

UPGRADING OF EXISTING BRIDGES WITH CFRP PRESTRESSING SYSTEM – RECENT POLISH EXPERIENCE

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SUMMARY

The paper presents a recent Polish experience of applications of strengthening bridges using prestressed CFRP strips. Within the framework of the domestic R&D project the new CFRP prestressing system has been developed at the RUT in cooperation with the Tines Composites, Poland. The system relies on patented steel anchors (CFRP plate end is simultaneously bonded and bolted inside special steel pockets) that are attached to the substructure with high-strength bolts or anchors, following prestressing the strip with a relevant tensioning device. In the scope of the R&D study the actual RC and steel bridges proof tests before and after the strengthening were also carried out. The results of the bridge testing proved the strengthening efficiency. Moreover, the paper presents another case studies revealed the effectiveness of the new prestressing system, which seems to be reliable and easy to use for bridge applications.

Keywords: *Bridge Strengthening, CFRP Strip, Prestressing System, Site Application, Testing.*

1. INTRODUCTION

One of the most important challenges in contemporary civil engineering is maintenance and keeping in service aging and deteriorating infrastructure. Bridges are a large part of this infrastructure and nowadays, for instance in Poland, lots of them are older than 50 years, especially within local roads. The increase of live loads and deterioration during service and harsh environmental conditions cause the need for retrofitting or rebuilding of existing bridges.

One of the modern solutions for strengthening bridges is using composite materials, such as CFRP (Carbon Fibre Reinforced Polymer) strips or sheets to improve their flexural or shear capacity. Thanks to many advantages, like high strength to weight ratio, ease of transport and installation, excellent fatigue characteristics and non-corrosiveness thus high durability, CFRP strips can be considered as a good alternative for structural strengthening. Research in this field have been conducting for over 30 years and during this time lots of research reports and state-of-art reviews have been published, i.e. [1], [2], [3]. At the beginning passive externally bonded laminates were considered as a strengthening solution. The first application of CFRP strips for bridge strengthening was carried out in 1991 in Ibach near Lucerne, Switzerland [4]. In Poland this technology was implemented six years later to strengthen the RC bridge over the Wiar river in Przemyśl, in the south-east part of Poland [5], [6].

In recent years, extensive research has focused on strengthening of bridges by using prestressed CFRP strips [7], [8], [9]. By prestressing the CFRP strip, which combines benefits of passive bonded CFRP strip with the advantages due to external prestressing, the ultra-high tensile strength of carbon fibre composites can be utilized and much higher effectiveness of the strengthening technique is achieved. A greater CFRP's tensile capacity is employed and it contributes to the load carrying capacity of the strengthened structure under both service and ultimate conditions.