European Cooperation in the field of Scientific and Technical research

COST PROJECT TU 701
www.costtu0701.unife.it

IMPROVING THE QUALITY OF SUBURBAN BUILDING STOCKS

Workshop Meeting, 16th and 17th January 2009, Porto-Portugal

Ana Monteiro; Fátima Matos; Helena Madureira

anamonteirosousa@gmail.com; fatima.matos@tvtel.pt; hmadureiramail@gmail.com

WG – 02

TU 701 – WG – 2009

DATE: 2009-01-16

INDEX

1. COST ACTION TU0701 OBJECTIVES

Domain: Transport and Urban Development

Action title: Improving the Quality of Suburban Building Stocks

Suburban building estates represent more than 50% of all European Urban Heritage. Most of the buildings – generally multi-familiar housing blocks, consisting of small apartments – were completed after 1950, using low-cost technologies and are often characterized by very poor quality, which contributes to the suburbs social decay. The aim of the Action is to investigate, compare, define and disseminate common knowledge concerning to methods, procedures and technologies towards the renovation and revitalization of suburban housing settlements, increasing their value, and improving its inhabitants' safety and the quality of life.

The approach is based on a Quality concept, which incorporates a multitude of factors including energy efficiency, accessibility, sustainability and multi-functionality of buildings. On the other hand, quality standards must be improved, in order to satisfy the users' needs, such as comfort, safety and accessibility, as well as the new European regulations concerning sustainability and energy savings. In order to achieve these objectives, new specific social, financial, technical and procedural models must be developed to facilitate the decisions taken by local authorities, housing corporations, owners and designers.

A relevant number of representative case studies from the countries involved in the Action will be analyzed to test and validate the results achieved.

Keywords:

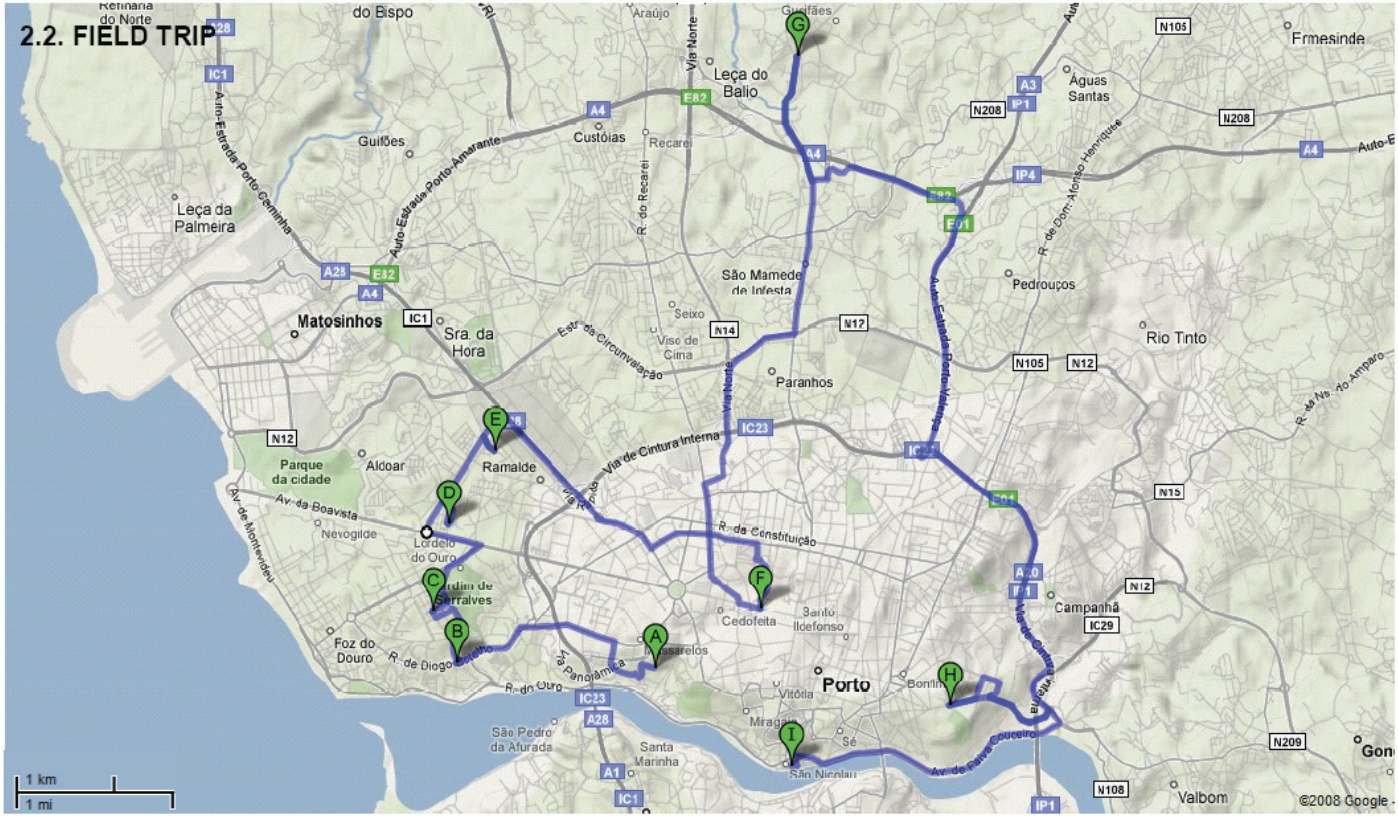
Suburban Areas, Building Quality, Housing Stock Improvement and Renovation, Sustainable Development, Energy Efficiency, Quality of Life, Safety of Citizens, Accessibility, Social Integration, Employment Opportunities

2. WORKSHOP MEETING 16TH AND 17TH JANUARY 2009 (PORTO-PORTUGAL)

2.1. PROGRAMME

		16 Jan	17 Jan
am	9.00 - 10.30	meeting	meeting
		cofee break	cofee break
	10.45 - 12.30	meeting	meeting
		lunch	lunch
pm	2.30 - 4.00	meeting	
		cofee break	Porto housing estates field trip
	4.15 - 6.00	meeting	
	6.30 - 8.30	Porto wine caves tour	

2.2. FIELD TRIP



A Flup

B Aleixo
Lordelo
Pinheiro Torres
Pasteleira Novo
Murteira
Pasteleira (Improvement Plan)

C Gomes da Costa (Casas Económicas)

D Previdência (Inatel)

E Campinas
Pereiró

F Bouça

G Norbiceta

H "Ilhas" (S. Víctor)

I Ribeira

B

Aleixo

Lordelo

Murteira

Pinheiro Torres

Pasteleira Novo

Pasteleira(P. M.)

C

Gomes da Costa

D

Previdência (Inatel)

E

Campinas

Pereiró

F

Bouça

G

Norbiceta

Source: LiveMaps

3. THE CHARACTER OF PORTO

3.1 POPULATION

Porto is the second most important town in Portugal and is situated inside a metropolitan area (Porto Metropolitan Area) with 1 281 424 inhabitants, located in the NW coast (Fig. 1). In 2005, Porto had 233 465 inhabitants. Porto is a city with a daily flux of more than 500 000 persons. It concentrates mainly services – administrative, educational and cultural – and offers more than 218 000 jobs. 50% of the employees come from nearby municipalities.

Fig.1 - Location of Porto

Porto's population evolution was, until the 80's, very similar to the rhythm of its metropolitan areas' (AMP). After this decade, while Porto's population decrease, its metropolitan area experienced a population increment (Fig.2). The demographic regression of Porto along the last decade of the 20th century happened mainly because of the huge housing decentralization, as well as it was due to an enormous fall on the birth rates.

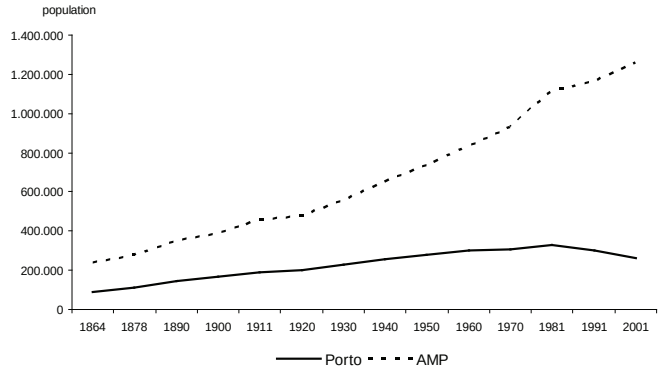


Fig.2 - Population evolution in Porto and AMP. Source: Census, INE

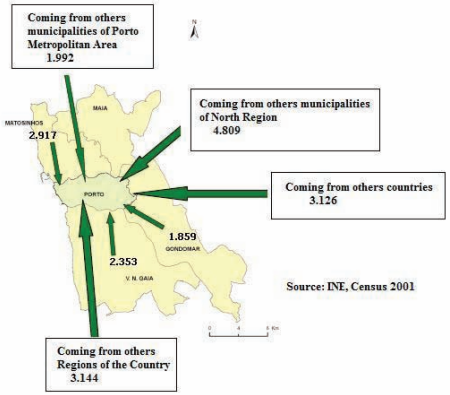


Fig. 3 – Porto's immigrants according to departure place (1995-2001)
Source: CMP (2007)

Porto's population drainage process, mostly towards the nearby municipalities of AMP (Fig.3,4), and the births drop was accompanied by structural changes in family type and in the age pyramid distribution. The average family size diminished, the number of single parent families augmented and the number of lonely elderly people increased.

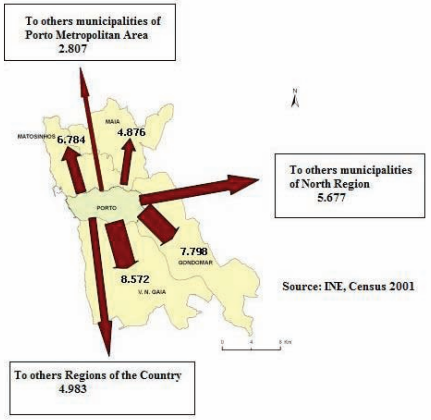


Fig. 4 - Porto's emigrants according to the arrival place (1995-2001)
Source: CMP (2007)

Porto's immigrants coming from other municipalities of Portugal	***17074***
Porto's immigrants coming from other countries	3126
Porto's emigrants coming from other municipalities of Portugal	41497
Population that moved from one civil parish to another inside Porto	26076
Population Resident in Porto, 2001	263131

Table 1- Resident population in 2001 and residential migration from 1995. Source: INE (2001)

Nevertheless, the population pouring out process was not homogenous in the city: higher in the central and eastern civil parishes; lower in the western and peripheral civil parishes. Ramalde is the only parish with a positive population budget of 3,7% from 1991 to 2001 (Fig.5).

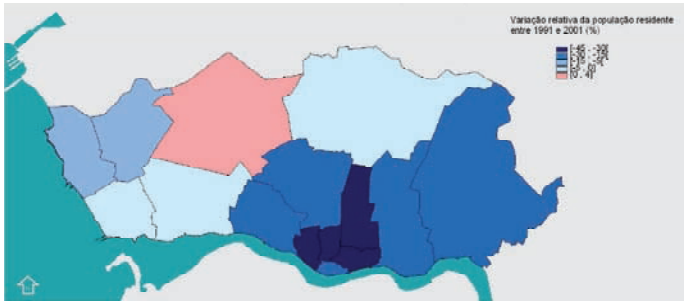


Fig. 5 - Porto's population variation (1991-2001)
Source: Census, INE

Porto's population density (2001) was 6500 inhab/km2. However, there was a great inner differentiation, with about 70% of the city with population densities above the average (i.e. > 20000 inhab/km2). The lowest population densities were in the outskirts of the city (Fig.6).

Porto's Metropolitan Area population density (2001) was 360 inhab/km2. Metropolitan municipalities closer to Porto shown higher densities - Matosinhos (2681 inhab/km2), Vila Nova de Gaia (1690 inhab/Km2), Maia (1435 inhab/km2), Gondomar (1231 inhab/km2) and Valongo (1178 inhab/km2).

Fig. 6 - Population density in 2001 by statistical section
Source: CMP (2007)

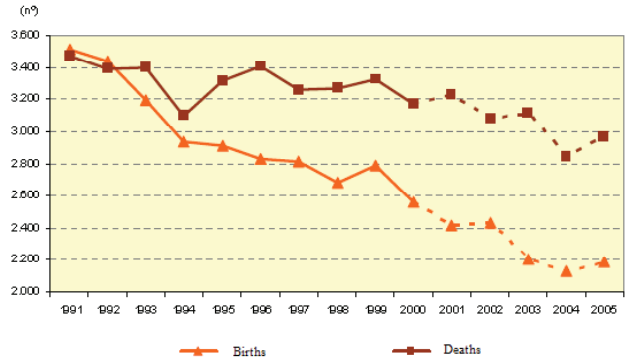


Fig. 7 – Births and Deaths in Porto, 1991-2005
Source: INE, Demografical Statistical

The number of births and deaths has decreased during the last 20 years. The reduction on births' gradient is, since 1993, steeper than death's. In 2005, the huge difference between births and deaths results in a deep negative natural budget.

Fig.1.8 – Population with <= 15 years age by statistical section, in 2001
Souce: CMP (2007)

Nowadays, Porto's age profile shows a great number of old people mostly in the ancient city centre. During the 90's, the citizens with more than 65 years augmented from 15% (1991) to 19% (2001). The elderly rate rose up from 87 old/100 young (1991) to 147 old/100 young (2001). Anyway, people in active age correspond still to 68% of Porto's population.

3.1. BIOGEOPHYSICAL CONTEXT

"...A house is an imposition on the land when the resources necessary to sustain it are funnelled through a one-way system: water supply - bathroom tap- drain- public sewer or, food- kitchen- dump. The byproducts of use serve no useful function..." (HOUGH, M.; *City form and natural process*, Routledge, London, 1989, p.24).

3.2.1. CLIMATE AND BIOCLIMATE

Climate

The concept of climate as an open, active and complex system, whose vitality is directly dependent of the energy and matter exchange capacity with the exterior, helps our understanding and awareness of how close are the relationships among Built Environment and Climate.

Nowadays, particularly in urban areas, we assist to an increasing instability of the climatic system. The multiple and different alerts already shown by climate, combine cause-effect reactions of several stimulus coming from different time and space scales. Unfortunately, it is yet not possible to differentiate the noise in the correlation among built environment and climate. Part of this is due to the climate systems' complexity. This organized structure is capable of memorizing events and conferring consequences in time.

However, and besides the increase of hazards due to the higher urban vulnerability to climatological extreme events, the number of people leaving the country and coming to the city searching for a better "quality of life" doesn't diminish. More than 50% of the globe's population still prefers to live in urban environments.

To understand this global human preference on a higher risk level scenario we must remember that "well-being" is a complex concept that means: having the capacity to survive and to reproduce; being able to practice diversified physical exercise without exhausting himself; being able to rise and then maintain position in society and, feeling well emotionally well. The fulfilment of, at least, some of all this requisites is better achieved in cities than in rural areas.

When looking to Porto's century's temperature data it is easy to find the existence of a steady increase mainly in the winter minimum, which cannot be merely interpreted as the result of intrinsic climatic variability (Fig. 9). Frost nights, summer days and tropical nights' episodes, as well as the cold spells' and heat waves' frequency appear to point out the strength of climates' impulsiveness due also to men activities.

Rainfalls' behaviour along the last century also illustrates some kind of climatic disorganization. The increase of exceptional episodes of heavy rain or drought, as well as the unexpected occurrences of rain in summer or drought in winter are examples of this unusual irregularity (Fig.10).

