

LAND SUBDIVISION IN BRAZILIAN METROPOLITAN CONTEXT

The case of the Greater Porto Alegre

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0. Abstract

This paper deals with land subdivision in the Brazilian metropolitan context, specifically in the Metropolitan Region of Porto Alegre - MRPA. The effect of local decisions related to parcelling projects approved by municipal authorities on metropolitan urban structure is discussed. Urbanistic regulations, political and institutional aspects, faced to the actual spatiality, are analysed through a case study about three cities of the conurbation: Esteio, Sapucaia do Sul and part of São Leopoldo. The spatial configuration is registered in two different moments: 1970 and in an hypothetic moment after 1990, simulating an alternative of urban growth. Space Syntax is taken as an appropriate tool to verify the evolution of the urban structure as a consequence of the new parts added to the whole, inner vacant sites and also as a result of the construction of a surface metro and a highway in the system. The results of the case study show the depth increase of some sectors of the spatial system and how most designers and authorities ignore that cities are in fact global systems. Therefore locality, especially in metropolitan urban areas, cannot be related to any specific parcelling project in any specific municipality. Effects on the metropolitan urban space integration, with regard to land subdivision, are not necessarily a consequence of the property size, proximity to municipal boundaries or metropolitan highways as argued by municipal authorities and developers.

1. Introduction

The present study aims through a configurational analysis to contribute to the discussion about state and municipal government performances regarding territorial ordering, showing the importance of land subdivision for the integrated urban development.

The territory of the Metropolitan Region of Porto Alegre – MRPA - has been subdivided under control of a state government agency since 1979. This policy must be studied and discussed, once municipal authorities and developers have been constantly argued against it.

The big metropolitan city, which is a totality, is crossed by institutional and administrative limits which are spacially virtual but in fact taken by designers and authorities as real ones. Mayors and technicians of metropolitan municipalities are usually concerned up to the limits of their respective territories, and developers up to the limits of their projects. Both see themselves as designers of the local space. On the other hand, metropolitan authorities tend to analyze global space as something generic, made by big enterprises, accessed

through the super grid, regulated by macro-zoning or restricted by large areas of ecological importance. These two non-relational approaches reinforce each other, tend to minimize complexity and are responsible for many urban planning and design failures.

Therefore, especially in the Brazilian metropolitan context, marked by a deficient global planning and where urban land development comes usually from individual decisions, subdivision control deals, among others, with the "part-whole problem", approached by Hillier (1992, 1996), worsened by political and institutional aspects which are often in conflict with the conurbation spatiality.

The goal of the configuration study, based on Space Syntax theory and modelling, is to examine how projects of land subdivision influence metropolitan urban structure and what the effects are of local decisions on global organization of the metropolis.

The illegal subdivision of urban properties, although one of the most important problems of Brazilian metropolitan reality, will not be discussed here. They were included in the configuration as long as their streets network allowed minimum conditions of pedestrian and vehicle traffic.

2. Spatial and institutional aspects of the Brazilian metropolitan process

There are different ways of urban fabrics fuse in metropolitan areas: central cities grow faster than satellite towns and absorb them; important towns near a central city grow as fast as it, forming a continuous urban space but keeping their own characteristics; a central city spreads its occupation over the territory of the neighboring municipality, but still far from the town itself (Villaça, 1998). Either way, one single system is formed, with its own structure, where each component influences all others.

Although the acceleration of the metropolization process in Brazil occurred in the 40s, creating a necessity for a new approach in urban and regional planning, metropolitan areas were officially recognized in 1973.

From that time on, the State, together with the municipalities, should have dealt with public functions of common interest, such as the ordering of rural and urban land and its subdivision. However, metropolitan planning and management have faced difficulties because the Federal Constitution attributes autonomy to the municipality regarding land use decisions. Although the thesis that metropolitan municipalities must have a relative autonomy is very well justified, local authorities often reject regional programs. Regarding land use and subdivision, municipalities, usually with fragile implementation systems for Master Plans, cannot resist political pressure from developers, whose ideas about urban space happen to prevail over the urbanist's. The result is sprawl, low densities, a public space network not efficient for movement, leisure, or public equipment for education, health and crime protection.

