Delft University of Technology

Architectural History Thesis

APPLICATION OF LE CORBUSIER'S 5 POINTS OF ARCHITECTURE AND RICHARD MEIER'S MODULAR TECTONIC DESIGN PRINCIPLES IN THE BARCELONA MUSEUM OF CONTEMPORARY ART

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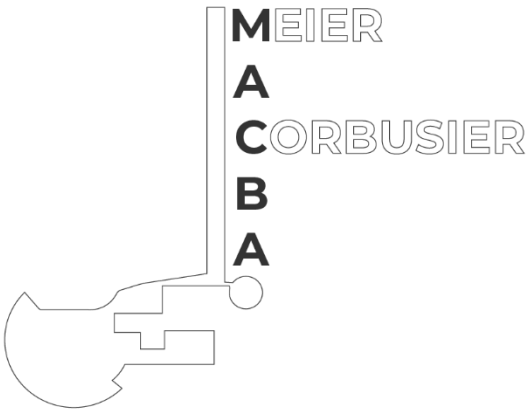
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1. Introduction

Historically, architects have continually drawn inspiration from the work of those who came before them, engaging in an ongoing dialogue with the past. Whether subtly referencing norms, reinterpreting principles, or evolving and modifying ideas, each generation builds upon a foundation shaped by cultural, technological, and theoretical aspects of the ones that preceded them. In the same manner, the literature regarding the work and design approach of an architect, Richard Meier, displays a frequent mention of the many influences that shaped his work, most notably, always with the prominent role of Le Corbusier. Meier himself has acknowledged on numerous occasions, both in his writings and interviews, that Le Corbusier was a significant reference for him. To further explore this influence and deepen the understanding of Meier's design approach, this research aims to bridge and connect Le Corbusier's philosophy and Richard Meier's design. Corbusier's design philosophy, initially dominantly applied in domestic architecture but later in other building types, such as Unité d'Habitation and the Capitol Complex, has always orbited around and referenced the five points of architecture, the principles he put in place that proposed a theoretical background to his work. By analyzing Meier's work through the lens of these principles, this thesis introduces a new perspective on the connection between Le Corbusier's theory and Meier's architectural language.

To establish this connection, an analysis of Richard Meier's Museum of Contemporary Art in Barcelona is conducted through the lens of the five points. The choice of the museum is based on the building typology that imposes fewer constraints on the building's design, allowing Meier to freely and purely implement his design approach. More specifically, the choice was further concentrated on the Museum of Contemporary Art in Barcelona, because the project was built in a period of Meier's design maturity, when his design approach had already been refined and perfected, allowing the analysis to be direct and precise when considering and comparing it to Le Corbusier's Five Points. However, it is important to note that the analysis focuses on only four of the five points. The fifth point, the roof garden, is not implemented in MACBA due

to the necessity of ceiling-mounted skylights that provide natural lighting for the museum's interior. Given the functional requirements of the museum, incorporating a roof garden would have been contrary to the condition of allowing the light to enter the galleries.

In addition, the analysis provides an insight into the geometrical order present in Richard Meier's work. From his earliest projects, Meier has used modular systems and geometric proportions to articulate his designs. Therefore, a thorough analysis of his work, including the Museum of Contemporary Art in Barcelona, isn't complete without considering this design aspect. It represents an inseparable part of Meier's design approach and, as a result, serves as a necessary reference point when examining and analyzing his work through the lens of Le Corbusier's Five Points.

This thesis is organized into 5 different sections. The first provides a theoretical background on Le Corbusier's Five Points of Architecture and their practical implementation in Villa Savoye. The second offers an overview of Richard Meier's design language, with emphasis on academic training and tectonic principles. The third section presents a detailed analysis of the Museum of Contemporary Art in Barcelona, conducted through the lens of four of Le Corbusier's Five Points. This is followed by a part that will yield a better understanding of geometric order in Meier's MACBA as an essential part of its design. Finally, the conclusion summarizes the findings and reflects on the connections between Le Corbusier's Five Points of Architecture and Meier's design for the Museum of Contemporary Art in Barcelona.

2. Le Corbusier's Five Points of Architecture

The Five Points of Architecture (Cinq points de l'architecture moderne) were first published in L'Esprit Nouveau, a creative magazine founded by Le Corbusier alongside poet Paul Dermée and painter Amédée Ozenfant in 1920. They later appeared in Le Corbusier's 1923 book, Vers Une Architecture. These principles dictated the architectural design style of Le Corbusier throughout his career and held a specific relation to his design process.

Serving as a theoretical framework for his vision of modern architecture, the five points reflected Le Corbusier's concept of functional residential design—what he described as a "machine to live in." This vision introduced a new design approach that allowed for an infinite number of plan combinations. Rejecting the past and the ornate styles derived from it, Le Corbusier emphasized efficiency, simplicity, and an architecture that was expressive of its purpose. He proposed that every element of a building should serve a distinct and specific function, with the primary one being to provide shelter. (Figure 2.1)

The five points:

Pilotis:

Le Corbusier referred to reinforced concrete columns as Pilotis. These pylons, organized in a grid, had the function of bearing the structural weight of the building, replacing rigid load-bearing walls. Pilotis allows for all other points to be possible and is the most important principle of the new aesthetic agility.

Free design of the plan:

One of the focal aspects of the Five Points, the ability to organize the floor plan with flexibility, without the interference of structural partition walls, allowed the house to be independent of it's organization.

Free design of the façade:

Free design of the facade refers to the building envelope, its exterior that is free of structural restriction. Like the flexible ground floor, but on a vertical plane, the free design of the facade allowed for the building skin to be independent, essentially becoming “free of weight”.

Horizontal windows:

Windows that run horizontally across rooms, provide a better view of the surroundings and allow equal amounts of light to enter the interior of the home.

Roof Garden:

A roof garden, or a roof terrace, allows for added functionality of the home, providing access to the building roof, compensating for the area of the ground that is covered by the building.

The five points can also be seen as a conclusion, as they represent an ordered and codified form of the ideas Le Corbusier tested in his domestic architecture from the Maison Citrohan (1920) to the Weissenhof exhibition (1928). (Figure 2.2) Rather than focusing on individual objects or designs, Le Corbusier hinted at the continuous evolution of a single idea, developed and refined over multiple instances, which was ultimately cultivated in 1929. with his design for the Villa Savoye. (Oechslin and Wang, 1987)

Savoye, designed by Le Corbusier and his cousin Pierre Jeanneret, was built from 1929. to 1931. is a representative of the new design and construction that incorporates every out of the five points of architecture in the purest form. The Villa's main construction is formed from concrete Pilotis with an elevated free ground floor plan. Its roof is finished with a garden, and the facade is its envelope with wide horizontal windows spanning from corner to corner. When Le Corbusier was approached with the commission in 1928, he had reached a stage of extreme clarity in the formulation of his vocabulary. (Curtis, 1996) Out of the entirety of his work, Villa Savoye serves as the greatest example of how the "five points" are practically articulated and implemented. (Figure 2.3) It is important to understand that the principles that were previously defined, tested and, in the case of Savoye, mastered by Corbusier are directly applied in his work

in order to later analyze and understand how, in what way, and in what quantity Meier implements and builds upon them in his own practice.

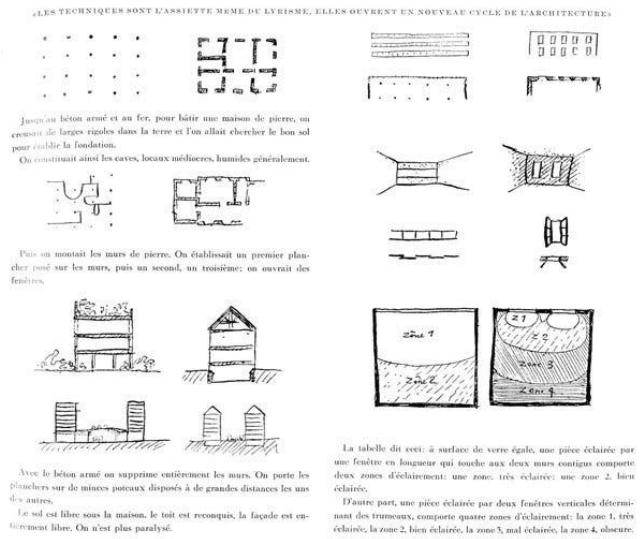

Figure 2.1 : Ilustrated Five Points of Architecture from the book "Vers Une Architecture" (Source: Author)

