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The ultrasonic technique for in situ investigations on stones: suggestions for uses

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The Ultrasound Pulse Velocity (UPV) is one of the main non destructive techniques to detect both in laboratory and in situ the stone decay and many international papers of the recent years deal with its application. This technique is often executed in laboratory, where the possibility to keep constant the environmental and test conditions are a guarantee of the reliability of the results.

It is known in fact the UPV are mainly conditioned by the following factors:

- the characteristics of the stone tested (not only petrographic properties such as texture and structure, but even specimen dimension and water content);

- the transducers features such as frequency, divergence angle , near field and wavelength;

- external climate factors such as environmental temperature, humidity.

In spite of the many factors affecting the measurements, UPV performed in laboratory is well correlated with mechanical strength of the stone , with its porosity and, as consequence, it is a reliable technique to detect the durability of a stone.

On the other side, for in situ UPV test it is important to take into account that the measurement uncertainty is affected by the unknown water content in the stone. From tests performed on different rocks (marble, limestones, travertines, granites, gneiss, schists , sandstones) , the ratios between UPV tested in dry and saturated conditions can be > 1 or < 1 depending on the porosity .

On the base of the results obtained, in this paper suggestions for UPV measurements in situ have been advanced concerning: the importance of the petrographic characterization of the stone in order to choose the suitable measurement frequency; the correct choice of transducers frequencies; the use of a reference slab, with a known UPV in dry conditions, to be exposed in the investigated site some days before the in situ tests, in order to appreciate the UPV variation due to climate factors.