The temperature and rainfall extreme and exceptional episodes seem to take place much more frequently now

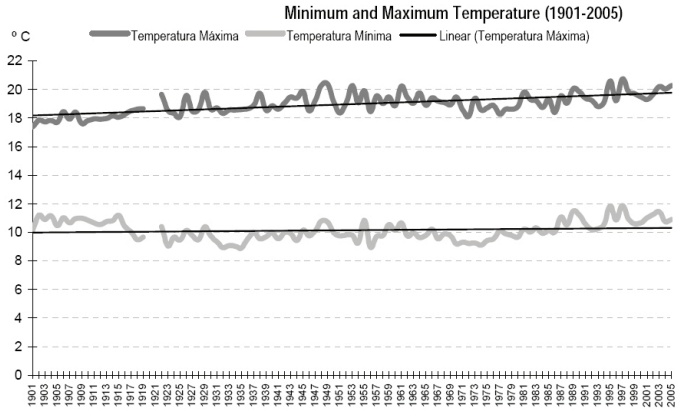


Fig. 9 – Minimum and maximum temperature in Porto (1901-2005)

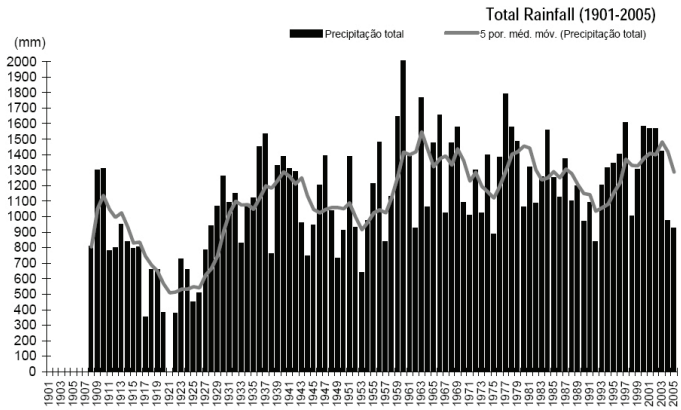


Fig. 10 – Total rainfall in Porto (1901-2005)

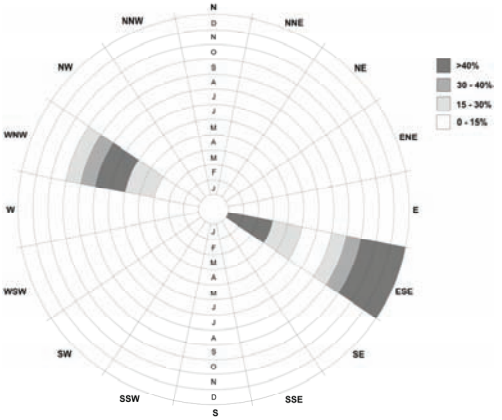


Fig. 11 – Dominant wind directions in Porto (1900-2005)

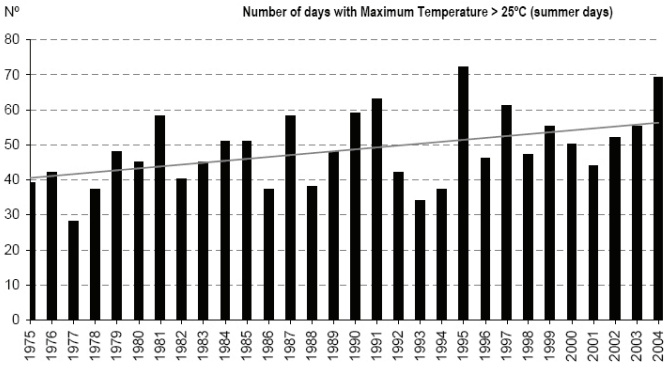


Fig. 13 – Number of days with maximum temperature >25ºC (summer days) in Porto

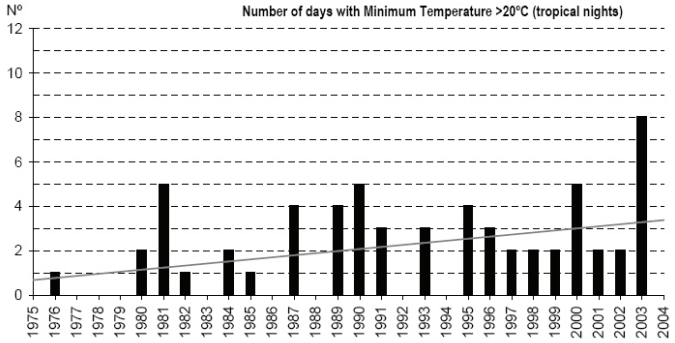


Fig. 12 – Number of days with minimum temperature >20ºC (tropical nights) in Porto

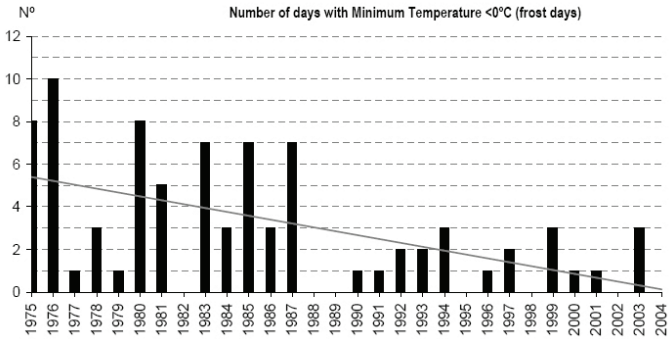
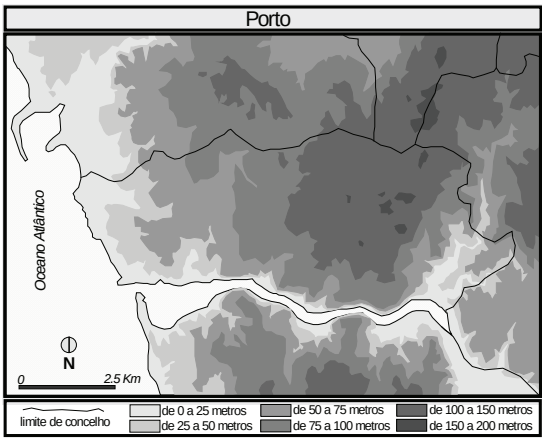


Fig. 14 – Number of days with minimum temperature <0ºC (frost nights) in Porto



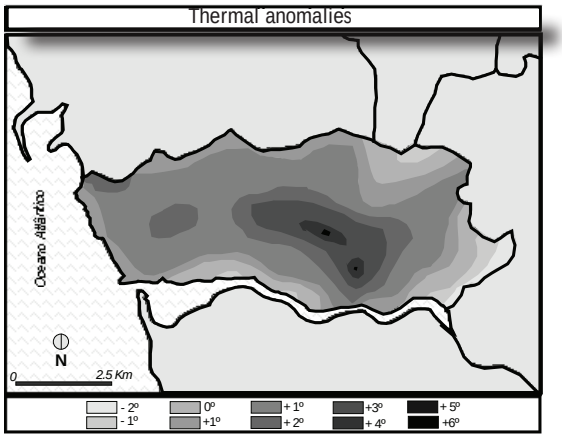


Fig. 15 – Thermal anomalies in Porto

CITY	INHABITANTS	T(u-r) MEASURED	PREDICTED	AUTOR
LONDON	8500000	10°C	9.9°C	CHANDLER, 1965
BERLIM	4200000	10°C	9.3°C	GRUNOW, 1936
VIENA	1870000	8°C	8.5°C	SCHMIDT, 1927
SHEFFIELD	500000	8°C	11.5°C	GARNETT, 1966
MALMO	275000	7.4°C	7.4°C	LINDQVIST, 1972
LISBON	830000	4°C-5°C	7.8°C	ALCOFORADO, 1988
COIMBRA	98000	5°C	6.0°C	GANHO, 1992
PORTO	**300000**	**6.0°C**	**6.9°C**	**MONTEIRO, 1993**

Table 2– Comparison of positive thermal anomaly effectively found in several cities with the predicted by Oke

than before (Fig.12 to Fig. 14). This type of unusual performance can be viewed also as a short-term temporary answer to the uncountable human interferences in the climatic system. It seems almost certain that Porto's climate already shows some cumulative effects of Global Warming and Urbanization impact.

The urbanization impacts on local climate context are well described by itinerant temperature measurements done in the city (Fig.15, 16). There is a tight relationship between urban life metabolism, life rhythm, housing typology, sky view factor and the presence of stronger nocturnal positive thermal anomalies.

At Porto, neither the E-W topographical differences, nor the closeness of two important water mosaics (the Atlantic ocean and the Douro River), nor even the effects of the diversity of the built environment constructed along more than eight centuries of history are enough to dissipate the impacts of the urban metabolism on city's energy balance (Fig. 15). The geographical differences may also contribute to explain the "heat-island" shape and intensity, but rarely withdraw it.

During the last 20 years of experimentation, under the most diverse weather conditions, in different seasons and at several hours of the day and night, we verified that there is always a well defined strong core involving Aliados Avenue –Republic Square-Boavista Street area and the Marquês - Constituição - S.Roque area, with temperatures above those registered at the other points distributed throughout the city. These two "heat

islands" are coincident with the city centre, from an administrative and functional point of view. The first "heat island" delimits the coalescence of the main CBD, located at Liberdade Avenue, with the secondary CBD, at the Boavista roundabout. The second "heat island" includes the areas most used by the transport network, the corridors of better accessibility to and from the city centre, which serve the E area.

These "heat-islands" are obviously particularly evident on days of great atmospheric stability, weak barometric gradient, weak wind and very frequent periods of calm.

The effects of urbanization on local climate emerge in a very simple formula that only takes into account the population size (Oke formula: DTu-r (max.) = 2.01 log. pop.- 4.06). When we compare Porto or any other city, the positive thermal anomaly effectively found with the predicted by Oke formula shows that the values are very similar (Table 2).

The values likeness found result from the significance that population has in terms of number and diversity of urban activities, as well as traffic intensity, artificial waterproofing, of anthropogenic emissions of energy and pollutants. As all this components of the urban built environments interfere with the energy budget and affect the climate system resolution. So it is reasonable thinking that the population size of a city may clearly suggest the "urban heat island" magnitude (Table 2).

The reconstruction of the natural surface made in an urban area creates a bunch of unique microclimates due to

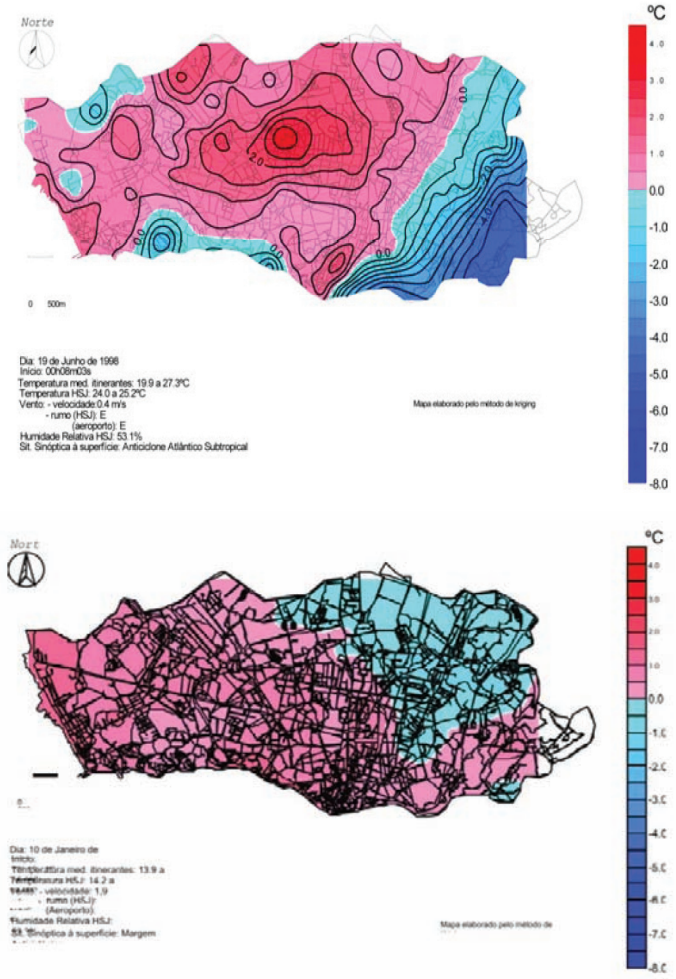


Fig. 16 - Porto's "heat-islands"

the way energy inputs and outputs happen. Construction materials, building volumes and height, number and relative position of windows, façades' dimension and orientation, road width and orientation, sun exposure, etc. contribute to the generation of several new local energy budgets (Fig. 15, 16).

Bioclimate – Porto's comfort

The atmospheric context, combined with the complex artificial reconstruction of natural cover, produces, at Porto, a collection of unique outdoor and indoor comfort conditions.

The citizen's quality of life and well being feelings depends much more of this final result – natural and artificial climate factors – than of the scenario description obtained from the climatological stations data. Porto's PET index and Givoni and Watson's formulas illustrate how Porto has excellent outdoor comfort conditions during almost all the year. In summer and during 4 months (June-September), about 50% of the days might be slightly hot and uncomfortable. From October until May, the majority of the days are comfortable with a low frequency of uncomfortable cool days. While in January more than 50% of the days might be very cool.

The consequences of this outdoor comfort conditions should advise decision makers and citizens about some building and designing construction strategies like: construction materials; facades colour, materials and dimensions; roofs type; roads width, etc.

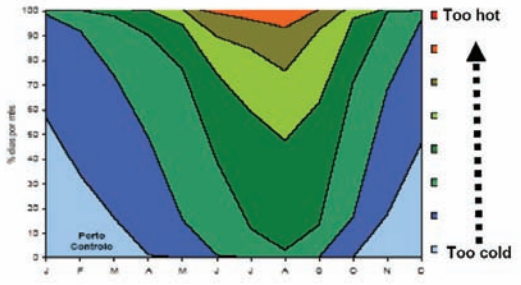


Fig. 17 - Porto's Physiological Temperature Index (PET)

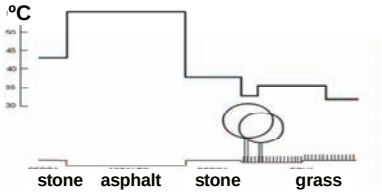


Fig. 18 – The impact of surface cover in urban albedo(TOJO 1990)

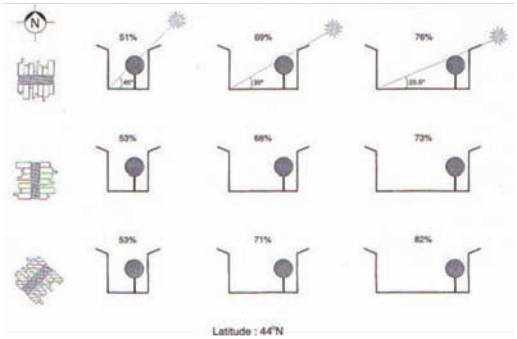


Fig. 19 –The impact of road geometry and orientation
Source: UE et al, 2001.

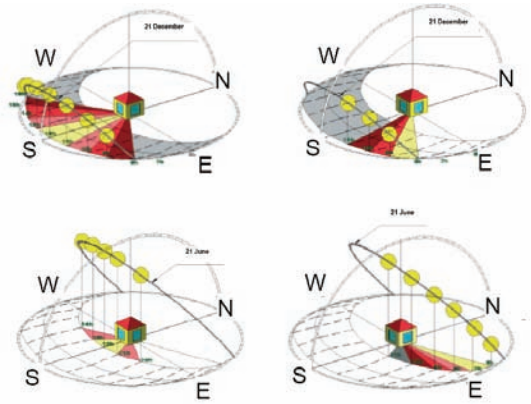


Fig. 20 – The sun exposure in different façade orientations.

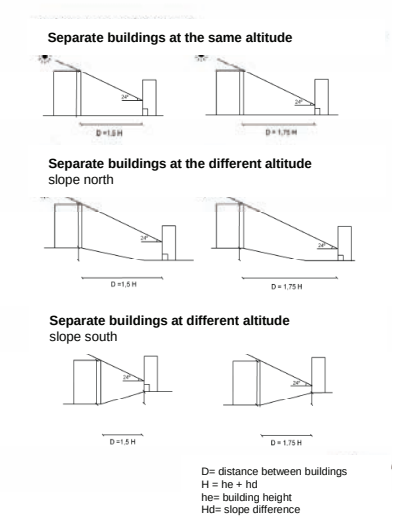


Fig. 21 – The impact of site and position in sun exposure.

