

Demonstration tests



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Through a series of demonstration tests the research project has explored some of the possibilities with new automation technologies by creating full-scale prototypes in concrete.

Staircase sculptures

A set of sculptures in concrete has been produced and exhibited in *Eventyrhaven* (Adventure garden) in Odense, Denmark. The work is by the artist Esben Klemann. It consists in adding two concrete elements to an existing staircase in the garden. One element fills up a rectangular hole in the side of the staircase. The other element continues the side of the staircase down to the ground in a twisted movement. Together, these two elements form a unique example of work, where art and architecture melts together in new compositions.

The production showed how robot technology can be used in the process of making art. First Esben Klemann came up with the idea which was transferred into digital drawings. Then the drawings were used to make tool paths for the robot, which was used in order to mill out the needed moulds in expanded polystyrene. The moulds were then filled with self-compacting concrete. The de-molding showed that the expanded polystyrene was easy to remove when the concrete was still hot. The production of the two concrete elements was performed in the high-technology concrete laboratory at Danish Technological Institute.



Fig. 25: On the left is a computer model of the concrete elements. On the right is the production of the moulds using robot technology at Danish Technological Institute.

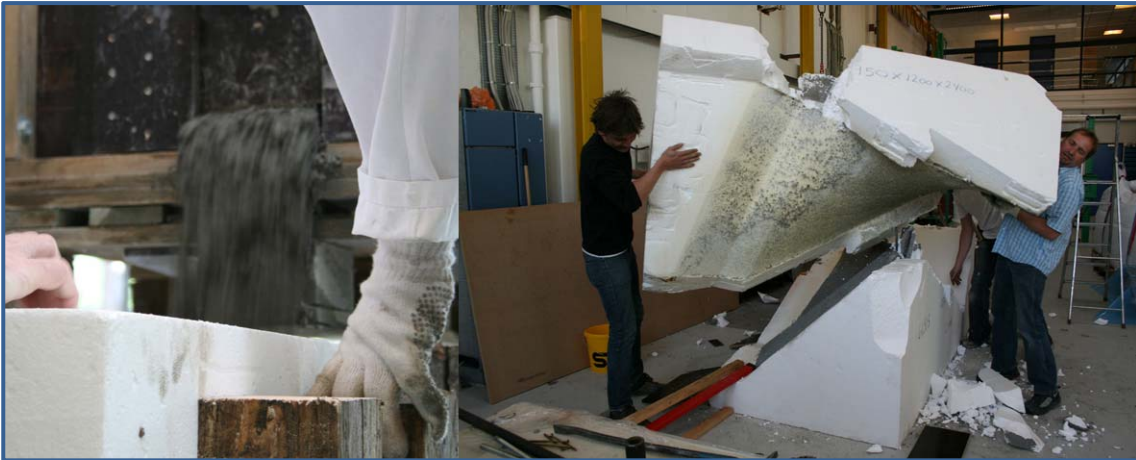


Fig. 26: On the left the mould is cast with concrete. On the right de-molding.



Fig. 27: The finished concrete elements.

Artistic concrete element

In connection to a special exhibition at the Bornholms Art Museum on Bornholm in Denmark a full-scale concrete element was produced.

The artistic concrete element is now exhibited direct on the existing facade of the Bornholms Art Museum. It shows how artists can bring art into the architecture in an industrialized process.

The project was made in several steps. First a small model of polystyrene was milled out by Esben Klemann in order to achieve the desired surface. Then the model was scanned into the computer using a 3D scanner. Then the surfaces was scaled and stretched using a 3D modeling program in order to fit into the building and the final shape of the concrete element. Hereafter the surface was further treated digitally to bring out the main relief of the surface. After the digital treatment, the formwork was milled out in polystyrene on the robot at Danish Technological Institute and the parts was then sent to Bornholm where PL Beton sponsored the concrete for the element. Finally the casted concrete element was placed on the facade of the Bornholms Art Museum.



Fig. 28: The artistic concrete element exhibited at the Bornholms Art Museum.



Fig. 29: Left: The robot mill out the polystyrene part for the formwork. Right: The parts brought together in the final formwork ready for the casting.





Fig. 30: Left: Computer illustration of the element. Right: The element in place in connection to the building facade.

A new production method developed for singular silicone moulds

In connection to the production of a concrete chair for an exhibition in Copenhagen, a new production method has been developed. The chair had been almost impossible to produce without the use of digital production methods. Thus, the chair is produced by milling out the chair in expanded polystyrene using the robot in the high-technology concrete laboratory on Danish Technological Institute. Then the prototype was used to cast a silicone mold which was used to cast 6 identical concrete chairs.

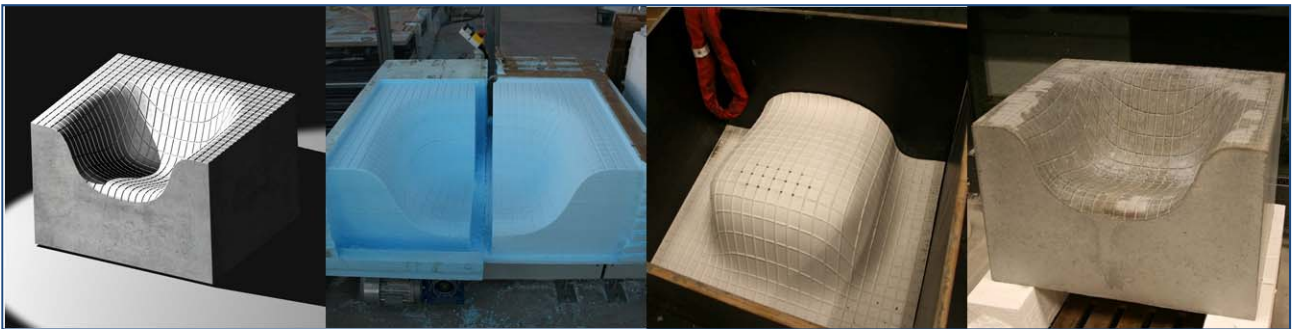


Fig. 31: From digital model to the final concrete object.