Contributions for the implementation of preventive conservation and maintenance strategies in the Faculty of Architecture in Porto
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ABSTRACT:
The sharp decrease in economic and ecological resources calls for a paradigm shift in order to ensure their more sustainable management. This means moving from an exclusively reactive and interventionist approach (post-damage) to preventive conservation (pre-damage) and continued care over time. The paper will include an introductory background on preventive conservation and maintenance, followed by the implementation of strategies applied to specific case studies. Special emphasis will be made on the contributions for the implementation of maintenance strategies and user’s empowerment in the buildings of the Faculty of Architecture of the University of Porto, designed by Alvaro Siza and built between 1985 and 1992. These strategies provide for a better management of resources, guaranteeing good performance levels and the preservation of the building’s authenticity, as well as its more sustainable transmission to the future generations.

1. CONTEXT

“Maintenance (…) means not allowing a building to decay. Firstly, it’s only about small tasks, but often we let things progress until the building arrives at a state of profound decay. Then, it’s not about maintenance anymore, but about rehabilitation and rehabilitation is expensive. So, carrying out constant maintenance is also a question of economics. (…) The lack of maintenance results from the loss of habits (…) and a lack of the money that is needed to perform the maintenance works.” (Siza, 2016).

As Álvaro Siza maintains, the current context of economic depression, ecological saturation and an excessive amount of recent constructions (many of which are empty, useless or obsolete) calls for a careful approach to the management and preservation of built heritage. Acknowledging that the heavy and exceptional “restoration” of single monuments is no longer an exclusive or a sustainable practice, it is important to consider strategies such as planned conservation and maintenance practices, which have always existed in the history of construction, specially before its industrialisation. These practices provide for a more sustainable management of resources, shifting from a reactive and interventionist approach (post-damage) to preventive conservation (pre-damage) and continued care over time.

In this context, some international initiatives can be signed, among others, the Society for the Protection of Ancient Buildings (SPAB) in the UK, the Monumentenwatch in Belgium and the Netherlands (Lipovec and Van Balen, 2010), the “Conservazione Programmata” experiences in Italy (Della Torre et. al., 2003), the UNESCO chair on Preventive Conservation, Maintenance
and Monitoring of Monuments and Sites – PRECOMOS (Van Balen and Stulens, 2001). Moreover, there is a vast lexicon used in the field of maintenance, which also varies according to different languages, countries and contexts of action (Lipovec & Van Ballen, 2010; Ferreira, 2011).

In Portugal, the term “maintenance” is more commonly used, meaning broadly the “set of preventive operations to maintain in good state a building as a whole or each of its constituent parts” (Henriques, 1991). Maintenance is thus a system of preventive practices, controls, small repairs, cleaning and proper uses. In this regard, one can distinguish different types of maintenance: preventive or predictive maintenance (inspection and preventive actions), conditioned maintenance (post-symptomatic actions) and curative or corrective maintenance (post-damage actions) (Paiva et al., 2006; Calejo, 2009). Hence, the productive cycle of maintenance is generally divided into three phases: (1) “Information” (research, collecting information, database, characterization, diagnosis), (2) “Programming” (developing manuals and handbooks, scheduling inspections and repairs) and (3) “Implementation” of maintenance actions that can range from cleaning, visual inspection, monitoring, minor repairs or replacement actions, instructions for use (Flores-Collen and Brito, 2003). Maintenance is therefore a very broad term, encompassing a vast range of operations, which are direct or indirect, simple or qualified, varying also in their frequency (daily, weekly, monthly, biannual, multiannual) or according to the seasons of the year (Coias, 2004).

Furthermore, it is important to consider the potential of involving all users in preventive conservation practices, namely through the “User Manuals” and “Instruction Handbooks”, with information and guidelines about use and maintenance in a language that is accessible to all. Thus, users are a key factor in heritage maintenance, helping to avoid improper use, preventing risky situations, contributing to the recording of information and collaborating in daily maintenance activities (cleaning, ventilation, shading, etc.). From this point of view, civil society has an important role to play in preserving heritage, and contributing to a sustainable and culturally integrated development (Ferreira 2011).

