

## The valencian rammed-earth wall (“*tapia valenciana*”) in the restoration of Alaquàs Castle (Valencia, Spain)

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**ABSTRACT:** The Alaquàs Castle, declared as historical heritage, is one of the best examples of renaissance manor palaces in the valencian area. It has suffered different interventions throughout its history, and even came close to being demolished in the early 20th Century. Yet despite this, its walls, coffered ceilings and other architectural elements have been preserved and had been put in value in the last intervention completed in 2007. Ashlar walls, made of limestone, frames the rest of the walls built with the so-called valencian rammed-earth wall, formed basically of sand-clay soil with lime and medium size gravel, a crust rich in lime and sand, and a brick reinforcement forming courses separate about 10 cm height. Its thickness is between 45 and 90 cm. The valencian rammed-earth wall interventions have been: consolidation or replacement of damaged areas, and rebuilt of nonexistent elements.

### 1 THE ALAQUÀS CASTLE-PALACE

#### 1.1 *Castle or Palace: A brief description*

The Alaquàs Castle-Palace constitutes one of the most remarkable examples of isolated Renaissance manor palace typology of all the valencian territory. It is a square plan building with central courtyard and four battlemented towers in the corners.

The courtyard is delimited by a stone arches system allowing a very clear opening to the gallery that communicates the different rooms. The four aisles have in some of their galleries up to four different levels delimiting different rooms with different heights. The main floor houses have large noble rooms with invaluable Renaissance coffered ceilings and singular ceramic pavements decorated and dated in the 16th Century. It occupies approximately 1500 m<sup>2</sup> in plant and its battlements reach a height of 24 metres.

The building we can see today was built at the beginning of the 16th Century by the García de Aguilar family, that occupied important political positions and with a relevant implication in the valencian high society of the time. Although it was a new plant building it was built over remnants of the Vilaragut family former palace that had the Alaquàs lordship from 1373 during almost a hundred years.

During the 17th Century, the castle lived one of the most international episodes by the hand of Pardo de la Casta, keeping a very deep-rooted link with the Manfredi family and, by extension, with the city of Cremona. Afterwards, the building suffered an important decadency until the beginning of the 20th Century, when the ownership of the castle passed on to Julio Giménez Lorca, announcing

in 1918 the demolition of the castle to take benefit of its building materials, mainly wood as a mere commercial element. Thanks to the important and quick civic answer, it was achieved that on the 26th of April, the king Alfonso XIII signed a Royal Order according to which the building was declared Historical and Artistic Monument.

During the following years large studies were prepared by architects concerned with the enormous value of the building, gathering plenty information about its artistic importance (In 1922 the Valencian Culture Centre published the book “*El Palacio señorial de Alaquàs*” by José Manuel Cortina Pérez and Vicente Ferrán Salvador that gather the first multidisciplinary study that symbolizes the attainment of the declaration of the castle as a Historical and Artistic Monument).

Even so, in 1928 and in a clandestine way, there took place the partial demolition of the northwest tower, whose reconstruction is described in this article.

Finally, after several transfers in inheritance the property passed into the hands of the Lassala family that used it as private residence and exploited it for other business and diverse uses. The first democratic Town Hall in April 1979 promoted and started a long process to recover the castle as a public space that finished in 2003 with the monument expropriation being completely managed since then by the Town Hall.

#### 1.2 *Its most recent history*

Nowadays, the building is declared as Property of Cultural Interest since 1999 and it creates a complex



Figure 1. View of the castle in the final processes of the restoration works. In this image we can notice the extension of the of the valencian rammed-earth in the walls.



Figure 2. Air view of the castle before starting the restoration works, where can be noticed the northwest tower inexistence.

