

Formal and functional analysis of contemporary interventions in multifamily housing buildings from the mid-twentieth century. The case of the Cerco housing complex (Porto)

L. Rocha & R.F. Póvoas

University of Porto - Faculty of Architecture: Centre for Studies in Architecture and Urbanism (CEAU-FAUP), Porto, Portugal

ABSTRACT: This paper undertakes an analysis of the *Cerco* housing complex (1963), in Porto (Portugal), a state-funded project built under the scope of the 'Improvement Plan' for the city of Porto (*Plano de Melhoramentos*). This plan consisted of a housing programme approved by Decree-Law No. 40616 of 28 May, 1956, designed to contribute towards solving the problems of the city's unhealthy neighbourhoods.

The neighbourhoods built under this programme are notable for the fact that they share a common urban concept, being composed of large housing ensembles with surrounding green areas and occasional connections to the remaining urban structure. The buildings have a minimum of four storeys, whose access systems consist of vertical cores or distribution galleries, and display a rational layout. They offer a different model in terms of residential urban concepts, typologies, access systems and architectural languages that have had varying impacts according to each specific case.

Over the last few decades, the *Cerco* housing complex has been subjected to a series of different interventions promoted by the municipality for the rehabilitation of social housing in Porto. The first phase, in the late 1990s, consisted of a general intervention project, directed by the architect Virgínio Moutinho, which focused on both the rehabilitation of the buildings themselves and the regeneration of the common outdoor spaces. The second phase, which began in 2017 and has yet to be completed, consists of three interventions undertaken by different architects: on the buildings with 'left-right' access by the architect Virgínio Moutinho (completed); on the buildings with distribution galleries by the architect José Gigante (ongoing); and on the surrounding public space by the architect José Manuel Soares (whose project was completed, but never implemented). These interventions are marked by their different strategies and intervention types, adopting different approaches to the pre-existing architecture and the adjustments that need to be made in accordance with current comfort requirements.

The main aim of this study is to identify and analyse the various interventions undertaken on the buildings, from the formal (architectural) and functional (technical/constructive) point of view, and to establish a relationship between the preservation of the built heritage and possible approaches in terms of intervention, above all in relation to the implementation of sustainable strategies.

The *Cerco* housing complex also represents an architectural heritage, although it is not related to any particular historical structure. Thus, the in-depth study of this ensemble will allow for the development of an informed reflection on strategies involving different levels of intervention of current housing heritage, as well as an analysis of the adaptability of these buildings to current comfort requirements.

KEYWORDS: Collective housing, Heritage preservation, Thermal comfort, Cerco housing complex, Retrofitting

✉ L. Rocha: lrocha@arq.up.pt

✉ R.F. Póvoas: rpovoas@arq.up.pt

© Green Lines Institute for Sustainable Development 2020

R. Amoêda, S. Lira and C. Pinheiro (eds.). *HERITAGE 2020*

Proceedings of the 7th International Conference on Heritage and Sustainable Development, pp. 559 - 571.

Green Lines Bookseries on Heritage Studies, Volume 01.

1. INTRODUCTION

This paper is part of a broader ongoing research project relating to the preservation of architectural housing heritage and the improvement of the inhabitability of buildings, namely in terms of their comfort and energy efficiency. This project thus proposes the formal (architectural) and functional (constructive) analysis of interventions applied to specific cases, with a view to establishing a relationship between built heritage protection measures and the implementation of sustainability strategies.

The theme of energy efficiency in the context of social housing raises questions that frequently relate to the levels of thermal comfort and the strategies for reducing both energy consumption and the use of mechanical means. Another pertinent issue is the constant inefficiency of some regulatory requirements in adjusting to the economic and social standards of inhabitants. But have recent interventions on social housing been fit for purpose?

The methodology adopted for the analysis of the specific cases is based on three phases: data collection, diagnosis and interpretive analysis. The first phase involves the collection of graphical elements relating to the original designs, further complemented by bibliographical research; the second phase corresponds to an in-depth diagnosis of the current state of the buildings (data collection *in situ*); and the third phase consists of the interpretation and comparison of the collected data. This research will be further complemented by the development of sensitivity studies on site for a better understanding of the effects of different levels of intervention on the thermal comfort performance of buildings and their corresponding adjustment to the social and economic status of the inhabitants.

This paper specifically analyses the **Cerco housing complex**, originally built in 1963 in the context of the ‘Improvement Plan’ for the city of Porto. The main interest of this case study derives from the significant dimension of this housing ensemble and its specific characteristics, which make it representative of the various social housing complexes that were built in this context. This neighbourhood is also important for the specificities of the interventions that have been carried out over time, due to the fact that the two phases of intervention had different requirements, while also involving the simultaneous association of several projects with a shared common basis. This study proposes an interpretation and comparison of these interventions in order to arrive at an adequate understanding of their potentialities and limitations.

1.1 *The Improvement Plan for the City of Porto*

1.1.1 *Background and Legal Framework*

In Porto, the turn from the first to the second half of the twentieth century was marked by a combination of factors that encouraged the development of a strategy for solving the housing problem. These factors included the completion of a number of relevant studies, such as the Regulatory Plan developed by the engineer Antão de Almeida Garrett, approved in 1954 and followed by the Master Plan developed by the architect Robert Auzelle (in 1962), as well as a general awareness of the degradation and overcrowding of the “ilhas” (a precarious solution of very low-cost construction that had resulted in the creation of slums), together with the consequent need for new housing construction.

The ‘Improvement Plan’ for the city of Porto (*Plano de Melhoramentos: CMP, 1966*)¹ (Fig. 1), developed by engineer José Albino Machado Vaz and approved in 1956 by Decree-Law N° 40616 of 28 May (MOP, 1956), arose as a possible response to the city’s housing problem and marked the beginning of a new phase in its urban development (Queirós, 2016:41).

The plan envisaged the construction of a minimum of 6000 new dwellings for the residents of the “ilhas” and unhealthy neighbourhoods of Porto within a period of 10 years and the implementation of an urbanisation process that involved the creation of expansion areas for the construction of new neighbourhoods and the development and decongestion of the city centre; the rehabilitation of unhealthy areas; and the reorganisation of the territory and circulation systems assigned to the new areas (MOP, 1956:631). This process also allowed for the possible conversion of existing buildings for housing purposes. However, the demolition of the “ilhas” was the prevailing concern, as well as the consequent rehousing of their residents in new neighbourhoods (Queirós, 2016:49).



Fig. 1. 'Improvement Plan' for the city of Porto. Location of housing complexes (CMP, 1966:17)

The success of this programme – with the construction, until 1966, of 14 neighbourhoods in the city's surrounding areas – led to a further extension of the plan, approved by Decree-Law N° 47443 of 30 December 1966. This expansion of the Improvement Plan envisaged the construction of more than 3000 dwellings over a period of five years, in order to continue the relocation of the inhabitants of these unhealthy neighbourhoods. This process not only exceeded the estimated budget for the implementation of the plan, but also the time allotted for the completion of the construction work. Nonetheless, the plan successfully achieved its main objective, resulting in the building of approximately 3500 new dwellings in 11 different neighbourhoods, with the work being completed by the end of the 1970s (Queirós, 2016:56).

The implementation of the 'Improvement Plan' thus resulted in a broad urban and social transformation of Porto, both by exploring areas for the construction of new neighbourhoods and by transforming and restructuring the city centre (Queirós, 2016:56).

1.1.2 Building features

The Improvement Plan provided for the construction of an expressive group of housing complexes, located in the expansion areas (the first periphery) of the city of Porto. The programme envisaged the provision of the new dwellings in small-sized buildings, in housing ensembles integrated into urbanised areas served by urban equipment and social facilities in accordance with the municipal plans (MOP, 1956: 631). The buildings were to be constructed in keeping with the urbanisation plans and "standard designs" approved by the Ministry of Public Works, following the applicable requirements and cost restrictions for this kind of initiatives (MOP, 1956:632).

The housing ensembles built in the first phase of this plan thus consisted of buildings of four or five storeys, with vertical access systems or distribution galleries, characterised by a rational distribution of the different housing typologies, as had been the case with the construction of the first neighbourhoods: Bom Sucesso (1956-1958), Pasteleira (1957-1960) and Pio XII (1957-1958).

The further extension of the Improvement Plan followed the same principles as previously. It did, however, introduce innovative features, both in terms of the urban insertion of housing complexes in areas closer to the centre and in terms of the typological and constructive characterisation of these ensembles: the design of new models, such as the use of the tower block (e.g. the Aleixo housing complex, 1969-1976); and experiments in the design of apartments the material composition of the buildings (e.g. the Falcão housing complex, 1967-1972).

Formal and functional analysis of contemporary interventions in multifamily housing buildings from the mid-twentieth century. The case of the Cerco housing complex (Porto)

2. THE PARTICULAR CASE OF THE 'CERCO' HOUSING COMPLEX

The *Cerco* housing complex is located in the eastern part of the city of Porto, in Campanhã, between *Rua do Cerco* do Porto, *Rua Vila Nova de Foz Côa* and *Rua Peso da Régua*. The neighbourhood, originally built in 1963, comprised 32 buildings and 804 dwellings, and was later enlarged, in 1991, with the construction of two more buildings and 88 dwellings. This complex is one of the largest neighbourhoods built under the Improvement Plan for the city of Porto, being surpassed only by the *Campinas* housing complex, situated in Ramalde. It also represents one of the most significant social interventions in the city (Queirós, 2016:53-54).

2.1 Architecture and Construction Analysis

The project developed by Vasco Mendes and Miguel Reimão Pinto is based on a series of principles relating to urban integration, access systems, typologies and architectural language that were also to be found in the other neighbourhoods built under the 'Improvement Plan' for the city of Porto.

