A MULTIDISCIPLINARY APPROACH TO UNDERSTANDING HISTORIC ARCHITECTURAL FAÇADES/

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Abstract. The current article is part of a broader theoretical approach to studying the architectural façade, and it aims to reveal, in a technical manner, good practices for understanding the historical architectural façade.

Working on a solid basis in the restoration field requires a thorough knowledge of the historical monument. The theoretical foundation for the architecture project is laid by research, which is often multidisciplinary, involving painters, restorers, historians, and architects.

Plaster is a classical render used on architectural façades and can take virtually any form, color, or texture to achieve the desired effect on the building. The general composition of a plaster renders consists of the base layer (plaster body) of hard consistency, adherent to the support layer (e.g., brick masonry), and the finishing plaster of a fine and dense consistency with a small thickness. By sanding in various directions and brushing, different textures can be achieved that are perceived differently in the light and will develop a distinct patina (depending on the sanding direction). Optionally, a fine layer of painting film can be added in order to protect the finishing plaster.

In the case of historical monuments, the first stage consists of the *in situ* analysis of the plaster, especially the cohesion of the material. The cracks, their direction and depth, are visually inspected, and the cohesion is checked by non-invasive techniques. The next stage consists of the analysis of the plaster taken from the site to determine the chemical and physical composition using the latest technology available, such as XR or SEM. By covering the vast expression of plaster renders throughout architectural history and evaluating current practices in conservation and restoration, we will see how laboratory research and technology can aid in restoring the historic façades.

Introduction. The following paper is based on visual research on several historic houses located in Bucharest and was inspired by *Forgotten textures* [1], a robust research project on historic interwar plaster renders (cement-based plaster), coordinated by Pro Patrimonio Foundation. Because the time and funding resources were limited, the research developed over a period of eight months and it was founded on the following methodology. The project corroborates four types of research: the bibliographic research sets up the broader European context at the beginning of the XX century and the spreading usage of cement-based plasters in the given context. The other tools used were laboratory testing of samples of plaster, practical experiments on site, and photographic documentation [1]. As the study suggest, the limited bibliography can only deepen the lack of knowledge in the restoration of interwar historic façades. Architects need to rely on practical experiments on site, and exploring different types of recipes of plaster in order to create a batch of samples to choose from. Ultimately, the samples must be laboratory tested in order to certify material compatibility.

By exploring the interplay between aesthetic attributes and the underlying physical characteristics of plaster, this study seeks to develop a comprehensive framework for assessing and preserving these surfaces. Plaster render façades are a versatile canvas to exploit architectural expression, and understanding the material can lead to durable and visually rich results. The embellishment of the architectural façade is not a theme of the past but an acute problem in contemporary architecture in order to achieve an alternative architecture rooted in the classical tradition of composition, texture, and ornamentation, as opposed to industrial, cold, technological façades. This research aims to delve into the methodologies and tools used in the visual analysis of plaster façades, emphasizing their application in heritage conservation, contemporary architectural practices, and material innovation. A plaster façade can become a shell of the desired appearance of the building, regardless the load-bearing wall that supports it.

Visual analysis of plaster façades. The research took place in Bucharest, in an area covering Calea Victoriei and neighboring streets, selecting a number of historic buildings which belong to the XVII-XIX century period. Plaster is a valuable material in rendering the appearance of a building, as it is often used to dissimulate a more precious or inaccessible material, such as stone. The ubiquity of plaster façades (especially in Bucharest) is also a component that justifies this study in better understanding the historic façades and how to care for them. The following examples studied in the present article were selected on two criteria: firstly, the façades belong to the same urban context; together, the façades convey a coherent appearance in the urban public realm; secondly, the three façades render a bossage-type plaster. The visual analysis aims to reveal if there is a particular type of detail, texture or material application that would make a more durable façade over time. If so, it would be relevant information for the technical papers that deal with historic conservation, given the little bibliography available on the topic. This chapter follows the idea that texture and details have a significant impact on the aesthetic qualities of the façade, but also on the durability. Learning from the historical façades can shape the way contemporary architects can use plaster renders, considering also the evolution in time of the façade and the main risks.

