NEW OLD RESTORATION TECHNIQUES FOR MODERNISTA BUILDINGS. REFURBISHMENT OF LA CASA DE LA MADRINA, VALENCIA.

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ABSTRACT:
The cities in the Mediterranean basin are characterised by the numerous examples of Modernista and Art Deco architecture, a token of a period of prosperity and development for many of them. Urban development in this world-famous style sometimes configured whole quarters in these cities. That is the case of the city of Valencia, which, with the impulse of great economic growth, reformed its historic centre and created the Ensanche and Grao quarters with buildings whose typical Modernista style reveals the fact that they were built at the turn of the 19th–20th century.

In spite of the destruction caused by bombing during the Spanish Civil War and the urban speculation of the nineteen sixties, in the Grao quarter in Valencia, close to the docks linking the city to the Mediterranean, some magnificent examples of this architecture can still be found.

This is the case of La Casa de la Madrina, built in 1910, which has been studied and restored by the authors of this article. The analysis of its structure and materials revealed the techniques and building procedures commonly used at the time it was built. The restoration project focused on an attitude of absolute respect for the original building methods, reinforcing and enhancing its structure by reinterpreting its mechanisms rather than the usual approach, which consists in replacing the original structure with new technologies foreign to the historic building in concept, function and results. The work performed on the building to date demonstrate the suitability and feasibility of this approach to the world of refurbishment of this sort of building, which gives it a greater guarantee of long-term survival as built heritage in our cities.
ARTICLE:
The house known as La Casa de la Madrina is situated in the Grao quarter in Valencia, near the city’s port. It is part of a large block of buildings that includes the old Gothic shipyards. The historic nucleus of Valencia was created in Roman times on a hill flanked by two arms of the River Turia, some four kilometres away from the sea. This fluvial city added a subsidiary town called Villanueva del Grao (which means literally “new port town”) on the coast, which served as a point of union with the Mediterranean. This situation continued for centuries, until the dawn of the 20th century, when the increase in maritime traffic due to exportation called for the organisation and construction of great docks and warehouses for the port, whose residential area was entirely renewed as the city expanded to fill in the land that separated the city from the sea.
La Casa de la Madrina belongs to this period of profound urban renovation in Valencia port, whose effervescence took place in a very short lapse of time, between 1905 and 1915. Besides the already existing warehouses and churches, which were respected in this process of total urban transformation, the Grao quarter is characterised today by a built network of exquisite three- or four-storey Modernista buildings, of which La Casa de la Madrina is an outstanding example. A rigorous preliminary study and a restoration project have been carried out on this building, the first results of which are expounded below.

Configuration of the Building
The building stands on a corner opposite Grao market, built between 1907 and 1909 in the same campaign to regenerate the district (Vegas, 2004). It has a ground floor, two upper floors, an attic and a roof, standing on a plot of approximately 150 m². A four-flight staircase illuminated by a skylight communicates the floors with each other and provides access to the roof.

The ground floor was originally intended as business premises and still serves the same purpose today, since it is occupied by a café. The interior layout of the two dwellings contains several reception rooms looking onto the street and several bedrooms at the
back, with hydraulic floor tiles decorated with the typical Modernista motifs in vogue when the house was built. The attic, with a low ceiling and a terracotta floor, was designed as a storeroom.

The flat roof bears an element characteristic of this quarter near the port, an additional structure known as a miramar, a lookout tower standing at one corner, which affords a view of the ships entering the harbour and a pleasant sea breeze in warm weather. Some twenty of these miramares can be found along the Valencian coast today, and if the authorities do not do something to preserve them, they are in danger of disappearing. The rest of the roof is made of plain tile hips sloping towards the main facade or the back of the building.

The facade has a splendid appearance thanks to its refined Modernista decoration. At ground floor level, it has a horizontal strip of false ashlars made of stucco, interrupted by the stylised vertical windows with railings finely ornamented with arabesques. The two upper storeys boast french windows giving onto small balconies with elaborate railings, of which there are ten in the whole house. The attic is ventilated by bull’s eyes surrounded by garlands all around the perimeter of the building. The most outstanding features are the hall door with its elaborate timberwork and its round arch, the numerous fancy bull’s eyes and the figurehead and the unusual triangle and prism ornamentation on the staircase and the above mentioned lookout tower.

**Constructional Study of the Building**

The facades of the house are solid brick fabric finely bonded with lime mortar and later clad in the same type of mortar plaster. The frames are made of pinewood girders and joists supported by the facade walls, the partition wall and the stair well, along with a few interior piers. Little brick vaults are formed between the wooden joists, that is, small flat vaults clad with gypsum mortar that cover the 70 cm spans between the axes of the joists. The spandrels of these vaults were filled with gypsum mortar on the first and second floors, and with sand mortar in the attic.

