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Measuring the protective role of clay-based renders in adobe masonry using thermal imaging and ultrasonic velocity imaging

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The protective role of renders in masonry is well recognized. Renders constitute a constructing tradition since clay-based masonry but they were extensively used also in stone and brick structures up to modern concrete domination. However, the parameters that are taken into account regarding renders such as thickness, composition, pathology and adhesion are mainly qualitative. Consequently, up to now the positive role of renders actually cannot be measured.

Objective

In the present work, un-rendered and rendered adobes were used as masonry units. Two different render types were used. In one case, clay and lime were combined as binders while in the other cement was used. The techniques applied to measure the final pathology were ultrasonic velocity imaging and thermal imaging.

The aim is to suggest a methodology which can measure the deterioration and give a quantitative rather than qualitative evaluation.

Samples

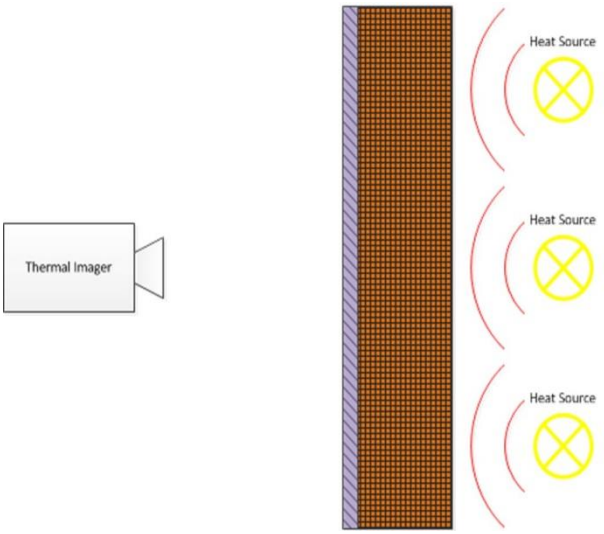
In masonry units consisting of clay bricks (adobes) of 12×10×25cm two types of renders were applied. One was clay-based and the other was cement-based. The thickness of the renders was 7-10mm. The pathology of the clay renders was different in order to record the velocity propagation as well as the thermal behavior of the brick-render system. For that reason capillary cracks are present in some renders and in other case the adhesion of the render to the brick is loose.

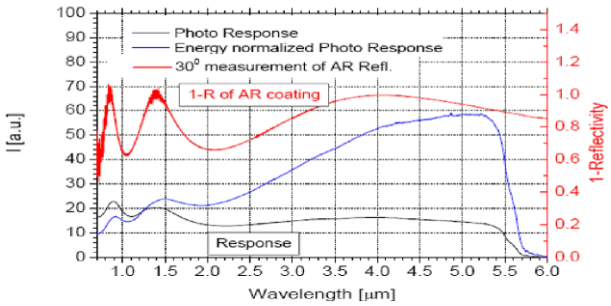
Sample of the clay bricks (adobes). Sample P1.

Sample of the clay bricks (adobes). Sample P3.

