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Behavior of transition plates crossing high-speed railway bridge joints in Germany

Sisi Zhang, Steffen Marx

Leibniz University Hanover, Hanover, Germany

Marc Wenner

Marx Krontal GmbH, Germany

Contact: zhang@ifma.uni-hannover.de

Abstract

Great stresses at the continuously welded rails (CWR) and large fastener forces at bridge joints due to the deformation of bridge ends have been observed in German high-speed railway lines. In order to limit the influence of this localized track–bridge interaction, a novel structure with a transition plate crossing the bridge joints has been applied in the new German high-speed railway line. The utilization of transition plates reduces the restraint forces caused by the deformation of the bridge ends. It divides the large gap at the bridge ends to two smaller gaps at the transition plate ends and ensures that the tensile and compressive forces in the fasteners do not exceed the permitted values at the bridge ends. In this paper, the behavior of the transition plates crossing the bridge joints is discussed. Measured bearing settlements and the dynamic response of the transition plates crossing bridge joints under high-speed train loads are analyzed.

Keywords: Transition plates; bridge joints; track–bridge interaction; high-speed railway; bridge monitoring.

1 Introduction

The initial reason for using transition plates running across bridge joints was the requirement in DB Richtlinie 804 for a maximum permitted fastener distance at bridge joints. For large bridges that require longer expansion lengths, the maximum permitted fastener distance (650 mm) could hardly be satisfied, which may cause huge forces at the fasteners and the rail under train loads. A transition plate serves as a small bridge across the big gap, and leaves two smaller gaps between the bridge deck and the transition plate. Thus, the permitted fastener distances can be achieved while producing a longer expansion length for the bridges (see Figure 1).

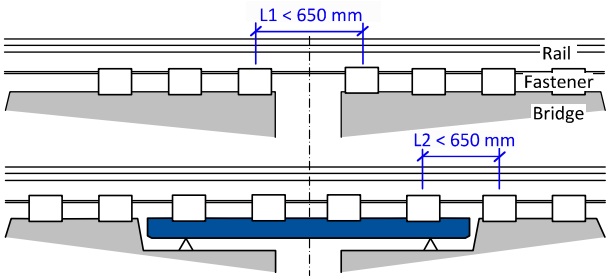

Figure 1. Transition plate across large bridge joint

In addition, the deflection curve of the rail caused by the rotation and vertical displacements of the

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