The use of science in long span bridge engineering

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Dr. Robin Sham received his doctorate from Imperial College, London. He has a career that spans over 3 decades and several contingents, in bridge engineering. In 2011 he was conferred the highly prestigious Fellowship of the City and Guilds of London Institute. In 2013, he was elected Fellow of the Royal Society of Arts, London. He will be recipient of the Institution of Civil Engineers (UK) 2013 Gold Medal.

Abstract

This paper advocates the use of science for the advancement of long span bridge engineering. A description is given of bridge projects over some three decades, which are exemplary of our quest for conquering increasingly long spans and daunting challenges. The case examples have been specially chosen for fundamental improvements on bridge engineering, and for creative influence on our profession. The projects have individually and collectively shaped the prevalent thinking and steered future trends. The paper seeks to illustrate that the achievements of these projects have been underpinned by scientific principles, and implanted through creative use of engineering science techniques. Through his involvement in these cable-stayed, suspension and major marine bridge crossings, the author also recounts the revolution in bridge technology which has pushed new frontiers and made possible the creation of each of the magnificent bridges. Within the confines of this paper, the chronology of development of selected influential bridge projects is described, including the Second Severn Crossing, the world's all-weather crossing with protection to users against cross-winds; the Aberfeldy Bridge; the world's first all-fibre reinforced composite cable-stayed bridge; Kap Shui Mun Bridge, the world's longest two-level, combined rail-road sea crossing upon completion; Zwolle Bridge, an aesthetically striking cable-stayed bridge with a single, inclined pylon; Tsing Lung Bridge, a third generation suspension bridge with a shallow, streamlined twin-box deck girder; Sutong and Stonecutters Bridges, the world's two longest cable-stayed bridges upon completion; Padma Bridge, a 6.15km long, two-level, combine rail-road river crossing; Second Penang Bridge, a 25km long sea link, and the most substantial bridgework in South East Asia; and Taizhou Bridge, the world's first long-span, three-pylon, two-main span suspension bridge. The objective of this paper is to encourage further use of science, combined with engineering intuition and practice, in pushing the frontiers of long span bridge engineering.

KEY WORDS

Cable-stayed bridges; suspension bridges; river crossings; railway bridges; design; construction; construction engineering; aerodynamics; wind tunnel testing; earthquake resistant design; seismic isolation.

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