



A.Hak enters into the Guinness Books of World Records

HUMBER PIPELINE PROJECT

During the successful delivery of the project in Humber we achieved a world record in replacing a 1,050mm diameter concrete weight coated pipeline. From start to finish the management were highly involved which supported the achievement of all the safety goals. However, this all started back in 2014, when the first signals for this project were reaching the market. Therefore, how did we achieve a world record for this project?

In summary, the project achievements were:

- Construction of a nearly 5km concrete segmental lined tunnel up to 30m deep below the Humber, based on Engineering – Procurement and Construction (EPC)
- Installation of a 1,050mm diameter concrete weight coated pipeline with a maximum operating pressure of 70bar, based on an alternative design presented by ourselves during the bidding phase
- Connection of the new pipeline to the existing connections approximately 120m onshore at Goxhill and 400m at Paull
- Decommissioning of the existing Feeder 9 pipeline
- Cathodic protection facilities for the new pipeline
- Two construction compounds, one each side of the river at Goxhill and Paull, adjacent to the existing AGIs
- Significant environmental works to mitigate the impact on the existing protected local environment
- Associated works for permanent and temporary accesses, highway works, drainage works, temporary spoil storage, temporary lay-down areas and ancillary works

The pipeline is designed to have a minimum operating life of 40 years and the tunnel a minimum design life of 120 years.

Project Background

A strategic component of the United Kingdom Gas National Transmission System (NTS) is the Feeder 9 pipeline that crosses the Humber estuary near Kingston Upon Hull. In 2009, underwater surveys highlighted an unprecedented amount of erosion near Feeder 9 which had exposed sections of the pipeline in the navigation channel. It was necessary to find a long-term solution for this Feeder 9 pipeline. A tunneled solution was determined to be the most; economical, environmental, and safe way to proceed.

As well as being economically significant, the Humber Estuary and the intertidal mudflats surrounding the area are of significant ecological importance for many species including birds, mammals (seals and otters), and fish. As such requires some of the highest levels of environmental protection available through International, European and National legislation. The Humber Estuary is an internationally a European designated Special Area of Conservation (SAC), a Special Protected Area (SPA), a nationally designated Site of Special Scientific Interest (SSSI) and an Important Bird Area (IBA).

The Feeder 9, River Humber Pipeline project replaced the existing Feeder 9 gas pipeline with a new 1,050 mm high pressure gas pipeline under the estuary of the River Humber. To avoid any impact on the local environment, the pipeline was to be installed inside a precast concrete lined tunnel. The tunnel was to be excavated utilising a 4.4m diameter Slurry Pressure Balance Machine to provide a tunnel of 4.9 km in length with an internal diameter of 3.65m.

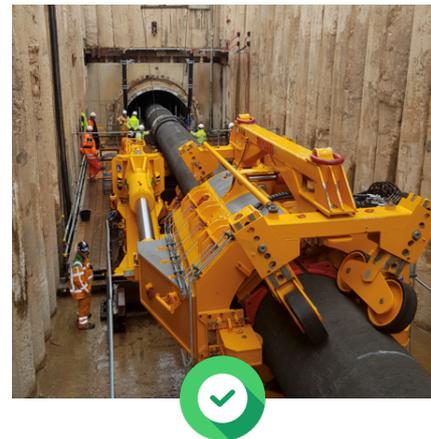
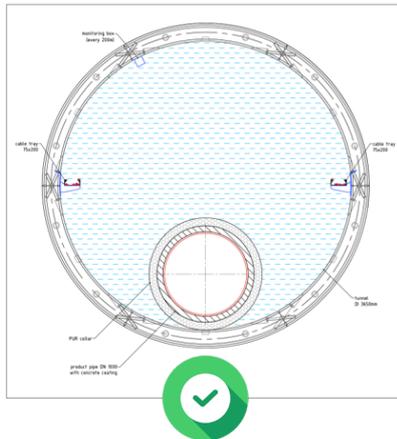
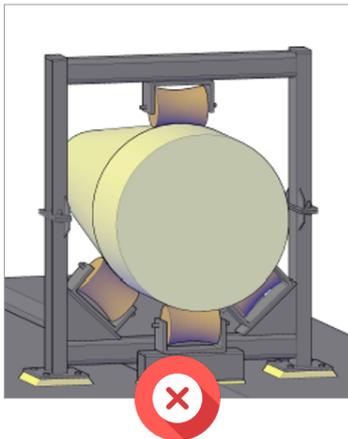
Award Winning Project Delivery

In 2020, during the tunneling operation, this project achieved to be the safest project of National Grid, which was recognised with the **National Grid UK Safety Project Award**.

Following completion of the tunnelling works the pipeline was inserted as a continuous 4,992 m string into the water filled tunnel before connecting at each end to the existing Feeder 9 pipeline. Despite the huge technical challenges involved in this project, the project team in collaboration with National Grid, developed a solid technical solution for the installation of a circa 5 km pipeline into a flooded tunnel, an achievement that has not been equaled anywhere in the world, which led to the project's registration in the **Guinness Book of Records!**

Challenges that we had to overcome:

1. Flooding risk of the project site.
A combination of low-lying land, tidal flows and locked-in water leads to cumulative risks of flooding from groundwater and surface water. All vulnerable components of the site, offices and generators etc., needed to be elevated above the risk water level or protected by flooding barriers.
2. Because of the tidal impact up to 6.5m tidal variance of the river, internally in the tunnel during the tunneling operation, the working pressure in the tunnel needed the same variance in compressed air, which went up to 3.45 bar. Engineering of an alternative pipeline installation, because of unworkable original design of inserting the pipeline in the tunnel.



3. The image above (left) shows the original design which was unworkable for installation and with design life quality issues. The images (middle / right) shows the alternative solutions proposed during the tendering phase which lead to us being awarded the contract.
4. Risk of sinusoidal pipe string buckling loads during installation

How we overcame them:

Solutions through alternative pipe insertion designed by using:

1. Concrete coating to mitigate buckling of the pipe
2. Design the insertion of the pipe with the theory of floating the pipe into the tunnel filled with water instead of rollers
3. Using Pipe thrusters to handle the pipe movements precisely

Conclusion

The Feeder 9 pipeline project successfully delivered the longest pipeline in a tunnel in the world and will transport up to 20% of the UK gas supply. The new pipeline will not be subject to the uncertain conditions of the Humber Estuary and will thus ensure the reliable and safe transportation of gas for the foreseeable future.

Despite the huge technical challenges involved in this project, the project team in collaboration with the National Grid, developed a solid technical solution to the installation of a circa 5 km pipeline into a flooded tunnel, an achievement that had not been equaled anywhere in the world. Not only will this project set the bar in respect to overcoming technical challenges never before encountered it will provide a long-term sustainable solution to the transmission of gas across the UK.

This EPC-project was commenced in May 2016 and was fully completed by August 2021. Along with the achievement of a world record this project also passed all key milestones to completion.

