WOOD EDUCATION SYMPOSIUM
REPORT OF OUTCOMES
OCTOBER 2018

This REPORT was PREPARED through the joint efforts of technical committees at SEI and NCSEA, and was co-sponsored by the SEI and AWC:

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AMERICAN WOOD COUNCIL
Wood Education Symposium

PREFACE

The lack of wood engineering exposure in civil engineering programs has been discussed for the last 20 years. It is more obvious now than ever that the United States (U.S.) is lagging behind Canada, Europe, Australia and New Zealand in the use of modern wood materials for design and construction of tall and large span wood buildings. As U.S. building codes and academic research are attempting to close this gap, it becomes even more important to educate future generations of engineers in the effective design and use of wood in modern construction so that they are able to design wood buildings that meet the requirements of the building codes and can innovate and respond to demand for more sustainable solutions.

The American Society of Civil Engineers – Structural Engineering Institute (ASCE/SEI) – Wood Education Committee (WEC) recognized that wood design is undergoing significant changes due to development of new modern materials and manufacturing techniques. Structural engineers are acutely aware of the impact the selection of structural material can have on the environment. The building industry is acknowledging and embracing the contribution of the sustainable qualities of wood to reduce the environmental footprint of the project through its carbon storing capabilities and renewable qualities. Wood also offers unique solutions in situations where weight of the structure has significant impact on design, such as poor soil conditions and/or higher seismic activity. The structural adaptability and aesthetic appeal that wood brings to the project is an important architectural design consideration. Multiple tall structures using mass timber construction have been built during the last 15 years in many countries, but only now is it making its way into the U.S. Universities in the U.S. are lagging far behind their European, Canadian, Australian, and New Zealand counter-parts. Even more relevant is the introduction of cross-laminated timber (CLT) into the 2015 International Building Code (IBC) and creation of the International Code Council (ICC) Tall Wood Building Ad Hoc Committee that is investigating the viability of increasing the allowable heights and areas of mass timber construction which resulted in code change proposals for the 2021 IBC to provide for allowable story heights of mass timber to 9, 12 and 18 stories depending on assembly fire ratings, occupancy, and other safety requirements. Yet, wood engineering courses are offered at less than 50% of the Universities throughout the U.S. as opposed to 100% of the Universities offering steel and concrete courses. There is a glaring void related to wood engineering education that the committee proposed to fill.

To that end, the WEC proposed to assemble key stakeholders that were currently involved in any efforts related to improving wood engineering education to collaboratively develop a strategic plan on how to identify and effectively utilize limited existing resources for development and implementation of wood engineering curriculum. To assure successful outcomes and provide a well-rounded representation to this effort, it was important to assemble a team that represented key building industry influencers including academia, design professionals, and wood industry. Since most of the WEC represented the academic sector, a successful partnership was formed with National Council of Structural Engineers Association (NCSEA) Basic Education Committee representing the structural engineering profession and American Wood Council (AWC) representing the wood industry. A full-day symposium was proposed to coincide with the annual ASCE/SEI 2017 Structures Congress. A strong emphasis was placed on an initial draft for undergraduate and graduate level curriculum as well as identifying entities (such as, wood industry - Forest Business Network, Softwood Lumber Board, United States Department of Agriculture (USDA) Forest Products Lab and WoodWorks, private and public institutions, and practicing structural engineers) that would participate in developing materials that can be used by academics to teach the subject matter. An additional high priority was the development of a strategic plan that would help the industry to better understand current gaps and effectively assist in addressing needs for adoption of wood courses by civil engineering programs around the country, especially those currently lacking it.
# Wood Education Symposium

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INTRODUCTION

The national policies of the United States and the interests of the wood industry are more closely aligned today than ever before. National concerns related to climate change, sustainability and community resiliency are effectively addressed through the use of wood as a structural material for various components of U.S. infrastructure, including buildings and bridges. A shift to wood could be more effectively capitalized if a long-term strategic view of design and construction professionals towards improving wood education is developed and embraced. The quality and quantity of wood undergraduate and graduate engineering education has not been competitive with steel and concrete education. In the area of tall wood building designs, for instance, the U.S. wood industry is embracing new technology developed by many European countries and Canada. The U.S. building codes are beginning to catch up with new wood technologies and design practices and U.S. research in this area is showing promise. However, wood education will need to improve to address the expected increase in demand for design professionals trained in this fast growing market.

The American Society of Civil Engineers Structural Engineering Institute (ASCE/SEI) Wood Education Committee, the National Council of Structural Engineers Associations Basic Education Committee (NCSEA BEC), and the American Wood Council (AWC) are collaborating to address higher education wood engineering needs and opportunities. In June 2016, a joint committee, started specifically to explore the issue of limited availability of university-level wood design courses for engineers, began development of a strategic plan for increasing the quantity and quality of wood engineering offerings in Civil Engineering Programs in U.S. universities and colleges. In this collaboration, ASCE/SEI largely represents academia, NCSEA represents practicing structural engineers, and AWC represents the wood industry. The joint ASCE/SEI-NCSEA-AWC Wood Education Committee (WEC) met at least monthly following its formation, leading up to a Wood Education Symposium (WES) in April 2017 that coincided with the ASCE/SEI Structures Congress in Denver, CO. The WES provided an opportunity for a broader group of experts and stakeholders to meet with WEC members to help inform development of a strategic plan for increasing wood engineering education. This report of outcomes summarizes results of
the WES. It should be noted that WEC members and participants in WES are grateful for the financial support of this effort provided by ASCE and supplemented by NCSEA and AWC.