Located on a plot of considerable size, the complex follows an urban concept based on some of the principles of the 'Athens Charter', with buildings placed parallel to each other, either perpendicular or at an oblique angle to the streets (running counter to the logic of housing blocks) and surrounded by green areas, crossed by footpaths and with occasional connections to the adjacent urban structure (Fig. 2). The four or five-storey buildings have vertical access systems and/or distribution galleries, with different typological solutions for the dwellings (ranging from one to four rooms), characterised by the compactness of their interior spaces and the maximum rationalisation of the functional programme. The living room consists of a multifunctional central space that includes both the kitchen and the circulation areas. The architectural language of the neighbourhood results mainly from the rational design of the buildings' functional programme and the consequent construction system. The composition of the buildings' façades has a predominantly granite base, covered with painted plaster and using wooden frames for the doors and windows. The most prominent features of these façades are the galleries and/or balconies, and the ventilation grilles of the laundry rooms.



Fig. 2. Cerco housing complex. Construction phase, 1961 (Arquivo Histórico Municipal do Porto)

The construction system reflects a transitional period of the mid-twentieth century characterised by the combined use of structural stone and wood, with an increasing use of reinforced concrete and other industrial constructive elements (Vale & Abrantes, 2012). In the specific case of the *Cerco* housing complex, the buildings displayed simple exterior walls of structural stone ma-

sonry, solid concrete slabs and interior partitioning in the form of brick masonry walls. The sloping roofs were covered in ceramic tiles, consisting of a wooden support structure, with possible brick masonry bracing.

2.2 Diagnosis before the interventions

The diagnostic report produced by the architect Virgínio Moutinho prior to the first intervention, in 1996, describes the main negative and positive factors that informed the first design project. These points identify the main problems and/or potentialities that existed at that time in relation to this housing ensemble, which had already been in place for more than three decades (Fig. 3). The main difficulties highlighted by the architect were the evident degradation of the buildings and the inadequacy of their functional programmes, as well as the disruption that had been caused to the surrounding public space, without any hierarchical structure or public support equipment. Such issues are usually associated with the population that is faced with significant social and economic problems (Moutinho, 1996:1).



Fig. 3. The neighbourhood before the intervention (Domus Social E.M.)

The same diagnosis underlined the significant dimension of this public space, stressing the quality and variety of the green spaces and wooded areas, as well as the structure of its road system (Moutinho, 1996:1), which seemed to provide an adequate response to the needs of the housing complex. The report also focused on the community spirit and the esteem that the inhabitants felt for their neighbourhood, as shown by the treatment that was given to some common spaces, such as the gardens (Moutinho, 1996:1). These considerations formed the basis for the first phase of interventions.

3. CONTEMPORARY INTERVENTIONS

The municipal council has played an essential role in promoting the rehabilitation of social housing in the city of Porto. Its work started in the late 1990s, with a first phase of general interventions in the main problematic neighbourhoods, but has increased mainly since 2000 with the formation of CMPH – Domus Social, E.M., the Housing and Maintenance Company of the Municipality of Porto, in accordance with Article 19 of Law N° 50, of 31 August 2012.

Among other aims, Domus Social E.M. seeks to manage the housing stock of the municipality, which includes the definition and implementation of intervention strategies (rehabilitation, renovation or reconstruction) for housing in a state of degradation².

These interventions focus mainly on the general maintenance of the buildings, through the treatment of the façades, roofs and common spaces, as well as the regeneration of the common outdoor areas. The interventions of the second phase, however, differ by placing greater emphasis on the issue of housing comfort, resulting in several façade solutions, together with thermal insulation and ventilation systems for the interior spaces.

This research analyses the various interventions carried out in the specific case of the *Cerco* housing complex. The interventions are divided into two phases, which took place at different times, displaying different approaches in both architectural and constructive terms. These interventions differ in both the level and type of intervention, resulting in quite distinct levels of preservation and transformation of the buildings.

The following analysis will focus on the formal and functional aspects of each intervention in order to identify their main potentialities and limitations and the corresponding consequences for the balance between architectural heritage protection and thermal comfort improvements.

3.1 First phase. Dealing with the main issues of the neighbourhood's state of degradation

The first intervention on the *Cerco* housing complex, undertaken by the architect Virgínio Moutinho (Fig. 4), was based on three essential aspects: the regeneration of the public space; the inclusion of neighbourhood equipment; and the general rehabilitation of the buildings. This general intervention thus sought to address the main problems of the neighbourhood, such as the advanced state of degradation of the buildings and the adjacent exterior areas and the lack of available spaces for collective use, as explained previously. The interventions that focused on the exterior spaces were designed to revitalise the neighbourhood and, simultaneously, enhance its relationship with the city (Moutinho, 1996:1-2).