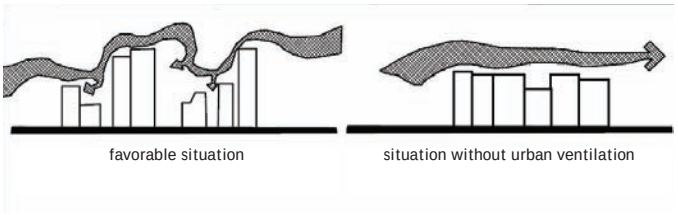


Fig. 22 – The impact of building volume in urban boundary layer ventilation (ROMERO, 1988, p.108)

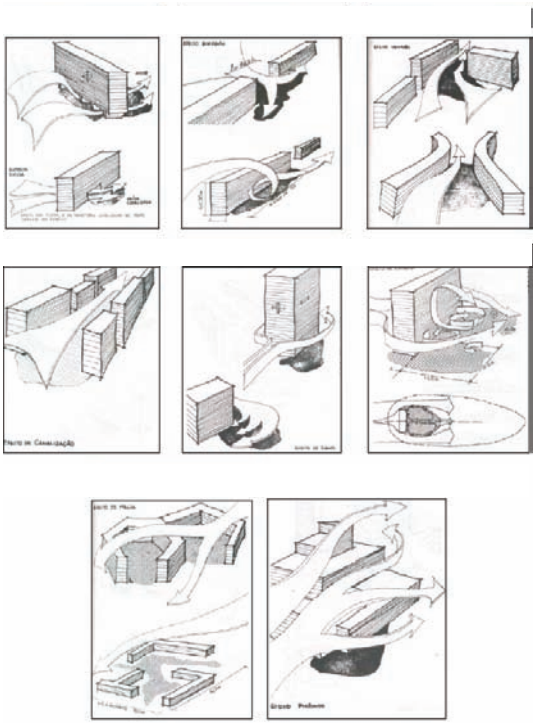


Fig. 23 – The impact of buildings volume and relative location in wind direction and velocity interferences

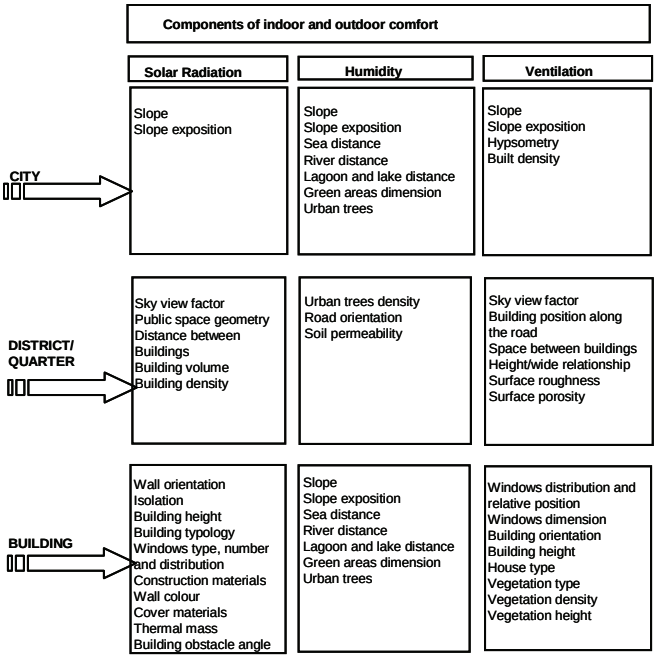


Fig. 24 – Components of indoor and outdoor comfort

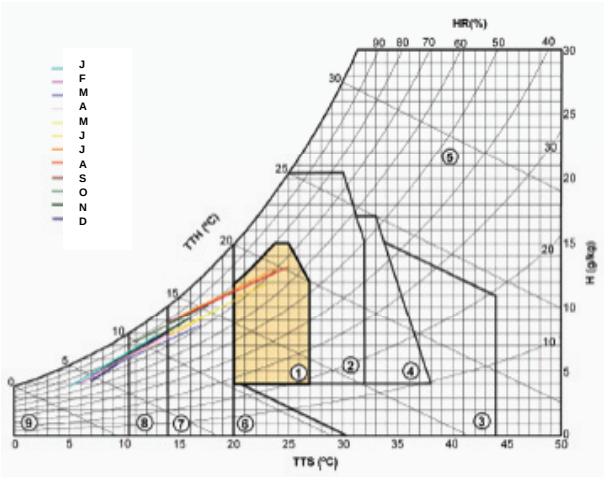


Fig. 25 - Porto's bioclimatic needs (Givoni)

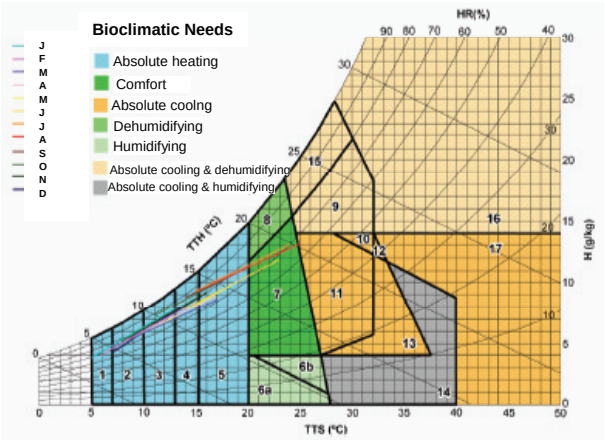


Fig. 26 - Porto's bioclimatic needs (Watson & Labs)

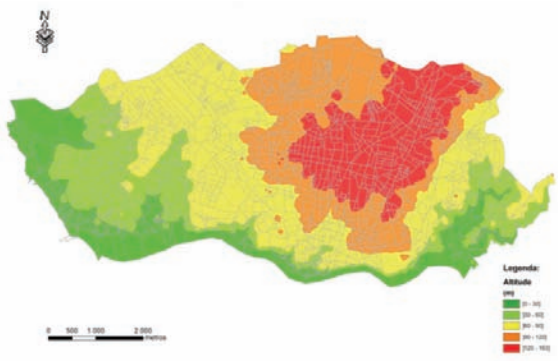


Fig. 27- Porto's hypsometry

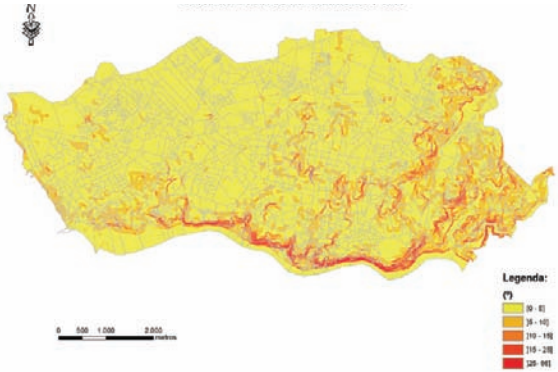


Fig. 28 - Porto's slopes gradient

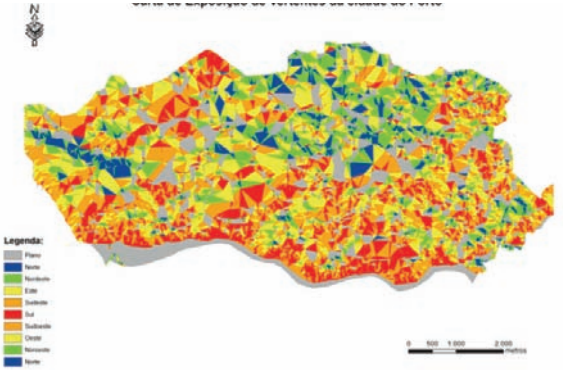


Fig. 29- Porto's sun exposure

3.2.2. GEOMORPHOLOGY AND HYDROLOGY

Porto is located between 8º33'W-8º41'W and 41º8'N-41- º11'N, occupying a rectangle of approximately 12km width and 5km height.

The natural morphology of Porto is composed by a sequence of surfaces tilt towards W from 160m, at Areosa, until 0m, at the Atlantic Ocean. The higher elevations, in the eastern area of Oporto, are aligned on a NNE-SSW axis. The topographic differentiation is due to features belonging to the marginal relief and others related to the shore platform. The first ones are steeper, higher and narrower, while the second ones are more extensive and less steep.

The predominant geological materials are the Porto's granite and the schist-grauvaque complex covered in some places by recent deposits from antique river terraces and beaches.

The slopes gradient varies between 0º and 66º. The slopes gradient, orientation and altitude, combined with the artificial built up environment, promote great sun exposure diversity at Porto. The majority of the numerous smaller river basins are submerged.

3.2.3. GREEN AREAS

Porto has lived a great part of its history with a tight relationship with nature. If inside the big walls of the city the housing was dense and the space was few, on its exterior the agricultural fields were abundant, assuring the daily supply of fresh food to the city.

The Porto of the end of the 19th century, although already reflecting the urban development caused by the industrialization process, was yet a city dominated by the "green". It was green on the enormous ring which surrounded its yet small urbanized core and also green in the interior of the housing blocks from the new neighborhoods, and green on the great number of public gardens which served the city.

That was a context well differentiated from that found in 2000. The decrease of the city's available green is flagrant. If one century ago the green occupied more than 75% of the territory's surface (3044ha), nowadays it occupies less than 30% of the same surface (1164 ha), representing a reduction of about 60%.

Simultaneously, occurred a "territorial homogenization" process that conduced to the disappearance of almost all the rural ring that surrounded the city and the proliferation of more urban green typologies – i.e. gardens and public parks.

The decrease of the presence of green in the city was an inevitable process when we know that one century ago the council was yet not many urbanized. Therefore, this fatal diminish of green was associated to a desirable urban development process. The shapes which this urban development assumed, resulting mainly from the inoperativeness of planning, are those that should be questioned about, namely for being responsible for one of the main characteristics of the green's actual structure: its great fragmentation and discontinuity.

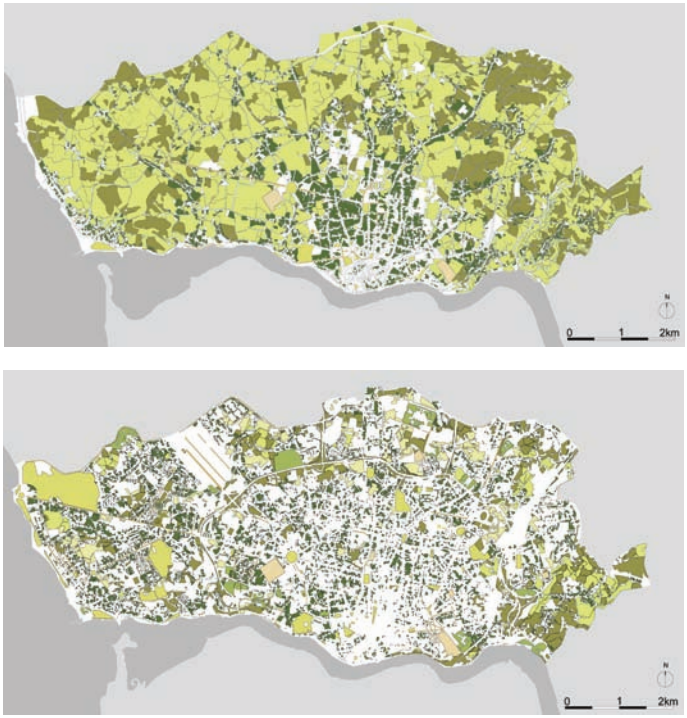


Fig. 30 - Porto's green structure in 1890 and 2000.

IV. PORTO'S SUBURBAN BUILDING ESTATES HERITAGE

4.1. HOUSING SETTLEMENTS CONTEXT (2001)

The main Porto emigration fluxes may be explained by decisions to change residence towards lower cost housing areas in suburbs. About 80% of the Porto's emigrants went away from the city following the dream of living in their own house. The soil price inside the town rose up and some urban functions like housing were obliged to move out. The average expenditure with house purchase, in 2001, was 488€/Month in town and 400€/Month in the suburb. The average expenditure with house renting, in 2001, was 330€/Month at Porto and 270€/Month in the suburb. That's why the house ownerships, in Porto, decrease about 63% during the last decade of the 20th century.

One of the negative impacts of this urban functions modification in Porto was the increase of dependency rate, the augment of abandoned houses and the generalized buildings degradation.

A simple comparison between housing offer and number of families at Porto show precisely the effects of the urban citizens loss due to the raise of housing (Fig. 31). Nowadays, we have in the city housing market a much greater offer than demand. This difference is mainly noticed when we appreciate the temporary housing and the vacant lodges whose increment overpass the rhythm of regular dwellings.

At the same time, the lodgement size grew in number of pavements, number of apartments and number of rooms

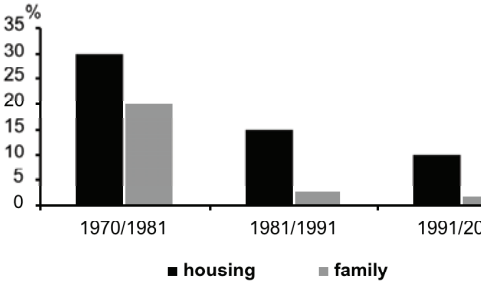


Fig.31- Housing and families evolution.
Source: Census 1970, 1981, 1991, 2001, INE

	Classical families	*Classical housing*	*Precarious housing*	*Permanent housing*	*Seasonal housing*	*Vacant housing*
Porto 2001	99661	124494	773	95899	9760	18835
Variation 1991/2001	0,3%	10,0%	- 1,3%	1,3%	79,8%	53,0%
AMP 2001	432592	537001	3336	424426	51833	63737
Variation 91/2001	22,3%	30,6%	69,6%	25,2%	58,7%	61,2%

Table 4- Transformations in housing occupancy in Porto and AMP, variation 1991-2001 (%). Source: Census 1991 and 2001, INE

	Owned	*Rented*
Porto 2001	47911 50,0%	44747 46,7%
Var.1991-2001	13384 38,8%	-1048 -19,2%
AMP 2001	277169 65,8%	131319 31,2%
Var.1991-2001	113948 69,8%	-19628 -13,4%

Table 5 - Transformations in the Occupancy regime of housing
Source: Census 1991 and 2001, INE

	Owned	
	With mortgage	Without mortgage
Porto		
2001	19530	28381
	40,8%	59,2%
Var. 91/2001	9251	4133
	90%	17%
AMP		
2001	127017	150152
	45,8%	54,2%
Var. 91/2001	76679	37267
	152,3%	33,0%

Table 6– Owned housing, with and without mortgage
Source: INE Census, 1991 and 2001

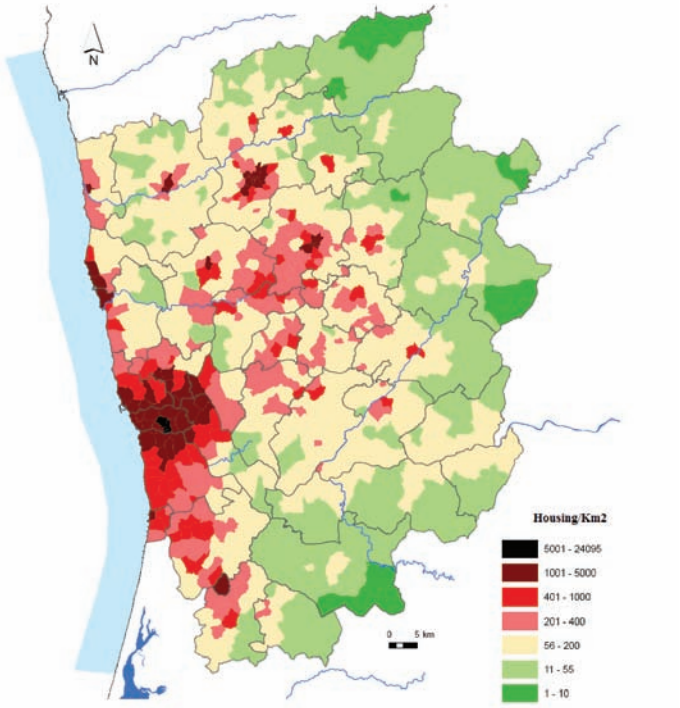


Fig. 32–Density of the housing stock by parish in the NW (2001)
Source: MARQUES et al (2006/2007)

by house. As this coincided with a families size decrease we have now a higher available space per person.

The housing density is higher in Porto and nearest suburban areas and decreases with the distance. The exceptions are the NW medium-size cities and a narrow corridor along the coastline (Fig. 32).

From 1991 to 2001, the housing ownership increased and the rented housing decreased (Fig. 33). This was induced by the bank credit policies that made cheaper the acquisition than the renting. Only in the ancient downtown dominates the rental.

The percentage of overcrowded housing is mainly in the urban city centres and among these in Porto (Fig. 37).

