



Photo: Marty McIntyre.

Georgia Tech Students

BRING MUSICALITY TO PRECAST

— **Marty McIntyre**
PCI Foundation

The School of Architecture at Georgia Tech has a focus on the relationship between research, teaching, and practice. While the design faculty is diverse, it emphasizes transforming the relationship between conceptual design and real-world construction via advanced technologies and material systems. Its curriculum development grant from the PCI Foundation will support teaching and research in the School of Architecture for a period of four years to support innovation on the leading edge of precast concrete, and to promote fundamental design knowledge and competence for graduates entering the architecture, engineering, and construction industry.

The program began in the fall of 2017. Each year, the fall semester is a jointly taught architectural design studio in the third year of the graduate program, with additional student participation from the school's master of science program in Digital Design and Fabrication. The studio is taught by Professor Tristan Al-Haddad; Professor Russell Gentry serves as the primary engineering consultant within the studio. Industry partners are from Georgia/Carolinas PCI, Metromont Precast, Tindall Precast, Gate Precast, and US Formliners.

The spring workshop is structured as a technical development, engineering, and prototyping workshop that advances and develops the best design from the fall studio. The spring semester workshop is a collaboration with the civil engineering Capstone course, where the engineering students partner directly with the architecture students to produce a full set of design calculations and details. Professor Gentry will lead the civil Capstone students and will collaborate with Professor Al-Haddad on overall project planning. The end result of each year is a collection of concrete design proposals and one full-scale prototype of the most promising design from the fall to be fabricated by Gate Precast Company.

PROJECT WILL BE BUILT

The students will work with Gate Precast to develop a detailed building information model of the design and full specifications from which Gate Precast will build the forms and cast the structure. The body of work is exhibited at Georgia Tech in the summer and will travel as a scaled version to the Fab City Summit in Paris in July 2018. Fab City is the gathering event of the international Fab City network, a global initiative to develop locally productive and globally connected cities.

The project that the students developed during the first semester workshop is a precast concrete folly for the Beltline in Atlanta, Ga., a 33-mile network of multiuse trails and public space around the city. The student-designed structure serves not only as a decorative threshold, but is also designed to create music as a xylophone.

"I think the project is really magical because people will walk up to it and they won't think it is concrete," says architecture student Jane Ilyasova. "It is a really inviting experience for people of Atlanta coming to the Beltline, which is a really big spot for visitors. When they do come, it is an eye opening experience—and they will think, 'Oh wow! I can't believe concrete can really be like this.' I think it is really cool. And the shadows it's going to create will help make it an instrument in more than one way."

STUDENTS CHOOSE DUCTILE

To begin the creation, the students worked a lot with materials, which is where they tried to bring in much of the innovation on the project, according to Al-Haddad. In the end, the students settled

on using a product called ductile. Ductile is an ultra-high-strength concrete that is six to eight times stronger than convention concrete and contains metal fibers that makes it ductile.

"We were really inspired by this sheet of ductile that we have in our fabrication lab; when you tap on, it sounds so metallic," says Ilyasova. "Hopefully, we can create a similar experience that everyone can be a part of in a more public place."

Designing a project that will actually be fabricated and erected is an exciting prospect for the students in the program. Not only do they focus more on the engagement with the community, but also on how the structure will be fabricated. "Our initial idea was to create an instrument for the community," says student Sean Miller. "It would create both a shelter and a sense of space. It will also create some community engagement through music. We decided on this idea of a xylophone. Each band in the project has a different length, which will create a different resonance, so when you proceed through this structure you will get a series of

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higher notes until you progress down where the length increases and you get a lower resonance. That is where ductile really came in. The density of the material is almost a metallic resonance when you tap it, unlike typical concrete which sounds hard when you hit it. The ductile produces actual notes. That is our next phase of research: looking at the cross section versus length and determining the notes we can actually produce."

Geometry and formwork will play a large role in the second semester of this project. "The students are working with rubber molds, and the intent is that the geometry of each one of the forks is a section which transforms from a rectangle at the base, which becomes post-tension," says Al-Haddad.

"We will create a jig so we can move the molds and create a variety of shapes with as little formwork as possible to create the whole installation," says Ilyasova.

The students have gone as far as creating a virtual reality (VR) model that allows one to experience walking through the instrument. They had the VR model on hand during a recent showcase at the PCI Convention. "Since Georgia Tech is such a technical school, we decided to create the VR as a way for people to interact with the project while we are here and hopefully get more people excited about what we are excited about," says student Katie Koski.