

Sandwich wall beneath Amsterdam Centraal Station An innovative approach for jet grouting under difficult conditions

Directors of the Steering Group:

ir. J.C.W.M. de Wit , ir.P.J. Bogaards: Adviesbureau Noord/Zuidlijn Amsterdam ('Amsterdam North/South Line Consultants'), Royal Haskoning, Rotterdam
R.D. Essler MSc, prof. J. Maertens: Consultants
ing. O.S. Langhorst*: VOF Stationseiland Amsterdam, Movares Nederland BV, Utrecht
ing. B.K.J. Obladen, ir. C.F. Bosma: Principal Contractor, CSO, Combinatie Strukton Betonbouw van Oord ACZ
ir. J.J. Sleuwaegen, ing. H. Dekker: Jet grouting Subcontractor, Smet Keller

An excavation, within which a tunnel is sunk as a part of the Centraal Station underground station (platform section) of the Noord/Zuidlijn ('North/South Line'), is to be created beneath the Amsterdam Centraal ('Amsterdam Central') station. The section beneath Amsterdam Centraal Station is characterised by the application of a particular technology in the form of, *inter alia*, the so-called 'sandwich wall'. This is a composite wall consisting of two rows of Tubex piles with a body of jetgrout columns in-between. This wall acts both as an excavation support wall and also provides vertical bearing. The installation of the wall, including both Tubex piles and jetgrout columns, within these specific conditions (limited height, sensitive historical building), within the design requirements set in terms of construction tolerance and water and soil retention, may be regarded as being a pioneering achievement. The environmental constraints are that the trains should continue to run, the inconvenience to passengers should be kept to a minimum and the historic station should not suffer any damage. Because of the complexity of the working conditions, the project is being overseen by a steering group of experts in the specified construction processes. In order to manage the project risks, jet grouting trials were initially carried out, in order to highlight and control execution problems; the practicability of the design is then tested. Work commenced on the sandwich wall in 2003, when the wooden piles were extracted at the locations where the sandwich wall was to be constructed; in 2004, the steel Tubex piles for the southern wall sections were installed. From May 2005, the construction of the sandwich wall got under way; in addition to the described process supervision, an extensive measuring programme was established, so that the process could be adjusted as necessary and the quality of the finished product determined. This applied to both individual columns and for the end product, the sandwich wall. The measurement results were processed for each column, interpreted and the effect on the work still to be conducted was assessed for each future column. Preventative and corrective measures were, if necessary, taken in order to control or counteract the measured defect. In addition to the process-oriented and qualitative measurements, various independent measurement systems at the station building served as a further control in order to prevent damage to the building.

Conclusions

- The jet grouting trial raised a number of points of interest in terms of technical content (design and construction) and procedure for the final work;
- The work-oriented alterations were setting up an extensive measurement programme for the jetgrouting process, for the model, taking into account 'as-built' information and this required a highly focussed approach and supervision (→ observational method), in which the design and/or implementation parameters had, if necessary, to be adjusted;
- After production of approx. 65 % of the perimeter columns and approx. 20 % of the infill columns, it was found that intensive process control was necessary and fruitful, and has therefore been continued undiminished. On-site adjustment and adaptation to the operational methods remain daily activities, despite the learning experience undergone. As a result of the intensive process control, this method of working is time-consuming, but has nevertheless proven necessary in order to obtain optimum quality of the desired end product.



Author's address for correspondence

Author's Name: Onno Langhorst (e.a.)

Company: Movares Nederland BV.

Street: Daalseplein N°:101

City: Utrecht Zip code:3500GW

Country: Holland.

Tel: 030-2655555 Fax:030-2653608

Email: onno.langhorst@movares.nl

Notice:

Please submit your abstract to the Member Society to which you belong. Do not submit your abstract directly to the Organizing Committee.