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Original

Livable neighborhoods for sustainable cities: Insights from Barcelona / Staricco, L.; Vitale Brovarone, E.. - In: TRANSPORTATION RESEARCH PROCEDIA. - ISSN 2352-1465. - ELETTRONICO. - 60:(2022), pp. 354-361. (Intervento presentato al convegno XXV International Conference Living and Walking in Cities tenutosi a Brescia nel 9-10 September 2021) [10.1016/j.trpro.2021.12.046].

Availability:

This version is available at: 11583/2972732 since: 2022-11-01T13:41:17Z

Publisher:

Elsevier

Published

DOI:10.1016/j.trpro.2021.12.046

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XXV International Conference Living and Walking in Cities - New scenarios for safe mobility in urban areas (LWC 2021), 9-10 September 2021, Brescia, Italy

Livable neighborhoods for sustainable cities: Insights from Barcelona

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Abstract

The paper proposes a reflection on the superblock model - or supermanzana, in its well-known Spanish application - in the context of the debate on the 15-minute city and on the functional reorganization of mobility and public space to improve the quality of life, health and accessibility in urban areas.

The impacts of car traffic on the livability of cities and neighborhoods, in terms of safety, air pollution, noise, but also in terms of consumption and quality of public space, are widely acknowledged. These issues are not new to the debate: since the first decades of the 20th century, with the advent and rapid diffusion of the automobile, concerns on the impacts of vehicular traffic and issues of urban livability and traffic separation have been raised by urban and transport planners. As a consequence, various models of neighborhood planning emerged, proposing solutions to limit these impacts.

The supermanzana model takes up the principles of neighborhood planning by identifying a main road network and setting up a system of superblocks within the meshes of this network, in order to improve accessibility, equity, health and livability; it aims on the one hand to transform public spaces at the neighborhood level and on the other hand to reorganize the existing urban structure. The application of the supermanzana model in Barcelona offers an interesting contribution to the debate on the 15-minute city, showing how the principle of traffic separation can be applied to existing, dense urban contexts, reclaiming public space to more livable neighborhoods and sustainable cities. The analysis of the case study of Barcelona can contribute to research and policy, learning from this experience and especially from the critical issues that emerged.

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Peer-review under responsibility of the scientific committee of the Living and Walking in Cities

Keywords: Supermanzana; superblocks; Barcelona; traffic separation; neighborhood planning; quality of life; livability

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1. Introduction

The impacts of vehicle traffic on the livability of urban space are now widely recognized, from the point of view of safety, air pollution, noise, but also in terms of consumption and quality of public space (Botteldooren et al., 2011; Cakmak et al., 2012; Ewing & Dumbaugh, 2009; Mukhija & Shoup, 2006). The issue of livability of neighborhoods and the conflict with vehicular traffic is not new in the debate: already at the beginning of the 20th century, with the rapid spread of cars, various models of reorganization of urban spaces or new settlement through neighborhood planning proposed solutions to limit these impacts, starting from the principle of separation of vehicular traffic from non-motorized traffic (Brody, 2016; Sharifi, 2016).

The Supermanzana model (SM), developed on the initiative of the Barcelona Urban Ecology Agency, takes up the principles of the neighborhood unit by identifying a main road network and setting up a system of superblocks within the meshes of this network. The aim is not only to transform public spaces at the neighborhood level but also to reorganize the existing urban structure, in order to improve accessibility, equity, health and livability. The reclaimed spaces previously used for traffic and parking have a considerable potential for more livable neighborhoods, even more so in relation to the current health emergency. The road space is no more meant only for vehicular traffic but for multiple uses, providing larger and safer public spaces and offering the opportunity to carry out outdoors those activities that in health emergency conditions cannot be carried out in enclosed spaces with poor air circulation. Although the SM model has several potentialities and is receiving increasing interest in the scientific and policy debate, its implementation is showing a number of difficulties.

This paper, which derives from a research work presented in Scudellari et al. (2020), aims to present and discuss the SM model and its application in Barcelona, with a focus on the Poblenou neighborhood and on the latest evolutions of the implementation of this approach in the case study of Barcelona. The potentialities of the superblock approach in Barcelona and the evolution of its implementation in the last years are discussed, as well as some critical aspects. The latter relate in particular to the coherence between the urban and neighborhood scale, the temporal progression of the implementation, and the conflicts between different actors and users.

