Sawley Road/Nooning Lane Defective Rising Main

replacement of 6km of 450 and 500mm GRP rising main with PE100 across open countryside including lining and no-dig sections

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The existing Sawley Road/Nooning Lane rising main lies to the east of Derby, connecting the Sawley and Draycote Pumping Stations with Derby Sewage Treatment Works. The 450/500mm diameter GRP sewerage line has reached the end of its asset life having recorded fifteen major failures since 2006 due to severe distortion and major de-lamination of the glass fibre pipe, upstream of Church Wilne Water Abstraction Point. Additionally, there were a further two bursts recorded during the early design period, emergency repairs for which were completed by NMCNomenca in line with the proposed design under a separate contract.

GPS Pipe with recycled sand bed and surround - Courtesy of NMCNomenca

Project background

The project was to replace 2,470m of 450mm diameter pipe and 3,600m of 500mm diameter pipe which included:

- 170m of relining through private gardens.
- 180m of relining archaeological mitigation.
- A structural integrity survey of the River Derwent pipe bridge crossing.
- Undertaking no-dig technology for stream/road crossings.
- Major utility crossings.

Procurement

Two significant material suppliers were involved during the early design period to stimulate innovative proposals. GPS PE Pipeline Systems are manufacturers of high density polyethylene pressure (HPPE) pipe and they promoted the following savings:

- Demonstration of the savings compared with the use of ductile iron pipe.
- Procurement of the pipe at the current rate prior to the April 2011 price rise, saving 11%.
- Challenge the pressure rating reducing the design from a 10 bar to a 6 bar rating. (SDR 17 to SDR 26). Agreement ensured a thinner walled pipe saving 30% in value plus a reduction in CO_2.
- The pipe was designed during feasibility and delivered to site in 18m lengths (compared with convention of 6m or 12m lengths) reducing the number of on site welds by 33%.

R2M are distributors for Nova Siria mechanical couplings. Early involvement challenged the template designs enabling:

- Deletion of all the dismantling joints.
- Reduction in the total number of couplings required.
- Ability to deal with 'out of round' pipes.
- 60% faster installation period.

These changes amounted to an overall saving of 4% monetary value to the contract.

Sustainability

NMCNomenca continually strive to reduce the impact of construction activities on the environment. A number of specific actions were implemented on this scheme:

- In agreement with the Environment Agency (EA), recycled sand from a previous local scheme was imported to replace the gravel surround to the pipe.

- Reuse of the existing air valves which had been replaced by Severn Trent Water (STW) in 2007 at a cost of £25,000.
- Spoil arisings to landfill kept to an absolute minimum.
- Hedgerow crossings: the hedges were cut at ground level and the foliage chipped. The root balls were left promoting rapid redevelopment upon completion of the contract.

Application engineering principles and judgement

Eastwood and Partners carried out a structural integrity test on the pipe bridge crossing the River Derwent to confirm the projected asset life was in line with STW guidance. On the north side of the river the pipe crossed under the EA flood embankment. It was agreed that this section of main would be replaced using direction drilling techniques to ensure that the integrity of the embankment was maintained.

The use of HPPE pipe reduced the health and safety risks associated with working in a trench as the pipe was jointed above ground. During excavation the level of the bed was maintained using a rotating level negating the requirement for personnel to enter the trench. The pipe was butt fused using automatic welding equipment in long 'strings' which could then be installed using the excavation equipment.

The flexible structure of HPPE pipe reduced the requirement for fabricated bends and thrust blocks improving the flow characteristics and reducing the project expenditure and CO_2 emissions for fabrication, in-situ concrete and material deliveries. Quality control of the butt fusion was maintained using automatic welding equipment.

Route considerations

The route followed the existing main with the following exceptions:

- 30m exclusion zone in the vicinity of a badger sett.
- Avoidance of contaminated ground and buried structures in the vicinity of Nooning Lane Sewage Pumping station.
- Localised route crossings of the high pressure gas main, 11kV overhead cables and ditches were kept perpendicular.
- Line moved parallel to the National Cycleway route to maintain public access.

For two sections, the existing pipe was utilised and was strengthened with a structural liner; a 170m section ran through private gardens containing trees with preservation orders, and a 180m section was relined to avoid a known area of archaeological interest.

A further area of archaeological interest was noted during the topsoil strip which was overseen by Wessex Archaeology. Nine burial cremation sites were located in leather purses. A licence was applied for to remove the remains and permit the works to progress.

Throughout the contract period, customer liaison was kept high on the agenda and concerns addressed as they arose. Three display boards were put along the route to keep the public informed.

Summary

NMCNomenca delivered the 6km pipeline using their own plant and labour with no environmental or health and safety incidents. Through integrated design and construction teams they outperformed the programme, completing the works in six months and removing the environmental incidents blighting STW before. The design and procurement initiatives and collaborative involvement of strategic supply chain partners on this project have helped the delivery team realise capital expenditure efficiencies in excess of £300,000 or 17%.

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Hedgerow crossing - Courtesy of NMCNomenca

Pipe bridge - Courtesy of NMCNomenca

R2M Nova Siria couplings at an air valve position - Courtesy of NMCN

Pipe easement - Courtesy of NMCNomenca