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Solving real decay and conservation problems of building materials by ultrasounds technique

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In this study a variety of case studies and different building materials in which ultrasounds velocity played a significant role are shown, either to characterize building materials, to measure deterioration, to assess conservation techniques or for preventive purposes.
Regarding to materials properties, ultrasounds velocity provided interesting indices such as the quality index (useful when selecting replacing materials, materials for new constructions or either for sculptures); alteration index (very much related to pores and voids, and fissures); mechanical strength (assessing its reduction when materials are affected by several decay processes, being fire one of them) or anisotropy indices, which highly condition the decay of elements and materials in buildings and sculptures, and which vary themselves with decay progress.
The technique is also a tool for detecting and locating elements inside structures, like metallic ones, and also to detect and locate discontinuities inside elements, both for consolidation purposes or even in cases of structures movement, which is quite common nowadays. Using some specific software, ultrasounds results can be plotted as iso-areas, which allows to define areas or zones of structures with the highest risk of detachment in a short-time in order to plan the most adequate interventions.
Not new is also the aid of ultrasonics to assess consolidation products and to determine the degree of materials decay when submitted to artificial ageing.
Much more innovative is the fact that ultrasonics measurement can be also helpful to determine different building periods in a same building, even the fact of determining an element´s lifetime. The results obtained by this non destructive and portable technique that will be presented in this session correspond to both real case studies (results that helped to solve a real problem), some of them corresponding to emblematic monuments de España (Royal Palace of Madrid and some other monuments belonging to the Spanish National Heritage or Trust, archaeological structures and sculptures), and also to laboratory research to understand processes and helpful to see the best way of preservation. In some of the cases, other techniques have been used as complementary, such as sclerommetry, magnetometry and IR termography.

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