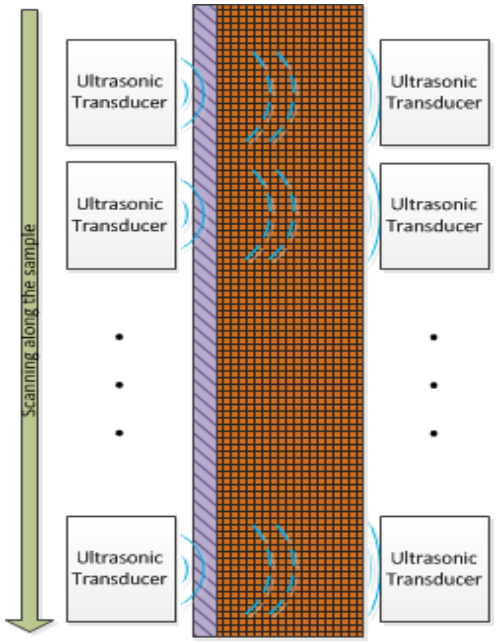
The Methods

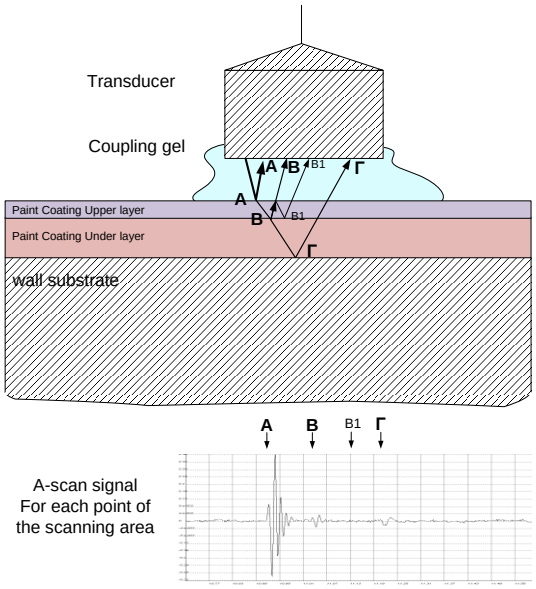
1. Thermal imaging





2. Ultrasound P/E or Transmittance





Application

Application of the renders on the masonry sample.

Scanning the masonry.

Results

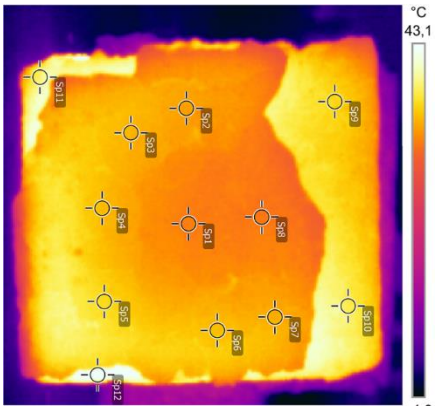
Sample	Render case		
P1	Un-rendered	Compact clay render	
m/sec	1014,52	1428,62	
P2		Clay render with cracks	
m/sec	1075,01	1248,66	
P3		Cement-based render	
m/sec	1164,39	1417,19	
P4		Clay-render with good cohesion to the substrate	Clay render with opening on the interface
	1167,01	1662	1546,4

Sound velocity in rendered and un-rendered adobes.

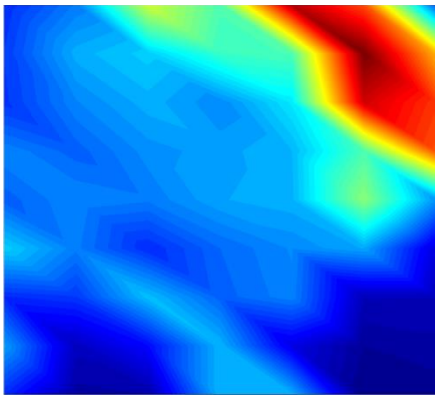
The differentiation of the thermal emission in the areas where the clay pathology presents detachments and cracks is also in accordance with the differentiation of the ultrasonic velocity at the same areas, thus revealing the differentiation of the mechanical properties of the structure in the particular areas or the alteration of its continuity.

This information is evident on the thermal images as well as the ultrasonic velocity images provided in the figures.

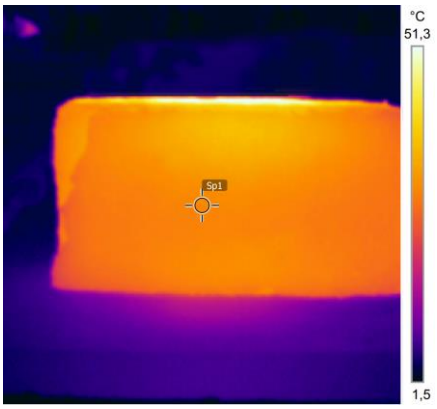
Both ultrasound velocity and thermal imaging can indicate the preservation state of the render and its compactness with the substrate. The results indicate that the methods can give measurable indications for recording the protective role of renders and their preservation state.



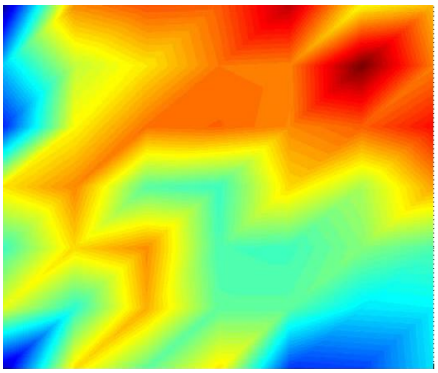
Thermal field image of the clay bricks (adobes). Sample P1.



Ultrasonic velocity image of the clay bricks (adobes). Sample P1.



Thermal field image of the clay bricks (adobes). Sample P3.



Ultrasonic velocity image of the clay bricks (adobes). Sample P3.