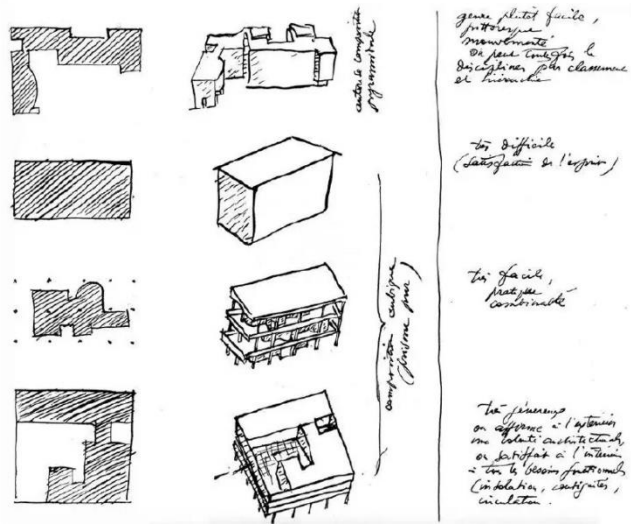

Figure 2.2 : Variation on the syntax of the "Five Points" (Source: Boesiger, Stonorov, Bill, 2013)

Figure 2.66 : Villa Savoye (Source: Frampton, 2003)

3. The tectonic language of Meier's Design

Through the design process itself and over the course of their careers, architects develop a certain instrumental set, distinct conventions, and tactics that, over time, become constant in their line of work. Covering a vast scope of designs and building types, these conventions ultimately form a design strategy that becomes a formal design language, differentiating one designer from another. (Bafna, 2001) This section will provide an overview of Meier's training and design language, focusing specifically on his style's geometric and modular qualities. Although his design philosophy includes a broad spectrum of ideas, ranging from the architectural promenade to the mediations on light and space, through spatial interchange between the public and private realms, and the redefining of the sense of order, the review of "rules of thumb" or design conventions that regulate the geometry and proportions of his buildings is crucial for carrying out a modular analysis at the end of the following chapter.

3.1. Training

After graduating from Cornell University in 1957 with a degree in architecture, Richard Meier traveled to Israel and then throughout Europe, visiting Paris, Rome, and Barcelona for six months, meeting architects and studying architecture while carrying his portfolio of student work. After continuing his travels for a time, he returned to the United States in 1959 and worked at Skidmore, Owings & Merrill for six months before joining Marcel Breuer’s firm, where he worked for three years, until 1963 when he established his own practice. In the beginning, Meier’s work primarily focused on private residences in the United States. By the late 1960s, his work had expanded to include different building types, including administrative buildings, public housing, office buildings, commercial buildings, churches, and museums. In addition to practicing architecture, he taught at Cooper Union, UCLA, Harvard, and Yale and has lectured extensively across the United States, Europe, South America, and Japan. The work of his office is acknowledged by various authors and featured in nearly sixty publications, including books, monographs, journals, numerous architectural magazines, and features. Throughout his

career, Meier has received numerous national and international awards, including the 1984 Pritzker Architecture Prize, the Royal Gold Medal from the Royal Institute of British Architects in 1989, and the American Institute of Architects Gold Medal in 1997.

3.2. Tectonic Language

Tectonic characteristics of Richard Meier's designs can be understood as an important determinant of his design language. The use of different approaches, such as implementing geometrical grids, modularity, and proportions in coherence with carefully dimensioned wall metal cladding panels, presents a hidden code that underlines his work. The architect's formal language can also be described in the idea that the composition can be regarded as an interplay between the spatial animation of the work, the overlapping forms, and the regulating lines, or the modulated grid, and their relation. (Frampton, 1991)

From his early projects, such as the Smith House (1967), Meier used structured geometric compositions, utilizing forms like squares and circles to regulate the house organization. (Figure 3.1) With bigger scales, later on, with projects for public buildings i. e. the Bronx Development Center (1977), the grid became not only a planning device but also a structural principle that began to influence the building aesthetic. (Figure 3.2) This project marked Meier's first use of metal cladding panels, although rectangular, a design solution that emphasized the building's modular articulation and facade's dynamic variation.

Figure 3.1 : The Smith House on the left; the southeast elevation of the house (Source: Frampton, 2003)

The Atheneum (1979) in New Harmony, Indiana, presents Meier's further application of grid-like modularity. (Figure 3.3) Here, superimposed grids, expressed through vertical planes, circular columns, and overlapping façades, introduce Maier's complex spatial layering. In 1996. Peponis published a paper titled The Spatial Construction of Architectural Meaning where he analyzed the building from different aspects including the presence of underlying geometry in the shifted grids. Additionally, the Atheneum was among the first projects to feature white, porcelain-finished steel panel cladding, this time in a square format, a material that would become one of the symbols of Meier's identity. The smooth and reflective material enhances the play of light, allowing large amounts of sunshine to penetrate the building, connecting the interior and exterior space, which is another critical aspect of the architect's philosophy. Furthermore, the material can be seen as more than a technical cladding system because it formed an organizational system upon which the geometries of rectangles, squares, and straight lines were superimposed.

Figure 3.3: : The Bronx Development Center (Source: Frampton, 2003)

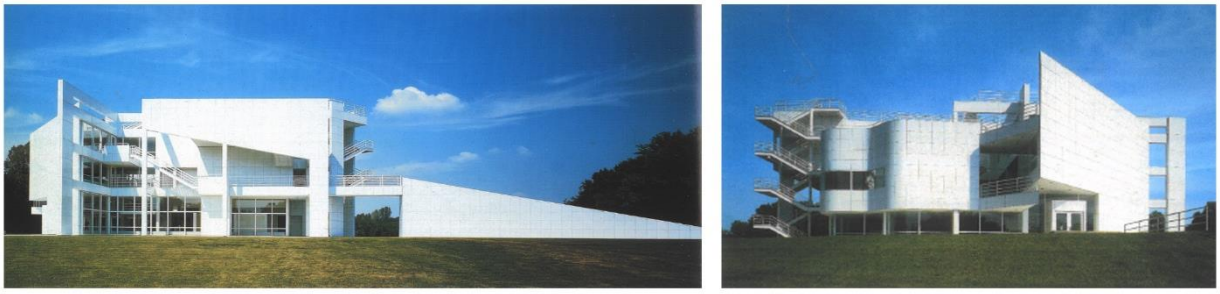

Figure 3.2 : The Atheneum in New Harmony (1979) (Source: Frampton, 2003)

Cassarà (2005) affirmed that Meier's commitment to the grid and modularity is not just a technical exercise but an instrument for achieving compositional coherence that manifests the building's functional role. Another interesting view on Meier's modularity and strict proportions can be seen in the text Creative Repetitions by Cohen (1999) where

he mentions Meier's plan as a project generator and points out the use of geometry that is regulated by the line in a grid:

"The regulating grid allows him to lay out the entire building on the ground and sets into place a matrix that permits the negotiation of the internal geometries of the project with those of the space in which it is inscribed. The grid becomes an ordering device capable of coordinating the two systems through which Meier conceives the relation between his buildings and their space of inscription: the relation of figure/ground and object/texture." (Cohen, 1999, p.19)

Understanding Meier's design language, his precise approach to building proportions, and the way he carefully classifies them with a strict but fluid and always adapting order is of crucial value for this research because the case study of the Barcelona Museum of Contemporary Art, that follows in the next chapter, will besides the analysis of the museum through the lens of Le Corbusier's five principles, include a section focusing on MACBA's proportions, revealing and explaining its modular organization.

4. Analysis: The Barcelona Museum of Contemporary Art

4.1. Museum Background

Regaining municipal democracy in the early 1980s, under Mayor Pasqual Maragall, Barcelona launched a reconstruction program affecting the entire city. The new initiative was in line with the earlier urban design policies developed by Oriol Bohigas and his colleagues, also including the Raval neighborhood, where the museum is now located, which was one of the most important areas expecting urban regeneration and reconstruction

The strategy for the urban renewal of Barcelona concentrated on smaller-scale interventions to restore the decayed city fabric. The approach focused on developing new public spaces and rehabilitating historic buildings, such as churches and convents, within the densely distributed narrow streets of the Barri Gòtic (Figure 4.0). This strategy proposed selective demolitions throughout the city to address the problems of aging and marginalization. The urban planning initiative introduced five connected public squares, each with a unique local character. The proposal to consolidate the cultural life in the area also included the plan for the redevelopment of Casa de la Caritat and Casa de la Misericòrdia.

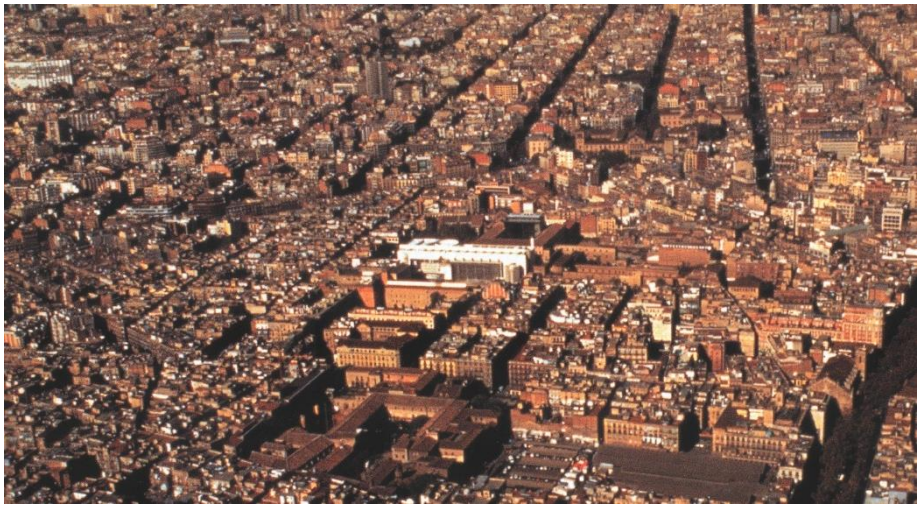

Figure 4.0 : Aerial image of MACBA in Barri Gòtic, Barcelona (Meier, 1997)

In the spring of 1984, Meier met Mayor Pasqual Maragall at the National Academy in New York, where they discussed the Mayor's vision for the new development of Barcelona. Maragall emphasized the city's transformation linked with the preparation for the 1992 Olympic Games. Following this meeting, Maragall invited Meier to come to Barcelona and visit several potential locations for the contemporary art museum. After touring several sites with the mayor and his advisers, Meier recommended an old Gothic quarter-Casa de la Caritat in the Raval neighborhood as the most suitable location for the new museum. A former monastic enclave surrounded by history provided a central location that allowed the museum to integrate into the pedestrian network and contribute to the development of this historically significant but neglected area near Las Ramblas (Meier, 1997) (Figure 4.2) .

In 1987, the city of Barcelona decided to build the museum, and Meier was commissioned to design it in 1988. (Dahanbreh, 2006) The construction began in 1990. and was completed 5 years later in November 1995. Meier's design process evolved through various sketches and models, reflecting and incorporating unique principles that ultimately developed into the museum's design (Figure 4.1). Although the process was not entirely linear, going back and forth on many revisions that influenced the development of different designs before reaching the final ideas realized in the museum, its construction along with the Caritat Cultural Center and the added university building, transformed the area of the Raval neighborhood into an arts quarter with a focal significance within the broader urban context of Barcelona.

Figure 4.1 : A view from the Plaça dels Angels towards the main facade of the museum (Source: Meier, 1997)

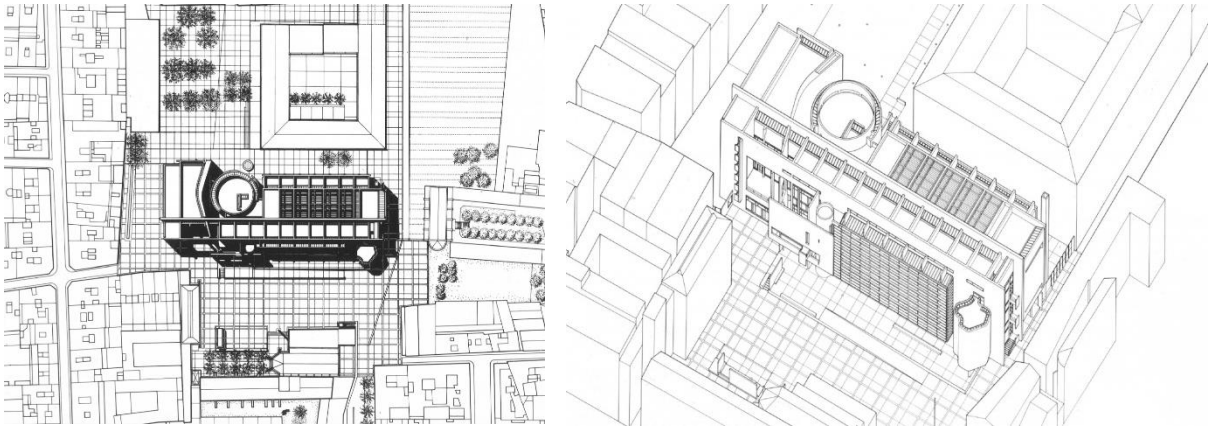

Figure 4.2 : left-Site Plan (Source: Meier, 1997); right- Axonometric Drawing of the museum (Source: Meier, 1997)

4.2. Pilotis in MACBA

Pilotis:

> *Le Corbusier referred to reinforced concrete columns as Pilotis. These pylons, organized in a grid, had the function of bearing the structural weight of the building, replacing rigid load-bearing walls. Pilotis allowed for all other points to be possible and are the most important principle of the new aesthetic agility.*

As the definition suggests, the introduction of pilots essentially presented a filtering of the building's structure, where the rigid load-bearing walls were replaced by a system of slim stick-like columns, distributed in a grid. Each grid axis presents a restraint of the pilotis' location, making its distribution on the plan strict to only the places where two axes intersect. Having a first look at the ground floor of the Barcelona Museum of Contemporary Art, the pilots don't seem to be noticeable immediately, but that doesn't mean they do not exist. The underlying column distribution seems to regulate the MACBA's ground floor, and consequently all the other floors above.

The main entrance to the museum is located at a third of its length from the west end. This area also encloses the main entrance lobby and the rotunda, the cylindrical form at the north side of the building. To the west of the rotonda, the administrative wing with

7 floors of offices is located, and to the east of the circular rotonda are the main gallery spaces, the atrium, and the ramp connecting all the floors. Taking an initial look at the ground floor plan, pilotis can most easily be spotted in the middle of the exhibition spaces in the east wing of the museum (Figure 4.3). The traverse horizontal hallway stretching the whole length of the museum, located just below the middle of the plan towards the south facade, carries the pilotis linearly through the main entrance to the west administrative wing. Here, the pilotis cease completely as a self-standing structural element and are merged with the partition walls. Although the white columns fade in the west wing, their distribution and relation throughout the plan are constant. (Figure 4.4). To better spot this underlying order, 16 axes are overlaid on top of the ground plan in intervals of 24 feet between each other in the x direction, passing respectively through each of the pilotis. To further fortify their position, another set of 6 axes, this time in the y direction, can be put on the ground floor to intersect with the latter group and form a grid. (Figure 4.5). Taking a look at the floor plan now, it is more evident that the pilots exist throughout the entirety of the museum's plan. Keeping this in mind, an interesting distinction between pilots in Le Corbusier compared to Meier's work can be made here. Predominantly in his domestic architecture, but later on in bigger housing projects as well, like D'Unite Habitation and some public buildings such as the ones in the Capitol complex in Chandigarh. Le Corbusier always follows the strict pilotis grid and their distribution in its majority. On the other hand, MACBA's floor plan shows Meier's approach, different from Corbusier’s. Instead of following the pilotis’ distribution strictly, Meier uses them flexibly and fluidly. Their complete absence, at the first glance of the plan, in the west wing shows, this distinction. Furthermore, more explicitly than the west wing, the entrance area with the large circular rotunda in the middle of the plan bears the same characteristic. The pilotis don't go through the space of the rotunda, in which case the rotunda in the plan would be located around the columns, but instead, Meier pulls the pilotis towards the rotunda's circumference, disturbing their order in the floor plan but still using the same structural language.

