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Applications of Green Walls in Urban Design

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Abstract. Green walls are a choice towards achieving sustainable urban rehabilitation, due to the lack of free space in the consolidated urban fabric. Nowadays, green walls are considered to be an innovation in the fields of ecology, horticulture or buildings. Nevertheless, in the domain of urban design, they are still surprising and unexpected ideas. Thus, this research aims to reflect on green walls as a feature in urban design and rehabilitation, identifying the advantages of their utilization as an enhancement of the quality of city's image, especially in dense urban areas. It aims to demonstrate some practical applications of green walls in urban design proposals, showing model solutions and their real application in several architectural examples.

1. Introduction

Many factors lead to shortages or lack of green spaces in cities specially in historical urban areas. Morphologically, these spaces are characterized by narrow and winding streets, compact urban fabrics, high densities of construction and lack of conventional green spaces (gardens or parks). Therefore, the application of innovative strategies in order to bring greenery to the densest parts of the cities, is a way to achieve sustainable urban rehabilitation. In this context, green walls of buildings can be the opportunity to make cities greener and to improve public enjoyment of the urban environment [1] without using free space at street level, which is scarce in the compact city. Actually, the social life is not confined to the interior of the walls of the buildings. In fact, the walls are the elements of communication between interior and exterior, according to which the building ceases to have a neutral position in the city and begins to take an active role. The green walls are vertical surfaces which have plants growing on them or integrated within them. Whilst using green roofs is not new, contemporary green wall systems are on the cutting edge of urban design. In fact, modern green facades are still very much in their infancy [2].

The facade greening began in Europe, in particular during the decade of 1980 in Germany, but is now becoming popular all over the world. People are becoming aware of the benefits of green walls to enhance surroundings and spatial planning strategies are making advances in their uses and appreciation.

2. Types and features of green walls

Several criteria could be used to define different types of green walls, according to the features and development of plants, the type of growth substrates or the constructive system. Therefore, the green



walls systems, related to all vertical surfaces covered with vegetation, can have different denominations, which can be summarized as indicated in the following image (see Fig. 1), in two main types: green facades comprising a scattered development of plants on the building surface, with climbers regarding to an ascendant growing or hangers concerning to a descendant growing; living walls with an uniform growth of plants on the building, comprising modular systems which are related to interlocking units and vertical gardens which are regarding to lightweight screens.

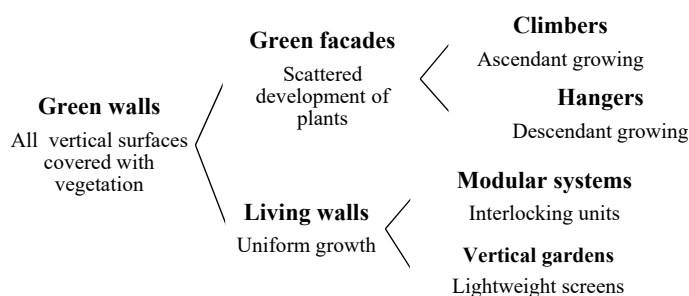


Figure 1. Current green walls systems

The use of green facades based on the application of climbing plants is not a novelty. However recent progress as enabled to support a much wider range of climbing plants to reach new heights on buildings. Today, some of the most innovative approaches concern to the use of several other species of plants (which are not climbing) in living walls, supported by modular systems, based on interlocking units, and vertical gardens, based on lightweight screens. The most recent investigation in this field reveals that green walls, either green facades or living walls, improve not only the aesthetic behaviour of buildings but also their performances and their integrations at city scale.

In general, there are several modern building techniques, construction materials or mechanical systems linked with the creation of green walls. They can be used as a coating for new or existing buildings, as an autonomous structure or as defining and conforming elements of the urban space. The contemporary use of living walls is distinguished from previous uses by the integration of plants, and is supporting structures with the construction of the buildings themselves [2]. These solutions of using greenery on buildings are flexible systems that can be adapted to difficult shapes, sizes or inaccessible places such as windows (see Fig. 2) or window-ledges of existing buildings in historical urban areas. The case of the green wall of the Athenaeum Hotel in London, is an example of a landmark in the Mayfair area in Piccadilly. Other important things to consider in plants choice related to green walls include the size and the visual aspect of the vegetation, which will be determined by climate or other local issues. Therefore, the use of autochthonous species of plants could be a good solution, given that they are very well adapted to local conditions and their use will further serve to allow citizens to identify themselves with a particular place, because the local people are aware of these species.



Figure 2. Living wall of Athenaeum Hotel in London, United Kingdom

Conditions such as temperature, rain and snow should be considered as well in order to decide which plants should be used, not only in green walls but also in other urban green areas. Adverse conditions or peaks of temperature, both up to zero or below have to be studied to ensure plant's survival.

3. Applications of living walls in urban design

The use of green walls as elements of urban composition and design of the cities is a way of influencing aspects such as urban indexes and parameters, densities, site conditions or urban development proposals. The application of green walls can be used to express urban design contents such as the regulation of buildings height, the definition of buildings alignments along the streets, the camouflage of blank walls with absolutely no aesthetic relevance or the reinforce of the sense of intimacy in small spaces [3].

3.1. The use of green walls in urban design in order to normalize the buildings heights

One of the most import aspects to be considered in the urban design is the building height due to its context in the surrounding area. Thus, green walls can be used as refined elements in order to promote the harmony in between different buildings heights. They can be a way to promote the sense of regularization of low-rise buildings which are surrounded by higher buildings or vice-versa (see Fig. 2.a). As of yet there are no known examples of application of green walls with the express purpose of regularizing different buildings heights, either regarding new buildings as elements of rehabilitation of historical places, or as elements of urban composition. However, the case of the renewal of Casal Parroquial, a building from the 1950's, located in Golmès village, near to the city of Lleida in Spain serves as a reference in this field (see Fig. 3.b). The solution designed by the architect Salvador Gine Macià, allowed the creation of a green facade surrounding the previous building, with climbing plants supported by a metal structure, which is independent of the original facade. It allows to level the building height, giving to it a new image. As with the previous example, the project of Patrick Blanc from 2009, for the building of Pacha-The Driver, located on the corner in between Wharfdale road and Killick road in London, created a living wall. This is made by an innovative coating set of plants, that can be seen as a way of marking the height of the building, along both sides of adjoining buildings, which are markedly different between the two streets (see Fig. 3.c).

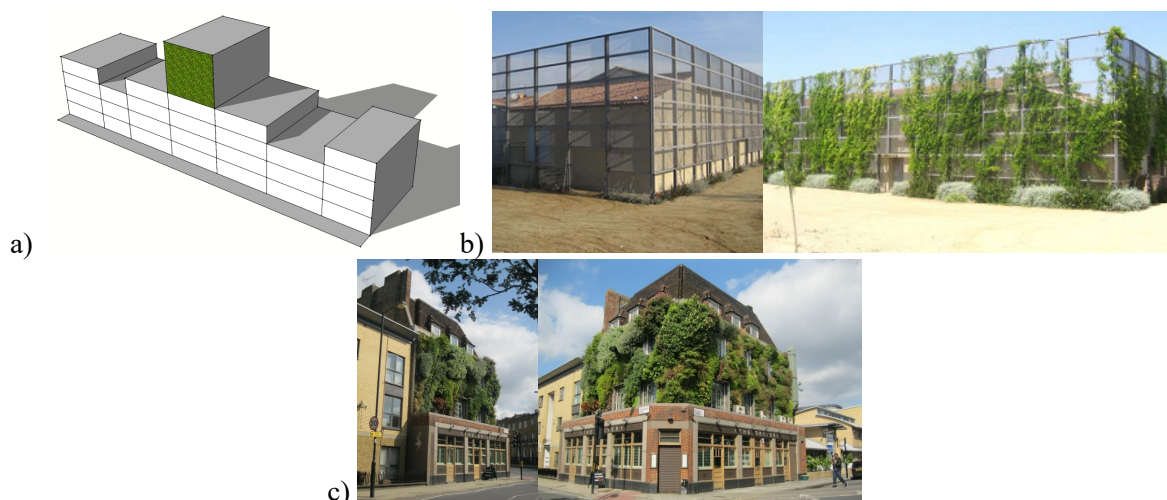


Figure 3. Green walls (a) regularizing the buildings heights; (b) Casal Parroquial, Spain [4]; (c) Pacha-The Driver by Patrick Blanc, London, UK

