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THE RELEVANCE OF HARMONISING THE TECHNICAL LEVEL OF SOCIAL HOUSING WITH THE URBAN LEVEL OF THE NEIGHBOURHOOD THROUGH THE EXAMPLE OF THE 500 DWELLINGS IN ALBACETE

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Abstract. The Architecture and Household Trade Union built nearly 2,000 subsidized dwellings in Albacete from 1941 to 1971. It was the responsible entity from the end of the Civil War until the beginning of Democracy of the social policy programs in Spain. Later on, and together with the National Housing Institute, were responsible for the construction activity. Its limited budget, scarcity of technical and human resources and an urgent need for new housing developments, constituted the basis for producing a vast housing market of low construction qualities. However, thanks to the true architectonic expertise of some of the professionals, some of the developments were designed with a clear urban strategy and in direct relation with the city, which characterizes them to be studied and conserved. This is the case for the selected development for the analysis, the urban complex of the 500 dwellings in Albacete, the Hermanos Falcó Neighborhood. Designed and built between 1963, Alfonso Crespo and Adolfo Gil architects, and 1977 second reformed project by the architect Fernando Rodriguez. It is characterized by its layout on the territory, its controlled relation with the city and its different types of
open blocks. Above all, its spatial and human scale strengths, directly related to the European post-war proposals, have to be emphasized; although its technical deficiencies affect the interior quality of the houses. This paper examines its virtues and failures and proposes, using current tools, its renovation. This proposal main aims are to extend its lifetime and develop the particular and urban sustainability levels.

**Keywords:** Albacete, dwellings, renovation, sustainability, tools

1. Introduction

1.1. PRECEDENTS

The update and improvement of the Spanish construction business, directly derives from the directions of the European Union (EU) to create a truthful sustainable building market. This initiative propels through the endorsement of Directive 2002/91/EC on the energy performance of buildings, compulsory for all real estates. However, the EU did not publish 20-20-20 commitments until 2008 and this lack of exposition made it difficult to ensure compliance with law until deadlines are getting close.

It is in Directive 2010/31/EC where, irrefutably, the EU exposes the only possible direction, focusing on energy independence. It obliges every Member State to design a National Action Plan to achieve the first compromise: a 20% primary energy consumption reduction. Not only it is necessary that buildings have a good energy performance, but also, either old or new, buildings use a low quantity of primary energy with low levels of greenhouse gas emissions. This Directive particularly asks the new energy consumer or renovated installations, to be technically, functionally and economically feasible. It doesn’t show how to achieve this great aim, though. It neither establishes conditions of maximum consumption according to different characteristics of the buildings. Not even a system of common certification is suggested which could be valid for all European countries and could guarantee a more independent procedure of taking
measurements. On the one hand, the directive emphasizes the local climate conditions, interior environment and the correct relation cost-efficiency to be considered. But, on the other hand, it keeps other requirements untouched: accessibility, safety and functionality. Data for calculations to achieve the required level of efficiency must include not only thermal insulation, but also heating and air conditioning installations, the use of renewable energy, passive cooling and heating elements, shading, indoor air quality, adequate natural light and building design. Highlighted among the rest of measures, is the obligation of writing an energy performance certificate. This will be valid for 10 years, for all new or existing buildings when sold or rented to a new owner or tenant.

Directive 2012/27/EU on energy efficiency appears to solve the failure of nearly zero-energy buildings and the lack of definition of practical measures in EU energy efficiency Plan in 2011. It suggests the investment in building renovation through a long-term primary energy reduction strategy to the Member States, leaving other commitments to be held beyond 2020. This strategy would include a study on domestic building market based on statistical sampling in order to define feasible renovation focus related to the kind of building and climate zone. Particularly practicable renovations, even if they need to be accomplished in several steps. States should fairly accelerate the renovation of the existing buildings rhythm as a whole, as it constitutes the sector with more energy saving potential. Spanish Royal Decree 56/2016 of 12th of February translates part of the Directive 2012 focusing on big energy service providers, basically promoting co-generation in urban areas.

1.2. THE SITUATION IN SPAIN: OBJECTIVES

As far as Spain is concerned, in the period 1990-2012, residential buildings represent an average of 84% per year, regarding the total new buildings as a whole. However, only 45% of the renovations in the country are directed to housing, decreasing gradually up to 26% in 2012. Energy consumption is about 17% out of the total in Spain and 25% regarding electric demand
The effort of developing and accomplishing the European regulations must be understood as a chance to appreciate and improve our existing buildings regarding the relation cost/efficiency.

