STRESS-RIBBON PEDESTRIAN BRIDGES SUPPORTED OR SUSPENDED ON ARCHES

Jiri STRASKY
Prof., DSc. Technical Director
Brno University of Technology Strasky, Husty and partners
Brno, Czech Republic Brno, Czech Republic

Summary

A new structural system that combines arches with the stress-ribbon is described in terms of the architectural and structural solution, static and dynamic analyses, and the process of construction. The advantage of this structural system is demonstrated on several structures built in the Czech Republic and in Oregon, USA.

Keywords: Stress-ribbon, arch, self-anchored structural system, precast segments, prestressing, non-linear analysis, dynamic response, comfort criteria;

1. Introduction

Stress-ribbon bridges consist of very slender concrete deck segments placed over bearing cables in the shape of a catenary. Prestressing the deck segments stiffens the structure, providing stability to the cables. These bridges are characterized by successive and complementary smooth curves. The curves blend into the environment and the curved shape, the most simple and basic of structural solutions, clearly articulates the flow of internal forces. The main advantage of these structures is their minimal environmental impact because they use very little material and can be erected without falsework or shoring, which could disturb the natural environment. Because there are no bearings or expansion joints, the bridges require only minimal long-term maintenance. The bridges built in the Czech Republic and in the USA were discussed in a paper presented at the International Bridge Conference in Pittsburgh in 1999 [1]. Problems connected with the design and construction of the stress-ribbon structures and a survey of such bridges built all over the world is presented in [2].

A disadvantage of the classical stress-ribbon type structure is the need to resist very large horizontal forces at the abutments, which determines the economy of that solution in many cases. For that reason, a new system that combines an arch with the stress-ribbon has been developed. The stress-ribbon is supported or is suspended on an arch. The structures form a self-anchoring system where the horizontal force from the stress-ribbon is transferred by inclined concrete struts to the foundation, where it is balanced against the horizontal component of the arch.

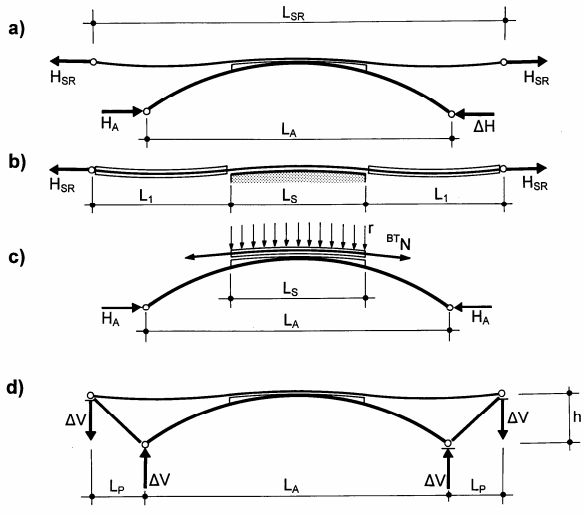

Fig. 1 Stress ribbon supported by arch

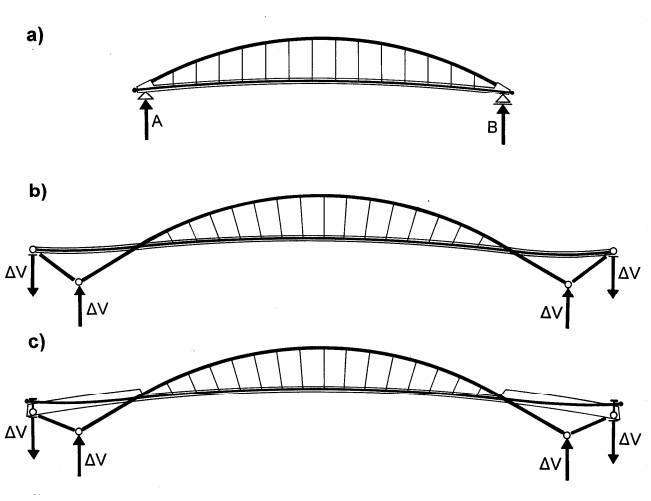

Fig. 2 Stress ribbon suspended on arch