

Expanded Horizons

Students throughout University of Southern California's architecture program have expanded their knowledge of precast concrete with PCI Foundation sponsored studio concept

— Craig A. Shutt



Studio participants give presentations in class to outside experts, including local precasters.

When the Architecture School at the University of Southern California began its precast concrete studio in conjunction with the PCI Foundation three years ago, the material wasn't represented in the curriculum. Today, precast solutions have become an integral part of classwork at all levels, and the school has introduced a number of programs and events that address its attributes and benefits.

"Prior to the studio's introduction, there was effectively nothing on precast concrete being taught in material-sciences classes, they only really addressed cast-in-place concrete," says Douglas Noble, associate professor. "It's been a pretty dramatic change since then. It's not only become a focus in the studio course but also part of the general curriculum, including second-year students through graduate students."

The studio, held each spring semester, has been so successful that a variety of programs and events have developed from it. They include an annual conference on precast concrete for local design and construction professionals and a published book planned for this fall showcasing precast concrete case studies. A hy-

pothetical annual project located in a nearby national park also will go live this year.

The program began about five years ago, when PCI West Executive Director Doug Mooradian contacted Noble about the possibility of introducing a studio course with the support from the PCI Foundation. The Foundation sponsors studios within architecture schools at 11 universities. Noble and assistant professor Karen M. Kensek developed the course, which initially involved 12 fourth-year students.

The two have worked together for more than 30 years and share an office, making their partnership a natural. Noble's architectural background focuses on facades, while Kensek focuses on technology aids and design-support tools, BIM, and analysis of reinforcing and similar topics.

Getting Started

"The first semester was fun, because there were so many things we didn't know about precast concrete, and that includes us as instructors, as well," Noble says. "We invited local precasters to view the projects we created, and they asked basic questions that we hadn't considered,

like why we weren't using precast concrete framing and foundations. That first year really changed our understanding of the material's capabilities."

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Part of their increased understanding came from the faculty attending the PCI Convention to see what other university studios were doing and participate in sessions. "The professors at USC were not especially knowledgeable about precast concrete at the start of the program," Noble admits. "We had a lot to learn about embeds, GFRC, hollowcore, double tees, and myriad other facets of the industry. The intense rhythm of the 24-hour cycle in the precast plant is not something that most architects fully appreciate."

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That has changed at USC. The precast studio became the most popular studio in the architecture school,

PCI FOUNDATION STUDIOS							
COLLEGE/UNIVERSITY	PROGRAM			STRUCTURES STUDIED		PARTNERSHIPS	
	Architecture	Engineering	Construction Management	Structures/Buildings	Transportation	Local Partner	Secondary Partners
CalPoly Pomona Pomona, CA	✓	✓		✓		PCI West	
Clemson Clemson, SC	✓			✓	✓	G/C PCI	Metromont Tindall
IIT Chicago, IL	✓			✓		PCI IL & WI	Lombard Architectural
MSU Mankato Mankato, MN		✓	✓	✓	✓	Wells Concrete	PCI Midwest
NJIT Newark, NJ	✓			✓		MAPA	
RISD Providence, RI	✓			✓		PCINE	
SDSU Brookings, SD	✓		✓	✓		Gage	PCI Midwest
USC Los Angeles, CA	✓			✓		PCI West	
UNCC Charlotte, NC	✓	✓		✓		G/C PCI	
UNF Jacksonville, FL		✓		✓	✓	Gate Precast	
UTA Arlington, TX	✓			✓	✓	PCMA	
UW Milwaukee Milwaukee, WI	✓	✓		✓	✓	Spancrete*	

*The Spancrete studio took place prior to the start of the PCI Foundation Studio program.



Plant tours, including this one to Clark Pacific, give students a better understanding of the processes involved in producing precast concrete components and finishes.

leading administrators to find ways to expand on the instruction. Other courses now have integrated precast concrete content, starting with second-year material and methods classes. “They work in teams to create a real cast-concrete project so they can learn hands-on about it,” Noble says.

