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Survey to architects: challenges to inspection and diagnosis in historical residential buildings

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ABSTRACT: Using a web query among architects (n=57), we could identify the main obstacles found in the application of inspection and diagnosis procedures in historical residential buildings. The results revealed that these procedures are not yet uniformly applied in this built heritage and pointed out the need to develop simplified methodologies and less resource-consuming methodologies, to ensure their applicability.

1 INTRODUCTION

In the recent history of built heritage preservation, there is a constant concern for the prior understanding of the building, through historic analysis and state of conservation assessment (Viollet-le-Duc, 1873; Boito, 1893; Giovannoni, 1924; League of Nations, 1931; ICOMOS, 1964, De Nayer, Arroyo & Blanco, 2000). The evolution of thinking on this issue has essentially two vectors: on the one hand, the extension of the concept of heritage to entire groups of buildings and historical towns (European Council, 1975; UNESCO, 1976; ICOMOS, 1987); on the other hand, the technological progress, which introduces new tools that empower more detailed forms of survey.

The international document that most emphatically expresses the "principles for the analysis, conservation and structural restoration of architectural heritage" was presented by ICOMOS in 2003. It intends to "ensure rational methods of analysis and repair methods appropriate to the cultural context" (ICOMOS, 2003). It recommends diagnosis based on qualitative approaches – i.e. historical information, direct observation - but also quantitative, through trials and monitoring.

New technologies have followed the need to gather more information about the building, without, however, eliminating it. Recent literature includes studies about the development of computer tools to support technicians in the inspection procedure (Cacciotti & Valach, 2015), the use of laser scanner and photogrammetry for detailed survey of historical buildings (Haddad, 2013; Balzani & Maietti, 2015), the non-destructive analysis of old structures through digital

images and thermography (Moropoulou, Labropoulos, Delegou, Karoglou, & Bakolas, 2013), and the development of integrated methodologies for the transposition of data collected for parameterized three-dimensional models (Li, Liu, Wang, Wu, 2015). In common, all these studies confirm the survey as an active process of selection, essential for weighted decision-making.

These studies and methodologies are, however, predominantly oriented to intervention in monuments, although several authors emphasise their importance in residential buildings, to preserve the authenticity of ancient historical urban fabrics (Appleton, 2011; Cóias, 2009; 2017). According to Vítor Cóias, president of the Heritage Guild of Portugal, “good rehabilitation practices are not sufficiently widespread, although the necessary know-how is available” (Pedro, 2017).

Cacciotti, & Valach (2015), identified as the main problems at this stage of the process the fragmentation of information, often incomplete, and the incompatibility between data collected using different methodologies and from local authorities. They also point out that most inspection and survey methods, other than purely visual ones, consume too many resources and are, therefore, only applied in exceptional situations. However, there are no relevant studies that allow understanding the reasons for the low acceptance and practical application of these methodologies between the involved technicians.

In this paper, we report the results of a web-based questionnaire, disseminated to Portuguese architects, that was used to qualitatively analyse this problem and that contribute to identifying the main obstacles that affect the procedures for inspection and diagnosis in professional practice, in Portugal.

2 METHODOLOGY

A web questionnaire was used to collect information from Portuguese architects about perceptions and attitudes about surveying, inspection and diagnosis practices in historical residential buildings. About 500 professionals were contacted via email, using the online database of the Portuguese College of Architects (OA). In addition, the survey was also disseminated through social networks and mailing lists of professional communities (web-platform Reabi(li)tar and INTBAU - Portugal).

The questionnaire was divided into four parts, in a process of sequential filtering of the respondents. In this way, it was possible to obtain the specific sample of “architects involved in the rehabilitation of historical residential buildings that carry out the inspection and diagnosis of the state of conservation”. The first part of the survey recorded information about the professional background of the respondents. Still, in the general observations, the second part referred to the experience of respondents in rehabilitation projects. In the specific observations, two groups of questions were considered: survey practices in residential buildings, and procedures for inspection and diagnosis of the state of conservation.

The form consisted solely of semi-structured response questions: multiple choice, closed response, or selection. Whenever possible, a free response field (“Other”) was considered, allowing the respondent to add specific answers not initially contemplated. For only two cases, a 10-point Likert-type scale was used to evaluate the respondents' emotional perception. At the end of the survey, a long response field was included to allow respondents to share experiences not considered in the questions presented.

