

41<sup>st</sup> IAHS WORLD CONGRESS  
Sustainability and Innovation for the Future  
13-16<sup>th</sup> September 2016  
Albufeira, Algarve, Portugal

## THE ARCHITECTURAL AND ENVIRONMENTAL RETROFITTING OF PUBLIC SOCIAL HOUSING AS A RESOURCE FOR CONTEMPORARY CITIES. THE REDESIGN OF BUILDING ENVELOPES

Roberto Bianchi<sup>1</sup> and Spartaco Paris<sup>2\*</sup>

1: Department of Pianificazione Design Tecnologia dell'Architettura - PDTA  
Faculty of Architecture  
Sapienza University of Rome  
e-mail: roberto.bianchi@uniroma1.it, web: <http://www.architettura.uniroma1.it>

2: Department of Ingegneria Strutturale e Geotecnica - DiSG  
Faculty of Architecture  
Sapienza University of Rome  
e-mail: Spartaco.Paris@uniroma1.it, web: <http://www.architettura.uniroma1.it>

**Keywords:** Retrofit, Regeneration, Construction, Suburbs, Building envelope

**Abstract** *The current focus on the transformation of Western cities puts forward, in a shared and far-reaching manner, 'degrowth' as an opportunity to renew and update the perspective of sustainability, not only from an environmental point of view, but from a social and economic point of view as well. The most modern updated legislation is also headed in this direction: considering building stock as a resource for renovation, adopting policies and strategies aimed at reducing land and energy consumption, reusing and recycling building stock.*

*Nowadays, the interpretation of the terms Reduce, Reuse, Recycle in relation to urban development offers the opportunity to create a new generation of spaces and architectures that sees buildings – dilapidated, neglected, worn out or abandoned – as a real resource and, hence, value. Renovations concern new programmes and projects for rethinking the uses, meanings and the values contained in existing construction (from individual buildings to whole neighbourhoods) and which can change.*

*Within this scenario, suburbs are now considered part of the contemporary city and they are becoming the object of particular attention from those who are involved in urban planning and managing urban developments. Among the resources that have already been built, social housing stock is a wide field of investigation, from different points of view.*

*This built heritage can involve different levels of building and space transformation and defines various design approaches: the overall architectural quality is to be acknowledged.*

*These design approaches reinterpret regeneration activities and are not just limited to the 'technical' renovation of buildings: they also take into account the consequent urban, social and economic implications.*

## 1. IMPROVEMENT STRATEGIES AND METHODS FOR REDEVELOPING PUBLIC HOUSING IN EUROPE

Public housing renovation projects are now an opportunity and a resource for redesigning and retrofitting public built heritage with a view to environmental, social and economic sustainability [1].

Today's updated regulations and recent European political strategies – aimed to reduce land consumption, to save energy and to re-use the built environment – consider renovation projects an opportunity to reinterpret, regenerate and modernize entire housing estates. With this aim in mind, densely populated 'modern' public housing estates in Europe have been redeveloped in recent years, estates originally built in the 1960s and '70s. When we consider these improvement projects, which involve different levels of public space and building renovation, we can identify different design approaches of significant architectural quality, influenced by best practices that are useful when working in such a complicated and complex cultural sphere [2].

These 'anti-*tabula rasa*' approaches to design offer a new approach to redevelopment projects and do not limit themselves to upgrading buildings to conform to current technical regulations and modern functions and typologies. Instead, they consider the urban, social and economic implications. These projects adopt operational strategies that involve the addition or integration of new areas instead of focusing on demolition; they make the most of light construction technologies and innovative organizational and practical construction site methods; they adopt principles oriented towards a prudent use of means, using low-cost materials and industrialized systems and components; they use standardized construction solutions that match existing structures and allow residents to remain in their homes during the entire duration of the renovation work, reducing the social distress caused by having to temporarily move house; they draw on passive technological systems; they envisage flexible, functional environments that are open, multiple and indeterminate and that can be easily adapted over time to the various different lifestyles of residents. These renovation projects have the merit of determining the best conditions for social integration and 'inclusion', as found in the renovation measures established by mutually agreed European political strategies [3].

In adopting the principle of recognizability, suburban public districts and buildings – characterized by the monotonous, serial, uniform nature of both buildings and public spaces – are being redeveloped/regenerated/reutilized. These original factors, a result of the political choices and standardized construction methods of a particular phase in the construction industry, are collectively recognized (both by citizens and public opinion) as non-values and elements that are in themselves of no quality.

In such an international benchmark scenario, we can distinguish two prevailing types of redevelopment project from a reading of a series of case studies completed in Europe over the past ten years, projects that identify recurring strategies and attitudes.

