

Working on a Dream

The final section of *Dream*, a 20m-high sculpture has been lifted into place, creating a highly prestigious piece of public art for St Helens in north-west England.

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Photos: Cordek Ltd.

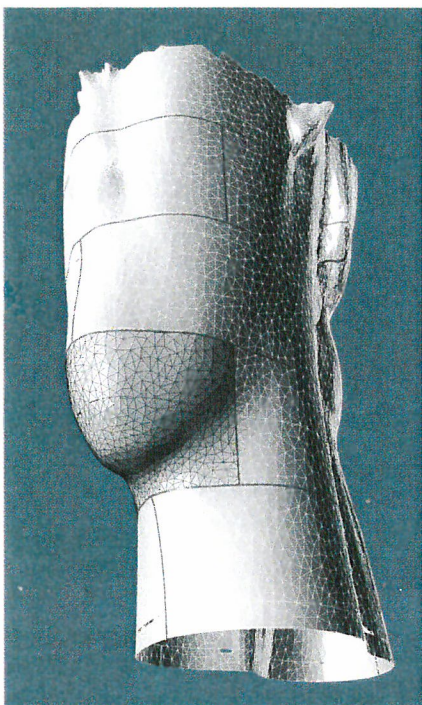


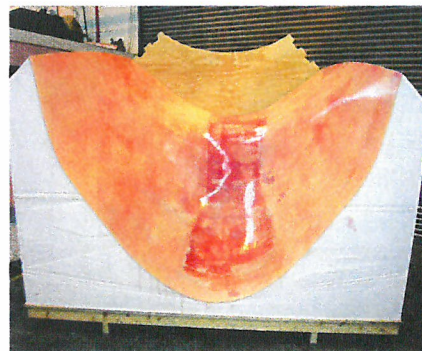
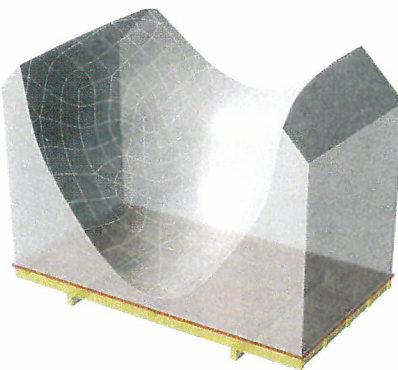
Figure 1 above: Image showing the chin area of the digital model.

Figure 2 right: CAD drawing of mould for casting the chin unit.

Figure 3 far right: A mould set up for five-axis machining.

Figure 4 below left: Chin unit complete including plywood side panel (note rebates and holes for location of cast-in fixings).

Figure 5 below right: Moulds being prepared for epoxy seal coat.



Designed by internationally renowned artist, Jaume Plensa, *Dream* is fabricated entirely from white precast concrete and takes the form of a head of a girl with her eyes closed, seemingly in a dream-like state⁽¹⁾. A landmark feature for the north-west, symbolising regeneration in the region, the sculpture stands on the site of the former Sutton Manor Colliery.

Chosen by a group of ex-miners, it was commissioned by St Helen's Council as part of Channel 4's Big Art Project – an ambitious public art initiative supported by Arts Council England, the national development agency for the arts and independent charity The Art Fund.

Arup was appointed as lead consultant for *Dream*, directing the project from its feasibility stage and being responsible for structural design and the planning, tendering and commissioning process.

Civil engineering contractor Cheetham Hill Construction was appointed principal contractor, managing the work on-site from

commencement through to completion. Specialist precast concrete manufacturer Evans Concrete Products secured the contract to supply the 90 unique precast concrete units that make up the complete sculpture.

Cordek was invited to supply the moulds required to form the hugely scaled-up version of the artist's original model of the sculpture.

Initial workshops involving all parties were used to establish a joint pattern for the precast units. Numerous alternatives were considered until an optimum solution was achieved that met the artist's aesthetic requirements, the engineer's structural design and the construction team's manufacture, transportation and installation limitations.

Arup, using a digitally scanned model of the original sculpture, scaled this up to the required 20m height. Cordek then machined a 1m² panel and identified that the digital surfaces needed refining. Arup, using Rhinoceros software, recreated the artist's



Figure 6: Positioning of final precast unit.

original surfaces and created the internal void necessary to reduce the size and weight of the 54 units.

This was the starting point for the manufacture of the moulds. Cordek, after discussions with Evans, re-orientated the units into the optimum plane for casting the concrete. Consequently most of the Cordek moulds were made with the finished surface at the base.

The CAD CAM technician then digitally created the 3D mould profile required to support the concrete pressure, which was in excess of 50 kN/m^2 . First a timber and ply bed was formed as a rigid base onto which the mould was constructed. Using the 3D mould drawing, high-density expanded polystyrene blocks were cut oversize on a computer controlled hot wire cutting machine. The profiled blocks were then laminated onto the timber bed ready for the routing.

The moulds were then aligned within the 13m-long five-axis router and the surface profiles were machined into the polystyrene blocks at a level 10mm below that required for the final sculpted surface. A layer of dense polyurethane foam, approximately 20mm thick, was then applied to the surfaces. Once the coating had cured the moulds were ready for final machining.

The skilled CAD CAM operator then designed the tool paths to produce the accurate sculpted surfaces. Typically this involved machining with a 10mm-diameter routing tool with a 1–2mm stepover between passes. To achieve the detail and accuracy required, this operation took up to 20 hours for a single unit. The final process for the sculpted surface of the mould was to seal the foam with an epoxy resin to facilitate the striking of the moulds.

To ensure that the same level of accuracy was achieved on the mating surfaces between units, Cordek extracted the top and bottom surfaces of each unit from the 3D



Figure 7: Ceremony to mark 'unveiling' of Dream sculpture.

model and CNC machined these profiles out of plywood. These then accurately defined the sides of the concrete mould and ensured that when cast the units were dimensionally accurate.

The finished formers and the plywood stop ends were shipped to Evans, who in turn built the mould structures around them. Steel reinforcement, individually handmade for each unit to suit the various features of the face, was then inserted into the finished mould. Fibre reinforcement was also used with the mix to accommodate areas with excess cover.

To complete the set-up process, Evans positioned the fixings in the moulds. The concrete was then poured and vibrated to achieve a high-quality finish and then the

units left for 24 hours to cure before being stripped from the moulds.

The face of each unit was then acid etched to expose the brilliant white of the Spanish Dolomite used in the unique mix that Evans created for *Dream*, comprising Spanish dolomite main aggregate and fines, white cement and titanium dioxide pigment.

For Cordek it has been a great experience working on this most challenging project with such a great team of people and being, in part, responsible for a sculpture that will accentuate the north-west landscape for at least 100 years. ■

Reference:

1. McBRIDE, G. Making the Dream a reality. *CONCRETE*, Vol.42, No.11, pp.38–39, December/January 2008–2009.