Cementation

SKANSKA

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DLR Package 6

Employer
Docklands Light Railway Ltd

Client
Skanska Grant Rail JV

Specialist Contractor
Cementation Skanska
Ground Engineering

Consulting Engineer
Arup

Cementation Skanska was involved in a significant ground water control and ground stabilisation scheme for Skanska-GrantRail Joint Venture at Canning Town, London. The project required the construction of a lift shaft linking the new DLR station with existing DLR and LUL passageways at lower level at Canning Town Station. The works are part of the wider DLR 3-Car upgrade and development prior to the London 2012 Olympics.

The project involved the construction of a new 13.6m Internal Diameter shaft excavated to 6m depth, a 1m deep lift pit at the bottom of the shaft and a 3.5m by 4m opening cut through an existing diaphragm wall – all this with no disruption to the adjacent DLR and LUL facilities.

Ground Conditions

The site is underlain by:

- 2m of made-ground consisting of a 500mm thick layer of loose grey and pink fine to coarse gravel sized fragments of granite with a geotextile membrane at the base. This was placed over compacted ballast and sub-base, coarse gravels and silty sand.
- Immediately beneath the made ground is a 4m layer of River Terrace gravels consisting of medium dense grey medium to coarse sand and sub-angular to sub-rounded fine to coarse flint gravel with occasional quartz and quartzite.
- At a depth of 6m is the London clay stratum which consists of stiff mottled brown to very stiff dark grey fissured clay. This stratum was sampled to a depth of 25m.

As the site lies within the lower reaches of the Thames river basin, ground water is present at 1m from existing ground level within the made ground, River terrace gravels and alluvial deposits.

The pre-treatment to enable the shaft construction involved the drilling of 140mm diameter boreholes to the London clay and installation of 'Tube-a-manchette' (TAM) pipes held in place within the bore with low strength sleeve mix consisting a '10:1:20 cement/bentonite/water' grout. A sodium silicate based chemical grout was then injected at controlled pressures through the TAM sleeves using double packers. This allowed for accurate delivery of known volumes of grout into the targeted treatment zones.

A total of 516m of TAM pipes were installed in 52nr vertical bores installed in two rows, around the proposed shaft and 12Nr inclined bores installed beneath the concrete cantilever slab to treat the area adjacent to the diaphragm wall. Approximately 93,300ltrs of grout to a designed mix of water, sodium silicate and R100 hardener was injected. This permeated into the targeted treatment area effectively forming a 1.5m wide stabilised zone around the perimeter of the proposed shaft.

Grout injection to the boreholes was carried out until grout reached the specified parameters for pressures and/or volume. The TAM technique allows re-injection of grout at individual sleeves to ensure adequate permeation of grout into the targeted zones. Injection parameter values were rigorously monitored throughout the works to allow for adaptation of the mix design and numbers of injections to suit the specific ground conditions and to confirm the extent of grout treatment.

Following stabilisation, the shaft was excavated and formed using sprayed concrete in 1m to 1.5m high panels to the base of the shaft in the London Clay.

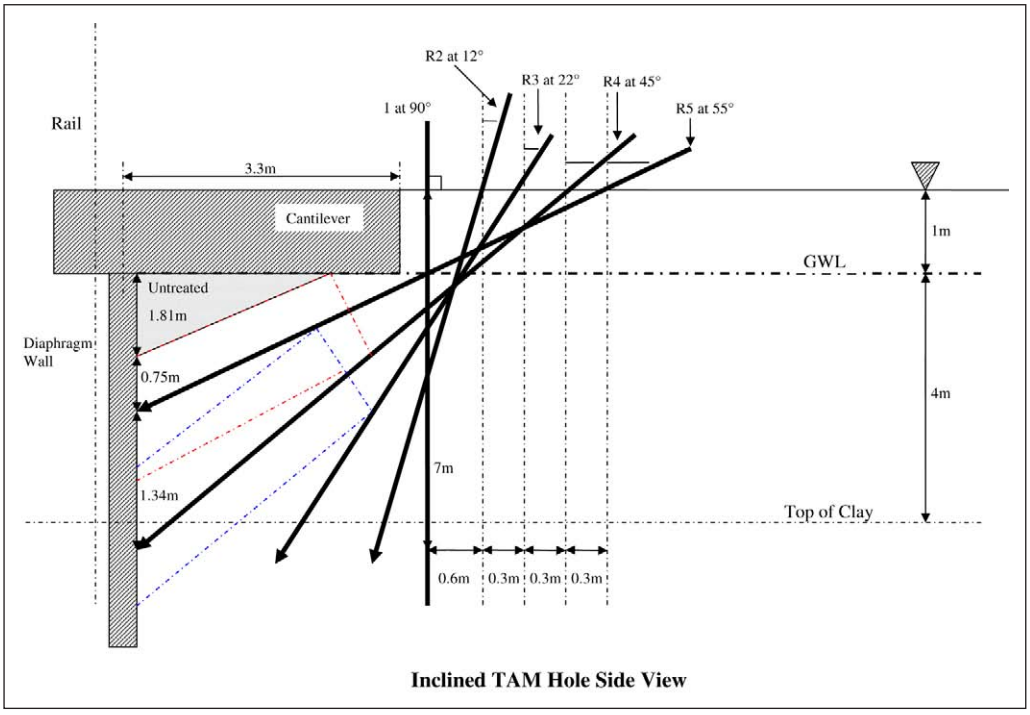
Summary

A small foot-print low impact solution was effectively employed using the following;

- Drilling: TwinTech TD308 mini-piling rig
- TAM Installation: Colmono 4/10 colloidal mixer/pump used to mix the Cement/Bentonite Sleeve grout
- Chemical Grouting: Paddle Grout Mixer, Agitating holding tanks and an SPC50 variable speed pumps.
- Chemical Sleeve Injection: Via TAM sleeves using double hydraulic packers to effectively isolate TAM sleeves and accurately deliver the grout to the targeted treatment zones.

Our design and construction team provided a cost-effective and complete geotechnical solution using the company's wealth of ground engineering and design experience to meet the Client's requirements.

The solution allowed for control of ground water during shaft construction and provided stability to allow excavation of the face in the unstable sands and gravel strata.



Inclined TAM Hole Side View