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Holistic Consideration of the Sustainability on Steel-Concrete-Composite Motorway and Railway Bridges

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Abstract

Nowadays, sustainability is a key issue for the design of constructions, especially relevant for bridges with a service life of 100 years and where all the life-cycle stages need to be considered. Therefore, at the tender stage decision making should no longer be only based on construction costs but on a holistic assessment of sustainability aspects along the whole lifespan of the bridge.

In the European research project "SBRI" and the German research project "NaBrüEIS" a holistic approach of the sustainability on bridges has been developed. "SBRI" is devoted to the analysis of realistic case studies on motorway and crossing motorway bridges, while "NaBrüEIS" has the focus on the holistic evaluation of railway bridges. In both projects, environmental and economic aspects were assessed with the methods of LCA (Life-Cycle Assessment) and LCC (Life-Cycle Costing) together with external effects.

An important difference between the motorway bridges and the railway bridges is the external effects due to the traffic interruption, that play a crucial role on the holistic approach of the bridge. In motorway bridges, the external effects relate to the impact on the traffic flow in terms of user costs whereas in railway bridges, the external effects refer to the operation encumbrance costs linked to the operation of the railway net.

Keywords: Sustainability Assessment, Life-Cycle Assessment (LCA), Life-Cycle Costs (LCC), Holistic Approach, Motorway Bridge, Railway Bridge

1 Introduction

The holistic approach for the evaluation clearly depends on the type of construction, the sustainable design of bridges is different from sustainable design of buildings. For buildings, the main impacts are dominated by the energy performance and maintenance actions. In contrast, the sustainable bridge design depends strongly on local conditions such as e.g. the traffic situation or climatic conditions. In addition, due to the long operation phase of 100 years, durability and fatigue issues, together with questions of efficient maintenance are decisive.

Within the following, two research projects (coordinated by the author), "NaBrüEIS" [1] that involves the German railway DB and several German research institutions and "SBRI" [2] with participation of a number of European road authorities and partners, the sustainability of railway bridges and motorway bridges is studied. The aim of this paper is to show the main results of the holistic assessment with a special remark on the differences between both types of bridges, derived from the loading and the operator costs.

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