

Thinking Public Spaces for Low Carbon Cities

Introduction

The urban structure hosts an enormous variety of factors and interactions that, on the one hand, reveals its interest and uniqueness but, on the other hand, leads to some of today's territorial cohesion problems. Some of these problems are strongly related to the increase of carbon emissions in cities, such as: fragmentation of urban spaces and important natural structures; weak and inadequate connectivity / accessibilities within the cities; and predominantly mono functional cities.

To reduce carbon emission in cities is necessary to adopt specific interventions of construction and technologies that promote urban sustainability. However, it is also fundamental to think strategies of urban development in a broader territorial scale. It is, thus, fundamental to adopt strategies and guiding principles for urban planning that create basis in the city structures so that real conditions for reducing carbon emissions are effectively created. This work is developed considering this broader scale of definition of guiding lines for urban planning, more specifically, for public space projects which promote the "Low Carbon Cities" concept.

Indeed, public spaces have a fundamental role in the urban structure and city life, as they enable formal and environmental continuity, accessibility and legibility, contributing to the reinforcement of social and economical centralities. Therefore, thinking of public spaces as important instruments to find solutions to the named problems is fundamental, opening the way to low carbon cities.

In this context, the main goal of this work is to establish principles that may constitute the general guiding lines for the reduction of carbon emissions in cities through public space projects, in order to lead the development of planning actions, their programming and design, towards the construction of cohesive, coherent, inclusive and structured territories promoting sustainable development. Looking to evaluate the way in which projects for public space can contribute to lower carbon emissions in cities, but also aiming to test the applicability of the guiding lines that have been developed, their application to the case study *Rambla de la Mina* – Barcelona follows.

Planning public spaces: the potentialities for low carbon cities

Public space strongly contributes to the structuring of cities, giving them an identity. It also plays an important role in connecting different areas of the city, promoting the formal continuity of the urban structure, concerning, not only the built structure of the urban space (buildings and infrastructures), but also the natural structure (green corridors, fundamental to the ecosystems life), a reason why these spaces are considered to be associated to the environmental structuring of cities. Furthermore, public space implies a public character of social, collective use and multi-functionality, being physically characterized by its accessibility, often giving it a character of centrality. Thus, in the scope of this work, it is defended that public spaces can qualify its surroundings and also have the capacity to promote the continuity of urban space and structure the territory.

In the context of today's cities, we come across problems associated to the strong, unordered urban growth and expansion, characteristic of recent decades. A lot of these

problems are, directly or indirectly, related to a weak promotion of territorial cohesion in the urban space and, consequently, to the increase of carbon emissions in cities. Problems of [1] fragmentation of important natural structures; [2] loss of identity and problems of connectivity between different areas of the urban space; [3] economic disparity and lack of diversity are frequently seen.

The answer to these problems lies in the creation of coherent and inclusive cities, so that the public space emerges as a privileged element in the attainment of that goal. In fact, given its genesis and potentialities, as well as its encompassing nature (dimension, vocation, localization, typology, etc.), public space allows for the connection and coherence of the urban fabric, playing a determinant role in defining the urban landscape and its connections. This way, it constitutes an operative instrument concerning formal and environmental continuity, the mobility /accessibility in the urban space and the legibility of the city, thus adding coherence to urban shape, promoting the interconnection of urban areas, as well as continuity the urban networks (structuring road axis, other infra-structures, ecological structure, green spaces, among others).

The continuity of the urban fabric is a fundamental requisite for carbon emission reduction, as building cohesive and coherent public spaces concerning the axis of internal mobility, ecological structure, among others, is only possible through it. In fact, the continuity / connectivity within the urban fabric are related with two distinct issues, though simultaneously complementary, concerning formal and environmental cohesion, where the public space plays a determinant role.

It should still be noted that one of the essential conditions, in urban planning, for the reduction of carbon emissions in cities, is the creation of multifunctional public spaces, promoting decentralization of functions such as of facilities, commerce, services, entertainment / recreational activities, etc.. In this way, it is possible to reduce the number of trips (in motorized transport modes) of people inside the city, once that goods and services of first necessity are planned in an integrated logic of proximity, promoting travelling on foot or by bicycles.

