Introduction
As urban populations grow many cities around the world are facing serious water shortages, which is aggravated by the leakages from their old networks. Replacing these old mains in the congested streets can seem daunting but the correct materials choice can make installation easier and much less expensive.

The Cost of Components
The costs of PE pipes and fittings are usually lower than those of other materials for small diameter systems, but in larger diameters they can be more expensive. Despite this, PE systems are still the preferred solution in Europe because other factors such as:

- Network designers can make use of the smoother walls and superior flow characteristics of PE.
- No corrosion in the pipe bore means that water quality is maintained at a high level through the operational life.

The Cost of Installation
The installation costs for PE pipe systems can be lower than other materials:

- PE pipes can be supplied in longer lengths reducing the installation time reducing labour and traffic management costs.
- PE pipes can be butt welded above the trench enabling the trench width to be reduced.
- PE pipes are lightweight requiring little mechanical lifting equipment.
- PE pipes will flex around bends or obstacles reducing the number of fittings
- Welded PE systems will resist axial forces therefore no anchor blocks are required.

If trenchless techniques such as slip-lining, directional drilling (HDD) or pipe bursting are used even greater savings can be realised using PE pipe systems as shown in fig 2.

The Cost of Ownership
The cost of ownership covers the cost of maintenance and repair of the system throughout its operational life and in independent surveys PE systems have shown the lowest failure rate of all pipeline materials. PE pipes have a lower ownership costs:-

- Welded PE systems resist axial loads without failure and can better resist the ground movement experienced in modern cities.
- PE systems do not corrode and therefore need no expensive protection or monitoring systems
- No corrosion means no build up in the pipe bore which means lower cleaning and pumping costs.
- Longer operational lifetime means lower replacement costs for PE systems.

Fig 1. Congested streets make pipeline renovation very difficult and costly

Fig 2. Relative costs of using trenchless technology in an urban environment
TechNote

Costing the options

In 2004 Thames Water decided to replace a substantial part of their pipe network in central London which was over 100 years old and in need of replacement. In considering their options they needed to compare the different costs but realized that it was essential to consider all the elements and not just the initial cost of the products themselves. They therefore decided to use the Whole Life Cost (WLC) which is the summation of the cost of the components, the cost of installation and the cost of ownership of the system over the full life of the system. The costs will vary considerably depending upon the location of the project and local conditions and therefore it is necessary to look at a specific project. The simple scheme shown in fig. 3 was used for this purpose and was evaluated for 5 km of DN 400mm ductile iron (DI) and glass reinforced plastic (GRP) pipes and 450mm diameter PE100 being installed in an open trench in a city centre environment.

The graph in fig 4 show the results of the costing exercise carried out in collaboration with Thames Water to assess the Whole Life Cost of different pipe options in Central London. The coloured bands in the vertical bars show the different cost elements. The largest elements are associated with installing the pipes and managing the traffic while this construction work is carried out. Because the PE100 pipe can be supplied in longer lengths and butt welded above the trench the installation time was shorter and these costs were therefore significantly lower. The estimated repair costs of the PE100 system were also the lowest because the statistics collected by the UK water industry shows that PE was the most reliable system.

Based on these calculations PE100 pipes were selected which also meant that Thames Water were able to make use of trenchless technology and save even more on the cost of installation. In subsequent years Thames Water renewed and replaced around 2,000 km of their old cast iron mains in central London and 40% of that pipe was installed using trenchless technology. The same can be true for cities such as Mumbai or Beijing.

References


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