The current state of Wood Engineering Education

There is a growing trend in structural design to embrace sustainability and resiliency of structures as an overarching performance design criteria. Wood, as a renewable, carbon sequestering and cost effective resource, is an ideal material for reducing environmental cost and increasing resiliency of buildings. Additionally, due to availability of innovative products and systems, wood is now positioned to effectively compete within the tall building market segment. However, to fully realize the potential of wood used as a structural material in modern buildings, there needs to be improvement in wood engineering education for design and construction professionals. There is a clear lack of wood engineering educational courses in academia and only a small portion of professors are familiar with wood design and construction. Wood design is not a core subject in most engineering programs and availability of full time faculty with wood design expertise is limited. The consequences of these gaps in expertise and offerings result in students with engineering degrees lacking the skills to research, design, and build with wood. It limits innovation in wood design and reduces the likelihood of wood use in construction and infrastructure development.

The wood industry can take advantage of the current interest in wood design and the use of wood as a construction material by developing a strategic focus on wood engineering education in undergraduate and graduate civil, structural and architectural engineering programs.

Observations made through independent research by the NCSEA (National Council of Structural Engineers Associations) confirms that while 100% of U.S. Universities offer steel and concrete design courses, only 55% offer wood design courses. Of those universities that do offer a wood design course, often the course is only offered on a bi- or tri-annual basis. Past NCSEA structural engineering curriculum surveys also indicate that universities often combine wood and masonry design into a single course. More than half of graduating civil, structural and architectural engineering students have either no exposure or limited exposure to the proper application of wood as a structural material. Subsequently, even when wood is a viable option, the absence of foundational knowledge results in either its avoidance or improper and/or ineffective use.

The ASCE/SEI Wood Education Committee recognizes that wood design/wood engineering is undergoing significant changes with the advent of new manufacturing and construction techniques, modern materials, innovations and technological advancements. Design professionals (structural engineers and architects) are more aware of the impact of structural material selection on the environment; and they increasingly recognize that wood offers unique solutions and benefits. The building industry is embracing the sustainable qualities of wood, including its carbon storing capabilities and renewable nature.
Wood Education Symposium

Through exploration of wood engineering course availability, the WEC identified four issues and developed the following priorities for “What is Needed?” to improve engineering education.

FOUR KEY ISSUES

- The current Civil Engineering (CE) programs consider steel and concrete design as core courses while wood design is treated as either unnecessary or optional and graduate programs most often are entirely devoid of wood related education.
- There is a lack of faculty with knowledge of wood engineering. While almost every structural engineering department is able to teach steel and concrete, wood is usually taught by part-time or adjunct faculty often resulting in a lack of rigor and focus on wood engineering fundamentals.
- There is a disproportionally greater amount of steel and concrete research at major universities as compared to wood, and a majority of PhD students (future faculty) have no exposure to wood related research.
- There is currently no established mechanism for reciprocity of courses between universities.

WHAT IS NEEDED?

The proposed strategy must address all four issues in a comprehensive manner that fundamentally addresses wood engineering education through a typical civil engineering curriculum. Key components of what is needed to support success are listed below.

1. **Educational Materials:** Widely available instructor resources (such as course modules, PowerPoint presentations, creative hands-on assignments, wood samples) are needed. It would be ideal if these were free, at least to start.

2. **Curriculum Definition:** Defined topics for the minimum level of wood education for four-year and advanced degree graduates wishing to practice structural engineering.

3. **Widespread Adoption:** Wood design should be an integral part of the CE curriculum, and the available time for structural design courses should be equally divided between steel, concrete and wood. This is an approach that requires innovative thinking and a variety of approaches could be considered.

4. **Comprehensive Materials Science Education:** The aspects of wood mechanics and wood science should be covered with the same rigor as steel and concrete in construction materials courses. The content should be created for easy integration into standard material courses. Extra time (e.g., an extra unit) is not needed, just adjustments in time allocation and the material to be covered.
5. **Accessible Information:** The ability to take a wood engineering course online or via remote access from an accredited source that provides credit towards a civil engineering degree is needed.

6. **Education Beyond the Classroom:** For Universities that are unable to integrate a wood engineering course into their curriculum, an opportunity for students to obtain exposure elsewhere is needed (such as reciprocal agreements with other Universities or through continuing education programs or professional elective credits, etc.).

7. **Leadership in Advanced Degrees:** Graduate programs in wood education should be developed at strategically chosen universities in partnership with national leaders in wood education and governing wood engineering associations.

**PARTICIPANTS**

The WEC felt it vital that invited guests for the Wood Education Symposium be representative of the building industry and engaged stakeholders that included academia, wood industry, related construction industry, design professionals, government, etc.

