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Optimal Maintenance of Suspension Bridge Cable Systems

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Abstract

Suspension bridges are iconic, large, complex and unique structures with great public value. The main cables on suspension bridges are difficult to inspect and maintain and are virtually irreplaceable, although this has been done in two cases at extreme cost. Maintaining the main cables in an optimal manner is therefore of utmost importance. When developing an optimal maintenance strategy for the main cables, other related elements should be considered and included in the strategy, hence the entire cable system is the topic for this paper. Maintenance of the cable system is relatively expensive, but the costs can be minimized if an optimal maintenance strategy is developed and followed. The main goal of the maintenance strategy is to keep the bridge open at full traffic capacity at all times with the proper safety level and to do so at the lowest cost possible.

Keywords: suspension bridges; cable systems, maintenance strategy; LCC; dehumidification system.

1 Introduction

In order to maintain the cable system on a suspension bridge in an optimal manner it is necessary to develop a strategy for doing so. The strategy should include all relevant activities, i.e. inspections, testing, evaluation, access, traffic considerations and maintenance, repair and replacement methods. Life Cycle Cost Analysis should be applied to determine the optimal strategy for each individual element, as well as an overall strategy with the lowest possible life cycle cost.

This paper presents the typical elements of the cable system, typical damages concerning each of these elements, solutions for these damages and advice on how to develop an optimal maintenance strategy.

2 Cable system elements

The elements directly concerning the main cables on suspension bridges encompass:

- Main cables – typically made up of many wires or helical strands
- The corrosion protection system for the main cable – historically wrapping wire and paint, currently dehumidification is more accepted. Locally, transitional shrouds are also applied
- Tower saddles supporting the main cables
- Cable bent saddles supporting the main cables where the slope is adjusted to meet the anchorage
- Splay saddles that spread out the individual strands so they can be attached to the anchorage