



Structural Integrity Assessment of Aging Infrastructure in Uganda

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Abstract

The structural integrity of aging infrastructure in Uganda is a critical issue, particularly in bridges and buildings that are approaching or have surpassed their design lifespans. Non-destructive evaluation (NDE) methods such as ultrasonic thickness gauges and eddy current probes were employed to assess the condition of steel reinforcement bars in selected bridges. A Bayesian hierarchical model was used to estimate the probability of failure based on NDE data, accounting for uncertainties associated with material properties. Ultrasonic testing revealed varying degrees of corrosion around rebar in several structures, with a proportion exceeding 20% in some critical components. The non-destructive evaluation methods employed provided reliable estimates of structural integrity but were subject to measurement uncertainties due to material variability and environmental conditions. Immediate repairs are recommended for bridges identified as having rebar corrosion levels over 20%, with a focus on strengthening vulnerable areas using proven repair techniques. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geology, fatigue cracking, finite element analysis, heritage structures, non-destructive testing, seismic vulnerability, structural deterioration*

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