

**Understanding the urban space:
The relationship between free space and urban voids in Erechim-RS¹**

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SUMMARY

This article presents a study based on the urban structure of the city of Erechim-RS. Furthermore, it seeks to understand the relations between the public form of the city and its free spaces, making it possible to verify if those spaces are characterized as urban voids. Concerning the objectives of the work, the methodology is based on a morphological analysis with survey and mapping of data in addition to the development of the syntactic analysis of the urban network by the Spatial Syntax Theory method to superimpose this information and understand the current city conformation. The research is justified by the fact that public open spaces in the city are not configured as a planned system and the fact that some appear to be underused. It exposes the essential concepts for the development of work such as urban morphology and spatial syntax, public empty spaces, and their appropriation, contemporary city and urban voids. The study points out that public open spaces are mainly located in some neighborhoods in the central area, which is an area with greater integration, and a considerable part of the neighborhoods are unassisted from such spaces. Due to the current situation, some of these spaces are characterized as urban voids.

KEYWORDS: Urban Morphology. Public Empty Spaces. Urban Voids.

1 INTRODUCTION

This work is part of a thesis that studies the urban empty spaces in the city of Erechim - RS. The research in this article is based on the premise that public empty spaces (PES's) do not integrate a planned system, seeking to obtain an overview of these places in the city. In this context, urban planning includes organized spaces that foment the appropriation. However, urban growth often does not occur in synchrony with this outline, resulting in the development of idle areas, urban voids (TARNOWSKI, 2007).

Urban morphology tends to condition the way spaces are appropriated because it is related to social practices, uses, and activities. For Krafta (2014), the urban form is composed of matrices - public space, private space, built form, urban fabric - and the city is made of elements that give unity and shape for its meaning. According to Tarnowski (2007, p. 24), "[...] the study of urban morphology provides important subsidies for understanding the configuration of occupied and unoccupied spaces, as well as for the analysis of the formation of the city and its consequent evolution."

Hillier and Hanson (1984) developed the Theory of Spatial Syntax (TSS), a method to describe elements that compose the urban space and is based on its logic. Among the factors of analysis, the first one refers to the global scale of the city, in which urban areas generate and condition the pattern of people's movement. The second addresses the local scale, entering into the way that public spaces are constituted and related to buildings.

TSES seeks to verify the reasons why and how social formations materialize in different spatial formations, as certain places have a greater or lesser tendency to social appropriation due to global and local characteristics (LEITOLES, 2016). It analyzes the relationship between urban form and the appropriation of public space. For Peponis (1992), the theory makes it possible to understand how society is inserted in the relational patterns of architecture, which is essential to understand the urban system as articulated parts. This system can be characterized by the urban network and the integrating nucleus, which is the most accessible and integrated part since the degree of integration of the space concerns the number of people who circulate in it (LEITOLES, 2016), which can be restrictive or permissive to collective appropriation.

For Whyte (2007), well-structured urban spaces condition greater appropriation because a new space encourages people to create new habits and use them. Most used squares

are sociable spaces, with a larger number of people in groups, promoting their interaction. For the author, the movement of people is due to the diversity of activities in the surroundings. In this context, the urban configuration goes beyond the set of structures and buildings, also constituting the space between these components, reflecting on the image of the city, influencing the way the population understands it. (TARNOWSKI, 2007).

The Free Spaces System (FSS) shapes free building spaces in the urban fabric, its hierarchical and functional relations, its location and can be configured based on local planning or interventions. (ALVAREZ, 2008). It encompasses the organization of open spaces in an urban area, from the intra-urban to the regional scale, regardless of its functions, dimensions, appearances, and forms. It consists of subsystems of public spaces, which are the scene of public life, such as the street, the main connecting element of the city, in addition to squares, parks, sidewalks, beaches, rivers (QUEIROGA, 2011).

The FSS structure enhances habitability conditions in the urban space through leisure activities, social relationships, in addition to the well-being of the population throughout the vegetation. (OLIVEIRA and MASCARÓ, 2007). For contributing to the quality of life, it must be spatialized as a system so that the entire population can enjoy it (PUPPI, 1981). Free spaces form a "pervasive fabric" fundamental to the existence of cities, with different contexts and degrees of appropriation (ALVAREZ, 2008, original emphasis).

FSS is in continuous transition, given that the fulfillment of social demands depends on political decisions, resources, cultural elements (QUEIROGA, 2011). In this perspective, transformation in the society reflects in equipment and external activities. They change according to each era and become spatial in new urban forms and habits, changing the PEEs as well as the way that society uses them. (ALVAREZ, 2008). It should be noted that for urban life to take place in the public space, it is important that current interventions consider local memory, foster the diversity of urban functions, which enable the circulation of people and meet social demands in the collective space. (Tibbalds, 1988).

For this research, PEEs are considered as open spaces that have no buildings, make up the urban structure of the city, and can conceive public life, such as squares, parks, and roads with central flower beds, regardless of whether they are conformed by a planned system or not.

Complementing the research, references on urban voids also structure the work. Studies referring to urban voids started in the 1970s, in France and England, as a result of deindustrialization (BORDE, 2006). The interpretation of the term urban void is broad and can be analyzed from different perspectives according to temporal and regional contexts. (TARNOWSKI, 2007). It can be understood as a consequence of the elements that cause the appearance of residual areas in the territorial occupation. After all, they lose their relevance because they are disconnected from the city (DITTMAR, 2006).

