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IMPACT OF REMEDIAL INTERVENTIONS ON RISING DAMP: INSIGHTS FROM A SINGLE-CASE STUDY

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Abstract

This paper addresses the problem of rising damp and its negative impact on residential buildings. The focus is a specific case study of a family house, where remedial measures were applied and in situ monitoring of their effects was carried out. The main objective is to evaluate the effectiveness of the chosen technology and its contribution to improving the indoor environment as well as extending the lifespan of the construction. The results demonstrate that the intervention significantly contributed to drying the masonry and stabilizing building elements, thereby improving their technical condition. At the same time, a positive influence on the indoor microclimate was confirmed, particularly in reducing moisture-related issues and secondary defects such as mold growth or damage to surface finishes. The case study highlights the practical importance of appropriately selected remediation technologies and their application in typical residential construction. The conclusions provide insights applicable to the protection and maintenance of similar buildings, emphasizing the importance of early diagnosis and targeted implementation of measures.

Keywords: Rising damp; Moisture remediation; Remedial interventions; Undercutting; Case study

1. Introduction

Moisture problems in masonry structures, particularly rising damp driven by the capillary transport of groundwater, are recognized as a prevalent and destructive form of building pathology. This phenomenon leads to significant material degradation, reduced thermal performance, and a decline in indoor air quality, posing a major challenge for the preservation of older buildings and the sustainability of residential buildings. In Europe, this issue is particularly critical due to a large and aging building stock, where old construction methods and materials are highly susceptible to moisture ingress. Today, however, by combining modern technologies and materials, we are able to effectively address the problem of rising damp [1]. Extensive research has focused on remedial strategies for damp-affected masonry, including mechanical undercutting, chemical injections, and the application of specialized remedial plasters. While various remediation technologies have demonstrated varied levels of effectiveness, their performance is often context-specific, dependent on factors such as building material composition, environmental conditions, and specific construction details [2], [3], [4]. A notable gap in the current literature is the scarcity of comprehensive in situ case studies that systematically evaluate the long-term performance of combined remedial interventions, particularly in the specific climatic and material conditions [5].

This paper addresses this research gap by presenting a detailed in situ case study of a family house in Western Slovakia, severely affected by rising damp. The primary objective is to evaluate the effectiveness of a combined remedial approach—specifically, mechanical undercutting complemented by the application of remedial plasters. We aim to quantify the improvements in both the structural integrity of the masonry and the indoor environmental quality, thereby providing empirical evidence that contributes to a more nuanced understanding of these rehabilitation methods.

2. Methodology

The research methodology consisted of several sequential steps (Figure 1). The investigation was carried out primarily in situ, as continuous measurements were required. The first step involved an on-site inspection of the building, the preparation of necessary documentation, and an assessment of the current condition of the construction, during which specific measurement points were identified. At these locations, the moisture content of the investigated construction was monitored throughout the entire study.

In the second step, initial measurements were conducted at the designated points across the construction. The collected data were systematically recorded in tables, which included the identification of the measurement point, the measurement height, and the date of data collection. Based on these values, the degree of dampness was subsequently diagnosed.

The following step focused on the selection of an appropriate remediation technology. This required the consideration of several factors, including the extent of moisture penetration and the spatial accessibility of the construction for the application of the chosen technology. After implementing the selected remedial intervention, additional measurements were performed at regular intervals, typically every one to two months, to continuously monitor the development of moisture content in the construction. On the basis of these successive measurements, it was possible to observe the temporal progression of moisture levels within the construction and to evaluate the effectiveness of the applied damp-proofing intervention.

