

# Piles - Diaphragm walls

Barrettes - Micropiles - Ground Anchors

## LARVOTTO HOTEL COMPLEX

MONACO



**Deep foundations constructed on a quay reclaimed from the sea which comprised loosely placed larger rock ballast to form the embankment**

The “LARVOTTO hotel complex” site is situated on the LARVOTTO quay in MONACO, at the edge of the Franco-Monacan border.

The site is accessed via Avenue Princesse Grace.

The site area is around 5 hectares on which the Monte Carlo summer Sporting is already built. The project fits into the eastern part of the peninsula, across the entire north to south length covering an area of 23,000m<sup>2</sup>.

### Description of the works

Lot 3B - Foundations - comprising a diaphragm support wall in the western part, the general earthworks and the deep foundations : support piles under the hotel area, piles under the parking areas and micropiles in the critical areas and those difficult to access.

### Site geology and geotechnical difficulties

The stratigraphy of the terrain encountered is as follows :

- Very open quay surface ballast composed of limestone blocks and massive rock



General view of the worksite

CONTRACTOR:	SOCIETE DES BAINS DE MER - SOGETEL
PROJECT MANAGER:	CABINET IORI- MONACO
SUPERVISORY OFFICE:	APAVE MONACO
CONCRETE STRUCTURE:	SETOR
MAIN CONTRACTOR:	SOLETANCHE SAM - SAM PASTOR
DURATION OF WORKS:	JANUARY 2003 TO SEPTEMBER 2003

### MAIN QUANTITIES:

- 1 100m<sup>2</sup> of diaphragm wall comprising :
  - 125 micropiles (1,600m of bores)
  - 255 anchor rods (2,800m of bores)
  - 1,100m<sup>2</sup> of sprayed concrete 0.30m thick
- 52,000m<sup>3</sup> of earthworks
- 71 support piles from 0.62 to 1.02 m thick (3,800m<sup>2</sup> of excavation) varying from 16 to 21m deep
- 370 STARSOL piles reinforced over their entire depth from 0.62 to 1.02m in diameter, representing 7,300m of bores : 18 to 24m deep
- 55 foundation micropiles for 1,500m of drilling



Hotel complex project



Foundation support pile works

fillings of +1.50 NGM to -12.00 NGM average.

- Sands and Gravels over 8 to 10m.
- Marno limestone substratum consisting of the cretaceous era which was utilised for anchoring into.

### Diaphragm wall works

The first work phase consisted of erecting a support wall composed of micropiles produced by the ODEX method with permanent casing to drill through the difficult terrain.

The HA32 anchor rods were produced with bags in their fixed length to minimise slurry losses through the ballast during grouting. The B25 sprayed concrete was produced by a

dry process after installation of a reinforcement composed of welded mesh panels.

### Foundation support pile works

After removing the large blocks and pre-treatment of the open embankment material by injection, guide walls of large plan dimensions were fabricated in order to provide :

- A good reserve of drilling mud (loss compensation),
- passage during the rock filling drilling of more than one meter.

The support piles were produced using two mechanical grab appliances by means of heavy drill bits to destroy

the large top limestone blocks and provide the anchoring in the cretaceous limestone.

### Foundation pile works

Considerable resources were employed to perform the preliminary material removal over the first 14 meters. The blocks were destroyed according to areas either by drilling protected by vibro-sunk casings or by recess drilling at right angles to the supports with down-hole hammers and special reinforced augers. The piles were then produced using 2 Starsol 12000 piling rigs and 1 Starsol 20000 piling rig for the 1,0m diameter piles at 24m depth.



Diaphragm wall works



Foundation pile works