The case study has been analyzed through documentary analysis and semi-structured interviews, aimed to understand its potentialities and challenges. In particular, in parallel to a systematic review of the scientific and grey literature and the official documents (plans, regulations, contracts, etc.), eight in-depth semi-structured interviews were run with local stakeholders (members of various institutions and associations in some way involved in this project) affected by its effects, and thirty short semi-structured field interviews were run with people encountered in the Poblenou SM, representing different points of view. The in-depth and on field interviews allowed to gain insights and discuss specific issues related to the implementation phase.

The application of the SM model in Barcelona offers an interesting contribution on how the principle of traffic separation can be applied to existing, dense urban contexts, reclaiming public space to more livable neighborhoods and sustainable cities. The analysis of the case study of Barcelona can contribute to research and policy, learning from this experience and especially from the critical issues that emerged. Although the latter referred to the phase of implementation of SMs by area, they are very relevant to the current phase of implementation of the model (§5).

The paper presents the SM model (§2), then its implementation at the urban level in Barcelona (§3) and at the neighborhood level in Poblenou, which has been a pilot project for the implementation of the model (§4); section 5 presents the shift of focus which occurred in the very last years, moving from proceedings by areas to creating a network of “green streets and squares”. Finally, section 6 proposes and discusses some final thoughts.

2. The SM model

The idea of the Supermanzana (SM) model was developed by the Barcelona Urban Ecology Agency, directed by Salvador Rueda, as part of the "Ecological urbanism" approach (Rueda, 2019). The SM is meant as the basic module to reorganize the existing city and improve its sustainability, reducing the modal share of the car and improving the quality and livability of public space in neighborhoods. The size of these 'urban cells', which group several blocks together, is about 400x400 metres, made up of some blocks and the streets, sidewalks and squares between them. The dimension of the SMs is in line with the typical distance of intersections between roads in settlement contexts meant to pedestrian mobility (Mehaffy et al., 2010). This dimension is set on the basis of the average speed of walking and

driving (Rueda, 2019), the latter being on average 15-20 km/h in urban areas (Rueda's estimate is actually based on the average speed in Barcelona), four times faster than the human walking speed. Assuming 100 meters as the right dimension for the sides of a block, as it allows pedestrians to turn around it and choose different paths to reach a destination (Siksna, 1998), the aggregation of four blocks is therefore designed as the optimal distance for both walking and the main road network.

The road network is divided into two levels: the roads inside the SMs are destined to access traffic, while the roads defining the edges of the SMs are for fast and cut-through traffic. Cut-through traffic is discouraged within SMs in several ways: by reducing the space for cars to circulate and park (the space for cars is reduced to a single lane per street and most on-road car parks are removed), by changing traffic directions, by setting speed limits (10 km/h) and by placing logistic platforms for goods on the edges. As a result, 60-70% of the road space is made free from car traffic. The network of thoroughfares whose meshes are the SMs is designed to host cut-through traffic, public transport (buses, taxis, tramways, etc.) and bike lanes. The model is designed to be applied not only to one or more isolated neighborhoods, but to the whole urban area, reconfiguring its functioning according to this structure. If the model is applied to a whole city (or to a large part of it), a new urban morphology is established, made up of thoroughfares and SMs.

The street space within the MS is at the heart of the model: its redesign is not only intended to discourage through traffic, but also to revitalize and regenerate public space. To this end, the Urban Ecology Agency of Barcelona has developed a special plan for the design of this space, the Mobility and Public Space Plan. The Plan is meant to adopt an integrated approach to the application of the principle of traffic separation. Furthermore, it provides for the gradualness of the intervention, starting in a first phase with low-cost and reversible interventions of tactical urbanism (Lydon & Garcia, 2015), which are made structural at a later stage.

As its conception and application is rather recent, the literature on the Supermanzana model is still rather limited, particularly with regard to the empirical study of its effects on mobility, environmental quality and the livability of public space. In particular, analyses were carried out in relation to its benefits in terms of improved pedestrian mobility (Delso et al., 2017), effects on social interaction (Speranza, 2017), participation aspects (Oliver & Pearl, 2017), critical elements in moving from conception to practical application at the local and urban scale (Scudellari et al., 2020), the success factors and potential unexpected effects (López et al., 2020), the role of political barriers and power relations as hindering factors (Zografos et al., 2020).

