

# Urban Rehabilitation Towards Sustainability

Patrícia Oliveira

*University of Minho, School of Engineering, Department of Civil Engineering, Guimarães, Portugal  
b5829@civil.uminho.pt*

Luís Bragança

*University of Minho, School of Engineering, Department of Civil Engineering, Guimarães, Portugal  
braganca@civil.uminho.pt*

**ABSTRACT:** The sustainable concern is nowadays reflected in construction, reconstruction and rehabilitation of the building and how it can contribute to a lower environmental impact. Is intended to understand how the culture expressions forms, by the (re)construction and, of architectural styles in their inherent periods, is able to transform implicitly with creativity in the evolution of cities and societies. To reverse the amorphous urban area situation, it is necessary to intervene with sustainable geniality based on particular policies and strategies to regenerate the built space contributing to a sustainable social, economical and environmental growth and development. Why rehabilitate? What is the weight of rehabilitation on sustainability? These are some questions seeking an answer approach on the development of this paper. It is further developed as a sustainable city reference, the city of Freiburg im Breisgau, Germany, due to the implementation of reconstruction and rehabilitation policies and measures environmentally viable.

## 1 INTRODUCTION

Currently the concept of sustainable urban design focuses on energy efficiency, involving principles based on energy resources effectiveness, reducing waste and pollution, in the community configuration and structure, in their health and well-being. Notwithstanding is the implementation of a sustainable urban design plan and their own buildings, searching for the proliferation of a community independently able to support themselves using renewable energies and sustainable practices, environmentally friendly, based on people daily needs.

Nevertheless, sustainability is still perceived as an added value and not as a basic and substantial need to the cities development, maybe because of the actual mentality in most cities where the society presents itself as “lazy” and accommodated. Regarding the urban rehabilitation, the urban centres preservation and of their architectural and cultural heritage maintenance. Is breathed the need for evolution, though much more controlled and orderly than any urban area, that does not have this significant weight of the cities evolution history involve. It is also required an adequate intervention in the urban revitalization and sustainable spatiality adaptation, so that can provide life experiences and forms that are integrated into the premises currently required to society. City centres are devoid of people, it is necessary to overcome this situation and implement strategic plans for sustainable development in action. But, how play the lead role in urban growth and development according to the reality and contemporary exigency, following sustainable principles and environmentally healthy? Stimulate sustainability and implement promoting measures to the attractiveness and optimization of energetic-environmental redesign to the built means (Tirone, 2007), can be an important development solution, but should also be made according to a set of parameters that can be revitalizing to the city. The rehabilitation of urban centres must have in consideration design liability premises contributing so

to a cost reduction, of fuel consumption and reducing the pollution level in order of a better quality of life and therefore, a better environment.

## 2 IMPORTANCE OF REHABILITATION TOWARDS SUSTAINABILITY: WHY SHOULD WE REHABILITATE?

During the last decades, the cities decentralization was witnessed, in the seeking of better living conditions. The privileged in society are often able to improve their quality of life, for instance by moving to better neighbourhoods or to the countryside in order to escape from unhealthy conditions (EEA, 2009a). As consequence this factor has developed disqualifying physical, functional and built environment in the historic centres and their significant urban degradation.

What is the importance of urban regeneration in the context of sustainability? Firstly it is necessary to understand what implies rehabilitating. Rehabilitate the urban environment –public and built space – implies inhabiting existing buildings, so that they can acquire life and thus assigning movement to the public spaces. To inhabit these buildings it is necessary to recover them, providing good living conditions, space functionality and environmental effectiveness, that is, rehabilitate the existing buildings, improving their efficiency.

