

# Wood+: Strategies for a Material Shift in Architectural Design

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**Our architecture program is committed to promote the use of wood as the major structural material in architectural design, reinforcing a much-needed material shift to mitigate climate change. Wood is a robust alternative to concrete and steel, sequestering carbon rather than spewing it into the atmosphere. Our region is experiencing a rapid re-emergence of the use of timber and manufactured wood structural products. Timber can be sustainably harvested and locally milled, further reducing carbon pollution in the supply chain. The development of timber construction offers an opportunity to increase our Architecture Program's commitment to addressing environmental sustainability in architecture education.**

**Our program has addressed this commitment by expanding curricular and pedagogical strategies encouraging a material shift in key courses in undergraduate and graduate curricula. This paper presents those strategies in four of our architectural design studios where a wood-focused theme inspires our students to be "future stewards to shape zero-net-carbon buildings and communities<sup>1</sup>" These strategies exemplify efforts to explore intersections between research and teaching, and partnerships between academia and industry in the United States and abroad.**

**The four architectural design studios discussed include: a third year undergraduate competition-based studio that is tied to our one-year structural systems sequence and is sponsored by a State Commission funded by the forest industry since 2012; a 400/500 level vertical studio; and our Integrated Architectural Design graduate studio where we have defined the use of mass timber as the theme for comprehensive architectural design projects that include the AIA Framework for Design Excellence (previously known as the COTE Top Ten Toolkit<sup>2</sup>); and our immersive United Kingdom (UK) Study Abroad graduate program (a spring preparatory seminar and a summer research studio in the UK) where we expanded content and pedagogical strategies on green buildings and cities to include cross-laminated timber (CLT).**

## INTRODUCTION

Faculty in our Architecture Program who teach both building technology courses and architectural design studio at University of Idaho have been collaborating since 2012 in promoting the use of wood as the major structural material as a much-needed material shift to mitigate climate change. For this paper two faculty joined efforts to document the experience of expanding curricular and pedagogical strategies in four architectural design studios and associated building technology courses at key levels in both undergraduate and graduate curricula at the University of Idaho. Carolina Manrique, an assistant professor, teaches architectural design studios and the one-year sequence in structural systems. Bruce Haglund, a distinguished professor, teaches design studios and the one-year sequence in environmental control systems. This paper also builds on previous publications with Professor Emeritus Diane Armpriest.

## WOOD IN THE PACIFIC NORTHWEST AND AT THE UNIVERSITY OF IDAHO

The focus on wood-themed studios in our Architecture Program has evolved due to interests of individual building technology faculty, the informal collaborations between them due to common topics, and program curriculum changes aimed towards integration of building technology courses with design studios at key levels in our program.

**Sustainability & Wood:** Two topics connect our teaching of building technology courses and promoting the use of wood in our architectural design studios:

- Foremost is the importance of inspiring our students in sustainable design approaches so they become "future stewards to shape zero net carbon buildings and communities."<sup>3</sup> We recognize the use of wood is a robust alternative to concrete and steel, sequestering carbon rather than spewing it into the atmosphere.
- The second topic of interest is tied to the rapid re-emergence of the use of timber and manufactured wood structural products in our region. Timber can be sustainably harvested and milled locally, further reducing carbon pollution in the supply chain.

