

Birmingham (A45) Water Mains Diversions

the design and installation of 180mm, 400mm and 600mm water mains alongside the 2km dual carriageway diversion near Birmingham Airport

by Raff Whitehead BSc (Hons) CEng MICE MEPS

The A45 dual carriageway carries traffic between the centre of Birmingham in the west to Coventry and the M1 in the east and links Birmingham International Airport to the motorway network. When plans were made for the A45 corridor improvements adjacent to the airport runway, these included diverting the A45 and the utilities within it. Severn Trent Water had three cast iron mains that were more than 25 years old in the original road. The water mains diversions were carried out under a 'Self-Lay' agreement meaning that Severn Trent Water adopted the assets after design and installation. This arrangement was unusual because self-laying is typically used for smaller mains on development sites and not large mains.



Aerial photograph of the site, early in the works programme - Courtesy of Volker Fitzpatrick Colas

Planning the route

Meetings were held to coordinate the programme and timings for the availability of the proposed routes. Although the route was largely determined in advance by the route of the A45 diversion and the land purchased by Birmingham Airport, many details were addressed in the detailed design.

The main constraint for the route was a previously installed relief sewer, over 1m in diameter and 4m deep meaning that a wide strip of land was not available. A substantial offset from this was required to allow for future access to the sewer and the water mains. Other constraints were:

- Land boundaries.
- The proposed road embankments.
- New watercourses already under construction to replace several ditches.
- Existing trees.

- A pond that had to be partially filled to create land for laying the water mains.

The route around each of these was discussed and agreed with the main contractor coordinating the utility diversions and approved by Severn Trent Water and Pick Everard.

Pipe selection

The pipe sizes were selected to match the existing and the choice of pipe material was based on ground conditions, including contamination in some places, and installation methods. The smallest main was replaced with a 180mm PE 100 pipe, including a length of barrier pipe to protect the water from contaminated material in the surrounding soil. The 180mm pipe was laid in the service strip along the new cycleway. In order to allow for the substantial road drainage and the connections required, the usual NJUG (National Joint Utilities Group) utility arrangement was altered for this diversion.



The site with one of the diverted watercourses
Courtesy of Waterco Consultants



A diverted watercourse to be crossed
Courtesy of Waterco Consultants



The route of the 600mm main beyond the roadworks
Courtesy of Morland Utilities



An anchor gasket
Courtesy of Morland Utilities

The two larger mains were replaced with 400mm and 600mm DI pipes which meant that no specialist jointing equipment was required. The choice of material was selected by the contractor, Morland Utilities, based on commercial and practical decisions.

Protective coatings

Following resistivity tests undertaken by the pipe supplier, it was established that a zinc aluminium and epoxy coating was required for the external protective coating.

The internal protection was cement mortar lining with epoxy coating, as required by Severn Trent Water's design specification.

Anchor gaskets

The parallel mains and proximity of the large, deep sewer led to the decision to use anchor gaskets for thrust restraint instead of traditional thrust blocks. Large concrete thrust blocks were not considered a suitable solution at parallel bends as they would need to encase both mains to transfer the forces to undisturbed ground. Near the large relief sewer there was no undisturbed ground and concrete blocks would have obstructed access to the sewer and increased loading on the sewer.

Instead, anchor gaskets, containing stainless steel gripping inserts, were specified for calculated lengths each side of bends, tees and valves requiring restraint. These work by preventing pipes pulling out of the joints and mobilising the friction restraint of the surrounding bedding. The joints are still able to accommodate small angular deflections so the flexibility of the pipeline is not affected.

Special marker tape was also laid for physical identification in the event of any future excavation as any disturbed joints in future would need to be replaced with anchored joints. The joints can be released with the use of specialist tools.

Using anchor gaskets had the added benefit of no curing time for concrete thrust blocks before the pipeline could be tested. This reduced the programme time.

Approximately 50% of the 400mm and 600mm DI pipes were laid using anchor gasket joints.

Important requirements of this system for its future maintenance are:

- The lengths of the pipes restrained by the anchor gaskets are identified on as-constructed drawings and on record plans.
- The details are recorded on the health and safety file.
- Anchor gasket marker tape is used.

Tie-ins

Trial holes were arranged by Severn Trent Water to locate the position and level of the tie-in points immediately outside the carriageways. Tees and valves were installed in advance for the connections. The coordinates were used to finalise the route of the diverted mains across the carriageways. Road closures were arranged at each end of the site for the tie-ins.

Setting out coordinates and levels were provided for each bend, tee and air valve – around 40 (No.) on each of the trunk mains. This enabled a GPS unit to be used in the ever-changing earthworks landscape of the site.

Construction programme

The main construction programme focused on the logistics of the road diversion and the cut and fill operations. Therefore the installation of the three water mains could not proceed simply from one end to the other, but had to be coordinated with the areas available.

Filling in one end of the large crayfish pond was carried out by Volker Fitzpatrick Colas using gabions and clay excavated from the site. The displaced water, screened for crayfish and other aquatic life, was pumped to the local watercourse.

Undertakings

Main contractor Volker Fitzpatrick Colas managed the programme of work and consultants Pick Everard was appointed to approve the design and installation on behalf of Severn Trent Water.

Morland Utilities was employed as the subcontractor for the installation of the water mains, who employed Waterco Consultants for the design. Waterco and Morland each hold the WIRS (Water Industry Registration Scheme) certificate in their specific areas of work (design and installation), qualifying them for the project.

Works programme

The installation of the £1.4m water mains diversions was programmed between October 2012 and June 2013. The winter of 2012-2013 provided severe weather to deal with. Throughout the winter large amounts of snow were experienced which disrupted the works.

The snow meant that as well as access to the site being difficult, materials and trenches were obscured by snow and pipelaying work on the site was stopped for safety.

Morland prepared well for the winter weather by fuelling the plant with 'cold weather diesel'. This avoided time-consuming and expensive breakdowns, which was some consolation for the considerable time lost.

The Editor & Publishers would like to thank Raff Whitehead, Associate Director with Waterco Consultants, for providing the above article for publication.



A cross connection - Courtesy of Morland Utilities



Programme advancing well - Courtesy of Volker Fitzpatrick Colas

www.waterco.co.uk

waterco
consultants

Water

Hydrology and Water Quality Modelling, Security, Asset and Strategic Planning, Pipelines and Distribution systems (including self lay)

Drainage

Pre Planning Assessment, SuDS, Groundwater Modelling, Sewerage and Sewage Treatment

Flood

Risk and Consequence Assessment, Hydraulic Modelling, Natural Flood Management, Coastal and Breach Assessment, Flood Risk Management, Flood Hazard Maps, Response Plans

Tel: +44(0)1824 702220

Waterco Ltd, Eden Court, Lôn Parcwr Business Park, Ruthin, Denbighshire, LL15 1NJ