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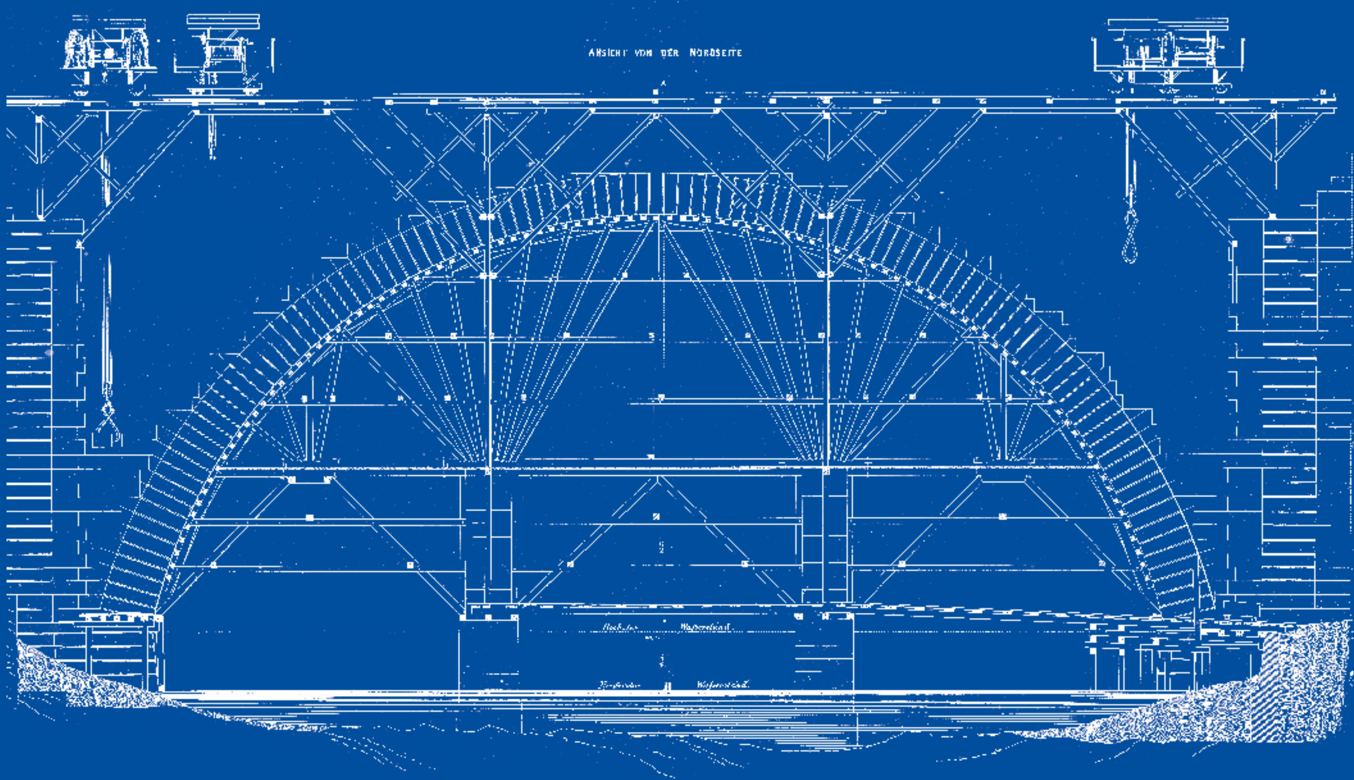

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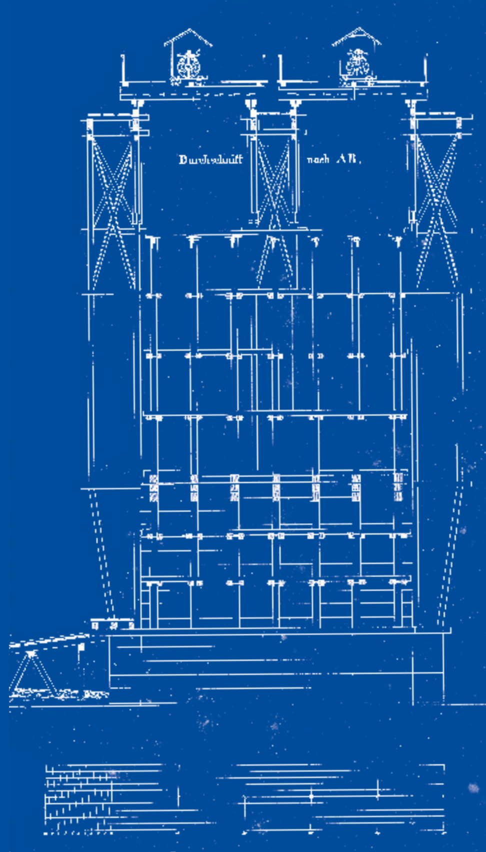

Matters

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Building with limited resources in times of revolution. Construction processes in Social Housing by Álvaro Siza in the early 1970s

Clara Pimenta do Vale, Teresa Cunha Ferreira, Tiago Cruz, Joaquim Teixeira, Rui Fernandes Póvoas

CEAU/Faculty of Architecture University of Porto, Porto, Portugal

Abstract: The aftermath of the Carnation Revolution (1974) in Portugal included high demand for affordable housing despite the longstanding context of post-war resource scarcity. This paper addresses the development of the innovative and qualified construction process by the Local Ambulatory Support Service (SAAL) that emphasized popular participation and self-construction. This paper aims to deepen analysis of the participatory housing construction process within a context of resource scarcity, focusing on the actors, the construction systems and building materials. Following previous experiences, Álvaro Siza designed two neighborhoods in Porto for SAAL: S. Vítor [1974–1975] and Bouça [1975–1978]. While the former responded swiftly to the urgent need for housing, with modules designed for self-construction using readily available materials, the latter represented an adaptation of a pre-revolution project optimized for economy through its rational design and material use.
The research methodology incorporates the cross-analysis of archival and bibliographical research, in situ analysis of the buildings, and the production of 3D drawings of representative construction sections and details.
This paper aims to deepen the analysis of the construction process of participatory housing in the context of scarcity of resources, focusing on the building actors, construction systems and materials. The results demonstrate the innovative and qualified solutions achieved through strategies such as self-construction, simple finishes, prefabrication and high design standards underpinning the control of all details. In a context where interventions with a strong urban character were being debated, Siza recognizes the "difficulty in assuming the boundary between plan and project" (Siza 2000, 85), reflected in various interventions at different scales.

Introduction

In April 1974, the Portuguese Revolution highlighted the problem of inadequate housing for a significant proportion of the lower-income population. Despite earlier efforts, the social housing programs implemented under the Estado Novo were insufficient to address the housing shortage, especially in major cities. Consequently, new policies were introduced post-revolution, establishing the Local Ambulatory Support Service (Portuguese acronym SAAL hereafter) to enhance housing conditions. Architect Nuno Portas, Secretary of State for Housing and Urbanism, played a crucial role in emphasizing popular participation and self-construction. In this context, new housing developments were planned nationwide to improve living conditions by upgrading existing dwellings and constructing new homes.

Particularly noteworthy were the initiatives in Porto, where the School of Architecture [at School of Fine Arts located in São Lázaro, near S. Vítor] had already established a close relationship with the populations most in need. This reflected in the student surveys carried out in Ribeira-Barredo (included in a pedagogical program established by Professor Octávio Lixa Filgueiras) which later became part of the 1969 Urban Renewal Study by Fernando Távora. The formation of Technical Brigades of architects was a natural consequence of this context, who then collaborated with residents associations to design projects that met the needs of residents despite the prevailing material and economic constraints, a very intertwined process.

Álvaro Siza [Pritzker Prize 1992] constitutes a prominent figure in the architectonic culture of the 20th and 21st centuries, with works built in sixteen countries and four continents. However, the existing literature on his work has focused broadly on formal issues, leaving the material and constructive features of his buildings to a secondary level. Some exceptions to this trend include the essays by K. Frampton (1997) and P. M. Barata (1997), as well as other specific case studies focused on the tectonics underlying Siza's works (Vale 2011–12 2018; Vale & Abrantes 2012; Ferreira et al. 2019; Ferreira et al. 2023; Teixeira 2021–22).

As regards the neighborhoods of S. Vítor and Bouça, despite receiving widespread attention early on in international architecture journals (Gregotti & Bohigas 1976; Huet 1976; Nicolin 1975; Siza 1978), there still remains a lack of consistent studies framing these productions in their political, economic, and social contexts, and on how they have influenced and impacted on the design and construction processes.

To address this gap, this paper sets out comparative analysis of the construction processes in the S. Vítor and Bouça neighborhoods, their constructive features and materials, the building actors, and the context of their times.

Figure 1. S. Vitor neighborhood (Arqtº Álvaro Siza. Col. Fundação de Serralves – Museu de Arte Contemporânea, Porto. Donation 2021).

1. Methodology

The research methodology applies the cross-analysis of different methods and tools: i) archival and bibliographical research; ii) in situ analysis of the buildings and; iii) the production of 3D drawings of representative construction sections and details as a research instrument. The study draws on archival research undertaken in the archives belonging to the Serralves Foundation, the Municipal Council of Porto, Porto District, the architect's personal archive and Drawing Matter (drawingmatter.org). The data collection process included access to original documentation from different phases (from preliminary studies to execution projects as well as not-built phases), including sketches, photographs, technical drawings, details, and written documents (specifications, bill of quantities, etc.).

2. S. Vítor [1974–75]

Despite the efforts of the Municipality of Porto to provide better housing conditions from the mid-20th century onwards, in 1974, there were still 7,000 dwellings in the "ilhas" (Teixeira 1985, 86). These "ilhas" were neighborhoods of low-income and precarious homes, tiny, generally 4m x 4m, built inside urban blocks and without any direct contact with the streets. The Porto 1956–66 Improvement Plan had displaced about one-fifth of the "ilhas" population to 13 modern neighborhoods on the city's outskirts but without solving the housing problem. This process greatly impacted on the urban landscape and social relations, breaking ties between neighbours (Pinto 2015, 15) and was clearly a negative reference for future avoidance.

The intervention in the S. Vítor neighborhood consisted of a development plan for the north-west sector of Praça da Alegria [Sr.ª das Dores] with plans to build 32 dwellings in the first phase and 20 more in a second phase. The project started in November of 1974, and with actual construction beginning in October of the following year. This operation involved four different types of procedure: i) inside the block, intervention on totally vacant land; ii) on the outskirts of the block, construction on land that had never been built on; iii) reconstruction, using the foundations and walls of half-demolished buildings and; iv) restoring and equipping buildings that had already been vacated. Of the 32 houses initially planned, 12 rowhouses were built within the block, three homes were rebuilt, and five were restored in the adjoining streets.

The plan for the S. Vítor is remarkable in its ability to preserve the morphological structure of the area and, even while running against the existing orientation of the plots, continuing to build rowhouses inside a block. As Siza noted, "In the popular neighborhood of S. Vítor, the block's interior was practically public" (1991). Siza simultaneously incorporated building typologies influenced by international housing experiences, such as the Siedlungen designed by architects like J.J.P. Oud in Rotterdam, in 1930. Souto de Moura, who collaborated on this project as a student, compared the axonometries of S. Vítor with those of the Pankokweg in Stuttgart, 1927, in his internship report (1980). We may identify remarkable similarities between the S. Vítor neighborhood and the conceptions of the modernist architects of the 1920s and 1930s. However, what makes the project particularly interesting is how Siza managed to integrate local references, reinterpreting them, and respecting the existing cadastral and topographical movements (Costa 2002, 14).

Within Siza's works, the references for this project are the Caxinas and Bouça neighborhoods [Bouça was developed in parallel with S. Vítor]. As with the Caxinas project, in S. Vítor, Siza again adopts the extension of walls between houses to allow for an appropriation of the exterior space in dialogue with the existing, partially demolished, walls in a skilful reflection on the city/housing dialectic. As Trigueiros (1995, 186) states, "[t]he importance of this building for Portuguese architectural culture has not yet been properly evaluated".

2.1. Building actors and processes

The Housing Development Fund (FFH)/SAAL supported the construction program and set a maximum deadline of twelve months for the work to be completed. Drafting the specifications, including measurements, a topographical survey, and the respective drawings, was entrusted to the services of the "Gabinete Técnico de Estudos" (Technical Office of Studies), based in Porto. However, it is essential to point out that the gathering of information about the area and preparing the project's contents relied on a fundamental contribution from the surveys carried out among the residents here by the architecture students of the then School of Fine Arts, located in São Lázaro, near S. Vítor, in the 1972–73 academic year (Report, November 1974). The working team

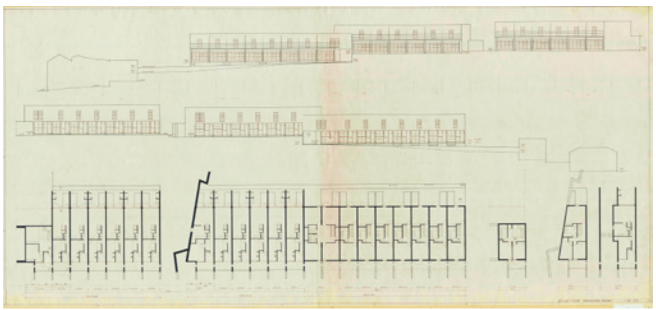

Figure 2. S. Vitor neighborhood, plans, elevations and sections, March 1975 (Arqtº Álvaro Siza. Col. Fundação de Serralves – Museu de Arte Contemporânea, Porto. Donation 2021).

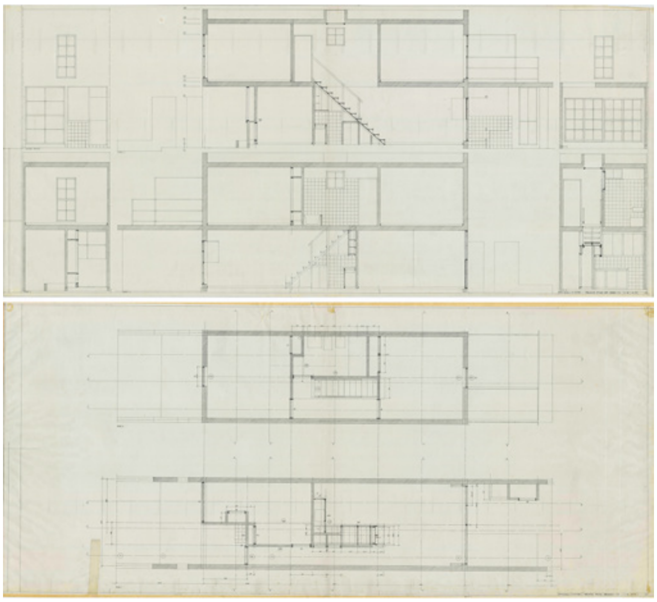

Figure 3. S. Vítor neighborhood, plans, and sections (Arqtº Álvaro Siza. Col. Fundação de Serralves – Museu de Arte Contemporânea, Porto. Donation 2021).

Figure 4. Photograph of the rowhouses, with the presence of the half-demolished buildings (Siza 1978: 38).

included architects Domingos Tavares and Francisco Guedes and students Souto de Moura, Adalberto Dias, Graça Nieto, Manuela Sambade and Paula Cabral.

Work formally began on 1 November 1974. The initial monthly report, part of the brigade's duties, describes the development of activities such as topographical surveys, photographic surveys, typological studies, the extent of the surveys carried out and verification of the projects approved for the site. The brigade's collaboration with the S. Vítor Residents Association resulted in a more precise assessment of the number of residents and dwellings and establishing not only the prioritization criteria and the steps for the whole operation but also the subsequent phasing of the expropriation process. In his description of this intervention, Siza emphasizes that: "[t]he interest of experiments of this type depends on the ability to maintain a permanent dialectical relationship between the dynamics of the residents' struggle and the response at the project level" (Siza 1974).

In the first month of the brigade's activity, the population expressed their firm conviction that the car park planned for Sr.ª das Dores made no sense and instead proposed the construction of housing on the site. This idea gained momentum, leading to the expropriation of the land and the plan to build rowhouses on the site, as this typology was considered the most viable option for providing as many houses as possible.

On 25 September 1975, COPREFA (the Workers' Cooperative for the Production and Assembly of Prefabricated Products) presented a budget for the work, with an average value of 194,000$00 [for a 3-bedroom house]. The contract was signed on October 23rd, stipulating that the Association or its representative would supervise the work and that payments would be made monthly. The budget summary included 21 two-story dwellings [19 T3, 1 T4 and 1 T5], totalling an estimated 4,322,772$20.

However, of the 21 dwellings planned, only twelve were actually built. The finishing work (à forfait) of this housing block, carried out by the firm Rosil – Rodrigues, Silva & C.ª, Lda, was adjudicated for 2,143,676$00, according to the budget presented on 28 May 1976. In addition, there was an extra 18,368$00 to cover work not foreseen in the contract, which included tasks that COPREFA, the previous company, should have originally carried out. In addition to Rosil, budgets were also submitted by Redinil [2,557,500$00], Joaquim de Oliveira [2,900,00$00] and Socove.

2.2. Structural System

The structural system was optimized to "make it possible to speed up the pace of construction by taking advantage of all the benefits that technical processes provide" (Siza 1975: 8). Cyclopean concrete served for the foundations of the partition walls and façade walls that make up the vertical structure in the "Mecan" type, 15cm thick, concrete blocks. These walls also incorporated reinforced concrete sections, such as beams to support the slabs, reinforcements and intermediate billets in the slabs. The first floor and roof are made of lightweight slabs of the "Prefor" type, including the prestressed joist, ceramic blocks, reinforcements, compression layer, solid reinforcement bands for the supports, and billets. The reinforced concrete applied was type B 225 and the cyclopean concrete was type B 180.

The pavement on the grounds floors and accesses was laid as follows: firstly, the ground was levelled and compacted; then a base was created consisting of a 15 cm thick layer of tout-venant and cylindrical gravel; on top of this, a layer of mass concrete was applied with a minimum thickness of 10 cm. Class B 180 concrete with 400kg of cement was used. On the outside, the thickness of the concrete mass was 7 cm. All the inside floors were levelled with cement and sand mortar, 1:3 in volume, with a thickness of between 2.5 and 4 cm, and with the finish suitable for a final coating.

With a single flight, the interior staircase to the 2nd floor is made of treated "SOPRE" pine wood, including the handrail. The staircase contains a lower structure of beams and "Aparite" chipboard, partially supported by the existing walls, where the step covers are attached to small supports. The staircase's interior position, particularly in relation to the kitchen, turns it into one of the features Siza paid the most attention to judging from the number of sketches and detailed drawings available.

2.3. *Walls*

As detailed in the specifications, the exterior and interior walls were made from "Mecan" type concrete blocks, 15cm and 7.5/8cm thick, respectively. The blocks were laid with cement and sand mortar, with a 1:3 mix and a joint thickness of 1 cm. The lintels are complemented by 25 cm reinforced concrete piers inserted on either side of the span. When building the masonry block walls, precautions were taken to ensure they were soaked before usage.

