

Hexham Water Main – River Tyne Crossing

Contract Value	£2.4M	Commenced	Sep 2005
Contract Period	52 Weeks	Completed	Sep 2006

Features

- 1600mm diameter pipe jack sleeve river crossing
- 2 No 23 metre deep bolted segmental shaft.
- Remote controlled slurry tunnelling machine
- 3No x 300dia 16 bar water main installation
- Partnering/Target Cost NEC Option C

Brief Description

In January 2005, Hexham and the surrounding area experienced serious flooding. Scouring of the bed of the River Tyne occurred and twin water mains which had been laid in the river bed were washed away. Some 6,800 residential properties in Hexham were without water until a 5.5km of temporary overland main was constructed.



The long term, secure solution was deemed to be a tunnel beneath the Tyne to carry three 300mm dia water mains, two to be connected to the existing network, and the third to be available for meeting future demands. A tunnel was considered to have least environmental impact on the river and, when constructed at least 10 metres beneath bed level, any concerns over river bed scour were overcome. (The river at Hexham has been a commercial source for dredged gravels in the past). Both river banks are environmentally sensitive areas. The south side is a riverside footpath with an avenue of trees and forms an extension to Hexham’s riverside park. Access to the shaft site utilised an unmanned level crossing on the Newcastle to Carlisle railway.

The target cost contract for construction of the tunnel, insertion of the new mains and their connections to the existing mains was secured by competitive tender.

Site investigations had indicated ground conditions at tunnel horizons to be dense silty gravelly sand with layers of gravels and occasional cobbles. The water table approximated to river levels. Byzak’s proposal provided a 120 metre long, 1000mm dia pipejack to be installed by a Herrenknecht AVN 1000 machine driven between segmental shafts, 4.5m dia on the north bank to 4.0m dia on the south bank.

The 23m deep shafts were constructed as caissons using a sacrificial steel cutting edge and an external insitu concrete carcass to the segmental rings.



Deep wells were sunk at both shafts locations to lower and relieve water pressures in the moderate to high permeable sands and gravels. Removal of the precast concrete segmental plates at the tunnel horizons facilitates provision of a soft “eye” with seal arrangement to be created, suitable for tunnelling machine launch.

The drive shaft was completed satisfactorily but the ground encountered at the reception shaft (south bank) contained increasing quantities of cobbles and large boulders. Additional kentledge had to be applied to the caisson. Excavation progress was considerably reduced and the shaft was completed only with extreme difficulty.

The unexpected presence of unconstrained cobbles and large boulders gave rise to concerns that the relatively small TBM selected would not be adequate for the ground conditions.



Accordingly, a decision was made to switch to Byzak’s larger and more powerful remote controlled Herrenknecht AVN 1600D which had proved successful in equally onerous ground conditions. Modifications were made to the TBM to further improve performance for the site conditions and the drive was completed successfully with the TBM in bentonite slurry mode without incident as a 1600mm dia pipejack.

A pipe bundle of three 300mm dia PE 16 bar rating pipes was installed in the tunnel and connected to riser pipes in the shafts. Connections were made to the existing mains and the new system was tested and commissioned. The temporary main was removed and the site reinstated.

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