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SOCIAL HOUSING: INTERVENTIONS OF DENSIFICATION IN URBAN REGENERATION (1995-2010). CRITICAL ANALYSIS OF STRATEGIES ADOPTED IN MILAN, LONDON, SÃO PAULO

SOCIAL HOUSING: INTERVENTI DI DENSIFICAZIONE PER LA RIGENERAZIONE URBANA (1995-2010). ANALISI CRITICA DELLE STRATEGIE ADOTTATE A MILANO, LONDRA, SAN PAOLO

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1. Introduction

> People deserve to get an accommodation [...]. The house should have those values that involve the community and make it better. The house must [...] be prepared for the inevitable future of our cities, which will become increasingly multiethnic and then offer accommodations that allow to cook not only an omelet but also, if necessary, the kebab or the couscous [...] I am more and more convinced that the dwelling should fully respond to the different cultures of the communities, through different ways of living the private and urban spaces, to live the individual, family, collective dimension. Since the architecture should serve people and not the opposite.
>
> *Giancarlo De Carlo*

The prospect of the continuous multiplication of life styles, the obsolescence of the traditional typological diagrams, the usability of spaces on different territorial scales, imposes on contemporary architecture the search for new models of living.

Limited densities in urban development have produced the erosion of territory, the increase of the harmful emissions and energy consumption (Gelsomino and Marinoni, 2009). The goal for a long-term sustainable development requires the densification of our cities. The reason that should push forward in this direction is not only the "surplus of amenities" (Schittich, 2004), but also the awareness that the compact city fosters creativity and progress, producing better social, economic and environmental results. The principle of proximity encourages people to travel on foot or by bicycle, making roads safer and limiting the consumption of territory and energy (Willis, 2008).

Within a greater progressive match between the complexity of what exists outside the living space and what happens inside, high density housing cannot refuse the social emergency to ensure high quality and low cost dwellings, to a new people target: students, temporary workers, key workers, foreign, young couples without children, families with children and, in general, people who carry out public services.

Uncomfortable living conditions in Italy include both that socially integrated fringe of population that, however, cannot afford the average prices of the rent market, and the deep housing exclusion people, who often comprise immigrants. The share of renting housing, at the national level, reaches the 18.7 %, which is far below the values of the more developed European countries, ranging between 30% and 40% (CECODHAS, 2012). With regard to the supply of residential units in public housing, the data is even more worrying, because the assignments of social housing cover the 8% of the demands (CECODHAS, 2012).

Social housing strategies have become particularly relevant in regenerating high density urban outskirts, both in terms of the urban and socio-economic implications carried out, and as a real tool in improving the overall quality in cities, under new social pressures, increasingly evident in periods of crisis, which will affect significantly the construction sector the next years.

The house is the place that represents the measurement unit in cities, and social housing means ensuring all people to have access to a dignified life, which also grow up through the community dimension and the network of relationships (Pavesi, 2011). By promoting the quality in life, through the integration of policies and professionals, either in renovation interventions or in new buildings, housing design plays an important part in the overall regeneration of the city and its connections.

1.1. Main research questions

The choice of this research topic derives from the desire to deal with the recent accommodation emergency, according to different perspectives, with a view to give a contribution to the current literature, by proposing some tools for a correct design of the social housing, by ensuring good quality, cost-effective, and eco-sustainable solutions, from the concept phase, through management and maintenance, until the end of the building life cycle.

The purpose of the thesis is defining a framework of guidelines that become effective instruments to be used in designing the social housing. They should also integrate the existing regulations and are mainly thought for those who work in this sector (professionals, technical institutions, private operators etc.). They would aim at supporting students who have to cope with this particular residential theme, and also the users themselves, who demonstrate the desire to participate by person to the modification and qualification of their living environment.

In the context of high density interventions, there have been selected three metropolitan areas: Milan, London and São Paulo. With regard to the first two urban centers, their selecting is due to the primacy for the high concentration of social dwellings, for the quality and innovation of the experimentation conducted, and also due to deep knowledge, gained from my personal long stay in both cities. São Paulo, an area of extremes and deeply rooted social contrasts, also widely involved in a huge program of social housing provision, has been included in the analysis to search for interesting similarities in comparison with the European areas and to deepen some dynamics of a country affected by a profound process of socio-economic transformation.

The scientific evidence of either the reported data in the most recent specialized literature or the solutions adopted in some case studies within the considered urban contexts, it is possible to identify the principles of this new design approach, in which the connection between typology, morphology and technology pursues the goal of a high living standard. In almost all cases, these examples also show how it is possible

to unlink high energy efficiency choices from the typological and fragmented uniformity often found in the green-architecture buildings.

Although the objective of this study is the pursue scientific results, and therefore aimed at the accuracy of the analysis, these design criteria remain as guidelines, because a good margin of freedom to the choices made by the designers should be guaranteed, considering the complexity of the examined theme. The challenge for anyone who works in this area is to imagine, design and produce a response to the home demand, taking into account the sociability issue as predominant.

1.2. Research methodology

This research begins with the examination of the current state of the scientific literature on social housing, with particular reference to the three considered geographical areas, then contextualized in the relevant national frameworks. Being the theme examined particularly complex and varied, special attention has been paid to the interdisciplinary contribution of several subjects, which go from the social architecture to the economy and construction management, from urban sociology landscape architecture, from urban planning to the energy containment strategies.

In addition to an in-depth analysis of the literature on the topic, there have been identified some models of densification that operate simultaneously at the scale of the building and the urban context, trying to select those quantitative and qualitative parameters able to ensure high levels of living quality, in a perspective of a renewed range performance. The set up analysis concerns, therefore, the highlight of those factors of space structuring that ensure values of connection between each architectural intervention and the relative urban environment.

The contribution of literary production has allowed the creation of a framework of performance parameters, translated into specific requirements, which should be achieved by a proper social housing design.

Analyzing a group of about fifty projects in the three considered urban areas, further more for some case studies, selected for quality relevance and wealth of technical and formal solutions, has completed the research iter and allowed to identify a wide configuration of models that have assumed the densification as the basic principle of intervention.

The main found interesting elements, subsequently used for the construction of a comparison chart, within the cluster examined, concern: the densification of the existing, the architectural quality, the low budget in relation to environmental sustainability, the energy efficiency and the construction strategies.

As examples of good design practice, the case studies have responded to the parameters identified and translated into theoretical knowledge the project ideas

already tested with success. The critical evaluation of the examined samples allows to propose a series of guidelines to be taken for the regeneration of urban areas that foster those characterising elements and types of intervention that meet the new living needs.

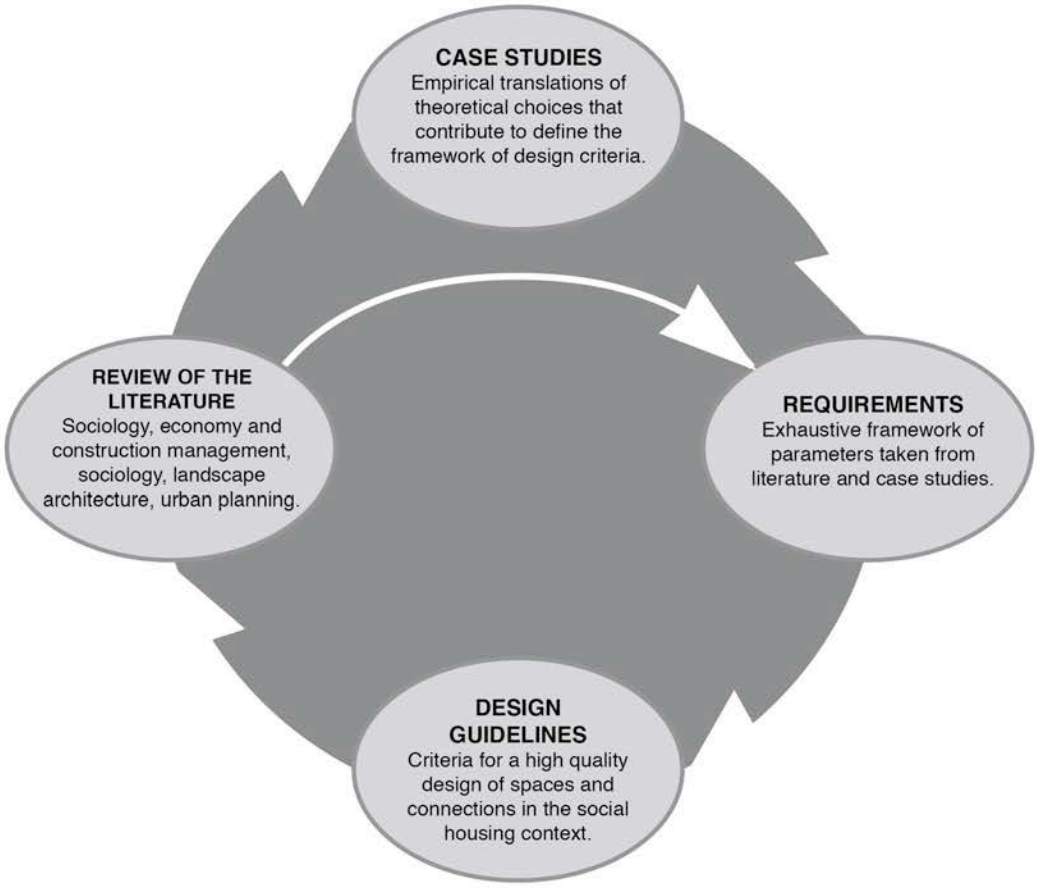


Fig. 1. The proposed research method.

1.3. The outline

This thesis is articulated in four main sections, plus a final summary.

The first one (Chapter 2), starts with a debate on the implications of living at superdensity. Then it focuses on the geographical areas analyzed with the relative national contextualization. Historical, regulatory and market dynamics, and the current status of research in the social housing sector, are taken into account.

The second part (Chapter 3) proposes a digression on the current techniques for the energy control and the cost containment, applied to residential buildings, with particular reference to the collective ones. Construction techniques and building high

performance innovative materials and some strategies related to the reuse and recycling are deepen. The last section focuses on the overall quality in residential buildings.

The third section (Chapter 4) identifies a number of ecological, social and functional-spatial requirements extrapolated from the literature, and provides a critical analysis of some case studies built in Milan, London and São Paulo. The objective of this step is understanding which design choices have been made in examined buildings to meet the identified requirements. The results will then be used to compose the the next chapter. The presented case studies do not aim at giving a framework of the worldwide social housing context, in fact they are selected examples aimed at better understand design issue presented in the literature.

The original contribution of this research is reported in the fifth part (Chapter 5), which proposes more than sixty design guidelines extrapolated from the literature, in the form of requirements to be satisfied, and from the analysis of the case studies reported in the previous chapter. The criteria presented are deliberately general and comprehensive, in order to leave a high degree of freedom in their interpretation. Some of the guides lines show the theme of the social welfare, both individual and communal, others are focused on the spatial and functional configuration with large flexibility implications, others promote the eco-sustainability and cost containment in designing the life cycle.

The final part (Chapter 6) summarizes the most important findings, prospects the implication of the goals achieved and proposes suggestion for a possible research development.

2. Historical and legislative evolution in Milan, London and São Paulo

2.1. Implications of living at super-density

In 2006 more than 50% of the planet's population was living in cities and they are expected to grow further in the near future. Spread of population changes depending on the area, and Europe, Asia and China are the regions with the highest density. There are exceptions and perplexities about the positive nature of this trend: for instance the increasing level of stress related to a big city lifestyle could be an obstacle (Freedman, 1975), secondly the flattening of diversity (Edward Ng, 2009).

The control of urban sprawl has become the central problem of long-term sustainability in cities, but also for its competitiveness and rigidity of short period. This highlights the theme of "sustainable form of the city", in terms of density, land use, balance between open space and built one. For the first time the Green Paper on Urban Environment in 1990, explicitly focused on the problem of controlling urban dispersion, by launching the motto "compact city" that refers to a urban sustainable form (Camagni, 2002).

Quality of the living space and the social interaction of the inhabitants are deeply influenced by traffic links, urban planning accessibility to public facilities, building access, layout and design of green spaces and the rising integration of living, working and leisure, has induced the need for housing sets where facilities are more than mere supply of living space (Schittich, 2004). Unlike in other areas of the planet, our territories essentially need a qualitative growth: avoiding limited density and further erosion of a more and more rare territory, reducing harmful emissions and energy consumption, water and non-renewable resources (Gelsomino and Marinoni, 2009).

Super-density in the past has often meant unhappy episodes of slums, high-rise downgraded buildings and squatters, nonetheless higher-density living has already become an unchangeable process of the human development and many cities are moving towards an increasing of density (Edward Ng, 2009). Hence these reasons are pushing to rethink the design of the future housing stock (Edward Ng, 2009). The need for proximity, density and variety, are largely considered catalysts of an innovative economy (Willis, 2008). This is true both for villages and towns, as compress village centres create the conditions for community growth, indeed the physical configuration of a settlement is a key factor in fostering connectivity and interaction, in fact common facilities like pubs, shops, churches and libraries encourage encounters (Willis, 2008).

In 1966 some architects and practice worldwide, like Eckhard Schulze-Fielitz, Archigram, Superstudio, Yona Friedman and Kenzo Tange, aimed to transform urban design and architecture by “means of flexible spatial constructs”, explained that densification is not negative if it produces “synergic advantages” in the urban development (Schittich, 2004).

Notion of density is related to human perception of interaction between individuals and physical environment. High density definition is various from place to place. In UK, for example, a residential settlement with less than 20 dwellings per net hectar is considered low density, between 30 to 40 medium density and higher than 60 is considered high density (Edward Ng, 2009). In USA 110 dwellings per net hectar is high density, instead in Israel this limit is more than 290 dwellings (Edward Ng, 2009).

The proximity principle is the idea that compact cities, towns and villages produce the best social, economic and environmental achievements, driving creativity and overall progress (Willis, 2008). Proximity fosters a sustainable development by encouraging people in walking or cycling instead of driving a car, with safer streets, and less land and energy consumption (Willis, 2008). People generally like to live in communities rather than in isolation, and a city could easily generate a “surplus of amenity”, where daily life with shopping and leisure, the route to school and office, culture and communication influence the quality of the spatial experience (Schittich, 2004). R. Camagni (2002) has studied the implications and benefits of the "compact city", which refers back to a form of the city that offers the best performance in terms:

- containing local resources consumption and preserving not fragmented and compromises open spaces;
- reduction in the number of travels by car and strengthening of the opportunity to active transport by bicycle, public transport systems and efficient systems of para transit,
- reduction in the consumption of energy and water, thanks to a most wise eco-design in building operations;
- revitalisation and regeneration of central and semi-central areas;
- Improvement in quality of urban life and, in particular, a greater opportunity for social interaction guaranteed by a rich functional diversification of land use.

2.2. Social housing and urban regeneration in Europe

In several countries in Europe there is no single prim definition of social housing. Generally it can be related to ownership (non-profit organizations and local authorities who constructs the dwellings), rents below market levels, the funding and/or subsidy stream) and the aim for which the housing is provided (Whitehead and Scanlon, 2007). The European Commission has stated that in the countries of the European Union the possibility of living at affordable prices is considered one of the key factors to prevent and combat social exclusion and represents one of the objectives of the new Agenda 2020 (Pavesi, 2012).

European cities are facing a complex framework of economic, social and environmental problems: investment and economic growth and attending the dereliction left by previous generations are great challenge for the future and the demand for travel in sprawling cities has to be supported while try to limit energy consumption and environmental pollution (Couch et al., 2003). The current economic crisis has induced an increase in real estate prices rising the number of poor families. Over recent years working relationships have become more precarious, buying power has fell down in many countries and after the decreasing the of social housing supply, waiting lists have risen and are set to continue to grow (Casolo, 2007). Europe still continues to facing problems of housing health and access to basic service facilities (these problems are more consistent in eastern European countries). In the overall Europe, 11% of families report that they have at least two problems in the housing (Casolo, 2007).

A new sustainable and intense urban form is required to designers; residential architecture needs generally a more incisive quality. Central areas and land prices dictate the maximum density and on the outskirts the compromise between housing demand, speculation, produces forms without an overall logic; this drop of order is a huge plague in the recent urban planning, in particular on the scale of the neighborhood (Gelsomino and Marinoni, 2009).

Overall evolution of the social housing sector

According to Edoardo Longa and Michelina Venditti (2009), in the historic reconstruction within a broad context like the Western Europe, the development of the social housing can be summarized into seven steps:

1. Between 1800 and 1900 cities are facing the living insertion of "migrant masses" and the first initiatives of social housing are not taken by the government but by private actors as owners of factories, philanthropists and foundations.
2. By the end of First World War to the beginning of 1929 can be pointed as the period where the public administrations assume a significant role, involving also the actors.
3. From the crisis of 1929 to the Second World War. The devastating effects produced by the crisis are reflected in the social housing in different ways

among the various European countries, however sharing a lack of importance of the public sector in social housing supply.

4. From 1945 to 1960, is defined the “shot phase”, because it was oriented on the reconstruction and to tackle the housing shortage, due to the subsidies and government funding.
5. From 1960 to 1975, the growth phase, characterized by greater attention to the quality of buildings and urban renewal. In the 1970s a wider dissemination of the accommodation and the gradual spread of property have already emerged.
6. From 1975 to 1990, State reduces its own economic commitment; the residential sector becomes increasingly market-oriented, competitive, open to the economic dynamics, while the social housing is reduced in terms of stock and becomes accessible to increasingly restricted groups of population.
7. From 1990 to today, which can be described with the growing social polarization, the growing imbalance between average income and living expenses. The emergence of these new factors makes necessary an important commitment by governments, together with an evolution of the relationship between private finance and territory development.

Trends in the total supply and access

Real estate markets in the European Union (EU) are characterized by the high percentage of properties, which is a widely shared datum in most of the countries. According to more recent surveys, the percentage of households varies by more than 90% in some eastern European countries, such as Estonia, Romania and Bulgaria, decreasing up to 40% in Germany (CECODHAS, 2011).

Rentals sector varies significantly within the European area: small in Eastern Europe and in southern Europe, such as Spain, Greece and Italy (Whitehead and Scanlon, 2007). In some countries rented social housing represents more than 50% of the overall market of rentals and this trend has been greatly enhanced by the encouragement policies for the home purchase through policies that promote the building and selling of social housing, such as the introduction of the “Right to Buy" in the United Kingdom, in 1980 (Whitehead and Scanlon, 2007). Today there are signs of revival in almost all countries that have had a collapse of the real estate market, but now the price increases are related to other market indicators: the upward trend of prices does not correspond to a resumption of construction (CECODHAS, 2011).

Regarding accessibility, in several countries there are income limits for households who request to live in social housing. However, the prim limits could be so high that most of the population is eligible (Austria and France). Special treatment is often served for key workers, or indeed, as in the case of Denmark, for any worker. In many countries social housing is oriented to accommodate homeless people, ex-psychiatric patients, ex-addicts and female victims of domestic violence, and in general the vulnerable and those in most precarious housing need, a group called “very social housing” (Whitehead and Scanlon, 2007).

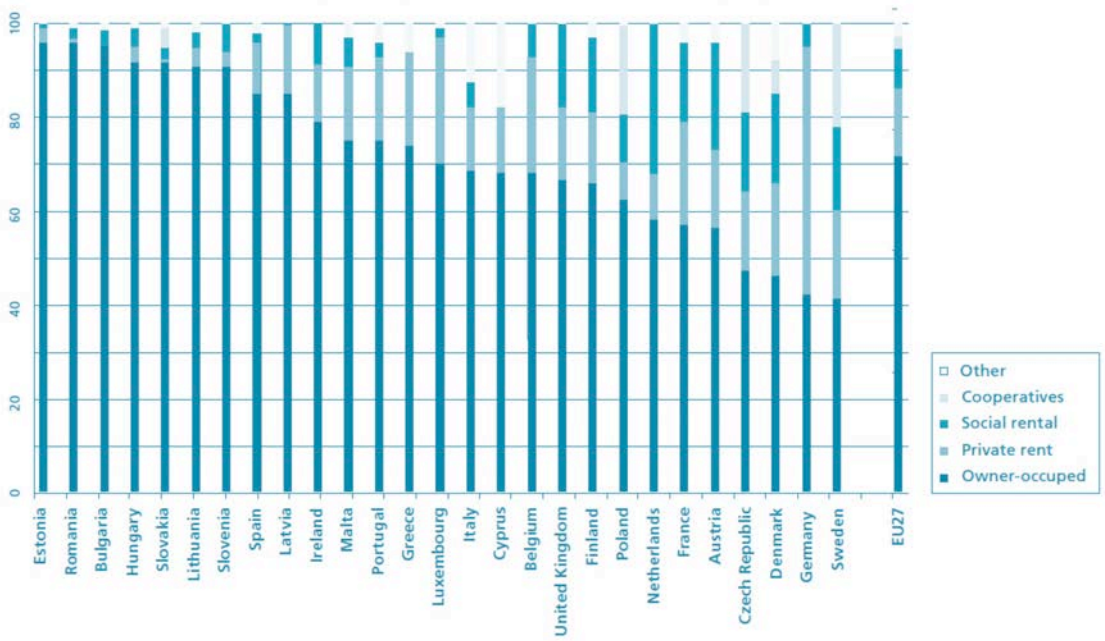


Fig. 1. Tenure split in the 27 EU Member States as a percentage of the housing stock.

Quality housing conditions and demographic dynamics

In 2009 the average 17,8% of the European population was living in overcrowded homes, with peaks in most of the countries of Eastern Europe (CECODHAS, 2011). Due to the decrease of the average size of families, which is linked to a series of different factors, such as life expectancy, fertility rate and yew of divorce and separation etc., the number of households has increased much more rapidly than the population in most European countries over the past decades (Dexia Crediop, 2008). The total number of households in Europe has increased from about 193 million in 2005 to 202,8 million in 2009 (CECODHAS, 2011).

In Europe the two largest components of family structure are represented by individual adults and couples without children; furthermore, in recent years these two categories have grown more rapidly than the others. The phenomenon of the population aging is expected to have a significant impact on the real estate sector in terms of adaptation of dwellings to the needs of the elderly. Together with the ageing trend, there is an alarming trend growing in several countries: young people between 19 and 30 years old and up who still live at home because they cannot afford to live by their own (Casolo, 2007).

Generally many countries have positive policies to promote owner-occupation in order to foster the departure of the middle class from social housing. However, it also encourages diversities on income and tenure. It is largely observed how increasing income and social segregation affects especially unpopular estates (Whitehead and Scanlon, 2007). Old problems are currently reaffirming: sub-standards, unhealthy living condition and forced cohabitation (Casolo, 2007).

Ethnicity and mix use tenure

In many European countries providers of social housing are involved in plans for urban regeneration and social mix even through by only inner and outer house renovations. Furthermore, in order to avoid forms of ghettoisation some strategies could be adopted by attracting wealthy families towards social housing areas or by inserting precarious households into different areas (Venditti, 2009). Within the city limits there may exist considerable differences in terms of economic and social opportunities in different areas, but also in terms of different qualities of environment. In addition, the differences between social and economic development are still growing, thus fostering the phenomenon of urban destabilisation. A social integration policy that contributes to reducing inequalities and to prevent social exclusion should be the best solution to maintain our cities safe.

The housing issue should underlie a new conception of living, which can no longer be traced back to the construction of individual apartments (the "bricks and mortars" logic often and sadly configured ghetto districts) (Venditti, 2009). Designers should foresee the provision of social infrastructure (aggregation, listening-cultural and sporting centres, meeting places etc.), commercial and economic facilities that are significant factors of social inclusion (Venditti, 2009).

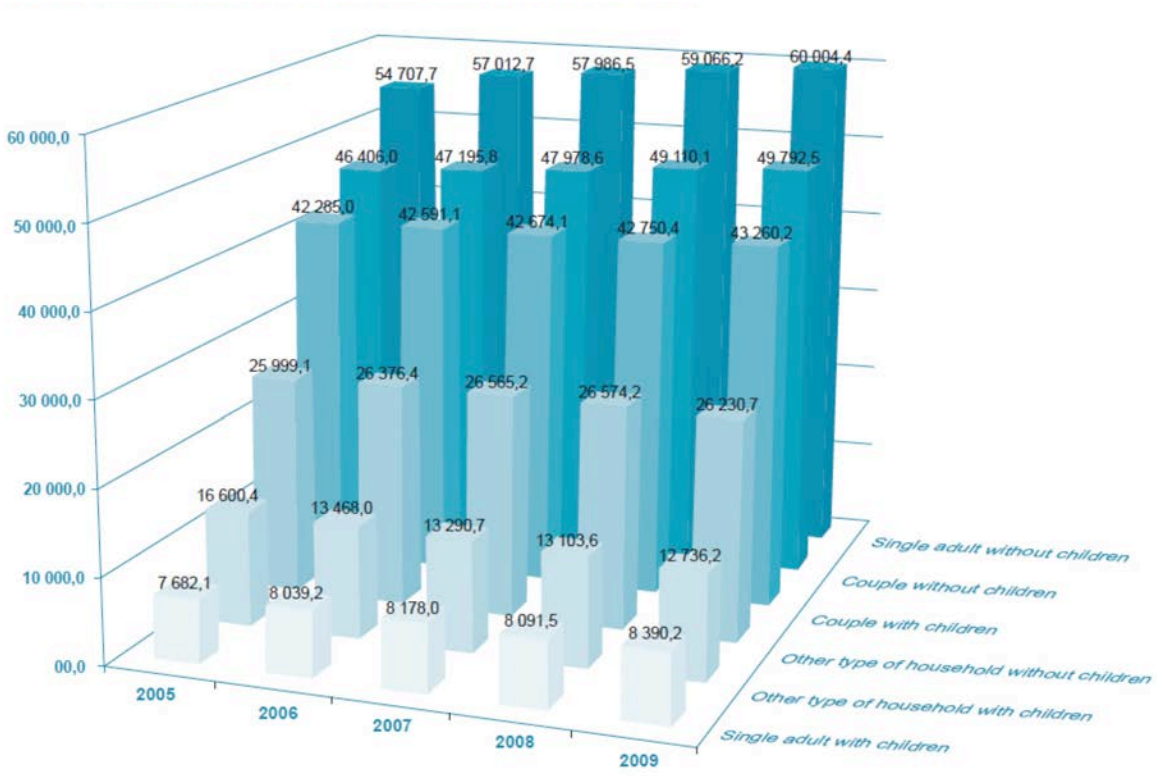


Fig. 2. Private households by household composition (*1000), 2005-2009.

2.3. From popular to social: the Italian housing context

Nowadays, in the city of condominiums, it is impossible to recognize the architectural model which the contemporary culture aspire to, and also the social model of reference is not yet recognizable. The new suburbs no longer contain the common figures of the city and the village, and neither the visionary shapes of immense "housing machine" (Braghieri, 2009). Once missing the established and recognizable models, agglomerations of randomly arrange objects appeared in space always the same way, and the market is projected to a medium density urban configuration (Braghieri, 2009).

In Italy, the percentage of housing owners is high, in fact more than 80% of households the accommodation where they lives. From the middle of the 1990s there has been a significant increase either in price of property and rents in comparison to household incomes, or in the population demand as a result of the enlarged flow of migrants, the growing number of small families, the aging of the population, the lack of job for young people (Venditti, 2009). The new types of discomfort adhere not only to the poorest in precarious housing condition (first of all immigrants), but also to families, to young people, students, elderly. The situation of many families belonging to the medium-low class, especially in large areas, does not allow them to be eligible for public housing because of holders of higher incomes than the minimum required, for more they do not have sufficient means to access a property home and they suffer for the increase in rents that they are not able to face. With reference to young people, it is observed that in 2006, 73% of the population, comprised in the age group between 20 and 30 years, was living with their parents (Pugliese, 2005).

The meaning of social housing in Italy

In the first sense, the social housing includes all the interventions in support of housing by the public. In a second mean the social housing represents a housing policy sector contextualized to public housing, but different in flexibility, reference target namely a wide range of people in difficulty. A further approach identifies the social housing as all those activities aimed at promoting housing offer and specific targets in the context of a broader policy of social cohesion. Within this plurality of meanings, the significant elements of social housing are related: to the implementation of general functions for the promotion of a stronger regional social cohesion: to the intervention in non-extreme discomfort areas, hence excluded from public interventions; to people not able to support the free market; to the application of the horizontal subsidiary principle and to the integration between policies (Venditti, 2009).

The social accommodation is configured as an essential element within the social housing system, consisting of that set of housing services aimed at fulfilling the primary needs. It is possible to consider as "social housing" those accommodations built, or re-qualified, from public and private operators, with public contributions or facilities intended for the temporary location (at least 8 years) and also to property

(CECODHAS, 2011). According to Edoardo Longa (2009), social housing is distinguished from public housing mainly because:

1. it is not based on the expropriation of the areas, but on the use of already public areas available or acquired by private sector through equalization;
2. it tends to be a component inside of not specialized urban transformations, by replacing the model of neighborhoods built entirely from public housing with integrated social needs within socially mixed tissues;
3. it tends to produce accommodation for rent, not only under social canon, but on a range of more articulated canons, precisely because the access to renting accommodation is no longer referred only to the weakest popoluation;
4. it tries to involve private resources in real estate investments that are paid with resources from rent, through a new relationship between the public and in private.

It is observed that the public housing has the accommodation as finalizing, while the social housing construction has a wider housing policy represented by general social and economic services to be contextualized on a welfare system, centrality of the person, personal rights due precisely through services and operations of social housing (Venditti, 2009).

Social target and demand

The large economic residential crisis that has hit the United States in 2006 came also to Italy and the European market, and leaded many families indebted for having purchased home, to more serious problems. Therefore, all over the country, the demand booms, involving not only the so called "poor" classe, but more and more also the "middle class" (Delera, 2009). In Italy, Regions have the responsibility to define the eligibility criteria to access social housing as well as the rules for the determination of rentals (CECODHAS, 2011).

The issuing of the law n. 112 on 25 June 2008, entitled "urgent measures for economic development, simplification, competitiveness, stabilization of the public finance and tax equalization", pointed to overturn the modalities of intervention carried out by the government until then. On the one hand, new financial actors are involved through the establishment of an integrated system of security funds (SIF), constituted both on a national level and on a network of local funds, and the other by addressing a changed and completely different target of interest (Delera, 2009). The requirements for access to a social accommodation, by recording on the waiting lists, are defined by the following criteria: income of the applicant, address (to check whether there is a direct connection between the family and the requested municipality) and nationality. The priority of access to social housing is assigned on the basis of the discomfort, the family size and situations of forced cohabitation (CECODHAS, 2011).

This system of welfare is addressed to households, even single-parent and single-income, and young low-income couples; to elderly persons in disadvantageous social

or economic conditions; families with handicapped components; students out of the office; those who have a procedure to executive eviction; illegal immigrants, with a low-income and resident for at least five years in the same region and at least ten years Italy (Delera, 2009).

Current adopted actions and instruments

Concretely the initiatives put in place to cope with the enlargement of the offer are numerous and diversified. In this sense there are three ways of action:

1. the first approach normally deals with situations where interventions in residential building above a certain square meters are necessary, to create a minimum significant percentage of the area for rents lower than market rates;
2. the second approach is constituted in the provision of public areas for the realisation of houses for renting;
3. the third approach has produced a direct action of joined real estate companies in order to create a new typology offer for accessible rent.

With reference to the recipients, the interventions have been focusing on mobility of the italian and foreign workers (immigrants, elderly people, young people, students and actors in insecure working conditions, separated, young couples, ex-prisoners, people belonging to social groups at risk, entities and organizations) (Venditti, 2009).

As regards the construction phase, there are three special categories of addenda: the cost of the land, the cost of construction and the tax cost. From the drastic reduction of the land cost it is possible to check the total cost condition that makes the social construction economically sustainable, in a context where realizing a virtuous social mixture between people that need social protection and middle class, aims to avoid the conditions of ghettoisation often linked to the old model of public buildings (Longa, 2009).

Social housing market today

In the 1998/2007 decade, according to the elaborations by ANCE on Istat data, the investment in the construction sector has reached its historic peak with 120 billion euros at the national level. In this legislative context, all state funding for the house renting end up to a determined point where, in addition to obtain from the European Commission continuous complaints for the absence of social measures directed to the housing sector, Italy is placed in 2006 at the third last place with 1.004.130 social rented dwellings equal to 5% of the total housing stock, and 3,5 % of cost per inhabitant (Delera, 2009).

Funding is made available from the Regions and the municipalities, together with Regions, co-finance grants directed to people, aimed at hiring and providing areas for manufacturers. Recently, the Decree by the President of the Council of Ministers, DPCM July 16, 2009, “Piano nazionale di edilizia abitativa” (National housing plan)

has laid the groundwork for the definition of a new form of public-private participation, through the function of “Cassa depositi” and loans “Investmenti SGR”, with the creation of “Fondo Investimenti per l’Abitare” (Fund Investments for Dwellings).

Due to the economic-financial crisis and the resulting reductions of funds to the local authorities, the exemption from the house property tax applied to affordable housing is due to be eliminated. At the same time, both in public and in private market, the phenomenon of non-paid rent has raised, due to the depletion of Italian families. In addition, since the current system of social rent definition is based on family income, it is clear that the sector of public rentals will have to support an increase in costs, even if the revenue related to the payment of the fees will fall (CECODHAS, 2011). Finally, the ability to retrieve funds through the sale of public buildings is currently very limited, due to the financial crisis; all of these elements together endanger the existence of the sector itself (CECODHAS, 2011).

Hundred years of legislative process

In Italy the development of Social Housing is accompanied by specific legislative measures on public housing and starts in the early twentieth century with the law Luzzatti (law n. 251/1903), which introduced the “Istituti Autonomi per le Case Popolari” (IACP). This operation, and those that followed in pre-war period, were designed to transform and improve the living conditions of the population and to provide for proletarians, artisans, small settlers, small rural owners, employee, through the construction of new living quarters (Longa, 2009).

The development of public house themes begins in the post-war period through the instrument of popular house. Interventions occurred from the first post-war period until the beginning of 1970s have been based on legal framework introduced by the “Testo Unico per l'edilizia popolare ed economica” dated 1938 (April 28, 1938, N. 1163) and include, among others, the INA-Casa plan and the Gescal plan (Pugliese et al., 2005).

After the post-war reconstruction started, the government launches a broad policy aiming at creating employment and labor with buildings through measures which give origin to the INA-Casa plan, which is "plan for increasing workers’ employment by the construction of houses. Since beneficiaries of the plan could redeem their home in which they were rented, more than 70% of the apartments are ransomed; for the first time, 40% of families become owner of a dwelling (Venditti, 2009). The objective is to build the largest number of accommodation at the lowest cost as possible, within the framework of defined technical and typological characteristics. The best examples are the district Harrar in via Dessie in Milan (1951/1955), the Villaggio San Marco in Mestre (1951/1961), the district Falchera in Turin (Longa, 2009).

The Plan INA-Casa is replaced with the Law n. 60 14 February, 1963, by the “Programma decennale di costruzione di alloggi per lavoratori”. New organizational structures are established, such as the Comitato Centrale and Gescal (Gestione case per lavoratori). Compared to the previous Plan there is a notable decentralization in

execution stages, achieved by giving full operational responsibility to the IACP, which become executive instruments of the program at the provincial level. One of the introduced novelties is the provision of funding for the construction of facilities and services for recreational, social and spiritual activities. The primary purpose is to provide the concrete tools to plan interventions in the housing sector by contrasting the land speculation and directing the construction development to be realized on expropriated areas (Longa, 2009). In the period 1963-1973 there is a new concept of ratio home-services: among the examples of the period, the district Sant'Ambrogio in Milan (1964-65) and the residential complex in Gallarate neighborhood in Milan (1967-1974). The Gescal system is deleted from the Constitutional Court's sentence n.424 in September 12, 1995, and ceased between 1995 and 1998 (Venditti, 2009).

With the approval of the Law n.865 October 22, 1971, “Programmi e coordinamento dell’ediliza residenziale pubblica. Norme sull’espropriazione per pubblica utilità”, there is the introduction of the unitary programming principle for all the interventions. The IACP are the only administartions responsible for the implementation of interventions in residential public buildings. In the same time it sets up a new central unit, the CER (Comitato per l’edilizia residenziale) for the distribution of funds to Regions (Pugliese et al., 2005). As a result of the application of the law n.865 /1971, new neighborhoods, designed as real cities self-managed, starts growing, as, for istance, the Rozzol Melara district in Trieste. Conceived as a self-sufficient settlement, from the beginning this district has been isolated from the urban context, with a consequent social exclusion of the population and a growing degrade (Venditti, 2009).

According to Edoardo Longa (2009), 1970s are characterized by regulatory interventions on public housing, culminating with the law n.457 /1978, by introducing the “Piano decennale per l’edilizia residenziale”. This plan is related to:

1. the interventions of subsidized housing oriented to the construction of dwellings and to the recovery of the built heritage of the public administrations;
2. the interventions of subsidised and facilitated housing oriented to the construction of houses and the recovery of the existing built heritage;
3. the acquisition and urbanisation of areas intended for residential settlements.

Normative activity resumes in the 1990s with the law n.179/1992, which introduces rules relating to urban regeneration and the "Piani Integrati di Intervento". The latter has to be promoted by the municipalities in order to renovate the urban and environmental tissue. Veneto and Lombardy, respectively in 1995 and 1996, are the first regions to transform the IACP in companies also by changing its name, respectively in ATER (Azienda Territoriale per l’Edilizia Residenziale) and in ALER (Azienda Lombarda per l’Edilizia Residenziale Pubblica) (Pugliese et al. et al., 2005).

As stated by Michelina Venditti (2009), the real transformation takes place after the transfer of the central powers to Regions, operated by the Bassanini reform which promotes:

1. the determination of guidelines and objectives for interventions;

2. the planning of the financial resources allocated to the sector;
3. the management and implementation of interventions, as well as the definition of the incentive system;
4. the determination of intervention types through integrated programs of urban redevelopment and renovation;
5. the establishment the criteria for the assignment of accommodations destined to housing assistance, as well as the determination of fees.

Starting from the 1990s there have been approved some reforms for the liberalization of the housing policy, in order to promote the private investments, to create a national fund for housing construction and a national observatory aimed at analyzing the living conditions and giving new responsibilities to Regions. However, the gradual reduction in the number of resources for the financing and the maintenance of the public housing heritage (ERP), and in particular the disappearance of ex-Gescal funding, have fostered the creation of new housing policies expressly called “social housing” (Longa, 2009). This new trade is positioned next to the regional or municipal programs, traditionally articulated in the subsidized housing sectors financed by the government, carried out in support of the families concerned primarily to purchase accommodations through low-interest loans, and of the social housing (Longa, 2009).

In recent years the Law D. L. 112/2008 establishes the approval of a national housing plan to increase the real-estate assets by offering residential dwellings, to achieve with the involvement of public and private resources, oriented primarily to the first home and designed for:

a. households with low income, even single-parent or single-income families;
b. young couples with low income;
c. disadvantaged elderly people in terms of social or economic conditions;
d. out of office students;
e. legal immigrants with low income, resident in the national territory for at least 10 years or in the same region from at least 5 years.

The centrality of the “Piano nazionale di edilizia abitativa” (National housing plan) can be discovered in the construction of new houses, and in the implementation of actions for the recovery of the existing housing stock. Several interventions are made with resources taken from the constitution of real estate funds, aimed either at the exploitation and the increasing of the housing supply or at the promotion of innovative financial instruments, even with the participation of more public or private subjects, for the acquisition and construction of new residential buildings.

2.4. Strategies promoted in Milan

Lombardy: a pioneer region

It is possible to identify four main periods in the hundred years' history of social housing in Milan; a first period between 1900 and 1930, is characterised by Giovanni Broglio's intervention "mimesis" of the middle class housing architecture; the second period lasted fifteen years and is considered the season of rationalism and the hypothesis of a new order in the city; a third period goes from war and implied the recovery of the tradition, in the 1940s and 1950s; and finally the period of the large dimensions' ambition in the late 1970s and 1980s (Pugliese, 2005).

In the regional policy the approval of Law n. 27 18/12/2007 has increased levels of rental in 176.308 houses owned by Aler and municipalities. It has concluded the reform began in 2000 as a result of the allocation of legislative powers on social housing to the regions by the government. According to Anna Delera (2009) these key elements can be deducted by a comparison between laws, regulations and decisions of the Lombardy region**:**

1. articulation of public funding toward the most varied categories of bad demand, where the subsidized building social fee is taken as a priority;
2. a particular attention is reserved for to the households that have a certain income and buy a house to obtain from the region a lost fund of € 5000;
3. funding to municipalities, Aler and private operators and foundations for the construction of affordable housing;
4. reduction in the social rented housing supply through shares of reserve intended for special categories (policemen, nurses, temporary workers, etc.);
5. sale of public existing stock (20% of the total, approximately 37.000 dwellings) and introduction of the compulsory mobility for those who refuse to or cannot buy their own accommodation inserted in the sale plans;
6. increase of 60% of the revenue from Aler rentals starting from lowest incomes and in oldest and most degraded housing conditions;
7. reduction in all of those tools of social fund for the poorest local people (about 13.000 Aler households in Milan);
8. halving and/or reset of regional resources for new constructions and refurbishment of the public housing districts;
9. prohibition to apply, for a social accommodation, for those who do not have the residence in Lombardy by at least five years, for those who have needed a accommodation over the past five years, and for those poor who were evicted from a popular house for arrears in the past five years.

