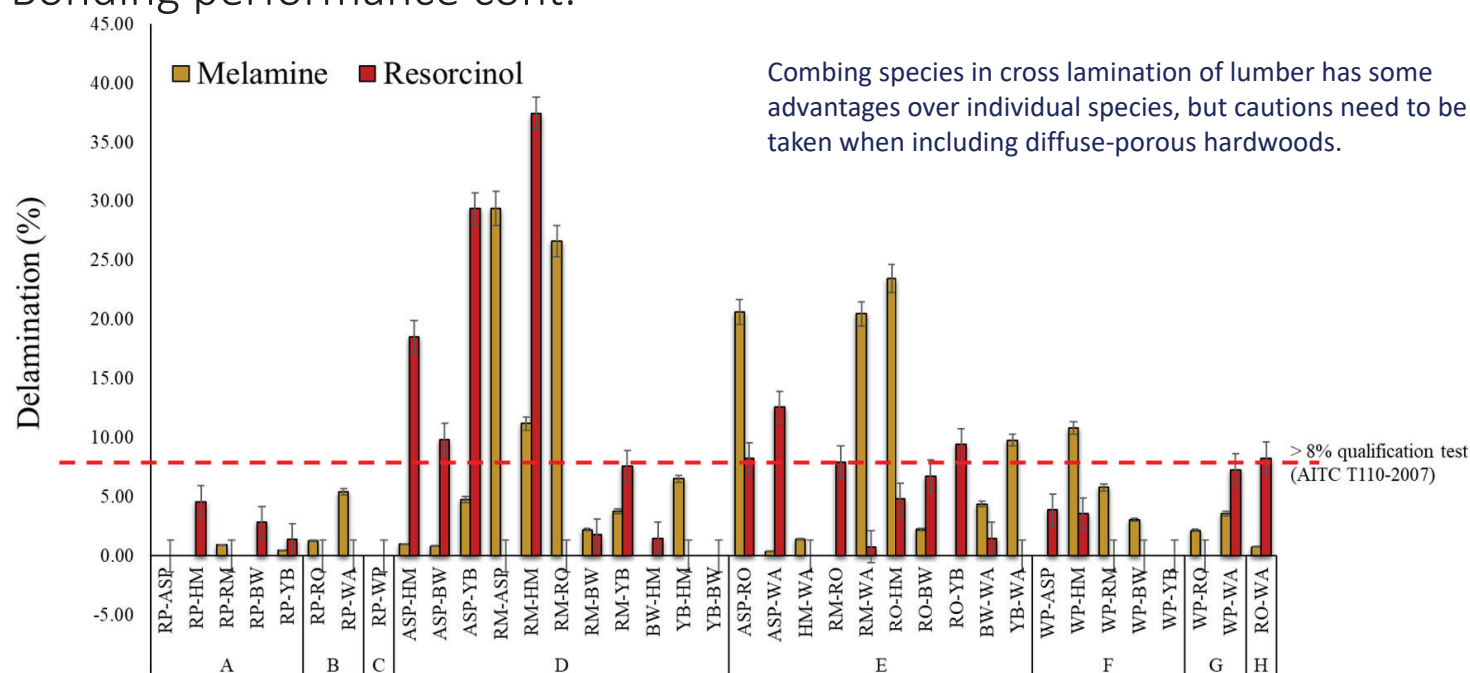
Suitability for Cross Lamination

Bonding performance cont.



Average bonding strength and percentage of wood failure of cross laminated mixed species (ASTM D905)

Bonding performance cont.