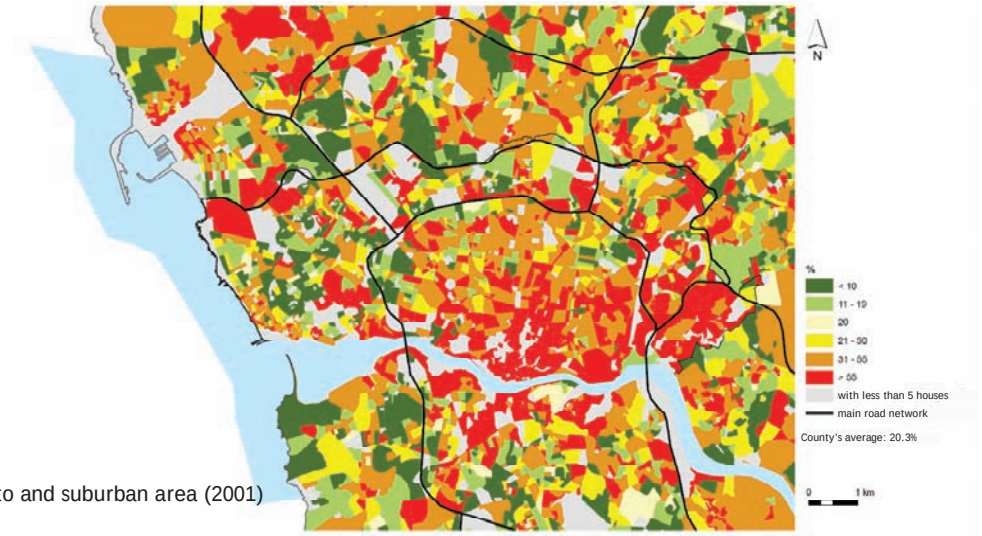


Fig. 33– Percentage of rented house at Porto and suburban area (2001)
Source: MARQUES et al (2006/2007)

Fig. 34 Average age of buildings in Porto and suburban area (2001)
Source: MARQUES et al (2006/2007)

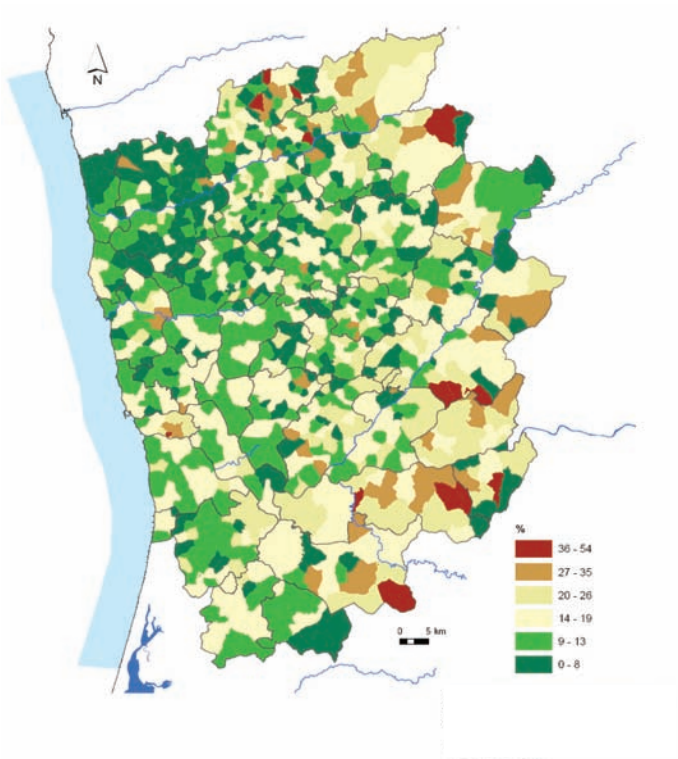


Fig. 35– Percentage of building degradation by parish in the NW(2001)
Source: MARQUES et al (2006/2007)

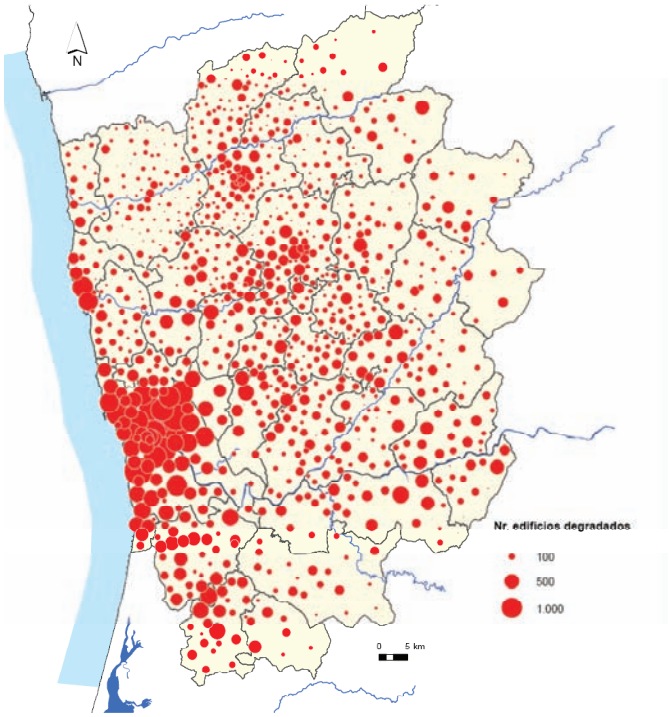


Fig. 36– Number of building degradation by parish in the NW(2001)
Source: MARQUES et al (2006/2007)

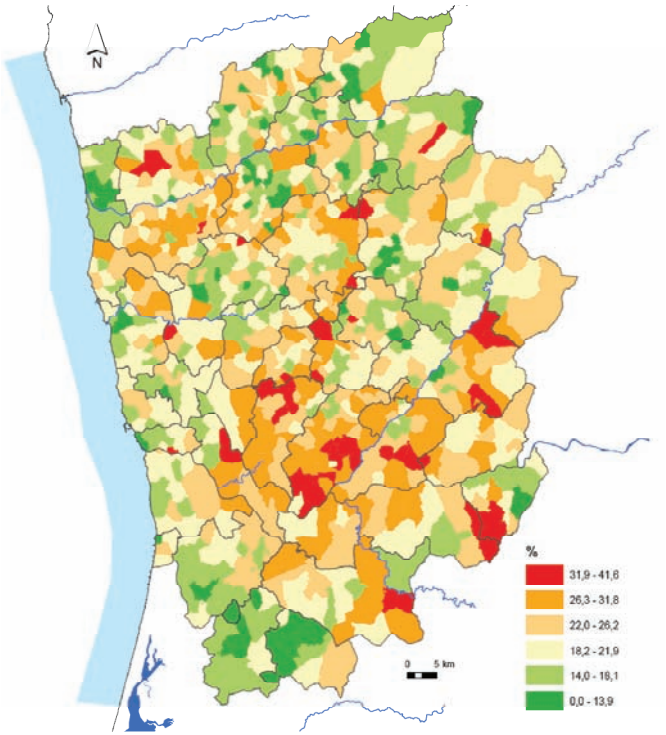


Fig. 37– Percentage of overcrowded housing by parish in the NW(2001)
Source: MARQUES et al (2006/2007)

	Housing without			
	electricity	water supply	bathroom	toilet
Porto 2001	249	471	5760	1220
Var. 1991-2001	-263	-1121	-4117	-1275
AMP 2001	2088	27672	51972	8114
Var. 1991-2001	-1467	-24970	-27289	-4175

Table 7 - Qualitative deficiencies - 1991 and 2001.
Source: Census 1991,2001, INE

4.2. SUBURBAN BUILDING ESTATES CONTEXT

The problem of housing for the most needed populations is not a new subject in the city of Porto and has been persisting during time.

However, the transition from the 19th to the 20th century has been a crucial moment in this process.

All the needed conditions have then turned together for the emergence of bulding estates, a group of solutions capable of mitigating the various problems which affected the city at that time: population growth, rural exodus, city's over-occupation and insalubrious conditions of the residential units.

For the best comprehension of the evolution process of the city's building estates, we shall retain the image of Porto at the end of the 19th century, resuming the main marks that its long history has printed on it.

4.2.1. GENERAL CONDITIONS TO THE EMERGENCE OF BUILDING ESTATES AT THE END OF XIX CENTURY

Fig. 38 - Telles Ferreira city plant from 1892

At the end of the 19th century, Porto suffered from the first industrialization symptoms. The Telles Ferreira city plant, from 1892 (Fig.38), clearly shows a densely built central nucleus, corresponding to the big wall of the city, and the consolidation of an urban structure which had been developing since the 18th century, on the outside of the elder big walls, with strong foundation on a

group of axis that linked the old nucleus to the regional surroundings.

Apart from this expanding nucleus, the city's maritime edging and mainly the urban nucleus of S. João da Foz were also highly built up.

The Walled City

Since the time of its foundation, Porto's history was majorly developed inside the city walls. At a first stage, inside the "old fence", which existed since the beginning of the 3rd century, and was rebuilt on the 12th century. Afterwards, inside the "Muralha Fernandina" of the 14th century, which embraced a larger area, reflecting the urban nucleus' growth of the two precedent centuries.

Ancient Porto's dynamics was based on two fundamental nucleuses: one at the higher quote, around the cathedral, which presented better defensive conditions, the religious and administrative life was concentrated; the second one nearby the river, where the commercial activities from the harbour were established. It was a city with high occupational density, with streets and narrow streets as well as few open spaces.

In fact, this compact city, defined by its wall and its outskirts, disappeared with the populational afflux of the end of the 18th century. The wall was then demolished, and the city expanded, beginning the undifferentiation between the city and the open country. The old inside walls city is Humanity's World Patrimony since 1996.

The Almada's intervention

On the second half of the 18th century, the city lived an economical prosperity period, mainly due to the growing importance of Porto wine's commercialization, which would come to stimulate a notorious population growth, causing high over-occupation of the space inside walls, as well as the first significant pour over off the city wall.

At the same time, the bourgeois from Porto, already in a socio-economical transformation process due to national nobility crisis, had already tended to modify its mentality, through an effort of openness and comprehension of the new European ideals, where the influence from the British community installed in the city was decisive. By the other side, this context was coincident with Lisbon's 1755 earthquake, which had a decisive influence on the principles and mechanisms that guided the interventions in Porto.

On a situation of illuminated despotism, traced by a highly centralized power and an esthetic taste focused on order, clearness and severity, João de Almada founds, in 1762, under the control of Marquês de Pombal, the "Junta de Obras Públicas do Porto", a staff devoted to urban management that reflect the acquired experiences of Lisbon's reconstruction after the 1755's earthquake.

If the earthquake in Lisbon largely justified by itself the urban changes, the actions carried out in Porto presupposed a clear ideological and style justification, ruled by the creation of a new urban potential that can

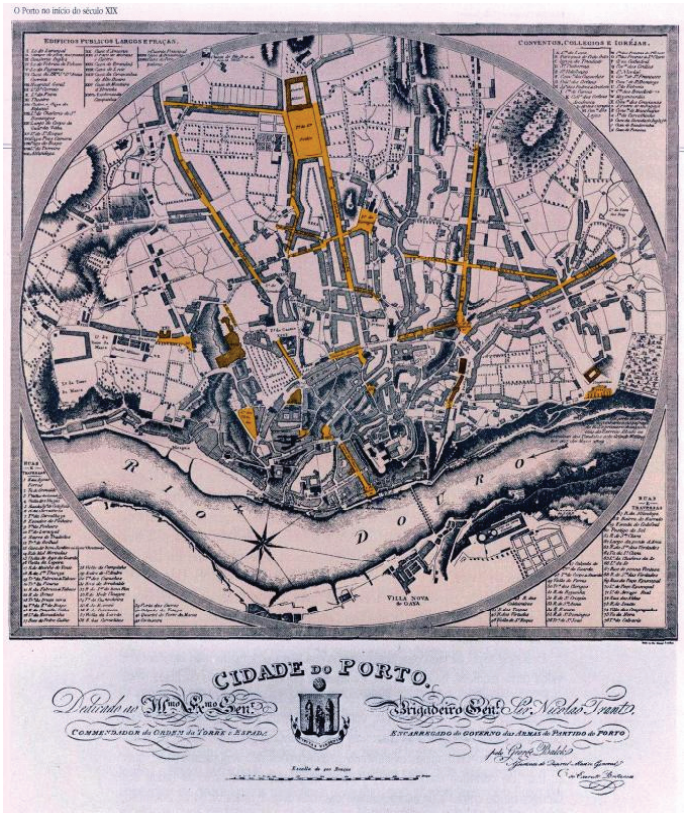


Fig. 39 - George Black's plant (1813) with the Almada's intervention
Source: Ferrão (1985)

carry the city towards a better future development. It was in fact the creation of a future urban scenario, conciliating the illuminist and the rational perspectives, where the openness, the light, the hygiene, the rationalization of the city's morphology and social space were the fundamental premises of future actions.

With a notorious influence of the Eugénio dos Santos project for Lisbon's downtown, where the iluministic power materialized itself, through the rationality of its orthogonal trace, as well as for its functional hierarchy of spaces, Porto's urban transformation had also a strong influence from the English colony, namely by the selection of the architectonic models subjacent to the intervention.

According to this premises, João de Almada and later Francisco de Almada, came to concentrate their efforts on the solution of three main objectives: i) the definition of the new lines of expansion for the city; ii) the construction of new residential areas on the exterior of the medieval nucleus for the more fortuned bourgeois; iii) and improvement of the connections between the city's old centre and this new neighbourhoods.

The four big building axis of the city's urban future development, which irradiated from the centre towards the main agglomerates of the region - Almada street (1762-64), Sta. Catarina street (1774), Rua Direita de Sto. Ildefonso (1778) and Cedofeita street (1782) – and the connecting streets between the old nucleus and the expanding area near the big wall, already demolished by

that time - Clérigos street (1792) and Sto. António street (1795) – together with a series of transversal streets which interlinked them, constituting the structure of the new urban expansion (Fig. 39).

The 1784 "Improvement Plan", beyond defining the city's expansion lines, created norms relative to the construction of buildings, establishing general principles in what concerns to façades' composition and defining an allotment regular pattern, based on a 5,5 meter wide and generally very long lots, sometimes reaching 100 meters (TEIXEIRA 1996). The adoption of this allotment pattern established an urban morphology which contemplates large open areas on the building's backyards, where it were established deep particular kitchen-gardens, breaking up with the occupation density of the intra-wall nucleus (Fig. 40).

The city of the transition between the 18th and the 19th century, despite reflecting important urbanistic transformations, still preserved the appearance of a big village. The river still played a primordial role for the city's economy, and the Ribeira's Square perpetuated itself as the city's "engine" and the population was concentrated in the intra-wall nucleus.

Outside walls, the urbanization occurred near the big wall and specially around the main exits.

The domestic and the public spaces were superposed, the residential unity integrated also a production unity, maintaining the street structure of the offices and the social segregation was fundamentally done in height.

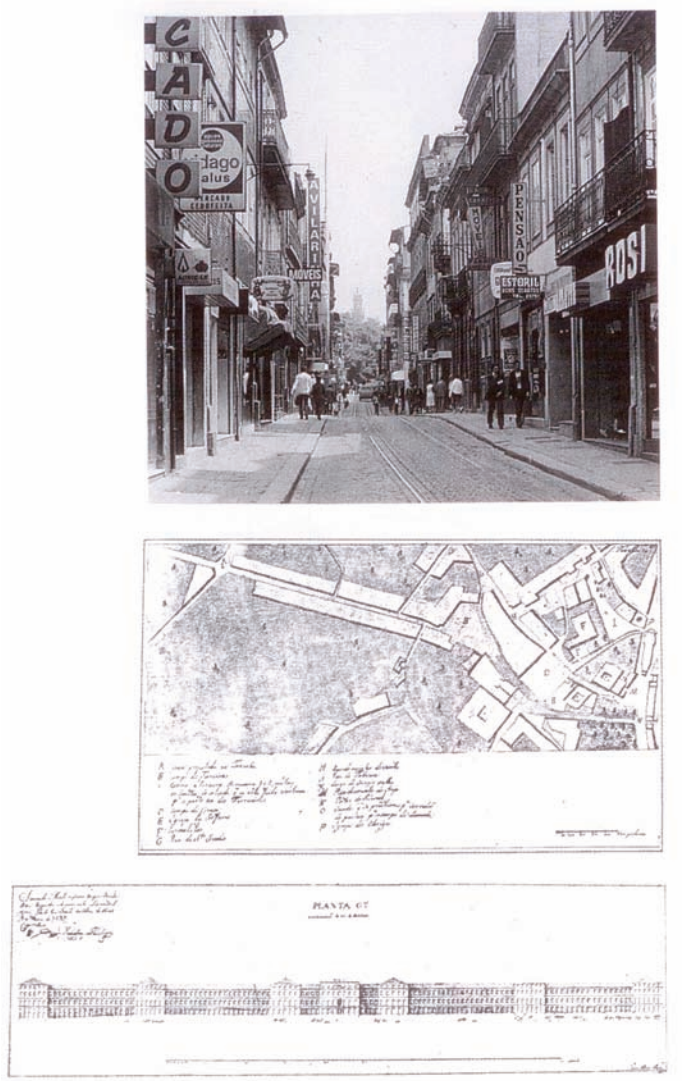


Fig. 40 - Almada's intervention example
Source: Ferrão (1985)

George Black's plant (1813) gives us precisely this image about the city, with wide urbanistic transformations not yet accompanied by a development and structuring process for the city (Fig. 39).

It is possible to observe that despite the main axis transformed by the Almadas being occupied by constructions following the routes of exit from the city it was still possible to find great extensions of land to construct and urbanize, allowing that the strong rural marks remain near the city big wall.

Industrialization, urban expansion and "ilhas" proliferation in the second half of the 19th century

The city of Porto has met a strong development during the 19th century especially during the second half of the century.