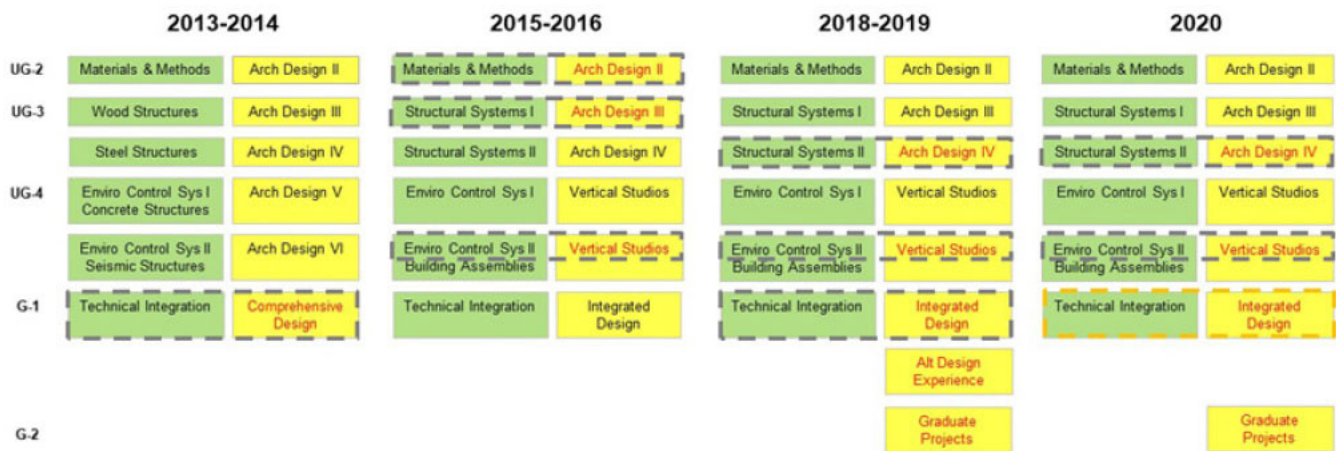


Figure 1. Design and building technology curricular diagram illustrating: (1) areas curriculum where intentional links have been made between building technology and design in new or revised courses (dashed lines). The yellow dashed lines mark an integration done only in one of the sections. (2) Highlighted in RED the design studios with wood as the theme. Adjusted and expanded from Armpriest & Manrique (2017).<sup>7</sup>



Figure 2. Expanding pedagogical strategies for strengthening them-base design studios: wood as the theme (material shift). Updated and expanded from Armpriest & Manrique (BTES 2017<sup>10</sup>), Manrique (BTES 2019<sup>11</sup>), Manrique & Haglund (RS 2019<sup>12</sup>).

Cross-Laminated Timber (CLT) construction is an emerging technology in the Pacific Northwest highlighted by Kattera’s 2019 opening of a state-of-the-art mass timber factory in Spokane Valley, WA, less than two hours away from our campus in Moscow, ID. The Catalyst Building, located in Spokane, WA, became the first project constructed with CLT panels from the new Kattera factory.<sup>4</sup>

At a local level, the University of Idaho is a U.S. Land Grant University with programs in Architecture, Engineering, and Renewable Resources. These programs have contributed to the development of several engineered wood structures on our academic campus. An important example is our main sports facility completed in 1975 known locally as the

Kibbie Dome. This trussed arch structure was designed by architecture alum and inventor Art Troutner, who promoted the idea of poetic engineering—“design that demonstrates structural understanding, structural clarity, and expressive structural form”—an idea that has since been embodied in our Architecture program mission.<sup>5</sup>

The University of Idaho is currently in the construction phase of a new arena that “is seen as an opportunity to work with the forest products industry within the State of Idaho to examine and explore the use of wood and engineered wood products that are being used in a unique and innovate manner.”<sup>6</sup> This on-going case study (estimated to be open in Fall 2021) is being used during design and construction stages as a learning



Figure 3. Arch553 Comprehensive Design Studio - IFPC (Fall 2013): Integrated Research and Innovation Center (IRIC) at University of Idaho in Mass Timber – 1st Place IFPC, Faculty Bruce Haglund’s first studios promoting Mass Timber (student Kevin Nobel, 2013) in Haglund (2013<sup>5</sup>).

laboratory for students in architecture, engineering, and natural resources. In our architecture program we have engaged our students in both graduate and undergraduate programs with its architectural designers from Opsis Architecture,<sup>8</sup> and more recently with a construction visit (focused on the structure) hosted by Hoffman Construction Company.<sup>9</sup>

#### **EXPANDING & INTEGRATING THE CURRICULUM: MATERIAL SHIFT**

The development of timber construction offers an opportunity to increase our Architecture Program’s commitment to environmentally sustainable architecture education.