3. Characteristics of formal land subdivision in Brazil

Until the end of the 70s, land subdivision control was up to municipalities. As a result of industrialization and migration towards the capitals, subdivision was stimulated by local authorities through donation of land, free of taxes, and infrastructure supported by public resources.

In 1979, federal legislation attributed to developers the responsibility of all necessary infrastructure to each urban land subdivision, which started to be officially recognized under two situations.

The first one corresponds to conventional subdivision of a piece of land, with the necessity of a grid layout, squares, spaces for utilities and infrastructure. The main problems regarding to this type are the lack of street continuity, oversizing of blocks, low centrality of squares and other public spaces, absolute prevalence of environmental variables against connectivity and integration. Figure 1 shows a subdivision where environmental authorities didn't approve the proposed grid because of a creek, isolating the northern part of it from the rest of the city.

The second one, called dismemberment, is when properties are divided into lots with no need of street opening or extension of the existing ones. Little importance was given to this type of subdivision, which resulted in urban barriers, environmental damage, and legislation fraud. Figure 2 shows the edges of an urban block first dismembered into lots, with very few possibilities of street linkage. Afterwards, the block's inner part was subdivided in bad conditions regarding to movement and recreational spaces location.

The condominiums (gated communities) were recently identified by state legislation as a land subdivision type, although some municipalities don't recognize them as so. This type tends to increase in MRPA. Developers take lack of crime protection and environmental preservation in big cities, as arguments to hidden space privatization impetus through large condominiums. They actually act as barriers to movement, cause spatial and social segregation, and don't allow necessary densification for urban sustainability. Figure 3 shows a 145 ha land reserved for a low-density condominium, erasing an important road project (dotted line) from Porto Alegre Master Plan and barring grid expansion. In the State of São Paulo, for example, condominiums happen to occupy lands over 1.000 ha.

In MRPA, approximately 80 % of subdivided properties are under 20 ha, which indicates the great necessity of planning and government articulation of the different public and private agents involved with the matter.