2.1. The case study of Barcelona

Although SMs have been tested in a number of Spanish cities, Barcelona is the city that has not only conceived but also most experienced the application of the SM model. The model has been widely tested also in Vitoria-Gasteiz (the capital city of the Basque Country in Northern Spain). In 2008 a Sustainable mobility and public space plan was adopted; it identified 68 SMs all over the city; 17 of them have been implemented till now. Moreover, more recently also the cities of Ferrol, Madrid and Valencia have been applying the SM model. In this article, Barcelona was preferred as a case study instead of Vitoria-Gasteiz for two reasons: the first is that Barcelona is a metropolis, four times higher in population than Vitoria Gasteiz, which challenges the implementation of the SM model on the whole urban area. Second, Barcelona's road network is particularly regular (while in Vitoria-Gasteiz it is radial): it is characterized by a very homogenous grid network (differently from the radial network in Vitoria-Gasteiz) that can be a critical issue for the SM model, as it will be discussed in section 4.

The first areas in which the SM model was tested in Barcelona are the *Ciutat Vella* and *Gracià* districts. After these first two experiences, the Administration wanted to spread the SM model to the rest of the city; to this aim, it has drafted three SM programs. The last one, *Omplim de vida els carrers*, was launched in 2016, and proposed each of the ten city's Districts to adopt a Mobility and Public Space Plan, and to implement a SM pilot project. Nowadays, Barcelona has several SMs in different locations and at different implementation levels (Scudellari et al. 2020, <https://ajuntament.barcelona.cat/superilles/en/>).

What makes the case of Barcelona particularly interesting is also the fact that the Administration has assumed during the last decade the SM model as a key issue in its main policies and plans, such as the local Agenda XXI (*Compromís Ciutadà per la Sostenibilitat 2012-2022*), the Plan for green areas and biodiversity (*Pla del Verd i de la Biodiversitat de Barcelona 2020*), the Urban mobility plan (*Pla de Mobilitat Urbana 2013-2018*), the Plan for air

quality (*Pla de millora de la qualitat de l'aire de Barcelona 2015-2018*) and the Strategic plan (*Pla d'actuació municipal 2016-2019*). Therefore, a strong policy framework underlies and supports the implementation of the SM model on the whole city.

Finally, also its physical and social features make Barcelona an interesting case study. Barcelona is the first large city (over 1 million inhabitants) that has planned to adopt the SM approach on its whole urban area. It is one of the densest cities in Europe, hence the availability of public spaces at the neighborhood level is particularly relevant (Howley et al., 2009). Last but not least, the road network in its core part (about 13 km²), that was planned by Cerdà, is particularly regular (Salat et al. 2014) (Figure 1): 550 identical square blocks, which sides are 113.3 meters long, in an orthogonal grid of 20 meters wide streets (excepted two diagonals and some minor streets).

3. The implementation of the SM model in Barcelona

Barcelona's administration has implemented the SM model during the last decade through plans and measures both at the city and the neighborhood level.

At the city scale, the *Pla de Mobilitat Urbana 2013-2018* identified the main network of thoroughfares (figure 1), whose speed limit was set to 50 km/h; the meshes of this network were identified as SMs (mostly corresponding to a 400x400m square made up of 3x3 blocks), whose inner streets (the 67% of the urban streets) have a 10 km/h speed limit. According to the plan, enough car parks should be ensured to the residents inside their own SM, whereas public on-road car parks for visitors should be reduced and charged. In order to allow thoroughfares to support the traffic diverted from the inner streets of SMs, the Pla aimed to reduce car modal share by 21%, from 26.7% to 21.1%; a further reduction to 18.5% is pursued by the *Pla de Mobilitat Urbana 2024*, currently pending approval.



Fig. 1. The main network of thoroughfares (source: INFORME. Pla d'Espai Públic i Mobilitat del Districte de Sant Martí, Barcelona)

These 'push' measures were combined with 'pull' ones aimed at improving public transport and cycling in line with the SM model. The Pla proposed the reorganization of the bus system, creating a 'Nova Xarxa de Bus', made up of 28 bus lines riding along the thoroughfares (8 horizontal lines, 17 vertical and 3 diagonals), without crossing the SMs. In addition, the Pla identified over 200 km of new bicycle lanes on the main network in order to guarantee a high-speed cycling mobility; inside each SM, streets were supposed to become shared spaces where pedestrians and cyclists have priority on vehicular traffic. For goods distribution a decentralized system was proposed, based on 'neighborhood logistics platforms' and 'urban distribution centers' located on the fringes of the SMs, and non-polluting electrical vehicles and cargo-bikes for last mile distribution inside the SMs.

The *Pla del Verd i de la Biodiversitat de Barcelona 2020* was another urban plan that promoted the implementation of the SM model at the city level. This plan set the different minimum tree density both along the thoroughfares and inside the SMs, whose inner streets, partially freed from car traffic, offered the space for new green areas.