In 2001 Lombardy was populated by 8.953.515 people, whose 319.564 were foreigners, and 3.652.954 were families. Compared to the beginning of the 1990s, Lombardy had seen a constant increase in population and housing with a greater percentage than the national average and other regions of the North West of Italy (Gay, 2006). 90% of residential buildings are located at towns and villages, while the remaining 10% are equally divided between settlements and scattered houses. In

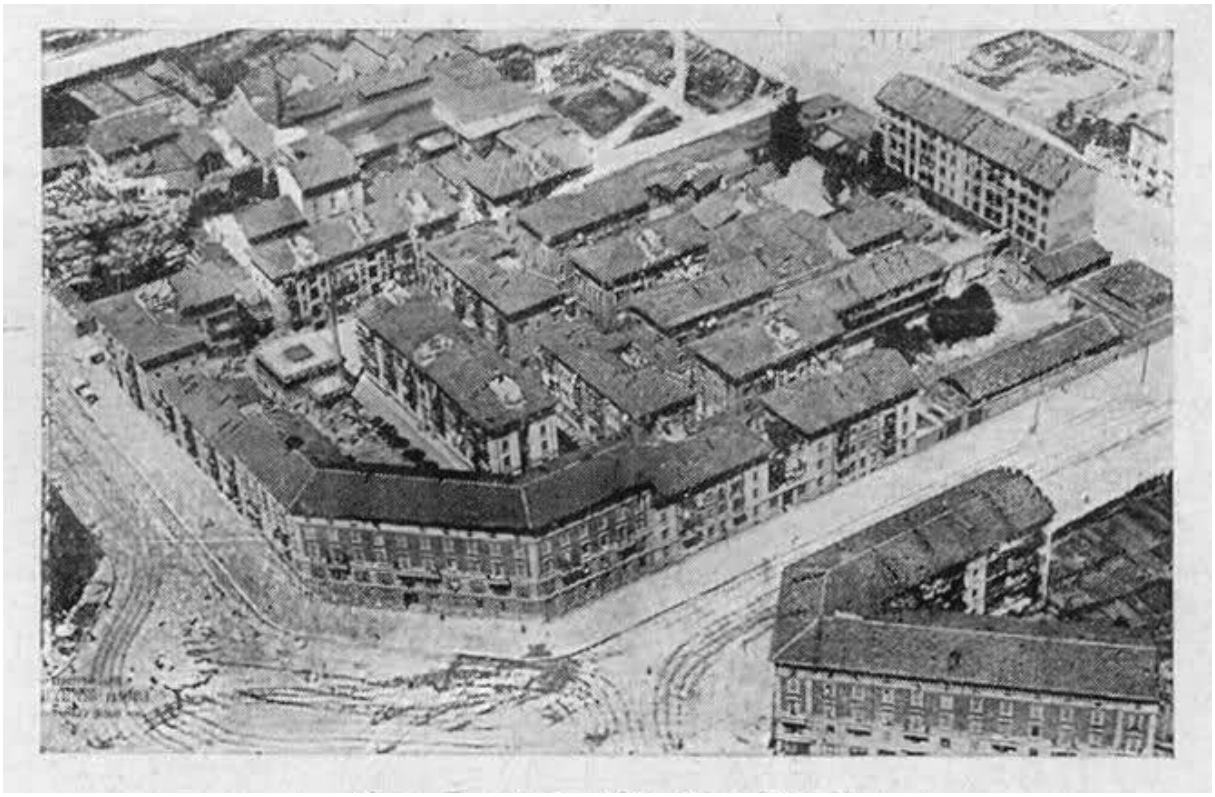


Fig. 3. Popular housing of Tiepolo district, designed by Giovanni Broglio.

Milan nearly a fifth of the buildings has at least four floors above ground, and this percentage rises up to 23,1% in the high housing tension municipalities, even to 66,4% in the inner Milan (Gay, 2006). The regional program for public housing, arranged by the Lombardy Region to 2002-2004, introduces new methods of intervention of the public housing in relation either to the funds' exhaustion of ex Gescal or to changes in society. The enabled strategies operate in three possible direction: the recovery and enhancement of the existing heritage, the construction of approximately 11.000 new homes for social or moderate rent and finally the review of the rules for the access elegibility (Pugliese 2005).

According to a report compiled by Lombardy Region (2007), the strategic aims that need to be achieved in order to build a new housing policy in Lombardy are listed as follow:

1. to widen the number of professional involved in the performing of the policies;
2. to direct policies to a wider target of people;
3. to change Regional Government role to actor able to promote actions and to generate the best conditions involving a wide range of actors;
4. to consider housing policies more as a welfare issue and less as a building speculation policy;
5. to promote sustainable interventions from an economic, social and environmental point of view.

The Lombardy Region is also orienting itself towards the Public Private Partnership model (PPP). Ethical Real Estate Fund. involves private (and non-profit) actors. This pilot project is born in Lombardy and then has been brought in Rome and become a national policy planning (Plebani and Merotta, 2011).

Social changes and present challenges

In recent years the municipality of Milan has been focusing on the difficult problem of rebalancing the outskirts by acting on different directions, first of all through a refurbishing policy of disused industrial areas (over 6,5 million square meters in 1997): with the essential contribution it was possible to achieve a stunning urban transformation and renovation process (from Bicocca and Portello to Rogoredo and Lambrate) by investing, in the period 1998-2004, in renovation of suburban areas with interventions on the building heritage, for a total amount of 1 billion and 350 million euro (Bargiggia and Bricocoli, 2005).

The aging of the population is a typical and widespread phenomenon in high-tension urban areas: some have experienced higher quotes of aging population. In particular, in all areas of Milan, both those central and peripheral, the aging phenomenon is common in 30% of the elderly persons. The reasons for the aging in urban areas are connected to the emigration of the younger families to the outskirt metropolitan areas, attracted by the availability of larger and cheaper houses and, perhaps, by a better quality of the environment and, by the efficient service of the urban infrastructure (Gay, 2006).
Another component of the metropolitan transformation is represented by the foreign immigration. Immigrants are distributed in the metropolitan area according to a scheme where urban centers have a dominant attractor role. In fact, immigration is concentrated in the inner area of Milan, in those larger municipalities touched by a de-industrialization process: in Milan, the immigrant population represents the 7%. (Gay, 2006). In relation to the demand expressed by families it is necessary to consider some key elements such as: the composition of the family units, lifestyles of the components, the different models of fruition of the housing dimension, the propensity to mobility, the consumption expenditure, the costs of conduction and maintenance of buildings, the tax burden. Several researches carried out at the end of the 1990s have shown that around 40% of dwellings in suburbs should be renovated. Urban regeneration schemes are the latest attempt to enlarging the scope of intervention on public housing. In fact, the commitment to increase the housing offer for the marginal social bands is related their transformation into a complex system of actions aiming at the peripheral and degraded areas.

Aler and the heritage of public housing

Institutes of autonomous social housing (Aler) in Lombardy have often been involved in a constructive wisdom of exemplary value, reaching excellence levels under the direction of figures such as Giovanni Broglio or, within the framework of cultural currents, as the milanese rationalism. Overall, the popular houses built after the promulgation of the law Luzzatti represent a significant part of the housing culture in Lombardy (Pugliese, 2005).

According to G. Gay (2006) Aler in Milan manages 61.145 inhabitants (of which 4.7% illegally occupied) and houses 148.767 tenants (of which 5.3% from outside the European Union). Households, composed of on average between two to four components, are divided into four income bands that determine the level of rent that should be paid by the accommodated families. Historically, Aler impose on themselves the goal of supporting this category of individuals: mainly young, single or components of a one-income family; with a professional low level standing (mainly working class); with low cultural resources; with a small annual income and, consequently, with a high incidence of rental on the income (exceeding 30%). In fact, the average rents of a social accommodation could be even 3/4 times lower than the market ones. On the level of family income, maintaining standards of rent much lower and consistent has produced at least three types of issue that Aler should face with:

1. the lack of mobility in families who are living in an Aler house;
2. the progressive change in the eligibility classification of those families, who continue staying in the house despite their theoretical loss of right to privilege;
3. the difficulty in facing the needs of those families that are unable to access an Aler accommodation due to the lack of available dwellings, despite they have the requirements of assignment.

Aler is experimenting the creation of a new identity which could recover the original qualities of each agglomeration by building a service network that faces the new housing challenge, starting from the integration of new social classes, in order to build either comfortable and modern residences or facilities for the elderly, who represent almost 30% of the population of Milan neighborhoods (Bargiggia and Bricocoli, 2005).

"Contratti di Quartiere" (Neighborhood Contracts): a new instrument for the housing planning

The stipulation of the of the Neighborhood Contracts will transform the selected intervention areas as concerns social services, housing, roads, green, and urban decor with particular care for the safety, which is dominant issue in difficult districts linked to the problem of abusive occupations and petty criminality. The contract deals with some critical points of the city according to an overall design of "urban normalization"(Bargiggia and Bricocoli, 2005) through a profound intervention that

aims to eliminate the degradation and returns equal dignity to the popular districts with respect to every other citizen.

According to Bargiggia and Bricocoli (2005), considering the articulated and heterogeneous panorama emerged in areas which requires a substantial social, economic and environmental renovation, it had been necessary to evaluate how each individual scope responds to the aim framework, and in particular:

1. enhancing and increase the existing assets of public housing (ERP);
2. increasing the functionality of the urban context, even through the introduction of diversified use and users within the existing districts of (ERP);
3. adapting and/or to increase funding of infrastructure works and services (integration with the city);
4. improving the manufactured building and the living quality;
5. promoting the participation and involvement of the inhabitants;
6. existence of services and projects of integrated and coordinated intervention;
7. final solution of the problems of deterioration and social discomfort;

On the basis of these results (and taking into account the various instances of political order received by more than one organization), and after checking out the availability of financial investment and making the necessary assessments, the political group has decided to take up the challenge proposing five contracts, each one proposal for a particular district around the milanese territory: Mazzini, Molise Calvairate, Bajada, San Siro and Gratosoglio.

Future perspectives

In the panorama of the family dynamics of the coming decades, a certainly determinant role will be played by the phenomenon of immigration. In this respect, assuming as a constant the increase of population from origin macro areas, registered between 1 January 2001 and the 1 July 2003 (corresponding to an average annual growth around 55.000 units) at the beginning of the 2006 Lombardy was housing almost 1.250.000 people coming from one of the so-called “high migratory pressure” countries (developing countries or east European). The eastern Europe component was the 34% of this immigration (Gay, 2006). Within the province of Milan, in 2001 dwellings were 1.640.470 , of which 1.537.110 occupied and 103.360 not occupied (Istat, 2001). The old demand was 2.2% of the housing stock. Whereas a share of not occupied assets is engaged in various activities (studies, vacation house, city users, etc.), the share of not used assets fell on particularly content levels.

According to L. Bellicini (2006) the demographic development expected in the coming years in the province of Milan could be explained by the reflux of the demographic wave of 1960s in terms of primary population demand; a resumption of childbirth,

Fig. 4. Aler building, Via Reinach.

even if on contained values; a strong growth of dead; the attractiveness of the provinces through the Italian territory, especially in demands that can be placed in the context of the professions, universities and research; the internal dynamics in the provincial territory, with a strong attraction of Milan for the young from other municipalities and for elderly families; a significant migratory component to be evaluate through three hypotheses of increase (minimum, average and maximum), which derive from the attraction of the provinces in the opening and closing policies of the future. In summary, housing demand for the next decade is estimated at a minimum of 100.000 units, and in a maximum of 140.000.

2.5. A rooted reality: evolution of social housing in the United Kingdom

High-density debates

In the UK, government and planners define density in terms of dwellings per hectare (dph). Density can also be measured through rooms per hectare, counting rooms where kitchens and bathrooms are excluded. Another critic way of measurement counts the number of people per hectare, which determines the feasibility of commercial activities, public transport development and community feel of an area (Willis, 2008).

In Britain 89% percent of the territory is not yet built (and perhaps they will never be), due to a reaction to the consumption the territory caused by the industrial revolution. Adopting this point of view, many cultural movements have risen with a view to impose preserve the green space around the urban centres, in which the 15% of the land became an untouchable "green belt", limiting their expansion (Rossi, 2010).

Since the 1990s, effects of dispersal had caused social, economic and environmental damages in the British urbanisation. In 1999, the architect Richard Rogers proposed to the Deputy Prime Minister the *Urban Task Force*, a consistent esteem of the UK cities and based on the increase in the population density with the aim to achieve a higher level of urban efficiency and safety, providing a system of walkable communities and further developing the public transport. It obtained a whole consideration from Government, which produced in 2000 an orientation which proposed 30-50 homes per hectare as density levels, and limited the permission for car parking to 1.5 spaces per home (Rossi, 2010). In 2003 the CABE (Commission for Architecture and the Built Environment) was created to offer guidance on urban design and public space. It drove to the *Sustainable Communities Plan*, which encouraged higher density, brownfield development and regeneration of existing communities. In line with the Urban Task Force's principles, thanks to a policy of combination of refurbishment, demolition and house building, it identified development areas for housing in the South and East, and equipoised the housing market in the Midlands and North areas (Willis, 2008). The trend after this guidance was to build two-bedroom flats as part of a development, in order to meet density standards. Unfortunately, house builders forgot the Urban Task Force's recommendations regarding a better design, investment in public transport infrastructure, efficient public services; they didn't consider the feel of the general development.

Housing market in United Kingdom

Originally, social housing in England was provided by charitable non-profit organisations with the aim to manage the problems of particular groups, including for example employees, people living in unhygienic and unsafe accommodation, and women (Whitehead and Scanlon, 2007). In the late 19th century local authorities

started to give subsidies to the supply of rented housing, although to a very limited extent. Between the wars, tenure neutral supply side subsidies were made available and after the second world war that social housing started to play a major role in supply. At this stage non-profit providers had a very small role (quite difficult to quantify in the statistics) (Whitehead and Scanlon, 2007).

The latter measure had the effect of limiting the offer increment below the average of the European Union, reaching the number of new dwellings at 175.000 a year, even if every year there is an increment of 300.000 new households, as the population of Great Britain grows closer to 70 million (Roumet, 2007). The gap of 125.000 units a year between supply and demand influenced significantly the prices inflation of the property: from 1973 to 2003 the real estate prices in the United Kingdom rose by an average of 2.4% per year, whilst the average of the European Union was stated at 1.1 % (Roumet, 2007). The 60% of the total stock of social housing is in the form of houses and bungalows. In the social sector the median floor area per person (space per person), is lower than the private one. In 2004 the social average was fixed at about 31,6 sqm per person (lower in London at 28,2 sqm), instead the private one was 37,6 sqm in UK and 34,2 sqm in the capital. (Whitehead and Scanlon, 2007).

In 1999 only 8% of the private market houses were two-bedroom apartments. By 2006 they had incremented to 35%, 50% of the total new buildings. In a rapidly growing market these operations accommodated the estate operators who obtained more than 30% as return of the invested capital, since the apartments were bought to ensure their maximum profit (Rossi, 2010). In the early 2000s, 5.5% of households were overcrowded in the social sector, as compared to 2.5% all over the whole tenures. In term of bedroom standard they were defined as one bedroom or more below it. London had the double concentration of overcrowding, at 12.2%, in comparison with the 6.6% across all tenures. Overcrowding has risen consistently in rented sectors and especially in London, however the overall percentage has been almost unaltered over the last decade (Baldini and Federici, 2008). Even if there have been consistent improvements in the standard of the existing social dwellings in the last years, an overall of 37% of local authorities and 27% of HA dwellings do not currently encounter the decent home standard, which was the government goal to achieve by 2010. This occurred because of the lack in insulation and energy conservation (Holmes, 2007).

Today manufacturers in the United Kingdom are facing a cruelly negative financial situation, which is the result of the image of 2003-2007, because of the lack of financing for both real estate operators and buyers. Lenders have become much more strict on loans for the apartments rather than for the houses, aware that they had helped to create a bubble which should be correct by decreasing the offer, thus manufacturers are returned to build houses (Rossi, 2010).

The structure of social sector

Local authorities and Housing Associations (HAs) are the working actors in the social housing sector. The HAs are independent and non-profit organizations administrated

by the Housing Corporation, the governmental agency that also assigns public subsidies. The HAs registered in Housing Corporation are called Registered Social Landlords (RSLs), which are not influenced by the local government (Whitehead and Scanlon, 2007). The social housing sector comprises accommodation for rent, social patterns of shared ownership, and patterns for public sector workers employed in the areas of education, health or safety (key workers). The peculiarity of British social housing system is represented by the *Right to Buy*. The right to purchase was introduced in 1980 and consists in the right for tenants of local authorities and some HAs to buy at discounted prices the dwelling which they have lived in for a determined period of time (five years for leases start from 18 January 2005 onwards) (Baldini and Federici, 2008). Due to the Right to Buy around 1.8 million houses have been sold to placed tenants since 1980 with a massive concentration of sales in the first ten years, but still running at between 30-70.000 a year between 1990s and 2000s (Whitehead and Scanlon, 2007).

Currently the housing policy is defined in the *Plan for the Sustainable Communities* dated 2003, in which are reported measures adopted by the British government so that to meet the *Decent Homes Standard* of 2010 (Evans, 2005). In accessing homes it should be guaranteed a reasonable preference to some social groups: the homeless or those who live in unhealthy, unsatisfactory or overcrowding conditions and those who must move for health reasons or other special needs. In general, the candidates are classified on the basis of a scale system, which considers the time spent on waiting for social housing (the so-called living register), the level of housing need and other priorities (Baldini and Federici, 2008). And lastly, a preferential access to social housing is given to those who are in "priority need", such as pregnant women, households with dependent children, vulnerable persons due to mental or physical disability, or age (in particular between 16 and 21), and the people in prison or in the army (Baldini and Federici, 2008).

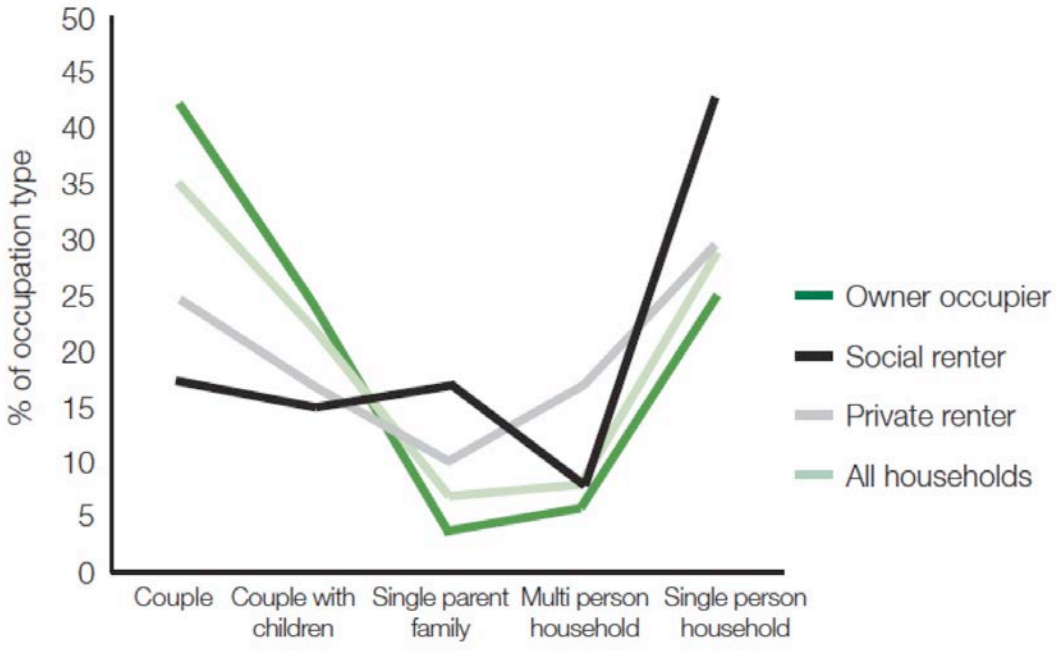


Fig. 5. The occupants of social housing in United Kingdom.

The British government grants monetary allowances to operators of social housing (local authorities, HAs, and a low number of cooperatives) for their development and the payment of part of the costs. Thus, new buildings by the HAs are funded both by loans obtained on the private market and the state subsidies, that arrive to cover up about 50% of all the costs. This could reduce the costs of the loan on the private market, and, on the other hand, the possibility for the government to recover the grant. Instead grants for local authorities cover every difference between the costs incurred and the rental income estimated.

Public subsidies tend to concentrate on low-income tenants. They benefit from the so-called Housing Benefit, grant aimed at reducing the burden of rent. Its amount depends on the family income and savings, the number of dependants, and the amount of the rent. Households with the highest income and savings receive a lower Housing Benefit: beyond a certain threshold of income the subsidy is reduced by 65%. Housing benefit is paid by local authorities. For the young singles (under the age of 25) system called Single Room System is used, which is based on the assumption that they share their accommodation regardless of the type of accommodation in which actually live. This means that for a young person that takes housing benefits, and chooses to live only for example in a studio cover his living costs would be difficult (Baldini and Federici, 2008).

Since 2008 the new compensation system *Local Housing Allowance* has become the grant assistance for private renters. In this case, the benefit is equal to a fixed allowance calculated on certain basis of private rentals for each area, distinguishing for size of the accommodation, number of occupants, and the size of the household (Baldini and Federici, 2008). Besides, the diagrams of shared property named *HomeBuy* have been recently introduced by the English government to facilitate the access to properties of those families that cannot purchase a house on the free market, in particular: social tenants, key workers and people who buy their first home. There are three types of HomeBuy: *New Build HomeBuy*, *Open Market HomeBuy* and *Social HomeBuy*.

The emphasis on increasing home ownership will necessarily reduce the number of the traditional social rented dwellings. This aims to assist those in lower income employment but unable to afford the property through the provision of low financial assistance. A proportion of new housing aims to cover the intermediate market whose provision is also the mixed communities goal for regenerated developments (Whitehead and Scanlon, 2007).

Recent development

About 8% of all households in England include a person from Black and Minority Ethnic (BME) groups, with an increasing average percentage of 12.5% per year; they are concentrated in some localities within urban areas and particularly in London. Proportions massively change between ethnic groups, with relatively few Indian and Chinese households and a relatively large portion of Caribbean and Pakistani social households (Whitehead and Scanlon, 2007). This is also a consequence of the Right

to Buy, that has encouraged the households to be more economically active in order to purchase their accommodation. Between 1979 and 2006 approximately 165.0000 accommodation of the local municipalities were sold this way. At the beginning of the 1980s The social sector has become about a third of the total housing stock in comparison to the current 20%. The increased residential prices in the last decades and the lack of housing at affordable prices have caused the pressure on the social sector and the elongation of the waiting lists (Baldini and Federici, 2008).

Nowadays the overall government subsidised for new buildings is currently stated at around 30.000 units a year (Whitehead and Scanlon, 2007). Houses show a great overcrowding and a less space per person. In the last decade there have been vast improvements in social housing standards. In fact the British government has fixed certain minimum standards of decency both in public and private accomodations, through the *Decent Homes Standard.* Recently financial planning allocated funds to finance the construction of 45.000 accommodation per year by 2011 (6.5 billion £); the construction of infrastructure in growing areas (1.7 billion £); grants to encourage local authorities to increase the housing supply (550 million £); Programs for urban renewal and creation of mixed communities (2 billion £); programs to promote integration and social cohesion (50 million £). Since 2007 the new national agency for the housing and the renewal have been working to achieve these objectives (Baldini and Federici, 2008).

HAs (2000 in total) own the social sector stock of which nearly 10% are LSVTs, together with around 200 local authorities which still continue to keep their stock. Only a small proportion of HAs own dwellings all around the country, in fact the grater part of them only possess one or two local areas. The majority of new social sector dwellings is built by around 250 associations, and some only manage stock for other organisations. HAs' group organisation puts together LSVTs (Large Scale Voluntary Trasfers), traditional HAs serving for either general or special needs, and "subsidiaries operating in the intermediate market" (Whitehead and Scanlon, 2007). The aim of HAs is contributing to the success of educational pathways and promoting the integration with a view to make these areas a safe and healthy with a high sense of satisfaction (Baldini and Federici, 2008).

2.6. Housing in London: density planning policies

Density distribution

In 2008 London was populated by 7.6 million people in 2008, and this number is destined to grow to almost 9 million in the next 20 years (some 800.000 by 2016). In addition to this there are many other pressing reasons to consider the housing sector a matter of emergency: the elongated life expectancy, the increased number of single due to the reduction of marriages and the rise in divorce. Over-prices and the lack of building land in central areas is pushing towards the request to use abandoned indutrialized spaces (the so-called brownfields) (Rossi, 2010). In 2007-2008 housing industry had built 28.199 dwellings, which is considerbly more than the previous average. Although there is a persistent crisis in the housing sector, after the finamcial cuts operated by the government in 2007, from now on the plan is to build 33,380 new homes a year and this could be achieved through operations of refurbishment and new construction (Rossi, 2010). The increased demand of housing in London requires a densification of the urban tissue, also because London's population is growing more and faster than any other city in Europe (Beharrell et al., 2007). London has a peculiar density distribution that could be considered an urban village spot structure: there is a ring of higher density areas around the centre and along "hallways" to the north and north-east (Minerva LSE Research Group, 2004). Considering the demographic distribution of the Grater London area, London is indeed a low density city, by comparison to Paris or Milan.

The document "Recommendations for living at superdensity" stated that we can call ''Superdensity" a concentration between 150 to 500 homes to the hectare. If London population's average density is stated at 68 persons/hectare there are several quarters that show a pretty higher distribution, around 80 persons/hectare, such as Kensington & Chelsea, in central London, and outer suburban areas like Croydon, Ilford or Manor Park. Furthermore areas with dwelling densities of over 60 units/hectare are located in Hammersmith, Camden, Hackney and in Battersea, Brixton and Clapham on south of the Thames. All these areas are characterized by different conditions of lifestyles, income, age and ethnic distribution, and range of house prices (Farrel, 2007). The latest trend in London social housing approach is making no difference between two-bedroom flats for private sale and two-bedroom flats for affordable rent. This happens because a huge percentage of the whole stock of flats, built for the private market, eventually get rented, and it often happens that tenants have some benefits or they are key workers. Besides the commonest typology of two-bedroom flats could be designed both for 2 and for 4 people (couples, family with two children etc.) (Minerva LSE Research Group, 2004).

Social diversity

Density in London is not only a prerogative of deprived areas, in fact there is a consistent difference between the outskirts, where underprivileged conditions are linked to density, and the central quarters, where there is also a component of

wealthy communities. Higher density areas in Inner London are composed by two kinds of social profile: community that have had the choice to live there, with different lifestyles, incomes, perspectives, ethnicities, ages, household types; and groups of people, mainly poor, who have had very limited or no choice at all in deciding where they live (Carter, 2008).

High density is strongly related to transport access. There is a consistent difference in the levels of public transport approachability from different areas of London. Car use in central areas is around 20% and rises in proportion until the fringes of the city. In general, people is tempted to use public transport when the service is well developed, and this happens in Inner London; on the other hand in lower density areas in Outer London people is more dependent from cars. Lack of car parking is also considered a big problem (Holmes, 2007).
Age influences the choice of living in a particular area too. People between 20-29 years old usually live in high density areas around Central and Inner London, instead families with people aged more than 45 tend to live in the outskirts of Outer London. (Minerva LSE Research Group, 2004).

Fig. 6. Odham Walk, Covent Garden.

Development of social housing in London

After the industrial revolution, from the beginning of the 20th century, London has developed an articulated system of housing policies. According to I. Rossi (2010) the historic development of the social housing in London could be summarized as follow:

- From 1890 to 1920. With the two *Housing of the Working Class Act* in 1890 and 1900 the local municipality tried to solve the problems of overcrowding, poor hygiene and abandonment in many districts of the city, and got for the first time the possibility to buy and develop land for the construction of houses appointed for the renting social sector, receiving support subsidies by the central government, thanks to the next Housing and *Town Planning Act* (1919).
- 1930s. The *Greenwood Housing Act* promoted a greater density of homes and the construction of apartment buildings in central areas. Some modern projects like the Ville Radieuse by Le Corbusier in 1922, influenced the interest for highly technological construction systems, such as steel, cement and prefabricated elements. In 1934 the ideas of Well Coates designed the Isokon Builiding, whose 34 apartments were equipped with modern prefabricated furnishings as well as a series of common condominium services, thus suggesting a system of urban life and minimal living. In 1935, Highpoint One by Berthold Lubetkin and Tecton was completed: a seven-storey building with 64 flats, built on a hill in north London, with a double cross plan that maximizes the sunlight exposure of each apartment, which was equipped with a heating system (thanks to a convenient centralized system), refrigerator and other furniture that attracted enthusiastic middle class residents.
- 1940s. Between 1941 and 1944 good part of the city was bombed and destroyed, and thousands of people remained without house. The country post war renovation comprised blocks of apartments and the use of new industrialized technologies. The *Dudely Reports* and *Housing Manual* of 1944 recommended the use of prefabricated houses in order to make the constructing process faster, and the use of steel, cement, and wood cladding panels. Furthermore, thanks to the *Temporary Housing Program* in 1944, the local authorities built more than 150.000 provisional prefabricated dwellings, which often lasted much more than the expected 20 twenty years. In 1949 a new *Housing Act* allowed local authorities to build houses not only for less wealthy classes, but for different social groups, aiming to create mixed communities and respond to needs expressed by different realities (families, mixed communities, single, etc.).
- 1950s/1960s. In 1951 was finished in East London the Lonsbury Summer, which summarised the sense of district community requested by the government of that time: it was an urban and social semi-autonomous unit, provided with schools, a pedestrian area with shops, churches and community buildings.The local authorities were concerned on ten-year plans of action (*Slum Clearance Act*, 1955), with the purpose to provide as many as possible dwellings. The use of industrialised building systems improved a lot. In the architectural debate, these years were very active. At that period, Alison and Peter Smithson ideas were synthesized in the project of the Golden Lane, a

Fig. 7. Isokon building by Well Coates.

long building serpentine would have been connected to the ground floor through wide walkways “streets in the air”. The building is raised up from the road surface to reach the upper floors, with the intention to create an urban continuum between road and houses. In 1956 Chamberlin, Power & Bon designed the Barbican Center, to create a real neighborhood, a huge integrated complex, that contained all the services and the urban features of a district: schools, shops, outdoor public areas and spaces for the free time, including the great center for contemporary arts. Three towers of over 40 stories in height and a block down to 150 m in length, connected by an intricate and interconnected system of courtyards, house still today about 6.500 people in 2.113 apartments.

- 1970s. People nurtured the modernist image of tall buildings, however, the vision of the modernist house remained an inspiration for many of the 1970s projects. In particular, the Camden Borough Architects Department developed a series of ambitious schemes between 1968 and 1971, based on the idea of long section block terraces, including High gate New Town, Maiden Lane,

Alexandra Road, and the Brunswick Center. From 1979, with the "less government intervention" by Margaret Thatcher, the government refurbished efforts a large amount of existing buildings.

- 1980s. With the Housing Act of 1988, the HAS become Registered Social Landlords, and since then the Public Sector Housing started to be in charge for Social Housing. There was the proclamation of the right to buy to allow families to purchase a house to pass on to future generations. Thanks to huge discounts and benefits, more than 1 million dwellings was already sold by the end of 1986. Due to the economic crisis and unemployment, people could purchase and the number of homeless became a serious social problem.
- 1990s. Twoimportanto documents had been promoted: Toward an Urban Renaissance (1999), and the Urban Task Force created by Lord Richard Rogers, a collection of 105 recommendations based on the quality of design, environmental sustainability and possible financial schemes.
- 2000s/today. The *Planning Policy Guidance 3* is dated 2002*: Housing,* a document produced by the government to adjust action planning of local authorities in the territory. The document was then replaced by *Planning Policy Statement 3: Housing* in 2006, which still aims to ensure that everyone has the opportunity to live in decent and economic housing. In 2007 studies HTA, Levitt Barnstein, PRP and Pollard Thomas Edwards, presented a document-report, *Recommendations for Living at Superdensity*, aimed at influencing the mayor on future decisions relating to the housing strategy in London. From a legislative point of view the Building Research Establishment has published in 2007, the *Code for Sustainable Homes*, a document that lists the parameters that each building must comply regarding environmental performance. The government expects that all buildings will be able to adapt to the parameters of the Code by 2016. Thanks to a policy of respect for the environment, the ratio energy/carbon in UK has improved by 25% in 2010 and expects to be over 44% by 2013. Sustainability is another key element in housing policy. Government is currently working, on reducting carbon emissions and a significant contribute in that sense has had the experience of Bill Dunster of ZEDfactory ltd., whose project (BedZED Beddington Zero Energy Development), a settlement completed in 2012 for the Peaboby Trust, has helped to the awareness of the problem.

The Peabody Trust experience

Peabody is the oldest housing association in London. It was founded in 1862 and nowadays Peabody owns and manages more than 20,000 homes across London: social housing, leasehold, shared ownership, supported housing, keyworker accommodation and commercial units. The whole range of Peabody's activities includes employment and training programmes; health initiatives; activities for young and older people; welfare benefits advice and and family support programmes. The goal of the association is letting as many people as possible live in decent house conditions (www.peabody.org).

According to the 21st Century Peabody Report, the foundation is committed into building and developing quality affordable homes that foster economic and social regeneration, in a perspective of sustainability that reduces environment damages and brings social advantages to the new communities created through the settlements. As stated in the seven major principles of the Peabody program, exemplary 21st Century communities should be a place where: people feel sense of belonging; people have homes that meet their needs and are suitable for the changing circumstances of life; landlord's service is tailored to the individual; no child is living in poverty; all residents are supported in their daily lives and in their longer-term aspirations; the community feels part of the wider, local area; the community has a sustainable environment.

Fig. 8. Alexandra Road Estate, 1968.

2.7. Brazil between social inequality and environmental exclusion

Unbalanced urban development

Over the last 70 years, Latin America has sustained an urban process that is comparable to the huge migration came off from the industrial revolution in Europe (Leguía, 2011). Brazil is one of the most urbanized countries in Latin America, indeed 81% of the population lives in urban context (IBGE, 2000). This urbanization trend is in line with the accelerated one happening in the whole Latin America, where at the moment more than 75% of the population lives in cities, compared to 38% in Africa and 36% in Asia (UNPOP, 2000). Since 1970s, after the population shifting from the rural regions, poverty started becoming a consistent social problem, particulary seen in large accumulations (Gutberlet and Hunter, 2008). In cities, the poorest people can earn income and find social support networks and find a job; and indeed all these opportunities are almost impossibile in remote poor places where they come from (Herling and França, 2009). Especially during the 1960s and 1970s many governments had been responding to the urban expansion electing the typologies of large super-structure and high-rise buildings the best solution to house migrants, but, unfortunately, the social and cultural reality of the inhabitants banged together with this solution (Leguía, 2011).

Nowadays industrial enterprises have drastically diminished the strong influence on the flows of internal migration, because of their better distribution over the national territory, but there is still a large portion of population that remains in the major Brazilian metropolises such as São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, and Recife, notwithstanding the social exclusion caused by a market demand of skilled labor (Herling and França, 2009). Brazil only began the economic stabilization process by subduing inflation in 1994, with the launching of Plano Real (Smith, 2007). Before this period Brazil has experienced periods of hyperinflation, like many others developing nations, with the consequencies of squash or cancel development of “long-term stable interest rates essential to the emergence of a proper housing finance system” (Smith, 2007).

Traditionally São Paulo, Minas Gerais and Rio de Janeiro occupy the southeast of the country, which is believed to be the economic heart of Brazil, where urbanization (and consequently people who live in cities) reaches 90%, which the maximum percentage compared to the whole Brazil (Gutberlet and Hunter, 2008). However, recent data census show that most of the very large cities are loosing population due to conglomerations inequalities, while on the contrary municipalities with more than 20.000 (especially cities between 100.000 and 500.000 people) inhabitants are increasing by a rate of 3% annually (IBGE, 2000. Gutberlet and Hunter, 2008).

In Brazil, many thousands of people live in slums and informal settlements, where they have created their own environment and their community structures (Derbyshire, 1991). This challenging context is pushing architects forward to develop new methods of research and responses to face the problem. Considering informality as a positive generator for the city, also sustainability becomes an increasingly important

issue, and a culture that needs resourcefulness and recycling, informal settlements offer a number of innovative sustainable solutions (Leguía, 2011).

Social exclusion and slums

Marginalization of urban population in developing countries could be read through the social exclusion issue, which analysis factors and processes involved by providing a useful theoretical frame work. Exclusion derives from marginalization through economic deficiency and social drawbacks from the rest of society; it could be also the result of a fragmentation of social relations due to a social and cultural isolation.
Social exclusion is the first cause of slums and informal settlements. Their inhabitants do everything by themselves, even establishing their own unofficial kind of justice where the municipality legal system has neglected them. Conditions in slums are unhygienic, sub-human economic and social for thousand of citizens. Poverty, pain and the want of job opportunities produce crime, drug abuse and other plagues and afflictions. (Derbyshire, 1991). Excludes are unable to overcome the populist state of radicalized corruption, political patronage, and short-term political measures (Gutberlet and Hunter, 2008).

Most favelaros have no legal entitlement to the land and the ground itself is often unstable, with landslips and collapses common. The favelas are insecure and crowded, with a typical density of 700-800 people per acre; violence is a plague and there are gambling and drug-running cartels. “They are unhygienic. The Jaguare has open sewers in many streets and the plastic drains installed by the inhabitants have so many holes made for new connections that they overflow, particularly when it rains” (Derbyshire, 1991). Poverty related to social exclusion often generate environmental degradation, due to informal occupation, such as deforestation, water contamination, and air pollution (Gutberlet and Hunter, 2008).

There is another unfavorable condition related to people forced to live in high-rise buildings, in fact unlike the favelaros they cannot enlarge their dwellings when their families grow, there is no place either to rest outdoors when it gets really hot or to meet for a chat or a drink or for children to play (Luiz Lara, 2011). In order to contribute to their family budget, ore even worst to be able to live by their selves, unemployed children take on informal activities (delivery, guarding services, collecting recyclables, street sales, washing cars, polishing shoes, and other street services including crime, prostitution, consumption of tobacco and illicit drugs) or begging (Zaluar, 2001).

Modern architecture in Brazil

At the beginning of the twentieth century new construction of cities and housing projects became the pivot for experimental solutions that underlied the intent of understanding the whole social problems. The aim of this Neue Wohnkult (new culture of living) was to limit the cost of construction through rationalisation, industrialisation and vertical production (Schafer, 2001). Around the first decades of

the twentieth century, Brazilian modernisation was played by very few members of the elite, trying to imitate the Europeans style" (Luiz Lara, 2011).

The reconciliation between modern ideas of modernization and Brazilian reality arrived after the Semana de Arte Moderna in 1922 and after 1930 when Getùlio Vargas took the power after a revolution. A new sense of nationality took place considering the complicate pattern of the Brazilian society, with a view to achieve the new search for "Brazilianness" (Luiz Lara, 2011). The whole country was involved in a deep process of industrial and educational modernisation, constantly controlled by a strong central power.

The reform of the architecture curriculum at the ENBA (Escola Nacional de Belas Artes) is considered the starting point of Brazilian modern architecture (Schafer, 2001). In 1930 Lùcio Costa became the director of the ENBA and became one of the first exponents of modernism by proposing the thought of Le Corbusier. Costa was faced with bitter controversies, and the thirties were characterised by a real battle between conservatives and reformers. Vargas played a role as a mediator but at the end, the modernists won in the 1940s (Schafer, 2001). The blend between traditional values of the baroque and modernist impulses has created the intellectual foundations for the subsequent development of the thought of many Brazilian architects involved in housing design, as Oscar Niemeyer, Luis Nunes, Carlos Leao, Mauricio and Marcelo Roberto, Affonso Reidy and others.

The modern Brazilian movement appeared in three different ways, even with the professional activity of some architects, including Attilio Correa Lima, who started urban planning in France in the 20s, and Carmen Portinho, who practiced in England after the World War II. The influence of Le Corbusier was fundamental too, and also the import of contemporary bibliographic material, after the first congress of architecture held in São Paulo in 1931. In the second CIAM the emphasis was placed on some space and features such as the kitchen and bathroom, which had always been absent (Schafer, 2001).

The importance of CIAM and European influence in Brazilian housing porduction is still common. When Latin America-based projects are studied, these are generally huge projects that were a clear imposition of the western in the name of a believed progress, but "within a different social and political reality where older residents can still remember life within a feudal system" (Leguía, 2011). The propagandistic approach of Brazilian architecture was a success especially in promoting an ideal of modernity, rather than achieving such this modernity. Traditional inequalities are still present in the modern housing design, which unfortunately has also absorbed class (and racial) inequalities in its different configurations (Luiz Lara, 2011).

Form and commitment in the architecture of the social housing in Brazil

The revolutionary government of Vargas established il 1930 the IAPs (Institutos de Aposentadorias e Pensões), divided into various professional categories. The projects promoted by the various IAPs were centred around the creation more

affordable housing blocks with social and community facilities, in contrast the typology of the isolated house with a backyard and garden (Schafer, 2001).

The Baixada do Carmo complex is one of representative IAPI projects. The project belongs to Attilio Correa Lima and has many of the most significant ideas of the modern movement, and it is inspired by the rigidity of the Gropius' diagrams, presented on the occasion of the third CIAM. The aim of this project was to achieve the maximum density and the economy that were possible. The designer needed to minimize the construction costs while ensuring good standards of hygiene and comfort, in terms of disposition, orientation and dimension of the rooms. According to Ashley Schafer (2001) between 1937 and 1950 IAPI, which is one of the six institutes, produced 36 housing complexes with a total amount of 31.587 units in 13 Brazilian states: 17.725 units in housing complexes; 7.940 buildings financed by neighborhood associations, 4.942 units financed by the middle-class condominiums; 1.161 units financed in residential complexes for employers; 20 hospitals, 15 union headquarters, 26 commercial and office buildings, and 10 schools.

Also architect Carlos Federico Ferreira played a central role in the housing production, because he had worked for IAPI and designed the first modern housing in Rio de Janeiro called Realengo Residential Complex, in 1939 (Gutberlet and Hunter, 2008). With a particular attention in limiting costs in Realengo Ferreira experimented new material applied to several new typologies, which became a reference for future residential projects in Brazil. IAPI tried to combine minimum units, which were about 30 sqm in the Realengo block, with collective facilities like schools, kindregartens, medical centres, shopping and leisure areas, sports fields, sewage treatement plants, etc. (Schafer, 2001).

Another aspect of modern architecture in Brazil had been a radical process of verticalisation, which started influencing both the urban form of many Brazilian cities and the ideal housing schemes. Apartment typology in multi-family high-rise dwellings became the desired middle-class living configuration in Brazil, although this typology started as a solution for the poorest and wealthiest people (Luiz Lara, 2011).

The Pedregulho social complex

The Pedregulho complex is a awarded example of working class housing is designed by Affonso Eduardo Reidy, for the city of Rio de Janeiro in 1945. Pedregulho was made to attract the attention of the entire world. In 1962 Le Corbusier elougized it: "I was astonished; I have never had the opportunity to realize such a complete work, according to my own principles, like you did". Pedregulho won first prize at the Architectural Biennal in Sao Paulo in 1951 and get estimation from great personalities as Walter Gropius, who preferred Reidy's social project in opposition to the formality of Niemeyer (Schafer, 2001). The concept started from a sinuous 250-meter long serpentine block that is perfectly integrated in the gorgeous landscape of Rio de Janeiro. The language adopted is modern, but in an open and original perspective: Reidy adopted the same conceptual and esthetic philosophy that under

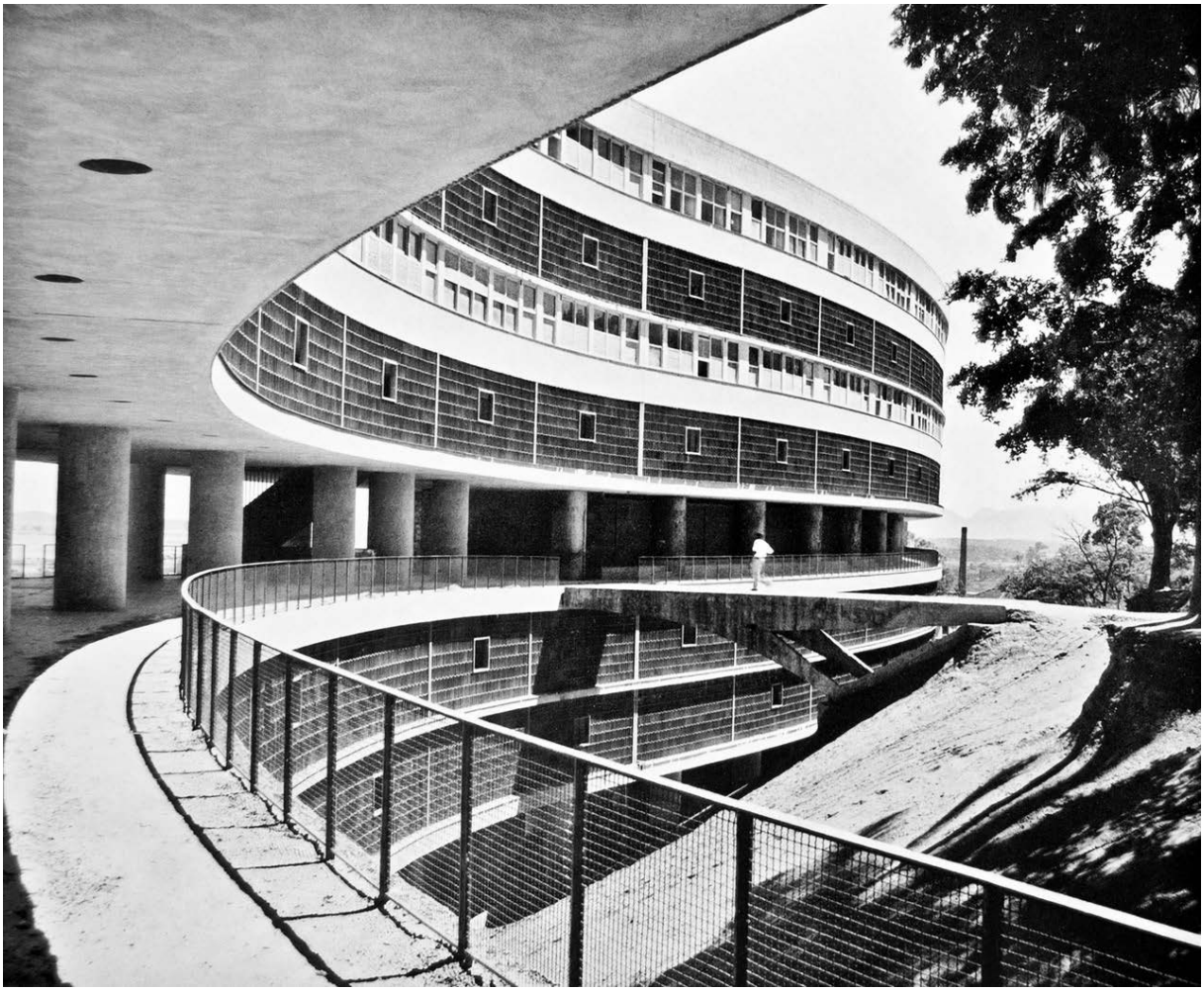


Fig. 9. The Pedregulho social complex, by Affonso Eduardo Reidy

lied some other original works in other typologies of Brazilian architecture, integrating the composition with the arts and logic proportions (Luiz Lara, 2011).

The Pedregulho project was built in 1946-47 to house low income municipal workers, on a sloping hill site in Sao Cristovao. Consisting in and of an array of collective equipment and services. For his 522 units project Reidy took inspiration from Le Corbusier's utopian proposal for Rio de Janeiro. The serpentine block has an internal suspended street located on the third floor, which is also the entrance floor in order to avoid the elevator, with a kindergarten and a recreation areas. The first and second floors contain units for childless couples and duplex apartments with two, three and four bedrooms are located on the upper floors. The lower part consists of four-storey floors on pilotis, with duplex units, and all the communal facilities and services: school, gym, swimming pool, commercial center, clinic, laundry and kindergarten (Schafer, 2001). Under an interdisciplinary vision promoted by Reidy, in Pedregulho famous artists had worked: Portinari for panel at the gymnasium, the mosaic panel at the school, Burle Marx at the landscape and Anizio Medeiro with the azulejos by at the clinic.

Although this positive and productive social commitment, the contemporary housing the inequalities that have been characterizing Brazilian architecture for seventy years. Regarding the gender disparity, If Pedregulho's was meant to free the women from some of the heaviness of the household chores, on the countrary the Guinle apartments designed by Lùcio Costa, targeted for the middle class, had two servant very small bedrooms. This condition is still largely accepted in Brazil elite. Perhaps the weakest aspect of the vision promoted by Pedregulho and Guilne apartments is the bad relationship of both structures with the city: there is no connection with the existing context and both of them are individual structures, with their own orientation (Luiz Lara, 2011).

2.8. São Paulo: a metropolis of contrasts

São Paulo is the Brazil's most populous city and the capital of the state of São Paulo, which comprises 39 municipalities covering an area of 7940 sq km. In 2006 it was populated by 19,7 million inhabitants, 10% of the total Brazilian population (EMPLASA, 2007). In its macro-metropolitan complex live about the 70% of the population of the state of São Paulo. It is also the most important city in terms of the production of wealth and produces the 9% of Brazil's national gross domestic product. (PMSP-SEMPLA, 2007).

The economy is fostered by a massive commercial enterprises set up in vacant industrial sheds. The so called São Paulo macro-metropolis is composed by new sites of economic production that co-exist with residential communities and companies in the metropolitan areas of Campinas, Baixada Santista, by the huge urban agglomeration along the valley of the Paraíba, in addition to intermediary urban agglomerations (Herling, 2009). This complex is formed by the metropolitan regions of Campinas, São Paulo, and Baixada Santista, in addition to the macro regions of Sorocaba, São José dos Campos, Bragança Paulista, and Jundiaí.

One-third of the city's inhabitants lives in favelas (slums) and informal land subdivisions, although São Paulo is Brazil's wealthiest and most populous city. Housing policy is always challenged into fighting against poverty, decreasing social inequality, creating jobs and generating revenue, and concurring to environmental sustainability (Herling, 2009). The city is also characterised by environmental degradation, traffic-jam, pollution, building abandonment and sub-employment. Generally construction standards are inadequate and illegal; real-estate devaluation as well as difficult ground structure; increasing of land prices and of commercial and third parties' activities. New head-ways of the real-estate valuation towards Faria Lima Avenue, Pinheiros Riverside, Castelo Branco Morotrway and Morumbi Region. A high-rise verticalization of the boundaries quarters, such as the District of Jardins, settled by the upper class population (Comoglio Maritano et al., 2000).

Slums in the growth of Sao Paulo city process

Before 1870 São Paulo had been constituted of a small commercial village with no infrastructure and limited services. Within this environment, slaves "used to throw the cans that contained latrine excrements from the healthiest houses into the rivers, and so did they collect water from the fountains" (Comoglio Maritano et al., 2000). Thereafter the city started becoming a more complex urban structure and between the late XIX century and the early XX century there was a demographic increment around the 30% per year. An intense economic growth due to the transformation process required the installation of the first net infrastructure, which occurred whether through an expansive movement of the urban tissue, involving new areas to the initial city settlement or through the demolishing and replacement of buildings in central districts (Herling, 2009). The urban space was defined according to the private interests. The County Company managed to complete real-estates operations, with a

Fig. 10. View of slums in São Paulo.

total amount of 1.238 hectares in the city in 1912. It had operated in areas such as Butanta, Vila Mariana and Mòoca after having subdivided 860 hectars in Lapa, Vila Romanaand Jardim América. Additionally it kept on with the urban process by subdividing Alto de Pinheiros and Pacaembù until 1925 (Comoglio Maritano et al., 2000). Even if in the past 35 years, industrial production has moved from southeastern Brazil to other industrial centers and is now distributed more homogeneously (evenly throughout the national territory), either São Paulo state or metropolitan São Paulo maintain their leadership in industrial production. However, the industrial domestic sector is loosing its record in economic production.

Only recently, from 1989 to 1992, the proposal of the County Administration enabled for the tenement population to be held in the central area through specific slums programs, such as the finance for the acquisition, the mandatory real-estate restoration procedure, and the popular housing project construction procedure (Comoglio Maritano et al., 2000). In 1980 1.700.000 people were living in slums, and in 1986 the number rose to 2.700.000, due to an increase of slum formation in the central areas of the city. After four years, in 1990, over 3.000.000 people occupied slums in the county of São Paulo. In particular 820.000 families settled around 88.000 real-estates. At that time each dweller occupies 6,5 sqm and each tenement is occupied by 3/6 people. Even though lots of low-income employees in the work market are forced to live in slums because of the economical situation, living in slums does not necessary means “unemployment”, in fact only 5% of the family heads was unemployed.
The Renaissance of economic growth started in 2004 in Brazil and in São Paulo in particular, has not yet allowed a consistent part of the poor population to access to jobs. Financial sector, as well as information technology, biotechnology are deeply linked to highly skilled and very innovative professionals. Unfortunately people who

live in slums and informal settlements have few chances to access that market, indeed they are often forced into lower-paid jobs (Herling, 2009).

Slums typologies

Slums are popular dwellings, parallel to the workers' housing projects, which are town-houses built by the industries. They are pertinent to the onset of industrialization period. As stated by A. Piccini (in Comoglio Maritano et al., 2000), the commonest slums typologies acknowledged in the first classifications of the 1893, but still used, are reported as follow: backyard slum: located in the middle of the block reached by a small corridor (aisle), it faces a street and aside the entrance gate there is almost ever a trade building; small tenement: independent street-fronted construction. Named also boarding house or pension; tenement house: two-storey building including many inner subdivisions. improvised slum: located at the back of warehouses, pubs, stable and coach-houses, they have always been poor housing conditions; hotel slum: double function space working as a restaurant during the day, and used to sleep meanwhile in the nights.

When real-estates that generate slums are specially built for rental purposes they consists on land subdivisions with different splitting, such as horizontal or two-story tenements, named usually "periphery yard" or "avenues". Sometimes spaces are mostly employed for commercial and residential or mixed purposes, in this case tenements, which are mainly a self-constructed single family residence, are lined at the back of the partition.

In January 1991 the unique law on slums was promulgated; the so-called Moura Act no. 10.928, which defines as "slum the unity employed as multi-family communal dwelling house, which presents totally or partially the following characteristics":

1. It is constitute by one or more constructions, built in an urban land parcel;
2. It is subdivided into several tenements, which are rented, sub-rented or granted at any title;
3. It groups several functions in the same tenement room;
4. It has communal access and employment of the non-built spaces and sanitary facilities;
5. It presents both precarious circulation and infra-structure:
6. Overcrowding in existence

Favelas and informal land subdivisions are located where the environmental conditions are adverse due to pollution of streams and under a geotechnical perspective, usually at the boundaries of the city. These settlements are often linked to important areas of water supply. For that reason the Municipal Housing Policy has been involved in either ensuring healthy surroundings or installing infrastructure and social equipment with a view to improve the living conditions of the inhabitants (Smith, 2007). Considered by now a kind of irreversible occupation and the only feasible alternative for the great majority of the city's poor, 1/5 of the total amount of

favelas is settled on private areas, whose lands are sold to the population both in public and private lots (Herling, 2009).
The Fundação SEADE conducted in December 2007 an interesting estimation survey to count the number of households and tenants in favelas and informal land subdivisions, which represented 10% of the total dwellings. That survey stated a total of 1,539,271 people living in favelas, 125,401 living in urbanised clusters, and 1,783,562 in informal land subdivisions.

Housing programmes

Over the last decades several administrations promoted and developed a range of urban instruments centred around the concept of "temporary configuration" of the downtown slums, and the consequent ease on solving them whenever needed: such way of proceeding would be taken through the dwellers' relocation and its following re-settlement into the periphery (Comoglio Maritano et al., 2000).
Since 2001 the Cities Alliance has been working with the municipality of São Paulo on housing programs. The first project was called Bairro Legal and ended in 2004, its aim and strategy had been the formulation of action plans for each of the three districts of the city that had the highest indices of social exclusion – Brasilândia (Zona Norte), Cidade Tiradentes (Zona Leste), and Jardim Ângela (Zona Sul). The programs' approach was centred around an interdisciplinary combination of skills in managing urban, social and environmental issues and comprised different actors: technical professionals of the municipality, social and neighborhood associations, other civil society people. The second project, directed from 2005 to 2008, carried on the research path achieved in the first phase. Its primary aim was introducing a set of planning tools and sharing among all the people involved in the partnership (including agents both form the public and private sector) all the results obtained in order to monitoring the city's housing policy progress (www.cityalliance.org).

Last but not least, important changes in urban development are achieved with the Estatuto de Cidade (City Act) and the Plan Director (Master Plan). The first one is based on a federal law promulgated by the National Congress (Law No. 10,257/2001 and the Municipal Law No. 15 547/1991 (Gutberlet and Hunter, 2008). Thanks to those programs neighborhood associations can also play a consistent role in urban planning by taking, if necessary, public actions supported by the Public Ministry where social rights are violated.

The Cingapura program

Housing policy and the problem of slums had been deeply influenced by the military dictatorship during the twenty years between the mid-1960's and the mid-1980's, when several episodes of hyperinflation had been recurring. Cingapura begun in 1992 and consist in a demolition-and-rebuilding program developed on site, avoiding the disperse of the current tenants. It proceeds with the rationalisation of the housing unit by creating a construction that is financed by the public administration. The new homes are 6 storey walkup flats and are then sold to the residents.

The organism that provides new construction of public housing is COAB (Companie Metropolitana de Habitacao). Under programs carried out by COHAB the municipality of São Paulo constructed almost 150,000 flats, mid-rise walkups, all built on public land, by private builders. After the construction they were owned and operated by the municipality had been presenting inadequate maintenance, physical wear and tear, and slow proceedings to what in São Paulo has become known as the “verticalized slum” (Smith, 2007). Cingapura's basic operational sequence was (and is) a long process lasting four or five years, composed as follows: neighborhood identification; enumeration of residents and households; determination of eligibility; beginning of resident education in high-rise living; demolition of existing slums and residents' relocation to nearby temporary housing; new construction of five-six storey walkup flats; returning households; post-occupancy social services (Smith, 2007).

Urban expansion into São Paulo’s water protected areas

In the municipality of São Paulo 10.2% of the population lives in precarious conditions (IBGE, 2000; Gutberlet and Hunter, 2008), and has to do with widespread political corruption and short-term planning measures. Social and economic inequalities in housing, education, and health are the clear manifestation of the over fast growing of disparities in the whole territory.

In early 1990s there was a considerable slop in squatting, especially in the outskirts next to the drinking water reservoirs of Lake Billing and Lake Guarapiranga in the south of the city, since the early 1990s (Gutberlet and Hunter, 2008). The process of settlement was little by little: originally slight, the area had been progressively settled informally by inhabitants moved from better-located favelas in central São Paulo. At the beginning the municipality didn’t consider them a problem because of the small number of cases, but sooner, as São Paulo's population expanded, both the Guarapiranga slums, and the effluent flowing into the water supply grew were magnified (Smith, 2007). A situation of lawlessness and lack of environmental protection programs, caused by the inability of the state government to face the problem, produced a strong “intra-urban migration flow” and the expansion towards the two watersheds (Gutberlet and Hunter, 2008).

Within a comparison between the Guarapiranga program and Cingapura, they acted on opposite directions: if Cingapura preserved the streetscape but demolished and rebuilt housing, in Guarapiranga the streetscape was totally rethought and a minimum amount of dwellings were demolished and rebuilt (Smith, 2007).

The UNEP Sustainable Social Housing Initiative (SUSHI)

In Brazil, population growth is pressing the housing market to meet the demand for new houses. Low-income families are excluded from the regular housing market due to the increase in housing prices, especially in urban areas,

The federal government is aiming at providing one million homes in two years. The State of São Paulo is facing a housing cut of 880,000 units (14% of the national deficit), concentrated mainly in the metropolitan areas.
Most of the subsidized units are low-quality, and also located in the outskirts difficult to reach out, and have high operation costs: energy, water, condominium expenses, as well as their usual expenses. This situation often forces families to return to slums and selling their houses for not being able to afford their mortgage.
The SUSHI program comprises stakeholders involved on finding sustainable solutions in the growing social housing sector in order to improve improve health, comfort and safety, as well as reduce the costs incurred for the use of water and energy.

3. Ecological and economic sustainability

3.1. The topic context

One of the best challenges of the modern age is combining economic and environmental responsibility. The first one is oriented in increasing the company value and its capacity to produce income, profit and labor, while the second one would answer to the need to analyze the environmental impacts of production activities with a view to preserve the environment for the future generations' benefit (Longa, 2009). The sustainable approach in social housing design has become a priority and should involve policies and programs of intervention, by forming a powerful strategic framework in facing the environmental challenges and the growing energy pauperisation in weakest families (Monti et al., 2009).

Nowadays the construction industry is characterized by a high environmental impact and at the European level, 40% of energy consumption is in the residential and tertiary sector, which is responsible for more than 30% of CO_2 emissions (Longa, 2009). Italy is one of the countries with the greatest consumption of energy in the civil sector. Within the whole planet, construction activities produce 70 million tonners of waste (17% of the total) and the consumption of materials for infrastructures is around 6 tonners per person per year (Longa, 2009). The crucial integration between energy policies and environmental is a common concept in all European Acts (EU Directive 28/2009). The connection between energy and environmental issue is also confirmed, at all levels, to be very sensitive in the development of tools, methods and technologies that underlie to the effective "sustainable" development, where low cost and energy resources represent closely linked variables (Battisti et al., 2012).

Compared to traditional building, an ecological house has an additional cost, but, considering these costs, it obtains: reduced pollutant emissions; lower expenses for power plants and for health; environmental quality in the cities; general improving the life quality (Longa, 2009). Quality of indoor spaces and the environmental and energy efficiency in building products are heavily influenced by the interaction between local microclimate factors, morphology and geopedological composition of soil, hydrological characteristics, morpho-typological configuration of built and vegetation, materials' and outside spaces' characteristics (Battisti et al., 2012).

In Europe there have been developed several interventions designed in concerted ways: rational use of lots and resources, sustainable mobility, participation of the community in the design of the environment, relationship between building and spaces for the services, energy sufficiency and use of solar photovoltaic, glazed capturing surfaces and movable screens, collection of rain water, use of heat pumps and geothermal probes, micro turbines, building insulation, economy in costs of construction and management, use of ecological, recycled and recyclable materials, removable and flexible systems with a view to a future deconstruction or partial modification to meet new functional requirements and/or performances (Monti et al.,

2009). Some recent experiences show the opportunity of an integrated approach with the construction of new social housing and the retraining of the existing large residential complexes, addressed both toward its environmental sensitivity of the interventions and the creation of the urban sense of identity, often deficient, with the propose of removing the ghettos and social discomfort phenomena repeatedly occurred in the past and with a view to offer good comfort levels of and appropriate operating costs (Boeri et al., 2013).

In Italy several acts have been promoted the rational use of energy and the development of renewable energy sources; lately, also as result of the transposition of the Directive 2002/91/CE on the energy efficiency in buildings. The Italian D.Lgs. n. 192/2005 provides a series of enhancer elements in energy requirements: the obligation of acquiring the energy performance certificate for all new buildings and for those ones in the purchase market; a reduction of 25% of the current energy consumption by 2010; the mandatory installation of solar panels for the production of sanitary hot water; the mandatory installation of sun shields; simplified procedures for the replacement of boilers; the introduction energy saving concepts in town planning instruments (Longa, 2009).

The contribute of the new technologies

Ecological architecture is created both in harmony with nature and therefore to guarantee healthy conditions to users. In recent years, especially in relation to the ratio between house and external environment (sunlight, humidity, etc), wholesomeness has been more and more controlled in reference to the conditions of inner comfort in dwellings (Delera et al., 2004). The optimization of performances and life duration of materials, the reduction of environmental loads in the production and disposal stages, both focused on testing new procedures for recovery and recycling, the closure of the productive cycles and reduction of the resource consumption by using innovative materials, all contribute to systems fully capable of responding to the new procedural model that tend to reach potential zero waste production ("cradle to grave" approach) (Battisti et al., 2012).

Sustainability is defined as a combination of three dimensions of eco-efficiency (environment), technological-constructive (production) and socio-economic (community) (Pugliese et al., 2005). The technological-constructive dimension is defined as the "increase of quality construction strategies and adaptability of the building organism". Short life cycles require a high recycling rate of materials and indeed industrialized and disassembled technologies. (Pugliese et al., 2005). Strategies that achieve the objective of eco-efficiency in social housing relate to:

a. material choice, construction elements, components and technologies: mainly renewable and recycling ecological materials; recovery processes and of recycled materials to encourage disassembly; ecological management of the process;
b. energy management: rational and efficient use of renewable energy sources; diffusion of renewable energy sources and integration of technologies related

to the different scales of the built environment (passive, thermal and photovoltaic solar systems), decentralised polygeneration;

c. soil/territory optimization: using existing structures (retrofit); development of low rise high-density building types with appropriated environmental technologies in large-scale used with renewable energy sources;
d. water saving: streamlining of end uses; recovery and reuse of rainwater and sewage (gray and black water) for defined end uses;
e. use of vegetation: adjusting the microclimate in external spaces; microclimatic adjusting in internal spaces (green wall and green roofs).
f. use of quality materials, techniques and facilities in internal spaces: choices of materials with well tested ecological labels; choice of materials and techniques with the Environmental Declaration Product; choice of aware ventilation systems and environment air treatment;
g. use materials and techniques that reduce the summer load and increase the winter one in the outer layers: forms of external spaces appropriate to the site with security rate; selective seasonal behavior protections (vegetation, tents, etc.); materials for cold outdoor spaces in summer and warm ones in winter.

A further dimension of the sustainability is the social and economic one: it means house accessibility compared with affordability and allowing a certain accommodation mobility, without letting other essential needs to collapse. The adaptability is another crucial factor that should be promoted by the designers, and it linked to the typological and technological flexibility that allows adjustments to the changing needs of users with little waste of resource (Delera et al., 2004).Typological flexibility means: possibility of extending and transform the single housing unit to ensure a simple adaptability of the building to the individual needs, without blighting the residential standards; study of extremely diversified and combined accommodations within the same building, so as to be able to respond to requests for different type of family; proposals for self-design that leave ample freedom to users in selecting and organizing their accommodation (Delera et al., 2004).

Social housing on the South of the world

In the South of the world context there are so many different ways to think about the living space. A diffuse model is the "cortigo", a kind of vertical favela born with the occupation, by poor families, of empty public or private buildings (Delera et al., 2009). Their living conditions are extreme: space is small, hygiene is approximate and forced cohabitation generates conflict, however, living in this context prevents the typical isolation of slums and allows to be able to take advantage of schools, means of transport, light and other public services (Delera et al., 2009).

In relation to the construction industry, in the selection of building materials, types and technologies in both urban and rural contexts show a conflict between what the tradition teaches, what is the local availability and what is influenced by the North the world. Local materials are considered "poor products", giving priority to those imported, which are a high-status symbol for those who cannot afford it. This situation increases the degradation level in buildings. However, from poor and climatically

more difficult contexts comes a lesson of local resources exploitation, both in using materials, which can be easily found in the neighborhood, and in implementing constructive strategies compatible with the climatic conditions. Examples of these strategies comprise houses made of earth, bamboo and stone.

The rising costs of materials and energy, and a new environmental sensitivity, are leading to a more conscious management of resources in these contexts. People grow up initiatives for the promotion of building materials found and processed in the intervention area and there is a spreading of more attentive approach to a climate design. At the same time, the culture of recovery, reuse and recycling is maturing in the most diverse fields (Delera et al., 2009).

For what concerns Brazilian context, as a result of government actions and research projects during the last years the awareness for energy efficiency in the Brazilian commercial and public building sector has risen. However, due to low interest from the public and private sector as well as lack of investment building, design in this sector has not been pushed towards energy efficiency (Bodach and Hamhaber, 2010). In Brazil 4% of the electricity consumption is consumed in buildings: 22% of that in the residential sector,14% in the commercial and 8% in the public buildings (EPE and MME, 2005). Due to population growth, urbanization and higher income, electricity consumption in the residential sector is growing steadily from 4.7% in 2003 up to 6.2% in 2009 yearly (EPE, 2009). The high initial costs are considered to be the major barrier to energy efficiency in social housing (Bodach and Hamhaber, 2010). There are almost no financing strategies for implementing energy efficiency measures in housing. For example electricity meters are not provided in social housing units. As a consequence, consumers ignore individual electricity consumtion. With a fixed share in the common energy bill dwellers lack any incentives for saving energy (Bodach and Hamhaber, 2010).

Only recently the federal government is aiming at providing one million homes in two years, due to the pressure demand. The State of São Paulo is facing a housing cut of 880,000 units (14% of the national deficit), concentrated mainly in the metropolitan areas. The UNEP Sustainable Social Housing Initiative (SUSHI) has grown up to find sustainable solutions in the growing social housing sector in order to improve improve health, comfort and safety, as well as reduce the costs incurred for the use of water and energy.

3.2. Designing the building life cycle

The increase in complexity of the design phase, which should forsee what will happen in building many years after construction, requires a more and more integrated approach to the project, where several involved specialists interact in the early stages of work according to a parallel and mutually fruitful process. European research Smart-ECO, which is in progress and is responsible for identifying the characteristics of sustainable buildings in 2020-30, identifies holistic design as one of the pivots to achieve high building performances with low environmental impacts. (Monti et al., 2009). Below some critical aspects are schematically identified with respect to the life cycle in buildings.

Construction phase

Considering the environmental aspects, the integrated energy capital for the production process of materials, semi-finished products and components, and also for building construction, is called "grey energy", or "embodied energy", which is encased in buildings. Within a high energy consumption building, it is overcome, within a few years of operation, by that energy required for operation (air conditioning, lighting, machinery etc.). According to G. Masera (2004) researches conducted on incorporated energy are done with the LCA methods (Life Cycle Assestments), by splitting the expendables on different phases of the process. For construction products they are typically:

- extraction of raw materials or the recovery of recycled materials;
- transformation with different complexity depending on the nature of product, which could be a material, a semifinished product or a component finite;
- transport from working place to site;
- building installation.

In LCA analysis one could identify two potentially effective approaches, which comprise the use both of local materials (a better control on production process by minimizing transport costs) and of global ones, coming from far away, but very used in the process (in order to compensate the higher transportation costs). As regards the operational aspects, designing the building assembly (site phase) requires the optimization of the construction times, costs and quality of the finished products. This goal can be achieved either by selecting material produced through low energy consumption processes (or those with a high content of recycled raw materials), or by providing processes that require limited energy input, using light elements, minimizing transport needs, rationalising on site processes, etc. (Masera, 2004).

Maintenance phase

The long life cycle of each building implies that it should pass through adaptive, retraining and maintenance operations which would retain performance or adapt them to different functions (Monti et al., 2009). In such this framework, the project aim

should be reducing the overall entropy, i.e. designing the assembling of component materials with different life cycles, so that they remain individually replaceable without damage to longer duration elements. Layers should therefore be designed according to an "onion" scheme with more durable elements placed in less accessible parts. To summarise, the construction techniques must ensure the possibility to operate specifically on failure elements without interfering with the adjacent ones, to minimize duration and extent of the operations of maintenance or spatial modification, to limit the use of machinery, the duration of interventions and needed transport, to reduce waste arising from maintenance operations in order to be reused, instead of being thrown away in landfills.

Disassembly phase

When a building reaches the end of its life cycle, once verified that it is not possible the reuse it for other functions (environmentally friendly option and indeed mostly convenient), it should be demolished or, with a more current term and targeted to practices of limited environmental impact, "disassembled". It reduces the use of landfills, thanks to the lower volume of produced waste and reuses elements already present in buildings; it also fosters either the recycling of non-reused materials, with the possibility of producing new component or the conservation of the embodied energy.

As stated by Carlo Monti (2009) building materials may be included in the life cycle by means of:

- downcycling: the material is used at a lower qualitative level (for example, aggregated from buildings that are used as road subgrade);
- recycling: the recovered material is entirely reintroduced into production cycle;
- upcycling: material is used for higher quality usage (for example, materials cleaned up of contaminants), which can therefore generate situations of:
    - reuse, based on efficiency retention of materials and components of the previous useful life (thanks to an appropriate maintenance). This approach can be problematic due to the associated costs for removal and the likely absence of warranty, once re-installed the component;
    - recycling, where raw materials are used with a view to produce other material components of the same type (for example gypsum boards coated, waterproof synthetic membranes, etc.);
    - other use: using raw materials to produce other types of component (an example could be thermal insulating products from PET bottles).

Privileged construction techniques are therefore the dry layered ones, because the traditional wet systems, and in general all those casted on site, require destructive demolitions, with subsequent grinding operations with reuse for filling in road works. Components based on concrete, brick or stone, can be re used only at a lower functional level compared to the original, contributing to an undesirable increase of energy (Di Giulio, 1991).

Construction system and obsolescence

Sustainability is a continuous requirement, in fact it affects all stages of life in buildings, from design until decommissioning. Since the environmental impact may not only affects the useful life and its related energy consumption, but also the stages of construction, management and removal, there are many factors that should be considered (Di Giulio, 1991). In spite of the length of life cycle in residential buildings (estimated between 50/100 years), it is essential to take into account all these aspects during the design process. Another aspect concerns the profound influence that the constructive system exerts on the overall performance of environmental sustainability in buildings. This element is beccoming more and more important in decreasing energy consumption and increasing legislative dispositions on waste management.

Intending as "obsolescence" the complex of factors of aging, decay and deterioration that cause a fall in performance levels throwing them below the values of predetermined accessibility, R. di Giulio (1991) distinguishes between physical obsolescence, functional obsolescence and technological obsolescence.
Internal and external factors, which finally activate processes of obsolescence, act rarely in isolated form by making the identification and origin of a further complicated disease. Among these there might be: human factors, chemical and environmental factors, structural factors, accidental events, design errors;construction errorsand abnormal behavior of technical systems and installations.

3.3. Pursuing the cost containment

Architecture is increasingly becoming a consumer product with quick depreciation. Low costs always dominate in searching for the optimal cost-performance ratio, mostly by sacrificing durability and sustainability is becoming necessary at the same time. The complexity of the matter is found in increasing labor costs and decentralised distribution of money (Atelier Kempe Thill, 2012).

Social housing sector has to consider the cost containment of intervention, management and maintenance among affecting factors. Specific evaluation of cost/benefit ratio of operations is crucial in order to make appropriate choices. Particular attention should therefore be directed to criteria on how administrating interventions: sharing with users is generally necessary to ensure the proper final outcome and the application of correct management methodologies (Monti et al., 2009).

Low cost architecture characters

Providing low cost buildings, yet always maintaining a high quality standard, means that architects should reconsider, temporally and structurally, some phases of the manufacturing process, such as the design, the award in contract and the implementation of building, in such a way as to significantly reduce the cost increase. The two strategies promoted are the wise use of existing systems and products available by catalog, which is often indicates a certain application technique of the company, and the reduction in cost of the used materials; reduced cost depends on the ability to easily find the material on site, or even the possibility of material recycling. According to Morabito and Bianchi (2010) functionality of strategies can be schematically explained by different approaches to the project, i.e. a special attention able to achieve a good quality and, at the same time, the goal of a cost-effectiveness:

- limiting the initial choices by directing the project toward an architectural idea that provides a functional organization of the environments and a rational distribution of spaces;
- adjustment of ratio between surfaces and cubic volumes, especially that volume between useful surface and total gross surface;
- rationalisation of the structural system;
- adopting a continuous construction type, consisting of massive walls, or a discrete type, determined by a timely and coordinated framing system;

In most cases, recent surveys have shown that costs related to the activities of management and maintenance of a building are significantly higher than the initial cost of construction. In order to be able to compute the overall costs of a building it should be considered not only the implementation ones, but also the maintenance ones. As stated by C. Monti (2009). Low costs of maintenance can be obtained by using the recent technological innovations occurred in the industrialised production, through:

- construction independence of the various elements that allows the rapid replacement through simple operations of disassembling and reassembling pieces without involving the other parts of the intervention;
- the ease of maintenance on the various parts in the building, since the recent prefabrication systems and the new systems for dry assembly facilitate these operations and optimize the time spent on maintenance;
- the best quality performance of industrialized products, since the use of computerisation production allows greater reliability of materials' performance and building components involving limited and more spaced in time maintenance.

3.4. Construction technologies and innovative materials

The role of technological innovation

In the contemporary broadest sense, technology means "technology of production", both the construction or components' one. The technique takes care of the tangible world of production and operation of the machine itself, leaving behind the principle that transforms it into an useful machine, focusing on its operation (Delera et al., 2009). The role of the technological progress as a propeller for alternative solutions for both the consumption of resources (use of renewable technologies) and in relation to their specific conditions of use, is partnered by foreshadowing and generator once again of new scenarios able to affect the concept of environmental sustainability (Battisti et al. , 2012).

The existing built heritage has poor performance levels of environmental welfare as well as a high energy consumption. The energy requirement in old buildings is around 250 kWh/mqa, around 150 kWh/mqa in constructions built after 1991, while a passive building consumes no more than 15 kWh/mqa. These issues have been addressed for long in European countries; especially in the north central nations (Monti et al., 2009). The Italian case is not completely exemplified in these experiences. Interior problems arise: the need to limit energy consumption not only in cold winter but also in hot summer, and the retraining of the relevant historical and monumental building heritage.

The correct and appropriate address of experiments and research on new materials and innovative technologies, high efficiency, and low environmental impact, is the only way to achieve the transition toward the use of renewable energy sources, by the construction of effective and realistic technological alternatives to the systems of fossil sources energy exploitation and to the generation of nuclear energy, or to the current systems of disposal and recycling of construction waste, or even to make feasible innovation, adaptation and efficiency of the water urban network (Battisti et al., 2012). Intervention techniques aim to decrease telecast losses, by increasing the envelope insulation and reducing the incidence of thermal bridges, to delete the ascending humidity induced by weather conditions, to adapt and renew installations with efficient generators and control systems for autonomous single units, to limit the heat loss for reaction, also by the introduction of mechanized ventilation systems for heat recovery (Monti et al., 2009). Engineered and prefabricated systems are used, in order to maximize processes of mechanical or chemical-mechanical assembling and to significantly increase both the rate of mechanization and the speed of the respective processes, while reducing as much as possible the use water or other solvents, so as to reduce the incidence of labor costs through an increase in yields.

The most applied configurations

Structure and envelope are the two main parts involved in achieving the sustainability goals. According to Carlo Monti (2009) there are various choices generally based on any of the following configurations of structure and envelope:

- high mass such as to give priority to the inertial behavior;
- low density and other external insulation to exploit the thermal resistance of the envelope, the natural ventilation and possibly also the plant cooling with low energy expenditure;
- suitable combination of medium mass (or better low) and external insulation, with a view to reconcile the use of energy performance with the structural strength, with particular regard to the case of multi-storey buildings.

High mass configurations are distinguished in particular those made with two-dimensional or even three-dimensional precast concrete in combination with the same external insulation directly coated or externally protected by a "ventilated wall" of thin skin slabs. Low mass and high external insulation configurations are particularly adequate for low height buildings, and they develop Str/En (Structure/Envelope) solutions, based on the stratified dry construction. In this regard, it comprises either the steel structure option or the wooden one, which will be deepen farther on. Within in the context of low mass and high external insulation configurations, a very performing solution comprises systems with structural panels made of wooden crossed layers to be assembled by various mechanical connection systems, such as to ensure high seismic safety standards. Finally, with regard to medium mass (or better low) configurations, there are significant steel and concrete (or wood and concrete) mixed solutions. Regarding technologies and systems in sustainable building projects eco-efficient technologies and systems can be investigated by identifying the following specify themes:

1. innovative systems for the management and monitoring of the solar radiation;
2. innovative systems for the management and monitoring of the hygrometric components;
3. high performance content innovative materials;
4. energy and environmental retrofitting;
5. integration between natural and artificial materials systems;
6. renewable energy in architecture: photovoltaic and thermal solar;
7. simulation, evaluation and control systems of the environmental performance in settlement assets;
8. architectural integration of technologies for rain water recovery.

Within the scope of the design process, these areas represent the primary issues to face with, both at the analytical level and at the operational level; they indeed constitute a necessary condition for the implementation of quality in the architectural and environmental sector.

Use of innovative materials

The range of low cost materials comprises either all those really inexpensive because characterized by low purchase price, as the raw earth, brick, cement-based materials and some plastic products, or even those materials with specific technical and

performance characteristics capable of providing savings in total cost for the entire life cycle in buildings; not only construction, but also maintenance and management, and also those aspects relating to environmental compatibility (Morabito and Bianchi, 2010).

Costs may be reduced by using materials readily available on site, achievable with low production costs, with dimensional characteristics that can be adapted to several types of product so as to simplify the operations of assembly, disassembly and replacement, as well as with those materials, which, once abandoned, through a minimum machining processes can enter the production cycle by ensuring an energy control and a good quality performance in time so as to recoup the initial cost, maintenance costs and prolong the obsolescence period of the building itself.

According to A. Battisti (2012). The main materials used today are:

- clay; good mold ability, plasticity, strong adhesiveness restraint, thermal capacity and vapor permeability (mixed with fragments of bricks the mineral of clay for the manufacture of load-bearing walls);
- prefabricated raw earth bricks; straw and slabs of compacted clay up to 50 mm thickness (curtain walls, coating elements for floors);
- ceramic materials; infinite textures and colors, mechanical strength at high temperatures and frost, good usage behavior, heat sealing, moisture, chemical agents, ease of processing, installation and maintenance (internal and external coating in buildings);
- concrete; lightened concrete blocks possess a minimum thermal conductivity and good acoustic insulation properties and fire-rating (internal and external walls, load-bearing and non-load bearing structures);
- bricks; composed of natural and artificial aggregated, in different colors, sizes, holes, specific weights and with improved characteristics of resistance to compression;
- plaster fiber prefabricated sheets and fiber cement sheeting; can be easily processed and cutlery quickly on site since they are equipped with jointing systems that facilitate connections;
- wood derivatives; today they represent new materials at a low cost; many types of panels with wood base, treated with special finishes and protective films that will enhance the chemical-physical performance of the material itself, are identified by OSB, MDF, LSM, FSH (coatings of interior environments, casing of buildings);
- glass; ease to assembly, disassembly and eventually replacing, quick installation and easy maintenance (surfaces of coating);
- Sheets of polycarbonate; films made out of PVC, polyethylene, polyurethane and polyester, in different color, transparency, and structure (coating materials for external façade, internal vertical non structural partitions, skylights and covering panels);
- metals; sheet-metal panels do not involve any loss of quality of the material itself; (claddings in corrugated plates, ribbed, wavy and shaped that have different lengths);

Large part of low cost products of today is mainly derived from the recycling of materials of three different consumes from processing waste and construction and demolition waste. This category includes recycled cellulose fiber pre-consumption and post-consumption; recycled pre-consumption wood; sawdust, fibers and flakes; concrete from demolition; pre-consumption and post-consumption recovered glass; recycled pre-consumer and post-consumption aluminum; steel recovered from the processing in industries and mechanical factories; copper; recovered pre-consumption and post-consumption plastics.

Ecology and building form

Since facades comprise up to 33% of total construction costs, a cost-efficient project should take into account the compactness factor. The ratio of useable area to facade should be as large as possible because when it is reduced, than savings can be invested directly in higher quality materials (Atelier Kempe Thill, 2012). A strich orthogonal structure is preferable to a contextual, amorphous or concentric form. In order to reduces costs, also bad widths need to be optimized and a compact building volume also achieves optimized energy values, reduced material consumption and more units per building foot-print (Atelier Kempe Thill, 2012). The facades are freed from traditional inexpensive coatings, usually used for this category. The outer walls increase in thickness, stratify and respond adequately to required climate performance (Gelsomino and Marinoni, 2009).

The A/V ratio (ratio of heat-transmitting exterior surface to heated building volume) is a key parameter in choosing the building form: small surfaces for the building's envelope, exposed to elements, mean small building's heating energy requirement (Schittich, 2004). Also the number of floors plays a key role: in fact high density housing with apartment towers often should face social problems because of the lack of social interaction and the failure to provide adequate connections to the outdoor space (Schittich, 2004).

The Passivhäus standard

Today the dominant model of low energy consumption house is the imported Passivhäus. The distinctive characteristics of a Passivhäus are a super thermal insulation and a strong containment air infiltration. Other characteristics arise from the previous ones: the forced ventilation with heat recovery, the weak thermal inertia of the construction (in general resulting from the choice of light and layered technologies), the integration of the solar thermal for the production of health and for heating through the air, the use of heat exchangers land-air, the photovoltaic energy production and the consequent use of this energy in active air conditioning plants (Delera et al., 2009). Some of the above characteristics are not essential in Italian climates and other ones are not even appropriate. But the Passivhäus model is often adopted in Italy with very small changes or even without changes (Delera et al., 2009).

The Passivhäus promotes the complete elimination of traditional heating (gas or diesel boiler) being inclined to a system that exploits the mechanical ventilation system, still fundamental to ensure air quality inside the building envelope with high resistance to penetration. Using ventilation air as vector fluid, whose specific heat is much lower than water used in conventional systems, limits the residual requirement of heating at 15 kWh/mqyear. According to Gabriele Masera (2004), the Passivhäus standard relies on improving performance of the opaque envelope in windows and mechanical ventilation system, avoiding neither to introduce complex components nor to require significant changes in users' habits. In order to achieve the expected levels of consumption, strategies to adopt (stating that they are valid in continental climate, so it can't be uncritically translate in other contexts) can be summarized as follows:

1. iper isolation of opaque closures and absence of thermal bridges;
2. high-performance glazing, appropriately sized for solar collector;
3. envelope air-tightness and mechanical ventilation system with high efficiency heat recuperator;
4. exploitation of renewable resources.

During sequences of cloudy days, a Passivhäus works better than an ordinary bioclimatic house, becasue bioclimatic houses mainly use parts of construction for storing thermal energy, while the Passivhäus may use both water of the solar heating circuit and, indirectly, electrical energy produced by photovoltaics (combined with heat pumps) (Delera et al., 2009).

Benefits of prefabrication

The increasing tendency of the contemporary society toward saving has more and more influenced the structure of the business in the industrial sector, where all the conditions for the optimization of processes were already present, such as the flow of materials and of production cycle, while in building industry there was introduced the first real interventions of rationalization (Morabito and Bianchi, 2010). Industrial standardized product is conceived from the years 1970s with a generic flexible and "open" structure, whose various constituent parts can be transformed, changed, expanded and conditioned, repaired and replaced according to a redefinable programd cycle (Delera et al., 2009). Next to the system of cells there has been subsequently developed the technology of prefabricated sandwich panels that has generated many opportunities for combinatorial development. Its original stiffness related to the structural system is opposed to a real possibility of a free dialectic expressiveness determined by a flexible arrangement of various elements (Morabito and Bianchi, 2010). The modular structure frame has made possible a layout organization with covered or open flexible environments, projections, or backsliding on the facade (Raimondo, 2005).

From a rigid standardization of the old production model, aimed at achieving economies of scale through the multiplication of serial products, there has been introduced a new production system based on a level of technological flexibility that

has allowed to reduce the mass standardization. This flexibility has represented a dynamic-economic factor that has encouraged the speed of production times, the economies of scale and the diversification of the product process (Marocco, 2000).
Recently, the development achieved by the programs of three-dimensional digital modeling allowed new possibilities to implement direct relationship between project digitized and building. Through the CAD computerized systems today there is the ability to change significantly the balance of production technologies (Monti et al., 2009). The masscustomization is therefore conditioning the manufacturing market in a decisive way.

Within the construction sector the use of products that comply with new technology requirements concerned on mechanical, structural and functional safety, fire rating, seismic safety, during assembly and disassembly on site, allows also a prediction of efficiency duration of the "pieces", with a consequent targeted control of maintenance and management costs for the entire life cycle of the product (Delera et al., 2009).
Two of the crucial points of this approach are minimizing the constructional details and choosing the pieces directly on a catalog provided by various manufacturers. Serial production ensures an easy installation on site with predictable construction times and a good duration (Morabito and Bianchi, 2010). The result that derives from these technological processes generates a hybrid transformation that satisfies different possibilities of development according to the specific needs..

Structure/Envelope technologies

Increasingly streamlined, lightweight and independent from the rest of the building, the envelope has become a sensitive membrane, with a thin support structure and junction elements more and more thinner and smaller. The new connection elements on the market are durable, lightweight, resistant to mechanical stresses, to atmospheric agents and to high temperatures, reusable, cost effective, connected to very small dimensional tolerances, which allow to easily be assembled and disassembled, directly on site, with other elements (Morabito and Bianchi, 2010). This way of industrialization focuses on the single product more that on its relationship with the other elements, allowing the development of dry layered construction techniques, known as Str/En (Structure/Envelope) (Masera, 2004).

These techniques are based on clear separation between structure and technical elements (shell, horizontal and vertical partitions etc.). Each piece belonging to the stratification, with a specific origin, performs a particular functional and primary role, and it is brought up to the other, in compliance with the problems of chemical-physical compatibility, depending on the requirements of each individual project. The growing affirmation of this approach can be explained mainly with the variability of combinatorial materials and components, which implies an inherent both volumetric and coating predisposition to compositional flexibility. Recycle of components is another key element: once the useful life is over, building could be dismantled in a controlled way.

Regardless of the used type of structure, joints are "open" and dimensioned in order to meet dimensional tolerances of production, thermal and micrometric expansion of the elements and the need to promote the disassembly and assembly of partial covering elements, when they have to be replaced or to facilitate the maintenance operations of minor parts. The systemization of connection systems ensures an adequate mechanical safety of various elements. According to C. Monti (2009), with a view to frame systematically the theme of the envelope innovative technologies for energy efficiency in social residential buildings, their benefits should be grouped in the following themes:

1. Evolution of components. Light or heavy components for perimeter walls are divided into small simple elements to be realized on site, large elements for prefabricated or assembled systems.
2. Vertical closure systems with dynamic behavior. Once framed, the fixed boundary conditions (general climate, orientation, morphology of the surrounding, environmental significant elements, building typology and intended use, etc.) and those variables should be defined (different seasons, different hours of the day, meteorological changes, distributive variables, etc.).
3. Interactions between vertical closings and other components of the distribution system. Envelops with dynamic behavior quite frequently involve the adoption of parallel layer solutions with interposed air, either stationary or moving ones. Ventilation in the gap can be for individual items, for vertical or horizontal channels or all over the surface.
4. Interaction between shell plants. In residential sector, which uses conventional heating systems, more and more frequently at low temperatures, the synergies between envelope and plant, capable of generating energy efficiency, can be either passive or active type.
5. Equippable of surfaces. As regards the use of photovoltaic modules, is becoming more and more tangible the possibility of making photovoltaic ventilated facade, which can be similar to materials of common use in construction industry, such as ceramic or glass.

The benefits of the steel constructions

According to Gabriele Masera (2004) the use of steel has many environmental benefits:

- a minimization of the amount of needed material, thanks both to the reduced input between weight resistance, and to the limited production of waste in construction, (compared to other construction systems);
- a limited supply of energy for the construction, thanks to the intrinsic lightness of components (which implies ease of handling and transporting);
- an inherent susceptibility to maintenance operations, replacement of parts, modifications of time and final removal by using little energy, thanks to the adoption of reversible connections;

- the management of construction site takes advantage of the speed of assembly, due to the absence of drying times of casting, the reduction of waste and, in general, the lower production of noise and dust.

One of the critical aspects on using steel is the high energy content, related to the amount of energy necessary for its production; as with all metals, the value of the incorporated energy is around 30 MJ/kg, due to mining processes of iron and steel. Infinite recycle of steel is easily achieved thanks to the magnetic separation from other waste, and this allows the use of recycled materials without losing performances.

A first constructive approach consists in the use of light metal supports arranged with relatively short step; they constitute both the load-bearing structure and the support for sealing layers and external finish; they could be suitably modified to provide the interior floors and coverage of building. These systems derive directly from the traditional techniques of the balloon-frame (Masera, 2004), with a discrete diffusion in the countries where constructive culture is based on the use of timber. Vertical walls (closures and any internal load-bearing partitions) are made up of vertical profiles, with step between 40 and 80 cm, fixed to horizontal guides. Relationship between floor and vertical walls determines the name of the constructive mode: if floor is located adjacent to the vertical elements in plan, with guides in contact with each other, there is a balloon-framing, while if it is inserted between them one can talk about platform-framing (Masera, 2004). A second construction method is based on prefabrication of entire three-dimensional elements, consisting of one or more rooms, which are then assembled together on site. Resarch has focused on the production of three-dimensional forms, freely assemble together externally on site, which can more easily adapt to the functional, esthetic and climate requirements of the location. Generally, elements are composed of a resistant peripheral laminated steel structure, which carries the own loads of module and those ones arising from other modules overly on it, and closures, which have different characteristics depending on whether they become internal partitions or forehead facing the outside. In the point structure systems, which is the third technique, plugging can be made with the most diverse materials, form the stratification of plates to the massive prefabricated elements, with a range of external finishes equally variable. The most effective strategy in these structures offers a natural predisposition in unlinking the outer envelop from the inner one, forming two completely independent shells. This way it is possible to obtain the best thermal and sound efficiency, because it avoids the direct transmission of external forces to the internal environment.

Building with timber

New technology solutions with timber prefabricated components and systems adequately address the requirements of a sustainable housing process oriented to a better control over the quality in the production phase, less waste of material from factory to site, more speed in the construction phase: processes for light type production with a reduction in consumption of resources, flexibility, dry assembly and recycle, reuse of components are the inherent requirements of timber construction

(Delera et al., 2009). Nowadays there are many different ways of classification of timber construction systems used in Europe: structural design; used constructive elements (beams and pillars, posts and panels); type of used connections; degree prefabrication of elements; construction methods. A basic classification can be made between of "light" type constructions and "massive" type constructions. In massive types insulating layer is separated from the supporting structure, made with elements either of plan type or large in size, while in the light type construction insulation and supporting structure, made with linear type products provided with a thin paneling, are found on the same plane.

In addition to the ease in composing solutions for isolated closing, by filling the respective hollow spaces with insulating material, timber has a small incorporated energy, which is around 5-10 MJ/kg (among the lowest value of all building materials) thanks to the limited number of treatments used for production. The framework of characteristics of wood environmental compatibility is completed with the possibility of reuse or recycling, fostered by the processes of element assembly, which are typically dry and reversible. According both to G. Masera (2004) and A. Delera (2009) the analysis of the current situation allows to identify the following application technologies based on timber structure and cladding:

- Frame and plates systems or panels; this is an evolution of the platform frame. It is a well coded and technologically evolved constructive system in relation to various technical problems common to all wood construction: fire resistance and protection from air infiltration and water stagnation. The constructive principle is based on solid wood frames and coatings floors with wood-based panels. Chipboard plywood, OSB panels, fiber gypsum or fiber cement are used for the coating. Assembling method are derived from the Platform frame system i.e. the prefabricated elements are mounted for horizontal planes.
- Framed beams and pillars systems; these ones represent an evolution of the load bearing system and are characterized by the separation between the supporting structure and plugging. The process starts with the embodiment of a structural cage with beam pillar elements, square or rectangular in section, sometimes formed by a double element and connected between each other through screws, bolts, pins, metal shoes and steel plates.
- Construction systems with multi-layered panels; multilayer panels of cross-tables are characterised by the use of plan massive elements with a load-bearing function. It is composed of at least three layers of wood planks, crossed and glued or connected together through pins. Individual tables can be glued on edges and joined in longitudinal direction by comb joints. Walls, floors and roofs are made in factory with all the openings of windows, doors, and for the inclusion of staircases, as well as uprights on site through a quite simple assembly technique by using angular steel and screws.
- Timber substructural system; these methods are based on a sub structure consisting of wooden uprights arranged with a relatively small step (60/80 cm), it can act as a buffer or as supporting structure of the building, as in the traditional balloon-frame and platform-frame American houses. Interspace, formed by the uprights, closed externally by fiber-cement or timber panels, and internally by lined plaster sheets, can be used for thermal insulation and

passage of technological systems. Outside this layering, an insulating coat could be put, to homogenize the thermal resistance of the closure, then finished in plaster so as to obtain an appearance of traditional building.

- Load bearing prefabricated panels; these components can be used alone, such as load bearing elements or being part of a layered wall package, in particular in applications of vertical closure. This second role is facilitated by the interspaces, filled with dissolved insulating material and often formed inside panels to decrease the mass. Using supporting boards has considerable technical advantages thanks to speed installation and ease of handling, while it shows limits in flexibility and in time of technical elements and systems maintenance.
- Three-dimensional cells; thanks to its intrinsic lightness, timber works perfectly in prefabricating three-dimensional modules out of site, being particularly suitable for constructing in a very short time or in difficult boundary conditions (environmental, meteorological, etc.). Cells come on site with whole finishes (except possibly external ones), and, since they are self-supporting, they do not require, the embodiment of a supporting structure. Advantages and disadvantages are similar to those ones related to metal technologies: in relation to a strict quality control, also guaranteed by the production of elements in a closed environment, there is an huge limitation of morphological-distribution variability and flexibility in the intervention.

3.5. Renewable energies in residential architecture

Photovoltaic and solar thermal

By using appropriate technologies in the urban environment, the architectural integration of renewable energies is strategically one of the emerging elements in eco-architecture, significantly influencing the way of production, management, and energy consumption. According to A. Battisti (2012), the primary integration between photovoltaic system and building takes place through the installation of new photovoltaic modules, which affects significantly the configuration of the horizontal and vertical envelope in construction by investigating technology, performance and composition aspects. The detailed ways of application, with respect to horizontal and vertical closing, are carried out according to different levels of integration. They could comprise an independent application, where the photovoltaic modules are independent of the closing horizontal and vertical mantle of the building and the layout of modules is not conditioned by envelope morphology. There is the overlap application, where the solar modules are placed, through a special structure, above the horizontal and vertical closing mantle of the building without taking its place, by adapting the configuration of the closure surface. And, finally, there is also the total integrated configuration, where photovoltaic component constitutes the outermost closure layer of the building, playing mainly the function of waterproofing and air sealing. Apart from allowing the achievement of significant energy savings and increasing the thermal and visual comfort, the recovery solar reduces degrade level of the facade, improves the architectural image and increases usefulness of space.

The most common application of thermal solar systems in retraining intervention is the installation of solar water collectors for the preheating of the household water and of ventilation solar collectors, in conjunction with the establishment of a system of mechanical ventilation, in order to heat the ventilation air (Masera, 2004). Solar water collectors must be oriented toward the south, but deviations to the east and west of 15-20° are also acceptable, having an inclination equal to the latitude of the installation site. As regards the ventilation solar systems, the most frequent application concerns the implementation of under-window ventilation systems for the heating, where the outside air circulates through collector directly without a specific accumulation (Malighetti, 2004).

Active systems

Active systems involve a process of transformation of direct solar radiation in another form of energy, or the conduct of a mechanical work for operating the system. They could be photovoltaic systems, which produce direct electric power thanks to the use of semiconductor materials. The most diffuse models currently use cells of monocrystalline silicon, crystalline or amorphous, connected in series to form modules. Solar panels for heating the domestic hot water, based on the greenhouse effect by trapping solar energy within a room: the heat accumulated is transferred to a coil, where water flows, through a metal plate in a dark color that is used as exchanger. The preheating systems for air ventilation are another possibility, which

exploits the same principle of water solar panels to supply heat to air taken from the external environment is directed to a mechanical ventilation system. This way is possible to reduce the thermal load of the same plant because the temperature of the fresh air is higher than the external one. The optimal orientation of photovoltaic systems is south and the optimal inclination depends on the latitude. In regeneration processes the more viable design solutions are the following:

- integration of existing roof by replacing the deteriorated roofing;
- construction of a second skin on the opaque facade producing a ventilated wall;
- integration into a system of under ventilating window;
- integration of the photovoltaic system in sunscreen screens to protect the existing facades that require a check summer overheating.

Passive systems

According to G. Masera (2004), G. Turchini and M. Grecchi (2006), passive systems are based on the direct exploitation of solar radiation, which can be used immediately to heat the interiors of the building, or stored in storage elements that gradually released the heat in order to mitigate the temperature peaks. A taxonomy of strategies of passive using of solar energy can be organized as follows:

1. direct gain systems: they provide that the solar radiation is permitted within the building through retractable elements, facing south, and smite of the storage elements that release the heat over time;
2. indirect gain system: combine the features of uptake, accumulation and distribution of the heat in a border element between inhabited spaces and external environment (massive capturing walls with air glazing, "Trombe" walls, water mirrors roof);
3. insulating systems: they are based on the collection function of solar heat elements separated from the rest of the building. Transfer of thermal energy from the collector to the inhabited spaces occurs with non-mechanical means, radiative or convective, or with the aid of fans with low power consumption (Barra-Costantini systems, insulation walls and roofs).

The more viable systems for the exploitation of the thermal radiation in case of social residential building recovery are those direct gain ones with massif wall and those ones with Trombe wall, systems to radiator and the creation of buffer spaces with external loggias or greenhouses (Battisti, 2012). A greenhouse is a buffer space leaned against the south wall, with a tolerance of 45°, and deducted on three sides and sometimes in coverage that may work, depending on cases, as direct, indirect or isolated gain system. Loggias are characterised by the presence of an under-window opaque element and realize a greater energy savings through direct solar gain and/or preheating of ventilation air. In both cases, the benefits obtainable from their adoption deal with energy saving, air preheating for ventilation, improvement of indoor climate, resolution of problems on thermal insulation of the perimeter walls and existing thermal bridges and increase the livability of the house environment.

In 2003 European Commission promoted a directive proposal on the energy efficiency in buildings, to establish a framework that allows Member States to co-ordinate the regulations in this construction sector. The main elements of the proposal are four:

1. Establishment of a calculating method integrated on the energy efficiency of buildings. Tools for calculating must account for all factors that contribute to the energy balance of the building.
2. Application of minimum standards for energy efficiency to new construction buildings and refurbishments;
3. Energy certification of new and existing buildings. It is expected that, at the time of construction, buying and selling or leasing of the building, both presented a certificate of energy efficiency, containing summary indications of immediate understanding, should be presented.
4. Specific inspection and assessment of the heating and cooling plants: a periodic checking is proposed (already mandatory in 10 member countries) and, for systems more than 15 years old. and the definition of alternative strategies that can improve efficiency.

Innovative systems of hygrometric control

In dealing with issues related to environmental comfort in indoor spaces, chemical/physical and environmental parameters should be taken into account because they influence the interaction between human body and surrounding environment (Turchini and Grecchi, 2006).
The thermohygrometric comfort in a confined environment, is defined by the behavior and the interrelationships that occur between a series of physical/environmental parameters: temperature and velocity of air, relative humidity, radiant heat energy, undertaken physical activity and thermal insulation characteristics of worn clothing. The mutual variations of the individual parameters and any inhomogeneity can give rise to a series of uncomfortable feelings that are generically referred to as uncomfort (Battisti et al., 2012).

In terms of air quality it is necessary to consider possible risks that can find purely environmental causes (chemical, physical and biological agents) or being related to the human presence (viruses, bacteria). In order to obtain the desired level of comfort, firstly appropriate technical/engineering solutions should be taken in relation to typological, morphological and functional characteristics of the own building organism (Turchini and Grecchi, 2006).
Within the composition process in an eco-sustainable project the environmental components, such as sunshine and ventilation, have an essential role as they define and characterize the technical and technological choices and their spatial configuration in relation to urban context, to aspect ratio of the building (S/V), to exposition of facades and the logic of distribution of air ventilation (Battisti et al., 2012).

Technologies for recovering rain waters

The theme of integrating building technologies for the collection, storage and recovery of rain water are taking leading roles in the debate on environmental sustainability in architecture. Even the regulation legislation is moving on this direction, with the inclusion of many urban planning instruments of prescribed information related to recovery and reuse of rain water affecting buildings, with significant, immediate and potential consequences on spatial, architectural and technological conception of buildings and their surroundings (Rocca, 2010).

Despite the overall situation of water resources, levies for civilian, industrial and agricultural purposes are growing consistently. As regards the civilian uses, the Italian national average is about 340 liters per person per day, which is very high compared with the one of the other European countries, which is around 200 liters (Delera et al., 2009). One of the main reasons is certainly attributable to the much lower overall cost per liter. In the rest of Europe (in Germany, France, Netherlands, United Kingdom, etc.) in fact, average higher rates match lower consumption. (Delera et al., 2009). Wastewater and the rain water can be treated with great success for the containment of pollutants in technological systems where water, plants and substrate of soil are at the base of the sewage system. This technology has also low environmental impact, i.e. it does not require complex mechanical components both in the implementation phase of the management and maintenance, and in high energy consumption.

Rain water, once collected on roofs, terraces or paved surfaces, should be separated from the "first rain", considering high pollutant load especially in the urban environment, because product from cars must be treated separately or conveyed in sewers. The "second rain", filtered in separators, is collected in suitable tanks or drums to be pumped then as needed within the building, passing through more filters and a battery of ultraviolet lamps to sterilization (Battisti, 2012).

Gray water is all that water going out from sinks, showers, bathtubs and bidets. It can be treated separately or together to the sewage water. The presence of a degrease actor may be useful before phyto purification plant.

Treatment of waste water is carried out for more than a reason, both for water recovery, especially in places where drinking water is scarce and, therefore, its use must be strictly limited to food and sanitation, and for natural fertilization (a system that irrigates and at the same time fertilizes the ground, thanks to the nutrients contained in its effluents) in cases where it is advantageous, as for example in farms, and the collection of animal slurry used as fertilizers it is already practiced.

Water saving systems

Water-saving means limiting the consumption of the good quality one, and encouraging the use of alternatives: rain and wastewaters. First of all, the conscious use of the resource must underlie each behavior. Good practices to limit wastage

both in kitchen and in bathroom with small daily gestures are associated with simple technological systems that, once installed, last for long and have very little maintenance. These are systems could be applyed to taps, drains or relate to the purchase of save-water household appliances, with a gain up to 50 % (Raimondo, 2005).

In particular, looking at the technological systems on the market there are also choices for faucets: from ubitiquitous aeration (mixers of air and water) to flow restrictors and thermostatic taps, which are very useful, especially in showers; monolever fittings with electronic timers are very functional in public spaces, where there is a high flow of users; once activated, they automatically close up after a certain time. About toilet flushing, common drains with single delivery can consume up to 18 liters each time, while those one with dual delivery have the ability to consume 3-5 liters or 9-12 liters, with savings up to 80% (Delera et al., 2009).

Integration between natural and artificial systems

Combining environmental and architectural aspects is in the design of the existing and the new construction, by achieving naturalized architectures, means synthesizing the two separate entities of natural and artificial, and therefore, the innovative relationship of mutual support between the natural components the artificial elements takes place through the provision of methods and innovative technologies for the project design (Battisti et al., 2012). The desire for integration, of interpenetration between artificial space and natural environment is explained in different situations: solar greenhouses, winter garden, facades and green roofs. These episodes highlight the desire not to depart from nature, but to displace it, controlling it, within the confined environments (Turchini and Grecchi, 2006).

Vegetation in the proximity of a building is used as a bioclimatic control device, since affect the energy interactions between it and the external environment, improving the conditions of summer comfort for the interiors and exteriors, and performing a function as a thermal insulator by limiting the temperature oscillations, and filtering the fine dust in the air.

Naturalised surfaces predispose both as architectural elements and as technological devices for improving the environmental quality of urban centers. Green spaces let relax and please, in addition, the seasonal chromatic variability of the used species is a further perceptual stimulus and participates in the dynamics of the decorative aspect that green can offer to low architectural value buildings, thereby improving the overall image of the city (Battisti et al., 2012). Green can reduce some of the negative effects on climate due to the urbanization, first of all because a layer of vegetation, apart from absorbing and then putting the incident solar radiation, through the evaporation-transpiration produces energy that is converted into latent heat, providing an increase in the relative humidity of the surrounding air, avoiding a rise in temperature.

Recycling and reuse of materials and components

Uncontrolled climate change, air pollution and progressive depletion of energy sources, reuse of materials and components represents a valid way to act, by producing ecological materials capable of generating a lesser impact on the environment in terms of energy pollution in buildings for the industrial production and lower incidence of waste disposal.

In addition, also due to the effect of the introduction of Community standards for prevention and promotion of the different types of waste, the quantities of material to be reused are significantly increased, making an increasingly broad range of new component materials economically advantageous (Masera, 2004). By replacing part of the natural aggregates with those coming from the demolition, it is possible to reduce the extraction of stone materials promoting a greater environmental protection and decreasing in volume disposed in a landfill, such as concrete, iron, plaster, bricks and stones, thus being able to restrict one of the major forms of environmental pollution that today, as is known, is derived from the materials produced in building processes (Morabito and Bianchi, 2010).

As an alternative to recycling, reuse can be an additional, sustainable and economically low cost strategy oriented in redesign of parts, elements, components and products and able to lead to a total rethinking of the replacement process and recovery of buildings, capable of producing technological innovation made of the logic of handling and storage, ease of assembly and disassembly and compatibility of assembly of various components.

Theme of reuse is transforming therefore in a design strategy based on a composing ability to freely combine and assemble component materials so as to generate spatial, formal and typological solutions and hybrid construction (Morabito and Bianchi, 2010). Therefore through compositional operations of addition, subtraction, replacement of materials and component and it is possible to change structure, shape, size and image of each product, in the context of a project experimentation in which savings and environmental friendliness, originality and creativity may stimulate the productive and constructive sector in a cultural sense (Morabito and Bianchi, 2010).

Nowadays recycling and reuse constitute, even in strategies with sustainability characters fostering the environmental protection, energy control, saving of raw materials, reduction and waste management and landfill, representing also interesting actions targeted to the conservation, reconfiguration and transformation of built design with a view to restore the original function and new features of compatible building components (Malighetti, 2004).

3.6. Global quality and certification

The requirement approach, which is the basis of current strategies for quality in the construction industry, was born in the 1970s, essentially as modern and efficient reply to the construction sector complexity and the growing importance of the qualitative components of the market, in particular in the residential sector (Turchini and Grecchi, 2006). Defining perceptual, emotional and satisfaction requirements, and transforming them into design solutions and even more, assigning their various parameters that are retrospectively verified to meet the required performance, is a distant goal to achieve and perhaps an impracticable research path.

These requirements, which belong to an intimate sphere, can find solutions only within design trials and be checked only to finished constructions through the investigation on different "levels of satisfaction" showed by inhabitants; this way they can be a valuable reference for future experiences. It should be also taken into account that any legislation could be modified and therefore should be substantially elastic because of social, cultural, economic and productive realities are continuously evolving (Delera et al., 2004).

Global architectural quality

Project and control of total quality should insert the temporal variables in the definition of performance standards and extend the operation of their instruments on interpreting the building process coinciding with life cycle product. The overall life cycle of a building and is subjected to the influence of different variables. It neither coincides with the physic life of the single parts that compose it nor the collapse of the system always determines its end (Di Giulio, 1991). The progressive "aging" in buildings depends on the interaction of obsolescence and natural deterioration phenomena which affects materials and components, on the emergence of new needs by users, or, finally, on the variables due to accidental or pathological events that may compromise the reliability of part or the whole system.

According to R. Di Giulio (1991) there are four levels of requirements in global quality:

- Durability. Performance that have to be guaranteed by subsystems and technical elements in order to last to the stresses induced by the various agents of deterioration due to aging. The durability of a component or a system expresses the ability to keep their levels of performance above the critical point beyond which it occurs a certain pathology or an irreversible process of obsolescence.
  Durability requirements largely depend on the characteristics of chemical-mechanical resistance of materials and sealing capacity of components and subsystems.
- Reliability. Keeping substantially unchanged in time its quality, therefore it becomes more or less the probability, in a predetermined time period (that is the useful life of the product), the technology unit would not break down.

- Maintenance. Complexity of interfaces between subsystems; way of assembling the technological units and, as a result, the procedures for disassembly and reassembly of the parties; accessibility of components; interchangeability of components.
- Adaptability to changes of use. It proposes, in fact, some of the maintainability requirements. However, readiness of subsystems to be dismantled, integrated with new components or equipment, partially demolished or replaced in some of their parts, does not express the aptitude to maintain the required quality standard of by these operations, but its ability to transform in relation to those effects produced by that particular type of obsolescence defined "functional obsolescence".

Simulation, evaluation and certification systems of environmental performance

Energy and environmental assessing in a building process consists of the analysis of the components and connections of its constructive system and its surrounding; in particular, considering resources that feed it, it concerns the processes of transformation that take place in its use period and the consequences that occur as a result of its disposal (Battisti et al., 2012).

The application of operational models and dedicated software that can monitor many aspects of constructions and provide summary information of the more complex phenomena in all phases of life cycle becomes a fundamental tool of designers. Specifically, the methodology focuses on the use of different tools, related to various phases of the project design (Masera, 2004). These instruments are divided into systems of control and bioclimatic simulation (ECOTEC, FLUENT, ENVI-MET, MITHRA), for the verification of the interactions between local climatic factors and project attitude, and assessment systems (EPIQR) and energy and environmental performance certification systems (BESTCLASS, DOCET), in such a way as to measure the the building organism efficiency in all stages of its life cycle, and to quantify, at the same time, the consequent effects in terms of technical-constructive innovation. All those programs related to the first category simulate, through 3D microclimate models, the interaction between urban surfaces, vegetation and atmosphere and proposed project arrangement, to verify its effectiveness in a energy-environmental feasibility. The simulation takes place by including data related to geometry and outdoor area, and local climatic data, in order to establish a range of environmental comfort conditions with respect to the radiative component of external and internal spaces (ECOTECT), the conditions of ventilation (ENVI-MET), flows of indoor air (FLUENT), and levels of sound intensity (MITHRA) (Battisti et al., 2012).

The evaluation systems of environmental performance (EPIQR), applicable to both existing and project arrangements, allow to quickly make a diagnosis of the physical and functional state of the property, to construct and to evaluate different action scenarios, determine with accuracy the work nature that should be carried out, and their cost, to identify the necessary measures to improve the level of interior comfort, to highlight and to assess the possibilities of improvement, yet from the initial phase. (Masera, 2004).

The certification systems (BESTCLASS, DOCET) are focused on the control of energy consumption in buildings and their management phase; therefore the operative procedure is directed to the strict definition of energy consumption in a building unit (hypothetical or measured), by quantifying it through a value (expressed in kWh/mq) which states the category of consumption.

Currently Directive 2012/27/UE of the European Parliament and of the Council on Energy Efficiency is in force. The new Directive establishes a common framework of measures for the promotion of energy efficiency in the European Union in order to achieve the objectives of 20% reduction in CO_2 emissions by 2020 and to pave the way for future improvements in the sustainable sector. Under the Directive, nations should develop a long-term strategy to promote the restructuring of both public and private, residential and commercial buildings.

Functional and spatial quality

The tools of functional quality-space are aimed at preliminary assessment of the quality planning in new construction interventions and do not consider, at all or only indirectly, environmental aspects while may include criteria of the technological and management related to the maintenance of quality levels over time. The Indicateur Qualitel (France), Sistema di Valutazione degli Alloggi (Switzerland) and the Housing Quality Indicator system (United Kingdom) are included in this group.
According to P. Melis (2010) the structure of these three tools could be summarized as follows:

- the Indicateur Qualitel examines the main technological, functional, environmental and management aspects of buildings through the definition of 13 evaluation criteria; each criterion and sub-criterion is associated with a performance articulated scale based on five levels as a function of the intrinsic quality and of the costs of use and maintenance;
- the main functional requirements and space of the accommodation in Sistema di Valutazione degli Alloggi are divided into three groups: housing unit (possibility of furnishing, living area net, private external spaces, etc.); building level (external spaces community, laundries and clothes racks etc.); localization (public transportation, the local center, regional center, etc.). They do not take into consideration other aspects of the construction techniques or energy efficienc;.
- the Housing Quality Indicator evaluates the "internal environment", in terms of spatial functional quality from the building staircase to the district, through the analysis of the three categories of criteria: sizing, layout and supply of services, which are given a score between 1 to 10; the latter does not only concern the housing unit in its wholeness and the individual environmental units, but also include the context and the neighborhood together with some aspects of use operation.

4. Framework of requirements and the case studies' contribute

4.1. Requirements for the social/environmental sustainability and the spatial/functional welfare

Starting from the data collected in the previous chapters, this paragraph will introduce a number of ideas related to social, ecological and functional-spatial goals that should be achieved by a virtuous design in the social housing context. They can be taken as a sort of planning brief for a good practice oriented on an overall cost containment.

Ecological requirements

a. Improving environmental indoor comfort
The modern practice in the social housing sector has developed several ways to assure an optimal wellness within the dwellings. Although the need of saving energy and thus money, people need also to live in high level conditions. In dealing with issues related to environmental comfort in indoor spaces, chemical/physical and environmental parameters should be taken into account because they influence the interaction between human body and surrounding environment.

b. Achieving optimized energy values
Optimizing performance and life duration of materials, reduction of environmental loads in the production and disposal stages, focused on testing new procedures for recovery and recycling, closure of the productive cycles and reducing the consumption of resources through using innovative materials, contribute to the realization of those systems fully capable of responding to the new procedural model.

c. Reducing waste of materials
Nowadays there is the need of strategies with sustainability characters fostering the environmental protection and waste management and representing also actions targeted to the conservation, reconfiguration and transformation of built design with a view to restore the original function and new features of compatible building component.

d. Minimizing material transport
Many virtuous built examples give a lesson of local resources exploitation, both in using materials, which can be easily found in the neighborhood, and in implementing constructive strategies compatible with the climatic conditions.

e. Accelerating construction processes

Nowadays industrial products are characterized by an intrinsic flexibility of use, in fact they are designed to be adaptable to the most different morphological situations by relatively simple and rapid operations of cutting, folding, bending etc., to be performed directly on site or in factory, thanks to a high grade of flexibility in production allowed by today's numerically controlled machinery.

f. Fostering constructive and combinatory flexibility

We are facing a constructive evolution which produces different combinatory levels that also provide for the sum and the coupling of parties and "pieces" of advanced technology and other "pieces" of traditional technology. The result that derives from this aggregation process generates a hybrid transformation that satisfies different possibilities of development according to the specific needs.

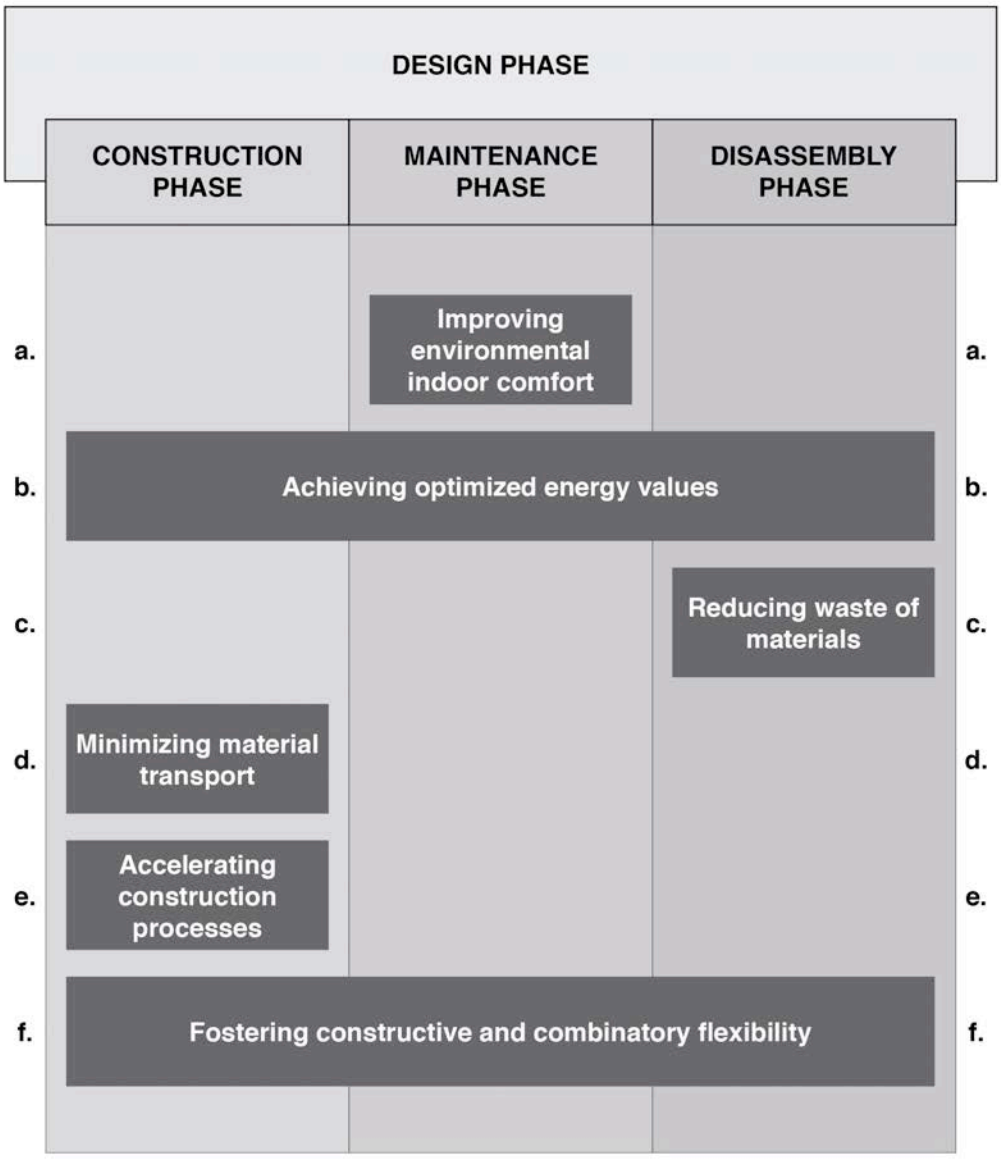


Fig. 1. Ecological requirements and construction phases.

Social requirements

g. Allowing the coexistence of people belonging to the same group
Due to the high rigidity of dwellings, induced sometimes by design choices but more often by the characteristics of construction systems originally adopted, the inhabitants are hardly allowed to the reorganization of the living spaces for more heterogeneous life styles. Improving the compliance of the building stock to residential demand characteristic, with particular reference to those requirements proposed by the poorest population, is one of the last crucial of redevelopment programs.

h. Providing different social dynamics in time
It is now accepted that housing needs of users are not a stable condition, unchanging in time, but in continuous evolution, both in relation to changes that occur in families, and in the wider social composition. Therefore it would not be wise continuing the search for "ecstatic" accommodation and building complexes, which are defined in relation to a family standard that responds to current models but for sure it will not be suitable for the future.

i. Feeling sense of belonging to a community and a place
Being part of a group is a common need among population, because it allows people to share visions and values. The community fosters the positive outcome of the individual characteristics.

j. Ensuring balance between individual and collective from the building to the urban scale
Quality of the living space and the social interaction of the inhabitants are deeply influenced by traffic links, urban planning accessibility to public facilities, building access, layout and design of green spaces. High density requires innovation, but it also means strengthening possibility of relations and pedestrians movements; at the same time high density facilitates the introduction of small radius transport systems, well integrated with those ones of wider distance

k. Allowing a profitable and peaceful coexistence of different people
Designers cannot offer standardized solutions. Socio-economic changes of the population, the evolution of the family composition, the new cultural models, the demand of different ages and different activities induce different operational needs.

l. Pursuing high density of relationships
The need for proximity, density and variety, are largely considered catalysts of an innovative economy. This is true both for villages and towns, as compress village centres create the conditions for community growth. The physical configuration of a settlement is a key factor in fostering connectivity and interaction, in fact common facilities like pubs, shops, churches and libraries encourage encounters.

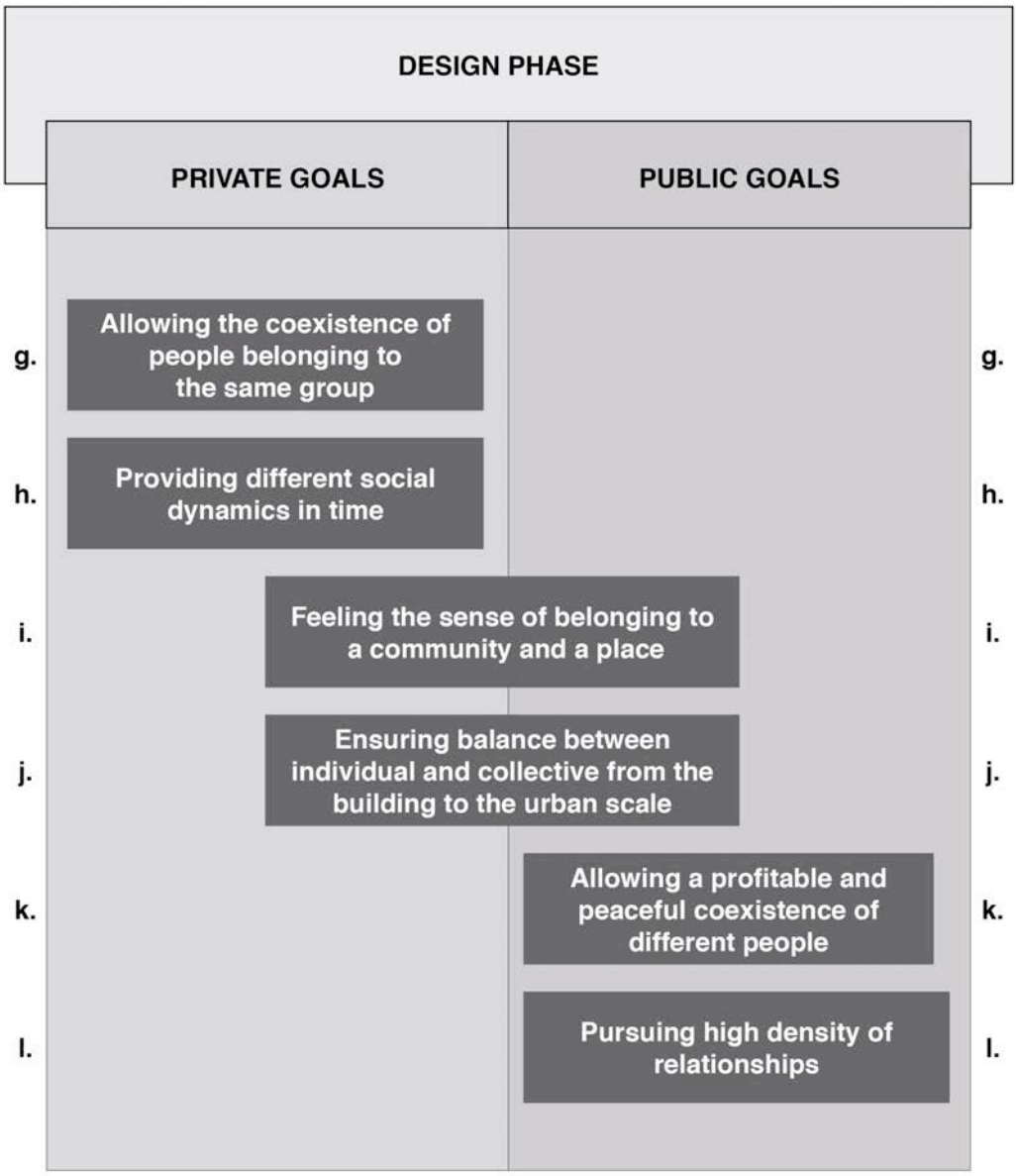


Fig. 2. Social requirements in relation to private and public aims.

Spatial-functional requirements

Several instruments to measure the level of spatial-functional quality in residential buildings have been promoted by different countries, for example the "Indicateur Qualitel" (France), the "Sistema di Valutazione degli Alloggi" (Switzerland) and the "Housing Quality Indicator system" (United Kingdom). The following requirements would integrate those ones proposed by the current range of quality, with other ones, linked to the concepts of privacy and different forms of psychological wellbeing.
The individual feels the need of some form of space that provides a refuge from the socio-environmental pressure, a need of personal and family privacy. It is not a simple biological responses because there are deep cultural differences among different human populations.