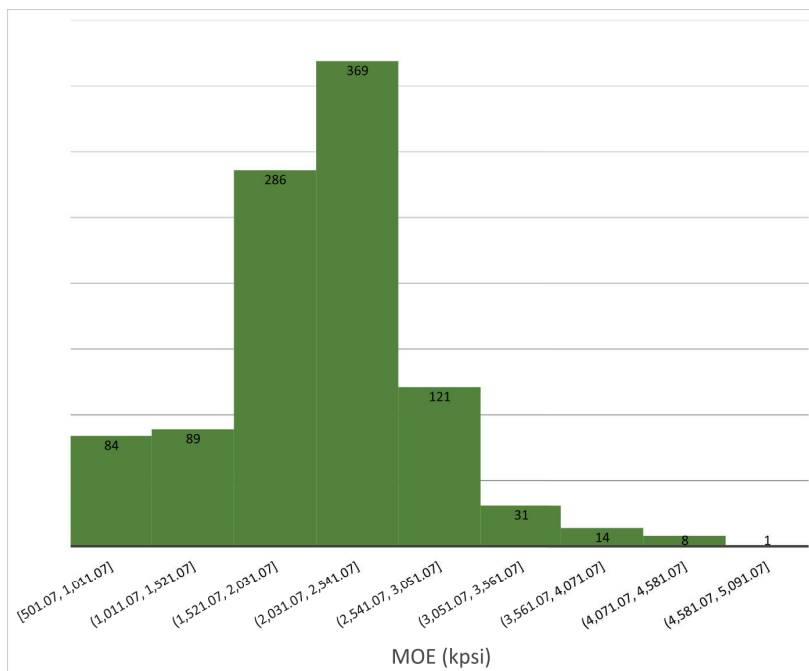


A = Abrupt-Diffuse porous, B= Abrupt- Ring porous, C= Abrupt-gradual, D= Diffuse porous- Diffuse porous, E= Diffuse porous-ring porous, F= Gradual-Diffuse porous, G= Gradual-Ring porous and H= Ring porous- Ring porous cross laminations.

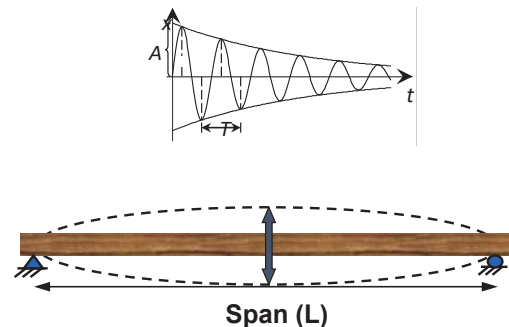
Cyclic delamination of cross laminated mixed species (AITC T110)

Mechanical Properties of Sugar Maple CLT

Non-Destructive Evaluation of Lumber Mechanical Properties



MOE distribution of industrial grade 4/4 sugar maple lumber (1003 boards)



$$MOE = \left(\frac{f_n}{C_n} \right)^2 \frac{mL^3}{I}$$

Measuring MOE of the lumber boards using transverse vibration method

Mechanical Properties of Sugar Maple CLT cont.

3-layer CLT panel types and the lamination MOE in each layer (unit: 10⁶psi)

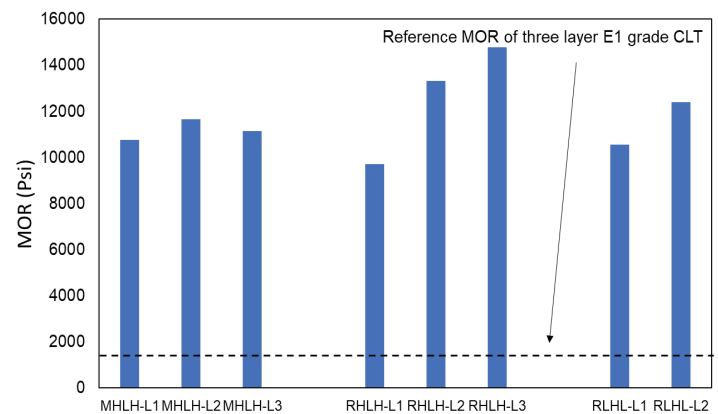
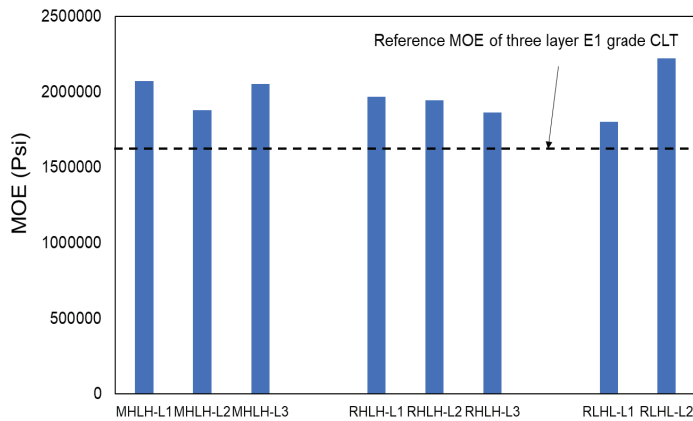
Panel Types	Longitudinal layers		Transverse layer	Average: longitudinal layers	Average: transverse layer
	Top layer	Bottom layer	Middle layer		
MHLH-1	2.69	2.534	1.0718	2.531783	1.050367
MHLH-2	2.8675	2.425	0.9915		
MHLH-3	2.2275	2.4467	1.0878		
RLHL-1	2.167	2.487	1.747	2.45125	1.6273
RLHL-2	2.455	2.3	1.592		
RLHL-3	2.485	2.565	1.6626		
RLHL-1	1.4	1.232	2.966	1.17035	2.82995
RLHL-2	0.9914	1.058	2.6939		