The top of the foundations was waterproofed with water-repellent mortar that was also applied to both sides to help prevent infiltration and ground humidity. Subsequently, the exterior walls were waterproofed with water-repellent mortar, applied in two layers, with a small interval in between within the scope of ensuring a 10 mm thickness. This was followed by a continuous blanket that was well-pressed and "trowel-fired". To ensure perfect impermeability, all the external features were contoured. The composition of this mortar was cement and sand in a 2:5 ratio. Bearing in mind the function of the spaces, the waterproofing applied to the floors extended up the bathroom walls by around 50 cm.

Figure 5. Didactic Model. Section: 1. Skylight | 2. Zinc finishing cap | 3. "Morter-Plas" and Bituminous mat | 4. Concrete slab made of prefabricated material, "Prefor" system | 5. "Mecan" type concrete masonry | 6. Cork floor | 7. Concrete beams | 8. Concrete slab 10 cm |9. Rockfill with gravel 15 cm | 10. Layer of screed 7 cm | 11. Cyclopean concrete foundations (authors).

2.4. *Roofs*

To ensure the greatest possible efficiency, the roof slabs were waterproofed with two types of membranes: "Morter-Plás", which includes a layer of protective plaster, and "Bituminous", reinforced with mineral fibers, to the Renel system N2 F.C specification, without any protective screed. The membranes fold at the edges to seal them and applying a helmet at the crown of the No. 14 zinc walls. The roof's surface was previously levelled with lightweight concrete, providing the slope necessary for rainwater drainage (with a 450 kg/m3 density, a minimum mortar thickness of 3 cm, consisting of 15/25 "Leca" granules and cement, in a ratio of 100 liters to 10 kg of cement). In the top layer, the size of the granulate was intentionally reduced to allow for the application and bonding of the mesh, which was only applied after the concrete was entirely dry.

The capping of the roof wall consists of a ruff made out of No. 14 zinc sheeting, affixed by clamps. Drainage from the roof is via a Ø75 diameter PVC pipe, ensuring the outlets for drainage and the expansion joints are adequately sealed to prevent future infiltration or damp problems. The downpipes to be laid along the two façades each have a diameter of Ø100 and their own reception sandbox, with the appropriate connections to the mains system.

2.5. *Frames*

The configuration of the openings took into consideration the need for protection against the climate and light. The exterior glazing frames are made of wood, with some sections cushioned by plywood, with 3mm national glass. The glazed areas have interior wooden security shutters. The main entrance doors are prefabricated and clad in chipboard on wooden frames. Their thresholds are covered in brass sheeting, which again shows the care taken in selecting materials despite the economic constraints faced by the project.

The exterior window frames and sills were set with bituminous mastic.

In keeping with the criterion of economy, the interior house doors are all prefabricated and clad in chipboard. The doors of the counters and cupboards (except in two bedrooms) are prefabricated in wooden frames.

On the 2nd floor ceilings, above the staircase, there is a fixed wooden lantern with cathedral glass. The skylight openings in the roofs, which provide natural lighting for the interior, are made out of a fixed structure, slightly inclined to allow for water drainage. The grill has been fitted with 5 mm thick wired glass, laid and set with bitumen and topped with a 14 mm zinc profile. The kitchen chimneys are also sealed with No. 12 zinc sheeting.

2.6. *Finishes*

For the exterior pavements of the 1st floor, the entrances and the patios, limited in extent by the side walls, a layer of smooth screed was applied, composed of cement and sand mortar in a 1:3 ratio, with a minimum thickness of 2 cm.

The floors in the kitchens, dining rooms, bathrooms and the corridor leading to the living room were covered with marbled hydraulic mosaic, laid with a cement-sand mortar in a 1:5 ratio. According to the specifications, after the mosaics were laid, they had to be given a cement-rich watering so that the joints were well-filled. The remaining floors were covered with cork mosaics ["corticite"-dimensions of 0.20x0.20 or 0.30x0.30] manufactured by Electro-Cortiça do Porto. The "corticite" was applied with contact glue after thoroughly drying and cleaning the screed. All the floors covered in the "corticite" and hydraulic mosaics, except the bathrooms and kitchen, featured wooden skirting boards ("Soprem" type) to match the wall.

Both the interior and the exterior walls were plastered with a sanded finish. The walls to be plastered were cleaned and dampened beforehand, while the waterproofed or smooth walls were coated with 1:1 cement and coarse sand mortar to enable better plaster adhesion. The plaster for levelling the walls and ceilings was applied in successive layers when the surfaces were already very dry to avoid cracks. The final sanded mortar was applied with a sponge.

The mortar applied to the ceilings was based on cement, lime paste and sand in a 1:1:6 ratio. The ceilings adjoin the walls by either a fillet or molding. As initially planned for in the specifications, the interior walls were plastered. The specifications also inform us that the ceilings are whitewashed with lime emulsion and fixative.

The decision was taken to clad the walls of the bathrooms, the kitchens, the exterior surfaces of the entrances, the lower part of the door frames and the areas around the washbasins, up to the height of the windowsills, in 15x15 white tiles. The tiles, of "Fábrica Valadares" quality, were laid with cement, lime and sand mortar in a 1:1:6 ratio. These tiles were laid up to the height of the top cupboard in the kitchen while reaching the height of the door frame in the bathroom. The walls were finished with a small fillet. Under the windowsills, the tiling continued up to the parapet.

The terraces on the exterior elevations have a galvanized tubular steel guardrail, with welded connections detailed in the drawing. All the metalwork was painted with enamel paint as a finishing touch. In his proposal for the exterior window frames, Siza suggested painting them in brown enamel paint, complemented by orange curtains.

3. Bouça Housing Complex [1975–78]

According to Siza, the Bouça Housing Complex was an economically radical project from the outset, and in 1974, simply could not have been any other way (Siza 2006). This departs from a previous Siza project, from 1973, and is adapted to the SAAL framework. This complex sets out to reinterpret local ways of living, particularly the aforementioned "ilhas" and their morphology, which is revisited in its scale and relationships with the outside world. On the other hand, as in S. Vítor, we can also clearly identify modernist references to European housing models, such as the 1931 residential blocks of Bruno Taut in Berlin, that Ernst May built in Frankfurt in 1927 and Alvar Aalto in Sunila in 1938. The influences are visible in the "line construction, the repetition of small single-family houses, in bands or blocks with a gallery, the insertion of small support facilities as a link between the different parts of the neighborhood and the city" (Machado 2021, 201).

As in S. Vítor, the Bouça project resulted from a two-level process: direct contact with the local inhabitants and the development of the architectural project. The aim was to respond to a set of "generalizable problems for the entire city center, for large sectors" (Siza, 1996, 33). In addition, to optimize the means and resources available in the Bouça Housing Complex, there is strong linkage between the spatial and typological definitions and the construction solution applied.

The Bouça Housing Complex plan called for the construction of 138 dwellings of different types, distributed across four four-story blocks laid out in parallel with each other. The dwellings are organized across two floors, with direct access to the units on the lower floor from the common spaces between the blocks and access via galleries to the units on the upper floor. The dwellings are arranged symmetrically, with the common areas on the middle floors and the bedrooms on the first and fourth floors. Some areas have also been reserved for commerce or services.

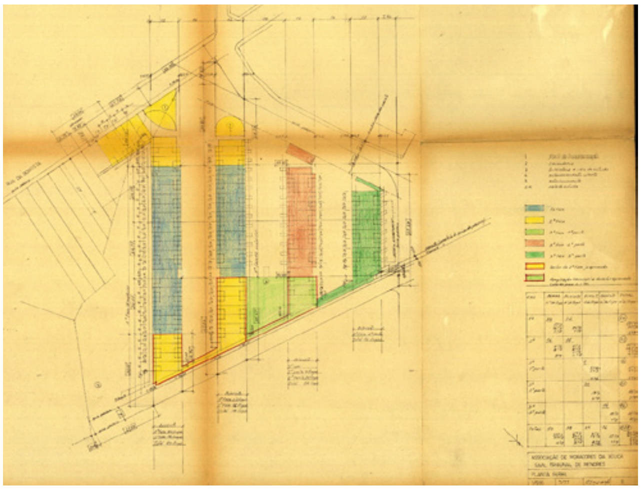

Figure 6. Bouça Housing Complex urban plan and construction phases. Only the blue phase was completed in the 70s (Porto District Archive.

3.1. *Building actors*

The Bouça Social Housing Complex started out under the management of the Housing Development Fund in 1973 and was later integrated into the SAAL operations. Although the overall urban configuration is maintained, everything else undergoes adaptation to the new context. The SAAL brigade responsible for this operation was made up of the architects Anni Gunther, Sérgio Gamelas and Maria José Abrunhosa, under the responsibility of the former. As with S. Vítor, Álvaro Siza was invited to develop the project, while not a brigade member.

The structural project was designed by G.O.P. – Gabinete de Organização e Projectos (Projects and Organization Office) with the construction work carried out by Soares da Costa.

The SAAL program ended in 1978, and construction came to an end with only about a third of the houses completed, totaling 58 dwellings. The construction of the second phase, more than thirty years after first beginning the project, brought about the scope for updating the original project, providing a higher level of quality and comfort to the spaces designed and completing the set as initially programmed.

Upon the completion of the complex in the 21st century, João Sobreira (son of the engineer for the 1974 project) analysed the original project-related design decisions and economic concerns, stating, "The structural project of '75 designed the buildings using traditional construction, load-bearing block walls and prefabricated reinforced concrete beam slabs, given the need to build very economically" (Sobreira 2002).

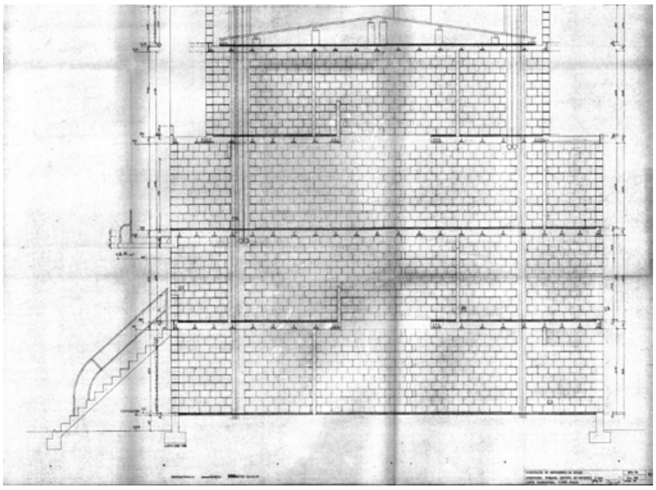

Figure 7. Bouça Housing Complex section with concrete blocks layout (Porto District Archive).

Figure 8. Bouça Housing Complex in construction (Siza 1978: 38).

3.2. Structural System

Like S. Vítor, Bouça structural system is based on a sequence of load-bearing masonry walls without any discontinuity along their height, reinforced at floor level by a beam, to improve seismic performance, and supported on the ground (soft rock, easily extracted by pickaxe) by running lintels (Sobreira 1976–78, 1). These walls are spaced 4 meters [between wall axis—in S. Vítor, it was 3,60 m] a dimension considered the minimum necessary to meet the functional requirements of the different areas of the houses and to be very economical. These load-bearing walls stand out as a fundamental feature in the formal composition, corresponding to the dividing walls between dwellings while simultaneously guaranteeing their vertical support structure. Each dwelling comprises of two floors (4 x 12 m, measured along the axis of the exterior walls), with each floor corresponding to three square modules with 4 m sides.

While the first structural drawings pointed to a granite block ("perpianho") load-bearing masonry solution, the walls were later built in "Mecan"-[type 300 series 30x20x20] concrete blocks (Vale and Abrantes 2012, 6), and the layout of the dwellings, in plan and in height, relates to the dimension of entire concrete blocks. It is also important to note that the principal and rear façades play no role in the supporting structure but do contribute, through their connection to the floor slabs, to bracing the buildings.

There is practically no reinforced concrete in each of the four-story blocks. Almost no formwork was used (only props), with the cantilevered slab that forms the access walkway to the third floor one of the few exceptions (Sobreira 1976–78).

The foundation footings for the walls and retaining walls are set with B 180 reinforced concrete and A40 steel reinforcements. The sloped roof rests on these walls, using prestressed purlins supported on small pillars.

The floor slab system was chosen based on the criteria of rationality and economy, opting for a "Daviga"-type system "as it can be considered more economical than solid slab solutions" (Sobreira 1976–78). "Daviga"-type floors are "floors that are beamed in the thickness of the slab, lightened using brick blocks that rest on prefabricated elements that contain the tensile reinforcement of the beamed slab" (Sobreira 1976–78). According to the stability project description, this floor solution displays several advantages over lightweight prestressed slabs. Firstly, Daviga eliminates the need for massive areas in the support zone while also generating better fire safety standards as the prestressing is more affected by high temperatures. Finally, this system eliminates the need to use lightweight concrete for filling and false ceilings on the floor below (Sobreira 1976–78). The floor slabs are 20 cm thick instead of the 15 cm that was then more common. This enabled the sanitary equipment pipes to fit within the thickness of the slab. The total weight of the floor, including coverings, is around 350 Kg/m^2, which guarantees adequate sound insulation between floors.

3.3. Walls

Although concrete blocks were no innovation, as there had been examples ever since the 1920s, this approach was not common in collective housing buildings (Vale 2018: 6). Its use in S. Vítor was an important reference. In Bouça, these blocks were filled with dry sand (Sobreira 1979) to ensure adequate acoustic comfort. The balcony railings are also made of "Mecan" blocks, series 450 (40x25x7.5) to form a 7.5 cm wall.

The partition walls are free of any structural restrictions and are built with 10 cm thick "Ytong" blocks [lightweight aerated autoclaved concrete blocks] coated with a 2 mm thick projected plaster layer. "Ytong" blocks are known for their high-precision dimensions and lightweight and excellent thermal properties, contributing to the building's energy efficiency and reducing waste at the construction site.

3.4. Roofs

The ceiling slab was built out of a slab similar to the floor slabs, insulated with a 5 cm thick layer of aerated concrete. A ventilated roof, made up of "Super Habit" asbestos cement sheets, was installed over this layer and laid with a rubber cord and with three staples per sheet. The slabs were laid on prefabricated, prestressed "Civibral"-type beams supported by small Mecan block pillars (22x20x20), using prefabricated concrete cushions to ensure the beams were laid evenly.