Supporting the planning of public spaces in network logic is needed in order to:

- > Promote adequate biophysical integration of these spaces in the natural structure;
- > Promote formal urban design connectivity in the urban space;
- > Create good accessibilities, namely through non motorized transport modes (green modes), promoting the car free cities" concept;
- > Develop multifunctional urban spaces, providing a coherent, mixed land use, so that people have easy access to their daily activities;
- > Use sustainable / recycled materials, not only adapted to the functions they will provide, but also to the biophysical characteristic of the urban space where they are located;
- > Use sustainable energy technologies.

Guiding principles

As previously stated, public spaces are a privileged element in helping to promote the "Low Carbon Cities" concept. Therefore, it is fundamental to establish general guiding lines that can lead public spaces interventions towards reducing carbon emissions in cities.

It is worth stressing that these guiding principles should not be static, but dynamic, thus needing to be adapted to the specific reality of each urban space in order to achieve its objective.

In this study, the mentioned guiding principles should take into consideration themes such as the biophysical characteristics of the space; socioeconomic factors and dynamics; conditions of mobility and accessibility; aspects of continuity /permeability of the urban area; the existing uses and functions and the materials and technologies in use.

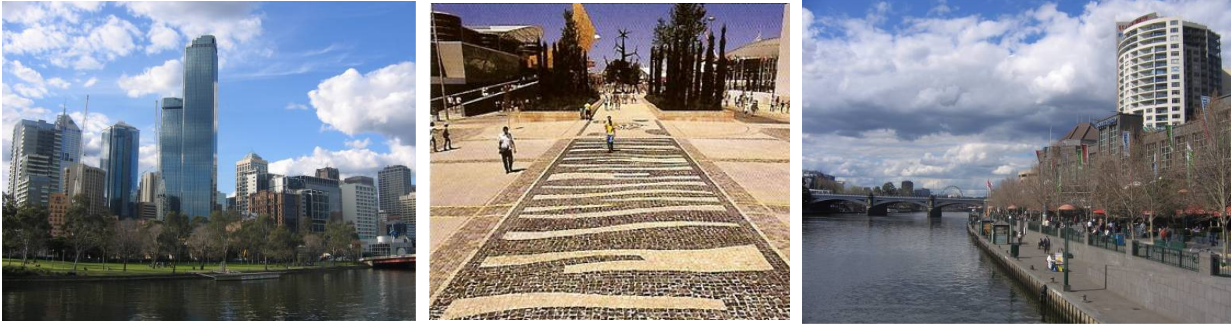
Therefore, the following general guidelines are considered essential to guide the planning, programming and design of public spaces, aiming at a reduction of carbon emissions in cities:

1. **Sustainability:** the concept of sustainability should always be kept in mind, attempting to find development models which promote equity on an economical, social and environmental level;
2. **Biophysical integration:** promotion of the biophysical integration of public space, its adaptation to the physical reality in which these are inserted, looking to minimize negative impacts on the biophysical surroundings, promoting the continuity of important natural structures like ecologic pathways, water courses, etc.;
3. **Multifunctionality:** promotion of multifunctional public spaces, ranging from commerce and services to facilities and entertainment / recreational activities. The characteristic of multifunctionality should not be confined to a single space, but in a logic of a integrated network, promoting functional complementarity between several public spaces in the city, always keeping the principle of proximity in mind;
4. **Mobility and Accessibility:** Creation of mobility and accessibility conditions that endorse cohesive urban spaces, of easy access to all the population, promoting the "Car Free Cities" concept, through the incentives on using green transport modes.
5. **Continuity and permeability:** Configuration and design of public spaces in order to promote continuity and permeability with the existing urban structure, insuring, not only the chain of accessibilities, but also the relationships between adjacent buildings and the complementarity of spaces, as with the continuity and the complementarity of functions and activities developed there;
6. **Adaptability of materials and technologies:** Adaptability of materials and technologies, used in the public space, to the biophysical characteristics of the urban space, in an attempt to maximize its performance. Privilege the use of recycled materials and technologies, mainly the ones using renewable energies.