As the Union suggests, gathering data about existing buildings as a whole and, particularly, residential buildings, constitutes the first step towards energy efficiency and energy independence. These are obliged aims to be achieved gradually from 2018 up to 2020. This technical information is gathered at the moment through EPC (Energy Performance Certification), compulsory for new dwellings from 2007, using LIDER and CALENER software tools. The EPC has been now extended to existing buildings, too, as published in Royal Decree 235/2013, of 5th of April on Energy Performance of buildings. It is complemented by the Building Renovation National Plan of 2013-2016, for energy performance. They are based on building constructive characteristics and active-passive sustainable criteria that should be applicable to every dwelling in the country. At the same time, the National Action Plan is complemented by the Autonomous Communities, which have been enabled by central government to handle data and use it consequently. Thus, analysis of the existing residential buildings starts with the outlines determined by the Autonomous Community EPC Registry. It must follow local, regional and state regulations that will make sure its correct adjustment, in the long term, to compulsory EPC requirements of new dwellings, creating a homogenous housing market as a whole, whether it is already built or new. However, it is necessary to implement a systematic study of adaptation for existing residential developments. This will allow to carry out integrated programs with similar principles of action for the dwellings of the development altogether. Also, a common method will speed up the work in cases where a big construction volume is implied.

In this regard 40-70 year old social housing in Spain is really interesting, as they were centrally developed and programmed. They were also built with a very scarce use of materials, livable area and improvable execution. Even though, in some cases, they have irrefutable architectural
value, they have to adapt to present equipment and development, from an urban point of view, but also counting on habitation requirements, accessibility, energy performance and construction technology. This report outlines the study of a social housing residential development through an analytical process and implementation of the necessary measures to be far beyond energy efficiency requirements. This method can be exported to other similar developments creating an archetype of systematic study and diagnosis for existing residential architecture in Spain. The chosen development for this report has been the 500, a social housing residential development in Albacete. It is also called Hermanos Falcó District and it has been selected because of the contradiction between its building deficiency and the quality of its urban life. The main objective of this research work is to design a constructive proposal to extend the life span of the dwellings, in order to reach their high level of urban and architectural design. It could be an example reproduced in other similar developments throughout the national territory.

2. Method and Materials

Urban design, dwelling design and building technology are the most important aspects of the 500. In order to lay out a possible coordination among them, a method is established for three different phases. Study-practice-proposal is carried out by the two authors who are architects, both of them Doctors. The breakdown is as follows:

1. Analysis of the development through the state-of-the-art study.
2. Verification of the features through a fieldwork.
3. Detection of improvable aspects and intervention proposal.

2.1. STUDY-PRACTICE-PROPOSAL

Method implementation is not related to the study of the 3 scales an architect has to bear in mind, but rather the study of the conjunction of architecture and urban design in order to achieve a beautiful city (Arnau,
1996:33). It can be identified, therefore, as an approach, since it is studied from the global to the particular conception. In this case, the start point is the whole residential development, its chronological context related typology, its footprint on the territory and relation with the city. This is a first approach to a singular outstanding development that helps us know and improve its features. In a second step, the housing typology is studied regarding its historical frame and spatial context, and basically, as a highly interesting prototype of social housing in a middle-sized Spanish regional capital city. From an architectural point of view, data collected from direct experience as a user is as important as data from its transformation and conservation throughout five decades. Finally, and motivated by the needs of its inhabitants, the constructive aspect is studied. These decisive needs of adaptation derive from the scarcity of materials and resources the buildings were built with. These basic deficiencies were never solved along this period.

Once acquired, knowledge from the object of study needs to be checked in situ, on-site, either data from previous studies or inhabitants testimonies. This way it is possible to produce original documents which continue the work developed by previous researchers. The final aim of the fieldwork is to collect enough information in order to make technical proposals that alleviate detected possible problems in the best, and most efficient, way. It is always necessary to have in mind the reality of the block and district.

2.2. PREVIOUS WORKS

The first review of the bibliography about the 500 cannot be other than the original project itself. For its reference, it is a recent work (Gutiérrez and Caro, 2015:158-163) which development is the last one by the OSHA in this capital city of La Mancha, Albacete. It comprises a first phase of 539 dwellings, supplementary buildings and urbanization works (1963-1964) by Alfonso Crespo and Adolfo Gil, architects that also make a reform project (1970-1971) while the construction was being started, delayed until the late
60s. The second phase consists of 741 dwellings (1972), project designed by Juan de Haro and José Luis Aranguren which was not built. A second project to reform the roofs, hallways and urbanization works (1977) by Fernando Rodríguez and José Mascagni, was developed and was used to restore the urbanization works (1981). Other following projects, not directly related to this district were Plan Urban (2000), remodeling of the promenade next to the ring road in Albacete (2006) and Plan de Barrios (2009).