Fig. 4. General plan of the first intervention (Domus Social E.M.)
[1. School; 2. Activity Centre; 3. Market; 4. Square; 5. Sports complex; 6. Open-air amphitheatre; 7. Extreme sports area; 8. Climbing wall; 9. Plaza – Coffee and pergola; 10. Kiosk; 11. Children's playground]

The reorganisation of the public spaces consisted mainly of clarifying and hierarchising the many components such as the road and pedestrian networks, parking areas, squares and gardens, among others. This action also included the treatment of the different pavements and surfaces, the integration of urban furniture and the maintenance of the lighting system.

The integration of the public equipment included the creation of several sports spaces, leisure areas and playgrounds, as well as commercial areas such as small markets and a café. Some of the most significant interventions included the transformation of the central square and interventions in already existing spaces, such as the Primary School, the Multifunctional Activity Centre and the area outside the Social Centre.

The intervention on the buildings focused mainly on the external envelope, which included the treatment of façades with reinforced plaster, the repair of roofs, the replacement of window frames (aluminium), the enclosure of certain areas, such as the laundry rooms and access to the building

and the integration of standardised awning solutions (Fig. 5). This intervention was notable for its use of bright colours, both in the painting of the façades, as well as in the tiles that were placed in the laundry rooms and the decorative panels of handmade tiles that were placed on the buildings' gables. According to the architect, this different treatment was designed to break away from the previous solutions and, mainly, to guarantee that each building had its own separate identity (Moutinho, 1996:4-5).



Fig. 5. First intervention. General view (Domus Social E.M.)

3.2 Second phase. New challenges. The importance of domestic comfort

The second phase of interventions took place roughly twenty years after the previous actions. At this time, the previously transformed neighbourhood was already displaying new pathologies and accentuated signs of degradation. However, this phase also presented new challenges, such as the necessary optimisation of energy efficiency in the buildings.

The strategy for this phase involved the integration of three different proposals, all with the same purpose: the general rehabilitation of the buildings and the exterior environment with the aim of improving housing comfort.

The two projects by the architects Virgínio Moutinho (completed) and José Gigante (nearing completion) focused specifically on the buildings. In contrast, the project developed by the architect José Manuel Soares (not implemented)³ proposed the treatment of the common exterior areas. The result of this joint intervention – which is still being concluded – shows different solutions to a common problem, which allows for a comparative analysis, both in an individual and a collective sense (as a whole).

The project developed by the architect José Manuel Soares will not be carried out, but it is also an essential object of analysis because of the relevance of the proposal and its integration with the other ones.

3.2.1 Façade protection with External Thermal Insulation Composite System (ETICS): intervention by Virgínio Moutinho – Arquitecto Unipessoal, Lda.

The intervention developed by the architect Virgínio Moutinho – with the structural project being developed by José Fernando Moreira de Carvalho (Omega, Engineering Services) – focused, in general, on buildings accessed via a vertical communication core and a 'left-right' distribution system, which also includes the two blocks built in the course of the 1991 expansion. The project proposed several actions intended, above all, to correct recurring anomalies in the external envelope (façades and roofs) and common spaces (accesses) (Moutinho, 2017) (Fig. 6).

The façade protection system consisted of the application of a new coating material, the External Thermal Insulation Composite System (ETICS), which ensures the application of an insulation layer on the entire surface of the exterior walls (Fig. 7). This solution has no structural implications and allows for the preservation of the existing granite base. However, it also involved the removal – and subsequent replacement – of the panels of the handmade tiles placed on the buildings' gables during the first phase of interventions.

