Addressing Climate Resiliency in Long Span Bridges Through Early Stage Aerodynamic and Climate Consulting

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Abstract

New long span bridges must be designed for climate resiliency based on historical records and long-term predictions. Existing bridges must be rehabilitated for climate resiliency to ensure safe operation and increased longevity. A multi-hazard assessment combined with bridge monitoring, wind tunnel studies and numerical analysis can provide an accurate picture of the current state of the bridge as a whole and specific components of the bridge including cables, deck, and hangers. Bridge microclimate past, present and future can be modelled, and climate scenarios can be applied to a digital model of the bridge to predict the response of the structure to the windstorms of tomorrow and to develop a framework of climate change adaption.

The authors will illustrate how aerodynamic and climate engineering consulting can inform decisions about the design and rehabilitation of long span bridges using case studies. Aerodynamic and climate consulting early in the design process contributes to both design, material, and carbon cost savings. Aerodynamic consulting and climate (weather) forecasting in construction stage planning ensures safe, efficient, and cost-effective construction of a bridge or a bridge rehabilitation plan.

A case study of the design of a new signature long span bridge, case studies of bridge cables and hangers and a case study of a bridge rehabilitation will be detailed to outline the benefits of early stage aerodynamic and climate consulting.

Keywords: Bridge Aerodynamics, Bridge Microclimate, Wind Effects, Bridge Rehabilitation, Carbon Footprint

1 Introduction

In recent years and even more in the last 3 years it has become apparent that aerodynamic studies targeting performance goals of long-span bridges are not limited to the detail design phase of new structures. There is a societal push globally to rehabilitate major bridges to adapt to their current and future use and to extend their design life.

In fact, aerodynamics studies are now carried out throughout the entire life cycle of a bridge, from the planning, conceptual design, detail design and construction phases to the in-service phase for safe operations and rehabilitation phase into a new configuration involving changes to the deck cross-

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