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Spanish 'Plastic' Architecture
A critical reading and design approach

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Abstract: The following critical text proposes a series of notes and reflections on reinforced concrete architecture, not on the material itself. Since its invention, concrete combined two potentialities, deriving from two materials they compose it: the 'elastic' potential, which developed and reached a consolidated form and tradition, and the 'plastic' one. The last one has been little experienced at the beginning and, in the course of recent history, found space in architectural criticism in the meaning of 'expressive', 'brutalist', 'sculptural' concrete, ending up to influence 'superficially' (related to the surface) architecture. The 'plastic' architecture, instead, is three-dimensional architecture and unifies the construction and spatial qualification in a single design gesture. This critical approach not only allows to reconsider the history of modern/contemporary architecture starting from the necessary collaboration between space and construction that unifies the final judgment, but allows to influence the project, adhering to a formative process of those geographic-cultural areas that possess those certain characters, the masonry ones. The Spanish 'plastic' architecture is, in that sense, a clear example: in many buildings, this 'masonry' character is clearly identified, due to the architectural exploitation of the reinforced concrete plastic potential.

Key words: Critical reading approach, Spanish modern/contemporary architecture, Plastic and elastic concrete.

Introduction

The following notes represent a critical analysis of the Spanish concrete architecture. They constitute a small part of a broader research conducted on a greater geographical perimeter, which involved the entire emerged area of the Globe. The interest of this research lies in the development of the possibility to rewrite the history of architecture through a new critical filter. An alternative history, to all the others that, for different reasons, resulted partial, tendentious and subjective, which could provide, at the same time, new tools and methods for the project of the new/next architecture, developing new design/compositional theories.

It is well known that man's constructions, that architecture recognizes and individualizes their state of the art, derive directly from the action of man on the available matter on our planet. A 'matter' which reveals constructive attitudes that man recognized, transforming it in 'material', than changing it into an 'element' which, in turn, composes the architectural 'organism'. Before the advent of reinforced concrete, two types of material were available to the critical man sifting that followed this formation process, and they are, for example, wood and stone. Those constitute the 'masonry-plastic' world (stone, brick,...) and the 'wooden-elastic' world (wood, iron, steel,...), because it is generally possible to recognize in them common characters of these two materials.

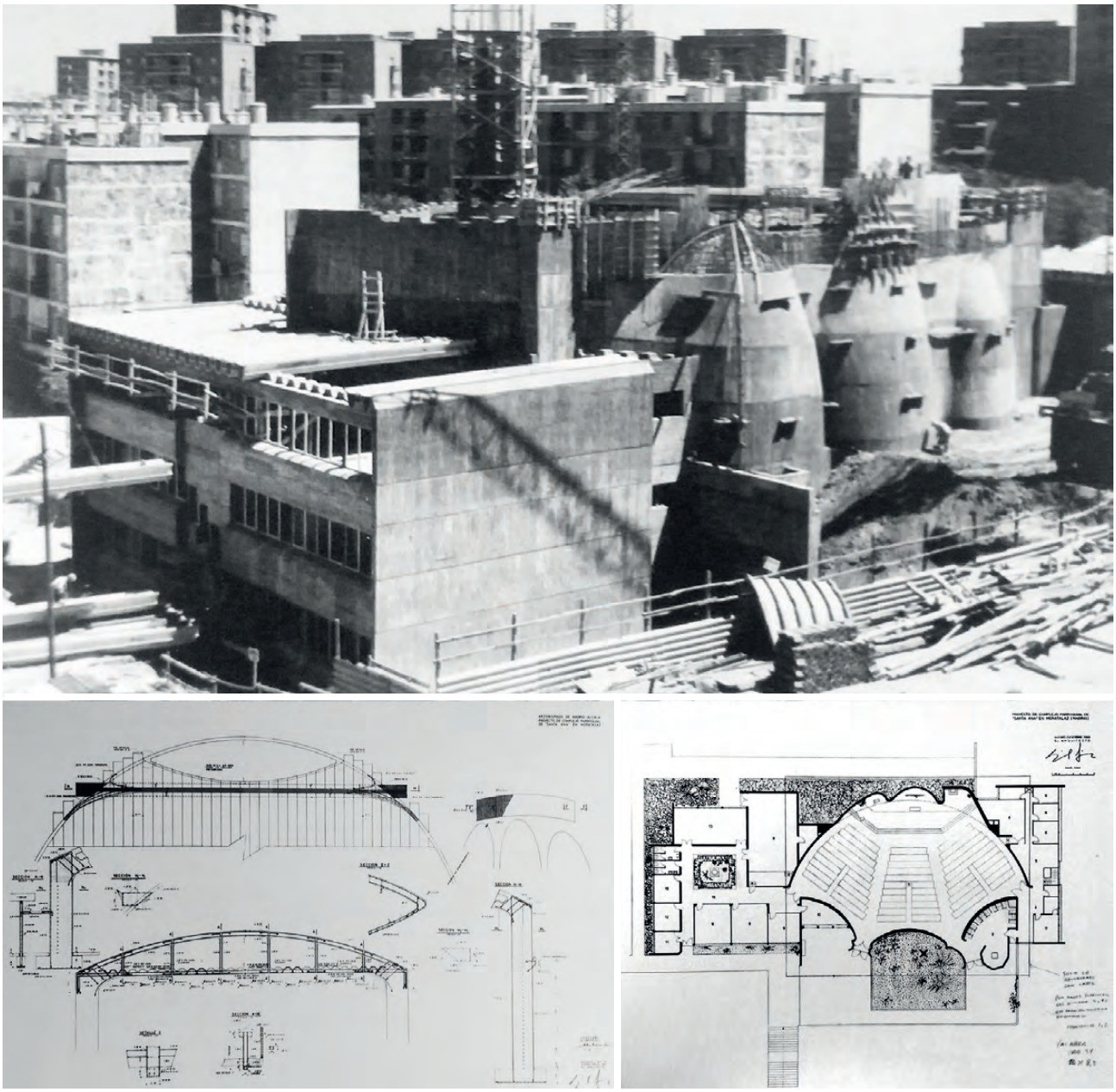


Figure 1. Santa Ana de Moratalaz. Miguel Flsac. 1965-71. Source: Hidden Architecture (http://www.hiddenarchitecture.net/2016/09/santa-ana-de-moratalaz.html). Copyright: Hidden Architecture.

Fundamental characters are identifiable, on a global scale, in structures that necessarily influence the definition of the space that will be built. Wooden-elastic structures (beams and pillars structures) carry out the load-bearing function but do not define closures of the space, while the masonry-plastic structures (walls, boxes) are load-bearing structures and, at the same time, define the quality and the hierarchization of the space they construct. Those two adjectives, 'elastic' and 'plastic', refer to mechanical characteristics of those two materials and to their structural mutual collaboration. Stone and wood, (afterwards together with bricks and steel) represented these characters in architecture.

Reinforced concrete has both characteristics: it can be elastic producing 'elastic architecture' and can be plastic producing 'plastic architecture'. This, in fact, has really happened: if we analyze the history of architecture through this critical filter we could identify two strands of formation. The first includes Modern Architecture and defines an 'elastic' development and exploitation of reinforced concrete with its 'gothic' structures composed by pillars and beams, codifying and consolidating its use. What is interesting to underline here is the design approach that foresees two distinct moments: the structural definition moment and the subsequent spatial definition one (but it could also be the vice versa).

The second could concerns the plastic potential of reinforced concrete, that makes the spatial design and the structure definition coincident in a single architectural gesture. At the beginning it remains confined to stylistic experiments (Neo-Expressionism, Neo-Plasticism, Neo-Brutalism,...) and solves technical problems in the industrial field. More recently, it is equivocated with the easiest and 'superficial' meaning of a 'sculptural' potential, relative to opacity, massiveness, closure as an external 'sensation' simply related to a 'skin'. In my opinion, it is possible to draw a new formation line and development of a certain type of reinforced concrete architecture, which I define 'plastic'. This identifies construction characteristics that are determined by the exploitation of the plastic potential of reinforced concrete, which makes these architectures particularly interesting and organically[1] conceived.

Spanish 'Plastic' Architecture

In Spanish architecture, in my opinion, the profound relationship established between the 'plastic' use of reinforced concrete and spatial hierarchy, its own degree of organicity and the final expressive weight/apparence it presents are more readable than in others. It returns the built image coherent with the cultural and geographical context in which it developed.

In fact, beyond those consolidated critics that stop at the description of the only 'emotional' effects that a certain color, a certain thickness, a certain play of volumes produce at sight, the Mediterranean area owns and preserves far deeper characters that are linked to the type of 'matter' available in nature, to the way of transforming it into 'material' useful for construction, to define the anthropic measure of 'elements', and finally to organize them in 'organic' unity, converging towards the ultimate goal of the construction that is the shelter protection, in which will occur any type of human activity. The material that characterizes the Mediterranean is mineral, stone, clay, limestone, more volcanic than wooden. In Spain, as in other Mediterranean areas, this kind of matter has undergone a certain type of process which fixed its characteristics and which was consolidated, dominated and codified maintaining its intimate, profound, constitutive characteristics: the particular cut of the stone, of which every aspect has been codified in the stereotomic discipline[2], supports the plastic nature of the mineral homogeneity, seeking and finding the static collaboration of each element that, in the compression work unity, builds the wall and the vault, and defines simultaneously a spatial hierarchy.

This legacy, developed and consolidated over time, finds new and unprecedented lymph with Gaudì's structural experiments, bringing it to extreme consequences with the development of the loads funicular principle, according to which each element of an arch or vault is completely compressed. But, in this case, arches and vaults remain like they are: the unity that, on a smaller scale, involves the single constructive element, does not correspond to the globally 'elastic' nature of that architecture, considered as a system of elements. So we could say that Gaudì's architecture generally maintains a 'gothic' character, due to the need to close the space that the only supporting structure does not define, concentrated as it is in discrete points corresponding, i.e., to columns and pillars. Concrete arrives in Spain in a delicate moment in its history, and generally undergoes the same process of introduction into construction (and then in architecture) that occurs in other areas of the world: initially used in civil and industrial infrastructures, later, with the parallel spreading of Modern Architecture, coding the 'elastic' frame and invading, albeit in a much smaller amount, the Spanish architecture[3].

After a relatively short period that sees it confined to the traditional masonry construction[4], it reinvigorated thanks to the experimentation of great architects such as Miguel Fisac[5]: the Parish Church of Santa Ana and Our Lady of Hope (Fig. 1) reaches an high degree of plasticity linked to the continuous and massive use of reinforced concrete: the large ecclesial hall is defined by three continuous reinforced concrete walls that feature the convexity, determined by the particular shape of the church, towards the altar, placed in the direction of the benches. On the other three sides, the continuous wall that 'contains' the space 'deforms' plastically, forming three niches that could be interpreted as three Romanesque apses. The roofing is made up of a serial aggregation of hollow section beams that stop in correspondence of the altar, producing an horizontal opening that illuminate the internal space through zenith light that is reflected on the dark concrete of the wall. The degree of plasticity is, we could say, relative to the single contructive element, and does not reach the maximum degree of organicity for the 'serial' system that characterizes the roof, which tectonically rests on the underlying structures, involving them for simple vertical support.

We could include, in this quick selection, Fernando Higueras's structural experiments, that could be considered because of

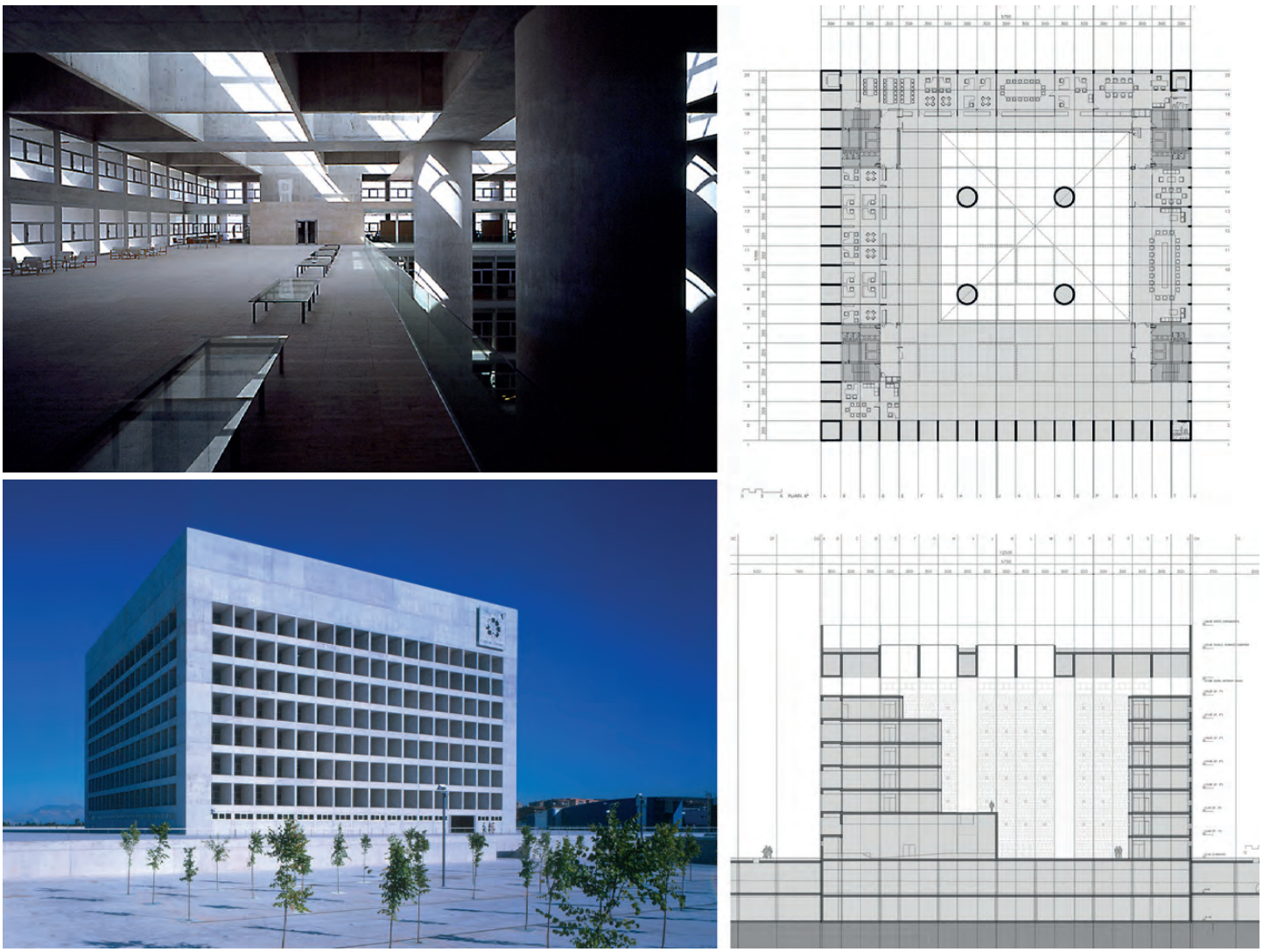


Figure 2. Caja Granada. Alberto Campo Baeza. 1992-2001. Source: http://www.campobaeza.com/caja-granada/. Copyright: Hisao Suzuki, Fernando Alda, Duccio Malagamba, Alberto Piovano, Roland Halbe.

the 'element' that specializes itself and, aggregating each others, forms architectural organisms of greater degree[6]. Those of Fernando Moreno Barbera[7] that, i.e. in the Univeridad Laboral of Cheste, finds a good global level of organicity: the serial use of horizontal linear elements forming the external frames of pavilions is mediated by the global plasticity of facades that denounce their role: closing spaces structures but non-supporting one. In the specialized nodal building of the auditorium concrete assumes a plastic character defining, in a masonry way, the massive aspect of the construction and its spatial definition. We could conclude this first chronological phase with a rapid focus on Javier Carvajal Ferrer's experience who exploits the plasticity of concrete in the organization, even complex, of the house in Somosaguas that somehow 'rationalizes' in the university library building in Pamplona.

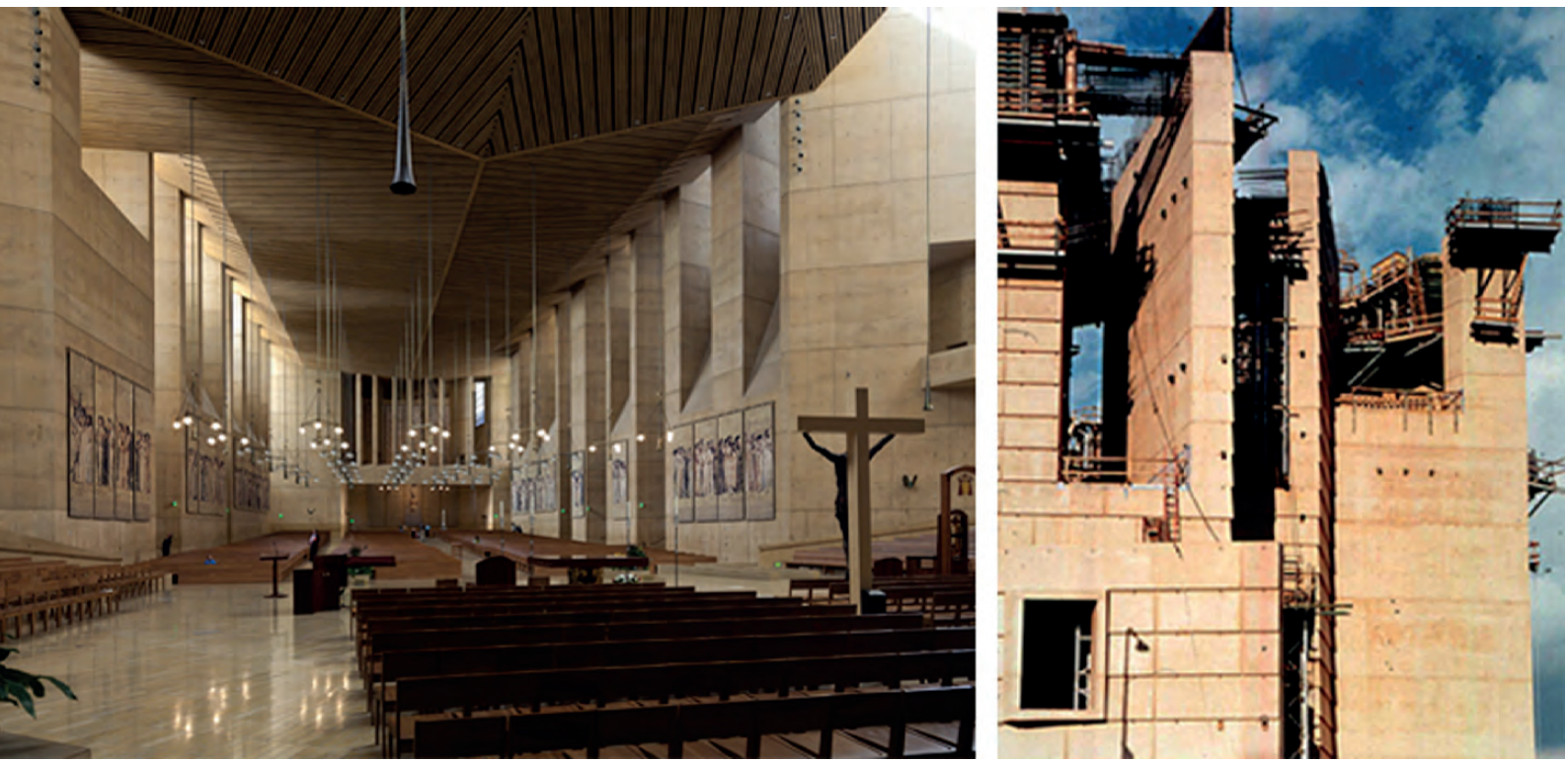
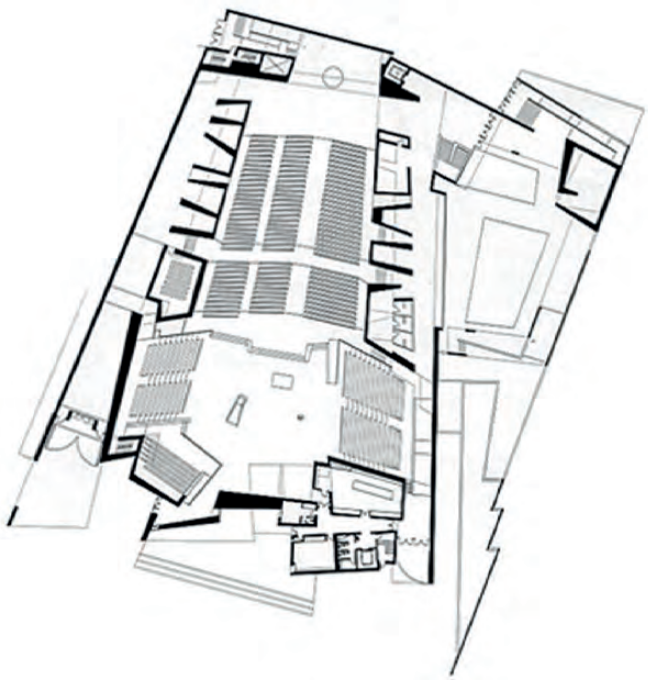


Figure 3. Los Angeles Cathedral. Rafael Moneo. 2002. Source: http://www.johnnava.com/COLA/COLA.html; http://www.aplusu.org/index.php?/malibu-studio/cathedral-of-our-lady-of-the-angels/. Copyright: John Nava, Nick Roberts.

Focusing now on contemporary Spanish architecture, we could mention another great master who was able to manage the 'plastic' potential of reinforced concrete and the degree of structural-constructive and distributive-spatial collaboration in architecture, including the typological specialization: Alberto Campo Baeza. In the impressive Caja Granada building (Fig. 2) continuous reinforced concrete assumes, in various reading scales, a determinated role and a coherent, constructive, distributive, expressive form: the four hollow pillars, freeing the central space that becomes the important and nodal place of the building, support the great coverage defined by a large plate whose thickness is lightened by a grid of very high and resistant beams, which allow light penetrating into the central courtyard reflecting on the concrete surface itself. On plans it is interesting to note how the slight diagonal movement of the four pillars supporting core organically involve punctual support structures on the building perimeter, which on two of the four sides become coherently elongated septa due to the new distribution of the weight of the roof. These septa, which have a structural function, contribute, at the same time, to the filtering of horizontal solar light coming from the south, since the building, with a square and volumetrically cubic plan, is set diagonally in a north-south direction, placing to the south these facadas. Furthermore, there is a coherent and rational facade composition that links the structure to the spaces it builds: corners are full/solid, corresponding to reinforcements in which elevators find their place; a baseline barely mentioned is overlapped by the horizontal 'stratification zone' coinciding with the legible and identifiable elevation thanks to the 'cells' serial repetition that is determined by the length of the transverse partitions; the 'conclusion' of what we could define as a tectonic stratification of the façade corresponds to the full band of the height of the roof system. Not far away there is the 'plastic' structure of the Museum of Memory, also in Granada. The real tectonic scan, using also different materials, and the influence on the spatial organization that the plastic use of reinforced concrete allows is more directly traceable in some single-family houses built by Campo Baeza:



Casa de Blas, Casa Olnik Spanu, Casa Rufo, present a basic box structure, made of continuous reinforced concrete, which organizes spaces and paths and which is massive and bearing, tectonically topped by slender steel and concrete structures (Casa Rufo), punctual and discreet[8].

Rafael Moneo, another fundamental contemporary Spanish architect, exploited the plastic potential of reinforced concrete, achieving important results in many architectures, including the Los Angeles Cathedral (Fig. 3). Here supporting structures are enlarged and emptied becoming real resistant boxes, aligned and closed, ideally forming the two continuous side walls of the church. These boxes host serving functions, i.e. side chapels and the sacristy on ground floor, while from above they allow, through diagonal structural stiffeners, the penetration of light and the illumination of the main space. The light is further filtered by the 'masonry' use of the onyx that characterizes all façades and which contributes to the building masonry character[9].

The Musical Theater building in Valencia, by Eduardo de Miguel Arbones, uses the same 'organic' principle: load-bearing walls, designed, conceived and built with continuous reinforced concrete, are enlarged for structural reasons and, at the same time, welcome serving functions, contributing to global organicity in which space and construction are inseparably and necessarily linked togheter. Juan Navarro Baldeweg reaches a high level of organicity, plasticity and architectural unity in the Salamanca Congress Palace (Fig. 4): the hall, that is the building nodal space, is covered by a concrete dome that pushes through arched partitions towards perimeter walls, which play a structural role and together organize serving spaces for the auditorium. In addition, the 'organic' structure of the roof allows the zenith light to filter and illuminate the interior. Francisco Mangado, beyond the masonry character of buildings such as the Baluarte of Pamplona and the Municipal Exhibition and Congress Center of Avila, designs the Auditorium of Teulada, using load-bearing concrete walls, defining the structure and the internal space at the same time.

Ignacio Mendaro Corsini is the architect of the Oaxaca Historical Archives Palace (Fig. 5). Here the correspondence between the path, generated by the motion, and the served space becomes clear, thanks to the constructive and compositional definition of continuous load-bearing reinforced concrete walls. The position of the stairs is defined by the doubling of these load-bearing walls which, at the same time, carry out a structural supporting function for the upper box walls. These box walls are readable and identifiable thanks to the thickening of the two planes that delimit the roof and the first floor, and thanks to the insertion of an intermediate floor whose, by its inferior thickness, only has a stiffening function. To the general masonry aspect of these walls contributes not only the plasticity and continuity of load-bearing concrete walls, but also a different color of the cement, due to local characteristics of components, which melt and, in a certain sense, 'plant' the building firmly on the ground. Roofs are almost flat but the full height main entrance and the reading room are covered by large beams that manage the lighting that reflects on their surface, obtaining a necessary filtering effect that contributes to identify typologically and physically these nodal spaces of the building.

Many other works have been excluded from this rapid discussion for reasons of opportunity[10] and space, and many other architects, less known and however important, could be re-considered through this critical 'reading and design' method, looking for and measuring the influence of the continuous reinforced concrete structure in the constructive, distributive, expressive definition of space through gradations of 'plasticity' that necessarily involves more aspects in the convergence towards the architectural unity.

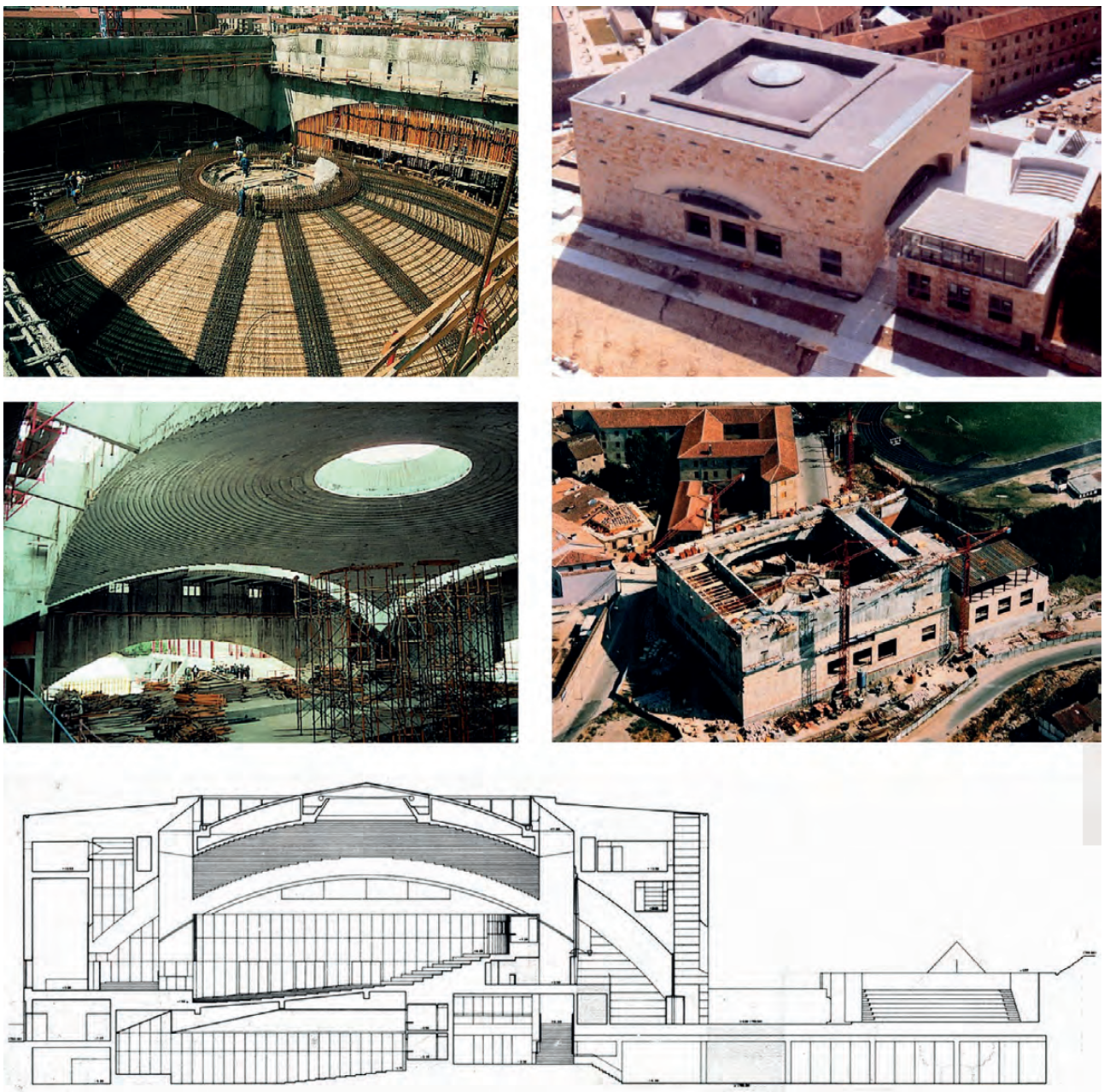


Figure 4. The Castilla y León Convention Center in Salamanca. Juan Navarro Baldeweg. 1988/92. Source: http://www.mc2.es/ficha_proyecto.php?i=es&id=171&idcategoria=11 Copyright: MC2 Estudio de Ingegneria.

Figure 5. Oaxaca's Historical Archive Building. Ignacio Mendaro Corsini. 2016. Source: https://www.archdaily.com/868849/edificio-del-archivo-historico-del-estado-de-oaxaca-mendaro-arquitectos. Copyright: Elena Marini Silvestri, Ignacio Mendaro Corsini.

Conclusion as a starting point

Many are the possible conclusions of this rapid collection of examples, critically read through an organic approach to the study of architecture, that we could try to fix. We could say, now, that they are all defined by a 'plastic' character: these notes reached a temporary and partial unity, ready to be 'attacked' by further critical reflections that will test their resistant structure and, in the best case, will offer a new critical synthesis, up-to-date and operative, but again ready for subsequent tests and so on. So, this critical text could be considered as a sort of plastic structure that seeks its own equilibrium whenever it undergoes critical load actions.

Now, we could propose small final arguments that are structured on two different lines. The first is more closely related to the historical-critical domain, while the other reflected and influences the

design sphere: through this analytical method one could review critics judgment on some crucial points concerning the history of modern architecture and those concerning, i.e., Brutalism and those stylistic currents defined through a 'superficial' impression that reinforced concrete procured in the general criticism. Reinforced concrete can build continuous walls and resistant boxes, can define the space through its construction, exploiting its plastic potential, thus adhering to a precise and identified process of transformation of the mineral matter.

The awareness of its masonry character, derived from the recognition of its architectural attitudes, could possibly opens the way to numerous research lines in the design field. This respond to a technological demands for energy savings and could allows a first reversal of a consolidated 'commercial' approach, based on different moment of the contemporary design process that divide and dissects architecture in various parts, i.e. the structure and its 'skin', only creating fabulous images without constructive consistency and, of course, architectural organicity. External forms, sometimes arbitrary and far from the human measure, that amaze and marvel eyes as a pictorial image, hide the solution of the problem, always human, of gravity. This duality serves to image trade and empties architecture about its deep meaning, both theoretical and materical. In this sense, Spanish 'plastic' architectures[11] represent a first positive example that recovers and seeks to unify the arbitrariness of forms with the crucial statics need by exploiting the plastic potential of reinforced concrete, finally reaching a new, totally unexplored, architecutal language.

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Notes

[1] The definition of architectural 'organism' that I use in my researches is the Giuseppe Strappa's one: architectural organism is 'set of elements releted by a necessity link that contribute, together, to the same common purpose' (Strappa, 1995).

[2] For example, it is worth mentioning the scientific and treatise contributions of Alonso de Vandelvira who, inspired by Philibert Delorme, imports and disseminates the art of cutting stone in Spain, or Antoni Rovira i Rabassa who more recently proposed the same theme updating it.

[3] See, for example, the experiences of GATCPAC, a group of leading architects of Spanish rational architecture in connection with the international context.

[4] See, for example, the story of the 'Pueblos de Colonizacion', in which reduction of resources paradoxically allowed the development and experimentation of a new masonry architecture, with constructive elements made of reinforced concrete collaborating structurally in the same stone masonry.

[5] Known are the experiments on beams lightening that, for the strong resemblance to dissected femurs, have been called “los huesos” and on the surface rendering, “textile” of the reinforced concrete. Among the most famous works we can mention the “pagoda” tower of the Jorba Laboratories, in which the virtual rotation of the floors conceals it with an elastic frame structure and the IBM building whose globally massive and masonry structure is given by the use of prefabricated concrete elements, folded and positioned with the concavity once towards the outside the other towards the inside, obtaining small slots for lighting. The horizontal lines of the stringwalls indicate a certain “wall” of the walls, which however is lost with the dematerialization of the ground floor, in which appears the elastic supporting structure with pillars. Plasticity achieved and completed at scale of the architectural element.

[6] See, for example, the well-known building of the Heritage site in Madrid, where a certain level of plasticity achieved by beams and systems that put them in collaboration, reaches a higher degree of organicity given by the circular design that predisposes and closes, knotting it, the central hall.

[7] See, for example, the Faculty of Law and the Faculty of Letters and Philosophy in Valencia in which the concrete element collaborates with the overall masonry character of the building, denouncing its non-structural function, allowing the filtering and dosage of light.

[8] Please note the project for two sports pavilions in Zurich, where the load-bearing structure, conceived in continuous reinforced concrete, supports a relatively light covering structure, composed of a lattice of steel beams. The basic load-bearing structure, massive and opaque, supports that light and translucent flow, which becomes a lantern when artificial lighting is activated inside.

[9] See the most recent Church of Jesu in San Sebastian, whose concrete partitions, organizing side chapels, support a lighter roof, here plastered.

[10] I would refear to a parallel research, that I am developing on a possible definition of a ‘plastic city’, in which city transformations are read and interpreted critically, re-proposing and identifying the same process phenomenon on a larger scale. In this regard, we could add other Spanish experiences and architects: Ignacio Mendaro Corsini, José Ignacio Linazasoro, Antonio Jimenez Torrecillas, Jose Maria Sanchez Garcia, Tabuenca y Leache, among others.

[11] In reality not just Spanish. See for example development centers such as Switzerland and Japan and many more and more interesting experiments that come from all over the world.