MORPHOLOGY AND THE RIGHT TO THE CITY: THE HIDDEN DIVERSITY PRESENT IN BRAZILIAN SLUMS

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ABSTRACT

The different morphological aspects between the regular city and the Brazilian favelas are widely studied. However, these studies do not deal with the social and spatial diversity present in the same settlement. This work aims to highlight the social and spatial diversity present in Brazilian favelas, often ignored by public policies, designers and academics. There are several building types and road and traffic patterns, and so are socio-spatial qualitative differences. In the same slum, the right to the city may be a reality for some residents, while, for others, it may be a distant reality, depending on the area where they live. When interventions in favelas do not consider its diversity of morphological patterns, the socio-spatial differences in the favela deepen further. The need to occupy and build upon restricted spatial and socio-cultural contexts eventually generates creative morphological patterns while enhancing urban, environmental or building precariousness. The proposed discussion will bring elements to more adequate interventions, based on the patterns and morphological structures commonly found in Brazilian favelas, taking as references settlements from São Paulo and Rio de Janeiro, examples of the Latin American megacities, and Maceió, a medium size state capital city. Keywords: Morphology, built environment, precarious settlement, favela, project and innovation.

INTRODUCTION

This paper aims to highlight the morphological diversity found in Brazilian *favelas*, arguing that interventions on these neighborhoods, often led by public policies, should be more sensitive to it in order to obtain better social and urban results. Previous academic and professional author's experience supports the ideas presented, developed through a morphological approach to producing a systematization of the main types of favelas. The result contributes to the understanding of the several levels of precariousness found in a given settlement, an image of the overall city's inequities.

Recent data estimates a deficit of 6.360 million housing units in Brazil (FUNDAÇAO JOAO PINHEIRO,2016). Estimation of slum dwellers are not precise, and the ongoing National Census forecasts 3,224,000 substandard dwellings, housing more than 11,445,000 million people (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATISTICA, 2020). The called "substandard agglomeration" is composed of different patterns of settlements, varying in the precariousness of housing and urban infrastructure. Population and built environment density are high in many settlements, and levels of density in those areas are also increasing in Brazilian cities.

The presence of favelas or other forms of informal housing is no exception. It is a result of the urbanization process of Latin American cities in the last century, in which the industrialization fostered migration from rural to urban areas, turning the region the most urbanized on the planet (UN HABITAT, 2012). This process occurred in a few decades, based on low wages plus insufficient public investments in urban services and housing to supply the demand. It shaped the region's cities, composing a specific urban dynamic in which poor workers have to solve their

housing needs by themselves, using its means, a process known as peripheral urbanization (CALDEIRA, 2017).

Efforts to upgrade these settlements, reducing risk and vulnerability while providing adequate infrastructure networks and better habitability conditions are in place since the second half of the last century (VAN DER LINDERT, 2016) and Brazil has a large experience on it. However, cities are undercutting investments in these policies since the 2008 crisis (BARRETO, 2018). The following discussion intends to present and reflect upon different situations that should be addressed through urban and environmental design, contributing to the next generation of slum upgrading interventions. We base it in real places from Brazil, but it might be useful to apply these reflections to other cases in Latin American cities.

DIVERSITY OF VULNERABILITY CONDITIONS IN SLUMS

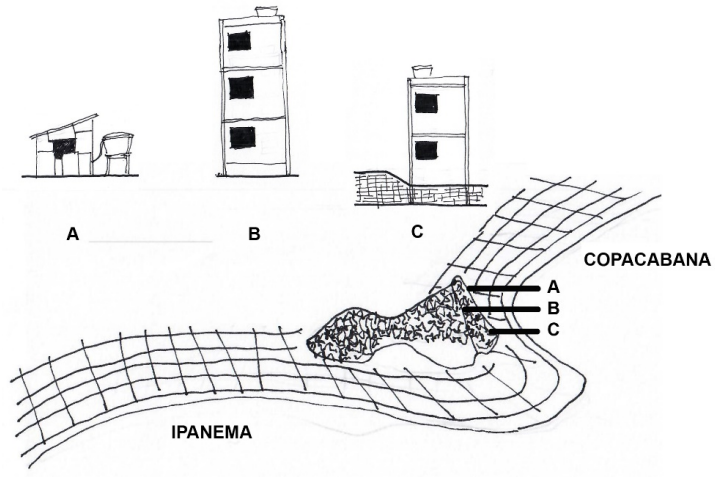

Figure 1: Sketch of the Pavão-Pavãozinho Favela, Rio de Janeiro, located in the prime area between Copacabana and Ipanema beaches. Vulnerability increases according to the height of the hill. Design: Jonathas

