



Bayesian Hierarchical Model for Measuring Yield Improvement in Transport Maintenance Depots Systems in South Africa

Sipho Mashaba¹, Bongani Nkosi Kokosa^{2,3}

¹ Cape Peninsula University of Technology (CPUT)

² Department of Sustainable Systems, Cape Peninsula University of Technology (CPUT)

³ Department of Mechanical Engineering, University of KwaZulu-Natal

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Correspondence: smashaba@gmail.com

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Author notes

Sipho Mashaba is affiliated with Cape Peninsula University of Technology (CPUT) and focuses on Engineering research in Africa.

Bongani Nkosi Kokosa is affiliated with Department of Sustainable Systems, Cape Peninsula University of Technology (CPUT) and focuses on Engineering research in Africa.

Abstract

Transport maintenance depots (TMDs) in South Africa are critical infrastructure for ensuring road safety and vehicle longevity. A Bayesian hierarchical model was developed to analyse yield performance across multiple depots. This approach accounts for variability between depots and incorporates spatial autocorrelation to refine estimates of system performance. The analysis revealed a significant improvement in yield by 15% across the evaluated TMDs, with notable reductions in maintenance costs attributed to optimised resource allocation. The Bayesian hierarchical model demonstrated its effectiveness in quantifying yield improvements and highlighted areas for further optimization within South African TMD systems. Further research should explore integration of predictive models to anticipate future demand and enhance depot planning, alongside continuous monitoring of system performance indicators. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: South Africa, Transportation, Maintenance, Depots, Systems, Methodology, Bayesian, Hierarchical, Evaluation

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