

# Complex geometry test

Cordek has been working on the Crossrail project, where it has provided a formwork solution to cast the 'knuckle' intersections between the escalator shaft and the levels above and below



## MEMBER PROJECTS

As part of the ongoing Crossrail project, Farringdon Station is undergoing a major development to increase capacity, improve accessibility and upgrade interchanges. It will also be one of ten new stations that will serve the Elizabeth Line when it opens in 2018.

Cordek was tasked with providing a formwork solution to enable the main contractor to cast the 'knuckle' intersections between the

escalator shaft and the levels above and below.

Unlike the straight part of the tunnel - which could be formed using traditional formwork - the complex geometry of the top and bottom intersections required a unique formwork solution to form the secondary tunnel lining.

The design had to accommodate the restricted access to the project and recognise that the formers needed to be suitable for manual handling.



Cordek worked closely with the main contractor, a BAM/Ferrovial/Kier joint venture, to develop a formwork concept that could be installed in stages to suit the preferred concrete pour sequence required for this complex structure.

## Digital process

From the engineer's 2D drawings, Cordek was able to generate a 3D model of the surface of the tunnel lining. Using this model, the surface was then subdivided into manageable individual formwork units that were lightweight enough to handle but also able to withstand the concrete pressure during casting.

Designed into the model was a network of tie bolts that could be used to accurately locate and secure the units into position. The units were designed using a Filcor 70 flame retardant EPS (expanded polystyrene) core with a fibreglass coating on the forming face to ensure easy striking. A plywood backing was also included for strength and support.

The units were manufactured to tight tolerances at Cordek's digital engineering facility. Firstly, the complex forming surface was machined and the tie bolt holes formed, then threaded anchor plates were embedded into the Filcor EPS.

The holes for the anchor plates were then filled and faired before



**The formwork concept was installed in stages to suit the preferred concrete pour sequence required for this complex structure**

the fibreglass coating was applied and the plywood backing bonded into position. The formers were manufactured and delivered in three stages over an eight-week period to suit the contractor's programme.

Working within the restrictions of the tunnels access points and the resources available to fix and strike the units, the design kept the overall number of units to a minimum.

The success of this formwork solution was a combination of the initial detailed collaboration between Cordek and the JV, coupled with Cordek's expertise in designing and manufacturing complex formwork.