Built environment rehabilitation is not limited to heritage conservation factor. According to João Belo Rodeia (2009b), urban rehabilitation aims to enhance citizens life quality by improving the built environment. Therefore, the rehabilitation must be conducted with the intention of promoting spaces with effective premises to give responsiveness to current requirements and social, economic and environmental values integration. The heritage conservation and urban rehabilitation are strategic areas for Europe, due to its rich comprise cities historical culture character, and so is naturally concerned about the urban policies sustainability. The shift to more sustainable lifestyles is therefore not simply a matter of putting the environment first but also about recognizing that the economic viability of cities must built on a sustainable basis of long-term social, environmental and economic stability and equity (EEA, 2009a). It is then need to ensure the evolving mentalities so that can be available to face a new perspective on quality of life, based this time on sustainability, generating a real increase in quality of life equal to all social groups and encouraging developments so that does not prejudice the future generations. Lies with policymakers to clarify these factors in order to use them as a basis for sustainable cities development so that can effectively contribute to a urban sustainability successful strategy.

## 3 TO A SUSTAINABLE DEVELOPMENT

Rehabilitation allows the reconciliation of the urban society and city centre decline, provides the social cohesion and minimizes the environmental impact caused by urban development. The Charter of European Cities & Towns towards Sustainability, usually known as Aalborg Charter, comes to show this reason, when it refers the urban sustainability principles by seeking to ensure sustainable development as a creative process, local and balanced; an urban economy that works for sustainability and where natural capital is a development limiting factor; creation of employment in according to sustainable principles whereas economic inequality is reflected in unsustainable behavior blocking the evolutionary process; development of planning policies carried out by the city itself where are shown the environmental impact assessment taking advantage of the opportunities offered by large urban agglomerations, having essentially in account the public transport services, energy supplies and, the spread of strategies to reduce the use of means of individual transport modes and stimulating the use of "environmentally friendly" transports.

The cities governors can and must boost changes in inhabitants' behavior reducing the negative impacts of urban development both in the urban sprawl and urban growth based on the automobile utilization (EEA, 2009a).

Rehabilitation permits the exploitation of resources and preexistent infrastructure and consequently reduces the consumption of raw materials, decreases the waste production from construction, and reduces also the fuel consumption for the transportation of raw materials and adjacent work materials. The regeneration allows also the neighbourhood economic revitalization as well as the replacement of the comfort associated with the security that entails each space.

According to UNESCO Director-General, Irina Bokova, (2010) the provision of equal access to social services is crucial, not only because of the social justice question but also as an essential contribution to sustainability in the urban environment. Cities dwellers have to be equally able to access, independently of their origins, to a good education quality, to a sustainable urban water supply, greener, efficiently energetic, and to a full range of cultural activities which focuses on diversity. It is necessary the implementation of integrated strategies in the urban context covering the spatial diversity of urban regeneration.

#### 4 SUSTAINABLE STRATEGIES: REUSING MATERIALS

Cities have to be reproduced and therefore change is something inherent in reality and urban condition. Cities have to follow the time progress and therefore should be attractive and provide production clusters in which people feel able to live, to experience culture, leisure and entertainment. It is needed the regeneration of the city having into consideration a new ecological dimension and in a kind of challenge, in search of the environmental impact reduction caused by the pollution from constructions and everything that comes from these. For this, reusing the existing building by itself is not enough. This is not about heritage rehabilitation by "washing building faces", in a sustainable perspective, it is also necessary to reuse the building components that are in a position to do so and providing the material recycling, applying them whenever possible in the same construction works. Paola Sassi (2006) states that to minimize the need for new materials, it is important to use the maximum of existent materials. Furthermore, the reutilization of these existent materials, reduces the impact associated to the waste elimination. The way to assure a greater extension of life to buildings is having in mind an "environmental solidarity", that is, designing carefully to promote the minor environmental impact as possible, and also formulating the building so that it can be changed functionally, relatively easily, through the own structure flexibility. The materials reutilization is always preferable to its recycling. This should be avoided whenever as possible, but when materials are not reusable or economically unviable the solution involves the inevitable recycling and this is facilitated if the materials are the purest as possible.