M: melamine adhesive; R: resorcinol adhesive; H: high MOE; L: low MOE



Mechanical Properties of Sugar Maple CLT cont.

Comparison of MOE and MOR between the reference value in APA/PRG-320 and the tested value.



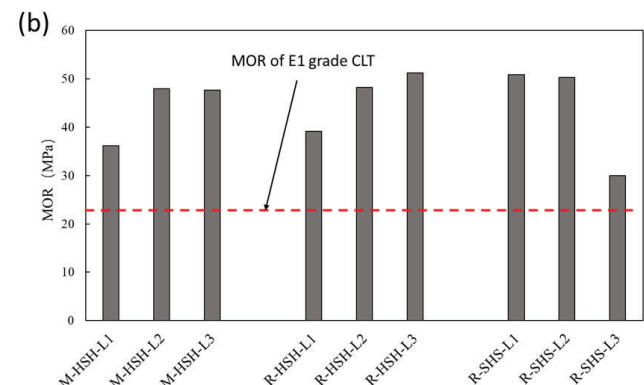
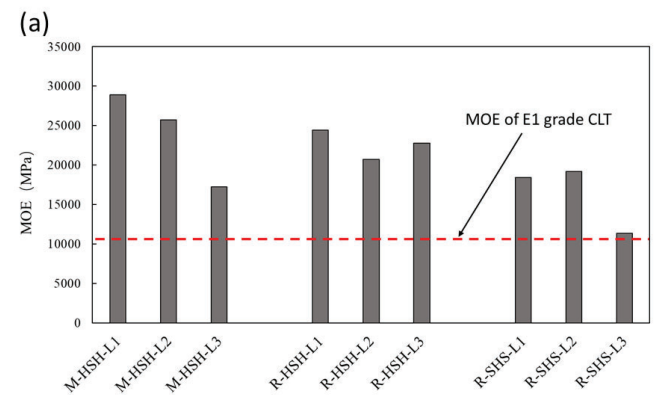
The bending MOEs of sugar maple CLT are up to 35% higher than that of layup E1 (3 layers), which is the highest in the Standard. The MORs of all tested sugar maple CLT panels are at least 5 times that of layup E1 in the PRG-320 standard.

Mechanical Properties of Sugar Maple/Spruce Hybrid CLT– Bending Properties



Simulation results and their comparison with test results

Sample type	Peak load (kN)	Peak displacement (mm)	MOE _{CLT} (MPa)	MOE _{CLT} relative difference	MOR _{CLT} (MPa)	MOR _{CLT} relative difference
M-HSH-L	4.53×10^1	2.97×10^1	2.27×10^4	-5.21%	4.99×10^1	13.66%
R-HSH-L	4.01×10^1	2.10×10^1	2.84×10^4	25.64%	4.41×10^1	-4.45%
R-SHS-L	4.62×10^1	2.29×10^1	1.87×10^4	14.71%	3.72×10^1	-14.89%

