Ultrasonic methodology in in-situ investigation of historical masonries: a theoretical-experimental experience.

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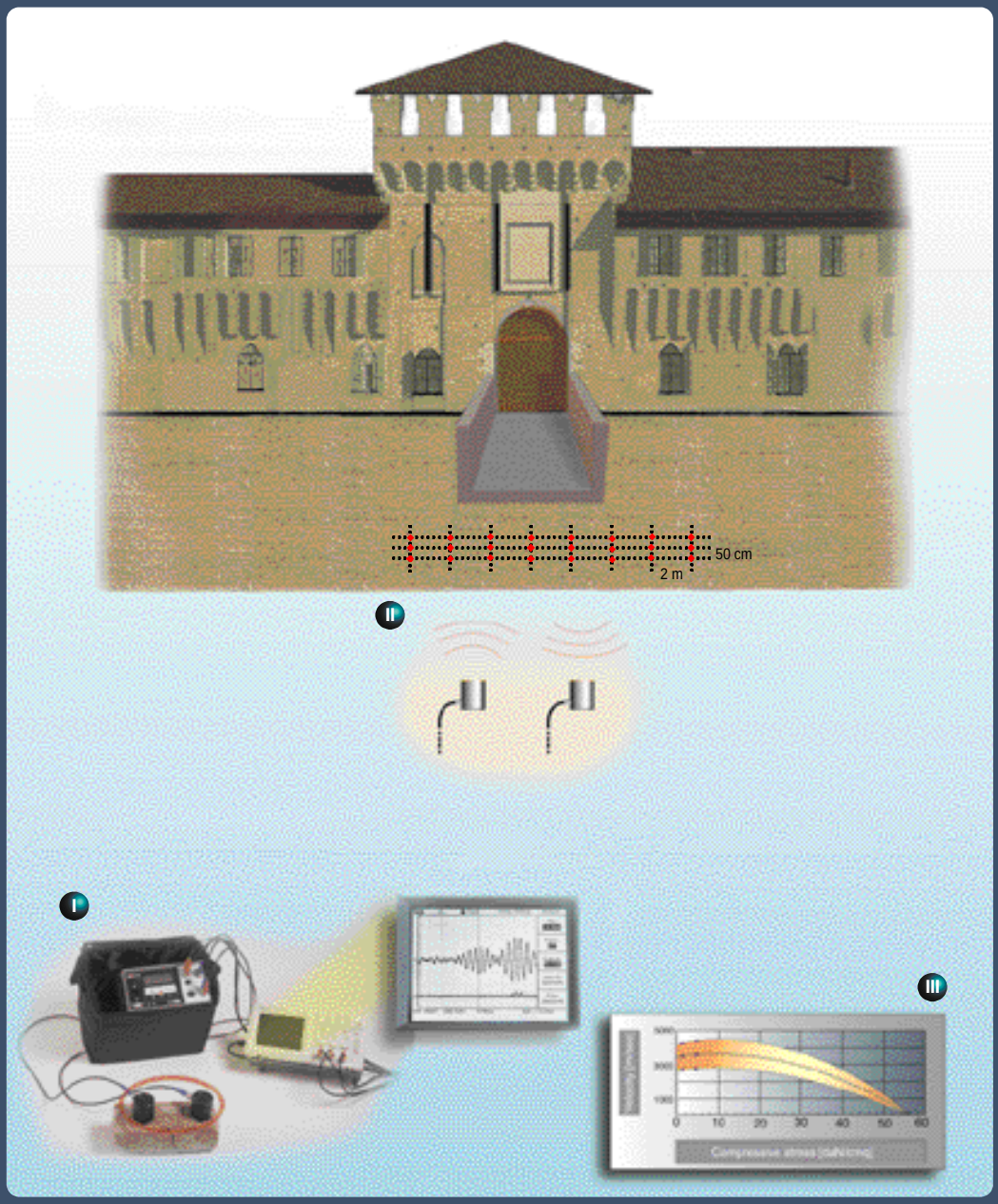

I Instruments (according to prEN 12504 - 4)

The measurement of the propagation velocity of ultrasonic pulses diffusing through the facings of the brick masonry was made possible by the use of test equipment consisting of the following electronically connected units:

- a generator of electric pulses coupled with the relevant piezoelectric transmitting probe.
- a receiving probe,similar to the transmitting probe,turning the mechanical vibrations, picked up on the surface of the wall facing, into electric signals to be amplified and synchronised.
- an electronic circuit measuring the time interval elapsing from the moment in which the pulse is emitted until it reaches the receiving probe.
- a time display circuit.
- an oscilloscope displaying the pulse shape.

II Procedure and measuring method

The determination of propagation velocity is based on the measurement of the time needed by the pulse to cover the distance between the transmitting and the receiving probe.
The technique adopted for this experimentation has been operationally defined on the basis of the reciprocal position of the probes,which is known as *indirect* or *homeosuperficial transmission*, where both probes are applied on different points of the same side of the wall facing to be characterised.
The measurement was made by using a hypothetical grid with a 200 x 50 cm rectangular mesh represented by the intersection of pre-defined courses with certain vertical alignments of the joints of the masonry's solid bricks.

III Statistical analysis of the results

The method used to investigate the statistical dependence between stress states σ acting on the masonry and velocity v of sound propagation was that of regression analysis.
Points (σ , v) were interpolated following some considerations,by sorting the velocities having the same probability values obtained from their respective distribution functions.The analysis allowed some curves to be obtained,referred to as "Stress possibility curves for compressive strains"that establish the relations of functional dependence between the observed physical quantities and that define the most probable variability range of σ and v for the masonry that has been monitored from a ultrasonic methodology.

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Fig 1:

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