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The duality of urban mobility as a heterogeneous phenomenon in the construction of sustainable living space in cities: a look at the inference of poverty in the city of Campina Grande, Brazil

La dualidad de la movilidad urbana como fenómeno heterogéneo en la construcción del espacio vital sostenible en las ciudades: una mirada a la inferencia de la pobreza en la ciudad de Campina Grande, Brasil

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Abstract: The use of statistical and geo-referenced tools helps to explain the differentiation of urban mobility given the pre-existing urban configuration in cities. The city of Campina Grande-PB, object of this study, is characterized by the prevalence of dualist elements such as the growing demographic explosion and the new layout of urban strata in terms of the smart cities concept. That said, the analysis on screen comprises the existing mobility system, demonstrating how the current space influences the potential of movement in different social strata through the Theory of Spatial Syntax. The research used the Geographic Information System-GIS, processed through Depthmap® and QGIS, in the production of spatial syntactic measures in neighborhoods combined with socioeconomic variables. In this study, it was concluded that the method identified in central areas, with a high concentration of middle and high income, a format more conducive to car use, while in neighborhoods with a higher concentration of vulnerable population, a system that favors the walkability and the use of bicycles and motorcycles. The public transport system presented a more efficient coverage, as it presents itself as a restrictive factor in the circular causation of local poverty, although it has the potential to be a driver of local economic dynamism to favor increased income in the most vulnerable and segregated locations spatially.
Keywords: *Mobility; Poverty; Cities; Campina Grande; Spatial Syntax.*

Resumen: El uso de herramientas estadísticas y georreferenciadas ayuda a explicar la diferenciación de la movilidad urbana dada la configuración urbana preexistente en las ciudades. La ciudad de Campina Grande-PB, objeto de este estudio, se caracteriza por la prevalencia de elementos dualistas como la creciente explosión demográfica y la nueva diagramación de los estratos urbanos en términos del concepto de ciudades inteligentes. Dicho esto, el análisis en pantalla comprende el sistema de movilidad existente, demostrando cómo el espacio actual influye en el potencial de movimiento en los diferentes estratos sociales a través de la Teoría de la Sintaxis Espacial. La investigación utilizó el Sistema de Información Geográfica-SIG, procesado a través de Depthmap® y QGIS, en la producción de medidas sintácticas espaciales en los barrios combinadas con variables socioeconómicas. En este estudio, se concluyó que el método identificó en las áreas centrales, con una alta concentración de ingresos medios y altos, un formato más favorable al uso del automóvil, mientras que en los barrios con una mayor concentración de población vulnerable, predomina un sistema que favorece la caminata y el uso de bicicletas y motocicletas. El sistema de transporte público presentó una cobertura más eficiente, ya que se presenta como un factor restrictivo de la causalidad circular de la pobreza local, aunque tiene el potencial de ser un propulsor del dinamismo económico local para favorecer el aumento de los ingresos en las localidades más vulnerables y segregadas espacialmente.
Palabras clave: *Movilidad; Pobreza; Ciudades; Campina Grande; Sintaxis espacial*.

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INTRODUCTION

From the mid-twentieth century on, there was a significant growth of urbanization in Brazilian cities, similar to what occurred in most large and medium-sized Latin American cities. This process, without planning, has unleashed a series of urban problems such as: environmental pollution, urban violence, social inequality, real estate growth in semi-protected areas and, above all, with the expansion of the number of automobiles, the compromising of urban mobility.

In this study, we analyze the relationship between urban mobility and poverty in the configuration of urban spaces delimited by neighborhoods. The object of the research is the city of Campina Grande - Paraíba, located in the northeastern region of Brazil. The aspects that guide the study refer to the low mobility in geographical areas of concentration of the low-income population and the implications for overcoming the causes of the poverty circle. Income is a variable that measures aspects related to poverty; however, it is important to note that although it is an attribute to be considered in social categorization, it is not enough to explain the multidimensional poverty present in the class structure of Brazilian society.

The size of the fleet has brought numerous problems to the urban fabric, among them the presence of congestion, pollution and accidents, which compromise the quality of the natural built environment. However, it is possible that these externalities occur in a heterogeneous way in the spatial configuration, given that aspects of infrastructure and social inequality are expressed differently in the various social strata. The concept of sustainable development is understood as a process that, on the one hand, would generate wealth and well-being, but would also promote social cohesion and prevent environmental destruction. This understanding is, therefore, a counterpoint to the traditional view of development, pointed out above, with the local economy.