It should be noted that, in the process of planning and projecting public spaces in a city, it is necessary to promote the complementarity of all principles referred to above, and not only some isolated principles, as they are all interdependent and, therefore, will not be effectively reached when separated.

As an example, to promote the use of green transport modes, the creation of a good network that fosters its usage among the population is necessary and, for that, the promotion of continuity and connectivity of public spaces is needed, as well as a correct biophysical integration, and also the creation of multifunctional spaces that promote relations of proximity between residential areas and of commerce, services, facilities, etc..

Figure 1 – Examples of public spaces which promote de guiding principles for low carbon cities



Source: Author's pictures

“Rambla de La Mina”: public space evaluation

In an attempt to frame the case study of this work, it should be noted that the *Barrio de La Mina* is located in the oriental area of the city of Barcelona, however, being integrated in *Sant Adrià* municipality. The neighborhood is separated from the remaining municipal area to which it belongs by two marking physical barriers: the river *Besòs* and the coast train line of the city of Barcelona. Therefore, and although the neighborhood is considered a part of the metropolitan area of Barcelona, it has a very peripheral location in relation to the city. It is a densely inhabited neighborhood, with a population ranging from 13.000 to 15.000 inhabitants.

Figure 2 – Geographic location and aerial view of Barrio de La Mina - Barcelona



Source: Author's drawing up over aerial pictures (Google Earth)

This area of *Sant Adrià de Besós*, adjacent to the city of Barcelona and, as in other European cities, already with a quite peripheral location, is characterized by its various urban problems, not only regarding its insertion in the evolving urban structure, but also hosting socio-economic fragilities, problems of social exclusion and marginalization. Several operations of reconversion of this part of the city have been put into practice so as to find a solution for these physical-social unbalances between the oriental part of the city and the east and central parts.

One of the instruments that have been developed to solve those unbalances and initiate the reconversion process of the neighborhood was the joint intervention of the [1] urban design plan regarding the formal transformation of the neighborhood (national Spanish award for urbanism) and [2] the plan of transformation for the *Barrio de La Mina*. This instrument considers the development of the *Rambla de La Mina* as a central axis, organizing the entire territory, with a strong civic character, to be a structuring intervention to the reconversion of the neighborhood.

Through this, the project *Rambla de La Mina* attempts to find solutions that potentiate the living and appropriation of the public space, with the central purpose of contributing to a renewal of the identity and the image of the neighborhood in the city of Barcelona. This way, the project intends to [1] establish the connectivity with the city of Barcelona as much as with *Sant Adrià de Besòs*, namely, through the tram which crosses the public space; [2] create a multifunctional space that offers commerce, services, facilities, and entertainment and recreational activities as a complement to the residential area; [3] promote the route that extends from *Parc de Besòs* to the waterfront, and also the continuity between the several adjacent spaces, the centre and the rest of the neighborhood.

To sum up, with the project *Rambla de La Mina*, there is the intention of creating a nucleus of strong symbolic relevance that can become a new urban centrality, promoting the connectivity with the remaining network of public spaces in Barcelona, namely, through green transport modes and even urban design solutions, based on principles of urban sustainability, contributing to a reduction in the city's carbon emissions.

Figure 3 – Views of the actual stage of *Rambla de La Mina* project



Source: Remesar, 2007

In an attempt to evaluate the way in which this particular project of public space can contribute to the reduction of carbon emissions in the city, in the light of the new planning principles just enunciated (presented in the previous point), a evaluation process of this space has been developed, as well as of its insertion in the surrounding urban structure. This process consists of the evaluation of the public space (through field work, using evaluation records), taking the six guidelines defined before into consideration, identifying the main strengths and weaknesses of this case study in face of these same principles. Here, only a synthesis of the evaluation that has been done is presented, with a selection of the main strengths and weaknesses to bring out.

