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Geotechnical Foundations on Expansive Soils: A Methodological Approach in Sudanese Contexts

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Abstract

Geotechnical foundations are crucial for ensuring the stability of structures in various geohazard-prone environments. In Sudanese contexts, expansive soils pose significant challenges due to their unpredictable swelling and shrinking behaviour, which can compromise foundation design. A systematic review and synthesis of existing geotechnical literature were conducted to identify best practices for foundation design on expansive soils. A case study involving field investigations, laboratory tests, and numerical simulations was employed to validate the proposed methodological approach. The findings indicate that incorporating a predictive model based on historical soil moisture cycles can significantly reduce settlement risks by up to 30% in expansive soil environments. This study provides a robust framework for foundation design on expansive soils, offering practical guidelines and a predictive tool to mitigate associated geotechnical issues. The recommendations include the use of the developed model in future projects, alongside ongoing research into advanced materials and techniques that could further enhance foundation stability. Geotechnical Engineering, Expansive Soils, Foundation Design, Sudan The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geotechnical Engineering, Foundation Design, Expansive Soils, Soil Mechanics, Site Investigation, Consolidation, Analytical Methods*

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