Figure 1 highlights key points in our curriculum where integration between building technology courses and architectural design studios have been implemented (marked in dashed lines), and where the “Wood” theme has been explored (highlighted in RED).

#### **EXPANDING PEDAGOGICAL STRATEGIES: MATERIAL SHIFT**

In addition to expanding and integrating our curriculum, the initiative of merging building technology topics related to sustainability, construction and structures with wood as a theme provides opportunities to expand “exemplary approaches, lessons and activities,” organized as pedagogical strategies, in four of our architectural design studios. The matrix in figure 2 summarizes the complex array of strategies and tactics we employ to meet our pedagogical goals.

#### **The Idaho Forest Products Commission (IFPC) Wood Competition in ARCH553**

The IFPC architectural design competition, one of our most important collaborations with industry, started in 2012 in our Comprehensive Design Studio (now known as Integrated Architectural Design) with the leadership of Professor Emeritus Diane Arm Priest who retired in 2019 and also taught our construction courses (Materials and Methods, Building Assemblies, Technical Integration, etc.).

The purpose of the IFPC architectural design competition “is to encourage, recognize and support the creative and innovative use of Idaho wood in architectural design”<sup>13</sup>. An example of student work for our second IFPC competition (Figure 3) in 2013 explores developing a comprehensive design alternative in mass timber to the proposed schematic design by NBBJ for the Integrated Research and Innovation Center (IRIC)<sup>14</sup> at the University of Idaho.

Highlighted Pedagogical Strategies include:

- *Developing and expanding external collaborations:* Continuity with a second edition for the IFPC architectural design competition started in 2012. This collaboration has continued until today with more recent editions occurring in our undergraduate program.
- *Developing and expanding internal collaborations:* In 2013 one of Professor Bruce Haglund’s first studios promoting Mass Timber and was developed in collaboration with Professor Diane Arm Priest who taught the Technical Integration course that year.
- *Applying and developing metrics from building technology courses in design studio:* The comprehensive design studio addressed Carbon Accounting to evaluate the impact in the use of wood as a material shift.

#### **Integrating Structures Lectures and Design Studio (ARCH361/362 & ARCH353/354)**

In 2015 our IFPC wood competition was moved in our curriculum to first semester third year in our undergraduate architecture program, paired with the long-standing Idaho Concrete Masonry Association Competition (ICMA, 50th Edition in Spring 2020), and linked to the one-year Structural Systems course sequence.

This integration started in the first semester of the third year as a gateway for students continuing from second year in our four-year B.S. Architecture degree. Students at this level enter the third year from several paths (e.g. transfer students) which includes in recent years a very successful summer Bootcamp