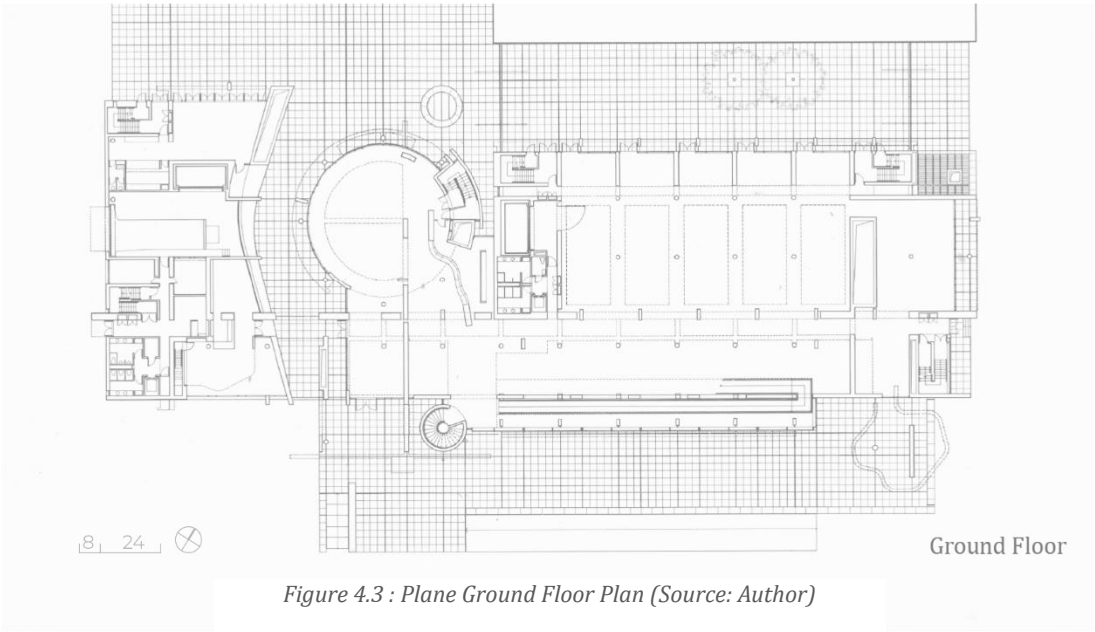

Figure 4.3 : Plane Ground Floor Plan (Source: Author)

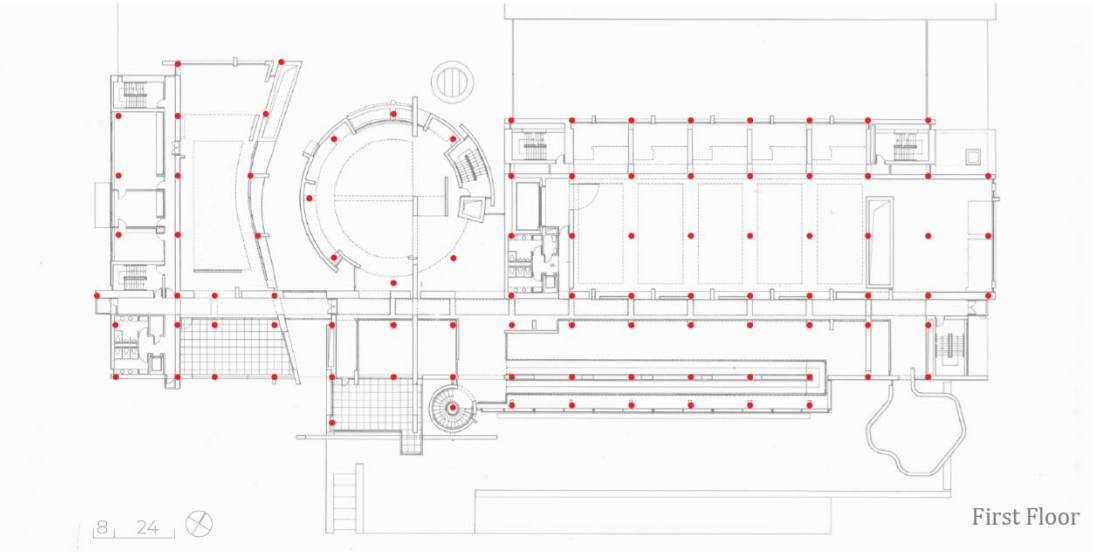

Figure 4.4 : Pilotis juxtaposed over the first floor plan (Source: Author)

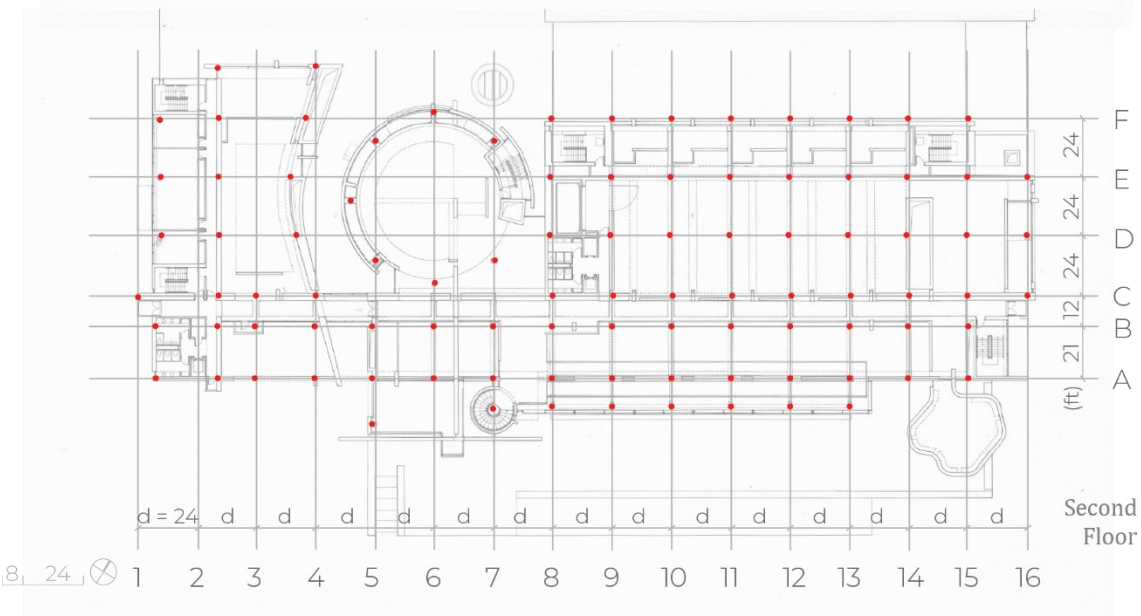

Figure 4.5 : Second floor plan overlayed with axis and pilotis (Source: Author)

4.3. Free Design of the plan in MACBA

Free Design of the plan:

> *One of the focal aspects of the Five Points, the ability to organize the floor plan with flexibility, without the interference of structural partition walls, allowed the house to be independent of it's organization.*

The principle allowed the house (in this case the museum) to be independent of its organization. Although a museum as a building type can be considered a low-restrain category in regards to how strictly its functional organization influences the building design, the free design of the ground floor can still be spotted in multiple ways in Richard Meier's design for the Barcelona Museum of Contemporary Art.

The most explicit example of this correlation is expressed in the planar geometry of different functional volumes in the plan's composition. Looking at the floor plan with some of the zones highlighted and a grid of pilots overlayed on top, it is obvious that the zoning of the museum isn't restrained by either the partitioning or the structural system. [Figure 4.6] The fluid spatial organization of these elements on the ground plan can further be observed in the implementation of the dominant datum wall, as labeled by (Richards, 1993). The datum wall slices through the plan from east to west, representing both a circulation corridor and an organizational element that connects different functional zones of the museum. In this sense, the wall can be seen as a device that defines the linearity of the composition while also holding together various parts of the floor plan: an entrance rotonda and two block volumes on the northern facade, and a hovering entrance plane, a cylinder spiral staircase, the ramp glass box, and a free form gallery on the southern facade (Dahabreh, 2006). This interplay between the different masses Meier conducted in the design of the MACBA's ground floor emphasizes the design's close relation to the free ground floor design principle.

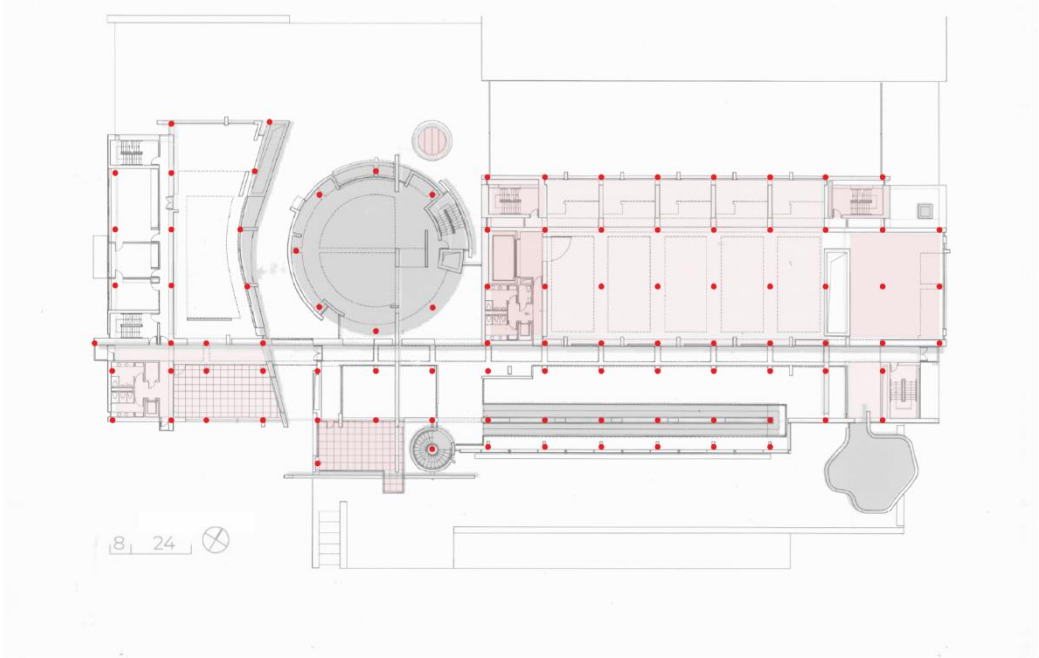

Figure 4.6 : Grid of pilotis and different functional zones overlayed with the first floor plan (Source: Author)

Furthermore, the main circulation system in the museum, anchored by a glass-enclosed ramp hall that runs parallel to the datum wall, provides an open and continuous movement experience. [Figure 4.7] As visitors use the ramp, they are visually and physically connected to various exhibition spaces on one side, while also having a direct relationship with the exterior plaza on the other. This topic of bridging between the museum's interior and the surrounding exterior space is an important design motif of Meier and completely coincides with the principle of an unconstrained floor plan. The ramp hall, in combination with the datum wall, emphasizes the building's openness and creates a layered experience of movement in a dynamic spatial organization. Consequently, the whole interior space of the west wing can then be read as one continuous space: the atrium, the ramps, the glass box, the linear circulation hallway (datum wall), and the galleries with no divisions. In this way, Meier builds upon the principle of the free floor plan design, extending and merging it across floors in one volume of connected and layered parts.

Another key feature of MACBA's design that implements the free floor plan principle is the integration of the Paseo, a pedestrian pathway that cuts through the museum's main body just to the west of the rotunda and the main entrance. [Figure 4.8] More than just an outside circulation route, the Paseo acts as an essential spatial element that brings together the interior of the museum and the exterior space of the plaza. By dividing the

museum into two wings, it creates an off-central axis, allowing visitors to transition from one space to another while maintaining an uninterrupted visual and physical connection between Plaça dels Angels in front of the museum and the garden at the back of the museum. This connection extends beyond practical accessibility, as the Paseo echoes Barcelona's labyrinthine alleyways, embedding the museum within the city's urban fabric. The design of the ground level of the museum continues the existing paths on the site linking the newly formed plaza in front of the museum with the surrounding pedestrian system (Dahabreh, 2006). [Figure 4.9] This shows that through Meier's focus on connecting public and private spaces, MABCA's ground floor plan exceeds the building boundary and extends around it as well.

Figure 4.7 : Glass-enclosed ramp hall as a main circulation system of the museum (Source: Meier, 1997)

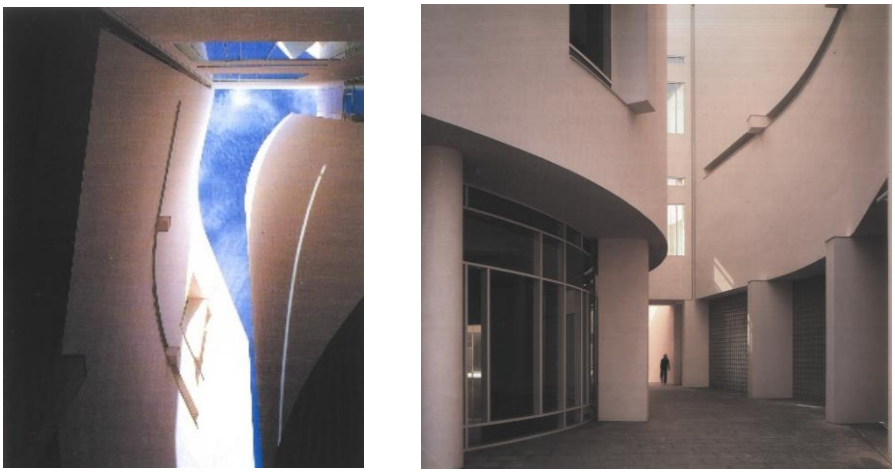

Figure 4.8 : left – walls of the Paseo; right Paeso entance from the North side of the museum (Source: |Meier, 1997)

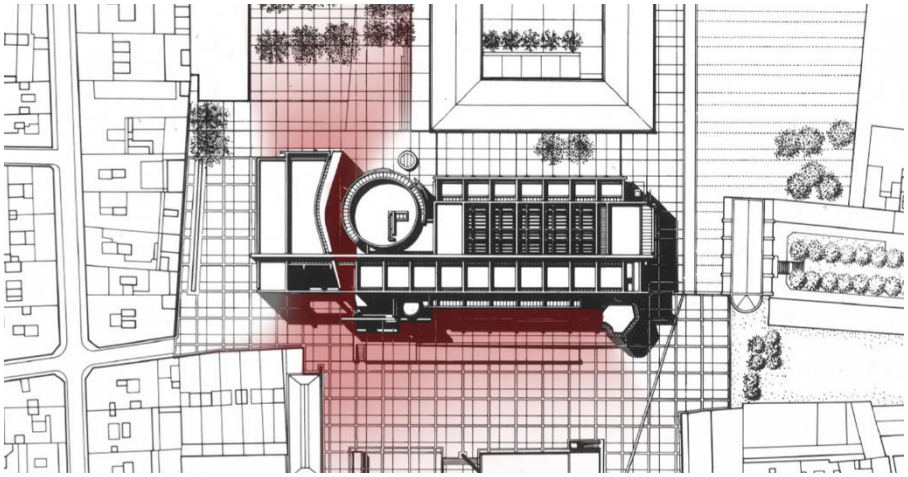

Figure 4.9 : Both square and the Paeso marked on the site plan (Source: Author)

4.4. Free design of the facade in MACBA

Free design of the façade:

> *Free design of the facade refers to the building envelope, its exterior that is free of structural restriction. Like the flexible ground floor, but on a vertical plane, the free design of the facade allowed for the building skin to be independent essentially becoming "free of weight".*

Meier's design of the Barcelona Museum of Contemporary Art approaches the "Free design of the facade" principle from different perspectives. Through multiple strategies that are present in every elevation of the museum, in the case of MACBA, the free facade arguably presents the most implemented principle of all the other 4 points.

The most evident way in which this can be observed in the museum is in how its exterior reads as an independent, expressive composition of forms rather than the consequent reflection of the internal structure. The museum's southern elevation, the facade facing the Plaça dels Angels square, can be read as a dynamic interplay of different elements: beginning from the west, a plaster cut-out plane hanging above the entrance, the green-blue three-sided glass box, and a sculptural form "special exhibition" gallery set

at the eastern end of the main facade. [Figure 4.10] Just west of the earlier mentioned passage through the museum, the Paeso, the elevation is further animated by a double-height terrace making an indented void at the west wing of the museum. [Figure 4.11] These elements can be understood as parts of the main facade that are arranged in a composition extending in front of the museum's main body as well as being in front of the datum wall that acts as the background for the composition. While looking at the main facade it is interesting to notice that, besides the glass box that is transparent, there is not another element that, in its entirety, shows or translates the building structure to the elevation. This means that the museum's facade does not rely on the building's structural system in order to be articulated, in that regard essentially making them two separate entities.

Figure 4.10 : Main museum façade facing the Plaça dels Angels (Source: Meier, 1997)

While the southern facade actively interacts with the public plaza, the northern elevation adopts a more restrained aesthetic in response to the adjacent structures, while continuing to coincide with the free facade design principle. The most dominant form on this facade is the circular rotunda, which separates the museum into its west and east wing while occupying the same facade plane. [Figure 4.12] It doesn't break the block of the museum, it's only juxtaposed with the two wings against the datum wall (Dahabreh, 2006). In its articulation of the facade, the cylinder is not static: it is animated by the recessed glass behind the structural pilotis at the ground floor; by a curved wall that is offset from the main cylinder volume housing the stairs close to the eastern wing: a vertical wall segment stretching through the first and the second floor and an indented

glass opening above the ground floor, while the top part of the cylinder is solid. This exterior play of the cylinder composition displays a flexible disposition of the facade elements, identifying the museum's skin as an independent part of the building.

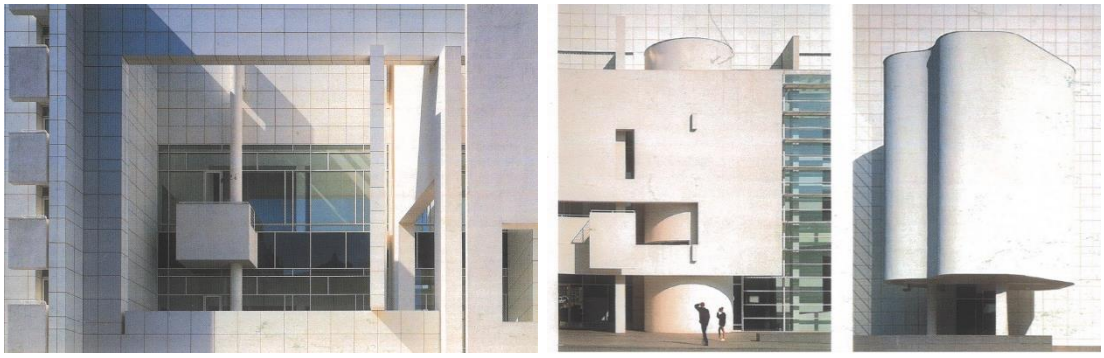

Figure 4.11 : left – double height terrace; middle – cut-out entrance plane; right – special exhibition gallery (Source: Meier, 1997)

Figure 4.12 :The circular rotunda, the north façade (Source: Meier, 1997)

Moreover, while the northern and southern main facades can be considered "free of weight", in terms of the Corbusier's principle, the side east and west elevations are examples of how the free design of the facade is directly implemented in the museum. A series of planes and reliefs implemented in the facades demonstrates one of Meier's design methods regarded as layering by Steele, 1994. From this perspective, MACBA can be observed as a union of two sets of layers meeting at the datum wall. This is especially emphasized while taking a closer look at the side elevations. Starting from the south side of the east elevation, first, a "special gallery space that is separated from the thin aluminum panel wall, then a facade segment of opaque Luxfer prisms, followed by the balconies on each floor that are the exterior extension of the hallways, and then the datum wall. The same applies to the other, north, side. Meier separates the north external wall

from the aluminum cladding mass with a vertical window slit and uses the same window slits to separate the main middle wall of the east facade from the datum wall. [Figure 4.13] Also, what is important for the principle in consideration, the west elevation has the north exterior wall separated from the side façade as well, essentially making it seem as if it is "floating" independently.

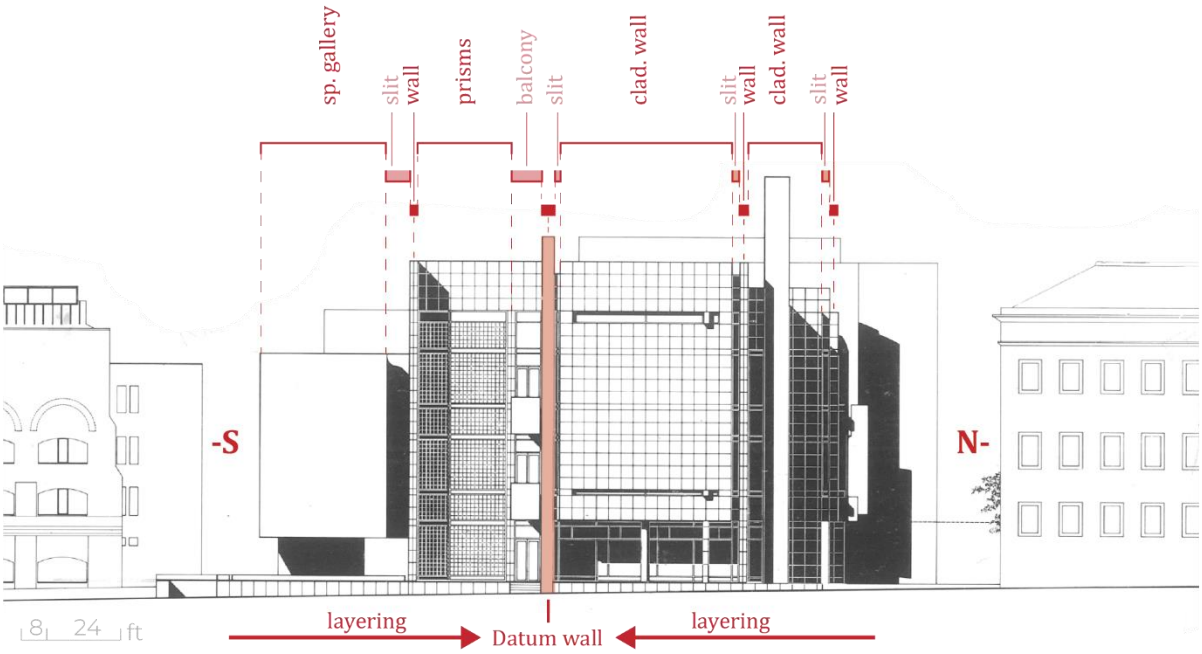

Figure 4.13 : East elevation showing separation between facade and building parts (Source: Author)

As we have now come to highlight where and how the principle of free facade design is implemented by Meier in the design of MACBA, in order to make a distinction between his and Le Corbusier's usage of the same principle, it is equally important to mention how Meier builds upon and adapts this idea. In Le Corbusier's works, a facade that is free of structure can be regarded as the building's envelope, a border, or a contour of the building. This contour is made out of facades that are sitting on a vertical plane, practically bounding the building's mass per each of the elevations respectively. On the other hand, Meier extends this notion of a free facade out of the vertical plane into the space in front of it. In this sense, the outside building border is three-dimensional, and in the case of the Barcelona Museum of Contemporary Art, the south facade occupies the square and contests the space in front of it. This is particularly noticeable if we compare the facade articulation, where an opening is opposed to the solid part of the facade. In the case of Meier, a dialogue is made between a void and a solid mass, in contrast to Corbusier, where the liberation of the facade is made on the basis of contrast between a window and

the facade wall. So, what a window is to the facade wall for Corbusier, a void is to a solid volume for Meier. The MACBA's facade, in this sense, functions both as a boundary and a threshold, representing a spatial transfer rather than acting as an explicit border.

4.5. Horizontal windows in MACBA

Horizontal windows:

> *Windows that run horizontally across rooms provide a better view of the surroundings and allow equal amounts of light to enter the interior of the home.*

Le Corbusier's "Horizontal Windows" principle, emphasizing elongated openings that enhance exterior views and allow uniform natural light penetration, is directly implemented by Meier in the design of the Barcelona Museum of Contemporary Art. This principle, which, as will be explained at the end of this chapter, contributes to the independence of the 'free' facade, is arguably the most directly visible among the other five points in the design of the museum. Across multiple elevations, MACBA's horizontal windows take on varied forms—differing in size, articulation, and length—yet consistently being a part of the building's envelope.

In the northern facade, the horizontal windows are articulated as horizontal thin bands placed on the white panel plane in the western wing, introducing rhythmic patterns of light and shadow into the gallery spaces behind them. The east wing also contains windows, but with a different position on the top and bottom parts of the facade plane. [Figure 4.14]

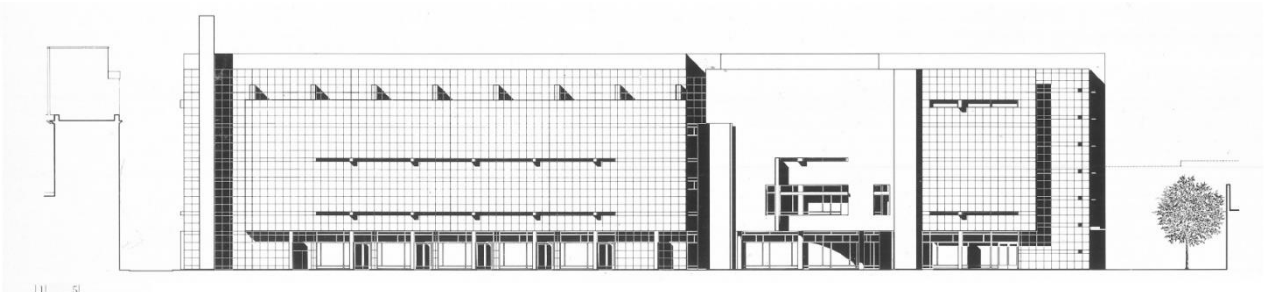

Figure 4.14 : North elevation of the museum (Source: Meier, 1997)

These horizontal strips are penetrated by five projecting beams each, hovering in front of the elevation plane. Besides the controlled natural illumination they provide to the interior, these windows also emphasize the linearity of the museum's composition. Similar to the west wing of the northern facade, the east side elevation contains thin horizontal windows that are placed on the top and bottom parts of the hovering facade plane in the middle of the elevation. [Figure 4.15] These two windows are also segmented into two parts with beam ends that project in front of the elevation plane. On the other side of the museum, the central aluminum panel-covered plane of the west side facade is fenestrated by five lines of horizontal windows, one on each floor, opening up the wall in front of the offices. [Figure 4.15] In this case, Meier didn't use the thin, low-profile strip windows that are present in other elevations; rather, the windows on the west facade are larger in height and profile.