To understand the diversity existing in a single area, we use the example of Favela Pavão-pavãozinho, located between two famous beaches in Rio de Janeiro: Ipanema and Copacabana. It is a century-old slum that had its first occupations at the beginning of the 20th century. Figure 1 indicates **A** pointing to the most precarious buildings, located at the top of the hill, with altimetry above 100 meters from sea level. The precarious dwellings in **A** are a result of the difficulty of bringing building material to the place; therefore, it is the newest occupation area in the favela. At this point, it is possible to observe dwellings improvised with pieces of wood or traditional constructions made of pau-a-pique, one of the pioneering construction techniques used in Brazil (Lemos, 1976). **B** shows masonry buildings, often on stilts that overcome the unevenness of the terrain. In consolidated areas, buildings with more than one floor are typical, with an average of 3 floors, but up to 6 floors. **C** is placed on a low elevation and closer to formal city. Despite this proximity, there is no access to the indicated place. Here, garbage is accumulating, carried by rainwater. Over the years, uncollected garbage put houses at risk of fire and increases environmental unhealthiness. **C** is the most vulnerable situation compared to **A** and **B.**

This case reveals the need to understand the physical and environmental context to understand each situation's vulnerability. What causes vulnerability is a combination of building techniques with the location conditions. Some experiences begin to emerge in order to consider these conditions. However, they come from the design practice of some groups of architects and urban planners and other social scientists (SANTO AMORE, 2014; FEREIRA, L. I. C., 2017), without having been incorporated yet by the institutions that formulate public policies.

DIFFERENT CLIMATE AND GEOMORPHOLOGICAL SITUATIONS

Geomorphological context is another factor that produces different levels of vulnerability. Figure 2 takes three different contexts as an example:

Favela do Dique da Vila Gilda, located in the southeastern region (municipality of Santos), near one of the largest Brazilian ports. This place part one of the largest stilts favela complex in Brazil. The vulnerability of those on stilts is higher than those located on firm or grounded soil. This informal landfill is the result of several years to silting and the accumulation of solid waste;

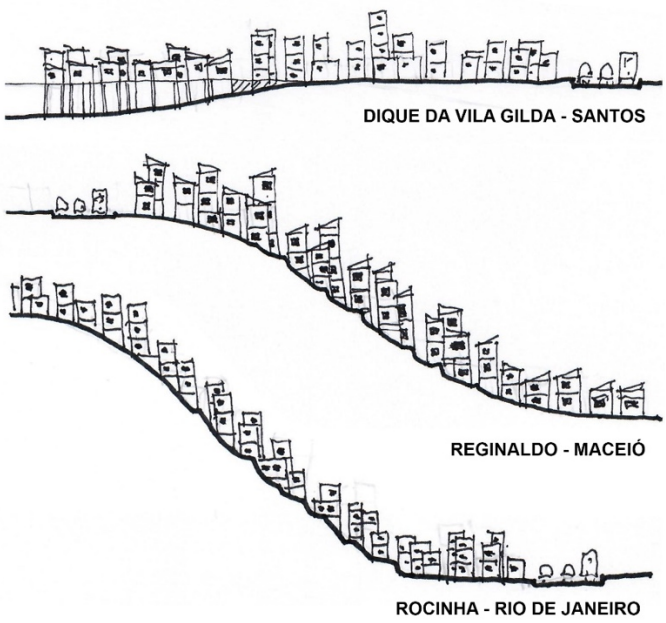

Figure 2: Geomorphological aspects: Dique da Vila Gilda, Santos, SP; Reginaldo, Maceió, AL. and Rocinha, RJ. Design: Jonathas

Favela do Reginaldo, located in the northeast region (municipality of Maceió). The city of Maceió occupies a coastal plain towards highland. In the transition, crevices abruptly cross the altiplano to the coastal plain. Favela do Reginaldo occupies one of its crevices. The vulnerability is highest at the lowest elevations located far from the city's urban mobility infrastructure.