Data was collected and analysed using the Google Forms and Spreadsheets online tools. In the first phase of surveys, which took place between 20 March and 12 April 2017, 57 responses were received. This paper presents a descriptive statistical analysis, with the aim of synthesising the data and describing, graphically and numerically, the variables considered and the results obtained.

3 RESULTS

3.1 General observations

All respondents belong to professional areas of the construction sector and 94.7% were architects. The answers cover the whole national territory (Fig. 1). The districts of Lisboa (35.1%), Braga (19.3%) and Porto (15.8%) have recorded greater participation. Only 8.8% said they had not been involved in rehabilitation projects throughout their professional careers. In the following analysis, only the responses of architects with experience in rehabilitation were considered (n=50).

It was found that 84% of the respondents had experience in the rehabilitation of residential buildings (Fig. 2), either exclusively (36%) or in parallel with other typologies (48%). More than half of the respondents (56.1%) have more than 10 years of experience (Fig. 3). However, this number decreases (41.9%) when referring to the specific experience in rehabilitation.

The fact that the promoters/owners only, or predominantly, meet the economic criteria, disregarding the heritage value of the buildings is considered as the main problem by 72% of the respondents (Figure 4). It was also highlighted the lack of knowledge of the builders regarding the intervention procedures, with 54% of respondents identifying this problem.

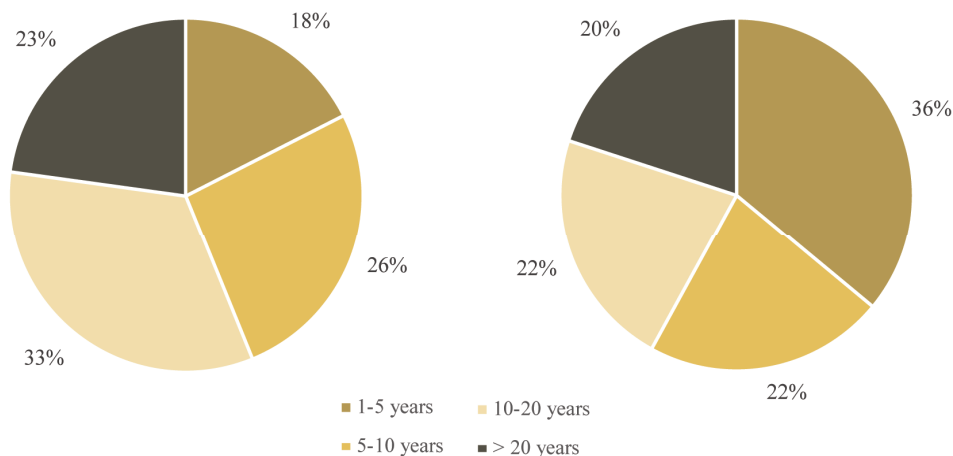
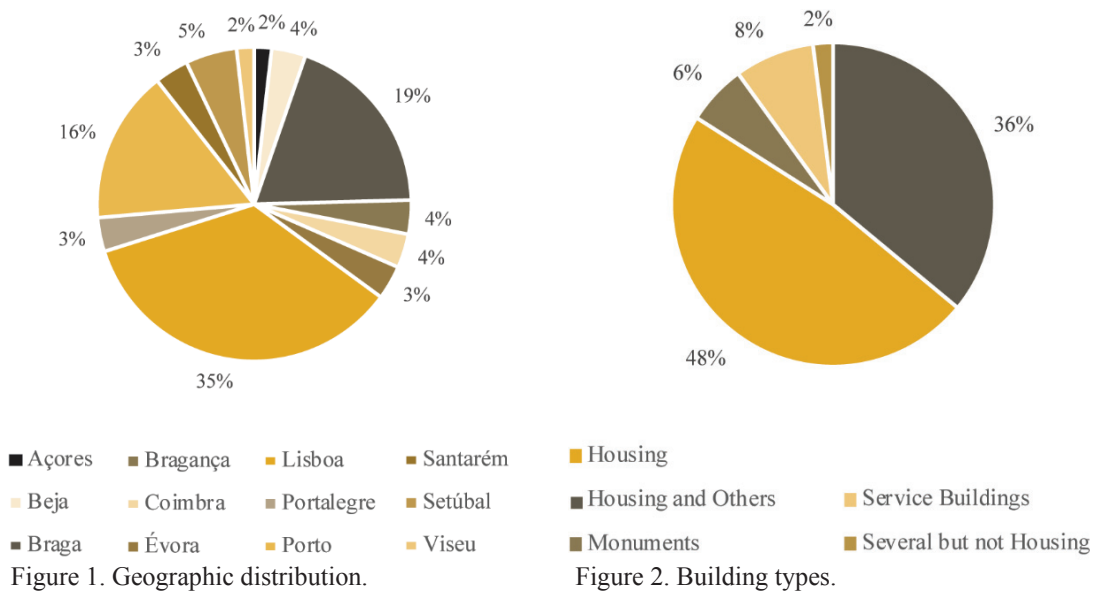


