



Integrated Life-Cycle Analysis of Steel-Composite Bridges – Conclusions from a European Case Study

Philippa MAIER

University of Stuttgart,
Institute of Structural Design
Stuttgart, Germany

Philippa.Maier@ke.uni-stuttgart.de

Ulrike KUHLMANN

University of Stuttgart,
Institute of Structural Design
Stuttgart, Germany

U.Kuhlmann@ke.uni-stuttgart.de

Vera PERDIGÃO

Brisa Engenharia e Gestão
São Dominogs de Rana,
Portugal

Vera.Perdigao@brisa.pt

Paulo BARROS

Brisa Engenharia e Gestão
São Dominogs de Rana,
Portugal

Paulo.Barros@brisa.pt

Helena GERVÁSIO

University of Coimbra
Department of Civil Engineering
Coimbra, Portugal

HGer@dec.uc.pt

Heinz FRIEDRICH

Federal Highway Research
Institute (BAST)
Bergisch Gladbach, Germany

Friedrich@bast.de

Summary

Within the European research project “Sustainable Steel-Composite Bridges in Built Environment” (SBRI) a holistic approach was applied by combining analyses of environmental, economic and functional aspects. As bridge authorities were involved a valuable collection of real bridge data and a life-cycle scenario including maintenance strategies were elaborated. The integrated life-cycle analysis combining LCA, LCC and LCP is described here. Results of a case study for different motorway crossings are presented. Conclusions and recommendations for a sustainable life-cycle design are given.

Keywords: Steel-composite bridges, sustainability, case study, integrated life-cycle analysis, LCC, LCA, maintenance strategy.

1. Introduction

Traditionally bridges are designed to achieve minimal initial costs. But in regard of sustainability, not only the construction stage must be taken into account but the entire life-cycle of 100 years. In the European research project SBRI [1] a methodology for an integrated life-cycle analysis was developed combining Life-Cycle environmental Assessment (LCA), Life-Cycle Costs (LCC) and Life-Cycle Performance (LCP). The entire lifespan, from the production of raw materials and construction over the operation of the bridge (including maintenance) to the demolition at the end-of-life is regarded and analysed. Different maintenance strategies were taken into account in order to improve the lifetime performance of highway composite bridges. The approach was applied to three realistic case studies representing European standard situations of steel-composite bridges. With the different aspects addressed in the project an integrated life-cycle analysis was carried out. Design variants and alternative maintenance strategies were used to elaborate improvements for the life-cycle of steel-composite bridges.

In this paper the main results and conclusions from the analysis of three different motorway crossings are presented. In a first part the integrated life-cycle analysis combining LCA, LCC and LCP is described. Following the case study is explained and the results presented. Conclusions and recommendations for a sustainable life-cycle design are given for the motorway crossings.