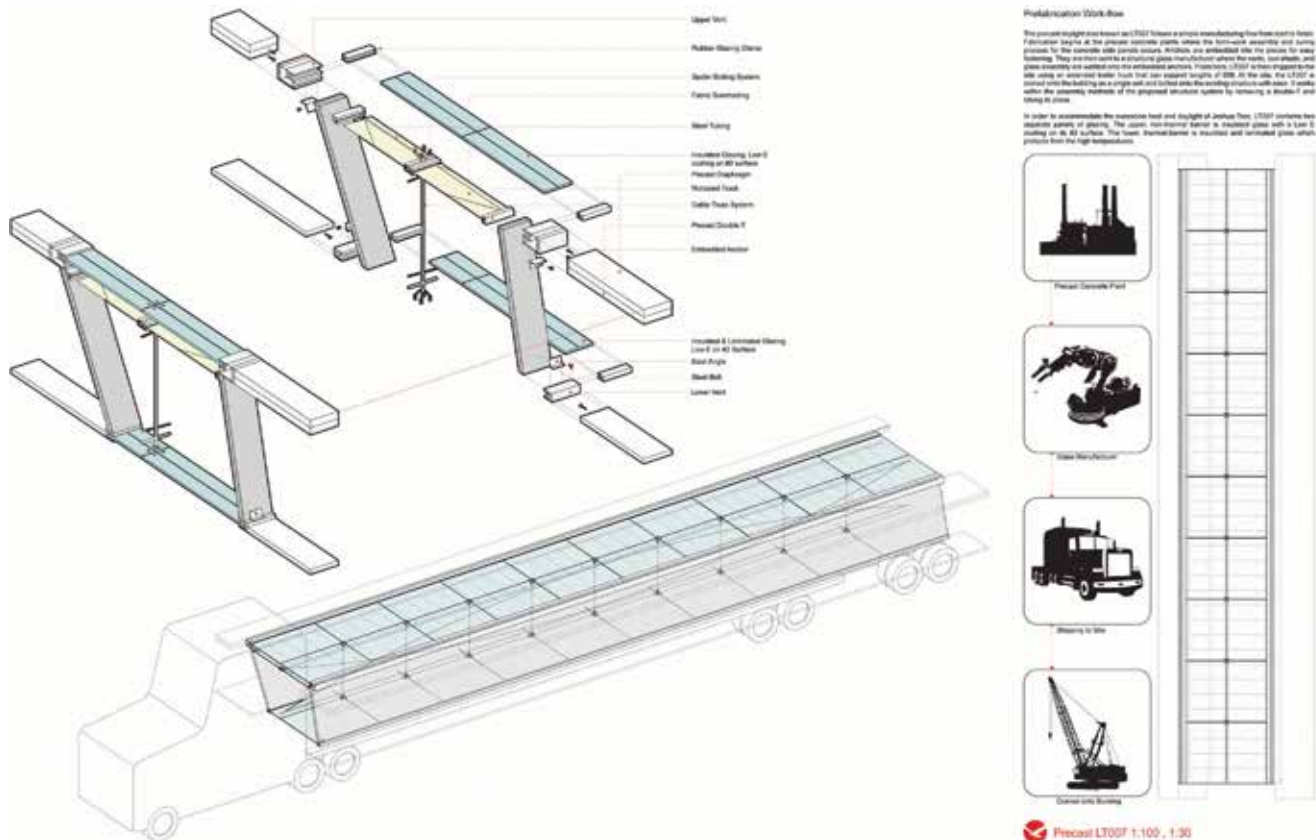
“It introduces new concepts to them that they don’t consider with other materials, such as reusing forms.”

Students in the studio explore aspects of precast concrete on their own for part of the class, looking at its properties, processes, and implementations. One student attempted

to create a “self-tanning” concrete that would lighten when it was warm and darken as it cooled. “The tests worked but proved prohibitively expensive,” Noble says.

Another student wove a complicated textile of fiber optics that was embedded into a model of a precast concrete wall panel to transfer daylight from the exterior to the interior in more energy-sustainable ways. Yet another tried using sound absorbing materials as aggregates to improve acoustic properties (not promising). Although only 12 students participate in the class, the others in the 80-student school take part in projects and hear lectures as part of their own coursework.

Masters’ degree and PhD candidates also work with the material, including one who is studying Frank Lloyd Wright’s use of prefabricated concrete in the 1920s and determining how he might have used precast concrete in his housing designs today. Part of that work examines the prefabricated concrete blocks used to build the textile-block style Freeman House, owned by USC, and how it can be renovated to best withstand seismic events.



Classwork includes creating drawings of precast concrete components as well as considering aspects that include transportation and erection.



Field trips include site visits to buildings underway, including these three adjacent projects in downtown Los Angeles: the Grand Avenue Apartment tower, the Grand Avenue bridge park, and the Broad Museum.

Joshua Tree Project

The highlight of each year's program is the creation of design drawings to construct a building in the Joshua Tree National Park. "It teaches the students how to use the material's advantages for the unique extreme climate of the eastern desert area," Noble explains. Students learn to handle the large daily temperature swings in the location by using precast concrete's thermal-mass

characteristics, crafting a Net-Zero energy building.

"The site is far from any source of water, electricity, or other resources," he says. "They learn the benefits of prefabrication and off-site construction for structural and façade systems to lower construction-site impacts. That's an important attribute in national parks but also at dense downtown construction sites."