3.2. The use of green walls in urban design in order to normalize buildings alignments along streets

In urban design, the notion of alignments of buildings along streets regards to the position of the buildings facades on the street. When the alignments between adjoining buildings are different, green walls can be used as an element of urban composition to rectify this aspect (see Fig. 5.a). Although no known cases exist of the use of green walls for the express purpose of regulating the alignments between buildings. However, some examples may serve as inspirations in this matter, such as the case of the MFO Park structure, located in an outlying district of Zurich in Switzerland. This project comes from 2002 by Burckhardt + Partner Architects and by the landscape architect Raderschall, creating a public green area (see Fig. 6.b). Its structure respects to the creation of a vertical garden, consisting of a metal frame covered with climbing plants and placed in the alignments of the adjoining buildings. Another example of the use of green walls in the definition of buildings alignments is the proposal prepared by the architectural firm ARUP Associates for the Citi Data Center in Frankfurt, Germany. This has resulted in a draft copy for integrating sustainability criterion through an extensive front garden. On the one hand, this living wall marks the altimetry of the building's architecture (see Fig. 4.c). On the other hand, it combines technical solutions that have ensured a more energy-efficient building, rated in 2009 as Platinum by the certification system LEED® - Leadership in Energy and Environmental Design.

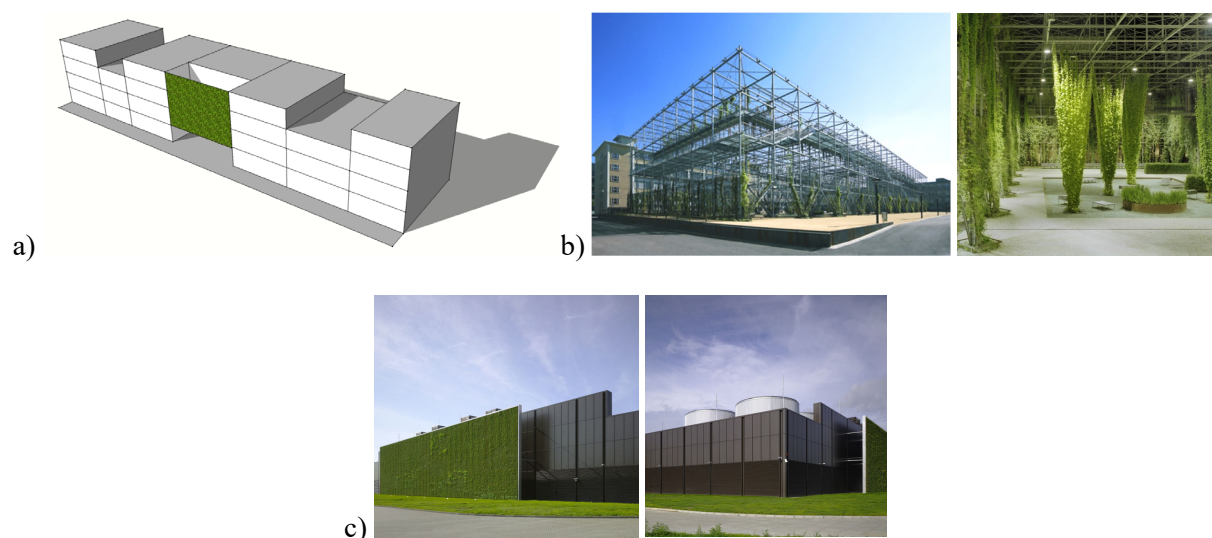


Figure 4. Green facades (a) regularization of alignments; (b) MFO Park in Zurich, Switzerland; (c) Citi Data Center in Frankfurt, Germany

