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# Traditional Portuguese techniques for application and maintenance of historic renders

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**Abstract:** The Portuguese architectonic heritage is mostly composed by old buildings needing interventions, especially on exterior renders, plasters and finishes. Preventive and conservative interventions must be preferred, to avoid the extraction of historical elements, representative of the art and inventiveness of past generations. Subsequently it is necessary to use repair methodologies adapted to the situation, meaning efficient, compatible and viable. In order to adapt repair methodologies to the historic renders and masonries, to improve the compatibility of conservation actions and to increase the link of conservation work with the traditional techniques and with communities, it is fundamental to gather and analyze traditional techniques, tools and materials for render application, decoration and protection. A review of traditional application and maintenance techniques, materials and tools, that have been used to execute historic renders, their protection and decoration, are presented and their importance and viability discussed, in order to contribute to the development of a methodology for conservative intervention on historic renders.

# 1 Introduction

The urban image of many Portuguese historical localities is changing quickly, mainly due to uncontrolled renovation practice and to lack of heritage culture concerning the old urban scenarios. There is currently an ignorance of the cultural and technical value of old exterior renders, plasters and finishes, resulting in difficulties in decision making and the adoption of adequate conservation and restoration techniques.

A major part of old Portuguese architectonic heritage presents a decay process on exterior architectural surfaces, especially due to natural ageing and lack of maintenance. Old building façades are very diverse, mostly based on mortar renders, plaster work and paintings [1]. Renders and wall surface finishes have the double function of protecting in wall materials (often poor materials) and improving their appearance. Very often they are used to simulate richer materials like stone. Aesthetic function is thus very important, as well as the capacity to protect the wall from external actions such as rain, wind, chemical or biological agents, among others. Renders and finishes also condition the exchange of moisture between the building and the environment. To meet requirements and also to avoid the loss of historic elements, representative of art and inventiveness of past generations, preventive and conservative interventions must be programmed. Therefore it is necessary to use repair methodologies adapted to each situation, in terms of efficiency, compatibility and viability.

Scientific knowledge about materials and skilled restorers are important contributes for conservation of monuments and classified buildings. However, concerning the vernacular heritage, it is necessary to study in-situ the techniques used in each region and to involve the inhabitants in the conservation practice, by the reapropriation of traditional techniques, still preserved in the memory of older people.

The study of the techniques for old buildings' renders and exterior finishes need larger development and a methodological systematization concerning techniques, materials and tools, to complement the study investment recently carried out in this area [1, 2, 3].

In order to adapt repair methodologies to the historic masonry, renders and finishes, to improve the compatibility of conservation actions and to increase the link of conservation work with communities in Portugal, the traditional techniques, tools and materials for render application, decoration and protection should be systematically gathered and analyzed.

# 2 Materials

Over time a close relationship has been established between landscape and construction. Thus, the materials used contribute to the definition of the urban landscape and establish a link of territory and buildings. The knowledge of the renders' constituents is a step for the construction of a dynamic of heritage conservation and restoration.

Materials traditionally used in Portuguese renderings and façade finishings are briefly referred in the next paragraphs, most information collected by oral transmission and research by the team members over years.

• **Earth** - Some earths were used in mortars, sometimes mixed with a small content of air-lime (Fig. 1 and 2). If the earth was very rich in clay, some sand was added. Earth mortars were less expensive than lime mortars (earth could be collected while lime needed to be purchased), but they were also less durable. Ochres and other coloured earth were frequently used as natural

pigments. The search and choice of the colouring earth and clays required experience.

