Looking to the Future

AT UNIVERSITY OF TEXAS AT ARLINGTON'S PRECAST PROGRAM

— **Marty McIntyre**
PCI Foundation

Students at the University of Texas at Arlington (UTA), working with associate professor Bradley Bell, have taken advantage of opportunities to work with local precasters in order to use their time to advance precast concrete material technology and material innovation. The innovation begins with a trip to Gate Precast's plant in Hillsboro, Tex., where students see today's state-of-the-art fabrication methods. From there, they use new technologies and digital fabrication methods to research new materials and methods that might in years to come change the way precast is fabricated.

Performative Precast is a 3-year program of integrated design and seminar courses for upper- and graduate-level students now in its last year. The design studio course is taught in the fall and the seminar course takes place in spring. These courses concentrate on a specific area of precast application (façade, structure, and infrastructure) and together provide a unique opportunity to conduct in-depth design and research into digitally fabricated precast concrete components.

Manifold Concrete Systems is a graduate design studio course focusing on the implementation of applied research methods as a means to explore new developments in performative architectural components. Specifically, these components, regardless of scale and functional application, synthesize the interaction of the material properties, geometry and contextual forces. Furthermore, these components leverage the use of precast concrete means and methods to conduct research.

Students undertake a demanding semester-long project following specific research methodology that will result in quantifiable results for the purpose of application and future development. The course makes use of strategic industry partnerships to construct and test prototype components to understand limits, viability, detailing, and assembly. Industry partners have committed to assist in the production, research, and interactive learning environment created through working with an approach of simulation. The students use CAD/CAM techniques to explore the research projects and seek out innovative solutions via these methodologies.

Like all PCI Foundation programs, the UTA program takes place over several years. Each program sponsored by the PCI Foundation is different depending on the curriculum needs of the university and the expertise of the professor. At UTA, the focus is on research and digital fabrication, which works well with its partner organization, Gate Precast.

"The students go on a plant tour each semester to see the workings of the plant and understand how the plant produces large scale architectural precast panels," says Bell. "Conrad Filo, Gate Precast quality control manager, has been a great asset. He discusses what is happening on the outer edge of precast and helps students understand not just the basics of the parameters of designing with precast, but also how to leverage the decision-making process to expand options. When the students start to work in an office after they graduate, how do they make an argument for what would make sense with precast? How do they expand the paradigm?"

Visiting the precast production facility allows the students to move

from the designing and drawing to seeing the full impact of what they draw. By spending time in the plant, the students understand the material from a solution side as well as from an architectural side. Additionally, students have had the opportunity to work with concrete insulation supplier Thermomass to explore possibilities for new insulated concrete products.

"Having the students in the plant has been a very good experience. It amazes me that there are people who have been in the construction industry for 10 or 15 years and have never seen a precast plant. Through this partnership, we are able to give students this experience before they enter the working world," says Michael Trosset, southwest regional sales and marketing manager at Gate Precast Company.

"The plant tour is an eye-opening experience about what precasters do and how they do it," says Trosset. "When the students go back to the classroom, it helps them make a lot more sense of the testing and designing they take on.

"We are very intentional in terms of how we ramp up," says Bell. "One of the things that has been beneficial is the part of the learning curve that brings out important questions as we start to create bigger and bigger things. We discuss how we move them around, and what we do with them after we've made them. Those become important questions.

"The dean seems to come through every semester and ask me 'why is it you are working with this really, really heavy stuff?' The students have a certain type of tactile relationship with it that is so immediate and relatable that it has been pretty remarkable."

In addition to working with industry partners, Bell has formed a good relationship with the civil engineering department at UTA. Of great interest to both departments is the use of high-performance, high-strength concrete. "It has opened up a new way of doing partnerships within our school," says Bell.

Filo has traveled to the university to help with classroom experiences specifically working with ultra-high-strength concrete and insulated products. The ultra-high-performance concrete was developed in house. Strength-wise it is comparable to ductal, but it is a slightly different material in terms of its process and the way heat actually comes from the process. The architecture/engineering conversations around high-strength, high-performance materials, along with some other grants, led research to look at some architectural applications. As that presented itself, Bell saw forging a relationship over time would help the research sharpen the set of questions they asked and how they were using engineering.

The program continues to look at different ways that mold making and production can change the way architects think about precast concrete. One exciting prospect is a reconfigurable form. The reconfigurable mold is probably the most sophisticated in terms of what it could do although it is still rather speculative. The size of the form is one of the stalling points. "We are seeing our limits as far as how much we can scale up. The range is 18 inch by 18 inch currently," says Bell. "What now may be possible is to look back at ultra-high-performance concrete which would eliminate reinforcing and open up other opportunities for our research."

Students working on semi-rigid form work to allow more 3D shapes and new design applications.

Dean Gwin, president, COO of Gate Precast and chairman of the PCI Foundation, is excited to watch the research at UTA that has uncovered real world applications for forming techniques that could materially move the fabrication of precast concrete forward. "Imagine if a BIM model and ticket could feed mold information to a system, where at the push of a button, you could change the shape of the mold, incorporate waves, bullnoses, or whatever is envisioned," says Gwin. "You cast the precast piece, the form flattens, and you build the next piece, as opposed to five mold builders constructing a fiberglass form over the course of 3 weeks."

"The research the university and Gate has conducted with fiber-reinforced, high-strength concrete will allow the design community and the precast concrete industry to design and build more projects with thin architectural precast cladding which is a game-changer development," Gwin adds.

The experience between the school and the plant is not just a one-way street. Trosset notes having a relationship with the school has allowed Gate to use the school to test new products such as lifting devices.

The 3-year funding of the precast studio allows the program to be an incubator for future precast concrete education at the university. Once the PCI Foundation funding is completed, the partnerships usually stay in place. "I'd like to still be involved after the program is officially finished, says Bell. "Anytime we have a chance to influence architects early on is exciting. I like knowing that a big architecture school is getting this kind of precast experience. For us, it is priceless."