State of the Art of Concrete Segmental Bridges

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Abstract

The objective of this paper is to summarize current theory, design, and construction methods of concrete segmental girder bridges and to propose future research needs. First, the analytical theory will be overviewed, including concrete creep and shrinkage, bending strength with external tendons and unbounded tendons, web crack control, anchorage, etc. Then, the paper covers design methods regarding corrosion, including the use of Electrically Isolated Tendons (EIT) system, Fiber Reinforced Polymer (FRP) tendons and other corrosion protection techniques. In addition, internal redundance; the use of ultra-high-performance concrete (UHPC); and standardization for expediting the concrete segmental bridge design will be presented. The paper concludes with a discussion of research needs for future development of concrete segmental bridges.

Keywords: concrete segmental bridge; creep and shrinkage; crack control; dynamic allowance; corrosion protection techniques; standardization; new material; construction; research needs.

1 Introduction

Concrete bridges that are built segment by segment or piece by piece are often called concrete segmental bridges. Due to a prevailing desire for expedited construction with minimal traffic disruption, lower life cycle costs, appealing aesthetics and the need for super-elevated to curved roadway alignment, segmental concrete bridges have developed rapidly and become a primary choice for major transportation projects throughout the World. The maximum span length for girder type segmental bridges has reached 330 m. Concrete segmental girder bridges are not only widely used for long span bridges but are also used extensively for elevated viaducts in urban settings. It has been demonstrated on numerous projects that precast concrete segmental bridges can not only significantly reduce construction time and traffic disruptions, but also can provide the most economical, cost-effective bridge choice. Segmental construction is not only applied to girder type bridges but also widely applied to a variety of complex bridge structures, such as cable-stayed, arch, and rigid frame bridges [1].

To better develop concrete segmental design techniques, this paper summarizes current theory, design, and construction methods of concrete segmental bridges by focusing on the girder type concrete segmental bridges. First, current segmental bridge construction methods are briefly discussed. Then, the analytical theory is

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