

FRP BARS FOR REINFORCED CONCRETE: MAIN CHALLENGES OF TECHNICAL ASSESSMENT

Ana LOURO^{1a}, Susana CABRAL-FONSECA^{1b}, João FIRMO², João FILIPE^{1c}

¹ National Laboratory for Civil Engineering, Portugal
email: ^a analouro@lnec.pt, ^b sbravo@lnec.pt, ^c jfilipe@lnec.pt

² University of Lisbon, Instituto Superior Técnico, CERIS, Portugal
email: joao.firmo@tecnico.ulisboa.pt

ABSTRACT

Fibre-Reinforced Polymer (FRP) bars are increasingly being recognised as a viable alternative to traditional steel reinforcement in concrete structures. They typically consist of high-performance fibres such as glass, carbon or basalt embedded in a polymeric matrix. These materials exhibit distinct mechanical properties, behaviour and durability characteristics that set them apart from conventional steel reinforcement. The advantages of FRP bars include their non-corrosive nature, lightness, non-magnetic and non-conductive properties and the potential to significantly reduce maintenance demands over the service life of a structure. However, the adoption of these materials comes with some challenges, such as their low ductility and stiffness when compared to steel rebars. The bond behaviour between FRP bars and concrete differs significantly from steel-concrete behaviour, especially due to the wide range of FRP rebars surface finishes currently available in the market (e.g. sand coated; ribbed). It is therefore important to characterise their performance and durability as to guarantee they have sufficient bond strength, since it's critical to structural integrity. Additionally, the brittle nature of FRP bars makes their use in seismic regions a key area of concern. Despite their resistance to corrosion, and depending on the matrix that is used, FRP bars can degrade when exposed to harsh environments, such as high alkalinity or elevated temperatures. Accurate prediction of long-term durability through accelerated ageing tests remains a significant challenge, emphasising the need for continued research and development to ensure a reliable performance in a variety of conditions. Finally, unlike steel, which is subject to widely accepted product standards, FRP bars are governed by a complex and diverse set of national and international guidelines. Despite the comprehensive lists of test methods and material specifications to support design and construction guidelines available worldwide, also multiple design codes (some very recent) make the evaluation and use of these materials for structural applications a complex process. This paper intends to summarize the main technical/regulatory challenges that the use of FRP bars in reinforced concrete still presents, due to its unique properties and the fact that it is not possible to apply the same performance requirements as for conventional steel reinforced concrete.

KEYWORDS

FRP bars; reinforced concrete; technical assessment; regulation and compliance.