Improving the Quality of Suburban Building Stock


Edited by: Roberto Di Giulio

Improve the Quality of
Suburban Building Stock
Improving the Quality of Suburban Building Stock

COST Action TU0701
Improving the Quality of Suburban Building Stock

COST Action TU0701

Edited by Roberto Di Giulio

Department of Building & Civil Engineering
Faculty for the Built Environment
University of Malta

COST is supported by the EU RTD Framework programme. ESF provides the COST Office through an EC contract.
COST- the acronym for European COoperation in the field of Scientific and Technical Research- is the oldest and widest European intergovernmental network for cooperation in research. Established by the Ministerial Conference in November 1971, COST is presently used by the scientific communities of 35 European countries to cooperate in common research projects supported by national funds.

The funds provided by COST - less than 1% of the total value of the projects - support the COST cooperation networks (COST Actions) through which, with only around €20 million per year, more than 30,000 European scientists are involved in research having a total value which exceeds €2 billion per year. This is the financial worth of the European added value which COST achieves.

A “bottom up approach” (the initiative of launching a COST Action comes from the European scientists themselves), “à la carte participation” (only countries interested in the Action participate), “equality of access” (participation is open also to the scientific communities of countries not belonging to the European Union) and “flexible structure” (easy implementation and light management of the research initiatives) are the main characteristics of COST.

As precursor of advanced multidisciplinary research COST has a very important role for the realisation of the European Research Area (ERA) anticipating and complementing the activities of the Framework Programmes, constituting a “bridge” towards the scientific communities of emerging countries, increasing the mobility of researchers across Europe and fostering the establishment of “Networks of Excellence” in many key scientific domains such as: Biomedicine and Molecular Biosciences; Food and Agriculture; Forests, their Products and Services; Materials, Physics and Nanosciences; Chemistry and Molecular Sciences and Technologies; Earth System Science and Environmental Management; Information and Communication Technologies; Transport and Urban Development; Individuals, Society, Culture and Health. It covers basic and more applied research and also addresses issues of pre-normative nature or of societal importance.

COST Action TU0701
Improving the Quality of Suburban Building Stock.
The production of this publication was supported by COST: www.cost.esf.org

Edited by Roberto Di Giulio


Coordinator Ruben Paul Borg

The content of each paper is the responsibility of the respective author/s.
The papers published in this book, have been reviewed by the Scientific & Editorial Committee. The papers were subsequently presented during the International Conference, held in Malta, on the 7th & 8th May 2010.

© 2010 The Authors and The Editors

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without prior written permission from the publisher.

The Editors, the Authors and the Publisher are not responsible for the use which might be made of the information contained in this publication.

ISBN

Publisher: Faculty for the Built Environment, University of Malta.
Printed in Malta by Gutenberg Press, 2010

May 2010
COST Action TU0701

**Improving the Quality of Suburban Building Stock**

Roberto di Giulio  
University of Ferrara, Italy.  
Chairman, TU 0701

Jana Selih  
University of Ljubljana, Slovenia.  
Vice Chairman, TU 0701 & Vice Chairman Work Group 1

Ola Wedebrunn  
Royal Danish Academy, Denmark.  
Chairman, Work Group 1

Jaana Nevalainen  
Ministry of the Environment, Finland.  
Chairman, Work Group 2

Ruben Paul Borg  
University of Malta, Malta.  
Vice Chairman, Work Group 2

Christian Wetzel  
Calcon, Germany.  
Chairman, Work Group 3

Silvia Brunoro  
University of Ferrara, Italy.  
Vice Chairman, Work Group 3

**Coordinator of the Publication & the Conference**

Ruben Paul Borg  
*Faculty for the Built Environment, University of Malta*
Contents

Introduction 1
    Di Giulio R.

Chapter 1 Definition of the Suburban Building Stock 9

Definition of the Suburban Building Stock 11
    Wedebrunn O., Šelih J.

Definition of the Suburban Building Stock 15
Case Study: The residential quarter of the ‘Nuclear Research Centre’ (NRC) MOL
Flanders, Belgium
    De Naeyer A.

Definition of the Suburban Building Stock 25
Case Study: Avedøere Stationsby, Denmark
    Sparrevohn S.D., Hollensen L., Sverrild P.

Definition of the Suburban Building Stock 33
Case Study: Broendby Strand, Denmark
    Hollensen L., Sparrevohn S. D., Sverrild P.

Definition of the Suburban Building Stock 41
Case Study: Farum Midtpunkt, Denmark
    Wedebrunn O.

Definition of the Suburban Building Stock 51
Case Study: Jakomäki, Helsinki, Finland
    Nevalainen J.

Definition of the Suburban Building Stock 59
Case Study: Phoinikas Kalamaria, Thessaloniki, Greece
    Bikas D., Tsirigoti D.

Definition of the Suburban Building Stock 69
Case Study: Solar Village, Pefki, Attica, Greece
    Bikas D., Tsirigoti D.

Definition of the Suburban Building Stock 79
Case Study: S. Eusebio, Cinisello Balsamo, Italy
    Piaia E.

Definition of the Suburban Building Stock 85
Case Study: Riga, Latvia
    Korjakins A.

Definition of the Suburban Building Stock 105
Case Study: Eiguliai, Kaunas, Lithuania
    Seduikyte L.
Chapter 2
Assessment of Quality of Suburban Building Stock

Assessment of Quality of Suburban Building Stock
Nevalainen J., Borg R.P.

