



# Methodological Assessment of Municipal Infrastructure Assets Systems in South Africa: Multilevel Regression Analysis for System Reliability Evaluation

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### Abstract

Municipal infrastructure assets in South Africa are critical for urban development and public services. However, their reliability is influenced by various factors at different levels of governance. A comparative study employing multilevel regression models to evaluate system reliability across different municipal tiers. Data from - was analysed for over 50 municipalities. Multilevel regression revealed significant differences in asset condition between urban and rural areas, with a coefficient of determination (R<sup>2</sup>) of approximately 70% capturing system reliability. The multilevel approach highlighted the importance of considering both local and national governance levels for accurate reliability assessments. Future studies should incorporate more granular data to further refine system reliability models. 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:** *Multilevel Analysis, Regression Models, Geographic Information Systems, Urban Economics, Infrastructure Management, Public Policy, Spatial Statistics*

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