



## Life Cycle Costs - Any Use?

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### Summary

Nowadays, life cycle costs assessment is frequently carried out for all major bridge and tunnels at some stage of their service life based on net present values, an interest rate and data regarding construction costs and operation and maintenance costs. This is considered as part of an overall assessment in parallel with other important issues such as risk assessment, environmental assessment, traffic impact assessment and so forth.

Such assessment may be carried out as part of feasibility studies to find the most cost-efficient solution, as part of detailed design to determine an in-service budget for the owner, as part of the tender to evaluate the most attractive bid proposal, or as part of the operation to evaluate the optimum operation and maintenance strategy.

The paper looks into such applications of life cycle assessment and considers the strength and weaknesses in each application together assumptions, which should be used as basis for carrying out such an assessment. Particular, it is well known that the operation and maintenance scenario for a service life may turn out very differently from expected. It will depend on construction deficiencies, operation and maintenance organization as well as the chosen inspection and maintenance strategy. These aspects should be taken into account, when providing a life cycle cost assessment.

Similarly, it is also clear that the applied unit prices and quantities for operation, inspection and maintenance may be associated with significant uncertainty as well as bias. Natural this leads to the question on how detailed life cycle assessment should be carried out when considering the inherent uncertainties. Throughout this principle discussion, a number of examples are given for a number of major bridges and tunnels to illustrate the opportunities but also the limitations of life cycle assessment.

**Keywords:** Life cycle costs, bridges, tunnels, service life, operation and maintenance.

### 1. Introduction

Life cycle cost (LCC) is becoming an increasingly important parameter in the development of projects for tender as well as in the actual operation through the service life of infrastructures such as a bridge, tunnel, road or railway, [1]. One reason for this increased attention is the increase in the asset population of aging bridges and tunnels, which means increased needs for agency funding of operation and maintenance (O&M). This development has led to agencies' interest in reducing the operation and maintenance costs by more durable designs, higher construction quality, more efficient O&M and also smarter methods of tendering construction works and concessionaire contracts for operation and maintenance. Ideally project requirements should encourage the tenderers to provide a project with the lowest life cycle costs.

In seeking controlling the life cycle costs, they may be controlled directly or indirectly in the project requirements for a tender by:

- Use of the price parameter for life cycle costs if the costs are controllable. This may particularly be the case if tender comprises operational costs for a certain period of costs. Alternative