On the map from 1865 (Fig. 41), is still visible a great super-occupation of the older nucleus, where the new arrivers concentrated themselves.

It was on the decade of 1860 that two groups of factors were combined for the development of an "urbanistic revolution" on the city: the decisive industrial development of Porto; the development of transports and the construction of new bridges.

The first one is related with the decisive industrial development of Porto, with the increase of immigration into the city and the growth on the demand for housing,

Fig. 41 - City plant from 1865

what would bring visible consequences on the city's structure: due to industry's localization in specific areas, to the lost of strategic importance of the river and to the dissemination of "ilhas" all around the city. The development of transports and the construction of the new bridges over Douro constituted the second factor of urban development of the city, through the introduction of new dynamics and a broader notion of the city scale.

At that time, the population from the Porto was growing at a vertiginous rhythm, almost duplicating itself between 1864 (85.583 inhab.) and 1900 (165.729 inhab.).

On the other side, this pronounced population growth has changed the secular spatial distribution of the population in the city, with an increasing occupation of the suburban civil parishes.

Thus, the intense urban renovation of the second half of the century not only affected the central area of the city, but also, and each time more, the suburban areas that, with the notorious development of the transports, were faced with new realities.

At the centre there is the " Praça Nova" (New Square), assuming itself progressively as the social life and commercial centre of the city.

This centrality goes on getting stronger with the progressive river's loss of importance as economic engine of the city, with the construction of the new bridge D. Luís I and, finally, with the S. Bento train station, in 1896.

Various interventions occurred in the city's central area – Mouzinho da Silveira street, Infante D. Henrique square,

Ferreira Borges market, Alfândega street – reflecting precisely the necessity for connection between the city's near river nucleus and this new centre, the "Praça Nova".

At Boavista, on the western side of the city, was constructed the Boavista square (1868), from which irradiated new roads towards various directions, for instance the Boavista Avenue towards the sea. The mouth of the river, Foz, has also lived a remarkable development during the second half of the century, going from simple fishery agglomerate into a privileged space of the city, as it can be proved by the construction of Passeio Alegre and the actual Brazil and Montevideu avenues.

On the eastern part of the city it was inaugurated, in 1875, the railway station of Campanhã, which definitely reinforced its industrial aspect and promoted urbanization through housing construction of "ilhas" type to accommodate mainly workers.

The "ilhas" occurred as an answer to the increase on search for low cost housing, when the saturated buildings from the historical centre could not give an answer to the city's growing immigration. They constitute a specific type of housing of labour workers whose productive logic was the maximization of family incomes paying low rents. They were mainly located at the backyards of the bourgeois houses and, in some cases they occupied more than one floor, constituting authentic labourer neighbourhoods.

The existence of "ilhas" similar types in many industrial cities, as in the british ones, the back-to-back houses,

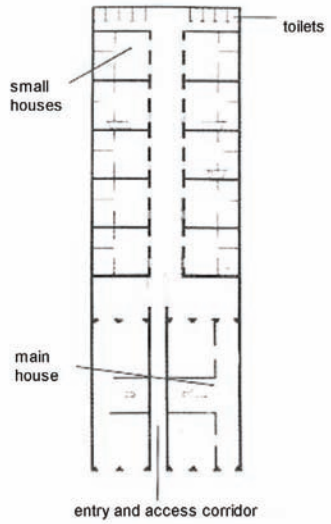


Fig. 42 - The simplest form of "ilhas"
Source: Teixeira (1996)

the dumbbell houses from New York or the "courons" in France, allows to consider them as a characteristic urban form of industrial capitalism.

On its simplest form, the "ilhas" consisted of rows of 10 to 20 small houses of one only floor with 16m2, with one front façade of 4m, with one single door and window, built on the terrains of the middle class houses, with access to the street just through the straight corridors under this bourgeois houses built at the face of the street.

This form of managing the space resulted from two main factors: on the first hand, profiting from the Almada's long and straight lots; on the other hand, from the demolition of the city walls. This situation brought great soil availability, with lower prices relatively to the ones practiced on the old nucleus interior.

The greatest part of the "ilhas" was built between 1864 and 1900, representing 63% of the total built up volume in this period. According to the data presented by Ricardo Jorge (1899, p. 153), at that time existed 1048 "ilhas", with 11 129 houses, lodging over 50 000 people.

The localization of this "ilhas" turns evident that the biggest concentrations of this kind of housing were located near the main industrial areas: Bonfim, Cedofeita, Santo Ildefonso and Massarelos. (Fig. 50).

The Porto's "ilhas" are the housing solution to answer to social, economical and urban specific conditions from a certain moment in time, and which persisted in the city during time. They were later denounced as insalubrious focus (due to constructive characteristics,

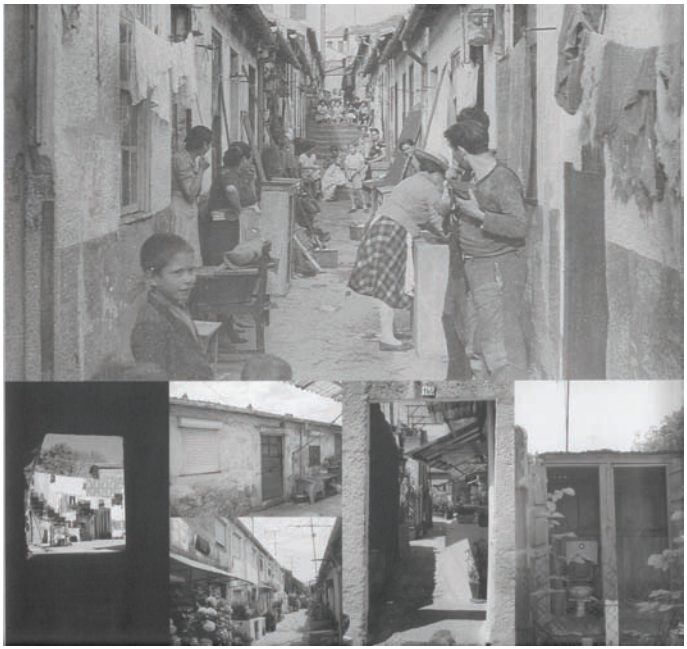


Fig. 43 - Old photographs of "ilhas"
Source: CMP (2001)

over-occupation, common sanitary facilities, lack of basic sewage, physical degradation, etc.) which urged to be eradicated. These are precisely the central and persistent preoccupation of the various plans which were developed during the 20th century.

4.2.2. THE XX CENTURY PLANNING AND BUILDING ESTATES

The XX century planning

The 20th century had an intensive demand for a global plan for the city.

The awareness about the lack of infra-structures and urban management happened because the city lived a period of intense growing population, industrial and commercial development. So, the consecutive planning proposals that appeared during this century reflect the new challenges imposed by the city's dynamic, as well as the new concepts of urban form. Despite this intense activity, only the two last plans were approved and therefore rectified.

Barry Parker, who had projected, together with Ebenezer Howard, the first english garden city, realize a plan for the renovation of the Porto city's centre. The plan generically consisted on the opening of the city's Avenue, future Aliados Avenue, as well as on the transformation of D. Pedro's Square and the built up of the City Hall.

The target was to draw a space that may be simultaneously

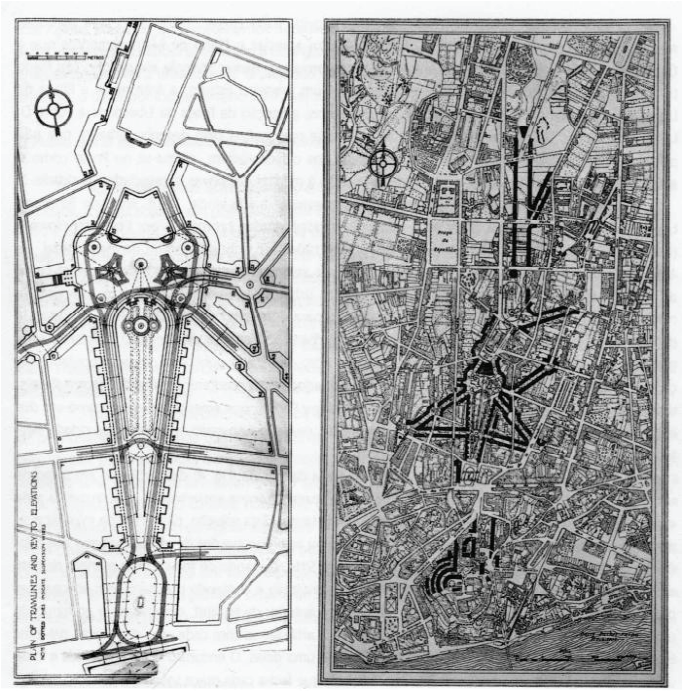


Fig. 44 - Barry Parker Plan (1915)

representative of the centre at a city's scale, creating a administrative and services area and reformulating all accessibilities (Fig.44). Barry Parker's initial project would come to be modified and reduced, and would only be concluded half a century later after being reformulated, with the inauguration of the new City Hall in 1957.

In 1932, Ezequiel de Campos presented the "Prologue for the Plan of the city of Porto", the first known draft of a plan, at urban scale. According to Ezequiel de Campos, the city of Porto was highly disarticulated, exaggeratedly concentrated on the traditional occupation area, without industrial zoning or any other kind of zoning, without convenient connections towards Leixões harbour, which was still in construction, without an adequate internal circulation system or even articulation with the western area, in bunted urbanization and without global perspectives of urban planning or even regional integration.

Ezequiel de Campos presented the regional planning as an alternative to the urban congestion, proposing that the Urban Plan for Porto should integrate the satellite councils, taking into account the joined development, on a visionary concept of global planning. LOBO (1995) argued that Ezequiel de Campos represents the Patrick Geddes' views, where the city planning requires the consideration of a broader analysis context, at the regional scale.

In 1934, a new legislation about the General Plans for Urbanization was created, obliging the Council of Porto to elaborate its plan within term of five years. However, this

Fig. 45 - Ezequiel de Campos proposal (1932)

plan was only materialized 20 years later, after a troubled process. The Council was not sensible to the "Prologue for the Plan of the city of Porto" from Ezequiel de Campos and, it was only in 1938 that initiated a cooperation with two Italian architects for the coordination of the respective studies; Marcello Piacentini (1938-40) and, later, Giovanni Muzio (1940-43).

Piacentini presented a definition of three main land uses – residential areas, a large industrial area and a sports area - in addition to the definition of street grid, based on a set of north–south and east–west main streets, in order to produce a squared scheme.

Later, Muzio proposed a redefinition of the street grid. He selected the two great axis disposed on the form of a cross, moving away from the squared scheme proposed by Piacentini (OLIVEIRA, PINHO, 2008). At the same time, Muzio developed some urban morphology studies and detailing sitting plans like the Campo Alegre residential area (Fig.46).

Fig. 46 - Giovanni Muzio plan for Campo Alegre (1942)

This plan never got to be concluded, being its failure attributed to the inexistence of up-to-date topographic plants in convenient scales and to the methodological and disciplinary divergences between the architects and the Council Urban Department (GARRETT, 1974).

The conclusion of the General Urbanization Plan was demanded to Antão de Almeida Garrett, who presented in 1952 the Regulator Plan for the City of Porto.

Having in mind the definition of a global structure of organization for the urban tissue, the Plan synthesizes

the actions to develop in five fundamental matters: i) the communications; ii) the city's organization; iii) its equipment; iv) the open spaces; v) the regulation. It constitutes the first global and systematic proposal about the functional qualification of the urban tissue according to the use of zoning. There were considered four kinds of "zones" in the city: the residential, the special (commercial, industrial, railway, harbour, beaches, some public buildings and the historical, archeological and touristic zone), the greens and the rural.

The Plan from Antão de Almeida Garrett gathered simultaneously influences from the two main urban theories at that time in Europe. Two years after its approval, the content of some of its main dispositions got into conflict with the objectives of the Improvement Plan done in 1956.

It consisted mainly on a great investment program on low cost housing, and it was not a formal tool for urban planning, the Improvement Plan had, as CARDOSO (1996) referred, a much bigger and immediate influence on the city's urban development than the other precedent plans and projects of plans.

On the first hand, the location of the new residential neighbourhoods at the city's suburbs promoted, on a systematic way, the occupation of this large peripheral ring around the city, which was almost exclusively rural before. By the other side, this new city expansion phase introduced a type of buildings which differed from the one used until then: with a clear influence of the Modern

Fig. 47 - City plan from Almeida Garrett (1952)

Movement, very common by that time through Europe, this new neighbourhoods went on according to the typology of "blocks" absolutely independent from the street as urban structuring elements.

The conflicts between the objectives of the Improvement Plan and the Regulator Plan has conducted to the Regulator Plans' revision and the consequent elaboration of the Director Plan for the City of Porto, finished in 1962 and approved in 1964.

The Director Plan was compiled by a French urbanist, Robert Auzelle, who was deeply involved with the Modern Movement.

Like in the Regulator Plan of 1952, the key issues were the problems of internal circulation, as well as of city crossing, residential and industrial zoning and the articulation of the original urban stain with areas yet to conquer on the western side.

Modernism concepts were widely applied, on the use of zoning as a form to organize the city which separates its different functions, contradicting the functional mixture that characterized the city until then, as well as by the proposed model of edification for the new residential expansions, autonomous blocks implanted independently from the road structure.

In 1978, the city council established a new planning office, choosing Duarte Castel Branco to co-ordinate the preparation of a new master plan for Porto. The process was once again longer than the expected: the plan's policy options (1984); the plan's proposals of 1986; the

Fig. 48 - Master Plan of Porto (1989)

final version of the plan (1989); the plan updating agenda of 1991 (Fig.48).

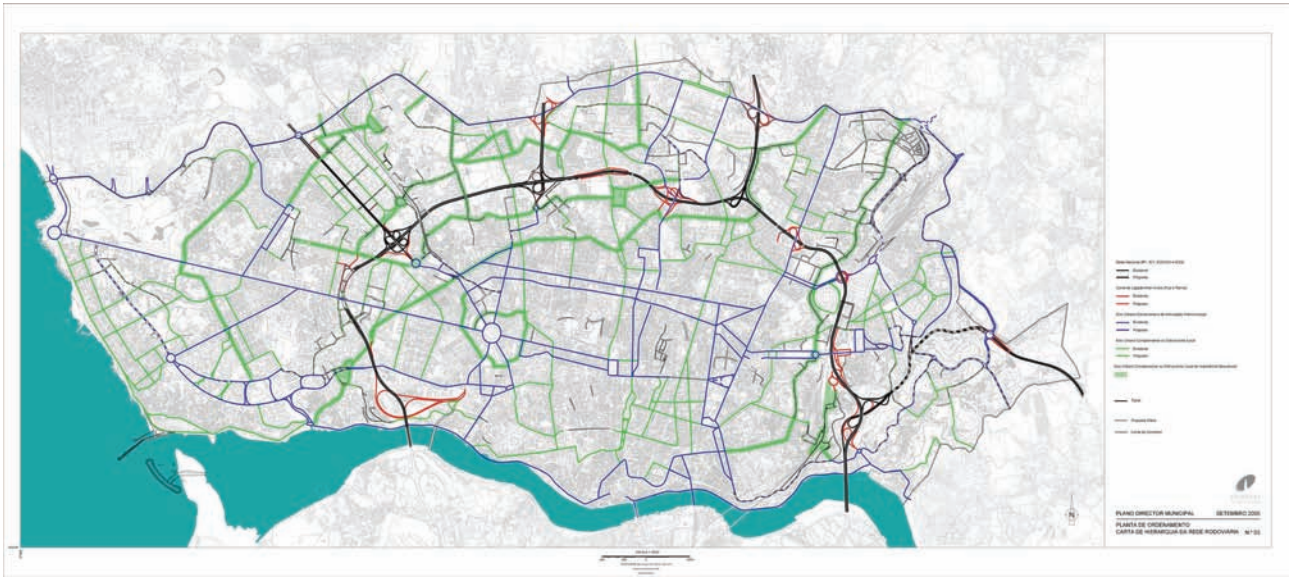
The Master Plan proposed the urban spatial organization according to Planning Units, with its respective equipments and infra-structures that were ruled for the first time by soil occupation coefficients.

As essential concepts of this proposal it defined: the soil occupation as a size condition for all functions and respective determination of economical and financing values; the establishment of a functional hierarchy on the road system, which assured ramifications for easy access to all points in the city and its external links; the organic framework of the new urban tissue between different parts of the city, through the Planning Units.

Later on, new planning studies started under the supervision of the architect Fernandes de Sá. The new plan was finally approved by the city council in 2005 and ratified by central government in January of 2006 (Fig.49).

