

# The effects of expansion joint design on bridge life-cycle costs - initial investment versus total cost of ownership

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## Abstract

The need to maximise long-term value for money supports the consideration of life-cycle costs rather than just initial construction costs when investing in key infrastructure such as bridges. This is especially true in the case of a bridge's expansion joints, which are much less robust than the structure as a whole yet subjected to continuous movements and dynamic loading. The life-cycle costs of a bridge's expansion joints may be considered to include not only initial supply and installation costs, but also maintenance and repair costs throughout their service life, and replacement costs, and the user costs associated with maintenance and replacement work – especially those relating to traffic disruption. Increasingly, the effects of avoidable work on the environment should also be considered. This paper will address this topic, discussing issues that should be considered in choosing the optimal solution for any individual structure.

**Keywords:** Life-cycle costs; expansion joints; bridges; durability; maintenance; replacement; user costs.

## 1 Introduction

As with any engineered object or product, the choice of the particular expansion joint solution selected for use on any bridge structure can have a very significant impact on long-term “costs” – especially when these costs are considered to include indirect costs such as those resulting from traffic disruption (delays, lost time, etc.) during maintenance or replacement works, or even non-monetary costs such as the environmental impacts of traffic disruption and avoidable rehabilitation work. Therefore, adequate attention should be given to the design of the expansion joint solution – most importantly in terms of the selection of the expansion joint type from the many types available (for example, as shown in Figure 1), and the standard design, quality, reliability and

functionality/features offered by any particular manufacturer. The importance of this is discussed and illustrated below, along with guidance on how the long-term costs associated with a bridge's expansion joints might be minimised by timely consideration of important factors.

## 2 The importance of life-cycle cost analysis

Life-cycle cost analysis is now widely accepted among engineering professionals as an important element in the planning of any major project, and represents a great improvement on the traditional approach often used in the construction of infrastructure, which considered only the initial direct costs of design and construction.