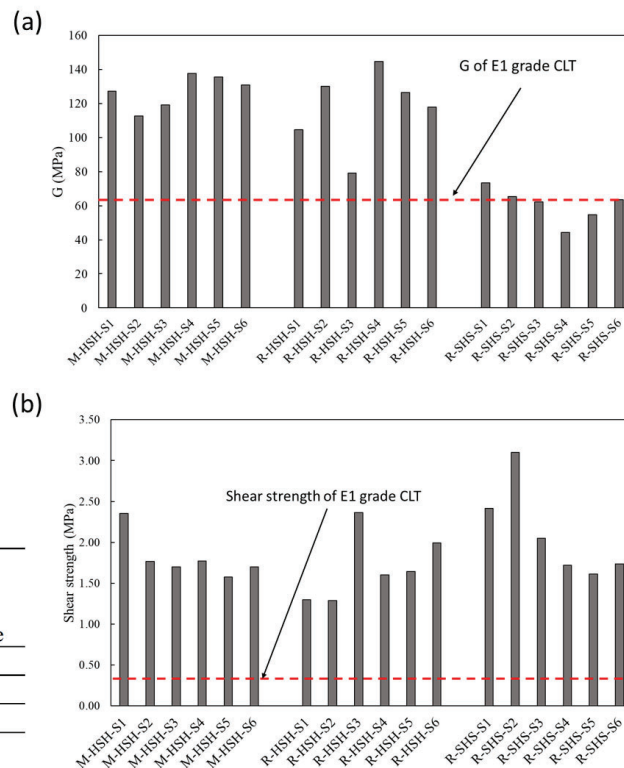


Mechanical Properties of Sugar Maple/Spruce Hybrid CLT – Shear Properties



Simulation results and their comparison with test results

Sample type	Peak load (kN)	Peak displacement (mm)	G (MPa)	G relative difference	Shear strength (MPa)	Shear strength relative difference
M-HSH-S	50.99	3.9	71.30	22.09%	1.38	-23.67%
R-HSH-S	60.14	4.28	76.65	27.11%	1.63	-4.16%
R-SHS-S	84.29	4.9	61.30	73.81%	1.43	-32.29%



**Michigan
Technological
University**

College of Forest Resources and Environmental Science

Thank You!

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USDA Forest Service Wood Innovations Program

