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The Urban Morphology of Ourinhos: Exploring the City's Expansion from the Perspective of the English School

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A morfologia urbana de Ourinhos: explorando a expansão da cidade pela perspectiva da Escola Inglesa

RESUMO

Objetivo - Analisar a formação de núcleos urbanos em função da implantação da ferrovia Estrada de Ferro Sorocabana (EFS), com ênfase na cidade de Ourinhos, e investigar a influência das rodovias na expansão urbana e nas configurações morfológicas.

Metodologia - Adotou-se a abordagem da Escola Inglesa de Morfologia Urbana (Conzeniana), com critérios como inserção topográfica, interação com a rede hidrográfica, legibilidade formal do contorno, hierarquização do sistema viário e relação entre áreas urbanas e rurais. Foram elaborados mapas de expansão urbana para representação gráfica dos dados.

Originalidade/relevância - O estudo preenche uma lacuna teórica ao explorar a dinâmica urbana de Ourinhos sob a perspectiva morfológica, destacando o papel da ferrovia e das rodovias na configuração socioespacial, tema de relevância para a história urbana e o planejamento regional.

Resultados - A EFS foi fundamental na criação de cidades no oeste paulista entre 1860 e 1930, com Ourinhos emergindo como caso emblemático devido à sua posição geográfica e ao impulso do café. Identificaram-se duas fases de crescimento: a primeira (1908-1940) ligada à ferrovia e ao café, e a segunda (pós-1950) marcada pela modernização e expansão populacional. A ferrovia fragmentou a estrutura urbana, perpetuando divisões socioeconômicas.

Contribuições teóricas/metodológicas - A aplicação da metodologia Conzeniana permitiu uma análise sistemática da morfologia urbana, oferecendo um modelo para estudos similares em cidades de origem ferroviária.

Contribuições sociais e ambientais - Os achados destacam a necessidade de políticas urbanas que integrem áreas historicamente segregadas, além de subsidiar reflexões sobre o impacto de infraestruturas de transporte no desenvolvimento sustentável.

PALAVRAS-CHAVE: Morfologia urbana. Ferrovias. Ourinhos. Expansão urbana. Escola Conzeniana.

The Urban Morphology of Ourinhos: Exploring the City's Expansion from the Perspective of the English School

ABSTRACT

Objective – To analyze the formation of urban centers resulting from the implementation of the Sorocabana Railway (EFS), with a focus on the city of Ourinhos, and to investigate the influence of highways on urban expansion and morphological configurations.

Methodology – The study adopted the English School of Urban Morphology (Conzenian) approach, considering criteria such as topographic insertion, interaction with the hydrographic network, formal contour legibility, road system hierarchy, and the relationship between urban and rural areas. Urban expansion maps were created for graphical representation.

Originality/Relevance – The study addresses a theoretical gap by examining the urban dynamics of Ourinhos from a morphological perspective, highlighting the role of railways and highways in socio-spatial configurations—an issue relevant to urban history and regional planning.

Results – The EFS played a vital role in the creation of cities in western São Paulo between 1860 and 1930, with Ourinhos emerging as a key case due to its geographic position and the influence of coffee production. Two growth phases were identified: the first (1908–1940) linked to the railway and coffee, and the second (post-1950) marked by modernization and population expansion. The railway fragmented the urban structure, perpetuating socioeconomic divisions.

Theoretical/Methodological Contributions – The application of the Conzenian methodology enabled a systematic analysis of urban morphology, providing a model for similar studies in railway-origin cities.

Social and Environmental Contributions – The findings emphasize the need for urban policies that integrate historically segregated areas and support discussions on the impact of transportation infrastructure on sustainable development.

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KEYWORDS: Urban morphology. Railways. Ourinhos. Urban expansion. Conzenian School.

La morfología urbana de Ourinhos: explorando la expansión de la ciudad desde la perspectiva de la escuela inglesa.

RESUMEN

Objetivo – Analizar la formación de núcleos urbanos en función de la implantación del ferrocarril Estrada de Ferro Sorocabana (EFS), con enfoque en la ciudad de Ourinhos, e investigar la influencia de las carreteras en la expansión urbana y las configuraciones morfológicas.

Metodología – Se adoptó el enfoque de la Escuela Inglesa de Morfología Urbana (Conzeniana), considerando criterios como inserción topográfica, interacción con la red hidrográfica, legibilidad formal del contorno, jerarquización del sistema vial y relación entre áreas urbanas y rurales. Se elaboraron mapas de expansión urbana para representación gráfica.

Originalidad/relevancia – El estudio aborda un vacío teórico al explorar la dinámica urbana de Ourinhos desde una perspectiva morfológica, destacando el papel del ferrocarril y las carreteras en la configuración socioespacial, tema relevante para la historia urbana y la planificación regional.

Resultados – El EFS fue fundamental en la creación de ciudades en el oeste paulista entre 1860 y 1930, destacándose Ourinhos por su posición geográfica y el impulso del café. Se identificaron dos fases de crecimiento: la primera (1908–1940) vinculada al ferrocarril y al café, y la segunda (a partir de 1950) marcada por la modernización y expansión poblacional. El ferrocarril fragmentó la estructura urbana, perpetuando divisiones socioeconómicas.

Contribuciones teóricas/metodológicas – La aplicación de la metodología Conzeniana permitió un análisis sistemático de la morfología urbana, ofreciendo un modelo para estudios similares en ciudades de origen ferroviario.

Contribuciones sociales y ambientales – Los hallazgos resaltan la necesidad de políticas urbanas que integren áreas históricamente segregadas, además de fundamentar reflexiones sobre el impacto de infraestructuras de transporte en el desarrollo sostenible.

PALABRAS CLAVE: Morfología urbana. Ferrocarriles. Ourinhos. Expansión urbana. Escuela Conzeniana.

RESUMO GRÁFICO

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1 INTRODUCTION

Until the mid-19th century, the configuration of the transportation system in Brazilian territory was almost exclusively dominated by maritime and river navigation, a result of physical and geographical constraints. As evidenced by recent studies in human geography (LIMA, 2021; CARDOSO & TEIXEIRA, 2022), the combination of the country's vast territory, complex topography, and dense vegetation acted as a structural barrier to the implementation of land-based transport infrastructure, consolidating waterways as the primary vectors of spatial integration.

