Design-Build: Models for Expanded Impact

Across the United States, Design-Build studios broadly adopt the pedagogy of a single project for a single client, designed and built by student labor. These projects are accomplished through a mix of traditional and digital construction methods, and often result in meaningful personal experiences, and increased visibility in the community for the architecture school. However, with so few projects, Design-Build studios have limited impact on the built environment.

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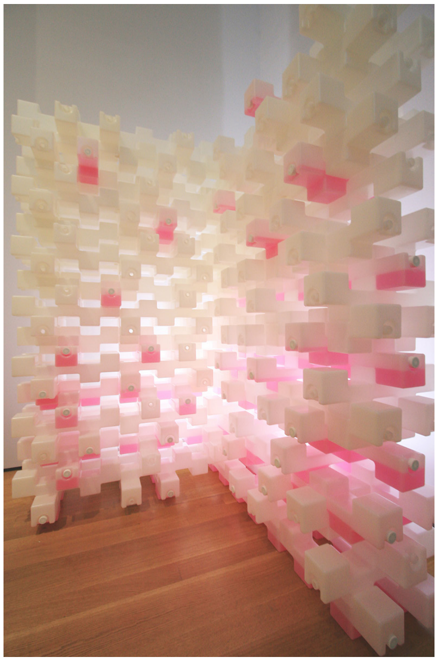
Nor do these projects often interrogate the basic relationship between design and building in academia. How might one look at different pedagogies that embrace more wide ranging implications for Design-Build? Is there a way to rethink Design-Build so that it probes the relationship of architecture design and construction? This paper presents several models currently used in critical practice that could be adapted to academic Design-Build studios to create broader impact within the built environment.

The first model investigates the model of product design. A project would start as a prototype designed by students which could then be manufactured in a factory and constructed on location by the client. By using this model, many of the same projects could be built concurrently, impacting a larger client base. In particular this model would be relevant for emergency housing. Precedents include Kengo Kuma's Water Branch House and Ikea's refuge shelter. Kengo Kuma's Water Branch House is constructed from an assembly of containers, all of the same design. The containers are filled with liquid to provide both stability of the structure and a clean water source. Ikea's refuge shelter builds upon the technologies Ikea has developed to facilitate home-assembly of furniture into a resource for emergency conditions. The flatpak technology developed by Ikea creates an easily shippable product; the visual language of assembly instructions developed by Ikea easily translates in any global emergency location, including being understandable to those who are unable to read; finally Ikea's standardized connection details, and patented hardware assume assembly by unskilled labor. Rocio Romero's model for construction of the LV home could also serve as a model. Relying upon local labor, Romero provides detailed instructions on construction, a prefabricated kit of parts, and a list of materials that must be purchased directly (such a kitchen cabinets). This methodology allows Romero to provide what is most effectively prefabricated, and to allow local contractors to supply what is most effectively sourced locally.



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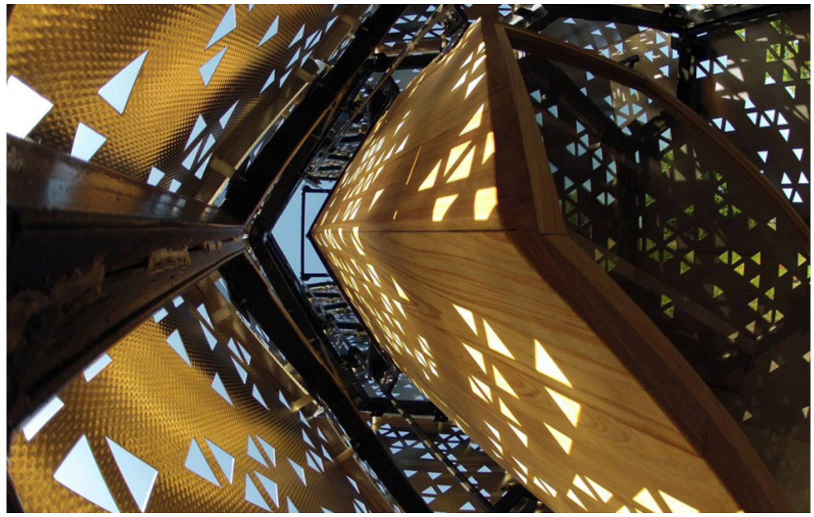

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To develop coursework based upon mass production, however, requires direct interaction with fabricator(s) and a dedicated infrastructure for collaboration within the broader design curriculum. For example, in Julie Tolvanen's furniture design courses at Washington University in St. Louis (2001-2006), students worked directly with local St. Louis fabricators to design constructible furniture. Instead of students focusing upon crafting the furniture themselves, they learned to communicate with the fabricators through drawing, and discussion. With access to advanced equipment, beyond the scope of the digital fabrication and analog tools available at the time in the architecture school shop, and an ability to talk directly to tradesmen, the students accessed the knowledge of the workmen to develop their ideas into realized projects that fully utilized the capabilities of the fabrication equipment. Students also learned how to communicate their design ideas to a range of audiences, from shop drawings for fabricators, to design drawings for instructors, to presentation materials for clients.