3.3. The use of green surfaces to mask blank walls and to strengthening the sense of intimacy in small spaces

In architecture, the expression blank wall is used to describe the side of the building in which there are no openings - doors nor windows. Usually the blank walls reveal an unplanned urban development, resulting in an unqualified image of the place. This situation can be alleviated by bringing nature into the city, across the use of living walls, qualified as part of public spaces, making them more stimulating for users (see Fig. 5.a). There are some examples of the use of green walls in order to disguise blank walls. A case in point is the cultural building CaixaForum located at the Paseo del Prado in Madrid, Spain (see Fig. 6.b). This project was created in 2008 by architects Herzog & de Meuron, on the basis of remodelling the former Mediodía Electrical Power Station building, combining new materials with the old facades. This action has introduced a vertical garden, created by Patrick Blanc, in the blank wall of an adjoining building, bringing to this part of the city a mix of biodiversity, colours and shapes of about 15.000 plants of 250 different species.

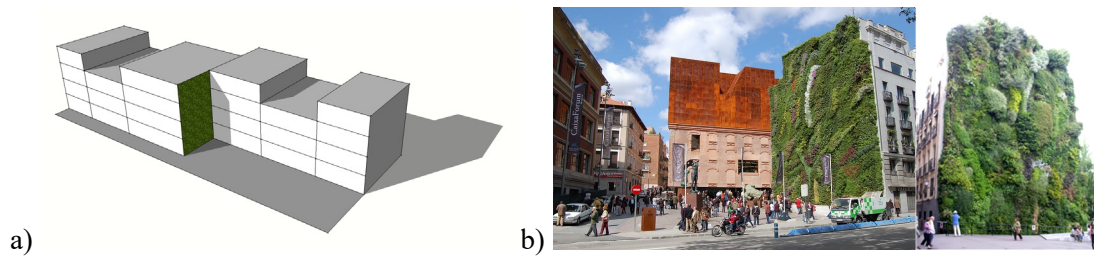


Figure 5. The use of vegetation (a) to disguise blank walls; (b) at CaixaForum, in Madrid, Spain

A similar example is the regeneration of a blank wall along one side of the street Rue d'Alsace in Paris, France (see Fig. 6.a). In this project designed by Patrick Blanc in 2008, was created a vertical garden based on the lining of the entire blank wall of the existing buildings. As a result, the urban environment of this place was greatly improved, making it a more pleasant public space for the citizens with a further qualified image. This solution turned a dark and narrow street, causing a feeling of insecurity among pedestrians, into an extensive vertical garden, reinforcing the sense of security among the users (see Fig. 6.b). The use of green walls can help to reinforce the sense of intimacy in small spaces within the blocks. A good example of this particular benefit of green walls is the integration of a vertical garden on the fence wall that encloses the inner courtyard of the Royale Café in Lisbon, Portugal. This solution allows this small private space to have green elements, providing a more welcoming, friendly and cosy environment among the customers. At the same time, it draws their attention from the inside of the block to the exterior features, invoking the presence of nature, and offering a pleasant feeling of joy while they are having a coffee with a group of friends (see Fig. 6.c).



Figure 6. Rue d'Alsace in Paris, France (a) the previous blank wall; (b) the living wall; (c) the inner courtyard of Royale Café in Lisbon, Portugal

4. Conclusions

As referred previously, green walls can be an opportunity to contextualize urban design contents and strategies, moving into the direction of integration and sustainability of all city elements, such as buildings, public spaces and greenery. The scientific research on green walls systems and their benefits in the environment of the cities is still in the development stage. The most common knowledge about the applications in this field is associated with new or existing buildings, which are seen as landmarks in the urban fabric, such as the CaixaForum in Madrid or the Citi Data Center in Frankfurt. Despite of these very well-known buildings, the fact is that green walls have been rarely used as elements of urban design, and urban fabric composition, either in new urbanizations or in the rehabilitation of historical places. As shown by the presented examples, their use can play a decisive role in the composition of the city's shape and in the qualification of the urban image, in matters such as the regularization of different buildings heights and alignments, in the camouflage of blank walls or in the qualification of small places.

In summary, the use of green walls as elements of urban regeneration and cities design continues as a challenge, of linking the buildings to the urban environment and to the nature. Thus, is in this context that their application should be encouraged, as part of basic urban homeostasis, i.e. the ability of the city to stay in balance. Green walls can be an ingenious way of greening the historic areas of cities, which otherwise would remain void of biodiversity.

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