

ASSESSMENT OF NATURAL AND ARTIFICIAL AGEING OF GLUED LAMINATED TIMBER. CORE DRILLING, SHEAR AND DELAMINATION TESTS

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ABSTRACT: This paper describes the results obtained on glued laminated timber beams of maritime pine, with and without preservative treatment, exposed to natural outdoor environment as well as to artificial weathering. The assessment of glue lines' degradation due to ageing was investigated through the extraction and testing of core and block shear specimens, and delamination tests. The results highlight the different performances of glulam made with various preservative treatments and cure temperatures, in terms of the measured delamination and shear strength after the ageing process. They also show that shear testing of drilled cores may be a promising tool in the assessment of glulam structures on site.

KEYWORDS: Glued laminated timber, ageing, delamination, shear strength, core drilling

1 INTRODUCTION

As in any type of structure, monitoring of glued laminated timber structures in service is essential to check their conditions and to prevent premature degradation and failure. This is particularly important for structures exposed directly to atmospheric agents.

However, a large amount of glued laminated timber structures is not inspected regularly. In many cases, owners are not fully aware of this need, especially if they have little experience in timber construction and do not realize that even a simple visual inspection may detect potential problems at an early stage of the degradation process, allowing corrective actions to be taken in time.

Glued laminated timber structures in service often show considerable delamination, raising distrust. Recent collapses in large structures of various materials [1, 2] stress the importance of design, detailing, fabrication, inspection and maintenance to guarantee their safety. Regarding glued laminated timber structures, it is necessary to understand the glue lines degradation: why they occur, how to detect them and how to quantify the associated loss of strength.

Degradation of bonded joints may not be detected with a simple visual inspection, not only because of its often microscopic nature, but also because visual access to the degraded area may not be possible. However, besides visual inspection, no other reliable methods are yet available to assess their structural integrity in service.

In the scope of a PhD program the glue lines' degradation was investigated, as well as some methods to evaluate their performance in pine glued laminated timber in service. This paper describes the results of delamination tests as well as the extraction and testing of core and block shear specimens.

2 MATERIALS AND METHODS

The experimental work involved glued laminated timber beams of maritime pine (*Pinus pinaster* Ait), some of which were glued after a copper azole deep preservative treatment. Maritime pine was glued in laboratorial environment with a phenol-resorcinol-formaldehyde (PRF) adhesive to produce 6 lamella beams with 0.115m × 0.2m × 1.5m. Given that cure temperature affects glue lines performance [3], untreated pine timber beams were cured at either 20°C or 45°C. Treated pine timber beams were cured at 45°C.

Natural and artificial weathering were applied to beams from all types. For natural weathering, the beams were sit on a fully exposed rig placed on a flat roof of the Polytechnic Institute of Leiria, and were spaced from each other, about 0.9m above ground and oriented so that one of the vertical faces was facing South. A transparent protection coating was applied to all surfaces, as recommended in practice, to prevent premature degradation. No other protective measure was

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