Designing and Constructing Prestressed Bridges

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Jiří Stráský and Radim Nečas

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Foreword

Everywhere today an environmentally-conscious public is paying greater attention to the structures that make up their environment, such as bridges, viaducts, railroad overpasses. As people realise these are structures built for over a century of useful life, they express concern that so many of these structures are boring, repetitive, and even ugly. Increasingly, an unhappy public and our clients are tending to hold engineers responsible for the proliferation of unimaginative structures in their environment.

The most common approach taken by clients, especially public agencies, to get more beautiful and aesthetically-pleasing structures has been to turn to architects. It is not unusual for clients to require architectural treatment or architectural mitigation of the structural designs by architects as part of the design process.

It can be argued that this approach usually fails, and does not result in better architectural solutions from architectural treatment, not because architects are professionally incompetent as architects, but because the approach arises from false assumptions. Arguably, the way to improve the architecture of bridges is to produce better structural solutions. In bridge design the responsibility for producing better architectural solutions lies not with architects but with structural designers.

When ICE Publishing asked me to prepare a third edition of my book 'Stress ribbon and cable-supported pedestrian bridges' I came to the realisation that the main portion of my work is not the design of these special structures, but the design of so so-called 'bread-and-butter' bridge structures – typical overpasses, viaducts, river crossings, and where possible, bridges across deep valleys and wide rivers. The intention was always to ensure that these structures were structurally-efficient but also aesthetically-pleasing. That is why I suggested to the publisher that the focus of this book should not be about exceptional structures, but those more typical ones, mirroring core projects in my own work.

As I always have a proactive approach to my life and work, and since prestressing enables us to actively control the structural behaviour, I have always used them in my designs. The layout and level of prestressing can be chosen in the way that dead load is balanced, boundary conditions are changed and supports are created within structures. Prestressing is a radical step away from passive reinforcement to creative thinking and development.

I started my professional career in 1969 in the former socialist Czechoslovakia. I was working as a designer in the state company, designing and constructing highways and bridges. Since there were restrictions in collaborations with other countries and since there was a desire to create progressive structures, the organisation had to develop not only the structures, but also the technology for constructing them, which helped with developing a greater understanding of both prestressing and constructing. After the Velvet Revolution, there was an opportunity to work in the United States where I participated in the design of several outstanding structures designed by the firm T. Y. Lin International, San Francisco. When I returned to my homeland, I started to teach at the Brno University of Technology. and with my colleagues opened our design firm. Since I also own an engineering office in California, I have continued to participate on design of several outstanding bridges built in the USA and Canada. Our firm in Brno is designing bridges not only in the Czech Republic but all over the world (UK, European Union, South America and Asia).

When we started our firm, we wanted to design structurally-efficient bridges that have a high aesthetic standard. We want to design structures whose form is inherent to the site where they are constructed, and structures that express their static functions. To be able to design such structures, the designer must fully understand the structural behaviour, possess deep knowledge of static and dynamic analyses and be familiar with the technology of their construction. To prepare qualified engineers, my colleagues and I are trying to cover all discussed aspects. Since we hope other students and engineers might be interested in our lectures too, we have summarised their subject in this book.

The book was prepared with the collaboration of Dr Radim Nečas, who worked out the calculations and drawings. Since 2001 Dr Nečas is teaching with me at the University and participating in the structural design and static and dynamic analysis of our bridges. The discussed approach to designing of bridges is illustrated using examples of many structures. Since it is difficult to obtain information about designing and constructing bridges designed by other designers, the structures designed by the author's design office are presented here in many cases. Other structures included here are those which we admire from both architectural and technical points of view.

Jiří Stráský

About the authors

Jiří Stráský has worked in industry since 1969, and is Technical Director at Strasky, Husty and Partners Ltd, Brno, Czech Republic. He also holds a teaching post at the University of Brno. Jiří has won numerous awards for design and technical papers, and has been published numerous times.

Radim Nečas is a full-time academic at Brno University of Technology, Czech Republic. He has worked in research since 2001, and has seen his projects realised in his native Czech Republic, Spain and the USA.