

# **JOEM Promotions**

INTERNATIONAL PUBLIC RELATIONS & PUBLISHING

10 Victoria Road, Deal, Kent CT14 7AP

Tel: +44 (0)1304 368688 Fax: +44 (0)1304 375181

email: val@joempr.demon.co.uk

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RELEASES**

## **Singapore's Downtown line goes underground at Bugis**

**A total of 11 Liebherr excavator rigs, including seven HS 855 HD duty cycle crawler cranes are being used by contractor Soletanche Bachy to excavate deep trenches for the slurry wall being built as part of the Bugis interchange station at the new Downtown Mass Rapid Transit line (DTL) in Singapore. A further four Liebherrs are being used on two other Soletanche Bachy DTL contracts; bringing its total to 15 units on the DTL project.**

Singapore's historic Bugis district is one of the most visible signs of construction of the island's new Downtown underground line, with tunnelling work now underway albeit with minimal disruption to surface traffic.



The 40 km DTL is being built in three phases and will be entirely underground. With 33 stations including interchanges with existing lines and provision for future connections, DTL will facilitate direct travel from the northwestern and eastern areas of the island to the Central Business District (CBD) and the Marina Bay.

Consisting of eight civil contracts with five interchange stations, the line has to deal with existing infrastructure, a diverse geology, a four-tube river crossing plus the environment and logistics of a thriving urban cityscape.

Only two of the sections are being constructed using TBM technology and while challenging in themselves, notably the four-tube river crossing in twin piggy-back configuration, the majority of this phase is being constructed using cut and cover tunnels constructed within slurry wall retaining structures.

French contracting group Soletanche Bachy is involved in three of the first phase contracts.

The first phase is the middle section dissecting the CBD from Chinatown to Bugis, passing on its way the financial heart of the city, the new Marina Bay area, and then on to the established commercial centres around Suntec City and Bugis Junction.

At the far end of phase one, for Bugis station and tunnels, Soletanche Bachy is working in joint venture with local contractor Koh Brothers, to construct the interchange station and associated cut and cover tunnels at the busy commercial and highly populated area around Bugis Village.

No fewer than seven Liebherr HS 855 HD crawler cranes, together with a HS 845 HD, a HS 875 HD, a HS 833 HD and a HS 873 HD are working on the Bugis station contract. Soletanche Bachy also has two further contracts for stations and tunnelling work on the Downtown Line (DTL), where the company is using a further four Liebherr HS 855 HD units..

C903 is the largest of the eight major civil contractors to be awarded on the 4.3 km first phase of DTL. The Soletanche Bachy-Koh Brothers joint venture is constructing 600 m of cut and cover station and tunnels below major traffic intersections and the existing Bugis MRT station.

This area was up until recent times the foreshore and the underlying ground comprises very soft marine clays. With the vertical alignment dictating that the new Downtown Line goes below the existing Bugis Station, the line is considerably deeper which, allied to the soft ground, means deep and substantial slurry walls to form the cut and cover structures.

Cross-walls are being used in the main to add support to the slurry walls below formation level. The structure is essentially constructed below the busy Rocher Road, which brings traffic into the city centre from the East Coast Parkway; the main artery between the airport and the residential areas to the east of the city.

Towards the northern end of the site, the cut and cover tunnels will again be constructed in phases in an extremely tight working area, between commercial and residential buildings as well as the access and ventilation structures for the existing station.

Soletanche Bachy's regional director Alistair Sim says that four of the Liebherr HS 855 HD machines excavating the slurry wall trenches on this project are each fitted with KS3000 hydraulic grabs.

"The combination gives us very accurate control of the digging, which is important on a site with restricted space, and wide experience has shown it to be very productive," he says.

"The sound level is also significantly lower than it would be with a rope-operated grab, which is an important factor on a city-centre project such as this."

Much of the slurry wall is 1.5m thick and up to 65m deep in places, and is being constructed using four Liebherr HS 855 HD crawler cranes equipped with grabs. With such soft ground, the slurry wall contains heavy reinforcement cages weighing up to 100t/panel and constructed in concrete pours greater than 600m<sup>3</sup>.

Soletanche Bachy is constructing around 140,000 m<sup>2</sup> of slurry walls, cross walls and barrette foundations on this contract. It is using a fleet 11 Liebherr excavator rigs, including in addition to conventional and hydraulic grabs, an Evolution 3 hydrofraise for the deeper foundations, penetrating in to the hard underlying alluvium.

Apart from the sheer quantity of retaining walls to be constructed in a short time, another aspect of the Bugis project are the three sections of hand-mined tunnels that are required to pass under the busy traffic intersections and below the existing operational underground Bugis Station.

These tunnels are being excavated entirely within the layer of soft marine clay and require extensive temporary works. For each of the road intersections, the tunnels will be formed by constructing an interlocking pipe piled box from the cut and cover tunnels at either side.

The mined tunnel below the existing Bugis Station poses different problems and is by far the most sensitive part of the works. Using the base slab of the station above as the soffit for the tunnel, interlocking pipe pile walls are being constructed from either side of the station.

Driving these pipe pile walls will have its challenges, given the king posts left in from the original station works. Due to the sensitivity of the structure above and in the interest of avoiding undue construction movements using traditional soil improvement techniques, the contractor has proposed a ground treatment scheme using soil-nailing to reinforce the soft marine clay with fibreglass nails ahead of the bulk excavation.

Work on site began in January 2009 and will be completed by 2013.

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For further information please contact:

John Hooper  
Joem Promotions  
The Court Yard  
Sondes Road  
Deal, CT14 7BW England  
Tel: +44 (0)1304 368688  
Fax: +44 (0)1304 375181  
Email: [john.hooper@joempr.demon.co.uk](mailto:john.hooper@joempr.demon.co.uk)