In this perspective, the workshop “JANELAS com TINTA têm muito + PINTA” was a successful participatory project for the maintenance of windows in Porto’s historic centre (UNESCO World Heritage since 1996). The aim of the workshop was to focus on an essential constructive element for the authenticity and identity of this site – the window – which has been a recurrent target for replacement, due to a lack of maintenance habits or as a result of intrusive renovation projects. The workshop took place over several days and involved practical demonstrations and direct “hands on” experiences by the participants throughout the different stages, techniques, instruments and materials applied in the conservation and maintenance of windows. The whole process was compiled in an illustrated handbook of good practices and was also recorded in a video disseminated on YouTube (http://www.youtube.com/watch?v=OO3nBLXibnU).

Furthermore, this experience enhances the potential of engaging and empowering local inhabitants and users through their active participation in the conservation process, by increasing their quality of life and self-esteem and promoting their relationship with heritage. In this way, “Local people, civil society, and elected local and national officials will play a key role in the design and implementation of heritage as a driver of development, and, through raised awareness of heritage, they will have ownership of the development process” (ICOMOS, 2011).

1. **FACULTY OF ARCHITECTURE OF THE UNIVERSITY OF PORTO (FAUP)**

The building of the Faculty of Architecture of the University of Porto (FAUP) was designed by Álvaro Siza, a former University Professor and the winner of the Pritzker Prize in 1992. The building was designed and built between 1985 and 1993 on the site known as Polo III of the University of Porto (Campo Alegre), bordered to the north by one of the main access roads to the city of Porto, to the east by the former manor house and estate of Quinta da Póvoa, which is located at the highest point of the terrain, and to the south by terraces overlooking the River Douro.

The new building of the Faculty was opened in 1992 and is a construction whose coherence is established through its relationship with the landscape, which has been carefully planned right down to the smallest detail. Thus, it is considered beautiful through the way that it meets certain
uses, needs and objectives, as well as because it is pleasing in its form, precise in its implementation and in harmony with its surroundings, rigorous in both its building technique and use of materials (Costa 2003). FAUP and the Carlos Ramos Pavilion are currently listed as buildings with a special interest in the Heritage Charter of the Porto Municipal Master Plan and are inventoried in the twentieth-century Architecture Survey (IAP20). The FAUP buildings were initially designed to house 500 students, but are currently used by about 1100 students, including all the students on external mobility schemes. The building has thus been forced to adapt to a more intensive use (it is in permanent use – 24 hours per day and seven days per week).

The body responsible for the maintenance of the FAUP buildings is the Faculty’s Executive Board, with one of its members being responsible for Premises and Equipment, a portfolio that includes such different aspects as cleaning, maintenance of the outside space and garden, procurement of equipment and furniture, networks (water, electricity, computers, etc.), services and facilities, everyday maintenance and repair work and occasional interventions requiring rehabilitation work of a more profound nature.

According to those responsible, the main difficulties encountered in managing and maintaining the various FAUP spaces are economic and administrative in nature, either because of the limited funds made available (which necessarily results in a shortage of human resources) or because of the administrative constraints that often affect the flexibility and speed of processes. Nevertheless, these conditions have been improving gradually, in terms of both the internal organisation and the level of support provided by the Rectory of the University of Porto (UP), with more comprehensive interventions being undertaken (such as the rehabilitation of the external surroundings of the FAUP buildings, which is currently in progress), as well as the maintenance of infrastructures and equipment. A survey of all FAUP’s networks, services and equipment was recently carried out by the Rectory of the University of Porto, with the aim of adapting them to the new legal requirements and optimising their use and future maintenance.

