PRESS RELEASE

BRITISH PLASTICS FEDERATION PIPES GROUP

2 October 2017

RESEARCH-BASED ARTICLE FOR WWT NOVEMBER ISSUE

RESEARCH PROVES PLASTIC PIPES CAN BENEFIT THE BELOW-GROUND NETWORK

By Caroline Ayres, Director, BPF Pipes Group

With increasing pressure to minimise disruption in highways, the need for trouble-free drains and sewers is well understood.

Here we look at some practical advice for designing pipelines for longevity and resilience. A flexible pipe is, by definition, a pipe which will deflect when subjected to external loads. It is a commonly held assumption that any deformation of a plastic pipe is inherently detrimental and indicative of failure of the pipe to perform properly. This is a fundamental misconception. Flexibility in pipes is a desirable attribute. Understanding how the flexible pipe relates to its neighbouring soils – thereby establishing a functional pipe/soil composite structure – is key to successful design.

How does a thermoplastic pipe perform under load?

A buried pipe and its adjacent soil will attract earth loads and live loads in accordance with a basic principle of structural analysis: stiffer elements will attract greater proportions of shared load than those that are more flexible. In other words, the more flexible pipe will attract less crown load than a rigid pipe of the same outer geometry. This is because the rigid pipe does not transmit the loads into the surrounding material but the loads are transferred through the pipe wall into the bedding and, therefore, are subject to much greater load than the flexible one.

How can this be a benefit?

In general, flexible pipes rely upon their deformation from imposed loads to mobilise the support of material on both sides of the pipe. Their primary structural function is distributing the imposed vertical loads to the surrounding soil and bedding material. Only a small portion of the imposed loads are actually carried by the flexible pipe itself.

The design of a gravity pipe uses this stabilisation effect of the soil to minimise deflection in the pipe, by constraining it in the horizontal direction, and simultaneously transferring the surface loads being inflicted by the ground above the pipe, traffic, structures etc. to the soil. During construction (the installation phase) the weight of the soil above the pipe will cause it to deflect and this will continue as the soil is compacted (the settlement phase). With good installation these deflections are very small – less than 2%. Thereafter, during the lifetime of the pipe, there is no significant change in the shape of the pipe. In very well prepared ground, the deflection during the settlement phase can be almost zero. The pipe can happily sit there for many years operating as planned whilst withstanding the external loads placed on it.

How does installation affect performance?

Extensive field and laboratory testing was carried out and reported by TEPPFA (the European Plastic Pipes and Fittings Association) in their Design of Buried Plastic Pipes study (1999). More information can be found on http://www.discover-plasticpipes.com/uk/category/flexibility/

TEPPFA Buried Pipes Study http://www.teppfa.eu/buriedpipes/

During this work, trials were carried out in both clay and sand, and in well compacted through to non-compacted ground. It was, unsurprisingly, found that pipe deflection in the settlement phase depended on the compaction of the ground around the pipe. However, even when reality kicks in and compaction is impacted by weather conditions, change in soils along the pipeline, type of fill available, the measured deflection in a plastic pipe is still well within the practical limits set for the UK (6% adoptable sewers, 5% highway applications) and represents a very large factor of safety compared to the capability of the pipe material. Good preparation is always encouraged but the engineering properties of plastic pipes mean that less than perfect preparation is not a problem.

What about traffic loading?

The loads from traffic and surface loads are taken up by the ground surrounding the plastic pipe. The TEPPFA buried pipe study has shown that when pipes are more rigid than the soil that surrounds them, the pipe itself has to resist all the loading from above.

Plastic pipes, correctly installed with well-compacted backfill material, spread the load to the ground itself – meaning they are subject to lower loads than traffic and weight of soil exert. Once the backfill and soil have settled after installation, traffic loads have no further impact on pipe deflection.

Is designing thermoplastic structured wall pipe installations complicated?

The accepted UK method for the design of non-pressure pipelines is included in BS EN 1295-1: 1997 Annex A. Clear and well-presented supplementary guidance is included in BS 9295: 2010 *Guide to the structural design of buried pipelines.* This guidance is easily accessible to pipeline engineers and ensures that a good design can be carried out without the need for complex calculations.

Much of the background research has been carried out using complex design and evaluation methods such as Finite Element Analysis. **BPF Pipes Group members** are active in the UK and European Standards committees which translate the experience developed over the last 30–40 years into practical design methods and guidance.

What about large diameter pipes?

Structured wall thermoplastic pipes in diameters ranging from 400mm to 2200mm have been in use in Europe since 1985 and in the UK since 1995. The size range was extended to 3000mm in 1999 and to 3500mm in 2008.

BPF Pipes Group members who supply these large diameter pipes can help with scheme designs where calculations can be performed to the latest Eurocodes. Experience has shown that using large diameter pipes can equal other more traditional solutions in performance and can offer a range of added benefits as well.

Dr Vasilios Samaras of BPF Pipes Group member Asset International, referred to the work by BPF Pipes Group members and the TEPPFA buried plastics pipes study, in stating: “Through extensive and sound research, the benefits of using thermoplastic pipes have

been proven. The evidence is irrefutable and by using best practice techniques, excellent long-term performance, asset life and protection of the entire pipe network can be achieved."

Conclusion:

- Choose well – the inherent corrosion resistance of plastic pipes means that they retain the same performance throughout their lifetime;
- Design well – to the method given in BS EN 1295-1:1997 – but don't spend time in more complex calculations;
- Install well – to achieve the best results at the outset – but plastic pipes are very tolerant of less than perfect site conditions;
- Rest easy – the composite nature of pipe and ground is future-proof to increased traffic loads and volumes.

BPF Pipes Group provides support documents on its website at www.bpfpipesgroup.com

ENDS

PHOTO CAPTION: Structured wall thermoplastic pipes at larger diameters are widely used in the water and wastewater industry and the positive evidence for them stacks up

Contacts
Media information:
Bridget Summers, Footprint PR, 01723 447424, bridget@footprintpr.org.uk

BPF Pipes Group:
Caroline Ayres, BPF Pipes Group, 01932 343409, carolinea@bpfpipesgroup.com

About the BPF Pipes Group

Part of the British Plastics Federation, the BPF Pipes Group is a trade association representing manufacturers and material suppliers of plastic piping systems across the UK. Committed to sustainable construction, its aims are to provide a forum for the exchange of technical expertise between member companies and to promote the importance of plastic as a pipework material, for the full spectrum of above and below ground, pressure and non-pressure applications. It also plays a key role in initiating and disseminating research and informing and influencing the standards bodies pertaining to plastic pipe systems. It works closely with the BPF and TEPPFA, the European Plastic Pipes and Fittings Association.