Cities have also become the focus of discussions focused on environmental problems and on the construction of sustainability, giving rise to a great deal of room for change in their management and in the projects aimed at them. A city considered sustainable is organized in the perspective of ensuring that all its inhabitants can meet their basic needs and increase their well-being, but without damaging the natural world or endangering the living conditions of other beings, in the present and in the future.

The city of Campina Grande became a strong economic influence and the source of this was its irregular urbanization process due to the period of the cotton cycle and the arrival of the railway line in the years 1940-1950. In the 1980s, a physical expansion occurred with the construction of the Malvinas complex; and recently a new expansion occurred with the Aluísio Campos complex. Unlike the other cities of the Northeast region, the urbanization process of Campina Grande was consolidated in the 1960s and 1970s, converging to more than 90% of the population living in the urban area.

Therefore, by way of understanding, we used Urban Morphology, which is multidisciplinary in nature, as an explainer of the environmental debate on sustainable development, given that there is a shift from the conservationist approach - which denied the possibility of reconciling development and a healthy environment - to the sustainability[1] approach, which seeks to reconcile economic growth with principles such as social justice, improved quality of life in more dignified and healthy environments with an optimistic outlook for the future.

There are three degrees of poverty: extreme (or absolute) poverty, moderate poverty, and relative poverty. In the first, families are not able to meet basic survival needs; in the second, basic needs are met, but with difficulty; and in the third, it is characterized by a family income below a certain proportion of the national average income (Sachs, 2005). In order to define, identify, and explain the low income level in poor nations, Nurske (1957) and Myrdal (1968), Economic Development theorists, studied these mechanisms and proposed some theoretical solutions to overcome their causations and achieve a virtuous circle of economic growth.

Economic progress could be achieved by underdeveloped nations by increasing the level of income, through actions directed by the state and supported by society, as a way to overcome the vicious circle of poverty. The state must provide institutional guarantees and incentive policies that allow society to act to overcome the vicious circle of poverty. The essential objective of public finance is not a change in the interpersonal distribution of income, but an increase in the proportion of national income through domestic market development programs aimed at capital formation (Nurske, 1957). The identification of cumulative circular causation as explanators of development was one of the constants in the plans of the nations of the Americas trying to absorb as much as possible the time lag between pre-industrial models. The main hypothesis of a supposedly more realistic economic theory should seek to contemplate the circular causation among all factors of the social system (Myrdal, 1968).

These circular[2] causations are fostered by regressive effects that limit the action of the propulsive effects on the country's socioeconomic structure, which are both a consequence and a cause of the low level of development. The low levels of social mobility and education are obstacles to the propulsive effects of an expansionist movement based on greater national integration and the reduction of internal inequalities.

[1]It studies the arrangement of morphological elements in the urbanized environment: streets, squares, plots, buildings, etc. - is, in fact, the science that studies the physical form of cities, as well as the main attractors and transformation processes that shape urban space.

[2]The approaches of these theorists converge and present possible complementarities. The observation of the existence of weak propulsive effects defined by Myrdal (1968) would be one of the components that would help explain the permanence of the vicious circle of poverty defined by Nurkse (1957). The positive chaining effects of the cumulative circular causations highlighted by Myrdal would be a potential means of overcoming the vicious circle of poverty and achieving development (CARDOSO, 2012).

(Myrdal, 1968). The question of mobility in large urban agglomerations is difficult for the poorest populations, because the most dynamic area of the economy in the cities is in the central regions, while the significant portions of the low-income population are in the outskirts of the urban area. This fact is an aggravating factor for access to better employment and income opportunities for these more vulnerable social segments (Pero & Mihenssen, 2013).

METHODOLOGY

First, a documental and bibliographic research was carried out. Subsequently, the spatial modeling of the geoprocessed information (axial and segment maps, spreadsheets, images, etc.) was carried out; the development of the Georeferenced Information System - GIS, in the implementation, analysis (configuration, spatial, location) and crossing of data for the statistical validity of the variables generated and observed, and the final results, for the presentation of the model in the research. The methodological tool used was Spatial Syntax, in which we sought to understand the configuration of urban space and the pre-established social relations of flows and movements, with multidisciplinarity as an approach for connectivity, accessibility, and global integration (Al-Sayed et al., 2018). The cost of the distance between two line segments of least angular (geometric) change in a street network and the criterion of road hierarchy is measured by summing the angular changes that are made on a route, assigning a weight to each intersection proportional to the angle of incidence of two line segments at the intersection (Hillier & Iida, 2005). The weight is set so that the distance gain is 1 when the turn is at right angles or 90 °; 2 if the angular turn is 180 ° and 0 for angular distance gain if two segments remain straight, as per the equation (Al-Sayed et al., 2018):

$$\omega(\theta)\ \alpha\ \theta\ (0 \leq \theta < \pi), \qquad \omega\ (0)=0, \qquad \omega\left(\frac{\pi}{2}\right)=1 \qquad [1]$$

Where: θ is the angle of incidence between two segments; π is the radius measure; and ω is the weight assigned at each intersection.