An eco-efficient reconstruction will bring benefits to the communities through the reduction of long-term operating costs of the construction, in the economy, biomass and fuel consumption and in the reduction of water and electricity consumption.

##### 4.1 *Focusing Passive Design*

Cities are the focus of energy and other resources consumption (EEA, 2009a) and it is exactly on the urban scale where occurs the amplification of the problems related to the energy resources consumption and on the fossil fuels conservation more conducive to the environment. Energy efficiency is part of an integrated search for a sustainable development considering the impact on regional and global atmosphere, on earth, water, vegetation, wild life and human population (EC, 1999).

Generically, the passive design strategy tries to promote good environmental performance buildings through their architecture. The architectural design provides the maximization of the solar radiation catchment for storage to use in winter heating and in the summer seeks to protect and dissipating the heat away from buildings reducing the energy consumption needs to obtain a pleasant thermal comfort in the building. In accordance with Livia Tirone (2007) over the years it was verified that human activities have changed and, what city dwellers currently require, regarding the health and comfort at home, is quite different from the reality experienced in previous decades. Also states that a traditional mediterranean house replies passive and naturally to the needs for which it was created but, may only artificially respond to the needs of an healthy and comfort required nowadays. But what affects the dwellings comfort? The comfort is affected by the air temperature, wind and his movements, the humidity and by the solar radiation. Is there a solution for such problems? Taking advantage of the same factors at the time of architectural design without thereby disturb the environment. It can be said that a building will have a

lower environmental impact when it contemplates the use of natural elements such as wind, sun, water and building materials themselves, in search of the actual comfort needs.

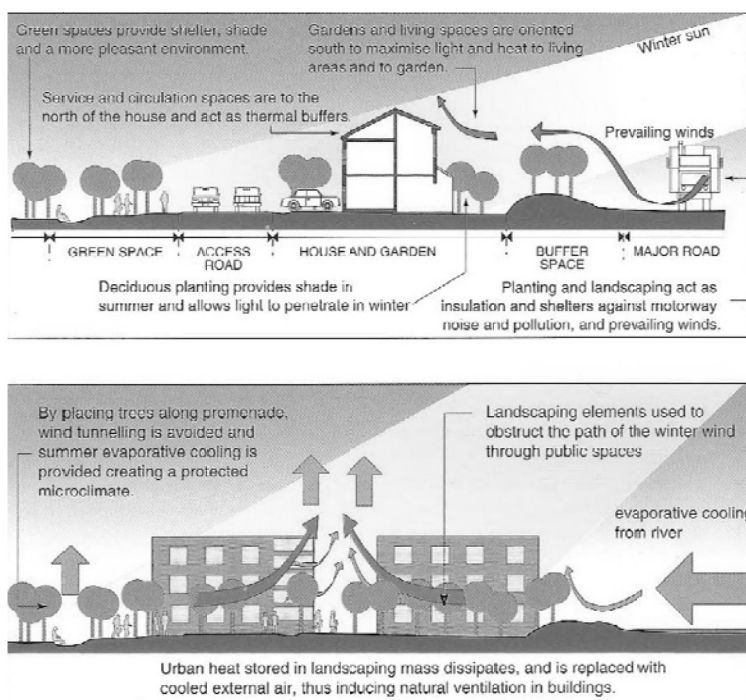


Figure 1. Some strategies for residential and commercial buildings, (source: A Green Vitruvius, 1999).

Exist in the cities a strong relationship between shapes and urban spaces, and it is convenient to use the urban design as a strategy for energetic efficiency. This premise during the urban design decision-making can allow a significant improvement in the local microclimate through the shelter creation on the excessive exposure to sunlight or wind spaces, and can also mitigate negative impacts of urban conditions (EC, 1999). Nevertheless, it is also a matter of balancing passive strategies relations, which should always be reflected through their annual performance, with other aspects of environmental fulfillment, particularly natural ventilation and lighting.