As defined in the work Plaster, Render, Paint, and Coatings: "Plastering / rendering Plastering / rendering, as defined in the standard, is a single-or multi-layer coating of plastering or rendering mortar applied to walls or ceilings with a defined thickness (other coatings as a top coat are also possible). Its final properties develop only after hardening" [2].

Starting the list is a valuable example, the plaster render of a pilaster at Monteoru House. The first image, FIGURE 1, is important because of the trowel technique used, a combed texture with vertical lines that conduct the raindrops in this direction. So the raindrops are quickly drained; there is no water stagnation, and this can improve and maintain a good quality visual appearance of the façade over time.

Regardless of the application complexity of this type of plaster, the aesthetic appeal of the combed plaster technique adds visual interest with its unique linear patterns and can suit various architectural styles. It was often used in the Art Nouveau period and in the early 1920s by architect Horia Creanga to embellish the main façade of his very first commission that marked his return from Paris, which was the residential building located on Bv. Schitu Măgureanu no.19, Bucharest.

As previously stated, this combed technique can contribute to the overall durability of the façade by conducting the raindrops properly. Also, the grooves can mask minor imperfections or wear over time, maintaining an appealing surface for longer compared to smooth finishes that show cracks and stains more easily.

In comparison, the next example would showcase some improper or less desired results when applying a plaster render finish to the façade. The analysis will focus on the Romanian Athenaeum, a neoclassical cultural icon of the city, designed by architect Albert Galeron and finished in 1888. Although it had some interventions and restoration works during the last century, the last major one finished in 2004-2005. The visual analysis of the plaster highlights the following aspects: The finishing layer of paint gives a less mineral aspect to the plaster, it creates a fine, film-like look. Underneath the paint, the last stroke on the plaster had been done in a circular manner, which creates an uneven aspect of the bossage and even stains caused by the raindrops. This unguided water dripping on the façade may be a cause for the fine cracks observed on the surface of the plaster.

Focusing on the following photos, FIGURE 4, there is something to say about the degradation of the plaster just by visual observation: the lack of adequate slope at the joint of the bossage pieces can cause rainwater stagnation, which leads to stains and horizontal cracks. FIGURE 4a, 4b.

The following example, FIGURE 5, will showcase a type of joint that has an adequate slope and there are no visible cracks caused by water stagnation.

As a general conclusion on the visual analysis, the trowel technique used, the ratios, and the recipe of the plaster can have a significant effect on how the façade will age over time. Architects, as professionals in the field should take in consideration construction detail that would prevent water stagnation on the decoration of the façade.

Multidisciplinary approach in understanding the historic façade. As the title of the chapter suggests, in the field of conservation of historical heritage, a multidisciplinary approach is necessary to fully comprehend the materials in question and to make the right decisions.

The good practice, as various studies suggest, after the visual analysis, is best to sample and analyze the physical and chemical composition of the plaster. Using the latest technology available, such as XRF[1] or SEM[2]. By covering the vast expression of plaster renders throughout architectural history and evaluating current practices in conservation and restoration, we will see how laboratory research and technology can aid in restoring the historic façades. This type of research implies different tests and involves a full range of specialists:

-Chemist: to determine the chemical composition of the plaster and the ratios of different materials: sand, cement, and limestone, and to operate laboratory equipment.

-Biologist: to sample and perform specific laboratory analysis to determine the presence of fungus or other biological decay (if there is present on the façade).

-Paintings restorer: to analyze the chromatic pigments and their type (natural, acrylic pigments) and their layering, if the façade or the ornament in case had been through multiple restoration stages.

-Architect: to coordinate, analyze all the feedback and to decide the best approach in restoring or repairing the historic façade.

In the decision-making process charged by the architect, the first step of the assessment is to choose upon the strategy: the conservation and repair of the façade using compatible materials and techniques or the substitution of the historic material with new compatible render [3].The decision is often preceded by the visual assessment and the diagnosis that involves: moisture presence in the body of the plaster, types of degradation (biological or mechanical), and also the quantity and placement of these types of degradation [3].