In this context, analyses based on historical Geographic Information Systems (GIS), such as those conducted by Silva et al. (2023), indicate that rivers performed functions that went beyond mere logistical mobility, establishing themselves as structuring axes of territorial organization, around which the first colonial urban centers were organized.

The transition to the railway model, as demonstrated by Oliveira and Santos (2022) through the analysis of quantitative historical series, occurred in parallel with the consolidation of the coffee complex as the main driver of the national economy. This phenomenon, defined by Martins (2023) as the "logistical revolution of coffee," demanded transportation systems with greater transport capacity and operational reliability—attributes more adequately met by railway infrastructure compared to river transport.

Evidence from industrial archaeology corroborates that the São Paulo railway network, particularly the Sorocabana Railway (EFS), was designed based on advanced technical parameters for the period, incorporating engineering solutions aimed at rationalizing routes and minimizing operational costs (GONÇALVES, 2023, p. 34).

The interdependence between railway expansion and the urbanization dynamics of Western São Paulo has been re-evaluated using new theoretical and methodological approaches. Recent studies (SOUZA et al., 2023), using quantitative spatial analysis, show that approximately 87% of the urban centers founded between 1870 and 1930 were located within a radius of up to 2 km from railway stations, configuring a centripetal pattern of urbanization around this infrastructure and reproducing, on a regional scale, the hierarchy of the railway network.

Ghirardello (2002) highlights that the presence of the railway not only spurred economic growth but also guided the urban morphology of the cities that emerged in this context. Stations began to function as structuring hubs of the urban space, around which public squares, institutional buildings, and commercial areas were organized. Frequently, the urban layout reflected the orientation of the railway lines, influencing urban expansion and the spatial distribution of residential and commercial uses.

Additionally, the railway system promoted the articulation of the cities in western São Paulo with other regions of the state and the country, intensifying economic, social, and cultural flows. In this sense, the railway not only shaped the physical structure of the cities but also acted as a vector of modernization and an inducer of regional urban growth.

Urban morphology, as a field of investigation, is dedicated to the study of the forms and structures that constitute the built environment, considering not only the physical organization of urban elements—such as streets, buildings, squares, and neighborhoods—but also the

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socioeconomic, cultural, and political dynamics that condition their configuration and transformation. As Moudon (1986, p. 15) points out, morphological analysis allows for the identification of patterns of growth and spatial reorganization, as well as the structuring principles that inform such processes.

In recent decades, the field of urban morphology has incorporated significant methodological and technological advances. Zhang and Chen (2023), in a comparative study of global cities, demonstrate that contemporary approaches integrate complex network analysis (to measure urban connectivity), the use of artificial intelligence in processing urban images, and 3D spatio-temporal modeling (aimed at reconstructing historical transformations).

Recent contributions, such as those by Batty (2022), introduce innovative methodologies based on pre-defined structures of quantitative morphological analysis, capable of measuring parameters such as road connection density, degree of land-use mix, and urban fragmentation indices. Applications of these methodologies to the Brazilian context, as demonstrated by Ribeiro et al. (2023), indicate that São Paulo's railway cities exhibit greater geometric regularity in their layouts, greater spatial integration (measured by space syntax), and clearer patterns of functional centrality.

The author also highlights that, based on the principles of the English School of Urban Morphology, it was possible to develop a set of analytical criteria for interpreting urban form. Among these criteria, the following stand out: the articulation between the urban grid and the topography; integration with the hydrographic network; the coherence of the design composition; the hierarchization of the road structure; the legibility of the orthogonal layout; and the formal interface between urban and rural areas. The systematic application of these elements provides a robust analytical basis for formulating more effective urban policies aimed at promoting sustainable and orderly territorial development.

2 OBJECTIVES

This study aims to analyze the formation processes of urban centers conditioned by the implementation of the railway network, with an emphasis on the city of Ourinhos. Additionally, it seeks to understand the role played by the insertion of highways within the urban perimeter and the resulting effects on the city's expansion towards the northern sector, highlighting the induction of new growth vectors and the configuration of distinct urban morphologies. This research allows for an examination of how the interaction between railway and highway infrastructure decisively influenced urban development, guiding dynamics of spatial expansion and promoting significant transformations in the urban fabric of Ourinhos over time.

3 METHODOLOGY

Adopting a processual morphological approach, the research seeks to understand how the implementation of the Sorocabana Railway (EFS) in the early 20th century acted as a generative element of the original urban core, establishing the city's initial growth vectors. The analysis integrates diverse historical sources, including digitized cartography from the 1908-1930 period, railway heritage records, and disaggregated census series, allowing for a precise reconstruction of the initial patterns of territorial occupation. In a second phase, the study

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focuses on the transformation of urban growth patterns resulting from the insertion of the highway system from the 1950s-1970s onward. Through spatial analysis techniques, such as the use of GIS and historical photogrammetry, the study examines how the new transport routes reoriented the city's expansion vectors, particularly northward, and influenced the reconfiguration of land use.

The theoretical foundation of the work is based on the framework of the English School of Urban Morphology, as developed by Whitehand (2021), articulated with recent approaches in urban network analysis (Batty, 2022) and quantitative morphology (Ribeiro et al., 2023). This integrated perspective allows not only for the reconstruction of historical urban formation processes but also for the identification of specific morphological patterns arising from the interaction between distinct transportation systems.

The creation of the urban expansion maps of Ourinhos in QGIS began with the systematic compilation of historical cartographic sources held by the Public Archive of the State of São Paulo and the Municipal Government. The process began with the digitization and georeferencing of cadastral plans from the 1930s, using permanent urban features such as the railway station and the main church as control points, adjusted to the SIRGAS 2000 coordinate system. These pioneering maps reveal the embryonic urban core, characterized by an orthogonal street grid concentrated within a 500-meter radius of the station, a typical pattern of São Paulo's railway towns.

For each subsequent decade, up to the present day, specific sets of documents were processed: aerial photographs from the 1954 aerophotogrammetric project, approved subdivision plans from the 1960s-70s, and the contemporary digital urban atlas. In QGIS version 3.28, these sources were converted into temporal vector layers, allowing for the analysis of the transition from the linear railway pattern to the radial expansion induced by the SP-270 and SP-327 highways from the 1950s onward.

