

N^o 3 – Installation – Jacking Pipes

3. INSTALLATION – JACKING PIPES

3.1 INTRODUCTION

The installation of pipelines for drainage purposes in the UK has traditionally been carried out using open-cut trenches in both urban and rural locations. However, in recent years an increasing proportion of pipeline construction projects have utilised pipe jacking or the form of the miniaturised tunnelling technique known as microtunnelling. Although the basic pipe jacking method has been used in various forms for centuries, only in the past ten or twenty years have we seen significant advances in the equipment technology. This has resulted in a raising of confidence in the techniques and has led to a series of successful pipeline engineering schemes which have made extensive use of pipe jacking and microtunnelling. Normally, for pipelines constructed in this manner up to DN 900 the technique is referred to as microtunnelling and above this as pipe jacking but the principle remains the same. CPSA members manufacture a range of jacking and microtunnelling pipes and associated products (see <http://www.concretepipes.co.uk/members/index.html> for information on members).

3.2 TECHNIQUE AND EQUIPMENT TYPES

Essentially, the pipe jacking or microtunnelling method consists of the construction of a number of excavated shafts from which a tunnelling shield is launched and behind which a succession of smooth-walled concrete pipes are jacked. When the shield reaches the destination or reception shaft, it is either re-launched in a different direction or removed to another location and the process repeated. The excavated drive and reception shafts are usually converted to finished manholes once pipeline installation is complete.

Spoil excavated by the rotating cutting head in the front of the shield is removed by an auger flight or by mixing with water and pumping to the ground surface for treatment and disposal. Some progress has been made with the development of machines which can compact soil to the sides of the shield as it advances. Other equipment types use vacuum systems for the removal of excavated material to the surface.

Particularly high levels of installation accuracy can be achieved with these systems

since they use sophisticated steering and guidance methods based on laser technology and optional automatic computer control. Finished bores have frequently been described as “like rifle barrels”. Equipment has been developed which can install sewer pipes at small diameters (down to house connection or lateral size of DN 150) without the need for a trench.

3.3 ADVANTAGES OF THE TECHNIQUE

The advantages of using a trenchless method such as pipe jacking can be substantial. Any attempt to dig up long stretches of the urban road network very often results in severe disruption to the community, delays and diversions to traffic, pollution of the environment through excessive dirt, dust and noise, loss of profit for local businesses, damage to properties or other buried pipes and cables and so on. These items are usually referred to as social costs and are nearly always absorbed by the community rather than paid as direct engineering costs.

However, when one considers further, other equally serious problems become apparent. Frequently, the as-dug material excavated from the trench is not suitable for re-use as backfill. This waste spoil must be transported away from the area and dumped in some form of landfill site. Such sites are becoming more difficult to find and the cost of using them is increasing. Also, new backfill material such as crushed stone has to be imported to the site and these operations usually involve heavy wagons inflicting damage to roads and using fuel which in turn produces more pollution. These environmental costs are compounded by the damage and visual impact to the countryside from landfill and quarrying sites.

Pipe jacking and microtunnelling can dramatically reduce many of these social and environmental problems. The techniques now offer significant benefits in much reduced excavations since they only require relatively small launch and reception shafts for the miniaturised tunnelling equipment. Streets and roadways can often be kept open to traffic with little hindrance or disruption. The environment in general benefits from a no-dig approach because far less transportation of trench reinstatement materials is required (normally limited to only the displaced spoil from the actual pipes and manholes). Reduced levels of reinstatement lead to cost savings, as much of the cost of a pipeline scheme is in the excavation and subsequent reinstatement. Installation depths of up to 35m have successfully been achieved, which would not be possible with open cut methods.

3.4 CONCRETE TRENCHLESS PIPELINE PRODUCTS

The UK concrete pipe manufacturing industry is playing a leading role in the advancement of these trenchless techniques. Several of the CPSA member companies produce jacking and microtunnelling pipes in a range of sizes. These pipes are manufactured to produce accurate joint surfaces with square faces and a strong high density concrete with a smooth surface finish to assist in reducing jacking forces.

Jacking and microtunnelling pipes are available in sizes from DN 450 up to DN 2400

and utilise elastomeric seals in a steel banded joint. These pipes are manufactured to comply with the requirements of European Standard EN 1916:2002 and the UK complementary standard BS 5911-1:2002. The external surface of the pipeline is smooth for easy insertion through the ground during installation. For steel banded joints, both mild and stainless steels are available. Jacking pipes can be supplied with grout holes and cast-in lifting sockets as required.

Other products for use with this trenchless method include caisson sections in sizes from DN 2000 to DN 4000 complete with base sections fitted with cutting shoe. Also produced are lead pipes which are rebated to accommodate the tunnelling shield and interjack pipes (leading and trailing pipes in pairs) for use with intermediate jacking stations.

3.5 FURTHER INFORMATION

More information on the pipe jacking and microtunnelling method can be found in the publications of the Pipe Jacking Association (PJA) as listed in Section 9. The United Kingdom Society for Trenchless Technology (UKSTT) is another useful source of information on trenchless techniques including pipe jacking.

For specific product information please refer to CPSA member companies web sites.

<http://www.cpm-group.com/> ,
<http://www.enstone.co.uk/>,
www.cvbuchan.co.uk ,
www.stanton-bonna.co.uk
<http://www.fpmccann.co.uk>
<http://www.hughesconcrete.co.uk/>
<http://www.miltonprecast.co.uk/>

If you would like any further information please contact:

Concrete Pipeline Systems Association

**60 Charles Street
Leicester
LE1 1FB**

Tel: 0116 253 6161 **Fax:** 0116 251 4568

Email: mail@concretepipes.co.uk **Web:** www.concretepipes.co.uk

The information in this guide is to the best of our knowledge true and accurate, but all instructions, recommendations or suggestions are made without guarantee. Since the conditions of use are beyond their control, the Concrete Pipeline Systems Association disclaim any liability for loss or damage suffered from the use of this data or these suggestions. Furthermore, no liability is accepted if use of any products in accordance with this data or these suggestions infringes any patent. The Concrete Pipeline Systems Association reserves the right to change product specifications without further notice.