#### 4.2 Addressing Natural Light

In the urban network spaces are liable to the reception of sunlight, but in most cases city components, structures, buildings and other urban elements are causing obstruction to the direct solar radiation. In rehabilitation of the urban centres built environment is necessary to rethink current policies in order to improve the efficient natural factors use, as light, during its sustainable intervention. Location is obviously a very important factor when discusses the lighting impact in the built spaces. Urban form is the result of a complex set of pressures and influences acting on a interdependent feature: climatic, economic, social, political, strategic, aesthetic, technical and regulatory, and so urban climate differs according to the territory, territorial obstruction, which surrounds itself (EC, 1999).

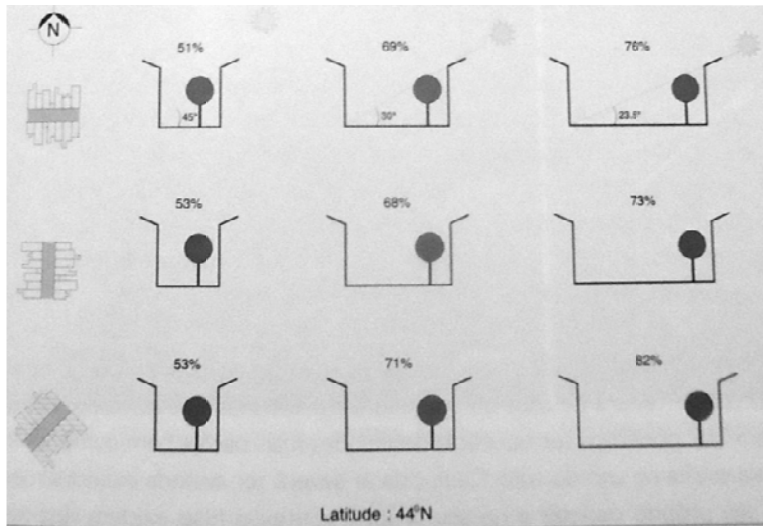


Figure 2. Solar access to buildings related to obstruction distances, (source: A Green Vitruvius, 1999).

The effectiveness of sunlight in the built environment depends on other factors of the microclimate which make this to become in a benefit or a disadvantage. Depending upon a lot of latitude to which the object is constructed, the sun can be the most important factor on their exposure or on protection during the summer. The buildings orientation and location, on spatial urban plan constitutes a conditioning factor on urban centres rehabilitation since neither all of the city configuration is provided with a good location in relation to sun exposure and therefore it is necessary to complement and appeal in order to take advantage of all natural elements to optimizing the building energy performance. It is not possible to outline specific rules generalizing to intervention cases, it is necessary to implement them in the cities. These range in terms of latitude, altitude, in the own climate and therefore also vary the climacteric conditions. In the building, the amount of natural light available inside varies depending on the position of the same territory, by the degree of shading that it is subject to, for the disposal landscape in the surrounding and for the exterior finishes that the buildings presents (EC, 1999).

The clear soil and adjacent building surfaces increase the light amount available inside of the buildings for many reasons, being the most evident by conduction, which according to Rafael S. Florensa (1995) this type of illumination are spaces also understood as non-habitable spaces designed specifically to conduct the solar radiation to certain areas of the building, and for the own surfaces reflection. The incident natural light on built space as a great influence on the visual and comfort quality of the same. Light can be captured through several solutions or mechanisms, and is mentioned as example the skylights, door banners glass, domes or even reflective blades among others. In the existing building, is necessary to rethink, in many cases, how the natural light can reach an area with greater amplitude.