The comparative morphological analysis revealed three distinct phases in the urban configuration. The first phase (1930-50) shows high elongation (shape index ≥2.5) along the railway axis. The second phase (1960-90) displays a concentric radial pattern (index 1.8–2.2) with growth sectors oriented by the highways. The contemporary phase (post-2000), in turn, shows evidence of urban fragmentation processes (index >3.0) and the emergence of multiple centralities. These patterns were validated through triangulation with complementary sources: construction permit records, a review of academic literature, and comparison with historical photographs, ensuring the robustness of the results.

The developed methodology made it possible not only to map the city's physical expansion but also to understand how the transportation system imprinted specific characteristics on the urban morphology. The temporal maps produced clearly reveal the transition from a compact railway town to a polycentric and dispersed urban configuration, offering valuable insights for the field of urban morphology.

4 RESULTS

The urbanization process in the western region of the state of São Paulo constitutes a phenomenon inseparable from the implementation of the Sorocabana Railway (EFS), whose

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construction began in 1905 in the present-day municipality of Bauru. As demonstrated by Ghirardello (2002, p. 60), the regional urban grid emerged predominantly from land holdings established by speculators or colonization companies, whose strategic location strictly adheres to the logic of the railway layout and the arrangement of the stations. This pattern of spatial occupation reveals the symbiotic nature of transport infrastructure and territorial organization within the context of the coffee expansion.

The occupation process of the territory crossed by the EFS dates back to the 1860s, when the first population centers were established in small clusters located in the topographically lower areas of the region. As noted by Silva (2003, p. 149), this vast territory—with approximate dimensions of 10 by 25 leagues—was under the almost exclusive domain of José Theodoro da Silva, a notorious posseiro (land-grabber) originally from Pouso Alegre (MG) who took possession of these lands after settling in Botucatu in 1856. Documentary analysis reveals that this historical figure played a central role in the founding of the village of São José dos Campos Novos do Paranapanema, which, as Silva (2003) demonstrates, for decades assumed the strategic function of a "boca-de-sertão" city (a gateway to the backlands), acting as an advanced base for the conquest and occupation of the interior territory.

The subdivision of the vast latifúndio (large landed estate) originally controlled by José Theodoro da Silva, later carried out by his heirs into large tracts, created the necessary land conditions for subsequent urban development. As observed in the research, the majority of urban centers that emerged along the EFS route were planned and managed by real estate or colonization companies, configuring a distinct pattern of corporate urbanization (SILVA, 1988, p. 151).

The construction of the EFS, which began in 1905, was notable for its rapid pace compared to other railways on the São Paulo agricultural frontier. The chronological data are revealing: by 1919, the line had already reached Presidente Prudente, extending to the banks of the Paraná River in Presidente Epitácio by 1922 (SILVA, 1988, p. 151). Although coffee served as the primary economic driver for regional occupation, the analysis demonstrates that the urbanization process itself developed in close correlation with the railway expansion.

As Silva (2003, p. 151) summarizes, "The apex of city founding occurs in a time interval that spans from 1910 to 1930, coinciding with the period of the railway's insertion deep into the sertão (backlands). During this period, about 21 settlements (patrimônios) were created in the region." This quantitative data highlights the catalyzing role of the railway infrastructure in the organization of regional space.

4.1 Contemporary Urban Morphology: Theoretical Interfaces, Digital Tools, and Socio-environmental Challenges

Urban morphology, as a consolidated interdisciplinary field, has undergone significant conceptual and methodological transformations in recent decades, incorporating contributions from geography, urbanism, and architecture. Studies such as those by Oliveira (2021) and Moudon (1997) reinforce the centrality of historical and typological analysis for understanding urban structure, highlighting how socio-spatial processes shape the form of cities. Concurrently, the configurational approach, grounded in Space Syntax Theory (HILLIER; HANSON, 1984), has

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gained prominence by establishing connections between road networks, land uses, and social dynamics.

In this landscape, works such as those by Kropf (2017) expand the methodological scope of morphological analysis by integrating quantitative and qualitative techniques, supported by tools like Geographic Information Systems (GIS) and 3D modeling. Such approaches enable a more precise reading of urban growth patterns, densification processes, and spatial fragmentation. Simultaneously, the perspective of "adaptive urbanism" highlights the relevance of resilient design strategies in the face of socioeconomic and environmental transformations.

The interface between urban morphology and sustainability has been widely debated, with authors such as Jabareen (2006) proposing the incorporation of principles of resilience, energy efficiency, and spatial justice into urban design. The arrangement of blocks, plots, and buildings directly impacts parameters such as urban mobility, natural ventilation, microclimate, and quality of life. Numerous studies demonstrate how spatial compaction and typological diversity can mitigate environmental impacts and promote more sustainable urban patterns.

With the advent of so-called smart cities, urban morphology is being reinterpreted in light of emerging technologies, such as "digital twins" and big data analysis (BATTY, 2018). Such innovations enable the simulation of future scenarios and the anticipatory evaluation of urban interventions. However, authors like Sennett (2018) warn against the risks of a reductionist technicism, arguing in favor of more humanistic and culturally sensitive approaches to the complexity of urban forms and a reduced dependence on digital technologies.

Recent scholarship highlights the need for theoretical-methodological syntheses that articulate classical schools—such as the English tradition represented by Conzen (1964)—with digital tools and contemporary challenges. The convergence of morphological studies, public policies, and citizen participation, as proposed by Godoy and Benini (2024), points toward promising paths to more inclusive, resilient, and adaptable cities, reaffirming the structuring role of urban form in territorial planning and management processes.

The peripheral expansion of contemporary cities has been reconfiguring their morphological patterns, demanding new analytical approaches. Caldeira (2017) observes that peripheral urbanization processes in the Global South are characterized by spatial fragmentation, self-construction, and deficient infrastructure, which contrasts with the formal paradigms of modern planning. In this context, the theory of "planetary urbanization" challenges traditional binaries such as center-periphery, proposing a continuous and fluid reading of territorial transformations.

The advancement of technologies such as machine learning and remote sensing has revolutionized urban morphological analysis, allowing for the identification of spatial patterns in high resolution. Research such as that by Batty (2022) applies neural networks to large-scale typological classification, while Silva and Pinho (2020) use clustering algorithms to segment road structures. These quantitative methods complement traditional approaches, such as morphological cartography, although they raise criticisms regarding the potential loss of socio cultural nuances in analyses that are excessively data-driven.