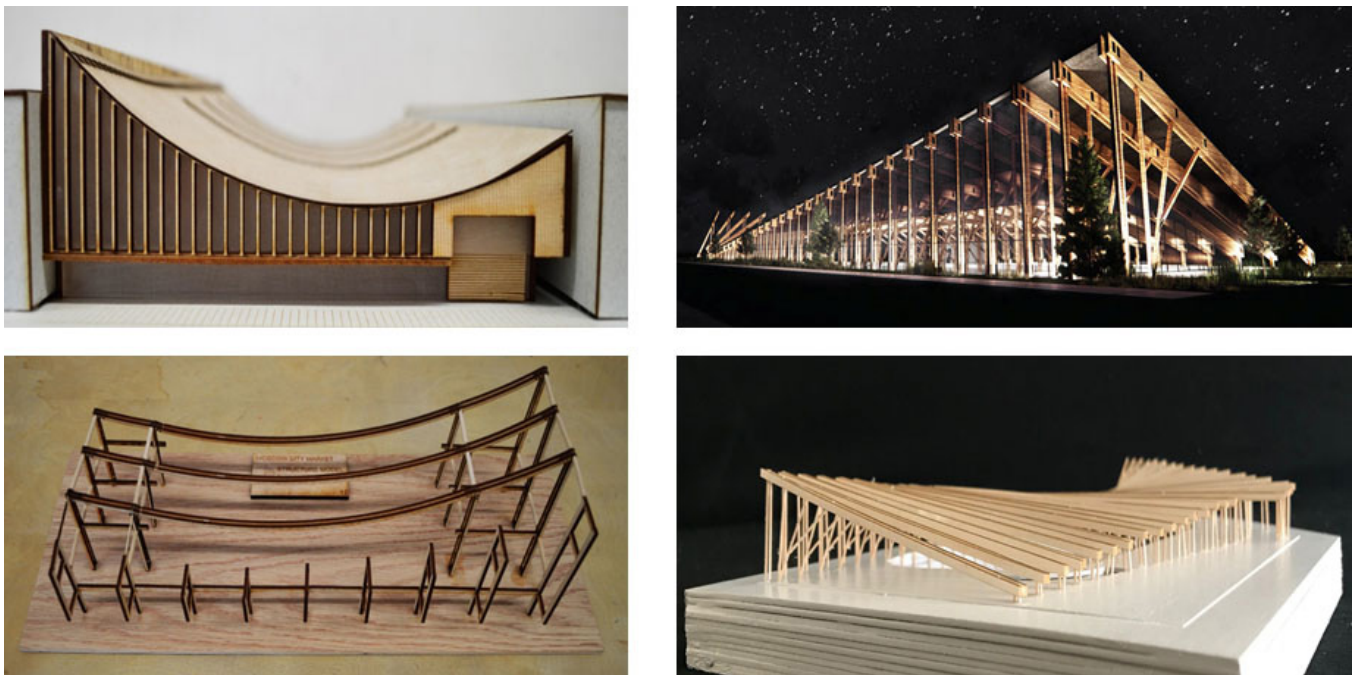


Figure 4. (left) Arch353 Architectural Design III – IFPC first place (Ehly, Fall 2015); (right) Arch354 Architectural Design IV – IFPC third place (Lempesis, Spring 2019).

“a program specifically designed to give advanced standing in the University of Idaho architecture program to those with bachelor’s degrees in other disciplines, transfers from other programs, and for those with community college AA and AS degrees.”<sup>16</sup> The integration of the IFPC architectural design competition in the first semester of the third year exposed challenges that suggested moving it to the spring semester. The need for more general design instruction in the first semester of the third year to accommodate all the different qualifications students have due to their variety of paths to enter our program. The move also accommodated the need for a previous structural systems’ course rather than the simultaneous introduction of structural concepts while challenging students with two fast paced material-themed architectural design competitions (ICMA is 8 weeks following by IFPC in the second 8 weeks of the semester).

In 2018 we moved our ICMA and IFPC architectural design competitions studio to the second semester of the third year with students more prepared in design process and for improved integration with the structural systems sequence.

Highlighted Pedagogical Strategies include:

*Developing and expanding internal collaborations:* Between 2015 and 2018, the two-faculty coordinating the two sections in our ICMA & IFPC architectural design competition studio collaborated in all aspects of the course. In 2019 an increased enrollment required the addition of a third section, so we added a new faculty to our coordinated team and

continued with the approach on collaborating in all aspects of the course. In 2020 we added a fourth section and agreed on coordinating main activities (e.g. guest lectures, judging and awards ceremonies, deliverables in key dates such as mid-reviews and final reviews) yet allowed independence for each faculty’s unique approach. The increased number of sections and faculty challenged the tight coordination in previous editions when only two faculty collaborated, but we were able to find middle ground to achieve a cohesive experience for all 52 students. Furthermore, including faculty from other areas (e.g. design fundamentals and architectural theory) provided stimulating opportunities to strengthen an emphasis in poetics of construction and reaped important contributions such as using a single project for the both competitions rather than a different one for each. We were further challenged by the sudden shift to online delivery due to COVID-19 in the middle of the spring semester.