Brian K. Brashaw, Assistant Director

USDA Forest Service, State, Private, and Tribal Forestry, Washington, D.C., USA

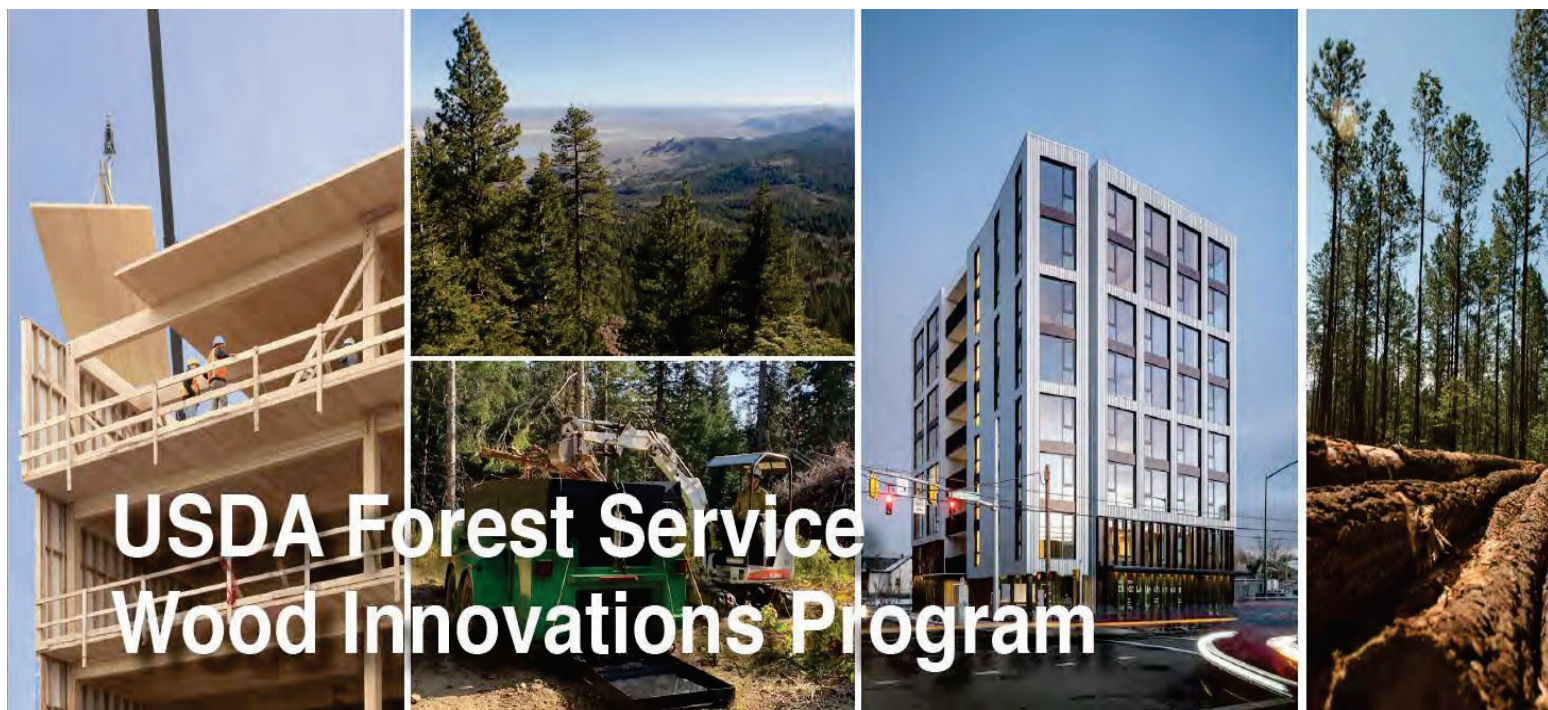


Brian Brashaw

Assistant Director – Cooperative Forestry

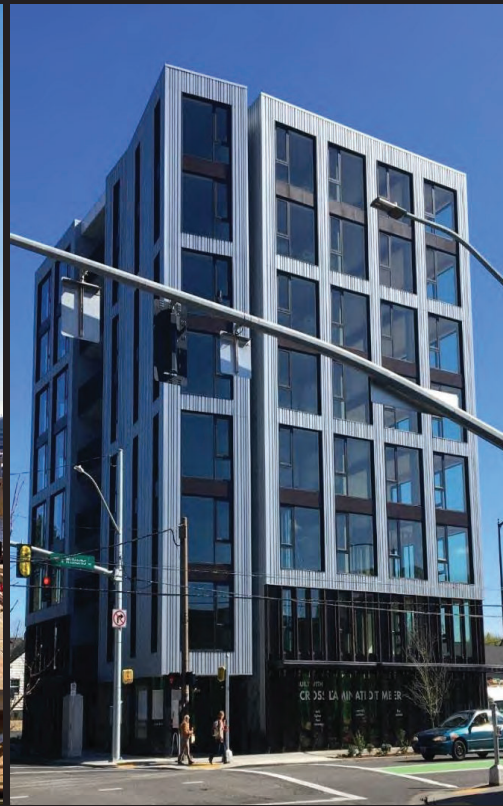
USDA Forest Service State, Private, and Tribal Forestry

**WOOD INNOVATIONS
NOVEMBER 2023**



**USDA Forest Service
Wood Innovations Program**

BUILDING MARKETS ... EXPANDING CAPACITY



WILDFIRE CRISIS

Landscape
Investments

CONFRONTING THE WILDFIRE CRISIS

Expanding efforts to
deliver on the
Wildfire Crisis Strategy

<https://www.fs.usda.gov/managing-land/wildfire-crisis>



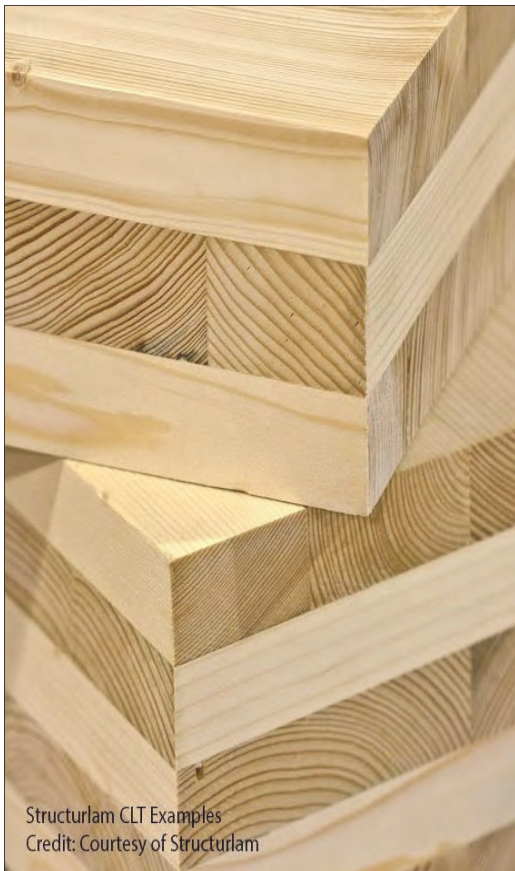


Photo: ThinkWood



Photo: Vaagen Timbers



Photo: StructureCraft

Structurlam CLT Examples
Credit: Courtesy of Structurlam

Mass Timber Strategy & Investments



Education

- WoodWorks, ThinkWood
- International Mass Timber Conferences

Technical Assistance

- WoodWorks Project Assistance
- Regional Wood Innovation Coordinators
- Forest Products Laboratory (FPL), University and NGO Research Partners
- International Building Code 2021 and 2024

