

Deep Basement & Foundations

Diaphragm Wall, Jet Grouting, Barrette & Bored Piles

MARINA BAY SANDS SINGAPORE



Basement retaining walls and foundations for 3 high rise hotels

The integrated resort being built on Singapore's Marina Bay waterfront by Las Vegas Sands forms an integral part of the city state's ambitious development plan for the Marina Bay area.

The integrated resort will include a casino, a three hotel towers with a total of 2,600 rooms, a 200,000 square feet (19,000 m²) arts and sciences museum, a convention centre with 1,200,000 square feet (111,000 m²) of floor space, a retail mall and one million square feet (93,000 m²) of waterside promenade.

The hotel structures, over 50 storeys high, will dominate the Marina Bay skyline. Each structure is different with sloping sides played in two directions. The three are linked at roof level by a 'sky garden' over 300m long that will offer spectacular views of the vibrant downtown of the city.

Bachy Soletanche Singapore were already on site to carry out the advanced works contract to clear an old seawall mole buried in the reclamation. This contract also formed the cellular retaining walls for Towers One and Two where the abandoned mole encroached on the footprint of the hotels. Known as the doughnut and peanut these were integrated into the final structure as the basement retaining walls.

The contract for the hotel foundations allowed for the construction of the remaining basement retaining walls between towers one and two and for tower three. The foundations for the three towers were essentially barrette piling although there were a number of bored piles for the lighter loaded elements of the structures.



An artists impression of the completed Marina Bay Sands integrated resort & during construction



OWNER:	MARINA BAY SANDS PTE. LTD.
ENGINEER:	ARUP SINGAPORE PTE. LTD.
MAIN CONTRACTOR:	BACHY SOLETANCHE SINGAPORE PTE. LTD.
PERIOD OF WORKS:	MARCH 2007 - NOVEMBER 2007

WORKS PERFORMED

Diaphragm Wall:	perimeter - 485m ; 1.2/1.5m thick ; surface area - 22,000m ²
Barrette Piles:	305 nr ; sizes - 1/1.5m x 2.8m ; depth - 78m ; surface area - 57,500m ² ; Including 70nr excavated through rock mole
Bored Piles:	164 nr ; diameters - 1m/1.2m/1.5m/1.8m/2m ; depth - 66m ; length bored - 9,000m
Jet Grouting:	ground treated - 17,000 m ³



Plan of retaining walls and foundations for the three hotel structures

Apart from the buried mole the site offered additional geological challenges due to the nature of the reclamation built over very soft marine clays. The retaining walls and the foundations were required to penetrate into the hard underlying old alluvium with many of the foundations reaching nearly 80m depth.

The Client had set an ambitious programme for the construction of the whole integrated resort and with the three towers being the most complex structures with foundations to match a tight programme was given to complete the works and handover each tower progressively to the follow on substructure contractor.

At the height of the activities on site Bachy Soletanche were operating up to 15 excavating rigs; 3 hydrofraise, 6 KS hydraulic grabs and 6 KL cable grabs all working 24hrs/day, 6 days/week. The logistics to keep this amount of equipment working efficiently meant a strong management team, with a mix of local, regional and European staff. With up to 1,200 m³ of concrete being poured per day, at a time when concrete supply across Singapore was extremely stretched, the management of the site logistics was critical to ensure the success of the project.



Pile caps under construction within the Tower One 'doughnut'

Given the tight programme, the bored piling and the jet grouting were executed concurrently with the diaphragm walls and barrettes adding to the already complex logistical challenge.

Despite the geological and physical constraints to the works, Bachy Soletanche were able to complete each section of the works on schedule handing each tower over to the follow on contractor to commence the bulk excavation, pile cap and basement structure ahead of the iconic superstructure.



Bulk excavation of the 'peanut'



24 hour working