This angular cost can be applied as a weighting function to the centrality measures called Normalized Angular Integration AIN_{θ}:

$$AIN_{\theta} = \left(\sum_{i=1} d_{\theta}\ (x, i)\right)^{-1} \qquad [2]$$

Where: dθ is the length of a shortest path between vertices x and i.

Integration is based on centrality and closeness. It indicates the best way to go from one point to another in the city (to-movement potential) (Hillier, 2009). This facility is based on the set of segments that minimizes the topological distance of changing direction to the other points in the city. The choice is based on the centrality of traversal (betweeness) by considering the possibility of traversing a specific segment from all other origin and destination points. It is calculated by generating shortest paths, with the lowest angular cost, between all pairs of segments in the system. The flow through each segment is then summed according to how many trips are made through each segment and divided by the total number of possible trips (Turner, 2007), defined as follows:

$$ACH_B = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \sigma (i, x, j)}{(n-1)(n-2)/2}, \text{ com } i \neq x \neq \quad [3]$$

Where: s (i, x, j) = 1 if the shortest path from i to j goes through x, and 0 otherwise.

To enable a better understanding of the syntactic properties of the measures between cities of different sizes, Hillier, Yang and Turner (2012) proposed the normalization of two main measures: the Normalised Angular Integration (NAIN) and the Normalised Angular Choice (NACH).The two measures correspond to the two basic elements of any trip: selecting a destination from an origin (Integration) and choosing a route, and thus the spaces to be travelled between the origin and the destination (Choice). Normalized Angular Integration is defined by:

$$NAIN_\theta = \frac{(n+2)^{1.2}}{(\sum_{i=1} d_\theta (x, i))} \quad [4]$$

and the Normalized Angular Choice NACHB is defined by:

$$NACH_B(x) = \frac{\log(\sum_{i=1}^{n} \sum_{j=1}^{n} \sigma (i,x, j)+1)}{\log(\sum_{i=1} d_\theta (x, i)+3)} \ (i \neq x \neq j) \quad [5]$$

Where: (i, x, j) = 1, if the shortest path from i to j goes through x and 0 otherwise.

Also called Spatial Accessibility measure, the INCH is an expression of the potential for human movement within urban space resulting from the combination of two centrality measures, Normalized Integration (NAIN) and Normalized Choice (NACH) (Hillier & Iida, 2005). In the former it is understood which spaces minimize distances; and in the latter the potential for traversal, according to equation 6:

$$INCH = \left(\frac{ND^{1.2}}{(TD+2)}\right) * \left(\frac{\log(CH)+1}{\log(TD+3)}\right) \quad [6]$$

Where: ND = Node count; TD = Total depth and CH = Choice measure.

RESULTS AND DISCUSSIONS

It was highlighted that the demographic density in the city, according to data from the 2010 IBGE Census, is 648 hab./km2, and the reference in the literature is that a value of 600 hab./km2 is the ideal to make public transport feasible. Therefore, the city presented the minimum requirements for the system to operate satisfactorily with respect to passenger demand and economic viability. However, according to the data presented in Table 1, the public transportation system can collapse and compromise sustainability.

It is interesting to point out that in the last hundred years, the urban area of the city of Campina Grande - PB has grown from what today corresponds to the region of the expanded center, reaching 43km2 more. As for the data of the urban mobility system, the variables observed refer to the period from 2013 to 2018.

TABLE 1: Variables about Campina Grande's mobility system.

Year	Motorcycle Fleet	Δ %	Bus Trips	Δ %	Motorcycle Accidents	Δ %	Vehicle Fleet	Δ %	Car Accidents	Δ %
2013	52,744		35,037,525		1,828		142,277		3,131	
2014	54,787	4	35,680,282	0	2,503	27	149,975	5	3,298	5
2015	58,792	7	33,483,906	-7	2,394	-5	159,179	6	3,023	-8
2016	64,692	15	31,387,331	-14	2,624	5	168,963	6	3,280	9
2017	67,443	19	28,067,633	-27	2,286	-9	175,261	4	2,789	-15
2018	70,245	22	25,140,160	-42	2,049	-22	182,241	4	2,520	-10
2013-2018		**33**		**-28**		**12**		**28**		**19**

SOURCE: Oliveira (2020) from STTP data (2020).

