

Exploitation problems with particular road and railway composite bridges in Bulgaria

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Abstract

Composite steel-concrete bridges are having wide implementation in the present bridge practice due to their advantages. On the other hand, composite bridges have complex time dependent behaviour due to long term processes in concrete – creep and shrinkage. Stress strain state is a function of the sequence of their construction. In general, building an effective composite bridge needs relatively higher level of knowledge, precision and responsibility from designers, contractors, and relevant authorities. Implementation of composite bridge superstructures in Bulgaria is discussed in this paper. The influence of some problems related with design and construction of particular road and railway bridges on their behaviour during exploitation are analysed. Exploitation problems of three bridges are discussed. Conclusions for reasons leading to these problems and variants for avoiding them in future projects are analysed.

Keywords: steel-concrete composite bridges; exploitation problems; concrete slabs; cracks; fatigue.

1 Introduction

Steel-concrete composite bridges are one effective solution in the field of medium span bridges when the speed of construction is essential. Their structural behaviour and analysis are relatively complex due to the rheological properties of concrete and the constraints imposed by the connection between concrete and structural steel. The stress-strain state of these structures depends on the sequence of their construction and vary in time of their exploitation [1] and [2]. The need for precise structural analysis and execution, as well as the lack of knowledge in this field in the engineering practice in our country are the main reasons for the relatively limited application of the steel-concrete composite bridges in Bulgaria, [3]. Before 1989 just three composite road bridges in the medium span range between 35m and 43m were built. All of them with simply supported plate

or box girders with different types of shear connection. One of these bridges, road bridge built in 1974, is presented in this article. Problems found, after more than 45 years of exploitation, are presented and discussed.

In the next 15 years, up to 2005, new significant bridges of that kind were not built, mainly due to economic reasons, which were consequence of the change of the political regime in the country.

In 2006 one railway overpass for the metro in Sofia was built. The superstructure consists of 8 spans, simply supported composite plate girder, each 24,1m in length.

The first two continuous composite girder bridges were built in 2010 under the project of Rehabilitation and electrification of the Plovdiv-Svilengrad railway line. These two structures are in the focus of the present article as well. After 10