The perception of space is sometimes tied to personal and subjective factors. It is possible, however, to treat some conditions that could contribute to make more pleasing residential spaces in term of psychological and physical welfare. The proposed list is a macro summary of space and functional requirements. The extreme synthesis is carried out due to the future analysis development of this research:

m. Ensuring sanitary and environmental wellness
n. Securing the safety of inhabitants
o. Predicting that sizing which allows an optimal welfare
p. Guaranteeing accessibility to all types of users
q. Promoting visual comfort
r. Providing the user with the most suitable equipment

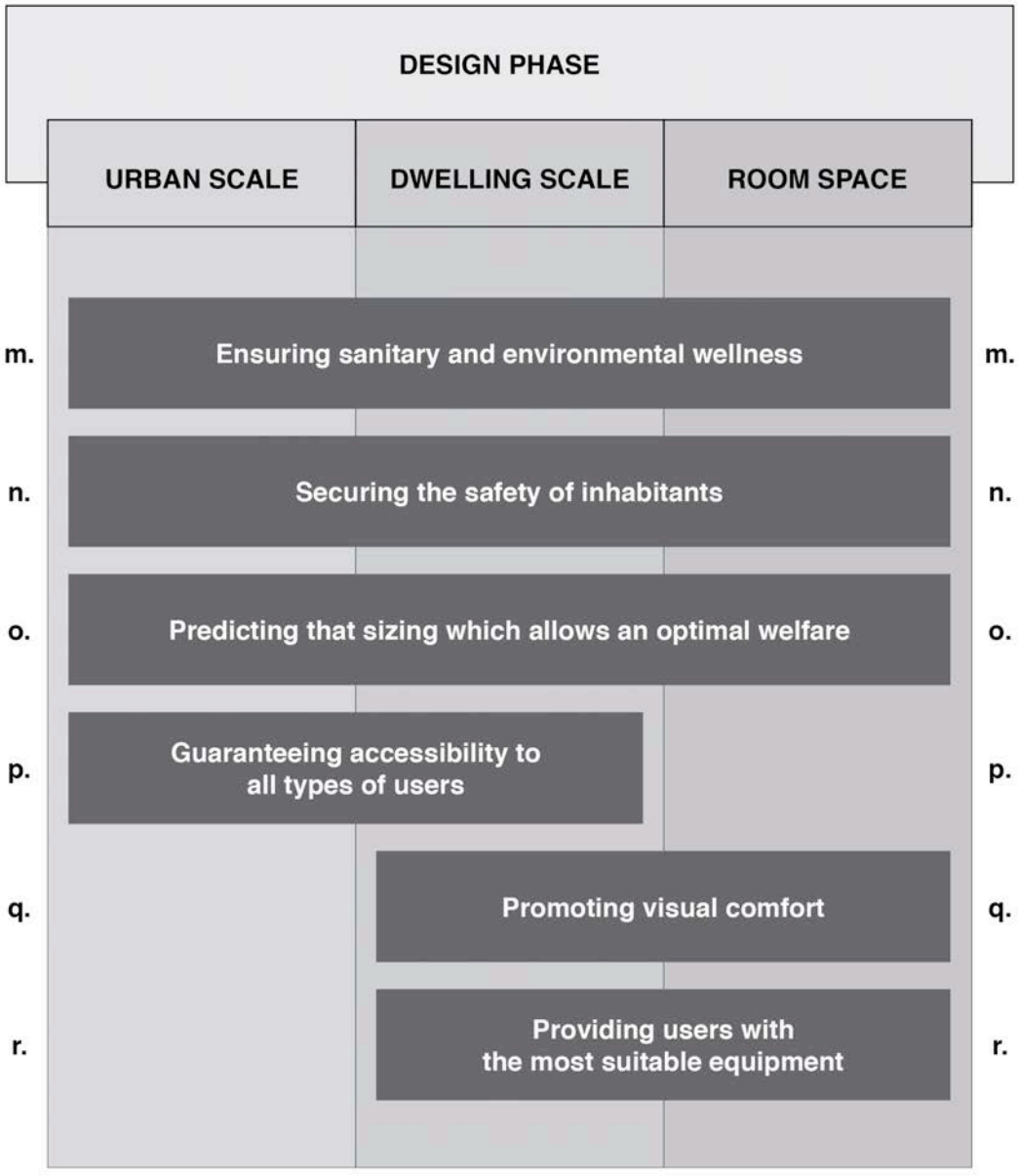


Fig. 3. Spatial-functional requirements in relation to the different scales of intervention.

4.2. Introduction of the case studies

In this chapter there will be also introduced some virtuous examples of social housing projects, either renovation or new building interventions, critically evaluated in relation also to the ideas and topics presented in the previous section.

As mentioned before, at the moment Brazil has not a consistent tradition in green architecture; that is one of the reasons why it has been not possible to find suitable examples of social housing renovation within the Brazilian metropolis.

The case studies presented are relevant to the themes of sustainability on the environmental, economical and social side, within a high density urban context. Every case study includes a brief overview with original pictures and drawings, a short section about the way the design choices meet the requirements, proposed in chapter three, which should be considered in practice.

In order to understand more easily the readability of the themes presented, a system of symbols will be associated to them; each symbol represents one of the eighteen requirements already analyzed.

Another list of icons will be related to a further classification, which arises from a system of selection operated by L. Gelsomino and O. Marinoni (2010), dealing with new built residential projects, and based on the space configuration either of the architectural conception or of the urban integration. The renovation cases have been separated into three groups of intervention, each one represented by a symbol: "adding layers" icon, which means increasing the stratification of the existing envelope by adding new corrective and integrating layers without transforming the spaces, but determining favorable environmental conditions; "adding or subtracting volumes" icons, i.e. reconfiguring the spaces with the increase (or unlikely subtraction) of closed and/or open volumes.

The analysis of such case studies is aimed at reaching a series of design notions that can be instrumental for the explanation of the design guidelines presented in the next chapter.

Ecological requirements

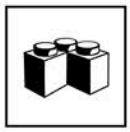
a. Improving environmental indoor comfort

b. Achieving optimized energy values

c. Reducing waste of materials

d. Minimizing material transport

e. Accelerating construction processes



f. Fostering constructive and combinatory flexibility

Social requirements

g. Allowing the coexistence of people belonging to the same group

h. Providing different social dynamics in time

i. Feeling sense of belonging to a community and a place

j. Ensuring balance between individual and collective from the building to the urban scale

k. Allowing a profitable and peaceful coexistence of different people

l. Pursuing high density of relationships

Spatial-functional requirements

m. Ensuring sanitary and environmental wellness

n. Securing the safety of inhabitants

o. Predicting that sizing which allows an optimal welfare

p. Guaranteeing accessibility to all types of users

q. Promoting visual comfort

r. Providing the user with the most suitable equipment

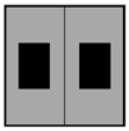
Architectural conception


Closed court building


Open court building


Horizontal development building


Vertical development building


Single units aggregate


Integration on the existing urban environment

Urban integration


Organization with small units


Organization with autonomous elements


Organization with built borders


Organization with aligned elements


Court systems


Complex organizations

Renovation processes


Layers adding


Volumes adding

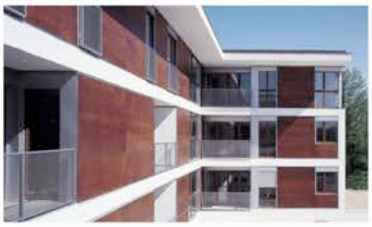

Volumes subtraction

The case studies have been taken from a large pool of examples, located in Milan, London and Saõ Paulo. They are listed as follows, by location and year:

1. **Edificio area Falck**, Piuarch, 2000, Milan;
2. **Complesso Nuovo Portello**, Cino Zucchi Architetti, 2002, Milan;
3. **Villaggio Barona**, Arch. Pier Luigi Saccheri, 2002, Milan;
4. **Complesso via Gallarate**, MAB Arquitectura, 2009, Milan;
5. **Abitare Milano**, Consalez Rossi architetti associati, 2010, Milan;
6. **Cenni di Cambiamento**, RPA - RossiProdi Associati Srl, on site, Milan;

7. **Iroko Housing**, Graham Haworth and Steve Tompkins, 2001, London;
8. **Gainsborough Studios**, Stephen Marshall Architects, 2002, London;
9. **Peabody Silvertown**, Níall McLaughlin Architects, 2002, London;
10. **Darwin Court**, Jestico + Whiles, 2003, London;
11. **Tanner Street**, Jestico + Whiles and Peter Barber Architects, 2004, London;
12. **Donnybrook Quarter**, Peter Barber Architects, 2006, London;
13. **Bourbon Lane**, Cartwright Pickard Architects - B+C Architects, 2007, London;
14. **Barking Central 1 and 2**, Allford Hall Monaghan Morris, 2007, London;
15. **Morris House**, Stephen Davy Peter Smith Architects Ltd, 2007, London;
16. **Adelaide Wharf**, Allford Hall Monaghan Morris, 2007, London;
17. **Angel Waterside**, Pollard Thomas Edwards Architects, 2008, London;
18. **Crossways Estate Regeneration**, PRP, 2008, London;
19. **Laycock Street Housing**, Brady Mallalieu Architects Ltd, 2008, London;
20. **New Heston Road**, PCKO, 2008, London;
21. **Tarling Regeneration Project**, S333, 2008, London;
22. **20 Bishop Square**, Matthew Lloyd Architects, 2009, London;
23. **Angela Carter Close**, Anne Thorne Architects Partnership, 2009, London;
24. **Barmenston Road**, Duggan Morris Architects, 2009, London;
25. **Boxtree Housing**, YOOP Architects, 2009, London;
26. **Grosvenor Waterside**, Make Architects, 2009, London;
27. **One Vale Street**, L&Q Group, 2009, London;
28. **Queensbridge Quarter**, Levitt Bernstein Associates, 2009; London;
29. **Stadthaus, 24 Murray Grove**, Waugh Thistleton Architects, 2009, London;
30. **Villiers Road Studios**, Peter Barber Architects, 2009, London;
31. **Brandon Street**, Metaphorm Architects, 2010, London;
32. **Coopers Road**, ECD Architects, 2010, London;
33. **Highwood Court**, SUSD Architects, 2010, London;
34. **Housing Hackney,** Fraser Brown MacKenna Architects, 2010, London;
35. **Nile Street**, Munkenbeck & Marshall architects, 2010, London;
36. **Peabody complex Pimlico**, Haworth Tompkins Ltd, 2010, London
37. **Harford Street Development**, East Thames Group, on site, London;

38. **Conjunto Habitacional Zaki Narchi**, 1995, Saõ Paulo;
39. **Conjunto Habitacional Jaraguá 4**, Costa Lima Associados, 2001, Saõ Paulo;
40. **Vila Mara - Rio das Pedras**, Vigliecca & Associados, 2003, Saõ Paulo;
41. **Dova Verde**, 2006, Saõ Paulo;
42. **Vila dos Idosos**, Vigliecca & Associados, 2007, Saõ Paulo;
43. **Box House**, Yuri Vital Arquiteto, 2008, Saõ Paulo;
44. **Conjunto Habitacional Virgem**, José Tabith Associados, 2008, Saõ Paulo;
45. **Residencial Alexandre Mackenzie**, Boldarini Arquitetura, 2008, Saõ Paulo;
46. **Paraisopolis Housing**, Elito Arquitetos, 2009, Saõ Paulo;
47. **Conjunto Habitacional Heliópolis**, Ruy Ohtake, 2010, Saõ Paulo;
48. **Residencial Corruíras**, Boldarini Arquitetura e Urbanismo, on site, Saõ Paulo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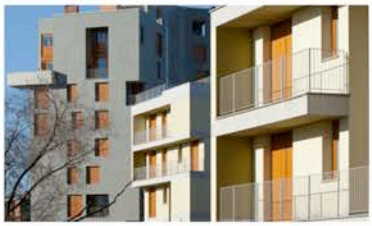
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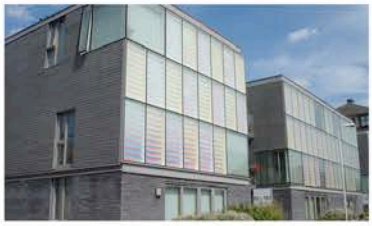
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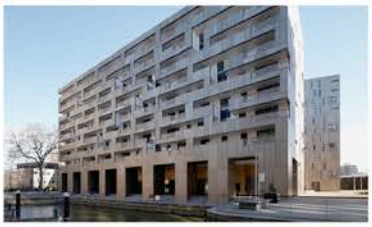
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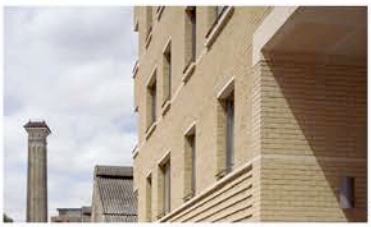
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1. Abitare Milano
Consalez Rossi architetti associati

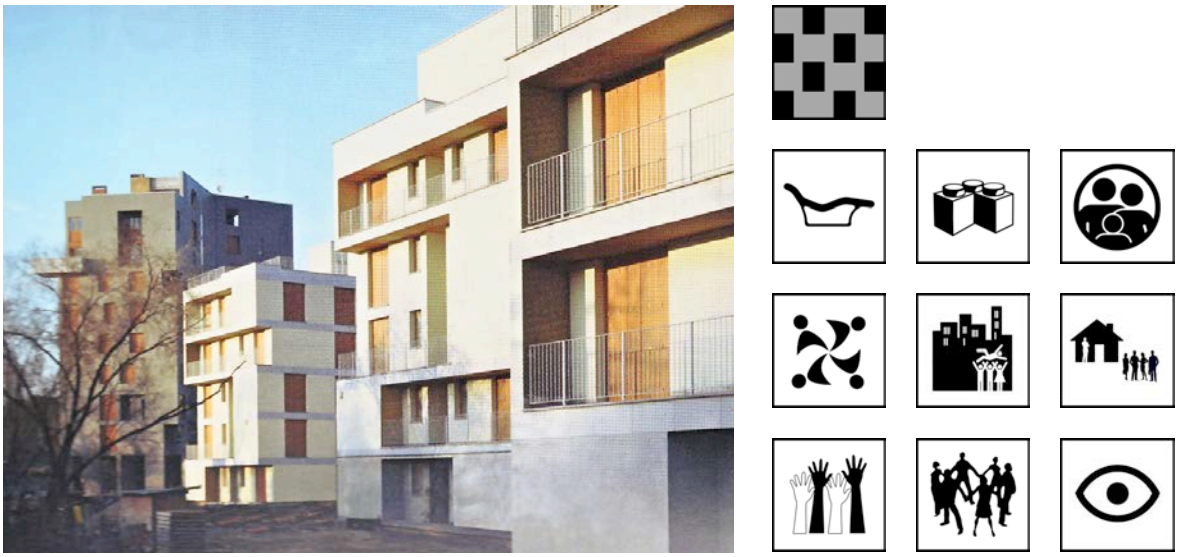


fig.1

Location: Via Civitavecchia, Milan

Architects: Consalez Rossi architetti associati

Intervention type: New building

Year of completion: 2010

Client: Municipality of Milan

Budget: €15.050.000

Gross floor area: 11.590 sqm

Total number of inhabitants: 125

Total number of dwellings: 110

Social target: one-parent family, elderly, young couples, etc.

Mix of private and social tenure: Yes

Awards:
1st Prize Abitare a Milano 1/ via Civitavecchia

fig.2

fig.3

fig.4

fig.5

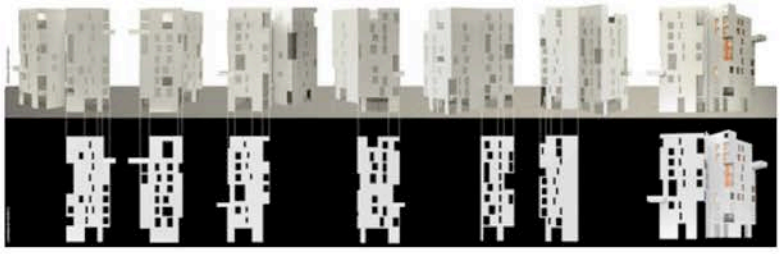


fig.6

fig.7

fig.8

fig.9

Overview

The project involved the construction of residential buildings, a new public park, commercial activities and services dedicated to the district and the city. The14.500 sqm park creates continuity between the city and the Parco Lambro. The ultimate goals of the project are encouraging residential development and urban landscape of this area and attracting new business.

The assignment was received in July 2005, due to the winning of International competition “Living in Milan/1“ in the area of via Civitavecchia. The project of building permit was consigned and approved by the Municipality (September 2005). The executive project is fixed for the 30th of November 2005. The aim of the project is to make a connection between Lambro Park to the city. The urban idea is to mirror part of the city into the park, and vice versa, in order to move forward the existing park into the city.

The housing project is based on two typologies of residential buildings: the tower, a typical urban building that is characteristically designed as a unique block, like a sculpture. The window compositions, that are cut out on the building face, remind the typical and traditional Milanese design. The social houses are conceived into using a modular system of six different apartment typologies that are combined together. The unique architectural image is based on the same six module. The combination of the apartments is not only a simple expression of an aggregation system, but also an attempt, in terms of form and colour, to find out a character that can be related to the context.

Requirements

a. Improving environmental indoor comfort
q. Promoting visual comfort
The facade has a system of openings that allocate of green vertical elements integrated into the collective spaces of the building. This expedient matches a contemporary trend where green is introduced as an integrated element for both landscaping and energy efficiency.

f. Fostering constructive and combinatory flexibility
Linear buildings are constructed with a modular system of eight kinds of apartments that can be combined in different ways. All housing units can be distributed into the building-case in order to support possible modifications of program. Structure-scheme of this buildings makes possible the units sliding along distribution line of corridor and staircase. Tower structure is made of armed-walls and traditional coating. Fronts are covered by duravit panels on a ventilated-facade. Large windows and obscuring systems are made of natural woods; railings are iron made. Low raise facades are plaster made and are interrupted by concrete bands signing floor partition.

g. Allowing the coexistence of people belonging to the same group
The overlapped accommodation units create broad double and triple height loggias, which create gaps in the facade and expand the possibilities of the accommodation customizing due to the needs of the inhabitants.

h. Providing different social dynamics in time
The second request in the competition brief was the need for housing flexibility, i.e. the ability to change or to broaden the configuration of the accommodation adapting them both to fulfill future demographic needs, and to allow the permanence of households that change their composition. In the tower block the scheme permits to conceive a plan with four apartments on the same floor. Thanks to the introduction of duplex typologies and to the emptying course of the façade, every floor can hosts apartments of different size, requested by the competition program.

i. Feeling sense of belonging to a community and a place
The piazza ideally continues through the staircase to the inside of the buildings through the the loggias until the last floor that hosts public rooms and gardens. The material that covers the path is the same everywhere, in order to sensorially highlight the public belonging of path and its crossed spaces.

j. Ensuring balance between individual and collective from the building to the urban scale
The continuity between park and city is be the dominant theme of the composition. The public areas are equipped and encourage the revitalization of this peripheral area. Priority have been given to the reception and wellness of the residents. The new district offer useful services to the rest of the city.

k. Allowing a profitable and peaceful coexistence of different people
The dwellings adopt two architectural types: the tower building for the subsidised housing and the line building in for the houses of ALER, the so-called "popular housing".

l. Pursuing high density of relationships
Designers have thought of a redistribution on all floors of line buildings also for the services, up to the roof, entirely dedicated to collective uses. The inhabited roofs house a community room and large terraces, accompanied by hanging gardens and a cloister, thought for the recreational activities of children.

2. Morris House
Stephen Davy Peter Smith Architects Ltd

fig.1

Location: Ealing, London

Architects: Stephen Davy Peter Smith Architects Ltd

Intervention type: Conversion

Year of completion: 2007

Client: Developer client, Lemon Land. End user client, Shepherds Bush H.A.

Budget: £5.5million

Total number of inhabitants: 175

Total number of dwellings: 41 duplex apartments (31 2beds & 10 3beds)

Social target: young couples

Mix of private and social tenure: 100% affordable (shared ownership)

Awards:
Chicago Athenaeum: International Architecture Awards for 2010 - Winner
First Time Buyer Awards 2010 - Shortlisted
Ealing Civic Society - Highly Commended.

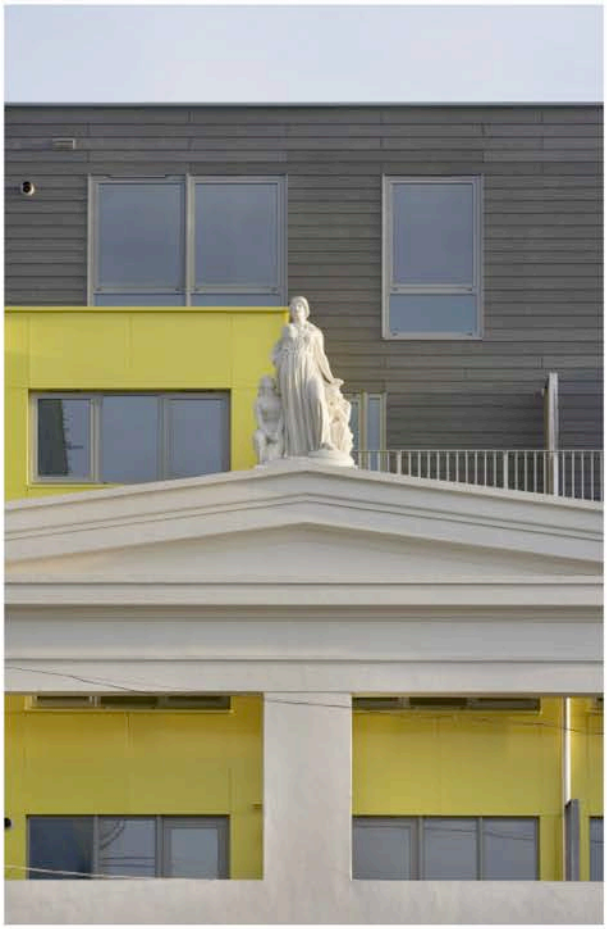


fig.2

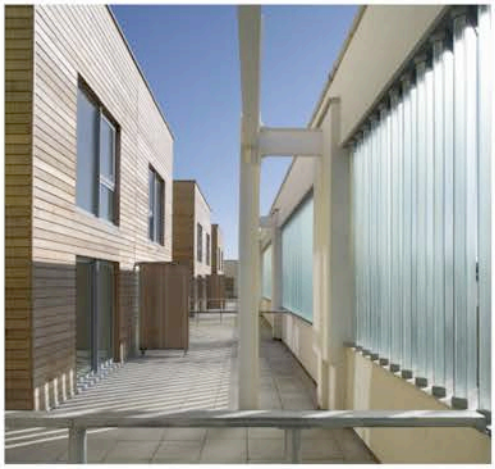
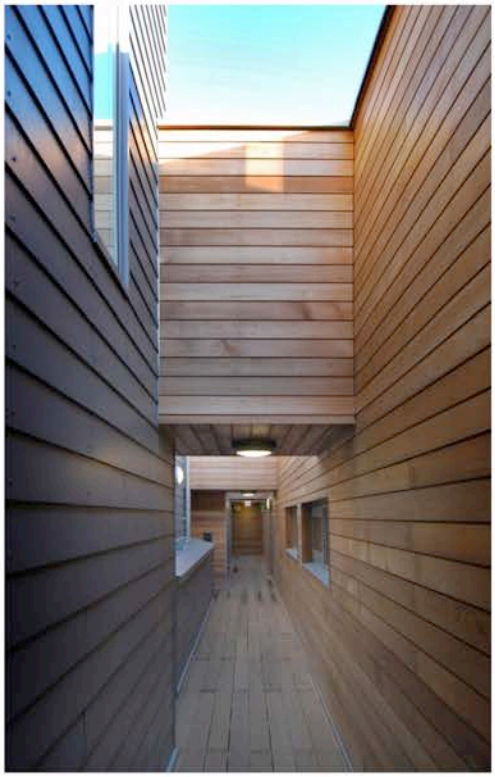


fig.3



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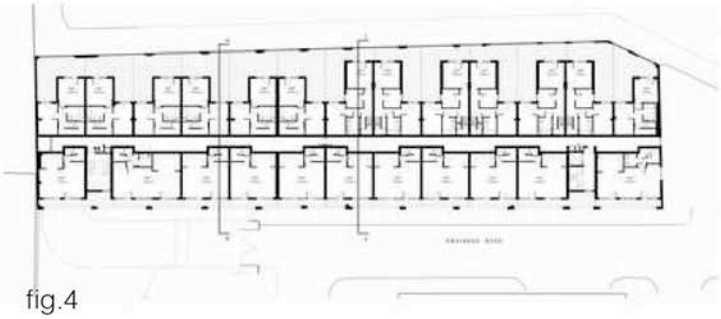


fig.4

fig.6

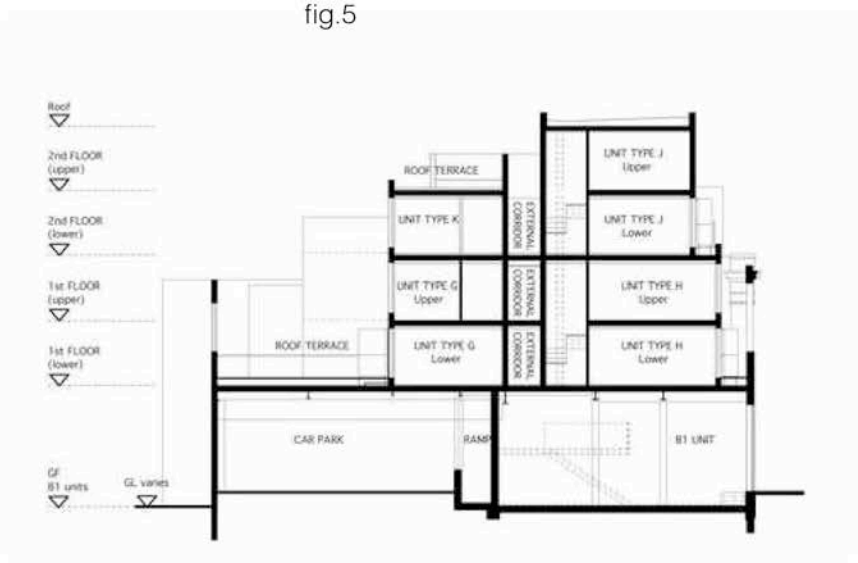


fig.7

Overview

Morris House is a refurbishment of a Morris Minor parts distribution warehouse in West London into a mixed use scheme. The development comprises 1.101 sqm B1 space, and 41 residential duplex apartments (10 3-beds, 31 2-beds). Each apartment has access to a generous private terrace.

The ground floor contains 9 B1 units to the front with car parking behind. (Limited car parking spaces have been provided in a S106 Agreement with the London Borough of Ealing to provide a city car club for the residents).

The concept for the scheme was to retain the existing external envelope of the warehouse and first floor slab and to place the new apartments within the envelope of the existing shell, set back from the existing structure to create a free standing building within a building.

The existing building extends to the site boundary and is in close proximity to a Victorian terrace to the South. The scheme initially met with some opposition from the residents, but through a series of meetings with the residents, their concerns were addressed and allayed.

The Architects originally gained an outline planning approval with Reserved Matters for a private developer, which consisted of a full live/work development with a retail store and B1 units. The site was subsequently sold to Shepherds Bush Housing Association and the architects were asked to re-design Morris House to increase the number of units and change the use from live/work to residential.

L. B. Ealing would not permit demolition of the existing warehouse, and the existing building was not suitable for a traditional conversion. The solution was to demolish most of the internal building and insert a brand new building within the old shell. This created a dynamic contrast between old and new.

Obtaining final written approval from L.B. Ealing for the façade colour proved complicated when had second thoughts about their approval decision but the issue was resolved, with the cladding colour intact.

Requirements

a. Improving environmental indoor comfort
b. Achieving optimized energy values

A good level of daylight in a home is very important to our practice and so the building was designed to have large windows and balconies. This reduces energy used for electric lighting and increases wellbeing. High efficiency combination boilers helped contribute to the 'Good' Eco homes rating this scheme achieved. This scheme was designed before the current 'Code for Sustainable Homes' rating system was implemented.

c. Reducing waste of materials
e. Accelerating construction processes

The building is constructed from a steel frame with lightweight cladding and infill.

i. Feeling sense of belonging to a community and a place

Morris House, formerly a warehouse building, which has been brought back into full commercial and residential use. The form of the warehouse provides plenty of outdoor private amenity space with terraces created behind the shell of the existing building.

j. Ensuring balance between individual and collective from the building to the urban scale

Reglit louvers have been used to maintain privacy.

l. Pursuing high density of relationships

Transport links are excellent as the site sits on a transport corridor and is very well served by local buses. A city car club encourages car sharing for residents and discourages private car ownership.

m. Ensuring sanitary and environmental wellness

Reglit louvers have been used to mellow the brightly coloured panels to the low key terrace behind whilst allowing light into the external rooms that have been created between the new and old elements of the building.

q. Promoting visual comfort

Cedar, Cembonit cladding and a light yellow aluminium cladding have been used to create a bright new building behind the existing façade which celebrates the contrast between the very different buildings.

3. Donnybrook Quarter
Peter Barber Architects

fig.1

Location: Bow, London

Architects: Peter Barber Architects

Intervention type: New building

Year of completion: 2006

Client: Circle Anglia Housing Trust (formerly Circle 33)

Budget: £ 4,930,376

Gross floor area: 2618 sqm

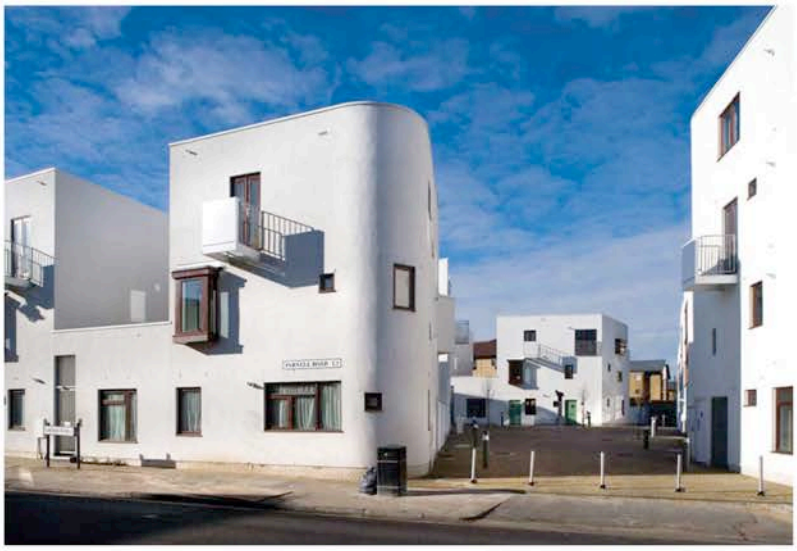
Total number of inhabitants: 130

Total number of dwellings: 40 units

Social target: students, elderly, young couples, etc.

Mix of private and social tenure: Yes (21% affordable housing)

Awards:
Innovations in Housing Competition' Winner 2001
Housing Design Award. Project Winner 2003
Royal Academy Summer Exhibition. Highly Commended 2004
AIA Award Winner 2006
RIBA Award Winner 2006



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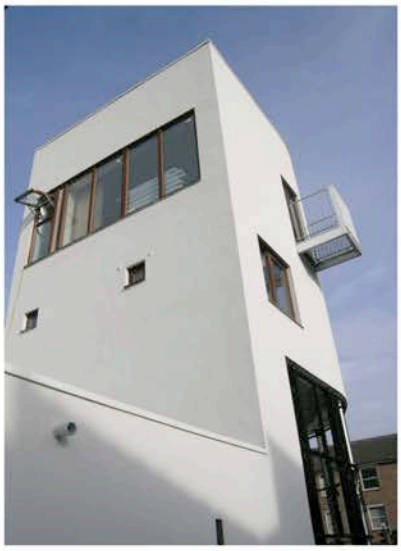

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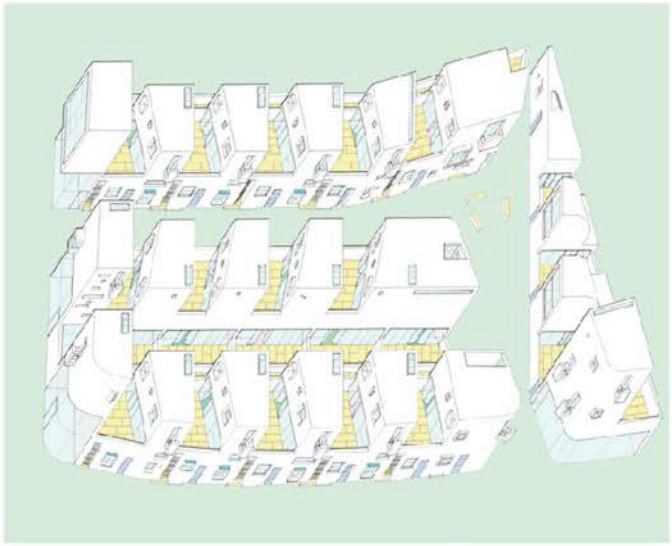

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fig.9

Overview

In the competition text (2002) Peter Barber wrote “Our proposal is a celebration of the public social life of the street. Every aspect of the design is configured to promote buzzing, thriving public space made with a hard edge of buildings. Streets overlooked by balconies, bay windows and roof terraces. Streets where people might enjoy to sit out, kids to play, people going to and from their homes or just passing through.”

Donnybrook Quarter is a low rise, high density street based city quarter located on a prominent corner site just south of Victoria Park in Hackney. The scheme is laid out around two new tree lined streets which cross the site creating very strong spatial connections with adjacent neighborhoods and a handy cut through for their residents. In its concept, streets and public spaces came first, and domestic layouts followed; its design had been driven in the first instance by an idea about the city.

The streets have an intimate scale being 7.5m wide and bordered on each side by two and three storey buildings. At their intersection, at the heart of the scheme, the two streets broaden out into a delightful tree lined square.

Along the eastern edge of the site an elegant residential terrace follows the slow sweeping curve of Parnell Road. At its north end the terrace rises to 4 stories marking an entrance to the site and terminating a view along Rushton Street. In formal terms the project is conceived as a rectilinear grid inflected and morphed by the complex geometry of the adjacent streets and urban form. To this extent it is highly contextual.

Throughout the project public space is heavily overlooked by the residents on either side. Balconies and oriel windows overhang the street, terraces and the numerous front doors create a sense of ownership and the opportunity for personalization (pots, deck chairs, hanging baskets).

The project was commissioned by Circle 33 Housing Trust in 2003, after it was selected aswinner of the Architecture Foundations' high profile 'Innovations in Housing competition' from 150 entries worldwide.

Requirements

g. Allowing the coexistence of people belonging to the same group

Balconies and oriel windows overhang the street, terraces and the numerous front doors create a sense of ownership and the opportunity for personalization (pots, deck chairs, hanging baskets).

h. Providing different social dynamics in time

The dwelling typology comprises a ground floor 2 bedroom apartment with large open plan living area and a fully glazed screen giving access into a rear courtyard.

i. Feeling sense of belonging to a community and a place
Throughout the project public space is heavily overlooked by the residents on either side. Balconies and oriel windows overhang the street, terraces and the numerous front doors create a sense of ownership. The street brings people into close proximity. It is a place where residents are highly visible to each other, where there is a strong likelihood that they will meet. The scheme is designed to promote a high level of interdependence between residents and, in the long term, it is hoped that this might help to empower a group of people which is strongly self determining, a community which can sustain and govern itself.

j. Ensuring balance between individual and collective from the building to the urban scale
The scheme is laid out around two new tree lined streets which cross the sitecreating very strong spatial connections with adjacent neighborhoods and a handy cut through for their residents. In its concept, streets and public spaces came first, and domestic layouts followed; its design had been driven in the first instance by an idea about the city. The 'notched terrace' in each contributes to:

- create a hard edge to the street with no front garden;
- enable every dwelling to have its own front door with circulation between units concentrated in the public open space of the streets and not in gloomy stairwells and decks;
- foster the strongest possible visual and spatial relationship between the street and dwellings so that every inch of public space is overlooked.

k. Allowing a profitable and peaceful coexistence of different people
Within the whole configuration, 21% of the inhabitants occupy an affordable dwelling.

l. Pursuing high density of relationships
Non residential uses are introduced at ground floor. The scheme make it possible to achieve high densities of 400 habitable rooms per hectare with a scheme that is only between one and three stories high. The ingenious sectional arrangement removes the problem of British Planning systems overlooking rules dictating back to back distances and has unlocked the potential for very high densities with a scheme that is only three stories high. This unique housing innovation has fascinating implications for the dwellings and their relationship with the city.

m. Ensuring sanitary and environmental wellness
q. Promoting visual comfort
An upper maisonette entered from the street up a gated external staircase through a delightful courtyard garden in the 'notch' at first floor. The living area has a fully glazed screen which faces south over the courtyard. At second floor there are two double bedrooms, a bathroom and a balcony overlooking the street.

o. Predicting that sizing which allows an optimal welfare
The design concept makes it possible for every single dwelling to have its own good sized private outdoor space in the form of an 8 m x 4 m courtyard garden and a very high level of privacy.

4. Bourbon Lane
Cartwright Pickard Architects - B+C Architects

fig.1

Location: White City, London

Architects: Cartwright Pickard Architects - B+C Architects

Intervention type: New building

Year of completion: 2007

Client: Octavia Housing

Budget: £11,700,000

Gross floor area: 6,861 sqm

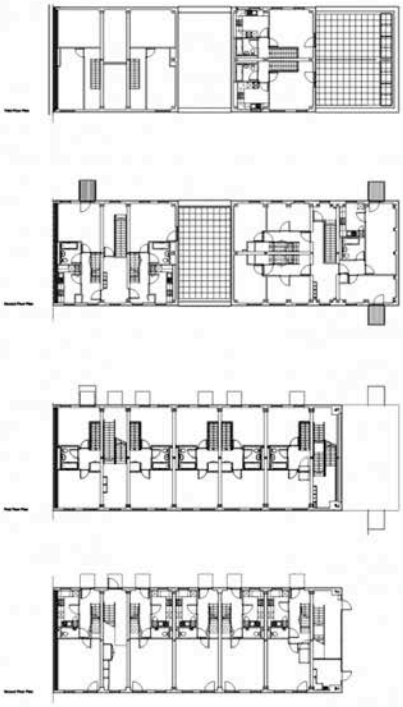
Total number of inhabitants: 450

Total number of dwellings: 27 houses and 51 flats and maisonettes

Social target: young couples, students, key-workers, elderly etc.

Mix of private and social tenure: 100% affordable (shared ownership)

Awards:
RIBA Regional Award
Civic Trust Special Award for Housing
Housing Design Award
British Homes Awards - Special Commendation
Structural Steel Design Award - Commendation



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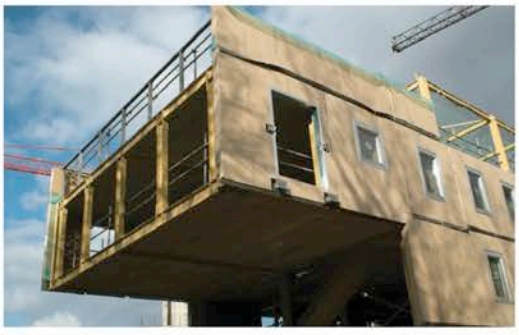

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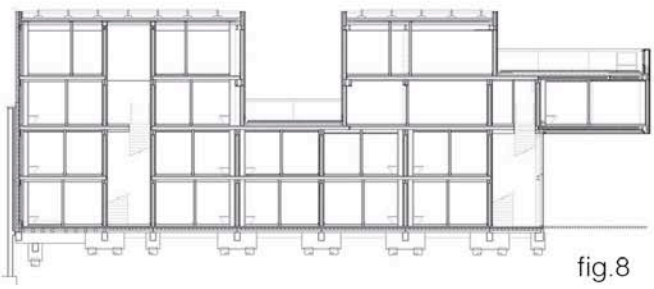

fig.8

Overview

This project was won in an international design competition to develop best practice in affordable housing. It has gathered many accolades and awards from the RIBA, Civic Trust and Housing Design awards amongst others, and has achieved Gold Building For Life Standard.

This was a challenging site; a crescent confined by gardens of traditional terraced housing on one side and Shepard's Bush Westfield shopping mall on the other. The requirement was for a wide range of housing types fitting in with the urban surround, which maximised the use of space whilst retaining an open feel to the development.

The scheme occupies a site between a massive retail development and mixed fabric of Victorian, Edwardian and later terraced housing. The retail development is bounded by a seven storey 'citadel' wall forming the northern boundary to the site from which run a series of timber clad blocks, up to four storeys in height, providing a succession of mews spaces alternating with private gardens. The development encompasses 27 houses and 51 flats and maisonettes for rent or shared ownership. A pedestrian friendly access road, over-sailed by dramatic cantilevers, separates the housing from a landscaped parking strip.

Cartwright Pickard Architects, in partnership with French company B+C Architects, developed an innovative cantilevered design, with steel at its heart, which was preferred to options worked up in precast concrete and timber. Structural steel enabled the 6m cantilevered sections, principle architectural features of the development, to be realised. The cantilevered sections consist of storey-high Vierendeel girders containing 254mm columns; the rest of the frame uses 203mm beams and columns with 150mm precast hollow core floor and 50mm in-situ structural topping to give floor plates with few downstands. This solution was chosen after careful consideration of several structural options by engineers Campbell Reith.