Climate change imposes new demands on urban configuration. In coastal cities, for example, urban morphology is being re-evaluated in the face of flood risks, with proposals such as "sponge urbanism" (YU, 2022), which proposes permeable urban fabrics inspired by natural

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hydrological processes. This eco-morphological approach converges with the principles of "bioclimatic urbanism," which associates urban form with cross-ventilation and thermal efficiency.

New theoretical currents have been questioning the predominant Eurocentrism in morphological readings. Watson (2022), by analyzing African cities through local epistemologies, proposes the valorization of contextual knowledge and non-Western spatial practices. The notion of "hybrid morphologies" seeks to represent the coexistence of formal and informal patterns, while the decolonial frameworks of Francisco and Manzato (2023) challenge universalist analytical categories. The dialogue with urban anthropology and political ecology broadens the disciplinary scope of urban morphology, suggesting an approach that is less normative, more situated, and committed to the multiple socio-spatial realities.

4.2 Characteristics of Urban Layouts Shaped by the Railway

The predominant urban layout in cities that emerged as a consequence of railway expansion in Brazil followed, to a large extent, the orthogonal model, with a central square acting as a structuring element. This urban typology dates back to the colonial period and was widely disseminated, especially in 19th-century frontier urban centers, often associated with religious foundations. With the advance of territorial occupation and the growing interest in opening urban and rural subdivisions in frontier regions, the consolidated urban planning practice and the accumulated expertise of technicians and engineers facilitated the systematic replication of this model.

The new urban centers incorporated traditional elements of urban design while simultaneously adopting solutions previously tested in other localities within the state of São Paulo. However, it is possible to identify specific exceptions in which more elaborate and methodologically structured urban compositions were sought. Despite this, cases in which the railway was fully integrated into the urban fabric in a cohesive and functional manner were rare (SILVA, 2003, p. 156).

As Ghirardello (2002, p. 61) argues, the companies responsible for urban planning prioritized layout models that optimized execution and minimized operational costs, aiming to maximize financial return. In this context, the adoption of the orthogonal layout was consolidated as a recurrent choice due to its simplicity and predictability. Often, urban planners had prior knowledge of the planned location of the railway station, which allowed for the development of the street plan in accordance with the axis of the railway line. However, in cities designed by real estate companies, the railway's influence on the urban structure was less pronounced compared to other contexts, revealing a distinct approach to the relationship between infrastructure and urbanization.

In general, the cities of the western São Paulo region exhibited limited diversity in their urban designs. As Silva (2003, p. 155) observes, the basis of the layouts was predominantly orthogonal, with specific variations such as the widening of main thoroughfares or the inclusion of central squares that deviated from conventional patterns. Despite these adaptations, a significant homogeneity prevailed among these urban centers, both in terms of the regularity of the layouts and the presence of architectural elements linked to the industrial railway

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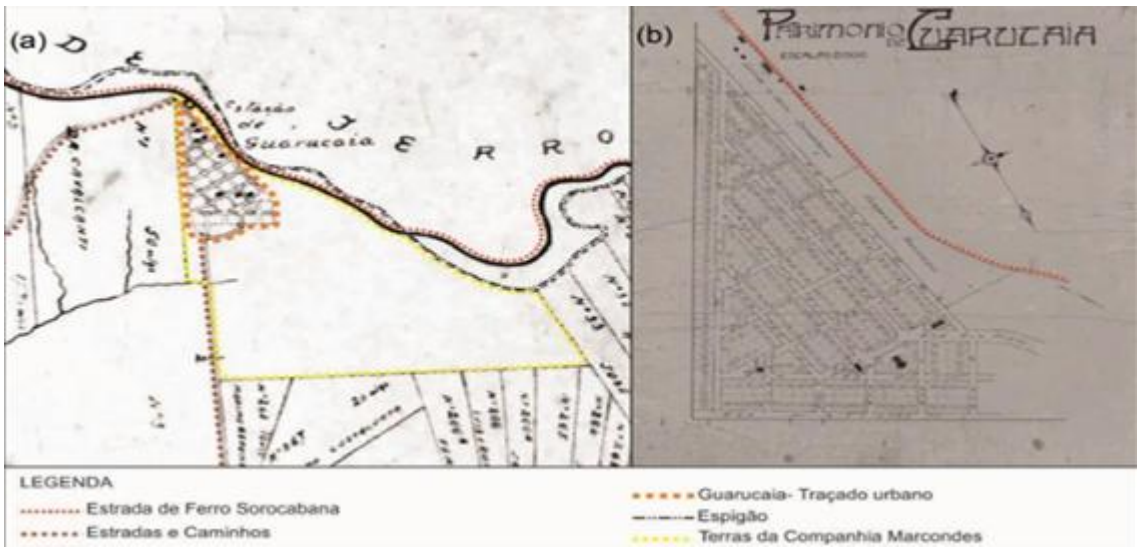
infrastructure. This standardization shaped an urban landscape marked by the repetition of urban planning solutions, reflecting the economic and technical dynamics of the era (Figure 1).

Figure 1 –The urbanistic model of cities in São Paulo



Source: Heritage Archives of the State of São Paulo (1945)

This analysis demonstrates that, although there was room for specific innovations, economic pragmatism and operational efficiency prevailed, resulting in an urban morphology characterized by regularity and functionality. Such aspects reinforce the importance of considering the historical and socioeconomic conditions in the study of urban development associated with railway expansion in Brazil.

Opting for the orthogonal layout was the most practical and viable choice, as it required little earthmoving and earthwork and allowed for the easy demarcation of streets and blocks. This layout aided in stipulating the value of the 34 plots, since they were all the same size and the price varied only according to location; consequently, it facilitated sales and the return on the investment made. Furthermore, such a layout facilitated future urban expansions, as the developer only needed to expand the original layout indefinitely (Ghirardello, 2002, p. 61).

4.3 The City of Ourinhos and the EFS as a Formative Element

Among the cities that emerged in the context of railway expansion in Brazil, Ourinhos stands out as an emblematic case, whose formation and development are intrinsically linked to the dynamics of the coffee-railway binomial and its strategic geographical location. Situated in an intermediate position between the far west of São Paulo—specifically the region of Presidente Prudente—and the North of Paraná, then in its initial phase of colonization, Ourinhos assumed the role of an articulating hub between these two regions undergoing occupation (Boscariol, 2006, p. 34). The implementation of the railway infrastructure not only consolidated its logistical function but also structured its urban and economic space in a manner characteristic of the period.

