

Xifré's Rooftop: "Floating" Wild Garden.

An opportunity to reintroduce nature to the heart of Barcelona.

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 Porxos d'en Xifré, Carrer de Llauder 1, Barcelona, Catalonia, Spain.

Objectives Habitat regeneration on top of a heritage building. Biodiversity, Community & Self-sufficiency.

Property Private

Designer Sergio Carratala, Mata Alta Studio.

Date 2019



Background to the intervention

This project has been a great opportunity to reintroduce nature to the heart of Barcelona. The Xifré Rooftop is a dual purpose renovation project, in terms of both architecture and ecology. Covering an early 19th-century block of ten buildings, this contemporary roof garden creates a “floating” wild space that enhances urban biodiversity and opportunities for social interaction between neighbors. Furthermore, the rooftop elements of the historic building have been carefully restored.

In 2017, when the Barcelona City Council launched the green roofs open competition Sergio Carratalá, the founder of MataAlta Studio, saw an opportunity to use his structural engineering expertise to develop innovations in this relatively new design discipline. He understood how to reintroduce nature in the middle of this densely built Mediterranean city, using a strategic combination of engineering know-how and sustainable technologies. In winning the city council competition MataAlta Studio was able to realise a rooftop garden that met exceptional standards in green roof design, while paying respect to the history of the site by giving equal weight to architectural heritage and local ecology. Els Terrats d'en Xifré is a renovation project across the top of an early 19th-century block of ten buildings in the old town of Barcelona. The building houses restaurants on the ground floor, and many residential apartments and tech company offices. One of the key aspects of this project is the reversibility of the rooftop design. By using a ballasted multilayer technical solution, the design avoided attaching the garden directly to the building. In fact, the structure “floats” on top of the building, lying on top of the existing terrace. This highly respectful approach allows the whole project to be fully reversible.

Description of the building

Located in the Ciutat Vella District, near the port, the *Porxos d'en Xifré* is a set of 10 buildings that occupy an entire rectangular block located on land that was developed in 1834 after the demolition of the old sea wall. The complex includes the ground floor, mezzanine, three floors and a walkable roof. On the roof were the exits of the different buildings, and in the four corners, lowered domes of concentric ceramic courses that originally contained the water tanks of the city's first running water systems. In addition to the ventilation patios between party walls, a long and narrow central patio provides light to all floors of the buildings.

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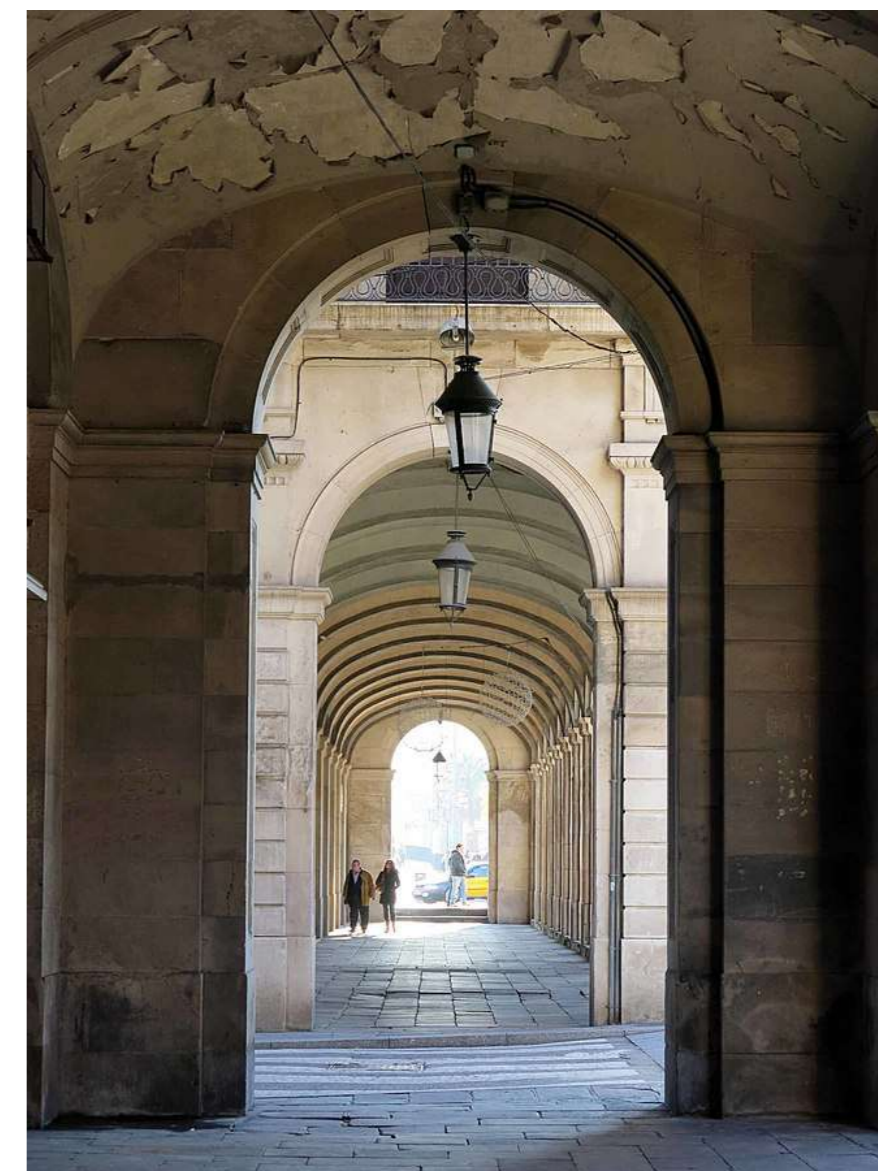


Fig.1: Main corridors arcades. © https://commons.wikimedia.org/wiki/File:Porxos_d%27en_Xifr%C3%A9.jpg



The diagnosis of the building (values and state)

The structure is made of ceramic load-bearing walls and floor slabs with wooden beams and ceramic vaults, with some structural elements built with ceramic vaults and arches in the communication and access spaces. Between 1874 and 1878 Elies Rogent made a series of reforms to improve the accesses, the kitchens, the services and the water distribution circuit. Since then it has been the object of various interventions made by individuals, without a unitary project and adapting to various uses. On the ground floor of the complex there are several shops and restaurants, among these, the Restaurant *7 Portes*, the oldest in Barcelona.

The diversity of actions had turned the passable roof into a deteriorated space, filled with obsolete service facilities and systems, ventilation and smoke evacuation chimneys, and irregular use by some residents and users.

Rehabilitation works

The roof has been rehabilitated, turning it into one of the largest green terraces in Barcelona. Winner of a contest organized by the Barcelona City Council, and from the financial aid obtained, the intervention consisted of turning an entire space - that was in disuse and generating problems, injuries and conflicts - into an element of socialization and enjoyment for the community of neighbors.

Work has been carried out to recover the existing structure, repair the walls, coat with dosed lime mortar from various samples and the recovery and adaptation of elements to guarantee the safety measures required for use and accessibility.

It is worth mentioning the work to rationalize elements on the roof, the removal of obsolete elements, the redistribution of the



Fig.2: Building's main façade. © <http://www.barcelonaentremuralles.com/edificacions.cfm/ID/6020/CAT/poxos-en-xifre.htm>

network layout, the improvement of the water collecting system for its use on the old water reservoirs, and the installation of solar panels.

The green roof solution has consisted of the installation of various technical layers, an irrigation system, the appropriate substrates according to the bearing capacity of the structure and the planting of more than 10,000 plants, a dozen trees, a pond and two vegetable garden areas.

Assessment of the results

Els Terrats d'en Xifré is a rehabilitation project, both in the strict architectural-patrimonial sense and in the ecosystemic sense. This green roof is situated on top of an early 19th-century block of ten buildings.

The project has restored the original elements of the historic building while also creating a “floating” wild garden that enhances urban biodiversity.

Biophilic Design

This design concept aims to deepen connection with the natural environment through the use of direct nature and place conditions. This principle drives public health, environmental, and economic benefits for the building's occupants and the urban surroundings. Furthermore, it allows local ecosystems to be restored and strengthened. The planting design for this green roof focuses on biodiversity, functionality, and aesthetics. With more than 40 plant species and nearly 10,000 plants, the garden features mostly native perennial plants that were chosen for being aromatic, pollinator friendly, drought resistant, pollution-filtering and disease resistant. These careful choices provide year-round blooming, as well as bird feeding and nesting places. The design includes several water

ponds, insect hotels and nesting structures, all with the purpose of encouraging biodiversity.

Social Design

This project creates a green living space for the inhabitants of the entire ten-building block to enjoy. The design avoids squared angles and straight lines to help visitors escape confining urban grid patterns and relax in a gentler and more nurturing environment. The careful placing of organic-shaped benches and plazas is designed to enhance social interaction between neighbors.

Low Impact

Every material has been carefully chosen to lower the carbon footprint and environmental impact of this design project: from recycled brick-waste gravel to reclaimed timber from the original building; from traditional lime mortar to 0% use of Portland cement; and from FSC-certified timber to local providers of native plant species. Even the structural design considers the inherent remaining load capacity of the building to accommodate the earth dunes without any reinforcement other than the rehabilitation of damaged elements.

Towards Self-sufficiency

This project incorporates the use of energy and water resources in the most sustainable way. The design ensures that no additional water, electricity or fertilizer are needed. The solar panels provide energy, the rainwater harvesting system provides irrigation, while the use of green manure and composting techniques avoids the need for any chemicals in the soil.

Water cycle:

The multilayer green roof system is designed to retain up to 50% of water. Excess rainwater flows into the inner drainpipes that have been segregated from the building's wastewater

pipes. This segregation enables rainwater storage in an underground cistern to be pumped up for drip irrigation during the dry summer months.

Biomass Cycle

Compost boxes have been included in order to close the biomass cycle by transforming the organic leftovers from maintenance into hummus that will enrich the soil. Nothing goes to waste!

Energy Cycle

Photovoltaic panels on top of the staircases supply energy to the irrigation pumps and the LED lighting system, making the whole project highly self-sufficient.

This successful case study demonstrates how nature can and must be reintroduced into every gap in our cities. All the learnings will be transferred to the public domain.

The Universitat Politècnica de Catalunya (UPC) established a collaboration program with MataAlta Studio in order to further develop a structural engineering protocol based on the learnings of this project. This program will help future green roofs designers to maximise the landscaping and planting design with total safety for each specific building.

A series of 'before and after construction' evaluations have been monitored to measure the impact of the project. 3 key parameters to understand the public benefits of this project are: temperature, noise, and stormwater flow.

Temperature monitoring: measurements were carried out on the roof level and in the apartments below, before and after the construction of the project. This allowed the team to compare and assess the project insulation efficiency and the comfort improvement.

Noise level monitoring: noise level measurements were carried out at roof level and in the apartments below, before and after the construction of the project. This allowed the team to compare and assess the noise reduction efficiency of the project.

Storm water flow monitoring: a series of flowmeters have been installed on the rooftop, in order to measure the rainfall runoff curves on the drainpipes, the water deposit filling patterns and the garden's irrigation requirements. 3.

The biology species counting program to monitor the biodiversity impact. As part of the city Atlas of biodiversity of Barcelona, the project is involved in several citizen science projects such as the BioBlitzBCN. The atlas of biodiversity is a powerful tool that communicates urban nature to society and monitors the evolution and health of our ecosystem.

