



Structural Integrity Assessment of Aging Infrastructure in Uganda: A Comparative Study

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Abstract

Uganda's aging infrastructure poses significant structural integrity risks, particularly in bridges and buildings. These structures are critical for national development but face challenges due to age-related deterioration. A mixed-methods approach combining field inspections with expert evaluations was employed. Data were analysed using a Bayesian hierarchical model to estimate uncertainty in structural assessments. Concrete beams in Ugandan bridges exhibit deteriorated strength, with an average reduction rate of 15% from initial design standards over 30 years of use. Building foundations show varying levels of subsidence, affecting their stability and safety. The comparative study reveals significant discrepancies between the structural integrity of bridges and buildings in Uganda, necessitating targeted interventions to ensure safe infrastructure usage. Immediate action is recommended for critical structures identified as falling below safety standards. A long-term strategy should focus on regular inspections and maintenance schedules to prevent future failures. The maintenance outcome was modelled as $Y \{ \} = \beta_0 + \beta_1 X \{ \} + u_i + \text{varepsilon} \{ \}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, structural health monitoring, fatigue crack analysis, finite element modelling, material deterioration studies, seismic vulnerability assessment, life cycle assessment*

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