Additive manufacturing helps build a work of art

Artist Edra Soto's stunning *Screenhouse* installation is a rich immersive experience that evokes decorative screens (known as *rejas* and *quiebrasoles* in Soto's native Puerto Rico) to create a free-standing social structure that challenges the distinction between public and private spaces.

Soto was commissioned to build her outdoor installation in Chicago's iconic Millennium Park, where she envisioned creating a 10-foot-tall structure that could withstand Chicago's harsh climate. She partnered with Navillus Woodworks to construct the installation, which would be composed of more than 400 custom-cast concrete blocks.

Though the Navillus team were experts in traditional manufacturing methods, they knew little about making molds for casting Ductal® concrete material. The center support structures in the mold proved especially difficult. The Navillus team had unsuccessfully tried several methods to craft the center pillars, including CNC, when they turned to the Fast Radius team.

Manufacturing expertise

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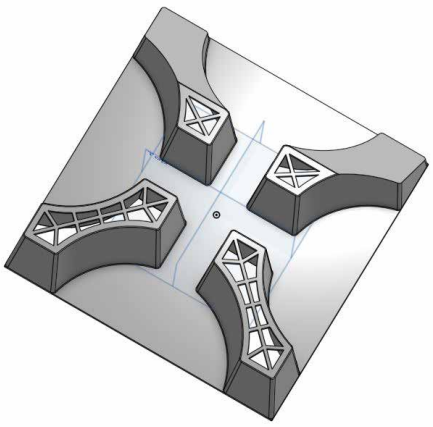
>
> **Bobby Bott**
> Director of Manufacturing and Supply Chain

Fast Radius engineers determined that the parts could be made of Polyamide 12 (PA 12) printed on HP Multi Jet Fusion (MJF) equipment. MJF produces fully densified, near-isotropic PA 12 parts, meaning the material retains its physical properties regardless of direction. Fast Radius knew this method would produce parts that stood up to the concrete casting process without compromising the structural integrity of the mold.

MJF was also well-suited to the low-volume production Navillus required because it doesn't require any costly machining or mold creation.

"Our team has deep knowledge of all the additive processes we use," said Bobby Bott, Director of Manufacturing and Supply Chain at Fast Radius. "In this case, we knew that PA 12 printed on MJF would be the right choice for the *Screenhouse* molds, so we moved into prototyping and production quickly."



Rapid iteration

The Navillus team had tried machining the molds with a CNC router, but the process was time-consuming and expensive. Mistakes proved costly: a machining or routing issue meant starting the whole process over. Plus, the Corian parts they machined were too heavy for the mold.

With HP MJF technology, Navillus and Fast Radius printed and tested three design iterations in a matter of only ten weeks before settling on the final design. And because MJF parts are suitable for end-use, Navillus tried out the prototypes in the context of the rest of the mold. The team settled on a design that was thin, lightweight, and suited to concrete casting.

Application engineering

Fast Radius' team of expert industrial designers and engineers made rapid iteration possible through their expertise in designing for additive manufacturing (DfAM). In the case of *Screenhouse*, Fast Radius and Navillus discovered that MJF technology could produce light, hollow structures without sacrificing the mechanical strength needed to support concrete. Fast Radius further saved material cost for Navillus by optimizing the design to fit multiple parts in each build.

"The guidance we got from the Fast Radius team proved invaluable." said Dan Sullivan, President and Owner of Navillus Woodworks. "Together we were able to make mold components that met our mechanical specifications, budget, and timeline. The results speak for themselves."

Results

Fast Radius ultimately produced nine PA 12 parts for each block mold and supplied Navillus with 21 sets of parts. It took three months from the moment Navillus met Fast Radius until they had parts in hand.

The *Screenhouse* installation went up in Millennium Park in October of 2019, and the finished product reflected Soto's vision. It casts a striking silhouette and will weather an entire year in Chicago.

"Our mission is to make new things possible to advance the human condition and I can think of no better way to serve that mission than helping bring Edra Soto's beautiful design to life in our city's famed Millennium Park," said Fast Radius Chief Executive Officer Lou Rassey. "This project shows the potential of additively manufactured molds to redefine construction project design."

Fast Radius help bring *Screenhouse* to life by taking advantage of MJF's ability to rapidly iterate on the designs collaboratively developed by their expert application engineering team.

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We can help with your project, too.
Contact us to learn more.