Figure 3. Respondent's professional experience and experience in rehabilitation.

Respondents assumed that the training of technicians (architects and engineers) involved in rehabilitation processes is insufficient to prescribe traditional construction techniques. This option was the second most voted, with 56% of answers. This problem is predominantly pointed out by professionals with more than 10 years of experience (74.9%). Only 14% of those who consider the training of technicians a gap have less than 5 years of experience in professional practice.



Figure 4. Major problems in rehabilitation processes identified by respondents.

In the specific observations about inspection and diagnosis procedures in historical residential buildings, only the respondents with experience in the rehabilitation of residential buildings (n=42) were considered.

3.2 Inspection and diagnosis procedures in historical residential buildings

Regarding the most used survey techniques, the results confirm the predominance of the metric and photographic survey, both used by 85.7% of respondents. Topographic surveying, considered in 80.9% of responses, closely follows these resources. The use of more complex techniques, such as laser scanner or photogrammetry, is only occasional, as shown in Figure 5.

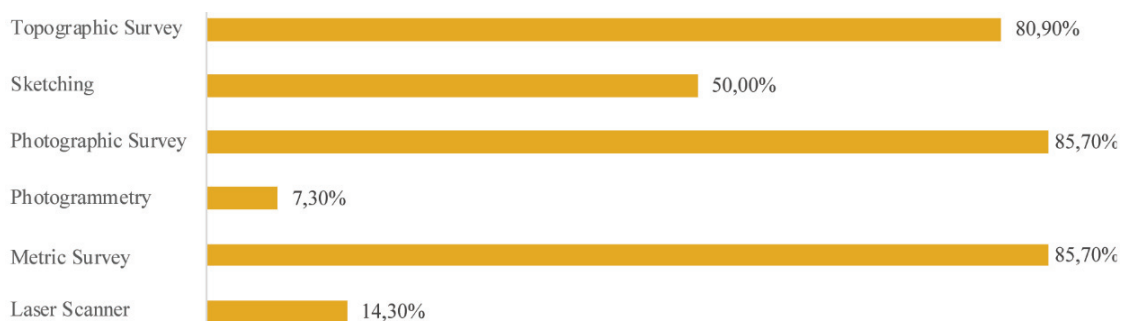


Figure 5. Survey procedures in historical residential buildings.

About a quarter of the respondents (26.2%) do not inspect the state of conservation of residential buildings or admit doing it only sporadically (Fig. 6). The reasoning for this are the limited financial resources, in 54% of the cases, the technical ignorance of the inspection procedures (representing 36% of these options) and the very limited deadlines, in 27% of the cases.

Considering only the respondents who, regularly or occasionally, inspect the state of conservation of residential buildings ($n = 40$), it has been found that in 95% of the cases the inspection procedures are visual and photographic. For 37.5% of respondents, photography is the only inspection-recording format; and 45% records the information collected in appropriate data sheets (Fig. 7).

