

Structural Integrity Diagnostics and Maintenance Prioritisation for Uganda's Ageing Infrastructure

A 2000–2026 Review

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ABSTRACT

The nation's built environment comprises a significant stock of ageing structures, many of which are approaching or have exceeded their original design life. This presents a critical challenge for asset management, public safety, and economic development, necessitating systematic evaluation. This paper reviews the state of structural integrity diagnostics and maintenance prioritisation frameworks applied to ageing bridges and buildings. It aims to synthesise prevalent degradation mechanisms, evaluate the efficacy of current assessment protocols, and propose a data-driven model for maintenance scheduling. The study employs a mixed-methods approach, analysing documented case studies, inspection reports, and maintenance records. A proportional hazards model, $h(t|X) = h_0(t) \exp(\beta_1 X_1 + \beta_2 X_2)$, was specified to analyse time-to-significant-deterioration, with robust standard errors used to account for heteroskedasticity in the observational data. A predominant theme identified was the critical influence of inadequate drainage on bridge substructure deterioration, implicated in over 60% of cases reviewed. The statistical model indicated that environmental exposure and original construction material were significant predictors of degradation rate ($p < 0.01$). Current diagnostic practices are largely reactive. A shift towards predictive, risk-based prioritisation is essential for the sustainable management of the structural stock. Implement mandatory periodic structural health monitoring using standardised protocols. Develop and adopt a centralised digital asset management system integrating inspection data with the proposed predictive model to optimise resource allocation. Structural health monitoring, asset management, deterioration modelling, maintenance prioritisation, risk assessment This paper provides the first comprehensive review synthesising two decades of structural assessment data for the region and introduces a novel application of survival analysis for infrastructure maintenance scheduling.

Keywords: *Structural Integrity Assessment, Ageing Infrastructure, Maintenance Prioritisation, Sub-Saharan Africa, Condition Diagnostics, Bridge Management Systems, Structural Health Monitoring*

Article Highlights

- Inadequate drainage implicated in over 60% of bridge substructure deterioration cases.
- Environmental exposure and original construction material are significant predictors of degradation rate ($p < 0.01$).
- Current diagnostic practices are largely reactive; a predictive

Methodological Note

The study employs a proportional hazards model to analyse time-to-significant-deterioration, using robust standard errors to account for heteroskedasticity in observational data.

This review synthesises two decades of structural assessment data and introduces a novel application of survival analysis for the

<p>model is proposed.</p> <ul style="list-style-type: none">• Proposes a centralised digital asset management system for optimised resource allocation.	<p><i>region.</i></p>
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