

## KCRC 320 HONG KONG

MIXED TUNNELLING MACHINE:  
EPB AND OPEN 8.75 m IN DIAMETER



NHI GROUP



The KCRC (Kowloon Canton Railway Corp.) is one of the largest railway operators in the world, transporting more than a million passengers daily to Hong Kong. In 1995, it initiated the two-stage West Rail programme in order to link the North West New Territories to the metropolis from South Kowloon (stage 1), and secondly, to create two "border" crossings in the North to the People's Republic of China for passengers and freight (stage 2).



### THE REALIZATION

#### THE OVERALL PROJECT:

Package DB320 is part of stage 1 of the programme between the stations of Tsuen Wan West and Mei Foo. It includes the boring of the two parallel tubes of the Tsing Tsuen tunnel (the North part of the package). The route unfolds under the water table, and crosses 3 areas of different types of terrain of similar length: an area of loose terrain (alluvium deposits), a mixed soil-rock area and a rocky area (granite).

#### THE PARTICIPANTS:

Project Manager: KCRC West Rail.

Consortium includes: Hong Kong Dredging & Public Works (Bouygues) + Zen Pacific.



#### TBM works

- Terrain: alluvial deposits (gravel, sand, silt, clay), mixed soil-rock, hard granite
- Compressive strength (hard granite): 100 to 250 mPa
- Maximum coverage: 25 m
- Maximum water head: 20 m
- Permeability:  $10^{-7}$  to  $10^{-4}$  m/sec.
- Length bored: 2 x 1,850 m
- Min. curvature radius: 300 m
- Max. gradient: 4%
- Finished tunnel inner diameter: 7.62 m
- Lining of universal keyed segments (13 positions):
  - 4 + 2 secondary key segments + 1 keystone
  - Thickness: 400 mm
  - Length: 1.8 m
  - Max. weight: 8 t

## THE TUNNELLING MACHINE

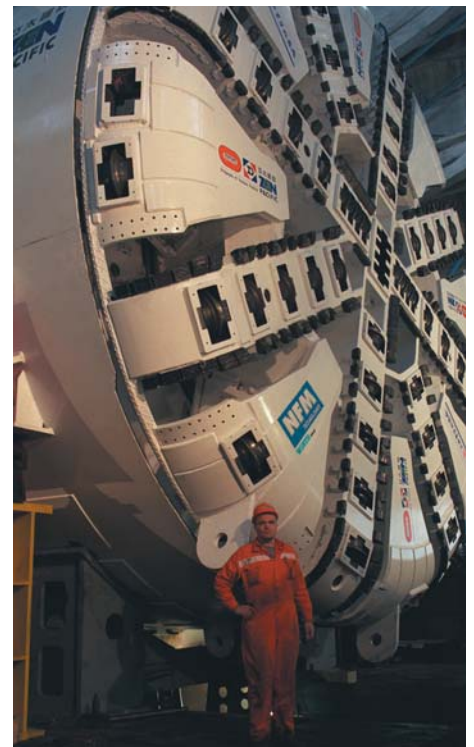
- Type: Mixed shield: open or closed mode (EPB, air) permanently installed in the shield
- Cutter head: 8 arms
- Cutter tools: 282 drag teeth, 60 disk cutters, variable overcut
- Electrically powered, variable speed with vector flow control
- Containment: compressed air or earth pressure, 3 bar maximum
- Evacuation of spoil: screw conveyor or retractable extraction conveyor; two belt conveyors
- Erector: 6 degrees of freedom, rotation  $\pm 220^\circ$  semi-automatic erection of lining segments
- Trailing train: 6 trailers
- Ancillary equipment: grouting injection system, probe drilling machine, injection of bentonite foam and mud
- 2 4-men airlocks + 1 emergency airlock

## CHARACTERISTICS OF THE MACHINE

- Excavation diameter: 8.75 m (new disk cutters)
- Shield length: 12.4 m
- Total length: 100 m
- Shield weight: 800 t
- Total weight: 1,200 t
- Installed capacity: 4,100 kVA
- Cutter head motor: 9 x 250 kW (2,250 kW)
- Thrust and stroke:  
13 pairs of cylinders x 2,650 mm
- Total thrust: 66,000 kN
- Articulation: 11 cylinders x 300 mm
- Head rotation speed: 0 to 3 rpm
- Max. nominal torque:  
14,200 kNm at 1.2 rpm
- Max. break out torque: 17,750 kN.m
- Max. speed of advance:  
8 cm/min. (using all thrust cylinders)

## THE WORK SITE:

- **Installation and testing time:**  
2 months
- **Tunnelling start date:**  
12/04/2000
- **Tunnelling breakthrough:**  
13/12/2000
- **Operating hours:**  
2 shifts of 10 hours per day,  
7 days a week
- **Overall performance:**  
Installation of 1 ring: 30 min.  
Best month: 410 m  
Best month in closed mode: 320 m  
Best week: 115 m
- **On-site services:**  
Location and management  
of replacement parts.  
Operational technical assistance
- **Benefits of the machine:**  
Location, manufacture and installation  
in China. TBM includes numerous  
functions to facilitate its operation and  
maintenance and is respectful of the  
environment (soundproofing of various  
components).



## NFM TECHNOLOGIES

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