Experimental analysis of the rising damp by the comparison between different geometrical configurations: mono and multi-blocks of carparo and pietra leccese

Experimental analysis of the rising damp by the comparison between different geometrical configurations: mono and multi-blocks of *carparo* and *pietra leccese*.

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Summary: The rising damp is the principal cause of the deterioration of the masonry in the existing constructions. Since *carparo* and *pietra leccese* are the most used materials in southern Italy, this study aims to underline the trend of the rising damp for the two building materials considering mono and multi-block configurations. All analyzes were developed with and without the influence of the Domodry® system.

Introduction

The phenomenon of rising damp is very common in historic buildings. Several studies analyze the rising damp phenomenon. The maximum height reached by humidity depends on the weight of three factors involved: water supply from the ground, water evaporation and from the characteristics of building materials (quantity and size of pores, pore connectivity, etc.). The variation of one or more of these three factors determines a different ascent height [1]. The study [2] carried out several numerical simulations considering several thicknesses ranging from 20 cm to 1.00 m and different compositions (two kinds of limestone and two kinds of Granite). The capillarity is a phenomenon that regulates rising dampness in a wall [3]. The water, subject to the capillarity, rises through the ducts, naturally present in the subsoil, until it meets with different construction materials. The heights reachable by the rising damp is equal to 15 m. The presence of different materials with different pore sizes, such as cement mortar and bricks, limits the height to one or two meters. The presence of salts [4] influences the height at which water rises into the wall.

The common materials, such as *carparo* and *pietra leccese*, are very porous and the phenomenon of rising damp is facilitated. This study puts in evidence the difference between these two materials with geometrical configurations.

Experimental analysis

The aim is to analyze the phenomenon of rising damp on the initially dry samples that are subsequently positioned into a freshwater tank, monitoring the phenomenon starting from the initial moment of capillary rise.

The day before starting the experimental analysis, the samples are placed in the dry tank, to allow acclimatization and stabilization of the surface temperature. The positioning inside the tanks involves the use of a support that allows the wetting of the lower base of each column.

To check the microclimatic conditions around the columns, a data logger has been placed near the sample. A daily replenishment of the water in the tanks was carried out to maintain the constant level of immersion of the column base (3 cm). Through continuous monitoring, based on a close sequence of thermographic shots and weighing at defined time intervals, it has been possible to have a qualitative and quantitative result of the water propagation inside the columns.

Figure 1 shows an example of visible imaging and thermography of *pietra leccese* and *carparo* for mono-block and *carparo, pietra leccese* and *tuff* for multi-blocks.

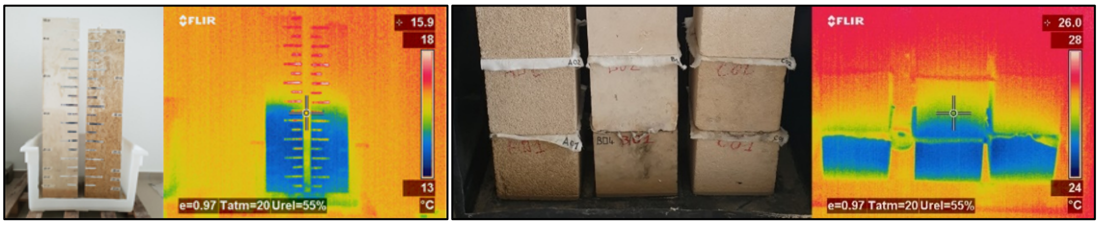

Figure 1: example of visible imaging and thermography of *pietra leccese* and *carparo* for mono-block and *carparo, pietra leccese* and *tuff* for multi-blocks.

The analysis has been done for two monolithic blocks, a *pietra leccese* block of 100 x 20 x 20 cm^3 and *carparo* block of 95 x 20 x 20 cm^3. At defined time intervals, the following actions have been taken: shooting of visible and thermographic images, weighing of each block, reintegration of water in the tank and graphical representation of the absorption curves.
The same analysis has been carried out for the multi-blocks case. The three samples consist of 10 blocks (20 x 20 x 20 cm^3) in *carparo, pietra leccese* and tuff. The contact between the blocks has been made with a suitable absorbent material (cotton fabric), in order to guarantee a good contact surface. The blocks and the cotton fabrics are numbered from bottom to top and each block has been weighted before and during the rising damp phenomenon, in order to evaluate the amount of water absorbed at different heights and to reposition everything in the same position.

Results and discussions

This study points out the first month of the analysis for mono and multi-blocks (Figure 3). The mono-block is analyzed from 15th January 2019 to 14th February 2019, while the multi-blocks block from 5th July 2018 to 31st July 2018. It is possible to note that the materials are strongly susceptible to rising damp, in fact, there is an exponential increase in the height of rising damp from the first day.

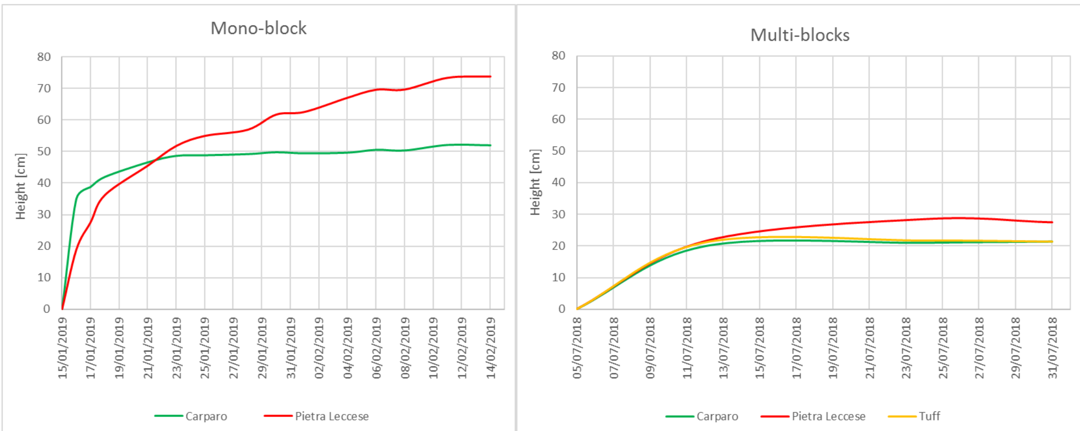

Figure 3: Mono and multi-blocks: height of rising damp during the first month.

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