Mobility and urban form
The case of Montevideo

Forma urbana y movilidad sustentable: reflexiones sobre Montevideo

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Abstract

The following article reflects on the relationship between the built environment and mobility. Sustainable mobility, which prioritizes public transit and actives modes, has a starring role in the future of urban planning. In the literature, this relationship between urban form and mobility has been vastly studied. Several authors have established which variables of urban form affect mobility, and what can be done through design to foster sustainable mobility. Also, the relevance of attitudinal factors has been studied and how, if possible, citizens' behavior could be affected in order to promote sustainable attitudes. Through the case of Montevideo, the relation between urban form and mobility will be exemplified. Also, the objectives and strategies of the city government's plans will be analyzed. Finally, conclusions and recommendations will be made according to the cited literature.

Keywords: Sustainable mobility, Urban form, Urban Planning in Montevideo.

Resumen

El siguiente artículo plantea reflexiones sobre la relación entre las características de la forma física de la ciudad y la movilidad. La movilidad sustentable (aquella que prioriza los modos activos y el transporte colectivo) tiene un rol prioritario en el futuro de la planificación urbana. En la literatura, se ha estudiado ampliamente la relación entre la forma urbana y la movilidad. Varios autores plantean cuáles son las variables de la forma urbana que impactan en la movilidad, y qué se puede hacer a través del diseño para fomentar una movilidad sustentable. También se ha evaluado la importancia de tener en cuenta los factores actitudinales y cómo, si es posible, redireccionar los comportamientos de los ciudadanos hacia tendencias sustentables. Por medio del caso de Montevideo, se ejemplificará la relación de las características físicas de la ciudad con la movilidad. A su vez, se analizarán los objetivos y estrategias que plantean los planes desarrollados por el gobierno municipal con respecto al desarrollo urbano y movilidad, y se realizarán reflexiones en base a la literatura planteada.

Palabras clave: Movilidad sustentable, Forma urbana, Planificación urbana en Montevideo.

Most cities in developing countries share certain characteristics in terms of their mobility: inadequate and deteriorated transport infrastructure, and little infrastructure for non-motorized modes (cyclists and pedestrians). This has led to an increase in the marginalization of the most vulnerable sectors of the population in many cities, which in general depend on public transport systems (UN, 2013).

Sustainable mobility (which prioritizes active modes and public transit) has a priority role in the future of sustainable cities (Banister, 2008). Despite the fact that in many parts the world policies have been implemented to reduce the use of private vehicles in urban centers, travel distances have increased as cities expand and, in turn, the desire for a suburban life, low density and dependent on the car, has become dominant (Banister, 2011).

In the literature related to urban planning, the relationship between urban form and mobility has been extensively studied. It has been raised whether it is possible to have an impact on the way we move through the built environment and the structure of the city. Several authors propose which are the variables of the urban form that impact on mobility, and what can be done through design to promote sustainable mobility. The importance of taking into account attitudinal factors and how, if possible, redirect citizens' behaviors towards sustainable trends has also been evaluated.

Through the study of the Montevideo case, we can exemplify the relationship of the physical characteristics of the city with mobility. In turn, we can analyze the objectives and strategies posed by the plans developed by the municipal government with respect to urban development and mobility.

Mobility and urban form

The issue of how urban form impacts mobility has been widely discussed in the literature, and is probably one of the most studied topics in urban planning (Ewing and Cervero, 2009). In a study carried out in 1997, where they summarize several of the findings of the literature related to this topic, Cervero and Kockelman define three characteristics of the urban structure that have an impact on mobility: density, diversity and design (Cervero and Kockelman, 1997).

Density

Authors Newman and Kenworthy have conducted one of the most extensive and frequently cited investigations of how density impacts mobility (Dieleman et. Al., 2001). In their study on transport and urban form in 32 cities around the world, Newman and Kenworthy (1991) argue that population density is the most important characteristic in impacting mobility. In this research, they compare, on the one hand, the density of inhabitants and, on the other, the fuel consumption of vehicles per person, and demonstrate the apparently linear connection between both variables. In the graph that the authors develop from these variables (see Figure 1), it is shown that the North American cities of Houston and Phoenix have the lowest population density (less than 25 people per hectare) and, in contrast, the highest level of fuel consumption per capita. The opposite case is that of Hong Kong, which, with a density of almost 300 people per hectare, has the lowest fuel consumption per person.

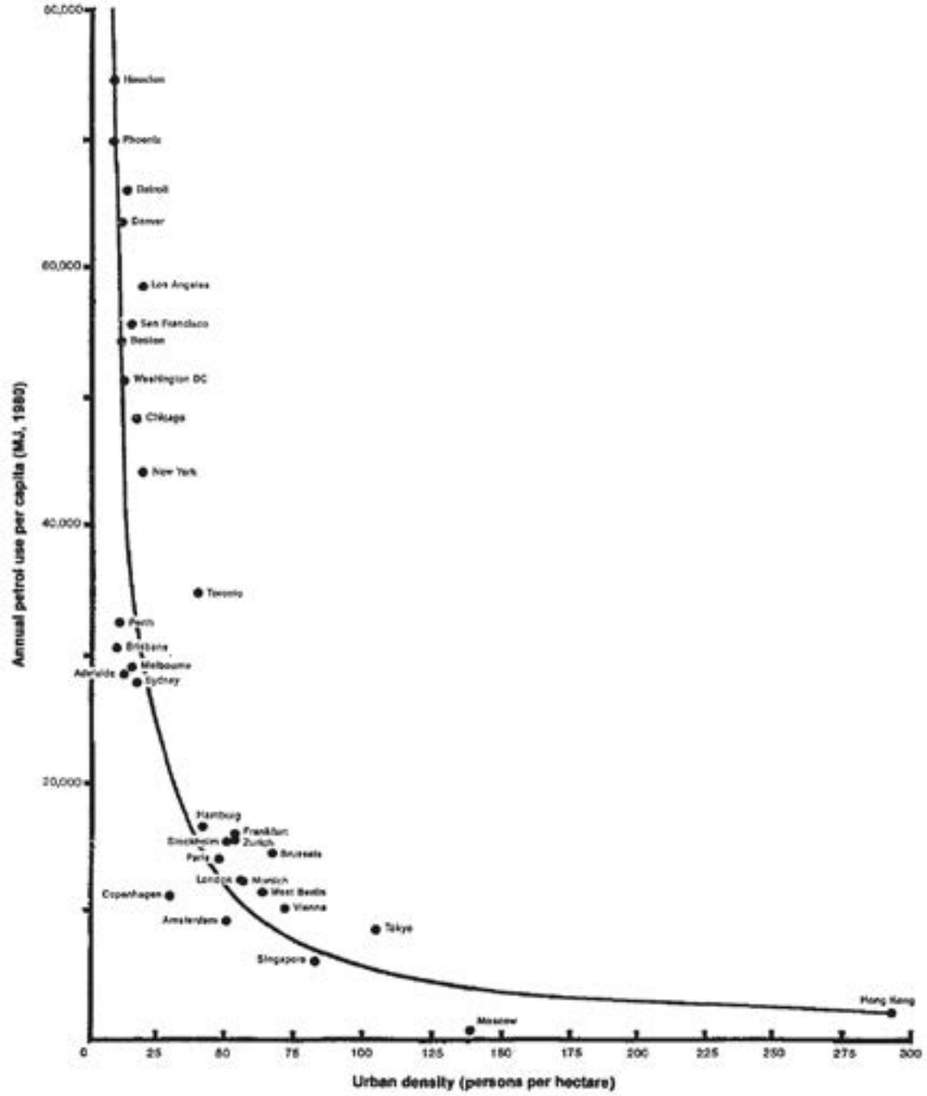

Figure 1: Annual petrol use per capita (MJ, 1980) Vs. Urban density (persons per hectare). Newman & Kenworthy, 1991.

Diversity

According to Cervero and Kockelman (1997), diversity measures the amount of land use for a given area. Low levels of diversity indicate single land use environments and, conversely, high levels of diversity indicate varied land uses.

Newman and Kenworthy also consider the diversity factor in their studies. The authors establish that in order to obtain more efficient mobility, it is imperative to reduce trips, and for this, it is necessary that the patterns of employment density are similar to those of population density (Newman and Kenworthy, 1999). In other words, a diverse urban fabric in terms of its uses causes the use of private cars to be reduced, since the distances to the different destinations are shorter and that favors pedestrians and cyclists.

In this same line, Rueda (2002) analyzes the antagonistic models of the compact and complex city in contrast to the dispersed and diffuse city. The author comments that the current land use planning consists on the allocation of land uses and functions in a dispersed and segregated way, that is, with low diversity. From the point of view of mobility, this means that the connection between these uses is only possible with mechanical means (road network), and that, in turn, the growth of the city is possible only through the growth of the road network that then becomes the structuring of the territory. The territory is then compartmentalized, which in turn has an impact on the segregation of the population. According to Rueda, the result of this model of a dispersed city with low diversity is a massive use of means of transport (generally private), therefore, saturated and congested road networks (Rueda, 2002).

Design

According to the study by Cervero and Kockelman (1997), design includes the characteristics of the road system in a given area. Roads can vary from dense networks with high connectivity and permeability, to dispersed suburban systems with low connectivity (for example, with cul-de-sacs). The different characteristics are the average size of the blocks, the number of intersections, the width of the sidewalks, the width of the streets, the number of pedestrian crossings, and other physical variables that differentiate pedestrian and cyclist-oriented environments from environments geared towards private vehicles.

The United Nations has developed a system to assess the prosperity of cities (City Prosperity Index), used to measure factors such as productivity, quality of life, infrastructure and environmental sustainability of cities. The report establishes that those cities with the highest rate of prosperity are, in turn, those with high connectivity in their network of streets. In turn, the design of streets that promote pedestrians and cyclists generates a positive impact on the quality of life and social inclusion, and therefore an increase in the prosperity index of said city (UN, 2013).

On the other hand, the large gap that exists between the connectivity of the road system in urban centers and the peripheries is a reflection of the enormous inequalities in most cities in the developing world (UN, 2013). The low connectivity, especially in suburbs, peripheries and informal settlements, generates a great negative impact on the capacity of the city to provide adequate infrastructure and services to these sectors of the territory. A well-connected street pattern has a large number of intersections, and few cul-de-sacs. As connectivity increases, travel distances decrease, and the options for both routes to be taken and modes of travel (public transport, bicycle, walking) increase, creating a generally more accessible system (UN, 2013).

The matter of choice

When studying how urban form and planning can impact mobility, some authors suggest the need to take into account other factors, such as attitudinal elements and the behavior of citizens. People decide on how to move around the city and where to live, and these decisions are not always related to the built environment but also to cultural elements, habits and aspirations.

