Challenges and solutions for expansion joints on super long span bridges

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Summary

Exceptionally long bridges, designed and built by a construction industry that continues to push the boundaries of span and performance for such structures while at the same time always striving for greater cost-effectiveness, require carefully selected and detailed deck expansion joints. While it may be quickly concluded that joints of the modular type should be used, it is important to also be aware of the differences between the modular systems of different suppliers, and to entrust the design and manufacture of these key components only to a supplier that can demonstrate substantial experience in the specialised task of designing and manufacturing such components to satisfy the exceptionally demanding requirements of extraordinary bridges.

Keywords: Expansion joints; bridges; long spans; large movements; testing; durability; life-cycle

1. Introduction

The design and construction of super long span bridges, with main spans of over 3km currently being designed, presents particular challenges for their mechanical and moving parts, such as the expansion joints that provide a driving surface for traffic at the ends of each deck section while allowing the deck to expand, contract and move due to a variety of forces. Notably, the expansion joints in the bridge's deck face unprecedented demands due to the larger, faster and more complex movements and rotations that result. Such extreme conditions call for innovative design concepts, taking into account various aspects such as the development of new materials, prototype testing, durability under normal and exceptional service conditions, construction logistics and life-cycle cost. While a great deal of research and development effort is devoted to the general challenges of super long span bridges (including extensive wind tunnel testing, for example), little consideration is given to the corresponding challenges faced by expansion joints, perhaps due to their very specialised nature. This paper explores these challenges and comments on how they may be addressed.

2. The challenge

Even on bridges which do not have very long spans, expansion joints are often recognised as being particularly susceptible to damage and failure. For example, the 2003 report, "Bridge Deck Joint Performance - A Synthesis of Highway Practice" [1], published by the Transportation Research Board of the American National Research Council as Synthesis 319 of the National Cooperative Highway Research Program (NCHRP), stated very plainly: "Most bridges have deck joints, and most deck joints have problems". This simple statement indicates how often the design / fabrication / installation / maintenance chain has broken down during the lifetime of even small expansion joints, which make up the great majority of all expansion joints installed to date. Larger expansion

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