

HORIZONTAL DIRECTIONAL DRILLING

For General Information on Horizontal Directional Drilling [click here](#)



DUBAI LOGO ISLAND - TURNING A LEAF INTO A HOME

Dubai's Palm Trilogy is one of the most ambitious engineering ventures ever undertaken. Three completely manmade islands, in the shape of palm trees, have been reclaimed from the sea to form a unique retail and tourist resort.

At one of the three complexes, the Palm Jumeirah, developer Nakheel has included two smaller islands shaped like date palm leaves – the development's logo. Jutting out from the main island's trunk, the Logo Islands give the Palm Jumeirah an iconic look from the skies above or from one of Dubai's many skyscrapers.

Nakheel began the land reclamation project for the Logo Islands in June 2003 and finished in February 2005. In total, 4.4 million m³ (155 million ft³) of sand and 1,000,000 t of rock were used to create the two islands, which together cover 140,000 m² (1.5 million ft²). Both islands are intended as highly exclusive residential area. The one on the Abu Dhabi side of the development has been sold to a property developer, while the one on the Dubai side will become home to one of the emirate's rulers.

For this second island, Nakheel had to supply services like drinking and irrigation water, telecoms and sewerage from the Palm. That meant creating three 550 m (1804 ft) crossings to the island and, for this, the company decided to use horizontal directional drilling (HDD). This method had already been used to bring services to the main Palm Island. HDD proved to be faster and cheaper than micro tunnelling, while having less impact on the island, its residents and local wildlife than dredging.

CHALLENGING CONDITIONS

The HDD contract was awarded to Al Naboodah Specialist Services LLC, a part of the local Al Naboodah group of companies. Having carried out the HDD project from the Palm, Al Naboodah was already well acquainted with the ground conditions at the site. The first 8 m (26 ft) of sand sits on a 1.5 m (5 ft) layer of cap rock. Beneath that, at a depth of 9.5 to 27 m (31 to 89 ft), drilling would be through sandstone for the first half of the horizontal section and gypsum and clay for the second.

As both the Palm and Logo Island are manmade, the top layer of backfilled material was a major concern for the contractor. Its soft nature meant bentonite drilling fluid blowouts at either end were a distinct possibility. This could have potentially caused problems in achieving an appropriate exit angle when drilling on the Logo Island. Moreover, much of the drilling would be under the sea, so keeping bentonite returns going was not going to be easy either.



The Vermeer NAVIGATOR D100x120 drilling rig used for the smaller diameter boring work.

STARTING OUT RIGHT

The service installation included 250, 355 and 500 mm (10, 14 and 20 in) HDPE pipes with sub-ducts ranging from 39 to 200 mm (1.5 to 8 in). Al Naboodah designed the drilling project with 17° entry and exit angles, and 400 m (1,310 ft) radius entry and exit curves. This design meant the deepest point of each bore would be 27 m (89 ft) below the surface.

For the drilling, Al Naboodah decided to use its Vermeer[®] NAVIGATOR[®] D300x500 HDD drill rig together with three Vermeer R300 reclaimer systems and a Vermeer SA300

Ready to start the pipe pull-in with reamer head, swivel and pipe attached to the drill string.

SPONSORS LINKS

Click Name for website access



[TT Group](#)

TT-Group: A leading manufacturer of Trenchless Technologies: Moles, Pipe Rammers, HDD, Pipe Replacement and Auger boring systems and NoDig-equipment



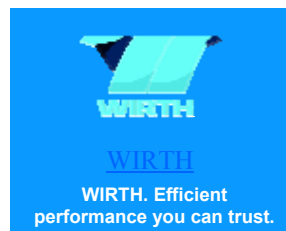
[Herrenknecht](#)

Manufacturer of TBMs, Pipejacking, Microtunnelling, HDD and Support Equipment and Engineering Services.



[Perforator Ltd](#)

Sales and Hire of Guided Auger boring and Pipebursting systems and tooling.



