African Geotechnical Engineering

# Bayesian Hierarchical Model for Measuring Yield Improvement in Transport Maintenance Depots Systems in Ethiopia

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## Abstract

This study focuses on evaluating transport maintenance depots (TMDs) in Ethiopia to enhance their efficiency and performance. A Bayesian hierarchical model was utilised to analyse data from multiple depots, accounting for spatial and temporal variations. The model incorporates prior knowledge about depot efficiency and uses likelihood functions to estimate parameters under uncertainty. The analysis revealed significant differences in yield improvement across different TMDs, with some showing a 15% increase in service delivery times compared to baseline levels. The Bayesian hierarchical model effectively identified areas for system optimization, highlighting the importance of maintenance schedules and resource allocation strategies. Based on the findings, specific recommendations were made to improve depot operations, focusing on training programmes for staff and upgrading equipment where necessary. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Ethiopia, Bayesian Hierarchical Model, Transport Maintenance Depots, Methodology, Quantitative Analysis, Spatial Statistics, Geographic Information Systems*

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