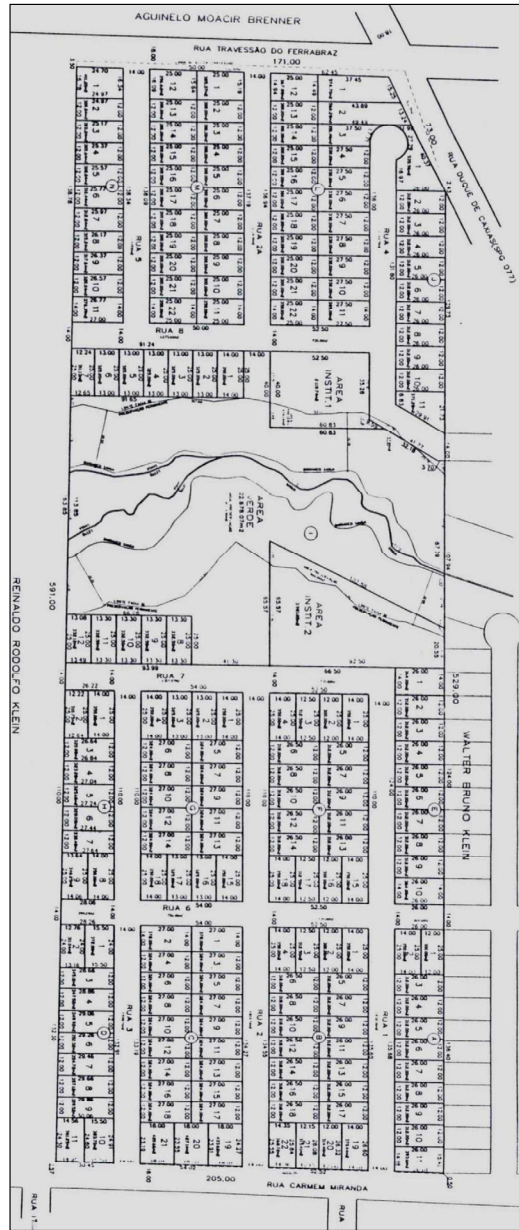
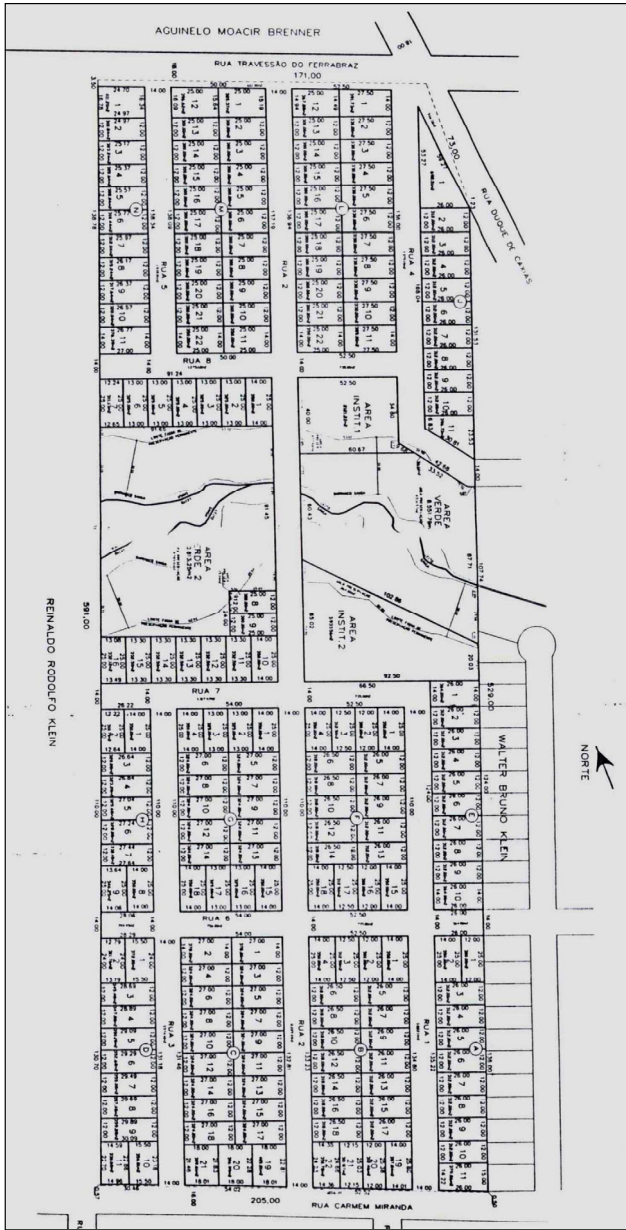


Figure 1: Subdivision in Saporanga municipality (source: UGALDE, 2002)