The stair well is built of solid brick fabric and the ramps of the stairs consist of flat vaults made of thin hollow bricks bonded with gypsum mortar, leaning on the perimeter of the well according to local tradition. These fragile-looking vaults are in fact extremely resistant, so much so that during the Civil War the residents sought refuge beneath them because when a building collapsed after bombing, the stairs often remained standing because of the resistance afforded by the walls connected by the curve of the vaults.
In the case of the flat roof, the slightly sloping frame diagonally divided by the edge of the ridge-piece consists of timber purlins, crossed timber laths and a double layer of 1.5 cm ceramic tiles bonded with gypsum mortar, and finished with a ceramic terracotta pavement grouted with lime mortar. This building system for flat roofs has a long-standing tradition in the city of Valencia, dating back to the Middle Ages. The waterproofing of this flat roof was achieved solely with this combination of three overlapping ceramic layers, aided by a 5-6% slope that made rainwater drain away immediately.

The inner brick walls of the lookout tower rest directly on the double layer of flat bricks on the roof. The superior frame of the lookout tower was made of a double layer of crossed timber purlins and laths and a final layer of terracotta pavement. The artificial stone fretwork aprons that once existed around the perimeter of the roof and the *miramar* were made of cement mortar on fine wires set in moulds and later fixed in place with cement mortar (Benito, 1983).

As regards the tile roofing, the hip is made of crossed timber purlins and laths as described above, a simple layer of flat bricks and a layer of tiles bonded with lime and sand mortar. This type of building system for roofs also dates back to the Middle Ages, as we can see by examining the roof of the nearby shipyard (Contreras, 2002).

The interior walls of the building are made of hollow ceramic bricks 1 cm thick bonded with gypsum mortar. The woodwork in the whole building, made of the same pine wood as the structure, is beautifully fashioned, both in the main entrance, the doors into each dwelling and the french windows. The decorative railings are made of cast iron, and the different pieces that form the balusters of the stairs and balconies are welded with melted sulphur. Rainwater runs through the channels of the roof leaders through pipes that lead to the sewage system under the adjacent pavements.

**Pathologies in the Building**

Just as occurs with its building, which is a perfect example of the standards of the time, the pathologies of *La Casa de la Madrina* are the typical problems to be found in this sort of building erected about one hundred years ago. The following pathologies can be seen:

- Subsidence of the house towards the back and towards internal zones. This is caused by the sinking of the foundations due to water seeping in from wells and, as in this case, leakage from the open drainpipes of the shipyard, which has washed away the
land under the building. This settlement has resulted in cracks in the interior walls and a slight rhomboid distortion of the woodwork inside the house.

- Fungus and, to a lesser degree, woodworm in the girders, joists and laths caused by leakage that created perfect conditions for woodworm to colonise them. The worst places were under the kitchens and bathrooms of the dwellings, corresponding to areas where rainwater had seeped in, and at the tops of the girders. Some of these attacks had taken place a long time ago and had been repaired with metal brackets and even layers of compressed concrete.

- Sagging of girders and joists in the frames particularly at the centre of bays, either because of deficient scantling or because these pieces had lost resistance as a result of the attacks described above.

- Outward displacement of the facade, caused by insufficient clamping of its horizontal and vertical structures. This displacement has caused the last vault to lose its shape and suffer the risk of collapsing.

- Lack of watertightness on the roof, the result of either breakage or displacement of the roof tiles or rainwater seeping through the three layers of ceramic, which had damaged the heads of the purlins resting on the walls inside.

- Breakage of the base of the double layer of thin bricks from the weight of the fabrics of the lookout tower, whose interior edge had sagged near the centre. The lack of a suitable base for the lookout tower had caused the bricks underneath it to sink and break.

- Rusting of the wires in the frame of the artificial stone fretwork banisters of the lookout tower, which had taken place a long time ago, probably aided by the sea air. These decorated aprons were replaced several decades ago by plain brick panels. Only traces of the original aprons are conserved today.

- Rusting of the rods fixing the sculptural elements, fleurons, pinnacles, etc., to the facade, causing the piers in which they are inserted to burst and threaten collapse.

**Philosophy of the Intervention**

Before beginning the refurbishment of *La Casa de la Madrina*, it was necessary to decide what philosophy to apply. The intervention had to show scrupulous respect for the original building systems in the existing house, reinforcing its weaknesses but allowing its own structure and functioning mechanisms to play the leading role.

Furthermore, we avoided introducing the staticity and monolithic quality of reinforced concrete in a historic structure characterised precisely by its flexibility. Apart from
striving to achieve the greatest possible ductility in the reinforcements, we intended to protect the building from earthquakes by clamping it horizontally, although Valencia is not an area of serious seismicity.

As regards the division of the different levels, the facade and the roof of the building, the solutions sought should allow the house to breathe. Permitting and even facilitating the release of steam from walls without an air chamber or a roof that was able to breathe perfectly when it was built safeguards against future problems and guarantees the long-term survival of the building by avoiding the humidity that is so harmful for the timberwork, for example.