They are characterized as spaces widely used until a certain period. Over time, they have become idle areas and unused in the urban network (BUSQUETS, 1996). According to Vázquez (2016, p. 25): "what defines these areas as urban voids are the processes of underutilization that space presents in: formal, functional, symbolic, and social terms, concerning their urban condition." Solà-Morales (2002) calls them *terrain vague*. For the author, they are beyond the physical void and encompass the collective memory of historical periods. They are abandoned irregular spaces. However, they possess particular elements of one another

(DONADON, 2009)

For Tarnowski (2007, p. 16) “[...] the conditions inherent to the area and its surroundings can define the role of the void, both in the city and in the perception of individuals who frequent the place.” Social, economic, and political factors influence the perception of voids. Because they are potential areas for urban transformation, they are important for the development of cities (VÁSQUEZ, 2016). The socio-spatial reintegration of these areas can be a way of intervening in the urban space and mitigating the respective negative impacts (SOLÀ-MORALES, 2002). Reintegration depends on strategies that can be applied in urban planning, and as Tarnowski (2007, p. 16) points out, “[...] with the expansion of cities, there is a need for the institution of efficient forms of administration of the urban environment, aiming to ensure the quality of life for its population. ”

In this research, the concept of urban voids is adopted in two aspects: the first is the underutilized space that over the years has been disconnected from the dynamics of the city. Furthermore, there is an infrastructure remaining from a certain period. Due to the lack of spatial readjustments, it does not meet the current social demands. The second is the category of residual spaces, which are remnants of the urban layout and are not effectively inserted in the city.

Surveys and mappings of the FSS with elements of the urban structure and the use of the ground are become fulfilled. In parallel, the remaining areas of the urban fabric are identified and with the Theory of Spatial Syntax (TSS), the syntactic analysis of the city is developed to verify the spatial integration. This information is superimposed to analyze existing connections to detect if there are PES's that constitute urban voids. The study points out that the PES's are concentrated in the central area of the city, which is more integrated, where, according to the TSS analysis, there is a greater tendency for people to meet each other. It is noted that the ELP's are located in specific neighborhoods and do not configure a planned system. Finally, many of these spaces are characterized as urban voids, mainly due to the disconnection of the socio-spatial dynamics of the city.

2 OBJECTIVES

The general objective of the study is to identify the existing relationships between the urban structure and PES's to understand the conformation of these spaces in Erechim. The specific objectives are:

1. Understand the relationship of the PES's with the structural elements of the city;
2. Check the existence of free spaces characterized as urban voids;
3. Identify the areas of greater integration in the urban network through the syntactic analysis of the city;
4. Identify the location of the PES's on the syntactic map.

3 METHODOLOGY

To reach the objectives of the study, the present work is structured in two stages. The first seeks to characterize the city through a brief historical contextualization of the initial urban

planning and current context, as well as identify relevant elements that can contribute to the understanding of the city. It is based on photographs, maps, and academic works that address the theme. The second one is based on data collection and exploratory analysis.

Initially, PES's mapping, land uses, morphological elements are carried out, based on cartographic bases and information obtained from the city hall, along with territorial observation. Subsequently, it is identified which of these spaces are remaining areas from the implementation of the road layout and which have furniture to verify the current situation of the PES's and identify whether they have characteristics of urban voids or not. Other residual spaces are also mapped to understand the relationships between the PES's and these other areas.

From the TSS, the syntactic map of the city is developed using the DepthmapX software to verify the most integrated areas of the city through the analysis of the Global Integration (HH) and Local Integration (R7) maps. By superimposing the mappings with the syntactic analysis, the urban space is read to identify areas with greater connectivity and tend to foster a greater number of people. Finally, to obtain the panorama of the analyzed data, the mapping of the spatialization of PEEs in the neighborhoods is done, and each category is exemplified.

4 INSTRUMENTAL APPLICATION

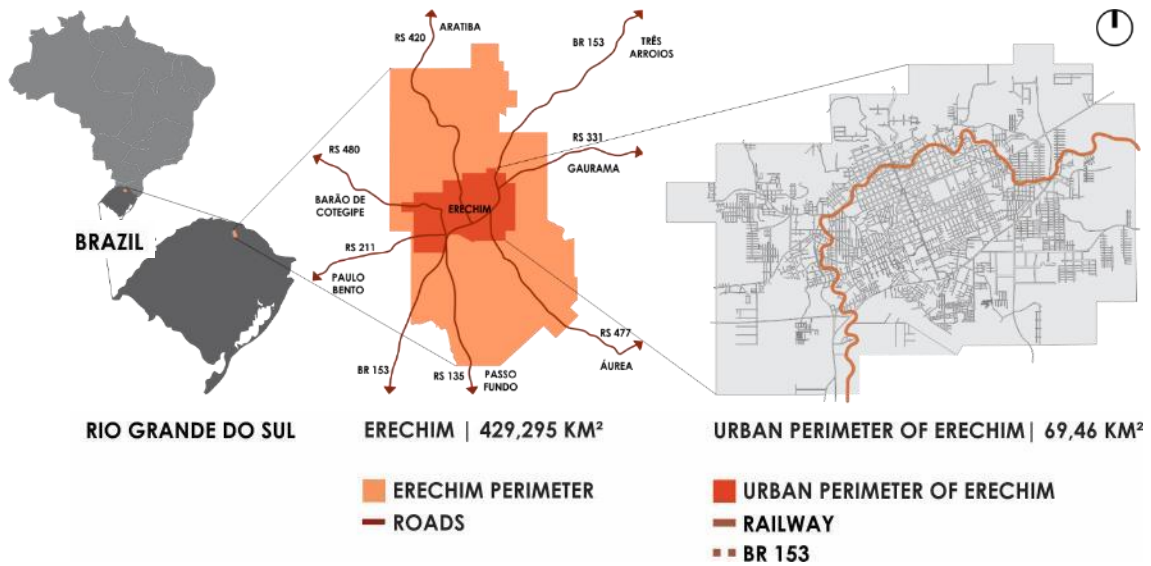
4.1 CHARACTERIZATION OF ERECHIM

The object of study is the city of Erechim, located in the northern region of the state of Rio Grande do Sul, with a population of 105,862 inhabitants (IBGE, 2019), a territorial area of 429,295 km² (IBGE, 2018) and according to the City Hall, the urban perimeter corresponds to 69.46 km². The city polarizes socioeconomic activities in 32 municipalities with up to five thousand inhabitants, connects with several highways, the BR-153 being the main one, and runs the entire length of the city.