Requirements

b. Achieving optimized energy values

Built using modern methods of construction this development utilised Nordicon light steel wall cassettes assembled offsite around a structural steel frame as well as a combined heat and power (CHP) engine to achieve an EcoHomes Good rating. A natural gas fired CHP plant provides low carbon affordable electricity to the homes as well as heat for domestic hot water use and space heating. Additionally each home is provided with a meter to enable the occupants to easily keep track of their energy use.

e. Accelerating construction processes

The offsite manufacture of both frame and cladding lead to a reduction in the construction program compared with more on-site solutions. As well as shortening the construction time and necessitating fewer onsite labourers, this method of

construction meant fewer deliveries and much less waste on site.

f. Fostering constructive and combinatory flexibility
Over 5,000 sqm of Nordicon wall elements were installed onto the frame. These pre-fabricated light-gauge steel panels were manufactured offsite to be fully weather protected, complete with windows and doors. Panels arrived in sealed packs and were hoisted up and fixed to the structural frame by expert installers who then affixed the larch rainscreen cladding using cherry pickers. The offsite solution was chosen to help minimise onsite construction and deliveries in this heavily congested area and ensure a highly consistent build quality.

g. Allowing the coexistence of people belonging to the same group
The scheme allowed excellent use of space, maximising the available footprint whilst maintaining an open feel on the development *Information compiled by the Steel Construction Institute*

i. Feeling sense of belonging to a community and a place
The scheme creates a strong sense of place. Dwellings are organised around strongly defined semi-public open courtyard spaces in a contemporary interpretation of the “London Mews”. The new buildings are of simple geometric forms and at second and third floor levels the blocks are cut into to provide private roof gardens for upper level dwellings

j. Ensuring balance between individual and collective from the building to the urban scale
The design was chosen over these others as it allows maximum use to be gained from the site whilst still maintaining provision of private space for residents and semi-public courtyards in the style of traditional London mews.

k. Allowing a profitable and peaceful coexistence of different people
Consisting of a mix of family houses, maisonettes and flats at three, four and five storeys the development provides 78 affordable homes including shared ownership opportunities as well as affordable rented housing.

m. Ensuring sanitary and environmental wellness
All homes are double aspect giving an airy and light feel with the north-south orientation allowing access to morning and evening sunshine. The flats have balconies, one to each aspect, with maisonettes profiting from roof gardens either in the cut-away or terraced over the cantilevered apartments.

o. Predicting that sizing which allows an optimal welfare
The scheme allowed excellent use of space, maximising the available footprint whilst maintaining an open feel on the development *Information compiled by the Steel Construction Institute*

5. Via Gallarate
MAB Arquitectura


fig.1

Location: Via Gallarate, Milan

Architects: MAB Arquitectura

Intervention type: New building

Year of completion: 2009

Client: Municipality of Mila

Budget: €24.500.000

Gross floor area: 20.683 sqm dwellings + 9.216 sqm parking

Total number of inhabitants: 503

Total number of dwellings: 184 units

Social target: one-parent family, elderly, young couples, etc.

Mix of private and social tenure: No (100% affordable housing)

Awards:
Premio Nazionale Categoria Social Housing Inarch-Ance 2011
Medaglia d'Oro All'architettura Italiana IV Edizione, 2012 - Shortlisted
Premio Mies Van Der Rohe 2011 - Nominated

fig.2

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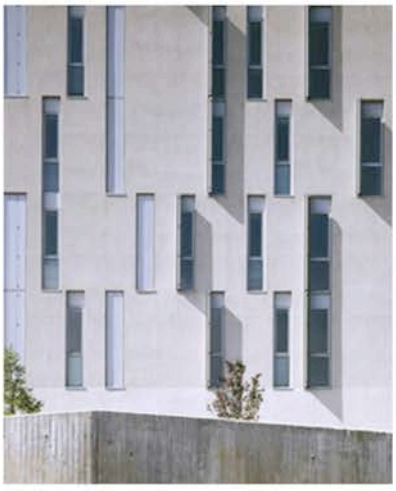

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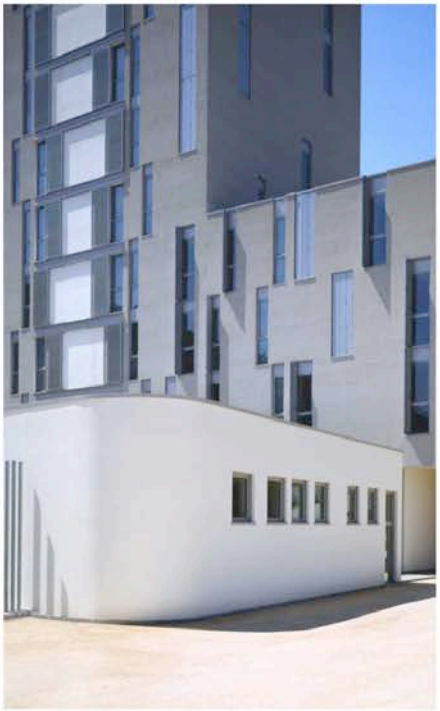


fig.8

Overview

The project proposes a "Social living" model where housing is supported by a strong structure of public spaces and services that create new synergies with the existing neighborhood and contribute to the correct insertion of the new community within it. The concept of "living" is not extinguished in minimum surface area of the apartment, but extends to the community spaces (meeting, common deposits), to the open spaces, the recreational areas of the park and to social services like the kindergarten, the socio-cultural center and the day care center for the elderly (the target is divided into three different age groups: children, young people and elderly). Retail spaces and cafés contribute to characterize the new intervention and become places of attraction for the whole district.

The park and the public space structure the architectural intervention by correlating buildings, green areas and routes in one continuous, homogeneous and unitary way. A east-west pedestrian path organizes the composition, fostering relationships between green bands in the north and south. To the south, the park is equipped with picnic areas with different uses and quality of materials, and is configured as an extension of the via Appennini, thus becoming public space for the whole Gallarate district.

This intervention has provided the realization of 184 accommodations, 7 commercial premises and neighborhood services (kindergarten for 30 children, center for the elderly and a socio-cultural center) for a total of 20,683 sqm. On the ground floor there have been are also planned several multipurpose rooms at the disposal of the inhabitants, access for a possible concierge service and local laundries.

Requirements

a. Improving environmental indoor comfort

The dwellings have wide windows high performance thermo-acoustic and loggias screens with aluminum brise-soleil that represent intimate places of transition between the interior and exterior.

b. Achieving optimized energy values

The type of masonry and the choice of windows and doors are designed to achieve the maximum energy savings and a reduction of the costs of maintenance, make this a real and practical example of green living. In addition, the decision to fasten the building to the district heating network product from the Silla 2 incinerator, give this project a strong environmental value.

g. Allowing the coexistence of people belonging to the same group

The various types of dwellings, mainly two and three-roomed flats, are organised with internal sliding panels that separate spaces where the floor is made of oak industrial parquet.

h. Providing different social dynamics in time
The apartments (the majority of three and four rooms) are characterized by a flexible distribution; it is for minimizing the space distribution; the kitchens could be integrated into living areas or separated with sliding panels.

i. Feeling sense of belonging to a community and a place
The intervention is focused on one of the most important issues relating the city: the relationship between social life, public dimension and neighborhood community. It is characterized by a concept of co-habitation between residences and public space, where the inhabitants can live in a pedestrian environment largely supported by infrastructure, commerce and public services.

j. Ensuring balance between individual and collective from the building to the urban scale
The park becomes a leitmotiv at all scales of the intervention, from urban project to the architectural, up to the landscape, becoming the basis where connections and paths interweave. A living park, thought for the growth of new social relations where also the choice of materials demonstrates the attention in the design process.

k. Allowing a profitable and peaceful coexistence of different people
Most of the accommodation is intened to social rent (those social housing for the poorest) and a significant percentage, approximately one-third, are assigned to moderate fee (for those who do not have the requirements for the social fee, but are unable to access the private market).

l. Pursuing high density of relationships
The complex is also provided with: a small kindergarten for thirty children from 1 to 3 years; a day center for the elderly; spaces for commercial activities; a center of orientation to the facilities for foreign citizens; more spaces for associations available to the residents of the district.

m. Ensuring sanitary and environmental wellness
The scheme guarantees the maximum insolation and preserves the views from the apartments. The accommodations are designed with a particular attention to the east-west sun exposure and cross ventilation. The acoustic problem and pollution produced by car traffic is solved with the creation of an inclined ground system with openings and closings that allow both visual links with the surrounding landscape and acoustic insulation. In its interior the wall-hill system also accommodates small semi hypogeal pavilions of service for the district.

6. Adelaide Wharf
Allford Hall Monaghan Morris

fig.1

Location: Hackney, London

Architects: Allford Hall Monaghan Morris

Intervention type: New building

Year of completion: 2007

Client: First Base Ltd & English Partnerships

Budget: £22,000,000

Gross floor area: 14,800 sqm

Total number of inhabitants: 538

Total number of dwellings: 147 new homes and 650 sqm of workspace

Social target: keyworkers, young couples, small families

Mix of private and social tenure: mix of private, key worker and social

Awards:
Building Magazine: Housing Project of the Year 2009
Civic Trust Award 2009
Civic Trust Special Award for Best Housing Project 2009
GLA London Planning Awards for Best New Place to Live 2009
Hackney Design Award 2009
CABE Building for Life 2008
Housing Design Award 2008
RIBA Award for Architecture 2008
RIBA National Award for Architecture 2008

fig.2

fig.3

fig.4

fig.6

fig.5

fig.7

Overview

Adelaide Wharf is a pioneering mixed tenure housing scheme comprising 147 new homes and 650 sq m of workspace. Located on the Regent's Canal in Hackney, a key regeneration area of London, First Base has created sustainable, adaptable and well designed homes set within a safe environment with communal facilities for all residents. The scheme is the first to be delivered as part of English Partnerships' London-Wide Initiative (LWI) with a mix of privately sold, Key Worker and socially rented apartments. There is no visible differentiation between tenures and all of the homes are built and managed to the same high specification. Adelaide Wharf combines sophisticated urban intervention, emerging efficient construction technologies and the latest thinking in residential development.

The LWI is a scheme by English Partnerships that aims to substantially increase the supply of affordable homes for Key Workers in London, in mixed tenure schemes. The LWI scheme also aims to encourage exemplars for regeneration of disused and abandoned property in key London Boroughs.

Adelaide Wharf combines high quality privately owned apartments with shared equity Key Worker and social housing in a non-hierarchical architecture and no visible differentiation between tenures. Whilst the private apartments overlook the canal the social housing element enjoys views over the expansive park to the south and beyond to the City skyline. The effort to ensure a social mix stripped of stigmatisation is a profound and important innovation, one that more than meets the Mayor's criteria, indeed pushes ambition far beyond the mandatory concessions to affordable housing.

The Adelaide Wharf site is in a residential part of Hackney, with the Regent's Canal to the north and Haggerston Park to the south. It was previously used as warehousing in a brutal building, on the site of an old timber wharf. The six storey block wraps around three sides of a landscaped courtyard defining the edges of the city block, and the two street elevations have coloured entrance courts lined in glossy vitreous enamel cladding panels punched through between streetscape and courtyard, linking into the circulation cores in each corner. The plan of the upper residential floors is based on a rotational symmetry about the two cores, from which the corridors radiate out. The three blocks express this rotation externally in the way in which they turn the corners and their gable ends are clad.

The two main entrances to the building are sheltered and gated outdoor spaces, double height slots extruded through the building, which are lined in glossy vitreous enamel cladding panels. They emphasise the break in the block at street level and frame views of the garden from the streetside. Graphics and the strong colour give each entrance a clear identity and address. Enclosed stair lobbies, post-boxes and concierge's facilities for the housing above are located to the side of these entrance courts. The cores take up the shift in the building grid at each corner, and the break is used to provide a full height slot window from lobby glazing up to a roof light, maximising daylight in the circulation, and providing views into the landscaped courtyard from each lift and stair landing.

Requirements

a. Improving environmental indoor comfort
Adelaide Wharf is currently with BREEAM for validation, targeting an Excellent rating (subject to the outcomes of acoustic and daylighting reports). The key drivers have been affordability and efficiency, with a pre packaged central plant on the roof providing heat to all flats, which may be easily replaced should the energy source need changing.

b. Achieving optimized energy values
Domestic hot water is also generated by the central plant from localised heat exchangers avoiding the energy losses of central hot water storage.

Lighting throughout the building has been designed to be low energy use. All flat types have 50 - 60% low energy fittings and occupancy sensors control landlord areas. Water saving devices such as aerated taps, dual flush cisterns and low-flow showers are specified to reduce consumption.

Situated next to the Wildlife corridor of the Regent's Canal, the north block has a brown roof which over time will be colonised by local flora, and 40 bird boxes designed for various different species. Rainwater from the roof is harvested and stored for landscape irrigation, and a strip of land between the building and the canal is planted and left to grow into wildflower grassland. All the timber used in the construction of Adelaide Wharf was FSC certified, including the untreated Larch cladding, internal floors, doors, joinery and timber used for temporary works. The development has 183 secure bike spaces and a children's' play area.

d. Minimizing material transport
The resulting system is a prototype for other First Base housing schemes, which has and will continue to evolve as lessons are learnt from the procurement, construction and operation of Adelaide Wharf and future projects. The modern construction methods employed reduced trades to as few as possible, minimising wet trades on site and making extensive and pragmatic use of prefabrication to reduce time on site and improve the quality of build.

e. Accelerating construction processes
The principal components are a concrete frame with flat slabs and blade columns using prefabricated reinforcement mats, a unitised cladding system avoiding the need for scaffolding, prefabricated bathroom pods, balconies and plant, and dry-lined internal partitions. The build was completed in 18 months, including for 2 months lost due to below ground obstructions in the former brown-field site. Through the use of modern construction methods, First Base has reduced overall construction costs at Adelaide Wharf by 20% whilst reducing delivery time for the project by 20%. This has also contributed to a 10% increase in property values across the schedule.

h. Providing different social dynamics in time
The layouts all have open plan living/kitchen/diners, to maximise the sense of space. Additionally, the one bedroom flats have double doors opening between the living and bedroom, extending the main space so that the occupants can occupy the space more flexibly.

j. Ensuring balance between individual and collective from the building to the urban scale
The courtyard at the heart of the scheme is a shared garden for use by the residents, the landscaping providing a focus when viewed from above and from the street. Simple use of geometric lines relating to the facades, circulation and lines of movement through the site create a variety of smaller spaces for the use of different groups of people for resting or playing in the space simultaneously. These are formed by lines of hedges and trees delineating different simple surface finishes.

The circulation is arranged in double banked corridors, each with daylight at one end to orientate the user. The corridor ending at the canal has a fully glazed slot, and double and triple height voids next to the window, to maximise the amount of daylight falling into the corridor, and to dramatize the view.

The ground floor is a smooth engineering brick base, taking up taking up the changes in level as the road climbs towards the canal bridge. Recesses and projections on the ground floor create a series of events on the street, with coloured doors acting as a contrast to the brick. The entrances to the ground floor 4 bed flats each have stairs projecting onto the street, defining their defensible space.

m. Ensuring sanitary and environmental wellness
Each flat has a balcony supported from beams at roof level, cantilevering like lifting beams on warehouses. Each balcony is clad with a coloured plane with a single fold in it, and offset from the windows, cantilevering in alternate directions at each floor to produce double height gaps between them and reduce overshadowing to the living rooms below. The colours on the planes of the balconies are then graduated across the façade, which seen are seen to best advantage obliquely down the street.

o. Predicting that sizing which allows an optimal welfare
The family flats within the upper storeys are mostly located on the south facing elevations. Their enlarged balconies are extensions of the living room areas, and provide a room sized external amenity, but even the balconies to the smaller flats are large enough for a table and chairs, and to operate as a useable outdoor space.

The design of the 1, 2 and 3 bedroom apartments all follow a similar strategy. Circulation is kept to a minimum, so that the living area is maximised and the deep plan locates all the serviced spaces along the corridor wall, with the living / sleeping spaces making maximum use of the window walls. The repetition of the bathroom

types, kitchen types and flat layouts allows for one carefully considered and worked out solution to be applied across all the flats, so that they all benefit from the quality derived by the standardisation of the architectural idea.

7. Complesso Nuovo Portello
Cino Zucchi Architetti

fig.1

Location: Viale Serra, Via Traiano, Milan

Architects: Cino Zucchi Architetti

Intervention type: New building

Year of completion: 2002

Client: Auredia Srl

Gross floor area: 32.912 sqm dwellings + 15.500 sqm retail + 47.000 sqm parking + 40.733 sqm offices + 2.500 sqm craft work and industrial activities

Total number of inhabitants: c.a. 2000

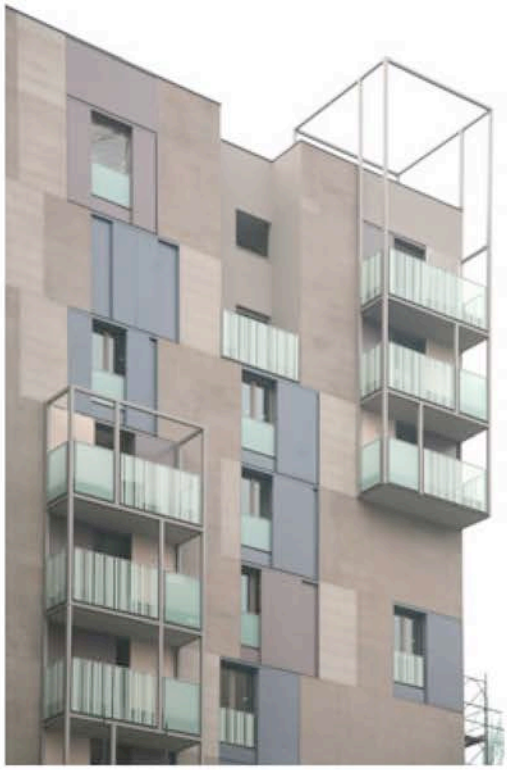
Total number of dwellings: 611

Social target: one-parent family, elderly, young couples, etc.

Mix of private and social tenure: Yes

Awards:
European Union Prize for Contemporary Architecture. Mies van der Rohe Award 2009 - nominated
Medaglia d'oro all'architettura italiana 2009 - highly recommended
Ecola Award 2008 - 1st Prize

fig.2



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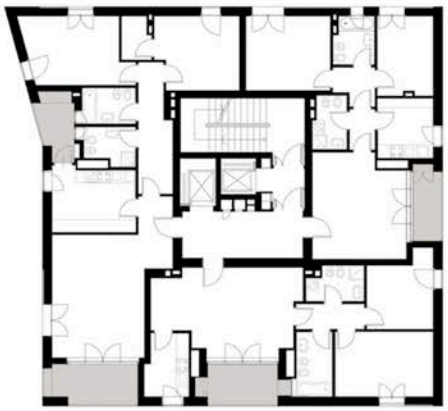

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Overview

The project for Nuovo Portello in Milan, is part of a large and articulated urban intervention on the area of the Alfa Romeo former factory, whose master plan was developed by Gino Valle with consulents Pirelli&C. Real Estate Project Management Spa. The operation includes a vast park designed by Charles Jencks, with Andreas Kipar and Land, a commercial complex, a new square-parking with three office buildings designed by studio Valley and, finally, some residential and commercial blocks designed by Guido Canali and Cino Zucchi.

The three residential towers rest on a common private garden entered by a single gateway. Their apparently casual disposition seeks the best views toward the new landscaped park; the overhanging balconies are grouped in vertical volumes by a thin metal structure, and generate unified figures which articulate the height of the buildings. The stone cladding in sanded and levigated finishes and the different colours of the sliding shutters, both randomly mixed in different proportion in the three buildings, give variety to the strict modular grid of the façades.

The two tall buildings, one adjoining via Traiano and the other set back from the street give form together to a new square which is the starting point of the path toward the park framing the front of the Milano Fair.

The windows of varying shape and proportion, the different rolling and sliding shutter devices, the deep loggias with the steel and glass parapets are disposed following a series of permutations which maximize the long views toward the city. The use of surface material (de-coloured terracotta tiles and white stone) and the gable silhouette constitute a critical reading of the features of post-war Milanese architecture.

Requirements

a. Improving environmental indoor comfort

The three eight-floor high slabs are unified by low walls into a single block. The orientation of the slabs maximizes solar exposure and the views toward the new park, while protecting the intervention from the high traffic noise of Viale Serra, towards which three blind elevations are posed.

i. Feeling sense of belonging to a community and a place

There are many elements that declare the common matrix of the project, but it is also possible to observe how, through a refined use of the variation, united with a careful inspection of the construction detail, Cino Zucchi has managed to give a precise identity to each of the parties involved in the project, both to micro-urban and the individual building scale.
The use of surface material (de-coloured terracotta tiles and white stone) and the gable silhouette constitute a critical reading of the features of post-war Milanese architecture.

j. Ensuring balance between individual and collective from the building to the urban scale

Tall buildings here proposed are not conceived of as isolated towers, but rather as a residential "porous" whose arrangement and orientation generates a significant transition between the mesh of the city and the smoother geometries of the new park.From the composition point of view, the towers of subsidised housing are characterized by a clear compactness of edges toward the city which is interrupted only by windows and doors-window. Vice versa fronts, which overlook the public spaces, identified with the new project, establish a close relationship with the open space through loggias, balconies, alternating with the windows.Pedestrians have access through high porticoes veneered in white stone which overlook the common gardens. On the side toward the park a large built screen protects the deep loggias of the apartments, trying to conjugate high density with high environmental quality.

i. Pursuing high density of relationships

The anomalous scale of the existing industrial Alfa Romeo precinct is opened to collective use by tracing a new series of pathways connecting it with the surrounding urban net. A new square along via Traiano generates a new diagonal pedestrian way which becomes the main access to the new park.
In the middle of the area, the volume of the former Alfa Romeo cafeteria is conserved and inflected toward the park by the new path cutting its corner.

m. Ensuring sanitary and environmental wellness

The three eight-floor high slabs are unified by low walls into a single block. The orientation of the slabs maximizes solar exposure and the views toward the new park, while protecting the intervention from the high traffic noise of Viale Serra, towards which three blind elevations are posed.

q. Promoting visual comfort

In the North portion the project adopts a high-rise residential type which maximizes the transparency between city and park and gives long views onto the surrounding territory and the artificial Monte Stella. The three residential towers rest on a common private garden entered by a single gateway. Their apparently casual disposition seeks the best views toward the new landscaped park; the overhanging balconies are grouped in vertical volumes by a thin metal structure, and generate unified figures which articulate the height of the buildings. The stone cladding in sanded and levigated finishes and the different colours of the sliding shutters, both randomly mixed in different proportion in the three buildings, give variety to the strict modular grid of the façades. A particular attention has been devoted to transparent closing elements that exhibit many variations: in size, proportion, in the material of the frame, in the system of blackout, the parapets that protect the doors-window and loggias. For the square windows it is provided a dual option of the aluminum or timber window frame, while all other windows and doors-window are made in wood.There have been designed two different blinding systems: a first one is an aluminum roller shutter; a second system is with sliding doors. Finally, for the protection of the loggias and door-windows, there are two different types of parapet: one made of galvanized steel with vertically arranged bars; the other in tempered and laminated safety glass with frame and uprights in galvanized steel.

8. Residencial Alexandre Mackenzie
Boldarini Arquitetura e Urbanismo

fig.1

Location: Favela Nova Jaguaré, São Paulo

Architects: Boldarini Arquitetura e Urbanismo

Intervention type: New building

Year of completion: 2009

Client: Prefecture of São Paulo, Municipal Housing Secretariat

Budget: R$130.000.000

Gross floor area: 32.722 sqm

Total number of inhabitants: 1281

Total number of dwellings: 295 (high-rise) and 132 (low-rise)

Social target: one-parent family, elderly, young couples, etc.

Mix of private and social tenure: No (100% affordable housing)

Awards:
Prêmio do Instituto dos Arquitetos do Brasil IAB/SP, 2010

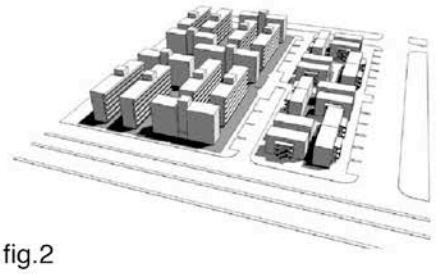
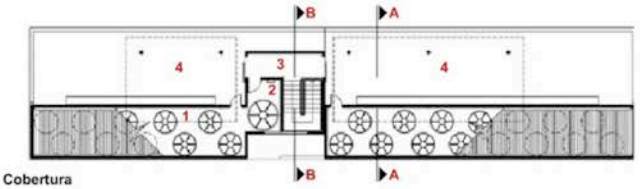


fig.2

fig.3



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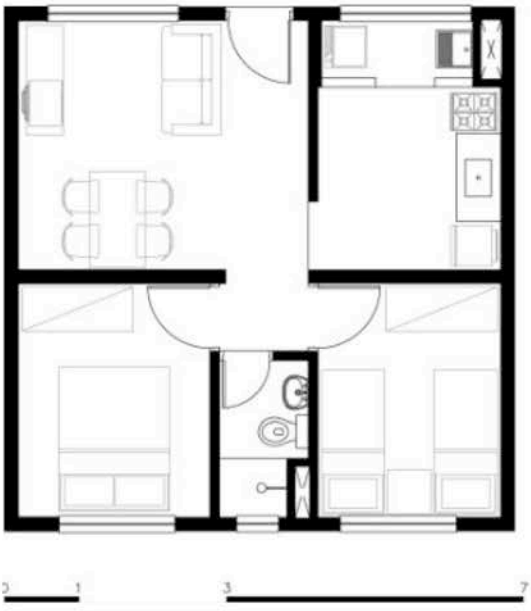

fig.6

fig.7

fig.8

Overview

With a cost of 130 million reais, the complex is the result of a partnership between the Municipal Department of housing (Sehab), which participated with 40% of the total amount, and the Company of development and Urban Housing (CDHU), which came with the remaining 60%. The architect Marcos Boldarini, since newly formed in developing works in risk areas, recognizes that in recent years the attitude of the municipal authorities of the sector has changed.

In the process the architect Elizabeth France, superintendent of Popular Housing Sehab, is a key figure. In the Residencial Alexandre Mackenzie, Boldarini had the privilege to develop the design for a lot of flats: a total of 135 and 160 units of two or three bedrooms, with areas of 48 and 50 square meters.

The linear buildings have four floors, in addition to the ground one. There are no lifts, only stairs. Access to the units on the upper floors is by external circulation, similar to lined balconies with metal railings. Composed of slabs in stock, they also play the role of eaves and protecting openings.

Some of them, located on the ground floor, have suitable design for people with mobility difficulties and come with special equipment, such as grab bars in the bathroom and wider doors. Another rare space in such these projects is the solarium/pergolado in each of the blocks. There were prepared individual reservoirs of water for fire fighting.

The deployment of the blocks - now geared to form cross-sectional and longitudinal, in relation to the lot - streamlines the whole and configures areas of geometry varied between the volumes. The solution intends to avoid the formation of confined spaces or dead corners, occupying the empty spaces with playgrounds and equipment for community use, as well as elements designed for residents, either adults or children: chess game, drafts, volleyball are some of these possibilities.

Requirements

g. Allowing the coexistence of people belonging to the same group
Each dwelling presents a flexible space where the dimension of the kitchen provides some positive features as, for example, some leisure space or even space for studying or working at home.

h. Providing different social dynamics in time
Each dwelling presents a flexible space where the dimension of the kitchen provides some positive features as, for example, some leisure space or even space for studying or working at home.

i. Feeling sense of belonging to a community and a place
All the buildings have a living roof for collective uses and to foster the sense of belonging to a community.

j. Ensuring balance between individual and collective from the building to the urban scale
The composition of dwellings show the aim of creating strong relationships with the external environment. One-fifth of the total dwellings (all at the ground floor) have direct access to the outdoors. All the apartments have windows and galleries that dialog with the context. The strong connection with the city is provided also by the link with the public transport. This matter is essential in term of urban equipment and residential quality.

m. Ensuring sanitary and environmental wellness
Another aspect that is important to point out is the care placed on cross-ventilation of dwellings through a large and window surface, supporting a good aeration and providing good conditions of natural light, served also by an adequate and cheerful interior color palette.

n. Securing the safety of inhabitants
There is also a security issue related to these visual accesses to the outside, because they enable the inhabitants to be able to naturally monitor and control what is happening outside their homes. There is thus a stimulating small neighborhood context of proximity, which provides a second protective "shell", which involves domestic spaces and prepares the relation with the urban environment by filtering it. The visual control is also guaranteed by a micro perphorated metal plate used instead of glazing.

o. Predicting that sizing which allows an optimal welfare
Regarding the adopted design solutions apart from the already mentioned, there is also a particular focusing on the overall humanized height dialoguing with the contiguous exterior, and a volumetric (chromatic) sense of ownership, breaks the overall urban sobriety.

p. Guaranteeing accessibility to all types of users
The scheme does not include elevators, even for the four storey buildings. People with particular handicap are located in dwellings at the ground floor.

q. Promoting visual comfort
In accordance with the architect, the variation of colors in blocks portrays the joy and the power of the inhabitants. The landscaping reveals 35 species of plants, some of them consisting in fruit trees.

9. Conjunto Habitacional Vila Mara - Rio das Pedras
Viglieca & Associados

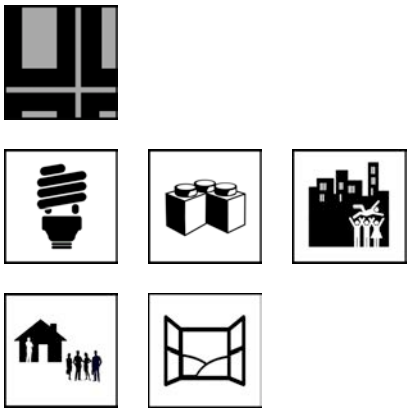

fig.1

Location: São Paulo

Architects: Viglieca & Associados

Intervention type: New building

Year of completion: 2003

Client: Prefeitura do Município de São Paulo – EMURB

Gross floor area: 10.000 sqm

Total number of inhabitants: 2.368

Total number of dwellings: 592

Social target: one-parent family, elderly, young couples, etc.

Mix of private and social tenure: No

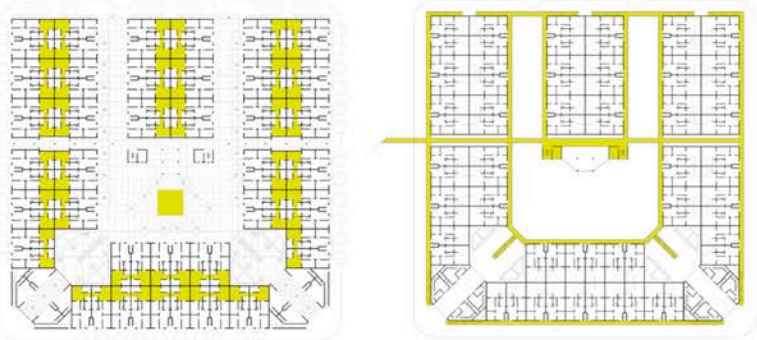

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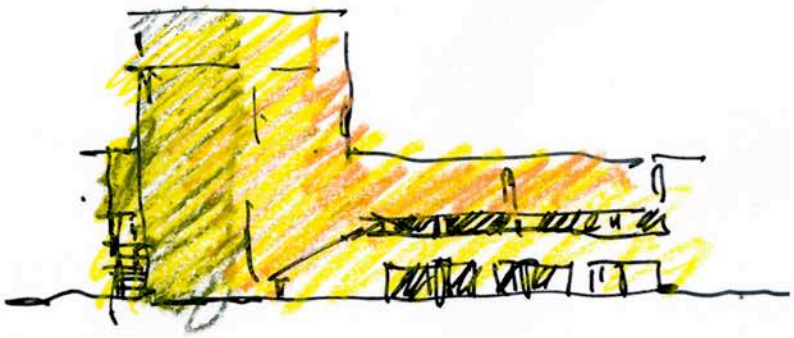
fig.6



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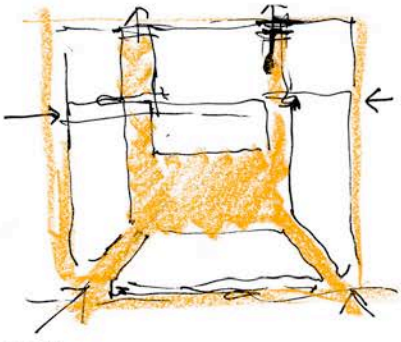

fig.8

fig.9

Overview

The Housing Rio das Pedras is composed of two identical blocks with 296 residential units each. Located in the eastern part of Sao Paulo, is a product of a collective effort made by hundreds of families.

Started in 1991, the building was based on a system of self-management and task force and was particularly emphasized the importance of architecture as social housing is usually treated as a matter of productivity and economy of scale.

Social housing should be addressed from the design of the city and not just an isolated fragment. The block, in this project, is rescued as a key structural element of the urban fabric, which provides greater integration with the surroundings and gives the sense of permanence and continuity to the spaces of the city. Assuming a party that opposes the fragmentation advocated by lot, collective and public spaces are valued.

The space is conceived and designed as a whole. However, there is the notion of certain local scale, a territory that gives residents a sense of place, identity, appropriation. Spaces are not just pass by, but living-in. And care and preserved as such.

Requirements

b. Achieving optimized energy values
Use of long durability materials and materials and finishes that require less maintenance.

f. Fostering constructive and combinatory flexibility
Use of modular system for construction

i. Feeling sense of belonging to a community and a place
The space is conceived and designed as a whole. However, there is the notion of certain local scale, a territory that gives residents a sense of place, identity, appropriation. Spaces are not just pass by, but living-in. And care and preserved as such.

j. Ensuring balance between individual and collective from the building to the urban scale
The block, in this project, is rescued as a key structural element of the urban fabric, which provides greater integration with the surroundings and gives the sense of permanence and continuity to the spaces of the city. Assuming a party that opposes the fragmentation advocated by lot, collective and public spaces are valued.

m. Ensuring sanitary and environmental wellness

The scheme comprises a very simple and low cost system for guaranteeing the internal comfort, taking great advantage from the natural ventilation achieved by placing windows in different sides of the building.

10. Conjunto Habitacional Heliópolis
Ruy Ohtake

fig.1

Location: São Paulo

Architects: Ruy Ohtake

Intervention type: New building

Year of completion: 2008

Client: Prefeitura da Citade de São Paulo

Budget: $60.000-70.000 (for each apartment)

Gross floor area: 94.300 sqm (the final development)

Total number of inhabitants: 7.000 (the final development)

Total number of dwellings: 1.886 (the final development)

Social target: one-parent family, elderly, young couples, etc.

Mix of private and social tenure: No

Awards:
Prêmio Planeta Casa - 2011

fig.2

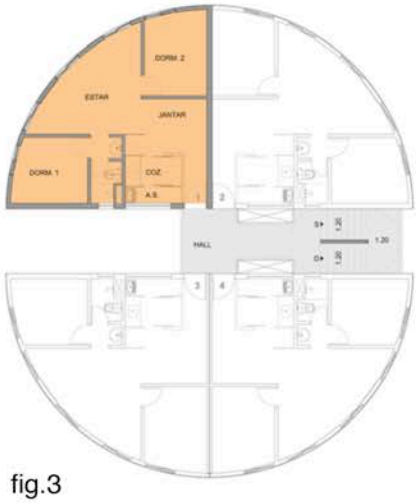

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fig.5

fig.6

fig.7

fig.8

fig.9

Overview

The Brazillian architect Ruy Ohtake has been working with the community in the favela of Heliópolis, São Paulo, Brazil since 2003. The intial project was a coordinated street colour scheme to unite an irregular street facade of characteristic red brick structures.

Ohtake has designed the *Conjunto Habitacional Heliópolis* (Heliopolis Housing Project) for the largest slum in Sao Paulo, covering a million square metres, as part of Ohtake Urban Plan initiated by *Sehab – Secretaria da Habitação* (Department of Housing) in August 2010. The project plans to improve urban living and leisure spaces, educational and health facilities, and provide housing for about 70,000 people in 18,080 households (www.aajpress.wordpress.com).

The first stage of Ohtake's design for the Residential Heliópolis, has created eleven 5-storey circular towers or rotundas known as 'redondinhos' (little round ones). Each building has 18 apartments with access via a central service stair: four 49 sq.metre 2-bedroom apartments per floor with a curved external width of 6.50-metres, with two apartments on the ground floor for the disabled. On the ground floor, there is an open recreation area for the tenants. Completed in late 2011, the first occupants moved from the most marginal sites in the favela (www.aajpress.wordpress.com).

This is not just an architectural project, it is a whole concept. When the city programmed the renewal of the Heliópolis area, the community asked that I be involved, and their wish was granted. Every circular building is for 18 families, on five levels (four apartments per floor plus a ground level with two housing units and a shared patio). The program calls for a first phase (16 buildings for 18 families each) with a deadline in October 2011; the second phase covers 21 buildings for 18 families each, in April 2012; then there is a third phase, 40 buildings (for 30 families) in a year and a half. The latter includes 7-storey buildings with lifts. Overall, the project creates housing for 1866 families (http://www.internimagazine.com).

Requirements

b. Achieving optimized energy values
The towers' circular plan makes for cost-efficiency using the as less connective surface as possible.

h. Providing different social dynamics in time
The circular volume ensures less rigid, more open spaces, also with respect to the outside, for a healthy public-private spatial relationship.

i. Feeling sense of belonging to a community and a place
Ohtake has a modernist's passion for improving society and was encouraged by community participation in the projects. Meetings with the residents in 2009 empowered them to discuss the density of the final design and the allocation of space. The *UNAS Heliópolis*, a neighborhood residents association, participated with

Ohtake on projects for a library, a recreational centre, and a housing project. Ohtake chose 30% of the colors, and the people of the place chose the other 70%. This is important to understand that architect and users are both part of a "construction together". The colored rings painted to highlight the circular volumes, each one for each floor, enhance the sense of identity and allow people to recognize their own dwelling from the outside.

j. Ensuring balance between individual and collective from the building to the urban scale

The residents felt empowered by the change, so the architect and community leaders moved on to more ambitious undertakings—a library, a recreational center, and a housing project; on the ground floor, there is an open recreation area for the tenants. At ground level, the curved walls of the redondinhos ("little round ones"; the term the residents use for the buildings) create the sense of play with which Ohtake likes to infuse all his projects. Cars are kept outside the grounds, leaving the kids free to run about safely.

k. Allowing a profitable and peaceful coexistence of different people

Ohtake's project was housing for the lowest tier, those living on wooden stilts above São Paulo's canals. In 2009, the architect began a series of meetings with the residents, to discuss the allocation of space and the density of the final design (www.metropolismag.com).

l. Pursuing high density of relationships

There are houses, but also shopping areas, schools, green spaces, sports facilities. At the center of the settlement a low volume contains a community center, a place for gatherings, events, weddings, anniversaries, exhibitions. Cars are kept outside the complex (http://www.internimagazine.com).

m. Ensuring sanitary and environmental wellness

The apartments are 50 sqm, organized with a circular layout in two bedrooms, a bath, a living room and a small kitchen, with spaces for a washing machine and a refrigerator.

p. Guaranteeing accessibility to all types of users

Each building has two apartments on the ground floor for the disabled.

q. Promoting visual comfort

In the living room a large continuous window, 6.6 meters, offers lots of light. There are no corners and no orthogonal perspectives.

5. Design guidelines for a long-term sustainability in the social housing environment

In this chapter there will be illustrated the design guidelines for the definition of the living space in the social housing sector, by identifying several quality requirements and their related planning strategies of intervention.
The formulation of the criteria comes from an interdisciplinary research based either on the study of the current up to date literature, partially addressed in chapters 2 and 3 of this thesis, or on critical examination of the case studies within the considered group, analyzed in chapter 4.
The goal, perhaps a little ambitious, is to contribute to the raising of the overall quality of the design in current national context of the super density housing.

5.1. The design guidelines

The contribution of the literature to the definition of the guidelines has highlighted the multidisciplinary nature of the research topic, motivating a study undertaken in various scientific fields, from the urban sociology to the architectural design, from the science of materials to the strategies for eco-sustainability.

If the contribution of literary production in the social housing sector has been crucial, the criteria set up for in this chapter have been also formulated considering the results obtained from a series of projects in the three examined cities: Milan, London and São Paulo. As examples of good practice, the case-studies have translated theoretical notions in empirical criteria.

Being the social integration and the mixed tenure a strategy promoted by this research, the contribution of the literature does not comprise exclusively social housing references, but the whole residential context. This consideration is particularly valuable for those criteria related to housing flexibility and economic and energy sustainability.

The guidelines instrument proposes a new design approach, sometimes alternative, considering the current regulatory constraints, able to meet the requirements of complexity previously treated, as a peculiar character of the contemporary overtures of housing design. Since this approach wants to be sufficiently comprehensive and mainly original, some aspects have been overlooked, such as those linked to the acoustic-lighting well being and the accessibility for disabled people, which are widely treated in the current legislation.

The criteria will be divided into macro-thematic areas, each of which responds to a range of requirements from the spatial and functional configuration linked to social, physical and psychological welfare, to the techniques for the cost containment and the energy saving. Each section, dedicated to a macro-area, is completed with a matrix that underlines the relation between the particular criterion adopted in the considered case studies, favoring an immediate comparison between different approaches to projects promoted in the same type of intervention.

The guidelines are proposed as additions to the present legislation on social housing and are mainly designed for those who work in the design sector and social housing planning (professionals, technical institutions, private operators etc.), they would be also a support for students who face this particular residential theme.
Even the users themselves, who have increasingly demonstrating the desire to participate in first person to the modification and qualification of their own living spaces, may use them, better if supported by a professional who can certainly guarantee more controlled results.

In order to understand the effectiveness of the suggested criteria, in the second section of this chapter there will be given a summary matrix that puts in relation the set out points of the guidelines with the requirements identified in chapter 4, centred around the analysis of the case studies, making room for further possibilities of discussions.