![WES Participants](image)

Table 1. Participants in the Wood Education Symposium, April 2017

<table>
<thead>
<tr>
<th>Company/Organization</th>
<th>Stakeholder Category</th>
</tr>
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<tbody>
<tr>
<td>Simpson Strong-Tie</td>
<td>Product Related Manufacturer</td>
</tr>
<tr>
<td>Dept. of Architectural Engineering, Cal Poly State University, San Luis Obispo</td>
<td>Academia/Design Professional</td>
</tr>
<tr>
<td>CBI Consulting Inc.</td>
<td>Committee/Design Professional</td>
</tr>
<tr>
<td>WoodWorks - Wood Products Council</td>
<td>Wood Industry</td>
</tr>
<tr>
<td>Organization</td>
<td>Role</td>
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<tr>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Dept. of Civil &amp; Environmental Engineering, Cal Poly State University, San Luis Obispo</td>
<td>Committee/Academia</td>
</tr>
<tr>
<td>Dept. of Environmental Conservation, University of Massachusetts Amherst</td>
<td>Committee/Academia</td>
</tr>
<tr>
<td>Wiss, Janney, Elstner Associates</td>
<td>Practicing Engineer</td>
</tr>
<tr>
<td>College of Architecture and Environmental Design, Cal Poly State University, San Luis Obispo</td>
<td>Committee/Academia/Design Professional</td>
</tr>
<tr>
<td>Nordic Structures</td>
<td>Product Related Manufacturer</td>
</tr>
<tr>
<td>Civil Engineering Dept., Cal Poly Pomona University</td>
<td>Committee/Academia</td>
</tr>
<tr>
<td>National Science Foundation</td>
<td>Government</td>
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<tr>
<td>American Wood Council</td>
<td>Committee/Wood Industry/Design Professional</td>
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<tr>
<td>MiTek USA</td>
<td>Product Related Manufacturer</td>
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<tr>
<td>Department of Civil and Environmental Engineering</td>
<td>University</td>
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<tr>
<td>Civil Engineering Program, Montana Tech</td>
<td>Committee/Academia</td>
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<td>Canadian Wood Council</td>
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<td>Dept. of Civil &amp; Environmental Engineering, Colorado School of Mines</td>
<td>Committee/Academia</td>
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<td>Passaic Valley Sewerage Commission</td>
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<td>LEVER Architecture</td>
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<td>PCS Structural Solutions</td>
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<tr>
<td>Department of Architecture, University of Oregon</td>
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<td>LP Building Products</td>
<td>Wood Industry</td>
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<tr>
<td>USDA Forest Products Laboratory</td>
<td>Government</td>
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</tbody>
</table>

**PRE-SYMPHOSIUM MEETING**

Due to the limited time the WEC had with invited guest at the WES, it was imperative to prepare guests prior to the symposium with background information and to also gain insight and ideas from them so that the WEC could conduct the symposium more effectively. Therefore, guests were asked to participate in a pre-symposium virtual meeting with the following agenda and prior to the meeting they were provided with a Wood Education Pre-Symposium Brief (Appendix A). The agenda for the one-hour meeting was as follows:
Wood Education Symposium

- General Background Information.
- Examples of educational resources:
  - Wood
  - Steel
  - Concrete
  - Masonry
- Canadian Wood Council (CWC) Overview of Educational Efforts.
- An overview of curriculum (APPENDIX B) recommendations developed by the Wood Education Committee.
- Introduction to the structure and objectives of the April 5th Wood Education Symposium.

Following the Pre-Symposium meeting, those that could not attend were given access to a recording of the meeting. All participants were asked to complete a pre-symposium survey which also provided the WEC valuable input to more intelligently prepare for the WES.

WOOD EDUCATION SYMPOSIUM

After several months of planning and organizing, the American Society of Civil Engineers Structural Engineering Institute (ASCE/SEI) Wood Education Committee, NCSEA Basic Education Committee (BEC) and the American Wood Council (AWC) hosted the one-day WES on April 5 in Denver, CO in conjunction with the Structures Congress. The agenda for the day was as follows:

A. Introductions-Background
B. MORNING BREAK-OUT SESSION I, organized by interest (Academia, Industry and Design Professionals)
   a. ACADEMIA TRACK - Discussion topics: How do we teach wood?
   b. INDUSTRY TRACK - Discussion Topics: Industry role in wood education?
   c. DESIGN PROFESSIONALS TRACK - Discussion Topics: Vision of the future of wood design.
C. AFTERNOON BREAK-OUT SESSION II, small mixed groups
   Strategic Plan for Wood Design Education
   a. What are the commons themes and ideas across tracks?
   b. What does wood education look like 5, 10, and 20 years from now?
   c. What are some of the milestones of the strategic vision? Are these measurable?
   d. What would be the best approach to provide leadership in the implementation efforts?
D. Group Discussion – Develop Strategy
MORNING BREAKOUT SESSION:

The morning breakout session consisted of three groups: Academia, Design Professionals and Wood Industry/Related Industry. Based on the pre-symposium survey, questions were developed by the WEC for each of the three groups. Questions and outcomes for each group are summarized below.

