Midway on the road to produce industrialized tailor-made concrete structures (TailorCrete)
The main goal of TailorCrete is to develop and demonstrate an industrialised process for producing unique, tailor-made structures using a radically new and cost effective approach = production of singular TailorMade concrete structures at mass production costs.

The concept involves both on-site and pre-fabricated elements and both load-carrying and facade elements.
From

To
Challenges with formwork and reinforcement
New possibilities with Self compacting concrete (SCC), robots and advanced 3D digital tools
TailorCrete partners

Architects/designers:
- Superpool, Turkey (SME)
- DesignToProduction, Switzerland (SME)

Construction:
- Dragados, Spain

Manufacturers concrete:
- Unicon, Denmark
- El Caleyo, Spain (SME)

Raw material manufacturers:
- Grace, Germany
- Bekaert, Belgium

Robot supplier:
- Giben, Denmark (SME)

Formwork suppliers:
- Paschal, Denmark (SME)

Research:
- Danish Technological Institute, Denmark (Co-ordinator)
- ETH, Zurich
- Chalmers, Sweden
- Czech University, Czech
- University of Southern Denmark, Denmark
Midterm highlights

- Mock up of three new formwork types
- Robot processing of traditional reinforcement
- Design models for fiber reinforced SCC
- Material models for fiber reinforced SCC
Mock-up of triangular formwork

- Good surface quality
- Good release properties
- Small gaps between plywood sheets needs to be minimized
- Assembling time needs to be minimized
Mock-up of wax formwork

- Good surface quality
- No melting or deforming of the wax during hydration process of the concrete
- Good compatibility with existing formwork systems
- Release properties could be improved
- Edges and joints should be investigated further
Mock-up of milled formwork with robot

- Good surface quality when using a rubber membrane as coating
- Easy assembling of the system
- Release properties could be improved – even when using rubber membrane as coating
- Edges and joints need to be further investigated
Reinforcement processing techniques with robot

Today:
• High degree of automation: Straightening and bending, cutting, making mesh
• Manual work regarding: Bending in 3D, Welding
• Most production methods today are developed to be used in large scale production of a specific product type with limited geometrical variations

TailorCrete solution, first prototype
• Gripping and bending tool
Structural design models of fiber reinforced concrete

- fib Model Code 2010 is more complete than Rilem and Spanish guidelines
  - more detailed
  - includes ductility requirements
  - the effect of fibers in crack width design is more properly taken into account
- Fibers add more bending moment capacity than given by the codes
- Nonlinear FE analyses give better estimation than the codes
Material models for fiber reinforced SCC

Relation between flow patterns and fiber orientation, new CT scanning method
Relation between flow patterns and fiber orientation
Relation between flow patterns and fiber orientation

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Bottom half

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Full-scale demonstrators are under planning
TailorCrete

TailorCrete will initiate a transition from the rectangular monotony of today’s industrialised concrete buildings that dominate the European landscape, to new industrialised unique concrete structures without the need for expensive and labour-intensive manual construction processes. This will be achieved by developing new industrialised processes for concrete, and thus play a significant role in transforming the construction sector from a resource-based to a knowledge-based industry.

Left: Dominating geometry of today’s urban landscape. Centre: A prestige unique concrete structure. Right: Handmade formwork for producing the unique concrete structure shown at the centre photo.

TailorCrete combines the knowledge resources of architects, designers, concrete technologists, civil and structural engineers, robot experts with the practical experiences of key players in the construction sector in a 4-year collaborative research. It will involve intensive testing and validation of results at laboratory scale and in full-scale demonstrations in experimental buildings. TailorCrete will develop a core of new technologies including digital architecture, new formwork and reinforcement systems and materials as well as digital fabrication tools to radically change the way concrete is currently produced and used.