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In 1908, the Ourinho railway station was inaugurated—then a district belonging to the municipality of Salto Grande—as part of the Sorocabana Railway Company's network, managed by the foreign group Farquhar-Lègru. The construction of the station, which began in 1905, attracted a contingent of workers who formed the embryo of the urban core. The consolidation of the railway is recognized as the founding milestone of the municipality, exerting a decisive influence on its development throughout the first four decades of the 20th century (Alves, 1999).

Before the arrival of the railway, the migratory flow to the Paranapanema River region was sparse and discontinuous, composed mainly of migrants from Minas Gerais (mineiros) in search of fertile lands in Western São Paulo (Monbeig, 1984). However, the implementation of rail transport enabled, for the first time, a constant and organized migratory movement. Immigrants, many of whom entered the country through the port of Santos, used the railway network to disperse throughout the interior, heading primarily toward expanding agricultural frontiers. This flow was crucial for the rapid demographic and economic consolidation of Ourinhos, culminating in its political emancipation in 1918, when the district, then with approximately one thousand inhabitants in its urban core, separated from Salto Grande (Alves, 1999).

Despite the early urban character developed in Ourinhos—in contrast to other cities in the region—its socioeconomic dynamics remained subordinate to agricultural activity, particularly to coffee cultivation during the initial period (1908-1940).

This cycle was marked by three interrelated processes that shaped local development: first, its insertion into the coffee economy through the arrival of coffee and the railway, which positioned Ourinhos in the third cycle of coffee expansion, consolidating its function as a distribution hub for goods and a regional articulator within the state and national economic context; second, its role as a receiving and redistributing center for labor, attracting and directing migratory flows to other frontier regions; and finally, the emergence of economic activities complementary to agriculture, aimed at meeting the logistical and commercial demands generated by the intense movement of people and goods (Rosaneli, 2009).

This triad of factors demonstrates how the initial urbanization of Ourinhos was intrinsically linked to the agro-export economy, even while exhibiting more developed urban characteristics than its regional neighbors. From the 1950s onward, the urbanization process in Ourinhos took on new characteristics, transcending mere population growth. The modernization of urban infrastructure and economic diversification spurred an accelerated spatial expansion, with the population nearly doubling between the 1950s and 1960s. This growth remained constant throughout the second half of the 20th century, reflecting the transition from an agro-dependent economy to a more complex and diversified urban profile.

The case of Ourinhos illustrates in a paradigmatic way how the interaction between geographical, economic, and infrastructural factors shaped urban development in the interior of São Paulo. The railway not only enabled regional integration but also structured the city's morphology and economy, consolidating it as a logistical node and a pole of population attraction.

4.4 The Spatial Arrangement of Urban Activities in Ourinhos

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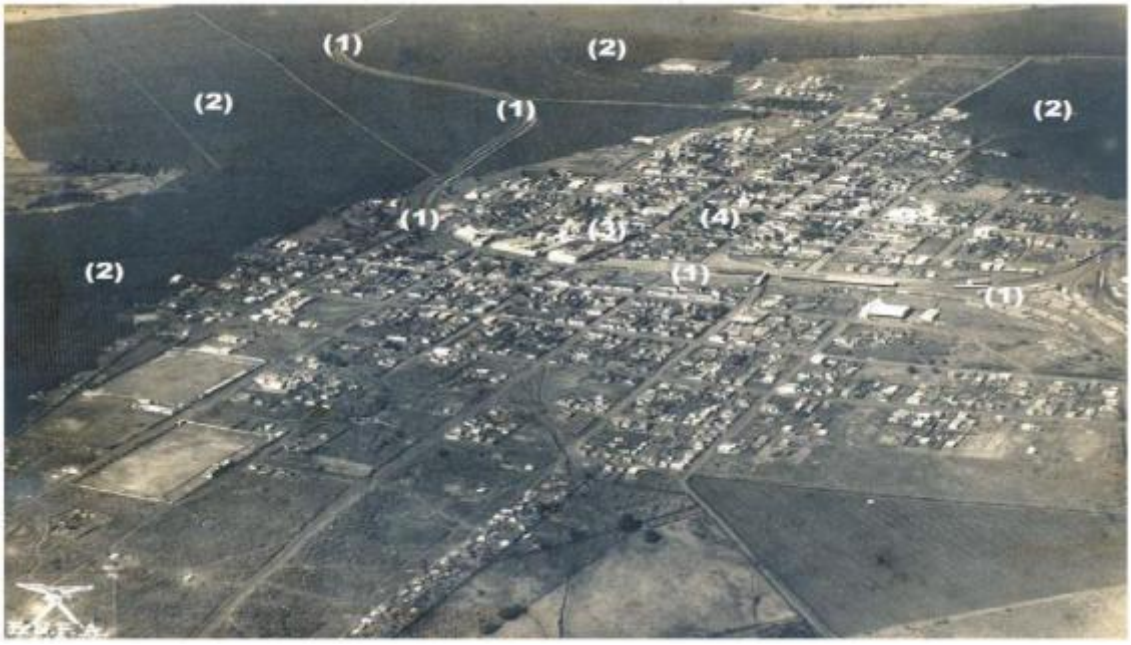
As Silva (2003, p. 158) demonstrates, the urban centers of western São Paulo had two distinct origins in their formative process: they could result from plans developed by companies specializing in colonization or emerge from entrepreneurial initiatives without a predefined urban layout. The analysis of Ourinhos's urban configuration, corroborated by available historical documentation, shows that its development followed the latter model, being characterized by organic and unplanned growth.

The urban fabric of Ourinhos presents a clear spatial dichotomy, with the main core divided into two distinct areas—north and south—by the railway line that bisects the city. This physical fragmentation was reflected in the socioeconomic organization of the urban space, as pointed out by Boscariol (2006, p. 115). As early as the 1940s, when the city had approximately 10,000 inhabitants (65% of whom resided in the urban area), a clear spatial segregation was observed: the more affluent social classes were predominantly concentrated in the southern region, while the population with lower purchasing power mostly occupied the northern area (Figure 2).