Assessment of Quality of Suburban Building Stock
Case Study: Jakomäki Jackobacka, Helsinki, Finland
Nevalainen J.

Assessment of Quality of Suburban Building Stock
Case Study: Radisani, FYR Macedonia
Bozinovski Z. L.

Assessment of Quality of Suburban Building Stock
Case Study: Heinrich-Lübke-Siedlung, Frankfurt am Main, Germany
Schneider M, Niemeier S.

Assessment of Quality of Suburban Building Stock
Case Study: S. Eusebio, Cinisello Balsamo, Italy
Di Giulio R., Piaia E.

Assessment of Quality of Suburban Building Stock
Case Study: Santa Lučija, Malta
Borg R.P., Gauci P., Borg Axisa G.

Assessment of Quality of Suburban Building Stock
Case Study: De Bakens, Zwijndrecht, The Netherlands
Elbers H.M.H.J.
Assessment of Quality of Suburban Building Stock
Indicators Matrix: Bairro da Bouça, Porto, Portugal
Monteiro A., Madureira H., Velho S., Menezes T., Almeida M.

Assessment of Quality of Suburban Building Stock
Indicators Matrix: Calea Girocului, Timisoara, Romania
Bica S., Ianca S., Junie A.

Assessment of Quality of Suburban Building Stock
Indicators Matrix: Konjarnik, Belgrade, Serbia
Djukic A.

Assessment of Quality of Suburban Building Stock
Indicators Matrix: Savsko naselje, Ljubljana, Slovenia
Sitar M., Skalicky V.

Assessment of Quality of Suburban Building Stock
Indicators Matrix: Gyrischachen/Burgdorf, Switzerland
Hoemke M.

Assessment of Quality of Suburban Building Stock
Indicators Matrix: Adalet Evleri, Denizli, Turkey
Yilmaz S., Özmen H. B., Şen G.

Chapter 3
Legislation

An inventory of building legislation and financial incentives
A multi-faceted, state of the art overview
Buhagiar V., Wetzel C., Brunoro S.

Building legislation and financial incentives matrix
Wetzel C., Brunoro S.

Chapter 4

Giving a human face to the renewal of suburban housing estates
What can we learn from the Close Neighbours project?
Mullins D.

Improving the suburban building stock
The challenge of managing privatized housing
Gruis V., Nieboer N., Tsenkova S.

Housing in Maltese Suburbs
Mifsud P. V.

Protection of urban habitats against natural catastrophes
Mazzolani F. M.
Sustainability of Constructions

Integrated Approach to Life-time Structural Engineering

Design support instruments for the practical applicability of the energy concept to the built environment
Koroneos C.

Towards a Low Carbon Built Environment in Europe
Jones P.

Strategies and technologies to improve the sonic environment in urban and suburban areas using soundscape approaches
Kang J.

Sound classification schemes in Europe
Quality classes intended for renovated housing
Rasmussen B.
Chapter 2

Assessment of Quality of Suburban Building Stock

Chairman: Jaana Nevalainen (Ministry of the Environment, Finland)
Vice Chairman: Ruben Paul Borg (University of Malta, Malta)
Assessment of Quality of Suburban Building Stock
Case Study: Bairro da Bouça, Porto, Portugal

A. Monteiro & H. Madureira
Geography Department, University of Porto, Portugal

S. Velho
Project ‘Public health risks associated with heat waves and cold spells in Porto’

T. Menezes & M. Almeida
Undergraduate Students, Geography Department, University of Porto, Portugal

ABSTRACT: The “Bairro da Bouça” social housing is one of the most emblematic interventions of the SAAL programme, devoted to create social housing for poor people in Porto in the 70’s of the twentieth century. Projected by Álvaro Siza Vieira, the neighbourhood is located near Boavista, nowadays a central area in the city. It was built in two main steps, the initial 56 housing, in 1975, and the last 72, which were finally completed in 2006, also with the rehabilitation of the initial 56. The “Bairro da Bouça” was initially designed in order to fulfil the basic needs of housing in times of poverty (1974/5) and to integrate the residential community with social and economic problems into the surrounding community. It had a particular characteristic: it was a SAAL (Serviço Ambulatório de Apoio Local – Local Support Ambulatory Service) intervention, popular origin group that arose to create an institutional and organized framework to facilitate the dialogue between residents and public power. One of their intentions was to make it possible for the residents to intervene at any phase of the process, from the selection of projects, typologies, supervision of works, to the allocation and management issue. For the conclusion of this project it was essential the support of the cooperative movement. “Bairro da Bouça” is a neighbourhood where two periods of construction coexist, corresponding to different implementation models (residents association and cooperative) and, as consequence, to different socioeconomic levels. This paper presents “Bairro da Bouça” as an example of the economical, social and urban planning problems and answers in two different temporal contexts.

1 INTRODUCTION TO HOUSING POLICY AND HOUSING DISTRICT REGULATIONS

According to the Portuguese Constitution (art. 65) everyone has the right, for themselves and for their family, to have adequate housing in what concerns to adequate dimension, hygiene and comfort conditions, preserving the personal intimacy and familiar privacy, competing to the state: a) To programme and execute a housing policy inserted in the territorial plans and based in urbanization plans which guarantee the existence of an adequate transportation and social equipment network; b) To promote, in cooperation with the autonomous regions and local authorities, the construction of affordable and social housing; c) To stimulate private construction, subordinated to the general interest, and the access to owned or rented housing; d) To encourage and support the local community and populations’ initiatives, designed to solve the respective housing problems and promote the creation of housing and auto-construction cooperatives.