It is characterized by the planning of the initial urban layout developed by engineer Carlos Torres Gonçalves, implanted in 1914 (FÜNFGELT, 2004). The mesh design was based on the Paris layout, following the positivist ideals of the time. In the plan, ten avenues converge to the central square, currently known as Praça da Bandeira, and from this place, the checkered grid is structured with regular and triangular blocks resulting from the diagonal avenues. In the project, eight squares were planned on the axis of the avenues as a visual framework for the perspectives created by them.

"[...] the planning of the headquarters takes as its starting point the layout of the roads, considering circulation as the primary function of the city" (FÜNFGELT, 2004, p.19). The railway line runs through the city in a south-west direction, a condition for the implementation of the initial route. The urban fabric is structured by a central avenue in the north-south direction, with a width of 40 meters, from where the other roads that make up the road layout, composed of checkered mesh and irregular parts, have spontaneously conformed in certain periods adapting to the topography (Figure 01).

Figure 01: Contextualization of Erechim



Source: Map obtained from the City Hall with the author's edition, 2019.

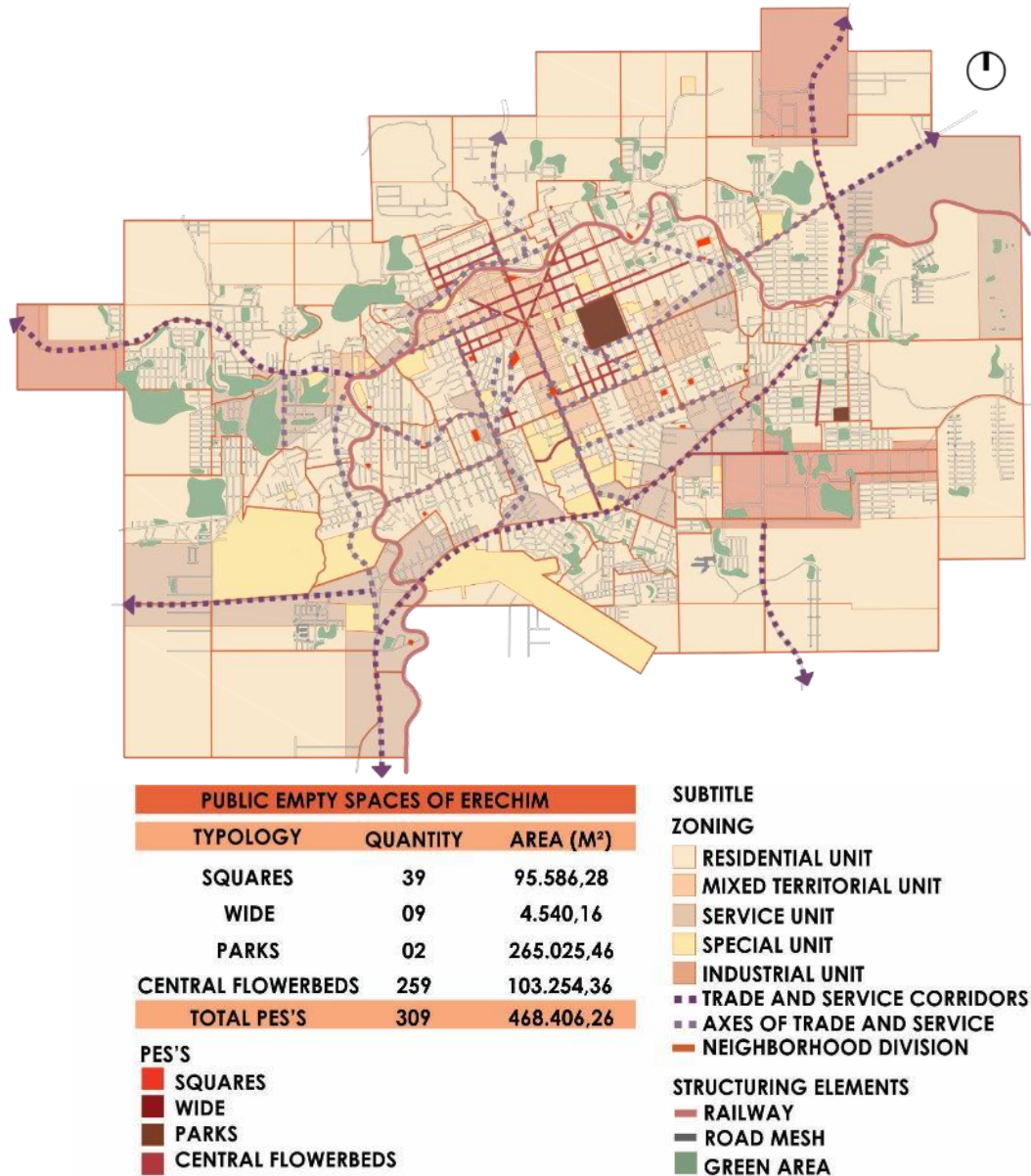
4.2 PANORAMA OF THE PEEs IN THE CITY

To obtain the panorama of the PES's, a survey and mapping of elements such as land use is carried out. Since the urban area is divided into regions of macrozoning, the Territorial Planning Units, and subdivided into Residential, Mixed Territorial Use Units, Services, Special, Industrial. Residential use is predominant, there is a concentration of mixed-use in the central area, and the rest are located promptly. Linear Units refer to the Trade and Services Corridors, made up of federal and state highways and the Trade and Services Axes, characterized by roads that mainly comprise commercial and service activities.