1. Balanced communities

1.1 Creating mixed communities through a placemaking approach
1.2 Half of four-person affordable dwellings should have three bedrooms
1.3 Housing provision should be calculated in terms of floorspace, rather than by the number of dwellings
1.4 Provision of at least 30% of families with children
1.5 Making the general appearance and physical access as identical as possible for different tenure groups

2. Outdoor space and the public realm

2.1 Superdensity planning: settlements should be viewed in the context of a masterplan framework
2.2 Improvement of the accessibility of the peripheral areas through a hierarchy of routes
2.3 Implementation of functional mix
2.4 Proximity and access to public transport, to large and safe open spaces, and to shops and social facilities
2.5 Core public areas for local activities
2.6 Providing clear demarcation between the different categories of external space: public, private and semi-private
2.7 Provision for parking and servicing need to be organised in three dimensions as part of the building design

3. Building configuration and accessing flats

3.1 Security of shared areas and dwelling accesses should be considered at the earliest design stage
3.2 Measures to foster the representativeness of the building
3.3 Built form and massing needs to be organised carefully
3.4 Provision of internal spaces for children's activities
3.5 Programming of the interior common spaces: gardens, courtyards, collective rooms, etc.
3.6 Participation of inhabitants in the design of the common areas
3.7 Spaces that allow the development of residents' hobbies
3.8 Spaces that allow to work at home

4. Providing flats that match family needs

4.1 Private open space should be provided for all homes of whatever dwelling tenure or type
4.2 Addition of a separate utility space of at least 1 square metre per person for all family dwellings which don’t have private garden space with external storage
4.3 Half of all five-person or larger affordable dwellings should have a separate kitchen/dining room
4.4 Single bedrooms should be demonstrably suitable for study and recreation by older children, and large enough to allow occupants to entertain visitors
4.5 Possibility of carrying out activities related to the living room, according to different traditions
4.6 Possibility of preparing and having foods according to different usage
4.7 To be able to accommodate different activities from those living ones, in conditions of privacy and autonomy
4.8 Promoting the recognition of one's own accommodation

5. Designing flexibilities

5.1 Flexibility for both indoor and outdoor collective areas
5.2 Design of connective spaces, or condominium, to ensure that initially common spaces may be used in the future to expand the accommodation areas
5.3 Multiplying the typological options to answer to different housing demand
5.4 Active participation of the future inhabitant to the design of the accommodation
5.5 Possibility of subdivisions and grouping of two or more accommodations both horizontally and vertically
5.6 Floor plans with a neutral space at the entrance
5.7 Allowing standard size furniture
5.8 Separating spaces by using fixed solutions
5.9 Separating spaces by using movable solutions
5.10 Possibility of closing of private external spaces through removable elements
5.11 Varying the distribution structure without interfering with the service blocks and without heavy intervention on plants
5.12 Possibility of adapting the accommodation to meet the changing needs of the family, by increasing the surface area keeping the same volume
5.13 Possibility of adapting the accommodation to meet the changing needs of the family, by increasing both surface area and volume

6. Privacy demand

6.1 Possibility of isolating from the external context
6.2 Internal plans should separate areas with too higher sound transmission
6.3 Outdoor private space should be as private as possible
6.4 Ensuring privacy in entering home

7. Maximizing the presence of nature

7.1 Having common equipped green spaces
7.2 Private green space should be provided for all dwellings
7.3 Landscape design must use materials and plant species that are tolerant of abrasion and wear owing to intensity of use
7.4 Buildings over eight storeys should include access to communal landscape space

8. Environmental and economic sustainability

8.1 Choosing compact shapes
8.2 Separation of layers and reversibility of connections
8.3 Lightness and maneuverability of the elements
8.4 High performance and low cost innovative materials
8.5 Using roofs in order to reduce water surcharge, and to provide biodiversity or amenity space
8.6 Innovative systems for the management and monitoring of the solar radiation
8.7 Innovative systems for the management and monitoring of the hygrometric components
8.8 Renewable energy in architecture: photovoltaic and thermal solar
8.9 Architectural integration of technologies for rain water recovery and saving
8.10 A Waste Management Strategy should consider how daily refuse and bulky goods are dealt with
8.11 A Green Transport Plan to encourage the use of alternatives to the car
8.12 Simulation, evaluation and control systems of the environmental performance in settlement assets

1. Balanced Communities

Vibrancy, social mix and other social attributes are amongst the most valued characteristics of densely-populated areas (Minerva LSE research group, 2010).
The community dimension is a structural part of the human being because every man is generated within a relationship and grows and develops through a network of relationships (Pavesi, 2012). The theme of social housing declines, through the word mixité, the concept of social equality that expresses the concept of ethical reciprocity through the principle of subsidiary (Pavesi, 2012).
Many new social housing developments have provided for disadvantaged people at one extreme ignoring the middle-income families, which are very often a key element of any community. The failure to create homes that will attract middle income families has caused unbalanced communities of residents (Recommendations for living at super density, 2007).

1.1 Creating mixed communities through a placemaking approach

Placemaking is the process that brings together local stakeholders with a wide interdisciplinary context in order to promote sustainability in social, economic and environmental terms. It also offers ideas about designing cities focused on to people, rather than cars and shopping centers: generally the priority is given to lively neighborhoods and inviting public spaces (Recommendations for living at super density, 2007).

1.2 Half of four-person affordable dwellings should have three bedrooms

In order to avoid forms of social ghettoisation, families with incomes above the average should be attracted toward the areas of social housing or the weakest household should be introduced in different areas (Venditti, 2010). Smaller dwellings are also cheaper, and this makes easier planning approval, rapid sale, and increases land value, but this is not a formula for long-term social sustainability, in a perspective of promoting balanced communities (Recommendations for living at super density, 2007). In the London area the provision for large social dwelling should reach the 50% of the entire amount.

1.3 Housing provision should be calculated in terms of floorspace, rather than by the number of dwellings

Many recent affordable residential schemes have produced a mix of one and two-bedroom units, many of them very small. Complexes with only small and undersized dwellings may become accommodation of last resort and even the slums of the future (Recommendations for living at super density, 2007).

1.4 Provision of at least 30% of families with children

Large families are composed of a greater number of children, who require collective spaces for the play activities. Catering for the rules of the market, the tendency is to exclude the many large families to avoid the provision of the amenities that would be required, and this doesn't foster the long-term social sustainability (Recommendations for living at super density, 2007).

1.5 Making the general appearance and physical access as identical as possible for different tenure groups

A further important factor for a balanced social environment is the perception to be able to enjoy the same benefits within the community. In residential neighborhoods with mixed tenure must be avoided the discomfort to perceive one's own residential block as that one that houses only low-income and disadvantaged people.

1. Balanced communities	**Milan**	**London**	**São Paulo**
1.1 Creating mixed communities through a placemaking approach	The placemaking approach is not entirely developed. There is lack in involving users in the design process. Provision of tenure mix (private and social) very often achieved.	Most of the cases examined adopt a placemaking approach. Provision of tenure mix (private and social) very often achieved (always promoted in large developments).	Most of the cases examined adopt a placemaking approach. Provision of tenure mix (private and social) never achieved, due to the inequities of society and the consequent strong urban demarcation of the social class areas.
1.2 Half of four-person affordable dwellings should have three bedrooms	This recommendation is not found in any examined case studies.	Although not at the percentage suggested, the trend includes a more increasing percentage of three-bedroom dwellings.	This recommendation is not found in any examined case studies.
1.3 Housing provision should be calculated in terms of floorspace, rather than by the number of dwellings	This criterion is suggested in the *Recommendations for living at super density* (2007). Generally not achieved, due to the market rules.	This criterion is suggested in the *Recommendations for living at super density* (2007). Generally achieved.	This criterion is suggested in the *Recommendations for living at super density* (2007). Never achieved. Due to the extremely poor conditions of people, planners are forced to allocate as many dwellings as possible, quite penalizing the floorspace.
1.4 Provision of at least 30% of families with children	This criterion is suggested in the *Recommendations for living at super density* (2007). Not verified.	This criterion is suggested in the *Recommendations for living at super density* (2007). Not verified.	This criterion is suggested in the *Recommendations for living at super density* (2007). Not verified.

1.5 Making the general appearance and physical access as identical as possible for different tenure groups	The perception to be able to enjoy the same benefits within the community is always secured. Sometimes materials and finishes could be different, but the design and the care of the detail show the same attention to different users.	The perception to be able to enjoy the same benefits within the community is always secured. Sometimes materials and finishes could be different, but the design and the care of the detail show the same attention to different users.	There are no cases that mix private and social tenures, but the perception to be able to enjoy the same benefits within the community is always secured. Sometimes materials and finishes could be different, but the design and the care of the detail show the same attention to all tenants.

2. Outdoor space and the public realm

It is important to locate the common spaces, easily accessible and traceable, spaces for passage, in such a way as to allow the subject the possibility to choose whether or not to participate in formal and informal group activities (Delera et al., 2004). The multiplication of the meeting spaces encourages socialization, as well as the differentiation of the spaces fosters different uses of time and a broader relationship with spatial contexts. The ability to orient themselves within the residential environment, to access all the spaces, to be able to reach them, improves the socialisation (Delera et al., 2004).
In superdensity affordable schemes it is seldom possible to accommodate any significant ratios of surface car parking. If possible, parking should be accommodated in communal garaging (Recommendation for living at super density, 2007).

2.1 Superdensity planning: settlements should be viewed in the context of a masterplan framework

Density policy and intensity on urban activities means that the planning of density (dwellings per hectare) is significant for sustainable sites strategies, and this should be an integrated part of the early phase in urban planning (Babalis, 2004). Extending well outside the boundaries of the development site itself, superdensity schemes should always be comprised in a masterplan that fosters a long-term sustainability program (Recommendations for living at super density, 2007).

2.2 Improvement of the accessibility of the peripheral areas through a hierarchy of routes

Respecting the requirements of readability, continuity, variety, safety, the project should locate a hierarchical order between the paths (Delera et al., 2004). A place with good permeability and connectivity with the surroundings and the wider city allows safe and easy movement pattern and good accessibility (Babalis, 2004). In order to facilitate the orientation in the context, the

improvement of the accessibility of the peripheral areas through a hierarchy of roads (by distinguishing either intentionally or formally roads of great vehicular traffic, access roads to houses and pedestrian roads), the inclusion of an adequate number of parking space, in relation with the organization of the district, should be provided, through the strengthening of networks of public transportation, which can be easily reached on foot (Malighetti, 2004).

2.3 Implementation of functional mix

A strong action strategy at the neighborhood level is to increase accessibility, functionality and amenities, through the implementation of functional mix (Boeri et al., 2013). For example, the introduction of activities of strategic importance, selected through analysis to identify both the shortcomings and the potential of an area, allows to meet the needs of the residents but also to attract new users, enhancing the role of the urban areas inside of the city, interpreted in its multipolar logic (Boeri et al., 2013). Mixed uses strategies reinforce vitality and identity of a place and avoid heavy vehicle movement, giving people the opportunity to work and enjoy close to their everyday living environment (Babalis, 2004).
Superdensity developments require very high standards of local amenity in close proximity, including healthcare, local retail, post office, banking, education, playgrounds, parks and open space, public transport, access to commercial centres, sports facilities and leisure and entertainment centres (Recommendations for living at super density, 2007).

2.4 Proximity and access to public transport, to large and safe open spaces, and to shops and social facilities

Higher levels of satisfaction are determined by the possibility of access to an excellent system of local amanities. (Minerva LSE research group, 2010). Proximity drives creativity and innovation, and brings people, shops, schools and healthcare closer together. A less distance to travel means that people are more likely to walk or cycle with less land and energy required. Today, it requires careful plannings and interventions (Willis, 2008). Modern apartments should not only declare their modernity through an advanced technology, but also by providing their residents with opportunities for cultural growth in the immediate vicinity (Schittich, 2004).

2.5 Core public areas for local activities

The creation of core areas can foster local identity and sense of place giving a consistence to mixed use neighborhoods; it can also encourage a high-quality pedestrian environment and a better connectivity (on foot, cycling, bus and car) with the adjoining areas (Babalis, 2004). In addition, core areas can create a focus for community life, local economic viability and offer many qualified open

spaces within green and water features; it should be important to be able to be reached easily by residents (Babalis, 2004).

2.6 Providing clear demarcation between the different categories of external space: public, private and semi-private

Paths are designed to different functions and must be differentiated through diversification of the levels of the plans that can be trodden with the used materials (Delera et al., 2004). The same strategy applied to all the types of space (public, semi-public, private) favors the immediately recognizable of the areas and the safety of inhabitants (Delera et al., 2004).

2.7 Provision for parking and servicing need to be organised in three dimensions as part of the building design

Very often the dynamics linked to the movement of spaces, and vehicles in a context of super density, as for example, provision for parking, servicing and so on, need to be organised in three dimensions as part of the building design; for example, podia will often be used for parking with private open space, shared amenity space, and pedestrian access above (Recommendations for living at super density, 2007).

2. Outdoor space and the public realm	**Milan**	**London**	**São Paulo**
2.1 Superdensity planning: settlements should be viewed in the context of a masterplan framework	This criterion largely depends on the size of the intervention. Large settlements are provided with a masterplan approach.	This criterion largely depends on the size of the intervention. Large settlements are provided with a masterplan approach.	This criterion largely depends on the size of the intervention. Large settlements (usually more than 1000 inhabitants) are provided with the masterplan approach.
2.2 Improvement of the accessibility of the peripheral areas through a hierarchy of routes	Roads of great vehicular traffic, access roads to houses and pedestrian roads, clearly separated in plan, and sometimes also in section. The separation could be either physical or by using different finishes.	Roads of great vehicular traffic, access roads to houses and pedestrian roads, clearly separated in plan, and sometimes also in section. The separation could be either physical or by using different finishes.	Roads of great vehicular traffic, access roads to houses and pedestrian roads, clearly separated in plan. The separation could be either physical or by using different finishes.
2.3 Implementation of functional mix	Presence of mixed use facilities as: commercial spaces at ground floor, kindergartens, orientation centres for foreign citizens, spaces for associations, recreational activities.	Presence of mixed use facilities as: commercial spaces at ground floor, kindergartens, spaces for associations, recreational activities, collective open spaces for different uses.	Presence of mixed use facilities as: kindergartens, spaces for associations, recreational activities, collective open spaces for different uses (both ground floor and roofs).

2.4 Proximity and access to public transport, to large and safe open spaces, and to shops and social facilities	Always good to excellent level of local amenities nearby.	Always excellent level of local amenities nearby.	Always good level of local amenities nearby.
2.5 Core public areas for local activities	Generally a park that comprises vegetation, leisure activities (also for children) and acts as a connection space between residential units.	Generally a park that comprises vegetation, leisure activities (also for children), or a newly created street between units which fosters the interdependence of residents and may accommodate social activities	Open space that comprises vegetation, leisure activities (also for children) and acts as a connection space between residential units is never public, but of relevance of the inhabitants. Barriers all around the site area.
2.6 Providing clear demarcation between the different categories of external space: public, private and semi-private	Paths are are differentiated through diversification of the levels of the plans that can be trodden with the materials used. Using also the same material for semi-public internal spaces and public outdoor spaces, for a functional continuity.	Paths are are differentiated through diversification of the levels of the plans that can be trodden with the materials used. Lines of hedges and trees form a variety of smaller spaces for the use of different groups of people for resting or playing in the space simultaneously. Organization around strongly defined semi-public open courtyard spaces in a contemporary interpretation of the intimate “London Mews”. Participation of the users in the design of the collective areas.	Paths are are differentiated through diversification of the levels of the plans that can be trodden with the materials used. Participation of the users in the design of the collective areas.
2.7 Provision for parking and servicing need to be organised in three dimensions as part of the building design	Podia are often used for parking with private open space, shared amenity space, and pedestrian access above. Parking is located on a basement level or outside the collective open spaces.	Podia are often used for parking with private open space, shared amenity space, and pedestrian access above. Parking is located on a basement level or outside the collective open spaces.	Podia are very seldom used for parking with private open space. Parking is generally located on outside the collective open spaces.

3. Building configuration and accessing flats

With regard to the aspects of socialization between people that make up a "community" within a condominium neighborhood, the attention should be focused on common environments and on opportunities to promote meetings. It is crucial to locate the common spaces, easily accessible and traceable, routes of passage, to be able to choose whether or not to participate in formal and informal group activities (Turchini and Grecchi, 2006). The multiplication of the relationships encourages socialization, as well as the differentiation of the spaces encourages the use of time and the connection with a broader spatial contexts (Turchini and Grecchi, 2006).
Considering the range of accessing flats, the deck access emerges as a cost-efficient way to serve a large number of apartments via a small number of stairways: despite social stigmatization, deck access is among the most common residential housing types and really cost-efficient because it provides as more apartments as possible for

disabled access (Atelier Kempe Thill, 2012). An optimised core building constitutes the only realistic alternative, because a central node provides access to the apartments. Floor plans need to be very compact and well arranged in order to compete with the deck access scheme in economic terms. Eight apartments per story are the minimum that can ensure profitability (Atelier Kempe Thill, 2012).

3.1 Security of shared areas and dwelling accesses should be considered at the earliest design stage

The semi-public condominium space, as a connecting element between the public and private, may also assume built-in functions and becomes a sort of protected square (Delera et al., 2004). This hypothesis must be made to ensure the safety conditions required by the inhabitants: all areas must be sufficiently lit naturally (or artificially) and the access routes to the dwellings must be as linear as possible, where each point must be reachable from the eye (Delera et al., 2004).
Where 25 or fewer dwellings share a single entrance point secure door entry systems should be provided to protect common circulation. In the case of more than 25 dwellings each entrance should ideally have its own concierge; if they cannot, taking account of the social mix of residents, there should be used remote control of access and an efficient layout (Recommendations for living at super density, 2007).

3.2 Measures to foster the representativeness of the building

The building should be able to be recognized among the many ones that delimit the neighborhood and one of the parameters for the evaluation is represented by the role of the atrium: the need for a representative lobby requires a correct geometrical proportion of the environment in relation to the size of the building by entering from the street, that may be the a single or double height space (Atelier Kempe Thill, 2012).
Since atriums then don't include a bare minimum or functions are often no longer affordable, they are ligitimized by allocating certain functions and HVAC technology. These organisation offers obvious advantages: small facade area, short access distances, flexibility, and a law degree of infrastructure. (Atelier Kempe Thill, 2012).
The atrium could assume also a backward position compared with the road space, or it can be in direct relationship with the external condominium spaces; in this case the connective area becomes a crossing space between the road and the internal collective area (Turchini and Grecchi, 2006).
For example a glazed wall allows interesting views and mutual communications between the street and the private interior garden, also in relation to not exclusively residential functions on the ground floor, which could be used in whole or in part (perhaps on urban front) for retail destinations (Turchini and Grecchi, 2006). Another virtuous example occurs when the atrium and the connective spaces comprise greenhouses, especially in particular climatic

conditions, both for a pleasant effect, and primarily to enable environmental and physical energy-saving control; it can be also a continuous space that vertically crosses the entire building, perfectly enlightened, on which some collective spaces, the deck of distribution and in part the dwellings themselves overlook (Turchini and Grecchi, 2006).

3.3 Built form and massing needs to be organised carefully

In affordable superdensity housing schemes, built form needs to be carefully arranged in relation to environmental impacts on external space by minimising areas in permanent shade, by mitigating downdraft and turbulence, by guaranteeing safety from falling objects and by providing areas for play (Recommendations for living at super density, 2007).

3.4 Provision of internal spaces for children's activities

In the forecast to have a direct relationship with the connective space of distribution, and not necessarily comprising enclosed areas, there are some specific requests related to the children play to be evaluated: the possibility of parental control, which involves analysis of the local distribution of these spaces within the building; the direct relationship with the green, is located on the outside and inside of the building, and not necessarily on the ground floor (Turchini and Grecchi, 2006).

3.5 Programming of the interior common spaces: gardens, courtyards, collective rooms, etc.

What in percentage terms is removed to public space should be reverted to the building in the form of places of collective use as courtyards, gardens, communal rooms, etc. (Delera et al., 2004)
The spaces that are specifically required of the users are not the typical amenities of residential buildings, i.e. deposits, spaces for bicycles, laundry rooms, which are in part obvious and in some cases rejected, but rather spaces linked to specific conditions of use, identifiable in: children's play, social life and relationships, hobbies, temporary private use, for several activities, ranging from organization of parties to working and parking (Turchini and Grecchi, 2006).

3.6 Participation of inhabitants in the design of the common areas

In controlling the common spaces inside buildings, the strategy of involving residents in design decisions, relating to the configuration of the common

spaces, implies their greater availability even in the management and maintenance operations (Babalis, 2004).

3.7 Spaces that allow the development of residents' hobbies

Common spaces for meetings, deposits, so as to allow variability in relation to the needs of the individual or the community, may be placed in different floors of the building (Babalis, 2004). They may also be surfaces obtained from the connective distribution areas, and not necessarily coinciding with closed spaces, but separated through screens and equipped with containers: this solution allows a more direct control of the individual accommodation; the use of, for example, internal rooflights also ensures considerable advantages in perception of the space distribution (Turchini and Grecchi, 2006).

3.8 Spaces that allow to work at home

The widespread trend to different social levels is being able to work at home, which is linked to changes in the productive offer and the widespread availability of new remote technologies, may suggest alternative solutions, where the space of the accommodation is reduced or not properly outfitted (Turchini and Grecchi, 2006). The interior of the building that allow individual working rather than meeting, with equipment and adequate plant, represents an interesting strategy of functional mix. In this case spaces can have locations and different characteristics, but always need to be flexible in order to allow the variable use in time (Turchini and Grecchi, 2006).

3. Building configuration and accessing flats	**Milan**	**London**	**São Paulo**
3.1 Security of shared areas and dwelling accesses should be considered at the earliest design stage	All areas are sufficiently lit naturally (or artificially) and the routes doesn't have unsafe distortions. Only presence of the core access configuration. Generally less than 25 flats per service node.	All areas are sufficiently lit naturally (or artificially) and the routes doesn't have unsafe distortions. Presence of: core access, deck access, double banked access (also with corridor ending fully glazed, and double and triple height voids next to the window, to dramatize the view and provide natural light), direct street access, where every inch of the street is overlooked.	All areas are sufficiently lit naturally (or artificially) and the routes doesn't have unsafe distortions. Presence of: core access, deck access, double banked access and combination of deck and double banked. Stimulation of small neighborhood context of proximity acting as a "shell". Use of micro perforated metal plate to ensure the control view.
3.2 Measures to foster the representativeness of the building	Presence of multiple height atrium only in mixed tenure typology with more than 25 dwellings per core. Use of external porticos.	Presence of multiple height atrium only in large development mixed tenure typology.	Atrium is always reduced to a distribution space to access flates. Ground floor open plan often with *pilotis*. Lack of representativeness.

3.3 Built form and massing needs to be organised carefully	Minimising areas in permanent shade, mitigating downdraft and turbulence, providing areas for play when achievable.	Minimising areas in permanent shade, mitigating downdraft and turbulence, providing areas for play when achievable.	Minimising areas in permanent shade, mitigating downdraft and turbulence, providing areas for play when achievable.
3.4 Provision of internal spaces for children's activities	Roofs are often used for collective activities rather than proper children' activities. Children's areas are always outdoors.	Children's areas are always outdoors.	Roofs are often used for collective activities rather than proper children' activities. Children's areas are always outdoors.
3.5 Programming of the interior common spaces: gardens, courtyards, collective rooms, etc.	Spaces for social life and relationships: collective rooms and roofs. Other collective spaces are always public.	Spaces for social life and relationships: collective rooms, courtyards and gardens (both open and closed configuration).	Spaces for social life and relationships: collective rooms, roofs, courtyards and gardens.
3.6 Participation of inhabitants in the design of the common areas	Sometimes involving tenants in the design of the common areas.	Very often involving tenants in the design of the common areas.	Very often involving tenants in the design of the common areas.
3.7 Spaces that allow the development of residents' hobbies	Spaces for social life and relationships: collective rooms and roofs. Other collective spaces are always public.	Spaces for social life and relationships: collective rooms, courtyards and gardens (both open and closed configuration).	Spaces for social life and relationships: collective rooms, roofs, courtyards and gardens.
3.8 Spaces that allow to work at home	Not found in any cases.	Not found in any cases.	Not found in any cases.

4. Providing flats that match family needs

The perception of space is extremely tied to personal and subjective factors; each of us has its own vision of its own concept of feeling good that it is not always simple to express. However, it is possible to treat some conditions that, however, could contribute to make more pleasing dwelling spaces (Turchini and Grecchi, 2006).
First of all, designers should promote a good balance between shared, social spaces where people can do things together, and private spaces where people can do things alone. There should also be space in living/eating areas to provide hospitality to visitors when all family members are at home (Recommendations for living at super density, 2007).
There are some flat typologies that reach some of the advantages of a house, which is eventually the most desired configuration among a super density urban context,. One of the key solutions is the provision of private outdoor space in making homes developments attractive to families (Recommendations for living at super density, 2007).

4.1 Private open space should be provided for all homes of whatever dwelling tenure or type

The space provided should be safe enough for children and large enough for the entire family to sit out with ease, and should also receive direct sunlight for some hours during the day (Recommendations for living at super density, 2007). In mixed developments there is often limited floorspace for ground floor family flats because of the pressure on ground floor area to allocate main entrances, stores and commercial uses; however, the maisonette (or duplex) typology allows to double the available floorspace because the night area should be put on the first floor or on the lower ground level (Recommendations for living at super density, 2007).
Also in top level flats, maisonettes (or duplexes) can offer a valid alternative. Because of the planning setbacks, although highly dependent on lifts, they often are provided with large private terraces and can therefore offer good outdoor space to families.

4.2 Addition of a separate utility space of at least 1 square metre per person for all family dwellings which don't have private garden space with external storage

There needs to be a balance between shared spaces and private storage space. There should be space to store a large variety of household and personal items, dispersed in convenient and accessible locations (Recommendations for living at super density, 2007).

4.3 Half of all five-person or larger affordable dwellings should have a separate kitchen/dining room

This recommendation has been formulated in relation to the London superdensity context, and deals with the need of large families to benefit of a proper defined space to share the meal time during the day. Large families are small community with complex social dynamics which need to be supported by an accurate design planning (Recommendations for living at super density, 2007).

4.4 Single bedrooms should be demonstrably suitable for study and recreation by older children, and large enough to allow occupants to entertain visitors

In super dense settlements there is often a lack of appropriate places for teenagers to find the privacy they need, or in which to do activities that need flexibility, like studying or entertaining visitors; for those reasons single

bedrooms should be large enough to accommodate a bed, storage and a desk as well as space for a visitor: a single bedroom dimensioned at 7 square metres floorspace (or 6.5) is not sufficient (Recommendations for living at super density, 2007).
Requirements in relation to the age, sex, number, state the ability to perform daytime activities that do not interfere with those carried out by adults. This changing space in time should be compatible with the needs of the younger components, the study, the activities of teenagers who need to isolate themselves or receive friends (Delera et al., 2004).

4.5 Possibility of carrying out activities related to the living room, according to different traditions

The living room may change a lot depending on the culture, the social level, the urban and geographical location. It is a space often coinciding with a room for which the regulations do not require special size, if not the minimum of a single room.
Turchini and Grecchi (2006) report several cases of configurations: the first case is the most traditional solution: a space with a single facing. The constraint of having a single directly illuminated side does not allow many internal partitions, and defining small spaces for different uses becomes rather complex; if the space is double height, one can have multiple contemporary uses, from collected and private individuals, to collective and social ones. The duplex solution allows greater opportunities, both in terms of definition and use of the spaces, either in relation to the architectural perception of volumes that could be articulated by giving also to the height of the room a crucial role. The solution to the living room with to fronts makes the identification of functions within the space to the arrangement of furniture, but the availability of two light sources allows the fragmentation of the space in two distinct environments, which could be made using furniture and movable or fixed walls. The "central" living room configuration requires careful evaluation in terms of verification of illuminating ratios: it is based on islands that provide different contemporary uses: individual and separated by mobile walls, collective by the aggregation of individual parts in a single space.

4.6 Possibility of preparing and having foods according to different usage

The role of kitchen derives from different habits in having meals, which vary in relation to the geographic location, size of cities, business requirements and traditions, determines different sizes and relationships with the living areas (Delera et al., 2004).
According to Turchini and Grecchi (2006), there are several different configurations of the kitchen; for example the traditional kitchen could incorporate the possibility of having meals. This solution addresses the need to distinguish between lunch had with family, rather than consumed with guests.

There is also the purely technical solution, which takes up minimal space, shielded but directly overlooking the dining area.
The choice of furniture allows a separation between the functions. With respect to the first solution, the second one guarantees to give more space to the living room.
The separation between the spaces can still be made with transparent or translucent walls, large sliding doors, which ensure a more global spatial perception. The same configuration may respond to different models of having meals, from the individual and fast lunch to the meal consumed with family or with guests, using a flexible furniture system.

4.7 To be able to accommodate different activities from those living ones, in conditions of privacy and autonomy

The need to stay in one's own home for long necessarily influences the definition of the accommodation which should also be designed to allow the increased use of surface, with large autonomy for some rooms, so as to absorb the changes and the needs that arise within the family (Turchini and Grecchi, 2006). The presence of alone elderly, but autonomous, and therefore able to support the family, children become adults, but remaining into the family nucleus, are now a reality that should be addressed in terms of housing design (Turchini and Grecchi, 2006).

4.8 Promoting the recognition of one's own accommodation

In response to the request for recognition of one's own accommodation inside the building in the urban context, there can be projects that lead to define very articulated buildings, obtained by the overlap of typological different residential ranges or by the usage of certain components in elevation (materials, doors, loggias, greenhouses etc.), to be chosen in relation to predefined repertoires (Turchini and Grecchi, 2006).
Another interesting aspect is the subjective relation with colors; the first input deals with the color, only in the second time the morphological characteristics of a environment or an object are caught, and in conscious or unconscious ways, colors, and color matching, influence attitudes, produce psychological reactions (Turchini and Grecchi, 2006).

4. **Providing flats that match family needs**	**Milan**	**London**	**São Paulo**
4.1 **Private open space should be provided for all homes of whatever dwelling tenure or type**	More than 95% of dwellings provided with terraces or balconies or loggias (also double or triple height) usually facing the internal courtyard or, at least, the more intimate available space. Around 60% of private open space suitable to sit out with ease**.**	More than 95% of dwellings provided with terraces or balconies or loggias or gardens (also roof gardens). Around 100% of private open space suitable to sit out with ease**.** Both deck and core configuration show duplex typology at ground floor with the night area on the first floor or on the lower ground level. Hard edge to the public street with no front gardens.	One case provided with terraces or balconies or loggias, but not suitable to sit out with ease. One case with private ground floor gardens.
4.2 **Addition of a separate utility space of at least 1 sqm per person for all family dwellings which don't have private garden space with external storage**	This criterion is suggested in the *Recommendations for living at super density* (2007). Never provided.	This criterion is suggested in the *Recommendations for living at super density* (2007). Not entirely verified but supposedly supplied.	This criterion is suggested in the *Recommendations for living at super density* (2007). Never provided.
4.3 **Half of all five-person or larger affordable dwellings should have a separate kitchen/dining room**	This criterion is suggested in the *Recommendations for living at super density* (2007). Always provided.	This criterion is suggested in the *Recommendations for living at super density* (2007). Always provided.	This criterion is suggested in the *Recommendations for living at super density* (2007). Always provided.
4.4 **Single bedrooms should be demonstrably suitable for study and recreation by older children, and large enough to allow occupants to entertain visitors**	Children's room is always more than 7 sqm, but it is intended also as a double bed room. No provision for strict single bedrooms. Always suitable for a wardrobe, desk and chair.	Children's room is always more than 7 sqm, but it is intended also as a double bed room. Always suitable for a wardrobe, desk and chair.	Children's room is always more than 7 sqm, but it is intended also as a double bed room. No provision for strict single bedrooms. Always suitable for a wardrobe, seldom for desk and chair if there are two traditional single beds.
4.5 **Possibility of carrying out activities related to the living room, according to different traditions**	Mostly single facing typology, some cases of double facing configuration. No central living room.	Both single and double facing typologies. No central living room.	Only single facing typology. No central living room.
4.6 **Possibility of preparing and having foods according to different usage**	Mostly traditional kitchen with the possibility to have meals, some cases with technical kitchen, some cases with separated technical kitchen.	Mostly technical kitchen and seldom traditional kitchen with the possibility to have meals.	Mostly traditional kitchen with the possibility to have meals, some cases with technical kitchen, some cases with separated technical kitchen.

4.7 To be able to accommodate different activities from those living ones, in conditions of privacy and autonomy	Generally not satisfied, at least not in condition of privacy. Some cases of mixed tenure show larger living rooms, indeed tenants could provide some privacy through flexible solutions.	Generally not satisfied, at least not in condition of privacy. Some cases of mixed tenure show larger living rooms, indeed tenants could provide some privacy through flexible solutions.	Generally not satisfied, at least not in condition of privacy. Some cases of mixed tenure show larger living rooms, indeed tenants could provide some privacy through flexible solutions.
4.8 Promoting the recognition of one's own accommodation	Personalization of each dwelling through: material finishes variation and size/shape/position variation of the openings and the private open spaces. Also vernacular re-interpretations.	Personalization of each dwelling through: color finishes variation and size/position variation of the openings and the private open spaces. External doors frequently have different color painting.	Personalization of each dwelling through: color finishes variation of architectural external elements or portions of plaster.

5. Designing flexibilities

The identification of new requirements that derive from the social transformations and new patterns of life should provide housing design with the definition of new criteria aimed at making as much as possible flexibility in relation to future needs and requirements that today, we still do not know (Malighetti, 2004).
In the social housing sector, where the accommodations are mainly intended for the rent, with a more frequent change of user than the private building, the increase in the flexibility of a accommodation, which comprises the acquisition of a higher degree of adaptability and of diverse needs that occur in time, allows to expand the spectrum of possible inhabitants and to change the characteristics in using spaces to those ones already established (Boeri et al., 2013). Also the functional improvement of the residential units represents a common need, for the most part equipped and built by saving amenities and spaces (Boeri et al., 2013).

5.1 Flexibility for both indoor and outdoor collective areas

A good design of the connective system space is a key solution toward the possibility of varying in time the distribution of the accommodations and the provision of several accesses to the houses, located in a way to give independence to a portion for different uses, which may also vary over time, ensures a good level of flexibility with extremely content initial cost (Delera et al., 2004). The deck distribution is the one that certainly allows more grades of freedom, but it is also that one that requires a more careful planning to ensure solutions in order to avoid visual intrusion, allow solutions with double overlooking which ensure the privacy levels required (Delera et al., 2004).

5.2 Design of connective spaces, or condominium, to ensure that initially common spaces may be used in the future to expand the accommodation areas

The "time" flexibility can be obtained with an increase in the area of the accommodation, however within the limits of a global volume that remains generally constant (Turchini and Grecchi, 2006). This operation is allowed by several arrangements that can be made in the design phase of the building. Among these there is the design of connective spaces, or condominium, designed to ensure that areas firstly designed as common may be used in a second time to expand the surface of the dwellings (Malighetti, 2008).

5.3 Multiplying the typological options to answer to different housing demand

The identification of different ranges of accommodations allows to better meet the market demand and the needs expressed by different users. The solutions proposed are many, some of which can contain a great flexibility of use over a period of time, or experiment more free distributions, with spaces that vary in relation to furniture and the partition's type selected (Turchini and Grecchi, 2006).
The design flexibility consists essentially in the adoption of the strategy to multiply the range offer in relation to the purchasing power of each tenant (Malighetti, 2008). This model can provide homes for classic families, for large families, single-parent families, accommodation for the young and elderly.
The wider the range of solutions, however the more will be satisfied the initial flexibility. At the base of this design hypotheses is required a careful analysis of all the changes taking place in the social composition, the needs with respect to the formulations of the spaces, innovative technologies and how these are perceived and interpreted by the average user (Turchini and Grecchi, 2006).

5.4 Active participation of the future inhabitant to the design of the accommodation

The possibility for users to be involved in the project choices relating to the distribution of their home, allows to define several custom solutions perfectly suited to the needs of each family (Delera et al., 2004).
In the case of the active participation of the future inhabitant to the housing design, the dweller expresses its needs to the designer, which processes, as a result, a number of options, already compatible with the range of accommodations-type within the overall project of the building, giving the user a freedom to choose (Malighetti, 2008).
The direct participation of the user in the design of multi-storey collective buildings and multi-family dwelling is currently being tested. It is expressed in different forms, ranging from the survey on the requests of the inhabitants with the drafting of local programs, the consult of the computer experts for the design

of specific interventions, the request of a direct opinion to families, by subjecting samples of accommodation in programming the assignment (Malighetti, 2008).
An alternative and more times tested project hypothesis is to provide a dwelling where some parts are not yet defined and that will be then self-built by the users themselves. In this case the guidelines should guarantee a simplicity and celerity of construction, as well as the possibility to choose between a range of solutions that have been already tested. Of course even in this case, the designer should identify criteria to safeguard and protect the overall good result of the construction (Turchini and Grecchi, 2006).

5.5 Possibility of subdivisions and grouping of two or more accommodations both horizontally and vertically

The demand for greater autonomy by the inhabitants, especially in cases of cohabitation between adults, involves the identification of precise localisation of some spaces in such a way to create a completely independent space even if in direct relation with the original cell (Malighetti, 2008). The ability to give autonomy to a local or a portion of dwelling through the provision of more doors in connection with the common connective is effective, also for the ability to associate additional areas to the space that should become more self-reliant (Malighetti, 2008).
The configuration of the building should allow as much flexibility as possible in accessing apartments. An added value for the quality of living and the guarantee of privacy is related to the choice of entering a flat through a secondary door (Babalis, 2004). A deck access configuration, for example, allows the creation, over time, of additional accesses for each accommodation, favoring the eventual fractionability; while its increase in surface area can constitute a reserve of space for those homes that need an enlargement (Malighetti, 2008). The deck, however, is an extremely binding solution as regards the privacy; it could therefore reach compromised solutions, for example, when services are positioned along the entrance front, which do not require particular outdoor-facing conditions (Turchini and Grecchi, 2006).
If the accommodation has a double height space, some variations within a constant volume are permitted, by dividing it into two separate units through galleries and lofts (Malighetti, 2008).
By providing the offset location of the deck space with respect to areas that require a facing on the outside, it is possible to eliminate phenomena of visual intrusion: this causes complications in the actual definition of the route that, necessarily, should comprise a sequence of ramps with landings to ensure access for the handicapped (Turchini and Grecchi, 2006).

5.6 Floor plans with a neutral space at the entrance

Floor plans must take the changing social phenomena into account and give solutions to the shift in household configurations. Fewer and fewer flats house

the classic nuclear family and the variety in contemporary lifestyles is reflected in flexible housing configurations (Schittich, 2004). Be it housing co-op, nuclear family ore single-parent family, work at home or home office (what is required are adaptable apartments where most rooms have neutral usage on plan), flexibility does not necessarily have to mean shifting and dividing walls; thus floor plans with a neutral space at the entrance, which can be used alternatively as a study or a guest room, or as a room for an older child or a grandparent, are both virtuous solutions (Schittich, 2004).

5.7 Using standard size furniture

The ability to configure multiple solutions in the arrangement of the pieces of furniture can be obtained by operating on the geometry of the spaces, taking care to intervene by considering the standard size of the needed furniture in such a way that the ratio between the dimensions of the different spaces in a room allows alternative configurations (Malighetti, 2004).
The placement of doors and external window frames should favor the propensity of walls to be equipped and should be designed so that each of the different solutions granted by the project gives a certain level of lighting, in compliance with regulatory requirements. For the purposes of flexibility, the design of the transparent vertical cladding should allow the construction of the different configurations permitted by the project concept. For example, in the case of contiguous windows, the middle upright should have such dimensions to accommodate partitions in its thickness: this requirement, as well as other related to flexibility, can be solved by a dimensional coordination of modular elements of the vertical closure between them, with internal partitions and with the supporting framework (Malighetti, 2008).

5.8 Separating spaces by using fixed solutions

The equipped walls are constructive polyvalent elements that enrich the functional characteristic of separation between two spaces of the new partition with the function of the contained furniture with all its accessories (Malighetti, 2008). Those solutions have devices, such as guides and profiles, which allow to integrate, where needed, the simple separation wall with a series of additional three-dimensional elements that can be closed with access doors, in relation to the intended use of the delimited environments and needs expressed by the users (Malighetti, 2008).
According to Turchini and Grecchi (2006) the division of the spaces can occur by full height furniture. This solution can be used in all those cases where one doesn't need a good level of sound insulation. The production on the market today provides an extensive range of interchangeable, flexible and modular components that allow to fit different size typologies. Using fixed screens that allow a more visual space separation than physical, in order to keep the overall perception of the entire space. Another solution comprises "shoulders" of masonry or plaster, which are designed to support the insertion of fixed walls,

doors, or container of furniture. The provision for electrical systems, telephone, wire harnesses, ensures the possibility of placing video equipment, computers, hi-fi, but it is necessary to interface plant with the horizontal distribution (floor and ceiling).

5.9 Separating spaces by using movable solutions

The use of doors or moving wall panels easily accomplish different configurations in the organization of the domestic space.
According to Malighetti (2008) and Turchini and Grecchi (2006), doors and internal walls can be moved in relation to the particular type of movement that could achieve, and it may consist of panels that perform simple movements, removers or rotators, or even both of them. The pivoting doors and walls, respect to the sliding panels system, clear completely the compartment in the open position. This type of closure comprises also the version with rotating panels for a better acoustic and thermal insulation of the spaces delimited by the moving wall. In addition to pivoting panels there are the balancing panels, which adopt the garages type of closure. The mechanism of movement of these elements provides the translation of the individual panels along vertical binary and their simultaneous rotation around the horizontal axis of the sliding pin.

5.10 Possibility of closing of private external spaces through removable elements

A closure through mobile elements of private external spaces appropriately provided for that purpose, such as loggias, grants, however, many advantages in the housing flexibility. In addition to the increase of the surface of the accommodation, the temporary closure of the loggias allows, in fact, the continuous use of these spaces all over the year, even in winter season or in adverse weather conditions, and creates winter gardens, which are green spaces that can also be used in summer periods (Malighetti, 2008).

5.11 Varying the distribution structure without interfering with the the service blocks and without heavy intervention on plants

Each change of the arrangement of the accommodation that has not been defined in the design stage of operations requires high technological complexity, since it involves demolition and reconstruction operations that restrict the ability of the user to manage directly any changes (Malighetti, 2008).
The blocks services deserve attention in relation to the actions of future modification. According to Turchini and Grecchi (2006) the solution with services block placed in a central position, combined with an inner court or to a light well, can resolve in a flexible way the distribution of the different spaces. In this case, the operations of maintenance occur without heavy interventions; the multiplication of services allows to articulate the sleeping area in a more flexible

way. An alternative solution is the a division of the toilets, so as to allow a simultaneous use of the facilities.
The ability to carry out plant variations in later times from the construction, limiting the destructive operations on the building, requires the adoption of innovative technologies that involve high cost increases (Malighetti, 2008). Currently, the technological innovation is based on the concept of planting redundancy and on the use of floors and technical vertical dividing elements conceived as borders: functional dry assembled layers eliminate the interference of masonry and reduce installation times (Malighetti, 2008).
The combination of the rising columns with the supporting structure and, therefore, their propagation, while representing an additional cost during the initial phase, gives considerable degree of flexibility either in the positioning of the equipment or in the indication of the service areas, also the future ones (Turchini and Grecchi, 2006). In addition, the multiplication of the rising columns of the plants on the external front, interspaced by doors or windows according to modules which allow a flexible variable fractionation of spaces, is a strategic solution for future change integration (Turchini and Grecchi, 2006).