Research and Code

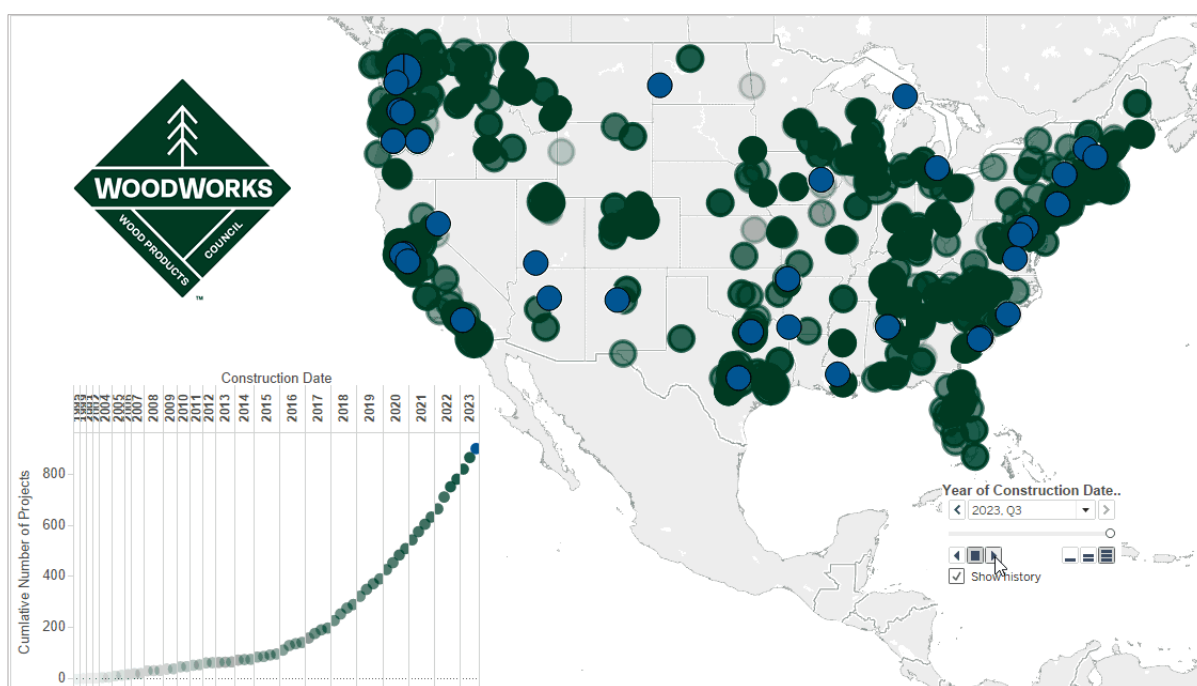
Initiatives

- SLB Mass Timber Competitions (2015, 2022, 2023)
- Wood Innovations, Community Wood Grants
- Communications

Over \$60 M invested ...

