

Deep foundations

Diaphragm wall - Barrette piles - Piles - Jet grouting

MRTA BLUE LINE
BANGKOK - THAILAND



Construction of nine stations and associated works for Bangkok's first underground railway line

As part of construction of the first section of the first underground railway line in Bangkok, the Blue Line project involves construction of 20 kilometres of tunnel with 18 stations, 1 depot and a number of aeration shafts and other works.

The project is split into two routes, known as the North and South Routes.

As part of the foundation works, SBB JV (in which Soletanche Bachy had a 66% share) was awarded the works for nine stations and associated works.

The geology (water table 3 metres below ground, soft clays and sands below the water table) called for the following works:

- Construction of perimeter diaphragm walls of variable thickness and depth, acting as permanent retaining walls, seepage cut-offs and structural underpinning for vertical loads.
- Prefounded columns and/or barrette piles on station centrelines as added support for vertical loads.



View of work at Samyan station

OWNER:	MRTA
ENGINEER:	OVE ARUP (NORTH ROUTE) - MAUNSELL (SOUTH ROUTE)
MAIN CONTRACTOR:	ION JV (ITALTHAI, OBAYASHI, NISHIMATSU) (NORTH ROUTE) BCKT JV (BILFINGER, C KARNCHANG, KUMAGAI, TOKYU) (SOUTH ROUTE)
STATION CONTRACTOR:	SBB JV (66% SOLETANCHE BACHY)
CONSTRUCTION PERIOD:	OCTOBER 1997 - FEBRUARY 2000

WORKS QUANTITIES:

Diaphragm walls

Thickness 800 - 1200mm, Depth 20 - 55m
Excavated area 160,000m²

Composite diaphragm wall

Thickness 1200mm, Depth 45m
Excavated area 20,000 m²

Piles

120 no. 1m diameter
Depth 45m

Barrette piles

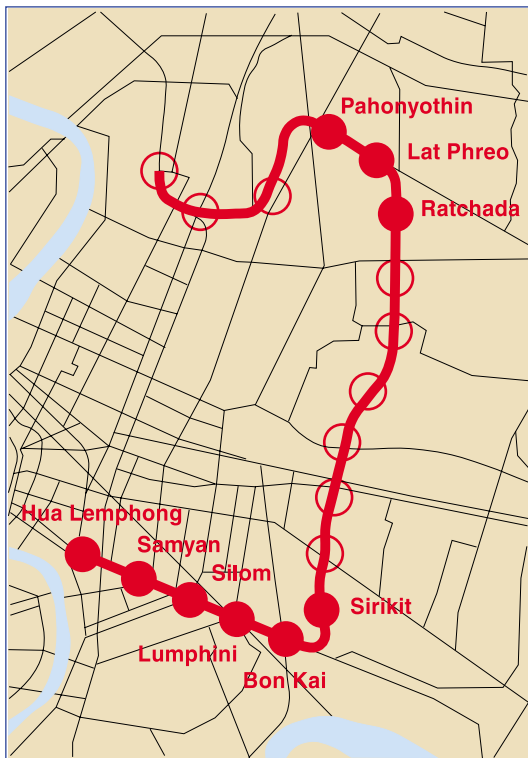
23 no. 1200mm
Depth 60m with confined headroom

Prefounded columns

114 no. 1.5 - 1.8m diameter
Depth 71m

Jet grouting

20,000m³ (single and double jet)
Depth 45m



"Short KS" excavating under a flyover

< The nine stations awarded SBB

- Jet grouting of the plugs for the TBM break-in and break-out at the stations.

The special construction conditions surrounding these underground engineering works in the city centre without interrupting street traffic meant that the stations had to be built in two halves, backed up by special works such as:

- At Silom station, composite concrete and steel diaphragm wall, 45m deep. The technique consists of using interconnected steel beams over the whole length of the structure, instead of the usual steel bar cages. At Silom, the steel beams were 900mm wide (the trench was 1200mm wide) and installed to a depth of 45m.
- The diaphragm walling had to be carried out with a headroom of only 6 metres.
- Barrette piles were built to take the loads from the motorway flyovers.
- Circular diaphragm-walls were installed to construct shafts 25m deep with an inside diameter of 7 metres, with very little ground level space for the work.

Together, the severe geological, scheduling and quality constraints required six diaphragm wall teams, two piling teams and three jet grouting teams to operate simultaneously with a maximum workforce of 700 people and

- three KL 1000 and 1200 diaphragm wall trenching rigs
- three KS 3000 rigs with 1000 and 1200 hydraulic grab buckets
- two 1500mm and 1800mm piling rigs
- three CMV jet grouting units with Techniwell pumps
- concrete plant with a peak capacity of 2000 m³ of concrete per day.

All the KS 3000 hydraulic rigs were equipped with a real time data acquisition system monitoring grab deviation, in order to meet the design tolerance of 0.5% on verticality.

Special trenching grabs had to be made to suit the non-standard geometry of diaphragm wall panels, with a maximum 4.5m length. The KS 3000s had a grab bucket opening of 4.20m

to ensure trench verticality and successfully meet the productivity requirement for completing a panel every 24 hours.

Construction of Silom station and the underpinning for the motorway flyovers had to be performed with a headroom of only 6.00m. A "Short KS 3000" was built especially for the job, capable of

- digging diaphragm wall and barrette pile trenches with a working headroom of only 6.00m
- performing this work to within 0.5% of the vertical to depths of 60m.