

## **Evaluation of Factors Influencing the Effectiveness of Backfill Support in Mechanized Deep to Ultra-Deep Gold Mining**

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### **Abstract**

Accurate backfill design and optimum backfill properties are crucial for the success of backfill support in underground mining. There are several types of backfill materials that have been used for the purpose of enhancing the stability of underground excavations in most deep to ultra-deep gold mines in South Africa. However, it is significant to understand water to cement ratio, cement quality, the strength of the backfill and other factors when designing the backfill. In this study, the ratio of water to cement, tailings flow rate, compressive and tensile strength of both full plant tailings (FPT) and classified cement tailings (CCT), comparison of the modelled backfill response and response estimated by Raffield et al. (1998), performance of backfill under dynamic conditions, the effectiveness of backfill support in highly stressed ground were evaluated. Rheology tests were also conducted. The tests include yield stress and plastic viscosity of the backfill. The results of the study indicated high strength of CCT as compared to FPT. On the other hand, the plastic viscosity of CCT was found to be 0.50 Pa.s and 0.25 Pa.s for FPT. The slurry yield stresses were found to be 180 Pa and 60 Pa for CCT and FTP respectively. The utilization of the backfill in the mine was also considered, it was found that the traveling and flushing time increases with the increase in distance from the shaft, which then compromises the filling time.