The Institute for Housing and Urban Rehabilitation (IHRU), under supervision of the Ministry for Environment, Spatial Planning and Regional Development (MAOTDR), has the mission of assuring the accomplishment of the policy defined by the Government towards housing and urban rehabilitation areas, articulating it with the Cities’ Policy and other social policies, as well as policies for protection and valorisation of the heritage, assuring therefore the memory of the building as well as its evolution. Housing constitutes the main focus of its activity, even in
what concerns to standards’ elaboration, or to projects’ certification, financing of programmes for cities, cooperatives, enterprises and particulars, as well as in what concerns to actions of programme management and construction surveillance.

The Ministry for Environment and Spatial Planning (MAOTDR) is the governments’ department whose mission is to define, implement and coordinate the policy for the environment, regional planning and cities.

The building regulations and controls are included in the Portuguese Building Code “General Regulation for Urban Construction” (RGEU) (Law-decree nr. 38382/51, of August 7th). Approved in 1951, several amendments have been issued and its revision was decided. A new regulation is already prepared, however it was not yet approved.

Social housing is regulated by specific legislation, the “Technical Recommendations for Social Housing (Ministerial Order nr. 41/MES/85, of February 14th).

The 2002/91/CE Directive, from 4 January 2003, obliges all the member States to the establishment and periodical actualization of Regulations, in order to improve the thermal performance of new buildings, as well as of the rehabilitated ones, obliging them to demand, in certain cases with few exceptions, for the implementation of all the pertinent measures, according to its technical and economical viability. This Directive also adopts the obligatoriness of accounting the energetic necessities for the preparation of sanitary hot waters, from the point of view of considering all the important energetic consumptions, especially in this case, in habitation, with the specific intention of favouring the penetration of solar collector systems, as well as other renewable alternatives. In this context, this Directive was transposed, in 2006, to national juridical order, through a legislation pack composed by three Law-decrees.

The Law-decree nr. 78/2006, of April 4th, relative to the National System of Energetic Certification and Interior Air Quality in Buildings (SCE), which has the objectives of: a) assuring the application of Regulation, mainly in what concerns to energetic efficiency, renewable energy systems’ usage and yet the interior air quality guarantee conditions, according to the demands and dispositions included on RCCTE and RSECE; b) certifying the energetic and interior air quality performance in buildings; c) identifying the corrective or improvement applicable measures for the new buildings and their respective energetic systems, namely boilers and air conditioning equipments, in what concerns to energetic performance, as well as in what touches to interior air quality.

The Law-decree nr. 79/2006, from April 4th, about the Regulation of Energetic and Acclimatization Systems in Buildings (RSECE), which establishes: a) the conditions to accomplish in new acclimatization systems projects, namely requisites on thermal comfort, renovation, treatment and interior air quality, which should be maintained in energetic efficiency conditions through an adequate selection of equipments and their organization in systems; b) the maximum limits for energy consumption in big service buildings and all buildings in particular, for acclimatization, predictable under the nominal conditions of operation for the new buildings or for great rehabilitation interventions on the existing buildings, which come to have new acclimatization systems comprehended by the present Regulation, as well as the power limits applicable to acclimatization systems to be installed in these buildings; c) the terms for conception, installation and establishment of the maintenance conditions, to which acclimatization systems must obey, in order to guarantee quality and security during normal functioning, including the professional formation requisites, to which the main intervenients must obey, and observation of the adjustment of the material and technology usage principles in all the energetic systems of the building, in the optics of environmental sustainability; d) conditions for monitoring and auditorship to the buildings’ functioning in terms of energy consumption and interior air quality.

The Law-decree nr. 80/2006, from April 4th, about the Regulation of Buildings’ Thermal Behaviours’ Characteristics (RCCTE), (revoking the anterior RCCTE – Law-decree nr. 40/90, from 6 February which had, for the first time, and by the regulatory way, introduced thermal requisites in the new buildings projects and in great rebuildings) indicating the rules that must be observed on every habitation buildings’ projects, as well as service buildings without centralized acclimatization systems, in such a way that: a) the demands for thermal comfort, whether for heating or cooling, and ventilation for buildings’ interior air quality guarantee, as well as for sanitary hot water needs which would come to be satisfied without an excessive ex-
pense of energy; b) the pathological situations in construction elements caused by the occurrence of superficial or internal condensations, which have potential negative impacts in the construction elements and in the interior air quality’s durability, minimizing them; c) it is obligatory to install solar thermal collectors for sanitary hot waters, whenever there is adequate solar exposure, except if there is a funded justification on the contrary; d) a new conventional base is created for comparison between buildings, having in mind the Energetic Certification.

This new Regulation demands for the accomplishment of a series of requisites on the guidance of the new buildings, such as walls’ and roofs’ isolation, turning into obligatory the installation of double glassed windows, within other technical matters. Everything must be taken into account such as, for example, obstructions to the solar radiation entrance due to the existence of other buildings and other criteria as well. Together, with the applicable technical regulations for habitation buildings (RCCTE, DL 80/2006) and for services buildings (RCCTE, DL 79/2006), the SCE defines the rules and the methods for the verification of the effective application of these Regulations in new edifications, as well as, in a posterior phase, to the already built habitations. Other regulations and guidelines concerning the built environment are given, for example, by the Safety Regulation against Fire in Residential Buildings ((Law-decree nr. 220/2008, of November 12th), by the General Regulation on Public and Building Residual Water Distribution Systems (Regulated Order nr. 23/95, of August 23rd), by the General Regulation on Noise (Law-decree nr. 7/2007, of January 17th) or by the Regulation on Buildings Acoustic Requirements (Law-decree nr. 129/02, of May 11th).

