



# Minimization of Life Cycle Cost for Bridge Asset Management with Multi Stage Optimization

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## Abstract

The purpose of this study is to minimize life cycle cost (LCC) for bridge asset management. This study attempts to develop an optimization method for bridge maintenance planning. It is realistically difficult to keep the safety level of all bridges within a limited budget. Furthermore, a local government needs to manage a large number of bridges. These cause the difficulty of optimization such as the increase of the number of bridges and strict constraint conditions. However, an optimization of maintenance plan for multiple bridges is significant to decrease an annual total cost. Hence, this paper proposes a new method to formulate a maintenance plan, which has the flexibility against uncertainties that involve the change of schedule, by multi-stage optimization that consider an appropriate budget allocation based on each bridge's importance. Several numerical examples are presented to demonstrate the effectiveness for the planning of LCC minimized maintenance.

**Keywords:** life-cycle cost; bridge maintenance planning; multi-stage optimization; genetic algorithm;

## 1 Introduction

It is important to reduce the life-cycle cost (LCC) of bridges in order to establish the sustainable bridge

management. A long-term planning for bridge maintenance is expected to be effective for cutting the life-cycle cost. Thus, the optimization of maintenance plan has been studied [1]. The