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MODERN TECHNOLOGY FOR WATERPROOFING BUILDING INFRASTRUCTURE

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Abstract: *In order to remove capillary moisture from brick walls and to create a damp proof course there are some known technologies which solve for good the problem, if they are properly applied. At Alba-Iulia synagogue Wykamol Ultracure was successfully conducted. The aim of this article is to present few of the main characteristics of the method mentioned above as well as some related works in such situations.*

Key words: *moisture capillarity, waterproofing materials, rising damp, foundation ventilation.*

1. Introduction

When we talk about moisture capillarity and rising damp we should mention the basic waterproofing principles in the way they appear in literature. Therefore, the 90%/1% principle and the 99% principle are recognized as the most important guides in designing, constructing, and maintaining a waterproof structure [2].

The 90%/1% principle: 90 percent of all water intrusion problems occur within 1 percent of the total building or structure exterior surface area.

The 99% principle: Approximately 99 percent of waterproofing leaks are attributable to causes other than material or system failures [2].

At the existing buildings and especially the old ones, the defects have been caused by rising humidity, condensation, salt attack, degradation of structural materials.

In many of these situations, problems occur as a result of improper exploitation of buildings, namely:

- heating rooms that worked unheated till then;
- construction work that prevented outward migration of moisture;
- finishes applied to walls, using materials with sealed effect on moisture transfer;
- raising the elevation of land arranged;
- deficiency in proper way of rainwater collect and removal.

Some of the possible sources of moisture from building are according to Figure 1 [1]. The notations that has been made represents: a - storm water; b - water penetrating the exterior walls due to wind action; c - freeze-thaw phenomenon; the aggressive action of chemical agents in the atmosphere; d - bouncing rain; e - condensation caused by insufficient insulation; f - condensation due to psychrometric cooling; g - water vapours; h - mass condensation in the wall; i – concentrations of salts which attracts

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vapours from the air; l - direct infiltration of water from the ground; m - lack of water; n – phreatic water level o - electro-osmosis forces; p - infiltration of moisture from the ground.

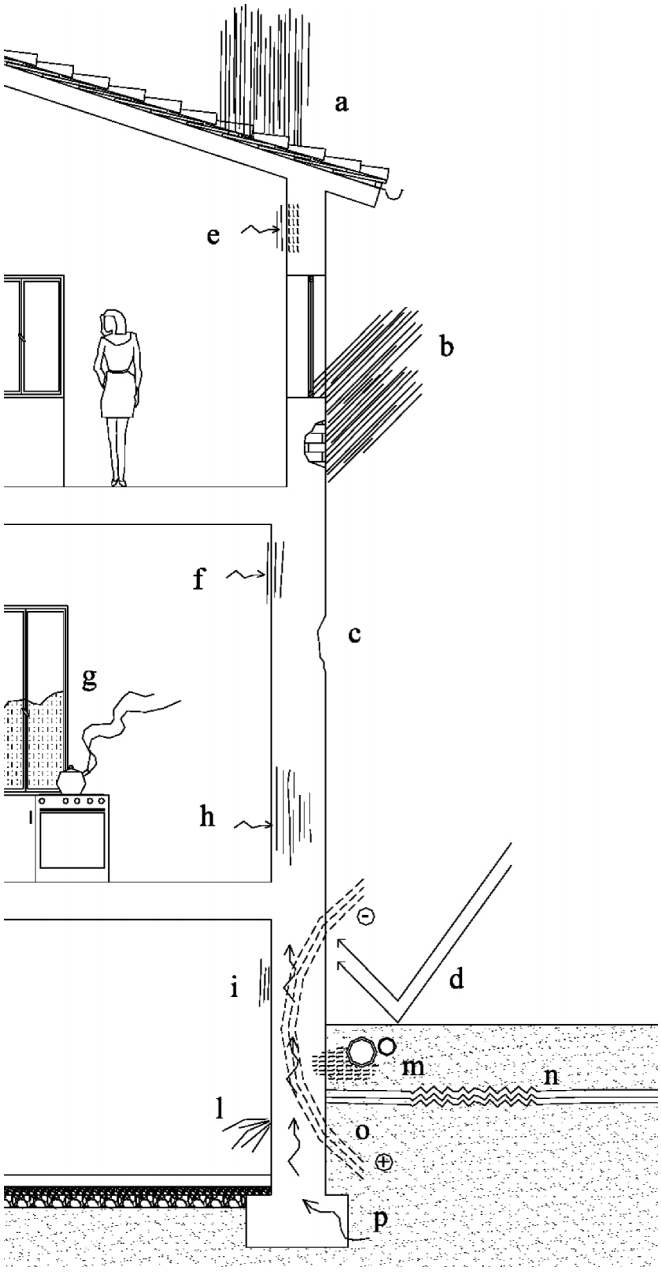

Fig. 1. *Moisture sources in buildings*

2. Technical Expertise

One of the objectives affected by the capillary moisture was the Old Synagogue from Alba Iulia and the technical expertise conducted revealed dampness variation in

wall height as well as blooms and coloured spots on the plaster (Figures 2 and 3) [3]:

Fig. 2. *Variation of capillary moisture in wall height*

Fig. 3. *Blooms and coloured spots on the plaster*

The variation of capillary moisture in wall height can be observed as well at the main façade (Figure 4) [3]:

Fig. 4. *Capillary moisture at the main façade wall*

3. Waterproofing Technology

Due to its high rate of success, Wykamol Ultracure was the method used to solve the humidity issues.