A second methodology teams universities with manufacturers of products and materials. Students work with a manufacturer's product line to envision new applications, or to develop altogether new product lines. This model has currently been adopted by a range of manufacturers in collaboration with established architecture firms and designers. For example, Kieran Timberlake collaborated with DuPont to develop the SmartWrap™ skin, a prototypical material envisioned for lightweight construction. This product was showcased through its launch in the Cellophane House™, developed for the Home Delivery exhibit at MoMA in 2008. Zahner also collaborates with individual architects and designers to realize the designers' vision, and then they patent the advances required in manufacturing as new "product lines." For example, Zahner and ABI (Adaptive Building Initiative: Chuck Hoberman and Buro Happold) collaborated to develop the Tessellate™ product line. Utilizing a series of screens that move in relation to one another, Tesselate™ provides constantly varying pattern and changing lighting conditions. Zahner then worked with Worksbureau and ABI to incorporate this new technology with Zahner's other patented fabrication techniques to create a hybrid assembly for the KAFD men's and women's portal spas. The result was a cladding system that served the designers vision, while at the same time investigating applications for Zahner's new product line.

Figure 1: Photo courtesy of © Kengo Kuma, *Water Branch House*

Figure 2:Photo courtesy of © University of Buffalo School of Architecture and Planning, *B[ee] Tower*

Similarly, a range of manufacturers have worked in collaboration with academia to encourage students to experiment with materials re-envisioning how they might be used. For example, students from Parsons worked with Xorel, manufactured by Carnegie Fabrics, to design an installation for the International Contemporary Furniture Fair in 2012. In that project, students used digital techniques to model and cut out the units, developed detailing, and completed installation. As another example, Rigidized Metals teamed with University of Buffalo to design and construct projects such as 3xLP and B[ee] Tower. These projects have found new applications for Rigidized's metal plate product lines, exploring the structural capability of the materials. Through communication with tradesmen, and utilization of digital fabrication tools located at the university, students bridge between more traditional fabrication processes and digital advances. In both of these examples, fabrication occurs at the university. Zahner provides a final example. In 2009, Zahner collaborated with Virginia Tech University to develop a metal screen for the solar decathlon house, introducing students not only to Zahner's material product line, but to their digital modeling system, and manufacturing capabilities. While Zahner has not marketed the screen as a new product line, the collaborative design exhibited how Zahner's fabrication methods could be used in relation to energy modeling to create screens optimized for shading. For each of these cases, the collaborations have the added benefit of introducing the students, who will later be practitioners, to the product lines of these companies and their fabrication capabilities.

The last pedagogical model incorporates the craft of skilled tradesmen with the design ability of students. By engaging in a problem solving methodology, normative building practices are sidestepped, and a creative model is encouraged. Students could work with local contractors, or nationally recognized sub-contractors who have experience with world class architects. These specialized contractors could include companies like Gate Precast, the precast concrete contractor on Thom Mayne's Perot Science Center, and Rudolph/Libbe, the glass installers for the Toledo Glass Pavilion by SANAA.

A one credit course held in conjunction with a colloquium on the construction of Tadao Ando's Pulitzer Foundation for the Arts provides a good model for this methodology. Taught by Steve Morby, construction superintendent for the Pulitzer Foundation for the Arts, and Eric Hoffman, professor-of-practice at Washington University in St. Louis, this course was designed to be collaborative. Students completed precedent analysis on the building, and then spent roughly half of the class time pouring a concrete corner of the building. By interacting with Steve Morby on the pour, students learned each of the steps in the process and how to maintain quality during those individual steps. Steve Morby states "We walked them through seals and gasketing, learned the hands on of the concrete, tying rebar – saddle ties, lap ties….They got down and dirty. They were very involved... When the forms were coming off I was listening to the students talking amongst themselves and they were calling the holes in the concrete bug holes, so that told me right there, three sessions ago someone listened to what I was saying and they were beginning to talk concrete. They could look at the walls and see where they needed to vibrate longer…" Brooke Helgerson, a student from the class, comments "This was a very particular way of making concrete, so all of the details, once we got into the shop, were supporting that end, and that level of precision, while still allowing students to put the formwork together. No book could tell us the specifics of what (Steve Morby) knew – especially how long to vibrate, or how exactly the forms came together. During the class, I never really thought of (Steve Morby) as a contractor but more as an artisan, a craftsman…"