The first type of redevelopment project envisages 'light' retrofit improvements that involve the architectural and environmental redevelopment of communal areas (entrances, terraces and open spaces), the addition of small units on flat roofs and the incorporation of a new building envelope to improve the energy efficiency of an existing building (retrofit). The typology of the apartments remains almost entirely unchanged, except for tiny alterations to partition walls,

designed to make a building's functional organization more efficient. Changes are mainly made to optimize the natural ventilation and lighting of apartments by enlarging and rearranging windows and doors and adding natural ventilation shafts that take advantage of existing wiring and heating ducts.

Some architects have spent years working on the restyling of building envelopes, experimenting with new external wall insulation systems – notoriously unpopular among architects themselves – and thus tangibly demonstrating the possibilities for redesigning a building's facade with a three-dimensional remodeling, implemented by overlapping insulation layers, glued together, combined with the dry assembly of subtle cladding features.

This first type of approach includes redevelopment projects like those undertaken by the architects Lion, Lepierre, Gap, Berim with their *Squesredessports* homes in Gonesse, France (2010) and Kempe Thill's Europarei housing estate in Uithoorn, the Netherlands (2012). As well as redesigning the facades with new windows, doors and insulated, high-performance sandwich panels, these improvement projects envisaged the use of external wall insulation systems, new solar panel and thermal collector systems and glass panes that turned balconies and open galleries into conservatories for accumulating heat in the winter and thus halving a building's total energy consumption. In addition, small annexes were built near the entrances on the ground floors and on flat roofs and outdoor common areas were redeveloped.

The second method is implemented using 'medium-scale' improvements that involve fitting a new energetically sustainable envelope, the addition of galleries, balconies, conservatories fitted with solar control glass, functional ground floor areas and new annexes on the roof and/or extended from the existing building. The construction of new staircases and lifts on the outside of a building permits us to convert vertical stairwells and distribution shafts into indoor ventilation and lighting atria. The original indoor layout and its common spaces are rearranged.

These renovation strategies are particularly widespread and can be recognized in the Winterthur residential tower in Switzerland (2009) designed by Burkhalter Sumi and Albisetti and in a series of projects constructed in France in recent years, such as the homes located in the Genicart district of Lormont (2009) by the LAN architectural firm, the residential building in Paris (2013) by Aasb\_Agence d'Architecture Suzelbrout and the apartments in Sant-Nazaire (2014) designed by Lacaton&Vassal and Druot.

In the above mentioned projects, the new, prefabricated, light sections were designed to be seamlessly connected to the existing buildings thanks to a double system of galleries and balconies that act as a filter between the building and the exterior. Covered galleries became flexible, functional spaces that turn into winter gardens in the colder months of the year, thanks to a double system of sliding glass doors. The glass parapet along the edge of the balconies allows people to enjoy a view of the surrounding landscape, forming a continuous interior-exterior walkway. The facades were clad in light, prefabricated, pre-plastered polycarbonate panels and in pre-painted, corrugated, micro-perforated metal. South-facing glass areas were fitted with indoor PVC curtains. Redevelopment work affected both indoor common areas and outdoor common garden areas, which were completely redesigned and rationalized with small, multi-purpose, functional spaces.

The definition of a case history of the most commonly adopted improvement strategies used in

these two categories/methods – light retrofit and medium retrofit – can be an initially useful tool, providing a chart of retrofit improvements with different degrees of impact on buildings and their residents, adjusted to suit the lack of public funds available for carrying out improvements on housing stock:

*Light retrofit*

- Maintains existing typologies;
- Optimises natural ventilation by introducing natural ventilation shafts;
- Optimises natural lighting by modifying doors and windows;
- Reduces energy consumption by improving building envelopes;
- Renovates the architectural features and energy efficiency of common areas (terraces, entrances, open spaces etc.).

*Medium retrofit*

- Modifies the interior layout and the size of apartments;
- Adds new public spaces on the ground floor and builds new apartments on flat roofs using prefabricated construction systems;
- Re-uses vertical distribution shafts and stairwells to create indoor ventilation and lighting atria;
- Builds new staircases and lifts on the outside of a building;
- Builds new open galleries, balconies and conservatories fitted with solar control glass;
- Builds new uses for roof areas (renewable energy source systems, collective uses, vegetable gardens).

## **2. REDEVELOPMENT SCENARIOS IN ITALIAN PUBLIC HOUSING**

In Western cities (and in the cities of today’s emerging economies), large-scale ‘modern’ housing estates – both public and private, which constitute the planned parts of a city, designed and constructed in separate stages – are an enormous shared asset that require policies and improvements designed to integrate and upgrade these built resources.

Urban, town planning and territorial management policies generally all share two aims: that of recognizing land as a limited resource that needs to be preserved, and the need to upgrade existing housing stock in order to transform it into a lasting value that is less energy hungry. Even the architectural field’s most authoritative and esteemed figures recognize that the parts of a city termed ‘suburbs’ are an immense built resource that will need work in the coming years to improve and include them in the city in a way that meets the needs of the contemporary habitat.

