

CASE HISTORIES

Diamond helps to bridge the gap

Renovation work to the famous Forth Road Bridge involved around 17,000 m of diamond drilling to facilitate the placement of steel reinforcement bars for strengthening of the bridge's foundations.

From around 1130 onwards, pilgrims travelling to St. Andrews crossed the Firth of Forth using the "Queens Ferry". That all changed in 1964 with the completion of the construction of the Forth Road Bridge, which at that time was the 4th longest suspension bridge in the world spanning over 2.5 km. Today, this elegant and hard-working Scottish icon of engineering provides a safe crossing for more than 24 million vehicles each year and links the capital, Edinburgh with Fife and the North East of Scotland.

As part of a regular maintenance programme, work commenced on site in May 2010 to replace all the bearings on both approach viaducts on the north and south of the Forth and will continue until the end of 2012. The approach viaducts are supported by reinforced concrete piers with steel bearings to allow the bridge deck to move to compensate for changes in temperature and traffic loading. The project involves jacking up the bridge deck to allow removal and replacement of the existing bearings, with the concrete being strengthened at the jacking points by the addition of reinforced concrete corbels added to each side of the piers.

Corecut Ltd, based in nearby Broxburn, are carrying out a package of sub-contract works on behalf of main contractor, Balfour Beatty Civil Engineering having worked together previously on similarly technically demanding contracts. One of the main aspects of Corecut's work is the drilling of holes in the existing concrete piers to accommodate the placement of new steel reinforcement bars that would 'tie' the new corbels to the existing structure.



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The scope of work involves mapping the depth and location of the existing reinforcement within the bridge piers, drilling holes up to 5.5 m deep and inserting new resin-bonded rebars into the cored holes. Corecut chose Hilti as its tool and equipment supplier since it was one of the few companies that offered a complete range across all these activities.

Prior to commencement on site, a “mock pier” was built at nearby Rosyth in order to gauge the accuracy of the diamond drilled holes. Using a core bit guide previously developed by Hilti, a tolerance of ± 10 mm was achieved whilst drilling horizontally to a depth of 5.5 m, the maximum for the job.

Mapping the depth and location of the existing reinforcement within the bridge piers is being carried out using Hilti’s PS 200 Ferrosan. In this way, Corecut operatives work alongside Balfour Beatty site engineers to determine where best to drill holes for the post-installed reinforcing bars. A Hilti PR 25 Rotating laser is then used to transfer levels around the pier at the required height and aid in setting the location of the holes to be drilled.

Once this is agreed, Corecut then uses Hilti’s DD 200 diamond drilling system to core out the 57 mm diameter holes to the depths and accuracy specified. On completion, the total distance drilled will be in the region of 17,000 m.

When the holes are drilled, the additional reinforcing bars are installed using Hilti HIT-RE 500 resin, which the company claims has high load values over a wide range of bar diameters backed up by extensive test data. Using a Hilti HIT-P8000 pneumatic dispenser and long lengths of hose with piston plugs attached ensures the resin is installed from the base of each hole – a precise volume of resin is used to ensure the design loads are achieved – up to five 1400 ml tubes are used on the larger diameter holes and a total of 5,500 litres will be used on completion of the project.

Contracts Supervisor for Corecut on the project, Peter Ferguson said, “Our initial trials were critical to ensure every bar is installed correctly, our operatives are well trained and know exactly what is required.” Every detail of the installation process was thought through even down to keeping the resin at a constant temperature in insulated crates at the workface to ensure easy and cost efficient use.

Alongside the strengthening works, Corecut are also employed by Freyssinet UK to cut grooves for the installation of a cathodic protection system to reduce corrosion rates of the reinforcing bars within each pier. 12 m long grooves are cut at a 45° angle into the structure using a Hilti TS 20-E track saw to a depth of 45 mm. Once again, accuracy and a precise depth of cut are needed to ensure the existing reinforcing bars are not damaged.

Project Manager for Balfour Beatty Civil Engineering, Alan Brisbane speaks highly of the relationship built with Corecut on this project, “Finlay Crocker (MD of Corecut) and his team have helped in making an awkward and challenging job run smoothly and it is a pleasure to work with such a professional and conscientious contractor.”

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The surface is scanned to locate the rebars prior to diamond drilling of 57 mm diameter holes up to 5 m in depth



Resin is pumped into each hole and a reinforcement bar inserted



View showing new reinforcement in place for the new concrete corbels, which is tied to the post-inserted bars

