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Shear and flexural strengthening of existing bridges with textile reinforced mortar

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Abstract

Increasing traffic loads and changes in code provisions cause deficits in shear and flexural capacity of many highway bridges. Therefore, a lot of structures in Europe and North America are expected to require refurbishment and strengthening soon. This projection is based on the current conditions of many older road bridges. Many different strengthening methods have been established, all having specific advantages and disadvantages. By applying a thin layer of textile reinforced concrete (TRC) to bridge deck slabs and the webs of prestressed concrete beams the load carrying capacities of those members can be increased significantly. This new method has been investigated experimentally. The TRC layer is a combination of a corrosion resistant carbon fibre reinforced polymer (CFRP) fabric and an efficient mortar. In this paper, the strengthening method and the test results obtained at RWTH Aachen University are presented.

Keywords: existing concrete bridges, textile reinforced concrete, carbon fibre reinforced polymer, shear strengthening, flexural strengthening, experimental investigation.

1 Introduction

A functioning road system and an intact infrastructure enable a high level of mobility and an efficient transportation of goods. Bridges are essential for the infrastructure. For example, the German Federal Highway System comprises about 39,000 bridges. In terms of the road surface area of these bridges, almost 90 % are made of reinforced or prestressed concrete [1]. The demands on existing bridges have been increasing over the past decades and are expected to further increase in the near term, particularly due to heavy goods traffic [2]. Moreover, many of these bridges were built according to technical standards of the 1950's to the 1970's (Figure 1). From today's point of view, the then applied load models for trucks according to DIN 1072 [3] are too low and therefore lead to design deficits in the structural assessment [4].

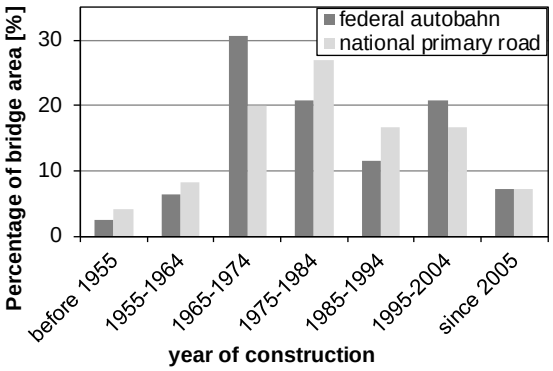

Figure 1. Age structure of the bridges (Germany) [1]

The traffic volume increased by more than 500 % between 1980 and 2010 (Figure 2). Additionally, more heavy haulages and unapproved excessive charges lead to bridges loaded to their design capacity or beyond. Due to a persistent increase in transport performance, the amount of such bridges grows every year (e.g. [1], [2], [6]).

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