1 Bearings

1.1 Introduction

All bridges are subjected to movements due to temperature expansion and elastic strains induced by various forces, especially due to traffic loads. In former times our bridges were built of stones, bricks or timber. Obviously, elongation and shortening occurred in those bridges, but the temperature gradients were small due to the high mass of the stone bridges. Timber bridges were small or had natural joints, so that the full elongation values were subdivided into the elongation of each part. On the other hand, the elongation and shortening of timber bridges due to change of moisture is often higher than that due to thermal actions. With the use of constructional steel and, later on, of reinforced and prestressed concrete, bridge bearings had to be used. The first bearings were rocker and roller bearings made of steel. Numerous rocker and roller bearings have operated effectively for more than a century. With the development of ageing-, ozone- and UV-radiation-resistant elastomers and plastics, new materials for bearings became available. Various types of bearings were developed with the advantage of an area load transmission in contrast to steel bearings with linear or point load transmission, where elastic analysis leads theoretically to infinite compression stresses. For the bearings the problems of motion in every direction and of load transmission were solved, but the problem of insufficient durability still exists. Whilst it is reasonable to assume the life of steel bearings to be the same as that of the bridge, the life of a bearing with elastomer or plastic parts can be shorter.

1.2 The role of bearings

The role of bearings is to transfer the bearing reaction from the superstructure to the substructure, fulfilling the design requirements concerning forces, displacements and rotations. The bearings should allow the displacements and rotations as required by the structural analysis with very low resistance during the whole lifetime. Thus, the bearings should withstand all external forces, thermal actions, air moisture changes and weather conditions of the region.

1.3 General types of bearings and their movements

Normally, reaction forces and the corresponding movements follow a dual principle – a non zero bearing force corresponds to a zero movement and vice versa. An exception is given only by friction forces which are nearly constant during the movement, and by elastic restraint forces which are generally proportional to the displacement.
Usually, the bearing forces are divided into vertical and horizontal components.
Bearings for vertical forces normally allow rotations in one direction, some types in all directions. If they also transmit horizontal forces, usually vertical forces are combined.