BELFAST SEWERS

Belfast, N.Ireland  Value - £125 M in JV

Summary
The purpose of the project was to improve the quality of life for thousands of people in Belfast. The Belfast tunnel controls the risk of flooding and improves the water quality in the River Lagan. The tunnels run for a distance of 9.4km under Belfast from Broadway roundabout and Ormeau Park to Duncrue WWTW.

Key Facts
- To reduce the risk of flooding and provide the City of Belfast with 21st century infrastructure, 1,400,000m³ of stormwater will be transferred annually from 10 new connections through 9389m of new stormwater tunnels and 20 new deep access shafts. 583,000m³ of the stormwater will be transferred to the WWTW for treatment. The remainder will be screened by 2x8m diameter drum screens to 6mm before discharge at up to 16m³ per second.
- The shafts & tunnels required 45,300 precast concrete segments and 20,000 cubic metres of ready mix concrete.
- The project excavated in the region of 250,000 cubic metres of spoil.
- The storage volumes within the pumping station when full is 4,000,000 gallons of water, equivalent to 7 Olympic swimming pools.

Challenges and steps to success
- The close proximity to local residents presented the need for excellent community relations. Using Farrans Assure, our customer care system, allowed us to introduce the project to the local community, especially schools. Innovative measures included the provision of school patrols to help children avoid the sites on their way to and from school.
- Working within the residential area we were presented with the challenge of keeping noise disruption to minimum; to achieve this we enclosed our most sensitive shaft site in sealed acoustic building to protect residents from dust and noise.
- The Belfast tunnels were driven through rock, sands and gravels and stiff clays. The TBM’s are Earth Pressure Balance (EPB) machines were selected for their mixed face capability. EPB technology relies on controlled positive pressure at the face of the machine to limit effects at ground level and potential surface settlement. Face pressure was maintained by careful control of the extraction screw and rate of advancement. Injecting additives at the face helped to further control the pressure at the screw. Polymers made sands and gravel cohesive, while foams prevented stiff clays from binding.
**ABBERTON**

**Colchester, England**

**Value - £22.7 M**

**Summary**

The Abberton project consisted of a new pipeline, break pressure tank and Pumping Station and formed part of the £150 million Abberton Scheme, which is designed to provide security of supply of raw water to one and a half million people in Essex.

**Key Facts**

- Construction of more than 32kms of 1200mm diameter spirally wound welded steel trunk pipeline for Northumbrian Water Limited, including reinforced concrete tank construction and M&E works.

- Combination of two separate pipelines working with the River Stour natural water course in the transfer of 120 Mega Litres per Day, from Newmarket in Suffolk to Colchester in Essex, forms part of the nationally significant Ely Ouse Transfer Scheme.

- Incorporating; major pipeline installation, crossing of fields, minor roads, national highways and the high speed London-Colchester commuter railway line.

- Including trenchless technology challenges across the spectrum of tunnelling techniques, closed face Earth Pressure Balancing (EPBM) tunnels, micro tunnelling, and the use of back actor shield tunnel construction.

- Working in partnership with the Northumbrian Water team, Farrans delivered the project safely, ahead of programme and lower that the NEC Option C Cost Target.

**Challenges and steps to success**

- A key challenge was the single crossing of the high speed London-Colchester rail line and the 6-lane A12 dual carriageway. Road and rail closures were not permitted for either site investigation or construction.

- Working closely with NWL and with our specialist partners Jacobs Rail, Ward & Burke and Herrenknecht, Farrans as Principal Contractor co-ordinated the approval process through comprehensive investigation, liaison and design. The process commenced in October 2010 and culminated in formal approval in May 2011.

- Poor ground conditions including a high water table, a layer of glacial deposits and a railway embankment which Network Rail classified as marginal to poor all added to the difficulties both through the approval process and construction phase.

- The 8m diameter 14m deep launch and reception shafts were constructed using a specialist in situ concrete caisson method which eliminated concrete segments and provided a fully sealed shaft.

- To limit any potential settlement Farrans utilised an 1800mm diameter Earth Pressure Balance Tunnelling Machine (EPBM) and installed the 150m long tunnel 18m below the railway and highway in two weeks and recorded settlement of less than 2mm.

- The key success in Farrans delivery of the Abberton Pipeline was the proactive approach taken by an experienced and comprehensive management team in delivering such a large scale pipeline in a single year through a proactive approach to landowner liaison, right on time delivery of pipe from Spain, value engineering of pipe dumps/road crossings and equipment selection, resource and programme management installing up to 1600m of pipe per week and a comprehensive final field reinstatement, drainage, testing and commissioning plan.
Summary

Roads Service DBFO Package 1 was Northern Ireland’s first privately finance road project. Farrans were a member of the DBFO Company awarded the 25 year DBFO concession and Farrans delivered the £114m design and build project.

Construction of a 140m, 30m wide and 7m deep long underpass to carry 6 lanes of the M1 motorway beneath the busy Broadway Junction. This underpass was constructed using top down construction methodology though very difficult and challenging ground conditions.

Construction of a 16m deep x 5m internal diameter shaft to form the drainage pumping station servicing for Broadway underpass.

Construction of a 12m deep x 4.5m internal diameter shaft to the drainage pumping station servicing for Grosvenor Road underpass.

70m long twin pipe jack under the Blackstaff River and M1 motorway to accommodate a 1000mm diameter foul sewer pumping main and 1050mm diameter sewer.

Key Facts

• Broadway Underpass was constructed using 1200mm diameter secant piles
• The construction of Broadway Underpass involved the excavation of approximately 100,000m3 of material using top down construction methodology
• The shafts were constructed using precast segmental sections jacked down from ground level and an internal structural lining

Challenges and steps to success

• All works were undertaken in challenging ground conditions comprising made ground overlying very soft alluvial ‘Belfast Sleech’ overlying glacial till with intermittent layers of water bearing gravel overlying Sherwood Sandstone.
• Artesian groundwater was encountered at Broadway in both the permeable bands within the Glacial till and in the Sherwood Sandstone. This created a significant challenge for construction of both the underpass and pumping station shaft. Special measures were employed to counter this problem including installation of temporary sheet piling, grouting and construction under water.
• All works were carried out in very confined sites with temporary traffic management in place to maintain the uninterrupted flow of 65,000 vehicles through the project construction site each day.
• Broadway underpass was opened 13 months ahead of programme giving an estimated benefit to the local community of £25 million to £30 million by removing the requirement for the main motorway traffic to pass through the heavily congested Broadway junction.
Challenges and steps to success

- A key challenge throughout the lifecycle of the project was its proximity to residential areas and a major football stadium catering for up to 60,000 people on match days. A communications flow was established to inform all local stakeholders of the construction works schedule and updates. A Community Benefit partnership was also established with the local Regeneration Agency to deliver on employment targets.

- A traffic management system was developed to ensure construction activities could be done safely and to achieve construction programme in areas where interfacing with existing roads and traffic signals.

- Onsite challenges included the development of an earthworks strategy to minimise material off site and manage low level contamination of onsite materials.

- During the tunnel works a key challenge was dealing with variation in ground conditions, we have used information gained on site to amend construction methods for future works.

- Early Utility Authority involvement to avoid programme delays.

- Introduced LEAN construction techniques to identify areas of waste and develop measurement, monitoring and improvement systems for each area of concern. Through this we identified Manholes, Kerbing and Drainage as areas of concern. Standard Operating Procedures were compiled to try and identify areas where construction methods could be improved.