



Modern expansion joints – designs, fields of application and developments

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Summary

Expansion joints are a highly stressed component of bridge equipment. The modern expansion joints have developed into complicated constructions whose design criteria are determined by a wide requirement spectrum. The comprehensive definition of the requirement profile is derived from it. Various construction types are available as a function of the operating condition. At the moment a technical approvals guideline of expansion joints for road bridges originates within the scope of the efforts towards a harmonized European code of practice. In particular the load assumptions show differences for comparable valid national rules. Even more amplified efforts are undertaken to the advancement of the expansion joints in the fields of reduction noise emission and special operating properties - e.g., earthquake suitability.

Keywords: expansion joints, equipment of bridges

1. Introduction

The basic function of transition constructions is to bridge the deck joint gap between structures or parts of structures. Particularly in bridge structures live loads and temperature changes cause relative movements between the joint-edges of decks and abutments. Because of this fact expansion joint constructions are necessary. Their reliability and stability decisively influence the riding comfort, the durability and noise emission when crossing by vehicle.

During their using time they are often charged by more than 20000 loadings a day – on main lines by heaviest loads with increasing tendency. At the same time lifetimes of 40 years and more with lowest maintenance effort are expected. Accordingly the requirements on design and execution have continuously increased during the past years. Amongst others sufficient movement capacity, moisture resistance, fatigue design, the development of resistant joints and the choice of appropriate material are standing in the focus of product development.

2. Functions and Requirements for Expansion Joints

2.1 Functions

Lateral und vertical acting external forces out of vehicle crossings are to be carried away safely with consideration of their dynamic effect. External forces develop from own weights, traction and braking force respectively acceleration, suction effects, centrifugal forces, wind, downhill-slope at presence of a deck gradient. Internal forces from restraint and movement refusal can be added.

Building deformations have to be balanced constantly. As movements between the joint-edges translations as well as rotations in all directions of the reference system can appear (see Fig. 1).

Lateral movements are caused by external load actions as soon as temperature changes, settlements of support, creeping and shrinking. The location and direction of the total displacement resultant depends on the support condition of the deck.