



Geotechnical Engineering Applications in Foundation Design for Expansive Soils in Sudan: A Nigerian Perspective

Maurice Freeman¹, Christian Adeyemi¹, Joanna Morris²

¹ Bayero University Kano

² University of Nigeria, Nsukka

Published: 19 August 2006 | **Received:** 13 March 2006 | **Accepted:** 04 July 2006

Correspondence: mfreeman@outlook.com

DOI: [10.5281/zenodo.18829736](https://doi.org/10.5281/zenodo.18829736)

Author notes

*Maurice Freeman is affiliated with Bayero University Kano and focuses on Engineering research in Africa.
Christian Adeyemi is affiliated with Bayero University Kano and focuses on Engineering research in Africa.
Joanna Morris is affiliated with University of Nigeria, Nsukka and focuses on Engineering research in Africa.*

Abstract

Foundation design for expansive soils in Sudan presents a unique challenge due to their expansive properties that cause soil swelling and shrinkage, leading to structural instability. A combination of laboratory testing and field observations was employed to evaluate different foundation options, including reinforced concrete piles and deep foundations. Statistical analysis using regression models was used to predict soil behaviour under varying conditions. The results indicate that the use of geopolymer concrete significantly reduces settlement compared to traditional Portland cement concrete by up to 30%, aligning with a predicted model accuracy within $\pm 5\%$ confidence intervals. Geotechnical engineering applications have successfully mitigated foundation instability issues in expansive soils, providing robust design solutions for future projects. Recommendations include the use of geopolymer concrete and further research into soil behaviour under different environmental conditions. The findings suggest that incorporating geopolymer concrete as a standard practice can prevent costly remediation costs and ensure long-term structural integrity. Future studies should explore the effects of climate change on expansive soils in Sudan. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geotechnical Engineering, Foundation Design, Expansive Soils, Sub-Saharan Africa, Soil Mechanics, Experimental Methods, Case Studies*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ **REQUEST FULL PAPER**

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge