

Addition of attic floors.

Integral rehabilitation with the incorporation of an attic floor with prefabricated modules in the Barcelona Eixample.

Type of intervention

Restoration Rehabilitation / Renovation

Concerned elements on the intervention project

- 1. Foundations and underground structures
- 2. Vertical structures
- 3. Horizontal structures and vertical connections
- 4. Roof and terraces
- 5. Façade and building envelope
- 6. Finishes and completion elements
- 7. Integrate services
- 8. General strategies for building recovery

Site Carrer Muntaner 75, Barcelona, Catalunya, Spain

Objectives Construction of an 200m² attic floor on top of an existing building and providing it with an elevator, as well as restoring and rehabilitating the common areas.

Property Private

Designer IRABÉ PROJECTES S.L.
Arch. Rosa Bassols

Date Project: 2016
Works: 2021-22



Background to the intervention

Barcelona is one of the most densely populated cities, with 16,000 people per square kilometer, ahead of New York, Tokyo and London. However, municipal regulations allow the height of existing buildings to be increased according to the width of the streets and for years, it was allowed to increase the height of buildings from attics and penthouses, recessed from the plane of the façade.

In recent years, a rehabilitation strategy has been incorporated consisting of increasing the built volume by one floor (the most common), using prefabricated modules, which reduces the time of inconvenience for neighbors and usually involves lighter systems than those of traditional construction. In exchange for this right to increase the buildable area, the developer of the project carries out works to improve common elements such as accessibility through the incorporation of an elevator, the restoration of artistic stairwell elements or even the restoration of the façade, both in terms of energy and stucco or protected ornamental elements



Fig.1: Location and site plan of the property.

Description of the building

The property is located on urban land, in the Eixample district of Barcelona (Spain), bounded by the streets Muntaner, Aragó, Consell de Cent and Casanovas, at 28.08 m above sea level.

The plot, of **214 m²** (according to the Municipal plot plan), is trapezoidal in shape, adjusted to the usual corner chamfered layout, typical of the Cerdà Plan, and between two properties, with a frontage length of 12.56 m on Muntaner street and 13.91 m on Aragón Street.

The property is a multi-family building between party walls, aligned with the road, consisting of **Ground Floor + 5 Floors**. According to cadastral data, the building was built in 1920, and has a construction area of 1284 m². According to the Barcelona City Council, the property is not individually listed but is located in the specific protection environment of the "Conjunto Especial del Ensanche" (Special Ensemble of the Eixample) on which the Technical Commission for the Maintenance and Improvement of the Eixample acts, with a level of protection D.

The property consists of first floor, main floor and four upper floors. On the first floor there are three commercial spaces (sale of computer related products, clothing, and a bar) with independent access and access to the vertical distribution staircase to all floors on the façade of Muntaner Street. Each floor of the building consists of two dwellings with street view and, therefore, there are 11 units, three of which are commercial, and the rest are dwellings.

Considering that Aragon Street is 30 m and according to Art. 327 of the Urban Development Regulations of the General Metropolitan Plan of Barcelona, the maximum number of floors allowed is Ground Floor plus 6 Floors, so it is allowed to increase one more floor of the building, without exceeding the maximum regulatory height. Muntaner Street allows only

Ground Floor plus 5 Floors, but according to article 240 3b, the greater regulatory height may be extended towards the narrowest street, so that the entire front of the façade is of the same height.

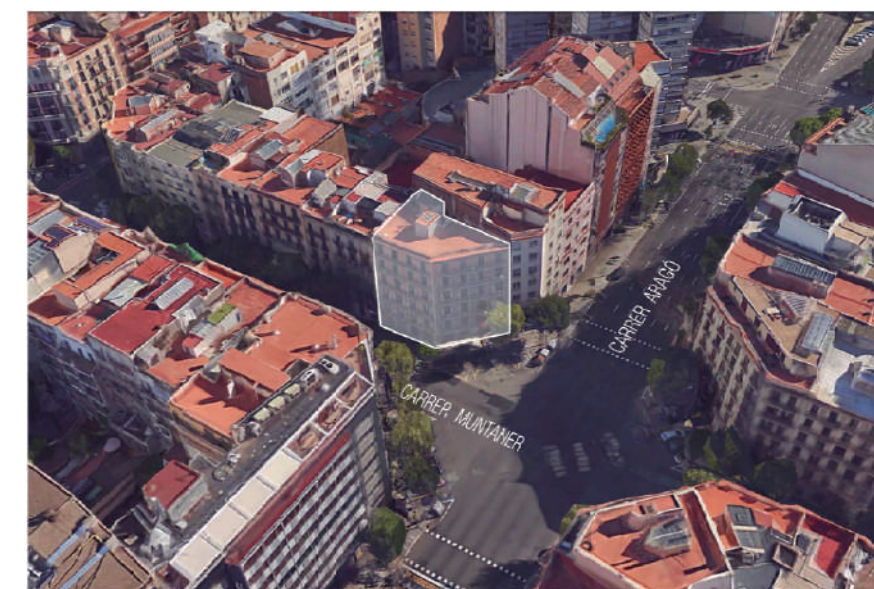


Fig.2: 3D View of the property on its context in the Eixample.



Fig.3: Drawing of the façades of Muntaner and Aragón Streets.

The Diagnosis of the building (values and state)

The building is made up of the following elements: main façade, rear patio, left patio, left party wall, rear party wall and roof, where the stairway exit body is located.

The main façade: the main façade was the object of an intervention within the "Raphael Program for the Restoration of Modernist Sgraffitoes" in 2002, which has been taken into account in the chromatic study carried out. The result of the intervention on the façade is very good and the current state of conservation is also satisfactory, so it will only be necessary to carry out cleaning operations.

The main facade has a classical composition, with central symmetry axes. On the upper floors there are 4 architectural openings on each façade plane that have balconies: on the main floor and fourth floor it is continuous, and on the rest, the two central openings share a balcony, while the side balconies are individual. In the corner of the building, there is a decorated pilaster at full height that, on the third floor, changes its decoration.

The building shows a rich ornamentation for the corresponding period, (first period of the buildings of the Ensanche Conservation Sector, between 1880 and 1920). The most outstanding elements are the first-floor plinth, the balcony slabs, the moldings, impostes and balustrades of natural stone; the stone surrounds, pilasters, capitals, corbels, balusters and crowns of artificial stone; and plinths, sgraffito stucco, friezes, both of framing and crowning of the building and cornices of work.

The façade walls on the first floor are 45 cm thick natural stone. For the rest of the floors, the façade, 30 cm thick, is made of ceramic brick with a lime stucco coating with sgraffito. The second floor is separated from the third floor by a fascia.

The access door to the building is made of wood, with wood and glass doors and a black wrought iron grille. On the upper floors, the openings have wooden balconies that give access to the balconies with cast steel railings. All the openings in the façade are framed and have pilasters with ornamental capitals on both sides.

The main façade is topped with a masonry cornice with corbels at the bottom and finished with traditional ceramic pieces, on which is the crowning balustrade formed by masonry parapets and buttresses that frame the balusters of artificial stone. The railing is topped with ceramic pieces with drip.



Fig.4: Detail of the damages and issues on the façades, to be repaired.

The lobby: in the chromatic study carried out prior to the intervention, it was determined that the state of conservation of the lobby and the stairwell is not correct, so the restoration and rehabilitation of this set of common spaces will be carried out.

In its present state, the walls of the vestibule, made of 15 cm thick masonry, have a stucco covering with sgraffito that has been repainted white. The whole is composed of strips separated by brown painted pilasters that are topped with capitals that form decorated beams. The walls have a wainscot of approximately 1.20 m, which is divided into three strips: the lower one by a black marble plinth topped with molding of a height of 60 cm, coinciding with the first three steps of the vestibule; the intermediate one of fire stucco, of dark yellowish color, and the third one is formed by a new molding of three faces, of brown color.

The paving is of white Macael marble, in 40x40 cm pieces arranged diagonally to the walls and framed by a 15 cm strip of reddish marble. The steps, both the tread and the riser, are in white marble.

The staircase core: the layout of the staircase is "volta a la catalana" with three flights. The box walls are painted cream with a maroon wainscot. The access doors to the apartments are made of wood, painted brown. The staircase is paved with white Macael marble up to the landing on the main floor. The rest of the staircase is paved with gray hydraulic mosaic tiles. The railing has wooden handrails and cast-iron uprights.

Light and ventilation courtyards: the property has two light courtyards. The central courtyard is located in the stairwell and communicates directly to the windows of the landings of each floor. The walls are made of 15 cm thick masonry, coated and the carpentry of the window openings is painted wood, although some changes and differences can be detected.

In the back patio, the windows have balconies with ceramic slabs.

In both courtyards there are various elements of installations:

Restoration and rehabilitation works

rainwater and sewage downspouts, various wiring, ventilation ducts, air conditioning units, etc. Both patios are uncovered.

The roof: the roof is communal and occupies the entire plot on the fourth floor and is accessed directly from the stairwell.

It is a flat walkable roof, "a la catalana" composed of a wooden beam structure and a common ceramic tile floor. It has separation walls with neighboring properties and around the perimeter of the courtyards. The main façade is finished off with a railing with masonry parapets and buttresses to frame the artificial stone balusters. The railing is topped with traditional ceramic pieces, "rasilla" type with drip.

The volume of the stairwell is covered with a non-accessible flat roof, finished with ceramic tile pieces and a central part of glass. On the roof there is a storage room covered with corrugated fiber cement board.

Deficiencies detected: The common elements as a whole suffer from slight deficiencies due to the passage of time and lack of maintenance.

Although the main façade is in a very good state of conservation, there are some humidity stains and some cracks. There are also cracks in some balcony slabs, so it is recommended to carry out maintenance work to prevent deterioration of the property.