Figura 2 – Divisão da cidade de Ourinhos



Source: Heritage Archives of the State of São Paulo (1945)

The analysis of Figure 2 allows for the identification of four fundamental structuring elements in the urban configuration of Ourinhos. First (1), the railway emerges as an organizing element of the urban space, not only as a transport infrastructure but also as a determining factor in the city's morphological configuration and the dynamics of its development. Second (2), the extensive coffee plantations that surrounded the urban perimeter visually reinforced the primacy of coffee-growing activity in the local economy.

Two large-scale buildings (3 and 4) stand out in the urban landscape, functioning as warehouses for the outflow of agricultural production and the distribution of goods. This logistical infrastructure was essential for Ourinhos's integration into regional and national economic circuits. A comparative analysis of the northern and southern areas further reveals significant differences in building typology: while the southern region showed greater

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constructional homogeneity, the northern area exhibited a greater diversity of architectural patterns, with a predominance of small and medium-sized buildings interspersed with larger structures.

These urbanistic characteristics not only document the predominant economic activities of the period but also reveal the beginnings of the socio-spatial disparities that would mark the city's subsequent development. The railway, as a structuring element, acted simultaneously as a factor of regional integration and as a physical barrier that crystallized social differences within the urban space. This phenomenon exemplifies how transport infrastructures can exert a multifaceted influence on urban development, shaping not only the city's form but also its social and economic dynamics.

4.5 Urban Growth in Ourinhos: Dispersion and Ruptures

The process of differential occupation of urban space in Ourinhos shows clear signs of socio-spatial segregation from its earliest days, as evidenced by the distribution patterns of railway employees' housing. The Sorocabana Railway (EFS) established an explicit spatial division, allocating manual and less-skilled laborers to the northern region, while administrative staff and specialized technicians were allocated to the southern region (Boscariol, 2006, p. 54). This practice constitutes the first documented record of intentional spatial stratification in the city, creating a precedent that would profoundly shape the subsequent urban structure.

The phenomenon of segregation progressively intensified with demographic growth, consolidating a spatial pattern where the more affluent social classes preferentially occupied the southern region, while populations with lower purchasing power were concentrated in the northern area. This socio-spatial division became so pronounced that, according to historical accounts, many residents of the southern region reported being completely unaware of the buildings and dynamics of the northern area, never even needing to cross the railway line for their daily activities. Such a situation clearly illustrates the degree of social fragmentation produced by this model of differential occupation of space.

The analysis of this process reveals three fundamental aspects: first, the deliberate action of the railway company as a structuring agent of spatial relations; second, the progressive internalization of this division by the population, who began to reproduce it spontaneously; and third, the crystallization of symbolic and material barriers between the two areas. This spatial configuration reflects not only economic differences but also the construction of distinct territorial identities that persist to this day (Figure 3).

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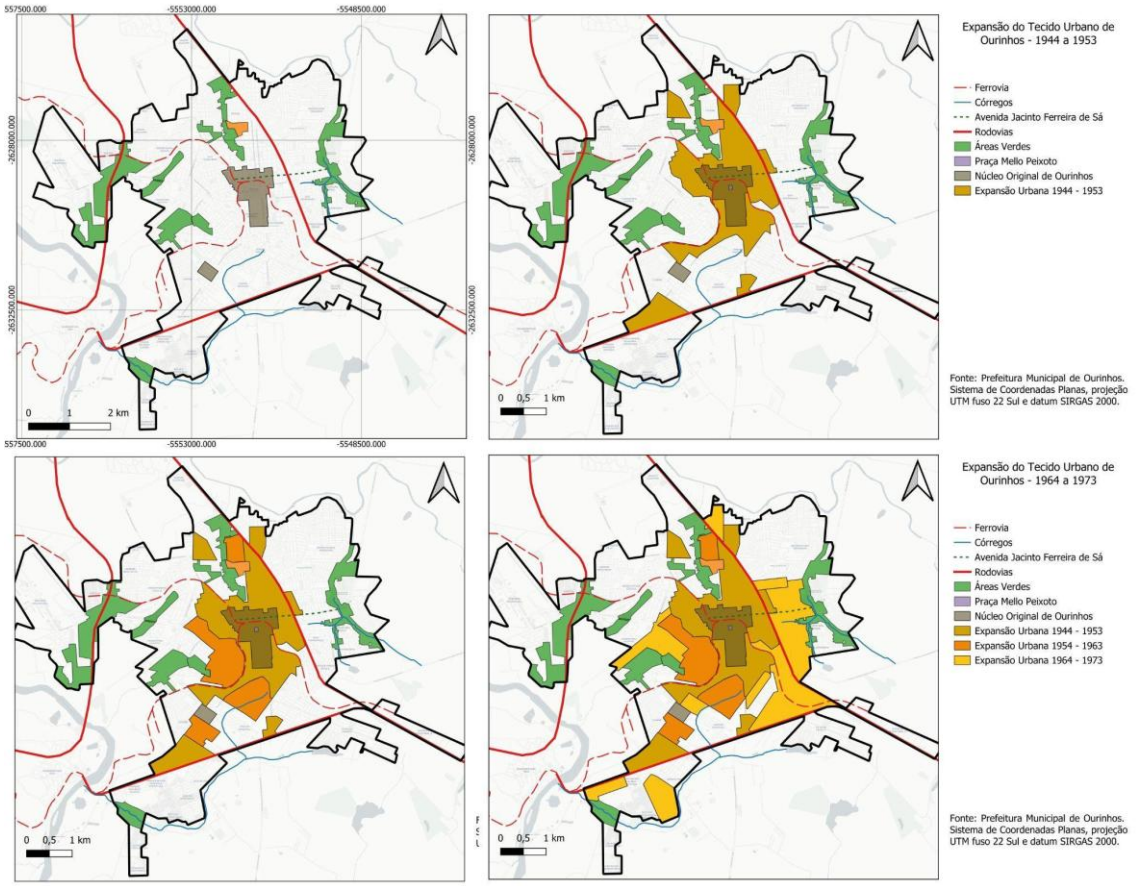
Figure 3 – Maps of Ourinhos's urban expansion: 1930-1973



Source: Personal archive (2025).

The case of Ourinhos exemplifies how transport infrastructures, beyond their technical function, act as powerful instruments for the social organization of space, capable of establishing and perpetuating spatial hierarchies. The railway line, in this context, transcends its function as an axis of circulation to become a symbolic frontier between distinct social strata, demonstrating the intricate relationship between mobility, power, and the appropriation of urban space.