AM Academia Breakout

A. What percentage of BS/MS students are reasonable to expect to be exposed to basic and advanced knowledge of wood design?
   a. 100% of exposure to materials with a basic understanding. This can be covered in a general Civil Engineering materials course.
   b. 60-70% of graduating Structural Engineers should be “day one” NDS proficient.

B. Curriculum - core subjects and best practices.
   Action Item: Committee should produce a high-level document recommending what constitutes “Basic Understanding” vs. “Day One” NDS ready. The document should outline the subjects and time devoted to each of the subjects. This should follow the “Core”/“Best Practices” type format. This document could be a deliverable as an “Introduction to Wood Instruction” book or a primer for “Introduction to Wood Design”.

C. What is preventing generating students with knowledge?
   a. Restrictions on academic units/credits
   b. Too few new Ph.D. faculty in wood
   c. Inadequate research funding and faculty with expertise
   d. Current regional demand and practices (some areas of the US are more receptive to wood design)
   e. Lack of exposure/excitement in wood

D. How to overcome obstacles?
   a. Bring practicing engineers into the classroom to teach wood.
   b. Change the way we teach – replace material based with structural components based (BIG IDEA). Studio Model? Modular teaching?
   c. Non-profit institution focusing on wood education and research to liaise with policy/decision makers.

E. What should the educational framework be?
   a. Treat as other courses (2 of 3): “Choose two of three: Concrete/Steel/Wood”
   b. Adjunct with experience.
   c. Competitions (ASCE).
   d. Online Courses (works great for the wood basics but need interaction in design).
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e. Maybe blended or flip taught courses.
f. Certification with “wood camp” (BIG IDEA).

F. Vision - How do you (we) envision Wood Engineering Education 5 years from now?
   b. Master’s degrees in Wood Engineering at (at least) two universities.
   c. Core level Wood Engineering online courses with support from ASCE/Industry/Practitioners.
   d. Online coupled with some on-site hands-on design (through “wood camp” certification).

AM Design Professional Breakout

A. When ranking potential new hires, what is the importance of wood design experience?

Firms are searching for individuals with the following qualities:
   a. An understanding of connection design.
   b. How materials work.
   c. How building systems function (perform).
   d. Firms will mentor new hires; project management, connections, client care/contact.

General discussion: Wood education is not critical and the necessity of wood education as a requirement for hiring is dependent upon the building sector the individual firm works in. It’s more important for hires to meet the needs of the firm. Firms will hire individuals with a bachelor’s degree, a master’s is not a requirement, but again this depends on the sector and the needs of the firms, those firms in larger cities are requiring a MS degree.

B. What type of training is completed on the job or what is your expectation for entry level engineers?

   a. Two-year program with an engineer.
   b. Paired with an engineer for 1-10 years.
   c. No formal program – expected to seek out those with knowledge.
   d. Sink or swim, should be the “go between” for engineer and (wood) fabricator, can you design around the given project.
   e. More mentoring related to functioning within an office, more weighted towards practical experience, some technical training happens along the way.
   f. Overall mentoring – office training, practical training, some technical, but start before hiring.

C. What is missing from wood education? Course Topics to meet firm needs:
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a. Connections and load path at the detail level.
b. How do materials work or behave? Wood is not isotropic.
c. How do systems function or behave? Systems approach is required.
d. Overarching systems overview, this may allow new technologies to be introduced into the curriculum, such as cross-laminated timber (CLT).
e. Composite systems.
f. History of (heavy) timber and building precedent studies (case studies).
g. Performance issues – the building is only as good as the envelope; effects of shrinkage and expansion, and knowing the question(s) to ask.
h. More specifically – stick framing, hybrid systems, CLT, glulam, composites, too much emphasis on adjustment factors ($C_D, C_r, C_M, ...$), history of wood design and construction.

D. How can the design industry help get wood education into universities / curriculum?
   a. Identify a champion.
b. Relay what is missing from the current curriculum; teach as adjuncts.
c. Develop a specialty class in wood.
d. Get into the universities – guest lecture and communicate with students.
e. Emphasize that PE and SE exams test on wood design.
f. An umbrella entity that identifies companies or individuals to review courses, interact with students, pair projects with students, develop a data base for instructor access.
g. Is there a demand by industry? So should wood be taught?

AM Industry Breakout

A. How does the group feel about the wood industry and the building market sector growth?
   a. Enthusiasm from the industry and builders and community like they’ve never seen before. We sense the demand now and recognize that integrated educational opportunities are to extend beyond light-frame-construction.
b. There’s a tremendous amount of energy and sharing this information with the media should be beneficial for dissemination of information.
c. The sustainable aspects of wood are playing a very important role in increased enthusiasm. Attributed in part to environmental and conservation organizations and others sitting at the table together.

B. How does the group feel about the wood industry and the building market sector growth?
   a. The engineered wood products (EWP) industry understands the need for growth and how important education is to the industry.
b. Sawmills aren’t as enthusiastic about education and don’t understand the benefits of it and they may not be thinking long term. Inertia can be leveraged
within the design community, with industry, and with universities to assist with this.
c. There needs to be some education and outreach with wood product manufacturers to raise awareness of the benefits to garner their support.