*Developing and expanding external collaborations, stimulating activities and embracing opportunities with online communication tools:* The collaboration with IFPC has connected our faculty and students with architects and local industry involved in the use of wood in architecture through field trips, lectures, and events. Field trips have included the Idaho Forest Group Lumber Mill in Lewiston, ID (built in the 1920’s and “one of the first large mills in the region”<sup>17</sup>) and Forest Tours to the University of Idaho Experimental Forest. Our IFPC judging and awards luncheon typically has as guest architects involved in key projects in wood such as Chris Patano from Patano Studio Architecture designer of the University of Idaho Reveley



Figure 5. (left) Arch553 Integrated Architectural Design, BTES 2019 Student Award (Florence, Fall 2019); (right) Arch556 Graduate Project (Doan, Spring 2020) published in *Archinect News*.<sup>24</sup>

Classroom Building (Franklin H. Pitkin Forest Nursery<sup>18</sup>) invited to our IFPC 2015 edition, and Alec Holser and Chris Roberts from Opsis Architecture, design architects of the University of Idaho's new ICCU Arena<sup>19</sup>, invited to our IFPC 2017 edition. Both projects constitute campus showpieces at University of Idaho that promote the use of Idaho wood products.

*Expanding internal collaborations:* We expanded the networks to develop new external partnerships and opportunities. Major contributions to enhance the experience for our students came out of a partnership with faculty from the School of Design and Construction at Washington State University (WSU), located 7 miles west of our campus.

This partnership, referred to as "Wood+," has the objective of collaborating "on a multi-faceted exploration of wood in design and construction"<sup>20</sup> that included planned joint activities such as lectures with key guests in architecture design with wood, a tour to the Washington State University (WSU) Wood Lab, and a tour of both the Katerra factory and the Catalyst Building in Spokane.

Even though each school conducted a separate sponsored design competition (WSU's graduate studio architectural design competition was sponsored by Katerra and University of Idaho's undergraduate architectural design competition was sponsored by IFPC) and all our programmed fieldtrips were cancelled due to COVID-19, students and faculty from both institutions benefited with an enhanced experience including online lectures via Zoom by Kiel Moe (Architecture Chair at McGill University<sup>21</sup>) and Thomas Robinson (Lever Architecture<sup>22</sup>). With the online resources we started to use actively due to COVID-19, we were able to connect far more students, faculty, and guests to our

original IFPC annual events. Our final reviews for the IFPC competition included 25 architect guests from different locations in the United States and Canada connected via Zoom.

In order to take these initiatives beyond our individual course, we have increased our presence on social media platforms to share the experience and celebrate our students' achievements with other students and faculty in our Architecture Program, College, and University. Furthermore, this increased presence has allowed us to involve the Alumni community and the network of Idaho architectural firms that support our program.

*Expanding references, introducing design thinking to building technology courses integrated with design studio, and coordinating content from building technology courses in design studio:* Integration between the one-year Structural Systems sequence and our IFPC-sponsored architectural design studio competition is strengthened by the assignment of relevant precedent studies that encourage students' exploration of wood as the main structural material in our long-span design challenges. For our IFPC competition we have used a variety of building types located in Idaho that encourage long-span with wood solutions such as Markets in Moscow and Lewiston, a Library branch in Boise, an Ice Rink in Moscow, the University of Idaho Basketball Arena in Moscow and the Moscow-Pullman Regional Airport (PUW). A recent change (Spring 2020) included using the same design challenge during the whole semester for both our ICMA (concrete masonry units and structural steel) and IFPC competition (mass timber). Normally we had two completely different design challenges for each 8-week competition during the semester. With this change we were able to address site analysis and programmatic studies at the beginning of the semester with the

ICMA competition, which allowed expanding the IFPC competition to push forward more advanced work in exploring the use of mass timber.

#### **Wood in vertical studios ARCH454/554**

Since his first studio promoting the use of Mass Timber in 2013, Bruce Haglund has continued with a mass timber emphasis in his vertical studios with projects that focus on developing other's schematic designs or proposing adaptive re-use of buildings. His studios focus on applying and developing metrics introduced in his one-year Environmental Control Systems courses supporting design decisions.