There is a widespread awareness in Italy, too, that improvements launched by legislation on public housing are the outcome of town plans where parts of cities were designed with clear urban layouts and are still, *de facto*, benchmarks of suburban planning.

Such districts – both as far as the way they were envisaged and the way they were constructed are concerned – are now recognizable parts of the city, even when they are not perfect examples of urban and residential quality, areas that require, above all, renovation strategies and improvements rather than ‘tabula rasa’ actions that are now no longer economically, socially or environmentally sustainable.

When it comes to the issue of renovation, housing estates and single buildings have become an interesting and ‘necessary’ subject for study and for critical reassessment, where the same construction systems – as regards the housing built from the late 1960s to the early 1980s – have already demonstrated the weaknesses of policies where the priority to build as cheaply as possible has now clearly proven its inadequacy after less than 50 years.

Thus, tangible cases of buildings and districts that require renovation strategies and projects and that are still publicly owned are the subject of experimentation; this is being done in the conviction that it is possible to launch innovative socially, economically and environmentally sustainable policies thanks to an organic and unified administrative approach. By starting with public housing, we can define models that can be reproduced in the private sector as well, as happened, after all, when constructing planned cities. Some of the problems that recur in districts made possible by Law 167 include – apart from similar conditions of physical decay and energy inefficiency – the lack of, or inadequacy of, services, the undefined use of open spaces and the prevailing condition of buildings and districts that are entirely residential in nature.

Today, policies designed to incentives urban and building regeneration, energy efficiency and the reduced consumption of our built environment are generally applied to private properties on the scale of individual apartments and not of buildings as a whole. The chance to study and intervene on buildings owned by one single body, such as ATER housing authorities, is an enormous opportunity to plan choices rationally, choices whose repercussions can create real occasions for urban, economic and social regeneration, for making building administration cost-efficient and creating buildings that are social resources, as well as energy resources.

The methodology applied to the case studies adopted design solutions that set themselves a series of preliminary aims, in line with the trends now seen in the most innovative international approaches to existing housing stock:

1. Improvement strategies that prioritize the reduction of land consumption by increasing the number of apartments – based on new social requirements – within one building;
2. Renovation work that improves the overall energy performance of buildings with comprehensive improvements that can be implemented in separate phases on the building envelope, on its energy production systems and on intermediate social spaces and common areas;
3. The definition of building use strategies that help reduce tenants’ social distress as much as possible;
4. The new identity of public housing estates, by improving potential uses that can engender new non-residential social and economic functions in buildings and their open spaces.

Design projects involved alterations that removed, added and shifted various elements, such as: the redesign of outdoor spaces, featuring public gardens as well as gardens belonging to private apartments on the ground floor; the upgrading of the ground floors and distribution areas with the addition of useful public services and new common areas encouraging social activities; the rearrangement of apartments involving a layout that could diversify the type and size of flats available, with a rational and flexible arrangement of rooms, thus tailoring houses to suit different needs.

As far as a building's construction was concerned, design projects mainly affected the building envelope, prioritizing the choice of functional, simplified structural systems, preferably dry-assembled, that would suit the existing building and technological solutions from the most innovative production sector.

In partnership with ATER housing authorities, two design experiments were launched, applied to two case studies that differed in age, construction characteristics and in housing density – from low-to-average to high, and then high housing density – located in the boroughs of Rome and Latina respectively. Despite featuring different residential characteristics, what prevails is a common distance from the human scale of public spaces and similar conditions of physical and architectural decay, particularly in common areas. Both case studies featured excessive energy consumption, due to the inadequate state of the building envelopes, and an inefficient administration of heating and electricity systems; they also shared similar social problems caused by the lack or inadequacy of services and the lack of a sustainable use of public spaces and the 'parterre' (an illogical use of parking areas and neglected gardens).

Such similarities raise different possibilities for improving the conditions that would be in line with different levels of architectural renovation: from a minimum level where the economic and physical impact of the renovations is minor and in keeping with the social needs of residents (who can remain in their homes during the renovation work) up to more complex redevelopment work that tackles the replacement and integration not only of the 'light' parts of a building but of the 'heavy' parts as well.

From a structural point of view, this requires a diagnosis of the current state of a building and an assessment of how much existing structures can sustain any extension work. As regards the Italian case studies, seismic vulnerability imposes severe limits on improvements that must not increase the seismic risk of existing buildings. As regards this aspect, it is necessary to identify improvements that are structurally independent of existing structures; or in the case of superfluous additions, it is necessary to envisage a structural seismic upgrade that can include significant improvements to existing structures as well.