As for the PEEs, the initial project provided for some squares. However, this planning did not happen to structure them in an articulated way across the entire urban fabric. In the current context, occasional renovations or revitalizations usually take place mainly in the central area. The green areas of the city consist of closed tree masses that are not used as public spaces of appropriation.

The first mapping (Figure 02) points out that of the 58 neighborhoods, only 16 have PES's, which is equivalent to 27.58%. The total quantification of PES's corresponds to 0.67% of the area of the urban perimeter, with a total amount of 309, comprising 39 squares, 09 wide, 02 parks, and 259 central flowerbeds distributed over 38 roads. They have different sizes and are unevenly distributed in the urban fabric, a fact that prevents to meet the demands of different regions of the city. Those PEEs are concentrated in the central area, where there is mixed or residential use, and there is little expansion from these places to the neighborhoods, which makes it difficult for residents who do not reside in the central region to access the public space.

Figure 02: Panorama of PES's in the city structure.

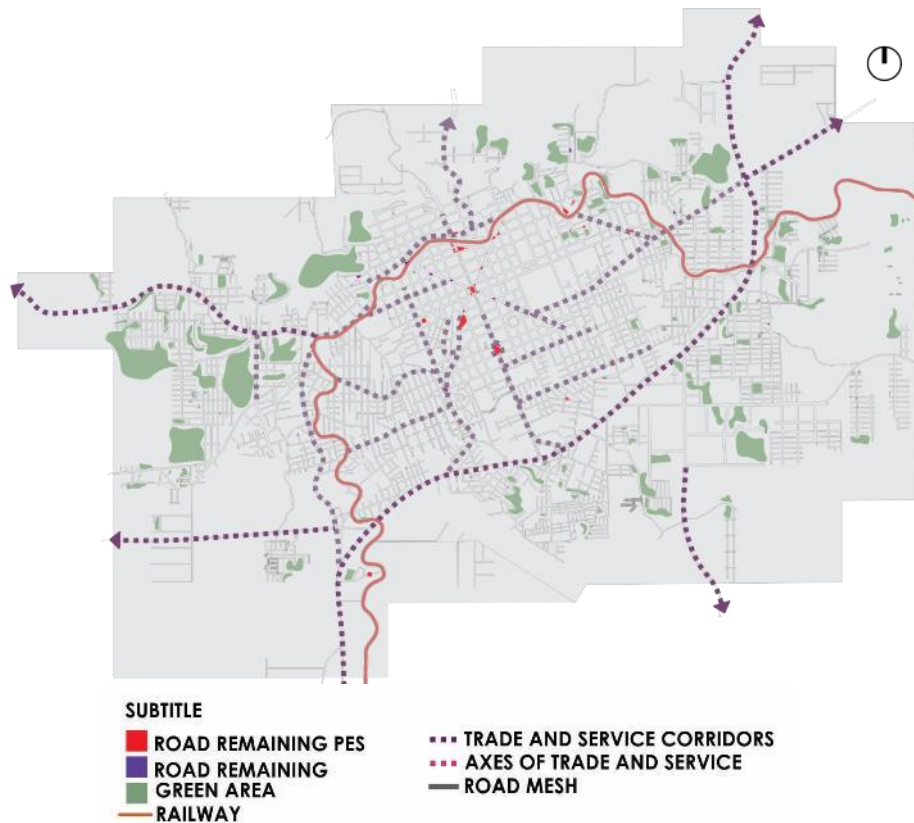


Source: Map obtained from the City Hall with the author's edition, 2019.

Then, it was verified if, among those spaces, there are road remnants. It appears that 30 PES's are the result of the implementation of the urban structure, with a smaller scale, roundabout configuration, and have no furniture. Along with these factors, the insertion in monofunctional areas restricts the movement of people at specific times instead of stimulating the continuous flow in different areas of the city due to multifunctional uses. In addition to these, other residual spaces were also counted, totaling 22 spaces.

The detected elements from the PES's analysis show that there are remaining road spaces of different sizes, a situation that promotes disconnection with the city, and thus the 52 locations are characterized as urban voids (Figure 03).

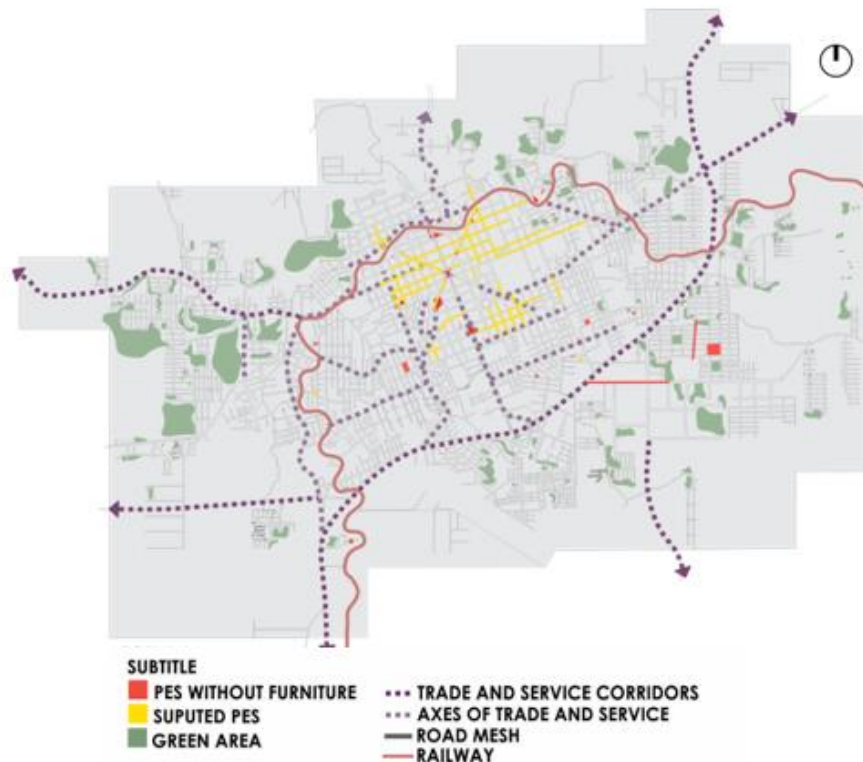
Figure 03: Identification of the remaining roads.



Source: Map obtained from the City Hall with the author's edition, 2019.

Figure 04 shows the PES's that do not include furniture and those that are underused. It was identified that 30 spaces do not have furniture, limited only to the presence of vegetation of different sizes, and 36 spaces are underused since it does not appear to receive periodic maintenance. They contemplate benches and sports courts, for example. However, they do not come from planning, which means that they do not receive local improvements. Most of the roads with central flowerbeds are located in the area that belongs to the checkerboard of the central region of the city, they have arboreal and small vegetation, but only a few encourage appropriation and have furniture. The others only divide the lanes of the roads.

Figure 04: Characterization of PES's.



Source: Map obtained from the City Hall with the author's edition, 2019.

From the analysis, it appears that 66 PES's are classified as urban voids since the current situation does not favor their socio-spatial insertion because some places are underutilized, and thus they tend not to encourage use by the population. On the other hand, they are places that could be optimized and reinserted into the socio-spatial dynamics of the city. The first part of the analysis resulted in a total of 88 PES's considered to be urban voids due to the context of underuse, because they are idle in the socio-spatial dynamics or because they are residual spaces, inserted mainly in the areas of mixed and residential use.

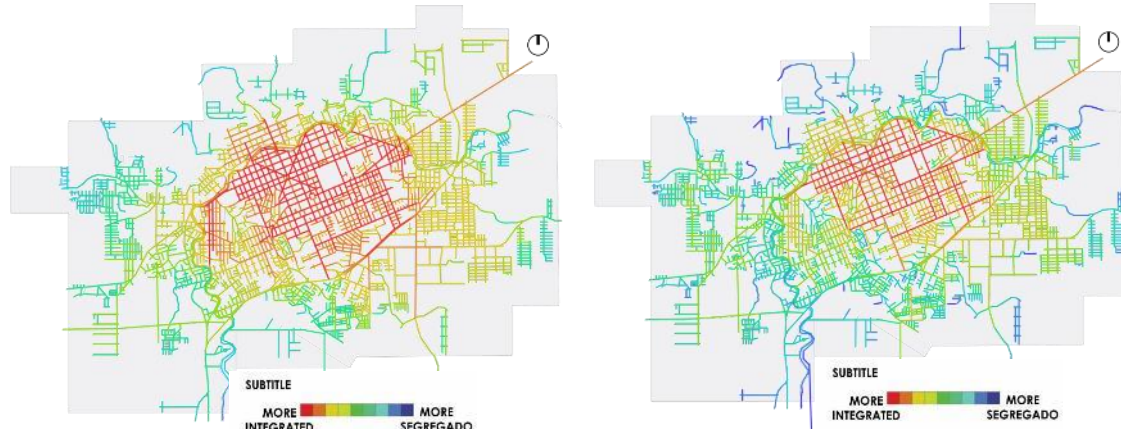
4.3 PESs AND SYNTHETIC ANALYSIS

This stage seeks to understand the relationship between the mapped PES's and the syntactic analysis of the city to identify locations more or less integrated with the global scale (HH) and local (N7) analyzes that collaborate in the understanding of the morphological compositions of Erechim, to verify if PES's are located in places with a greater tendency to appropriation. The syntactic analysis is generated from axial lines, and the color scale helps to understand the hierarchy of roads according to the degree of connectivity. Warm tones refer to the more integrated spaces (red), and as the colors become colder, the areas are more segregated (dark blue).

Global integration (HH) shows how each line is related to the other lines of the city's network and points out that more integrated locations are in the central region, have greater

access possibilities, and encourage the circulation of people, whether residents or strangers. On the other hand, more segregated sites do not favor this flow, located in more peripheral areas, which are less accessible. The local integration (N7) presents the secondary centers of the layout, inserted in the main centers, with a greater relationship in the neighborhood scale and can foster the natural movement as well as the establishment of service and commercial establishments. In Erechim, they are concentrated in the central area, and there are some in dispersed regions in the mesh (Figure 05).

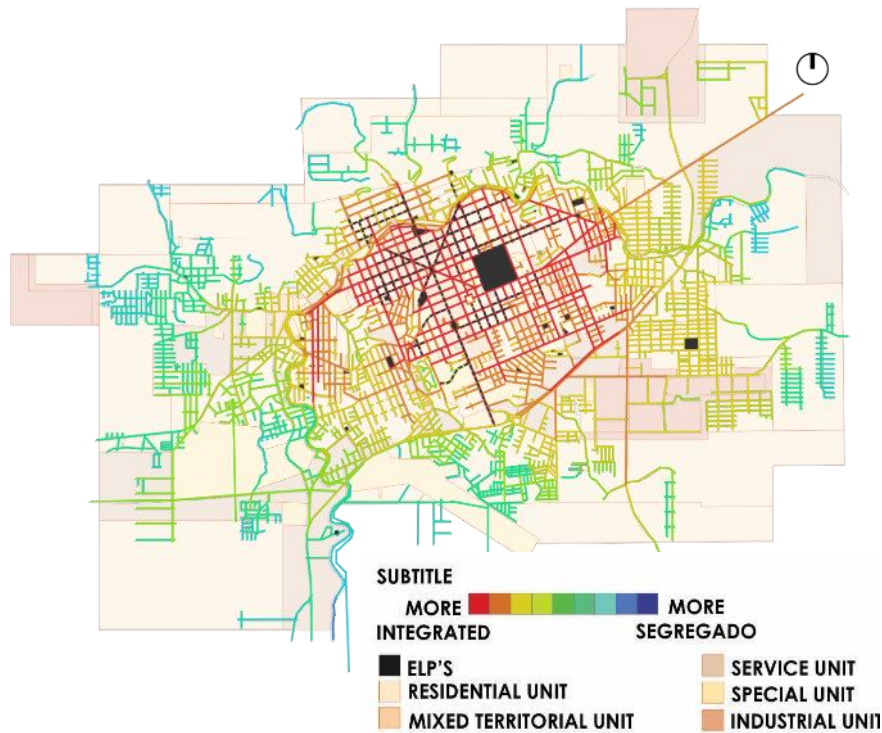
Figure 05: Analysis of Global Integration (HH) and Analysis of Local Integration (N7)