Taking samples of plaster is an important step in the evaluation of the façade render. A sample needs to be taken to a specific laboratory to be analyzed with X-Ray Fluorescence spectroscopy or scanned by an electron microscope: electron microscope with balayage. The sample is carefully sliced in order to reveal its component layers, which generally consist in: from the exterior of the wall to the interior, a very thin layer of paint, the finishing plaster layer, the main plaster body, and the support of the plaster (the structural wall). The microscopic analysis could reveal important data that conclude to the appropriate intervention, such as the component layers of the façade, the type of aggregates and binders, and ratios, chemical composition, type of degradation (such as loss of cohesion between different materials and layers).

Following this step, in considering the choice of materials, there are several aspects to follow regarding the environmental factors, understanding the conservation principles, and the test and validation in situ.

Climate and moisture remain the main parameters in considering certain types of renderings. Plaster acts as a protective barrier against environmental elements such as rain, wind, and sunlight. Understanding the composition and application of the finishing layers ensures that the building remains resilient to these factors, preventing water infiltration and structural damage.

Some plaster finishes are designed to regulate thermal performance and control moisture. Knowing the properties of different plaster types (e.g., lime, cement, or gypsum-based) can help improve energy efficiency and indoor comfort.

The main principles stated by the Chartas stand for compatibility of the materials, reversibility, and minimal intervention, meaning to retain as much of the original material as possible and to replace only what is

necessary because of unrecoverable damages. The references cited in this article reveal specific ratios to obtain historic plaster, but also the choice of materials, such as "very fine, clean sand washed at least six times in distilled water" [4].

The in situ tests are generally non-evasive and important to evaluate certain parameters such as water permeability with Karsten tube techniques or surface hardness with a durometer [3].

Conclusion. Following this study, we hope to reveal why it is important to understand plaster render façades in order to properly choose the right approach in the repair or simply maintenance of a historic façade. The plaster, like any other render, such as stone cladding, is like a piece of garment, an ornamentation of the façade. This was established particularly in the Renaissance, when *façadism* gained momentum especially in Church façades, and the idea of the façade as a shell emerged. The shell could have a classical appearance while the supporting structure belongs to a completely different system. The embellishment of the brick wall took off with the plaster ornamentation and texture. Further embellishment can be added on a façade by controlling the texture with trowel techniques, grain dosage, and color, even decorative paint, depending on the desired effect of the façade.

The status of plastering on architectural façades is a current issue because it intersects with multiple contemporary concerns, from sustainability and restoration to aesthetic trends and urban regulations. As architectural practices evolve, the role of plaster continues to be reassessed, balancing tradition with modern demands for durability, efficiency, and environmental responsibility.

The tension between the standardization of construction processes and the need for high-quality craftsmanship is a significant issue. While prefabrication and mechanized plastering methods can reduce costs and speed up construction, they may also lead to a loss of the fine detail and texture that traditional plaster techniques can achieve. The conflict between standardization and craftsmanship is particularly acute in Romania, where very few architectural firms design with consideration for how the façade will age. Even fewer implement a maintenance plan for plaster façades, despite plaster being the most common and accessible finishing material for the façades. The standardization, the modern approach, leads to a flood of industrial variants of plasterings in the current market.

The traditional historic textures, featured in the visual analysis at the beginning of the paper and also featured in an organized manner based on typologies in the *Forgotten Textures*, do have superior aesthetic values and a timeless and vibrant appearance, while the industrial variants, pre-dosed, generally have a poor appearance, although the physical characteristics regarding moisture transfer of the pre-dosed plaster are good and mostly compatible with the traditional plaster. What is lacking is a general preoccupation in the aesthetic spectrum of the plaster render, despite being a versatile medium to showcase architectural expression, and a lack of durability measures, which can be fought with a rigorous attention to the details. The consumerism exploitation on the construction sites is taking a toll on the image we project as architects on the architectural façade.

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References.