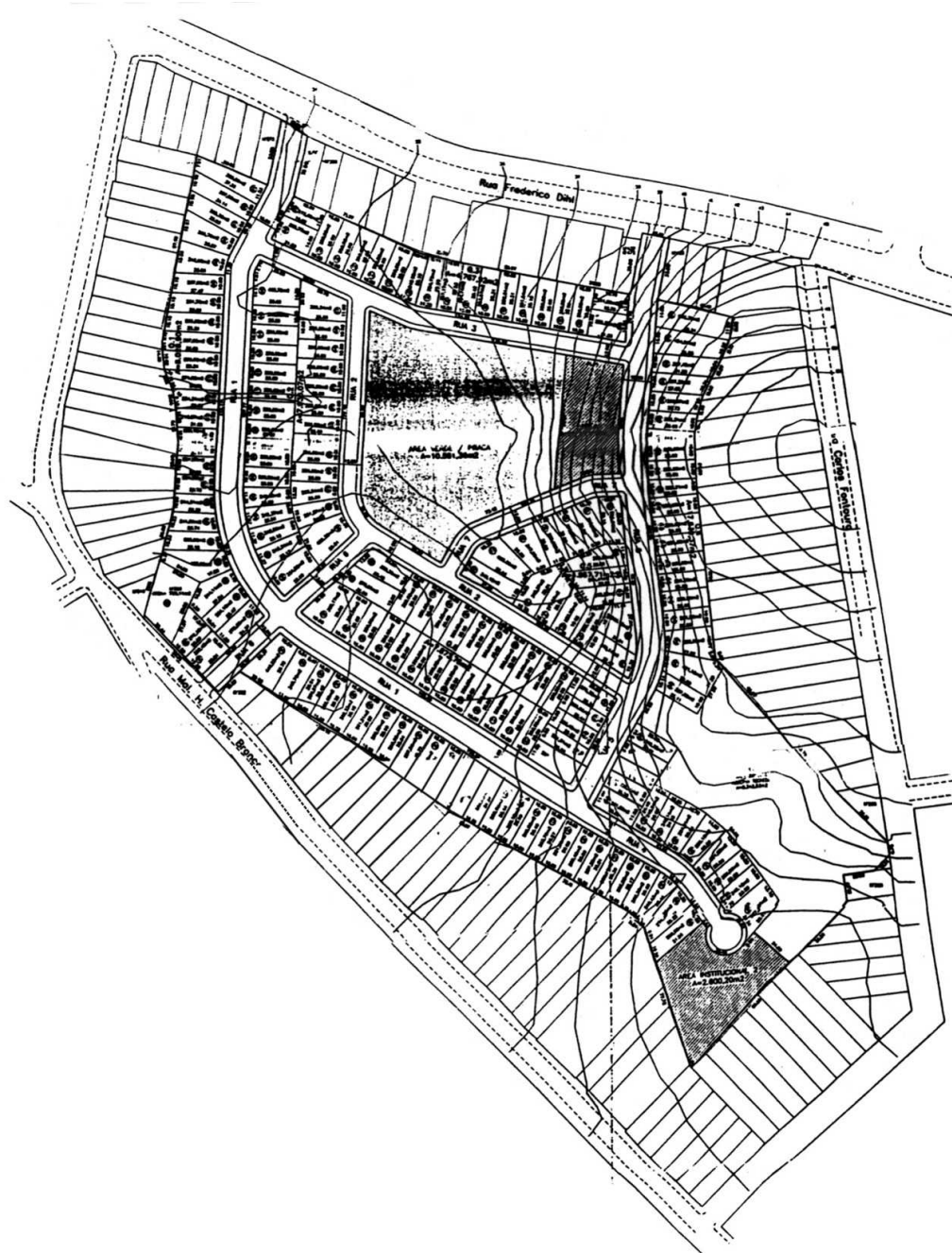


Figure 2: Subdivision in Alvorada municipality (source: METROPLAN)

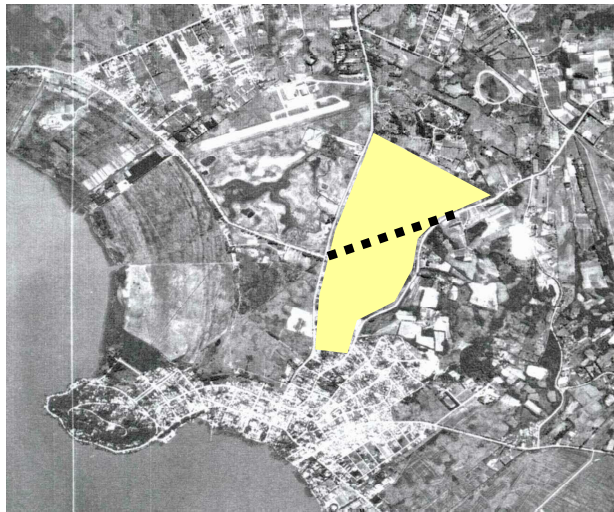


Figure 3: Condominium in Porto Alegre municipality (source: UGALDE, 2002)

4. Configuration analysis

The spatial configuration of MRPA, besides being a result of a heterogeneous and discontinuous urban fabric in permanent growth, reflex of Brazilian social and economical reality, is influenced by its hydrography and specially marked by its particular condition of access to other regions in the State of Rio Grande do Sul.

With the construction of a railroad, in 1874, linking Porto Alegre to northern cities, little towns appear around the stations, originating a "linear metropolis". This occupation morphology is reinforced by a federal highway, BR-116, built in 1940, closed to the train line. Although, urban expansion can be observed along other directions, this axis concentrates higher densities (Figure 4).

Based on the criterion of conurbation, minimization of "edge effect" (Penn et al, 1998), and non existence of significative altimetric differences, a subsystem of Greater Porto Alegre (MRPA), corresponding to three

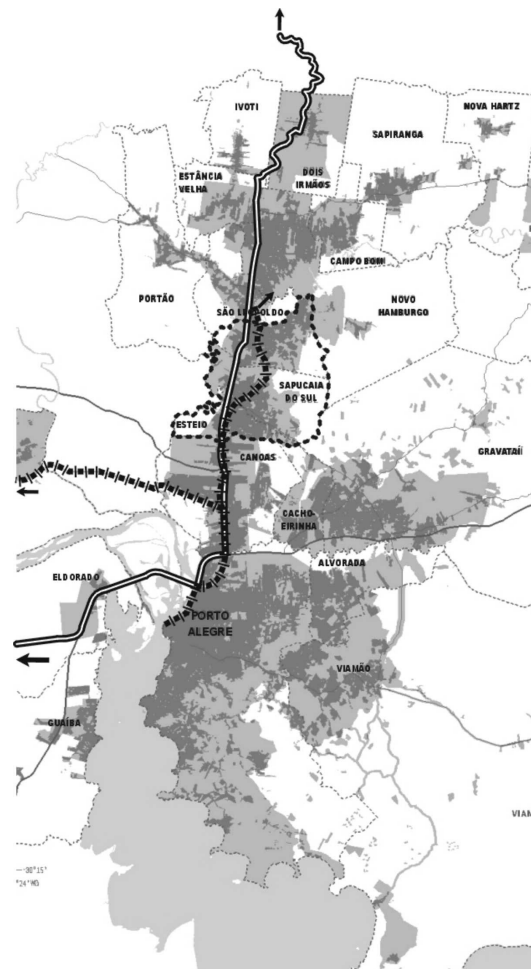


Figure 4: Metropolitan Region of Porto Alegre. Urban occupation, BR-116 (double line) and railroad. Perimeter indicates the case study area (source: UGALDE, 2002)

satellite towns, was selected: Esteio, Sapucaia do Sul and part of São Leopoldo. The edges of the subsystem are real: Sinos River (north and west), Sapucaia Creek (south) and the limit of occupation, to the east.

Figure 5 shows the spatial configuration in 1970 (global integration). Two sectors of intensive occupation are linked mainly by two groups of axial lines: BR-116 and Horto Road. Although geometrical distances between these two sectors are similar, topological distances covered by those lines are completely different. This fact is a determinant of the global accessibility and it is responsible for the significant difference between movement quantity along them. BR-116 is more linear and is connected to a higher number of axial lines, if compared to Horto Road.

To the east of BR-116, higher values of integration correspond mainly to subdivisions that originated Esteio (A), Sapucaia do Sul (B) and specially São Leopoldo (C), whose foundation and importance preceded the railroad. On the other hand, later occupations in São Leopoldo seem to depend upon the foundation grid. It must be remarked that the most intensive occupation occurs, in fact, on this highly integrated grid, as argued by Hillier et al (1993). Far east, there are rural roads accessing farms and plantations.

Although both railroad and highway could be crossed at the same level, on this period, what was positive for global integration of space, configuration illustrates the degree of dependence upon BR-116. Other alternative ways started to emerge like Theodomiro P. da Fonseca and Ruben Berta avenues. However, both together with Horto Road still represent spatial depth.

The more segregated axial lines are located in the south of Esteio and in the northeast of Sapucaia do Sul and São Leopoldo, due to the beginning of an axial fragmentation process and being at the edges of the system.

