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Sliding materials – the often essential but generally weakest links in bridge bearings and expansion joints

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1 Abstract

Bridge bearings and expansion joints, being engineered components that accommodate movements and rotations, are typically the parts of a bridge that are subjected to the greatest demands although being far less robust than the main structure. As a result, they generally cannot offer a service life that approaches that of the bridge as a whole. Therefore, the durability of the bearings and expansion joints selected for use in a structure is an important factor to consider in maximizing life-cycle performance. Most bearings and expansion joints that facilitate significant superstructure movements have sliding interfaces, which provide much of the flexibility required by the main structure's design. These sliding interfaces generally involve the use of non-ferrous materials such as PTFE, which are subjected to friction and abrasion with every movement, and are therefore the component parts that are subjected to the highest demands. Therefore, the performance of the sliding materials used in a bridge's bearings and expansion joints has considerable influence on the structure's long-term performance. This paper discusses this subject, with a special focus on the state-of-the-art UHMWPE alternative to the PTFE sliding material traditionally used in main sliding interfaces.

Keywords: Bridge; sliding; movement; expansion joint; bearing; durability; friction; PTFE; UHMWPE.

2 Introduction

Bridge bearings and expansion joints are typically the parts of a bridge that are subjected to the greatest demands, considering both static and dynamic influences. And being engineered components that accommodate movements and/or rotations and are thus far less robust than the main structure, they generally cannot offer a service life that approaches that of the bridge as a whole. Indeed, bearings and expansion joints might be considered the weakest links in many bridges, at least from a durability perspective. Therefore, the durability of the bearings and expansion joints selected for use in a structure is an important factor to consider in maximizing life-cycle performance and minimizing the costs of maintenance and replacement – including indirect costs such as associated traffic disruption.

Most bearings and expansion joints that facilitate significant superstructure movements have sliding interfaces, perpendicular to the main direction of load transfer, which provide much of the freedom and flexibility required by the main structure's design. These sliding interfaces generally involve the use of non-ferrous materials such as PTFE, which are subjected to friction and abrasion with every movement, and are therefore the component parts that are subjected to the highest demands – making them, in a manner of speaking, the weakest links within the bridge's weakest links. Therefore,

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