The plan highlighted five strategic objectives: (1) the enhancement of Porto's urban identity, through a dynamic conservation of the existing urban fabric and sensitive design of new in-filling urban forms and buildings; (2) the rehabilitation of public space and of the built environment, adopting a systemic view of ecological and landscape resources; (3) the rationalization of transport systems, giving clear priority to public transport, walking and cycling; (4) the reduction of urban disparities, in particular between the eastern and the western parts of the city, deeply divided by social and physical conditions; and (5) the promotion of the historic kernel and of the whole central area, not just as part of the city, but as part of a larger metropolitan area, the second largest in Portugal (Fig. 49).

The plan defined 24 priority areas for intervention, according to the "Units for Planning and Management". These units should be subject of further planning studies at a lower scale, to refine urban design options and apply compensation and improvement mechanisms.


PLANO DIRECTOR MUNICIPAL
SETEMBRO 2015
PLANTA DE ORDENAMENTO
CARTA DE HIERARQUIA DA REDE RODOVIARIA


PLANO DIRECTOR MUNICIPAL
SETEMBRO 2015
PLANTA DE CONDICIONANTES

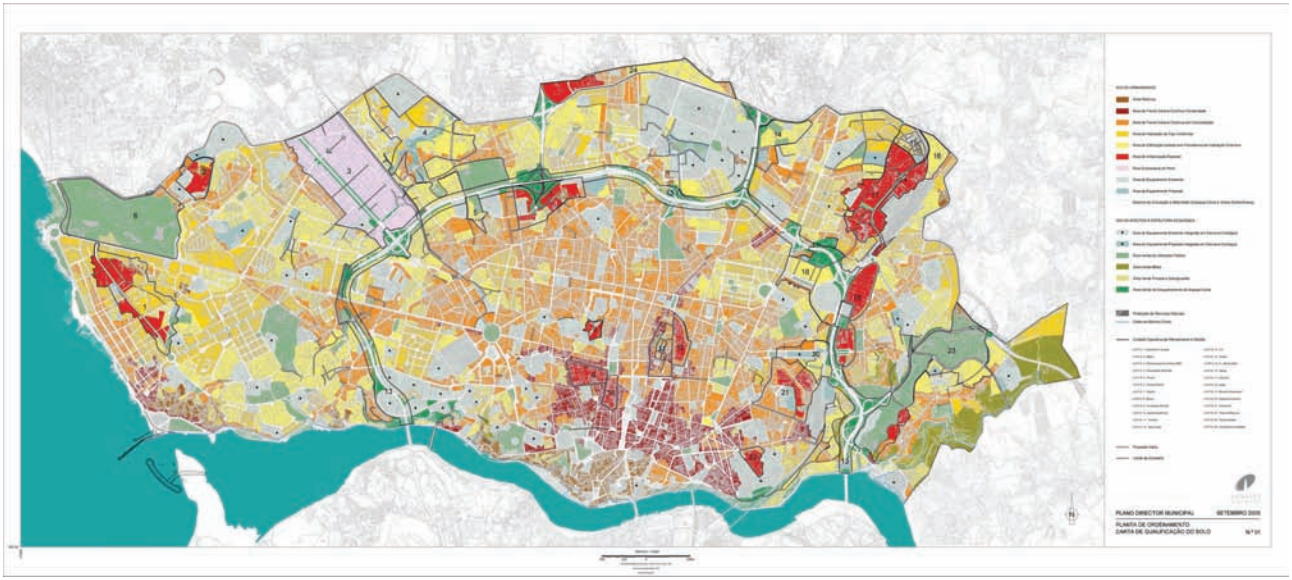


Fig. 49 - Master Plan of Porto (2005)

4.2.3. PORTO'S 10 STEPS OF HOUSING ESTATES DEVELOPMENT

At the beginning of the 20th century the city had more than 150000 inhabitants living in a very promiscuous environment without public water supply or sewage networks. The housing estates implementation in Porto started precisely at that time to mitigate the severe public health, socio-economic and political impacts due to the boom of "ilhas" (Fig. 50, 51).

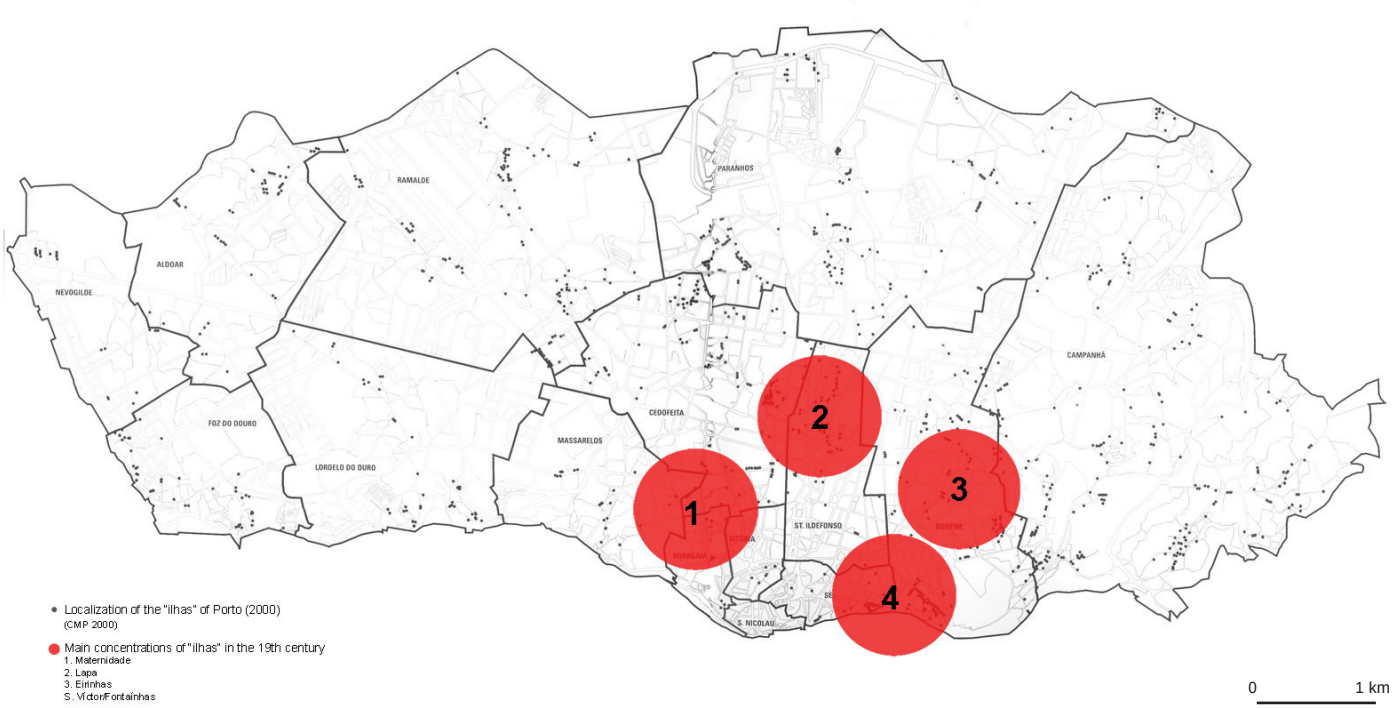


Fig. 50- Localization of the "ilhas" of Porto in 2000 (Source: CMP, 2000)

Comércio do Porto

1 Monte Pedral
2 Bonfim
3 Lordelo

Colónias

4 Sidónio Pais
5 Viterbo Campos
6 Dr. Manuel Laranjeira
7 Estevão de Vasconcelos

Casas económicas

8 Amial
9 Azenha
10 Paranhos
11 Costa Cabral
12 Ilhéu
13 S. Roque Lameira
14 Condominhas (CE)
15 Vilarinha
16 Viso (CE)
17 Ramalde
18 Gomes da Costa
18* António Aroso

Famílias pobres

19 Duque de Saldanha
20 Rebordões
21 S. Vicente Paulo
22 S. João de Deus
23 Condominhas
24 Rainha D. Leonor

Improvement Plan

25 "Bom Sucesso
26 Pio XII
27 Carvalhido
28 Pasteleira
29 Outeiro
30 Agra do Amial
31 Carriçal
32 Fernão Magalhães
33 Fonte da Moura
34 Cerco do Porto
35 Regado
36 Campinas
37 S. Roque
38 S. João de Deus
39 Francos
40 Aldoar
41 Monte da Bela
42 Falcão
43 Lagarteiro
44 Pinheiro Torres
45 Eng. Machado Vaz

Post- 1974 (for rental)

46 Aleixo
47 Lordelo
48 Bessa Leite
49 Central de Francos
50 Santa Luzia
51 Vale Formoso
52 Bom Pastor
53 Contumil
54 Mouteira
55 Pasteleira Novo
56 Antas
56* Ramalde

Post- 1974 (for sale)

57 Santa Luzia
58 Vilar
59 Condominhas
60 Contumil
61 Pasteleira

PER

62 Choupos
63 Ilhéu
64 Ferreira de Castro e Cruzes
65 Jerónimo de Azevedo
66 Monte de S. João
67 Parceria Antunes
68 Fontinha
69 Salgueiros
70 Fontaínhas

IHRU

71 Pereiró
72 Ramalde do meio
73 Viso
74 Paranhos
75 Amial
76 S. Tomé
77 Leonardo Coimbra
78

Fig. 51- Localization of the "housing estates" of Porto

First Step (1899-1905)

The first group of housing estates buildings were promoted by the newspaper "O Comércio do Porto" with the public support. At that time in France, during the Paris Universal Exhibition (1899) was created the "Societé des Habitations à Bon Marché" to solve the lack of low cost housing solutions.

The 3 housing estates buildings were built with public funds and the ownership obtained after the payment of a annual fee.

- Monte Pedral (Serpa Pinto), consisting of 26 single family houses in groups of 2 and 4 with a small garden. The construction started in 1899 and the project was designed by architects José Marques da Silva (the first 14 houses) and Thomas Pereira Lopes (the remaining 12).

- Lordelo, consiting of 29 single family houses, projected by Fortunato Manuel de Oliveira Motta,

- Bonfim (Monte das Antas) consisting of 40 single family houses in groups of 4 with a small garden. The project was designed by Manuel Fortunato de Oliveira Motta and Joaquim Gaudêncio Rodrigues Pacheco.

Fig. 52 - Monte Pedral neighbourhood - STEP 1 (Source: LiveMaps)

Second Step (1914-1917)

The Republica establishment promotes several housing estates policy measures that didn't survive. Afterwards, under the Sidónio Pais' dictatorship's, the need to prevent the political demands easy promoted very dense poor communities led to the construction of neighbourhoods and to the resettlement of people in separate apartments

- the "Colónias". The 4 workers colonies built at that time and endorsed by Town Hall to sell later to the residents were: Colónia Antero de Quental, with 28 houses (1914-17); Colónia Estevão Vasconcelos, with 90 houses (1914-17); Colónia Dr. Manuel Laranjeira, with 130 houses (1916-17); Colónia Viterbo Campos, with 64 houses (1916-17).

Fig. 53 - Colónia Estevão Vasconcelos - STEP 2 (Source: LiveMaps)

Third Step (1933-1974)

The "Estado Novo" (1933-74) had a greater role in promoting housing estates. During that time several neighbourhoods of single family homes with garden and yard were built (1933 to 1972), following an orthogonal plan of pairs of individual or two stories' houses. The streets' names among each neighbourhood were flowers, Portuguese villages and rivers underlining the general rural landscape intention.

The incentives were mostly to build individual houses that prevented social and political quarrel and disputes. The houses quality and size depended to who their owner was to be. The rent was different and adequate to several different social classes' degree. With this policy we had a social segregation of housing within the city.

Since 1935 until 1965 the State built 12 neighbourhoods of low cost houses to resettle 2378 families. The houses were constructed in the suburban areas like Campanhã, Lordelo do Ouro, Paranhos, Aldoar e Ramalde. This was the first public fund investment in suburban housing estates made in a completely new area in the outskirts of the city.

Fig. 54 - Paranhos neighbourhood - STEP 3 (Source: LiveMaps)

The houses' ownership was achieved by a monthly rent paid along 20 years.

Fourth Step (1940-1956)

After the 40's, the research done showed that there was still a large number of people living in sub-human conditions at Porto.

The municipality of Porto decided to build a string of multi-familiar apartment blocks to quickly solve the house degradation and poverty in the city centre. These apartments were rented to people and the payment was proportional to the families' income.

The first apartment's block of this period was close to the place where people came from - Duque de Saldanha block (1940) with 115 apartments.

- Rebordões (Campanhã) -145 unfamiliar houses (1940);
- S. Vicente de Paulo (Campanhã) – 198 houses built in 4 diferent phases since 1950 till 1954 (148 +18+12+20);
- Raínha D. Leonor - 250 houses built in 2 phases (150 in 1953 and 100 in 1955);
- S. João de Deus – 296 houses built in 2 phases (144 in 1944 and 152 in 1956);
- Condominhas - 26 houses built in 1955;
- Pereiró – 64 houses built in 1956;

The use of land for housing estates purpose in suburban areas was very intense during the 50's and 60's.

Fig. 55 - S. Vicente neighbourhood - STEP 4 (Source: LiveMaps)

Fifth Step (1956-1977)

The Improvement Plan (1956) was the first political efficient action taken by the Municipality to eliminate the "ilhas". They were substituted by social rent housings.

Since 1956 until 1977 were built 20 building estates with a total of 8251 houses. Only 2 of them were built in central area, the others were in the suburbs. It created a considerable population movement (15%-20%) from the city centre towards the periphery. At the same time the "ilhas" were demolished.

The housing estates built at this time were successively enlarged during the 80's and 90's.

This plan introduced significant modifications in the city's urban framework because it created a completely new urban piece – the building estate group.

These neighbourhoods were totally forgotten by the public power during several years and the physical and social degradation spread all around.

Only in the end of the 90's the City Hall started the rehabilitation and renovation process to qualify these neighbourhoods.

Fig. 56 - Fonte da Moura neighbourhood -STEP 5 (Source: LiveMaps)

Sixth Step (1960-1985)

In the 20th century we had two different ways of answering to the lack of houses: shanties and illegal building construction.

Both forms are characterized by being built without permission from municipalities. The works were done by

Fig. 57 - Falcão neighbourhood- STEP 5 (Source: LiveMaps)

individuals and all the process occur without license or technical monitoring.

Shanties were usually made with old and used materials, frequently wood, on public land or private rented land.

The illegal buildings were made of masonry with a quality very similar to statutory construction usually on land belonging to the occupants. They acquired the land for the purpose of constructing through a process of blending illegal sets up.

After the 60's, this 2 types of housing grew a lot around Lisbon and Porto's metropolitan areas due to the huge immigration fluxes. The absence of planning and the lack of low cost houses motivated the individual search of solutions. The rural and green public land, the river banks and the steeper slopes were the preferred free places occupied to build this type of illegal housing.

In these circumstances, an illegal land market was developed, leading to the rapid consumption of the free spaces available (agricultural and forestry) in a chaotic process of urban growth.

This housing type has a blend of land uses with a lot of signs of uncompleted and on-going urban pieces. The spontaneous nature of this process of urban construction transformed these places in an absolute chaos, from the planning point of view, and in a serious social problems nest. The 1993 Special Rehousing Plan helped on the reduction of the shanties in both metropolitan areas.

The illegal building construction ended in middle 80's after the modifications introduced in the urban land division

Fig. 58 - SAAL Massarelos - STEP 7 (Source: LiveMaps


Fig. 59 - SAAL Antas - STEP 7 (Source: LiveMaps)

legislation and the municipal plans implementation. The neighbourhoods and lots were recovered and legalized.

Seventh Step (post-1974)

With the arrival of democracy, in 1974, the poor housing conditions and the existence of a great housing deficit generated a large movement to fight for better living and housing conditions. The collective awareness of the right for several common needs mobilized people to claim for better housing conditions.

At Porto, after April 25, there were several movements inside the housing estates blocks in order to demand better living conditions. At the same time, there were also several house illegal occupation of public and private empty lodgements. The housing estates residents creating fight movements towards the improvement of housing conditions - Resident Commissions.

These popular groups lead to the emergence of a very important group – the SAAL (Ambulatory Service for Local Aid). The SAAL (1974-78) arose to create an institutional and organized framework to facilitate the dialogue between residents and public power.

The SAAL had an innovative program thought to encourage the rehabilitation of existing "ilhas" and require the construction of new neighbourhoods in places occupied by the "ilhas" avoiding thereby the forced displacement of populations to areas distant from their usual living places, as had happened with previous projects of social housing. The SAAL created conditions for an active

Fig. 60 - Lada neighbourhood's recovery(CRUARB) - STEP 7
(Source: LiveMaps)

participation of residents in the process of reconstruction / construction of neighbourhoods on many cases through the model of self-construction with the support of local technical brigades.

