



Development of a Structural System for Short Span Bridges

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Summary

In the present contribution the development of an innovative structural system for short span road-bridges is presented. In particular, the use of prestressed concrete tension ties is shown to offer new possibilities for the conception and design of bridge structures. Aesthetics as well as structural efficiency are discussed. Transparency and structural simplicity are characteristics that contribute to a clear appearance. The reduction of dead load while maintaining sufficient stiffness is a general optimization task in structural engineering; it is shown that by choosing suitable dimensions and materials and an appropriate level of prestress convincing solutions can be achieved.

Keywords: bridge design, concrete tension ties, inverted bowstring girder bridge, prestressed concrete, structural behavior.

1. Introduction

One of the common tasks for structural engineers is the conception and design of short span road-bridges for the crossing of rivers, highways or train tracks. Typically, such bridges have spans ranging from 20 m to 40 m; they form a relevant part of the built infrastructure in western countries. Today, a lot of such bridges have to be replaced or renewed and the question arises, how this can be done while improving durability and aesthetical appearance.

The development of a new structural system for bridges may start with the attempt to increase the efficiency as well as the overall transparency of such structures. As a rule, an ingenious flow of forces and an efficient use of materials should be perceptible. Structural members and materials should be used according to their specific properties and quite often, the visual impact of a structure depends on the gripping combination of different elements. On the other hand, the use of different materials and structural elements requires connections which are rather disadvantageous from an economical point of view as well as with regard to durability. Monolithic and integral structures are preferred. To reach this goal, cast-in-place concrete, precast concrete segments and post-tensioning can be combined. In the following such a structural concept is described.

Twenty years ago, Menn [1, 2] proposed a new structural system for concrete bridges with spans in the order of 30 to 40 m which consists of a concrete deck slab that is supported by steel tension ties. In recent years, this idea was further developed and extended by replacing the tension ties with composite steel and concrete or prestressed elements [3, 4, 5, 6]; this measure leads to an increase of the stiffness of the ties and of the overall system, respectively. As there is a big potential for such structures and remarkable progress in concrete as well as in post-tensioning technology is made, research and practice should contribute to further promote the idea.