Cast Thicket

Cast Thicket is a prototypical installation that furthers earlier research into tensile concrete molds through the use of plastic formwork and a layered structural network. This research projects beyond this prototypical installation to address current issues in creating tall concrete structures. Cast Thicket presents one spatial outcome from a flexible system that can be multiplied and scaled. The flexibility inherent in the system allows for a new type of porosity while the casting process creates a novel tectonic outcome.

The 12’x8’x8’ white concrete structure provides a proof-of-concept model testing the software workflow, logistics, materiality and details of the system.

Dynamic Tensile Network
Leveraging the fluid materiality of concrete and the machinability of polypropylene, Cast Thicket creates a lacy network of thin members that disperse and coalesce to address structural and spatial needs. Constructed within an external, compressive scaffold the tensile network is designed and optimized to act as the centerline for both concrete mass and steel reinforcing. An initial grid is derived from a diagonal subdivision of the bounding scaffold. The grid is converted into a network of virtual springs to create an optimization scheme similar to a game of cat’s cradle. Played out over a series of iterations the virtual spring simulation is trained into an interlaced, stable network. Using two types of nodes, fixed and dynamic, allows the framework to be moved either directly by positioning fixed nodes or more subtly by changing the tension on the springs thus repositioning the dynamic nodes. This nuanced, haptic design process sets up an interface that adjusts to the structural concerns while creating a formation that demonstrated maximum flexibility of the system.

Steel Frame
Replacing the rebar used in typical concrete construction a precise steel frame serves as a tensioning device and holding the concrete in compression. The steel frame is composed of a series of struts and nodal joints, and is assembled node-by-node. The nodal joints are radially notched steel pipes accepting corresponding struts at specified angles. Further calibration of the joint is achieved using an angle-finding jig to ensure the precise welding of each node and its corresponding strut component. The struts are fabricated with male and female components which, when assembled, produce a T-shaped cross section and allowing for a cold assembly with zip ties to be positioned prior to final welding.

Plastic Formwork & Casting
A formwork of polypropylene, ruled surface panels wraps the steel frame. Refined from optimized, relaxed surfaces these hexagonal tubes simultaneously direct the flow of concrete and create a free-flowing system of load paths. This .02” thin membrane of polypropylene replaces typical plywood and steel forms. The individual pieces of plastic formwork are hand assembled along their seams through a system of interlocking tabs. Each tab changes its shape and width to respond to the curvature of each piece. Once completely stitched together the mold accommodates a specially developed low-viscosity, lightweight concrete mixture. Poured in sequential lifts the hand-operable seams allow access to any part of the mold not yet full of concrete.
Cast Thicket is a prototypical installation that further explores research into tensile concrete molding through the use of plastic formwork and a layered structural network. The research projects beyond the prototypical installation to address current issues in creating tall concrete structures. Cast Thicket presents one spatial outcome from a flexible system that can be multiplied and scaled. The casting process creates a novel tectonic outcome. The 12’x8’x8’ white concrete structure provides a proof-of-concept model testing the software workflow, logistics, materiality and details of the system.

**Dynamic Tensile Network**

Leveraging the fluid materiality of concrete and the machinability of polypropylene, Cast Thicket creates a lacy network of thin members that disperse and coalesce to address structural and spatial needs. Constructed within an external, compressive scaffold, the tensile network is designed and optimized to act as the centerline for both concrete mass and steel reinforcing. An initial grid is derived from a diagonal subdivision of the bounding scaffold. The grid is converted into a network of virtual springs to create an optimization scheme that reacts to the forces of gravity. The virtual spring simulation is trained through two types of nodes, fixed and dynamic, allowing the framework to be moved either directly by positioning fixed nodes or more subtly by changing the tension on the springs that reinforce the dynamic nodes. This nuanced, haptic design process sets up an interface that adapts to the structural concerns while creating a formation that demonstrates maximum flexibility of the system.

**Steel Frame**

Replacing the usual load in typical concrete constructions a precise steel frame serves as a tensioning device and holding the concrete in compression. The steel frame is composed of a series of steel struts and steel joints, which are assembled node-by-node. The nodal joints are radially notched steel pipes accepting corresponding struts at specified angles. Further calibration of the joints is achieved using angle-finding jigs to ensure the precise welding of each node to its corresponding strut. The struts are fabricated with male and female components which, when assembled, produce a T-shaped cross section allowing for a cold assembly with zip ties to be positioned prior to final welding.

**Plastic Formwork & Casting**

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**Materials**