



# **Geotechnical Engineering in Foundation Design for Expansive Soils in Sudan: An Ethiopian Perspective**

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## **Abstract**

Geotechnical engineering plays a crucial role in foundation design for expansive soils, which are prevalent in arid regions like Sudan. These soils experience significant volume changes due to moisture variations, posing challenges for construction projects. The study employed a mixed-method approach, combining laboratory tests with field observations to validate design calculations based on empirical data collected during construction phases. A statistical model was used to predict soil behaviour under varying moisture conditions. Field observations showed that the designed foundations consistently performed within expected variability margins, indicating successful adaptation of geotechnical principles to local conditions. Laboratory results confirmed predicted soil expansion rates with a confidence interval of  $\pm 5\%$ . The study supports the feasibility of applying geotechnical engineering in foundation design for expansive soils in Sudan's context from an Ethiopian standpoint. Given the successful application, it is recommended that similar designs be considered for future projects involving expansive soil foundations in Sudan. Further research should focus on long-term performance and potential improvements to existing models. The maintenance outcome was modelled as  $Y = \beta_0 + \beta_1 X + u + \epsilon$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Geotechnical Engineering, Foundation Design, Expansive Soils, Soil Mechanics, Site Investigation, Pedology, Stability Analysis*

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