Innovative Bearing Design for Bridges

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Abstract

Bridge bearings represent a small percentage of the overall cost of a bridge, however if improperly designed or installed they can result in the majority of the problems. As a result it is imperative that bridge bearings be easy to install and have a trouble free design. Many types of bridge bearings have been utilized over the years with a mixture of success and failure. One type of device that has had an impressive performance history for over 40 years is the disk bearing. The disk bearing has undergone extensive testing and offers engineers several different innovative design features for curved girders, uplift restraint, high horizontal loading and high rotations.

Keywords: bearings; bridges; cost effective; multi-rotational; polyurethane; PTFE; sliding.

1 Introduction

Disk bearings were developed in the late 1960's as a cost effective means to safely transmit the loads, rotations, and translations of a bridge superstructure to the substructure [1]. The primary component of the disk bearing is the load and rotational element, which is comprised of a polyether urethane elastomer (Figure 1).

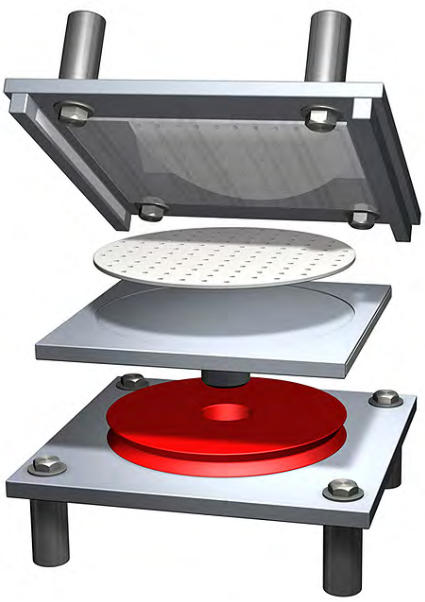

Figure 1. Unidirectional Disk Bearing

Due to this material's high compressive strength, there is no need for confinement of the elastomer, which acts much like a conventional elastomeric bearing. This immediately eliminates the sealing ring problem, inherent with many pot bearings. The urethane material used in the disk has outstanding weathering properties and remains stable from -70 to +121 degrees centigrade. Therefore under normal atmospheric conditions there is no problem with the rotational element softening or crystallizing during temperature extremes. The unconfined disk accommodates rotation by the differential deflection of the elastomeric element. The way it works is as the polyurethane rotational element is loaded it wants to expand but the friction between the upper and lower bearing plates inhibit this expansion resulting in a bulging effect around the perimeter of disk. The reason for the V notch on the edge of the disk is to reduce the shape factor and control the amount of deflection during load and rotation.

The horizontal loads of the structure are transmitted through a shear resisting mechanism (SRM). This ball and socket type connection allows the free rotation of the superstructure up to .04 radians or 2.3 degrees in the standard design but inhibits shear from being applied to the rotational element [2]. The standard SRM accommodates a

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