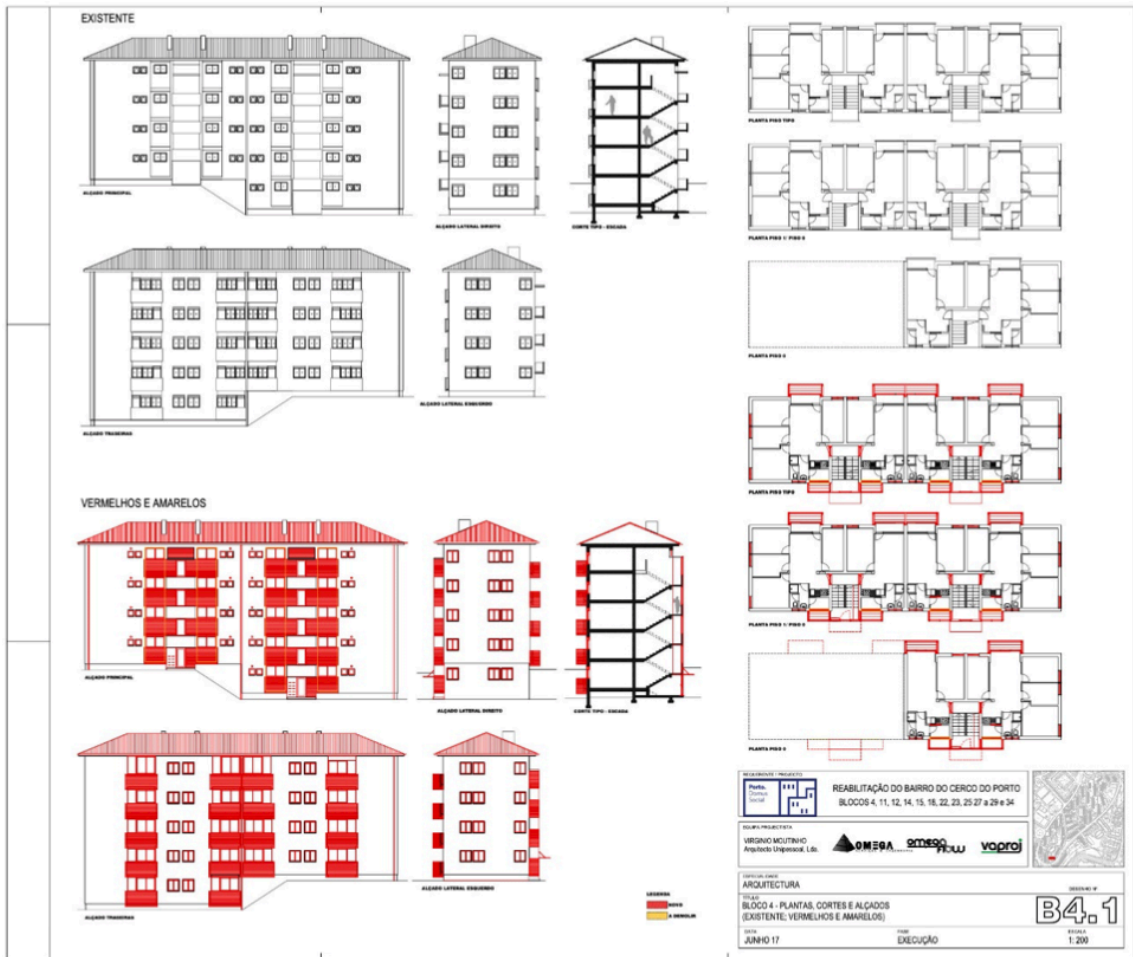


Fig. 6. Intervention by Virgínio Moutinho. Block 4. General plans (Domus Social E.M.) [Red: to build; Yellow: to demolish]

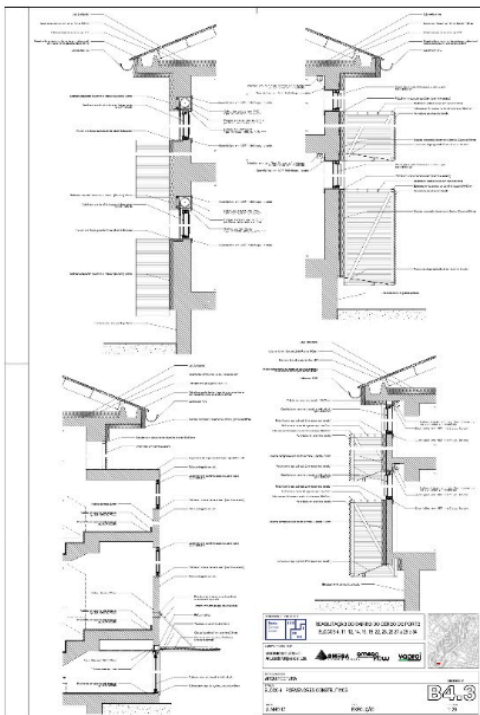


Fig. 7. Intervention by Virgínio Moutinho. Block 4. Constructive details (Domus Social E.M)



Fig. 8. Intervention by Virgínio Moutinho (Luciana Rocha, 2020)

The intervention also included the demolition of the original tiled roofs with a wooden support structure and their replacement with a new light support structure and a roof in the form of a self-supporting galvanised steel panel with polyurethane insulation. The application of thermal insulation on the last floor slab was another important addition, as well as the building of a new rain-water collection system (gutters and drainpipes).

Other significant actions involved the replacement of the exterior window frames with lacquered aluminium, with thermal shutters, a built-in ventilation system and the enclosure of the balconies and laundry rooms with aluminium frames and ventilation grilles, which also serve to hide the drying racks. These grilles, which are composed of a tubular structure and lacquered aluminium shutters, are a notable feature of the composition of the new elevations (Fig. 8).

The main interventions in the common areas resulted in the enclosure of the stairwells and the alteration of the water, gas, electricity and telecommunications infrastructures, with their respective concentration in the new meter cabinets. The new accesses to the buildings are protected by a sheet metal roof supported by steel ropes.

3.2.2 *Second skin façade: intervention by José Gigante - Arquitecto, Lda.*

The intervention in buildings with a gallery distribution system is based on the same principle: general rehabilitation of the constructive envelope (walls, window frames and roofs) and common accesses (stairs and galleries) (Fig. 9). However, the architectural project by José Gigante, with the Hygrothermal Study being conducted by the engineer Vasco Peixoto de Freitas, is notable for its analysis of a possible typological reconfiguration of the dwellings, which can be carried out in the future.

