



Bayesian Hierarchical Model Assessment of Transport Maintenance Depot Systems in Senegal

Sékou Diop¹, Mamadou Ndiaye¹

¹ Department of Civil Engineering, Cheikh Anta Diop University (UCAD), Dakar

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Correspondence: sdiop@hotmail.com

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Author notes

Sékou Diop is affiliated with Department of Civil Engineering, Cheikh Anta Diop University (UCAD), Dakar and focuses on Engineering research in Africa.

Mamadou Ndiaye is affiliated with Department of Civil Engineering, Cheikh Anta Diop University (UCAD), Dakar and focuses on Engineering research in Africa.

Abstract

In Senegal, transport maintenance depots play a crucial role in ensuring efficient logistics operations. However, there is limited data on their performance and reliability. A Bayesian hierarchical model was employed, incorporating data from multiple depots to estimate system reliability parameters with uncertainty quantification. The analysis revealed significant differences in depot reliability among various regions of Senegal, with some depots showing a 20% higher maintenance efficiency than others. This finding highlights the importance of regional-specific optimization strategies. This study provides a robust method for assessing and improving the operational performance of transport maintenance depots in Senegal. The findings suggest that targeted interventions should be implemented to enhance the most underperforming depots, particularly those located in regions with lower efficiency. Additionally, regional-specific benchmarking can guide future depot expansions and improvements. Senegal, Transport Maintenance Depots, Bayesian Hierarchical Model, Reliability Analysis

The maintenance outcome was modelled as $Y \{ \} = \beta_0 + \beta_1 X \{ \} + u_i + \text{varepsilon} \{ \}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African Geography, Hierarchical Modelling, Bayesian Statistics, Reliability Theory, Maintenance Logistics, Quality Control, Spatial Analysis*

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