On the other hand, both the lobby and the stairwell are in a poor condition. There are many paint gaps, a generalized aging of the coatings and finishes, and many of the pavement pieces are broken or loose, so a complete rehabilitation of the whole is proposed. Since the main objective is the installation of an elevator, a complete renovation of this common space is being considered. Among the works to be carried out, the

pavements will be restored and/or replaced where necessary.

The two courtyards of the property also show a lack of maintenance and disorder in the installations that run through them (chimneys or ventilation grilles, downspouts, gas pipes, etc.). The wall coverings also show flaws, especially in the crowning elements and other singular points (lintel areas due to substitution of carpentry, opening of new apertures for the passage of wiring, etc.). It is therefore recommended that maintenance work be carried out to avoid the consequent deterioration of the property.

As for the roof, the pavement has a correct appearance, without water filtrations, but with an evident wear of the joints and with some broken ceramic pieces. The railings also show some deterioration, and it is recommended that maintenance work be carried out and that the façade railings be maintained even with the incorporation of the new floor.

All the elements that make up the building envelope (façades and roofs) and those in contact with the exterior (perimeter enclosures of patios) or in contact with non-air-conditioned spaces (stairwell enclosures) have no thermal insulation.

The rehabilitation project consisted of increasing the built volume with a new floor in which two apartments have been located, and the adaptation of the entire stairwell to incorporate an elevator in the ventilation shaft of the courtyard.

The new floor has been attached to the party walls of the existing buildings and is aligned with the main façade plane facing Muntaner and Aragó streets. The existing light and ventilation courtyards stretch up to the roof and are extended from the raised floor to comply with the regulations that indicate the minimum dimensions of the courtyards when they ventilate main rooms such as the bedrooms.

Tests were carried out on the brick masonry and foundations to verify their mechanical capacity, and it was concluded that structural reinforcements were not necessary in the building. Nevertheless, and coinciding with the load-bearing walls of the last existing floor, concrete beams were made in the space left free in the air chamber of the ventilated flat roof, which function as "foundation" and regularization elements to support the prefabricated modules.

This new story was built using a prefabricated modular structure in the workshop consisting of 6 modules, which once finished, were moved, and placed in their final location using a truck-mounted crane. The lifting operation and placement of the modules was carried out in a single day, with the necessary permits being requested to interrupt road traffic in the area. Once the modules were in their final location, they were assembled with the common areas and connected to all the installation systems. Although it was originally planned that the modules would arrive on site completely finished, some cladding and kitchen equipment placement work was carried out once they were already on site.



Fig.5: View of the pre-fabrication process of the modules (exterior).



Fig.6: Installing the pre-fabricated modules on its final resting place on the roof.

On the top floor there are two apartments with cross ventilation and direct sunlight in the day area. The first penthouse, with a constructed area of 87.81 m², has a hall / distributor, living room, kitchen, 2 bedrooms and two bathrooms plus dressing room, with a balcony inside the block of 6m². The 2nd penthouse apartment, with a constructed area of 97.24 m², has an entrance hall/distributor, living/dining room with integrated kitchen, three bedrooms and two bathrooms.

The works in the stairwell consisted basically of: covering the existing windows in the hallways of the apartments with fireproof plasterboard enclosures on the staircase side; replacement of doors and adaptation to comply with the corresponding fire protection standard; cleaning and removal of the damaged areas of the lobby cladding (approximately 50% of the surface); solution of the problems of rising damp; restoration of the sgraffito with lime mortar dyed in mass with colors according to the chromatic study; installation of a new handrail at the beginning of the staircase; demolition of part of the staircase leading to the landing to create a ramp to allow access to the elevator; repair and replacement of broken marble and hydraulic mosaic floor tiles, approximately 1 m² per landing; cleaning of the marble and hydraulic tile flooring and subsequent polishing; cleaning of the handrail bars and waxing of the wooden handrail; painting of the stairwell wall with smooth paint; painting of the lobby ceiling with smooth paint. A new flight of stairs was also built to allow access to the new floor and to the new roof by means of a folded sheet metal steel structure, coated on the bottom with a 4 cm thick fireproof mortar projection and finished with painted plasterboard. The upper face of the staircase has been varnished with polyurethane varnish.

The elevator installation operation was carried out in the main courtyard, adjacent to the stairwell, as this was the only possible space, with the stops landing on the mezzanine.

As for the façade, a general cleaning of the sgraffito was carried out with water mist. Where necessary, small restorations were made with lime mortar dyed in the colors identified in the color plan previously prepared for the intervention and according to the sgraffito technique. The cracks were stitched with U-shaped rods and repair mortar and some specific volumes were also repaired, as well as the cracks in the balcony slabs with reintegrating mortars. Finally, a layer of water repellent with xylophages has been applied to the entire facade. As for the façade carpentry, it has been kept all unified with a single color of satin enamel and locksmithing with a gray iron enamel paint. All distorting elements and air conditioning machines have been removed from the façade.



Fig.7: Main façade with all the modules already in place.

Assessment of the results

At the time of writing this document, the work is still in progress. All major construction work (structural, enclosure and location of the modules that make up the new floor) has been completed. The rehabilitation, restoration and elevator installation works are still pending.



Fig.8: Transporting the pre-fabricated modules to the construction site.

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Raphael Program for the Restoration of Modernist Sgraffitoes

<https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX%3AC1997%2F219%2F04>

AVS AWARDS 2013, Barcelona Gestió Urbanística

<https://www.premiosdearquitectura.es/en/awards/32-premis-avs-2013/all-proposals/606-installation-program-lifts-in-barcelona-2008-2013>

Images and drawings



Fig.9: Perspective of the main façade with the proposed intervention (with windows closed).



Fig.10: Perspective of the main façade with the proposed intervention (with windows opened).



Fig.11: View of the pre-fabrication process of the modules (interiors).

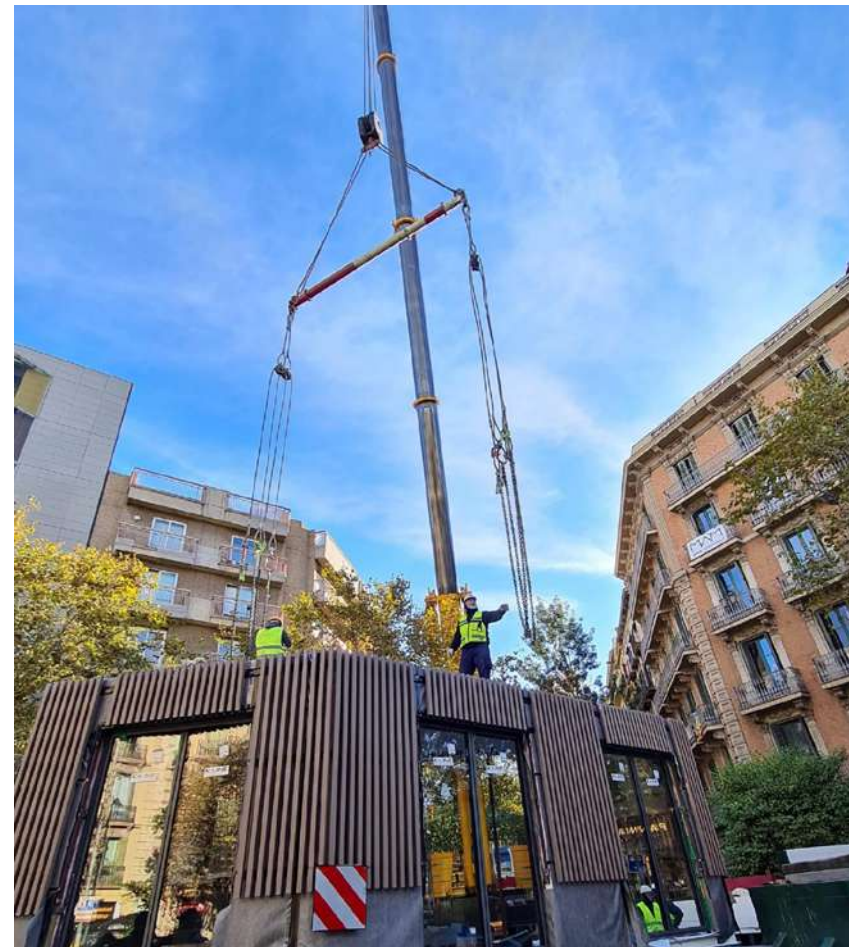


Fig.12: Preparing the cranes to lift the pre-fabricated modules.