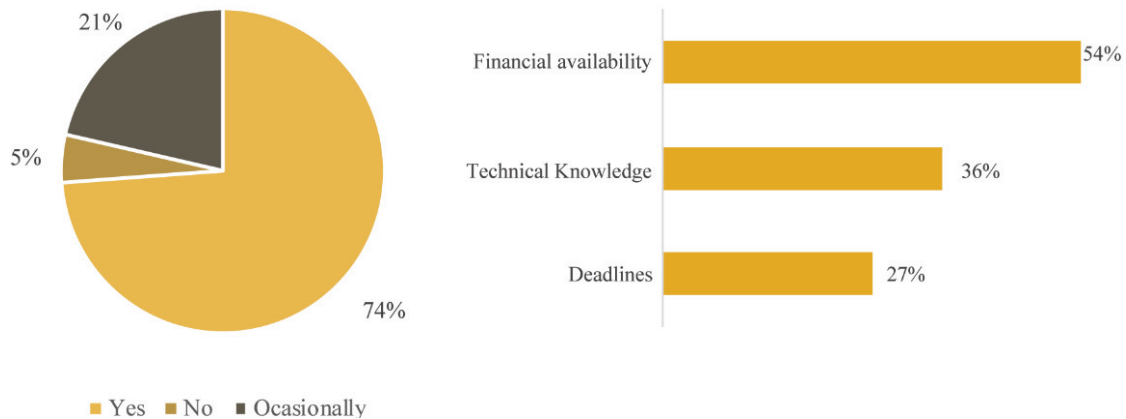


Figure 6. Respondents that perform inspection and diagnosis

More complex technical tests are not very representative: non-destructive tests - using resistographs or ultrasound, for example - are considered by 27.5% of respondents, and the destructive laboratory tests, by only 10%.

Most of the respondents (67.5%) do not know (30%) or never used (37.5%) the inspection and diagnosis models developed by LNEC (Pedro, Vilhena, Paiva & Pinho, 2012). Among the three methodologies developed between 2003 and 2007, the MAEC - Method of Evaluation of Buildings' State of Conservation - is the most recognised, and was used by 22.5% of the respondents. It was possible to verify that the respondents with experience in the application of these methodologies also use data sheets in their professional practice, corresponding to 55.6% of the total of individuals that identify this procedure.

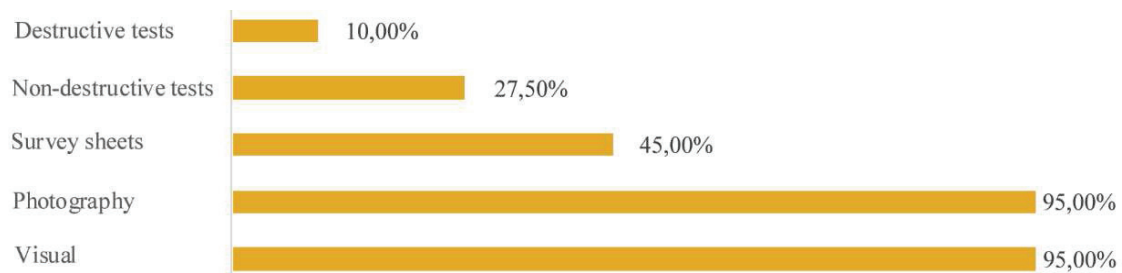


Figure 7. Inspection Techniques.

The main problems identified during these processes are related to the excessive consumption of resources (Figure 8): 47.5% of the respondents think that the procedures are too expensive and time-consuming. Of the latter, 31.6% stated that they spent more than a week, on average, to inspect and diagnose the building, although the majority (42.1%) devotes 3 days to this phase of the process; 10.5% of the architects who consider the procedures too time-consuming, dedicates only 1 day to them.



Figure 8. Problems identified in inspection and diagnosis procedures.

For 37.5% of the respondents, the information to support the analysis of results is scattered and complex to consult. The majority (62.5%) of the participants in this survey state that they seek support for their diagnosis in academic works (dissertations, scientific papers, reports) available in online repositories. Also, more than half (57.5%) considers the work of Appleton (2011), *Rehabilitation of Old Buildings - Pathologies and Intervention Technologies*, an important reference at the national level, being the most consulted publication. Only 17.5% of the respondents use the *Illustrated Glossary on Stone Deterioration Patterns* (ICOMOS, 2008).