Previous research works (Gutiérrez and Pérez, 2013b) present the development of Hermanos Falcó Neighborhood through a participatory action linked to the last important intervention in the area: the construction of the new church of Santo Domingo de Guzmán (2012). On the one hand, the scarcity of proposals of this kind gives evidence of the lack of training architects have. But, on the other hand, this research works mean the correct method for collective learning of built reality, both for inhabitants and architects. As previous unpublished studies, we find the Final Project of Degree in Building Engineering (PFG) by students Elena Cuevas y Luis López, guided by professor Francisco Javier Castilla from Cuenca Polytechnic School, as well as Master Final Project (TFM) of the program “Advanced Architecture, landscape and urban design” from the Universitat Politècnica de València during the academic year 2013-2014 by architect Ángela Alcaraz, guided by professors Javier Pérez y María Elia Gutiérrez. In both works, the urban aspect is highlighted as the most interesting value to preserve the development. The study of the improvement of its energy efficiency, in the first case, or focusing on the accomplishment of urban regulations in the second one, according to Law of Territory and Urban Activity in Castilla-La Mancha (LOTAU), legal Decree 1/2010 of 18th of May. This review has highlighted the dearth of high-quality quantitative research about the 500.
3. Results

3.1. STUDY

The study of urban scale reveals that the construction of 539 dwellings in the city of Albacete meant a phenomenon in those years: The “Polígonos”. They are unusual urban interventions that build simultaneous blocks of residential developments to alleviate the scarcity of dwellings (Magán, Op. Cit.:134). Situated in the outskirts of the town, in the confluence of Murcia Road and ring road and over a land of 44,976 m², the development implies, however, a clear new way of urban settling with the combination of three 12-storey tower buildings and twenty-eight 4-storey blocks of flats, arranged according the new European trends of its time. The intervention expects to establish real neighborhood relationships that create a city (Gutiérrez and Pérez, Op. Cit. b: 6). They achieve this point through a single gate road which gives way to secondary side streets with no way out or cul-de-sac, that implies traffic deceleration. Also, this derives in car parks and pedestrian squares oriented to south and east delimited by the low blocks. The residents of the area can take over the space of the city, spread the interior outdoors, favoring the use of the public space and its maintenance, turning pedestrians into protagonists. The city is alive. The original project proposes a large garden area for a “pleasant atmosphere”, that was not finally built, and the mentioned squares, with two different areas: playground for children and garden promenade areas equipped with street furnishing. The first project modification, in April 1971, improves the urban look of the Polígono with trees and facade embellishment. In 1977, with the second project modification, Marqués de Santillana Street is connected to the city road infrastructure and the development remains split in two since then. Finally, in 1981, a general review of the urbanization is undertaken based on a needs program elaborated by the town hall and the residents altogether. This program comprises the electric segmentation of the street lamp system and the installation of new ones to avoid shading
after the last modifications of the blocks. Extension of the sewerage system, new pavement for playground areas and improvement of the gardening were also included in this project. According to the referred FMT, compared with the urban standards of LOTAU, the development does not exceed maximum area per hectare and it is within the demanded car park areas. But it does accomplish neither equipment nor garden areas, as regulation demands double and triple respectively, regarding present situation.

Previous research works (Gutiérrez and Pérez, Op. Cit.b) present a document study, completed by the work Observatorio Municipal de Igualdad de Albacete (2010), which asserts that 21% of residents are over 65, 12% of them live alone and average unemployment reaches 58%. The opinion they have about their own home is for 32% of them a dilapidated home, bad or deficient. 48% have no central heating system. Overcrowding index is 4.5 and 100% have no lift. However, according to Cluster analysis, neighbors indicate that general state of the area is good. Despite segregation from the city, they appreciate low pollution, cleanliness, communications, garden areas and low crime rates as positive. The flats are designed within the limits of pure volumes, where only the entrance halls, built afterwards, stand out. There are three similar organized-through-hallway types:

- 4-storey blocks of social housing, 3 bedrooms. 49 m²
- 4-storey blocks of 3rd category housing, 2-4 bedrooms. 41-67 m²
- 11-storey tower blocks of 2nd category housing and commercial ground floor, 69-94 m²