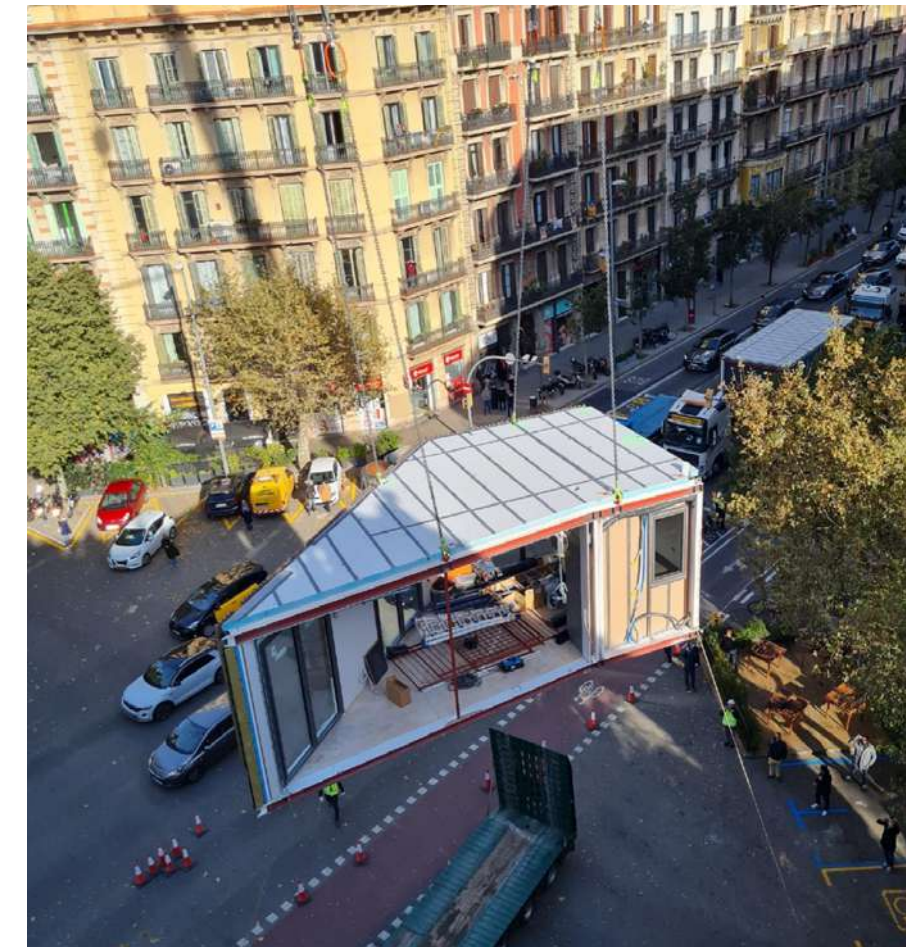


Fig.13: Lifting the pre-fabricated module to the roof of the roof.



Fig.14: Urbanistic definition, parcel plot implementation.

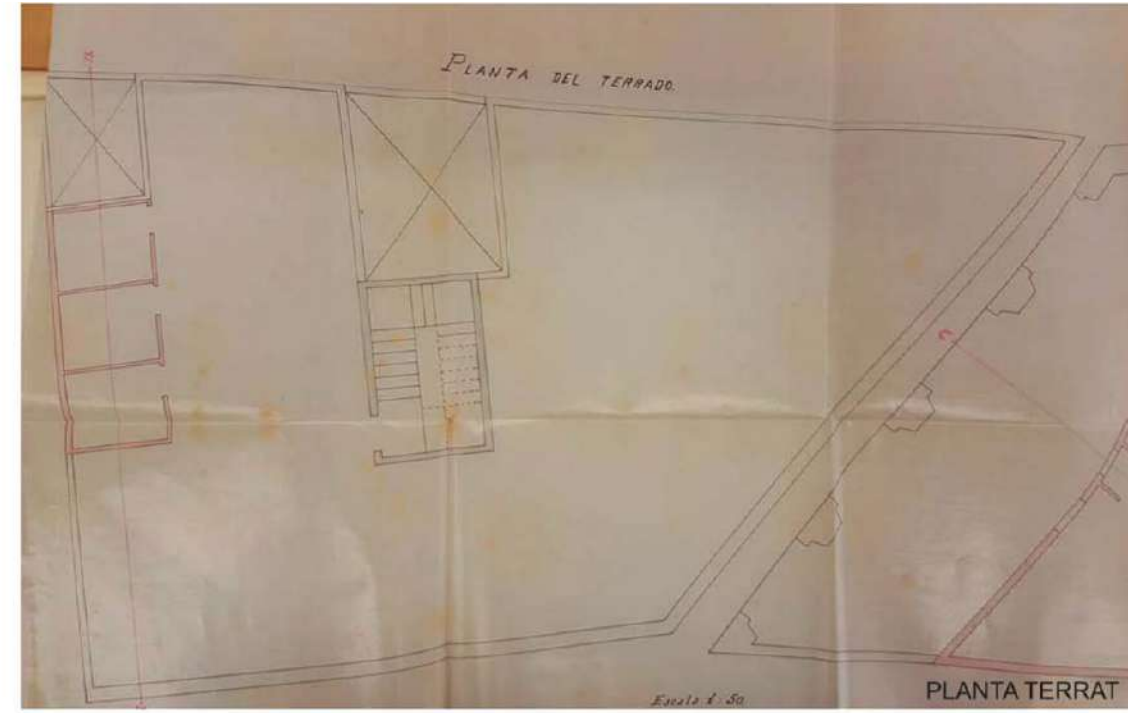


Fig.15: Historical drawings of the floorplans.



Fig.16: Existing conditions of the façades to Muntaner and Aragó Streets.

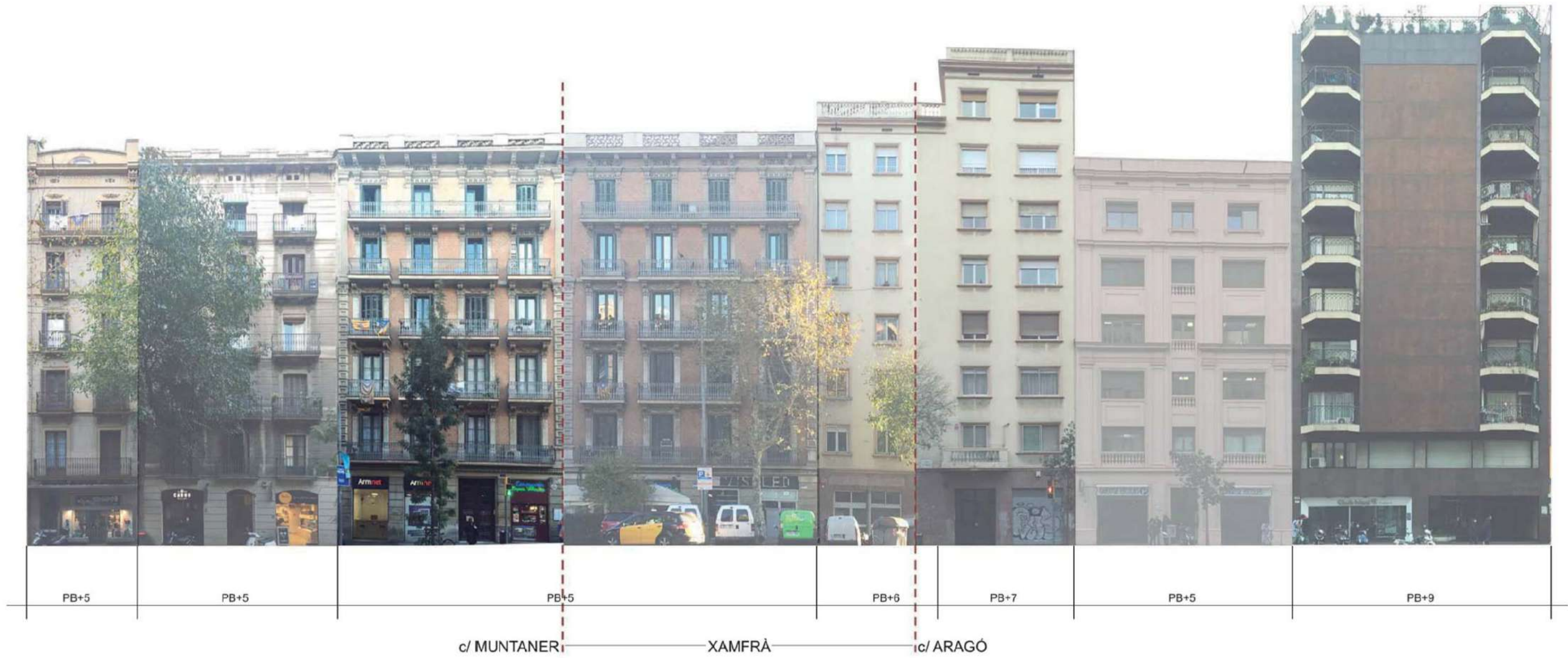


Fig.17: Ortophotography of the neighbouring buildings façades. (Xamfrà = chamfer).

