

Smooth structural liners for deformed rail culverts

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Over the past decade there has been an increasing need for the trenchless renewal of deteriorated culverts. Interflow Products Manager Paul Chalhoub outlines a recent case study where corrugated metal culverts were rehabilitated using the Ribline lining system.



Lined and grouted culvert prior to inlet rehabilitation.

CULVERT REHABILITATION IN THE HUNTER

Inspection of the spur rail line servicing coal mines in the Hunter Valley showed that two large corrugated metal culverts were suffering from corrosion and distortion along their length.

There was evidence that embedment was beginning to enter through distorted joints and it was thought that this might be contributing to the mild undulations in the rail track.

With a depth of cover of about 10 m to the rail line and heavy coal trains continuously using the route, structural rehabilitation was required. However, it was essential that any rehabilitation was carried out without interrupting operations

of the trains taking coal to the local power station and the sea ports.

THE CHALLENGE

The corrugated metal culverts on this project had nominal internal diameters of 1,800 and 1,500 mm. However, dimensions varied, with deformations in the crown, out-of-roundness and undulations in the invert along its length.

Design of the liner had to take into account the high loads from the embankment and the heavy coal trains. The project designers were also concerned that the irregularity of the shape of the deteriorated culverts could result in point loading being applied to the liner. Therefore the specification

CORRUGATED METAL PIPES have been used for decades as the material of choice for road and rail culverts. There are tens of thousands of corrugated metal culverts in Australia. As with all pipes, they have a finite life and we are seeing an increased demand for cost effective renewal solutions.

The typical failure modes of corrugated metal culverts are abrasion of invert, rust and buckling. As the wall of the corrugated metal culvert is either rusted or abraded away, the surrounding soil can be washed out, which leads to instability and buckling. Corrugated metal culverts can be successfully renewed in situ, provided the deterioration has not progressed too far – that is, the successful renewal can be undertaken before the surrounding soil is washed out and the pipe begins to collapse.

There are several renewal techniques and products available. Interflow has had a successful track record in offering a range of grouted structural liners and has performed projects in diameter ranges from 300 to 3,300 mm.

required a minimum annulus of 50 mm around the outside of the liner, which was to be entirely filled with grout. This was considered necessary to ensure uniform support for the liner, and uniform distribution of loads onto the liner. Interflow therefore faced the task of ensuring that this minimum annulus was delivered along the length of the irregularly shaped culverts.



THE SOLUTION

The rehabilitation solution selected for the repairs of these culverts was Ribline steel reinforced polyethylene spiral wound liners.

Ribline has been used for structural renewal of road and rail culverts throughout Australia for the past seven years. The liner is formed by a winding machine positioned at the headwall of the culvert. A continuous strip of ribbed polyethylene, with each rib encasing a continuous steel strip, is fed to the winding machine from a spool situated at a convenient location. The winding machine takes the polyethylene strip and winds it, continuously welding the edges together into a helix. The liner extends from the winding machine into the culvert until it reaches the headwall at the other end of the culvert.

The process installs a fixed diameter liner that must be grouted in place after installation. The winding machine is set to install a liner with the largest constant diameter that will fit into the culvert, taking into account deformations and deviations along its length.

The first step was to set up a laser through the culvert. At each metre along the culvert the distance to the invert and the obvert (crown) of the culvert was measured and plotted. This showed that the nominally 1,800 mm internal diameter culvert had deformed so that the vertical axis varied from 1,540 to 1,745 mm. The largest size was at the ends. The invert was also not straight, with dips along its length.

It was determined that to meet the minimum annulus requirements, the liners that could be installed would have internal diameters of 1,335 mm in the 1,800 mm culvert and 1,050 mm in the 1,500 mm culvert.

A check of hydraulic capacity showed that these diameters were acceptable because of the smoothness of the polyethylene liner compared to the corrugated metal culverts.

Rails were set up in each culvert to guide the Ribline liner to ensure the proper annulus was obtained. Four longitudinal rails were welded to the culverts at quarter points around the circumference. The two

bottom rails were to support the liner in the proper position during winding and provide a continuous grade to the invert, while the two top rails provided continuous support against floatation.

Restrained longitudinally and radially by the rails, grouting took place between host pipe and the newly installed liner.

The final stage of the works was to restore the inlet and outlet of the culverts to match the new levels of the inverts, and to accommodate the higher flow velocities that would apply because of the smooth polyethylene linings.

PROJECT COMPLETION

Interflow is committed to remaining at the forefront of the pipeline renewal industry and continuing to offer the highest value services to its clients.

Despite the challenges of this project and strict guidelines, the project was delivered successfully, on time and on budget using grouted structural liners to structurally rehabilitate a heavily deformed culvert.

Ribline liner in place.



Interflow has a product range suitable for almost every pipeline size, shape and situation. For more information about Interflow's sewer, stormwater and water pipe renewal capabilities, and to find out more about the full range of pipeline services Interflow can provide, visit interflow.com.au