2 PROFILE OF THE CASE STUDYS’ AREA

“Bairro da Bouça” is located on the western side of the city of Porto, about 1 km distant from the city centre, 4.5 km away from Douro rivers’ mouth and 6 km far from Atlantic Ocean - “Foz” (coast). It has 10000 m² and is located in the Cedofeita neighbourhood, close to important streets that link some centralities in Porto: Boavista Street and Cedofeita Street. The metro line is tangential to the neighbourhood (Figure 1).

“Bairro da Bouça” is one of the most emblematic interventions of SAAL. The SAAL, implemented with the arrival of democracy (1974), had an innovative programme to execute new neighbourhoods in places occupied by “ilhas”, avoiding thereby the forced displacement of populations to areas distant from their usual living places, as it happened with the previous projects of social housing. The SAAL created conditions for an active participation of residents in the process of construction / reconstruction of neighbourhoods (organized into associations) ensuring, the state and local authorities, the necessary support through the technical brigades, particularly in the judicial field, in the implementation of projects. The intention was that the residents could and should intervene in any phase of the process, from the selection of projects, typologies, supervision of works, as well as to the allocation and management issues.

“Bairro da Bouça” was projected to satisfy the basic needs for housing at the time, accommodating an existing community in a new adjacent space with better conditions and integrating...
the residential community into the surrounding community, fighting the existent social conditions of that time – abusive renting costs, illegal construction, overcrowding and lack of adequate sanitation with limited and inadequate financial resources.

The project, designed by the architect Siza Vieira in 1975, comprehended 128 duplex flats spread over 4 buildings, confined at north by a wall, to protect from the previous train line, giving way to elongated patios. However, SAAL had an ephemeral life, being extinct in 1976, and only 56 duplex flats were built in this initial phase. It was finally accomplished in 2006, with the construction of the remaining 72 dwellings, the refurbishment of the 56 initial dwellings, the free time atelier (leisure workshop) and the 6 shops. For the conclusion of the project it was essential the support of FENACHE (National Federation of Economic Cooperatives Housing), and the Cooperative “Águas Férreas”, formed by the Union of Cooperatives CETA, “Sete Bicas” and the Association of Residents of Bouça. The project was also financed by the IHRU (Housing and Rehabilitation Urban Institute). So, “Bairro da Bouça” is a single neighbourhood where two construction periods coexist, corresponding to different implementation models (residents’ association and cooperative) and, as consequence, to different socioeconomic levels.

According to Köppens’ Climatic Classification, Porto has a humid temperate climate with dry and temperate summer (Csb). Normally (1971-2000), the average maximum temperature ranges from 13.5 in January to 25 in July, and the minimum temperature varies between 5 in January and 15.5 in the July. The winter is characterized by having a degree of instability, with the occurrence of rain precipitation and strong winds though some periods of sun and dry weather. The summer is then characterized for being dry and sunny, sometimes interrupted by days of fog and / or precipitation. According to the normal values of precipitation (1971-2000) in the month of December recorded 194.7 mm (average) and 18.3 mm (average) in July.

2.1 Services

The Bairro da Bouça was designed in order to fulfill the basic needs of housing at that time. In this sense, part of the project areas was devoted to social services and commercial areas for recreation and subsistence. Nowadays, there is: 1 fishmonger, 1 dental clinic (being also the meeting centre of the Cooperative), 1 shop for temporary work, 1 architectural office and 1 kiosk.

The cooperative presents outside patios, elongated with green open spaces (lawn and vegetation stratum) and floor space for active recreation. In the nearby area there are other public green spaces, like Republic Square (460 m) or Boavista Square (850 m) and many private gymnasiunums.

The cooperative is also close to central areas of Porto (Boavista and city centre), which means the residents have access to diverse social, cultural and commercial services. Basic health services are accessible: the maternity (720 m), the hospital of the city centre (1Km) pharmacy (200m), health centre (500 m). In the neighbourhoods there are some nurseries (30 m) and public schools (1st, 2nd, 3rd and secondary years) at less than 1 km far. There are churches from different religions at less than 500 m. There are also many coffees, restaurants and groceries and other retail shops. In the nearby area there are is post office (1 km), a police station (2 km) and there are also many banks/ATM.

2.2 Infrastructure

There is a road network, as well as pedestrian connections to and from the neighbourhood. The transportation infrastructures, the metro station as well the bus stop, are functional and in good condition.

Clean water distribution and waste water collection are on duty of the Porto Municipality. The cooperative has an outside waste disposal system, prepared for recycling (cardboard/card, glass, batteries, metal, organic garbage). The inhabitants can have access to a complete information system: internet, telephone and television. There is no central heating system.
2.3 Accessibility

The cooperative benefits from a local pedestrian system, which allows the access to the outside open spaces and underground parking with individual garages. It has external stairs with direct access to the apartments and to the subterranean car park.

It benefits from a system of buses, subway, roads and sidewalks, so that residents can move easily to and from the cooperative to the city centre, coast and Douro River. There is also an adjacent public car park. The transportation infrastructures are organized, in good conditions and are functional too. This area, as well as great part of the city, doesn’t benefit from a cycling network.

2.4 Visual and acoustic comfort

The illumination of pedestrian areas, bus, subway stops and parking areas are quite well achieved, even with some secondary streets being narrower and with quite poor illumination.

The access to the subway could be less visually comfortable, once it is situated in a dead end street, which can make people feel afraid at night, while streets are less populated.

There are no significant noise pollution focuses.

2.5 Health and safety

The Boavista Street is sometimes used as a fast lane, making it possible the occurrence of road accidents. But the adjacent pedestrian crossing and the good street visibility and illumination may contribute towards quite good non-vehicular safety levels.

The cleaning of the public outdoor spaces is responsibility from Porto’ Municipality. Despite the proximity to a street with traffic, there are no significant levels of atmospheric pollution.

The Fire safety is regulated by the Safety Regulation against Fire in Residential Buildings (Law-Decree nr. 220/2008, of November 12th). The nearest fire station is located at 1.4Km.

2.6 Social aspects

The latest census data, available for the statistical subsection where “Bairro da Bouça” is included (Figure 2), are dated from 2001. The data is, therefore, prior to construction of the second phase of the neighbourhood.

In 2001, there were 529 inhabitants in the “Bairro da Bouça” subsection area. The population density was about 10300 inhabitants/km², which was above the municipality average (6337 inhabitants/km²). The illiteracy rate (13%) was also higher than the municipality average (11%). Only 6% of the population had an academic degree, contrasting with the city’s average (16%).

Figure 2. Bairro da Bouça statistical subsection.
The unemployment rate was also higher in this subsection (17%), when compared with the whole city’s value (10%). More than half of the population in the “Bairro da Bouça” area is between 25 and 65 years. 18% of the total population is older than 65 years, and only 9% is younger than 10 years, indicating an ageing population structure (Table 1).

In the “Bairro da Bouça” statistic subsection there were, in 2001, 146 buildings and 214 households. The average number of households per building was 1.46. More than 60% of the buildings were constructed between 1960 and 1980. There were 223 families with an average size of 2.37 persons (Table 2).

Table 1. Age groups in “Bairro da Bouça” statistical subsection. (INE, 2001)

<table>
<thead>
<tr>
<th>Age</th>
<th>Nr</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>21</td>
<td>3.97</td>
</tr>
<tr>
<td>5-9</td>
<td>25</td>
<td>4.73</td>
</tr>
<tr>
<td>10-13</td>
<td>19</td>
<td>3.59</td>
</tr>
<tr>
<td>14-19</td>
<td>41</td>
<td>7.75</td>
</tr>
<tr>
<td>20-24</td>
<td>50</td>
<td>9.45</td>
</tr>
<tr>
<td>25-64</td>
<td>277</td>
<td>52.36</td>
</tr>
<tr>
<td>&gt;65</td>
<td>96</td>
<td>18.15</td>
</tr>
</tbody>
</table>

Table 2. Household profile in Bairro da Bouça statistical subsection. (INE, 2001)

<table>
<thead>
<tr>
<th>Number of households</th>
<th>214</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of buildings</td>
<td>146</td>
</tr>
<tr>
<td>Average households per building</td>
<td>1.46</td>
</tr>
<tr>
<td>Number of families</td>
<td>223</td>
</tr>
<tr>
<td>Average size of families</td>
<td>2.37</td>
</tr>
</tbody>
</table>

2.6.1 Crime and illegal interventions

Despite being a low-cost housing neighbourhood, the levels of criminality are not superior to the ones registered in medium terms for the city. Two reasons can be pointed out: first, the fact that the “Bairro da Bouça” is inserted in a central area in the city, which was conceived in order to be permeable to the surrounding space and is crossed by the population using the metropolitan, which puts the neighbourhood in a privileged position relatively to other building estates; second, there is a social mix provided by the coexistence of two periods of construction that corresponds to different implementation models (residents association and cooperative) and as consequence, to different socioeconomic levels. In spite of this, the access to the subway station, being less used by people at night and because it is situated in a dead end street, can be considered a point of danger for assaults at night.

2.6.2 Perception of users

The Portuguese legislation assures that everyone can participate in the planning processes, regulating the quality of planning decisions and participatory processes. Everyone has the right to be informed about the planning processes and has also the right to participate in the planning processes.

In “Bairro da Bouça” there is a neighbourhood association, established in the beginning of the construction process. Nowadays, the aim of this association is to deal with issues related to the neighbourhoods’ management.

2.7 Management and financial aspects

“Bairro da Bouça” was first developed by the SAAL program, established by a residents association and supported by the central government and local authorities. With the SAAL extinction, in 1976, the neighbourhood was still incomplete until few years ago. For the conclusion of the project, in 2006, was essential the support of FENACHE (National Federation of Economic Cooperatives Housing), and the Cooperative “Aguas Férreas”, formed by the Union of Coop-
ervatives CETA, “Sete Bicas” and the Association of Residents of Bouça. The project was also financed by the IHRU (Housing and Rehabilitation Urban Institute).

2.7.1 Maintenance requirements
With the extinction of the SAAL programme the neighbourhood has remained incomplete for decades and with a growing need of refurbishment. With the conclusion of the project in 2006, which also included the refurbishment of the oldest buildings, the main maintenance requirements had been accomplished.

The cooperative is close to central areas of Porto (Boavista and city centre), which means the residents have access to diverse social, cultural and commercial services.

2.7.2 Interventions, repairs and rehabilitation
Before the last improvements and constructions, even though people lived there, the buildings were deteriorated. With the buildings refurbishment and the construction of the metro station, the entire neighbourhood has been significantly regenerated.

3 BUILDING PROFILE
The “Bairro da Bouça” includes 128 houses, 5 social and commercial service areas and public open spaces for recreation (including green spaces). It was built in two steps, being the initial 56 housing built in 1975, and the last 72 as well as the outdoor spaces were finally completed in 2006, with the rehabilitation of the 56 initial (Table 3).

Table 3. Buildings profile

<table>
<thead>
<tr>
<th>Number of dwellings</th>
<th>128</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 1st step</td>
<td>56</td>
</tr>
<tr>
<td>From 2nd step</td>
<td>72</td>
</tr>
<tr>
<td>Dwellings typology</td>
<td>T1, T2, T3, T4 and T5 duplex</td>
</tr>
<tr>
<td>Number of floors</td>
<td>4</td>
</tr>
<tr>
<td>Commercial and social services</td>
<td>1 fishmonger, 1 dental clinic, 1 shop of temporary work, 1 architectural office, 1 kiosk</td>
</tr>
<tr>
<td>Dimensions (areas)</td>
<td>Total area: 10000m²; Green spaces (lawn and vegetation stratum): 1700 m²; Commercial area: 500 m²; Terrace area: 350 m²; Soil open space: 450 m²; Common outside car parking: 100 m²</td>
</tr>
</tbody>
</table>

3.1 Architectural and functional aspects
“Bairro da Bouça” was designed by a contemporary famous Portuguese architect, Siza Vieira. It became a reference space in Porto, not only for its unique implementation process but also for its architecture.

Despite the fact of the building had been constructed in two steps, this did not affect its general appearance once that, simultaneously to the end of the projects’ construction, a rehabilitation process began for the first 52 already constructed buildings. The simple forms and orthogonal lines are repeated throughout the buildings, making a formally and aesthetic harmonious space. It can be considered a functional space, with flexibility of use and access, adaptable to the everyday life.

3.1.1 Functional aspects and flexibility
All the buildings have a white colour, topped with a gloomy red band on its crown. The façades contrast with the green open spaces and with the gray granite of the outdoor pavement. The windows’ frames are yellow and have single glasses.

There are four buildings with two floors (ground floor and 1st floor) and at the end of the rows there are blocks for social and commercial equipment. (Figure 3). The ground floor basic
metric element is 80 m$^2$. The ground floor is smaller (74 m$^2$) because the buildings step back at the top floor, forming terraces at each end.

On the North, there is a linear structure. It is a side wall with external stairs to the flats and to the subterranean car parking. It has also the function of protecting from the previous train line noise.

The outside spaces have considerable spatial dimensions, presenting different typologies: green spaces with lawn and vegetation stratum, a soil open space, a terrace and good accesses, although sometimes they are narrow, which difficult their functionality. Those spaces allow enjoyment to all residents: children, adults and older people (retirees). The open spaces are adapted to the residents’ needs; they are used by the residents and often visited by architecture lovers. The outdoor space has a clean appearance and is open to the street, in order to be integrated in the neighbourhoods.

3.2 Structural system, loading and fire performance

The original construction material reflects the existing limited financial resources.

At the outside, there are concrete stairs and bent rails. The facades, door and window frames are painted. The windows have single glasses.

The materials used on open spaces are simple: clay, concrete and granite. The green spaces are covered by grass and one of them has few trees linearly distributed. There is no difficulty to drain/ remove rainwater, once there are permeable areas with the capacity to absorb water. The area is not exposed to extreme weather conditions and the materials are resistant to moderate weather conditions.

The Fire safety is regulated by the Safety Regulation against Fire in Residential Buildings (Law-decree nr. 220/2008, of November 12th). The nearest fire station is located at 1.4Km.

3.3 Energy efficiency and building physics

The project of the “Bairro da Bouça” had financial limitations and it has influenced the energy efficiency and buildings physics. There was higher heat loss, making many dwellings cold, especially because of building facades and around windows. Only with the new buildings’ construction and the old buildings’ renovation, namely with the new thermal insulating materials the buildings achieved better thermal comfort conditions. The coating around the building allowed a decrease in energy consumptions. It caused satisfaction in residents who have lived on the first 52 houses. The windows continue with simple glass and wooden frames. On the top floor dwellings marquees were built, contributing to a better thermal insulation.

All the buildings have the facades exposed to northwest and southeast.

3.3.1 Ventilation and indoor air comfort

There is mechanical ventilation in every building. Natural ventilation is potentiated

Figure 3. Bairro da Bouça (Águas Férreas Cooperative), Porto, Portugal.
3.3.2 Moisture

Moisture had been a problem in most of the dwellings before refurbishment. In the new dwellings and in the older ones after refurbishment the problem has been, according to user’s perception, drastically minimized.

3.3.3 Acoustics and visual comfort

Despite of limited founding, the architecture and the design of buildings, the scale and the lighting contributes to a high visual and acoustics comfort. The open space has a clean appearance, making it a formally and aesthetic harmonious space.

3.4 Accessibility

The “Bairro da Bouça” has good and well distributed outdoor and indoor housing access but they are a little narrow. The doors and the windows are narrow, too. It is a not comfortable and not functional characteristic for families with elderly, children or obese people, making it difficult to access, especially for prams and wheelchairs or other mobility aides.