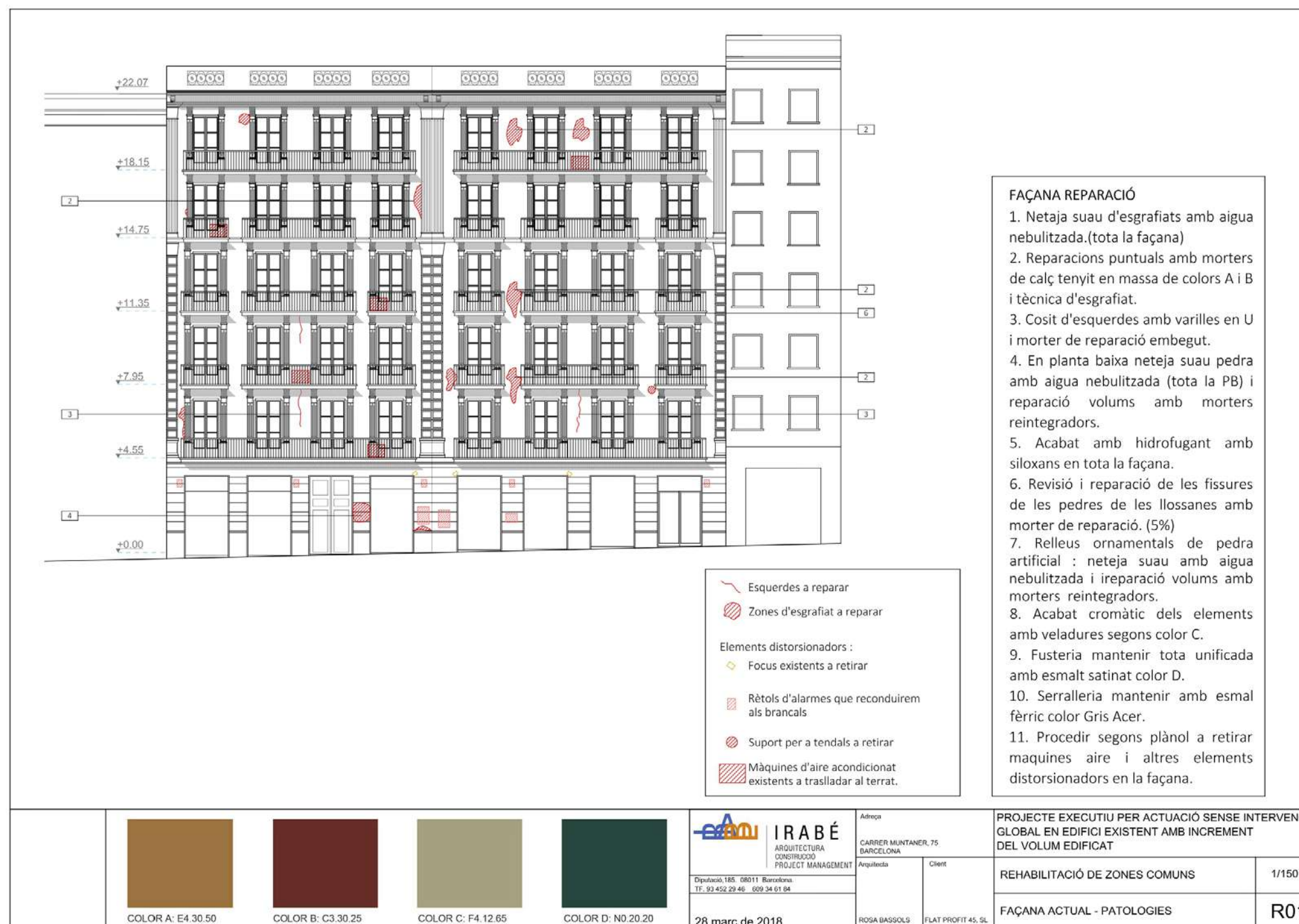


Fig.19: Pathologies on the existing façades.

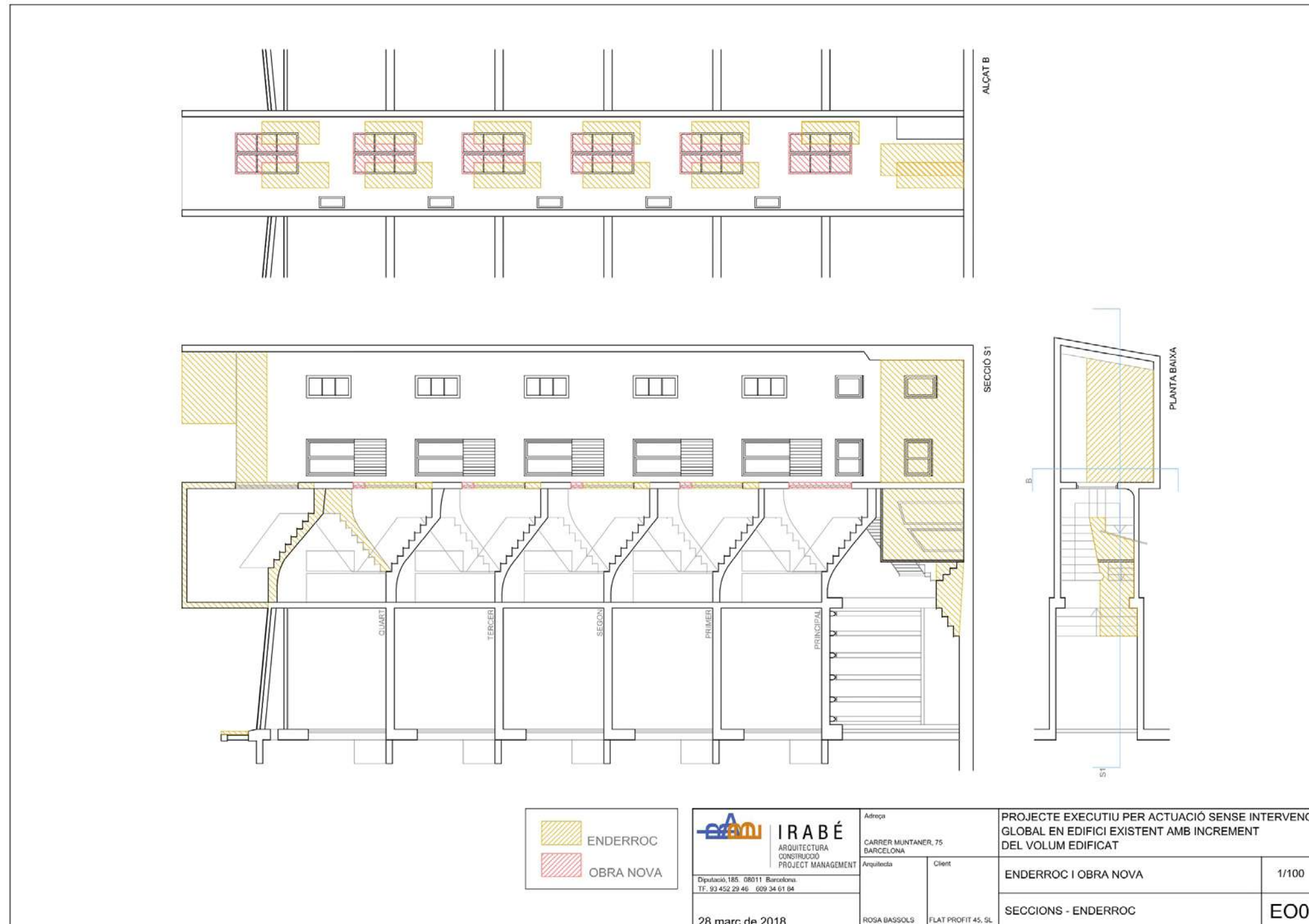


Fig.20: Demolition (showned in yellow) and new construction (showned in red) plan of the central patio and main staircase.

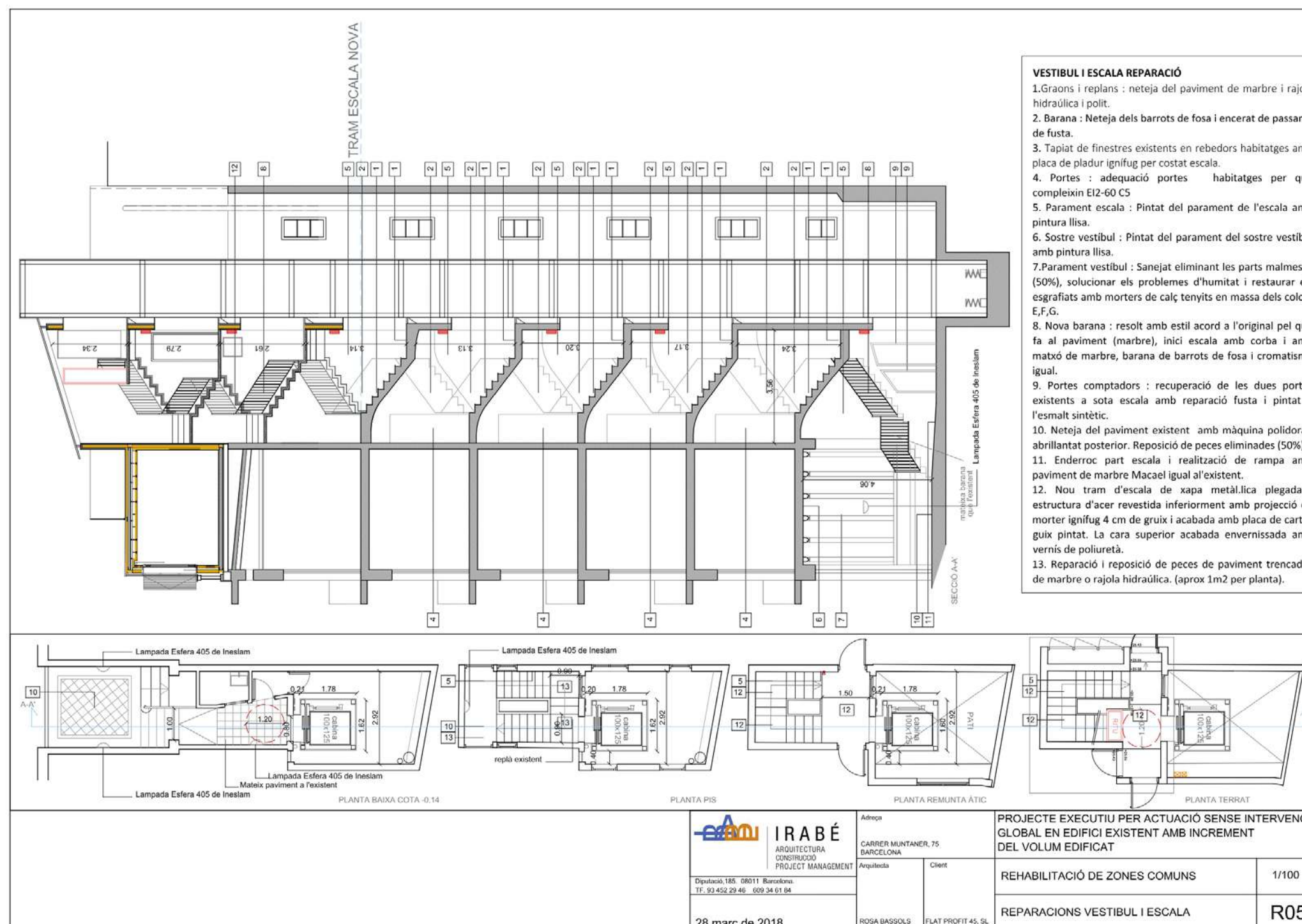


Fig.21: Reparations of the lobby and staircase.

