

# Evaluation of the Effects of Environmental Exposure on the Performance Decay of ETICS

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## 1 Introduction and State of the Art

Components in the sector of building construction require an in-depth analysis of the characteristics that determine the evolution of their performance over time, in other words the dynamics of their performance decay, as this aspect is crucial in determining the suitable maintenance strategies, considering the energetic importance and weight of maintenance activity.

The ETICS (External Thermal Insulation Composite Systems) are nowadays a very common solution, as they provide a very good thermal performance. Researchers have shown a big interest for the acknowledgement of their durability, and have mainly performed laboratory tests – especially accelerated aging tests – on them (Daniotti and Paolini, 2005), and built theoretical models for their behaviour (Daniotti *et al.*, 2014), while there is little scientific literature concerning field tests on ETICS (De Freitas, 2016).

The current work proposes a photographic and thermographic survey on a recent building complex with an envelope in ETICS, with the thermographic analysis constituting a quite original methodology relatively to the evaluation of durability for the ETICS.

## 2 Materials and Methods

The research has been carried out as a thermographic and photographic analysis on ten buildings in Naples, Italy – in Via Attila Sallustro - which have been built in 2012-2013. They are all buildings in reinforced concrete, consisting of seven floors and a total lateral surface, constituted by hollow bricks and ETICS, of 25000 m<sup>2</sup>. In accordance with the recommendations from UNI EN ISO 4628-1 code, performance decay was measured by adopting a scale from 1 to 5.

In several cases, the thermographic frames show thermal gradients – caused by detachments - also in locations where no performance decay is visible by sight or by photographic frames, nor is related to an anomaly in the superficial layers, as acknowledged through tactile contact: so, their origin has to be linked to an anomaly in the inner layers.

The photographic survey shows that the main typology of anomalies consist in cross-

shaped cracks in correspondence of some mechanical anchors, and in the form of horizontal lines, in correspondence of the contact between two adjacent panels, while thermographic frames show color – corresponding to temperature – variations both in the shape of lines, which confirm the detachment revealed by the photographic information, and in the form of diffuse areas.

### 3 Results and Discussion

After attributing a score to each of the thermographic and photographic frames, the results led to a mean value of 1.74, just below the definition of “slight symptoms”. This was highly influenced by the individuation of signals of incipient detachment between the panels through the thermographic inspection.

Statistical analyses on separate sub-groups of the sample, divided according to the cardinal exposition of the façade they belonged to, showed more homogeneous results – standard deviation was lower – and that on three façades performance decay was lower than in the fourth one, W-SW; this was assumed to be related to the its higher solar exposure.

### 4 Conclusions

The main focuses of the experimentations were, on one side, the exploration of new methodologies for durability surveys – the use of thermographic camera – and on the other side the analysis of the differences in terms of performance decay, induced on the same component, with the same stratigraphy, by different extrinsic conditions.

Concerning the first point, the usefulness of the thermographic camera for these purposes has been deeply proved, as the anomalies consisting in the detachment of the panels under the finishing layers could not be noticed otherwise; for future experimentations, it can be useful to associate thermographic inspections to partially destructive tests to ascertain the quantitative aspect of this detachment and its effects on the thermal behavior.

For the second aspect, the deep difference between the data on the first three, and the fourth façade, confirms the relevance of the micro-climatic aspects on the durability of a component, and its elaboration can be seen as an attempt of its codification, which requires, though, a wider analysis on different kinds of climates.

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