Another significant difference between these two types of horizontal windows in MACBA is that, unlike the thin indented windows on the gallery space and in the east elevation, the office window strips are aligned with the facade plane, positioned flush with the aluminum panels.

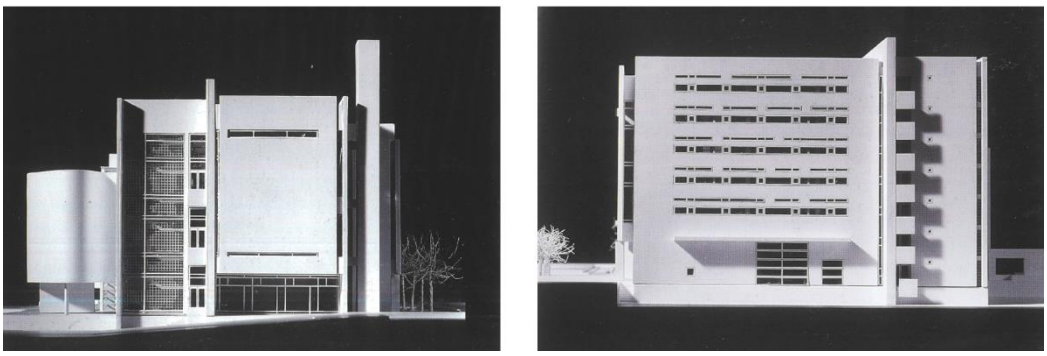

Figure 4.15 : Model of the museum; left - West facade; right - East facade (Source: Meier, 1997)

A more indirect and dramatic interpretation of the Horizontal windows principle can be observed on the museum's southern elevation, particularly in the part with the ramp hall, a three-sided glass volume that extends the full height of the building. This transparent hall acts as the primary circulation space and public interface, mediating between the museum and the plaza. The extensive glazing allows panoramic views of the Plaça dels Angels and the adjacent historical structures, establishing a frame for the dialogue with the surrounding historic context. This building segment can be seen as an indirect application of the "Horizontal Windows" principle, as the glass surfaces paired

with brise-soleil—a system of horizontal louvers that function as continuous bands, modulate natural light, and dissolve the boundary between inside and outside of the museum. [Figure 4.16]

Figure 4.16 : left - image of brise-soleil; right - image of the "glass-box" from the spiral staircase from inside of the museum (Source: Author)

4.6. Modularity in MACBA

The analysis of the pilotis carried out in the first section of this chapter revealed the hidden arrangement of columns that form a consistent grid throughout the floor plan of the museum. Taking a closer look at the plan, it can be noticed that an additional set of centerlines, one that does not align with the primary structural grid, but falls within the same regular intervals, can be derived from the plan. These secondary centerlines, marked in red color (Figure 4.17), also maintain the 24-foot interval but are offset by 9 feet in the x direction. This offset results in the formation of a, secondary, 'shifted' set of centerlines that influences the placement of different elements throughout the floor plan, such as the transverse wall, the circulation corridor, or the rectangular columns in the gallery space of the east wing. This shift is also prominently visible in the museum's site plan, reflected in the paving of the front and rear plazas (Figure 4.18), as well as the roof plan of the museum, where the structural beams are exposed. (Dahabreh, 2006.) The paving of Placa del Angels follows a regular 24ft × 24ft grid, with wide lines marking the structural module. A secondary 24ft x 24ft grid is overlaid with narrow lines and shifts 9ft, in this case, along both the X and the Y axes. Interestingly, the offset value of 9 feet in

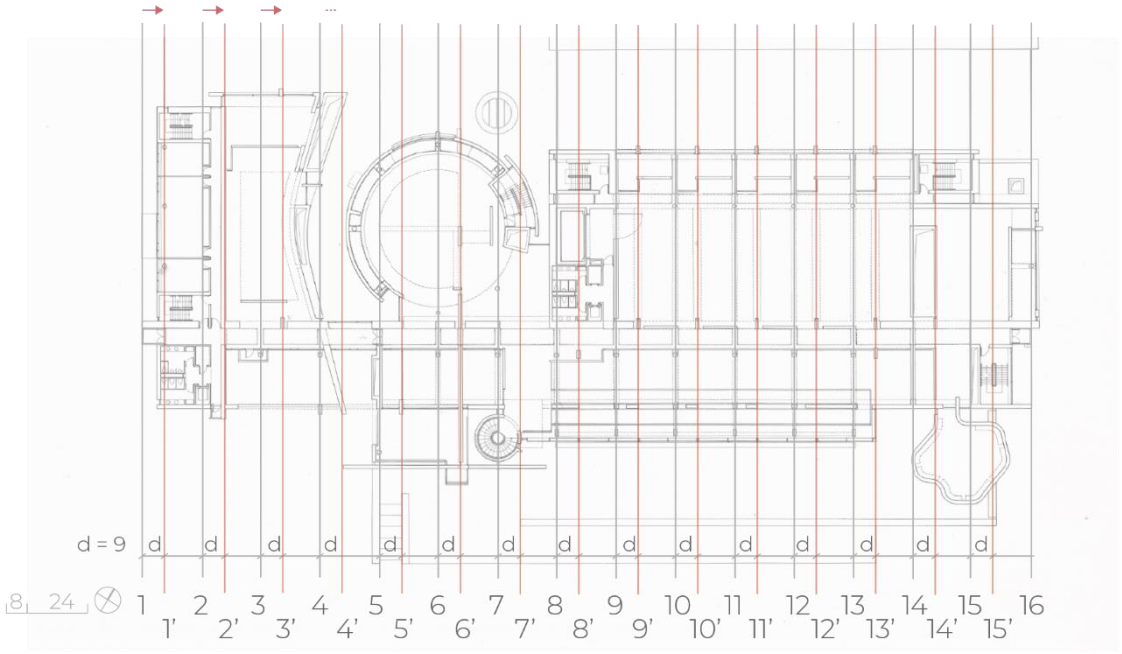

Figure 4.17 : Main and secondary centerlines overlayed over the second floor plan (Source: Author)

the floor and site plans isn't arbitrary. Knowing that in the case of MACBA, as well as in other buildings, Meier used a cladding system of aluminum panels dimensioned precisely as 3x3 feet squares, capable of being exactly distributed in 24, 21 and 9 feet distances, it can be understood that the floor plan of the museum was directly based on 3 ft module which can be seen as one regulating unit. This is visible in overlapping the floor plan with the 3 ft module. (Figure 4.19) The overall layout of the museum can then be understood as a grid of 15x5 24-foot squares, each consisting of the 8x8 modular units from the stairs at the southern facade to the end of the northern elevation.

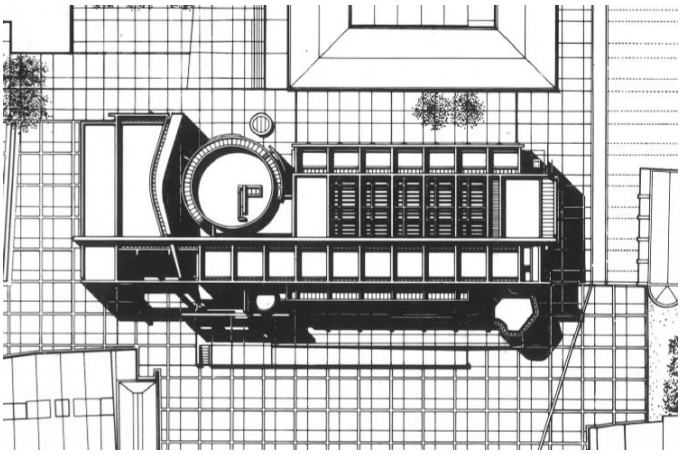

Figure 4.18 : Paving of Placa del Angels showing the two overlapping 24ft × 24ft grids (Source: Meier, 1997)

Although the modules are used to regulate the plans of MACBA, Meier's usage of the regulation unit is explicitly conveyed in the design of the two main museum facades. The

cladding of the elevations with white aluminum panels shows the basic module unit Meier used in the museum design. The south and the north elevations are both horizontally clad with full 3x3 feet panels coinciding with the main basic grid, in the case of the southern façade, resulting in the longest horizontal count of 120 units, while the vertical distribution of the modules varies across the museum height. The main full panel vertical articulation of the datum wall in the southern facade with modular units is segmented into seven parts. Each of the parts consists of several full-sized panels divided by a 1/2 unit horizontal strips continuing the entire circumference of the museum. The vertical distribution of units within each of the parts respects the following order, from bottom to top, the number of units in each section, separated by 1/2 unit strips, is: 4,2,4,2,4,7. (Figure 4.20).