C. Does the group feel that Design Professionals have adequate knowledge and confidence about wood products?
a. Not entirely.
b. The wood industry needs a “push” to understand the challenge of the implications of lack of university education but there also needs to be “pull” from the design community to let industry know that there is a need for university education.
c. There needs to be more education on sustainable forestry and harvesting techniques to education designers that the forests are being managed sustainably.
d. The wood industry needs to act as one body and do outreach to general public. ReTHINK Wood?
e. There’s an economic driver that developers understand about wood buildings BUT they need to have competent designers to design buildings and higher education can help this by educating students when they’re young and more eager to learn about different building materials.

D. What are some compelling reasons why industry should get involved with university wood education?
a. There’s movement in the market toward larger buildings.
b. The need for designers to properly understand how to specify and design wood structures to prevent potential issues in the field such as durability, safety, construction, etc.

E. How can the Wood Education Committee’s recommended “core” and “best practices” draft curriculum (Appendix B) be strengthened and supported?
a. Include education on sustainability, mass timber design, filling the gap, prefabrication.
b. Rethink how we currently deliver education- structural design, fire risk management, etc.

F. Continuing education – Education software components????

G. Undergraduate programs – Holistic opportunities.
a. Design principles.
b. Basic wood design.
c. Beyond universities.
d. Continuing Education - When universities that don’t teach wood see the success of other universities and making money they will become more aware.

H. Graduate – This might be an easier lift to get wood taught as there are fewer hurdles.

I. Other thoughts:
a. Industry needs to show need and work with design professionals.
b. Opportunities to educate at the university level exist; Opportunities to educate at the high school level may be possible as well.
J. Please identify wood industry resources that are readily available which we have not identified. Does the group know of other related resources that are of particular importance? Please indicate what if any of these resources are or should be devoted to wood education (undergrad, graduate, continuing education, etc.)?
   a. Mass Media Outreach - Publicity (ReThink Wood) and new growth through sustainability concept.
K. What creative opportunities can the group think of, to facilitate interactions between the wood industry and university educators? What are some suggestions for implementation?
   a. Industry needs to show need and work with design professionals ...Possibly include G.C. & Developers (see A above).
   b. Educational Tiers.
      i. 9-12 Introduce wood.
      ii. University
      iii. Fresh graduates from college bridge gap with wood course (AWC has done these workshops).
      iv. Continuing Education (AWC, WW, etc.).
L. What opportunities do you see on the horizon? Innovative Teaching.
M. What challenges do you see in making these happen? Getting funding.

AFTERNOON BREAKOUT SESSION

While the morning breakout session utilized three groups of attendees with the same professional focus in each group, the afternoon breakout sessions consisted of five groups of mixed professions. A summary of the morning session was provided at the end of the morning session in preparation for the afternoon session to inform mixed group discussions and identify common areas of interest. Predetermined questions were provided to the five groups to discuss based on the morning session. A summary of outcomes from the group discussion questions is provide below.

1. What are the common themes and ideas across tracks?
   a. **New teaching methodology** should be explored.
   b. Don't just leave it all up to the universities. Provide post-graduate options.
   c. There should be more interaction amongst the groups going forward (academic, professionals, and industry).
   d. The lowest hanging fruit for getting wood into more universities is in the **graduate programs** (especially given the trends of M.S. as the required degree for Structural Engineers). Introducing wood (or reintroducing it) would be difficult in existing undergraduate programs because of demanding unit reductions. Focus effort on graduate programs.
   e. At some point in the finalization of the strategic plan, developers should be involved.
f. Seek ways to highlight design decisions: such as automated processes (software) where students are required to write code.

g. Develop wood modules within software.

h. Concept to transition (re-think) to a “systems” teaching model. The group as a whole recognizes the current academic pressures to reduce undergrad degree graduating credits to 120 is a significant driver and a “systems” approach may be an avenue to explore to create room for a wood course.

i. System approach seems to be a great match for A/E Programs. Since the number A/E Programs is significantly less that Engineering Programs would in make since to focus on A/E programs before tackling the larger Engineer group?

ii. Track base line and then compare results 5 years and 10 years.

i. Interdisciplinary, hands on, systems approach to teaching was generally accepted as a better way of teaching both engineers and architects with high interest in interdisciplinary approach. The systems based approach and, real world problems was generally considered a better way to teach wood.

j. The use of technology, software, 3D, BIM was envisioned as the future of design and construction and should be part of wood education.

k. Opportunity for baseline and leadership roles in education. Not all universities need to be best. It is preferred that all universities teach minimum (the minimum needs to be established). Some universities, however should be identified as in the "best" category and supported accordingly.

l. Performance focus on resilience and sustainability would be a good long term strategy and would ensure that wood systems are competitive with other systems.

