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EXPERIMENTAL ASSESSMENT OF THE DURABILITY OF BONDED-IN ROD JOINTS USED IN THE REHABILITATION OF TIMBER STRUCTURES

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ABSTRACT: This paper describes the investigation carried out to address existing concerns about the reliability of bonded-in rod joints used in the rehabilitation of timber structures. The investigation assessed the influence of service temperature and humidity, timber species, realistic load history and applied stresses on the performance and durability of two commercial two-component structural epoxy adhesives, as well as their effect on bonded joints. From the investigation it was possible to develop a novel method to assess the long-term behaviour of bonded joints between timber and various adhesives and connecting materials suitable for timber structures rehabilitation. The data collected so far using the RPAT (realistic performance assessment test) appears to indicate that the developed method is assessing correctly the end-use performance for different adhesives as well as for different timbers.

KEYWORDS: Timber, epoxy, bonded-in rod joints, durability

1 INTRODUCTION

Rehabilitation of buildings has an increasing economical and social importance in most European countries. The choice of the method employed is influenced by a number of factors, such as, location, structural requirements, access limitations, fire resistance, aesthetics, cost and the degree of intervention accepted. Current interventions often involve total replacement of the damaged timber by new elements, instead of their recovery, even when that would be preferable, mostly due to the lack of knowledge of alternatives.

Rehabilitation/restoration systems involving bonded-in rods represent an efficient alternative method for the repair and/or reinforcement of both new and existing timber members. These restoration systems have several advantages over traditional repair techniques, namely: they minimise the disturbance to the building and to its occupants during the intervention; have low mass; are applied quickly and with minimum personnel and plant requirements; are versatile; have the potential for introducing "like-to-like" timber species and grades; the completed work is structurally efficient and aesthetically pleasing.

However, in spite of their advantages, their use is still restrained by the lack of knowledge about their long-term durability. The investigations undertaken thus far on repair and reinforcement techniques involving structural adhesives have been associated, essentially, with practical aspects of design and execution. In order to correct this situation it is necessary to gather, in particular, more knowledge about their long-term performance and durability. However, reliable and realistic accelerated ageing tests do not yet exist, and the application of the existing European or national tests and performance requirements standards to epoxy bonded products are much too penalising, since they merely impose severe conditions that are not verified in service although these may be suitable for other adhesives, namely for phenolic and aminoplastic adhesives.

The European Committee for Standardization (CEN) has already identified the need for development of standards for the evaluation of bond durability and long-term performance of epoxy adhesives, but so far, no standards have been published. To address these concerns a procedure to assess long-term behaviour of bonded-in rod joints was developed. This paper describes the test procedure developed and presents the results of the experimental campaign.

2 MATERIALS AND METHODS

The test method developed to assess and predict the long-term durability of bonded-in rod timber joints consisted of submitting loaded test specimens to natural or artificial accelerated weathering, and then to assess

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