Barhale

Millharbour Sewer Diversion

Client:	Ballymore Group
Location:	Isle of Dogs, East London
Value:	£3.44m
Duration:	10 Months

In Brief...

To facilitate the construction of several new apartment blocks, providing 766 new homes, Barhale were engaged by the Ballymore Group to divert an existing 1600mm sewer outside of the footprint of the future building.

TBM launch from MH2


TBM breakthrough

Design Feasibility: Value Engineering Solutions...

In order to provide a valuable solution to the client from the outset, Barhale undertook extensive design feasibility studies in collaboration with their design partner, Nicholas O'Dwyer. Through undertaking Early Contractor Involvement at tender stage, Barhale were able to challenge the outline design and provide an alternative solution which would be constructed faster, cost less and reduce disruption to the surrounding area.

The original tender scope was to provide a design and build solution for the diversion of a 1600mm diameter trunk sewer, which traversed along the northern boundary of the proposed development. This would have involved the construction of three off-line manholes, two connection manholes, two heading tunnels (15m and 20m in length) and a 125m long, 1800mm diameter Tunnel Boring Machine (TBM) drive.

Tenderers were given the opportunity to submit a non-compliant bid, if they believed this would offer better Value Engineering options. Barhale used this opportunity to propose an alternative alignment, moving the eastern tie-in location away from a service laden area, within a busy road junction.

On the back of this solution, Barhale entered into contract under a Letter of Intent to further develop the alternative proposal.

As the site investigation progressed it became apparent that the original tie-in location was not feasible. There were numerous obstructions including: high value fibre-optic cables, a DLR viaduct and a third party contractor occupying the proposed works area.

Barhale worked with Nicholas O'Dwyer to develop five alternative routes and presented these to the client, highlighting the viability of each. The client instructed Barhale to proceed with a proposal which would effectively re-route the sewer anti clockwise around the development. This would involve two TBM drives, and a side entry connection into the existing sewer via a hand jacked tunnel.

This was successfully designed and approved. The final design solution met all requirements posed by the client and the future adopting body (Thames Water), resulting in a curved drive to avoid the need for a build over agreement between the two parties.

Technical Features...

Barhale utilised their extensive tunnelling expertise, in-house resource and plant to install the diversion, which consisted of the following:

- 245m of 1500mm closed face boring tunnel
- 8m of 1800mm hand jacked tunnel
- Construction of three new manholes
- Diversion of a 250mm Water Main and a 100mm MP Gas Main

Once the new route was installed, the team made two connections into the existing Thames Water network Flows were then turned on to the new network and the original sewer was made redundant.

Each of the three new manholes (2.4m – 3m in diameter) were constructed within pits:

- MH F1: 6.2m x 4.2m x 5.9m deep
- MH F2: 6.3m x 6.3m x 5.2m deep
- MH F3: 4m x 3m x 6.5m deep

Technical Features Cont...

MH F2 was used as the launch pit for both TBM drives. The first drive headed east to MH F3 and the second went north, to MH F1. The team used a 1200mm Iseki Tunnel Boring Machine with an upsized kit attachment; increasing the Internal Diameter to suit the 1500mm new pipework.

The team also constructed dry weather flow channels within the tunnels post-drive. Bespoke timber frames were fabricated at ground level and then lowered into the tunnel, before being fixed into position. The formwork was fabricated to include sloped sides in accordance with the agreed design. Thereafter, a concrete pump was positioned at ground level, and concrete was poured in 50m sections into the tunnel to form the channels.

Good Practice...

Barhale undertook preparatory works on the existing West India Dock Sewer to ensure the connection to the network would be successful. This included CCTV surveys, high pressure water jetting and the relocation of several fibre-optic cables within the sewer. Works were undertaken during the night, when flow rates within the sewer were reduced. All man entry to the sewer was identified as high risk confined space working. As such, all necessary confined space procedures were in place throughout these works, including the implementation of a designated rescue team.