The motor vehicle fleet presents growing numbers, while the number of trips by public transportation decreases year by year. On the other hand, the number of motorized accidents decreases, related to a local government policy of clarification and inspection.

The diagrammatic representation in figure 1 refers to the Income variable by census sector. There is the classification adopted by IBGE in the 2010 Census, which considered the nominal monthly income of a person aged 10 years or older to be the sum of the nominal monthly labor income, plus income from other sources, including all persons living in the household who are over 10 years old and have some income.

To classify social class according to income, the IBGE (Family Budget Survey, 2019) considers Class "E" individuals who earn up to two minimum wages; Class "D", between two and four minimum wages; Class "C", between four and ten minimum wages; Class "B", between ten and twenty minimum wages, and Class "A", individuals with income above twenty minimum wages.

In the map legend, the same color gradation methodology was followed: dark blue tones represent a higher income range and light blue tones, a lower income range. The scale in this research comprises five classes, starting with earnings from R$ 0 to R$ 1,014 (approximately one minimum wage); from R$ 1,014 to R$ 2,028 (two minimum wages); from R$ 2,028 to R$ 3,042 (three minimum wages); from R$ 3,042 to R$ 4,056 (four minimum wages), and from R$ 4,056 to R$ 5,070 (approximately five minimum wages). Six census sectors in dark blue stand out for the predominance of income above five minimum wages per month.

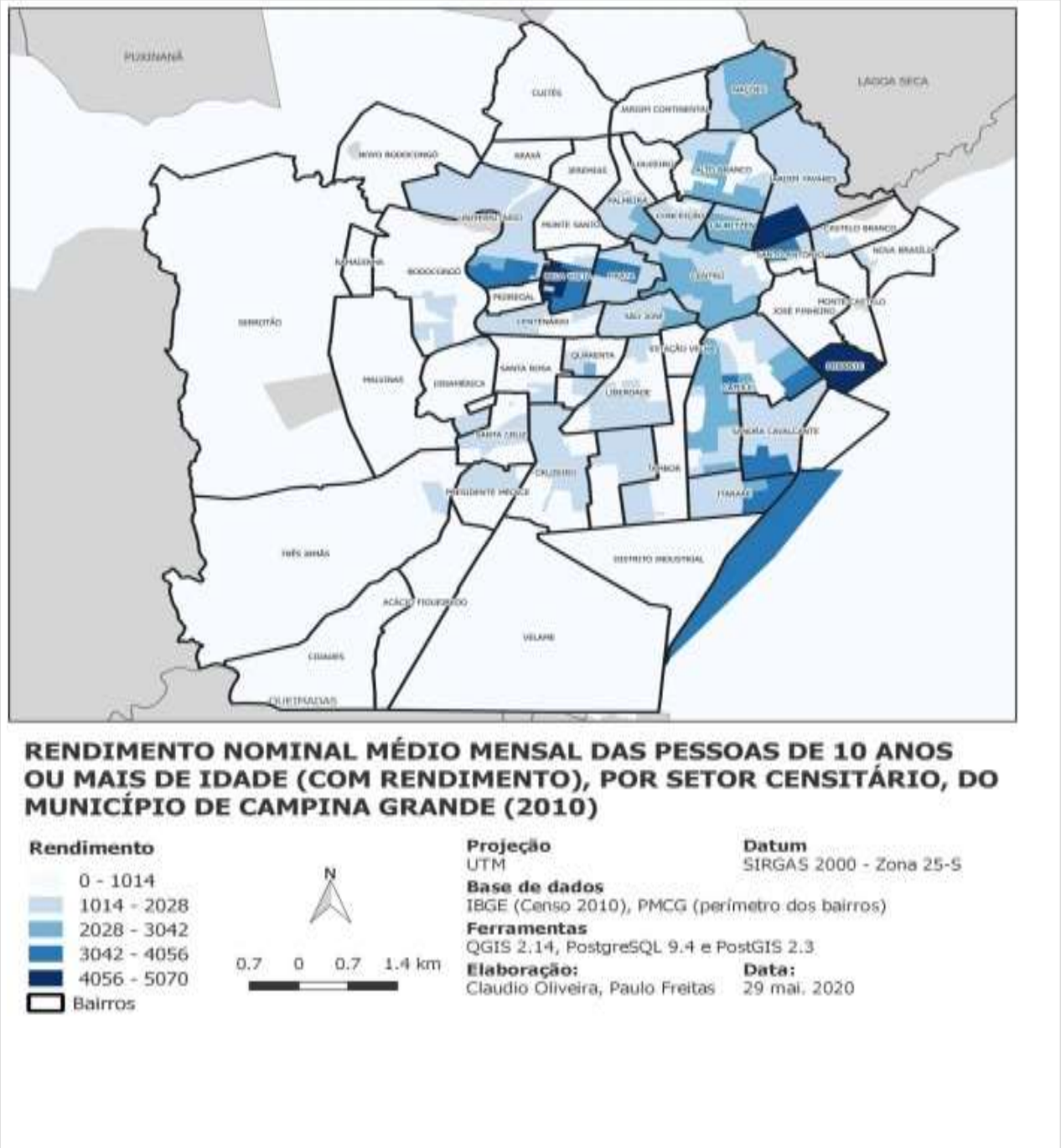
It is evident that low-income sectors are located in all parts of the city. There is less presence of these sectors representing low nominal income in the region called the historic center of Campina Grande, but the socio-spatial pattern of the city is quite complex and heterogeneous.

