The Evolving Metropolis
2019 IABSE Congress
New York City

IABSE 90 YEARS

Comparative analysis for monitoring long-term behavior of box girder bridges in Colombia

Luis F. RINCON
Civil engineer, Masters student
Industrial University of Santander
Bucaramanga, Colombia
luisrinconprada@hotmail.com

Álvaro VIVIESCAS
Civil Engineer, Ph.D. Associate professor
Industrial University of Santander
Bucaramanga, Colombia
alvivija@uis.edu.co

Gustavo CHIO
Civil Engineer, Ph.D. Associate Professor
Industrial University of Santander
Bucaramanga, Colombia
gchioch@uis.edu.co

Edison OSORIO
Civil Engineer, Ph.D. Assistant professor
Universidad Antonio Nariño
Bogotá, Colombia
e.osorio@uan.edu.co

Carlos RIVEROS
Civil Engineer, Ph.D., Eng. Assistant professor
University of Antioquia
Medellín, Colombia.
carlos.riveros@udea.edu.co

Contact: luisrinconprada@hotmail.com

Abstract

The use of prestressed concrete (PSC) box girder bridges built by segmentally balanced cast-in-place cantilevers has spread massively due to noticeable advantages over traditional. However, excessive deflections have been observed in 10-years old constructed bridges worldwide which have been designed based on old international code standards that underestimated rheological effects. To guarantee 100-year design life of bridges, it is necessary to have a periodic monitoring system that validates in-service performance. In Colombia there is a necessity to study in-service performance of this type of bridges after its construction, which is the main solution for structures with spans ranging from 80 m to 200 m, therefore this study seeks to propose a procedure to estimate the long-time behavior of box girder bridges in Colombia considering construction data scarcity. Therefore, altimetry data measured from a newly constructed bridge is collected, and the rheological effects of the structure are predicted using models previously developed and validated. Finally, a comparative analysis is carried out and guidelines are provided to propose a practical monitoring framework that guarantees adequate in-service bridge performance.

Keywords: Prestressed box girder concrete bridge; Deflection; Design standards; Creep; Shrinkage.

Introduction

The box girders in prestressed concrete built by segmentally balanced cast-in-place cantilevers have represented an economically viable solution due to the reach of large span and their benefits in mountainous areas without the need for the use of intermediate supports [1]. The first appearance of these structures occurred in Brazil in 1931 but its use increased from the 70s thanks to its massive implementation in Europe [2], [3]. Its constructive method consists in the symmetrical realization of new bridge sections using cantilever formwork commonly called travelling formwork, which is supported in the previously cast section. Once half of the light is reached, a closing section is built, ending the structure. To compensate for the deflections generated by cantilever during its construction, the sections are cast with a upward displacement, commonly referred to as camber [4], but the lack of controls during construction can cause unexpected stresses in the structure.

https://doi.org/10.2749/newyork.2019.2114
Distributed by Structurae