In Porto, most of the SAAL operations occurred in the areas of "ilhas" which intended to reconstruct these areas on a very similar way to the "ilhas" morphologies.

The neighbourhoods of Bouça and S.Victor, built by architect Siza Vieira, the Antas and the Leal by the architects Pedro Ramalho and Sergio Fernandes. They tried to open these spaces to the street, which were hidden inside the blocks, opening the "ilhas" to the street.

In addition to these interventions in "ilhas" there were also built new neighbourhoods, by the residents's associations, particularly at Campo Alegre (involving 136 dwellings) at Massarelos (on the platform of Bicalho, with 65 homes, planned by the Architect Fernandes de Sá) the Francos (on the Avenue Sidónio Pais, 136 dwellings), the Maceda (Alcino Soutinho project's Architect, 96 houses, the Lapa (Architect Alvaro Matos Ferreira), the Pego Negro and the Tirares (in Campanhã, with 132 houses).

Simultaneously to the SAAL development, the CRUARB was created (Commission for the urban renovation of the Ribeira-Barredo area) to act in an area of 168000m2 in the riverside track. In a first phase of this process of renewal, in order to facilitate the work, part of the local population was displaced, temporarily or permanently, to other projects in the city (i.e. Aleixo). In a second

Fig. 61 - Antas neighbourhood- STEP 8 (Source: LiveMaps)

Fig. 62 - Sta. Luzia neighbourhood - STEP 8 (Source: LiveMaps)

phase, after the 80s, CRUARB passes into the city hall dependency and follows a logic of outsourcing, promoting the rehabilitation of buildings with historical and architectural value and opening some commercial spaces on the renewed buildings.

In the nineties, in addition to the renovations on the existing buildings there was completely rebuilt the old quarter of the Lada (35 houses). In 1993 the official beginning of the Municipal Master Plan promoted the creation of a Foundation for the Development of the Historic Area. Later, in 1996, with the classification of the historic centre as World Heritage by the UNESCO, the philosophy of rehabilitation was extended to other areas of the historic centre, and also to the spaces and facilities nearby.

Eight Step (post-1974)

Other programs that originated in Porto the construction of new housing projects, either for rental or for sale, were the loans to the City Hall (created in 1974 and subsequently amended in the 80s and 90's) and the Cooperation Agreements between the City Hall and the National Housing Institute.

Some good examples of this policy are the neighbourhoods of Santa Luzia and Vale Formoso (in Paranhos), the Mouteira, the Bessa Leite and the Condominhas (in Lordelo do Ouro) and Antas (in Campanhã), for rent. Among those that were built for sale with controlled costs, are Santa Luzia and Condominhas.

Fig. 63 - Cooperative SACHE - STEP 9 (Source: LiveMaps)

Nineth Step (post-1974)

The housing cooperatives have played in Porto, an important part in promoting housing at low cost, in particular to groups of the middle class that were not covered by the construction of public or private housing. The first housing cooperatives appeared before the April 25th - Cooperativa “O Problema da Habitação” e “O Lar Familiar”.

These cooperatives functioned essentially as Cash Credit Property, in which the partners paid a certain monthly amount until they have reached the limit for their construction class.

The movement created after the April 25th, led to a profound restructuring of the cooperative sector by setting up the new system of cooperative housing, and highlighting the regime of “Economic Cooperative Housing” (CHE’s), which had preferential support of the state, such as tax exemption, reduction of taxes, including VAT (after 1986), subsidized financing and access to public land. This, provided conditions to meet better standards regarding the ownership and distribution of the houses.

The marketing made by cooperatives, defines itself by its non-profit profile and by the existence of an associative form of monitoring the whole process.

The existing legislation concerning the cooperative sector housing provides for the coexistence of ownership, with the right to use or rent, and individual property. In all cases the dwellings are attributed to the cooperative that could add to the final cost a percentage of mandatory

Fig. 64 - Prelada Cooperative - STEP 9 (Source: LiveMaps)

reserves for construction that can not exceed 10% of the total amount.

The cooperative ownership model had a very limited acceptance among us. The most common form of ownership was the individual property. In Porto there are now 17 active cooperatives with a total of around 4800 dwellings built.

It should be also noted that some cooperatives are already implementing several new requirements for innovation and modernization of the built up sector, through the certification of housing quality and sustainable housing as “environmentally friendly”.

It should be noted that the first environmental sustainable block of housing developed in Portugal among these low cost regime, was conducted by an association of cooperatives – NORBICETA – located in Ponte da Pedra (Matosinhos)

Fig. 65 - Ferreira de Castro e Jerónimo Azevedo neighbourhoods (PER) - STEP 10 (Source: LiveMaps)

Tenth Step (post-1993)

In 1993 several programmes were created to deal with these lack of low cost houses - the Special Rehousing Plan (PER), the Program for the Construction of Economic Housing (PCHE) and PER-Families - whose main goal was the eradication of shanties and other poor households in the two metropolitan areas of Lisbon and Porto.

These programs adopted a new set of issues, particularly regarding the location of the neighbourhoods. A greater focus was done on construction quality, equipments and

Fig. 66 - Salgueiros neighbourhood (PER) - STEP 10
(Source: LiveMaps)

public spaces.

The solutions focused on supporting families to promote self-renewal or purchase their houses (PER Families).

Porto has already constructed 909 lodgings under PER and 12 under PER Families, for a total of 1463 housing construction agreed with IHRU.

These successive programs of resettlement for the most needed people, led to a large social housing park. Currently there are 51 projects in Porto, on renting, with about 13156 houses where lived about 40000 people (18% of Porto population).

Fig. 67 - Monte de S. João neighbourhood - STEP 10
(Source: LiveMaps)

5. REGULATIONS IMPLEMENTATION (SUSTAINABLE HOUSING) - UE AND PORTUGAL

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 adopts yet the obligatoriness of energetic necessities contabilization for the preparation of sanitary hot waters, by 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 juridic order, through a legislation pack composed by three Law-Decretes:

The Law-Decrete nr. 78/2006, of 4 April, about the National System of Energetic Certification and Interior Air Quality on Buildings (SCE), which has the objectives of:

- Assuring the Regulation application, mainly in what concerns to energetic efficiency, renewable energy systems usage and yet the interior air quality warranty conditions, according to the demands and dispositions included on RCCTE and RSECE;

- Certify the energetic and interior air quality performance in buildings;

- Identify the correction or improvement applicable measures to the new buildings and respective energetic systems, namely boilers and air conditioning equipments, in what concerns to the energetic performance, as well as in what touches to interior air quality.

The Law-Decrete nr. 79/2006, from 4 April, Regulation about the Energetic and Climatization Systems on Buildings (RSECE), which establishes:

- The conditions to accomplish on new acclimatization systems project, namely requisites on thermal comfort, renovation, treatment and interior air quality, which should be maintained in energetic efficiency conditions, through the adequate selection of equipments and its organization in systems;

- The maximum limits for energy consumption on big service buildings and all building in particular, for acclimatization, predictable under the nominal conditions of operation for new buildings or for great rehabilitation interventions on 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;

- The terms for conception, installation and establishment of maintenance conditions, to which acclimatization systems must obey, in order to warrant 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, on the optics of

environmental sustainability.

- Conditions for monitoring and auditorship to the buildings functioning in terms of energy consumption and interior air quality.

The Law-Decrete nr. 80/2006, from 4 April, Regulation about the Buildings Thermal Behavior Characteristics (RCCTE), (revoking the anterior RCCTE – Law-Decrete nr. 40/90, from 6 February which had, for the first time, and by the regulatory way, introduced thermal requisites on the new buildings projects and on great rebuilding) indicating the rules that must be observed on every habitation building's projects, as well as service buildings without centralized acclimatization systems, in such a way that:

- The demands for thermal comfort, whether it is for heating or cooling, and ventilation for buildings' interior air quality warranty, as well as sanitary hot water needs which would come to be satisfied without an excessive expense of energy;

- Pathological situations on the construction elements caused by the occurrence of superficial or internal condensations, which have potential negative impact on the construction elements and interior air quality durability, are minimized;

- It is obligatory to install solar thermal collector for sanitary hot waters, whenever there is adequate solar exposure, except there is a funded justification on the contrary;

- 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 and on wall's and roof's isolation, turning into obligatory the installation of double glassed windows, within other technical matters. Everything must be taken into account such as, for example, the obstructions to 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 for new edifications, as well as, at a posterior phase, to the already built habitations.

Legislation related to the accessibility on new public buildings, as well as on habitation buildings and public roads to people with conditioned mobility:

- Law-Decrete nr. 123/97, of 22 May – defines the technical norms having in mind the elimination of urbanistic and architectonic barriers on public buildings, collective equipments and the public way;

- Law-Decrete nr. 163/2006 of 8 August (revocates the anterior Decrete) – defines the accessibility regime for people with conditioned mobility to buildings and establishments that receive public, public way and habitation buildings (access to habitations and its interior).

6. Social, financial and technical procedures models – case studies

EXAMPLE 1

Involvement of different local actors and local authorities to renovation - Lagarteiro

This case study is included in the pilot program "Initiative for Development and Reintegration Operations in Critical Urban Neighbourhoods" (Council of Ministers Resolution Nr 143/2005), which was intended to be intervene in urban areas that have critical levels of vulnerability. These interventions suppose and integrated socio-territorial action. For this pilot project in the city of Porto, was selected the block of Lagarteiro, located in the Campanhã civil parish.

The neighbourhood of Lagarteiro was built under the Porto's Improvement Plan in 1973 with an expansion later in 1977. The neighbourhood consists of 446 lodgings, with 1892 people with an average age of 35 years. With 17% of the population unemployed, 16% of retirees, 9% dependent on incomes from social inclusion funds, 5% domestics and 18% students, we understand how vulnerable is this group. The families consisting of elderly and motherhood in adolescence make family patterns very fragile. The low rates of scholarship and high school drop-out reinforces the weakness of the social tissue.

80.6% of buildings need to be repaired, 41% of the accommodations are overcrowded, public spaces are degraded and accessibility to the neighbourhood is poor.

The neighbourhood consists of 13 housing blocks, with 4 stages.

The intervention proposed for this neighbourhood, was

Fig.68 -Lagarteiro neighbourhood on the 70's
Souce: Marques et al (2006)

Fig. 69 - Lagarteiro neighbourhood
Souce: Marques et al (2006)

thought to be in a participatory process involving a vast group of local actors who had already worked in the area (schools, cultural, sports, social support to drug addicts, health promotion, youth associations, Central District of Social Security, police, etc) together with the City Council, the IHRU and some groups of residents.

During five months the team project and the local actors work together, "which allowed the actors to build a better connected network and more prepared for the design and implementation of a participated project. At the beginning of the process the actors play and interact in a hierarchical structure; with the organization of a participatory process, the actors developing an environment of trust, setting up leadership, giving up specific skills, building up a network of actors more connected and better organized for an integrated intervention" (MARQUES, T. 2005/2006, p.126).

Thus, it was possible to plan and propose a set of actions to streamline the process of social and territorial integration of the neighbourhood in the city, following institutional partnerships of different geometries, according to each action and strategy.

In terms of actions under the assistance and urban environment, the leadership is the City Hall and IHRU.

For actions in the area of family, culture and lifestyles, different institutions lend expertise and willingness to cooperate (dynamic networks of relationships with the city, (re)build a climate of security).

Moreover, the area of enhancement of skills and economic

activity has a weak institutional support, and require the contribution of external institutions (to increase self-esteem, the entrepreneurship of local base, increase the levels of education and professional qualification of residents and promote employability and occupation) while the health and safety are adequately supported.

Five strategic intervention axes were identified:

1. Intervening in the environment (the proposed measures: new buildings in front of the East Park and new structure of streets in the area of special urbanization, responsible Municipality and IHRU);

2. Quarters urban and environmental requalification (the proposed measures: new streets, new public spaces (collective), construction of new facilities in the environment, Social Equestrian Center, the new Police Squad, rehabilitation of houses and buildings in contracting Municipality, IHRU, Ministry of Education, Ministry of Cities, Planning and the Environment, Ministry of Culture, Sport Club of Porto, Police Public Security and Ministry of Interior);

3. Active citizenship and social welfare promotion (several proposed measures in the areas of health, sports, environmental education, security and citizenship with the participation of the local actors that work in the area);

4. Promote learning and economic entrepreneurship (some measures proposed in the area of recognition, validation and certification of abilities of the residents and learning of new information technologies);

5. Strength the capacity of local community action.

This project is under preparation, the rehabilitation of its buildings will be phased and implemented between 2009 and 2013. The works comprise the rehabilitation and urban socioeconomic integration of the residents and involves the City Council, eight ministries, Parish Board of the Campanhã, several institutions and organizations of city.

In addition to the recovery of the housing blocks and the mobilization of the residents for the repair and refurbishment of houses interior, the program also provides the reorganization of new urban public spaces and the creation of accessibility that connect the neighbourhood with the remainder city.

EXAMPLE 2

Sustainable housing Cooperative -Norbiceta

NORBICETA, Union of Housing Cooperatives, UCRL, was created in 1988, with the objective of promoting the development of housing and construction by its member cooperatives, accordingly to the Portuguese cooperative by-laws.

NORBICETA, is located in S. Mamede Infesta, municipality of Matosinhos and composes three of the biggest housing cooperatives at national level. They are: NOORTECOOP, SETE BICAS and CETA.

The Development of the Ponte da Pedra - 2nd phase, in the city of St. Mamede de Infesta, Matosinhos, was promoted by Norbiceta, co-financed by European Union project SHE (Sustainable Housing in Europe) and is the first cooperative project to build sustainable housing in Portugal.

This project is formed by 101 dwellings divided into 2 lots (40 lodgments and 61 lodgments), with types T2 and T3. It was completed in 2006, delivered and fully inhabited now. It has several equipments, park and public lake with extensive landscaped areas and pedestrian thoroughfares that accompany the entire urbanization and offer the real experience of the surrounding area, whose design includes special criteria for economic, social and environmental aspects that are innovative.

It is a pilot project that demonstrates the feasibility of sustainable housing development, from economic, environmental, social and cultural point of view. The management of water, waste, energy, environmental comfort and selection of materials are the main changes of the project.

In this buildings the less demanding materials in terms of maintenance were used and was made the use of rainwater in toilets and irrigation of gardens. Several solar panels reduced about 80 percent the consumption of energy used on heating water.

This project received the awards INH/IHRU 2007, attributed to the building of Ponte da Pedra. The first prize for promoting low cost cooperative buildings (homes sold at a price of 820 €/m2) and that, given the pioneering spirit of this European project who coordinated the promotion, construction and monitoring of a total of 600 housing cooperatives in four European countries (Italy, France, Denmark and Portugal), which includes our 101 houses, also earned the award of the European Prize 2007 - Sustainable Energy in Europe.

Ponte da Pedra Building is different because of its sustainability concern, implementing equipments to profit solar energy, recycling and allowing a rational use of water consumption, besides solid waste, in the context of the European program Sustainable Housing in Europe. These aspects are implemented in a balanced project, with widegreen areas, in comparison to the built space and to the number of inhabitants expected. These spaces also have pieces of urban art and “parterre d’eau”, which

complement living nature elements of the public space. It is also orientated by the concept of closed circuit aiming to treat and save water. In a future perspective, it is a pioneering example that every promoter of social housing must follow.

Fig. 70 - Cooperative Norbiceta.
Crédito: Infohabitar (2006)

EXAMPLE 3

Implosion and Housing Investment Fund creation (public and private) - Aleixo

The Aleixo neighbourhood, built in 1976, is spread by five towers, each with 64 dwellings, with 13 floors and a total of 320 accommodations where live around 963 people.

This neighbourhood is currently the most problematic in the city, with very degradated buildings, where the drug consumption and traffic is constant and with serious social problems, high levels of unemployment, insecurity and destruction of outdoor spaces.

The solution found by the city of Porto, to solve the problem will require the demolition of the five towers, the creation of a Special Fund Real Estate Investment (FEII), whose only asset is their own neighbourhood and the opening of a public tender for selecting a private partner that will support 70% to 90% of the fund, leaving the remainder to the municipality.

The winner of the contest will be required to built and rehabilitate vacant houses scattered around town, especially in Old City Centre. They will have to build the same number of square meters of construction that exists today in the Aleixo neighbourhood. About 20% of that area will have to meet the rehabilitation of housing in downtown, including the Historic Center.

As the winner of the competition authority is delivering the new homes to the local authority, will start the transfer of tenants of Aleixo, according to the policy of resettlement in force.

Meanwhile, the obligations of the investor's participation in that fund, which can not be less than 70%, will be awarded.

At the end of the transaction, which is estimated to be completed within 4 to 5 years, all people who have the right to housing will be accommodated.

