ARDAGH GLASS
Johannesburg, South Africa

Project Facts

Product
Micropiles

Market
Commercial

Client
Lesedi Nuclear Services

Consultant/Engineers
BSM BakerConsulting Civil and Structural Engineers

Scope of Works
240 No. Micropiles

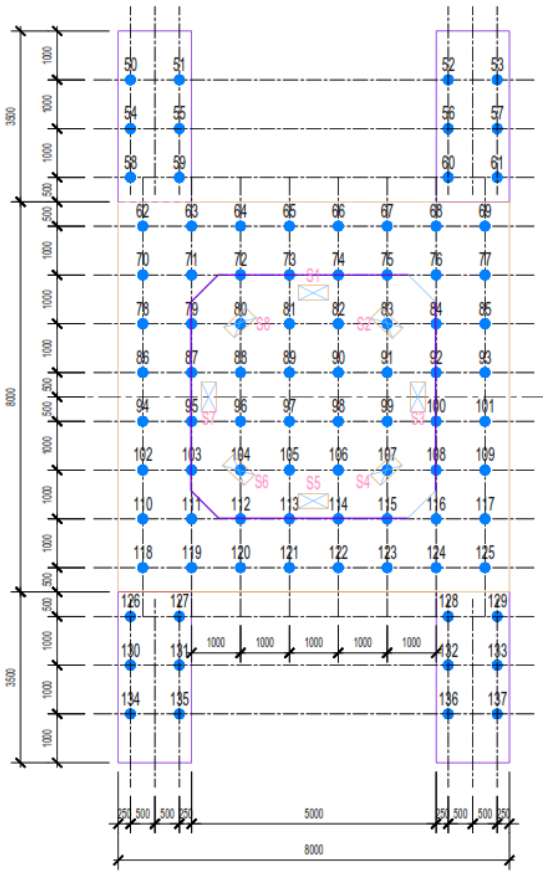
- **About the project**

Sinkholes are a significant concern in areas underlain by dolomitic geology. The Ardagh Glass site, located in Clayville, is classified as a D3 zone, indicating a high risk of sinkhole formation and subsidence. The dolomitic hazard poses challenges for development, requiring specialised foundation solutions to ensure both safety and long-term performance.

- **Challenges & Solutions**

The initial investigation comprised only percussion boreholes, which are suitable for identifying voids and classifying the geological profile, but are inadequate for the design of piled foundations.

Consequently, additional geotechnical investigations were undertaken in the form of rotary core boreholes with Standard Penetration Tests (SPT-N) and Dynamic Probe Super-Heavy (DPSH) testing to inform the pile design.



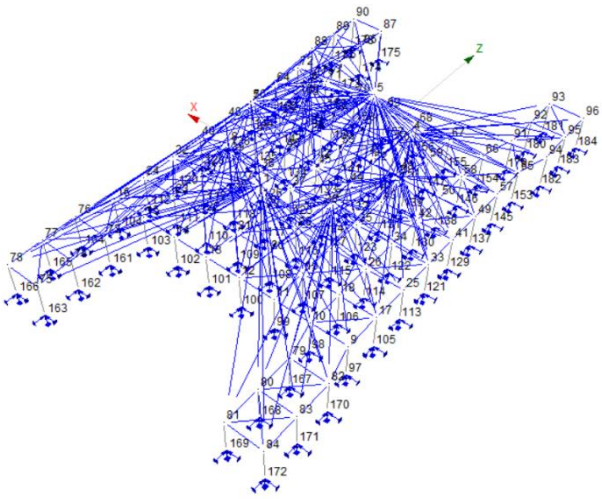
Sinkholes typically form when erodible material collapses into voids within a dolomitic rock profile, creating cavities in the upper soil horizons. This process is often initiated by specific triggers, including water ingress, seismic activity and vibrations from construction equipment.

Environments with dewatering, leaking underground services or significant ground vibrations are particularly susceptible to sinkhole formation, making them high risk areas which require careful geotechnical assessment and the use of appropriate mitigation measures.

The geological profile at the Ardagh Glass site in Clayville, Johannesburg comprises a complex stratigraphy typical of dolomitic terrain, consisting of residual chert, underlain by residual syenite transitioning into weathered syenite interbedded with residual dolomite, followed by weathered altered dolomite (WAD) and underlain by jointed dolomite rock.

- **Solution**

Due to the erratic depth to bedrock and the unpredictable nature of the dolomitic profile, a micropile solution was proposed for the development. The bearing capacity of the micropiles was derived from the chert and underlying residual syenite horizons. Residual syenite (non-dolomitic) is typically considered stable and provides a safe founding stratum for the micropiles under normal operational conditions.



The micropiles supported a reinforced concrete raft and were specifically designed to mitigate the effects of potential sinkhole formation beneath the structure. In the event of a 5m-diameter sinkhole, the raft is engineered to redistribute loads to the surrounding micropiles.

Due to the significant variability in ground stiffness across the site, the micropile design was conservatively based on lower-bound SPT-N values. Furthermore, to account for bending moments induced by lateral loads developing during potential sinkhole formation, steel casings were installed in the upper few metres to enhance the micropiles' bending stiffness.

The solution was not intended to prevent sinkhole formation, but rather to mitigate the severity of its effects, should one occur. The design process required collaborative effort between the geotechnical and structural designers to develop the most economic and viable foundation solution.