References

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Photos of the completed intervention



Fig.3: View of the recently finished rooftop. © *MataAlta Studio*



Fig.4: Aerial view of the recently terrace and its surroundings. © *MataAlta Studio*



Fig.5: Closer view of the terrace gardens and domes of the water cisterns. © *MataAlta Studio*



Fig.6: Closer view of the vegetation on the rooftop. © *MataAlta Studio*

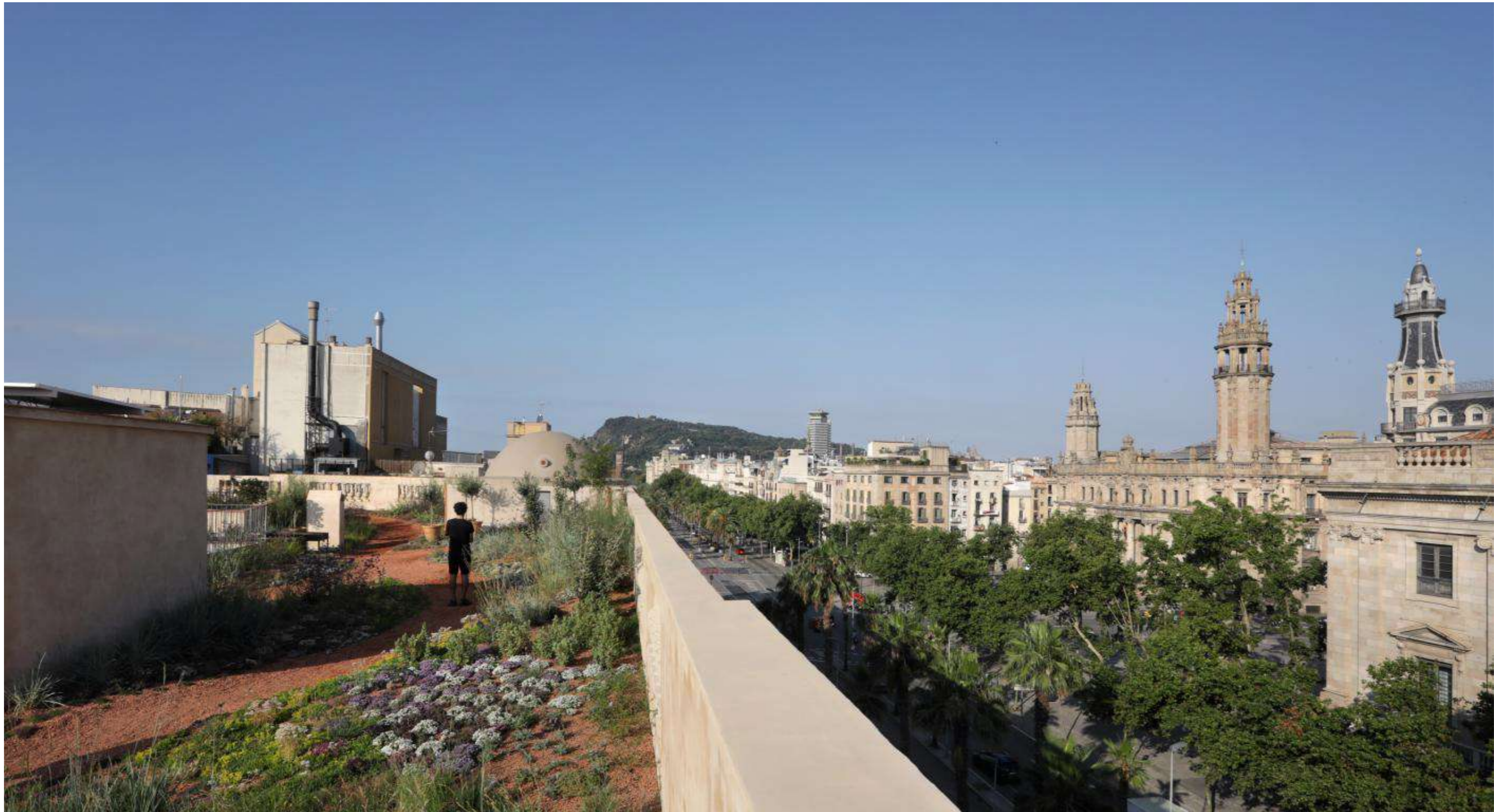


Fig.7: View of the terrace gardens, the Passeig Colom avenue and surrounding city. © *MataAlta Studio*