

SWAGELINING SAVES ANCIENT SITE

In early March, 1996, the Tayside Regional Office of North of Scotland Water Authority began to investigate ways to repair leaking joints in the two parallel 27" (675mm) cast iron water lines which served as a backup supply for the City of Dundee, Scotland. The project was complicated by the fact that the pipelines ran under the centre of an ancient settlement.

Since excavation could harm the historical site, the Water Authority decided that a trenchless pipeline rehabilitation process would offer significant advantages. After extensive study, bids were solicited from three different technologies, and the contracting firm, A. Hak, West Lothian, was selected to rehabilitate the two lines with the Swagelining process.

The Swagelining process was specially developed by BG plc as a method of rehabilitating its aging gas distribution network. Since its development, the Swagelining process has been used to rehabilitate over 500 miles of pipeline worldwide. The system uses polyethylene pipe that has an outside diameter slightly larger than the bore of the pipe to be renewed. The diameter of the PE pipe is temporarily reduced by a die, and then inserted into the old pipe. Once installed, the PE pipe expands to fit tightly against the host pipe. A full range of tapping, branching, and connection methods is available to provide a total renewal system.

CONDITION

Even though the Tayside pipeline was over 120 years old, it was in excellent condition except for the leaks through the lead-run joints. As a result, a relatively thin liner could be used to seal the pipe because the cast iron was structurally sound. After careful study and input from BG plc and hydraulic consultants, both the design

and project teams proposed that a 710mm-diameter, SDR 47, blue, MDPE (Medium Density Polyethylene) liner be used for the project. This would be the first time that such a large diameter, thin-walled MDPE pipe had ever been used in the Swagelining process.

It was necessary to design and build a new Swagelining launch rig and reception frame to accommodate the large diameter of the pipe. After approval of the design and structural calculations, the rig and frame were constructed by A. Hak technicians.

Since a project of this magnitude had never been attempted before, the project team decided to line a single 250m section first, in order to gather critical information and experience before committing to a final design of pipe, equipment, or flange connectors. As a result of the test, slight modifications were made in the diameter of the Swagelining die, the connection between the towing cable and the PE was changed, and a larger towing winch was employed.

A second section was successfully lined with those changes, but the design team decided to make more modifications. The Swagelining die was reduced another 3% to decrease drag pressures, and the liner termination flange fitting was changed. The Water Authority decided to switch to a Viking Johnson Aquagrip Liner Termination Fitting because it would provide a more secure attachment to the PE pipe and could save a great deal of time. The Aquagrip fittings were installed two or three days after the liner was installed.

"Following these changes, we felt the remainder of the pipeline could be lined without any problem," said Chris Mann, Project Manager, A. Hak Scottish Regional Office. Seven excavations were made at intervals along each pipeline to serve as launch and receive pits. The longest section was the 450m required to pass completely

under the historic site. Nine-metre sections of the original cast iron pipe were cold-cut and removed from the pits. Then, the remaining pipeline was inspected with closed-circuit television to determine the exact condition of the pipe, and the location of any bends, offset joints, fittings, or branch connections. After thoroughly cleaning the pipe, installation of the PE liner could begin.

INSTALLATION

Before pulling the liner into the host pipe, individual sections of PE pipe were fused together to form a single pipe longer than the section to be lined. The fused pipe was then tested for leaks. Then, the leading end of the liner was cut and formed into a self-contained towing head before being attached to the towing cable. A force of approximately 14 tons was required to pull the 710mm-diameter MDPE through the 620mm-diameter Swagelining die (a 12.5% reduction). As the liner passed beneath the insertion roller and entered the host pipe, the force increased to about 18 tons and remained constant until the leading end exited the host pipe in the next pit.

Two or three days after each section was lined, Aquagrip fittings were attached to the liner, and a new section of unlined cast iron pipe was installed in the 9 m space between the lined sections. At the time of writing, the first line has been hydrostatically tested and put back into operation with the other line excepted to be recommissioned within one week.

"The project, which was completed in March 1997, presented significant developmental challenges, but they were dealt with successfully. I'm very pleased with both A. Hak and the Swagelining process," said Mr. Bill Stephen, senior engineer for North of Scotland Water Authority.