The results of this experimental design work can constitute the basis for defining renovation models that, though impossible to reproduce within the heterogeneous body of public housing stock, propose categories of improvements that are recurrent, possible and usually compatible with the interpretation of housing stock – from an entire district to a single building – as a 'resource' worth upgrading and as an opportunity for creating economic, social and environmental value.

## REFERENCES

- [1] V. Bearth, Introduction to *Riuso del Patrimonio Architettonico*, edited by B. Reichlin, B. Pedretti, Mendrisio Academy Press/Silvana Editoriale, Cinisello Balsamo, Milan, Italy, pp.7-8, 2011.
- [2] P. Baldi, 'Qualità dell'architettura, riciclo del paesaggio', in *Re-cycle: Strategie per l'Architettura, la Città e il Pianeta*, edited by P. Ciorra, S. Marini, Electa, Milan, Italy, pp. 12-15, 2011.
- [3] J. Mozas, 'Remediate, Reuse, Recycle: Re-processes as Atonement', in a+t *Reclaim: Remediate Reuse Recycle*, independent magazine of architecture+tecnology, no.39-40, a+t architecture publishers, Vitoria-Gasteiz, Spain, spring-autumn, pp.4-25, 2012.



Figure 1. The redesign of building envelopes. From left above: ante operam and post operam of Rehabilitation residential complex Europarei, Uithoorn, Netherlands, 2012. Project of soft retrofit Kempe Thill; Rehabilitation of 709 housing units, Lormont, Francia, 2014. Project of medium retrofit LAN Architectur; Re-furbishment of an apartment building, Saint-Nazaire, Francia, 2014. Project of medium retrofit Druot, Lacaton & Vassal.



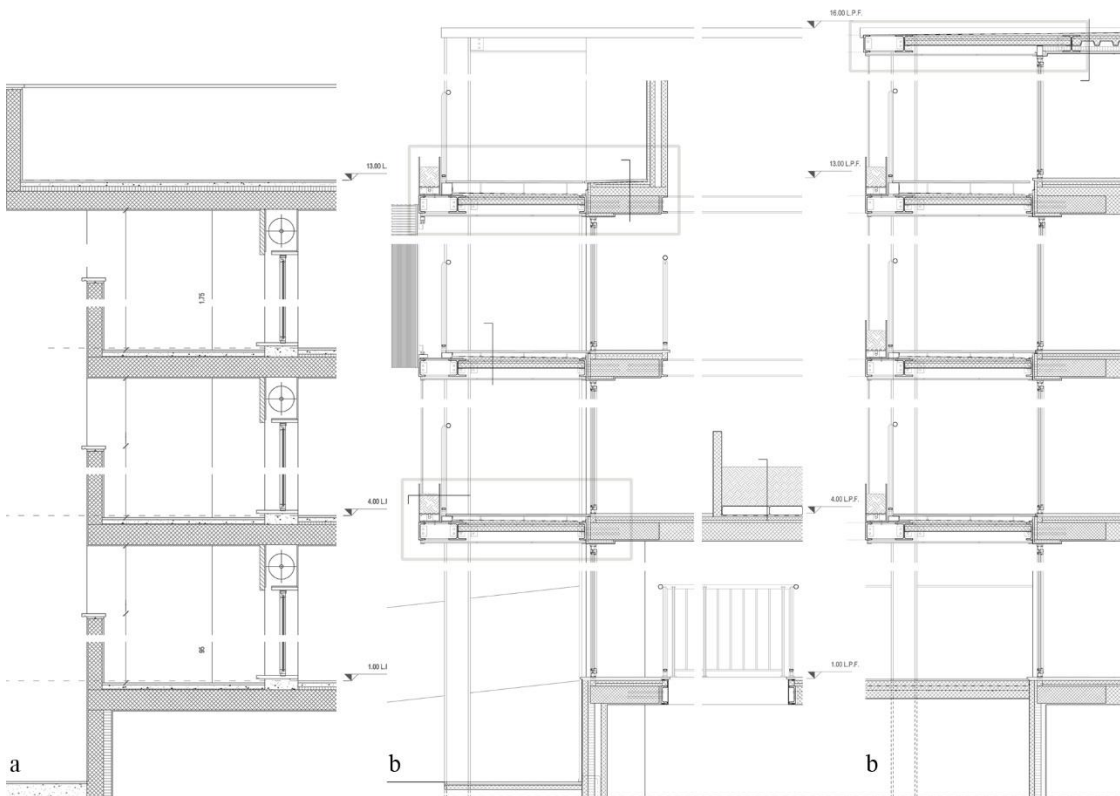


Figure 2. The redesign of building envelopes. Architectural and environmental retrofit of public social housing. Casale Caletto, Rome, Italy. a. before b. after