Constructs of Local Knowledge: Utilizing Local Material Streams for Community Based Projects

NICHOLAS BRINEN
James Madison University

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Between 2020-2022 supply chains saw delays and scarcity, especially in the realm of building and construction materials. Years before the 2020 pandemic disrupted economic systems, public agencies in the eastern half of the United States were, and still are, battling the pandemic of the Emerald Ash Borer (EAB) and its infestation of the ash tree species. Today EAB infestations have been observed in 36 states. While the total number of ash trees removed in the US is incalculable at this point, Michigan has recorded 30 million felled trees so far due to EAB infestations.[1] This pest has quickly become one of the most damaging insects to ascend upon the landscapes and streetscapes of the United States (see Figure 1). The removal and processing of the infested trees also poses an immense economical cost to the public. And yet, a larger subsequent question looms, what to do with the logs from the felled ash trees? Because of the absence of a clear alternative pathway for this valuable and viable building material, the wood is typically treated as waste and slated for a landfill, mulch, or firewood. In total, the labor, equipment, and energy used to dispose of ash logs signify inefficiency and lack of resourcefulness.[2] However, by studying businesses in storm prone areas that view damaged trees as a resource, the efforts of design-build programs can route this material stream to reconnect it with local communities and public agencies.

There is a long-standing historical practice and tradition of using felled trees from storms, riverbeds, or disease as a way of honoring the tree's previous life and service. There are companies nationwide that are dedicated to this sole practice, usually seeking out what is considered high quality wood, for example cypress or heart pine, to use in high end construction or furniture making. This practice has numerous benefits such as freeing up water systems and habitats, expediting storm cleanup, and reducing clear-cutting or similar predatory practices of deforestation. Another resourceful practice was the use of reclaimed barn wood. This model was structured around someone finding, then dismantling a barn, fence, or old building and reselling the reclaimed material at a higher cost. This was an excellent way of giving the wood a third life and keeping the embedded carbon intact, while feeding a circular economy through architects and designers.

These practical and inventive waste-to-wood models create an antecedent methodology for similar applications with pest-infested wood. The challenge for recreating this paradigm with a pro bono approach is establishing a replicable model that links pest-infested wood supplies with a robust network of community needs, public agencies, and academic institutions. These constituents are the key components for creating a blueprint to divert the EAB infested wood towards public projects.[3] Our first proof-of-concept project to establish such a blueprint involved three specific components: pest-infested ash wood supply, third-year architecture students in a design-build studio, and a willing community-based client with a viable project. In Fall 2021 before the spring's design-build project began, two curricular activities were occurring simultaneously, one in the classroom and one outside of the university.

The first in-class activity was teaching our future design-build students in their Materials and Methods course and discussing the histories of wood construction, hands-on traditional joinery techniques, and most importantly wood's renewable properties and the growing success of mass timber construction. Paralleling the reclaimed wood trend in the early 2000's, mass timber has had tremendous growth and utilization in the architecture and construction industry. This topic is covered

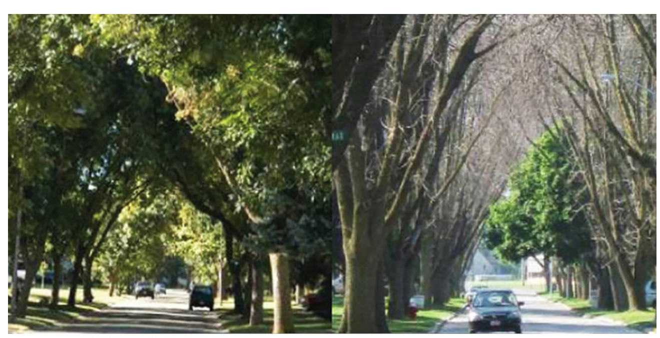

Figure 1. Toledo Street Before and After EAB. Dan Herms, OSU

Figure 2. Apex Building under construction. Virginia Dept. of Forestry

Figure 3. Student made hardwood-CLT sample. Nicholas Brinen, JMU.

in the course and there was a class trip to a construction site where they had the opportunity to see exposed cross laminated timber (CLT) and glulam members connected (see Figure 2). Furthermore, they learned that CLT goes beyond the lifecycle of the building. Normally, when a building's use comes to an end, it is demolished, and the material is trucked to the landfill. However, mass timber members are prefabricated and assembled in thoughtful and designed ways, so they can be disassembled and find another life in the marketplace of wood.[4] The growth of mass timber methods in the US is still young and the dominant variety of tree species remains narrow with softwoods. Thus, optimization has occurred in the developing products that incorporate small amounts of glass, fibers, steel, or concrete to the lamination process.[5]

