SWIMMING-POOL BUILDING MADE WITH X-LAM PANELS

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ABSTRACT: Cross-laminated timber panels (X-Lam panels) are produced for structural use in Service Classes 1 and 2, in accordance with Eurocode 5 and no producer have been able to certify for use in Service Class 3. The swimming-pools are known to be buildings with high hygrometry and the paper describes the use of X-Lam panels in such use, following a project completed in 2012, in Portugal. X-Lam panels are used within the building, through visible surfaces in walls and ceilings. Constructive solutions are presented in order to discuss the way to deal with the service conditions of the building and two years of continuous monitoring are also presented to analyze the validity of design options.

KEYWORDS: Service Classes, Use Classes, CLT

1 INTRODUCTION

Cross-laminated timber panels (X-Lam panels [3]) have been used extensively in Europe since more than 10 years in high demanding projects, fascinating and gathering people to timber construction. High-rise buildings already erected (till now, up to 10 floors) are used to demonstrate the reliability of this product. New limits were established for timber construction, entering into concrete and steel domain.

Within the range of moisture variations expected for Service Classes 1 and 2 (according to the definition given by Eurocode 5 [1]), dimensional variations, influenced by swelling and shrinkage of the panels, are at negligible level for in-plane deformations. This behavior can be explained due to the orthogonal disposition of the bonded layers. However, higher moisture contents are not allowed by Technical Approvals and therefore special attention should be taken in Service Class 3.

Façade walls or other elements with probability of high-moisture exposition are protected with cladding, painting or any other effective protection, avoiding to be classified in Service Class 3.

The project to be described in the paper is a swimming-pool building completed in early 2012, in Almada, Portugal. The building is characterized by having visible X-Lam panels in several areas, namely, the dressing-rooms, showers rooms and swimming-pool hall. The high level of hygrometry inside the building is being continuously monitored and the first year of results have already been reported [6].

2 THE PROJECT

The building integrate a 25m in-door swimming-pool and a gym with overall cost of 1,750,000€ and a construction area of 2,145 m². The panels were produced by the Austrian company KLH and transported by truck to Portugal.

The gym floor is composed by a flat slab made with 245 mm thick panels, supported on pairs of round steel columns arranged on a square mesh layout with 6 m side. At the top of each column is placed a steel plate to reduce stress compression perpendicular to grain. The panels are visible on both sides, and no thermal insulation was needed. A balcony surrounds the building (Fig. 1), made by a row of panels, in which each panel is half exposed to indoor conditioned environment and the other half is outdoor ceiling (in cantilever). The swimming-pool roof structure is composed by steel trusses, supported by 128 mm thick X-lam wall (Fig. 2). Whenever there are openings below, thicker panels were used in order to perform as a beam lintel. The ceiling of the roof is made by X-Lam panels suspended from the steel trusses.

Figure 1: Point supports on X-Lam panels.
The high level of water vapor production inside the building is a permanent concern and continuous monitoring is being made in order to control moisture content in the panels. Several French ‘Avis Technique’ doesn’t allow the use of X-Lam panels on swimming-pools due the high higrometry inside the building [4][5].

Prior to finishing coating with varnish painting, it was applied a preservative treatment for use class 3A, according to EN335-1 standard [2]. Nevertheless, the use class within the building doesn’t exceed 2, and this measurement is taken as redundancy for durability purposes. For more effectiveness on the treatment, pine specie was used in order to have higher treatability in comparison with ordinary specie used in Europe (spruce or fir). The pine has also higher natural durability.

Several constructive measurements were taken to improve durability. Example is given in Fig. 3 for the wall fixing under the concrete basement, where a short concrete wall was previewed against raising water. The paper should present several other details, namely, suspension of panels in the swimming-pool ceiling, support of steel truss on X-Lam wall, balcony fixing around the building and the flat slab for the gym.

![Figure 2: The roof of the swimming-pool [6].](image)

![Figure 3: Detail for wall fixing.](image)

### 3 CONCLUSIONS

Despite initial concern by the owners and the managers of the swimming-pool, on the massive use of timber in such building, till now no relevant pathology was found. The temperature and relative humidity revealed to be under the expected values for service class 1 and 2. For some periods, the values were exceeded, but redundancy measurements taken, expected to contribute for the good health of the timber structure. Initial measurements were presented previously in [6], but additional evaluations will be available for discussion in this paper, namely, some opening joins between panels due to shrinking of panels.

### REFERENCES