Guglielmetti et. to the. (2017) argue that it is necessary for municipal governments to implement mobility management campaigns that help to change habits and social norms, and they ensure that this should be an essential part of strategic mobility and transport plans. Hiselius and Rosqvist (2015) argue that these campaigns can be the tool that unifies the individual efforts of citizens, in such a way as to achieve a more forceful and holistic change.

The modes of transport that people choose are also related to the choice of places where they reside. In this regard, Bohte et. to the. (2009) point out that ignoring this factor when evaluating mobility would be to overestimate the impact of the built environment. The authors consider that it is important to identify people's habits and promote sustainable behaviors at home. But, if people consider that the use of the private vehicle is the best option to get around, the authors question whether investing in public transport can meet the desired objectives of sustainable mobility.

For Dieleman et. to the. (2001), consumer preference regarding the choice of places to live has tended towards less compact residential environments and, along with this, high use of private vehicles. According to the authors, the relationship between urban form and the choice of transport mode is difficult to elucidate, since many factors influence this relationship. For example, the characteristics

of each household with respect to income, composition, work activity, influence behaviors and choices regarding how they choose to move. In turn, the purpose of the trip also influences (work, shopping for home, etc.).

The attitudinal factor and the characteristics of the households add a layer of complexity to the discussion about mobility, and seem as relevant as the physical characteristics of the city. The difficulty presented by this variable is having to consider habits and attitudes that are not necessarily rational, which can not only be complex to predict and measure, but also to modify.

The case of Montevideo

Like most Latin American cities, Montevideo suffers from inefficient mobility, segregation, pollution, and high rates of traffic accidents (CAF, 2011). Using the three variables defined by Cervero and Kockelman (1997), we can analyze the urban structure of Montevideo and its relationship with mobility.

Despite the fact that its population has remained stable for decades, Montevideo has become a more dispersed city (IM, 2010) and, as has been the global trend, its center has suffered a process of loss of residents. The migration of people from the city center has occurred for different reasons, mainly economic (IM, 2010), and has manifested itself basically through two phenomena. The first and most significant is the increase in informal settlements on the outskirts of the city (Portillo, 2010). The second is the migration of the upper-middle and upper classes to the suburbs, concentrated mainly on the east coast of the Montevideo Metropolitan Area (MMA) (IM, 2013).

With regard to population density, in general the city has a relatively low density, especially in its intermediate and peripheral areas. The highest densities are concentrated in its central zone, in neighborhoods such as Centro, Cordón and Pocitos (see Figure 2). Since 1985, the central and intermediate areas of the city have lost population, while population growth has been concentrated in the peripheries of Montevideo (see Figure 3). The loss of population has not meant loss of households, since these have grown due to their transformation into smaller households. It is in the census period between 1996 and 2004 that the polarization between the increase in population in the peripheries and the decrease in the central and intermediate areas is most noticeable (Bervejillo, 2016).

If we follow the line of reasoning established by Newman and Kenworthy, the phenomenon of population density decrease could lead to an increase in travel distances (in the MAA they can be more than 30 km) and an increase in the use of private vehicles as a means of transportation (for those who can afford it), generating congestion and a worsening of the quality of life of citizens in general.

With regard to diversity, we can analyze the relationship between work and residential activity in Montevideo. Traditionally, the labor supply in Montevideo was concentrated in the central areas, both in its historic center (Ciudad Vieja), as well as the Centro and Cordón neighborhoods. In recent years, new office developments have emerged in other parts of the city, mainly along the coastline to the east (neighborhoods such as Punta Carretas and Pocitos). Broadly speaking, it could be said that both the Center and Pocitos, in addition to concentrating the largest amount of job offer in the city, are in turn the areas with the highest population density in Montevideo, which gives a priori a relationship between balanced population-work and, therefore, neighborhoods with high diversity.

According to the Mobility Survey of the Metropolitan Area of Montevideo (Mauttone and Hernández, 2017), Municipality B (which includes neighborhoods such as Ciudad Vieja,