Favela da Rocinha, located in the southeast region (municipality of Rio de Janeiro). It is one of the most well-known Brazilian favelas occupying a steep hill composed of earth mixed with rock. The vulnerability increases proportionally to the distance to the main roads, whether or not these are internal paths or at the edge of the favela.

The picture shows buildings according to the type of roof. Rio de Janeiro has an average annual temperature of 25°, so roofs like slabs plays an essential role as a leisure space. In Maceió, with an average annual temperature of 32°, the predominant coverage is clay tile, which response better to thermal comfort. In stilt slums, there is a predominance of asbestos tiles, due to their price and lightness, and the dwelling will be transformed as the areas are grounded, presenting a gradual difference from the construction and population density.

In Rio de Janeiro, the slab, until the 1980s, was used by family members, like a brother or sister who migrates from another city to the favela or household's children when they generate a new family and a new home. However, this process is currently quite dynamic and is subject to conflicts over the economic interest it arouses. This process is so frequent that legislation seeks to regulate the so-called "slab right" (Magalhães, 2014). This right entered into the Brazilian legal system through Provisional Measure 759 of December 2016, which gave rise to Law 13,465 of July 11, 2017.

BUILT ENVIRONMENTAL VULNERABILITY AND HEALTHY

Morphology often uses parametric geometry to identify an equation that reveals the logic of implantation of building types (Dias, 2014; Duarte, 2007). However these studies, it does not reveal the different levels of vulnerability among the buildings. They also do not establish a relationship between the kind of vulnerability and the building type and its surroundings.

To systematize the found situations without exhausting the possibilities, figure 3 presents five drawings with at least six different types of vulnerability.

The roof (slab **3A** and roof **3B**) impacts the dwelling's environmental quality. Depending on the maintenance required by the adopted solution, the vulnerability regarding infiltrations will vary.

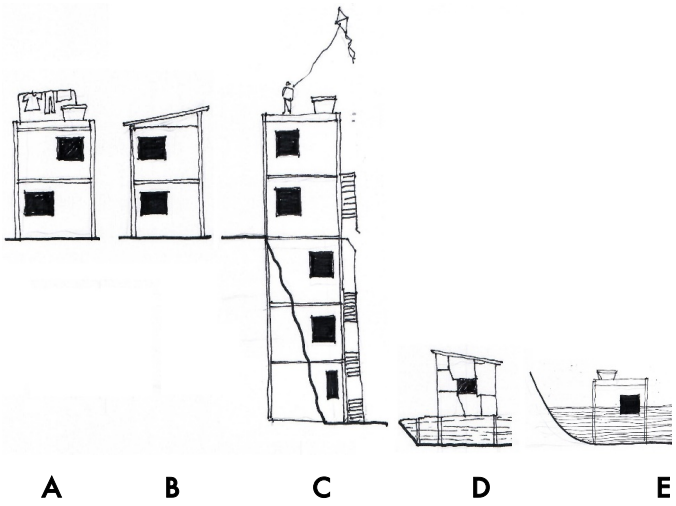

Figure 3: Different building patterns as a responce to socio-environmental and urban contexts. Design: Jonathas M.P.S., 2020.

figure 3C shows a building in which housing units occupy each floor, thus having different conditions of habitability. The units located above the ground will be in better condition than the units below the ground, where the humidity of the walls and the impossibility of cross ventilation further degrade the built environment.

Housing units on stilts (**3D**), despite the high humidity level, might be a better solution than the situation **figure 3E**, which shows a unit periodically subject to flooding. In the first case, the houses are adapted to deal even with variations in tides or increased water flow due to river floods. In the second case, residents are at constant risk of losing part or all of their belongings, including their lives, when a flood occurs.