[ONSITE/PERCO](#)

No-Dig contractors for: Sewer installation, renovation and maintenance including CIPP, Structural, Infiltration & Connection linings; Patch repairs; CCTV pipe inspection and assessment; pipe cleaning, flow monitoring; Auger boring; HDD; Microtunnelling; Shaft Sinking; Headings; Lateral Cutting; Pipe Bursting; Sliplining & Consultancy



HORIZONTAL DIRECTIONAL DRILLING

For General Information on Horizontal Directional Drilling [click here](#)



remote high-pressure bentonite pump. This combination had successfully pulled 10,000 m (32,800 ft) of 500 mm (20 in) diameter HDPE piping during the HDD project for the Palm.

The first task was to sink a 150 mm (6 in) steel pipe on the seabed, and determine its exact position using a Reduct DuctRunner. This pipe would house the wire for the Paratrack loop used to guide the drilling of the pilot bores, with return wire laid on the seabed with a 75 m (246 ft) clearance from the pipe. During the backreaming phase, the pipe would also be used to transfer the bentonite drilling fluid from exit to entry side.



Pipe handling during the pullback operation.

DRILLING STARTS

Drilling began with the bore for the 355 mm (14 in) diameter pipe. For this, Al Naboodah used a 171 mm (7 in) diameter mud motor with a 248 mm (10 in) diameter tri-cone milled-tooth bit. Behind this, two 9.2 m (30 ft) long non-magnetic drill collars carried the Paratrack tool and pressure sub. The drilling took five days. Then the bore was backreamed using a 500 mm (20 in) diameter milled tooth-hole opener, which took an additional four days. Finally, the pipe was pulled with a 450 mm (18 in) diameter barrel reamer in front of the swivel.

Next on the plan was the 250 mm (10 in) diameter pipe. However the D300x500 was needed for an urgent job elsewhere. So to stay on schedule, Al Naboodah called in its NAVIGATOR D100x120 for this smaller bore.

Again, a mud motor was used for the pilot bore, this time a 94 mm (4 in) diameter motor with a 120 mm (5 in) diameter tri-cone milled tooth bit. Two 6 m (20 ft) long non-magnetic drill collars created a similar bottom hole assembly as for the bigger rig. After five days of drilling, backreaming was carried out using a 304 mm (12 in) diameter milled-tooth hole opener and took three days. The pipe was pulled the next day.

A STICKY PROBLEM

A couple of days later, the Vermeer D300x500, R300s reclaimers and SA300 high pressure pump returned to the site so work could begin on the bore for the 500 mm (20 in) diameter pipe. Initially, a mud motor was used again. However, although mud motors had performed well on the previous bores, this time the drilling ran into difficulties when it reached the gypsum and clay in the second half of the horizontal section.

The layer was much stickier here than for the previous bores, and this was slowing down progress. By monitoring the bentonite returns, Al Naboodah realised that a jetting bit would be much more suited to the new soil condition. After making that change, drilling was finished in a total of six days and backreaming could begin.

When the first bore was backreamed, the hole opener had some difficulties getting through the gypsum and clay segment. So with the stickier condition in the segment for this final bore, Al Naboodah employed a new backreaming strategy.

First, a 760 mm (30 in) diameter milled tooth hole opener was pulled to the end of the exit curve and then pulled back out on the exit side. Next it was removed from the drill string and replaced with a 660 mm (26 in) diameter flycutter. This was pulled quickly through the 760 mm (30 in) diameter hole to start cutting the clay at the beginning of the horizontal section. Once the flycutter was through the clay, it was pulled slowly through the sandstone portion of the bore to reduce tooth wear and allowed to complete the backreaming without having to stop and replace the teeth.

This new strategy paid off and backreaming was completed within four days. A 610 mm (24 in) diameter barrel reamer was pulled through the bore to check it and no problems were found. The 500 mm (20 in) diameter sleeve was pulled the following day.

