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STRENGTHENING OF SLAB BRIDGES WITH TOP CONCRETE LAYERS

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SUMMARY

The reconstruction of conventional bridges into integral bridges, with their advantageous characteristics as the economical design and relatively higher possible loads in comparison with conventional constructions, is discussed. An improved efficiency variant is examined for the activation of reserve load capacity of a double span bridge by applying an additional top concrete layer. The structural behaviour of the built-up section was modelled by the use of a non-linear finite element software. Despite reinforcing the slab cross-section, the resistance in field areas still can be insufficient, while high potential is seen at the intermediate support. Therefore, a possible outer restraint of the bridge superstructure was taken into consideration for redistributing bending moments, whereby any creep phenomena were additionally analysed. Further, a plastic cross-section rotation according to the standards of Eurocode 2, could be successfully demonstrated to be sufficiently effective on a two-field system.

Keywords: *Redistribution of forces, additional top concrete layer, lowered bearings, plastic hinge.*

1. INTRODUCTION

The Austrian bridge stock has an average age of over 30 years. More than one third of the present bridge constructions were built over 50 years ago. This fact is not only associated with symptoms of age, where environnemental influences have partially damaged structural components. By comparing the outdated ÖNORM B 4002 with the current ÖNORM EN 1991-2 concerning working loads for bridge structures the increase of the recommanded loads is significant. For that reason measures to cope with the current bridge stock must be found. Not only for the purposes of ecology the focus must be basically to mantain and renovate engineering structures.

Concrete, as the presently most important material for infrastructure, is a major source of manmade CO_2 emissions. Therefore the question arises how the life cycle of the bridge stock can be extended. The activation of reserves in load capacity therefore, especially in matters of handling higher bending loads, is a focal point of the present work.

Different variants of strenghening a conventional bridge structure, especially doublespan bridges, should be analysed on their own and in combination with other retrofitting methods.
To achieve a higher bending resistance of a slab, top concrete layers can be applied to the structure. Often this is realised in the course of extensive mantainings of a bridge. A current example can be the integralisation of the bridge abudments.

A considerable disadvantage of an additional concrete layer on top of an existing structure can be the increase of the dead weight. Depanding on the buidling's parameters, for example the span, slab thickness or the percentage of reinforcement, the cross-section's bending resistance can be barely increased in field areas. Adding reinforcement in the tensile zones of the field areas would be necessary for better results, but in practical application this approach is related to complex and time consuming measures.
Reinforcing bars put in the top concrete layer can only cover the negative bending moments in the support areas of the structure. Whereas the laying of reinforcment would be easy and is possible in more or less any

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