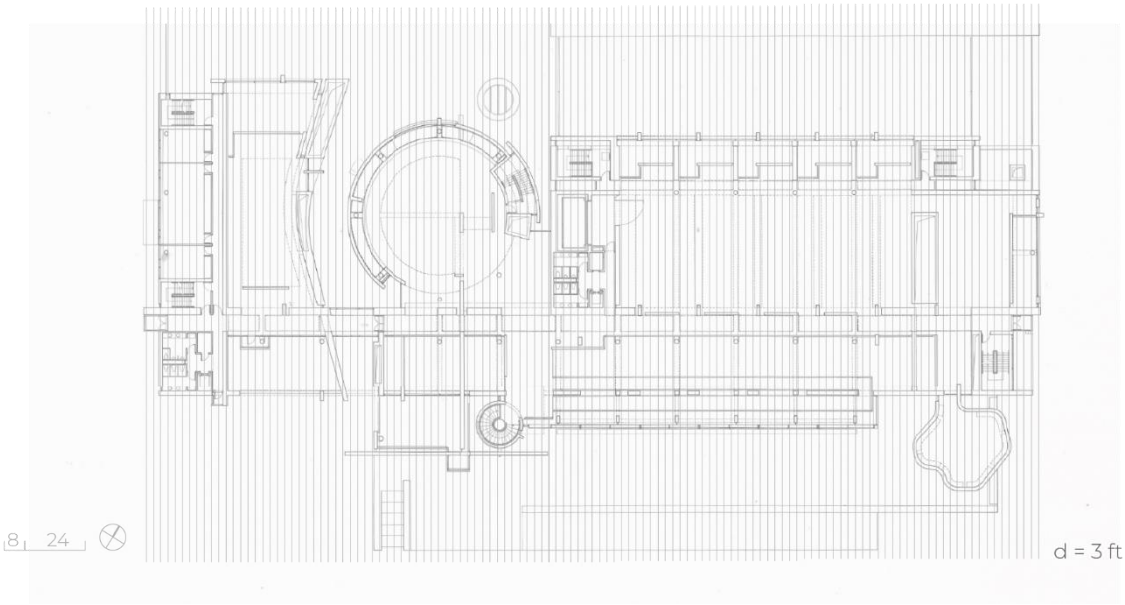

Figure 4.19 : The 3 ft module on top of the second floor plan (Source: Author)

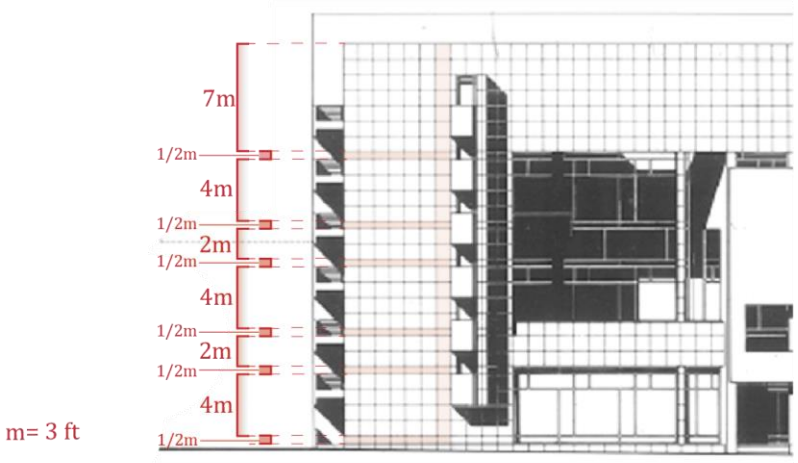

Figure 4.20 : The vertical distribution of modular units on the south façade segment (Source: Author)

5. Conclusion

Through a detailed insight into Richard Meier's Museum of Contemporary Art in Barcelona (MACBA) through the lens of Le Corbusier's Five Points of Architecture, this analysis has demonstrated an elaborate relationship between Le Corbusier's principles and Meier's own design approach. By analyzing the implementation of four of the five points—pilotis, free design of the ground plan, free façade, and horizontal windows—it becomes evident that Meier does not only use and implement Corbusier's principles but rather interprets, adapts, and redefines them within his expression of the architectural design approach.

The pilotis at MACBA propose a flexible distribution while maintaining a structural property similar to that of Corbusier's. Meier modifies their presence and visibility in response to spatial and functional relations within the greater museum compositional setting. Even though it is definite that he implemented the pilotis principle in the design of the museum, the variety of this application is what makes the comparison distinctive. The pilotis in MACBA change and adapt to the building form, while still falling under the system of a grid distribution. Some parts of the museum's floor plan have the pilotis completely arranged, some have them hidden and invisible, while others change their disposition, but all the parts make a coherent system that sets the base for all other principles. The second point, the free design of the ground plan is visible in Meiers design approach mostly through the connectivity of MACBA's organization, the museum's circulation paths, and the overlap of public and private building zones—particularly through elements like the datum wall, the ramp, the Paseo, and the expressive facade elements, which establish a porous, dynamic relationship between interior and exterior. Furthermore, the "free ground plan" for Meier is not only bound to the footprint of the building, liberating just the walls within it from their fixed position and dividing functions, like its application from Le Corbusier. Rather, the ground floor plan of MACBA integrates its immediate surroundings, liberating the building as a whole, presenting a cultural dialogue between the tradition and the present. Through these ground plan characteristics, it is observable that Meier successfully implements the "free design of the

ground plan", allowing for an unrestrained design of the ground plan that aligns with Corbusier's principle while responding to the typology of a museum and the historical and urban context of Barcelona.

Perhaps, out of all the points, most visibly, the principle of the free façade is explored and identified in the Museum of Contemporary Art in Barcelona. Meier transforms Corbusier's principle of a detached skin into a sculptural, three-dimensional layering that projects into public square space. His approach interprets the idea of the façade as a boundary, and develops a medium of transition from outside to inside. Subsequently, it can be understood that Meier's design successfully evolves and integrates Corbusier's free design of the facade principle in correlation with his own formal and material vocabulary. The MACBA's facade becomes a composition of distinct elements that define space, frame views, and mediate between the museum's interior and the exterior plaza while maintaining independence from the internal structure, gaining the attribute - "a building skin that is free of weight". Moreover, the principle of horizontal windows is applied both directly, through elongated thin window strips, and abstractly, through the entire glass box encasing the ramp hall that allows views of the exterior for numerous points on the inside. Complementary, all of the facades of MACBA are articulated with some form of a horizontal window, which can be considered as a further reinforcement of the independence of the facade. Since the windows appear to hover within the larger composition of white planes, long strips of horizontal windows indicate that the weight of the facade isn't passed through itself, but rather through the structure behind it, additionally adding to the floating appearance of the facade.

The fifth, and the final point of all the principles, is left as the only one that isn't present in any way in the museum. The absence of the roof garden is due to programmatic requirements for natural overhead lighting in museums, although its omission does not deviate from Meier's overall architectural language. Instead, it highlights how Meier prioritizes the important function of the museum, essentially pointing out and indicating that the Five points of architecture from Corbusier weren't always directly and explicitly used by Meier throughout his design process.

Overall, the analysis affirms that Meier's design is affected by Le Corbusier's theory, pointing out a new angle on this co-influence, and adding a new perspective on this to the literature, already thoroughly and extensively investigated. More specifically, in the case

of the Barcelona Museum of Contemporary Art, as the case study has indicated, the four points of architecture can directly be traced to parts of the museum's design. This direct implementation of the principle, together with the parts of the museum that translate the points symbolically, as well as the ones that are coordinated by Meier's interpretation, demonstrates a fresh perspective of Corbusier's influence on Meier. Ultimately, the case study affirms that Meier's work shown in the MACBA isn't based on a pure replication of the principles; rather, it reflects a mature synthesis of Meier's work that doesn't emerge as an imitation of Corbusier's theory, but a dialogue with it — an architectural conversation where the points are not just acknowledged but reaffirmed, reapplied, and reinterpreted.

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