Flood Renovation System Sanipor Gains WRc Approval

Anyone who has had connections with the trenchless technology industry over the past 17 years or so, particularly in respect of the pipeline renovation sector, may well have heard the name Sanipor.

Introduced into the UK in 1989 by the Warings Group of Portsmouth, Sanipor was originally developed in Hungary as a means of sealing gravity pipelines suffering joint failures or a deteriorating structure (cracking, pipe displacement etc) against infiltration or exfiltration without the need for excavation. Provided the pipeline has two access points, normally manholes, through which to operate, the process claimed to be able to provide a sealed pipe over the treated length and, very significantly in this day in age, to be environmentally friendly.

The Sanipor process is quite simple. It comprises the application of two specifically designed, silicate-based chemical compounds that interact to form a sealing gel/compound within any pipe defect and in the soils surrounding the pipe defect. How this is achieved will be become more obvious in the following process analysis.

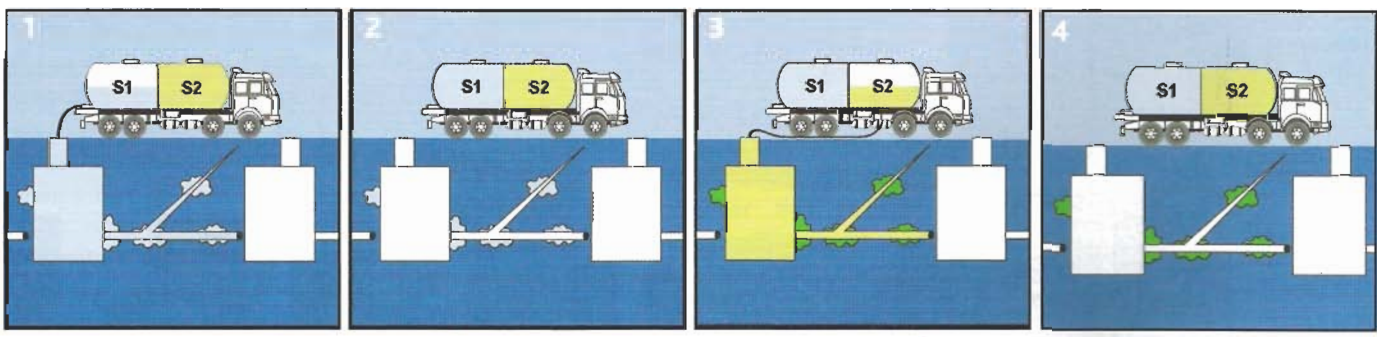
Step one is to isolate the defective pipeline section from the rest of its network, by inserting inflatable line stoppers within the manhole accesses at either end of the length being treated, with a stopper located particularly at the downstream of the treatment length but before inserting any stoppers the length is thoroughly cleaned and then surveyed to ensure that it is ready for the Sanipor treatment to begin.

The Sanipor chemicals are transported in a sectioned tanker with separate pumping systems that can both deliver and reclaim the chemicals from the treatment manholes. Once the pipeline is prepared the first chemical, known as Solution S1, a relatively viscous fluid, is pumped into the renovation section. The amount of solution pumped in is such that it reaches the top of the upstream manhole, without overflow. As the pipe is damaged and leaking, the level of this solution in the system starts to drop as pumping ceases and in order to maintain a head of liquid in the system pumping is continued to keep the level at the upstream manhole constant. Any lateral connections are monitored so that, as S1 solution appears at the outlet of the lateral access manhole, a stopper is put in place to ensure the solution remains within the lateral pipe.

With the system filled and after a predetermined time, deemed to be sufficient for the S1 solution to permeate the pipe defects and the ground surrounding these defects to the degree required, the S1 solution is quickly pumped out of the pipe. The speed of this retrieval is important to minimise the rate at which the viscous S1 solution starts to drain back into the pipe from the surrounding ground.

Once excess S1 has been completely recovered, solution S2 is quickly pumped into the pipe, again to the same level at the upstream manhole and this solution permeates the S1 saturated ground around the defects. This has two effects. First it prevents the S1 solution from draining out of the defects back into the pipe. Second, it starts to react with S1 to form an inorganic gel matrix both in the pipe defects themselves and in the S1-soaked ground around these defects. The latter reaction forms a concrete-like structure in the ground at the point of a defect which seals against the pipe's outer wall. This not only seals the defect but also forms an effective barrier against further external ground water flows into the pipe.

