

Budget Optimization for Maintenance of Bridges in Egypt

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Abstract : Allocating limited budget to maintain bridge networks and selecting effective maintenance strategies for each bridge represent challenging tasks for maintenance managers and decision makers. In Egypt, bridges are continuously deteriorating. In many cases, maintenance works are performed due to user complaints. The objective of this paper is to develop a practical and reliable framework to manage the maintenance, repair, and rehabilitation (MR&R) activities of Bridges network considering performance and budget limits. The model solves an optimization problem that maximizes the average condition of the entire network given the limited available budget using Genetic Algorithm (GA). The framework contains bridge inventory, condition assessment, repair cost calculation, deterioration prediction, and maintenance optimization. The developed model takes into account multiple parameters including serviceability requirements, budget allocation, element importance on structural safety and serviceability, bridge impact on network, and traffic. A questionnaire is conducted to complete the research scope. The proposed model is implemented in software, which provides a friendly user interface. The framework provides a multi-year maintenance plan for the entire network for up to five years. A case study of ten bridges is presented to validate and test the proposed model with data collected from Transportation Authorities in Egypt. Different scenarios are presented. The results are reasonable, feasible and within acceptable domain.

Keywords : bridge management systems (BMS), cost optimization condition assessment, fund allocation, Markov chain

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