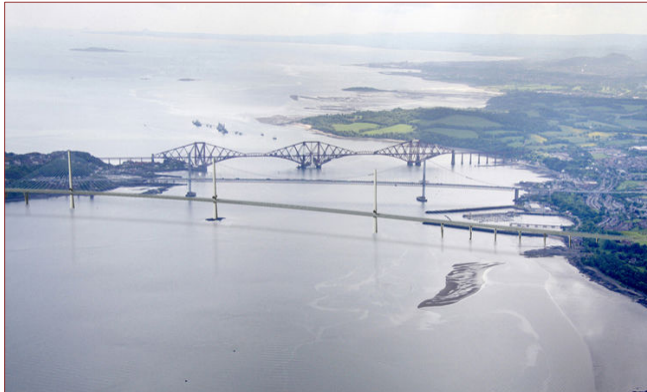


**FORTH REPLACEMENT CROSSING  
M9 JUNCTION 1A UPGRADE – KIRKLISTON NEAR EDINBURGH**



An artist's impression of the new River Forth Crossing



The P-140-TT Llamada CFA Rig

The Forth Replacement Crossing (FRC) is a major infrastructure project for Scotland, designed to safeguard a vital connection in the country's transport network.

Despite significant investment and maintenance over its lifetime, the current Forth Road Bridge is showing signs of deterioration and is not suitable as the long-term main crossing of the Firth of Forth.

The three main contracts that make up the project are...

- The principal contract to build the new bridge & connecting roads.
- A contract to install elements of the project's Intelligent Transport System (ITS) on the M90 in Fife.
- A contract for a major upgrade to the M9 Junction 1a at Kirkliston.

The piling works formed part of this 3rd section of the project.

The piles were required to support major new sign gantries at various locations in addition to the widening of 2 main structures, namely the Kirkliston spur overbridge at junction 1A of the M9 and the Overton overbridge.

The piling works comprised the drilling of 121 no piles of 600, 750 & 900 diameter and up to 21.0m deep.

**ULTIMATE CLIENT**

Transport Scotland  
An Agency of the Scottish Government

**CONSULTING ENGINEER**

Gifford, part of Ramboll

**MAIN CONTRACTOR**

SRB Civil Engineering Limited - A Joint Venture of John Sisk & Son and Roadbridge

**ROLE**

P J Edwards UK acted as Piling Contractor

**SPECIFICATION**

Specification for Highway Works

**EQUIPMENT**

2 No Llamada P-140-TT Piling Rigs

**CONTRACT PERIOD**

December 2011 – August 2012

The ground conditions consisted of backfill materials overlying Stiff Glacial Till and a founding stratum of Mudstones and Sandstones of the Strathclyde Group. A small number of the piles were terminated in the Stiff Glacial Till.

The preferred piling system was Continuous Flight Auger piling due to the installation speed of such rigs. However the Sandstones and Mudstones were known to be of strong consistency and were furthermore inter-bedded with veins of even stronger Dolerite at some locations.

To overcome the drilling difficulties that these rock types would present for CFA rigs, the system was supplemented, where necessary, by the use of a pneumatic Down the Hole Hammer (DTHH) and follow-on temporary casing, (the Odex Method) to maintain a stable bore behind it.

When drilling the hardest of rocks water was introduced into drilling process via the pneumatic pipe lines to environmentally control any dust emissions.

The safety of passing vehicles was assured by the use of a safety screen, suspended from the secondary hoist line of the piling rig.

Once the hole had been advanced to the required toe level the DTHH and temporary casing were withdrawn and the bore backfilled. The pile was then drilled and concreted using traditional CFA techniques.

The DTHH and casing could be attached to one of the powerful CFA rigs used for the project. This gave the necessary flexibility to the installation process that the piling programme required.

To confirm design assumptions 4 No preliminary test piles were installed in advance of the main piling works. Maximum applied test loads varied up to 4,730kN.



The two Llamada Rigs at Kirkliston Overbridge



The P-140-TT Llamada Rig in DTHH mode with safety screen suspended from the rig to protect passing traffic