2. What does wood education look like 5, 10, 20 years from now?

a. Short term

i. Consider industry/self supporting programs for training in wood engineering: both for practitioners and students. Maybe a summer program.

ii. Short “wood engineering certificate” course with multiple faculty participants - possibly 6 units. NCSEA/ASCE helps to market it. The program would be taught in a hybrid format (some in class and some on line). This is an expanded “Boot Camp” idea. The industry can use the materials developed from this endeavor as prepackaged materials for new courses to be started at other institutions.

iii. Questions are… 1) Funding for developing the materials?? 2) How does it get started, where, and by whom??

b. 5 to 10 yrs.

i. (5 year) Provide adjunct faculty with prepackaged material for wood (on line modules, HWs, exams, rubrics, etc.) similar to the Masonry society.

ii. Professional Masters in place throughout US universities.
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iii. Curriculum to be **interdisciplinary** (architects, engineers, and builders) and holistic to tell the whole story (consider more than just structural aspects ... sustainability, historical perspectives, from forest to product).

iv. Concentrate on **cost effective structures**. Create and teach details that are repeatable.

v. Offer education through **different modalities**.

vi. (10 year) Promote **more wood questions on the PE**. Folks that participated in the symposium should answer the call when it is time to write questions.

vii. (10 year) Promote **basic understanding of mass timber**.

c. 20 yrs.

i. Wood should be taught at the **same level as steel and concrete**.

ii. **Focus should be on advanced uses of wood**. Innovate, elevate and compete. Through advanced research, wood to be used in new places and applications.

iii. **Rewrite the structural engineering curriculum** and reinvent the way in which it is delivered. Materials should be taught in a more integrated way by instructing in the benefits of each material and how best they work together.

iv. 60-70% of graduating structural engineers are “**Day One**” NDS ready. Most likely this will be at the Graduate Level and thus, supporting universities to promote postgraduate wood programs is paramount to success. Wood education growth will happen sooner if engineering/design/construction in CLT’s become more prolific in the US. With this trend, the market demand with drive the research; which, in turn, will drive the education.

3. **Other thoughts:**

**University Education**

a. Wood should be become part of **Material Science Course**. Linear and non-linear behavior should be considered. Need to develop skills but just a important to **develop problem solvers**.

b. Build excitement around **wood design**.

c. **Use real world problems** that incorporate all design parameters (and associated disciplines).

d. In regards to **project based learning**; have practitioner reviews.

e. Can a University be identified as a **Champion for Wood Education**? Can Industry collaborate with a Champion University? Would a Graduate Research effort be a starting point? **Partner universities together** to create a specialized program.

f. A small working group might be one approach to begin this process.

**Supplemental Education**
g. **Boot camp** for new grads or master’s students.

**Design Industry**

h. ASCE has an initiative to **require MS before sitting for PE**. Should Wood design course be a prerequisite for sitting for PE. Would the SEBC consider wood education as a prerequisite to obtaining a SECB Certification?

**Partnerships with Industry**

i. Get beyond “word of mouth”.

j. The **relationship between Industry and Academia** – the design profession becomes a link. Design professionals specify new or current wood technologies; academia trains students to use the tech that is being used in the field.

k. Can Design Firms be used as Mentors to Students? Example program at Oklahoma a **“Reverse Co Op”** is being used. Concept is a group of students actively work on a Project for Design Firm. The Design firm is on campus at regular intervals to mentoring, reviewing and utilize Students work project for an actual Project.

l. Ask **developers** to help with funding wood courses since they are the beneficiaries.

**Further Research**

m. It was noted that only 15% of the Universities in Canada are actively teaching wood design. Therefore, the NCSEA data may not be giving an accurate **accounting of the Schools which are actively teaching wood**. (NCSEA survey did not drill down to the actual frequency of wood design being taught. Some Schools noted wood design is not taught each year; others were silent on frequency).

n. Potential Action Item is a **more detailed survey of wood education**.

o. Scalable solutions (test beds should be easily expanded).

p. WoodWorks Canada created a **tracking mechanism** for the number of touches they have and track results recording which touches lead to wood structural systems. Touch to project data can be one metric to track the growth of wood structural systems.

4. What are some of the milestones of the Strategic Vision?

a. Having **details for mainstream wood structures**.


c. Having wood design on **Professional Exams**.

d. **Acceptance of wood** in public culture.

e. Software: seeing wood addressed on **equal footing** with steel and concrete

f. **Widespread** wood education.

g. **Observe changes** in the way in which wood is taught.
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h. Currency in the material – is it state of the art? Are there adequate resources?

5. Best approach to provide leadership?
   a. Have a political champion.
   b. Educate!
   c. Industry and design officials can help authorities (regulatory bodies) acclimate.
   d. Liaise with code authorities and constructors (stakeholders in the widest sense).

STRATEGIC THEMES

At the close of the day, a small number of broad and strategic themes were identified from the discussions:

CHANGE THE WAY WE TEACH
Systems thinking, teaching and design; graduate level wood camp initiative, flipped co-ops.

BUILDING INNOVATIVE PARTNERSHIPS
Seek partnerships that are interdisciplinary, building industry involvement, research, and developers.

EXPAND PARTICIPATION IN WOOD EDUCATION
Focus on efforts that are scalable, leverage online technology, and innovative communications.

INCREASE SUSTAINABILITY THROUGH WOOD USE IN BUILDINGS
Address Life Cycle Costing, public engagement and perceptions, increase benefits of sustainability, and Life Cycle Assessment insights.

