Repair mortar –porous limestone compatibility: an overview of physical properties

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The compatibility of stone and repair mortar is a key issue in the longevity of restoration works. The mortar and stone used in heritage structures can differ in many aspects, in appearance (surface roughness, colour, texture, etc.) in physical properties (density, porosity, strength, etc.) or in composition (mineralogy, chemistry) and any of these differences can contribute to the loss of stone or historic mortar. The current research focuses on the physical properties and tries to outline and compare the properties of porous limestone with different types of repair mortars. A Miocene porous limestone and four different types of restoration mortars were tested. The Miocene limestone is an important “heritage stone” since it is found in historic buildings of Budapest and other cities throughout Hungary and in the surrounding countries of Central Europe such as Austria, Slovakia, Romania and the Czech Republic. The tested stone belongs to the one that occurs near Budapest at Sóskút quarry. It was used for the construction of bridges, fortresses and public buildings, as well as terraced houses. The tested repair mortars are commonly used in the restoration practice for repairing this porous stone. The compatibility tests focused on bulk density, porosity, ultrasonic pulse velocity and compressive strength. Cubic specimens of 3 cm in size were casted and tested 3-360 days after casting. Mortar with added limestone sand filler (50wt%) and pure repair mortars were tested. The results of the tests were compared to the ones of the porous limestone. These experiments have verified that most of the studied commercially available repair mortars have higher strength (10-20 MPa after 28 days) than that of the porous limestone (5-7 MPa). Adding 50wt% of porous limestone sand filler reduced the strength of the mortar but the required loss in strength was still not obtained for the higher strength mortars. The ultrasonic pulse velocity readings show the same trend, higher values were recorded on mortars. In terms of porosity and pore-size distribution most of the studied mortars had lower porosity (26-36%) than the porous limestone (34-38%) and the pore-size distribution was also different. 50wt% of limestone filler mostly increased the porosity of the repair mortars, but with this increase required rate of changes in pore-size distribution were not achieved. Our experiments have proved that the tested commercial repair mortars are not compatible with the highly porous carbonates and the assessment of the physical compatibility and durability require long-term monitoring of physical changes. The research was financed by Hungarian National Research, Development and Innovation Fund (K 116532).

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