

LABORATORY: CNR-ISPC

INSTRUMENT NAME

Ultrasonic pulse velocity UPV

GENERAL DESCRIPTION:

Ultrasonic measurement is a non-invasive method to assess the state of conservation and identify internal defects of concrete structures. It is also possible, with appropriate instrument configurations, to detect the presence of layers with a different state of conservation and to determine the extent of a crack visible from the surface.

TECHNICAL DESCRIPTION:

Ultrasonic measurement was also applied on stones for the evaluation of consolidating treatments. The speed of the ultrasonic pulse depends on the properties of the medium it passes through, in particular density and elastic characteristics. The pulse is sent by a transmitting probe and acquired by the receiving probe. The probe is coupled to the surface with a material such as vaseline, ultrasound gel, plasticine such as to minimize the presence of air at the interface between the probe / surface and fa. The ultrasonic measurement can operate with different instrument configurations both for investigative reasons and for surface morphology (see figure 1). For example, the indirect method realized with increasing distance distances can be useful to identify any changes in the properties of the cement (from healthy to altered or vice versa) this change is identified at the point where the slope of the ultrasonic value curve varies as a function of the distance. There are different types of ultrasonic probes that operate with different frequencies and that allow to investigate different path lengths.

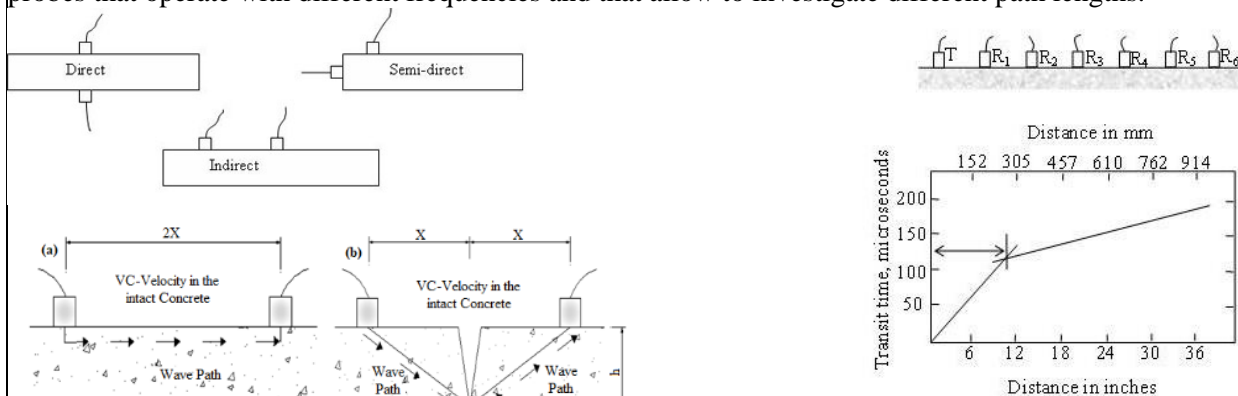


Figure 1. (left top) direct, semi-direct, indirect method; (left bottom) configuration for determining crack depth; (right) configuration for detecting changes in material properties

BASICS:

Instrumental details:

The instrument supplied is a Matest C369N equipped with 55kHz probes (Figure 2)

Applications:

Evaluation of the state of conservation and presence of layers with different state of conservation, identification of internal defects of cement / concrete structures; determination of the depth extension of fissures; evaluation of consolidating treatments on stones; the ultrasonic measurement is used as a reference for accelerated aging tests (freeze-thaw type).



Figure 2. (left) Matest C369N ultrasonic instrument; (right) in situ test at the War Memorial Tower (Torricella Peligna, CH)

FURTHER INFORMATION :

- BS 1881-203 Testing Concrete - Part 203: Recommendations for Measurement of Velocity of Ultrasonic Pulses in Concrete
- UNI EN 12504-4:2005 Prove sul calcestruzzo nelle strutture - Parte 4: Determinazione della velocità di propagazione degli impulsi ultrasonici;
- ASTM C597 – 16 Standard Test Method for Pulse Velocity Through Concrete
- M. T. A. Silva, J. H. A. Rocha, E. C. B. Monteiro , Y. V. Póvoas , E. R. Kohlman Rabbani (2018.) Evaluation of the ultrasound test for estimating the depth of cracks in concrete. *Revista ALCONPAT*, 9 (1), pp. 79–92, DOI: <http://dx.doi.org/10.21041/ra.v9i1.289>
- Wahyu Wuryanti (2019). Determination residual strength concrete of post-fire using ultrasonic pulse velocity. *IOP Conf. Series: Materials Science and Engineering* 620 (2019) 012064 doi:10.1088/1757-899X/620/1/012064
- Piotr Wiciaka, Giovanni Cascante, Maria Anna Polak Sensor and dimensions effects in ultrasonic pulse velocity measurements in mortar specimens. *Procedia Engineering* 193 (2017) 409 – 416
- Ana P. Ferreira Pinto, José Delgado Rodrigues (2012). Consolidation of carbonate stones: Influence of treatment procedures on the strengthening action of consolidants. *Journal of Cultural Heritage* 13 (2012) 154–166

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