LEVELS OF URBAN INFRASTRUCTURE'S PRECARIOUSNESS

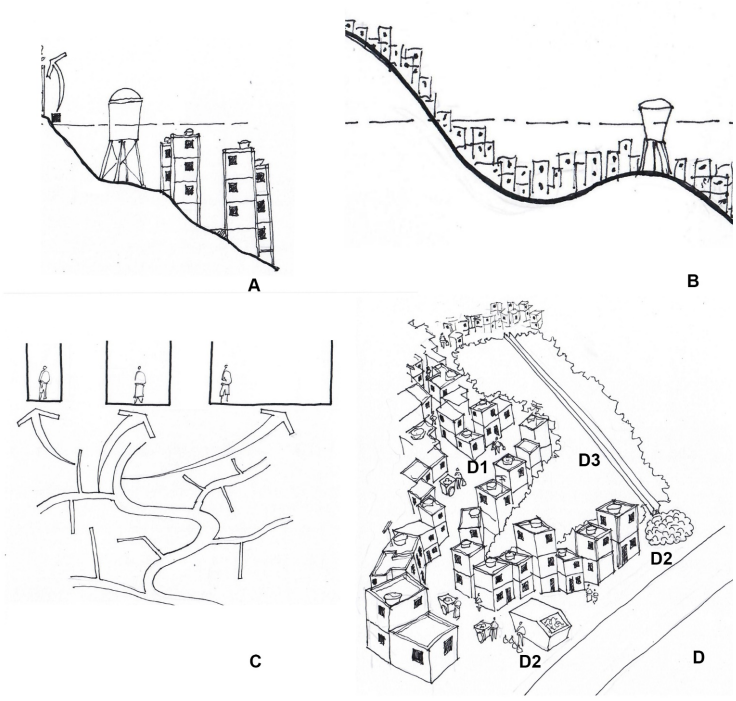

Figure 4: Above: limits of the water supply system; on the Left: strategies for implementing the Solid Waste Collection System; on the right: different conditions for the implementation of the sewage system. Design: Jonathas M.P.S., 2020.

The precariousness of the urban infrastructure in favelas varies, and it is directly related to location and the physical-spatial characteristics of the morphological elements, such as blocks and roads. In the southern zone of Rio de Janeiro (area of high land prices), legislation forbids occupation in areas located high than 60 meters above sea level. The law seeks to preserve areas that have high environmental fragility. However, it ended up causing the opposite effect: because as the real estate market does not dispute these well-located areas, they are subject to less inspection, facilitating their occupation by slums. Elements like slope, terrain's geological characteristics, accessibility, type of blocks, road's dimensions, will directly influence the conditions for the future provision of infrastructure in these areas after their occupation by slum dwellers.

As said, there is an accumulation of experiences in slum interventions in Brazil. Many of them were carried out in the last 40 years, bringing infrastructure to some parts of these areas. Some interventions end up further reinforcing inequities in access to urban infrastructure in the same favela.

The size and location of the water reservoir are essential to define the water supply conditions. Above the reservoir area, the adduction is more expensive due to the need to use pumps (Figure 4 - **A**). Due to the existence of many dwellings located above the reservoir, the adduction system depends on intense management in the maintenance of the pumps and the network, making it more expensive and complicated (Figure 4 - **B**). There are cases in which a measurement watch serves several units, sometimes an entire alley, making it challenging to seek leaks. The sewage network (Figure 4 - **D**) will depend on the roads and paths dimensions. The quality regarding the sewage and adduction system is directly related to the flexibility of the adopted solutions. The lack of alternative solutions to the traditional systems explains the difficulty of Brazilian municipalities to deliver sanitation services to 100% of the population (FURIGO, 2020).

Likewise, the waste collection system (Figure 4 - **D**) responds to the physical-spatial reality. In small alleys (Figure 4 - **D1**), residents deposit the garbage to the nearest point and "community garis" - residents hired by the public service - transfer the waste from the accumulation points (Figure 4 - **D2**) to the collection points of the favela, where it is common to require the presence of small compactors to account for the volume.

Municipal management tried many solutions over the years. One worth highlighting was the experience with the implementation of garbage ducts (Figure 4 - **D3**), which are large channels that overcome gaps, allowing the system to reach areas with difficult accessibility. However, experience shows that garbage accumulates much faster than the collection routine can attend. When this point of arrival is on ways accessible by vehicles of the public waste management company, it is possible to combine the solution with the compactor. However, when the point of arrival is in an area with little accessibility, the accumulation ends up generating great unhealthiness in its surroundings. Every point of waste deposit leaves the surrounding housing units more vulnerable, subject to foul smells and diseases.

MOBILITY AND OPERATING STRATEGIES

It is now possible to note the relationship between the quality of accessibility and built environment precariousness. In figure 5 (**A**, **B** and **C**), we present a synthesis based on existing favelas:

A - Favela do Reginaldo, AL; Pavão-Pavãozinho RJ;

B - Favela of Paraisópolis, SP; Favela do Realengo, RJ;

C - Rocinha, RJ; Heliópolis, SP.