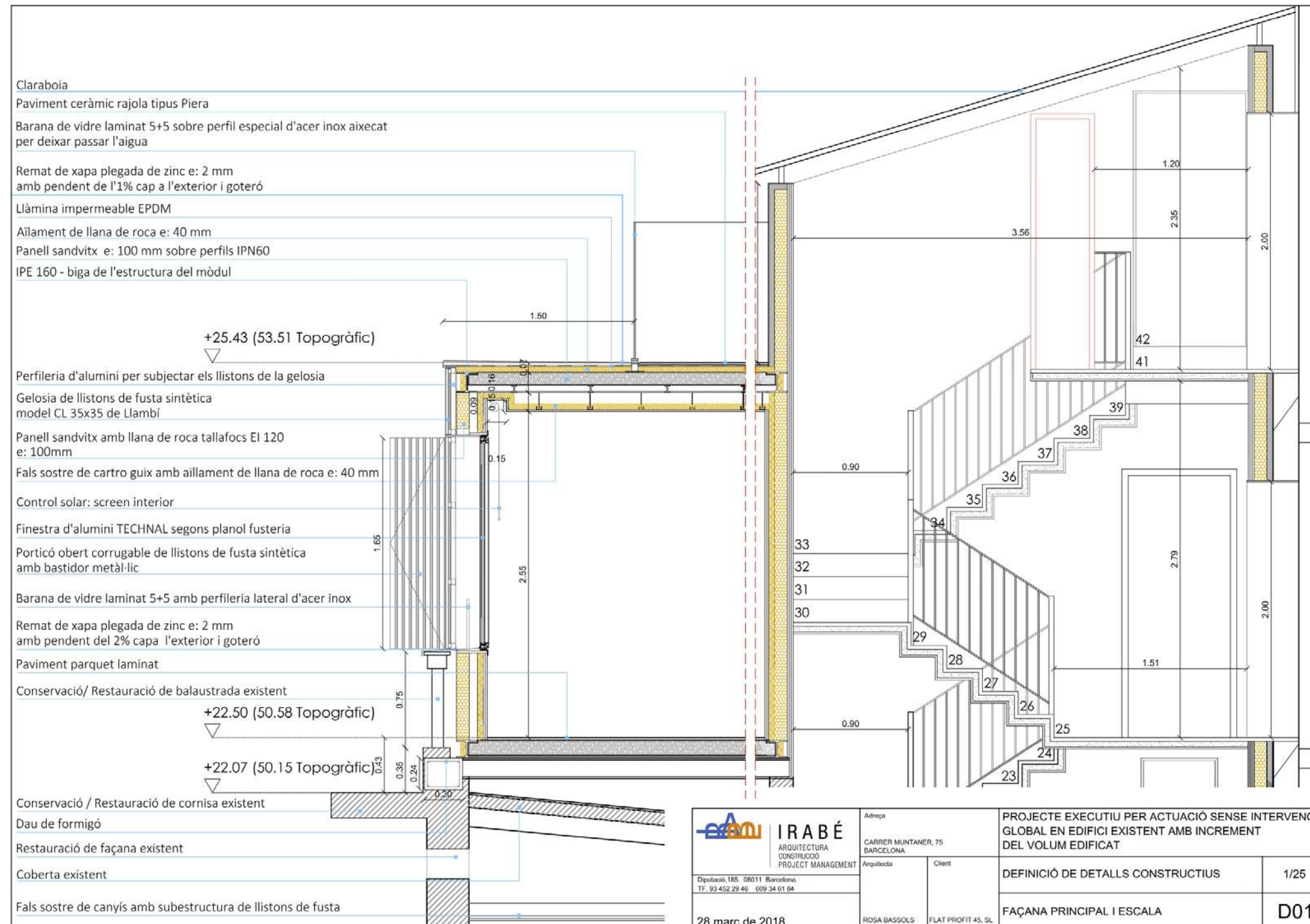


Fig.22: Construction detail of the module, main façade and staircase extension.

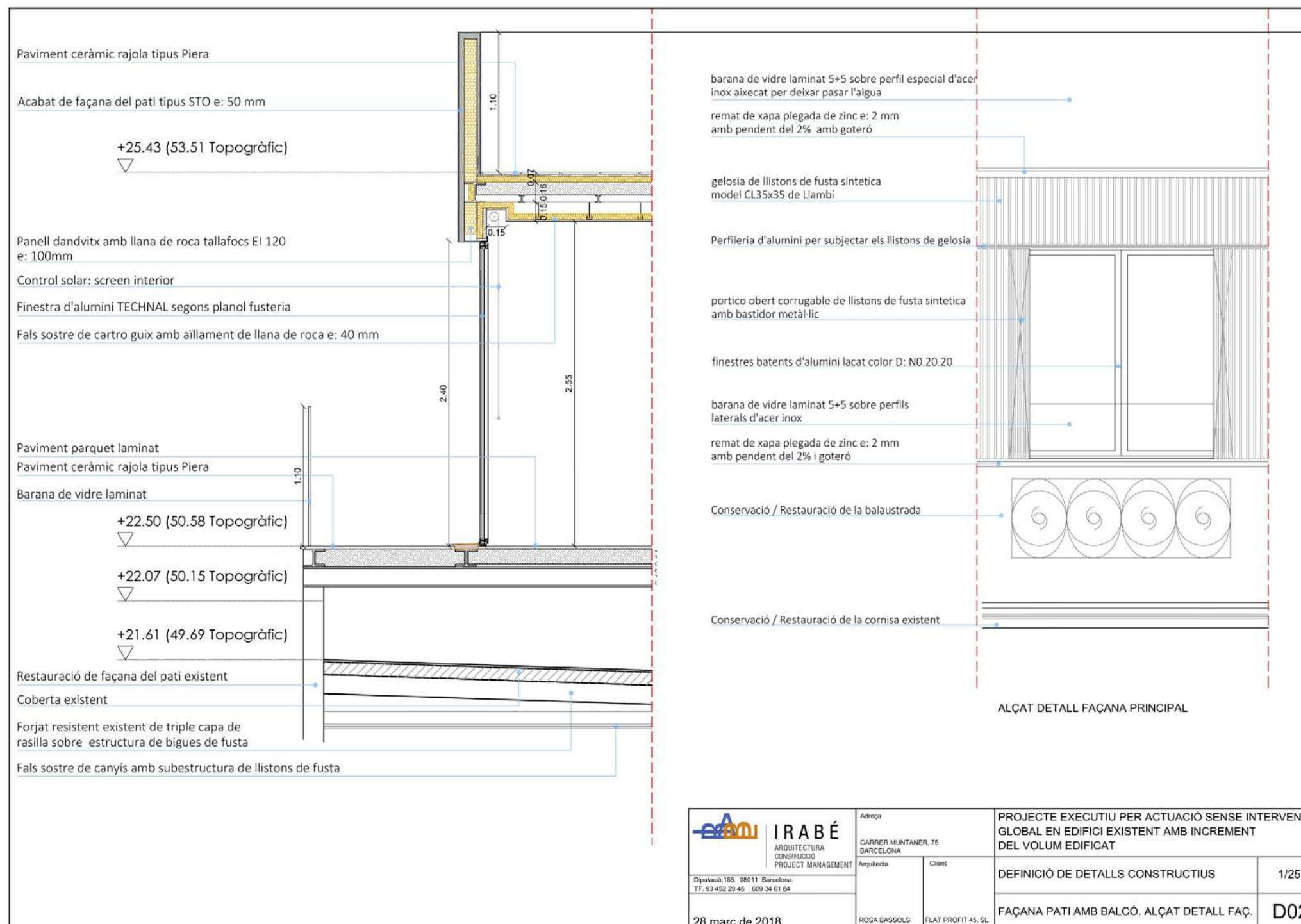


Fig.23: Construction detail of the module, courtyard façade with balcony and main façade to the streets.



Fig.24: Proposed façades to Muntaner and Aragó Streets.

