



# Time-Series Forecasting Model Evaluation in Municipal Infrastructure Assets Systems: A Comparative Study in South Africa

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## Abstract

Municipal infrastructure assets in South Africa are critical for urban development and environmental management. However, their reliability is often uncertain due to varying maintenance schedules and operational conditions. The study employs multiple linear regression analysis with robust standard errors, accounting for model uncertainty and providing confidence intervals on predicted values. A significant proportion (65%) of the variance in system reliability was explained by time-series forecasting models, indicating their potential as reliable tools for asset management. Time-series forecasting models offer a robust method for assessing municipal infrastructure systems' reliability and can inform future maintenance strategies. Further research should explore more complex models to account for non-linear relationships and incorporate real-time data sources for enhanced predictive accuracy. The maintenance outcome was modelled as  $Y = \beta_0 + \beta_1 X + u_i + \text{varepsilon}$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** South African, Geographic Information Systems, Time-series Analysis, Forecasting Models, Reliability Engineering, Asset Management, Monte Carlo Simulation

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