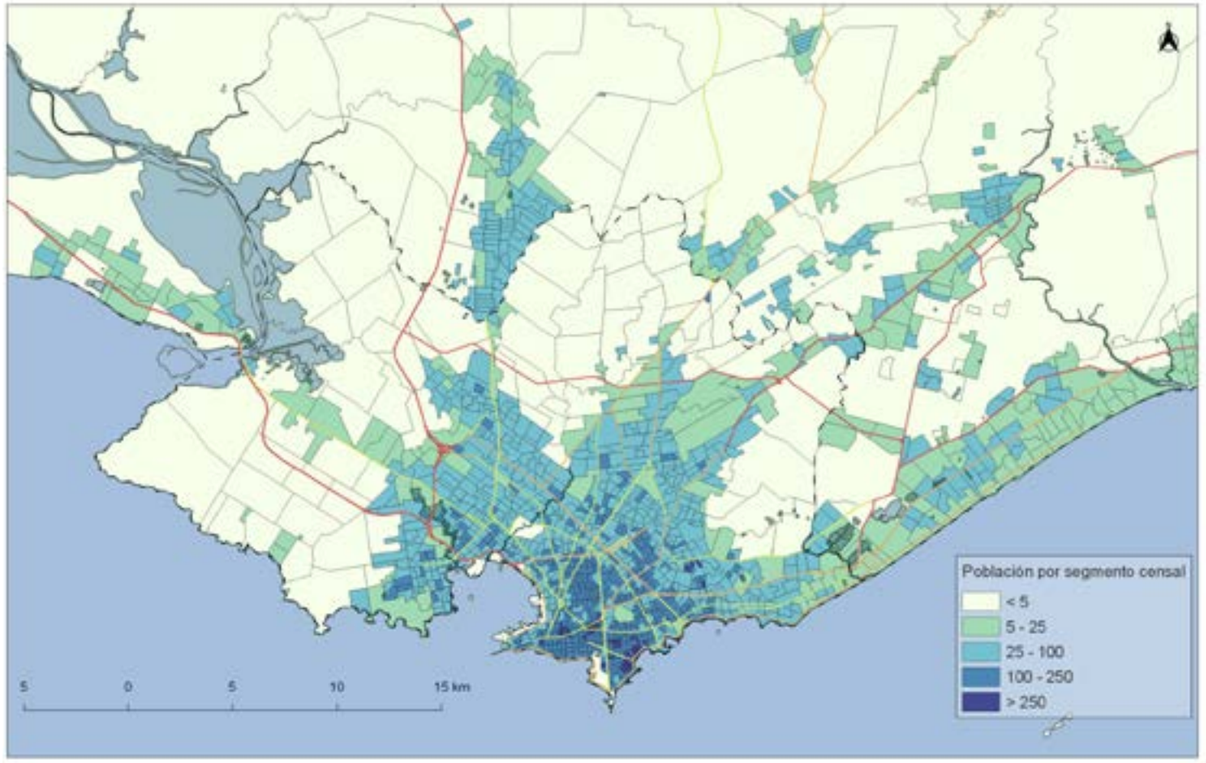

Figure 2: Urban density (persons per hectare) in Montevideo Metropolitan Area.

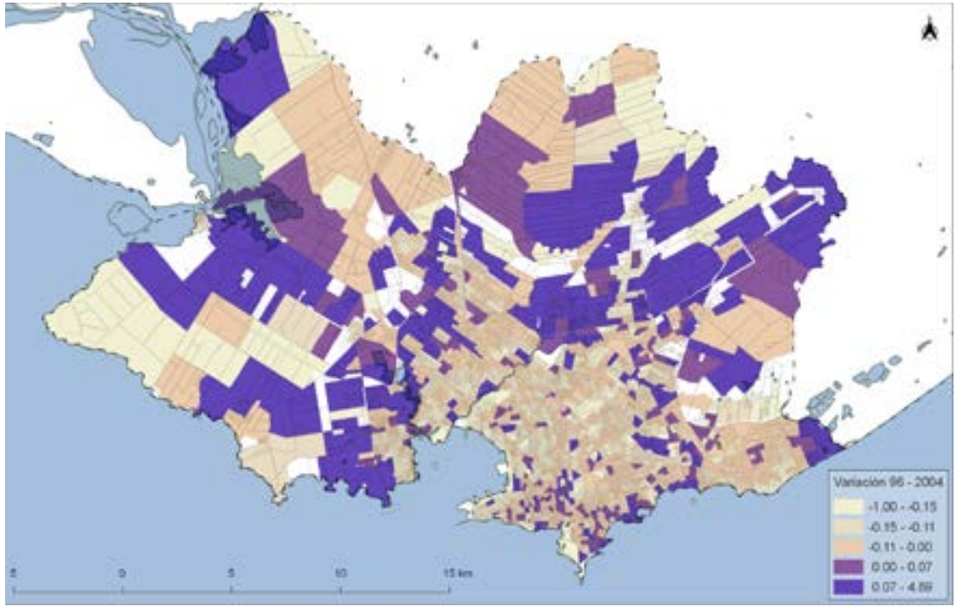

Figure 3: Population variation between 1996 and 2004 by census segment in percentages.

Figure 4: Montevideo mobility structure diagram.

Centro, Cordón, and Parque Rodó, among others), is the area that has the greatest attraction of morning rush hour trips, followed by Municipalities C and CH (which includes Punta Carretas and Pocitos). In turn, Municipality B presents the highest value of travel productions in the afternoon peak hours. The survey also details that, with regard to trips for work purposes, Municipality B is again the sector of the city that has the highest amount of production and attraction of trips. About half of the trips produced and attracted by Municipality B occur intra-municipality, that is, they are generated and are destined for some point in the municipality itself.

The analysis carried out in the Mobility Survey regarding the generation and attraction of trips considers municipalities as the minimum area, but these tend to be broad sectors of the territory, lacking homogeneity in terms of population density, work, and activity. In turn, in the analysis presented, the total amount of trips attracted and produced by Municipality B is not disaggregated by mode, so a priori it cannot be determined whether, due to the high diversity that this sector of the city has, they produce more trips in active modes with respect to other areas with less diversity. Of the rest of the trips produced and attracted by Municipality B, a large percentage have as origin and destination other municipalities of the MAA. It is also not clear in what modality these trips are made, so it is difficult to draw conclusions.

In any case, regardless of the mode, and due to a merely semicircle-shaped theme of the city, there is a funnel effect towards the central areas through specific access roads, which favors congestion at peak hours (see Figure 04). In turn, the survey shows that in the period between 2009 and 2016, there has been an increase in the use of private motorized vehicles as the main mode of travel (from 45.4% to 51.6%, excluding short walking trips), and in turn, a decrease in the use of public transport (from 39.1% to 35.7%). All this added to the fact that, in general, there has been an increase in the number of people who move around the city, and also an increase in trips per person (Mauttone and Hernández, 2017), may explain the congestion in central areas.

