

DURABILITY OF MOLASSE CONSOLIDATED WITH ETHYL-SILICATES

Molasses are the most important material in stone built heritage in the whole Swiss plateau. These stones contain swelling clays, which makes them particularly susceptible to weathering. More specifically, dimensional changes of clays resulting from humidity changes can lead to cracking and scaling. In the context of altered monuments, swelling clays also deteriorate the products used for the stones restoration very quickly.

Swelling inhibitors are specific chemicals that have been shown to potentially extend the durability of consolidation treatments applied on molasses by inhibiting the swelling of clays. However, such products are viewed with skepticism because of past experiences with materials successfully tested under laboratory conditions but then showing poor performance on site.

We have developed a special approach to address this concern in a way that is more relevant for the on-site practice compared to standard laboratory testing procedures generally used. Our methodology is characterized by a multi-perspective approach, which includes three complementary steps: on-site monitoring, laboratory testing and statistical analysis of the results.

For this purpose, we have designed sensors for on-site application capable of quantifying the water received by façades at different orientations during rain events and studied the application of wireless sensors for the characterization of the distribution of liquid water in the stone blocks.

Through a careful characterization of the local climate and parallel response of the material, we identify the combination of conditions that are most critical for the degradation of the stone and more challenging for the durability of consolidation treatments.

Once these critical cycles are characterized, they are faithfully reproduced in the laboratory on a machine specially built for the purpose, allowing for a realistic testing of the selected treatments. The machine for laboratory testing of large samples has been designed bearing in mind the characteristics of the weathering phenomenon on-site. Rain events can be reproduced faithfully regulating drop-size distribution, and quantity of water hitting the façade (wind-driven rain intensity). Different wind speeds and exposures to sunshine can be also reproduced by means of fans and infrared lamps. The acceleration of the degradation results from the increase in the frequency of the critical cycles rather than from an exaggeration of the intensity of the degrading agents.

Our project should therefore deliver novel and more representative information of material performance on-site, establishing in what conditions the consolidation treatments are worth applying and whether or not swelling inhibitors should become part of the solutions for better preserving molasses in Swiss monuments.