

**Outfall Tunnel – Hong Kong 1998****Waterproofing Tunnel****Holzman – Franki Joint Venture Kowloon, Hong Kong - Sealing tunnel**

Segments of the TBM tunnel started leaking water during construction. A Trail of 20 metres was initially done and the contract was awarded for the remainder of the leaking section. It was agreed that the area from Rings 216 thru 316 will be sealed under a performance based contract and that accurate water measurement was to be done before work commenced. This was achieved by measuring water flow via V notch weirs. For the application process 168 holes, each 3 metre deep (51mm dia.) were drilled into the lining.

The first stage of grouting was done by injecting directly into the rock face via mechanical packers installed at maximum depth and not behind the tunnel lining. This stage consisted of emulsion Scem66 injection only.

The second stage grouting consisted of packers being removed and re-installed to depth just behind the tunnel lining to inject emulsion, followed by Portland cement, into the annular gap between lining extrados and the cut ground face. The injection pressures were lowered to 10 Bar/145 P.S.I. for this stage.

The emulsion grouting took 10 shifts. The final water make measurement was done at the end of the application program and compared with the pre – sealing measurements and a success rate of 95.34% recorded. A total of 8480 litres of our special water sealing emulsion Scem66 was used.