- Air-lime Lime was traditionally the preferential binder for mortars, plasters and paints. Issues like water and biological protection inherent to the use of lime were underlined [1, 2, 4, 5]. The preparation techniques of air-lime (stone extraction, burning and hydration) were commonly known by lime producers [6, 7, 8, 9], builders, plasterers and the population in general. One of the reasons was the fact that limewash application was a part of the social activity of some communities, as regular maintenance of the dwellings.
- Sand, water, additives, admixtures Sands used in mortars were carefully chosen, by plasterers and building masters who had knowledge transmitted over generations of craftsmen. In internal layers coarse sand was used; in finishing layers sands were finer and were normally picked in creek beds [2]. Some aggregates had a pozzolanic effect, sometimes very low, and it is possible that they were selected for that reason. Other pozzolanic additions were sometimes used, with the aim of adding hydraulicity and colour and increasing the durability of the mortar [2]. Other products could be added in order to increase some mortar characteristics: stone dust to increase compactness in external mortar layers; vegetable fibers or animal hair to increase resistance to cracking.
- **Pigments** Earths were used as natural inorganic pigments like ochre with goethite. They are not homogeneous, generally found in clay soils with conditions to oxidation, as marshlands or near water sources. They were traditionally picked and prepared by women who worked in the fields. The earth were disaggregated, herbs eliminated, particles were wetted to dissociate grains, let to dry, milled and sieved. Different colours could be found, generally from yellows to greens and reds. The domestic tradition and knowledge of natural pigment extraction is now almost lost in Portugal [10, 11].

### **3** Tools

Many of the tools used were made by the artisans themselves, to suit them and their specialized work. They were specific for each type of work, many times inherited from fathers to sons and from masters to apprentices, designated by popular and regional names. They were very different from the tools bought nowadays, based on natural, more flexible basic materials, very diversified in shapes and nature. There were different types of trowels: brick layers trowel, gauging trowel, bucket trowel, dashing trowel, pointing trowel, float trowel, laying-on trowel and finishing trowel or smoother. Some of them were specific for different areas of work and for diverse mortars and layers; other tools like scraper, spatula, putty knife, hawk, plaster scarifier, rake, comb scratcher and different types of paint brushes, were used (Fig. 3) [2, 7, 8, 12].



colours of aggregates





Fig. 3 Finishing application tools

#### 4 Historic rendering and finishing techniques

The master plasterers developed their techniques since ancient times. The selection and preparation of the constituents and the execution and application of mortars and paints was first carried out by trial and error and the acquired knowledge was transmitted over generations of craftsmen. They had a deep knowledge of the available resources, the extraction and preparation processes of the raw materials, the compatibility between the utilized materials and the methods of application, to optimize their characteristics.

#### 4.1 Mortars

Calcitic lime and dolomitic lime were used in mortars all over Portugal. Dolomitic lime was darker than calcitic lime (due to the presence of iron in the chemical composition), less pure and less expensive. It was mainly used in masonry mortar, but sometimes also in renders, while calcitic lime was preferred for renders and plasters, especially for finishing works, and for lime paints [4, 5, 13, 14, 15, 16]. When money was a problem, lime was not purchased and mortars and paints were made with clay (or lime-earth mixtures). However, earth mortars and earth paints were recognized by the artisans as worse and less durable solutions than those based in lime [2, 17].

The proportions between the mortar constituents were empirical but carefully adjusted by the master builder to weather and application conditions.

The render was applied in multiple layers, with delays for setting between them. The first layer had coarser aggregates, sometimes with broken brick or stone for initial wall surface regularization; the following layers were thinner, with selected aggregates, finer and with lower percentage of clay [8]; the last layer was usually very thin, prepared with lime putty and low percentage of a very fine sand or stone dust.

### 4.2 Finishing techniques

Several coating techniques compose the architectural expression of old buildings. Especially in scarce resources architecture, architectonic coatings decorate the dwelling façades with relief renders, plasters and decorative paintings, often simulating the use of more expensive materials. Some of these techniques were also used to transform and up-grade pre-existing buildings.

The architectonic decorations were often associated with particular areas of the building elements, as the top of the exterior wall, eaves, talons and gargoyles, spans, frames of windows and doors.