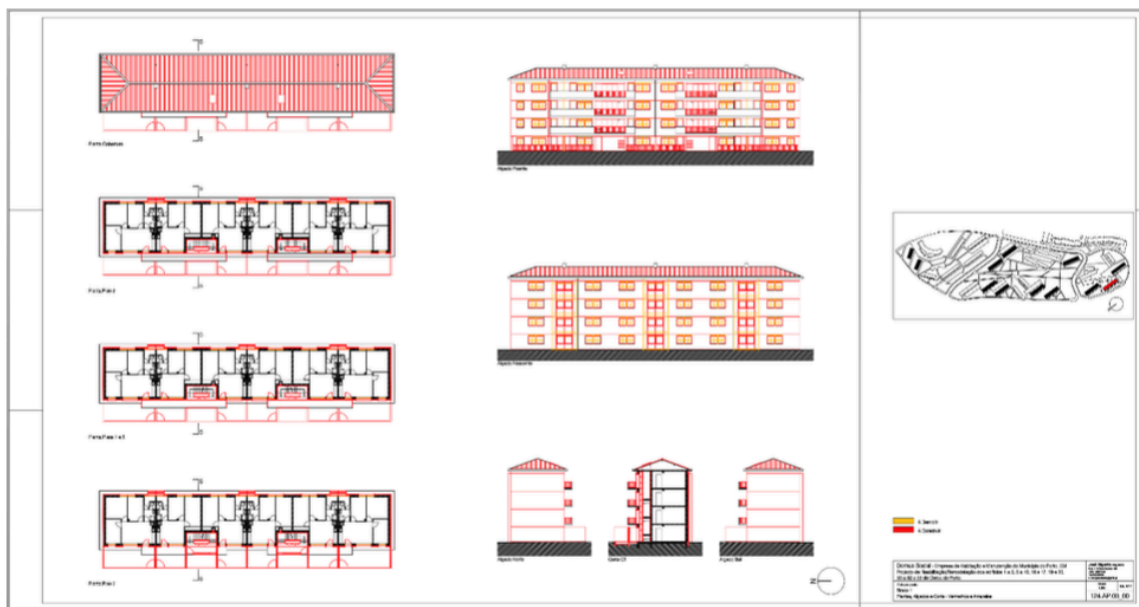


Fig. 9. Intervention by José Gigante. Block 1. General plans (Courtesy José Gigante)
[Red: to build; Yellow: to demolish]

The main intervention consists of the application of thermal insulation (extruded polystyrene) and a new layer of ceramic bricks over the exterior walls (Fig. 10). This solution is designed to increase the thermal performance of the existing wall, thus both improving the comfort of the dwellings and avoiding condensation on the interior surfaces of the building (Gigante, 2017:4). The strength and durability of the ceramic brick also ensure a better performance over time, requiring only minor maintenance works. The project also provides for the painting of the bricks in the most accessible areas (ground floor, stairs and galleries) to prevent the degradation of these surfaces.

The remaining interventions on the external envelope include the replacement of the original wooden window frames (already damaged or illegally altered) with double-glazed aluminium window frames, aluminium blinds with polyurethane insulation and ventilation grilles. The project also provides the application of metallic structures in the laundry room windows to support the drying area (Fig. 11).

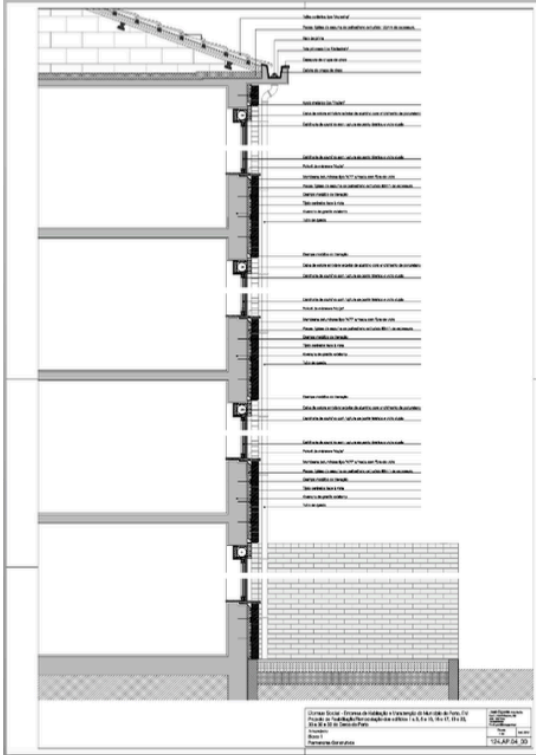


Fig. 10. Intervention by José Gigante. Constructive details (Courtesy José Gigante)



Fig. 11. Intervention by José Gigante. Block 10 (under construction). (Luciana Rocha, 2020)

The intervention on the roofs includes the replacement of the ceramic tiles and the inclusion of ventilation tiles, supported on a new structure, the application of thermal insulation on the upper floor slab and the application of zinc sheet finishes and drop tubes (Gigante, 2017:5).

