

## Global inspection, diagnosis and rehabilitation system for non-structural elements of the building envelope

### Summary

In the context of building maintenance, inspection plays an essential role in surveying the degradation condition of building elements. The systematisation of this activity contributes to a higher effectiveness of the maintenance works and, thus, to a higher durability of the buildings. This research creates a global inspection system for the non-structural envelope of current buildings. This system includes a set of knowledge about building elements and materials (defects, their causes, diagnosis methods and repair techniques) that support the surveyor during fieldwork. Although the systematisation of information on building pathology is not new, many studies are too specific. Other studies focus on the adoption and development of technologies for fieldwork, neglecting the importance of prior systematisation of information. Thus, the proposal of a global inspection system is innovative due to its scope.

To reach the proposed goals, this research used 12 identical individual expert inspection systems from the literature, each referring to a type of building element or material. These individual systems were merged, for which it was necessary to harmonise all the components that make them up, namely: classification systems, correlation matrices, detailed files and an inspection form. The harmonisation followed a specifically developed methodology, including validation. Only then was the global inspection system converted into a computer application to be used in fieldwork.

With the predetermined methodology, it was possible to define single classification lists of defects, their causes, and diagnosis and repair techniques. Each of these lists applies to most materials used in building envelopes, balancing detail and conciseness. Moreover, correlation matrices were built, reflecting the knowledge about the relationships between the mentioned items, including those between different types of defects. These matrices, although complex, are structured to be easily consulted and designed considering the different types of building elements and materials. To use the classification systems and correlation matrices in fieldwork, detailed files of defects, diagnosis methods and repair techniques, and an inspection form were created. These components are essential for fieldwork use of the global inspection system. Additionally, the global inspection system was transferred to a computer application to replace the use of paper. The interactivity of this application allows the adaptation of the forms and answers' options to the information provided by the surveyor, guiding the inspection more effectively.

This global inspection system, whether in paper or computer format, can be adopted by both inspection experts and technicians from the architecture, engineering and construction industry, and also academics. By incorporating a broad body of knowledge, this inspection system is expected to minimise the differences in results among surveyors. Additionally, the partial components of the global inspection system, such as the harmonised classification lists, synthesise dispersed information and can be used separately for different purposes. In terms of future developments, this research reached a stable model to carry out inspections, from which several possibilities are created: (i) further developments of the computer application, with additional capabilities; (ii) development of decision models based on this inspection system (scope of maintenance planning); and (iii) further studies based on fieldwork trying to promote improvements in architectural design to increase the durability of buildings.

### Keywords

Building envelope, building inspection system, building pathology, diagnosis, repair.



Defects in stone claddings, architectural concrete surfaces, rendered façades and adhesive ceramic tiling.



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