



The FRP Bridge in Friedberg Germany: Design, Analysis and Material Tests

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Summary

Public authorities look for innovative bridge systems that allow for minimum traffic interference both during their assembly as well as maintenance. In this light, bridge deck systems made out of fibre reinforced polymers (FRP) offer promising options, mainly high strength combined with low weight, rapid installation by high degree of prefabrication and resistance against corrosion. On behalf of the Hessian Road and Traffic Authority a design for a bridge was developed, which combines longitudinal steel girders with an adhesively bonded FRP bridge deck. In contrast to other FRP bridges in the US or UK, the composite action is considered. The absence of general accepted structural analysis methods, design codes and building regulations for fibre reinforced polymers necessitates extensive testing programmes. The conceptual design of the bridge, the material-specific way of analysis as well as the results of the extensive material tests are highlighted in this paper. By the time of writing this paper, the bridge was in tendering phase.

Keywords: FRP-bridge, pultruded FRP bridge deck sections, conceptual design, material tests

1. Introduction

Increase in traffic and workloads for bridges as well as road engineering structures require methods of building and materials which guarantee safety, durability, serviceability and minimum maintenance costs during the entire lifetime - according to German codes, 100 years for all engineering structures. Deterioration of bridge structures is accelerated due to their exposure to adverse environmental conditions, particularly the use of de-icing salts, increasing traffic volumes and loading. With increase in the numbers of bridges and engineering structures, maintenance costs are rising steadily, putting an ever-increasing burden on the shoulders of the taxpayer. That in effect has been draining financial resources of the projects, something which has otherwise been dedicated to improve the road infrastructure. In 2004 the German government spent € 300 Mio. on maintenance for the bridges of the federal motorways only, roughly 40 % of them for damages in concrete bridges, mainly corrosion of reinforcement, chloride contamination and cracks caused by erroneous design or poor workmanship.

In recent years, the Hessian Road and Traffic Authority has extended its view on life cycle costs. Located in central Germany, the state of Hessen suffers under an above-average volume of traffic, especially transit. Looking at construction and maintenance only and neglecting hidden costs, caused by e.g. traffic jams, detours and accidents during erection, would not reflect all expenses. Until recently, these additional costs could not be considered simply because there were no figures and guidelines available.