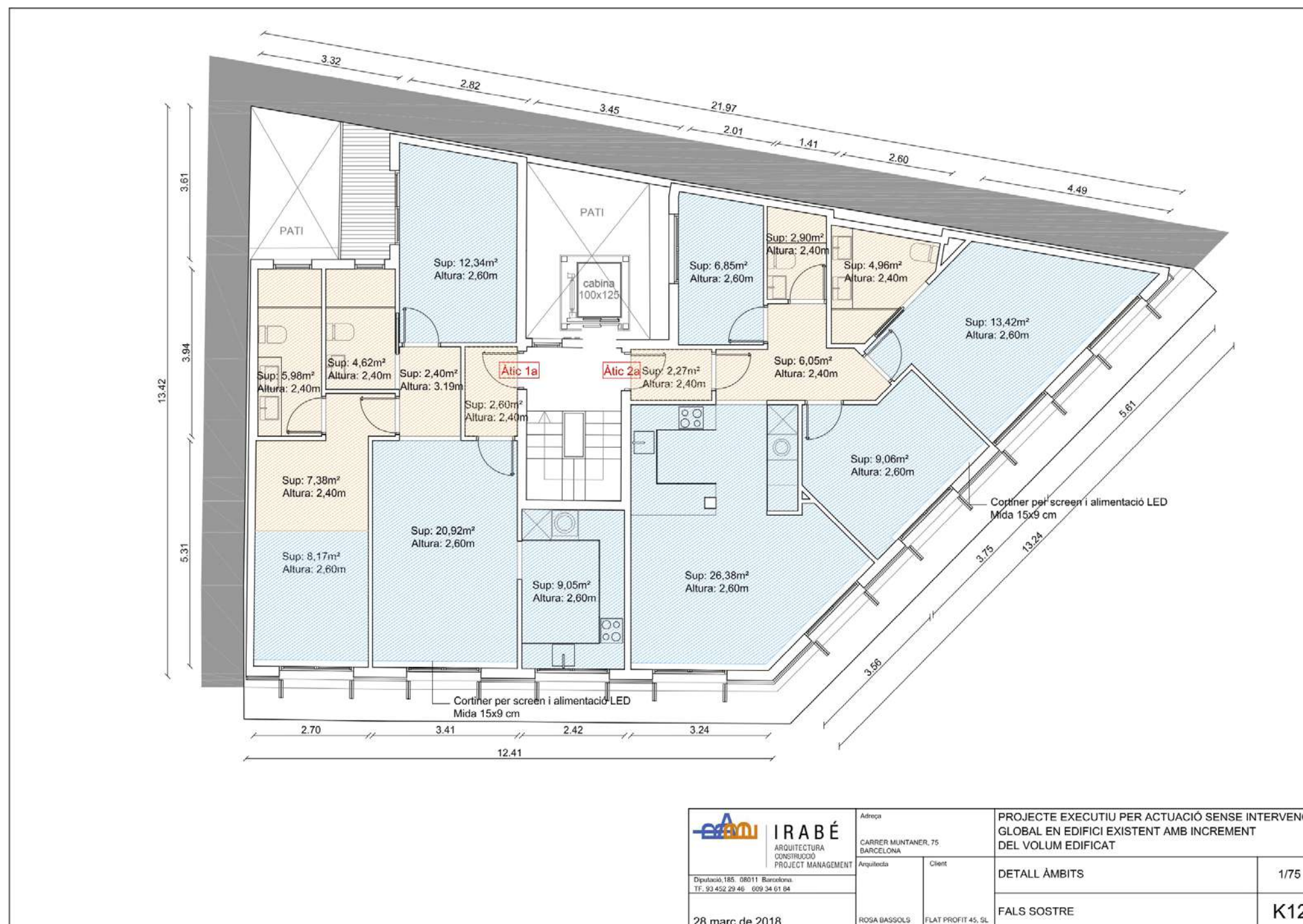


Fig.25: Floorplan of the proposed attic apartments, showing the area of each room.

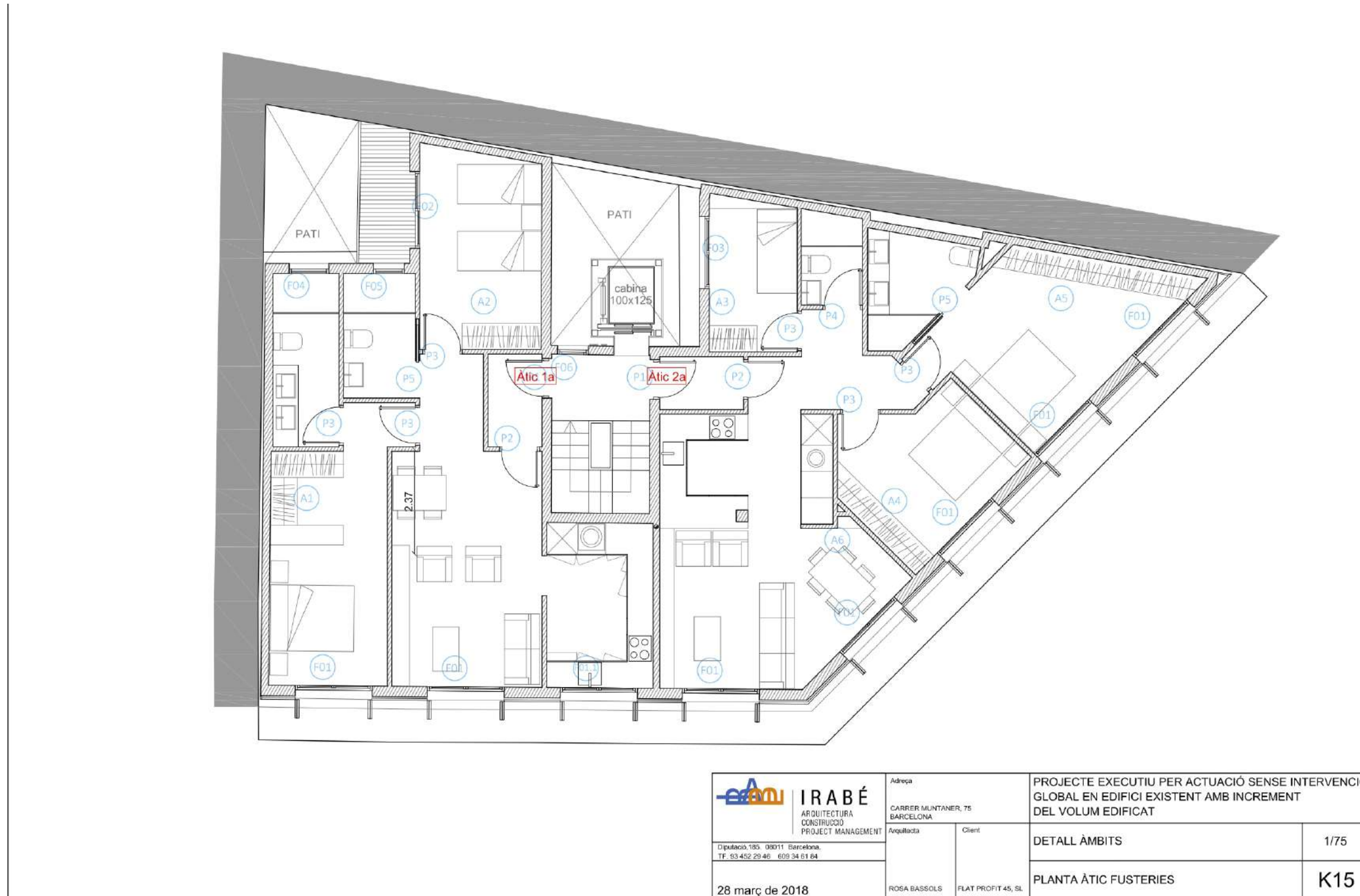


Fig.26: Floorplan of the proposed attic apartments, showing furniture.

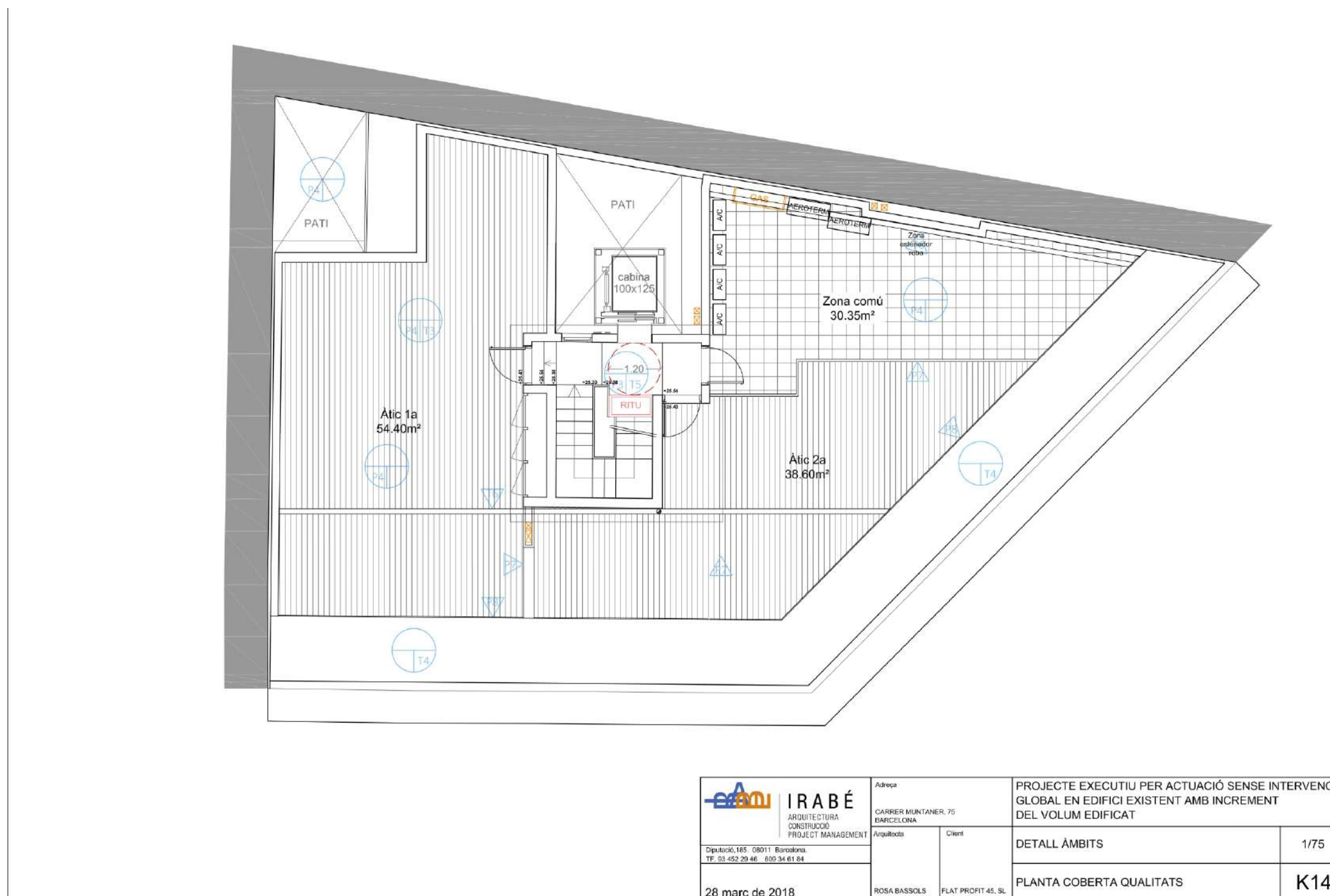


Fig.27: Proposed roofplan.

