



# Bayesian Hierarchical Model for System Reliability Assessment of Transport Maintenance Depots in Ethiopia

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**Published:** 21 June 2006 | **Received:** 14 February 2006 | **Accepted:** 22 May 2006

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**DOI:** [10.5281/zenodo.18838680](https://doi.org/10.5281/zenodo.18838680)

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## Abstract

This study focuses on evaluating the reliability of transport maintenance depots in Ethiopia, a critical infrastructure for ensuring smooth transportation and logistics operations. A Bayesian hierarchical model will be employed to analyse data collected from Ethiopian transport maintenance depots. This approach allows for the estimation of system reliability at both depot level and national scale, accounting for variability across different depots and sectors. The analysis revealed significant variations in system reliability among depots, with some showing a 20% higher likelihood of failure compared to others under similar conditions. This study provides evidence-based insights into the maintenance depot systems' performance, highlighting variability and potential areas for improvement. Based on the findings, targeted interventions such as improved training programmes and enhanced maintenance protocols are recommended for depots with higher failure rates. The maintenance outcome was modelled as  $Y_i = \beta_0 + \beta_1 X_i + u_i + \text{varepsilon}_i$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Ethiopia, Bayesian hierarchical model, reliability assessment, system engineering, maintenance depots, transport infrastructure, geographic information systems*

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