These census sectors with the highest predominance of income up to five minimum wages are located in the following neighborhoods: Santo Antônio, Alto Branco, Mirante and Prata. In this specific case, they are geographically joined sectors in each neighborhood or between neighborhoods. Of these, Prata is the only one with optimal Spatial Syntax indexes, although the other neighborhoods mentioned in this paragraph are also among the best values identified in the research for the city. That is, there is a higher concentration of people with income up to five minimum wages in the city that are located near the best conditions of urban mobility structure in the city, especially in the Prata neighborhood.

The sectors where the majority of people with low nominal income are concentrated, up to one minimum wage, are geographically located in the region far from what is known as the historic center of the city and present lower syntactic measures. The neighborhoods with the best measures of Spatial Syntax, on the other hand, are located around what is known as the historic center of the city, therefore, the farther away from this point, the more difficult the access to the optimal structures of urban spatial configuration identified through this study.

The neighborhoods located in the region known as the center, between this and the peripheral region, that is, in a central and intermediate area, present an income ranging from medium to low. The entire area of the geographic border, known as peripheral neighborhoods, presents a very low income, except some sectors in the neighborhoods of Nações, Itararé and Distrito Industrial, which present a concentration of higher income in relation to the population as a whole.

FIGURE 1: Income map of the municipality of Campina Grande/PB (2010).



SOURCE: Oliveira **(2020) from IBGE data (2010).**

The neighborhoods that presented income below R$1,014.00 reais are: Cuités, Jardim Continental, Louzeiro, Jeremias, Monte Santo, Araxá, Novo Bodocongó, Malvinas, Bodocongó, Serrotão, Três Irmãs, Cidades, Acácio Figueiredo, Velame, Monte Castelo and José Pinheiro. Of the 50 neighborhoods, 16 have low income in most census sectors.

For a better understanding of the data and its relations in the general behavior in the city, the table below was elaborated to identify the best and worst scores regarding the four measures/variables observed: NAIN, NACH, INCH and INCOME.

BOX 1: Classification of the neighborhoods by the scores of the variables/measures in the city.

	TOP-SCORING NEIGHBORHOODS	**WORST-SCORING NEIGHBORHOODS**
NAIN	Prata, São José, Jardim Quarenta, Santa Rosa, Liberdade, Centenário Quarenta e Bela Vista.	Cuités, Novo Bodocongó, Araxá, Cidades, Nações e Jardim Continental.
NACH	Prata, São José, Jardim Quarenta, Centro, Lauritzen, e Liberdade.	Castelo Branco, Cidades e Louzeiro.
INCH	Prata, Jardim Quarenta, São José, Liberdade, Santa Rosa, Centro, Bela Vista e Centenário.	Cuités, Novo Bodocongó, Cidades, Nações, Jardim Continental, Araxá Louzeiro e Vila Cabral.
REVENUE	Bela Vista, Jardim Tavares e Mirante (high revenue). Prata, Nações, Centro, São José, Alto Branco, Palmeiras, Catolé, Sandra Cavalcante, Itararé, Universitário e Santo Antônio (intermediate revenue and above one minimum revenue).	Acácio Figueiredo, Araxá, Bodocongó, Cidades, Cuités, Jardim Continental, Jeremias, José Pinheiro, Louzeiro, Monte Castelo, Monte Santo, Novo Bodocongó, Malvinas, Serrotão, Três Irmãs e Velame.