Besides, the exterior configuration and facade decoration were to be respected absolutely, although in any case there is a preservation order on the house. This respect for the external configuration of the building includes railings, balconies, woodwork, terracotta pavements on the roof, etc.

**Building Solutions for the Consolidation of the Frames: Pros and Cons**

It is the local custom in restoring buildings to screw a 3 cm layer of concrete reinforced with an electrically soldered metal grid to the girders. This apparently harmless albeit efficacious solution causes serious problems that affect the building in time, which we can sum up as follows:

- The introduction of a new horizontal structure which, although used to reinforce the existing structure, in fact largely takes over from it, since it diminishes it and imposes different functioning mechanisms from the original structure.
- The introduction of great rigidity and a monolithic quality in a flexible structure, which prevents it from adapting and settling.
- The added weight of this structure to frames that often sag already, frequently reaching a permanent weight of 400 kg/cm² at the centre of the bays, not to mention the additional weight of the pavements and use.
- The material incompatibility of the electrically soldered iron in the grid with the gypsum.
- The introduction of a large quantity of water to form this compression layer, which is absorbed by the timber, whose degree of humidity increases so that it is prone to fungus and woodworm attacks.
- The damp caused by this additional water in the plaster and brick and gypsum vaults completely diminish their resistance and leave them at the mercy of the concrete.
In view of all these problems, it was decided to consolidate the frames in a way that would be in keeping with their functional philosophy, with dry solutions that would not add humidity to the gypsum or the timber, would permit ventilation, be chemically compatible and not represent added weight on top of the existing frame. In this way, the existing joists would be reinforced by providing them with greater inertia in the spots where they most need it, usually coinciding with the centre of the bays. Below we explain the first steps taken for the consolidation of the roof of the building.

**Restoration of the roof of the building**

We proposed to level the sagging joists in order to flatten the roof by reinforcing them horizontally by screwing new wooden pieces to the old structure. In this way, the existing joists are strengthened by providing them with greater inertia where it is most needed, which is usually at the centre of the bays. The same type of supplementation is also applied in cases where a loss of section was detected in the timber as a result of woodworm.

Then 1 x 2 m 13-laminate phenolic plywood boards 3 cm thick and were placed in a criss-cross pattern, connected to each other at the side by means of metal bands screwed to each side of the boards. This large weft of phenolic boards forms a sort of efficacious, light, dry, flexible compression layer that covers all the existing frame and is structurally compatible with its original functioning.

Next the perimeter of all this surface of phenolic boards was attached to the walls of the building by means of angular metal pieces that help make the structural functioning of the horizontal planes more solid, as well as helping to absorb possible shear stress at the union of the joists with the walls. This solution, which also possesses antiseismic qualities thanks to the resistance of the metal bands screwed in both directions, represents an additional weight of 20 kg/m² at the centre of the bay instead of the 400 kg/m² that would result from the addition of a compression layer of reinforced concrete.

Afterwards, a layer of thermal and acoustic insulation was added, waterproofing was applied and a ceramic or hydraulic pavement recuperated from the house was laid. In this case, for the thermal and acoustic insulation, we resorted to a solution borrowed from the recycling world: a layer of retreaded tire rubber, extremely waterproof but not very transpirable, was laid. For this reason, perimetral ventilation was provided in the underlying layers of the roof. Finally, the recycled ceramic pavement was laid; in the form of large terracotta plaques grouted with lime mortar.

**Conclusion**
The study of the constructional and structural mechanisms of this building known as *La Casa de la Madrina* demonstrates that many of the solutions normally put into practice in the restoration of historic buildings of brick fabric and timber frames with isostatic functioning involve imported technology, overloading and the hyperstaticity of reinforced concrete. The incompatibility of both techniques undermines the dignity and form of the original structures and endangers their future in the long term. The experience expounded here shows that there are alternative solutions reached by means of analysing the original constitution and functioning of the building, which not only reinforce its antiseismic behaviour but involve an insignificant additional weight in comparison with the usual solutions using reinforced concrete.
CAPTIONS
1. Situation of *La Casa de la Madrina* in the port of Valencia
2. Floor plan of the first floor. Before the works
3. The facades reveal the *Modernista* language characteristic of the time
4. The section allows us to see the state of sagging of many of the frames
5. Floor plan of the second floor. Restoration project
6. Discovery of the original fretwork apron made of artificial stone and cement mortars
7. Raising of the roof recuperating the missing pieces
8. Repair and anti-woodworm treatment of the heads of the timber purlins
9. Laying of the first layer of thin hollow ceramic bricks with gypsum mortar on the timber laths
10. Scheme of the replacement of the second layer of flat bricks with phenolic boards attached to each other by metal brackets
11. Scheme of the connection of the phenolic boards to the lateral walls with metal brackets
12. Laying of the recycled retreaded rubber waterproof layer
13. Laying of the recuperated ceramic pavement
BIBLIOGRAPHY