The day-to-day maintenance of the FAUP spaces is carried out by three operational technicians, who are part of the Faculty staff and perform routine maintenance activities (gardening, cleaning of exterior spaces, inspection of roofs, electricity, plumbing, checking of networks, installations and furniture, minor repairs, among others), as well as giving support to the installation of exhibitions and other events held at FAUP’s premises. In addition to performing everyday tasks, the operational technicians also perform other necessary and deeper actions during school breaks, especially in July and August, such as the general checking of the electrical equipment, the painting of interior spaces, the repair of furniture, window frames and other important elements for the proper functioning of the premises at the beginning of the school year.

The cleaning of the interior spaces is outsourced to an external company according to specifications that establish the procedures and the products to be used. Currently, the cleaning work is performed by ten employees, who clean FAUP’s interior spaces (from 6:30 to 8:30 am), including the sanitary facilities, classrooms, corridors, library, auditoria and administrative services. The windows are cleaned twice a week (amounting to 4 hours work per week). Every year, during the summer holiday period, the interior spaces (floors, walls, stairs) are cleaned more thoroughly, and the wooden floors are varnished and sealed after having first been sanded with a machine. Twice a year, the outside windows to which access is difficult are cleaned by workmen using hoists and an elevated platform.

The everyday users of the FAUP spaces are employees, teachers, researchers, students and visitors (tourists or others). It is also important to emphasise the role of the security guard at FAUP. In addition to managing the keys to the rooms for teachers and students, they assist in the supervision of all spaces, recording any occurrences and damages that are then reported to the FAUP administrative services.
Fig. 1 – Plan of the Faculty of Architecture of the University of Porto (FAUP). A – Bar; B – Administrative Services and Auditorium; C – Gallery for Exhibitions; D – Library; E, F, G, H – Classrooms and Teacher’s offices; PCR – Carlos Ramos Pavilion – Classrooms; CAV – Old Stables (Polyvalent areas); CCR – Casa Cor de Rosa (Research Centre - Centro de Estudos de Arquitetura e Urbanismo)

Fig. 2 – Aerial view of the Faculty of Architecture of the University of Porto (FAUP)
2. CONSTRUCTIVE CHARACTERISATION AND DECAY

The exterior spaces of FAUP consist of garden areas, granite pavements and granite masonry walls that separate different levels of the terrain.

The constructive system of the FAUP buildings consists of load-bearing walls and slabs in reinforced concrete. The roofs of the main buildings (A, B and C) and the towers (F to H) are covered with a zinc standing seam system, consisting of a light concrete slab, thermal insulation of black cork agglomerate and a zinc sheet cladding. At the Carlos Ramos Pavilion, an inverted flat roof was used, composed of a light concrete slab, an asphalt membrane for waterproofing purposes, thermal insulation in extruded polystyrene sheets, a geotextile blanket and a heavy protective layer of gravel. At the Casa Cor de Rosa, the roof is covered with Marseille ceramic tiles, supported by a wooden structure.

The exterior walls (of the main buildings and towers) are insulated with thermal insulation on the outside in an “ETICS” system, consisting of expanded polystyrene sheets glued to the reinforced concrete wall, previously smoothed and waterproofed (with “ceresite”). The last layer consists of thin plaster based on the use of acrylic mortars, reinforced with a fibreglass net, and applied in multiple layers. The finish used at the base of the buildings consists of exterior protection panels made of granite and limestone.

Broadly speaking, the main problems and alterations at FAUP stem from the natural wear and tear of a public building that has been subjected to intensive use over more than two decades. Moreover, it is important to remember that it has been consistently used above the capacity for which it was originally designed (the number of students has doubled over the years).

Among the main causes of the degradation of the building are its exposure to atmospheric agents and the occasional deterioration of materials and construction systems, which gives rise to infiltrations, particularly in the roofs and sills. On the exterior walls, there are a number of occurrences such as stains, biological colonisation, cracks, blisters and deformations in the ETICS system. On the exterior window frames, there are clear signs that the paint has worn away and become detached, as well as evidence of damage to the fittings that hinders their proper functioning. In the exterior spaces, it can be seen that some concrete slabs have cracked, and that the micro-cubes have become detached from the pavement due to the growth of the roots of the surrounding trees.