SOURCE: Oliveira **& Fontgalland (2021).**

Box 1 shows us some important data when associated with income and the syntactic measures of mobility and accessibility. First, the neighborhoods with the lowest scores such as: Cuités, Novo Bodocongó, Araxá, Cidades and Jardim Continental, Louzeiro are among the neighborhoods with the lowest proportion of income in the city, except for the neighborhoods Nações, Castelo Branco, Vila Cabral. This finding corroborates the statement that most of these neighborhoods present the worst structure in terms of urban mobility. The neighborhoods with the highest proportion of income per census sector do not present the best scores of syntactic measures related to urban mobility, although, they do not figure among the worst indexes, they are: Bela Vista, Jardim Tavares and Mirante. Among the other ranked neighborhoods, none is in the lowest concentration by census sector.

This result raises the concern that the localities with the highest concentration of low-income people need the mobility system to be reformulated in order to satisfactorily serve users. This can be an important tool for overcoming the circular causation of poverty in these locations. This perspective contemplates the mobility in the city through the best roads, therefore, for the citizen who has a car, living in the neighborhoods with the best ranking enables better access and choice.

BOX 2: Classification of the neighborhoods by the scores of the variables/measures.

	TOP-SCORING NEIGHBORHOODS	WORST-SCORING NEIGHBORHOODS
NAIN_R500m	Pedregal, Conceição, Ramadinha, Louzeiro, Presidente Médici, Jardim Paulistano, Jeremias, Centenário, Nova Brasília, José Pinheiro, Quarenta e Malvinas.	Distrito Industrial, Cuités, Nações, Mirante e Castelo Branco.
NACH_R500m	Pedregal, Ramadinha, Conceição, Presidente Médici, Jeremias, Malvinas, Louzeiro e Quarenta.	Distrito Industrial, Nações, Cuités, Novo Bodocongó e Castelo Branco.
INCH_R500m	Pedregal, Conceição, Ramadinha, Jardim Paulistano, Presidente Médici, Louzeiro, Jeremias, Centenário, Nova Brasília e José Pinheiro	Distrito Industrial, Cuités, Nações, Mirante e Castelo Branco.
REVENUE	Bela Vista, Jardim Tavares e Mirante (higher revenue). Prata, Nações, Centro, São José, Alto Branco, Palmeiras, Catolé, Sandra Cavalcante, Itararé, Universitário e Santo Antônio (intermediate revenue and above one minimum revenue).	Acácio Figueiredo, Araxá, Bodocongó, Cidades, Cuités, Jardim Continental, Jeremias, José Pinheiro, Louzeiro, Monte Castelo, Monte Santo, Novo Bodocongó, Malvinas, Serrotão, Três Irmãs e Velame.

FONTE: Oliveira (2020).

According to box the neighborhoods with the best scores in the three measures are: Pedregal, Conceição, Ramadinha, Jardim Paulistano, Presidente Médici, Louzeiro, Jeremias, with a higher concentration of low-income census sectors. The highlight is the neighborhood of Cuités that both in the measures of the city and the measures within the radius of 500m, presents the lowest scores, therefore, a neighborhood that does not favor the mobility and accessibility of people.

A positive correlation indicates that the socioeconomic variables have a relationship with the highlighted syntactic measure, in the case of a negative correlation, it indicates an inverse relationship. The matrix is also presented in the coloration that goes from a darker shade of blue, indicating a strong and positive correlation to a lighter shade of blue of positive and low intensity correlation.