Solution S2 is left in place in the pipe, but this time the length of time it remains in place depends on the level in the upstream manhole. The level in this manhole is allowed to fall as the reaction between the two chemicals proceeds. The reaction causes the rate



of fall in the level to slow until the level stops falling altogether, indicating that sealing has been achieved.

If the process does not reach this conclusion, the whole process can be repeated with both S1 and S2 solutions being applied again to seal remaining defects until a full seal is achieved.

A typical sample of ground surrounding a leak point in a pipeline after application of Sanipor

The advantages of such a system are that, as the whole pipe section including the upstream manhole is treated at one time, the site operations duration is kept to a minimum; long lengths of a pipe can be treated in a single operation; all defects in the pipe are treated in one go from a single set of access points; and any defects occurring at or in laterals connected to the main pipe are also treated without further work to access them or treat them being necessary.

Whilst the Sanipor process has been around for almost 20 years, its main target sector has been the water industry. Here, successful projects for the renovation of sewers have been the main end-use for the product. Some work was also carried out in the Pharmaceutical and Petro-Chemical sectors but not to the same extent although, within the last few years, much successful work has been undertaken within the latter sector. Sanipor operations were undertaken by Warings across the South of England and O.C. Summers Ltd, under franchise, operating throughout the remainder of England and Wales. Many readers will recall the name O.C. Summers, which is now incorporated into Laing O'Rourke Utilities Ltd, part of the Laing O'Rourke Group of Companies.

The Sanipor system was utilised in various parts of the UK by a number of water companies and their contractors within the auspices of the UK's Asset Management Programmes (AMPs) which are laid down by the UK Water Regulator OFWAT. After several years of successful use in sewer renovation, the advent of AMP3 saw a change in focus within the UK water industry away from wastewater management to supply management. This saw the use of the Sanipor process becoming more sporadic yet, whilst the market was quiet, many successful projects were undertaken and with the future prospect of the spotlight returning to wastewater works under AMP4, the newly formed contracting group, Laing O'Rourke, took the opportunity in 2002 to obtain the Sanipor licence and became the sole UK operator.

When Laing O'Rourke took on Sanipor, the system, whilst relatively well-known, had not passed through any recognised independent approvals process that would enable the company to utilise an independent performance assessment to promote the product. So, over several years since acquiring the Sanipor licence, Laing O'Rourke has been working closely with the WRc (Water Research Centre) in the UK and a panel of drainage engineers to undertake a testing process that would ultimately give the Sanipor process an independent, industry-recognised approval that would level its 'playing field' alongside other established, approved renovation systems.

All research within this testing regime has been undertaken at the WRc Underground Testing Facility in Swindon, Wiltshire, and, at all times, under the direct supervision of a WRc engineer or technician.

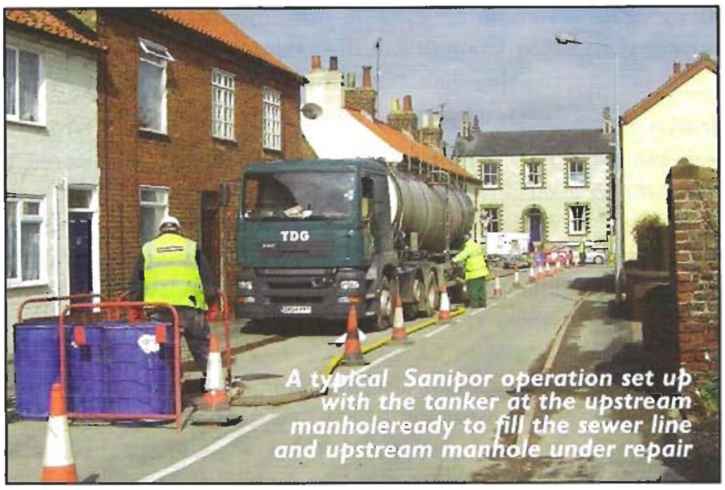
However, the process of testing such a large scale application system was never going to be easy. Scaling down the Sanipor operation to suit laboratory work, although not straightforward, was however achieved using three purpose-built, rectangular pressure vessels, sized at 520 x 520 x 840 mm internally, and fitted with bolted lids and circular holes cut into each end to take a 150 mm diameter clay pipe test section. A Viking Johnson 'Maxidaptor', bolted over each hole, allowed for a section of pipe to be fed through each vessel wall and held in position with the pipe protruding at each end. The sections of test pipe were installed with a 5 mm wide and totally open joint gap to replicate a defect, with, in one vessel, a perforated sleeve over the joint to simulate a void. The remaining volume around the pipe in each vessel was filled with pea shingle representing granular trench backfill or sand representing compactable material. Hydrostatic heads were achieved by connecting hoses from a header tank to 12 mm diameter ball valve ports, four built into the base of each vessel and a further four built in at the top to feed infiltration water into the test rig. The time taken for 100 litres of water to pass through the defect from the header tank at a 2 m hydrostatic head was recorded as the leakage (infiltration) norm.