1. *Texturi uitate* [RO], *Forgotten textures* [EN], coordinated by Pro Patrimonio Foundation, Authors: Ruxandra Sacaliş/ Editor Mirela Duculescu/ Graphic design: Mona Petre, https://www.propatrimonio.org.
2. A. Reichal, A. Hochberg, C. Kopke, *Plaster, Render, Paint and Coatings* (Munich, 2004), pp.32-55.
3. M. Do Rosario Veiga, *Conservation of historic renders*.
4. B.M. Feilden, *Conservation of Historic Buildings* (Architectural Press, princeps 1982, 3rd edition in 2003) p.68.

Figures.

FIGURE 1 - Pilaster, covered in plaster, Monteoru House, situated on Calea Victoriei street, Bucharest, copyright author of the paper.
FIGURE 2 - Detail, plaster of pilaster at Monteoru House, situated on Calea Victoriei street, Bucharest, copyright author of the paper.
FIGURE 3 - Western, main façade of Romanian Athenaeum, Bucharest, plaster finished façade, copyright author of the paper.
FIGURE 4 - (a), (b), Detail of the main façade, zoom on the plaster to showcase the cracks, copyright author of the paper.
FIGURE 5 - Detail of the eastern façade, of Theodor Aman Museum, Bucharest, copyright author of the paper.


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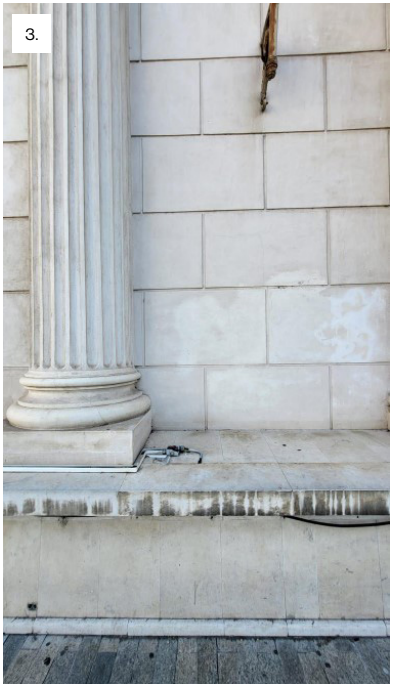
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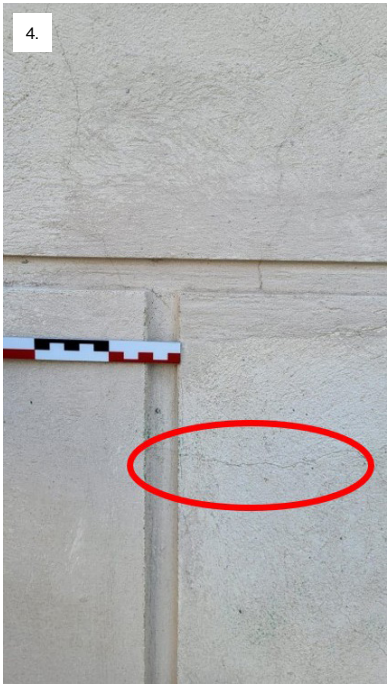
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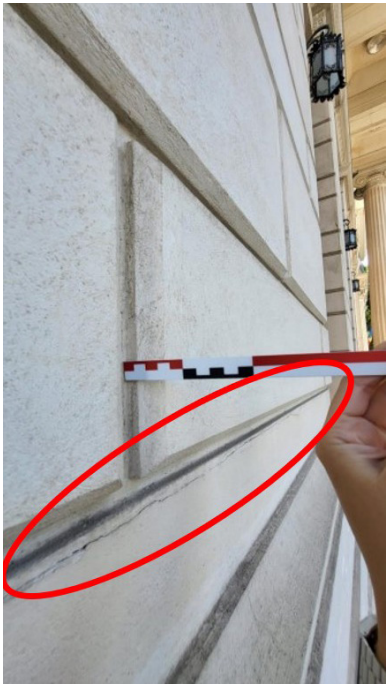


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