Auckland CBD Reinforcement Project

NAVEED UR RAHMAN KEN BARBER

Olex Cables (A division of Australian Cables)

(AUSTRALIA)

Summary

In 1997, Vector Ltd (previously known as Mercury Energy) awarded a Turnkey Contract to supply and install more than 80 kilometers of high voltage underground power cables in a tunnel designed specifically to house the cables.

The three-metre diameter tunnel was constructed from Hobson Substation to Penrose Substation in the Central Business District (CBD) over a length of 9200 metres. The tunnel section between Hobson substation towards Newmarket (2.5km's) was excavated with a Road Header and the remaining section from Penrose towards Newmarket (6.7km's) excavated with a Tunnel Boring Machine (TBM). There are three main vertical shafts along the tunnel route: at Penrose, Newmarket and Hobson with three smaller vertical shafts at Liverpool where cables from Penrose and Hobson exit the tunnel into the Liverpool Substation. A smaller tubed borehole allows two cables to exit the tunnel to supply a substation at Newmarket. When compared with underground buried installation, a tunnel offers benefits which include minimal interference with busy city streets during installation, a more direct cable route, ease of maintenance, greater cable protection, and possibilities for any future expansion/upgrade at minimal costs. In the case of Auckland there was a further advantage due to the nature of the soil conditions making direct buried cable installation more complex.

The power crisis in Auckland (March 1998) necessitated the fast track construction of an additional 110 kV XLPE cable underground circuit of 150 MVA capacity to ensure integrity of supply and also highlighted the need for completing this project at the earliest possible time.
The installation of the 9 km route length of underground cable circuit within 17 weeks from the award of contract has been the subject of previously published papers. This paper reviews the tunnel installation and special technical features of that project.

The installation of multiple cable circuits efficiently in the confines of a tunnel with access limited to several kilometres in each direction was a significant challenge. To achieve this an innovative technique using purpose-designed plant was developed with a specialised hydraulic equipment supplier.

The tunnel has a conventional light rail track on the floor. Cable drums weighing up to 30 tonne were lowered down the vertical shafts at Hobson and Penrose substations. A hydraulic caterpillar cable pusher then fed the cable onto custom-made trolleys attached to a wire rope guided by one of the rails. A diesel hydraulic locomotive driving on solid rubber tyres and guided by the light rail track towed the cable and trolleys along the floor into position. Finally the cable was snaked into position onto the wall-mounted brackets. The tunnel design consists of specially designed stainless steel brackets on both sides to facilitate current and future cable circuits. The use of corrugated stainless steel sheathed cables enabled greater spacing of supports and hence reductions in overall costs.

All cable circuits, 110, 33 and 22 kV, are supplied with Optical fibres included within the cables and these fibres are all connected to real-time distributed temperature monitoring equipment to provide on line performance and circuit protection.

Key Words: High Voltage Cable – Tunnel – Installation methods – Temperature sensing