The buildings located closer to the main roads present minor chances to be precarious. The difficulty in access jobs, public services, public leisure areas, public transport is gradually more significant as the distance from the principal access roads increases.

Figure 5 shows the locations with the most precarious accessibility (**5D**) and the locations with better mobility conditions (**5E**).

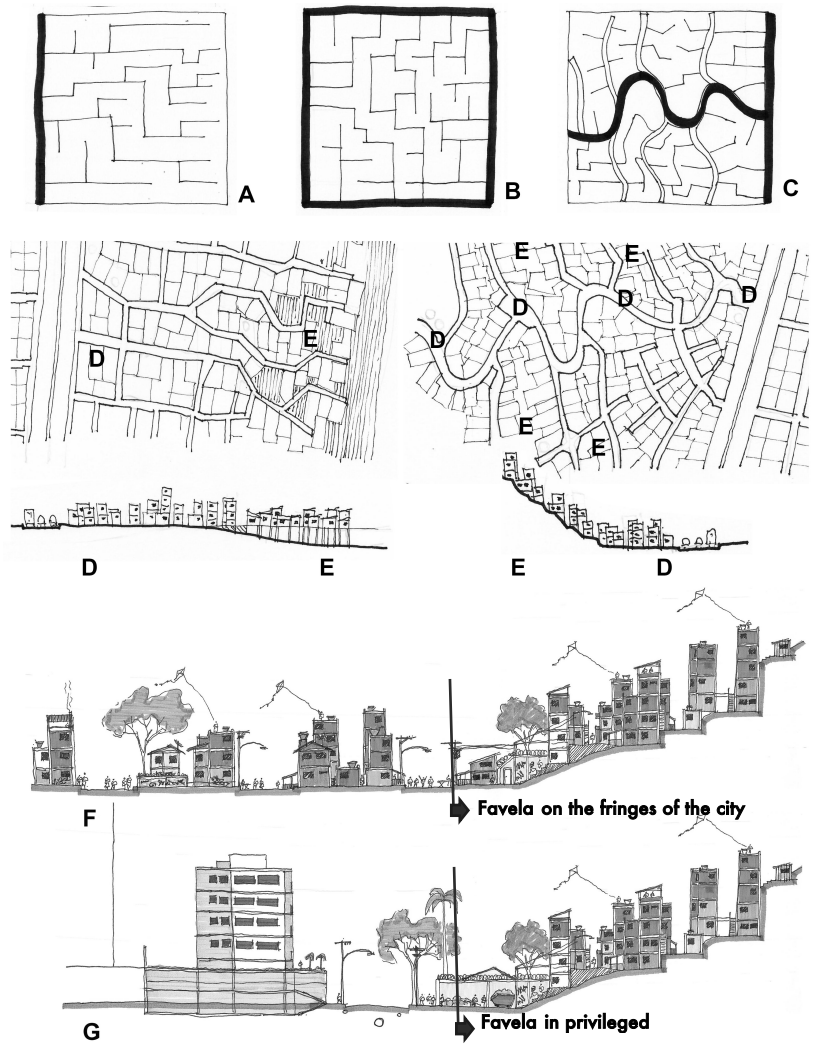

Figure 5: Urban patterns and location. Design: Jonathas M.P.S, 2020.

Some interventions alter or minimize these inequities, while others tend to emphasize the internal differences of the favela even more. The implementation of "metrocable" or "inclined plan" infrastructure tends to break with this structure. However, it is necessary to consider that these heavy elements of infrastructure are not always adequate. It is necessary to evaluate the equipment maintenance cost very carefully. Sometimes, a less technological solution can serve a larger audience and simultaneously generate job opportunities for residents. An example is the "mototaxis", a solution that increases mobility and affects the cost of living in places of difficult accessibility.

The urban location is one of the main features that affect the development of the settlement, conditioning its more or less prosperous future. Differences in location impact two scales: a) neighborhood: the distance between the main roads of the favela and areas with difficult access; b) city: accessibility to city's sectors with more significant job opportunities, urban facilities, and services.