3. MAINTENANCE WORKS (2016/2017)

Currently (starting in May 2016), work is in progress for the recovery of the external envelope of the FAUP buildings (roofs, façades and window frames) funded by the Rectory of the University of Porto. This work will make it possible to solve some problems arising from the natural aging process caused by the building’s exposure to atmospheric agents, since it had not previously been subjected to any profound repairs since its construction, which was completed in 1992.

The recovery works focus on FAUP’s most recent buildings (A, B, C, D, E, F, G, E and H) and are being carried out with different levels of profundity, depending on the anomalies diagnosed in the roofs, walls and exterior window frames. In the coverings, it can be seen that the cork agglomerate is rotting and the zinc flashing is becoming deformed, which has led to some infiltrations. The solution that has been adopted is to apply water repellent paint to the light concrete slab, to replace the cork agglomerate with extruded polystyrene and to finish with the application of a studded rubber waterproof membrane, over which the zinc sheet is then laid. At the same time, the intervention is expected to include the replacement of the existing flashing with a new one, with a slightly different profile, which prevents the water from seeping into the walls.

1 The work began in June 2016, with a budget of 395,062.95 euros and was expected to last 8 months. The coordination of this recovery work is the responsibility of Eliseu Gonçalves, who is working under the guidance of José Luís Gomes and with the help of the architect who designed the building complex, Álvaro Siza.
Fig. 3-5. – Constructive details and photos of roofs and window frames (Daniela Silva). Thermographic captions of Carlos Ramos Pavilion walls.
The anomalies identified in the exterior walls were essentially cracks, stains, biological colonisation, detachments of the surface layer, blisters and perforations. The different incidences and types of anomalies were mapped to allow for the recovery of the façades, corresponding to the different levels of intervention: (1) the first level refers to the areas without any identified pathologies, where the application of a new coat of paint is the only procedure that is required; (2) the second level corresponds to areas of superficial pathologies, such as stains arising from biological colonisation – in this case it is recommended that a fungicide is applied, followed by a new coat of paint, after washing the surface with water applied at low pressure; (3) the third level occurs when there are detachments of the surface layer, requiring only the replacement of the final coating layer and waterproofing (“Visoplast”); (4) the fourth level refers to the deeper blisters, cracks and detachments which require the replacement of the various layers of thin plaster; (5) finally, the last level corresponds to the parts that have been most deeply damaged and, which justify the replacement of the entire “ETICS” system (including the expanded polystyrene sheets).

Moreover, the main anomaly identified in the exterior window frames is the wear and tear and detachment of the paint, with some areas presenting signs of iron corrosion. In addition, some window frames are deformed and there are some parts that are either missing or damaged. Thus, these elements will be freshly painted both on the outside and the inside, including the replacement of the parts that are necessary to ensure the windows’ proper functioning.

From the point of view of the building’s use, it is also possible to identify some occurrences that are commonly found in a school of architecture where lessons are frequently of a practical nature, namely: wear and tear and the general deterioration of classroom furniture (benches and drawing tables, the latter suffering from the cuts made by craft knives resulting from the elaboration of scale models), wear and tear of equipment such as heaters and lamps, damage or malfunctions in the sanitary installations, dirt or writing on the walls and windows, accumulation of litter and rubbish in the classrooms and outdoor spaces.

Finally, related to the characterization and decay it was important to develop a chronology with the construction works in the Faculty’s buildings since it was built in 1985-1992. From this analysis it is possible to develop a speculative chart comparing a curve of estimated costs of those works, with what it could have been a more virtuous curve with maintenance practices (Fig. 6).

Nevertheless, it’s important to remark that the administrative procedures make it very difficult to proceed to the implementation of maintenance strategies and planning in public buildings such as the FAUP.