POTENTIAL NEXT STEPS

To follow on the ideas and strategies identified in the symposium, the committee’s next steps are:

- Develop report and share Symposium outcomes with participants and other key stakeholders.
- Pursue development of a Strategic and Tactical plan that builds off of the Symposium themes and ideas.
- Continue the Committee’s role as a convener for discussions of how to advance wood education.
- Schedule follow up meeting to occur at next Structures Congress with the intent to assess progress.
POST-WOOD EDUCATION SYMPOSIUM ACTIVITIES

- **Education**
  b. Possible course on tall wood construction- Cal Poly Pomona.
  c. Continued work on recommended curriculum-NCSEA BEC.

- **Industry**
  a. University Wood Design Competition-SST, SLB, AWC.
  b. Support of Wood Design Competition-NCSEA BEC.
  c. Possible strategic plan for implementation of University education-AWC.

- **Design Professional**
  a. Development of Connections Examples-Mikhail, Charles, WW.
  b. Continued work on Practitioner survey-NCSEA BEC.
Appendix A: Pre-symposium Brief

**WOOD EDUCATION PRE-SYMPOSIUM BRIEF**


**INTRODUCTION**

This brief provides context and additional information in preparation for the Wood Education Symposium on April 5th. The objective of the Wood Education Symposium (WES) is to identify and bring together carefully chosen stakeholders representing the public and private sectors of wood industry, academia, and design professionals to facilitate a collaboration to develop a national strategic plan for expanding and modernizing the wood engineering education in civil engineering programs.

**THE CURRENT STATE OF WOOD EDUCATION**

There is a growing trend in structural design to embrace the sustainability and resiliency of structures as an overarching performance design criteria. Wood, as a renewable, carbon sequestering and cost effective resource, is the ideal material for reducing environmental cost and increasing resiliency of buildings. Additionally, due to the availability of innovative products and systems, wood is now positioned to effectively compete within tall building market segment. However, to fully realize the potential of use of wood as structural material in modern buildings, there needs to be an improvement in engineering and architectural wood education. There is a clear lack of wood educational courses in academia and professors who are familiar with wood design and construction. Wood design is not a core subject in most programs and availability of full time faculty with wood design expertise is limited. These gaps result in students graduating with engineering degrees, lacking the skills needed to design with wood. It limits innovation in structural wood design, and reduces the likelihood of wood use in buildings and bridges.

The wood industry can take advantage of the current interest in wood design and develop a strategic focus on wood education by supporting wood education in undergraduate and graduate civil, structural and architectural engineering programs.

Observations made through independent research by the NCSEA (National Council of Structural Engineers Associations) confirms that while 100% of the Universities offer steel and concrete design courses, only 55% offer wood design courses. Of those universities that do offer a wood design course, often the course is only offered on a bi-or tri-annual basis. Past NCSEA structural engineering curriculum surveys also indicate that universities often combine wood and masonry design into a single course. More than half of graduating civil, structural and architectural engineering students have either none or limited exposure to proper application of wood as a structural material. Subsequently, even when wood is a viable option as a building material, this lack of understanding results in either its improper and/or ineffective use, or avoidance all together.
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The ASCE/SEI Wood Education Committee recognizes that wood design/wood engineering is undergoing significant changes with the advent of new manufacturing and construction techniques, modern materials, innovations and technological advancements. Design professionals (structural engineers and architects) are more aware of the impact structural material selection can have on the environment; and increasingly recognize that wood offers unique solutions and benefits. The building industry is embracing the sustainable qualities of wood, including its carbon storing capabilities and renewable nature.

The American Society of Civil Engineers Structural Engineering Institute (ASCE/SEI) Wood Education Committee, NCSEA Basic Education Committee (BEC) and the American Wood Council (AWC) have joined their resources to lead the development of a strategic vision that could be adopted by all stakeholders for improving wood education in university engineering programs.

SYMPOSIUM OBJECTIVE

The objective of the Wood Education Symposium (WES) is to identify and bring together carefully chosen stakeholders representing the public and private sectors of wood industry, academia, and design professionals to facilitate a collaboration to develop a national strategic plan for expanding and modernizing the wood engineering education in civil engineering programs.

SYMPOSIUM OUTLINE

To support the success of the symposium, a pre-symposium meeting will be held on March 20th to prepare participants for the discussions on April 5th.

The Pre-Symposium Meeting will provide:

- General Background Information for Symposium Participants.
- Results of the 2016 survey of Structural Engineering Curriculum and Structural Engineering Curriculum Practitioner Surveys.
- Examples of educational resources in other competing industries.
- An overview of curriculum recommendations developed by the Wood Education Committee.
- Introduction to the structure and objectives of the April 5th Symposium.

OUTLINE FOR DISCUSSION SESSIONS AT THE SYMPOSIUM MEETING APRIL 5TH

A. BREAK-OUT SESSION I, organized by interest (Academia, Industry and Design Professionals)

(1) ACADEMIA TRACT (symposium participants associated with civil, structural and architectural engineering programs in higher education institutions).

Discussion topics: How do we teach wood?

(2) INDUSTRY TRACT (symposium participants associated with manufacturing companies and industry associations supported by the manufacturing base).

