IOP Conf. Series: Materials Science and Engineering **133** (2016) 012049 doi:10.1088/1757-899X/133/1/012049

Methods for elimination of dampness in Building walls

Cristina Campian[1], **Maria Pop**[1]

[1]Technical University of Cluj Napoca, Faculty of Civil Engineering, Cluj-Napoca, Romania

E-mail: cristina.campian@dst.utcluj.ro, maria.pop@dst.utcluj.ro

Abstract. Dampness elimination in building walls is a very sensitive problem, with high costs. Many methods are used, as: chemical method, electro osmotic method or physical method. The RECON method is a representative and a sustainable method in Romania. Italy has the most radical method from all methods. The technology consists in cutting the brick walls, insertion of a special plastic sheeting and injection of a pre-mixed anti-shrinking mortar.

1. Introduction

Dampness in buildings gives rise to processes of change in building materials usually with very evident symptoms. In our profession, we often come across chipped plaster, crumbling bricks, corroded metal components and wooden beams which, because of their hydroscopic nature, swell up, crack and rot.

Let us consider the various causes of dampness in walls:

- Consideration dampness:

This is difficult to evaluate if the materials used in the construction and seasonal in changes in conditions are not known (winter maximum, summer minimum). It is to be found the inside of buildings at certain critical points (corners) or widespread (e.g. north facing walls) with mould in greater or lesser proportions.

In order to eliminate this dampness it is necessary to insulate the wall and ventilate the rooms both naturally and by using forced air.

In order to eliminate the mould it is necessary to use disinfectant products mixed in paint or wash the walls with vinegar or bleach.

- Descending damp:

This generally results from the breakage of drainage piping or defective or poorly made roofing with imperfect sealing of expanding joints.

Careful repair and successive regular maintenance should solve all these problems.

- Rising damp:

This is the worst type of damp as it always implies much more radical and expensive treatment compared to the others.

This type of damp may occur because of water rising from water tables in the ground, from water dispersed in the ground from a faulty or defective water supply or sewerage systems.

[1] Maria.pop@dst.utcluj.ro.

This problem may be solved by finding the fault and carrying out repairs with care.

Regarding this problem, there are several procedures which vary in their effectiveness and duration but which can be carried out to prevent this problem.

These procedures can be divided into three approaches: chemical, electro osmotic and physical.

2. Chemical method

The first stage of this procedure consists of drilling holes in the wall, usually only on one side and up to a certain depth of the wall. Depending on which company carries out the work, either injectors or simple transfusion tubes are used.

Resins are then fed into these tubes either under pressure using a suitable pump or simply by gravitational force so that a chemical barrier is created against the capillary rise of dampness and to saturate the treated part.

This de-humidification process may meet difficulties if the injected product does not penetrate the affected surfaced uniformly; it must be added that very often the walls to be treated are very old and may have vertical cracks, internal cavities and air spaces which impede the resins injected either by gravity or under pressure, from spreading in a capillary and correctly horizontal way which could jeopardize the entire treatment.

Even very few untreated points allow dampness to pass beyond the level of the line of holes.

A second chemical method consists of using special plasters which dry out the wall without stopping the capillary rise of damp through the wall but encourages evaporation of the dampness in the wall.

This effect is produced by including progenies in the mixture which create intercommunicating macrospores in the mortar and increase the total evaporation surface area.

In the presence of a high rate of rising damp it is possible that an insufficient exchange between the capillary action of the rising damp and the evaporation in walls treated in this wall can occur.

This type of plaster could be used together with the de-humidifying chemical barrier technique with holes.

We believe that these methods are too recent development to judge their effectiveness over a significant length of time. These procedures must be reapplied after few years (2-5 years), because this is not a definitive solution and the moisture reappears.

3. Electro osmotic system

One of the first procedures of this type consisted of introducing triangular, trapezoidal or round elements of brick, called siphons, into the wall which contained a small copper plate in an internal cavity whose function was to attract the dampness contained in the wall inside the element; water resulting from this process was transferred to the outside because of the inclination of the element itself.

After a period of enormous popularity (several public buildings and churches in Europe still bear the signs of this method) it was completely abandoned as the copper plate corroded and was no longer able to fulfil its function.

Another method using this system, mostly used in Switzerland, consists of encircling the entire building with cooper conductor wire connected to probes, also made of cooper, which are inserted at predetermined intervals in the wall to be treated.

The line of connection is then tied to iron or cooper pegs which are inserted in the ground so that a difference of potential is created which brings about de-humidification.

4. Physical Method

It must be started that this is a system which provides a radical solution to the problem of rising damp.

Whichever method is chosen, an insulating barrier is created in the cut made at the base of the wall and provides an effective stop to rising damp.

There are two main methods used at the present:

4.1. Mechanical holes drilling method

In this method a series of holes are made in a line along the wall.

The diameter of the hole depends on the type of material to be treated and the type of insulating material to be inserted.

A first series of holes is created in a horizontal line at a constant height from ground level and in alternating sections. Silicone resin mortars are inserted into these cut sections.

When the resin has hardened, more holes are drilled as before in the parts of the wall which had not been touched.

This system is very costly because of the number of holes which have to be drilled.

4.2. Mechanical cutting system

This method is commonly known as the COMER-RECON Method from the name of the company in Italy, Recon being its representative in Romania, which manufactures patented cutting machines as well as the accompanying products and equipment.

It can be used on outside walls made of brick, tinstones, and concrete and expanded clay blocks.

It is necessary to use diamond tipped tools on hard rock or stone walls.