The plaster master executed the finishing techniques; he started his work only after the bricklayer presented the surface right and smoothened by the application of mortar regularization layers.

The most common finishing techniques are briefly described as follows:

- **Barramento** or finish stucco coats -The finish stucco can be constituted by multiple thin layers of lime putty with additions like brick dust or stone dust and sometimes with pigments in the exterior layer. The application was carried out with a wood trowel, that could absorb the excess of water, or more commonly with a metallic but flexible trowel [1, 3].
- Sgraffito and graffito -The sgraffito technique was made through the extraction of parts of the exterior layer of the render, following specific drawings, turning visible the interior layer surface [17, 18]. Those decorative mural techniques were usually executed in specific zones of the dwellings, like corners, top of exterior walls and frame of windows and doors, to enhance them and decorate the façade (Fig. 4). The sgraffited motifs generally express nature or geometry and, through the complexity of the drawing, execution, application of plaster work and applied pigments in the under layer, show the skills of the master plaster; sometimes also express symbols related to the dwelling owner. The drawings were marked on the surface with wood or paper card moulds which belonged to the artistic repertoire of the master plasterer. The motif relief was generally marked with pigments and a pounce bag. The under layer was pigmented or differentiated with the presence of selected aggregates and turned visible when the upper layer was eliminated inside the marked motifs, with specific tools [1, 3, 18].

- **Relief mortar works** Relief mortar works were executed over a fresh rendered surface or fixed over the façade. As the previous described techniques, they intended to signalize or simulate building elements, and defined the façade and their limits. This type of work was made with lime mortars, with selected aggregates and careful preparation. Wooden moulds were used and a part of the exterior layer was extracted to define reentrant relief. When salient reliefs were sought, decorative motifs could be moulded and fixed over the façade. The aspect of this last type of application could be similar to *sgraffito* technique application (Fig. 5) but generally the motifs relief were thicker.
  - Simulations of stone and other decorative paintings Fake coatings were used to simulate the application of more expensive materials or homogeneous stone like marble or breccia stone, or even bricks (Figs. 6 and 7) [1, 17]. They could be executed over a surface of less noble stone, masonry, render or finish stucco coat. Simulations of noble stone presented diversified motifs representing different types of stones, supposedly applied in also different ways. Utilizing specific types of drawings and paintings, sometimes different distances of observation allowed diverse visualizations. The complexity of the design, the painting's execution, the polishing of the surface, defined the master and sometimes their family. Some masters, like artistic painters, left small marks (sometimes their name) in hidden places of the painted surface [2]. Other techniques were sometimes used to simulate stone masonry, such as *graffito* or *sgraffito* techniques (Fig. 7) [1, 17].



Fig. 4 Sgraffito decoration



Fig. 5 Relief mortar works



Fig. 6 Simulation of brick masonry

**Rough cast finishing simulating stone** (*marmorite*) - In Portugal rough cast finishing simulating stone was a special technique based in washing the fresh mortar surface to make the selected aggregates visible [19]. It was mainly used between the 50's and the 70's in the XX century; it was current at the Estado Novo administration period, being a much more recent type of finishing than all the others referred in this work. It was a resistant and durable

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finish, long lasting for many years without maintenance needs, and was applied over a regularization render (Fig. 8). The traditional mortar for rough cast finishing was a very rich mortar based on air-lime or, in later periods, on hydraulic lime or cement, stone dust and aggregates of different colours and dimensions (pebbles of different stones or sometimes glass). The mortar could be pigmented or just coloured by the aggregates.

### 4.3 Limewash and other paintings

Limewash was a very current finishing in the South of Portugal, both white or coloured (Fig. 9). Generally lime paint was applied over the render, but for economical reasons it could be directly applied over the masonry, or could even be applied only on the main façade of the dwellings or on a specific area of that façade.