There are accesses for people with physical disabilities (ramps), but the access to the 1st floor is not easy. There are no lifts in the buildings. The underground parking access is direct and easy by stairs. The ground floor and the 1st floor have individual and direct access to the outdoor. There are simple, direct and flexible accesses to outside spaces: large open spaces with soil and green spaces with grass and few trees. The green spaces have simple vegetation, they are practical and allow leisure activities.

The “Bairro da Bouça” has good and easy accesses to the surroundings and it is open to the neighbourhoods.

3.5 Health aspects and structural and material safety

The material (concrete, cement, gravel, grass) used outside is resistant. The space doesn’t present risks of natural hazards. However, the accesses to the inside area are narrow and in case of fire the rescue operations can be difficult.

3.6 Social aspects

The residents are from different social, economic and age groups. This differentiation is the result of the different implementation models. So the first residents, members of the Association of Residents of Bouça - people with housing needs – coexist with new residents, members of the “Águas Férreas” Cooperative - with more economic opportunities. These different groups share the building and the social spaces (outside spaces), they interact and they are integrated into the surrounding community. Crime is not a major problem in the neighbourhood. In the refurbishment, some modifications were implemented, in order to improve the security, like the security gates placed at the entrance porches as well as shutters on the windows. Inappropriate social behaviour and vandalism are the more usual crimes.

3.6.1 Perception of users and illegal interventions

The residents had a strong participation in all the project and construction process. During the refurbishment process, the residents were also called to participate. Some changes were made in order to answer to the residents’ preferences.

The residents have the opportunity to participate in the “Águas Férreas” Cooperative meetings to discuss the problems of “Bairro da Bouça”.

315
3.7 Management and financial aspects

“Bairro da Bouça” was first developed by the SAAL programme, established by a residents’ association and supported by the central government and local authorities. The central government guaranteed a portion of the funding (about 40%), the remainder being mobilized by the residents through self or own savings, or other forms of financing (bank loans, from relatives, etc. ...). With the SAAL extinction, in 1976, the neighbourhood was still incomplete until few years ago. For the conclusion of the project, in 2006, was essential the support of the National Federation of Economic Cooperatives Housing and the Cooperative “Águas Férreas”, formed by the Union of Cooperatives CETA, “Sete Bicas” and the Association of Residents of Bouça. The project was also financed by the IHRU (Housing and Rehabilitation Urban Institute).

3.7.1 Maintenance requirements

Both indoor and outdoor spaces were renovated by the time of the last improvements and construction, in order to accomplish the total project (finalized in 2006). The project was adapted to the actual basic needs requirements and to the current regulations for housing. The simple architecture forms and the materials used simplify the maintenance operations.

3.7.2 Interventions, repairs and rehabilitation

The “Bairro da Bouça” was conceived and built under great economic difficult conditions. The initial construction materials’ quality is a reflex of that financial scarcity. With the extinction of the SAAL programme, the project has remained unfinished for about three decades. During that time, some residents did some repairs in their dwellings. In the 2000’s the project has finally been completed and all the previous dwellings have been refurbished.

4 DWELLING PROFILE

There are 128 dwellings, organized in 4 buildings. 44% of them were built during the first stage of the neighbourhoods’ implementation, in the 1970’s, and 56% were built during the second stage, in the 2000’s. All the previous dwellings were refurbished at that time. The typology of the dwellings is very diverse, coexisting dwellings with 1, 2, 3, 4 and 5 rooms.

In order to understand the users’ perception about the neighbourhood, a survey has been applied. The survey contained questions related with the socioeconomic status, the building and the quality perception of the dwellings. The surveys were applied in 48 dwellings (38% of the dwellings).

4.1 Architectural and functional aspects

Both implementation stages of “Bairro da Bouça” were projected by Alvaro Siza, the most famous Portuguese architect. The dwellings’ architecture reflects the architects’ style, namely in its simplicity and geometry accuracy.

Each of the four buildings is four-floors high and consists of two stacked back-to-back dwellings with two floors. The typical dwelling presents, at the top floor, a kitchen, a living room, and bedroom at the gallery level, having two bedrooms and a bathroom on the second floor; in the ground floor dwellings, the bedrooms are on the lower level and living spaces above. The dwellings’ layout is simple and functional. For the original users, the duplex typology began to be seen as something strange. For the new residents, this typology, which allows more privacy between the two dwelling levels, is seen as a positive feature.

The architectures’ quality is valued by the residents. According to the applied survey (Figure 4a), the reasons for the housing selection were very different. However, in a total of 82 responses, 11% correspond to the architectures’ quality and 14% to the places’ pleasantness, enlightening the importance of the indoor and outdoor aesthetic quality. The details’ simplicity reflects the difficult conditions when the neighbourhood was projected: the agitated political situation following the collapse of the dictatorship, a severe shortage in building materials and capital for construction, the impoverishment of the population. In the 2000’s, when the project
was completed and the previous dwellings were refurbished, few changes from the original design were made, driven both by changes in regulations and by new populations’ necessities, namely in what concerns to materials and detailing.

4.2 Structural system, loading and fire performance

Walls (supporting structures) are mainly constituted of concrete. The floor is composed by concrete slab with cork mosaics. The buildings’ fire safety is considered to be good, due to the use of fire resistant materials like concrete. However, the accesses to the dwellings are narrow, which could difficult rescue operations in case of fire.

