



Fundamental field: CIVIL ENGINEERING AND MANAGEMENT
Specialisation: CIVIL ENGINEERING AND BUILDING SERVICES

HABILITATION THESIS

- ABSTRACT -

OPTIMIZATION OF EXECUTION TECHNOLOGIES REGARDING THE REHABILITATION OF HERITAGE BUILDINGS AFFECTED BY MOISTURE

Assoc. prof. dr. VICTOR - DORIN POPA
Faculty of Informatics and Engineering
“1 DECEMBRIE 1918” University of ALBA IULIA

- Cluj-Napoca -
2023

The subject addressed in the habilitation thesis, OPTIMIZATION OF EXECUTION TECHNOLOGIES REGARDING THE REHABILITATION OF HERITAGE BUILDINGS AFFECTED BY HUMIDITY, has an interdisciplinary character, practically continuing the research theme addressed in the doctoral studies, entitled "Contributions to the theory and practice of repairing foundations and walls for constructions historical and social cultural".

If in the doctoral thesis qualitative and quantitative studies were presented on the migration of water in the masonry of historical and socio-cultural buildings, as well as aspects regarding the methods of remediation of moisture from the walls of buildings, the qualification thesis continues the previous topic, concretely presenting the ways to optimize technologies for removing moisture from the masonry of heritage buildings, with examples through the case studies presented (Patent application registered with no. A00713/ 24.09.2018, within the project PN-III-P2-2.1-BG-2016-0302), such as and the method of improving the adhesion to the support layer and the antibacterial effect of the mortars used for the rehabilitation of heritage buildings, by developing innovative mortars (Patent application registered with no. A 100614/6.X.2022; PN-III-P2-2.1 -PED-2019-3739).

Currently, one of the important objectives aimed at the restoration and maintenance of historical buildings is to obtain mortars with improved adhesion to the support layer and with an antimicrobial effect with the role of mitigating microbial corrosion, caused by microbial metabolism. Many of the old buildings are currently in an advanced state of decay due to humidity and environmentally induced conditions. At a relative humidity above 65% microorganisms, fungi, algae, and lichens develop rapidly. Due to the moisture and alkaline salts contained in the binder, the organic matter is dissolved and transported to the surface of the masonry, where it is deposited with the evaporation of the water. Thin black layers up to 3 mm thick can be seen covering the stones, which increase in thickness and become more porous with time. Microbial action is influenced by physical, chemical, and biological factors, representing one of the main causes resulting in the deterioration of old buildings, also called biodeterioration.

The paper is structured in 2 parts: ***Scientific, professional and academic achievements; Career development and development plans;***

The first part "Scientific, professional and academic achievements" provides a motivational foundation for the development of the qualification thesis, taking into consideration the competences proven in the achievements obtained throughout the 23 years of the university career, the professional evolution, the scientific contribution, and the results obtained, as well as the future projection career development prospects. The interdisciplinarity of the subject allowed the reunification of research results obtained over the years and their inclusion in the field of Civil Engineering and Management within the qualification thesis.

"Scientific contribution and results obtained" is structured in 2 sections, respectively: Interdisciplinary research on heritage buildings, the ways of degradation of load-bearing masonry and Development of innovative products from advanced materials, used in the rehabilitation of heritage buildings.

In the first section, *Interdisciplinary research on heritage buildings, on the ways of degradation of load-bearing masonry*, the contribution consists in optimizing the technologies for eradicating moisture from the masonry of heritage buildings, for the interior and exterior of the buildings, by correctly identifying the type of degradation (physical, chemical, microbiological) and the correct treatment of these forms of degradation specific to heritage buildings, namely the identification of causes, effects and methods of combating them.

A complex technology of moisture eradication is proposed, both for the interior and exterior of the wall, technology that includes a sequence of correlated operations, in order to stop the

capillary ascent of water through the wall, natural ventilation of the walls/foundations and last but not least of evacuating water vapor from walls with very high humidity (Patent application registered with no. A00713/ 24.09.2018).

The second section, *Development of innovative products from advanced materials, used in the rehabilitation of heritage buildings*, solves a problem identified in the first research theme, namely the design and development of innovative products (mortar) from advanced materials, in order to improve adhesion to the layer support and the antibacterial effect of mortars, used for the rehabilitation of heritage buildings. The general objective was to obtain a mortar with an antibacterial effect and an improved adhesion to the support layer with a preservation or a slight improvement of the mechanical properties, without significantly affecting other properties of the materials. For this purpose, a mortar formula was obtained in the composition of which were introduced, as additives, combinations of graphene oxides functionalized with metal ions such as: Ag, Zn, Ti or fly ash (Patent application registered with no. A 100614/6. X. 2022).

The second part, " Career development and development plans", addresses the directions and perspectives of university career development, through direct actions that will support the implementation of the proposed objectives and future development directions. It starts from the idea that education represents one of the basic foundations of society, the university career having autonomous particularities, related to combining education with research activity, but also with the immediate and perspective needs of the economic-social reality, for which the majority of students prepare, going through the three training cycles: bachelor's, master's and doctorate. Carrying out teaching and research activity, of course, requires specific skills and abilities, which are acquired and perfected through a sustained activity.

I will continuously pay attention to the improvement of the didactic activity, the axiological and qualitative orientation of the educational process, the anticipation of the results and the evaluation of the efficiency of the activity carried out, as well as the development of the research activity and the increase of the scientific reputation.

The general conclusions of the paper highlight the sustainability of the results and the actions that will support the implementation of the proposed objectives and future development directions, as well as the maintenance/continuous improvement of all processes/activities considered, in accordance with everything that represents the requirements and the regulations in the fields of interest, from a professional or scientific point of view.