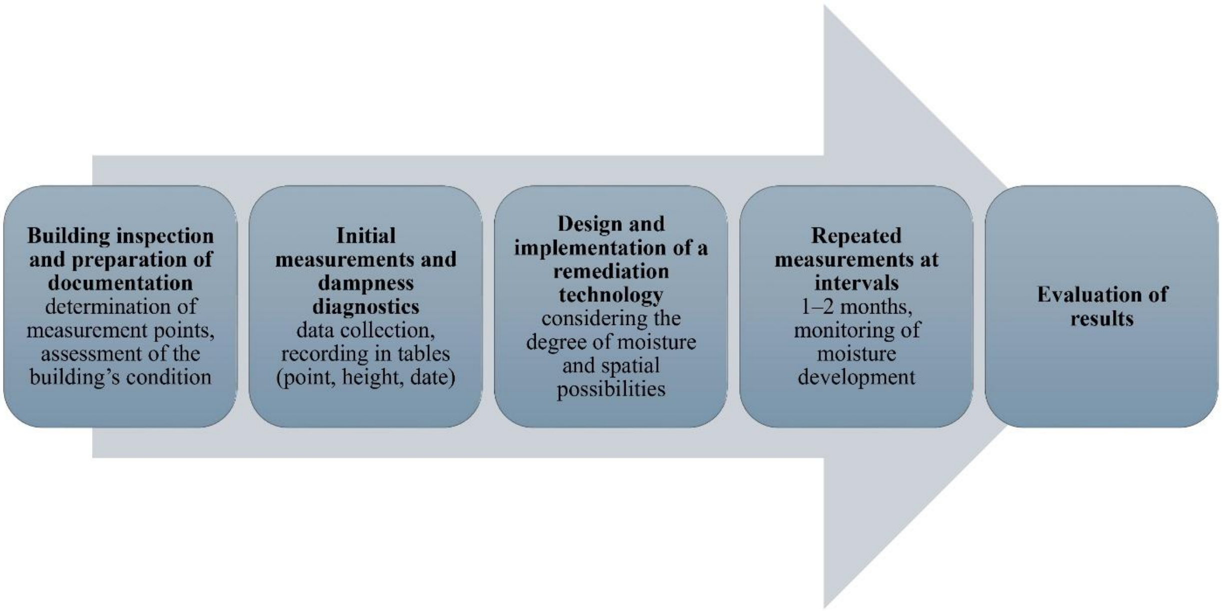

Fig. 1. Flowchart of methodological steps in building dehumidification (author)

3. Description of the Applied Remedial Technology

This article focuses on the technology applied to the investigated building, specifically the undercutting method. The fundamental principle of this approach is the creation of an additional impermeable barrier within the masonry, designed to serve as supplementary waterproofing against capillary rise and groundwater infiltration. In practice, this intervention aims to restore the structural integrity of the building envelope by interrupting the upward movement of moisture through the porous material of the wall. From a methodological perspective, the formation of additional impermeable layers represents a well-established approach within the field of building rehabilitation. As noted by Makýš [1], undercutting masonry is classified among the most effective methods in this category, particularly when dealing with historic or severely damaged structures. The process itself is executed in carefully sequenced stages to ensure stability, precision, and durability of the intervention. The undercutting procedure typically employs a diamond-wire saw, which, in combination with guiding rollers, enables controlled cutting across the masonry. This creates a narrow cavity or slot suitable for the insertion of a waterproofing barrier. Following the cut, the slot is meticulously cleaned to remove debris and dust, after which a waterproofing strip—usually composed of durable synthetic materials—is inserted. The strip is subsequently wedged to prevent settlement and ensure continuous contact with the surrounding masonry.

Work then progresses incrementally to the next section of the wall. The length of each section depends on multiple factors, including the type of masonry, the thickness of the wall, and the structural condition of the building; nonetheless, a working length of approximately 0.5 m per stage is considered standard practice. To secure the inserted barrier, wedges are applied systematically along the joints, preventing vertical displacement and maintaining even distribution of forces within the structure. Once a complete segment is stabilized, the process is repeated for the adjacent section, thereby advancing progressively across the wall. The final stage of the intervention involves sealing the joint, commonly using mortar injection or mechanical mortar application, which consolidates the barrier and re-establishes the wall's structural continuity. To complete the rehabilitation process, a finishing plaster is applied, serving both protective and aesthetic functions. Overall, the undercutting method represents a precise and labor-intensive technology that, when properly implemented, provides a highly effective and durable solution for the remediation of moisture-damaged masonry. Accordingly, it can be evaluated as effective [6], yet it imposes considerable economic costs [7].

4. Research Results

The building under investigation can be characterized as a residential structure with a floor area of approximately 120 m², which is permanently inhabited. It is situated on flat terrain with sufficient distance from surrounding developments. From a construction perspective, the building is predominantly made of brick, although in certain areas, mixed masonry was used. During the initial measurements, the building exhibited high moisture levels, which, according to ČSN P 73 0610 [8], can be classified as waterlogging. This standard divide moisture content into five categories (Table 1).

	Degree of humidity	Moisture (uM) [%]
1	Very low moisture	< 3.0
2	Low moisture	3.0 – 5.0
3	Increased moisture	5.0 – 7.5
4	High moisture	7.5 – 10
5	Very high moisture	> 10

Table 1. Degree of moisture of constructions, ČSN P 73 0610 [8]

As mentioned in Chapter 2, measurements were carried out at designated locations and subsequently recorded in tables. These data were then evaluated in accordance with the above-mentioned standard. Average moisture values before the implementation of remedial measures, taken at a height of approximately 30 cm above the floor, exceeded 10%. This indicated a high level of dampness in the building and the necessity for remediation. Following the implementation of remedial measures in September 2023, these values gradually decreased. The measured values may have been slightly influenced by prevailing weather conditions at the time of measurement; however, as shown in Figure 2, it is evident that moisture receded from the structure over time, and the masonry above the newly installed waterproofing layer gradually dried out. The use of heating during the colder season may also have contributed to this accelerated drying process.