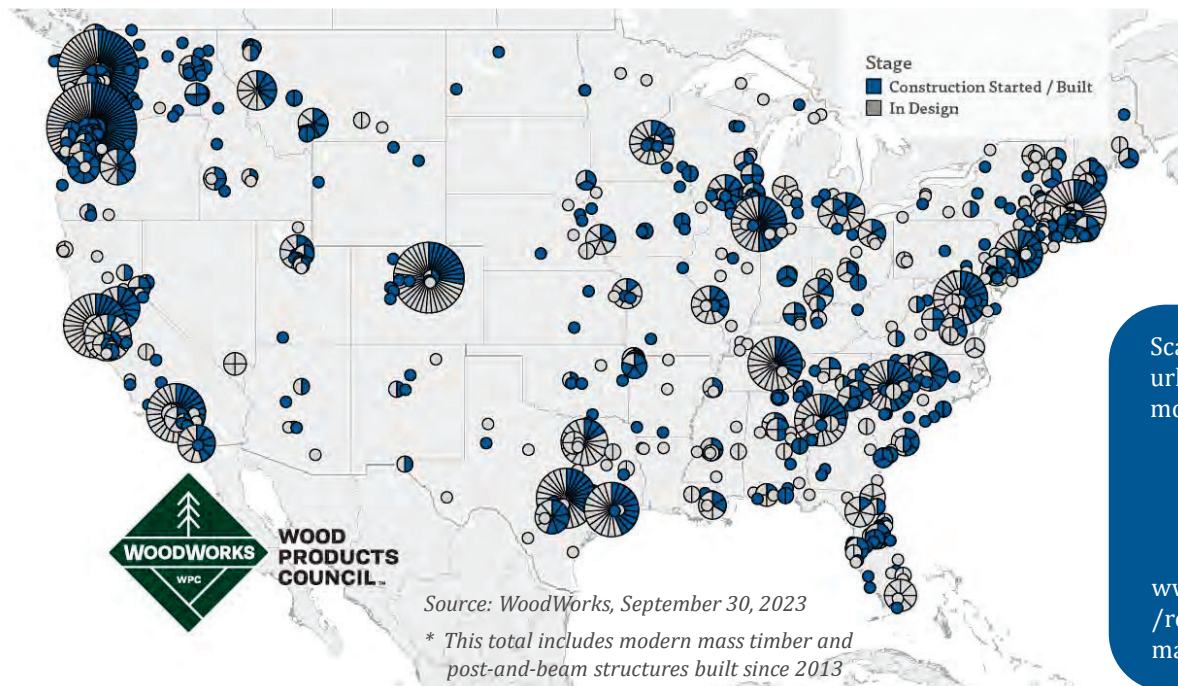
Current State of Mass Timber Projects

In the US, September 2023



Current State of Mass Timber Projects

As of September 2023, in the US, **1,934** multi-family, commercial, or institutional projects have been constructed with, or are in design with, mass timber.

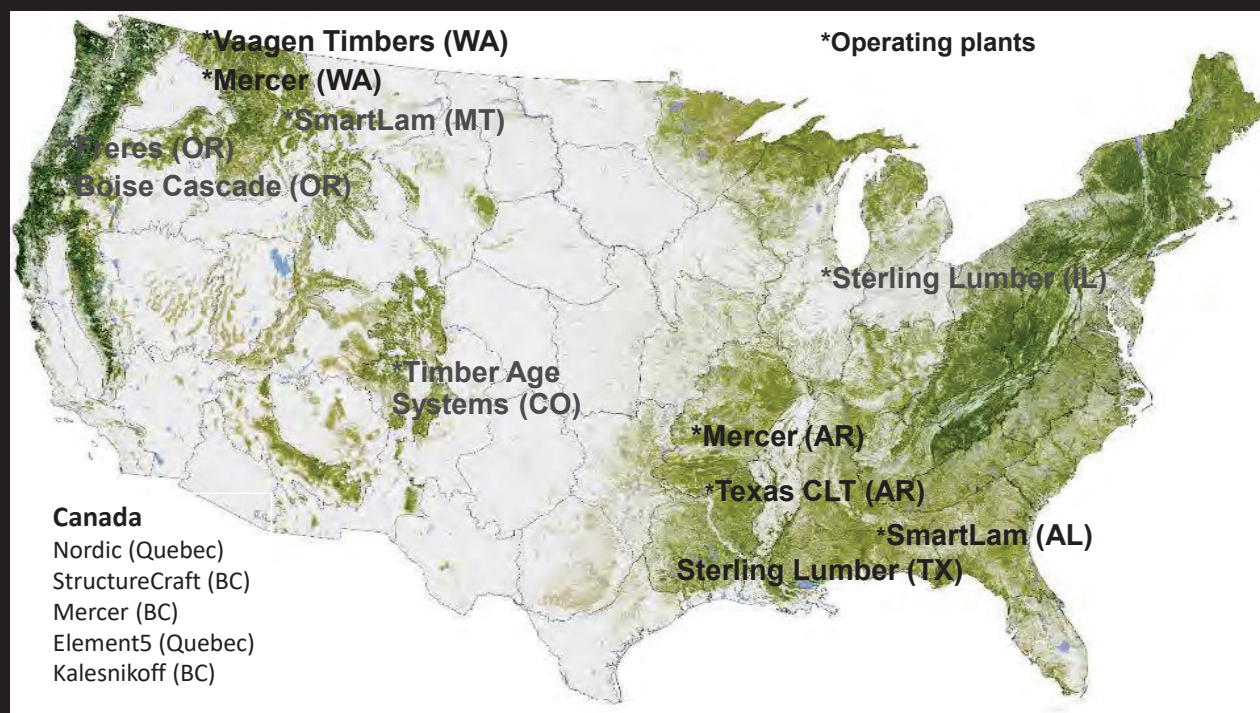


Scan this code or use the url to find the map and more details online.