As regards the local level, since the *Programa Superilles 2011- 2015* in 2011 a few programs were adopted one after another to schedule the implementation of the SM model in the different districts. They launched a few pilot projects of SMs in several parts of the city, which are now at different stages of completion. The first to be completed was the Poblenou project in the Sant Martí District, which will be analyzed in the next section.

4. The Poblenou SM: some critical issues

The Poblenou neighborhood was chosen by Barcelona's administration as a pilot project since it was already undergoing a renewal process, its levels of car traffic were low, and it allowed to test the SM model on the Cerdà grid. Its implementation started in September 2016, when 200 architecture students were asked in a two-week workshop to suggest how to reuse the street space freed from car traffic inside the new SM. At the end of the workshop, the Poblenou SM was implemented in a temporary version till the end of the 2016; in the inner streets, traffic directions were modified using vertical and horizontal road signs, street surface was painted to reduce car lanes, car parks were reduced, bus and the bike lanes were removed. As a result, the four inner streets were transformed in shared spaces for pedestrians and cyclists, while car traffic was prevented from crossing the SM by creating four 'rings' forcing vehicles to turn left at each intersection. In the early 2017, a permanent layout was started for the structural and definitive version of the Poblenou SM: benches, trees, street games, athletic tracks, etc. were placed to improve the quality of the public space in the inner streets.

The analysis of the implementation of the Poblenou SM revealed some critical issues, which could have important implications for the governance of the SM strategy.

Some of these issues are probably contingent on the 'pilot' role of the Poblenou SM, which was realized before the complete reorganization of the whole thoroughfare network. According to the SM model, thoroughfares at parallel sides of each SM should have opposite directions of movement, so to ease circulation around them. But when implemented (even if in the functional phase), the Poblenou SM happened to be bordered on its Eastern and Western sides by two one-way roads having the same direction; this gave rise to complaints from non-residents, who found it difficult to go beyond the SM without crossing it. A similar problem emerged for the bus and cycling network: a bus line continued to cross the SM and a cycling lane was erased inside the SM without being re-located to its boundaries. Finally, car parks were partially removed inside the SM before being replaced by new underground parking along the thoroughfares, causing strong dissatisfaction among non-residents.

A second order of problems was related to the stepwise, 'here and there' approach to the spatial implementation of the SMs strategy, according to the *Omplim de vidas els carrers programme* adopted by the city administration in 2016: one pilot SM was identified in each of the ten city Districts to be realized. Following this approach, the Poblenou SM was initially implemented alone and in isolation inside the Sant Martí District; this generated different reactions from residents, most of whom were satisfied with the renovated public space inside the SM, and non-residents who on the conversely perceived the SM mainly as an obstacle to their trips, due to the difficulty of crossing it.

Finally, a number of critical issues concerned the specific pattern of the Cerdà grid, in which the Poblenou SM is located. This grid is undifferentiated and extremely homogeneous, without a hierarchy between main and secondary streets, which are all 20-meter wide. In such an undifferentiated grid, classifying a street as main or inner depends only on the 'urban logic' of the SM model (i.e., creating an effective overall main network on the whole city) and not on the specific geometric features of the street. As a consequence, residents in the Poblenou SM living on one of its four bordering thoroughfares (where most cut-through traffic was diverted to) felt discriminated against compared to those living on a traffic calmed streets inside the SM. It turned difficult for residents to understand why one street could be full of trees and birds and without cars, while the next one is identical but must support all car traffic. The same discrimination – even if in the opposite direction – emerged for local tertiary activities: the ones located in streets inside the SM felt penalized compared to those along the thoroughfares of the main network, which could benefit from passers-by.



Fig. 2. The SM in Poblenou. Left: temporary intervention; right: structural intervention.

5. A shift of focus: from the implementation by area to the one by green streets

In the very last years, Barcelona's administration had changed its approach: instead of proceeding by areas, incrementally implementing the new SMs one after the other, the strategy was focused on creating a network of "green streets and squares" across the whole city, by enabling some streets to be freed of road traffic and to give priority to pedestrians.

This approach is being tested on the whole district of the Eixample, where 21 streets (for a total length of 33 km) and 21 squares at the intersection of these streets (for a total surface area of 3.9 ha) should be re-designed. These streets and squares will not be closed to car traffic; vehicles will be allowed to circulate at a maximum speed of 10 km/h, ensuring priority for pedestrians and cyclists who will be allowed to use the entire surface. In the squares, cars will not be able to continue in the same directions; they will be compelled to make a turn to the left or the right.

The aim is to provide the Eixample with 33.4 hectares of new pedestrian areas and 6.6 hectares of urban green areas; in this way, each resident in the district will have a square or green street within 200 meters of his homes.