5.12 Possibility of adapting the accommodation to meet the changing needs of the family, by increasing the surface area keeping the same volume

One of the simplest interventions to increase the surface of the accommodation is closing the outside private spaces, so as to increase the surface of the connected bathrooms or to create new ones (Babalis, 2004).
It is possible to provide in duplex accommodation suitable constructive predispositions to allow the increase in surface area inside the volume corresponding to the residential unit. This operation may involve the partial or total closure of the loggia, the fractionation of double height spaces with lofts rather than being closed (Turchini and Grecchi, 2006).

5.13 Possibility of adapting the accommodation to meet the changing needs of the family, by increasing both surface area and volume

The flexibility over time that requires more complexity is the one that provide, along with the increase in the initial surface, an increase of volume. This solution can be realized easier in low-raise buildings, mainly the array typologies. Once identified the original nucleus of the minimum home, enlargements of the initial volume of the construction can take place within the surface limits stated by the provision of a platform, equipped with the necessary plants, on which they will locate the additional volumes (Malighetti, 2008).
Considering the urban context of the building is essential in the design of this type of solutions. In fact it may often be necessary to evaluate which fronts are acceptable to be incremented and varied. Also in this case there should be arranged repertoires of components and solutions compatible with the formal control of the whole intervention (Turchini and Grecchi, 2006).

5. Designing flexibilities	Milan	London	São Paulo
5.1 Flexibility for both indoor and outdoor collective areas	No provision of more than one door entrance for each apartment in all the case studies. High grade of flexibility for all the open outdoor areas and collective condominium spaces.	No provision of more than one door entrance for each apartment in all the case studies. High grade of flexibility for all the open outdoor areas and collective condominium spaces.	No provision of more than one door entrance for each apartment in all the case studies. High grade of flexibility for all the open outdoor areas and collective condominium spaces.
5.2 Design of connective spaces, or condominium, to ensure that initially common spaces may be used in the future to expand the accommodation areas	Circulation spaces kept as lower as possible. This provision is not achievable.	Circulation spaces kept as lower as possible. This provision is not achievable.	Circulation spaces kept as lower as possible. This provision is not achievable.
5.3 Multiplying the typological options to answer to different housing demand	Good variation of dwelling typology. From studio flat, duplex, one and two bedroom flats, very low percentage of three bedroom flats and more.	Good variation of dwelling typology. From studio flat, duplex, one and two bedroom flats, low percentage of three bedroom flats.	Lack of variation of dwelling typology. Only two bedroom flats and very low percentage of one bedroom flats.
5.4 Active participation of the future inhabitant to the design of the accommodation	This strategy is rarely provided.	This strategy is rarely provided.	This strategy is not provided.
5.5 Possibility of subdivisions and grouping of two or more accommodations both horizontally and vertically	Deck access configuration allows the creation, over time, of additional accesses for each accommodation, favoring the eventual fractionability. Duplex can be fractionated.	Deck and double banked access configuration allows the creation, over time, of additional accesses for each accommodation, favoring the eventual fractionability. Duplex can be fractionated.	Deck and double banked access configuration allows the creation, over time, of additional accesses for each accommodation, favoring the eventual fractionability.
5.6 Floor plans with a neutral space at the entrance	Not found in any cases.	Not found in any cases.	Not found in any cases.
5.7 Allowing standard size furniture	Largely provided in all cases.	Largely provided in all cases.	Largely provided in all cases.
5.8 Separating spaces by using fixed solutions	Equipped walls, full height screens, shoulders etc. are not found in any cases.	Equipped walls, full height screens, shoulders etc. are not found in any cases.	Equipped walls, full height screens, shoulders etc. are not found in any cases.
5.9 Separating spaces by using movable solutions	Using sliding door panels to separate kitchen from living space.	Using sliding door panels to separate kitchen from living space. In one bedroom flats double sliding doors between bedroom and living space.	Using sliding door panels to separate kitchen from living space.

5.10 Possibility of closing of private external spaces through removable elements	Not found in any cases.	Not found in any cases.	Not found in any cases.
5.11 Varying the distribution structure without interfering with the service blocks and without heavy intervention on plants	Generally achievable due to the position of the block service, very often located aside. Lack of planting redundancy.	Generally achievable due to the position of the block service, very often located aside. Functional dry assembled layers walls. Lack of planting redundancy.	Generally achievable due to the position of the block service, very often located aside. Lack of planting redundancy.
5.12 Possibility of adapting the accommodation to meet the changing needs of the family, by increasing the surface area keeping the same volume	Increasing the surface area not allowed because of the lack of space. No double height spaces that could be separated into two lofts. Loggias could be closed up but this affects the general appearance: not planned from the beginning.	In the new interventions, increasing the surface area is not allowed because of the lack of space. No double height spaces that could be separated into two lofts. Loggias could be closed up but this affects the general appearance: not planned from the beginning. In renovation projects, increasing surface very often promoted.	Increasing the surface area not allowed because of the lack of space. No double height spaces that could be separated into two lofts.
5.13 Possibility of adapting the accommodation to meet the changing needs of the family, by increasing both surface area and volume	The concept design does not provide from the beginning such these changes.	Although the concept design does not provide from the beginning such these changes, cases with heterogeneous low raise development might be modified because this affects less the general appearance and the architectural language. In renovation projects, increasing both surface and volume is very often promoted.	The concept design does not provide from the beginning such these changes.

6. Privacy demand

Cities attract the average person, since people nowadays want to live in a social urban environment, which is often a source of noise and illness; self isolation from the urban context implies important reflections in design strategies either in buildings or in a single accommodation (Turchini and Grecchi, 2006).
Layouts also affect how noise travels between dwellings through the windows: for example privacy is compromised by putting two units side by side with bedroom windows very close to each other, especially when both windows are open, so the properties are effectively linked (Recommendations for living at super density, 2007). The individual feels the need of some form of space that provides a refuge from the socio-environmental pressure, a need of personal and family privacy. It is not a simple biological responses because there are deep cultural differences among

different human populations. Home is that universal element which performs the task of mediation between the individual and the environment: it is indeed the most important physical structure that can satisfy the privacy need (Turchini and Grecchi, 2006).

6.1 Possibility of isolating from the external context

Design of mixed-use developments should seek to minimise noise disturbance to residents (Recommendations for living at super density, 2007). The buildings, when locating in particularly busy areas, should be equipped with visual and acoustic guards. For example, against the road noise, on different scales, there could be proposed: cement and green raised walls; "trench" streets; very articulated building profiles (Delera et al., 2004).
One of the first conditions of isolation from the urban context is defined by the characteristics of the road. Therefore some analysis on some parameters that define the boundary conditions should be carried on, such as the distances from the other buildings, the intended use of the ground floor, the site size, local regulations.
According to Turchini and Grecchi (2006), on privacy there are several ways to isolated buildings (or part of them) from the urban context: shifting the building behind the roadside and the insertion of green barriers improve the conditions of visual isolation. Putting the main front in the perpendicular direction means define external condominium spaces less isolated and livable than those that are behind the building. Similar results can be obtained by articulating the building so as to create backsliding or niches. In fact, while maintaining the continuity of the roadside, the designer could orient the openings of the housing so as to avoid visual introspection. In some cases it may be created a protected condominium space, shifted back from the road front. This solution ensures conditions of privacy of the external spaces in addition to giving a pleasant view from the accommodations.

6.2 Internal plans should separate areas with too higher sound transmission

In providing accommodation with private areas that are in close relation with the collective internal life, the design of these places and their actual usability are requirements that should be faced by the current design (Delera et al., 2004). Internal plans should separate those spaces where sound transmission between different generations cause problems (Recommendations for living at super density, 2007).
The urgent request to dispose of one's own space shows the need to be able to self isolate to raise one's own interests, indeed the interpretation of accommodation as a sequence of bands, defined with respect to the degree of intimacy and/or community, allows to better safeguard the needs of the individual within the group (Turchini and Grecchi, 2006). The technological solutions to define the envelopes that determine or contain these spaces should consider the request of privacy and, therefore, ensure both sound insulation and/or restrict the visual introspection (Turchini and Grecchi, 2006).

6.3 Outdoor private space should be as private as possible

Also for the outdoor spaces, consisting of loggias, balconies or private gardens, it is necessary to ensure privacy view conditions as for all the other areas of the accommodation, as these spaces are designed to be a natural extension of the living area (Turchini and Grecchi, 2006). When, for example, the dwellings' configuration does not allow to guarantee conditions of privacy for all the outside private spaces, the design should provide efficient solutions, such as fixed or mobile screens, green barriers, increases in the thickness of the balustarde to prevent the overlooking on the spaces below (Turchini and Grecchi, 2006).

6.4 Ensuring privacy in entering home

Several researches on privacy show that residents worry as much about people seeing how they live as they do about being seen themselves both indoors and outdoors whilst accessing home and this may also reflect fear of encouraging theft (Recommendations for living at super density, 2007). Assuring privacy by entering home, totally depends on the chosen connective space of distribution: for already explained reasons, the deck access is the configuration that less ensures this requirement.

6. **Privacy demand**	**Milan**	**London**	**São Paulo**
6.1 **Possibility of isolating from the external context**	Orientation of the building to allow a private and intimate view on courtyards, green and collective open space. Avoiding to put large opening on the street sided. Landscape used as acoustic barrier and against vehicle pollution, in the form of an inclined ground system of green podia with parking at the lower ground and semi hypogeal collective rooms and facilities.	Orientation of the building to allow a private and intimate view on courtyards, green and collective open space. Avoiding to put large opening on the street sided. When a new pedestrian street is created as a core public area, ground floor flats directly facing the public space.	Orientation of the building to allow a private and intimate view on courtyards, green and collective open space. Avoiding to put large opening on the street sided.

6.2 Internal plans should separate areas with too higher sound transmission	Clear separation between living spaces and night spaces. Where open plan is adopted, generally limited self isolation (both visually and acoustic). In some cases there is enough room for a flexible separation system. Where traditional kitchen is adopted, possibility of isolation by separating it from the living room. Possible separation of spaces belonging exclusively to living rooms where the configuration is suitable.	Clear separation between living spaces and night spaces. Where open plan is adopted, generally limited self isolation (both visually and acoustic). In some cases there is enough room for a flexible separation system. Where traditional kitchen is adopted, possibility of isolation by separating it from the living room. Possible separation of spaces belonging exclusively to living rooms where the configuration is suitable.	Clear separation between living spaces and night spaces. Where open plan is adopted, always limited self isolation (both visually and acoustic). Where traditional kitchen is adopted, possibility of isolation by separating it from the living room. Configuration never suitable for separating spaces belonging exclusively to living rooms.
6.3 Outdoor private space should be as private as possible	Where loggias are not provided, fixed or mobile screens and green barriers ensure privacy on balconies.	Where loggias are not provided, fixed or mobile screens and green barriers ensure privacy on balconies and terraces. In the notched typology, the subsequent neighbor's dwelling has no opening facing the terrace. Private gardens never facing the street and separated by fixed partition or green barriers.	Private gardens never facing the street and separated by fixed partition or green barriers.
6.4 Ensuring privacy in entering home	Presence of core access (high level of privacy).	Presence of deck access (low level of privacy), double banked access (medium level of privacy) and core access (high level of privacy).	Presence of deck access (low level of privacy), double banked access (medium level of privacy) and core access (high level of privacy).

7. Maximizing the presence of nature

High density development requires maximising opportunities for green open spaces (Recommendations for living at super density, 2007). Since the building itself can become a nucleus of urban infrastructure, the design of green spaces between buildings impacts the social interaction of the inhabitants in considerable ways. With the growing integration of living, working and leisure, there is a need for housing settlements with facilities that integrate and improve the living space conditions (Schittich, 2004). Researches have stated that walking in a park reduces stress and tension, and that a view of landscape accelerates recovery from illness (Recommendations for living at super density, 2007).

The relationship with green areas has always been an important discriminating factor in defining the quality of living. In the collective imaginary the single house represents the optimum visibility condition, because it provides greater privacy and independence and the availability of private green areas, or moreover, outdoor spaces equipped with plants and furniture allow either a seasonal or a continuous use (Turchini and Grecchi, 2006).

7.1 Having common equipped green spaces

Green space is essential to keep local and global ecosystem in balance and to bring nature into the neighborhood (Babalis, 2004). Various functions and activities of green spaces can be identified both as recreational and relaxing (areas like parks and play grounds) as well as movement (pedestrian and cycle routes, green way and water way connections to urban activities) (Babalis, 2004).
The green collective space may include a courtyard or a common garden of larger size. In those climatic conditions that do not allow long periods of outdoor activities one have a proper winter garden, i.e. an internal court protected with a large greenhouse which can be opened, with directly overlooking from dwellers, where the volume of the greenhouse coincides with the height of the building, or enjoy the view through a rooflight, in smaller spaces (Turchini and Grecchi, 2006).

7.2 Private green space should be provided for all dwellings

Green space in term of availability of loggias, balconies or small gardens, is a common request that does not depend on the climatic conditions of the place. Then loggias, possibly, oriented on protected quiet spaces, such as an internal front, could benefit from the right conditions in full daylight. Protected spaces can be closed to ensure their use even in winter.
In the case of the loggias, the creation of a spatial continuity between the interior and exterior spaces may define certain conditions of privacy, with respect to visual intrusion of the neighbors. One of the main disadvantages is represented by the reduction of natural light inside the dwelling, but a good solution could be the light coloring of the ceiling and the adoption of reflectors that lead the light inside (Turchini and Grecchi, 2006). The choice of adopting terraces in place of more protected spaces depends on context, latitude and the climatic conditions. The terrace solution is comparable to the private garden: it could even be a considerable surface, shady and manageable in autonomy respect to building (Turchini and Grecchi, 2006). The ability to create roof gardens is one of the greatest advantages, while the disadvantages are the less privacy and the greater light amount.

7.3 Landscape design must use materials and plant species that are tolerant of abrasion and wear owing to intensity of use

Vegetation species should be selected, and materials specified in the full knowledge and understanding of the conditions that will prevail: generally intensive usage, abrasion and wear in addition to aspects of micro-climate described above (Recommendations for living at super density, 2007).
The choice of the species must be done by reason of different factors, including the maintenance, the management and the availability of green spaces

(Turchini and Grecchi, 2006). Landscape design should demonstrate a clear consideration of all of the above points and should use materials and plant species that are tolerant of abrasion and wear owing to intensity of use, as well as the particular conditions caused by a close proximity to built form (Recommendations for living at super density, 2007).

7.4 Buildings over eight storeys should include access to communal landscape space

This recommendation is provided for the London contest, but it is also suitable for the whole range of social housing in super dense environments. Communal landscape space might be contained within the building, as atriums or 'winter gardens'. Alternatives might be large balconies, smaller winter gardens within flats, or public open spaces within a ten-minute walk (Recommendations for living at super density, 2007).

7. Maximizing the presence of nature	**Milan**	**London**	**São Paulo**
7.1 Having common equipped green spaces	Presence of recreational and relaxing green spaces (parks, play grounds) and movement spaces (pedestrian, cycle routes, green ways).	Presence of recreational and relaxing green spaces (parks, play grounds) and movement spaces (pedestrian, cycle routes, green ways).	Presence of recreational and relaxing green spaces (parks, play grounds) and movement spaces (pedestrian, cycle routes, green ways).
7.2 Private green space should be provided for all dwellings	Loggias or balconies or terraces are always provided.	Loggias or balconies or terraces or private gardens are always provided.	Loggias or terraces never provided. Balconies very seldom provided. Private gardens very seldom provided.
7.3 Landscape design must use materials and plant species that are tolerant of abrasion and wear owing to intensity of use	This criterion is suggested in the *Recommendations for living at super density* (2007). Generally achieved. Inclusion of big and medium hardwoods.	This criterion is suggested in the *Recommendations for living at super density* (2007). Generally achieved. Inclusion of big and medium hardwoods.	This criterion is suggested in the *Recommendations for living at super density* (2007). Generally achieved. Inclusion of big and medium hardwoods, also fruit ones.
7.4 Buildings over eight storeys should include access to communal landscape space	This criterion is suggested in the *Recommendations for living at super density* (2007). Always achieved.	This criterion is suggested in the *Recommendations for living at super density* (2007). Always achieved.	This criterion is suggested in the *Recommendations for living at super density* (2007). Quite always achieved.

8. Environmental and economic sustainability

Superdensity schemes allow the achievement of green standards at a lower cost than less dense developments because of their configuration, surface to volume ratio and generally large scale (Recommendations for living at super density, 2007).
The social housing sector has to consider the cost containment of intervention, management and maintenance among affecting factors. Specific evaluation of cost/benefit ratio of operations is crucial in order to make appropriate choices. Particular attention should therefore be directed to criteria on how administrating interventions: sharing with users is generally necessary to ensure the proper final outcome and the application of correct management methodologies (Monti et al., 2009). Low costs always dominate in searching for the optimal cost-performance ratio, mostly by sacrificing durability, and sustainability is becoming necessary at the same time (Atelier Kempe Thill, 2012). Since financial pressures are mostly so intense that creating truly high-quality architecture seems to be really hard, for architects, design strategies are decisive to achieve good results (Atelier Kempe Thill, 2012).
Compared to traditional building, an ecological house has an additional cost, but, considering these costs, it obtains: reduced pollutant emissions; lower expenses for power plants and for health; environmental quality in the cities; general improving the life quality (Longa, 2009). Quality of indoor spaces and the environmental and energy efficiency in building products are heavily influenced by the interaction between local microclimate factors, morphology and geopedological composition of soil, hydrological characteristics, morpho-typological configuration of built and vegetation, materials' and outside spaces' characteristics (Battisti et al., 2012).
In Europe there have been developed several interventions, designed in a concerted way, where everything works in an integrated manner: rational use of lots and resources, sustainable mobility, participation of the community in the design of the environment, relation between building and spaces for the services, energy sufficiency and use of solar photovoltaic, glazed capturing surfaces and movable screens, collection of rain water, use of heat pumps and geothermal probes, micro turbines, building insulation, economy in costs of construction and management, use of ecological, recycled and recyclable materials, removable and flexible systems (Monti et al., 2009).

8.1 Choosing compact shapes

Since facades comprise up to 33% of total construction costs, a cost-efficient project should take into account the compactness factor and the ratio of useable area to facade should be as large as possible because when it is reduced, than savings can be invested directly in higher quality materials (Atelier Kempe Thill, 2012). The A/V ratio (ratio of heat-transmitting exterior surface to heated building volume) is a key parameter in choosing the building form: small surfaces for the building's envelope, exposed to elements, mean small building's heating energy requirement (Schittich, 2004). Facades should be freed from traditional inexpensive coatings, usually used for this category. The

outer walls increase in thickness, stratify and respond adequately to required climate performance (Gelsomino and Marinoni, 2009).
A strict orthogonal structure is preferable to a contextual, amorphous or concentric form. In order to reduces costs, and also bad widths need to be optimized. A compact building volume also achieves optimized energy values, reduced material consumption and more units per building foot-print (Atelier Kempe Thill, 2012).

8.2 Separation of layers and reversibility of connections

Serialisation and redaction are necessary to reduce the actual working hours on site, and thus, to save costs. On the other hand, complex construction logistics that can no longer permit technical application, often due to the lack of training among construction workers of companies involved in the project, should be avoided (Atelier Kempe Thill, 2012).
The new open structures have allowed an easy interchangeability and replacement of the various generic parts assembled of a specific component (Delera et al., 2009). Within the construction sector the use of products that comply with new technology requirements concerned on mechanical, structural and functional safety, fire rating, seismic safety, during assembly and disassembly on site, allows to know also duration of the "pieces", with a consequent targeted control of maintenance and management costs for the entire life cycle of the product (Delera et al., 2009).
The Str/En (Structure/Envelope) techniques are based on clear separation between structure and technical elements (shell, horizontal and vertical partitions). Each piece belonging to the stratification, with a specific origin, performs a particular functional and primary role.

8.3 Lightness and maneuverability of the elements

The new connection elements on the market are durable, lightweight, resistant to mechanical stresses, to atmospheric agents and to high temperatures, reusable, cost effective, connected to very small dimensional tolerances, which allow the production, directly on site, the assembly and disassembly with other elements (Morabito and Bianchi, 2010).
Nowadays industrial products are characterized by an intrinsic flexibility of use and this way of industrialization focuses on the single product more that on its relation with the other elements, fostering the development of dry layered construction techniques, known as Str/En (Structure/Envelope) (Masera, 2004).
The first design approach is minimizing the construction details. A second low cost design approach is choosing the various constituent parts of a building directly on the catalog of the various manufacturers (Morabito and Bianchi, 2010).

8.4 High performance and low cost innovative materials

Innovative materials, as an integral part of the contemporary architecture scenario, are distinguished from those traditional ones because their innovative content could be altered by acting on their physical and chemical structure. This process of management and control of materials takes place by improving performance levels of products with a higher functional content (Battisti et al., 2012). Costs may be reduced by using materials readily available on site, achievable with low production costs, with dimensional characteristics that can be adapted to several types of product so as to simplify the operations of assembly, disassembly and replacement. Nowadays the large part of the low cost products is mainly derived from the recycling of materials of three different consumes from processing waste and construction/demolition waste. The main materials used today are clay, prefabricated raw earth bricks, ceramic materials, concrete, plaster fiber prefabricated sheets and fiber cement sheeting, wood derivatives, glass, polycarbonate, films made out of PVC, polyethylene, polyurethane and polyester and metals.

8.5 Using roofs in order to reduce water surcharge, and to provide biodiversity or amenity space

Combining environmental and architectural aspects is in the design of the existing and the new construction, by achieving naturalized architectures, means synthesizing the two separate entities of natural and artificial (Battisti et al., 2012). The green space could reduce some of the negative effects on climate due to the urbanization, mainly because a layer of vegetation produces energy that is converted into latent heat, providing an increase in the relative humidity of the surrounding air, avoiding a rise in temperature. Next to the primary functions of protection from water, from the noise and thermal protection, the solution of green roofs offers great aesthetic benefits, the ecological improvement of the climate especially because it turns back to the environment precious green spaces. The advantages of this systems comprise the reconstitution of green surfaces, the water retention that lightens the load on the system of drainage and disposal of storm water, the oxygen production, the control of the environment climate.

8.6 Innovative systems for the management and monitoring of the solar radiation

According to Gabriele Masera (2004), passive systems are based on the direct exploitation of solar radiation, which can be immediately used to heat the interiors of the building, or being stored in storage elements that gradually released the heat in order to mitigate the temperature peaks. Within the strategies of passive solar energy, the direct gain systems provide that the solar radiation is filtered within the building through retractable elements, facing south. The indirect gain system combine the features of uptake, accumulation

and distribution of the heat in a border element between the inhabited space and external environment (massive capturing walls with air glazing, Trombe walls, water mirror roof etc.). The insulating systems transfer of thermal energy from the collector to the inhabited spaces with non-mechanical processes, (radiative or convective) or with the aid of fans with low power consumption (Barra-Costantini systems, insulation walls and roofs).
For what concerns the the solar excess radiation, the usefulness of shielding is proportional to its ability to filter it out, without compromising the necessary visual comfort, during the summer period, so as to allow incident radiation to enter the interior environments during the winter period, to provide a contribution in terms of direct thermal accumulation (Battisti, 2012).

8.7 Innovative systems for the management and monitoring of the hygrometric components

The careful assessment of the hygrometric comfort in winter and summer is crucial. Since one of the objectives is also to make the best use of all the renewable energy sources, the project of the envelope is fundamental. In winter it would be ideal a front oriented on south to ensure the best use of solar radiation. In summer, opposite openings, possibly on north and south fronts, activate a converted ventilation that not only reduces the temperature but also the humidity in the air. Hardwood trees play an important role with respect to intercept direct sunlight in summer, and do not constitute a barrier in winter.
According to Turchini and Grecchi (2006), a possible solution to direct solar gain is represented by the use of rooflights in the form of shed, oriented toward the south. This solution allows to better receive the solar radiation even in not directly exposed environments. In the passive indirect gain solar systems the solar radiation affects a thermal mass positioned between the radiation source (the sun) and the interior inhabited space. The heat transmitted by conduction through the accumulation wall is then distributed within the room by radiation, or by convection. An example of such solution is the "Trombe wall".
The water wall is quite similar to the Trombe system, with the difference that the water is the solid wall. Since the water has a significant thermal capacity, higher than the masonry walls, the system is more effective. In the gain isolated passive solar systems the capturing element, usually glass, and the heat accumulator, are separated from the environment. This allows the system to operate independently and to transmit heat to the internal spaces when required. If the wall that separates the greenhouse of the internal space is also made by a glazed surface, the system also works as a system of direct gain. The wall that separates the greenhouse from the internal environment can be a proper accumulation wall.
Generally the more common solution is a windowed masonry wall that could combine the effects of the direct gain with the characteristics of the isolated gain systems. The last strategy is the "solar chimney". It consists of a cavity located to the south and bounded by a glazed surface and an accumulation wall. The surface converts solar energy and heats the air that circulates through the gap.

The hot air rises and triggers a convective movement, pumping in the channels of distribution of solar thermal, through the upper openings.

8.8 Renewable energy in architecture: photovoltaic and thermal solar

According to Battisti (2012) the primary integration between photovoltaic system and building takes place through the installation of new photovoltaic modules, which affects significantly the configuration of the horizontal and vertical envelope. The detailed ways of application, with respect to horizontal and vertical closing, are carried out according to different levels of integration. in The independent application the photovoltaic modules are independent of the closing horizontal and vertical facade of the building, while in the overlap application solar modules are placed, through a special structure, above the horizontal and vertical closing mantle of the building without taking its place, by adapting the configuration of the closure surface. Finally, the total integration system shows a photovoltaic component that constitutes the outermost closure layer of the building, playing mainly the function of waterproofing and air sealing.
Active systems involve the process of transformation of direct solar radiation in another form of energy, or the conduct of a mechanical work for operating the system. Among these the main one are: photovoltaic systems, which produce direct electric power thanks to the use of semiconductor materials; solar panels for heating the domestic hot water, based on the greenhouse effect by trapping solar energy within a room. The heat accumulated is transferred to a coil, where water flows, through a dark metal plate that is used as exchanger.

8.9 Architectural integration of technologies for rain water recovery and saving

Wastewaters and the rain water can be treated with great success for the containment of pollutants in technological systems where water, plants and substrate of soil are at the base of the sewage system (Delera et al., 2009). This technology has also low environmental impact, i.e. does not require complex mechanical components both in the implementation phase and the management and maintenance, in high energy consumption (Delera et al., 2009).
Rain water, once collected on roofs, terraces or paved surfaces, should be separated from the "first rain", considering high pollutant load especially in the urban environment, because product from cars must be treated separately or conveyed in sewers (Battisti, 2012). The "second rain", filtered in separators, is collected in suitable tanks or drums to be pumped then, as needed, within the building, passing through more filters and a battery of ultraviolet lamps for the sterilization (Battisti, 2012).
Gray water is all that water going out from sinks, showers, bathtubs and bidets. It can be treated separately or together to the sewage water.

Water-saving means limiting the consumption of the good quality one, and encouraging the use of rain and waste waters. The market allows proposes also choices for faucets: from ubitiquitous aeration (mixers of air and water) to flow restrictors and thermostatic taps, which are very useful, especially in showers; mono lever fittings with electronic timers are very functional in public spaces, where there is a high flow of users; once activated, they automatically close up after a certain time. About toilet flushing, common drains with single delivery can consume up to 18 liters each time, while those one with dual delivery could consume 3-5 liters or 9-12 liters, with savings up to 80% (Delera et al., 2009).

8.10 A Waste Management Strategy should consider how daily refuse and bulky goods are dealt with

The aim of the Waste Management Strategy is to help people manage waste and resources effectively. This means using material resources in a way that reduces the quantities of waste produced and, where waste is generated, to manage it in a way that reduces its impact on the environment and public health and contributes positively to economic and social development in a perspective of long-term sustainability (www.rethinkwasteni.org).

8.11 A Green Transport Plan to encourage the use of alternatives to the car

Encouraging the use of alternatives to the car, including provision of secure cycle and motorcycle parking and electric car charging points, in order to promote healthier journeys to work and to reduce environmental pollution, should be carefully planned in the design stage.

8.12 Simulation, evaluation and control systems of the environmental performance in settlement assets

Operational models and dedicated software that can monitor many aspects of constructions and provide summary information of the more complex phenomena in all phases of life cycle, are divided into systems of control and bioclimatic simulation (ECOTEC, FLUENT, ENVI-MET, MITHRA), for the verification of the interactions between local climatic factors and project attitude, and assessment systems (EPIQR) and energy and environmental performance certification systems (BESTCLASS, DOCET), in such a way as to measure the the building organism efficiency in all stages of its life cycle, and to quantify, at the same time, the consequent effects in terms of technical-constructive innovation (Masera, 2004). Currently Directive 2012/27/UE of the European Parliament and of the Council on Energy Efficiency is in force.
The new Directive establishes a common framework of measures for the promotion of energy efficiency in the European Union in order to achieve the objectives of 20% reduction in CO_2 emissions by 2020 and to pave the way for

future improvements in the sustainable sector. Under the Directive, nations should develop a long-term strategy to promote the restructuring of both public and private, residential and commercial buildings (www.construction21.eu).

8. Environmental and economic sustainability	**Milan**	**London**	**São Paulo**
8.1 Choosing compact shapes	Range of compact shape typology: tower blocks, horizontal development, combination of horizontal and tower, open courtyard configuration.	Range of compact shape typology: tower blocks, horizontal development, open courtyard configuration, closed courtyard configuration, terraced development. notched terraced development.	Range of compact shape typology: tower blocks, horizontal development, circular configuration, open courtyard configuration, terraced development. Usually buildings up to four floor in order to avoid the provision of elevators.
8.2 Separation of layers and reversibility of connections	Use of traditional construction methods: armed concrete walls and traditional plaster coating. Use of modular systems. Use of ventilated facades. Use of timber structural systems and prefabricated timber systems of panels.	Minimising wet trades on site and making extensive and pragmatic use of prefabrication. Str/En technologies. Concrete frames and flat slabs and blade columns using prefabricated reinforcement mats, avoiding the need of scaffolding, prefabricated bathroom pods, balconies and dry-lined internal partitions. Steel framing system with lightweight cladding and infill, which could be wood or Nordicon light steel. Use of timber structural systems and prefabricated timber systems of panels.	Not provided.
8.3 Lightness and maneuverability of the elements	Use of traditional construction methods: armed concrete walls and traditional plaster coating. Use of modular systems. Use of ventilated facades. Use of timber structural systems and prefabricated timber systems of panels.	Minimising wet trades on site and making extensive and pragmatic use of prefabrication. Str/En technologies. Concrete frames and flat slabs and blade columns using prefabricated reinforcement mats, avoiding the need of scaffolding, prefabricated bathroom pods, balconies and dry-lined internal partitions. Steel framing system with lightweight cladding and infill, which could be wood or Nordicon light steel. Use of timber structural systems and prefabricated timber systems of panels.	Not provided.

8.4 High performance and low cost innovative materials	Use of traditional materials with long durability and less maintenance required. Materials readily available in situ, achievable with low production costs, with performed dimensional characteristics. Prefabricated raw earth bricks, ceramic materials, concrete, plaster, wood derivatives, glass, polycarbonate, PVC and metals.	Materials readily available in situ, achievable with low production costs, with performed dimensional characteristics. Prefabricated raw earth bricks, ceramic materials, concrete, plaster, wood derivatives, glass, polycarbonate, PVC and metals.	Use of traditional wet constructive materials with long durability and less maintenance required. Materials with performed dimensional characteristics. Clay, prefabricated raw earth bricks, concrete, plaster, PVC and metals.
8.5 Using roofs in order to reduce water surcharge, and to provide biodiversity or amenity space	Not provided.	Brown roofs which over time will be colonised by local flora. Bird boxes designed for different species. Use of roof gardens to collect water.	Not provided.
8.6 Innovative systems for the management and monitoring of the solar radiation	High performance thermo-acoustic and brise-soleil moving screens. Choosing the best orientation with living spaces possibly on south. Use of balconies and loggias to sunlight control. Using of big windows.	Energy fittings and occupancy sensors control landlord areas. Volumes (for example balconies) in alternate directions at each floor to produce double height gaps between them and reduce overshadowing to the flat below. Use of large windows and balconies. Use of balconies and loggias to sunlight control. Using of big windows.	Use fixed brise-soleil systems in Adaptation of windows and shading devices (masonry or metal). Choosing the best orientation with living spaces possibly on north.
8.7 Innovative systems for the management and monitoring of the hygrometric components	Placing windows in different sides of the buildings. Use of balconies and loggias to hygrometric control. Using of big windows.	Prepackaged central plant on the roof providing heat to all dwellings, which may be easily replaced. Combination boilers. Natural gas fired CHP (combined heat and power) provide low carbon affordable electricity, heat the domestic water and dwelling spaces. Use of roof gardens to hygrometric control. Placing windows in different sides of the buildings. Using of big windows.	Placing windows in different sides of the buildings. Increased ceiling height.lining and insulation..
8.8 Renewable energy in architecture: photovoltaic and thermal solar	Use of photovoltaic and thermal solar.	Use of photovoltaic and thermal solar.	Not provided.
8.9 Architectural integration of technologies for rain water recovery and saving	Water saving devices such as aerated taps . dual flush cisterns and low-flow showers.	Water saving devices such as aerated taps . dual flush cisterns and low-flow showers.	Water saving devices such as aerated taps . dual flush cisterns and low-flow showers.

8.10 A Waste Management Strategy should consider how daily refuse and bulky goods are dealt with	This criterion is suggested in the *Recommendations for living at super density* (2007). Not verified.	This criterion is suggested in the *Recommendations for living at super density* (2007). Not verified.	This criterion is suggested in the *Recommendations for living at super density* (2007). Not verified.
8.11 A Green Transport Plan to encourage the use of alternatives to the car	This criterion is suggested in the *Recommendations for living at super density* (2007). Not verified.	City car clubs to encourage car sharing for residents and discourage private car ownership.	Not provided.
8.12 Simulation, evaluation and control systems of the environmental performance in settlement assets	Achieving energy performance class from B to A+.	Good Eco Homes ratings. One case with BEEAM Certification due to be approved.	Not provided.

5.2. The ratio between the guidelines and the requirements

As already mentioned before, the design guidelines come as a response to the welfare requirements connected to the functional and spatial design, and the social and economic-environmental sustainability, each one introduced in chapter 4. For that reason, understanding what design criteria meet the requirement demand of the user is certainly crucial. The table below correlates the connection between the criteria and the requirements. A more in-depth analysis of each connection is described in the paragraph 5.1., and its related charts.

The left column reports the requirements: from a. to f., there are those ones oriented toward the cost-efficiency and ecological requirements, from g. to l. there is the group of the social sustainability, while the last six, from m. to r., relate the well-being related to the spatial and functional configuration of the environment. Most of all, the table shows that each of the guidelines have connections with multiple requirements, which may also belong to different thematic areas.

In the context of the social sustainability there is the highest concentration of guidelines, which means that every choice, taken in the design process, has strong repercussions (even indirectly) on the social welfare of the inhabitants. It is also interesting to note how the requirement j. (Ensuring balance between individual and collective from the building to the urban scale) is satisfied by all the criteria and therefore represents an essential step for designers. Criterion 5. (Designing flexibilities), in addition to meet the greater number of requirements, also covers the largest amount of thematic areas.

Nowadays "design flexibility", "flexibility of use" and "flexibility over time" are one of the greatest available tool in reading, interpreting, and answering a demand expressed by the population, moreover characterized by a complex social dynamism and oriented toward a request of performance increasingly more defined.

requirements \ guidelines	1. Balanced communities	2. Outdoor space and the public realm	3. Building configuration and accessing flats	4. Providing flats that match family needs	5. Designing flexibilities	6. Privacy demand	7. Maximizing the presence of nature	8. Environmental and economic sustainability
a. Improving environmental indoor comfort			●	●	●		●	●
b. Achieving optimized energy values		●	●		●		●	●
c. Reducing waste of materials					●			●
d. Minimizing material transport								●
e. Accelerating construction processes								●
f. Fostering constructive and combinatory flexibility								●
g. Allowing the coexistence of people of the same group	●		●	●	●	●		●
h. Providing different social dynamics in time				●	●	●		
i. Feeling sense of belonging to a community and a place	●	●	●	●	●		●	
j. Ensuring balance between individual and collective	●	●	●	●	●	●	●	●
k. Allowing a profitable coexistence of different people	●	●	●		●	●		
l. Pursuing high density of relationships	●	●	●		●			
m. Ensuring sanitary and environmental wellness		●	●	●	●		●	●
n. Securing the safety of inhabitants		●	●	●				●
o. Predicting that sizing which allows an optimal welfare			●	●	●	●		●
p. Guaranteeing accessibility to all types of users		●	●	●	●			
q. Promoting visual comfort		●	●	●			●	
r. Providing the user with the most suitable equipment				●	●	●		●

Fig. 1. Connections between design guidelines and requirements

6. Summary and perspectives for development

6.1. Summary of the findings

This thesis has demonstrated the functional, spatial, ecological and economic benefits that a certain design choices can bring in the social housing context. The variety and quantity of information produced have further confirmed the complexity and the multidisciplinary nature of the topic. A quality accommodation, which guarantees access to a dignified life, is the result of multi criteria strategies that operate on temporal and spatial scales varying from single compartment housing the the city system.

For the above set out reasons, this research has adopted a mid-project approach, aided by the analysis of some virtuous case studies. The main results, reported in the previous chapter and translated into design guidelines, which meet the specific social and environmental requirements, constitute an original contribution to the current specialized literary.

The requirements have been grouped, according to their belonging to a certain topic: the quality linked to the spatial and functional configuration, the economic and ecological sustainability, the social welfare both inside and outside the house. The analysis shows those factors of space structuring that could enhance the value of the connections between architectural intervention and urban structure.

The critical evaluation of samples examined in the cities of Milan, London and São Paulo has translated into theoretical knowledge the project ideas which have already been tried with success, and has allowed to formulate the guidelines to be taken for the regeneration of urban areas that find, in social housing and in the integration between urban functions and socio-economic mix, characterising elements and types the meet the new living needs.

The main items of interest have been used for the construction of a comparison grid between experiments conducted in the different geographical areas. Densification of the existing, architectural quality and low budget related to social sustainability and energy control, are gathered in more than sixty criteria, divided into eight macro-areas of investigation.

The first two charts, "Balanced Community" and "Outdoor space and the public realm" have shown that the current placemaking approach could be further enhanced, even through the increase in the percentage of large families, which is currently quite small in every city. The functional mix is the prerogative of all new interventions for social housing, but the success of this strategy is intrinsically linked to the deepening of the principle of proximity and the development of the public attractors. As regards the building system, analyzed in "Configuration of the building and access to housing units", Italy has revealed a deficiency in typological variation

access units and, together with the other two areas, the lack of condominium space for recreational activities and for working at home. The scale of the accommodation has denounced a considerable gap in the private green provision at ground floor: the London context show a high percentage, unlike Milan and St. Paul, where this criterion is totally excluded.
The "project", "use" and "over time" flexibility, addressed in "Designing flexibilities", together with the involvement of users in the design process, are among the major tools available for the reading, interpretation, and the satisfaction of the housing demand, which is characterized by an increasingly complex social dynamism, oriented toward specific performance needs. From the requests for visual and acoustic privacy within dwellings and in relation to the outer-city, the study has brought up some interesting solutions, often associated with the significant presence of green areas, both collective and private.
The latest macro-area presented, "Environmental and economic sustainability", has stressed the importance of the English examples, where the innovation in the design of the life cycle is mainly oriented to the containment of costs and energy waste. Recently Brazil is investing such these resources and energies; however, innovative technologies are still at an early stage and, especially, they do not involve examples that have valuable spatial and architectural solutions, such as those presented in this research. In the future the Brazilian social housing will have a duty to integrate the rules of good architectural practice, taught Brazilian internationally recognized schools and demonstrated by the excellence of illustrious projects, with more evolved green and low cost technologies.

6.2. Practical implications and further possible developments

The critical analysis transversely carried out in various areas of the research have defined a series of guidelines as effective tools to use in the social housing design. The pursuit of scientific results, aimed at the more possible accuracy of the analysis, has been one of the goals of this study. The nature of the results achieved allows, however, a certain margin of freedom in imagining, designing, and providing a response to the housing demand, considering the social factor as decisive. The identified design criteria may be reflected in various fields of application.

First of all, they have been designed for those who work in this field (professionals, technical institutions, private operators etc.). They could also support those students that face this residential topic, or the future tenants, more concerned in expressing their own living needs.

The criteria can further be used as quality parameters in the evaluation of project proposals, both in private and public architecture competitions, or within analysis carried out by the municipalities and local authorities, on the existing stock, to lay down the appropriate intervention strategies to be adopted in order to meet the requirements related to a long-term sustainability. Finally they could integrate the technical regulations in force and become further instruments to increase the overall

quality of social housing projects and their urban context, promoting a planning approach more transversal and holistic.

A further development of this research would require to verify, within the Italian context, the goodness of the criteria extrapolated from the literature and the case studies, or, at least, of the more innovative ones. It would be crucial to understand if a design that uses these tools produces an increase in the overall welfare of the social (and private) users, and how, and also of the neighborhood community.

In this sense there should be carried out a series of studies on buildings in use, which deepen the comparison between different models of management of the social housing, with particular attention to the cost-benefits dynamic, with detailed quantitative data, also related to systems of rentals and sales, and on the systems of home access, also involving government departments, associations and companies that operate within this market.

It is necessary to understand which solutions, although effective in confined ambit, should be abandoned (or re thought) because they result inconvenient for the overall budget. The ultimate goal will be further promoting strategies underlying the formation of a global wellness, which baits from the boundaries of the construction industry and extends the benefits of the social mixité and the environmental awareness, to an wider and articulated urban context.

7. Photo credits

Chapter 2

fig.1 Housing statistics in the European Union 2010
fig.2 Eurostat
fig.3 www.skyscrapercity.com
fig.4 www.gbrlferraresi.tumblr.com
fig.5 S.Greenhalgh and J. Moss. *Principles for Social Housing Reform.* Localis Research: London
fig.6 www.flickr.com
fig.7 www.flickriver.com
fig.8 www.flickr.com
fig.9 www.megat.tumblr.com
fig.10 www.forums.luxology.com

Chapter 4

1. Abitare Milano

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2. Morris House

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3. Donnybrook Quarter

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4. Bourbon Lane

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5. Via Gallarate

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6. Adelaide Wharf

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7. Complesso Nuovo Portello

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8. Residencial Alexandre Mackenzie

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9. Conjunto Habitacional Vila Mara - Rio das Pedras

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10. Conjunto Habitacional Heliópolis

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