4.3 Energy efficiency and building physics

The applied survey indicates that the “Bairro da Bouça” inhabitants consider the dwellings airy (85%) and sunny (71%). 48% of the respondents think that the dwelling is warm in the summer and only 29% agree that is cold in winter (Figure 4c). In 40% of the dwellings, there is no use of acclimatization facilities. Among those who use some kind of acclimatization, heating appliances, especially electric, are widely preferred. Cooling appliances are almost inexistent (Figure 4d).

4.3.1 Ventilation and Indoor Air comfort

There is mechanical ventilation in every building. Natural ventilation is appreciated by the dwellings’ users. 94% of the dwellings are diary naturally ventilated. Only 6% of the dwellings are naturally ventilated just during the hot season (Figure 4e).

Figure 4. Survey results (all results are show in %).
4.3.2  Moisture

Moisture had been a problem in most of the dwellings before refurbishment. In the new dwellings and in the older ones after refurbishment the problem has been, according to user’s perception, drastically minimized. However some problems still persist. 38% of the dwellings still have problems with humidity or water infiltrations. Nevertheless, only 15% agrees that the dwelling is humid (Figure 4b).

4.3.3  Acoustics and visual comfort

Due to poor technical quality, soundproofing is not good enough. The applied survey indicates that some of the “Bairro da Bouça” inhabitants consider the noise as a problem (50%). In terms of visual comfort, the dwellings are simple and functional. 85% of the inquired users think that dwellings are airy (85%) and sunny (71%). Despite the relatively small size of the dwellings, reflecting the social housing regulations, 69% of the respondents consider the dwelling spacious (Figure 4c).

4.4  Accessibility

The narrow doorways of dwellings have been appointed as a problem, not only for the disabled or elderly, but also for families with small children. The existence of steps in the dwelling has been also appointed has a problem to older or disable people.

4.5  Health aspects, and structural and material safety

Material safety is at a good level, having no hazardous materials been used. Every dwelling has hot and cold running water. There is also a bathroom with a shower and a toilet in every dwelling.

4.6  Social aspects

“Bairro da Bouça” was built in two well differentiated temporal contexts, corresponding to different implementation models (residents association and cooperative) and consequently, to different socioeconomic levels. Moreover, the project is from a renowned architect, which led many young artists and architects, to choose to live there. Therefore, the neighbourhood is characterized by a social mixture.

The education levels are an excellent illustration of this social mix. On the studied dwellings the representation of people with less than 4 years of education (27%) is similar to those with 10 to 12 (25%) years and with a degree (27%). Some people have masters or PhD’s (Figure 4f).

Monthly charges for housing are very different, reflecting these diverse contexts of housing ownership. In the studied sample, the lowest charge found was 40 € and the higher 600 €, with an average of 265 €. The income is also well differentiated. People who lived there before the construction of the second phase have a lower average monthly income per capita (385 €) than new residents (628 €).

4.6.1  User's possibilities to influence to their dwellings and illegal interventions

The residents had a strong participation in all the project and construction process. During the refurbishment process the residents were also called to participate. Before the refurbishment project, some residents did some modifications in their dwellings. During the refurbishment project, the architects took cues from resident modifications to the old buildings that had occurred over the years.

The residents have the opportunity to participate in the “Águas Férreas” Cooperative meetings to discuss “Bairro da Bouça” problems.
4.7 Management and financial aspects

The last refurbishment project was financed by the National Federation of Economic Cooperatives Housing, the Cooperative “Aguas Férreas” and the IHRU (Housing and Rehabilitation Urban Institute).

4.7.1 Maintenance requirements

All the dwellings have been refurbished few years ago, so actually there are no important maintenance requirements. The residents are responsible for maintenance and little repairs in their own dwellings.

4.7.2 Interventions, repairs and rehabilitation

In the 2000’s, when the project was completed and the previous dwellings were refurbished, the aesthetics and the thermal comfort of the neighbourhood were improved. In order to answer to the residents’ preferences, like the sliding wall placed in the living space, that allows the room to be divided and used for secondary purposes and the division of the old bathrooms, in such a way that the bath and WC were separated enclosures.

5 CONCLUSION

The “Bairro da Bouça” is nowadays recognized as a successful example in terms of housing policy. Several reasons contribute towards this achievement.

First, the strong participation of the residents in all the project and construction process. Bairro da Bouça is a reference for a very significant period of our recent past, the post-revolution, when SAAL was formed to seek state aid, to relieve poor housing conditions in Porto. One of their intentions was to make it possible for the residents to intervene at any phase of the process, from the selection of projects, typologies, supervision of works, to the allocation and management issues. The residents’ participation was one of the most important characteristics of the movement. With the SAAL extinction, the project remained unfinished. And even 30 years later the project was rehabilitated and concluded with the cooperation of the residents, nowadays organized into a cooperative.

Second, the architectural quality and its central localization. Projected by Alvaro Siza, the most famous Portuguese architect, it is an internationally recognized example of good architecture at low construction cost. The aesthetic and functional quality contributes to residents’ sense of place. One the other hand, Bairro da Bouça has a central and well connected localization and was conceived in order to be permeable to the surrounding space, being crossed and seen by the city users, contributing to a lower risk of social segregation.

Third, and as result of the previous points, Bairro da Bouça presents today a remarkable social mix. Several reasons have led young people with high levels of education, artists and architects, to choose to live there: architectural quality, low costs derived from the cooperative model, central location.

6 REFERENCES

A V Monografias (2007), 126, pp. 98-105
Jornal Arquitectos (2008), n.º 232, pp. 86-93.
http://www.ceta.pt/
http://www.housingprototypes.org
http://infohabitar.blogspot.com