This funnel effect seems only to be salvageable to the extent that other parts of the territory begin to have a more balanced residence-work relationship, especially intermediate areas that already have an appropriate infrastructure to accommodate both residents and workers. In this way, shorter trips would be generated and therefore sustainable modes of travel would be promoted. It would be interesting to be able to introduce in the analysis of the Mobility Survey the variable of physical characteristics of the studied environment (density, diversity, design), in such a way as to be able to draw conclusions regarding how people move in relation to the characteristics of the built environment where they live.

Regarding the design of the urban fabric, the city of Montevideo in general has high connectivity, provided by a grid of streets that characterizes large parts of the city (see Figure 05). However, the situation in the peripheries of the metropolitan area is different. Here, growth has occurred in small subdivisions attached to the large access roads to the city (see Figure 06). These divisions, despite the fact that they are grids themselves, are independent and do not connect with each other, so they depend on the routes as a unifying element. This situation is aggravated in informal settlements, whose intricate systems of passages and streets make the arrival of services and accessibility in general very difficult (see Figure 7).

In recent years the phenomenon of private neighborhoods has emerged in the AMM, as in many other Latin American cities. The Municipality of Canelones allows the construction of private neighborhoods, which normally have a poorly permeable design, in a specific sector of the department (Camino de los Horneros). These ventures have created suburbs that can only be accessed by private vehicles and that are totally disconnected from the rest of the urban fabric.

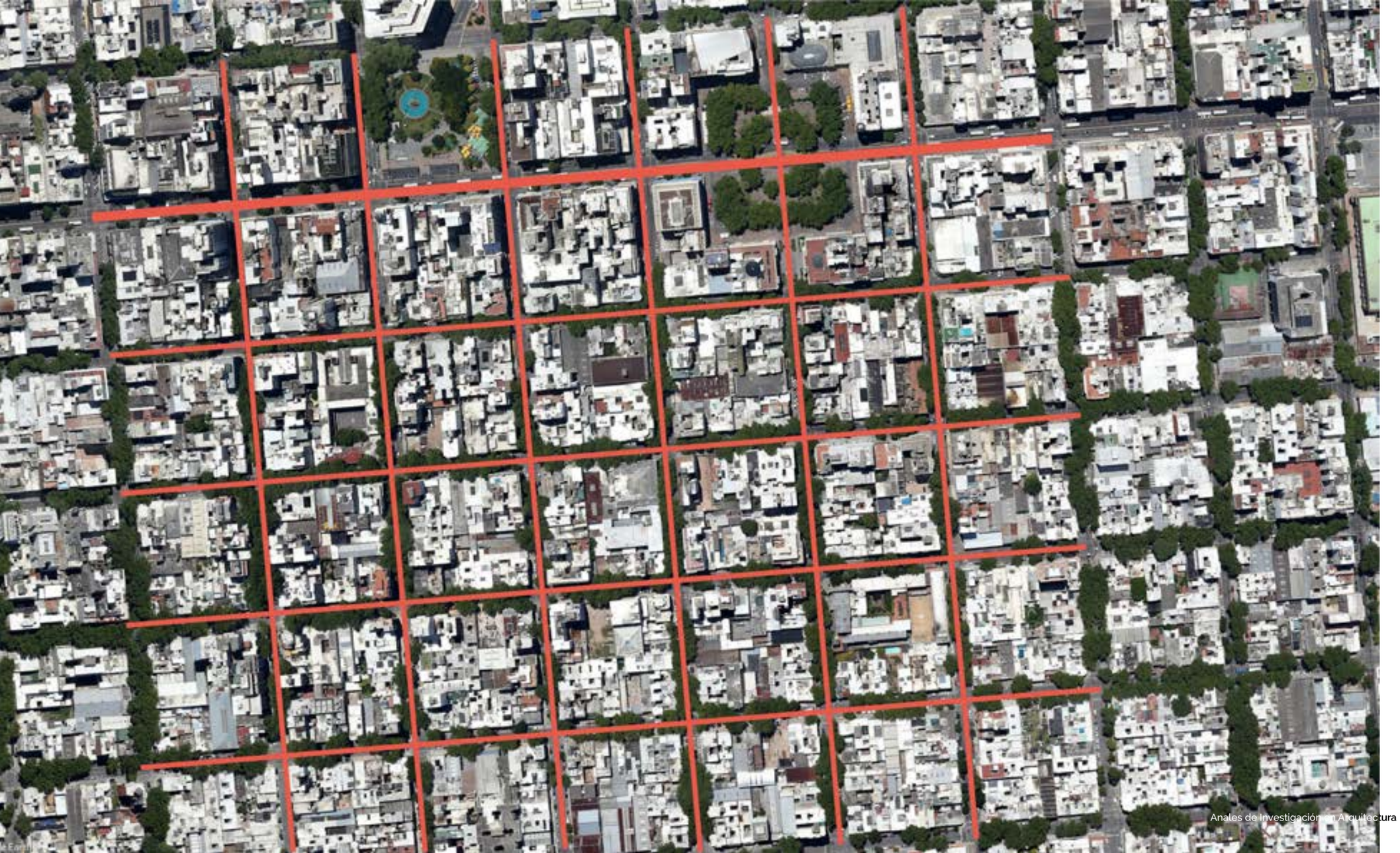

Figure 5: Network of streets in the central area of Montevideo.

Figure 6: Network of streets on the outskirts of the Metropolitan Area of Montevideo (Barros Blancos, Canelones). The path is the main structurer of the system, from which the tissues are organized, which have little connectivity between them.

