WHAT IS HDD?

IT IS HORIZONTAL DIRECTIONAL DRILLING.

To connect the hot and cold wells together and to the buildings, Heijmans is laying a double ring circuit around the entire campus site. This pipe network consists of long runs of plastic pipe (HDPE, high density polyethylene). In some places, we can dig a trench and lay the pipes in it. But in many places, it is not so easy. Because the pipe has to go under for example a road, trees or other underground cables and pipes, or because excavation work here could cause too much damage and nuisance. In these places, we use HDDs.

But how does this horizontal directional drilling work? How do you ensure that you come out in the right place? What other things are involved as well? We put these questions to Lizanne Voogt - van Hal, project coordinator of the drilling team at Heijmans. Lizanne has already been working in drilling engineering for over 12 years. She has progressed from assistant planning engineer to project coordinator. With her extensive experience in both planning and execution, she is able to tell us everything about HDDs.

Entry and exit pits

First of all, an **entry** and an **exit pit** are excavated, Lizanne begins. The entry and exit pits are excavated to gain a clear view of any cables and pipes and to collect the mix of sand and **bentonite** (a mixture of water and a type of clay that binds the sand) that is released. The **drilling rig**, which

Fig. 1: A drilling rigs at the entry pit. This heavy machine automatically connects the extension rods; with lighter machines, this happens manually

drills the connected-together rods into the ground, is positioned next to the entry pit. During the initial drilling phase (the pilot phase), there is a **steering head** at the leading end of the drilling rod. On this, there is a plate that can tip upwards, downwards or to the left or right like a kind of rudder, in order to steer the 15 cm thick **drilling head**. The depth at which the shaft is to be made and the route it must follow are determined in advance. On the surface, a colleague follows the drilling route with **detection gear** (ground radar), with which it can be seen how deep the shaft is and whether the drilling head is following the planned route. The drill operator can redirect the drilling head with this information if required.

From 150 mm to 450 mm

Once the drill comes up for the first time, the steering head is unscrewed and a **reamer** is fitted to the end of the drilling rod. Then the drill operator makes the reamer rotate and pulls it slowly back through the shaft to the entry pit. The teeth on the reamer widen out the hole. Also, bentonite is injected through the holes in the reamer. By this means, the sand from the drilling is taken along out of the shaft. The bentonite coats the wall of the shaft at the same time, so it is less likely to collapse.

Once the reamer is all the way back at the entry, it is exchanged for a **bob**. This bob is pushed back through the hole so the rods get back to the other end again. Once they are back at the exit, the reaming process can be repeated with a **larger reamer**. This depends on how large the shaft needs to be. For the larger tubes (450 mm) we repeat this as many as three times. For smaller diameter pipes, it may be that no separate reaming pass is needed, and these can be pulled through while reaming.

Pulling through pipes

The last time the drilling rod surfaces in the **exit pit**, we attach a **puller head** to it, which we have already welded to the pipe. We then pull this, together with the pipe, through the shaft to the **entry pit**. For a shaft 300 m long, there

Fig. 2: In one container, the bentonite is prepared and pumped into the shaft. The machine separates the bentonite-sand mixture coming out using vibrating screens and distributes it among the other containers.

Fig. 3: Various reamers and bobs

also needs to be space at the exit to lay out a pipe 300 m long. These pipes are laid out in the field beforehand and welded together using mirror welds that are watertight and proof against large tensile forces. To make the pulling in easier and minimise friction in the bore, we lay the pipe down ready on rollers and guide it into the bore as smoothly as possible with the crane. For diameters of up to 180 mm, this is not needed, because they are delivered on a drum.

Fig. 5: Alongside Radix Serre's greenhouses, two 450 mm pipes 300 m long are lying on rollers ready to be pulled in; the left pipe has already been fitted with a puller head.

Fig. 4: The pulled-in pipe has resurfaced at the entry, so the puller head can be removed and the reamer can be unscrewed.

Fig. 6: During pulling in, the pipe is guided by a crane to reduce friction.

Once the pipe is in, it is only necessary to suck the bentonite, now mixed with sand, out of the entry and exit pits. If we have to drill another shaft, we can recycle this mixture. By screening the mixture, we remove the sand, and we can reuse the bentonite mixture. If this is the last drilling operation in the job? Then we dispose of it to a certified waste processor.

A good insight into how HDD works. But a separate pipe like this that comes to the surface at both ends is of course useless by itself. To be useful, it must be connected to the well or to other pipes.

More in a later article about connecting the HDD to the well or to other pipes!

Fig. 7: "Done! The remaining bentonite-sand mixture is sucked out and disposed of."

Fig. 8: Two pipe ends on the surface ready to be connected.

HANDY POINTS

- Two drilled shafts are needed for each section of the HCS ring.
- On the campus, a total of almost 4.5 km will be carried out with HDD.
- The longest shaft on the campus is 300 m. The shortest is 45 m. But we can make shafts up to 1 km long.
- On the campus, most of the shafts are sited between 3 and 12 m deep. On other sites, shafts can sometimes be 25 or even 30 m deep.
- How long it takes to do the drilling operation depends on the machine, the subsoil and the diameter of the pipe. For the HCS ring circuit, the longest operation lasts about five days, and the shortest will be ready in around four hours.