The first stage consists of removing a certain high of the wall plaster, of the wall to be cut.

If the remaining plastering is in very bad condition, it is a good idea to remove it before cutting the wall in order to encourage evaporation of water contained in the wall to be treated and the removal of soluble salts.

Cuts sections of lengths varying according to the existing wall structure are made and plastic sheeting is inserted into them.

These sheets act as a barrier to the rising damp (figure 1).

In the lagoon city of Venice, because of the very particular structure in which walls are supported by foundation piles, an insulating barrier is created by inserting polyethylene coated lead sheets into the cut.

This type of operation was carried out by Fiat engineering in 1985 during the restoration of Palazzo Grassi in Venice, property of Palazzo Grassi Spa.

The use of sheets creates a perfect insulating barrier with excellent dielectric properties, good chemical inertia, and excellent thermal resistance to compression.

The normal procedure involves applying mortar to the insulating material.

Figure 1. Introduction of anchoring wedges.

Then a number of patented plastic anchoring wedges are inserted in the gap for each wall section which, while they compress the mortar in the cut, secure the insulating material and assure the stability of the wall during the hardening of the saturating mortar.

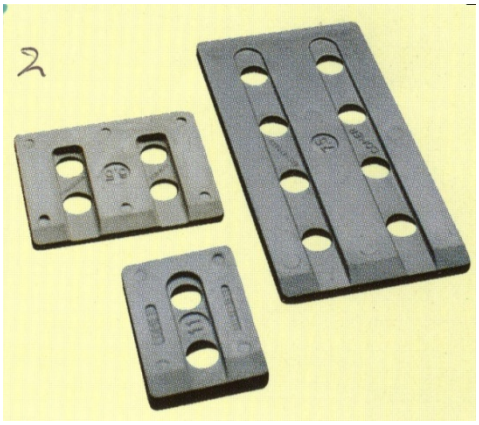

Figure 2. Anchoring wedges.

The wedges are inserted in the gap first.
Pre-mixed anti-shrinking mortar is injected into the cut.

Figure 3. Wall in treatment (Arcalia Castle, Romania).

This penetrates not only the wedge grooves and the cut itself but also any existing cavities in the wall structure, reinforcing it at the base.

It is very important to wait until the whole wall has dried out before proceeding to re-plastering. Regarding modalities for this type of operation in seismic areas, in Germany, Austria, Great-Britain, France, Thailand, Czech Republic, Slovakia, Hungary, Spain and Belgium, wall cutting machinery is used regularly.

It should not be forgotten that even in new constructions a separating cut is made for the insertion of waterproofing insulating sheaths (so-called wall-cutter product once made of asphalt sheets)

between the foundations and the base of the walls which are also used in multi-story buildings and are frequently simply laid without using any type of binder.

5. Procedure applied in Romania

In Romania, this procedure was applied with success at many buildings as old ones, historical monuments and even an old castle. These old buildings has become new buildings.

An interesting work was made at the Arcadia Castle in Bistrita-Nasaud in 2002. The castle was in a much degraded state, but now here it is the Centre of Biological Research oh Babes-Bolyay University, as it can be seen from the next pictures. Nothing has remain from the old state in which the building was before the intervention.

Figure 4. Wall before the treatment (Arcadia Castle, Romania).

Figure 5. Structural Wall the treatment.

Figure 6. Arcalia Castle today.

6. Conclusions

From the few methods presented here, some conclusions can be made.

The chemical method is too recent developed to judge their effectiveness over a significant length of time. This procedure must be reapplied after few years (2-5 years), because this is not a definitive solution and the moisture reappears.

The mechanical hole drilling method is costly because of the number of holes which have to be drilled.

The best method as we consider is the radical method, using the mechanical cutting system and the insertion of a special plastic sheeting with injection of anti-shrinking mortar, method successfully applied in Romania in many old buildings, common houses, and even an old castle.

References

[1] Agrement tehnic nr.007-03/051-1999 – S.C. RECON SRL, Cluj-Napoca, privind metoda de eliminare a umiditatii din pereti de caramida ai cladirilor, INCERC Cluj.

[2] T. Streza, Cr. Câmpian, 2002 *Tehnologia COMER de eliminare a umiditatii din ziduri*, 26-28 aprilie, „SIBSTIL 2002", Sibiu.

[3] C. Campian, 2005 *Methods for elimination of dampness in old masonry building walls*, Traditional Craft in 21 st Century Architecture", Conference Proceedings ISBN 83-921903-0-0, Szczecin University of Technology, Poland, pag 195-201.

[4] C. Campian, Z. Nagy, M. Pop, P. Pernes, 2015 *Sustainable Buildings* – 5th International U.A.B. – B.E.N.A. Conference, Alba Iulia 28-30 Mai, pp.46.

[5] N. Cobîrzan, S. Palacean, 2014 *Making existing building accessible*, Meditech, Springer Publishing Company, DOI 10.1007/978-3-319-07653-9_1, ISBN 10.1007/978-3-319-07653-9_1, Volume 4, pp 1-6.

[6] J. Carmody, B. Andreson, 2016 *Moisture in basements: causes and solutions*, University of Minnesota.

[7] C. Sharon Park, 1994 *Moisture in Historic Buildings and Preservation Guidance*, ASTM Manual Series, MNL 18 Febr., ASTM Publication Code Number 28-0018094-10.

[8] N. Moyer, D. Beal, D. Chasar, J. McIlvaine, *Moisture Problems in Manufactured Housing*, Florida Solar Energy Center, Publication Number FSEC-GP-212-01.