Finally, the sub-ducts were installed. These comprised a bundle of utility pipes for the 500 mm (20 in) diameter bore, and a 110 mm (4 in) diameter drinking water pipeline in the 355 mm (14 in)

SPONSORS LINKS

Click Name for website access



[TT Group](#)

TT-Group: A leading manufacturer of Trenchless Technologies: Moles, Pipe Rammers, HDD, Pipe Replacement and Auger boring systems and NoDig-equipment



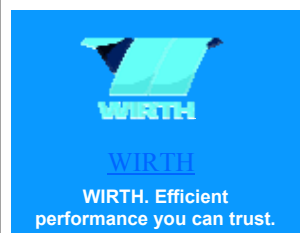
[Herrenknecht](#)

Manufacturer of TBMs, Pipejacking, Microtunnelling, HDD and Support Equipment and Engineering Services.



[Perforator Ltd](#)

Sales and Hire of Guided Auger boring and Pipebursting systems and tooling.



[ONSITE/PERCO](#)

No-Dig contractors for: Sewer installation, renovation and maintenance including CIPP, Structural, Infiltration & Connection linings; Patch repairs; CCTV pipe inspection and assessment; pipe cleaning, flow monitoring; Auger boring; HDD; Microtunnelling; Shaft Sinking; Headings; Lateral Cutting; Pipe Bursting; Sliplining & Consultancy

HORIZONTAL DIRECTIONAL DRILLING

For General Information on Horizontal Directional Drilling [click here](#)



diameter pipe. To do this, the D300x500 was used to push a drill rod through the sleeve, the bundled pipe and swivel was attached, and the rod pulled back.

SATISFIED CUSTOMER

“The Vermeer equipment helped Al Naboodah once again finish a job on time and to the customer’s satisfaction. The D300x500’s huge torque and 135 t (300,000 lb) pulling capacity allowed us to install the two biggest bores without hassle,” said Joeri de Koning, HDD Supervisor, Al Naboodah Specialist Services LLC. “Even the compact D100x120 proved it was powerful enough to handle bores exceeding 550 m (1,804 ft) without problems, with the rig-mounted pump delivering enough flow and pressure to let us drill with a mud motor. And the trio of R300s easily handled all the cuttings, allowing us to keep up a fast working pace.”

The project certainly had its challenges: from blowout risk and changing soil conditions to coordinating the HDD around all the ongoing backfilling and construction activities on Logo Island. But Al Naboodah executed according to plan. It was a vital step in the creation of the Palm Trilogy – which has since become an iconic symbol of Dubai’s rapidly growing tourist industry.

Website: www.vermeer.com



Pipe bundles are pulled into the casing pipes previous installed using HDD techniques.

SPONSORS LINKS

Click Name for website access



[TT Group](#)

TT-Group: A leading manufacturer of Trenchless Technologies: Moles, Pipe Rammers, HDD, Pipe Replacement and Auger boring systems and NoDig-equipment



[Herrenknecht](#)

Manufacturer of TBMs, Pipejacking, Microtunnelling, HDD and Support Equipment and Engineering Services.



[Perforator Ltd](#)

Sales and Hire of Guided Auger boring and Pipebursting systems and tooling.



[WIRTH](#)

WIRTH. Efficient performance you can trust.



[ONSITE/PERCO](#)

No-Dig contractors for: Sewer installation, renovation and maintenance including CIPP, Structural, Infiltration & Connection linings; Patch repairs; CCTV pipe inspection and assessment; pipe cleaning, flow monitoring; Auger boring; HDD; Microtunnelling; Shaft Sinking; Headings; Lateral Cutting; Pipe Bursting; Sliplining & Consultancy

Pioneers in Trenchless since 1962

HDD-Rigs with percussive hammer*
robust and reliable - even for rock bores

Grundodrill 15N

* for bores in gravel, stone, debris



• with digital display • pipes up to Ø 550 mm • bore length up to 400 m

TRACTO-TECHNIK GmbH & Co. KG · P.O. Box 4020 · D 57356 Lennestadt
Phone: +49 2723 808110 · Email: export@tracto-technik.de · www.tracto-technik.com



45 years of experience