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Geotechnical Foundation Design for Expansive Soils in Sudan: An Intervention Study in Chad

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Abstract

Expansive soils pose significant challenges to geotechnical foundation design in arid regions such as Chad, where they can cause differential settlement and structural instability. The study employed advanced numerical simulations to model foundation behaviour under varying moisture conditions and incorporated field data from existing structures for validation. Numerical models showed a direct correlation between water content and settlement rate, with expansive soils exhibiting up to 50% greater deformation compared to non-expansive soils at high moisture levels. The integration of geosynthetic reinforcement significantly reduced foundation deformations by approximately 20%, enhancing the stability and longevity of infrastructure in challenging environments. Field engineers should prioritise the use of geosynthetics for expansive soil applications, alongside ongoing monitoring to ensure structural integrity over time. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geology, expansive soils, foundation design, soil mechanics, pedology, geoengineering, sustainable infrastructure*

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