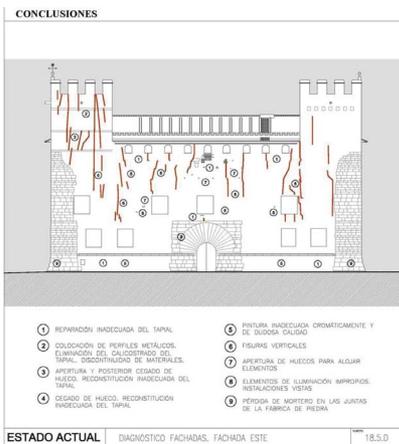


Figure 3. Plan of the previous study included in the Master plan.

with the Church of the Assumption to which it is joined by a covered gallery over an arch.

During 2003 to 2005 a Master plan was prepared under the direction of the architect Vicent García Martínez, with the collaboration of important scholars and researches (García 2005) that provided it with a common criterion at the time of studying the building, its pathology and the intervention to be prepared. After this analysis and defining the programmatic necessities the Alaquàs Town Hall decided to dedicate the building to an educative-cultural use according to the possibilities that the building presented.

In November 2005 started the restoration works according to the guidelines described in the Master plan. In March 2005 the building was inaugurated with a cultural exhibition that occupied all the ground floor, the noble floor, continuing later the works to adapt the chamber as educational space.

## 2 VALENCIAN RAMMED-EARTH WALL IN THE ALAQUÀS CASTLE

### 2.1 Valencian rammed-earth wall technique description

With the exception of the tower corners and the inner courtyard arches all the brickwork of the castle is done by means of the valencian rammed-earth wall. Essentially it is a reinforced wall with brick to courses separated from approximately five to ten centimeters and in all its thickness. The importance of this building system lies in the fact that achieves greater resistance and it ties up the valencian rammed-earth as a whole without eliminating its most important advantages such as the easiness of its construction, the little specialization required if its labour, speed of execution and, maybe the most important one, its least economic cost regarding to another type of walls such as stonework.

However, one of the attributed properties and that optimizes its use for defensive architecture would be the projectiles impacts good absorption; although it should be appointed as a disadvantage regarding other type of walls construction system, the need of greater thickness walls for its stability and to decrease buckling effects.

It is very well known and extended the building technique and its materiality, as its use became widespread as much for defensive architecture, as it has been said before, and for its civil and domestic use. Although its use goes back to the almohade period, it was generalized from the 14th Century in which flourished the construction of palaces and convents. A good example of defensive architecture is the Christian wall in Valencia dated in 1356.



Figure 4. Xàtiva's Almudín façade, in which the valencian rammed-earth wall can be seen, built on the ashlar brickwork.



Figure 5. Hollow horizontal section done in the rammed-earth wall of the Alaquàs castle where can be seen the traces of the bricks internal disposition.

The proper Alaquàs castle is another example, where both, domestic and defensive architecture are present.

In subsequent centuries this kind of construction has also been used for the domestic architecture, finding examples of rural architecture like in the façade of Mas de la Cova in Manises (Valencia),

Property of Local Relevancy, or in the Ribera and the Costera areas in several examples of public or residential buildings such as the Almudín in Xàtiva.

Fray Lorenzo de San Nicolás (de San Nicolás 1633) described in 1633: “*Valencian rammed-earth walls faïth make with sand, half bricks and lime, adding layers of one and the other; is very strong work*”.

Making an extension to the above description of this Hispanic writer, the valencian rammed-earth wall differs from the other rammed-earth walls in its constructive genesis and aesthetical aspect.

This technique, based on archaeological studies carried out in the Alaquàs castle, consist of the construction of brick courses lying on the rammed-earth arranged lightly separated from the façade surface, so that once the different layers of lime and clay are poured, the bricks remain sunk of the superficial crust, giving it such a characteristic image.

The use of the bricks provides greater resistance because it regularizes somehow the different courses giving major monolithic nature. This technique can remind us the “opus testaceum” being the difference that the lost formwork was the brickwork in which the different layers were poured.