Figure 7: Network of streets in an informal settlement in Montevideo (Santa Catalina). Intricate system of passages and streets that do not connect with each other, which complicates accessibility.

The choice of Montevideo

Users of the public transport system in Montevideo have decreased, at the same time that the use of the car and the total number of people who move is greater (Mauttone and Hernández, 2017). Part of this can be explained by an improvement in the country's economy after the 2002 economic crisis, which has led to greater purchasing power and, in turn, lower prices for cars and motorcycles (CAF, 2011). One of the worst evaluated aspects by Montevideo's regarding the capital's public transport system is its cost (Mauttone and Hernández, 2017). It is possible that some users choose to buy a private vehicle (especially motorcycles) since, depending on the trips they need to make, it is feasible that it is a cheaper option than collective transport. Another reason that can influence Montevideo's decision to use their own vehicles is the travel time. The average speed of public transport in Montevideo is 16 km / hr, and only 6 to 8 km / hr in central areas (IM, 2010), which means that this modality has the longest travel times. This, added to the aspirational aspect of owning a private vehicle, makes public transport an undesirable or profitable mode, and people choose other modes to the extent of their possibilities.

While in the world urban life is "in fashion" and sustainable lifestyles are being adopted by many people (Banister, 2011), surveys show the opposite for Montevideo. Although the construction of bike paths in central areas has been promoted, it has been slow and little regulated. Beyond some civil society movements that promote sustainable mobility, there is not a change in habits strong enough to counteract the trend of private vehicle use.

Montevideo Mobility Plan

In 2010, the Municipality of Montevideo presented the Mobility Plan, the objective of which is "to achieve a more efficient, comfortable, economical, environmentally sustainable and fundamentally democratic transport" (IM, 2010, p.7). Although its validity is currently questioned, especially due to the negative result obtained in the implementation of the first phases of the plan, at the moment the Municipality has not published a revision of the document.

The plan recognizes that the changes that the city has undergone in recent decades are leading to a mobility crisis, although, as detailed, a crisis not fully installed. In response to this crisis, an urban mobility based on terms of social equity and environmental sustainability is proposed, therefore, actions related to collective transport and active modes of travel are prioritized (see Figure 8). The Mobility Plan takes as its starting point the 1998 Land Use Planning Plan (Montevideo Plan). As detailed, both plans share a strategic vision and the Montevideo Plan includes the general guidelines regarding roads and transportation.

In general, the plan promotes sustainable mobility and a link with urban development, but lacks details on how to deal with problems such as population migration to the peripheries and attitudinal issues regarding the choice of travel modes. It is detailed that "an effort will be made to integrate transportation planning with urban growth planning, land uses and old and new centralities" (IM, 2010, p. 23), but it is not specified how this will go to carry out. Transport corridors and location of terminals are proposed "on the edge of peripheral urban areas seeking to contribute to consolidating urban fabrics, reinforcing existing centralities or becoming generators of new centralities" (idem, page 46), but there is no detail of an urban regulation that accompanies these road infrastructures.

The Montevideo Mobility Survey and the studies carried out by the Mobility Observatory have shown a trend towards an increase in the number of vehicles and a decrease in the use of sustainable modes of travel (Mauttone and