By engaging tradesmen as partners in Design-Build, students can achieve in depth knowledge of a specific material, larger projects, and more complex installations

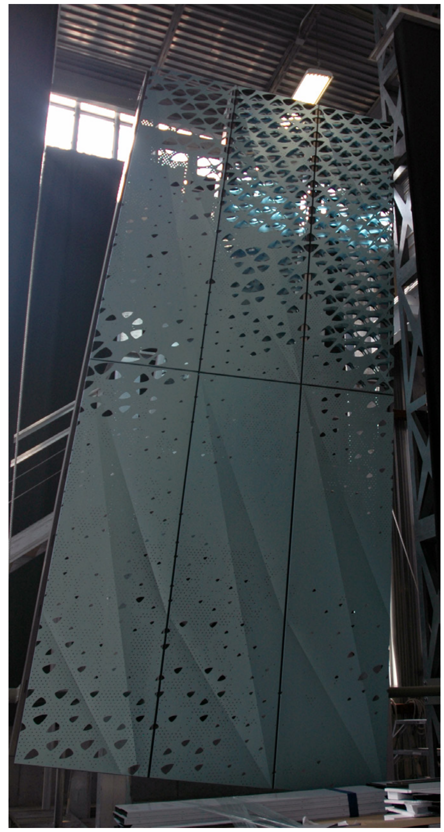
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Figure 3: Courtesy of Zahner and Associates, Inc. Photo by Liane Hancock, *KAFD Portal Spas Mockup*

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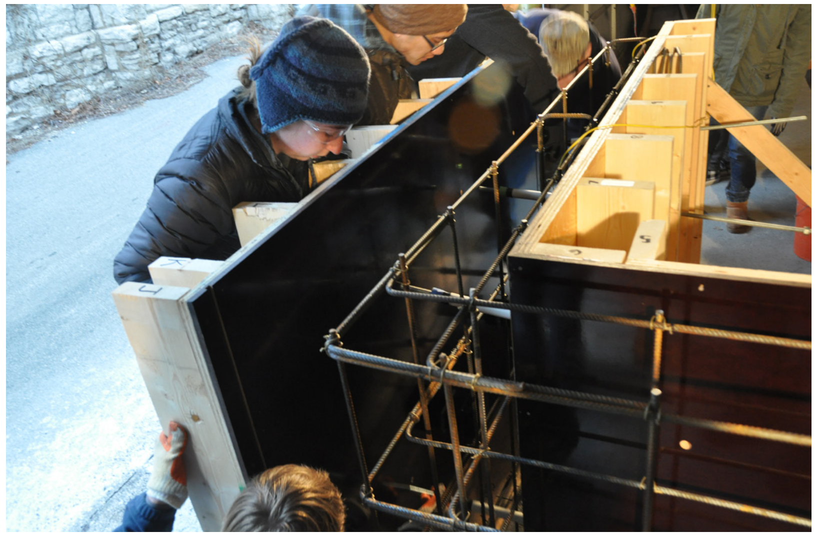
5 

than typically occur in a Design-Build studio. What is perhaps most important is that students would converse with tradesmen, and work directly with them to accomplish quality work. As a result, students would come to future construction processes both with a respect for the contractor and an understanding of the level of quality that is possible. As Steve Morby asserts, "We are partners in this - we are certainly not adversaries… Wanting to do the best job you can do happens as much for a carpenter as an architect. If you stop and analyze it, working together is the best way to get the result that you want… if the two sides would just have the discussion, but the difficulty comes in starting that conversation."

Engaging in a product design model, re-envisioning manufacturers' product lines, and enlisting the problem solving capability of skilled tradesmen all provide opportunities to create a new vision for Design-Build studios. In addition to forging long-lasting relationships between students and the community, the models presented in this paper could build stronger relationships between the design profession, manufacturers, and the building trade; in turn, these methods could fundamentally change the built environment at a scale unimagined by current Design-Build studios.

Figure 4: Photo courtesy of © Brooke Helgerson, *Pulitzer Foundation for the Arts Concrete Pour*

Figure 5: Photo courtesy of © Ruotian Cai, *Pulitzer Foundation for the Arts concrete Pour*