Lime paints are popular since the XVIII century due to its economy and applicability but also due to antiseptic and antibacterial properties, and they are still used nowadays, specially in the villages located in south Portugal [1]. Limewash could be coloured by pigments, which should be inorganic, in order to assure compatibility with lime alkalinity. Traditional lime paints could be reserved for years [2].

The traditional annual restoration of aesthetic function, with resource to limewash overpaints, generally based on slaked lime diluted with water, with or without pigments, has been commonly executed for centuries in Southern regions of Portugal, by spring. May was the preferred month for that practice, being a favourable period, with mild temperature and few rainy days. More than a conservative intervention, it was also a social practice, followed by generation after generation, with specific materials (lime wash, eventually natural pigments and/or animal fat products), particular tools (traditional brushes) and technologies (number of coats, direction of the brush). These maintenance practices were held mainly by women who traditionally always had a portion of aged lime putty in a container to apply whenever small maintenance interventions were needed [1, 2, 10].



Fig. 7 Simulation of stone masonry

Fig. 8 Rough cast finishing simulating stone



Fig. 9 Lime painted surface

# 5 Gathering traditional techniques as a tool for conservation

As referred by Menezes and Tavares [20, 21], one of the difficulties on the preservation of historical renders and finishes is related to the loss of technical information of traditional techniques, materials and tools. The knowledge of those techniques permits a better choice of conservation technology and it also enhances the sensibilization and reapropriation of those techniques by the populations, permitting that the users can (and want to) carry out their buildings' maintenance by themselves and in a correct way.

The gathering and registration of relevant information is crucial within conservation practice. However, this kind of knowledge is often in the hands of elderly artisans. Thus, the systematic gathering of this knowledge may contribute to the social inclusion of elderly artisans in a community, besides contributing to conservation of the historic patrimony. In parallel, this information gathering can be framed by a work plan within a specific formation, where the artisans can be involved as transmitting agents of a specific know-how. This can be very attractive to younger professionals, contributing to the improvement of their skills, professional qualification and integration. On the other hand, information gathering can be linked to a systematic registration of the involved instruments, combining with the techniques, methodologies, materials and extraction locations [20,21].

### **6** Final considerations

The diversity of construction materials and techniques is an issue of their cultural richness, contributing to the drawing of the characteristics of urban landscapes. However, the lack of sensitivity for heritage preservation, in particular in this case for historical renders and finishes, is a fragility of the policies of safeguarding urban and architectonic heritage. Additionally, there is a difficulty in the efficient reproduction of knowledge about the use of traditional materials and techniques. The importance of the recuperation of technical memory should be stressed, namely in an artisan environment where information is scarce, considering the ageing of old masters and the disappearance of experience socially transmitted, together with uncontrolled renovation actions carried out on historical monuments and urban centres during the last few decades. The lack of education and training structures in this area sensed in Portugal is an equally important issue. That is why the establishment and diffusion of correct and viable conservation methodologies are so important.

Each region of the country followed different ways of constructing, specific details and particular ways of covering the walls. This is particularly true in what concerns vernacular heritage, where the communities were predominantly self

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sufficient and did not resort to external masters. Maintenance and conservative interventions should not tend to standardize this rich, diversified reality.

In order to adapt repair methodologies to the historic renders and masonries, to improve the compatibility of conservation actions, and to increase the link of conservation work with the traditional techniques and with communities, it is fundamental to collect and analyze traditional techniques, tools and materials for render application, decoration and protection [9].

With an interdisciplinary team, Project LIMECONTECH - Conservation and durability of historical renders; compatible techniques and materials, co-financed by the Foundation for Science and Technology of Portugal (PTDC/ECM/100234/2008) aims to contribute for the gathering, registration and preservation of Portuguese traditional techniques of exterior rendering and plastering, based in on site surveys of privileged information in contexts of patrimonial richness of renders and finishes, but also with resource to laboratory and in situ tests to characterize materials and experiment the techniques.

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