The original core of Ourinhos featured a rectilinear geometric layout, strategically designed to convey to investors the image of a planned and organized city. However, this urban planning choice proved to be poorly suited to the region's rugged topography, hindering the drainage of stormwater and revealing a dissonance between the planning and the natural conditions of the terrain.

With the advance of socio-spatial segregation, the central commercial region underwent a process of specialization, reducing its residents' need to travel to other areas. This phenomenon contributed to the unfamiliarity of the northern region to the inhabitants of the center, limiting the interaction between the two areas.

The distinct social demands generated by these regions resulted in a differentiated growth of the urban center. Commerce became concentrated around Mello Peixoto Square, the most important of the 1930s, shifting the commercial axis from Jacinto Sá Avenue to its surroundings. While the first factories and industries were established in the northern region, the first school and hospital were located in the south of the city.

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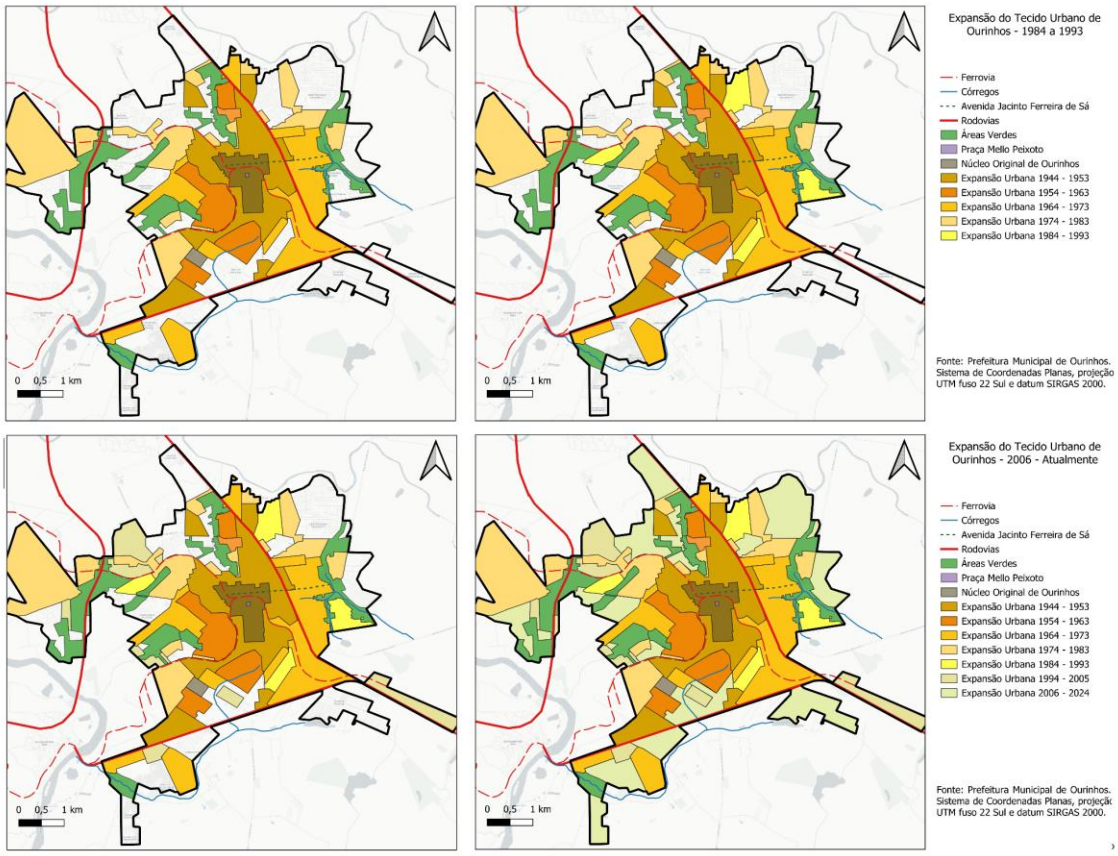
This dynamic consolidated a clear urban polarization based on income divisions: the northern region housed lower-income groups, factories, and productive facilities, while the southern region concentrated more affluent groups, who enjoyed proximity to the commercial center and urban amenities, configuring an area of amenities (Boscariol, 2006, p. 125). The Sorocabana Railway (EFS) played a crucial role in this division, serving as a physical barrier between the two social groups and guiding the city's growth. In the following decades, Ourinhos temporarily maintained its original rectilinear layout, with growth axes at its extremities.

From the 1950s onward, new subdivisions emerged west of the railway, becoming areas of segregation for the more affluent classes. As Villaça (2005) observes, these groups do not always occupy centralized regions, instead opting for gated communities in peripheral areas where land cost is lower, allowing for investments in larger and better-equipped residences.

In the 1960s, the migration of these groups to new urbanized areas altered the city's growth trajectory, abandoning the dense industrial region. The urban morphology began to expand in a circular pattern, with the railway station as its center, but without succeeding in integrating the areas separated by the railway.

The introduction of a roadway in the 1940s and, later, the highway in the 1960s, redefined the city's connections with the rest of the country. These routes spurred the growth of subdivisions along their paths but also accentuated the fragmentation of the urban fabric. Each expansion cycle brought with it a new urban design, distinct from the previous one, resulting in a confusing morphological landscape (Figure 4).

Figure 4 – Maps of Ourinhos's urban expansion: 1974-2024



Source: Personal archive (2025).

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Currently, the urban perimeter of Ourinhos is crossed by three highways — of state and federal jurisdiction — which play a structuring role in the conformation of the intra-urban space. These road infrastructures not only enhance the articulation between different areas of the city but also optimize population flows, particularly towards the industrial zones, whose strategic location in the vicinity of these road axes aims to maximize logistical efficiency (VILLAÇA, 2005).

As Silveira (2003) postulates, the implementation of new highways, by increasing accessibility, catalyzes real estate speculation processes, insofar as it induces the appreciation of urban land and the formation of urban voids — undeveloped spaces that function as a store of value in the circuit of urban land accumulation.