Fig. 6 - Speculative chart comparing a curve of estimated costs of those works, with what it could have been a more virtuous curve with planned maintenance works in dashed line. (Daniela Silva)

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2 This mapping was only possible after the erection of scaffolding (and after the surface had been cleaned with a water jet) because many of the anomalies in the façades (as well as in the roofs) were not visible from a lower level or were hidden by stains caused by exposure to weathering agents and pollution.
4. CONTRIBUTIONS FOR MAINTENANCE AND USE

The previous characterisation and diagnosis allowed for the definition of some strategies and contributions for improving the maintenance and use of the FAUP buildings. The planning of preventive and maintenance actions (inspection, cleaning, everyday tasks) can be scheduled according to their periodicity (daily, weekly, monthly, annual, multiannual), helping to optimise the management of resources and budget estimates. These strategies can be supported by a database and a computer application, which allows for the management of information and a systematisation of procedures. However, in addition to the preventive or more common maintenance actions\(^3\), there are always unforeseen events that require actions of an exceptional or urgent nature, which must be undertaken in a timely manner and provided for by a specifically directed reserve fund.

On the other hand, since maintenance is only possible with the involvement of the building’s users, it is fundamental to promote strategies for their participation, training and education. In this context, teachers play a key role at FAUP in raising awareness of good practices in the use of the space, particularly at the beginning of the academic year. A strategy that can be implemented is the development of illustrated “handbooks” that are easy to understand and user-friendly. For example, an infographic poster was developed with pictures clearly illustrating some recommendations for the use of spaces. The poster contains three levels of recommendations, from “suggestions” (organisation and cleaning of classrooms, furniture protection, recycling), “alerts” (stowage of scale models, electrical wiring and equipment care) and “prohibitions/obligations” (rules for the use of the sanitary facilities, the placement of litter and rubbish in their appropriate bins, writing or sticking posters on the walls and windows). These recommendations may be concentrated or arranged separately at strategic points, and it is preferable to only display posters on FAUP’s own notice boards, since excessive signalling disturbs the perception of the architectural space. It is also to be noted that any signposting would require prior authorisation from the author of the design project and the management bodies of FAUP (Ferreira 2016; Silva 2016).

At the same time, strategies can also be implemented that reward those classes that best exemplify good practices in the use and cleaning of spaces. This initiative can be an incentive to increase awareness of the good use and preservation of spaces, until the time comes when such care is no longer a rule and becomes an everyday and automatic habit for all users (Silva 2016). Finally, among other suggestions, several interviewees expressed an interest in creating a participatory system for signalling occurrences in the building online (for example, through “sigarra”, the Faculty’s website with a login facility), accessible to students, teachers, employees, operational technicians and cleaning staff. This could generate notifications addressed to the appropriate officials, technicians and members of the Faculty’s Management Board responsible for the maintenance of the premises and its equipment.

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\(^3\) Broadly speaking, current maintenance actions can be programmed according to their periodicity (daily, weekly, monthly, annual, multiannual), and, among many other actions, may include: cleaning and treatment of the gardens and outdoor spaces; inspection and cleaning of the rainwater drainage systems; inspection and general adjustment of window frames; checking and adjustment of furniture; painting of interior walls; application of antifungal products, cleaning, painting and treatment of exterior coatings; checking and inspection of the electricity system and other networks, infrastructures and equipment, according to the legislation and the specific procedures in each case, etc. It should also be noted that any planning or intervention work to be carried out requires the previous authorization of the architect of the building complex and the management bodies of FAUP.
5. FINAL NOTE

Finally, from these brief notes, we can see the great quality of the architectural project and its constructive solutions, which have determined the durability of the systems and their ability to adapt to changes in uses and infrastructures. We can also see the adequate planning and responses adopted by the FAUP management bodies and the staff responsible for the building’s maintenance and cleaning. At the same time, there is a high degree of satisfaction expressed by all the users with the spaces that they inhabit daily. Only with the commitment and care of everyone – architects, managers, employees and users – can we ensure the proper functioning of the building, the preservation of its architectural heritage value and its sustainable transmission to future generations.

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