

Stringless 3D Tunnel Paving in the Netherlands



Task

Stringless 3D High Precision Slipform Paving in Railway Tunnels

Customer & Client

Cobeton BV, Utrecht, Netherlands
Netherlands Railway Authority

Date

January – November 2003

Project Facts

Components

- 1 x LMGS-S System
- 3 x TCA1800 Total Stations
- 1 x GOMACO GT6300 Commander III Paver

Field

- Elimination of over 100km of stringline to be setup for 27km of precision paving.

Office

- Direct CAD export of paving production models to paver.



Benefits

- Elimination of six difficult and costly stringline installations.
- Enormous survey and preparatory cost reductions
- More accurate paving and as-built compliance checks
- Automated Quality Assurance Reports for Cobeton's clients



The Sophia Noordbuis Tunnel Project comprises twin-bore 4.5km (2.8 mile), 8.45m (26') diameter rail tunnels. Passing beneath the Rietbaan waterway (south-east of Rotterdam), between the towns of Zwijndrecht and Papendrecht, at approx 25m below sea level, Sophiatunnel forms a crucial link in the new strategic rail-freight line linking Europe's largest freight seaport, Europoort at Rotterdam, to the western border region of Germany.

Cobeton BV, a specialist slipforming contractor with considerable tunnel paving experience, based in Utrecht, Netherlands won the contract to slipform the tunnel base (shown above) and the two shoulders which formed the communications and power cable ducts and emergency escape walkways. Cobeton decided that the work had to be undertaken in three distinct phases, which traditionally would require 6 sets of stringline - a total of over 100km (63 miles) - to be installed near the top, or soffit, of the tunnel - work requiring weeks of expensive surveyor's time, safety equipment and access mechanisms. Cobeton therefore decided to invest in **Leica Geosystems' LMGS-S Machine Automation System for Slipform Pavers.**

In October 2002, prior to the Sophiatunnel project start, Cobeton's own Gomaco GT6300 Commander III (built in 1985), was retrofitted with Gomaco's S2X CAN-Bus Network Controller for simpler operation and 'plug and pave' compatibility with Leica Geosystems' LMGS-S 3D system; LMGS-S was installed at Cobeton's workshops in November 2002.

Cobeton decided that, for technical reasons, they needed to pave with the machine running in reverse (whilst also in Transport Mode). Hence the rear became the 'Front' (concrete delivery end) of the machine when paving in the tunnel. This presented an additional technical challenge when commissioning the LMGS-S 3D system, but did not affect the performance or operation of the system during

production. Furthermore, in order to provide the necessary clearance for the 3.1m (9') wide tunnel base slab during Phase 1, the machine tracks had to be adapted to be inclined to run on the sidewalls (at approx 30° to the horizontal).

The track-bed and shoulder works were completed in three phases, running 24hrs per day, 5 days per week. Two teams, working 12-hour shifts were established. In each case, the machine ran from the eastern portal to the western portal. After each phase the slip-former was raised from the access shaft and reconfigured prior to being re-inserted at the eastern portal.

Tolerances for construction were +/-15mm (0.6") position, and +/- 30mm (1.2") level, due to the ballasted trackbed design, but in practice, and much to the client's approval, these were greatly overachieved, with +/-10mm (0.3") in position and +/-3mm (0.1") in level being consistently achieved, subject to the concrete properties and tunnel geometry.

Space and mobility restrictions created enough challenges for Cobeton, but LMGS-S proved to be the right choice from day one; Cobeton completed the project on schedule and significantly under their original budget, and have now decided to use LMGS-S for all their future slipform paving projects - both above and below ground. Stringlines are now history for this innovative Dutch contractor.

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Application Report: Machine Automation

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