Table 1 – Synthesis evaluation of the public space *Rambla de La Mina*, concerning “Low Carbon Cities” criteria

STRENGTHS	WEAKNESS
	
<p>Adequate insertion in the biophysical structure, positively contributes to the recovery and requalification of the waterfront and the <i>Besòs</i> river banks. [Biophysical integration]</p> <p>Reduction of the barrier effect posed by the waterfront. This intention is present in the project of the public space by establishing a connection with this natural element, thus making it a surplus value to be taken advantage of by their users. [Biophysical integration]</p> <p>It is a public space that, being a structural axis, allows for a connection between the cities of Barcelona and <i>Sant Adrià</i> to be established; and for the extension of the tramway line, connecting these two urban poles – <i>Tram Besòs</i>. [Mobility and Accessibility; Connectivity and Permeability]</p> <p>Through the complementarity of functions and the connectivity this project establishes with the surrounding area, it promotes its integration in the network of public spaces of the city of Barcelona. [Connectivity and Permeability; Mobility and Accessibility]</p> <p>Implementation and promotion of green transport modes, namely, the Tram, bicycle lanes and pedestrian courses, thus enabling better conditions of mobility for the population, as well as the network of public transportation. [Mobility and Accessibility]</p> <p>Design of the network of routes within the public space to give continuity to the urban design of the neighborhood. [Mobility and Accessibility; Connectivity and Permeability]</p> <p>Alignment of trees, facilitating the reading of the space and, thus, the quick perception of the pedestrian areas and bicycle lanes, of the tramway circulation and of road traffic. [Mobility and Accessibility]</p> <p>Public space as a centre, generating several functions, promoting the surrounding public spaces to be given dynamism by the localization of commercial activities, services and facilities, developing urban areas of mixed functional character. [Multifunctionality]</p> <p>Existence of facilities that promote the multifunctionality of the space and the relationships of proximity, minimizing the use of motor vehicles. [Multifunctionality; Mobility and Accessibility]</p> <p>North-East – South-East solar orientation, granting good levels of insolation, allowing for the use of renewable energy technologies, namely, solar panels. [Biophysical Integration; Adaptability of Materials and Technologies]</p> <p>Alignment with the waterfront, allowing for natural cooling of the public space, through sea breeze – the ocean as a thermal regulator, saving energy and resources in cooling the public space. [Biophysical Integration; Adaptability of Materials and Technologies]</p> <p>Use of materials in the urban furniture well adapted to the biophysical conditions of the public space, avoiding unnecessary expenditure of resources with maintenance or early replacement. [Adaptability of Materials and Technologies]</p>	<p>Considering the general system of public spaces in the <i>Besòs</i> area, including the <i>Parc del Besòs</i>, and the future urban park in the river <i>Besòs</i>' bank, in the <i>Rambla de la Mina</i>, there should be green spaces to promote the continuity of this important natural structure. [Biophysical Integration; Connectivity and Permeability]</p> <p>Absence of thermal regulators, like water elements or trees of lapsed leaf, which can save energy in the public space, especially during the summer. [Biophysical Integration; Adaptability of Materials and Technologies]</p> <p>Some pedestrian connections with the neighborhood are poor (narrowed, with dark pathways, etc.) not favoring the connections with the surroundings of the public space. [Mobility and Accessibility]</p> <p>Poor connection between the proposed bicycle lanes and the existing ones. [Mobility and Accessibility]</p> <p>Inexistence of a bicycle lane from <i>Parc del Besòs</i> to the waterfront. Bicycle lanes only exist in transversal connections. [Mobility and Accessibility]</p> <p>No use of recycled materials. This factor does not seem to call attention in the project of this public space. [Adaptability of Materials and Technologies]</p> <p>The project did not preview the use of renewable energies, namely, of solar energy. [Adaptability of Materials and Technologies]</p>

It should be stressed that the principle of **sustainability** is not explicitly identified in the evaluative synthesis of the public space (presented in Table 1), as this is considered to be a transversal concept, encompassing all the remaining guidelines and, therefore, will only be really attained through its respective conjugation and complementarity.

The present diagnosis anticipates a very positive global evaluation of the public space concerning the guiding principles defined in order to contribute to the concept of “Low Carbon Cities”.

From the analysis, it can be seen that there is a noticeable concern in promoting the creation of a **multifunctional** space that establishes complementarity relationships with the functions present in the surrounding urban area of the public space *Rambla de La Mina*, being coherently integrated in the remaining network of public spaces of the city.