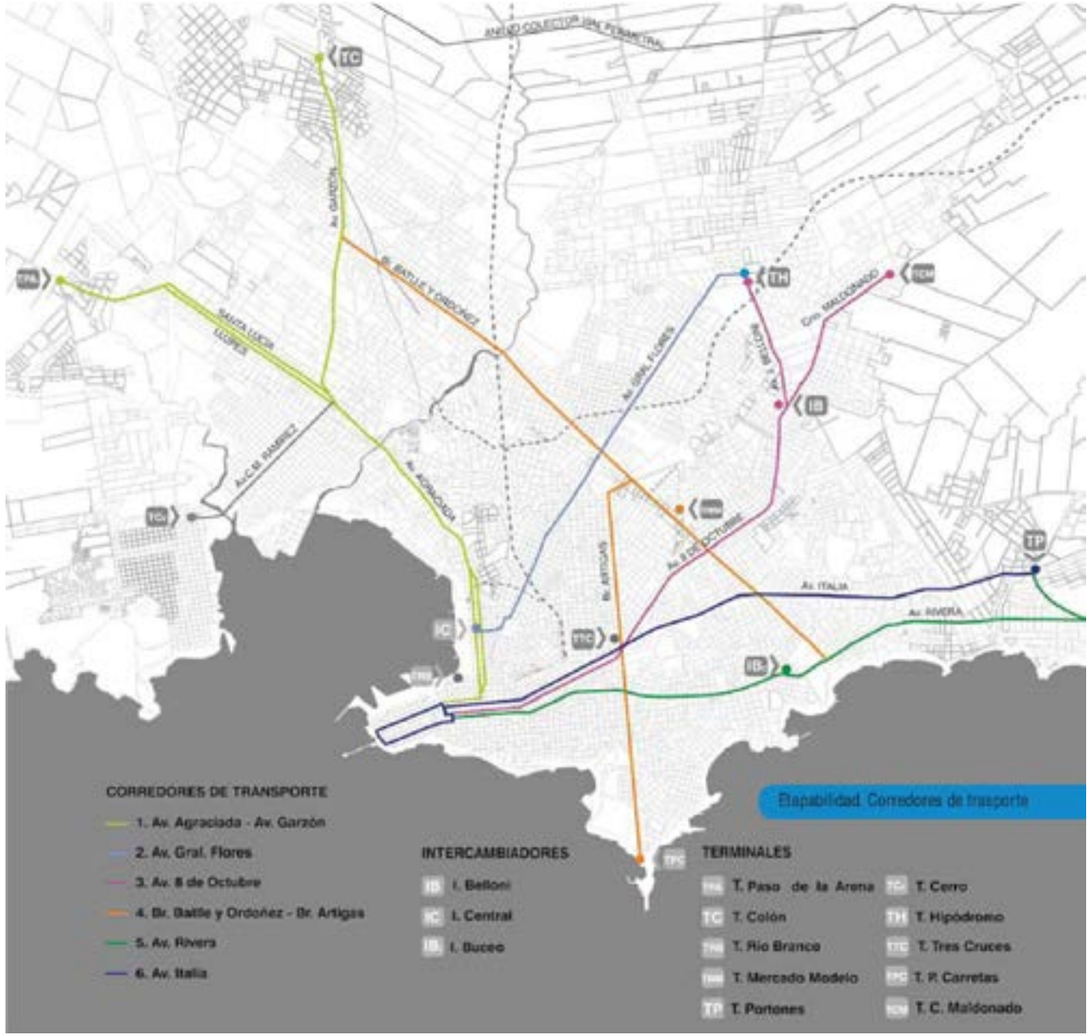

Figure 8: Transport corridors, interchanges and terminals according to the Mobility Plan. They pose as runners the following streets: Av. Agraciada, Av. Garzón, Av. Carlos María Ramírez, Bvar. Batlle y Ordónez, Bvar. Artigas, Av. 8 de Octubre, Av. Gral. Flores, Av. Italia, Av. Rivera. (IM, 2010).

Hernández, 2017; Vasconcellos and Mendonça, 2016). Eight years after its publication, the Mobility Plan has not managed to reverse this trend, so the need for its revision is evident.

Departmental Guidelines

In 2012, the Municipality of Montevideo published the Departmental Guidelines for Territorial Planning and Sustainable Development (DDOTDS). The DDOTDS arose as part of the revision process of the 1998 Montevideo Plan, “forming the instrument that will contain the structural and strategic decisions on the territorial ordering of the territory” (IM, 2012, p. 4). One of the aspects that the DDOTDS refers to is the formulation of general guidelines for sectoral policies (including mobility).

The DDOTDS discourse is in accordance with the literature seen above. Its guidelines go along the lines of compacting, redensifying, diversifying and generating an accessible and inclusive design. At the same time, the importance of road and urban development as a whole is recognized. There is a clear intention to integrate mobility planning with comprehensive planning of the territory adjacent to corridors and terminals. Road connectivity that rebalances the current concentric structure of Montevideo, enabling new links, is understood to be essential.

The document proposes a series of strategic territories, within which it includes two urban axes (Bvar. Batlle y Ordóñez and Av. Luis Alberto de Herrera, and Av. Gral. Flores), and proposes a series of interventions to be carried out in each one . Both axes are also proposed as corridors in the Mobility Plan (see Figure 09).

However, due to the fact that the nature of this document is of an orientation and general nature, the points that it develops are only general guidelines, and there is no

Figure 9: Strategic territories according to DDOTDS: Urban hubs (Bulevar Batlle y Ordóñez and Av. General Flores). (IM, 2012)

specific detail of how to carry them out beyond naming some possible interventions to be carried out. That is, again, there is no specific regulation that somehow reflects these intentions.

The current regulations, then, continue to be those proposed in the Montevideo Plan in 1998. With respect to the maximum permitted heights, although heights up to 37m are proposed in downtown areas and in some main axes, in general the plan proposes for Montevideo low heights (maximum 9m), especially in the intermediate areas, and in turn several axes are not hierarchical. The average height of 9 m in the intermediate areas is not a regulation that encourages densification and, although in theory it would allow moderate densification, it does not make these areas attractive for investment (Bervejillo, 2016).

Of the road corridors proposed by the Mobility Plan, only two are retaken in the DDOTDS as strategic territories (Av. Gral. Flores and Bvar. Batlle y Ordoñez). The rest of the corridors are not prominent, so there does not seem to be total coordination between the two plans when defining which axes are strategic. In the Montevideo Plan, both Av. Gral Flores and Bvar. Battle and Ordóñez have large sections with a maximum allowed height of 16.5 meters, which would allow the construction of low buildings of up to 6 floors, but precisely at the point where the two axes intersect, the allowed height is lower, of 9 meters (except in the section of Av. Gral. Flores the south). The regulations then do not seem to be in accordance with the hierarchy that is intended to be given to these corridors (see Figure 10).

Another of the corridors proposed by the Mobility Plan is Bvar. Artigas (north-south section). This axis has a maximum permitted height of 9 meters from Tres Cruces to the meeting with Av. Luis Alberto de Herrera. However, a height greater than 16.5 meters from Bvar is allowed. Artigas to the east, within the plot of the La Blanqueada neighborhood (see Figure 11). Something similar happens in the La Teja neighborhood, where on Avenida Carlos María Ramírez (another of the corridors proposed by the Mobility Plan), the proposed height is 9 meters, while the northwest sector of the neighborhood (towards the Pantanoso stream) It has a standard of 16.5 meters (see Figure 12). It is not clear what is the criterion with which this regulation was determined, but there does not seem to be, at least in these points, an intention to rank the corridors above the rest of the plot.

