Life-cycle considerations in the selection and use of bridge expansion joints

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Summary

Bridge expansion joints are often subjected to great challenges, such as large movements and relentless dynamic loading, and thus require proper periodic maintenance and, from time to time during the longer life of the bridge, replacement. Consideration of the long-term costs associated with the joints – including for supply, installation, maintenance, and replacement of the joints, and other costs such as those resulting from the traffic disruption caused by replacement works – demonstrates the importance of devoting adequate attention and expenditure to the procurement, installation and maintenance of high-quality joints. Indeed, the initial costs of supply and installation have been concluded by leading authorities to be insignificant in relation to the costs of joint replacement works, especially when user costs are considered. Recognition of this, and consideration of the measures which are proposed to assist in implementing a long-term strategy, can help minimise the life-cycle costs of a bridge's expansion joints – for the benefit of owners, users and society at large.

Keywords: Expansion joints; bridges; life-cycle costs; durability; maintenance; replacement; user costs

1. Introduction

In the responsible management of any construction project or asset management programme, life-cycle considerations must be to the fore. This is now widely recognised, even if this recognition has, to a large extent, regrettably not yet translated into consistent practice. A great deal has been written to assist engineers and owners in the assessment of life-cycle issues, and the field of bridges is no exception - for example, with the 2003 report, "Bridge life-cycle cost analysis" [1], published by the Transportation Research Board of the American National Research Council as Report 483 of the National Cooperative Highway Research Program (NCHRP). The field of bridge expansion joints, however, is considerably more specialised than that of bridges in general, and a concise commentary on the life-cycle considerations of these critical bridge components is not known to the authors. This paper seeks to provide such a commentary, in the hope that it will offer useful guidance to bridge owners, designers and constructors.

2. The challenges faced by bridge expansion joints

A bridge's expansion joints are generally considerably lighter and less robust that the rest of the structure which supports them, and at the same time must facilitate deck movements and rotations while subjected to dynamic, fatigue-inducing loading from traffic. The expansion joints of a bridge which is crossed by 50,000 vehicles a day, for example, will be subjected to well over a billion axle loads, or mini-impacts, during a 40-year service life. This enormous figure explains why the expansion joints of any bridge require proper maintenance throughout their lives, and why they will

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