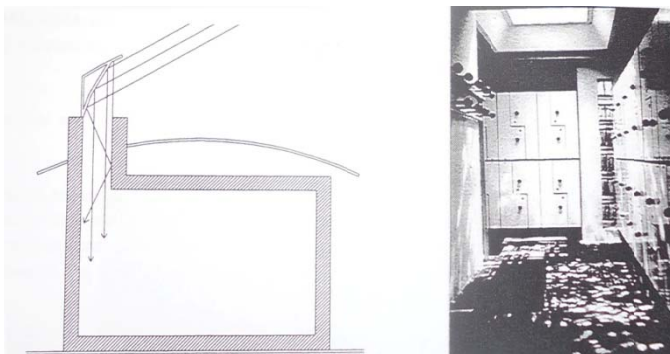


Figure 3. Example of illumination by conduction, (source: Florensa, 1995).

In the public space rehabilitation, care falls on the trees placement. These elements, when they do not have a well planned position, are reflected in a reduction of the light transmission even if they are native and deciduous elements. To prevent this fact, the ideal would be to locate trees on the building southern slope taking into account their height and distances they may have to the built facades. The solar exposure should contribute to the energy storage and exploitation of consumption not only for the building consumption, in the case of direct and indirect solar gains, but also to generate consumable energy to the distribution on a network for the society consumption. Why not take the urban regeneration and create a platform of solar energy to serve the city? As did Freiburg im Breisgau, Germany, after the bombing suffered during the world war, in the reconstruction of urban and planning of renewable energy.

## 5 ANALYZING FREIBURG

Like many other European cities the urban center of Freiburg was bombed during the II World War resulting in the destruction of almost 80% of the old city being rebuilt according to the preexistences of the old historical style. By 1970's, Europe suffers with the oil crisis, that has paralyzed a few countries, and to this joined the fact of the being planned a nuclear power plant to built at 30km from Freiburg. This fact generated considerable protests against the construction of the plant after the Chernobyl nuclear accident. Of this protest has resulted in the raising awareness about environmental problems within the Freiburg community. This is how the city takes the status of the ecological capital of Germany and becomes Europe most prominent solar city (Dauncey, 2003). It was necessary to reconstruct the city and tackle the nuclear power. Freiburg has traced firstly policies matching three fundamental principles based on energy conservation, in the utilization of technologies based on heat and power and finally the implementation of renewable energy use, creating their own sources, in order to meet the energy current needs and lowering the need of fossil fuels. With the Kyoto Protocol, Freiburg also committed itself to lower CO2 emissions by about 25% of the values registered by 2010. In addition to Freiburg solar activities, the city has had several other environmental initiatives. A cycling plan was drawn up in 1970, and the city has over 500 km of bicycle paths (WWF, 20008).



Figure 4. Freiburg city center, (source: Petith, 2008a ).

Regarding to the built, Freiburg has bet into the city rehabilitation with some measures previously planned to optimize buildings energetically. It was necessary to implant thermal insulation

for increase the thermal comfort inside of the buildings, regulate the energetic efficiency in the new constructions, and implement “winter gardens” and bay windows to promote the greenhouse effect and the planning of solar panels during the new construction project. But the measures taken by the Freiburg municipality do not stop here. The old town centre became car-free in 1973, and in 1990, a 30 kph zones was introduced for almost all residential streets, except main roads. Freiburg introduced a low-cost flat-rate monthly "environment ticket" for the region-wide bus service in 1991, and there has been a 100% increase in people using public transport since 1980 (Dauncey, 2003). It is doubtful to say that the most important step to take is the encouragement of the rulers, urban planners, city planners and residents to change their strategy in the design and in the new buildings construction, encouraging a more sustainable community lifestyle and a well-being.