Regarding the resources they use regularly, the respondents highlight the effectiveness of the research, understood as the ability to find what is sought. The main weaknesses are the lack of systematisation of information, the lack of efficiency of the research - considered too time-consuming -, and the availability of information, which is not always accessible when necessary.

4 DISCUSSION

The survey collected answers from 54 architects. It was verified that 92% are involved in rehabilitation projects and that 78% have been working in the rehabilitation of residential typologies, which demonstrates the potential impact of the dissemination of good intervention practices in this type of heritage. However, the inspection and diagnostic procedures are still regularly applied by only 74% of respondents.

From the presented results, it is possible to highlight three problems, specific to residential buildings:

- a) Very limited deadlines, with no room for time-consuming procedures;
- b) Low budget for tests that require the acquisition or contracting of specialised resources and technicians;
- c) Lack of interest from the promoters or owners, who do not consider the heritage value of the building to intervene.

These reasons justify the preference for visual inspections, recorded only photographically since they do not imply an increase of costs. Registration in survey data sheets allows for the systematisation of identified anomalies and “is a tool to promote and justify decision-making” (Silva & Vicente, 2004). Although this tool also does not imply an increased cost, this questionnaire evidenced that its use is not generalised, probably due to the lack of knowledge of the technicians. The predominance of users of this resource in the group familiar with the inspection models developed by LNEC (Pedro, Vilhena, Paiva & Pinho, 2012) demonstrated that these have the potential to be adapted to inspect the state of conservation of residential buildings with heritage value.

The knowledge gap in professional practice is associated with the scarcity and dispersion of information, low systematised, time-consuming consultation and not accessible everywhere. However, the investment made in the academic field to research traditional techniques and define good intervention practices (Teixeira, 2012; Freitas, 2012) is relevant for professionals, who consider them as one of the main sources of information during the projects.

5 CONCLUSION

The purpose of this study was to identify, with the support of the professional community, the obstacles faced in the application of inspection and diagnosis procedures in the rehabilitation of historical residential buildings.

The query showed that these procedures are not yet widespread in professional practice. It allowed concluding that in historical residential buildings, there is low budget and time available to resort to the current detailed methods of inspection and diagnosis.

According to the technicians, the training gap is still confronted by the scarcity of technical information and, above all, by its dispersion. This paper demonstrated the need to systematise an alternative approach that responds to the limiting factors of historical residential buildings' rehabilitation processes, with its multiple actors: building owner, regulators, architects, engineers, archaeologists, builders, final inhabitants.

The sample considered in this first analysis of the results is reduced (n=57) and it would be important to understand whether the results are generalizable at the national level. The weblink with the survey remains open, with a total of 78 responses registered on 7 of May 2017. A new round of dissemination is planned, considering a larger universe, to confirm the preliminary results.

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REHAB 2017

3rd International Conference on Preservation, Maintenance and Rehabilitation of Historical Buildings and Structures

REHAB 2017 - 3rd International Conference on Preservation, Maintenance and Rehabilitation of Historical Buildings and Structures aims to proceed with the discussion on built heritage and the preservation of its legacy, that was established in the previous editions of the event. The importance of conservation of historical constructions (built landscape, urban fabrics, buildings, and engineering works) are of utmost importance to preserve the cultural references of a community and was deeply discussed in March 2014, in Tomar, and July 2015, in Porto.

Under the main topics of discussion, subjects of preservation and rehabilitation methodologies and technologies, as well as the importance of the economic and social impacts of preservation practices are here covered as the main leading guidelines for the conference debate.

Furthermore, different communities' scales (local, regional, national or even worldwide) and authenticity interpretation raise different questions and approaches, and therefore different solutions that are worthy to study, to compare and to experience.

The sustainability approach is again covered, highlighting the importance of the commitment between heritage preservation and technical requirements related to its occupancy and use, such as energy efficiency or materials recovery.

Inclusivity is also an important aspect to be discussed as public historic sites and buildings need to be adapted to receive different kind of visitors (children, elderly or handicapped persons) and to establish an adequacy with the perceiving of the physical environment and information contents.

As a Special Chapter, Earthen Buildings are brought into a particular approach highlighting the complexity of their preservation, maintenance and rehabilitation. Earthen buildings techniques are in many cases of a great importance for local economies and access to housing.

The Editors