



Structural Integrity Assessment of Aging Infrastructure in Uganda

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Abstract

Uganda's aging infrastructure poses significant structural risks, particularly in bridges and buildings, necessitating a comprehensive assessment to ensure public safety and economic sustainability. Structural assessments were conducted using finite element analysis (FEA) integrated into a Bayesian hierarchical model to estimate uncertainty in load-bearing capacities. Data collection involved expert reviews and field measurements of key structural elements. The FEA revealed that approximately 40% of bridges and buildings exceed their design loads, indicating substantial risks from aging and neglect. This study underscores the urgent need for targeted maintenance and upgrading strategies to mitigate structural failures in Uganda's infrastructure. Immediate prioritization of high-risk structures should be followed by a phased national renovation plan informed by ongoing monitoring data. Structural Integrity, Aging Infrastructure, Bayesian Hierarchical Model, Finite Element Analysis (FEA), Load-Bearing Capacity The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geology, fatigue cracking, finite element analysis, non-destructive testing, seismic vulnerability assessment, sustainable infrastructure design, urban settlement patterns*

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