We see these vertical studios as bridge between the required third-year studio and the required graduate integrative studio. Vertical studios are elective in that students preference for instructor and content. The studio mixes undergrad and graduate students with varying academic backgrounds—all have had the structures sequence, some have had or are taking the environmental systems sequence. Because of the variety of preparation, group projects are used to take advantage of peer-to-peer learning and a diversity of skills.

#### **CLT in the UK Study Abroad Program (Green Buildings)**

One of the most comprehensive explorations in the pedagogical strategies listed is the United Kingdom (UK) Study Abroad Program. Bruce Haglund has been teaching this summer research studio in the UK and its preparation seminar since 2006 with a focus on Green Architecture. We included research and design with CLT in our collaborative 2019 course.

During the research studio in summer, students were required to visit, record, analyze, and critique at least four discovery experiences including a selected CLT case study.

"Expanding references for learning from wood during the research studio in the UK included organized visits to key architecture buildings and a two-day construction experience." Stimulating activities such as designing and learning from wood and innovative CLT Design included organized visits to architecture and engineering offices. Three CLT-savvy London architectural firms hosted our one-day charrette on designing a green alternative to the annual Serpentine Pavillion. Prior to the charette all the students visited the architects' offices and at least one of their CLT projects. For example, one of the three offices, Groupwork, are the designers of Barretts Grove (2016), a six-story residential project in Pure CLT with exposed load-bearing structural walls and roof panels.<sup>23</sup>

#### **Wood in ARCH553 Integrated Architectural Design**

In 2018 wood reemerged as a theme in our Integrated Architectural Design studio. One of our students, won the Building Technology Educators' Society Student Scholarship Award in 2019 with his work exploring wood in façade and structure components (Figure 5 left).

This theme-based studio approach provides an opportunity for introducing Mass Timber to our international students in their first Master of Architecture design studio experience, connecting them to current developments in the Pacific Northwest.

A design challenge approach has been used in some Technical Integration editions coordinated with their work in the Integrated Architectural design course, encouraging explorations between architectural technology and design process through detail studies. These two courses are corequisites.

#### **Wood in ARCH556 Graduate Project**

We are also starting to see the interest in selecting Mass Timber as a theme in some of our students' graduate projects inspired by their experience in previous wood theme-based studios. In a project by one of our international students working with Professor Bruce Haglund, we see an approach of connecting the use of mass timber to sustainability and well-being design goals (Figure 5 right).

#### **CONCLUSIONS**

Since 2015 our Architecture Program has engaged in the redesign of the curriculum rethinking the integration of design studio and building technology courses.<sup>25</sup>

Through a series of collaborations among three faculty teaching building technology and architectural design courses we have been documenting the pedagogical strategies implemented in our integrated courses. Documenting these efforts becomes a priority due to the turnover in faculty and representatives from each of our partnerships. In 2019 one of our three collaborating faculty retired as did the IFPC Director who had worked with our Architecture Program since 2012.

Furthermore, this exercise has led us to identify opportunities for sharing resources during this fast-evolving mass timber trend in the United States and Canada, has increased our points of convergence as common themes emerge that suggest new explorations, and has provided integrated support from different building technology lenses to our students, increasing their interest in the use of wood in architectural design.

As our collaborations increase in complexity due to expanded or new partnerships, and as higher enrollment requires adding more sections in each of our studios, we have identified some areas we need to improve, such as expanding references on poetics of construction to strengthen the theoretical framework for exploring the use of wood in architectural design.

We see the process of documenting these pedagogical strategies as providing a baseline to build-on our current experience and network.

As we move forward, this baseline provides initial parameters for developing a framework to assess learning outcomes



focused on continuous improvements, and to identify our possible contributions in growing discussions and initiatives in Schools of Architecture around curriculum, pedagogies, and research in mass timber.

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