

THE PRESERVATION OF ADOBE BUILDINGS

BY

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Abstract. Whether built in the 17th or in the 20th centuries, adobe buildings share common problems of maintenance and deterioration. These types of buildings represent today in Romania a traditional house for country people. It also makes recommendations for preserving adobe buildings. By its composition, adobe construction is inclined to deteriorate; however, the buildings can be made durable and renewable when properly maintained.

Key words: clay; adobe; dried brick.

1. Introduction

Traditional adobe construction techniques in Romania have not varied widely for over 3 1/2 centuries (Fig. 2). Adobe building methods employed in the 16th century are still used today (Fig 1). Because adobe bricks are not fired

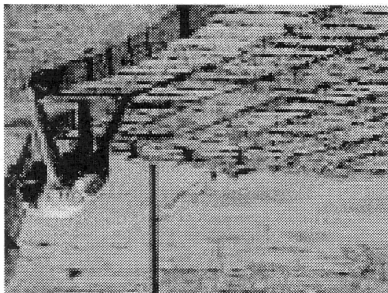


Fig. 1 – Sun-dried brick molding.



Fig. 2 – Adobe house.

in a kiln as are clay bricks, they do not permanently harden, but remain unstable

they shrink and swell constantly with their changing water content. Their strength also fluctuates with their water content: the higher the water content, the lower the strength.

A mixture of mud and straw is pressed into a mold to form an adobe brick. After the adobe brick is removed from the mold, it must dry in the open air for a month or more before it can be used.

Adobe will not permanently bond with metal, wood, or stone because it exhibits much greater movement than these other materials, either separating, cracking, or twisting where they interface (Fig. 3). Yet, many of these more stable building materials such as fired brick, wood, and lime and cement mortars are nonetheless used in adobe construction.



Fig. 3 – Adobe cond with wood.

For example, stone may be used for a building's foundation, and wood may be used for its roof or its lintels and doorways. In the adobe building, these materials are generally held in place by their own weight or by the compressive weight of the wall above them. Adobe construction possibilities and variations in design have therefore been somewhat limited by the physical constraints of the material.

Preserving and rehabilitating a deteriorated adobe building is most successful when the techniques and methods used for restoration and repairs are as similar as possible to the techniques used in the original construction.

2. Adobe Construction Techniques

2.1 The Brick

The adobe brick is molded from sand and clay mixed with water to a plastic consistency. Commonly, straw or grass is included as a binder. Although they do not help to reinforce the bricks or to give them added long-term strength, straw and grass do help the bricks shrink more uniformly while they

dry. More important for durability, however, is the inherent clay-to-sand ratio found in native soil. The prepared mud is placed in wooden forms, tamped, and leveled by hand. The bricks are then "turned-out" of the mold to dry on a level surface covered with straw or grass so that the bricks will not stick. After several days of drying, the adobe bricks are ready for air-curing. This consists of standing the bricks on end for a period of four weeks or longer (Fig. 4).