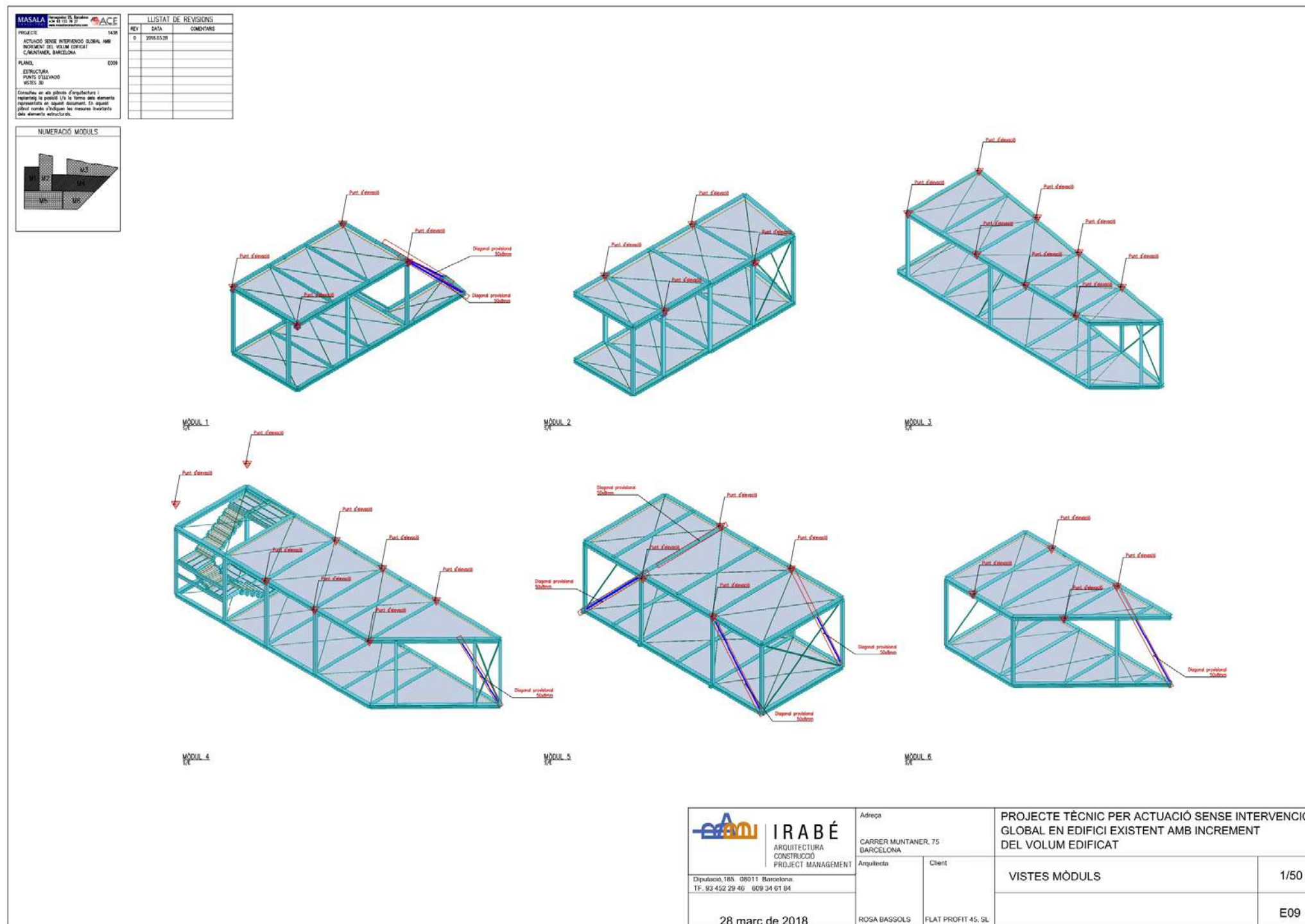


Fig.28: 3D views of each of the modules structure.

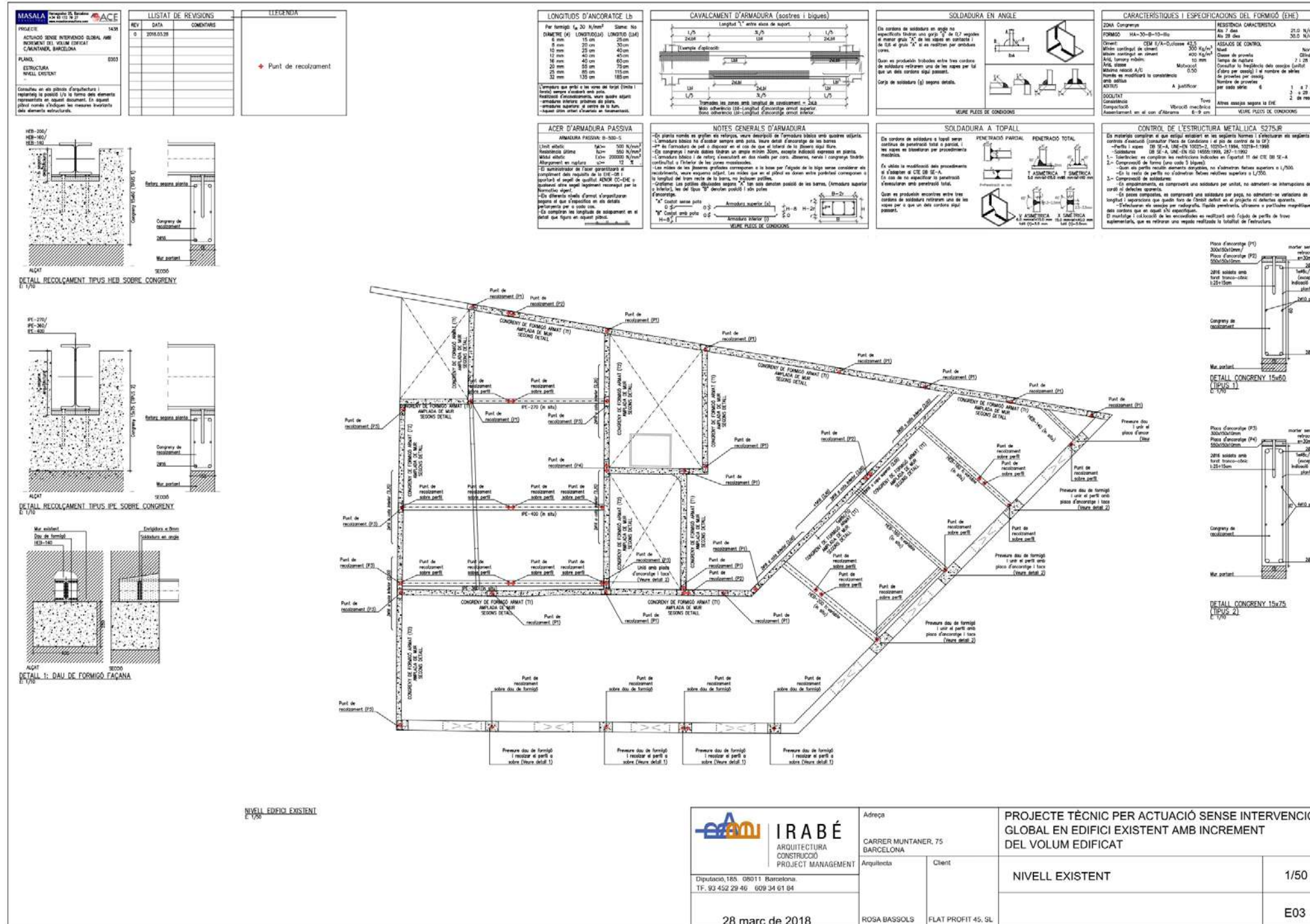


Fig.29: Structure plan of the existing roof level before the addition of the modules.

