



**Client:** DWR

**Main contractor:** Nelis Infra bv – Nacap bv

**Execution:** June 2004 - September 2005

**Machine:** AVN

**Pipes:** reinforced concrete pipes with steelplate core

**ID-OD:** 1.400 - 1.740 mm and 1.600 - 1.920 mm

**Lengths:** 210, 438, 675, 193, 111 and 457 m

The existing wastewater handling system in Amsterdam consists of a sewer network emptying into three sewage treatment plants (STPs). Two of these STPs no longer comply with the environmental regulations. Consequently, it was decided to build a single large, new STP in the western harbour area. The existing sewer network is to be enlarged by 49 km pressurised lines and four new pumping stations (booster pumps). Construction of the pressurised lines requires crossing several important waterways and the usual traffic infrastructure. Smet-Tunnelling was among the eligible contenders for carrying out several of these projects.

### The projects

Smet-Tunnelling already constructed two crossings in mid-2004 under the Stadhouderskade in the centre of Amsterdam, which has very high traffic intensity. The second tunnelling project to be started was the Vikingpad- Kadoelerbreek project. The specification called for four closed-front bores with a cross-section of 1400 x 1740 mm. Smet-Tunnelling proposed an alternative solution consisting of two jacked pipes joined to form a total length of 675 m, built in a curve. This allowed one intermediate pit to be eliminated, which represented a considerable benefit, since constructing a sheet-piled pit using underwater concrete takes a certain amount of time and is not entirely free of risks. The bore, which at that time set a new record for length, immediately at-



tracted the full attention of the client (DWR). Successful completion of the bore generated even greater confidence. Following this, the Basisweg project was awarded. This involved constructing three pipe-jacked bores with a cross-section of 1600 x 1920 mm and lengths of 193 m, 457 m and 111 m, respectively. This task was made more difficult by the fact that the line was located at a shallow depth in an area with very high traffic intensity. Many utility lines had to be crossed at very close distances. During preparation for the crossing under the IJ, in consultation with the client it was decided to use the 'active sealing' system in



the intermediate pressure stations, since it was necessary to resist water pressures of up to 30 m. Due to the level of difficulty, an accessible cross-section of 1800 x 2160 mm was chosen. The standard pipe sections had a length of 5 m, but several shorter sections were made available in consultation with Smet-Tunnelling. The series of projects was completed by a crossing under the North Holland Canal. This involved an additional bore with a cross-section of 1400 x 1740 mm and a length of 150 m, located at a depth of approximately 12 m.

### Soil

All of these projects were characterised by very weak soil consisting of (weak) clays, peat and 'wadzand' (fine sand). Cone resistance values on the order of 0.1 MPa occurred almost everywhere on the penetrometer charts. The crossing under the IJ was located at a much greater depth. The soil encountered here consisted primarily of layers of coarse-grained, wellcompacted Pleistocene sand, with occasional layers of gravel. At the deepest point, a portion of the bed of the IJ was dredged to a greater depth and then filled with all sorts of 'foreign' materials.

### Jacking pipes

The Betonson jacking pipes are made from reinforced concrete and have sheet-steel liners and a 'double joint' system. The standard length of the pipe sections is 6 m. The double joint system means that sealing between the pipe sections during tunnelling is ensured by socket-and-spigot joints with rubber sealing rings. These joints permit a certain amount of flexibility during tunnelling. Final sealing of the pipe sections is implemented after completion of tunnelling by welding the sheetsteel liner sections at the joint locations. The welded joints are suitably inspected and tested at no less than 4 bar.

### Delivery

When the new wastewater transport system and STP are put into service on the planned date of 1 January 2006, it can be said that a truly daring project, most of which was carried out underground, has been completed in Amsterdam. Smet-Tunnelling can justifiably claim to have made a special contribution to the success of this project and to enjoy an increasingly prominent position in the Netherlands market.