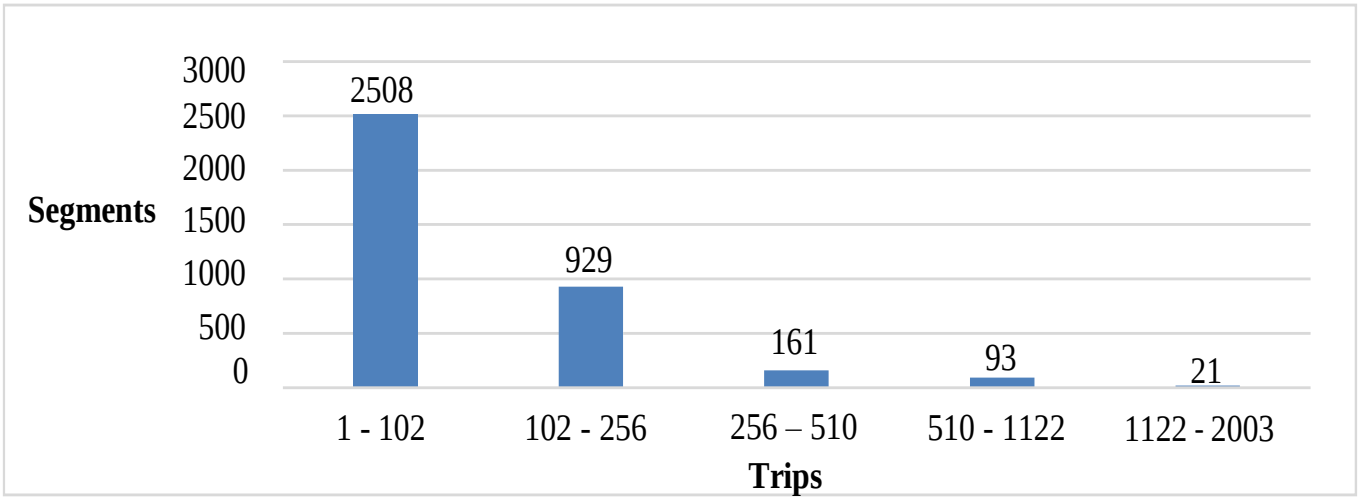
Correlations above 0.3 are more significant, because they express a robust linear relationship between the variables. In Figure 2, we consider only the normalized syntactic measures, which are better suited to express the specifics of the study.

FIGURE 2: Clipping of the correlation matrix.

SOURCE: Oliveira (2020) from IBGE data (2010).

The outstanding correlations were those of the income variable with the average segment length, which ranged from 40% to 42%, indicating that sectors of the municipality where higher income residents live tend to have larger blocks. The variable "income" was verified according to the four types of income presented by the 2010 Census. A significant correlation was found, in which the best correlations between the NAIN, NACH, and INCH measures by neighborhoods and the income variable were 0.29, 0.30, and 0.31, respectively. This indicates a positive relationship that where and when income grows there is better mobility structure. We tried to quantify the trips made by the city's urban public transportation system correlated with the segments that present the highest number of daily trips. Figure 3 shows the number of trips by number of segments.

FIGURE 3: Number of segments by trip range (n=3712).