According to this situation the proposed measures for breaking the capillarity was the execution of a horizontal barrier using Ultracure. Some of the main method characteristics, described in specific British Board of Agrément Certificate are presented as follow. Ultracure is a silane emulsion cream for injection into the mortar course for the control of rising damp.

It also can be used in all types of masonry without high pressure equipment. The cream is delivered by hand pressure only from a simple displacement pump and injector lance into a series of holes drilled into the mortar course. From here the low molecular weight Silane effectively migrates into the masonry pores and fully passivates across the mortar joint as the cream reverts to a liquid phase. Upon curing a hydrophobic chemical damp proof barrier is formed in-situ. Curing of the DPC starts immediately with the final cure taking 2-6 weeks depending upon wall thickness [4]. The succinct illustrations of

necessary stages, described from top to bottom are presented in Figure 5:

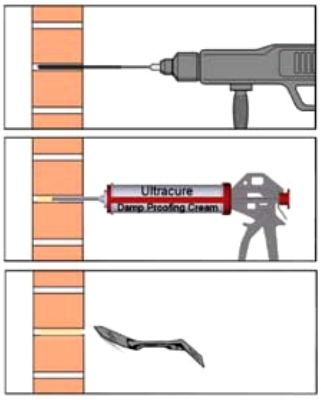

Fig. 5. *Technological steps: drilling holes; placing DPC; aerate finishing plaster application*

The holes of 12 mm diameter are drilled according to wall thickness. This can be at intervals of 120 mm and the depth is observed in Table 1. [6]

Depth of hole required / application rate Table 1

Wall thickness(1)	4 ½″ (115 mm)	9″ (230 mm)	13 ½″ (345 mm)	18″ (460 mm)
Drill hole depth [mm]	100	210	320	430
Application rate per 10 m wall lengths (litres)2	0.9	1.9	2.9	3.9

(1) For thicker walls the depth of hole should be to within 40 mm of the opposite face.
(2) Application rates for rubble, porous or highly-absorbent masonry may vary.

The data presented in Table 1 can be observed the linear variation between the resumed in Figure 6 and can be easily hole depth and wall thickness.

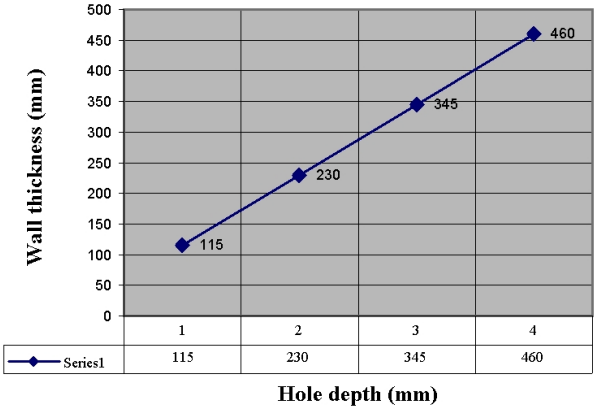

Fig. 6. *Hole depth – wall thickness variation*

4. Conclusions

A 230 mm tick brick wall treated in this way should normally dry out in approximately 6 to 12 month, if normal heating is provided during winter season.

There is also need to follow the prior technological steps, to assure proper treatment:

- exterior plaster should be removed to a minimum height of 50 cm above the intervention level;
- cleaning the mortar joints between the bricks on 2.5-3 cm. This situation must be maintained for minimum 4-5 months in order to remove the moisture accumulated in masonry;
- the treated surface will be plastered with lime-based mortar and lime-based finishing layer, until the complete elimination of humidity above the chemical barrier;
- concrete coating must be removed from the footing, leaving the foundation free for humidity movement.

Other specific measures conducted along with the injection treatment are related to:

- foundation ventilation on the exterior side of foundation as well as on the inside;
- moreover, at the interior side of floor a capillary break layer should be made over the whole perimeter of the synagogue, by creating a drainage layer of 25 cm thickness under floor insulation [5].

The expertise of the existing building was carried out with professionalism and according to existing standards and procedures.

The combined measures proposed to be adopted aim to solve for good the problem of capillary rising damp, as well as ventilating the foundation and creating a proper indoor microclimate.

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6. *** *BBA British Board of Agrément Certificate No 02/3961*, Detail sheet 10, Second issue, 7th December 2006.