One of the three WRc designed test rigs during a test run

Continued on page 26 ...

Continued from page 25

Sanipor sealing was undertaken on all three test rigs, using identical techniques to that used on site, but the rigs were found to not totally suit a flood grouting process. However, all repairs were tested at increasing hydrostatic heads applied within the rigs thereby replicating a variation in ground water pressure external to the pipe. The results, compared to the leakage norm, showed significant reduction in infiltration and have been included in the report document "Design and Specification of Sewer Sealing Systems" (WRc Ref: UC3987). Despite the successes of this particular research project, showing Sanipor performing well in saturated ground conditions with a void, it was decided by the engineer's panel that the results were not totally conclusive and should be supported by more extensive long term testing.



A typical Sanipor operation set up with the tanker at the upstream manholeready to fill the sewer line and upstream manhole under repair

Subsequent Sanipor repairs using modified and improved rigs, but this time using only pea shingle around the pipe with no simulated void, were successfully achieved against the most rigorous of research conditions. These three repairs were subjected to long term testing against fluctuating hydrostatic heads ranging from zero to 5 m, with all repairs achieving infiltration results well within the requirements for a new sewer, as defined in the document "Sewers for Adoption" 5th Edition, based on BS EN 1610.

All results have been incorporated into the report document "Long Term Testing of Sewer Repair and Sealing Techniques" (WRc Ref: P6532A) recommending the previous short term hydrostatic test procedure and the new long term procedure should be combined into one test thereby setting a more stringent test requirement. By far the most significant recommendation made on the strength of these results is that the "Sewer Sealing Specification" should be updated to include the long term hydrostatic test, re-issued to all participating parties and then submitted to Water UK for consideration to become a Water Industry Specification.

By the beginning of August 2006, having successfully completed a wide-ranging series of extensive long-term tests at WRc and with the results fully adjudicated by the testing organisation and engineer's panel, Laing O'Rourke received WRc Approved™ status for the Sanipor process.

The testing regime and approvals notice signifies not only that the Sanipor process has undergone a rigorous test programme that indicates it is recognised as an effective pipeline renovation technique within the broader family of pipeline rehabilitation options but it also shows the test results for the gel matrix and its long term operation properties, vital information for any prospective end user of the system.

It should also be noted that, whilst the testing procedure was based on a defective pipeline experiencing infiltration, the system is just as effective on pipes experiencing exfiltration, should they be placed in ground laying above the local water table.

Commenting on the approval achievement of the Sanipor process Dave Buxcey, Sanipor Projects Manager for Laing O'Rourke said: "The granting of 'WRc Approved™', by such an internationally well-respected independent body, not only confirms the Sanipor process to be fit for purpose but also, following a stringent Environmental Impact Assessment, that it is truly environmentally friendly."

For WRc, Andy Russell, Consultant Engineer WRc Utilities said of the Sanipor testing programme: "The award of a WRc Approved™ certificate is the culmination of a rigorous programme which included auditing the Sanipor installation manual, including two site visits to witness its application; an environmental impact assessment of the constituent Sanipor chemicals and long-term hydrostatic testing. This achievement is testament to the Sanipor system and the effort that Laing O'Rourke has made." ■


Ron Chapman (CEO-WRc) presents the WRc Approved™ Certificate for the Sanipor flood renovation system to Dave Buxcey of Laing O'Rourke Utilities Ltd.