Energy Case Study

Chelsea to Battersea Tunnel and Gas Pipeline

Client:	tRIIO and Cadent Gas
Location:	Chelsea, West London
Value:	Confidential
Duration:	15 Months

In Brief...

Barhale have recently carried out work on the new Chelsea to Battersea gas pipeline. As part of the ongoing work to replace and upgrade large diameter gas mains throughout central London, a new gas pipeline was required underneath the River Thames between the Royal Hospital Chelsea and Battersea Park.

The overall project was split in to two separate contracts, both of which were awarded to Barhale:

Contract 1: Construction of two shafts, connected via a new tunnel underneath the River Thames, which would facilitate the installation of the new 600mm diameter gas main. This contract was delivered to tRIIO.

Contract 2: Installation of the 600mm diameter, welded steel pipeline through the tunnel. Including the installation of several governors and the connection of the new pipeline into the existing network. This contract was delivered directly to Cadent Gas Ltd.

Shaft construction overview

Technical Features Contract 1...

Work commenced with the simultaneous construction of two shafts:

- The 7.5m diameter x 30m deep drive shaft was constructed in the grounds of the Royal Chelsea Hospital (which had to be completed and covered ahead of the Chelsea Flower Show)
- The 6m x 30m deep reception shaft was constructed across the Thames in the north-east corner of Battersea Park

Each of the shafts were constructed using a combination of caisson jacked and underpinning techniques.

Both shafts were constructed in sensitive, high profile areas of London, which required appropriate management.

Tunnel Boring Machine entering the shaft

The locations of the shafts, their sizes and the construction techniques used all had to be designed to optimise construction costs, whilst minimising the disruption caused to the public.

Once the shafts were completed, tunnelling operations could commence. A 1.8m diameter tunnel was installed via pipe-jacking techniques under the Thames at a total length of 330m.

Due to existing and planned third-party assets passing within the vicinity of the new gas tunnel (most notably the Thames Tideway tunnel, which will pass below Barhale's tunnel), the team elected to use a 2.1m Iseki slurry Tunnel Boring Machine. This TBM was best suited to cope with the London clay conditions encountered. This diameter machine was selected to ensure the tunnel was fit for purpose to house the gas pipes whilst not affecting the Thames Tideway tunnel. Barhale used Cyclone Slurry recycling equipment in conjunction with the TBM to control settlement and effectively manage spoil arising from the tunnelling operations. Once the tunnel was installed, the installation of the gas pipeline could commence under contract 2.

Technical Features Contract 2...

Cadent required a new Intermediate Pressure (IP) gas main to pass through the tunnel, picking up two new Intermediate Pressure/ Medium Pressure Governors along the route. These Governors will then reduce the pressure in the main from Intermediate to Medium, allowing the flow to tie into the existing Medium Pressure network.

The 600mm diameter welded steel pipeline was installed by Barhale throughout the entire length of the new tunnel. The two types of welding methods used by Barhale operatives were TIG and MMA:

- TIG (Tungsten Inert Gas) welding uses Tungsten and Argon for more detailed work for thinner gauge materials to achieve more accurate welding. This was primarily used on the pipeline because it provides a low Hydrogen weld, thus a lower risk of weld cracking due to high hydrogen content. It is also a cleaner process than MMA (Manual Metal Arc) which leaves slag that would need to be removed
- MMA is a different performance process that uses a consumable electrode covered with a flux (protective gas shield) to lay the weld. The MMA welding was used after TIG to complete the outer cord of weld

Barhale

Intermediate Pressure (IP) Gas Main

Pipeline welding in progress

Customer Benefits/Feedback...

Works within a busy area of London coincided with a major public event (RHS Chelsea Flower Show) and being in proximity of some high profile public areas (Royal Chelsea Hospital and Battersea Park) carried numerous logistical, planning and cost challenges. This included a high profile risk of damaging reputation or prolongation of programme. The Barhale team were able to overcome these risks through appropriate planning and design, as well as innovative working methods. Barhale have delivered these contracts without any delays or concerns, meaning neither Cadent, nor members of the public were disrupted.

The use of the Flying Factory resulted in working techniques which were safe, precise, efficient and cost effective. Overall, both tRIIO and Cadent have been very satisfied with Barhale's safe and collaborative approach to programme delivery.

Technical Features Cont...

The pipeline welding was then rigorously tested either pneumatically (air) or hydrostatically (water). Medium Pressure pipework (up to 3 bar) was subject to pneumatic testing, whilst Intermediate Pressure pipework (up to 7 bar) was tested hydrostatically, which is a safer method to test to working pressure as air pressure testing releases more energy in case of failure or leaks during the test.

Barhale carried out large portions of the pipe fitting and welding using a new concept known in the Industry as the 'Flying Factory'. This is a temporary facility which combines the precision of off-site manufacture (standardised quality control) with the adaptability of site based working (flexibility, mobility and adaption to site specific circumstances).

The 'Flying Factory' differs from conventional off-site manufacture in that it only operates for the duration of the project and then can be moved to another location for use on a different scheme of works. This provides faster on site solutions, installations and communication. Implementation of the Flying Factory reduced the risk of quality defects and resulted in improved programme certainty, with reduced commercial risk.

The specific benefits to welding on site were:

- Enhanced accuracy of measurements
- Ease of communication between all parties
- Better quality welds
- Increased the speed of the process
- Reduced risk
- A more controlled process

Long lengths of pipe were welded in the Flying Factory and then lifted in to the trench. This reduced risk by limiting the amount of welds that had to be carried out within confined spaces (trench or tunnel).

Flying Factory displaying pipeline welded and then lifted into the tunnel