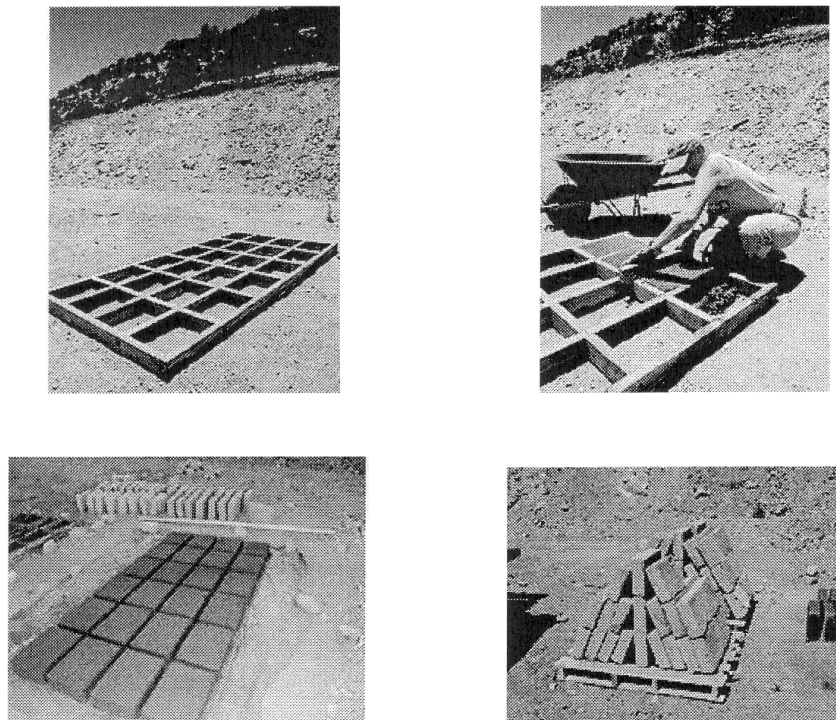


Fig. 4 – Adobe cycle.

2.2. Mortar

Historically, most adobe walls were composed of adobe bricks laid with mud mortar. Such mortar exhibited the same properties as the bricks: relatively weak and susceptible to the same rate of hygroscopic (moisture absorptive) swelling and shrinking, thermal expansion and contraction, and deterioration. Consequently, no other material has been as successful in bonding adobe bricks. Today, cement and lime mortars are commonly used with stabilized adobe bricks, but cement mortars are incompatible with unstabilized adobe because the two products have different thermal expansion and contraction rates. Cement mortars thereby accelerate the deterioration of adobe bricks since the mortars are stronger than the adobe.

2.3. Building Foundations

Early adobe building foundations varied because of the difference in local building practices and availability of materials. Many foundations were large and substantially constructed, but others were almost nonexistent. Most often, adobe building foundations were constructed of bricks, fieldstones (Fig. 5), or cavity walls (double) filled with rubble stone, tile fragments, or seashells. Adobe buildings were rarely constructed over basements or crawlspaces.

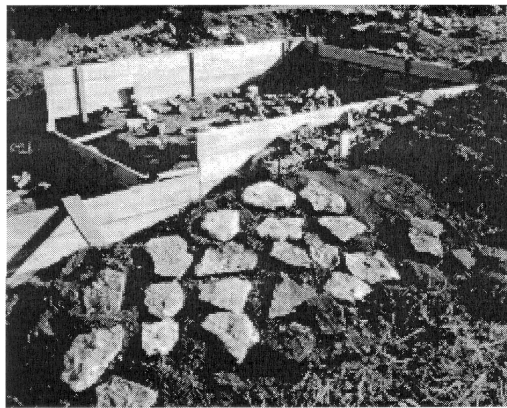


Fig. 5 – Stone foundation.

2.4. Walls

Since adobe construction was load-bearing with low structural strength, adobe walls tended to be massive. In some parts of the Romania, it was common to place a long wooden timber within the last courses of adobe bricks. This timber provided a long horizontal bearing plate for the roof thereby distributing the weight of the roof along the wall (Fig. 6).



Fig. 6 – Adobe walls.

2.5. Roofs

Adobe roofs tended to be flat with low parapet walls. These roofs consisted of logs which supported wooden poles (Fig. 7), and which in turn supported wooden lathing or layers of twigs covered with packed adobe earth. The wood was fir, oak, lime, elm, or whatever was available.

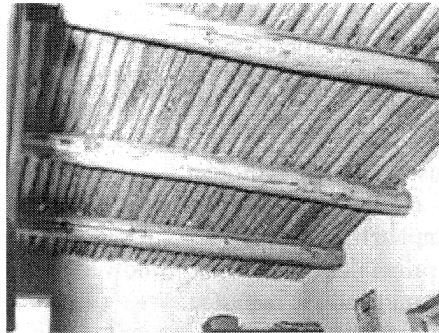


Fig. 7 – The wooden materials that comprise the traditional flat adobe roof create interesting and pleasing patterns on the ceilings of interior rooms.

2.6. Floors

Historically, flooring materials were placed directly on the ground with little or no subflooring preparation. Flooring materials in adobe buildings have varied from earth to adobe brick, fired brick, tile, or flagstone, to conventional wooden floors (Fig. 8).