Source: Map generated on DephtmapX with author's edition, 2019.

By superimposing global analysis, urban layout, land use, and PES's (Figure 06), it is noted that the integrating nucleus is located in the central area, has greater density, diversity of uses, and quantity of PES's. On the contrary, the segregated areas are located in the peripheral parts, distributed in a dispersed way throughout the urban perimeter, where there is less density, use of only residential, service, or industrial land. In addition to it, the existence of PES's is rare. These factors contribute to the territorial discontinuity of these areas, making them not so diversified.

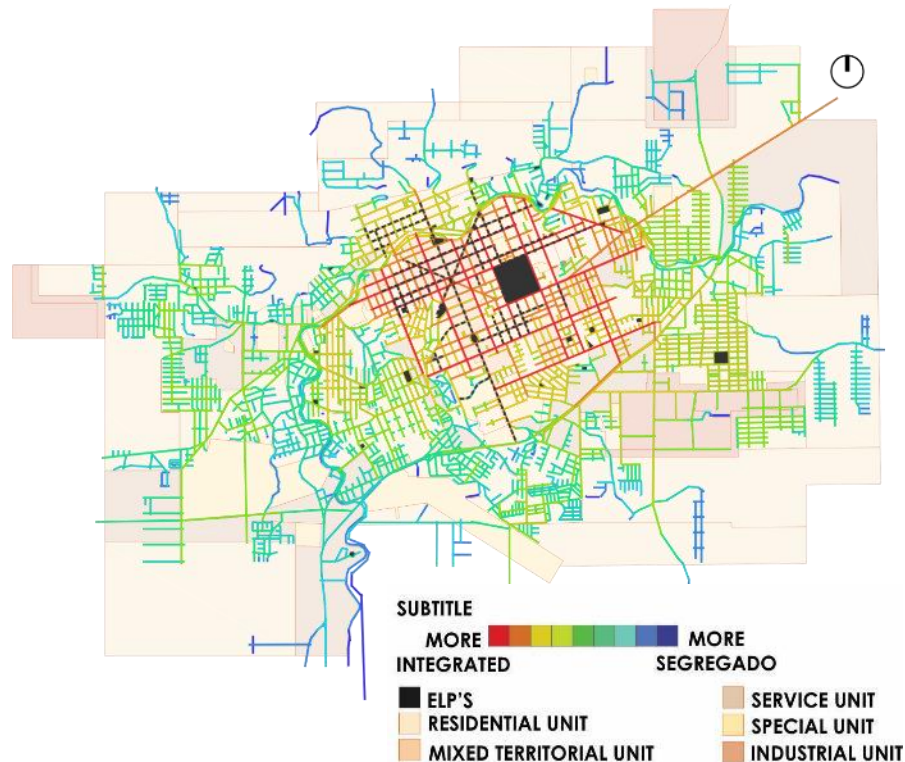
Figure 06: Analysis of Global Integration (HH) and PES's.



Source: Elaborated by the author, 2019

Relating the same elements with local integration (Figure 07), it appears that most PES's are located in the integrating nucleus with a greater tendency for different people to circulate, and the other spaces are inserted in less integrated areas where circulation tends to be from residents. Along with the fact that they are inserted in monofunctional areas, they are spaces that tend to have people circulating at specific times. They are limited to residents of the surroundings because the layout with little connection with other areas and the use of restricted soil do not encourage the movement of different people.

Figure 07: Analysis of Local Integration (N7) and PES's.



