

# Engineering marvel at foot of Lions Head places JG Afrika in the limelight

It is more than just sheer magnitude and modern aesthetics that have placed a new residential development in a very affluent area of Cape Town in the spotlight. This new six-storey residence at 145 Kloof Road at the foot of Lions Head in Clifton is also a major civil- and structural-engineering feat that has showcased JG Afrika's skills and capabilities.

The project was awarded second place in the SAICE Western Cape Branch Awards as part of the build-up towards the prestigious annual national finals. The panel of judges was impressed with the unique design and intricate construction processes involved in developing a three-level basement for the structure in an extremely sensitive area.

The close proximity of existing properties to the building's boundary eliminated the possibility of using conventional soil anchoring systems, due to boundary restrictions, and an alternative design had to be developed. Working closely with geotechnical sub-contractor, Franki Africa, JG Afrika designed an alternative which eliminated the need for conventional ground stabilisation systems in restricted areas during the construction process.

JG Afrika's senior engineer, Bobby Jarratt, who was involved in the project from the early design stages in 2014, says that the system also had to be designed in a very short period.

"We designed the system in as little as three months so as not to delay Franki Africa which had already been appointed by the time we understood the true extent of the risk associated with crossing the site boundary using traditional stabilisation methods. Both the JG Afrika and Franki Africa teams were under incredible pressure to devise a workable solution," comments Jarratt.

A number of solutions were proposed and narrowed down to three potential systems, including constructing a conventional

cantilever retaining wall; a propped retaining wall using side-wall buttresses; and an anchored reinforced-concrete (RC) box system.

The JG Afrika and Franki Africa experts agreed that the construction of an RC box system, with tension anchors rooted within the property boundaries that would resist horizontal forces and conventional vertical piles that intercepted the slip-circle plane, was the best solution for this development.

However, the preferred solution also presented its share of challenges, with the consulting engineer and civil-engineering contractor well aware of meticulous attention that would have to be paid to the co-ordination of the construction sequence to ensure stabilisation of the back and side faces.

Construction of the structure was divided into four phases, starting with the establishment of a small working platform at second terrace level where a 13-m-high slope was excavated at 60 degrees (°), and then temporarily stabilised using soil anchors and covered with mesh and sprayed with gunite. The installation of temporary anchors during this process was carefully monitored to ensure that none crossed the property boundary.

This provided a secure three-metre-wide platform from which the contracting teams could commence building the RC box at the second terrace.

Drilling rigs were lifted and placed onto the platform, 14 m above road level, to insert the 300-mm-diameter rotary percussion soldier piles and tension ground anchors at 10° to the vertical, to form the temporary side walls of the system.

Within the platform area, vertical piles of up to 25 m in length and tension anchors at 60° to the horizontal were then socketed into hard rock to resist slip circle failure and the horizontal sliding forces generated from the eventual rear vertical retaining wall.

A 500-mm-thick foundation slab was then constructed and, using a compact excavator, the excavation of the rear face followed in controlled three-metre widths to mitigate the chance of slope failure. The retaining wall was then built up to the total 5 m retained height sequentially to ensure stability.

Jarratt says that the completion of this phase of the project was an important milestone as the professional team had now established a suitable construction sequence.

"Many important lessons were learnt by the consulting engineering and contracting teams that led to the continuous refinement of the design and construction processes. Over-and-above the technical complexities, we also had to consider the very tight working environment that provided limited space for the crane laydown area, requiring careful co-ordination throughout the first two phases," he says.

A technical director at JG Afrika, Tim Davidson, who led the firm's team on this project, adds that the successes achieved during the first two phases of the project resulted from excellent team dynamics between JG Afrika and Franki Africa.

"This is an essential factor for any successful project. We were fortunate to have the opportunity to work with a very experienced geotechnical contractor that brought immense knowledge and capability to the team, complementing our own known abilities, as well as experience working in this challenging area," says Davidson. ■



Development nearing completion with building structure supporting side walls.

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