A greener way to rehabilitate water pipes

By Sadesh Mahalingam

The liner is impregnated on-site and pulled into place by a winch.

Although the dig-and-replace method for installing underground utilities has been widely accepted for decades, with growing awareness of global warming and the need to reduce airborne emissions, trenchless methods are becoming more common, particularly in congested environments. The cured-in-place-pipe (CIPP) methodology offers a number of environmental and other advantages for water main rehabilitation.

Deterioration of water main pipes is a major concern. Most structures built prior to the early 1970s had water main lines composed of predominantly cast or ductile iron. With these materials, tuberculation takes place over time, causing the pipe to lose some or all of its structural integrity.

City water pressure may be anywhere from 30 to 120 psi, so even a small crack in the water main can lead to a leak and eventually a break. Repairing a burst pipe will cost money, but water damage resulting from uncontrolled leaks can easily cost more. Water main breaks are, of course, more common in the winter season, because of freezing.

Aqua Pipe™ from Fer-Pal Construction is a CIPP technology that has been used successfully to rehabilitate damaged cast iron, ductile iron and asbestos cement pipes, with diameters ranging from 100 to 300 mm.

The liner is made up of two concentric, tubular, plain-weave polyester jackets with the inner jacket bonded onto a polyurethane elastomer. Jackets are impregnated with a curable polymeric resin. The resulting composite material liner has mechanical properties exceeding ASTM F1216 and ASTM F1743 recommendations for fully-deteriorated pipe.

Prior to insertion of the Aqua Pipe liner, the host conduit must be cleaned to remove accumulated scale and rust (tuberculation), and service connections located and mapped. A mechanical robot equipped with a camera is inserted into the rehabilitated conduit and activated by an operator using a remote control and television unit. The liner is impregnated on-site and pulled into place by a winch, before being formed using sponges and pressurized water.

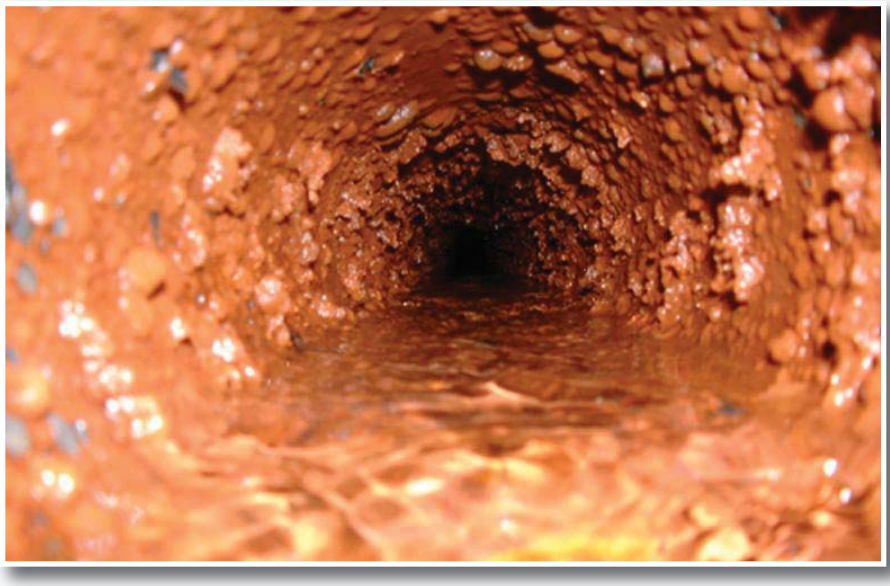
As the temperature gradually increases to the desired level, the epoxy cures, creating a solid composite with the liner. The robot is then equipped with a drilling tool that allows an operator to drill a hole in the liner at the precise location of the connection. After opening connections, the rehabilitated pipe is flush-cleaned and chlorinated. Service is then restored.

Benefits of CIPP technology

Going trenchless can cut the cost of rehabilitating pipes in half, including temporary restoration, valves, fire hydrants and other miscellaneous replacements. Customers also know they are doing their part to preserve the environment.

A carbon footprint study was conducted last year at Fer-Pal's Yorkville site in central Toronto, using a calculator offered by the North American Society for Trenchless Technology. It allows planners to estimate carbon emissions from traditional open-cut excavations and various trenchless methodologies, based on the machinery required to remove, dispose of and replace soil, as well as traffic disruptions.

The project in Yorkville consisted of structurally rehabilitating 2,500 m of 150-mm-diameter pipe. A typical project of such length would take 16 weeks of open-cut technology compared to between five and six weeks using CIPP technology.



Section of pipe before cleaning.

Section of pipe with liner installed and cured.

What was remarkable, though, was the fact that most local businesses were able to remain open throughout the entire project, in an area that is heavily populated with both vehicles and pedestrians. The City of Toronto even had the luxury of asking Fer-Pal to leave the site during the Toronto International Film Festival and to return to work upon its conclusion.

Looking back on the project, a total carbon dioxide emission of 250 tonnes would probably have been recorded if an open-cut methodology had been selected. This would have been broken down into: pollution due to traffic - 24 tonnes; trucks required to ferry dirt back and forth - 99 tonnes; machines - 54 tonnes; material footprint - 72 tonnes.

Using CIPP methodology, an estimated 5 tonnes of greenhouse gas were emitted over the length of the project - a saving of 98%.

Trenchless technology has other environmental benefits, as roads do not have to be torn up. It can also be used to reinstate or upgrade water services that run from city streets to homes, without the need to dig up lawns and cut down trees. The dig-and-replace method requires disposal of the old iron pipe, whereas CIPP technology keeps the old pipe, thus reducing waste.

Besides the environmental advantages, structurally rehabilitated pipe provides an increase in hydraulic carrying capacity, is corrosion-proof, and has a life expectancy of 50 years or more. The liner can negotiate through multiple bends, which facilitates the rehabilitation of water mains underneath creeks, highways, railroads and bridges.

The probability of a water main break is close to zero since the composite liner is known to withstand working pressures up to 150 psi.

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