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Earthen architecture: traditional constructions in the fertile lands of northern Valencia

This study focuses on the traditional architecture constructed in the northern area of the fertile lands of Valencia as a consequence of the development of agriculture producing a complex network of irrigation channels and roads. This architecture executed with traditional materials like mud, lime, straw or gravel used techniques based on experience handed down from generation to generation from the Islamic period until the mid 20th century. After studying the bibliography available and local documentation, the analysis and comparison of rammed earth farmhouses, cottages and mills in a catalogue of buildings from this area made it possible to establish a characterisation of the different building techniques found and their variants. According to this research four constructive typologies can be determined: rammed earth, adobe, earth and cement blocks, cob and earthen mortar. However, depending on their constructive, typological and chronological features, rammed earth walls can be subdivided into another four types, among which we can give special mention to brick-reinforced rammed earth as the most common constructive technique in this area or, where applicable, the one that has been best conserved to the present day.



Fig. 1 Outline of areas for cataloguing

Objectives and methodology

The main aim of this study is to catalogue and analyse the traditional earthen constructions of the fertile lands around the city of Valencia. These constructions are made using rammed earth, adobe, cob, earth blocks or mortars with a high percentage of earth.

Based on a review of the bibliography the earthen constructions found in the land lying on the original riverbed of the river Turia is catalogued in detail (Figure 1).

Once the area under study was outlined a type fiche was created for data collection, consisting of four sections: general building data, constructive technique used, wall details, and photographic study of the walls examined.

Analysis and characterisation by typology

Below we present a detailed analysis of the constructions according to their constructive technique.

Rammed earth walls

There are four constructive variants of rammed earth walls.

The first of these is the **simple rammed earth wall** (Figure 2). This variant was found in a very small number of cases, in rural homes and mills. The earthen walls themselves are approximately 40 cm thick and the nucleus is composed of earth, some straw to prevent the appearance of cracks during the drying process, and fine aggregate to increase resistance. All the walls studied had an exterior rendering in lime or cement mortar, 1.5 to 3.5 cm thick. The wall surfaces rise from a masonry or brickwork plinth that protects the earthen wall from rising damp; in addition, the corners, jambs and main joins are reinforced with bricks.



Fig. 2 Detail of a simple rammed earth wall

The second variant is a **type I Valencian rammed earth wall** (Figure 3), corresponding to constructions that are 40-52 cm thick, where the tamped mix contains high proportions of earth, lime to provide resistance and fine and/or coarse aggregate. The lime mortar used overflowed during construction to cover part of the more or less regular horizontal brick coursework, with header bonds at a vertical distance of 5-12 cm. Although these do not usually have any exterior rendering, in some cases lime mortar is found, with or without the occasional repair with cement, or with a cement mortar. This constructive typology is found mainly in dwellings although it can also be found in enclosures, mills and constructions built between the 14th and 17th centuries.



Fig. 3 Detail of a type I Valencian wall

The third variant, **type II Valencian rammed earth walls** (Figure 4), has a lower proportion of earth in the mix than in type I, but has a high percentage of lime and aggregates in different granulometries in the mix. The bricks are laid with header bonds, and the vertical distance between them is 4 to 15 cm. All the cases analysed are currently rendered on the surface with a mortar, either lime or cement, for protection, and in 90% of cases the surface finish is lime mortar. As regards building typology, this type of wall is usually found in dwellings but also in outer walls constructed between the 15th and 18th centuries.



Fig. 4 Detail of a type II Valencian rammed earth walls The final variant, type III Valencian rammed earth (Figure 5) are walls 30-55 cm thick, with a mix composed of earth, lime, brick and fine and/or coarse ag-

gregate in lower proportions than in the two previous cases. The ratio of bricks in the elevation of the wall is much higher, and the vertical distances between bricks range from 2 to 6 cm, laid with stretcher and header bonds. In terms of exterior rendering, most of these were not rendered or were simply limewashed, although currently many are rendered with lime or cement mortar. As regards general characteristics, most of these constructions were dwellings although there are also auxiliary constructions, mills, or religious buildings dating from the 16th to 18th century.



Fig. 5 Detail of type III Valencian rammed earth wall

Adobe walls

Adobe walls (Figure 6) are made out of earth blocks, large amounts of straw and a small percentage of aggregates – mostly finer – and using the same type of mortar. The constructive cross-section is 44-50 cm, with different types of bonds, in some cases with header or stretcher bonds or a combination of both. These adobe bricks are usually 40 cm long, 20-24 cm wide and 7-10 cm thick. Joins are 1-4 cm. These prismatic bricks are usually rendered in lime to ensure durability, with a plinth to prevent rising damp.

Although this typology was found mainly in dwellings it is also present in auxiliary constructions.



Fig. 6 Detail of an adobe wall

Walls of binder-earth blocks

Blocks of binder-earth are widely used in 20th century Valencian architecture. These walls (Figure 7), found in 20th century auxiliary constructions and residential buildings, are 14-40 cm thick, depending on the size and position of the block within the construction. These blocks are made up of a mortar of earth, binders, and gravel of different granulometries in high proportions. The binder may be either lime or cement, and the blocks are laid in the construction in coursework, using lime or cement mortar for the 0.5-2.5 cm joins. Measurements vary greatly as the blocks were manufactured manually: 29-40 cm long, 20-26 cm wide and 11.5-26 cm thick. In terms of bonding we found blocks laid in header, stretcher and header, or in stretcher position, which was the most frequent. These constructions also include horizontally coursed bricks at specific intervals and/or reinforcements at the weakest points of the constructions using the same bricks.



Fig. 7 Detail of a wall of binder-earth blocks

Earthen mortars

The walls built using earthen mortars (Figure 8) can be found in perimeter enclosures as high as 3 metres and in conjunction with specific types of building and in auxiliary constructions for agricultural and fisheries use.

These walls are 40-44 cm thick. The mortar used is mixed using high proportions of earth, a small percentage of lime as binder and fine aggregate. These are mostly mixed constructions of masonry and brick, or sometimes simply either masonry or brick.



Fig. 8 Detail of a wall with earthen mortar and masonry

Conclusions

This study and analysis was complex due to the wide variety of constructive typologies and buildings studied. However, examination of the parameters of the different constructive techniques revealed that Valencian rammed earth walls were the most common type in the region.

In addition, the in-depth study of individual typologies made it possible to identify the damage they present, which is most often derived from rising damp or rainwater. When carrying out interventions on these constructions it is therefore vital to take these factors into account in order to ensure lasting effects of the intervention.

All drawings and photos by C. Cazorla

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