Discussion Topics: Industry role in wood education?
(3) DESIGN PROFESSIONALS TRACT (symposium participants associated with organizations providing design, engineering and construction services).

Discussion Topics: Vision of the future of wood design.

COMMITTEE LEADS FROM EACH GROUP WILL SUMMARIZE DISCUSSIONS FROM EACH GROUP.

B. BREAK-OUT SESSION II in small mixed groups of Academia, Industry and Design Professionals

Strategic Plan for Wood Design Education

(1) What are the commons themes and ideas across tracts?
(2) What does wood education look like 5, 10, and 20 years from now?
(3) What are some of the milestones of the strategic vision? Are these measurable?
(4) What would be the best approach to provide leadership in the implementation efforts?

COMMITTEE LEADS FROM EACH GROUP WILL SUMMARIZE DISCUSSIONS FROM EACH GROUP

The break-out discussion sessions will be followed by full group discussion of the strategy and action items.

Following the Symposium, a report of the outcomes will be prepared and distributed to participants.

CONCLUSION

This is an opportune time for the wood building industry. The modern wood material innovations allow for solutions of wood structural systems that effectively compete with other materials in addition to offering unparalleled excellence in sustainability. The well-organized approach to wood education would significantly help the wood industry to take advantage of this opportunity. The drive towards taller and more sustainable construction with a focus on sustainability and pre-fabrication encourages growing use of wood in applications where steel and concrete have been long accepted as the default. The exposure of future design professionals to the proper wood application and design will ensure that wood will be used in projects when and where it is best suited.

Historically, wood engineering education has been viewed by most university programs as an elective instead of a core material course. Consequently, academic institutions either lack the incentive to solidify their wood engineering course offerings, and/or struggle to find qualified instructors. Similarly, engineering design professionals without a suitable exposure to wood engineering education lack the comfort level and expertise to provide contemporary, let alone innovative, wood design solutions, so they tend to specify familiar (steel, concrete) materials even for applications where wood is a better choice.

In order for wood to remain competitive in an existing building market and expand into the new markets, a strategic wood education plan with a collective vision is necessary to ensure the potential of wood as a structural material is fully recognized, understood and respected for its combination of structural beauty and engineering diversity. The objective of the Wood Education Symposium (WES) is to develop a national strategic plan for expanding and modernizing the wood engineering education in civil engineering programs.
Appendix B: Curriculum Recommendations

Engineering Education for Structural Wood/Timber Curriculum Recommendations

Structural Analysis

Core – Minimum Required:
- Application of Load Combinations
- Exposure to ASD conceptually
- Routine use of ASD in class
- Gravity & Lateral load flow (2D)

Best Practices:
- Exposure to LRFD conceptually
- Routine use of LRFD in class
- Gravity load flow in 3D

Advanced Elective or Graduate Level:
- Lateral load flow in 3D

Wood Properties

Core – Minimum Required:
- Nomenclature use in design
- Adjustment factors
- Shrinkage

Best Practices:
- Fire Design Considerations

Framing System Terminology

Core – Minimum Required:
- Stud, blocking, header, top-plate, sill-plate, ridge, hip, valley, rafter, joist, etc.

Gravity Elements

Core – Minimum Required:
- Column design (1st order analysis)
- Beam design – Solid sawn (Flexure, Shear, Deflection)
- Beam design – Glue-laminated (Flexure, Shear, Deflection)
- Serviceability limits (IBC limits, long-term creep)
- Bearing – Perpendicular to grain
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- Beam-columns (combined stresses)

**Best Practices:**
- 2\textsuperscript{nd} order effects of beam-columns
- Serviceability limits involving moisture content effects.

**Connections**

**Core – Minimum Required:**
- Nails, bolts, screws (Tabular values)

**Best Practices:**
- Nails, bolts, screws (European limit-state equations)
- Pre-engineered proprietary (Simpson Strong-Tie, etc.)
- Application of Group Action Factor
- Shear plates, split rings, timber rivets, etc.

**Lateral Elements – Shear Walls**

**Core – Minimum Required:**
- Segmented shear wall approach
- Tie downs (hold-downs)

**Best Practices:**
- Perforated shear wall approach
- Multi-story tie downs
- Computation of deflection (Story drift)

**Advanced Elective or Graduate Level:**
- Force Transfer approach
- Heavy Timber frame (Post & Beam)

**Lateral Elements - Diaphragms**

**Core – Minimum Required:**
- Shear design
- Chord elements
- Collectors (drag struts)

**Best Practices:**
- Sub-diaphragms
- Computation of deflection

**Advanced Elective or Graduate Level:**
- Diaphragms with large openings
Engineered Wood Elements

Core – Minimum Required:
  • Wood Structural Panels (OSB, Plywood) – Using tables

Best Practices:
  • Wood I-Joists – Using tables
  • LVL, LSL, OSL, PSL – Using tables/mfr. guides
  • Mass Timber – Conceptual awareness

Advanced Elective or Graduate Level:
  • Wood Structural Panels (OSB, Plywood) – Using stresses/deflection calc.
  • Wood I-Joists – Using stresses/deflection calc.
  • Mass Timber – Gravity Design
  • Mass Timber – Shear Wall Design