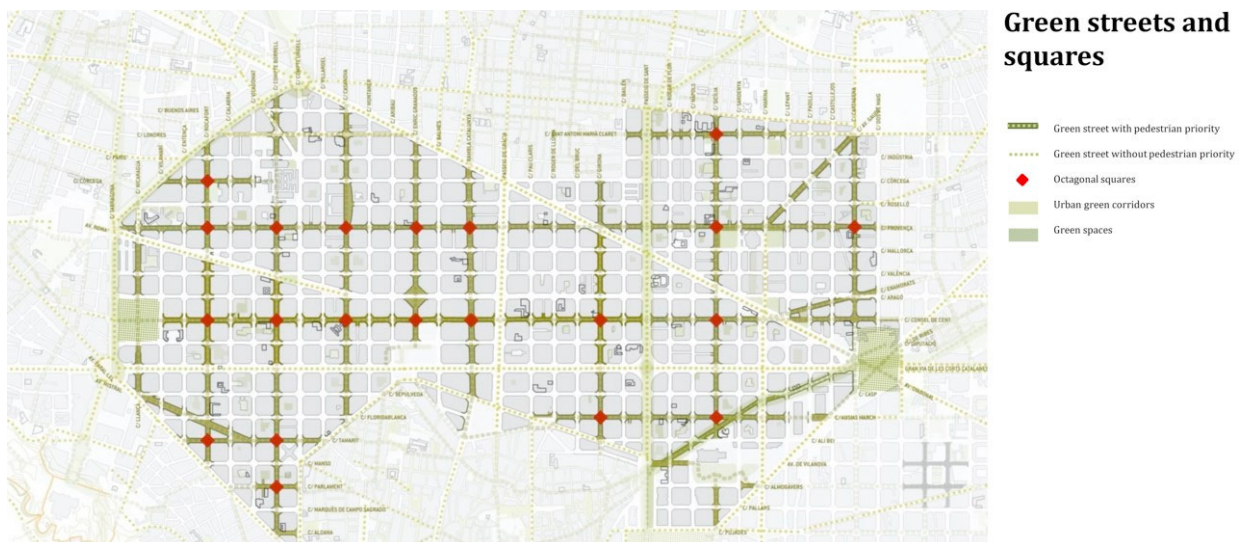


Fig. 3. The network of green streets and squares proposed for the Eixample district (source: <https://ajuntament.barcelona.cat/superilles/en>)

The implementation of the Eixample project will see a first phase in which four green streets (C/ Consell de Cent amb Rocafort, C/ Comte Borrell, C/ Enric Granados and C/ Girona) and four squares at their intersection will be realized within the first quarter of 2023. Two public competitions have been organized by the City to select the architect and engineer teams that will draft the traffic-calmed model for the streets and the squares.

6. Discussion and conclusion

In grey literature and on the Internet, Barcelona is often quoted as an example of 15-minute city because of its SM strategy (see, for example, C40 Knowledge Hub, 2020, Graells-Garrido et al., 2021, Intertraffic, 2021, Popescu, 2020). This is only partially true. On the one side, the SM strategy does not really take into consideration the level and time threshold of accessibility to main services, except to green areas in the recent project for the Eixample district. On the other side, it has to be acknowledged that this strategy is based on re-designing the street space in order to promote walking and cycling, which indeed is along the lines of the 15-minute city.

The SM strategy is evolving, moving from the approach based on small areas as in the case of Poblenou, to a street network approach applied to entire districts, as in the case of the Eixample (whose area is 7,5 square kilometers, nearly 50 times the one of Poblenou SM). This different perspective will perhaps allow to avoid the conflicts that emerged in the case of Poblenou between the residents of the San Martí district living inside the SM and those living around it.

At the same time, the analysis of case of the Poblenou SM let emerged some critical issues, that could reoccur in the Eixample district. They both are located on the homogenous Cerdà's grid; as a consequence, as it happened in the Poblenou, the creation of some green streets and squares inside the Eixample could determine a feeling of discrimination in those residents living in the remaining streets of the districts (where car traffic will not be reduced, and could even increase). The City of Barcelona justified the choice of the streets to be converted in green axes as they have more commercial activity and facilities. But in turn this could arise opposite protests from shopkeepers, who could not be happy of the redesign of the street in front of their windows, as they often think car traffic ensure visibility and customers (Porta et al., 2012).

An appropriate participation process involving local residents will probably be crucial for the success of the Eixample project, as just some deficits in this process determined most of the local protests during the implementation of the Poblenou SM (Oliver and Pearl, 2017).

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