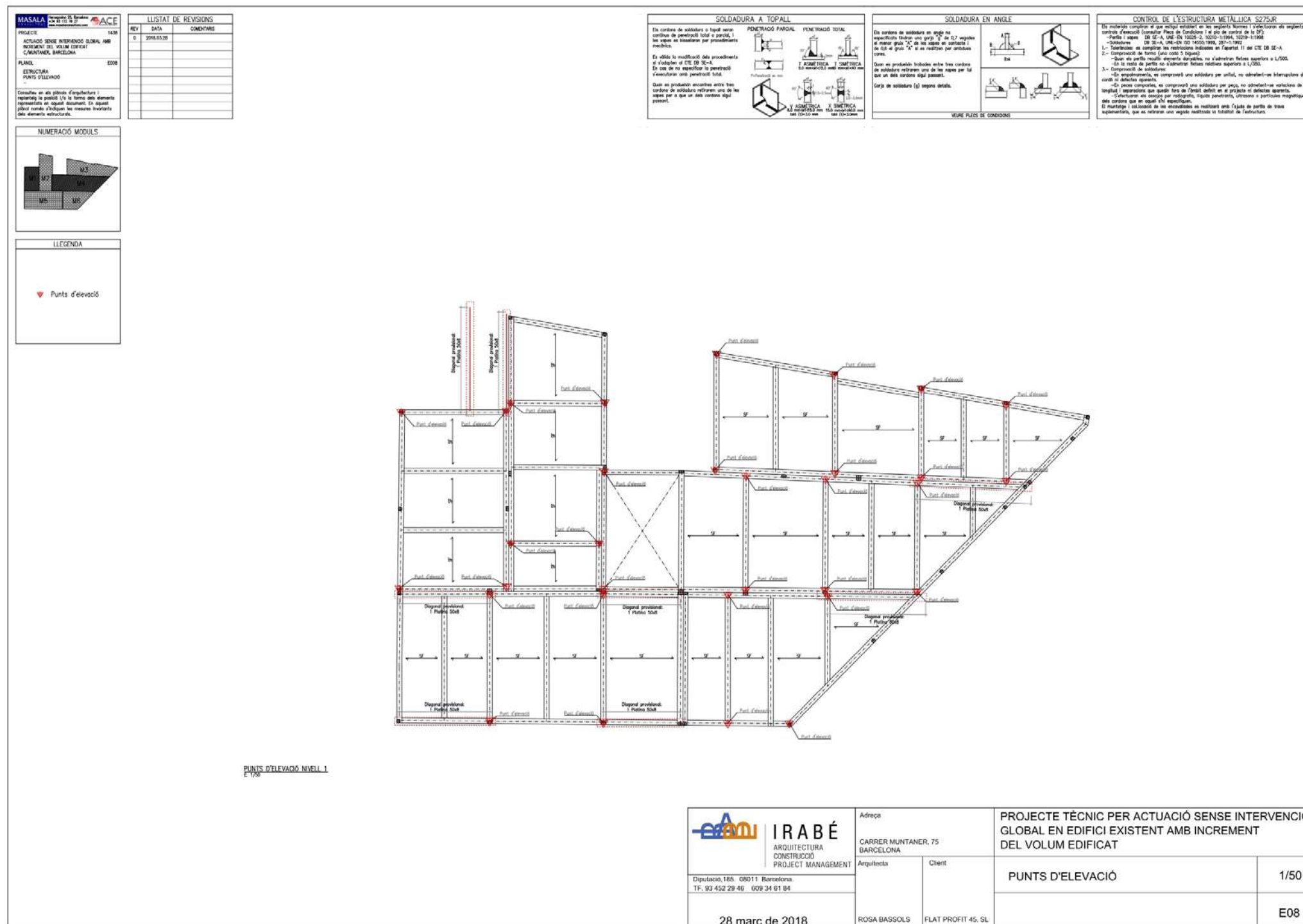


Fig.30: Structure plan with points of elevation for the modules.

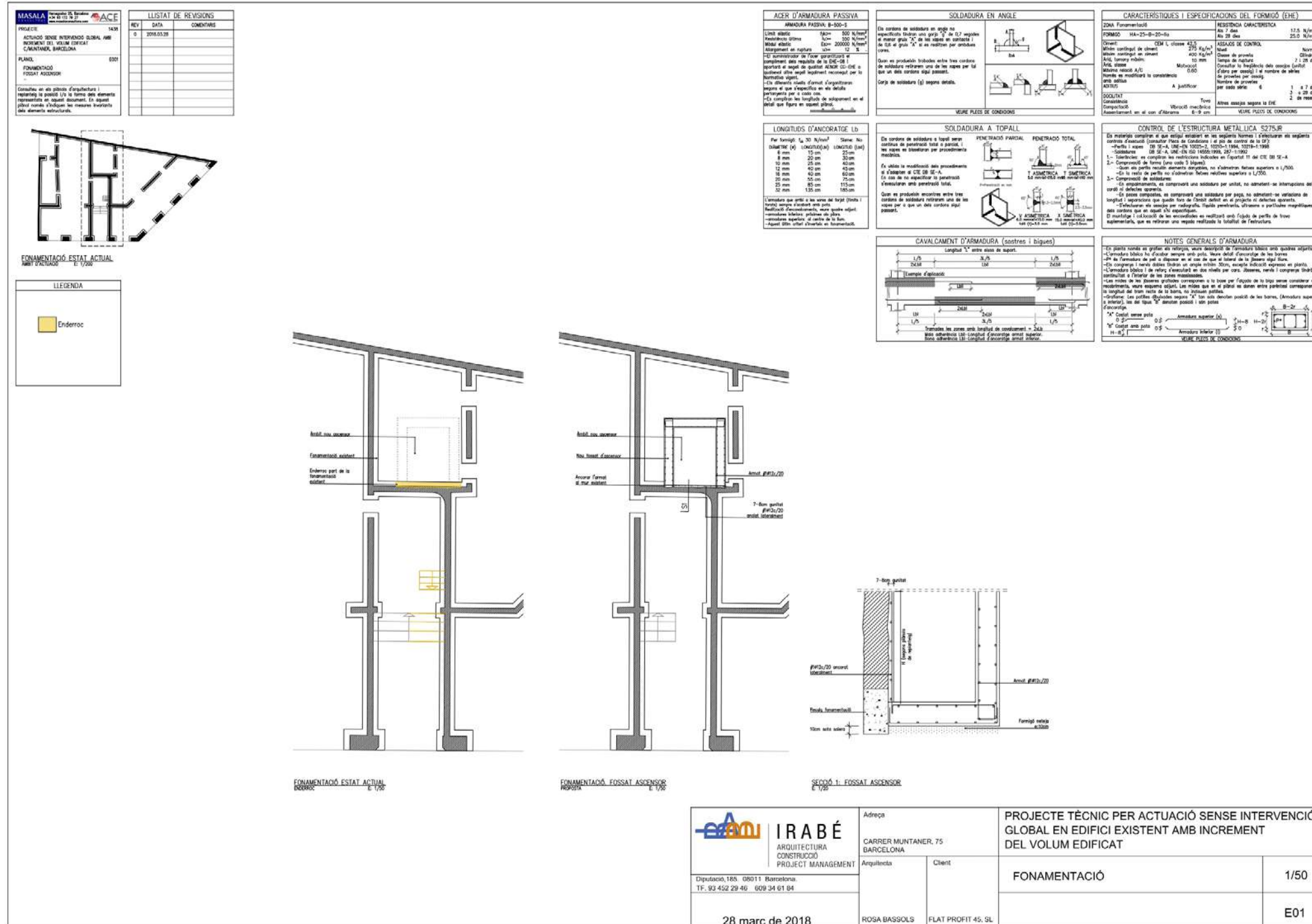


Fig.31: Structure plan of the foundations of the main staircase.

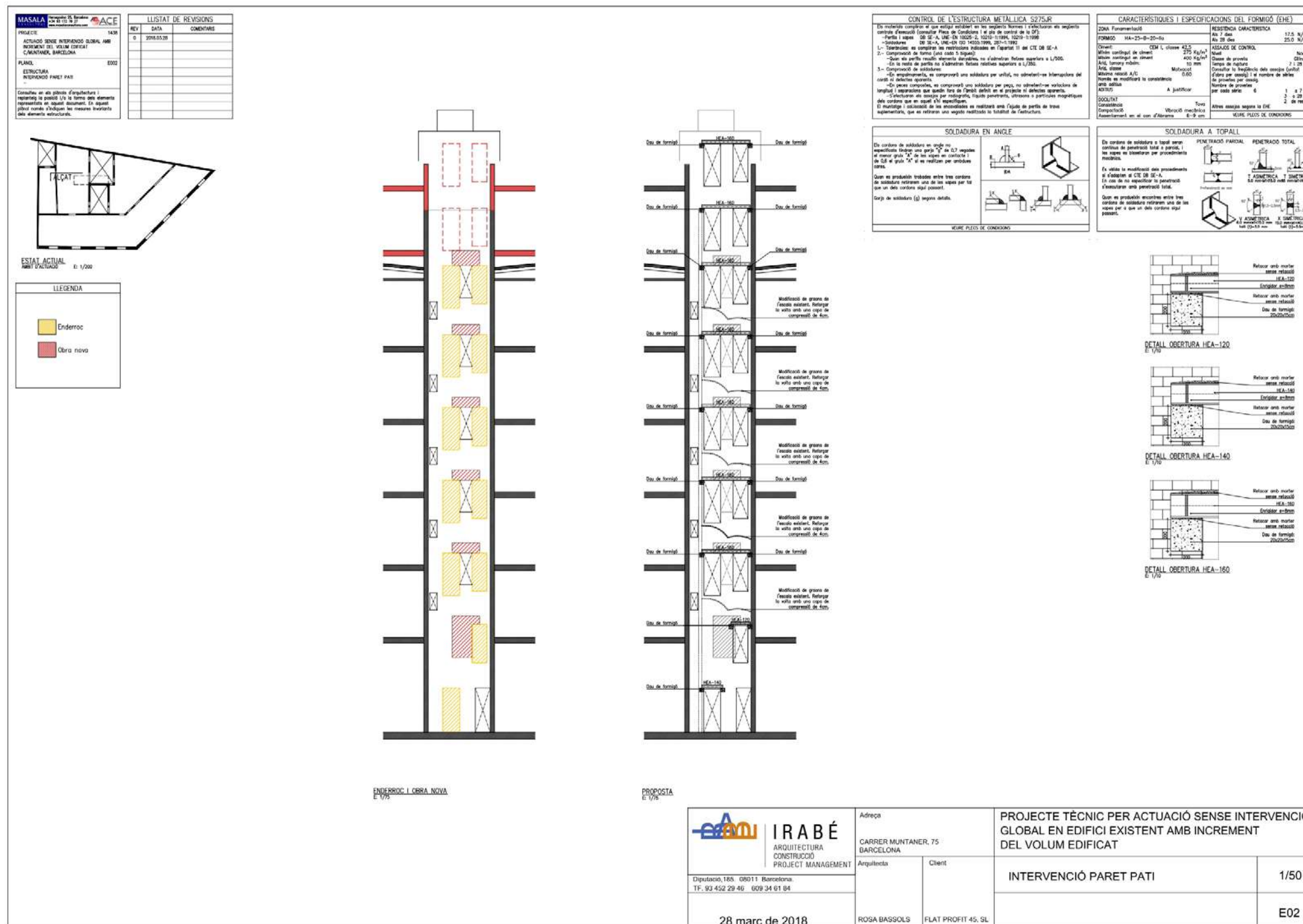


Fig.32: Intervention on the central courtyard's wall.