## 2.2 Characterization of the rammed-earth wall

The structural walls of the Alaquàs castle obeyed to a logical distribution according to the structural scope to be resisted. Generally speaking, they followed the disposition of placing ashlar at the four corners in such a way that the most exposed points to the changing weather conditions and even to the enemy's attack were made with a more resistant material. This stonework, usually, is composed of two sheets of regular ashlar placed in courses from between 25 and 45 cm height. Inside, there's a mortar rich in lime and arid completing the space in between the two sheets in such a way that consolidated enormously the corner giving to it an eminently structural function.

The studies carried out in the Master plan indicate that the valencian rammed-earth structural walls are the most generalized ones in the castle:

*“The rammed-earth wall is composed of a sand-clayish body with lime and gravels, a crust of mortar, made of lime and sand with reinforcing brick courses on which we can noticed certain homogeneity in the materials, in the formwork measures and in the reinforcing brick courses separation”.* (García 2005).

The approach in the intervention was mainly based on addressing three basics concepts that affected the valencian rammed-earth wall. The first one was related to superficial aspects of cleaning and punctual replacement of some eroded or

damaged bricks due to different reasons. The second one was based in blocking up the areas that had been open or that presented considerable lacks of material integrating them with the rest of the antique brickwork. Finally, the third one made reference to the valencian rammed-earth to be reconstructed in the tower demolished in 1928.

### 2.3 *Rammed-earth wall's cleaning and consolidation techniques*

As stated in the intervention project the general state of the rammed-earth walls was quite acceptable presenting several areas with pathology proper of this kind of walls like vertical cracks in coincidence with the limits of the formworks position. Besides, in certain points the bricks layout changed and there appeared many hollows and grooves to lodge facilities.

The approach when intervening was to correct these faults detected in the preliminary study and some others not previously detected but that followed the same typology. The first task in the intervention was responsible for removing a layer of acrylic painting present in the whole building. The method used for this cleaning up works was aluminium silicate projection at low pressure to remove the painting without damaging the appearance of the rammed-earth wall.

Once this work was done, it was proceeded to consolidate the surface by means of a spraying of potassium silicate so that it achieved a greater superficial resistance in those areas that presented superficial degradation.

### 2.4 *Rammed-earth wall's reintegration*

Former interventions in the castle's walls and the readjustment that some of the areas that suffered

throughout history, showed in some façades lack of homogeneity in the rammed-earth walls. The intervention project identified these areas and planned the works necessary to recover the original aspect of the rammed-earth walls.

Independently of the established concept for the volumetric recovery of the fourth tower that will occupy the third area of intervention, we refer to the rammed-earth wall's recovery to complete those hollows that had been open in previous stages, work that impelled an architectural recovery of the original spaces that had been distorted after several refurbishments and adjustments adding brickworks of another nature, that although it was not passing for a mimetic copy of the rammed-earth wall, it was necessary to give a superficial unique aspect to the rest of the rammed-earth wall. It is here where the execution and finishing techniques might be questioned but not the intention of recovering the rammed-earth wall aspect to unify wall faces.

Making a small reflexion about the restoration philosophy, for Roberto Pane (Carbonara 1976), *"every monument must be seen as a unique case, because it is such as a work of art and such must be its restoration"*. On the other hand, in Cesare Brandi's words (Brandi 2003), *"only the work of art's matter is restored"*, clearly alluding to the image and making sure its transmission making the intervention to remain as intact as possible over the course of time.

It is not a way to justify the work carried out but conceptual criteria that guarantee the works done at the Castle.

In this particular case, the main difficulty was the practical impossibility to carry out the original rammed-earth wall technique as we were dealing with walls' hollows to be completed, with a great mobility limitation on their upper part to be able to close the rammed-earth wall. Besides, other



Figure 6. Cleaning tests to remove the existent painting by means of aluminium silicate projection.



Figure 7. Reintegration of the rammed-earth wall in those areas with hollows of the former supports of the wooden beams.

difficulties arisen from the execution of the aforementioned Valencia rammed-earth wall need to be added, as that of the optimization of the resources due to the great amount of wall repair works to carry out and, above all, that of leaving a superficial aspect alike to the rest of the historical rammed-earth wall.