www.woodworks.org/resources/mapping-mass-timber/

Lumber and Veneer-based Cross-laminated Timber (CLT) plants



ANSI/APA PRG 320-2019

AMERICAN NATIONAL STANDARD

Standard for Performance-Rated Cross-Laminated Timber



Forest Service 1st CLT Building, Kamiah, Idaho



Housing

KAISER+PATH

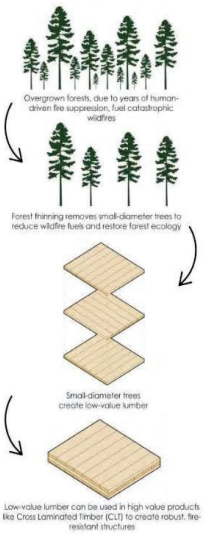


Fire-Hardened Homes and Forests with Mass Timber Construction

Design Strategies for Fire-Resistance



How can we advance forest and home hardening against wildfires?



2023 Mass Timber Competition

BUILDING TO NET-ZERO CARBON





Grant Program Timeline

(NEW) USDA Announces Availability of Nearly \$50 million to strengthen forest products economy, forest sector jobs as part of Investing in America agenda

- **Due 12/1**
 - Wood Products Infrastructure Assistance - \$23.3 million
- **Due 12/15**
 - Wood Innovations Grants - \$20+ million
 - Community Wood Grants - \$6+ million

Wood Innovations Funding Opportunity

Purpose: Stimulate, expand, and support wood products markets and wood energy markets.

Program goals:

- Reduce hazardous fuels and improve forest health on National Forest System and other forest lands
- Reduce costs of forest management on all land types
- Promote economic and environmental health of communities

Proposal Due Date: December 15, 2023

FY24 Program Funding Up To: \$20,000,000

- Award Ceiling: \$300,000, up to \$1,000,000 for stationary wood energy systems greater than 5 MW in thermal output

Cooperator Match

- 100% of the Forest Service requested funds (1:1 match).

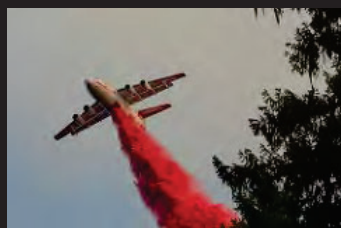


Forests and forest products sequestered 16.3% of US CO₂ emissions in 2020.





MOTTO
 — Caring for
 the Land and
serving
 people



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U.S. Endowment	Michael Goergen	michael@usendowment.org	Vice President – Innovation

Agenda

Time	Item	Contacts
8:30	Welcome & Introductions	C. West, Director, USDA FPL and NRS
9:30	State, Private, Tribal Forestry. Wood Innovation Grants. Spring 2024 Needs Assessment	Brian Brashaw & Charlie Becker. USDA Forest Service, State, Private, & Tribal Forestry
10:00	Break	
10:15	MSR evaluation of hardwood lumber & veneer	Robert J. Ross, USDA FPL Retired
10:35	Intro. to Stairbuilders and Manufacturers Association, Modeling and software for stair and guard systems.	David Cooper, SMA & Lewis Fitts, Fitts Industries
10:55	Intro. to Railway Tie Association, ongoing research & needs	Nathan Irby, RTA
11:15	Hardwood grading for structural opportunities	David Connor, TPI; Matt Pomeroy, NeLMA; & Dana Spessert, NHLA
11:45	Lunch	
12:30	Hardwood timber mats. Intro. to North American Matting Association, standards.	Jon Fiutak, Anthony; Mike Walsh, Dearborn; Rubin Shmulsky, MSU
1:00	Matting software, beam on elastic foundation, environmental protection	Rhoen Fiutak, Anthony
1:15	Wood in Dept of Defense. Structures, trailers, pallets.	Pete Stynoski, ERDC; Grant Kirker, USDA FPL; Marcus Madison, DEVCOM; Xinfeng Xie, Michigan Tech.
2:00	Blast and ballistic resistant CLT	A. Senalik, USDA FPL
2:30	Thermally modified hardwoods	Dallin Brooks, NHLA
2:45	Wrap up	Ross / Shmulsky
3:15	Break	
3:30	Tour of FPL, Centennial Research Facility, DOD trailer decking	Various
4:30	Adjourn	
6:00	Group Dinner	

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