Under this proposal, the Aleixo will entirely belong to FEII, which lie empty and demolish to reclassify that area, in accordance with current standards of the Municipal Master Plan, whose index of construction is 0,8.

(Source: CMP 2008)

Fig. 71 - Aleixo neighbourhood

EXAMPLE 4

"Renda resolúvel" - unifamiliar and plurifamiliar property ownership transference from public to private - Condominhas (1937), Sta. Luzia (1981), Condominhas (1993), Bessa Leite (1982), Contumil (1987), Vilar (1994) and Pasteleira (1997)

The system of resolvable property has been used in areas of economic houses in the Estado Novo, being a contract where the residents take responsibility for themselves and with the guarantee of a life insurance policy and the payment of 240 benefits, calculated in terms of household income and type of house, buying him or his heir, with the last installment payment of the full ownership of the house.

However, after the April 25, the same system has been used in neighbourhoods built by the City Hall for sale at low costs (the maximum sale prices are set annually by the Government), as is the case of the Santa Luzia, the Condominhas, the Vilar, the Pasteleira, the Contumil, the Bessa Leite neighbourhoods. These neighbourhoods were sold under the ownership resolvable through a public tender.

However, in the event of non-payment of benefits, the right of ownership of the resident-buyer can be resolved, by the devolution of the accommodation ownership and possession to the City Hall.

For the neighbourhood of Bessa Leite (blocks 2, 3 and 4), the buyer acquires the property only with the last payment of the 300 benefits.

Fig.72 - Condominhas neighbourhood

Fig. 73 - Sta. Luzia neighbourhood

EXAMPLE 5

SAAL – public and private involvements towards "ilhas" rehabilitation – Bouça

The SAAL, created in 1974, was undoubtedly an innovative program in two ways.

First, the SAAL intended to promote the rehabilitation of existing slums, demanding that construction of new neighbourhoods were made in places occupied by these slums (avoiding thereby the forced displacement of populations in areas distant from their places of living, as had happened with previous programs of social housing).

Second, 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 support necessary through the technical brigades, particularly in: the judicial field, the projects implementation, the administrative and accounting procedures, the construction implementation, land and subsidized financing. The intention was that the residents intervene in all the constructive process, since the choice of projects, typologies, procurement and supervision of works, until the allocation and management of houses.

The State 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. ...). This, in practice, limited to the use of the work of residents, which has not always happened, and the state ultimately has bared all costs of operations.

In conventional existing programs before the appearance of SAAL, were the central institutions responsible for the promotion of social housing, which determined the locations of construction, costs, programs, recipients, types, forms of allocation of resettlement and, finally, the whole process connected to construction and distribution of social housing.

The SAAL changed, fundamentally, this traditional procedure to technically support the organization of the residents in order to enable it to perform functions inherent in the process of design, manufacture and distribution of housing. The group of residents has become, not only, customer of the team of architects, but also sponsor, together with the State, of the houses that would inhabit.

Despite these issues, certainly very positive, the SAAL had an ephemeral life, being extinct in 1976.

One of the most emblematic of SAAL interventions was, without doubt, the Bouças' neighbourhood, designed by architect Siza Vieira, it was an intervention in an area of "ilhas" and has been designed 128 houses and public spaces. But by 2006, only 56 houses were built, and the project was finally completed in 2006 with the construction of the remaining 72, rehabilitation of the 56 initial houses, free time atelier, coffee shops and 5 shops.

The houses are duplex T3, spread over 4 residential

buildings, confined to the north, with a linear wall to protect the buildings from the metro line, giving way to patios elongated. The upshot of the buildings is done with dropped volumes establishing a connection between the new urban area and the whole environment.

For the conclusion of this project 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 financed by the IHRU (Housing and Rehabilitation Urban Institute).

Fig. 74 - Bouça neighbourhood (SAAL)

EXAMPLE 6

Programme "Casa como nova" - in many social neighbourhoods

The "Casa como nova" (house as new) program was launched by Porto's Municipal Council in 2006, being an initiative that intended to involve the municipal residents on the rehabilitation and maintenance of the lodgings interior on Council's neighbourhoods, using each 4 years, materials (such as interior doors, inks and pavements) acquired with a 75% discount in relation to the market prices.

Through the Council's Enterprise for Housing and Maintenance (DomusSocial E.M.) - responsible for requalificating constructions that were being made in social neighbourhoods and its management - , the program promotes daily demonstration actions, developed by professional technicians providing the best ideas and bricolage solutions so that each resident can improve his house interior.

This initiative, besides its social and pedagogical character, meets the necessities shown by the residents and contributes as a complementary measure towards deep requalification constructions on social housing, which are being executed by DomusSocial E. M., with the co-financing of the Prohabita Program (created by the Portuguese Government on 3 of June 2004, through the Law-Decrete nr. 135/2004), being one of its objectives the rehabilitation, by the city councils, of common parts and the exterior surroundings of the damaged buildings, integrated on social neighbourhoods, as well as the incorporation of sustainability, accessibility and rehabilitation solutions.

EXAMPLE 7

Intervention projects on the social integration of the neighbourhoods' inhabitants

The "Porto, bairro a bairro" (Porto, neighbourhood to neighbourhood) project was launched by Porto's Municipal Council on the ambit of its social integration activity, which aims to propitiate new opportunities to the neighbourhoods' habitants.

This project allows the neighbourhoods' most needed populations to assist, totally free, to opera, theatre fado and many other kinds of music, including national and international artists. The shows occur in spaces nearby the neighbourhoods,

It is intended to propitiate to the neighbourhoods inhabitants the access to a diverse group of shows, which they would never be able to get, due to their weak economic capacities.

The "Conversas de Bairro" (neighbourhood chat) project is also a social intervention project launched by Porto's Municipal Council.

With this project, it is intended that chats with specialists from many areas clarify residents about different issues, such as health and well-being, conflict resolution, domestic economy and access to justice.

Besides its pedagogical component, this project gives useful advices towards the quality of life improvement for the most needed populations.

REFERENCES

BALKESTAHL, L. (2005), "Os efeitos da intensificação dos processos de urbanização no balanço energético local: estudo de caso no pólo da Asprela", Tese de Mestrado, FLUP, Porto.

BITAN, A. (1984), "Climatic data analysis and its use and representation for planners" in «Energy and Buildings», 7, p. 11-22.

BITAN, A. (1988), "The methodology of applied climatology in planning and building" in «Energy and Buildings», 11,p.1-10.

CÂMARA MUNICIPAL DO PORTO (1939)," Elementos para o Estudo do Plano Geral de Urbanização", Inquérito, 3 vols., CMP.

CÂMARA MUNICIPAL DO PORTO (1952), "Plano Regulador da Cidade do Porto", CMP.

CÂMARA MUNICIPAL DO PORTO (1966), "Plano de Melhoramentos 1956-66", Porto, Direcção dos Serviços do Plano de Melhoramentos.

CÂMARA MUNICIPAL DO PORTO (1984), "Parque da Cidade do Porto". Exposição.

CÂMARA MUNICIPAL DO PORTO (1992), "Uma Cartografia Exemplar. O Porto em 1892". Exposição Comemorativa do 1º Centenário da Carta Topográfica da A. G. Telles Ferreira.

CÂMARA MUNICIPAL DO PORTO (2001), "As "ilhas" do Porto – Estudo Socioeconómico", Pelouro da Habitação e Acção Social.

CÂMARA MUNICIPAL DO PORTO (2001), " Estudo Socioeconómico da Habitação Social", Pelouro da Habitação e Acção Social.

CÂMARA MUNICIPAL DO PORTO (2007), "Notas sobre a evolução Demográfica do Concelho do Porto (1991-2001)", Gabinete de Estudos e Planeamento.

CÂMARA MUNICIPAL DO PORTO (2008), "Torres do Aleixo vão desaparecer", in «Porto Sempre», nº 20, p.14-15

CAMPOS, Ezequiel (1932), "Prólogo ao Plano da Cidade do Porto", Empresa Industrial Gráfica do Porto.

CARDOSO, Abílio (1996), "Do desenvolvimento do planeamento ao planeamento do desenvolvimento", Edições Afrontamento e Departamento de Engenharia Civil da F.E.U.P..

CARVALHO, V. (2007), "Contributos bioclimáticos para o planeamento urbano sustentável", Tese de Mestrado, FEUP, Porto.

COMISSÃO DE ESTUDO DE DESEMPENHO TÉRMICO DE EDIFICAÇÕES (2003), "Desempenho térmico de edificações: parte1 – definições, símbolos e unidades", Comité Brasileiro de Construção Civil, Brasil.

COMISSÃO DE ESTUDO DE DESEMPENHO TÉRMICO DE EDIFICAÇÕES (2003), "Desempenho térmico de edificações: parte3 – Zoneamento bioclimático brasileiro e directrizes construtivas para habitações unifamiliares de interesse social", Comité Brasileiro de Construção Civil, Brasil.

D'AMICO, F. C. (2000), "Arquitectura bioclimática, conceptos básicos y panorama actual", Boletín CF+S, 14,Instituto Juan de Herrera, Madrid.

DESSAI, S. (2002), "Heat stress mortality in Lisbon Part I – model construction and validation" in «Int J Biometeorol», 47, p. 6-12.

DESSAI, S. (2003), "Heat stress mortality in Lisbon Part II –An assessment of the potential impacts of climate change" in «Int J Biometeorol», 48, p. 37-44.

DESSAI, S.; LU, X; RISBEY, J. (2004), "On the role of climate scenarios for adaptation planning" in «Global Environmental Change», 15, p.87-97.

DOMINGUES, Álvaro (1994), «Oporto» in Atlas Histórico de las ciudades europeas, I, Península Ibérica, Barcelona, Centro de Cultura Contemporânea /UPC.

ELIASSON, I. (2000), "The use of climate knowledge in urban planning" in «Landscape and Urban Planning, 48,
p.31-44.

FERNANDES, O.; YANNAS, S. (s/d), "Energy and Buildings for temperature climates – a Mediterranean Regional Approach", Pergamum Press, Great Britain.

FERRÃO, Bernardo J. (1985), "Projecto e Transformação Urbana do Porto na época dos Almadas, 1758/1813. Uma contribuição para o estudo da cidade pombalina", FAUP, Porto.

GABINETE DE PLANEAMENTO URBANÍSTICO DA CÂMARA MUNICIPAL DO PORTO (1984), "Opções do Plano", Câmara Municipal do Porto.

GABINETE DE PLANEAMENTO URBANÍSTICO DA CÂMARA MUNICIPAL DO PORTO (1985), "O interior dos quarteirões na cidade do Porto. Proposta de uma metodologia de abordagem", Câmara Municipal do Porto.

GABINETE DE PLANEAMENTO URBANÍSTICO DA CÂMARA MUNICIPAL DO PORTO (1987), "Plano Geral de Urbanização", Câmara Municipal do Porto.

GABINETE DE URBANIZAÇÃO DA CÂMARA MUNICIPAL DO PORTO (1962), Plano Director da Cidade do Porto, Câmara Municipal do Porto.

GARCIA, F. (1996), "Manual de Climatología Aplicada: Clima, Médio Ambiente y Planificación", Editorial Sintesis, Madrid.

GARRETT, Antão de Almeida (1952), "Plano Regulador da Cidade do Porto", Separata da Revista «Civitas», Vol VIII, 2, Publicações da Câmara Municipal do Porto.

GARRETT, Antão de Almeida (1974), "História da evolução dos planos gerais de urbanização da cidade do Porto" in "Boletim", Secção de Planeamento Urbanístico, Centro de Estudos de Engenharia Civil, Faculdade de Engenharia, nº14.

GEIGER, R. (1990), "Manual de microclimatologia – o clima da camada de ar junto ao solo", Fundação Calouste Gulbenkian, 2ª edição, Lisboa.

GOLANY, G. (1996), "Urban design morphology and thermal performance" in «Atmospheric Environment», vol.30, n3, p.455-465.

GONÇALVES, H.; GRAÇA, J. (2004), "Conceitos bioclimáticos para os edifícios em Portugal", Tipografia Peres, Amadora.

GONZALEZ, E.; HINZ, E.; OTEIZA, P.; QUIROS, C. (1986a), "Projecto, clima y arquitectura", vol I, Ediciones G. Gili, México.

GONZALEZ, E.; HINZ, E.; OTEIZA, P.; QUIROS, C. (1986b), "Projecto, clima y arquitectura", vol II, Ediciones G.Gili, México.

GONZALEZ, E.; HINZ, E.; OTEIZA, P.; QUIROS, C. (1986c), "Projecto, clima y arquitectura", vol III, Ediciones G.Gili, México.

HIGUERAS, E. (1997), "Urbanismo bioclimático – criterios medio-ambientales en la ordenación de asentamientos", Tese de doutoramento, Escola Técnica Superior de Madrid, Madrid.

HIGUERAS, E. (2006), "Urbanismo bioclimático", Editorial Gustavo Gili, SL, Amadora.

JORGE, Ricardo (1899), "Demographia e Hygiene da cidade do Porto: Clima, População, Mortalidade", Repartição de Saúde e Hygiene da Câmara Municipal do Porto, Porto

LÔBO, Margarida Sousa (1995), "Planos de Urbanização. A Época de Duarte Pacheco", Faculdade de Arquitectura da Universidade do Porto.

MADUREIRA, Helena (2001), "Processos de transformação da estrutura verde do Porto", Tese de Mestrado, FAUP/FEUP.

MATOS, Fátima Loureiro de (2001), "A habitação no Grande Porto – Uma perspectiva geográfica da evolução do mercado e da qualidade habitacional desde finais do séc. XIX até ao final do milénio", Faculdade de Letras da Universidade do Porto, Tese de Doutoramento, disponível em http://ler.letras.up.pt .

MARQUES, T.; MATOS, F.; FERREIRA, E.; SILVA, F. (2006/2007), "Plano Estratégico da Habitação – documentos de base", Departamento de Geografia da FLUP.

MARQUES, Teresa et al (2006), "Lagarteiro uma intervenção alicerçada na participação". Projecto Bairros Críticos (polic.).

MARQUES, Teresa (2007), "Lagarteiro: redes de actores e processos de aprendizagem", in «Inforgeo», nº 20/21, p. 115-126.

MASCARÓ, L. R. (1983), "Luz, clima e arquitectura", S. Paulo, Nobel, pp.165-186.

MONTEIRO, C. (1976), "Teoria e clima urbano", Série Teses e Monografias, nº25, p.1-181.

MONTEIRO, A. (1997), "O clima urbano do Porto: Contribuição para a definição das estratégias de planeamento e ordenamento do território", Fundação Calouste Gulbenkian, Lisboa.

OLGYAY, V. (1998), "Arquitectura y clima: Manual de diseno bioclimático para arquitectos y urbanistas", Editorial Gustavo Gili, Barcelona.

OLIVEIRA, V., PINHO, P. (2008), "Urban form and planning in Lisbon and Oporto' in "Planning Perspectives",23:1,81 — 105

OKE, T. (1984), "Towards a prescription for the greater use of climatic principles in Settlement planning" in «Energy and Buildings»,7, p.1-10.

OKE, T. (1987), "Boundary layer climates", Routledge, New York.

OKE, T. (1988), "Street design and urban canopy layer climate" in «Energy and Buildings», 11, p.103-113.

RAMOS, Oliveira (dir) (1994), "História do Porto", Porto Editora.

TEIXEIRA, Manuel C., (1996), "Habitação Popular na Cidade oitocentista □ as ilhas do Porto", Fundação Calouste Gulbenkian e Junta Nacional de Investigação Científica e Tecnológica.

UNITED NATIONS (1971), "Climate and house design: design of low-cost housing and community facilities", Department of Economic and Social Affairs, UN, New York, vol. 1.

WORLD HEALTH ORGANIZATION (2003), "Climate change and Human Health – risks and responses", WHO library, France.

WORLD HEALTH ORGANIZATION (2003), "The health impact of 2003 summer heat-waves" – briefing note for the delegations of the fifty-third session of the WHO Regional Committee for Europe", Vienna, Austria.

WORLD HEALTH ORGANIZATION (2004), "Extreme weather and climate events and public health responses", Report on a WHO meeting Bratislava, Slovakia.

WORLD HEALTH ORGANIZATION (2004),"Results of review and data availability screening in Member States", World Health Organization Regional Office for Europe European Centre for Environment and Health Bonn Office, Rome, Italy.

WORLD HEALTH ORGANIZATION (2004), "Heat-waves: risks and responses", Health and Global Environmental

Change SERIES, No. 2, Copenhagen.

WORLD HEALTH ORGANIZATION (2004),"Review of evidence on housing and health", Fourth Ministerial Conference on Environment and Health, Budapest, Hungary.

WORLD HEALTH ORGANIZATION (2005), "Is housing improvement a potencial health improvement strategy?",Health Evidence Network, Copenhagen, Denmark.