

KCRC Contract No. DB320 West Rail Phase I

INTRODUCTION

The 3.6km Kwai Tsing Tunnels, which run between Mei Foo and Tsuen Wan, form a key component of the new KCRC West Rail Project which serves the Western New Territories of Hong Kong.

Atkins China Ltd led the design team commissioned by Dragages Zen Pacific Joint Venture to undertake the successful tender design and the detailed design for all aspects of the project including geotechnical, tunnelling, civil, structural, architectural, electrical and mechanical and system safety.

The project essentially comprises three major tunnel sections, the Ha Kwai Chung Tunnel (HKCT), the Tsing Tsuen Tunnels (TTT) and the Tsuen Wan Tunnels (TWT).

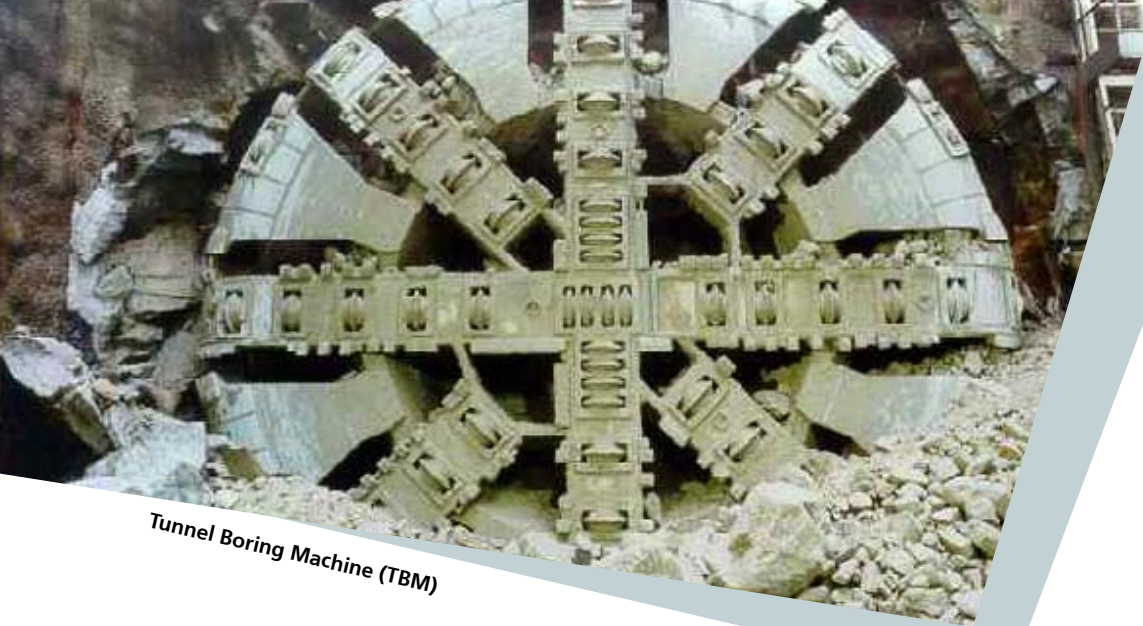
- The 1.7km HKCT is a twin-track, single bored tunnel with a central dividing wall excavated using Drill and Blast techniques.
- The 1.8km TTT comprise two single track bored tunnels excavated using a 8.75m diameter Earth Pressure Balance TBM through mixed ground.
- The Tsuen Wan Tunnels comprise 140m of cut and cover tunnels constructed in the TBM launch chamber.

In addition to the 3 tunnel sections, the project also included 3 major shaft excavations and demolition of two 26 storey existing building structures to facilitate tunnel construction.

Emergency Access Provisions (EAP's) and the design and construction of an Ancillary Building at Kwai Fong to house traction power and tunnel ventilation facilities was also included.

Completed HKC Tunnel with Railway





Tunnel Boring Machine (TBM)

HA KWAI CHUNG TUNNELS

For the design of this section of the tunnel Atkins undertook design of the tunnel alignment, portals, shafts, general arrangement and temporary and permanent tunnel support. In addition assessments were undertaken of the impact of blasting on the adjacent sensitive receivers, including natural and man made slopes and existing structures.

The skewed southern portal of the HKCT was particularly complex requiring excavation of large spans of up to 22m for the main passenger tunnel as well as future provisions for a separate freight tunnel adjacent to HKCT.

Detailed assessments were made of the rock mass conditions during the design and construction phases using the UDEC 3D software to assess the temporary and permanent support requirements particularly in areas with low cover to the tunnel crown.

Temporary support for the tunnel comprised rock bolting, shotcrete and steel ribs to suit the exposed rock mass conditions.

The permanent support for the tunnel comprised unreinforced concrete linings with the exception of the low cover areas adjacent to the south portal where a reinforced concrete lining was required. The permanent tunnel linings were designed by Atkins to provide high levels of durability and water tightness to meet the ultimate client's requirement for 120 year design life.



TBM Launch Chamber, Tsuen Wan



Construction of the HKC Tunnel using Drill and Blast Techniques



Completed Tsing Tsuen Tunnel

TSING TSUEN TUNNELS

These tunnels were constructed using an 8.75m diameter mixed ground Earth Pressure Balance (EPB) Tunnel Boring Machine (TBM). The use of a TBM was proposed at tender stage as an alternative to the conforming cut and cover and Drill and Blast option, and was the first use of a large scale EPB TBM in Hong Kong.

The use of a TBM approach to tunnelling enabled impacts on the adjacent Existing Building Structures (EBS) and services to be minimised. This enabled tunnel excavation to be undertaken without the need for expensive and disruptive underpinning or structural strengthening of the adjacent EBS.

An Ancillary Building was also constructed as part of the TT Tunnel works to accommodate the tunnel ventilation and power facilities.

OUR APPROACH

Atkins were responsible for liaison with the relevant government departments and also for gaining statutory approvals for the design of the tunnels and associated works.

Value Engineering featured heavily in the design process to develop and refine many aspects of the design in order to realise substantial cost and programme savings for the contractor and the ultimate client, KCRC. The Atkins design helped to facilitate efficient, innovative and high quality construction of the project with minimal impact to the adjacent existing building structures, services and the environment.

OUTCOMES

Atkins worked closely with DZJV from the earliest stages of this project to develop a design which was efficient, innovative and of high quality and which fully achieved the requirements of the ultimate client.