The replacement of the infrastructural network systems is a notable feature of the common spaces, while, in the outdoor areas, the illegally enclosed extensions on the ground floor are being replaced with clearly delimited patios. The proposal also establishes the location and marks out the area required for the future installation of a lift, although this work is not due to be undertaken at this stage.

3.2.3 Regeneration of the public space: intervention by José Soares, Arquitecto Lda.

The intervention in the public space developed by the architect José Manuel Soares – with the specialities project being provided by SOPSEC – is based on two essential aims: to re-establish the previously interrupted connection between the neighbourhood and the city, mainly through the building of two new streets; to restore the neighbourhood's original spatial arrangement (free of constructions in the centre) with the creation of a central garden that generates paths and spaces for encounters between the inhabitants (Soares, 2017:10–12).

The new streets result from the connection between *Rua do Cerco* and the roundabout on *Alameda de Cartes*, as well as from the connection of *Rua de Vidago* to the junction of *Rua Vila Nova de Foz Côa* with *Rua Peso da Régua*. These streets generate intersections throughout the neighbourhood, which promotes mobility and a closer connection with the surrounding urban structure. The central garden is the intervention that would have the greatest impact on the overall

structure of the neighbourhood. This area has a geometrical composition based on interlinked triangles that mark the limits of the paths, the intersections (living spaces) and the green areas (Soares, 2017:11).

The project thus includes a series of interventions that are mainly related with the definition of the pavement surfaces (circulation areas in tarmac, parking areas in granite cubes and kerbs in prefabricated concrete), the increase in the number of parking spaces, the resolution of the slopes in the circulation areas and access points, and the implementation of urban furniture (billboards, bus stops, recycling areas and waste disposal bins) and special elements (benches, walls, stairs, among others). One of the main functions of this intervention consists in adapting the neighbourhood, insofar as possible, to the legislation governing accessibility and the fire safety regulations (Fig. 12 & Fig. 13).

The implementation of this project would, however, result in the demolition of eight buildings (with a total of 200 dwellings), as well as obsolete or degraded social facilities (the headquarters of a sports association, small constructions, an indoor football pitch and benches). As an alternative, the project envisages the future construction of a new building with 81 one-bedroom apartments for senior citizens with day care services, a cafeteria, laundry and parking.



Fig. 12. Intervention by José Manuel Soares. General plan with alterations ©Domus Social E.M. [Red: to build; Yellow: to demolish]



Fig. 13. Intervention by José Manuel Soares. General plan ©Domus Social E.M.

4. FINAL CONSIDERATIONS

The main purpose of this research was to identify and analyse the different interventions carried out on the buildings of the *Cerco* housing complex, considering the respective framework in the Improvement Plan for the city of Porto and the role played by the municipal council and Domus Social E.M. This formal (architectural) and functional (technical/constructive) analysis allowed for a reflection about the potentialities and limitations of the different intervention strategies. The *Cerco* housing complex presents a set of characteristics of great interest, such as its significant size, the representative nature of the complex's urban integration and the language of its architecture and construction (current housing heritage), and, above all, the uniqueness of the interventions made in two phases with different intentions and stakeholders.

The study of this neighbourhood brought together several pertinent themes, such as the increasing importance of the energy efficiency of buildings and the concern with housing comfort, and the need for municipal interventions at controlled costs. This neighbourhood thus served as a laboratory for the analysis of certain particularities, such as the differences between the projects developed by the same architect for the two separate phases, the results of the association of three proposals made by three different architects, and the advantages and disadvantages of the proposal (not implemented) for the regeneration of the public space, from which some conclusions can be drawn.

The interventions of the architect Virgínio Moutinho in the first and second phases present different strategies and different degrees of transformation. The intervention carried out in the first phase focused mainly on the regeneration of the exterior space, so that the actions concentrated mainly on the treatment of previously existing pathologies and the guarantee of the building's own identity. The strategy of the second phase involved a much greater degree of transformation, especially from a formal point of view, by applying a new coating to the walls, changing the roofing materials and enclosing the balconies, laundry rooms and stairwells, among other actions. These differences result from the diagnosis that was made of the pre-existing situation, but also from the municipal strategy for each phase and the architect's own particular intentions and design approaches.

With the same aim of intervening in the built environment for the improvement of the thermal performance of the buildings, José Gigante's project for the second phase of intervention presented a significantly different solution, mainly because of the choice of the coating material – ceramic brick – and the construction system for the exterior façade. This option has several advantages, such as the durability and maintenance of this material and the improved energy performance offered by this solution. However, it also results in a significant alteration of the previously existing model. The joining together of different architects in the pursuit of a common purpose has thus resulted in significantly different proposals, without any clear formal relationship.

