African Agricultural Systems Engineering

Structural Integrity Assessment of Aging Infrastructure in Uganda

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Abstract

Uganda faces significant challenges in maintaining its aging infrastructure, including bridges and buildings, which are critical for economic development and public safety. A mixed-methods approach was employed, combining field surveys and advanced statistical modelling. Structural health monitoring data were analysed using a Bayesian hierarchical model (HB) for uncertainty quantification. The HB model revealed that approximately 25% of bridges in rural areas exhibit structural deficiencies beyond acceptable limits, necessitating urgent reinforcement or replacement. This study highlights the critical need for preventive maintenance and investment in infrastructure to mitigate potential risks associated with aging structures. Immediate action is required to address identified weaknesses. This includes reallocating resources from urban centers to rural areas where bridges are most vulnerable. Structural Integrity, Aging Infrastructure, Statistical Modelling, Bayesian Hierarchical Model The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Africanization, Durability, Fatigue Cracking, Life Cycle Analysis, Non-Destructive Testing, Oxidation Damage, Sustainability*

ABSTRACT-ONLY PUBLICATION

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