THINNESS: The Counterfactual World of Concrete

JULIE LARSEN
Syracuse University

ROGER HUBELI
Syracuse University

The project was developed in collaboration between Syracuse University Assistant Professors Roger Hubeli and Julie Larsen, and CEMEX GLOBAL R&D.

At the Fundamentals exhibition of the 2014 Venice Biennale, Rem Koolhaas referred to the ceiling and stated that it was “a domain over which architects have lost all control, a zone surrendered to other professions”. And that “our influence has been reduced to a territory that is just 2cm thick.”

In response to this provocation, THINNESS pavilion offers new insights into the future architectural potentials of concrete technology as a lightweight material. The design and fabrication of the 10’x10’x10’ pavilion consists of 16 mobile elements that hybridize veneer and structure to create a new approach to being ‘thin’ with only two centimeters of wall material thickness throughout. With the use of high-performance, lightweight concrete, the project generates a new perception of concrete through its structure, skin and surface quality. To alter the perception of concrete as a thick poche, thin, hollow and perforated ‘columns’ comprise the structure. This tension of a thin veneer and a volumetric poche expresses a design ambition beyond a material’s logic that questions preconceived ideas of concrete. The pattern on the facade was generated from a grasshopper script that responds to the overlapped stress and load patterns for the horizontal and vertical position of the element when they are moved.

Because the fiber reinforced mixture of the concrete has the capacity to allow for extremely thin casts, the elements were made with only two centimeter thick walls“shells”. Without traditional steel but fiber reinforcement, this is an achievement because of each column’s ability to maintain high structural strength despite the high bending stresses, due to buckling, in the thin cross-section of the walls. This is in stark contrast to more common, thin form-active structural shells, where no bending occurs due to load distribution along the curve of the forms. These forms, however, do not lend themselves to be stacked. But due to the structural strength of the high strengthconcrete used for the pavilion, can we design vertical structures with only two centimeters. The high performance concrete is able to reduce the structure to extremely thin, vertical 2CM surfaces to create hollowed-out column elements that would otherwise not be achievable with traditional concrete. The pavilion defines new, counterfactual arguments for the material of concrete in order to change base assumptions and question the parameters for the material. Therefore, we ultimately question the status quo of architectural production (such as concrete needs 28 days for curing, it must have steel reinforcement, etc.). If the common characteristics of a material are not questioned, then perceptions of a material will inevitably keep us at ‘two centimeters’.

THINNESS

THE COUNTERFACTUAL WORLD OF CONCRETE

The project was developed in collaboration between Syracuse University Assistant Professors Roger Hubeli and Julie Larsen, and CEMEX GLOBAL R&D.

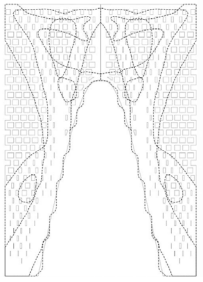
At the Fundamentals exhibition of the 2014 Venice Biennale, Rem Koolhaas referred to the ceiling and stated that it was "a domain over which architects have lost all control, a zone surrendered to other professions". And that "our influence has been reduced to a territory that is just 2cm thick."

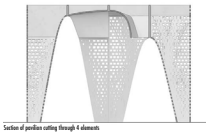
In response to this provocation, THINNESS pavilion offers new insights into the future architectural potentials of concrete technology as a lightweight material. The design and fabrication of the 10'x10'x18' pavilion consists of 16 mobile elements that hybridize veneer and structure to create a new approach to being 'thin' with only two centimeters of wall material thickness throughout. With the use of high-performance, lightweight concrete, the project generates a new perception of concrete through its structure, skin and surface quality. To alter the perception of concrete as a thick poche, thin, hollow and perforated 'columns' comprise the structure. This tension of a thin veneer and a volumetric poche expresses a design ambition beyond a material's logic that questions preconceived ideas of concrete. The pattern on the facade was generated from a grasshopper script that responds to the overlapped stress and load patterns for the horizontal and vertical position of the element when they are moved.

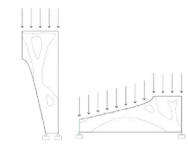
Because the fiber reinforced mixture of the concrete has the capacity to allow far extremely thin casts, the elements were made with only two centimeter thick walls"shells". Without traditional steel but fiber reinforcement, this is an achievement because of each column's ability to maintain high structural strength despite the high bending stresses, due to buckling, in the thin cross-section of the walls. This is in stark contrast to more common, thin form-active structural shells, where no bending occurs due to load distribution along the curve of the forms. These forms, however, do not lend themselves to be stacked. But due to the structural strength of the high strength-concrete used for the pavilion, can we design vertical structures with only two centimeters. The high performance concrete is able to reduce the structure to extremely thin, vertical 2CM surfaces to create hollowed-out column elements that would otherwise not be achievable with traditional concrete. The pavilion defines new, counterfactual arguments for the material of concrete in order to change base assumptions and question the parameters for the material. Therefore, we ultimately question the status quo of architectural production (such as concrete needs 28 days for curing, it must have steel reinforcement, etc.). If the common characteristics of a material are not questioned, then perceptions of a material will inevitably keep us at 'two centimeters'.

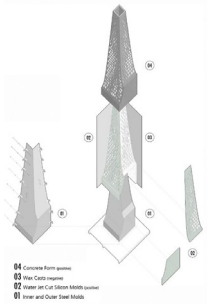

Installing last few columns and skylights at CCA Designing Material Innovation Exhibition

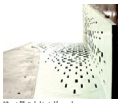

Looking down on hollow column from above

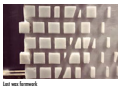

Bending moment diagram informing digital pattern on surface


Section of pavilion cutting through 4 elements


Structural diagram of elements in horizontal and vertical position



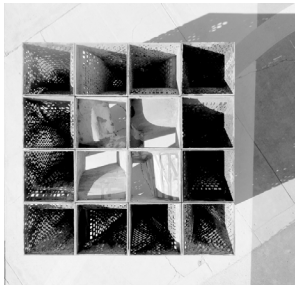

Silicon infill attached to steel formwork


Cast wax formwork


Cast wax formwork


One more column left to install...


Installing last lightweight columns with only 2 people!


Final installation of pavilion - above view