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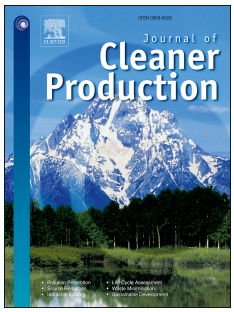

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Optimal Sustainable Life Cycle Maintenance Strategies for Port Infrastructures

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Abstract

Port operations are highly important in the central economic and industrial regions which rely heavily on the use of port infrastructures. An economic and efficient maintenance strategy is essential to govern the normal running of port infrastructures and thus seaborne transportation. Many agencies worldwide have managed to develop maintenance strategies to ensure optimal levels of serviceability and safety for port infrastructures. However, there is not much information about how sustainable issues can be implemented in the maintenance planning. This paper proposes a methodology for evaluating, comparing and improving sustainability of maintenance strategies for port infrastructures. The method is developed based on a proposed randomized structural deterioration model. The costs due to retrofitting, operating loss and environmental loss are considered in the total life cycle cost estimation. The concept of utility function is utilized to serve as a criterion for finding the optimal strategy among the alternative maintenance strategies. An investigation is performed on a Tokyo wharf to demonstrate the proposed approach. The maintenance strategies for different structural elements in the port infrastructures are discussed. The results show that the proposed approach can provide more reliable information on the maintenance timing. The predicted cost bounds allow owners/risk managers to understand the current condition of the structure in several ways, which include both safe-side prediction and average prediction.

Keywords: sustainability, life cycle analysis, maintenance, port infrastructure, Markov chain

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