## 6 FINAL CONSIDERATIONS

Changing attitudes alongside with the changing of societies needs is an important factor for the environment improving. The prejudice lived in many European cities blocks the sustainable communities' development. The climatic effects are reflected in the direct consequences for people health and performance. It was intended to understand during this paper development how to contribute to develop an urban areas regeneration strategy based on sustainability factors through treaties and letters, searching for measures to a better environment. The challenge ahead is to improve energy efficiency in the buildings rehabilitation and public spaces boosting structures and materials reuse wherever as possible. Therefore, it is intended to contribute to the utilization of existing elements as a source of construction. It is necessary to introduce issues directly connected with the society, as is the case of sociology and economics, so that these elements become focal points members of the city thought and it should be implicit in its planning. It is not wanted the distortion of the cities, what is wanted is their rehabilitation to allow their own revitalization and therefore, it is demanded that the perspective of urban spaces suffers the lower image damage as small as possible. Rehabilitating thinking about tomorrow, about sustainability and in the most natural way to apply it, using renewable energies and design techniques that allows the non-usage of fossil energies and mechanical means to the heating, cooling, lighting and ventilation in the built environment. Such as has been Freiburg in the strategic measures implementation in favor of a more sustainable mobility, energy consumption and life quality, it should be currently insist on the urban network and in their own building and how is their regeneration treated to take advantage of what the preexistence has to offer, making environmentally friendly cities, not only on the built but also in a healthy relationship between societies and built spaces and the way societies view the sustainability factor.

## REFERENCES:

- Boskova, I. 2010, *How can we create sustainable, inclusive and Life creative cities in today's urban age?* Speech at the occasion of Shanghai World Exposition 2010 available online at <http://www.unesco.org/new/en/shanghai-world-expo-2010> checked on 31-01-2012.
- Cerón, M. P. A. 2008, *Arquitectura y clima*. México: available online at <http://www.arquitecturasostenible.com.mx/investigacion.php> checked on 29-01-2012.
- Dauncey, G. 2003, *Freiburg solar city*. Victoria, B.C: available online at [http://www.solarregion.freiburg.de/solarregion/freiburg\\_solar\\_city.php](http://www.solarregion.freiburg.de/solarregion/freiburg_solar_city.php) checked on 01-02-2012.
- European Environment Agency. 2009a, *Ensuring quality of life in europe's cities and towns: Tackling the environmental challenges driven by European and global change*. Copenhagen: Schultz Grafisk, available online at <http://www.eea.europa.eu/publications/quality-of-life-in-Europes-cities-and-towns> checked on 01-02-2012.
- European Commission. 1994, *Carta das cidades europeias para a sustentabilidade*. Aalborg, available online at [http://ec.europa.eu/environment/urban/pdf/aalborg\\_charter.pdf](http://ec.europa.eu/environment/urban/pdf/aalborg_charter.pdf) checked on 01-02-2012.
- European Commission. 1999, *A Green Vitruvius-principles and practice of sustainable architectural design*. Earthscan.
- Florensa R. S. & Roura H. C. 1995, *arquitectura y energia natural*, Barcelona: Ediciones UPC.

- Petith, T. 2008a, *Sustainable City – Freiburg* report. Available online at <http://madisonfreiburg.org/green/sustainablecity.htm> checked on 31-01-2012.
- Purvis, A. 2008b, *Is this the greenest city in the world?* The Guardian article history available online at <http://www.guardian.co.uk/environment/2008/mar/23/freiburg.germany.greenest.city> checked on 31-01-2012.
- Rodeia, J. B. 2009b, *A Reabilitação Urbana parece ter entrado finalmente na ordem do dia em Portugal*, Amadora: IMPRESSÃO Ligrate, Atelier Gráfico, Lda, available online at <http://arquitectos.pt/?no=2020492638,154> checked on 31-01-2012.
- Sassi, P. 2006, *Strategies for Sustainable Architecture*, Oxon:Taylor & Francis.
- Tirone, L. & Nunes K. 2007, *Cosntrução sustentável* soluções eficientes hoje, a nossa riqueza de amanhã. Lisboa: Tirone Nunes SA.
- WWF. 2008c, *Freiburg in a pathway towards a sustainable city*. Finland: available online at [http://www.wwf.fi/wwf/www/uploads/pdf/sustainable\\_model\\_city\\_freiburg\\_in\\_germany.pdf](http://www.wwf.fi/wwf/www/uploads/pdf/sustainable_model_city_freiburg_in_germany.pdf) checked on 01-02-2012.