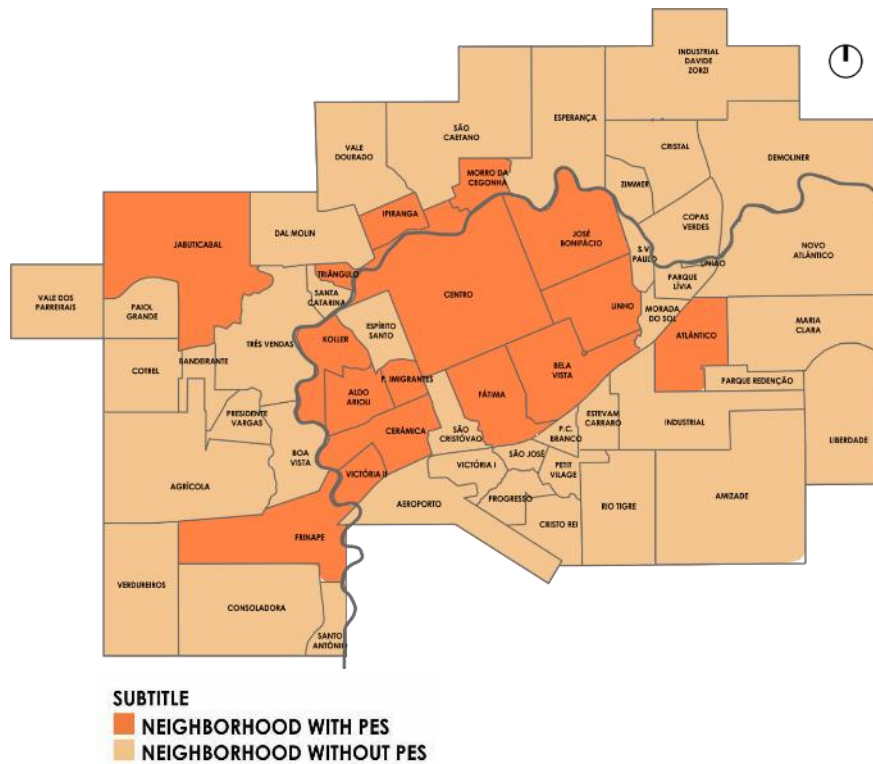
Source: Elaborated by the author, 2019

The morphological analyzes contribute to the understanding that the FSS of Erechim is formed by PES's concentrated in the central area, which has greater integration both on a global and local scale, characterized by residential and mixed-use. In contrast, areas with greater segregation do not have diversified land use and are not assisted by PES's, factors that contribute to the socio-spatial disconnection of these regions.

5 RESULTS

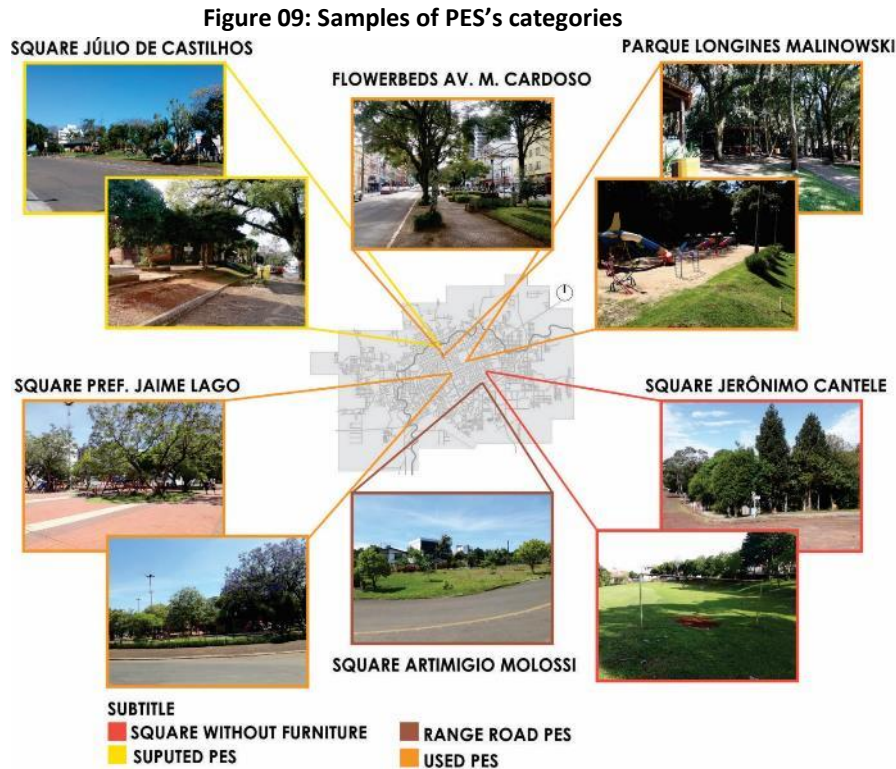
From the studies, it is noted that the distribution of the PES's that make up the FSS of the urban area of Erechim is concentrated in some neighborhoods in the central region of the urban fabric, and a considerable part of the other neighborhoods is lacking in spaces that provide public life. Once 42 neighborhoods do not have planned public spaces, it corresponds to an amount equivalent to 72.41% of the city's neighborhoods (Figure 08).

Figure 08: Identification of neighborhoods with PES's.



Source: Map obtained from the City Hall with the author's edition, 2019

The following is a sample of PES's to exemplify the conformation of the categories found (Figure 9). Those are spaces that present definitive structures that could be optimized through the action of planning. It should be noted that they are specific places, which means that each PES varies according to its peculiarities and urban insertion.



Source: Photos taken by the author, with author's edition, 2019

Given the above, surveys, analyzes, and verifications of the urban area indicate that there is a lack of PES's in the FSS of Erechim. In addition to a part of the existing spaces that do not allow appropriation, because, despite the existing infrastructure, they are not attractive spaces due to the lack of maintenance, insertion of equipment and activities that meet the current social demands, a situation that favors underuse. This context results in abandoned urban structures, and some of them are in notable locations in the city, which become urban voids due to socio-spatial disconnection.

Urban morphology is the structuring element of the PES's since many of the public spaces are remainings. Besides the existence of other idle and residual spaces, a fact that underlies the characterization of 96 PES's of Erechim as urban voids. It should be noted that these are spaces that have a certain infrastructure since most of them contain vegetation of different sizes, some furniture but do not receive routine maintenance and periodic readjustments to meet the current demands of the population.

6 CONCLUSION

The study seeks to contribute to the general objective proposed to investigate the relationship between urban morphology and the free space system of Erechim. As seen throughout the work, urban morphology and city use condition the use of PES's, and the research shows that they do not really configure a planned system that articulates spaces as a network that permeates the urban fabric, allowing residents of different regions to access public spaces.

Regarding the panorama of the conformation of the FSS, it was identified that they are

located mainly in the central region, expanding in a dispersed way to peripheral areas, with an agglomeration of PES's in areas with a greater diversity of land use and more integrated, which tend to foster a bigger movement of people. In areas with greater segregation, which are basically monofunctional, these spaces are isolated or non-existent.

