# 2 Expansion Joints

## 2.1 Introduction

As mentioned in chapter 1.1, movements in old stone and timber bridges were small and no additional devices were necessary to close the gaps between bridges and abutments due to bridge movements. The first expansion joints were built for steel railway bridges because their movements were not negligible. With the increase of road traffic and of its speed, closing the gaps became necessary for safety reasons, especially at the moveable bearings. Initially, cover plates were used for expansion joints. For longer bridges these cover plates were not sufficient, so that finger joints and sliding plate joints were used. All these types of expansion joints were not watertight and so the water ran down to the bearings and to the abutments. The first watertight expansion joints were built using steel rails between rubber tubes to absorb the movements. This principle led to a lot of different multisealed expansion joints which differed in the means of supporting the steel rails, in the rubber profiles and in controlling the gap widths. Another type of watertight expansion joint is the cushion joint, consisting of a rubber cushion with vulcanised steel plates which transfer the traffic loads. In spite of continuous amendments of all constructions for expansion joints, these still remain wearing parts, especially in bridges with high traffic density and high traffic loads. The following chapters give a short survey of expansion joints for different movements used in the construction of bridges.

## 2.2 The role of expansion joints

The role of expansion joints is to carry loads and to provide safety to the traffic over the gap between bridge and abutment or between two bridges in a way that all bridge displacements can take place with very low resistance or with no resistance at all. A further requirement is a low noise level especially in an urban environment. The expansion joints should provide a smooth transition from the bridge to the adjacent areas. The replacement of an expansion joint is always combined with a traffic interruption – at least of the affected lane. Therefore expansion joints should be robust and suitable for all loads and local actions under all weather conditions, moisture and deicing agents. The replacement of all wearing parts should be possible in a simple way.

## 2.3 Calculation of movements of expansion joints

Movements of expansion joints depend on the size of the bridge and the arrangement of the bearings. Normally the form of construction depends on the horizontal translation orthogonal to the joint. But it is necessary to consider all translations and rotations to ensure that the displacements will not reach the limits of the joint construction.
To describe the movements of an expansion joint in detail we have to consider three translations and three rotations (fig. 2.3-1).