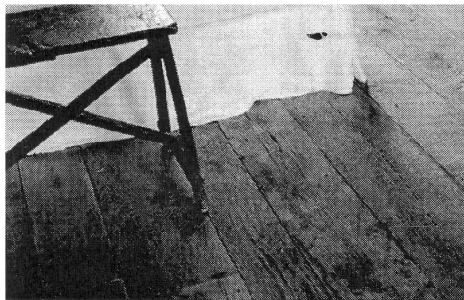


Fig. 8 – Ancient oak wood floor.

3. Adobe Deterioration

When preservation or rehabilitation is contemplated for an adobe building, it is generally because the walls or roof of the building have deteriorated in some fashion—walls may be cracked, eroded, pitted, bulging, or the roof may be sagging. When planning the stabilization and repair of an adobe building, it is necessary

- a) to determine the nature of the deterioration;
- b) to identify and correct the source of the problem causing the deterioration;
- c) to develop rehabilitation and restoration plans that are sensitive to the integrity of the historic adobe building;
- d) to develop a maintenance program once the rehabilitation or restoration is completed.

There are several principles that when followed generally it results a relatively stable and permanent adobe resource namely

1. Whenever possible, secure the services or advice of a professional architect or other preservationist proficient in adobe preservation and stabilization. Although this may be more costly than to "do-it-yourself," it will probably be less expensive in the long run. Working with a deteriorated adobe building is a complex and difficult process. Irreversible damage may be done by well-meaning but inexperienced "restorationists."

2. Never begin restoration or repairs until the problems that have been causing the deterioration of the adobe have been found, analysed, and solved. For instance, sagging or bulging walls may be the result of a problem called *rising damp* and/or excessive roof loads. Because adobe deterioration is almost always the end product of a combination of problems it takes a trained professional to analyse the deterioration, identify the source or sources of deterioration, and halt the deterioration before full restoration begins.

3. Repair or replace adobe building materials with the same types of materials used originally and use the same construction techniques. Usually the best and the safest procedure is to use traditional building materials. Repair or replace deteriorated adobe bricks with similar adobe bricks. Repair or replace rotted wooden lintels with similar wooden lintels. The problems created by introducing dissimilar replacement materials may cause problems far exceeding those which deteriorated the adobe in the first place.

4. Repairing and Maintaining the Adobe Building

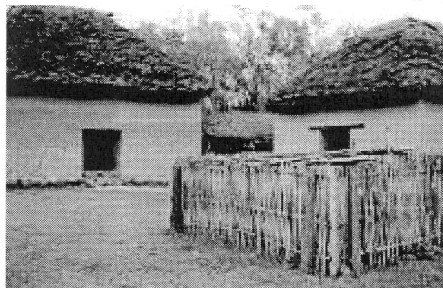


Fig. 9 – A traditional mixture of mud and straw plaster should be applied to stabilize the exterior of this house.

Once the adobe deterioration and any resulting structural damage is repaired, the restoration of the adobe building can proceed. Careful attention should be given to replace, repair, and/or reproduce all damaged materials with traditional or original materials (Fig. 9).

4.1. Patching and Repairing Adobe Brick

In patching and replacing adobe brick every reasonable effort should be made to find clay with a texture and colour similar to the original fabric. When an individual adobe brick has partially disintegrated, it may be patched in place. The deteriorated material may be scraped out and replaced with appropriate adobe mud. Often fragments of the original adobe brick have been ground up, mixed with water, and reused to patch the eroded area. However, some professionals advise against the reuse of material which has spalled off because it frequently contains a high concentration of salts.

If a substantial amount of the brick has been destroyed or spalled, commercially made adobe bricks and half-bricks can be obtained, or they may be made at the site or nearby. Generally they are composed of unstabilized adobe (that is, without any chemical additives). The deteriorated adobe bricks should be scraped out to insert the new bricks. If most of the brick is not deteriorated, then the deteriorated portion may be replaced with a half-brick. It may be necessary to cut back into undeteriorated portions of the brick to achieve a flush fit of the new or halfbricks. Spray (do not soak) the new brick and surrounding area lightly with water to facilitate a better bond. Too much moisture can cause swelling. Always use traditional adobe mud mortar.

