HDD HELPS TO BUILD ABU DHABI PEDESTRIAN TUNNELS

Abu Dhabi is a small emirate on the Arabic peninsula, which is part of the United Arab Emirates (UAE) and also the capital, reigned by the Sheikh Zayed Bin Sultan Al Nahyan for a long time. The UAE is a rich and open market with 2.6 million inhabitants, with some 85% of the population living in modern cities such as Abu Dhabi. Temperatures in the region can rise to 50°C in the summer.

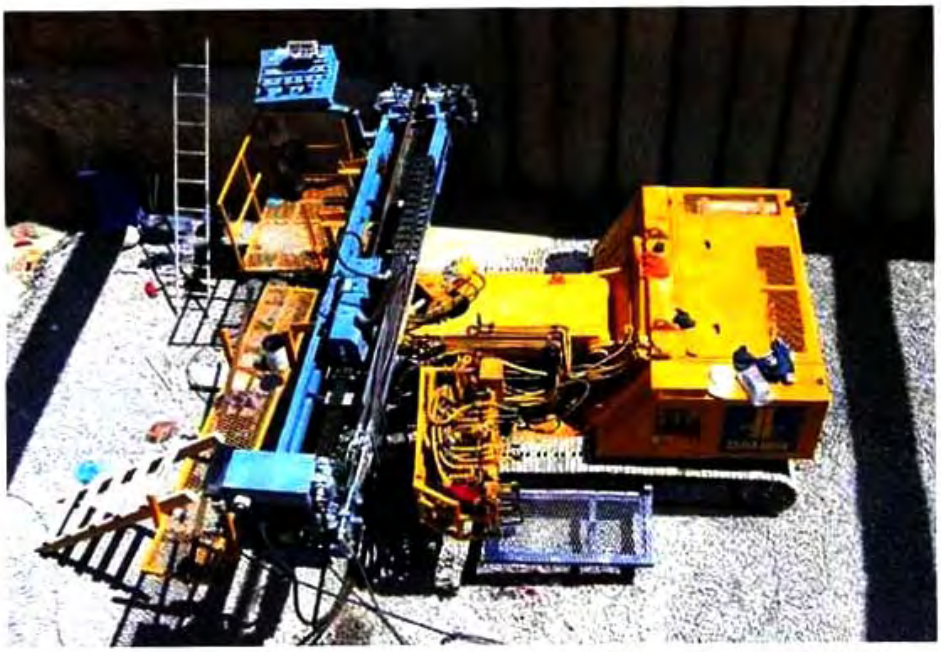
The city of Abu Dhabi is situated just above sea level, so that even with a pit depth of 1 m de-watering is necessary. Solid sandy stone soil can often be found at depths of 5 m, which requires special foundations for all buildings.

The infrastructure with 6 to 8 lane roads and very heavy traffic can be compared to any large city in the western world. Pedestrians, who often do not keep to the official road-crossings when crossing roads are always in great danger of being injured. The number of accidents involving people getting killed has risen, giving the Sultan reason to take drastic measures and about a year ago he ordered the building of an initial 15 pedestrian tunnels. It was made clear that bridges were not the preferred solution and breaking of road surfaces is prohibited by law, due to the difficult ground conditions. The single underground pedestrian tunnels are between 30 and 60 m long and approximately 4 m wide.

CONTRACT

The contract for the tunnel work was awarded to Bauer International's UAE branch, daughter company of the German special building contractor Bauer Spezialtiefbau GmbH of Schrobenhausen. The planning engineers from Bauer International and Bauer Germany have so far thought of a unique solution and proposal. The plan had foreseen a pit with an approximate width of 10 m, 30 m length and 7 m depth on both sides of the road. Before excavating the pits were to be secured with supporting tie rods with a diameter of 500 mm and pre-stressed H-beams.

Several water pumps with a high flow-rate were required for the de-watering. After the excavation and transportation of the soil, between 17 and 27 cored hole bores were to be produced on both sides of the planned tunnel at calculated points at distances of 500 mm, exactly mirror-inverted at a diameter of 150 mm, as well as to provide connection bores, into which special pipes with valves were pulled. With these pipes it was possible to inject a special sand stabiliser into the loose sandy ground. It was then planned to build the tunnel in sections, as well as the entrances and steps including a spiral pathway for wheelchairs.



Producing the pilot bore using the combination Bauer/TT Group Grundodrill 10S Bore rig.

A practical problem arose with the minimal road cover being approximately 1 m and subsequently the requirement to precisely execute the 30 to 60 m long bores in alternating soil between the 150 mm diameter core-hole bores. The question put forward to the planners was, who could possibly carry out such precision bores. The inquiry was sent to the consulting company Seeliger Drilling Services in Abu Dhabi, which due to their connections and experience over many years with horizontal bore techniques, recommended the manufacturer Tracto-Technik GmbH of Lennestadt in Germany, part of the TT Group.

In accordance with the forward thinking of Seeliger Drilling Services and Bauer International and thanks to the productive flexibility of the TT Group, a special rig based on a Grundodrill 10S was developed and produced at short notice. Instead of the standard set-up of the rig on a track-mounted undercarriage the rig comprised

Exit of the bore head from the core-hole bore.

Sectional construction of the tunnel after the injection bores.

The carcass tunnel completed.

only an upper slide, which was assembled on an undercarriage belonging to Bauer in UAE, to allow for the necessary mobility between the single core-hole bores at the various tunnel heights.

When the rig was ready to be put into action, the first precision bores were produced under the guidance of Jörg Frank Seeliger. To be able to follow the bore path exactly, the Mark III Digitrak detection system, from DCI, was used with a measuring sonde with an inclination tolerance angle of less than 0.1%. Using its experience of many years, Seeliger Drilling Services was able to direct each of these core-holes precisely. Even a deviation of 100 mm would have ruined the bore, as the space conditions would not have allowed for a second attempt to core-hole the bore, making distribution of injection material impossible. In the target area the bore head was exchanged for a 100 mm diameter backreamer and the special injection pipes were screwed together and installed.

INJECTION PIPES

The injection pipes are 3 m long and had a valve, set at pre-determined distances, which allowed for the injection material to be pumped into the loose ground by specialists Bauer after the pipe installation. The total time for the important bore work on each underpass took only 10 to 15 working days. After the successful completion of this first project, for which 10 months production time for each of the tunnels was planned, further tunnels are being constructed using this innovative and cost saving trenchless method.

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for TT UK