



UNIVERSITY CULVERT – MT OUSLEY WOLLONGONG



Combining traditional tunnelling technology with modern day rehabilitation techniques enabled ITS Pipetech to submit and provide a solution to RMS [Roads and Maritime Services] to extend the life of an existing set of culverts that crossed the M1/ Princes Highway outside The University of Wollongong.

The prime objective of the work was to provide structural integrity and equalise the bores of a triple cell culvert that passed beneath one of the busiest arterial routes in Australia and to achieve a design life of 100 years.

A secondary consideration was to devise a methodology and a sequence of works that caused the least disruption to the motorway that carries over 18,000 vehicle movements a day just two metres above the top of the culverts.

The university culverts carry the Dallas Street branch of Fairy Creek which crosses under the motorway via a three cell precast concrete pipe.

Over the years as the Princes Motorway was upgraded and widened, the original 1350mm triple culvert set was extended to take additional traffic lanes.

The northern extension, however, was sized at 1200mm, which at times of heavy rain, was restricting the flow of water into the culverts causing flooding to the upstream creek valley and threatening local property and the university campus.

The project identified the probability of one or more of the culverts becoming blocked under a one-in-100-year storm event; therefore the feasibility review recommended that the pipes at the upper ends of the culvert set be enlarged to a common profile similar to the remainder of the culvert.

It also recommended that an inclusion of debris barriers with vehicle access be installed to the culvert entrance for access to undertake maintenance and routine debris clearance under the project scope.

ITS Pipetech's submission was to develop a methodology to tunnel around the existing inlet pipes to standardise the three cells into a common profile to meet the hydraulic demands and reduce the potential for blockages and water retention in the upstream valley.

Once this had been engineered, the void profile of the existing culverts had to be created and structurally lined together with

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the existing pipe to complete the structural rehabilitation process.

The proposal also took into consideration any potential damage to the riparian zone and the effects this would have on damage to local flora and fauna, as well as designing an access down from the motorway level to the culvert level with an associated structural retaining wall.

It had been identified that any blockage of the culvert would result in significant flooding to the surrounding area during periods of high intensity rainfall.

This would bring the possibility of an eventual collapse of the culvert that would risk the security of the motorway above causing possible closure and widespread traffic disruption.

The section of motorway is a key link between the Port Kembla industrial area and the Hume highway, with an AADT of approximately 18,000 vehicles per day of which 16 per cent is heavy goods.

Closure of this stretch of motorway would have had serious ramifications on the local economy, as well as resulting in negative exposure for the client.

The proposal was to remove the restrictions in the head pipe, create a structural element to create a 1350mm void and then to relin this with a fully structural element to provide the required diameter and negate the need for extra works to maintain capacity and avoid road closures.

The proposal; to remove the initial 6.5 metres of 1200mm id concrete pipework to

each of the three cells and replace with a cast insitu reinforced structural pipe bore.

Matching the existing diameter, it could be structurally relined with a UV cured *Berolina* GRP liner to provide the client with an uninterrupted free-flowing three cell underpass to meet hydraulic requirements.

The initial 6.5 metres of each culvert progressed from a headwall intake under the breakdown lane and inside carriageway of the north bound lanes of the Princes Highway.

The contract scope preference was to avoid any closure of the highway. In order to remove the pipes without disruption to traffic, ITS proposed a modified tunnelling system using a three-stage heading arrangement commencing with the outer right; then the outer left before finishing with the middle bore.

As the heading advanced, the existing concrete pipe could be broken up and removed from the workings leaving a space large enough to facilitate casting a structurally reinforced surround to form a bore at a diameter similar to the existing downstream pipework.

Prior to the above, ITS had to construct an access to the site; a reinforced concrete driveway with spray concrete retaining wall was built to allow plant movements to the tunnelling site.

The cover to the motorway above was less than 1600mm above the existing pipe, with allowance for working room to build the tunnel reducing it to 1200mm. ITS' designs needed to accommodate SM1600 and 45 ton axle loadings.



ITS opted for the use of its *Tunneline* cast insitu structural lining system to construct the three bores that were set at 1350mm id to match the internal main cell diameters. Each bore was cast in a single operation using a 40Mpa structural concrete

The final stage in the operation was to install a 1350mm high strength UV cured fibreglass *Berolina* lining through the culverts to provide the client with a smooth bore structural lining with a design life of 75 years.

The adoption of old techniques and new technologies enabled ITS to complete the works efficiently, effectively and to the client's specification.

ITS was able to deliver the project without accidents, incidents or lost time events. The work was completed within program, with numerous benefits and at a significant all-round saving to the client and the community.