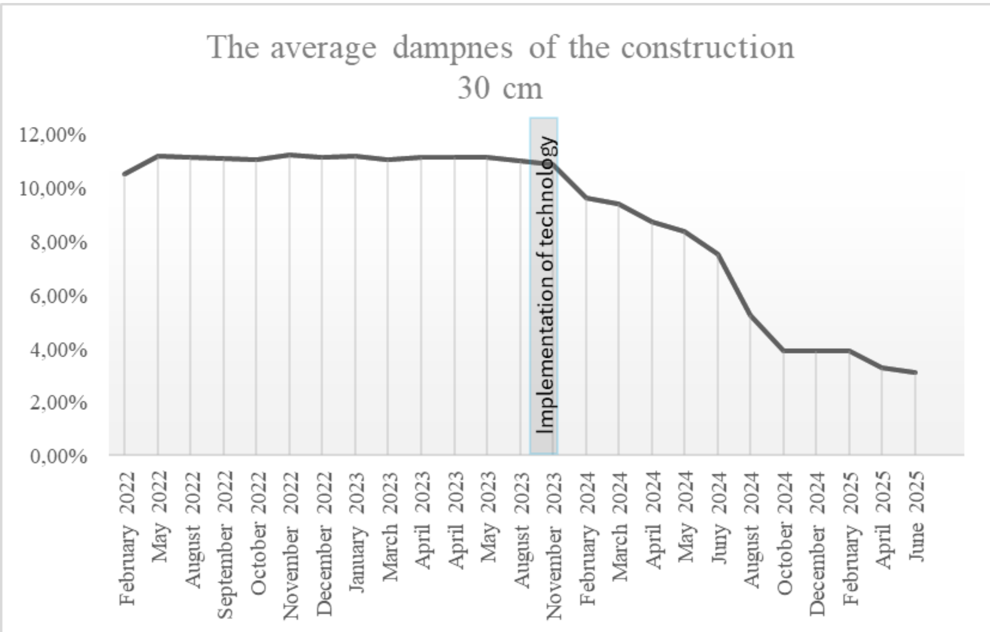

Fig. 2. Graph illustrating the average moisture development in the construction measured at 30 cm height, presented for the periods before, during, and after the application of damp-proofing technologies. (author)

Measurements were also conducted at a height of approximately 150 cm above the floor. From the very beginning, these values remained consistent, averaging around 1.30%, which according to the standard indicates that the masonry at this level was dry. These findings also excluded the possibility of condensation within the building and pointed directly to the influence of rising damp on the construction. Since the measured values at these points were consistently low, it is not necessary to present their course in this contribution, as they have no direct impact on the evaluation of the remediation technology's effectiveness and would only provide a supplementary overview of moisture levels at this height.

5. Discussion

The results of the research clearly demonstrated that the selected remedial technology—undercutting in combination with the application of remedial plasters—represents an effective solution for eliminating rising damp in masonry constructions. Prior to the intervention, measurements taken at 30 cm above floor level exceeded 10%, which, according to ČSN P 73 0610, corresponds to the category of "very high moisture." Following the intervention, however, the measured values gradually declined and stabilized within a few months at levels that can be considered technically acceptable. This trend highlights the ability of the applied technology not only to stop capillary rise but also to promote the progressive drying of the construction.

These findings may serve as a basis for further improvements through the application of active thermal protection (ATP), which could enhance indoor environmental quality and improve the efficiency of heating systems, even with reduced thicknesses of conventional thermal insulation, as indicated in publication [9], [10]. Active thermal protection represents a controlled dynamic process characteristic of building constructions with integrated energy-active components that provide one or more energy functions under different operational regimes of heating and energy supply systems. Such an approach could significantly contribute to the long-term sustainability of older buildings, many of which fail to meet today's energy performance standards. Nevertheless, the practical implementation of ATP remains the subject of ongoing research, which is expected to directly build upon the findings presented in this study. Preliminary assessments suggest that, for the walls investigated in this case study, the integration of ATP could enable a reduction in insulation thickness from 210 mm to approximately 50 mm, representing a substantial decrease while maintaining adequate performance.

6. Conclusion

The findings of this study confirm the positive impact of undercutting technology in mitigating rising damp. The applied intervention has proven its effectiveness not only in previous research but also within the framework of this case study. However, long-term monitoring remains essential in order to fully verify the durability and reliability of the system, as well as to establish realistic service-life expectations. Certain risks of reduced performance do exist, particularly when the intervention is carried out improperly or when low-quality workmanship compromises critical construction details. For this reason, strict adherence to professional execution and established technological procedures is indispensable. The study also emphasizes the importance of systematic in situ measurements as an objective basis for evaluating the effectiveness of remedial measures. Beyond confirming the suitability of the applied technology under the specific conditions of Western Slovakia, the research provides valuable empirical data that may serve as a reference for future studies and as decision-making support for the application of similar interventions in comparable buildings.

7. Acknowledgments

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