

**CONSTRUCTION OF CONCRETE BRIDGES WITHOUT  
EXPANSION JOINTS IN SRI LANKA**

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Dissertation submitted in Partial fulfilment of the requirement for the  
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## Declaration

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## **Abstract**

A structure would be more sustainable if maintenance problems and associated costs are minimized. Most of the concrete bridges have been constructed in Sri Lanka with expansion joints. It results in frequent maintenance problems and associated maintenance costs, and consequently affects the durability of the asphalt pavement and impairs the ride quality as well. It is a current issue faced by RDA maintenance unit. Therefore, avoiding expansion joints will not only improve the durability of the bridge and pavement, but also results in zero maintenance cost.

Expansion joints are provided to release stresses caused by movements of bridges due to the temperature variation. The temperature profile can be divided into two parts such as uniform temperature variation and non-uniform temperature variation. Uniform temperature variation causes the bridge to expand linearly while non-uniform temperature variation heats each fiber differently. Non-uniform temperature gradient can be categorized into two parts such as positive temperature gradient, which is due to rapid heating of the top fiber than the underneath fiber ; and negative temperature gradient, which is due to rapid cooling of the top fiber than the underneath fiber .

When the movement caused due to the temperature changes is restrained, additional stresses would be developed in the bridge. However, the structure would be capable of withstanding those stresses if these stresses are within a reasonable range. In Sri Lanka, daily temperature variations and maximum temperature rise are not too high compared to other countries like India and Australia. Therefore, it is possible to avoid expansion joints in concrete bridges in Sri Lanka.

There is no specific standard in Sri Lanka to obtain temperature values for the calculation of thermal loading except Bridge Design manual, RDA. In Sri Lanka, temperature differences for bridges can be obtained from Figure 2.4 in Bridge Design manual, RDA, which is similar to Figure 9 in BS5400. These values may not be suitable to be adopted in Sri Lanka as the climatic conditions in the United Kingdom are not similar to Sri Lanka.

However, it is possible to determine a suitable value for temperature variation for Sri Lanka by considering recommendations from other countries such as India and Australia. This can be done by comparing the climatic patterns of those countries with that of Sri Lanka and by referencing some experimental data collected within Sri Lanka.

Although shrinkage, creep and settlements could also induce additional stresses in the structures due to the continuity, it could be within the reasonable range which can be withstood by the structure.

This research will explore the possibility of avoiding expansion joints for concrete bridges in Sri Lanka with the determination of suitable values for temperature parameters which could be adopted for the calculation of thermal loading.

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## **Abbreviations**

BD	Bridge Design
BS	British Standard
EE	Executive Engineer
SDE	Senior Design Engineer
RDA	Road Development Authority
DG	Director General
IRC	Indian Roads Congress
AS	Australian Standard
BDM	Bridge Design Manual