When entire bricks or sections of the brick walls have to be replaced, caution should be taken when buying ready-made bricks. Many are now manufactured using stabilizing agents (Portland cement, lime, or emulsified asphalt) in their composition. While the inclusion of these agents in new adobe bricks is a technical advancement in their durability, they will prove incompatible with the fabric of the historic adobe building. Concrete blocks and cinderblocks are likewise tempting solutions to extensive adobe brick replacement; but, like commercially stabilized adobe bricks, they are not compatible with older and more unstable adobe bricks. However, concrete blocks have been used for interior partitions successfully.

4.2. Patching and Replacing Mortar

In repairing loose and deteriorated adobe mortar, care should also be taken to match the original material, colour, and texture. Most important, never replace adobe mud mortar with lime mortar or Portland cement mortar. It is a common error to assume that mortar hardness or strength is a measure of its suitability in adobe repair or reconstruction. Mortars composed of Portland cement or lime do not have the same thermal expansion rate as adobe brick. With the continual thermal expansion and contraction of adobe bricks, Portland cement or lime mortars will favour the bricks – the weaker material – to crack, crumble, and eventually disintegrate.

It is recognized, however, that some late historic adobe buildings have always had Portland cement or lime mortars in their initial construction. The removal and replacement of these mortars with mud mortar is not advised because their removal is usually destructive as regards the adobe bricks.

In repairing adobe cracks (Fig. 10), a procedure similar to repointing masonry joints may be used. It is necessary to rake out the cracks to a depth of 2 or 3 times the width of a mortar joint to obtain a good "key" (mechanical bond) of the mortar to the adobe bricks. The bricks should be sprayed lightly with water to increase the cohesive bond. A trowel or a large grout gun with new adobe mud mortar may then be used to fill the cracks.

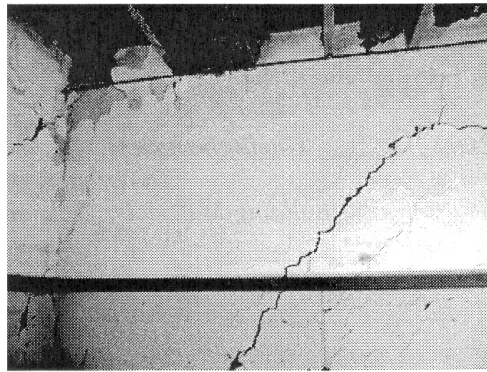


Fig. 10 – Adobe wall cracks.

5. Maintenance

Cyclical maintenance has always been the key to successful adobe building survival. As soon as rehabilitation or restoration has been completed, some program of keeping maintenance should be initiated. Changes in the building should particularly be noted. The early stages of cracking, sagging, or bulging in adobe walls should be monitored regularly. All water damage should be noted and cured at its earliest possible stages. Plant, animal, and insect damage should be halted before it becomes substantial. The roof should be inspected periodically. Surface coatings must be inspected frequently and repaired or replaced as the need indicates.

Mechanical systems should be monitored for breakdown. For instance, leaking water pipes and condensation can be potentially more damaging to the adobe building than to a brick, stone, or frame structure. Observing adobe buildings for subtle changes and performing maintenance on a regular basis is a policy which cannot be over-emphasized. It is the nature of adobe buildings to deteriorate, but cyclical maintenance can produce a relatively stable adobe building.

6. Conclusions

In conclusion, to attempt the preservation of an adobe building is almost a contradiction. Adobe is a formed-earth material, a little stronger perhaps than the soil itself, but a material whose nature is to self deteriorate. The preservation of adobe buildings, then, is a broader and more complex problem than most people realize. The propensity of adobe to deteriorate is a natural, ongoing process.

While it would be desirable to stop that process in order to safeguard the building, no satisfactory method has yet been developed. Competent preservation and maintenance of adobe buildings in the Romania must: (i) accept the adobe material and its natural deterioration, (ii) understand the building as a system, and (iii) understand the forces of nature which seek to return the building to its original state.

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CONSERVAREA CLĂDIRILOR DIN ARGILĂ

(Rezumat)

Avînd în vedere fondul de construcții din mediul rural din România, starea economică actuală a locuitorilor de la sate, construcțiile din argilă rămîn și vor fi o alternativă viabilă mulți ani înainte pentru acești locuitori. Astfel, conservarea și întreținerea acestor clădiri devine un deziderat imperios necesar pentru unii săteni.