Concerning **connectivity and permeability**, this public space has a very positive performance, contributing to the formal continuity of the urban design of its surroundings, facilitating the connectivity regarding the accessibility in green transport modes, namely, through the extension of the tram way. This space also takes in consideration the need to connect two important natural structures – the waterfront and the *Parc del Besòs* – although some fragilities have been pointed on this level, like the absence of green spaces.

Also concerning the conditions of **mobility and accessibility**, the public space presents a clearly positive performance, not only in the Barrio de La Mina itself, but also in what regards the connection of the neighborhood with its immediate surrounding and with the cities of *Sant Andrià* and Barcelona. It should be noted that this principle assumes a fundamental relevance in the reduction of carbon emissions, in terms of the case study, as priority is given to the promotion of green transport modes. These modes set up a connection with the city's remaining urban network, namely, through the connection established by the Tram, but also through the improvement of the conditions to pedestrian circulation and the creation of “bicycle friendly” spaces. However, although the evaluation at this level is quite positive, there are a few weaknesses in the project, namely, the degradation / disqualification of some accesses to the *Rambla*, as well as some lack of connections to the actual network of bicycle lanes of the city of Barcelona.

There is still an adequate **biophysical integration** of the public space, contributing to the recovery and requalification of the waterfront and of the *Besòs* river banks (important natural structures), taking advantage of this privileged localization, and with a favorable orientation regarding solar exposition and the dominant winds, enabling the use of alternative energies methods, like solar energy, to be applied. There are, however, weak points: the fact that the project does not predict the existence of green spaces which, could extend the natural corridor of *Parc del Besòs* – River *Besòs* – Waterfront; as well as the absence of natural thermal regulators, like water elements, or trees of lapsed leaf to promote the natural refrigeration of the public space, without the need for methods that spend energy.

There is still one last principle / criteria of evaluation, the **adaptability of materials and technologies**, which, despite having a generally positive evaluation, presents some negative aspects, relevant to the global evaluation of the public space, given the issue of the reduction of carbon emissions. The materials used are adapted to the biophysical characteristics of the public space; they are durable and resistant to intense use and to adversities posed by the environment, saving resources, minimizing expenditure with early maintenance and substitution. Besides this, the correct biophysical insertion, as well as the solutions of urban design adopted, can create conditions to the use of alternative energy technologies, namely

solar energy, as well as to the natural cooling of the space. However, there are weak points considered relevant to the reduction of carbon emissions in cities: [1] the fact that there is no concern with the use of recycled materials in the conception of the public space, [2] and also the fact that the project does not pre-establish the use of alternative energetic technology, namely, solar.

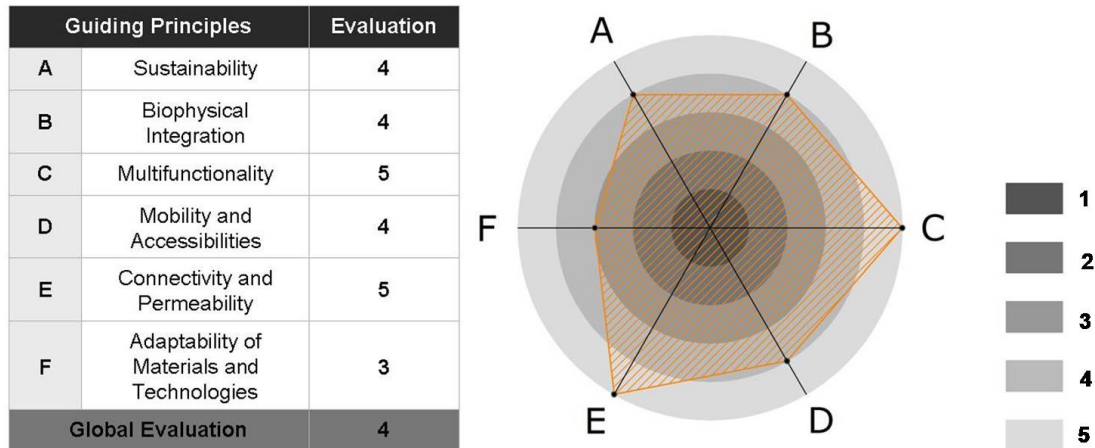
Aiming to substantiate the qualitative evaluation that is presented, a general evaluation has been elaborated, based on a quantitative scale, in which, for each principle / criteria, a classification is attributed to the project of public space, considering its performance within the concept of the “Low Carbon Cities”.

