Rig potential relieves

The new HDPE pipe is laid out in the street, ready to be installed

The Grundoburst 2500G rig with its extension frame in place during the Berlin swagelining operation

The Grundoburst system showed its thrusting capacity recently on a sewer pipe revamp operation in a Berlin suburb using the swage lining process

THE Berlin Waterworks recently appointed Ludwig Pfeiffer Hoch-und Tiefbau GmbH & Co KG to revamp a pressure sewer pipe in Berlin-Friedrichshain, Kreuzberg, using the cold swage lining method. Numerous delegates and show visitors witnessed the project, which took place during Water Berlin 2006.

The pipe to be rehabilitated was a DN1000 pressure sewer pipe running beneath Friedensstrasse and Greifswalder Strasse.

The project aimed to renew the DN1000, forge grade steel, pressure sewer pipe over some 600 m using cold swage lining. The sewer path runs in the streets of a residential area currently being redeveloped. Numerous restaurants and shops form part of the development programme. Therefore, renewing the pipes by open trench would have significantly affected the local residents.

To prevent any disruptions as would have been caused using open trenches and wide-ranging road closures, the Berlin Waterworks planned to pull a PE-liner into the old sewer pipe in two sections using the swage system, which would leave no annular space. This is known as close-fit lining and operates in accordance with DVGW regulation GW 320-2.

PFEIFFER FITS THE BILL

Pfeiffer uses swage lining for such circumstances as these, whereby a PE-liner is pulled into the old pipe on site within the diameter of the existing pipe and without a need for any heat sources, using a liner reduced from its original dimensions. This technique can help line pipes from DN100 to DN1200 over installation lengths of up to 1,000 m.

In swage lining, the liner pipe's diameter is designed to be larger than the existing pipe's internal diameter. This ensures that, when the deformed liner is re-rounded within the existing pipe, a durable and close-fit to the host pipe's inner wall is guaranteed.

Pfeiffer boasts extensive experience with the Grundoburst pipe renewal, through its use of a Grundoburst 800 G, which features 80 t of thrust and pulling-force capacity. This machine technology is suitable for replacing old, deteriorated pipes using the pipe-cracking or pipe-bursting technique as well as for calibre bursting, the TIP-method, re-lining measures and even for swage-lining tasks. At the worksite in Berlin, Pfeiffer used, for the first time, the largest unit available, the Grundoburst 2500G, with 250 t thrust and pulling-force capacity.

The Grundoburst comprises a robust rig, a Tracto-Technik hydraulic power unit, QuickLock burst rods and accessories. The single system components are tuned for performance and safety, while being very quickly installed, ready for action and safely and easily operated. Various cutting and bursting tools are necessary, depending on the pipe material to be cracked. Brittle materials (concrete, stoneware, cement) can easily be broken with simple bursting and with expander sleeves shards are pushed into the surrounding soil. Materials such as steel, grey cast iron and plastic pipes require a special blade to open the old pipes and expand the bore path while at the same time being able to break sockets and pipe clamps.

Special blade construction offers an optimal cutting geometry, which means the pipe is cut using a much lower pulling force. The expander in this case has to displace the two split pipe halves and push them into the surrounding soil, making room for a new pipe to be installed. The expander/pipe-puller is available in all standard pipe diameters.

BERLIN WORK

In Berlin, the power of the Grundoburst system was used as a pulling rig rather than a bursting rig. The construction work in Berlin was carried out in two sections: one of 322 m and one stretching 216 m.

The old pipe was exposed and cut in a starting pit with two target pits excavated at the 'pipe' end of each run. After a high-pressure jet-cleaning operation was carried out to remove loose particles from the inner wall of the host pipe, an initial inspection was carried out using a CCTV camera. Any solid encrustations were removed mechanically using a scraping tool. For swage lining, a smooth metallic surface is not needed.

Finally, any possible obstacles within the old pipe are removed using a milling robot. Then the old pipe is calibrated to determine the inner diameter and surface structure.

Commercial HDPE pipe, made of PE 100 material measuring 1,030 mm x 60.6 mm thick (SDR 17, PN 10), was used for the liner material. Some 3% is usually enough as the excess dimension of the liner pipe over the inner diameter of the host pipe to effect a 100% tight and durable close fit of the PE liner inside the old pipe.

The liner pipe lengths, normally provided as stick sections, are connected using butt-welding to the length required for the lining run. To facilitate the later installation or pipeline operation, the inner and the outer welding beads are removed from the liner pipe. A pulling head is welded to the front of the pipe length.

The prepared pipe is transported, even over relatively long lengths, to the installation pit on roller frames. This is a great advantage when working in tight space conditions.

During installation, the liner pipe length is pulled through a reduction tool, the swage lining die, to reduce the diameter to that required for installation. The reduced liner is kept under tension between the reducing die and the start pit by applying pulling pressure using the Grundoburst rig through the chain of 'bursting rods previously installed through

the pressure in Berlin

the host pipe. This way the tension in the liner pipe can be maintained while the pipe length is pulled into the host pipe. The process can be interrupted at any time – for example, to butt-weld new pre-fabricated pipe lengths together if required, while maintaining the tension.

The deformation and installation speed with this type of installation is 50-100 m/h, allowing pipe lengths of 300-600 m to be pulled in over the course of a day's work.

When the liner pipe lead end reaches the target pit, the pulling force applied by the pulling rig is reduced step by step.

This allows the PE liner to return to its original shape, but as the pipe has a larger diameter than the host pipe, the outer wall of the liner pipe pushes tightly against the inner wall of the host pipe to create the close-fit lining.

Where , in such projects, a bursting rig is not used, the necessary pulling forces for deforming and installing the liner are produced by cable and winches. The application of the tension forces undergo constant monitoring and is checked against pre-set limits to ensure they remain within the permissible tensions of the PE liner pipe being installed. To keep the friction losses as low as possible, environmentally-friendly lubrication fluids or greases are often applied to the liner before it enters the host pipe.

Once the liner pipe is in place, pre-welded sockets with flanges are welded to each end of the liner pipe length to complete installation. In this way, grey cast-iron and steel pipes can be connected without any problems.

After assembling the end flange, a pressure check, using 12 bar applied pressure, was carried out as well as a final CCTV camera inspection, so ensuring that no faults occurred during installation.

The PE liner has the quality of a new pipe after the installation, enabling it to carry all ground loads and any dynamic loading from traffic running above it, as well as handling the internal pressures required of the pumping main, without the need to rely on the old pipe. Due to the very good hydraulic characteristics of PE pipe, capacity and flow reduction due to the loss of diameter after lining is not normally expected.

Ultimately, this whole process was successfully carried out on each of the two pipe lengths requiring rehabilitation in Berlin.

The Grundoburst 2500G in the swagelining operation

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