In the context of Ourinhos, it is observed that the Mello Peixoto Highway is located in the southern sector of the municipality, while the BR-153 highway crosses its western portion. However, both exert a relatively limited influence on urban territorial dynamics when compared to the Raposo Tavares Highway, whose extensive route is being progressively incorporated by urban expansion. This thoroughfare is consolidating itself as the main structuring axis of the urbanization process, reflecting a growth pattern that prioritizes regional connectivity over the cohesion of the urban fabric.

In this scenario, Industrial Districts I, located near the BR-153, and II, situated to the southeast of the city, adjacent to the Raposo Tavares Highway, are prominent. The presence of these infrastructures has fostered a process of population densification on the urban edges, especially in peripheral areas.

However, a clearly defined hierarchization between the consolidated urban space and the rural territory is not observed, given the fragmentary nature of the urban grid, which frequently intertwines with areas of agricultural use — notably the soy plantations located on the municipal periphery. As Silveira (2003) notes, the Raposo Tavares Highway, which extends on a north-south axis to the east of the city, reinforces its function as a vector of urban expansion.

It is along this axis that the impacts of highways on urban morphology become most evident, as argued by Villaça (2005). The urbanization process tends to follow the road layout, guided by the search for accessibility and fluidity of movement. However, paradoxically, this same infrastructure acts as an element of socio-spatial segregation, insofar as it fragments the urban grid and erects physical barriers to integration between different sectors of the city. Although it provides a certain connectivity between the areas it divides, its primary function remains tied to regional articulation, limiting its effectiveness as an instrument of intra-urban integration (BOSCARIOL, 2006, p. 145).

Thus, the highways in Ourinhos assume a dual role: while they energize circulation and economic development, they also accentuate spatial disconnection and socio-urban disparities, reaffirming the complex relationship between infrastructure and the organization of space.

5 CONCLUSION

Coffee and railways emerged as fundamental structural elements in the urban formation process of western São Paulo, catalyzing profound transformations in both the rural landscape and the configuration of the cities. The coffee cycle not only fostered the emergence of urban centers intended for the logistical support of farmers and workers but also engendered

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spatial dynamics whose legacies remain materialized in the contemporary era—particularly with regard to morphological dispersion and the disconnection of the urban fabric.

In the embryonic phase of these urban agglomerations' constitution, the urban planners of the era based their projects on pre-existing natural and infrastructural elements: the railway and its central station, the river and its banks, as well as embryonic road accesses. It should be noted that, in this historical context, the absence of robust urban legislation allowed for ample freedom in land subdivision, use, and occupation of the territory. This regulatory gap transformed the cities into veritable laboratories for urbanistic experimentation, where multiple spatial arrangements could be tested without the constraints of stricter normative guidelines.

In their formative phase, railways constituted the main structuring element of the urban fabric of these municipalities. However, with the rise of automotive transport as the dominant mode for the transport of goods, highways began to compete with—and in many cases, supplant—the ordering role once held by the rails.

This redirection of logistical flows caused a reconfiguration in the urban structure, frequently marked by the fragmentation of the built fabric and by accelerated processes of spatial dispersion. Such dynamics, combined with the growth in housing demands, accentuated the peripheralization of cities, redefining their urban boundaries in a discontinuous and asymmetrical manner.

In the current context, it is observed that peripheral areas—once relegated to marginal uses—have come to be occupied by closed residential subdivisions, the so-called "enclave condominiums." These developments strategically appropriate the mobility offered by expressways and highways that bisect the urban perimeter, using these infrastructures as corridors for selective connection with the urban center and its services. This phenomenon consolidates a pattern of urbanization marked by spatial selectivity, where differentiated accessibility reinforces pre-existing socio-spatial cleavages.

The analysis shows that urban development in the region was profoundly marked by a dialectic between centrality and dispersion, where infrastructural elements—first the railways, then the highways—acted simultaneously as factors of integration and fragmentation. The legacy of this process is an urban grid that reflects, in its morphology, the inherent contradictions of the different economic and technological cycles that have shaped the region.

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STATEMENTS

AUTHOR CONTRIBUTION STATEMENT

Ao descrever a participação de cada autor no manuscrito, utilize os seguintes critérios:

- **Conceptualization and Study Design:** The lead author, Gisele Carignani, was responsible for the central conception of the study, defining the objectives, and outlining the methodological approach. The other author, Caio Cesar Tomaz de Oliveira, contributed with theoretical adjustments and alignment with the frameworks of the English School of Urban Morphology.
- **Data Curation:** Gisele Carignani led the organization, validation, and systematization of historical and cartographic data. Caio Cesar Tomaz de Oliveira assisted in verifying the consistency of primary sources and the integration of spatial data.
- **Formal Analysis:** Gisele Carignani conducted the quantitative and qualitative morphological analyses, applying Conzenian criteria. Caio Cesar Tomaz de Oliveira collaborated on the interpretation of urban expansion patterns and the cross-validation of the results.
- **Funding Acquisition:** No funding was sought for this study.
- **Investigation:** Both authors conducted fieldwork and archival surveys. Gisele Carignani coordinated the collection of primary data, while Caio Cesar Tomaz de Oliveira focused on photogrammetric and GIS documentation.
- **Methodology:** Gisele Carignani developed the methodological framework based on the English School, with contributions from Caio Cesar Tomaz de Oliveira in adapting the spatial analysis techniques.
- **Writing – Original Draft:** Gisele Carignani wrote the entire first version of the manuscript.
- **Writing – Critical Review:** Caio Cesar Tomaz de Oliveira performed a critical review of the content, improving the argumentative clarity and theoretical coherence.
- **Writing – Final Review & Editing:** Gisele Carignani supervised the final editing, ensuring compliance with the journal's standards and academic integrity.
- **Supervision:** Gisele Carignani coordinated all stages of the research, ensuring scientific rigor and the articulation between the authors' contributions.

CONFLICTS OF INTEREST STATEMENT

We, **Gisele Carignani and Caio Cesar Tomaz de Oliveira**, declare that for the manuscript titled "**The Urban Morphology of Ourinhos: Exploring the City's Expansion from the Perspective of the English School**":

1. **Financial Interests:** There are no financial ties that could influence the results or interpretation of the work. ("No funding institution or entity was involved in the development of this study").
2. **Professional Relationships:** There are no professional relationships that could impact the analysis, interpretation, or presentation of the results.
3. **Personal Conflicts:** There are no personal conflicts of interest related to the content of the manuscript. (Details, if applicable: "No personal conflicts related to the content have been identified").