Within the boundary limits of the Polígono, there are several single storey buildings, initially used as schools, nursery schools, shops and small enclosed car parks. Even though some of them have changed its use, library, civic center, or the new church mentioned before, they have kept their condition in the long term. As far as construction technology is concerned, the original project hardly defines the constructive systems to be used. Most of them are prescribed with humble materials already obsolete, like reinforced clay pieces in floor structure, single thin-bricked walls and
asbestos sheeting for the roofs. Its late execution, between 1969 and 1972, justifies the need of the reform in 1971 to update the project to the new earthquake resistant and installations regulations. Also the increase of measurements in quantity surveying, excavation in rock, correction of unleveled areas, tree planting, etc., proves the reform. It is remarkable the improvement of quality, but only possible where budget allows it. It is showed by the visit of the then Minister of Housing (Gutiérrez and Caro, Op.Cit.:167) and meant, mainly, the exchange of the wooden windows for aluminum ones, single glass for double glazing, addition of gas installation for hot water and an acid-treated rough concrete plinth to embellish the facade. In 1977 the most significant reforms took place: construction of attached volumes as new entrance halls for the blocks that prevent the ground floor flats from flooding. Roof thermal insulation and waterproofing and also sewerage system were improved. The proposal included the design of facade-attached metallic structures to hide the clothes lines but they remained unbuilt.

3.2. PRACTICE

During the fieldwork, the district becomes familiar and, after taking photographs and other data, a technical inspection to the selected flat is carried out. Several subsequent visits are needed. The last one was at the beginning of January 2016, with hard winter conditions. Some interventions at the boundaries of the development have improved accessibility conditions (Figures 1 and 2). Segregation with the rest of the city also has improved, only broken by the lack of connection of inner roads.

On the one hand, a good general state of the urbanization, garden and equipment areas is observed. On the other hand, almost every facade has been transformed regarding the original design. Moreover, ground floor dwellings have appropriated remaining areas next to them, and they have altered its entrance to gain access directly from the street. In order to
develop interior technical verifications, a work plan for taking data regarding accessibility, habitation and energy efficiency is established: visual inspection, sketch of the floor plan and elevations with measurements are undertaken to calculate the EPC. In order to carry out this work plan, a unit with the most unfavorable conditions of typology, orientation and energy demand is selected.

It is a ground floor unit that belongs to one of the blocks of social housing. This selection has been made because it still has the original finishing and it suffers the worst comfort conditions as it is directly built on the ground, with no structure floor underneath according to the original project. It is also facing 3 different orientations, 3 facades.

Figures 1 and 2. Boundaries of the Hermanos Falcó Neighborhood

It is located in Santa Teresa de Jesús Square (Figures 3 and 4). The block is in a very good condition, even though we detect a problem of accessibility. It does not have a lift and some steps were added in 1977 before the entrance hall to prevent flooding. However, this dwelling lacks good conditions of habitation because of the absence of direct ventilation in some of the rooms. They don’t accomplish either with minimum demanded area and other habitation standards. These problems have led the residents to reform regarding their needs, getting a new direct entrance form the street to avoid the steps and giving priority to gain area at the expense of
energy efficiency. It faces the orientation east-south-west. Windows were substituted by single glaze aluminum ones with no thermal bridge breaking. A new heating and hot water system was added with a natural gas. No air conditioning demand is needed, solved with portable fans. Gas consumption is an average 3.33 Kwh in winter, and the cost per month is 130 € on average. Some thermal bridges have been detected in the three facades and the utility room has been defined as not occupied. The enclosure wall in contact with the ground has been supposed as direct with no waterproof sheeting. CE3X v.2.1 software tool is used to do the EPC. This tool is admitted by the regulations, it’s been recently updated, it is easy to handle and allows the addition of improvement measures. Moreover, an architect is authorized to use the software and sign the EPC by Spanish Royal Decree 235/2013. After the calculations, a feasibility study on the amortization of each improvement measure and a combination of some of them is estimated. The overall result of the unit is level G, with an important heating demand 218.7 Kwh/m². The cooling demand is 29.9 Kwh/m² with level F, heating and hot water emissions 64.2 and 14.7 CO₂/m², respectively, and cooling emissions are insignificant.