This way, the six criteria presented define the matrix of the public space evaluation as a promoter of low carbon cities. In the context of the referred general evaluation, to each of these criteria is attributed, an isolated classification, which will form a part of a whole that will constitute the global evaluation. In fact, each principle / criteria has been evaluated according to a numeric scale of 1 to 5, expressing the higher or lower quality of the project of public space, given the studied issue, being (adapted from Nunes da Silva et al, 2001):

- > **5 the highest level of quality of the public space**, having few negative aspects, almost insignificant.
- > **4 a high level of quality of the public space**, having little negative aspects with little significance.
- > **3 the medium level of quality of a public space**, in which there is a balance between the positive aspects and fragilities.
- > **2 a low level of quality of the public space** – negative quality / problematic – in which very few positive aspects are diagnosed, with almost no significance.
- > **1 the lowest level of quality of the public space** – negative quality / problematic – in which few positive aspects are diagnosed, almost insignificant.

Taking in consideration the strong and weak aspects that have been diagnosed, a classification for each principle, is now presented, as well as a possible graphical representation of this evaluation (Figure 4), to help understand the reality of the public space *Rambla de la Mina*, within this approach.

Figure 4 – Global evaluation the public space Rambla de La Mina



Source: Author's scheme

It should still be noted that the global evaluation presented here is a result of the premise that all principles, defined to promote the reduction of carbon emissions, regarding planning and projecting of the public space *Rambla de La Mina* assume the same level of importance.

Therefore, it can be seen that the public space under analysis has globally, a very positive evaluation (4, in a scale of 1 to 5) as far as the reduction of carbon emissions in cities is concerned, leading to the conclusion that this space plays a very important role in the promotion of urban sustainability.

Conclusions

Through the development of this study, it was possible to verify that the public spaces play a structuring role in the urban territory, holding important urban functions (formal, economic, social and environmental), allowing for the interconnection and coherence of different spaces, thus having a fundamental role as far as urban sustainability is concerned, contributing to the strengthening of the “Low Carbon Cities” concept.

The results obtained in this work seem to prove that the reduction of carbon emissions in cities is not only related to the implementation of specific measures and actions in local scales, but are also dependent on a correct planning of the public spaces that structure the urban network. In this sense, public spaces should be guided by principles that allow us to:

- > Promote the continuity and connectivity of the urban area, so as to minimize dispersion, contributing for the construction of cohesive and coherent territories;
- > Promote an adequate biophysical integration of urban spaces in the existing natural structure, aiming to preserve it, and capitalizing on the advantages it can offer;
- > Create conditions of mobility and accessibility within the city, facilitating travels, minimizing times and distances so as to bring places closer, giving priority to non green transport modes;
- > Develop multifunctional urban spaces in which the present functions complement each other to promote relationships of proximity, minimizing unnecessary motorized trips in the access to primary goods and daily activities;

- > Foster the use of materials and technologies which promote urban sustainability, to minimize the consumption of resources, material as well as energetic.

Thinking public spaces interventions as instruments capable of contributing to the building of more sustainable cities has, therefore, proven fundamental. In this context, the definition of guidelines to lead projects of public spaces looking for the reduction of carbon emissions is demonstrated to be a very adequate form of promoting cohesive and coherent urban spaces.

Through the process of evaluation developed for the *Rambla de La Mina* public space, it was possible to verify that it has a better performance regarding the continuity and permeability of the urban space, as well as in the promotion of multifunctional spaces. Other principles follow, such as biophysical integration, mobility and accessibility and sustainability. Lastly, there is the adaptability of materials and technologies which, despite its positive general evaluation, still presents some weaknesses.

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