This hybridization with other material industries is no surprise outside of the academic realm, but in academia question-seeking occurs in lieu of problem-solving. So, with some ash wood scraps obtained from a local woodworker, the class was challenged to mockup and prototype samples of CLT, but with the discarded ash (a hardwood) in conjunction with softwoods (see Figure 3). After empirical comparisons with manufactured CLT samples, several advantages became obvious. The first was density and porosity. Ash wood by nature is an extremely dense hardwood, preventing less absorption of moisture than softwood. This also became apparent as the students tried to stain the ash, without success. In this failed attempt at staining, they realized the high contrast wood grain has aesthetic beauty when left natural, much like olive wood, to which ash is closely related. Lastly, the students realized they needed much more in the way of testing, such as point-loading, bending, and delamination. All of which went beyond the scope of the course. However, several of these students are continuing the research and development of hybrid samples with local partners and manufacturers. Dr. Federico Savini, who specializes in the milieu of environmental planning, institutions, and politics could describe this trajectory as a challenger to "linear based production and consumption models" by initiating modes of circular economy where minimizing waste and industrial symbiosis are championed goals.[6]

While the Materials & Methods course covered aspects of wood and future use, I was also engaged with the "outside activity" of locating pest-infested lumber and a willing community-based client. By contacting the local Public Works Department, I learned they had approximately eighty rough sawn and kiln-dried 1x10 inch ash boards, a hardwood, each measuring eight to ten feet long. They were eager to have a larger ongoing relationship with the university and were delighted to donate the lumber knowing it would be used in a design-build studio. As a result, they generously delivered this lumber supply within the same week as our initial inquiry, which also helped to make space for incoming supplies of felled logs. In addition, they set up a mobile milling demonstration and presentation for the design-build students, sharing how

Figure 4. Milling demonstration with students. Steve Aderton, JMU.

agencies are containing the infestation and processing the felled trees (see Figure 4).

The next essential component for the proof-of-concept project was to establish a community partner willing to work with students towards a project of appropriate scope and benefit. During my search for materials, I learned of a nearby occupational therapy clinic associated with our university, which serves children and teens in the local community. The children primarily underwent pro bono occupational therapy to rebuild fine and gross motor skills that have been lost from injuries or disabilities. The therapists utilized bicycle repair as an activity to aid the young patients in strengthening their fine motor skills. However, this activity took place in a parking lot where the participants were exposed to elements. They had nothing in place to hold the tools, provide shade, mount the bicycles, or sit comfortably during the therapy sessions of bicycle maintenance. After speaking with the clinic administrators and volunteers, their excitement towards the prospect of a mobile structure that could support and foster this activity meant that the final pieces, a willing client, and a project typology, were both dedicated and committed to our design-build studio.

The design-build methodology for the studio and pilot project positioned the students as designers, carpenters, fabricators, and composers to act as facilitators between the design factors and materials applied in the project.[7] In Spring 2022, the students worked with the teaching administrators of the clinic,

Figure 5. Dimensioned lumber by students. Nicholas Brinen, JMU.

but they also needed to tend to their dried, rough sawn lumber supply, which meant honing the art of surface planning and dimensioning uniform pieces. Only then could they produce a quantity survey and effectively design and build the project. Furthermore, the students developed a deep appreciation for each precious piece of ash shaped throughout this process (see Figure 5). They also developed a deeper understanding of the brittle hardness of this wood's density and that pilot holes would be needed for every fastener. Noting the resistance of this characteristic also allowed the students to borrow from their previous semester's introduction to joinery and employ those techniques (see Figure 6). When they finally completed this arduous task of lumber shaping, the students designed a

Figure 6. Student fabrication. Nicholas Brinen, JMU.

Figure 7. Project in closed position. Nicholas Brinen, JMU

Figure 8. Project in open position. Nicholas Brinen, JMU.

PROJECT

10’x12’ mobile structure that hinges open to create a comfortable and functional place to work on bicycles. The design strategy was based on a Swiss Army Knife: a singular construct that could pivot open to unfold and perform several duties, such as tool storage, bike storage, working surfaces, and shade (see Figure 7, Figure 8). The students presented variations of this concept and spent the semester confronting the space between question and solution, decision-making, and inventiveness (see Figure 9).[8] Needless to say, the completed pilot project was a success and is currently being used for bicycle repair sessions.

The completion of this project set into motion a circular framework of partnerships that is still expanding. Due to some attention and publicity from the community, this pilot project activated a viable route for the stream of ash wood to benefit community projects and pedagogical learning outcomes for the students. With grant funding beginning to ramp up, future studios and projects are being planned with public agencies and community partners. In addition, the grants are enabling student researchers to further develop our partnerships between the public works department, the department of forestry, and local manufacturers in the development of hardwood CLT products that incorporate pest-infested wood. Such an endeavor would champion a circular economy, increased building performance, carbon solutions, student participation, diverse replanting of urban forests, and a viable pathway for EAB infested wood and other secondary wood resources.

Figure 9. Presentation with clinic administration. Nicholas Brinen, JMU.

Figure 10. Student construction. Nicholas Brinen, JMU

ENDNOTES

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