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Enhanced affordable methods for assessment of material characteristics and consolidation effects on stone and mortar

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In situ considerate testing of surface cohesion of historic stone and mortar materials suffers from a lack of suitable affordable non-destructive methods. The problem is mainly important for assessment of surface degradation characteristics and/or evaluation of effectiveness of consolidation treatment of degraded historic materials. The paper presents two innovations of simple testing methods which provide reliable data on material cohesion and water uptake.

The so called "Scotch Tape Test" or peeling test has been introduced into the field of conservation for testing the cohesion qualities of historic materials mainly stone and renders in sixties without any standards or reliably verified recommendations for the above mentioned application in the conservation practice. Licentious use without adequate knowledge and sufficient understanding leads to non-comparable and non-reproducible as well as in many cases incorrect and severely biased results and assessments. Therefore, the authors after a research and comparative testing have established limits for its application, reliable procedures and a "standard" protocol for testing of cohesion characteristics of brittle and quasi brittle materials mainly mortars and stones. This article presents a detailed analysis of the peeling test procedures, and suggests recommendations for performing peeling tests and for evaluating the obtained results.

Also in situ testing of material water uptake is a very basic and indispensable technique in conservation practice and it correlates significantly with some other material characteristics. The capillary properties of porous materials can be measured in situ using a Karsten tube and modified tools or methods which are quite cumbersome, and cannot be performed on inclined surfaces, e.g. vaults or ceilings. There are other difficulties with Karsten tube measurements, e.g. problems with fixing a heavy glass tube on vertical surfaces, a need for two operators, and soiling of the surface by the sealing putty. An innovative method has therefore been developed and tested at ITAM AS CR for measuring water absorption under low pressure. It enables continuous or manually controlled electronic measurements of water infusion into the surface and recording the acquired data. This measurement procedure reduces the number of operators, and it is more precise, more effective and faster. Two prototypes will be presented: one for continuous laboratory measurements and a portable device for in situ applications. The portable device has been tested in laboratory conditions and also in situ for its basic performance on various types of stone and plaster surfaces, including treated and untreated historic materials. The acquired data was evaluated using software specially written for this purpose in MatLab, and the results were compared with standard capillary water uptake measurements on prismatic columns. Working with the innovated tubes, measurements can be made on complex stone or plaster surfaces, e.g. sculptures in a dense network. This feature is especially appreciated by restorers making interventions on materials that have been treated previously.