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Behavior of Waterproofing Systems Exposed to Environmental Agents

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1 Introduction

The waterproofing layer of the roof system can be considered as a building protection system since it prevents harmful actions of water as well as aggressive elements of the atmosphere (Gonçalves, Silvestre, de Brito and Gomes, 2019). These systems are composed of materials that are susceptible to temperature actions due to its thermoplastic characteristic (Bertolini, 2014). Therefore, in this work, the main objective is to analyze the bonding behavior of waterproofing materials applied in a concrete substrate submitted to weathering actions by temperature, air, and wetting.

2 Methodology

This work evaluated the behavior of waterproofing systems when submitted to wetting and drying cycles. In the experimental study, four waterproofing systems adhered to the substrate were evaluated: acrylic with and without polyester mesh, polyurethane, and bituminous. The specimens were submitted to the aging process by wetting and drying cycles, placed in a forced air circulation oven at a constant temperature of (70 ± 1) ºC for 48 hours and then placed in a water vat at (23 ±1) °C for 24 hours. So, each cycle corresponds to 72 hours.

Visual analyses were performed at each phase of the cycle. The test was performed in 0, 4, 8 and 16 cycles. The pull-off test was made at the end of these respective cycles.

3 Results and Analysis

3.1 Visual Analysis

Throughout each cycle, the tests are visually analyzed on the specimens. The following changes were observed: microbubbles, air bubbles, apparent pores softening and disbonding.

3.2 Pull-off Analysis

Test results show that all waterproofing systems presented a decrease in adhesion strength in the substrate. Acrylic membrane systems performed better on substrate than other systems.

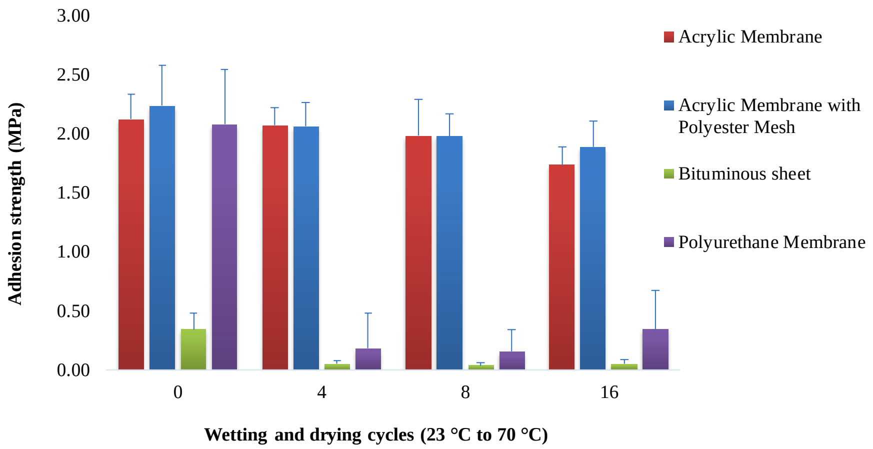

Figure 1. The standard deviation of each waterproofing system.

It is noted that the behavior of the bituminous and polyurethane systems proved to be very sensitive to temperature and wetting cycles. It is noticeable that the bonding of the bituminous sheet is the lowest among the other systems, even when it is in cycle 0. When in cycle 0 the resistance of the polyurethane system was considerably elevated concerning the other systems, but throughout the cycles of weathering, it lost this initial behavior.

4 Conclusions

The adherence of the acrylic membranes to the substrate is less influenced by weathering cycles than other systems. In addition, the use of reinforcement mesh does not influence significantly in this pattern. Despite the high adhesion strength of acrylic membranes, it was observed over the cycles the manifestation of air bubble disrupted and microporous. This may compromise the system in terms of watertightness. The polyurethane membrane system and the bituminous sheet system lost their bonding characteristic to the substrate after 4 cycles. In view of this behavior, it is necessary to evaluate previously the place where it will be applied; therefore, it is not indicated for regions susceptible to severe weather conditions, such as cycles of intensive rain and extremely high temperature. The results demonstrate the importance of the thermal protection layer in waterproofing systems that will be exposed to weather cycles. Moreover, a special attention should be taken in the design and execution of this layer.

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