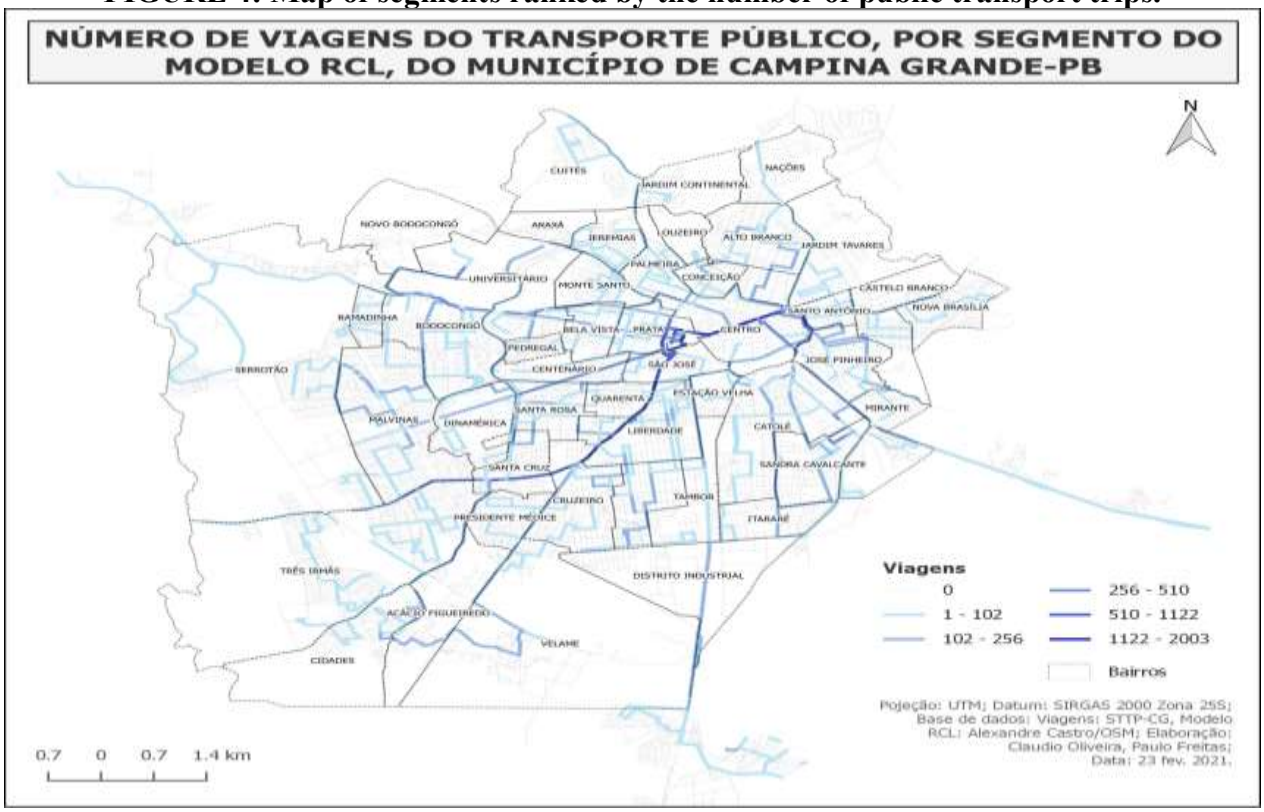


SOURCE: Oliveira (2020).

The first bar of Figure 3 corresponds to 67% of the spatial segments as Better Integration and Choice concentrate only from 1 to 102 trips, while 21 segments (0.5% of the total segments), concentrate from 1,122 to 2003 of the daily trips range. The evidence of this disproportion shows that the trips of the urban public transportation system route in the city still favor reduced routes represented by the avenues that cut the city in its longitudinal axis. The map of segments of the city's urban configuration in figure 4 demonstrates this spatial correlation between the routes of the public transportation system trips in the urban space presented by the municipality of Campina Grande on the Road Centre Line - RCL map. The dark blue shades show the segments with the highest number of trips. The result corroborates further evidence of the uneven dispersion of the number of trips throughout the city, as well as the limited access for residents of the peripheral region to different points in the city. A spatial redistribution of the routes could imply access to a larger contingent of users.

The result shows that there is, as already mentioned, a differentiation in the system's service in terms of the number of daily trips that cover the entire urban network. In the central region, there is a higher occurrence of lines and routes, while in the outlying regions, there is a lower frequency of daily trips covered by the system. In other words, the displacement system currently in place reflects characteristics that concentrate the activities of services and commerce in certain regions of the city.

FIGURE 4: Map of segments ranked by the number of public transport trips.



SOURCE: Oliveira (2020).

It is worth noting, moreover, that due to the high cost and the unavailability of new real estate in the area known as the historic center of Campina Grande, the population has occupied new areas more geographically distant, in search of larger and cheaper spaces. In this sense, the transportation system cannot adapt itself to satisfactorily serve these new locations, causing serious problems for urban mobility.

CONCLUSIONS

Initially, we investigated the urban design of the city over time, going through the inseparable processes of the constitution of the old Campina until the modern and technological Campina, but which still presents great economic and social disparities: practically two cities living together in the same territory; one modern, dynamic and organized; the other still with medieval aspects, such as lack of basic sanitation, income disparity and an urban layout that favors immobility and urban violence.

Aspects that should be pondered, however, regarding the study, since they can interfere with the flow of vehicles and pedestrians. Although a road presents a good score of Integration and Choice, this characteristic may not necessarily be interesting for the city as to mobility and accessibility, since it is necessary to have other parallel roads as alternative routes for pedestrians and cyclists.

Given the urban configuration of the city of Campina Grande, it is possible to conclude that the neighborhoods that present a set of better Integration and Choice, present a conjunction of attributes that favor mobility, in which it is possible to access the best attracting points of the city's centrality. Conversely, the peripheral neighborhoods, according to these syntactic variables, are segregated from the mobility system.

According to the radiocentric configurational design - since all roads lead to the center - presented in the results, it is possible to infer that the peripheral neighborhoods present a more restrictive characteristic regarding the movement of people in the city. In the regions of the expanded center, we find a pattern more favorable to the mobility of citizens who use individual transportation on the main roads.

The system presents a very cohesive and efficient structural network in the central part, while in the more distant regions there is still a lack of coverage for the population, compromising the mobility of low-income population segments.

Most of the higher income neighborhoods have a favorable structure for mobility by car, since they are endowed with large blocks and well-structured roads that give access to the various parts of the city, in addition to public transportation that also favors transportation. The neighborhoods with a higher concentration of low-income sectors present the worst indicators of syntactic measures, because they depend on a mobility model based on urban public transportation, and on the use of bicycles and motorcycles.

From the perspective of strengthening the city's economy, one can consider the theoretical approaches of Myrdal (1968) and Nurske (1957) regarding the measures for strengthening the internal market that favors the expansion of income in the peripheral regions, making mobility efficient for these localities, would change what today is characterized as a limiting factor, in a circular causation of development propulsion and strengthening of local markets.

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