

# Review

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Arup's Naeem Hussain comments on a recently published book from one of the industry's most eminent bridge designers

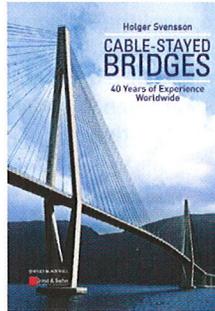
## Cable-Stayed Bridges – 40 Years of Experience Worldwide

**Author:** Professor Holger Svensson

**Publisher:** Wiley-Blackwell, Hard cover, 458 pages

**Price:** £105

**ISBN:** 978-3-433-02992-3



In the global bridge fraternity, Holger Svensson is well known for his contribution to the design and development of cable-stayed bridges. He has designed bridges that have been built on virtually every continent, so it was with great eagerness that I read this book. There are several excellent publications on cable-stay and cable supported bridges written by eminent academics and practicing engineers, but this book is different. The title belies the contents of the book, which is not just about the bridges that Holger has been involved with, but is a compendium bringing together in one book the history, theory and development of cable-stay bridges on a worldwide scale.

The book is lavishly illustrated with photos of bridges, extracts of engineering diagrams and drawings from the earliest development of cable-stay bridges to the present (including the record-breaking Russki Bridge in Vladivostok with a span of 1104m). This makes understanding the text easier as engineers by nature are able to grasp the language of diagrams. To bring this knowledge together in one book is a major undertaking and achievement of historical research. Students, academics and practicing engineers will find the book helpful, particularly graduate engineers who will obtain essential and informative insight into the behavior of cable-stay bridges from reading the chapters 'Design Fundamentals' and 'Precursors of Cable-Stayed Bridges'. For the practicing engineer, the wealth of practical details captured from the diverse

range of bridge types illustrated in the book, are a valuable source of knowledge in addressing design issues that they might encounter.

Holger quite rightly advocates that simplicity and refinement to the pure structural shape is most important. This is particularly relevant at the present time, as with the use of powerful computational aids almost any shape can be realised. The desire for unconventional bridge shapes is in many instances led by architects who in Holger's words "do not appreciate the logic of a pure structure and create bridges in which the flow of forces is wrong". Holger suggests that the jury for design competitions should always contain a majority of engineers in order to avoid the winning design not being realised for technical or economic problems.

The book has separate chapters on steel, composite and concrete cable-stay bridges and sets out how engineers in different parts of the world have addressed the design issues to reflect the particular period, type of bridge and environmental conditions. Within each type, several variations in the configuration of the deck, pylons and stay arrangements are shown, underlining the many possibilities that exist in the design for a cable-stay bridge.

The progression in the span lengths

of cable-stayed bridges is going to be influenced by the type of stays and how the dynamic behavior of the stays can be controlled. A review of currently used stay cable systems is given, along with explanation of the dynamic behavior of cables due to actions such as parametric structural excitation and rain/wind oscillation and how they can be suppressed by very recent developments in damper design by various manufacturers.

The issues of bridge dynamics, influence of wind and ship impact are addressed. Wind in particular for long span cable-stay bridges has a major influence on the design especially in cyclonic areas of the world. Each of these topics is dealt with in an exhaustive manner, firstly explaining the phenomenon/problem and then setting out how the problem was addressed and resolved for various bridges.

A welcome addition to the book is a chapter on construction engineering. A bridge is most vulnerable during construction and the configuration of the bridge in its permanent state can be governed by the construction stage. Representative construction techniques deployed on a number of bridges including very recently completed bridges such as Stonecutters Bridge and the Millau Viaduct are given. This is a useful reference source for the design of both temporary and permanent works.

Lastly, and perhaps of great use to graduates and engineers starting in the bridge profession, are the samples of preliminary calculations. In the present day culture of totally relying on the computer, it is essential that engineers are aware of and understand the principles of engineering and are able to carry out preliminary and approximate analysis by hand, in order to carry out a health check on the computer analysis.

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Recognised by the industry for his significant contribution to bridge design, Naeem Hussain joined Arup in 1969 and has 49 years of civil engineering experience. He was awarded the Prince Phillip Medal (the Royal Society of Engineering's highest individual award) in 2012.