The research also points out that there is a considerable amount of PES's characterized as urban voids due to the current context of underuse or because they are residual spaces. The results show that many of those spaces have a certain infrastructure. Therefore, it would be possible to optimize them and plan the expansion of the FSS, as it is noted that there was the initial intention of having articulated spaces since the central area holds a greater amount of PES's. In this context, the existing PES's can be the starting point to develop the expansion to the neighborhoods and encourage the use of the streets as a public space. This scenario could be changed through urban reintegration through planning actions that range from the diversity of land use to the structuring of PES's as a system to enable greater integration of these spaces with society.

Finally, it should be noted that the study between FSS, land use, syntactic analysis of the urban network, and other relevant elements is a way to obtain a diagnosis that can support future interventions. In this way, the research contributes to the understanding of the current situation of the PES's in the city of Erechim and can be complemented with the mapping of other categories of urban voids to understand the relationship of these spaces with the information raised in this study.

BIBLIOGRAPHICAL REFERENCES

ALVAREZ, Karla Lopez Blanco. **O projeto de espaços públicos na periferia de São Paulo**: uma questão sócio-ambiental. 2008. 220 f. Dissertação (Mestrado) - Curso de Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo, São Paulo, 2008.

BORDE, Andréa de Lacerda Pessoa. **Vazios Urbanos**: Perspectivas Contemporâneas. 2006. 242 f. Tese (Doutorado) - Curso de Programa de Pós-graduação em Urbanismo, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 2006.

BUSQUETS, J. **Terreny erm i potencial reestructurador = Terrain vague et potentiel de restructuration**. *Quaderns d'arquitectura i urbanisme*, n. 214, p. 80–81, 1996.

DITTMAR, Adriana C. C. **Paisagem e morfologia de vazios urbanos**: Análise da transformação dos espaços residuais e remanescentes urbanos ferroviários em Curitiba – PR. 2006. Dissertação (Mestrado)—Centro de Ciências Exatas e de Tecnologia, Pontifícia Universidade Católica. Curitiba, 2006.

DONADON, Edilene Terezinha. **Terrain Vagues**: Um estudo das áreas urbanas obsoletas, baldias ou derrelitas em Campinas. 2009. 184 f. Dissertação (Mestrado) - Curso de Engenharia Civil, Arquitetura e Urbanismo, Faculdade de Engenharia Civil, Arquitetura e Urbanismo da Universidade Estadual de Campinas, Campinas, 2009.

ERECHIM (cidade). **LEI N.º 6.256**, DE 15 DE DEZEMBRO DE 2016. Dispõe sobre o desenvolvimento urbano, sobre o zoneamento de uso do solo urbano e revoga a Lei n.º 2.595/1994.

FÜNFGELT, K. **História da paisagem e evolução urbana da cidade de Erechim – RS**. Dissertação apresentada a UFSC para obtenção do Título de Mestre em Geografia. Florianópolis, 2004.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). Disponível em <<https://cidades.ibge.gov.br/brasil/rs/erechim/panorama>>. Acessado em 10 de outubro de 2019.

HILLIER, B.; HANSON, J. **The Social Logic of Space**. Cambridge: Cambridge University Press, 1984.

KRAFTA, R. Morfologia urbana tipológica e morfogenética. In: KRAFTA, R. (Ed.). **Notas de aula de morfologia urbana**. Porto Alegre: Editora da UFRGS, 2014. p. 39–68.

LEITOLES, Maicon Lincon. **Permanências e transformações no espaço público**: o caso da rua XV de Novembro em Curitiba / Maicon Lincon Leitoles; orientador, Almir Francisco Reis, Florianópolis, SC, 2016. 183 p.

OLIVEIRA, Lucimara Albieri de; MASCARÓ, Juan José. Análise da qualidade de vida urbana sob a ótica dos espaços públicos de lazer. **Ambiente Construído**, Porto Alegre, v. 2, n. 7, p.59-69, jun. 2007.

PEPONIS, J. Espaço, cultura e desenho urbano no modernismo tardio e além dele. **Revista AU**, n. 41, 1992.
PREFEITURA DE ERECHIM. Disponível em: <<https://www.pmerechim.rs.gov.br/pagina/156/erechim-em-numeros>>. Acessado em 15 de outubro de 2019.

PUPPI, I. C. **Estruturação sanitária das cidades**. São Paulo: CETESB, 1981.

QUEIROGA, Eugênio Fernandes. Sistemas de espaços livres e esfera pública em metrópoles brasileiras. **Resgate**, n.i., v. XIX, n. 21, p.25-35, jan. 2011.

SOLÀ-MORALES, I. de. **Terrain Vague**. In: SOLÀ-MORALES, I. de. Territorios. Barcelona: G. Gilli, 2002.

TARNOWSKI, Camila Martinez Lima. **Percepção da Paisagem**: estudo sobre vazios urbanos no centro de Curitiba, Paraná. Curitiba, PR, 2007.

TIBBALDS, F. **Ten commands of urban design The Planner**. Making people-friendly towns. Improving the public environment in towns and cities Spon Press, London (1988).

VÁSQUEZ, Catalina Giraldo. **Reinterpretação de espaços subutilizados na cidade contemporânea**: Análise dos vazios industriais de Medellín / Catalina Giraldo Vásquez ; orientadora, Lisete Terezinha Assen de Oliveira ; coorientadora, Adriana Marques Rossetto. - Florianópolis, SC, 2016. 233 p.

WHYTE, W. H. The life of plazas. In: CARMONA, M.; TIESDELL, S. (Eds.). **Urban Design Reader**. Amsterdam: Architectural Press, 2007. p. 226–229.