The gutters were made of zinc-plated No. 14 sheeting, and the downpipes, with a diameter of 90, were in rigid PVC.

3.5. Frames

The windows play a crucial role in the composition of the Bouça Housing Complex elevations. These are marked by

Figure 9. Bouça Housing Complex Didactic Model. Section: 1. Zinc finishing cap | 2. Precast concrete | 3. Levelling layer | 4. Geotextile mat + 2 Sika trocal T Sheets (1.2 mm) + Geotextile mat | 5. Shaping layer - Lightweight concrete | 6. Concrete slab | 7. Concrete parapet | 8. Concrete blocks masonry | 9. Interior walls: Ytong block masonry and render finish | 10. Finishing. Concrete slabs | 11. Concrete staircase (authors).

vertical openings, which allow for better regulation of the light, creating nuances and avoiding uniform lighting. In contrast, the horizontal windows endow a certain autonomy on the façade in relation to the building system, one of the characteristic features of Modern Movement architecture. Furthermore, it is important to note that the choice of vertical windows in Bouça does not respond to an overall structural system constraint, as those walls do not support the slabs. In this sense, the option for vertical windows emerges as a tribute to traditional construction methods as Álvaro Siza has expressed how he was inspired by the bourgeois houses of the city of Porto in which Siza recognizes a British influence in the frame design and that he attributes great importance to in defining the city's urban image (Siza 2019).

The exterior frames are glazed, openable and made of exotic wood. The window frames are composed of single glass and painted yellow. They include wooden shutters. The railings of the windows, galleries and balconies are made of tubular iron, metallised, and painted. The sills are made of different materials depending on their respective location: in 50 mm thick white Estremoz marble, in white 15x15 cm "NOR" tile and in 35x5 mm metallised and painted iron.

3.6. Finishes

The exterior walls were finished with sanded mortar. Following the 21st-century intervention, the exterior cladding features an ETICS system (expanded polystyrene thermal insulation finished with an acrylic render coating reinforced with fibreglass mesh). The façades are white, except for the upper floors, which are painted red in homage to the complexes designed by architect Bruno Taut.

The interior walls and ceilings are finished with gypsum plaster and painted.

Window frames and handrails, painted in a light color, reinforce its aesthetic qualities and are solid examples of multi-scalar design and care in creating the whole.

Comparison and conclusion

Despite the severe economic crisis that hit Portugal in the aftermath of the Carnation Revolution, the two buildings analysed, built with low resources, and involving the participation of the population, reveal a high level of spatial and constructive quality. This was achieved, in both cases, with a huge rationalisation of the project from the implantation to the functional typology, using traditional techniques, mixing them with industrial materials, industrialised techniques and even prefabricated systems. The rationalisation of the two projects is evident in their urban insertion, in the morphological simplicity of the building complexes, in the functional pragmatism of the housing typologies, and also in the construction choices, both in terms of materials and systems used.

The choice of load-bearing masonry structures is related to the traditional construction techniques used in the city of Porto, including using mid-walls as the main structural elements of the houses, freeing up the façade walls for the placement of openings. On the other hand, the slabs already show some innovation, in the use of prefabricated elements (beams and hollow brick) with reinforced concrete. However, in S. Vitor, the interior staircases of the houses are entirely made of wood, as they always were in traditional architecture, but with a contemporary design. This option was taken up again in Bairro da Malagueira [Évora], from the late 1970s to the middle of the following decade.

In both projects, painted plaster is the main material used to finish the surfaces of the walls and ceilings of the interiors and exteriors of the buildings, which, incidentally, is the most economical option and which will recur in the master's work to this day. The other finishes are the same as those used in traditional architecture: tile wainscoting on the walls and hydraulic mosaics on the floors of kitchens and bathrooms. Only the cork mosaics are a novelty, having been tried before in some of the houses designed by Siza. The exterior frames maintain continuity with tradition, firstly through the use of wood as a raw material, but also, in the case of São Vitor, in the redesign of the traditional sash window and the choice to use "pinazios" (elements that subdivide the glass) in the remaining frames.

A close look at the quantity of drawings that make up the collections of these two projects reveals the great care taken with the detail and thoroughness of each construction element, evident, in the case of São Vítor, in the various drawings of the sanitary installation, with the indication of the supply networks, the positions of the sanitary fittings or the layout and cutting of the tiles; the care taken with the detail of the exterior frames or the drawing of the interior stairs to the second floor. The fact that these were buildings built on a shoestring budget, with standard materials and prefabricated systems was no reason to pay less attention to the smallest details, and this is certainly one of the main attributes that make these two works unique. It can be said that the care taken by Siza in these two works is no different from that found in his previous buildings, which will become one of his main marks of genius: the ability to give materials and the most varied constructive elements a special meaning, making them an integral part of the poetic expression of his architecture.

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