Understanding the porosity linked to the deterioration of construction samples product salt crystallization by micro computed tomography. Study case Ibarra, Imbabura.

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Abstract

Due to the importance of preserving structural integrity, the damage observed in different constructions around the world caused by salt growth was studied from the perspective of a pore distribution analysis through the implementation of micro computed tomography. Thirty different samples, taken from the city of Ibarra, Imbabura, Ecuador, were classified in concrete, cobblestones, clay bricks and lava rocks. With the use of micro computerized tomography, samples were reconstructed digitally and processed to obtain information on size, shape, distribution and location of pores in each sample. This method proved very reliable for determination of macropores (>50 nm) and mesopores (> 2 nm and < 50 nm) but did not have enough resolution for microporosity (< 2 nm). Results showed that concrete and cobblestone samples mostly had the largest pores. The resolution limit from this method could detect pores down to 20 μm. Clay brick samples seemed to have the least number of pores, yet, under closer analysis, these samples presented pores even smaller than 5 μm. It was confirmed that the method of computed microtomography is more reliable for concrete samples, in particular, by comparing these results with an estimation of porosity by a variation of the Archimedes method to calculate the porosity density. Additionally, it was possible to relate the shape of pores with their size and position along the sample, finding that the smallest pores were generally more spherical and in greater proportion to large irregular pores. In conclusion, it was determined that surface pores were formed due to salt deterioration and the damage caused to the structures, though initially observed as merely superficial, can go into much larger depths. Materials with a finer porosity such as clay bricks, seem more affected by damage of salt growth.

Key words:

Salt weathering, Concrete, Cobblestone, Clay Bricks, Lava Rocks, Construction materials