Extremely Slender Steel and Composite Deck Slab for Railway Bridges

Josef FINK
Professor
University of Technology
Vienna, Austria
josef.fink@tuwien.ac.at

Josef Fink, born 1961, received his civil engineering degree from the Vienna Univ. of Technology, Austria, where he became Professor in 2003.

Paul HERRMANN
Assistant
University of Technology
Vienna, Austria
paul.herrmann@tuwien.ac.at

Paul Herrmann, born 1979, received his civil engineering degree from the Vienna Univ. of Technology, Austria.

Lukas JUEN
Assistant
University of Technology
Vienna, Austria
lukas.juen@tuwien.ac.at

Lukas Juen, born 1983, received his civil engineering degree from the Vienna Univ. of Technology, Austria.

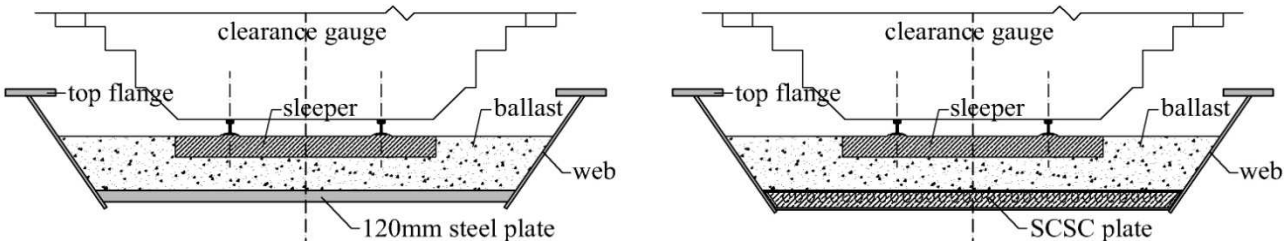
Summary

This paper presents the investigations of the static strength behaviour of an innovative composite sandwich system. It consists of a concrete core sandwiched in between of two steel plates and interconnected by continuous shear connectors. In the course of the research full-scale tests were made to derive simple models for analysis. After explanation of the functionality and characteristics of the composite plate, the evaluated test-results as well as the analytical models will be presented and compared. The main focus is thereby on the determination of stresses and strains in the composite cross section.

Keywords: sandwich structure; steel-concrete composite; shear connectors; crown dowel.

1. Introduction

At the Institute of Steel Structures in Vienna a construction variant for trough bridges (see Fig.[1a]) intended for use in railway bridges with spans from 10 to 25 metres was developed. The track slab consists of a steel plate with a thickness of 120 millimetres. Such bridge systems are especially used for replacing old-style bridge structures (for example track slabs with open construction by the use of girder grids) with given overall height, by modern ballast superstructures. This means that the new superstructure including the ballast bed as well as the supporting structure must find place within the limited overall height. This constraint requires an extremely low construction height for the track construction which is fulfilled by the 120 millimetre thick steel plate.



a)cross section with 120mm steel plate ***b)cross section with SCSC plate***

Fig. 1: Different construction variants for trough bridges

Due to various considerations (for example the availability of heavy steel plates on the market, high tonnage, etc.) it was additionally thought about an alternative to the described heavy plate track slab. In the course of the research, a steel-concrete-steel-composite (SCSC) plate was investigated (see Fig.[1b]). It is defined as a three-layer system, consisting of two outer steel plates separated by a core of unreinforced concrete.

For the use as track slab for railway bridges the main function of the composite cross section is to

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