Interflow grabs award for rehabilitation of Western branch main sewer

Some 37 m below ground in inner-western Sydney, Interflow has installed a structural liner in 1.4 km of 2 m high, 100 year old ovoid sewer, which saw the company take out the ASTT Rehabilitation Project of the Year, presented at the Trenchless Australasia 2008 Conference and Exhibition.

Since its construction in the late 1890s the Western Branch Main Sewer (WMBS) has been the major waste water pipeline servicing Sydney's inner west suburbs.

The pipeline is ovoid or egg-shaped and was hand built with bricks and mortar. While dimensions vary, it is approximately 2 m high and in places is over 20 m below ground level. It is an important heritage structure.

Access to this section of pipeline is through manholes situated along the route through the inner western Sydney suburb of Ashfield.

Despite over 100 years of continuous use, it remains structurally sound, with repairs having been done when necessary. But in 2008, it will be connected to the large Liverpool to Ashfield Pipeline (LAP), so it will be taking a lot more flow.

In early 2007 Sydney Water called tenders for a project to improve its condition to ensure it has the capacity to handle the additional flow well into the future.

The importance of the sewer and the large population it served meant that it could not be taken out of service at any time while the works were being done. Its location meant that methods that minimised excavation were preferred.

Possible Solutions

The specification allowed for two possible solutions to renew the exposed surface above the water line:

- Applying an acid and abrasion resistant coating such as gunite or epoxy mortar; or
- Installing a 'partial liner' above the water line.

The specification required installation of drainage strips behind the liner to drain water into the sewer and prevent the build up of hydrostatic pressure behind the liner.

Interflow Solution

Interflow proposed to install a partial liner based on the machine wound-in-place Rotaloc system. It was considered that this offered a higher quality, lower risk solution than any of the alternatives.

Benefits included a PVC liner with consistent properties and dimensions, providing greater quality assurance than a sprayed coating that relies on workmanship in difficult/confined conditions. In addition, the

Rotaloc liner has the stand-alone structural capacity to resist loads. It does not need to rely on successfully bonding to the host pipe.

The use of the Rotaloc system meant that surface cleaning in confined conditions in the operating sewer was not so critical and the machine installation meant less man entry, faster installation and better assurance of quality. There was also minimal loss in cross-sectional area compared to a solution that involved installing GRP panels.

The process Interflow proposed was to clean the sewer, attach the drainage strip system to the surface of the existing pipeline, place a beam along the invert of the pipeline to support the Rotaloc winding machine, mount the machine on the beam and wind the largest diameter of liner that would fill the crown of the pipeline.

Once this was done the bottom of the installed liner would be cut out and removed and the cut edges of the liner would be bolted to the wall of the existing pipeline so that the edges were the specified distance above the invert. A stainless steel angle along the cut edges of the Rotaloc liner would be installed and the liner ends sealed.

Although Rotaloc required grouting behind the liner, its structural capacity meant that the grout did not need to bond the liner to the host pipe.

Proving the Feasibility

Rotaloc is well accepted for structural renewal of deteriorated circular sewers. But the sewer's ovoid shape required developing work procedures that had not previously been attempted.

To demonstrate the feasibility of the solution, Interflow conducted a trial installation at their Girraween depot, witnessed by Sydney Water representatives.

The trial installation involved construction of an ovoid conduit whose dimensions matched those of the Western Branch Main Sewer. This was made by casting a concrete invert in the shape of the base of the ovoid. Steel reinforced polyethylene Rib Loc pipe with an internal diameter of 1,950 mm was then installed, the invert removed, and the pipe bolted into position to form the ovoid cross-section. The Rotaloc liner was then wound at the maximum diameter that would fit into the ovoid and the invert of the liner was cut out.

The trial confirmed that the Rotaloc liner could be successfully wound with the winding machine on the beam in the invert and once the base of the liner is cut and removed, the liner deflects to the shape of the host sewer - in this instance an ovoid shape. Anchoring the liner to the sewer was a satisfactory method of support once the invert was removed. Props were not needed.

Installation

Lessons learned in the above ground trials, combined with Interflow's experience of working in difficult underground conditions meant that the project was able to proceed according to the proposed program.

The work procedures and program on site were governed by the requirements to:

- Maintain operation of the sewer at all times; and
- Cause minimal disturbance to residents in the busy residential area.

All work was carried out at night when flows were lowest. As the pipeline was always operation, work was done in at least knee deep flow.

At the completion of each night's work, the Rotaloc machine was moved to the nearest manhole so that full flow capacity could be restored for the pipeline's daytime operation.

Productivity improvement – strip drain installation

As the project progressed, Interflow developed a more efficient method of strip drain installation made possible by the benefits of a machine installed wound-in-place liner.

Rather than fastening the drain to the wall prior to liner winding, the drainage strip was held against the wall using a tool developed for the purpose, and secured in place by the Rotaloc machine as it wound the liner tightly against the sewer wall.

The sewer walls were measured and marked to ensure the drain was placed at the correct locations and helix angle so that sufficient drainage capacity was provided to meet the specification.

This work method meant that installation of the drainage strip, previously a slow and labour intensive process, was completed in the same operation as the lining.

Conclusion

Installation of the liner effectively renewed the section of pipeline. Rotaloc increased the pipeline's structural and flow capacity while providing an abrasion and corrosion resistant lining.

The successful completion of the project required the development of innovative work methods. The small above ground 'footprint' and associated work procedures meant that inconvenience to the community was minimal. The project was completed with no significant safety incidents.