

## A problematic hotel

What happens when a Dubai hotel undergoes structural movement leading to water penetration in the basement? In this case, Casagrande undertakes micropiling in the hotel's basement

**A** hotel in Dubai, UAE, which was built in 2007 and consists of eight stories and two basements, was undergoing some structural movement in the basement levels, leading to cracked columns, walls and slabs. In turn, that had resulted in water penetrating through cracks in the basement's slab and walls since 2017. There was also the additional problem of the hotel suffering differential settlement.

An assessment of the building was carried out to fully identify the scale of the problems and the consulting engineer for the project compiled a detailed

design to enhance the stability of the structure, which involved utilising a combination of grouting and micropiling.

However, there was the additional challenge that the micropiles and tube à manchette steel grouting tubes needed to be installed in the basement area, which is subject to a high water table. A solution could have been achieved with temporary dewatering. However, this was not the preferred option due to the nearby location of an underground metro station.

The minimum proposed treatment area defined by the consultant represented a total

**“A solution based on underpinning using micropiles was designed with tube à manchette grouting to enhance the strength and stiffness of the underlying soils and reduce permeability”**

of 2,456.3m<sup>2</sup> and 1832.2m<sup>2</sup> when excluding the piling caps area.

### THE SOLUTION

The scope of works needed to correct the hotel's problems included designing a suitable ground enhancement scheme to increase the density, strength and stiffness on the one hand and reduce the permeability of the soils immediately underlying the basement slab on the other. The treatment area was located generally along the perimeter of the basement where most of the defects were identified. The depth of treatment needed to be mainly on the overburden sands directly below the basement slab.

A solution based on underpinning using micropiles was designed with tube à manchette grouting to enhance the strength and stiffness of the underlying soils and reduce permeability.

A preventer system and self-drilling micropiles were specified and employed to install the micropiles instead of temporarily dewatering the site. The preventer allowed the successful installation of over 300 self-drilling micropiles and 580 tube à manchette steel grouting tubes and further soil tests.

The micropiling was carried out at a level of minus 4.45m (groundwater at minus 1.45m) without the need for temporary dewatering.

The preventer used was a valve system connected to a compressor via an air line. The system operates by opening and closing a rubber insert, applying air pressure to inflate (close) or deflate (open) the insert. When the rubber insert is in the closed position, it restricts the ingress of water while pressing tight against the micropile, allowing the installation and grouting to be completed.

The preventer was fixed securely to the structure before the start of installation. It was removed once the grout had completely cured, exposing the top of the micropiles ready for



the head detail to be constructed.

All the drilling and injection works was executed from the second basement which had restricted headroom; just 2.5m. Both the confined space on site and the health and safety concerns regarding the fumes forced the contractor to use all-electric machinery, including the low-headroom electric drill rig from Hütte Bohrtechnik – the Hütte HBR 202 E. The compact machine features a telescopic mast that can extend up to 2.7m high with a powerful rotary of 2.8tm torque.

Drilling of all 312 micropiles and the 582 tube à manchette pipes was done using just the one machine working in double shifts.

### THE RESULT

The micropiles were installed and grouted using the preventer while implementing strict health and safety procedures. The whole procedure was done by NSCC International, the contractor while maintaining a production rate that satisfied the site engineers as well as the client.

The real benefit of the preventer system, however, was that it allowed the installation and grouting of the micropiles in a restricted working area – without the need for temporary dewatering. It has been estimated that there was a £350,000 saving on this project thanks to the use of the preventer system rather than conventional dewatering.♥

*Due to limited space and health and safety concerns, an all-electric Hütte Bohrtechnik rig was used in the basement of a Dubai hotel suffering from structural movement*

**“The real benefit of the preventer system was that it allowed the installation and grouting of the micropiles in a restricted working area without the need for temporary dewatering”**