LOCATION IN THE CITY AND OPPORTUNITIES

As we have shown, Brazilian favelas have great internal differences. However, it is necessary to consider that the degree of precariousness is directly linked to the location of the favela in the city. The most notorious Brazilian slums are in privileged locations in terms of access to the city and employment (Figure **5G**). The well-located settlements are usually more consolidated and end up being more frequently the subject of interventions through public policies. They have great diversity and vitality in trade and urban services, as well as high population and construction density. It is also common to observe an intense traffic of vehicles and the presence of a wide network of public institutions and non-governmental organizations working for different population strata. We can cite as an example the favelas, of Paraisópolis and Heliópolis in São Paulo and Favela da Rocinha in Rio de Janeiro.

Already on the fringes of the city (Figure **5F**), much more precarious slums are located, with medium population density and less commercial diversity. The population of these settlements is at greater social and environmental vulnerability. There is the absence or insufficiency of basic infrastructure and the presence of risk areas.

CONCLUSIONS

The article demonstrates the diversity of precariousness in the Brazilian favelas considering access to urban infrastructure and the different situations of vulnerability that affects households. We intended to make a synthesis of morphological characteristics that vary according to geomorphology, the climate context, the construction techniques, the buildings' location, and relationship with the surroundings. These physical-spatial conditions require a variety of solutions for implementing urban infrastructure (water systems, sewage, and solid waste collection).

REFERENCES

Barreto, M.A. (2018) The (desired) future of precarious settlements in Latin America. **Oculum Ensaios**, v.15, n.3, p.353-375. http://dx.doi.org/10.24220/2318-0919v15n3a4254

Caldeira, T.P.R. (2017). Peripheral urbanization: Autoconstruction, transversal logics, and politics in cities of the Global South. **Environment and Planning D**: Societ and Space. V.35, 1, p.: 3-20, Feb. 2017. Available at: https://journals.sagepub.com/doi/10.1177/0263775816658479. Access 1st Jun 2020.

Dias, M. A.. (2014) Informal Settlements ? A Shape Grammar Approach. Journal of Civil Engineering and Architecture (Online), v. 8, p. 1389-1395.

Duarte, J. P.. (2007). Personalizar a habitação em série: Uma Gramática Discursiva para as Casas da Malagueira do Siza. Ed. Fundação Calouste Gulbenkian, Lisboa.

Ferreira, L. I. C. (2017). Arquitetos militantes em urbanização de favelas: uma exploração a partir de casos de São Paulo e do Rio de Janeiro. Dissertation (Master in Habitat), Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo, São Paulo. doi:10.11606/D.16.2018.tde-27062017-150239.

Fundação João Pinheiro (2016). Déficit habitacional no Brasil 2013-2014. Belo Horizonte: FJP. 92 p. Available at: http://www.bibliotecadigital.mg.gov.br/consulta/consultaDetalheDocumento.php?iCodDocumento=76697. Access 1st Jun, 2020.

Furigo, R.F.R. (2020) Universalização do saneamento no contexto dos assentamentos precários urbanos brasileiros. Thesis (Doctorate in urbanism). Centro de Ciências Exatas, Ambientais e de Tecnologia, Pontifícia Universidade Católica de Campinas, Campinas.

IBGE – Instituto Brasileiro de Geografia e Estatística (2020). Aglomerados subnormais. Resultados preliminares 2019. Available at: https://www.ibge.gov.br/geociencias/organizacao-do-territorio/tipologias-do-territorio/15788-aglomerados-subnormais.html?=&t=acesso-ao-produto Acess 25th Jun, 2020.

Lemos, C. (1976). Pesquisas sobre habitação popular – 1964-1965. São Paulo: FAU/USP.

Magalhães, A. F. (2014). O direito das favelas. Rio de Janeiro, Letra Capital, p. 496.

Santo Amore, C., (2014) Precariedade Habitacional: um ensaio de qualificação e quantificação, Uma metodologia de projeto para intervenção em favelas, IN: anais do Seminário Nacional sobre Urbanização de Favelas, UFABC, São Bernardo do Campo.

UN HABITAT (2012). **State of Latin American and Caribbean cities.** Towards a new urban transition (Series title). Available at: https://mirror.unhabitat.org/pmss/listItemDetails.aspx?publicationID=3386. Access: 25th Jun, 2020.

Van Lindert, p. (2016). Rethinking urban development in Latin America: A review of changing paradigms and policies. **Habitat International**, V. 54, 3, p. 253-264. https://doi.org/10.1016/j.habitatint.2015.11.017

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