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# A Multilevel Regression Methodology for Evaluating the Reliability of Transport Maintenance Depot Systems in Senegal

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## ABSTRACT

**Background:** Transport maintenance depot systems are critical infrastructure for economic development, yet their operational reliability in many regions is poorly quantified. Existing evaluation frameworks often fail to account for the hierarchical nature of data collected from such systems, where individual depot components are nested within larger regional networks.

**Purpose and objectives:** This article presents a novel multilevel regression methodology to evaluate the reliability of transport maintenance depot systems. The primary objective is to provide a robust statistical framework that accounts for data hierarchy to identify key determinants of system failure and predict reliability metrics.

**Keywords:** *Multilevel regression modelling, System reliability, Transport infrastructure, Maintenance depots, Francophone Africa, Senegal*

### Article Highlights

- Proposes a two-level hierarchical logistic regression model for nested infrastructure data.
- Methodology partitions variance between depot components and regional networks.
- Provides a statistically sound framework to identify key determinants of system failure.
- Designed for complex engineering systems where data exhibits hierarchical structure.

### Methodological Contribution

A novel statistical framework employing multilevel regression to evaluate transport maintenance depot reliability, accounting for data hierarchy where components are nested within regional networks.

*This article presents a methodological framework without empirical case study results.*

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## ABSTRACT-ONLY PUBLICATION

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



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