The proposal by the architect José Manuel Soares is notable for the significant intervention that it recommends in the central garden. This action, which is designed to improve the general structuring of the neighbourhood, on the one hand, proposes routes and connections to the surrounding area in order to promote mobility, but, on the other hand, it also calls for the demolition of eight housing buildings and obsolete/degraded social facilities. Despite the advantages inherent in the regeneration of this central space, the intention of eliminating the existing volumes generated disagreement among the inhabitants, leading to the cancellation of this intervention. As a result, for the time being, these eight buildings remain without any planning in terms of future intervention.

In conclusion, the analysis reveals the high resilience and adaptability of the *Cerco* housing complex during these two phases of intervention. This housing ensemble presents a significant tolerance of change and an evident openness to the various degrees of transformation proposed by the different strategies, resulting mainly from architectural and constructive principles, such as the rationalisation of the model and the simple language of the façades.

One of the main challenges is to ensure a greater participation of the inhabitants, both in the project and in the development of the work, in order to balance the actions to be undertaken with the actual needs of the population. The inhabitants' experience is an indicator of architectural

quality, resulting from the confrontation between the design and the use of spaces. As such, an ongoing commitment and partnership between the inhabitants and the municipal council would benefit future interventions.

The outcome now depends on the effective performance of the proposals of the second phase, the relationship between the different solutions, the requirements of thermal/housing comfort and the patterns of use of the inhabitants. Later on, this analysis will be further complemented with sensitivity studies *in situ* and interviews with the inhabitants, in order to make a complete evaluation of each strategy.

ACKNOWLEDGEMENTS

This paper was developed with the support of the Centre for Studies in Architecture and Urbanism of the Faculty of Architecture of the University of Porto (CEAU-FAUP) and funded by the Foundation for Science and Technology (FCT, Lisbon, Portugal), under the project UIDB/00145/2020.

The authors are grateful for the contribution and collaboration provided by Domus Social E.M. through José António Ferreira and Joana Restivo.

ENDNOTES

¹ This analysis follows the reference made by João Queirós (2016) to the number of neighbourhoods and dwellings built during the course of this plan (a total of 25 neighbourhoods). The 30 cases presented on the MdH database (<https://mappingpublichousing.up.pt/en/database>) relate specifically to the period between 1910 and 1974, with their different construction phases being separately recorded. The present research project has also benefited from the support of Domus Social, E.M., which allowed for a more accurate confirmation of the data relating to this case (work in progress).

² Further information is available at www.domussocial.pt.

³ This distribution has changed throughout the process, mainly due to the integration of exceptional typologies, such as Block 22 and the two buildings of the 1991 expansion. However, the logic based on the division by type of access was maintained.

REFERENCES

- Câmara Municipal do Porto (CMP). 1966. *Plano de Melhoramentos: 1956-1966*. Porto: CMP.
- Gigante, J. 2017. Anteprojecto Bloco 1. Memória Descritiva. *Projecto de Reabilitação/Remodelação dos edifícios 1 a 3, 5 a 10, 16 e 17, 19 e 20, 30 a 32 e 33 do Cerco do Porto*. Projecto Geral de Arquitectura. Porto.
- Ministério das Obras Públicas (MOP, 1956). DECRETO-LEI N.º 40616. *Diário da República*, I Série, nº 108, 28 May 1956, 629-633.
- Ministério das Obras Públicas (MOP, 1966). DECRETO-LEI N.º 47443. *Diário da República*, I Série, nº 302, 30 December 1966, 2358-2359.
- Moutinho, V. 1996. Intervenção no espaço como fator decisivo no desenvolvimento social e urbano. Bairro do Cerco do Porto – 1963/91. *Seminário: Desenvolvimento Local – Intervenções e Perspectivas para o Futuro*. Porto.
- Moutinho, V. 2017. Projecto de execução – Bloco 4. Memória Descritiva. *Projecto para a Reabilitação/Remodelação dos edifícios 4, 11, 12, 14, 15, 18, 22, 23, 25, 27 a 19 e 34 do Bairro do Cerco do Porto*. Porto.
- Queirós, J. 2016. O ‘Plano de Melhoramentos para a cidade do Porto’ de 1956: Enquadramento político-social e elenco de realizações. In V.B. Pereira (org.), *O Estado, a habitação e a questão social na cidade do Porto*. Porto: Edições Afrontamento, 37-64.
- Restivo, J. 2014. *Habitação pública no Porto: Intervir para qualificar*. PhD Thesis. FEUP. Porto.
- Soares, J. M. 2017. Memória descritiva. Projecto de Execução. *O Espaço Público do Cerco do Porto*. Porto.
- Vale, C. & Abrantes, V. (2012). Entre tradição construtiva e modernidade arquitectónica. Caracterização construtiva da habitação corrente da cidade do Porto no segundo quartel do século XX, PATORREB 2012 – 4º Congresso de patologia y rehabilitación de edificios, Santiago de Compostela.