To do that, an exhaustive study of different faces of the castle walls was carried out, with a particular emphasis in the composition of the bricks' jointing grid where the brick's faces are slightly in the background and in the colour and superficial texture of the rammed-earth wall; this last aspect will be based on the dosage of the lime mortar crust. To do so, different samples of a composition of thin arid and lime grout adding the use of mineral pigments were carried out.

The proposal raised as suitable for this kind of intervention was to build up a brickwork wall with solid brick courses measuring  $28 \times 14 \times 3$  cm and a lime mortar with dosage 1:4, using the arids of the area to get a good integration with the existing brickwork. According to the location of the face to recompose, the different courses followed a cadence alternating 3 or 4 header courses and one stretcher course. The horizontal joints were about 6 to 10 cm thick, being the horizontal joint from 2 to 3 cm thick.



Figure 8. Tests carried out to build the valencian rammed-earth wall.

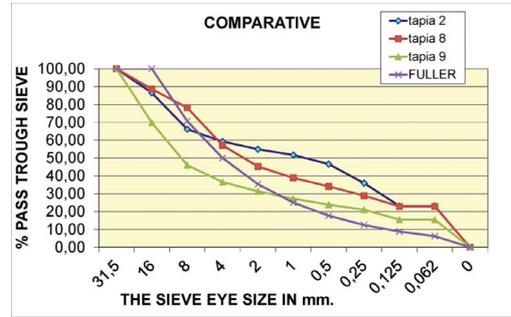


Figure 9. Granulometry of three rammed-earth walls samples compared with Fuller.



Figure 10. Image of the fourth tower during the reconstruction process.

Later, the outer plaster layer was made with lime mortar of dosage 1:3 with the same arids and pigments dosages that integrated with the annex brickwork. In some cases a superficial patina for a suitable chromatic reintegration was used.

### 2.5 The reconstruction of the fourth tower

The reconstruction of the fourth tower was, with no doubt, the work to which more time was devoted to the decision of the carrying out and the selection of the materials. The decision adopted was to use bricks with similar dimensions to the existing ones and rounded arid for the lime mortars. The rhythms of the bricks disposition were studied and a template to be used as a model was prepared. Over the existing rammed-earth wall a brick course was placed marking the difference between the intervention done and the existing wall.

Obviously, as it can be deduced, in this works the valencian rammed-earth building process of



Figure 11. Image of the process of placement of the brick course in the brickwork of the fourth tower during the reconstruction process.



Figure 12. Image from the courtyard during the reintegration and reconstruction works of the fourth tower.

the walls was not followed as we lacked the proper formwork of this technique that formworked the front parts of the wall faces in such a way that when tamping, the mass would flow around the bricks giving them their characteristic aspect. Due to this, the adopted solution in the reconstruction of the fourth tower can be considerate as a brickwork to the image of the valencian rammed-earth wall.

The final result of this method aimed at a visual integration of one of the most used techniques in historic buildings of the Levante area.

## NOTE

Architectural study: Vicent García, Miguel Monteagudo, Albert García, Marina Saura, J. Carlos Calderón, Soledad Caparró. Archeological study: Víctor Algarra, Paloma Berrocal, Alejandro Vila and Virginia Berrocal. Ceramics study: Jaume Coll, Victoria Domínguez and Isabel Caruana. Wood structures' study: Liliana Palaia, Santiago Tormo, Marina Saura.

## REFERENCES

- Brandi, C. 2003. *Teoría de la Restauración*. Carbonara, G. 1976. *La reintegrazione dell'immagine*. Roma: Bulzoni  
 García Martínez, V. 2005. *Plan director del Castillo de Alaquàs*.  
 San Nicolás, F. L. de. 1633. *Arte y uso de arquitectura*: 61.