The team engaged a specialist subcontract partner to undertake a number of Ground Penetrating Radar (GPR) surveys and developed an intricate 3D model, providing a comprehensive image of the existing utilities. This was then utilised to accurately design and plan the construction of the shallow tunnel drive; mitigating the risk of damage to third party assets through potential clash detection.

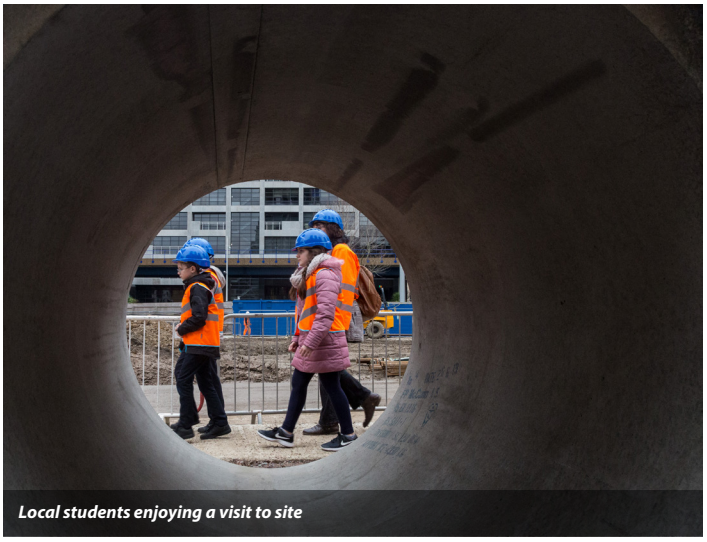
The TBM drive needed to adhere to a relatively flat gradient (1:600), meaning there was a very low tolerance for error. Through robust control of the tunnelling procedure, provided by an extensive Inspection and Test Plan (ITP) and an experienced tunnelling team, the quality parameters were assured throughout.

In order to connect into the existing 1600mm diameter sewer, a bespoke hand jacked shield was designed and fabricated (by BCS, Barhale's in house fabrication department). This allowed the hood to protrude over the top of the sewer, and mitigate ground loss. The alluvium ground was stabilised in advance of the hand jack using a geo-polymer injection, which made the face of the drive cohesive and semi-impermeable. Additionally, radial braces were installed to strengthen the internal wall of the existing sewer, to prevent any damage during the connection.

The site was surrounded by residential apartments and hotels. The need to limit the impact of the works was therefore paramount. The site team successfully controlled noise and dust emissions by placing a number of receptor instruments around the site boundary, and monitoring the readings regularly to ensure they did not exceed the agreed limits. Noise reducing equipment was also added to the tunnelling machinery.

The team invited a local primary school, River House Montessori, to visit the site. A number of pupils were shown around the site by Barhale's Senior General Foreman, Luke McDermott. Luke outlined the details of the project, and provided the children with an understanding of how the sewer network operates, in a way that was fun and accessible. The visit was very successful, encouraging the children to think about what happens to the water when it goes down the drain, and the role Civil Engineering plays in assisting that process.

Construction of dry weather flow channels within the tunnel



Local students enjoying a visit to site

Customer Benefits/Feedback...

This was a complex project, combining client and stakeholder interface, hydraulic and geotechnical design considerations as well as intricate delivery, using innovative techniques.

Barhale collaborated well their designers and third-party stakeholders to identify fundamental flaws in the outline design. Moreover, they were able to provide a series of practical proposals to the client, identifying Value Engineering solutions which could be implemented into the scheme. Barhale coordinated with several key stakeholders including Thames Water, London Borough of Tower Hamlets, Cadent and the Dockland Light Railway. Managing these relationships was integral to the successful delivery of this scheme.

All works on this complex project were delivered safely, on time, and in line with all quality standards, giving both the client and Thames Water great confidence in the final product.

All these factors contributed to a successful scheme, and cemented Barhale's position with Ballymore Group as a trusted supplier for complex civils projects