*Figures 3 and 4. Santa Teresa de Jesús Square and South façade of unit selected*
3.3 PROPOSAL

As established before, Hermanos Falcó Sector enjoys a good urban atmosphere, so proposed improvements in this regard are only a few: ordered appropriation of residual spaces, for the dwellings adjacent to them could be extended legally; widening of pavement areas in particular places, as in front of the block facing José Espronceda Street; and the addition of small pieces of urban equipment, like kiosks or paved playgrounds, to encourage the use of isolated areas. As far as blocks are concerned, it is obvious the need to install lifts in order to solve the accessibility problem. They could be placed outside with platforms giving access through the balconies. As a first step, though, it is proposed to adapt the ground floor dwellings for the disabled, giving order to the voids opened by the owners spontaneously. This could get the adaptation of 116-118 ground floor flats out of 59 existing blocks. Proposals of intervention in terms of energy efficiency are centered in a good rate cost/effectiveness. CYPE online software tool is used to generate an estimate of the cost of the improvement measures. The homeowners would have to bear this cost, helped by regional in/or state aids, though. For this case-study 9 possible improvement measures have been found, 4 of them a combination of the other single 5. Our intention has been to reduce energy demand regarding heating, improving facade and floor thermal insulation, but keeping in mind the balance cost/efficiency. Therefore it is not focusing on raising the overall results improving the letter in the scale. The single improvement measures are exterior thermal insulation system implementation (SATE), substitution of the heating system by a biomass one, new thermal bridge breaking aluminum windows, insulation of the shutter boxes and installation of a high efficiency heat pump. The combination measures are SATE with floor thermal insulation, floor and shutter boxes thermal insulation, SATE plus improvement of the windows and SATE with new windows plus floor insulation. From the single ones, the most effective reducing the heating demand is SATE, with a 27% reduction. However, overall scale result remains in E, while goes up to B with the addition of the
biomass without reducing the heating demand. Something similar happens with the heat pump, which makes it become an E with no reduction of heating demand. Substitution of windows and insulation of the shutter boxes hardly reduce heating demand a 8% and a 3%, respectively. Regarding the combination measures, the ones that include SATE reduce heating demand a 33% when it goes with the new windows, a 52% with floor insulation and 52% if new windows are added. Floor insulation and shutter boxes insulation means a 22% reduction. However, some measures are not feasible for its long amortization period goes beyond life span of the already old building, like the substitution of the windows or the biomass installation (Table 1).

On the opposite side, in no less than two years, investment in the heat pump would be covered and insulation of the shutter boxes hardly counts for amortization numbers for its low cost. As best amortization result and reduction of heating demand, 13 years, is SATE with floor insulation and new windows, which, at the same time, improve the overall result up to E. Floor and shutter insulation gives 12.8 years of amortization with an F. Investment in the second case is 50% regarding the first one, and it reduces to half the heating demand, also.

### TABLE 1. Improvement measures results

<table>
<thead>
<tr>
<th>RESULTS</th>
<th>IMPROVEMENT MEASURES</th>
<th>COMBINED MEASURES</th>
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<tbody>
<tr>
<td>EPC</td>
<td>SATE</td>
<td>BIO SYSTEM</td>
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<td>HDR (%)</td>
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<td>0.0</td>
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<tr>
<td>AMORTIZATION (Y)</td>
<td>12.7</td>
<td>242.6</td>
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4. Discussion and Conclusions

The 500 analysis has allowed doing an efficient constructive proposal within the homeowners’ reach. Development implementation design is clearly its best characteristic and present urbanization renovations keep them in good conditions. Apartment blocks must, however, improve their accessibility, and, basically, their comfort conditions, including habitation and efficient behaviors. Residents are reluctant to have lifts installed for their limited resources and the need to improve indoor comfort conditions first. That is why our proposal goes for the adaptation of ground floor flats as a first step. As far as energy efficiency is concerned, and, after verification, SATE is the most technically feasible solution, specially recommended because of its simple execution. In economic terms, it is the best option regarding the amortization period, with an investment that means less than 50% compared with other solutions like the substitution of the windows. In addition, almost all of them have been already renovated and only should be reviewed in terms of thermal bridge breaking and air tightness. SATE technique allows the use of the dwellings meanwhile it is been applied, as it is about rendering an insulated mortar and a finishing layer from the exterior. It means a 27% reduction of heating demand on its own, along with improvement of waterproofing of the walls and indoor comfort conditions. The ideal solution includes SATE, floor insulation and shutter insulation which reaches a 52% heating demand reduction and the overall result increase up to E. Regarding economic estimation, tools that have been used generally imply a cost a bit higher than real market pricing. Besides, these costs could be reduced in the case of group block interventions. Even so, amortization periods below 15 years are feasible enough for a population under 65 in 79% of the cases. They are, therefore, achievable intervention proposals that can reach the high quality of its urban standards and can be extrapolated to similar developments throughout the Spanish national territory.
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References