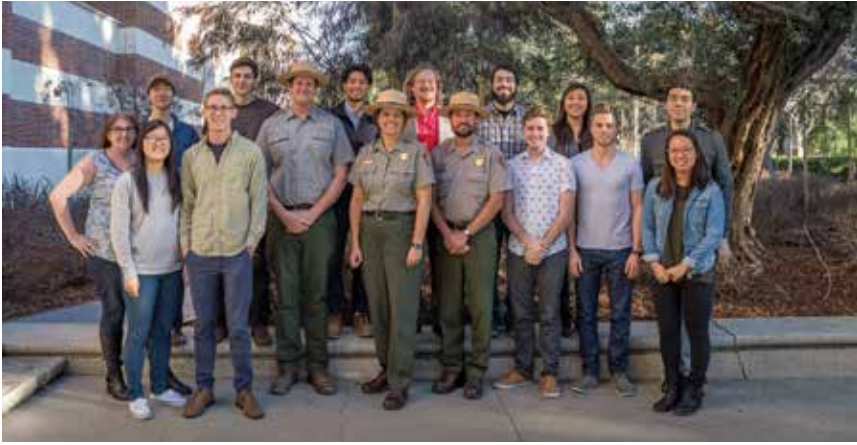
The students take field trips to nearby projects, including the Broad Museum's which features a latticed GFRC skin and the adjacent Grand Avenue Apartments. They also tour local PCI-member manufacturing plants to see components being designed and cast.

"We work with all 11 members of PCI West, and they've been great," he says. Clark Pacific is the school's sponsor-host, and they provide plant tours and employees to give lectures and judge projects. "They're willing to do anything we ask of them." Moordian also gives several lectures during the semester on various aspects of precast concrete.

Noble and Kensek work closely with Bob Clark, Clark Pacific president of operations, and Bradley Williams, plant manager, to arrange programs. "They have been especially helpful. The whole Clark Pacific team has been astoundingly supportive. We use up a lot of their time."

Other Events

The program's success led to the introduction of a precast concrete conference, which also has proven popular with local designers. The



Members of the class met with park rangers at the Joshua Tree National Park, where their hypothetical project to design a precast concrete structure was to be located.



Studio students look over the harsh, isolated terrain at Joshua Tree National Park, the site of a hypothetical project they were designing. In 2016, the class will build an actual structure there.

first attempt to integrate courses on precast occurred during a one-day seminar held in conjunction with the school's on-going Façade Tectonics program, a series of conferences held for several years. "We got a good crowd, but it was mostly precasters," Noble says.

The next year, the content was blended into a larger three-day architecture conference, which provided more exposure. "Once architects saw precast concrete related course options at the conference they were attending, they went to learn more," he says. With that base of interest planted, the program has been split off for January 2016 and will feature a variety of local precast concrete case histories.

That event will tie into another

activity, the production of a book of case histories showcasing local precast concrete innovations, to be published by the end of the year. The 8 ½- by 11-inch, four-color book, produced in collaboration with PCI Foundation Executive Director Marty McIntyre, will feature a variety of creative facades with descriptive text written by the students. "Architects love books," says Noble. "They aren't as web-oriented for this type of material."

The school's three-year funding grant from the Foundation has expired, but the program will continue to grow, he says. A significant amount remains in reserve, which will allow the school to fund prizes for a variety of class projects and even expand on its signature project.

Student Comments

Student feedback on the precast concrete studio indicates how popular the program has become:

"I didn't know the design potential of precast. It's not all double tees and parking garages! Some of the finishes and details that can be produced are really impressive."

— Christopher Penfold, fourth-year student

"Visiting Clark Pacific gave me new insight on the flexibility and wide array of possibilities that precast can do in aiding and enhancing design. I really enjoyed seeing the formwork and how the panels are transported in the work yard with huge, traveling crane machines."

— Caroline Kim, fourth-year student

"The Clark Pacific visit counts among the most informative experiences within my time at USC. The team was able to demonstrate how the architectural and structural benefits of precast concrete allow architects to create ambitious spaces with lower environmental impact, cost, and consistency than cast-in-place concrete."

— Sean Gowin, fourth-year student

"I never realized how many buildings use precast concrete elements, and it made me rethink the ways in which precast could be used."

— Wendy Lee, fourth-year student

'We intend to take our Joshua Tree National Park project and actually build it at full size.'

"We intend to take our Joshua Tree National Park project and actually build it at full size," he says. A pavilion-like structure with four walls, each with different openings and finishes, is currently planned. "It will give students a strong concept for casting, transporting, and erecting precast concrete under adverse conditions."

The Foundation's sponsorship has gotten the program off to a good start. "Our collaboration has become strong, and the precast emphasis will live on in courses and studios," he says. "We're just getting started." 