Figure 10 and 11: Regulatory ranges for building height in Montevideo, according to the Montevideo Plan (1998). Section. Sector Bvar. Batlle y Ordóñez and Av. Gral. Flores. (Bervejillo, 2016).

Figure 12: Normative ranges of building height in Montevideo, according to Plan Montevideo (1998). Section. Sector Av. Carlos María Ramírez. (Bervejillo, 2016)

Conclusions

Montevideo is experiencing, like many other cities in the world, a process of territorial dispersion that goes hand in hand with an increase in the number of vehicles. This has caused not only an increase in congestion, pollution, traffic accidents, but has also contributed to accentuating the problem of social segregation.

Based on what was previously analyzed for the case of Montevideo, the following recommendations can be made:

The Mobility Survey carried out by the Municipality of Montevideo is an essential instrument for urban and mobility planning. It would be relevant if the variables of density, diversity and design of the studied environments were added to the analysis, in such a way as to be able to understand exactly how Montevideans move with respect to the physical characteristics of the environments where they live and work. This would be an excellent tool for redesigning urban regulations.

In his speech, both the Departmental Guidelines and the Mobility Plan point to sustainable urban development, but in fact they do not propose concrete and joint regulations that unify urban development and mobility planning. Taking into account that both the Montevideo Plan and the Mobility Plan are in a condition to be reformulated, this would be an opportunity to review the current regulations (for example, regarding the permitted heights) and promote densification in the strategic axes and centralities. . In turn, the Mobility Plan should include strong management campaigns aimed at achieving a change in citizens' behavior. If people continue to migrate to the peripheries, and if they do not use public transport because it is not an economically viable or desirable option, the proposed sustainable mobility system will not be successful.

According to Banister (2011), urban plans should include actions to reduce the need to travel and reduce travel distances, which would encourage the use of public transport and active modes. The key is to provide quality environments, with easy access to services, so that people do not have to travel long distances in the city. Following the line proposed by the author, the future revision of the Montevideo Plan and the Mobility Plan should include two lines of action: on the one hand, the reduction of the use of private vehicles in urban centers, mainly through methods of control of the demand (increasing parking fees or access to certain points of the city), and at the same time with a strong investment in public transport systems (making it an economically viable option for those citizens who cannot afford it, and desirable for those that for convenience they prefer the use of the private vehicle), in appropriate infrastructures for pedestrians and cyclists, and in discouraging the use of private vehicles by only one person (promoting car-sharing); and on the other hand, based on urban planning, as we saw, modifying the regulations in certain strategic axes and centralities, promoting mixed-use undertakings (thus generating greater diversity), and promoting densification around public transport nodes (transport oriented developments).

Policies such as the Promoted Housing Law of 2011, promoted by the National Housing Agency (MVOTMA), can play an important role in the redensification of the central and intermediate areas of Montevideo, since it promotes the construction and renovation of housing in sectors consolidated. From this derives the importance of evaluating the impact of this law, not only in providing housing to the most vulnerable sectors (which is its primary objective), but also in generating an increase in density and diversity in different parts of the world. territory. This type of study would allow, for example, to assess the need to adjust the benefits provided in different sectors of the city, perhaps generating areas of greater exemption at points where it is intended to increase density and / or diversity.

Through the study of the Montevideo case, the relationship between the physical characteristics of the city (in particular, density, diversity and design) and mobility has been exemplified. This article aims to collaborate with the generation of specific knowledge in the areas of urban planning and mobility, as well as collaborating in the design of public policies aimed at developing a strategy and specific regulations for sustainable urban development. Banister, D. (2008). The sustainable mobility paradigm. Transport Policy, (15), 73-80.

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Figure 2. Credit: Arq. Gonzalo Pastorino. Source: INE.

Figure 3. Credit: Arq. Gonzalo Pastorino. Source: INE.

Figure 4. Autor. Source: Google earth.

Figure 5. Autor. Source: Google earth.

Figure 6. Autor. Source: Google earth.

Figure 7. Autor. Source: Google earth.

Figure 8. IM (2010). Plan de Movilidad, hacia un sistema de movilidad accesible, democrático y eficiente 2010-2020. Montevideo: IMM.

Figure 9. IM. (2012). Directrices Departamentales de Ordenamiento Territorial y Desarrollo Sostenible de Montevideo. Recuperado de: http://www.montevideo.gub.uy/sites/default/files/informe_de_elaboracion_y_participacion-noviembre12_0.pdf (10 de mayo 2018).

Figure 10. Bervejillo, F. (2016). Informe de desarrollo urbano. Presentado por el Consorcio Artelia-Halcrow-Rhama-CSI para el Plan Director de Saneamiento y Drenaje Urbano de Montevideo (IM - División Desarrollo Ambiental - División Saneamiento). Montevideo: IM.

Figure 11. Bervejillo, F. (2016). Informe de desarrollo urbano. Presentado por el Consorcio Artelia-Halcrow-Rhama-CSI para el Plan Director de Saneamiento y Drenaje Urbano de Montevideo (IM - División Desarrollo Ambiental - División Saneamiento). Montevideo: IM.

Figure 12. Bervejillo, F. (2016). Informe de desarrollo urbano. Presentado por el Consorcio Artelia-Halcrow-Rhama-CSI para el Plan Director de Saneamiento y Drenaje Urbano de Montevideo (IM - División Desarrollo Ambiental - División Saneamiento). Montevideo: IM.