XV International Conference on Durability of Building Materials and Components
DBMC 2020, Barcelona
C. Serrat, J.R. Casas and V. Gibert (Eds)

Global Inspection, Diagnosis and Repair System for Buildings: Homogenising the Classification of Repair Techniques

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Keywords: *Building Pathology, Degradation, Inspection Systems, Maintenance, Repair Techniques.*

1 Introduction

Building inspection systems standardise methodologies, guide procedures, and use uniform designations. This paper addresses the development of a global inspection system for the envelope of current buildings by a research team at Instituto Superior Técnico (IST), Universidade de Lisboa (UL), based on twelve individual expert inspection systems (Pereira *et al.*, 2018) for twelve building elements. The global inspection system includes classification lists developed from the homogenisation of individual classification lists. The goal is to require only one list to identify defects, for instance, in different building elements.

2 Classification List of Repair Techniques

The identical structure of the twelve expert inspection systems provided conditions to develop the global inspection system (Ferraz *et al.*, 2016). So, as each expert inspection system included a list of repair techniques, with curative and preventive repairs and planned maintenance work, they were the basis for a proposal of a global classification list of repair techniques.

First, all the lists were collected. Then, repair techniques referring to the same type of work were merged. Afterwards, similar techniques were grouped in a single repair technique, trying to obtain a more concise list. Finally, some specific techniques relating to only a type of building element were kept in the list, as no basis for merging or grouping applied.

A set of criteria guided the harmonisation process:

1. Building a **brief and concise** list of repair techniques without repetitions;
2. To decrease the extent of the list, coupling techniques in one repair technique considering:
    a. the **procedure** of the repair technique;
    b. the applicability of similar repair techniques to a **single type of building element**;
    c. correcting **similar defects**;
    d. using **repair materials** with **similar** properties;
3. Including all relevant repair techniques in the list, even though some may apply only to a single type of building element, so that the global classification list is **comprehensive**;
4. Grouping repair techniques into **categories** according to the intervention area within the

cladding systems, namely: surface of the cladding, cladding system, change in the bearing structure/substrate and singularities.

The proposed classification list includes 55 repair techniques organised in four categories, according to the fourth criterion. Each category corresponds to a code (R-A, R-B, R-C or R-D), as well as each repair technique (R-A1, R-A2, R-A3, and so on).

3 Discussion

The most often prescribed repair techniques are analysed using the data from the validation samples of the expert inspection systems. The absolute frequency of recommendation of each repair technique was considered, adapting the original lists to the proposed global classification. Then, absolute frequencies were divided by the number of detected defects in each validation sample.

The most frequently prescribed repair techniques are "R-A1 Cleaning" in painted façades (1.65) and "R-A12 Application of a new (adequate) cladding/finishing coat over the existent/replacement" in wall renders (1.43). Both repair techniques result from the union of several original techniques, partially explaining the high results. Still, in the case of cleaning in painted façades, the validation sample showed a high incidence of stain defects, which may be solved with cleaning procedures. Additionally, R-A1 may be frequently recommended as surface preparation for further repairs.

The results of R-A12 in wall renders may also be explained by the average age of the sample of buildings (27 years) and frequently attributing defects to irregular repainting periodicity.

4 Conclusions

The use of a single list of repair techniques in the context of building inspections is user-friendly for surveyors and contributes to the standardisation of inspection procedures and the improvement of communication between players in the construction sector. Such a single list of techniques may also be useful as it determines the general scope of repair techniques that should be expected within a maintenance plan, namely for this selection of twelve materials used in the building envelope.

Additionally, analysing frequency data on the prescription of repair techniques allows building owners and maintenance managers to prepare the staff for the execution of the most common procedures, training workers and acquiring adequate equipment while balancing costs and benefits.

Acknowledgements

The authors gratefully acknowledge the support of CERIS, from IST-UL, and the *Fundação para a Ciência e a Tecnologia* (FCT) project PTDC/ECI-CON/29286/2017 "Buildings' Envelope SLP-based Maintenance: reducing the risks and costs for owners", as well as the PhD Scholarship SFRH/BD/131113/2017.

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References

Ferraz, G.T., de Brito, J., de Freitas, V.P. and Silvestre, J.D. (2016). State-of-the-art review of building inspection systems. *Journal of Performance of Constructed Facilities*, *30*(5), 04016018. doi: 10.1061/(ASCE)CF.1943-5509.0000839

Pereira, C., de Brito, J. and Silvestre, J.D. (2018). Global inspection, diagnosis and repair system for buildings: managing the level of detail of the defects classification. In *Proceedings of the 7th Rehabend Congress - Construction Pathology, Rehabilitation Technology and Heritage Management*, Cáceres, Spain, pp. 572–579.