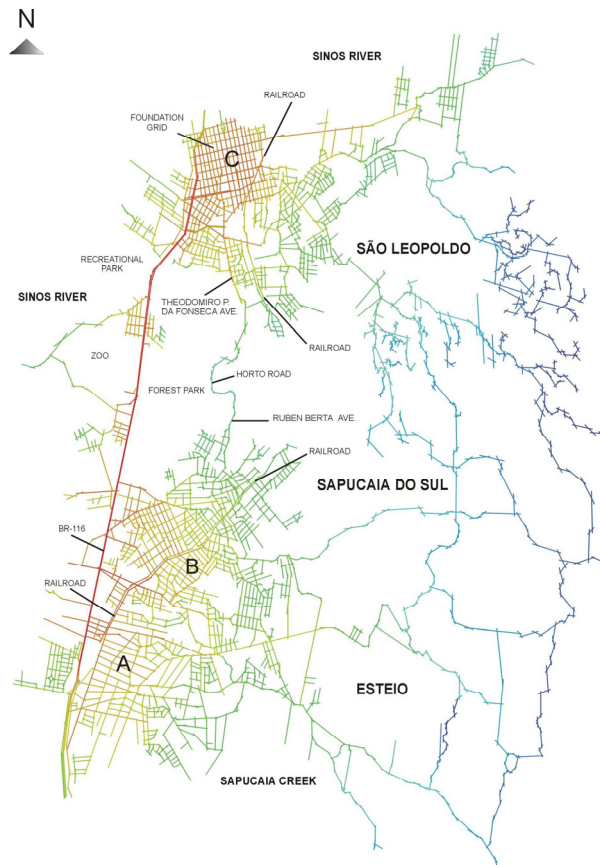


Figure 5: Spatial configuration of Esteio, Sapucaia do Sul and part of São Leopoldo, in 1970. Global integration (source UGALDE, 2002)

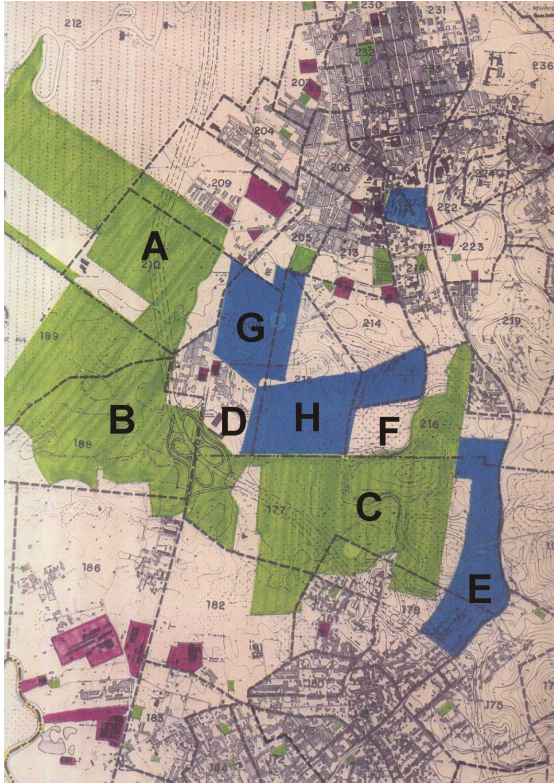


Figure 6: Large properties between Sapucaia do Sul and São Leopoldo, with low probability of being subdivided: recreational park (A), zoo (B), forest park (C), educational institut (D), militar area (E and G), cemetery (F), university campus (H) (source: UGALDE, 2002)

The mentioned central institutional areas remain unsubdivided and keep the same uses, as well as other areas inside São Leopoldo, like São José School (1), Sinodal School (2), 19° Militar Quarter (3) and Rossi Industry (4). Most of São Leopoldo's integration cannot be extended because many streets of the foundation grid (5) are barriered by this areas.

During the 80s, many housing estates were built in Brazilian metropolitan areas. In the study area, they are COHAB/Feitoria, COHAB/Duque de Caxias and COHAB/Santo Inácio (6). In São Leopoldo, part of spatial and social segregation corresponds to subdivisions and housing estates at northern and southern part, for being peripheral, poorly connected to the rest of the system and due to existence of vacant sites around them.

It is important to observe the existence of central barriers represented by large properties for military, recreational, educational and environmental preservation purposes, bringing negative consequences to global integration (Figure 6).

Figure 7 shows the spatial configuration of MRPA in 1990, plus axial lines representative of subdivision projects not necessarily implanted or built after this time. Therefore, it corresponds to a hypothetic configuration.

System grew predominantly to the east, from 2.000 to almost 4.700 axial lines.

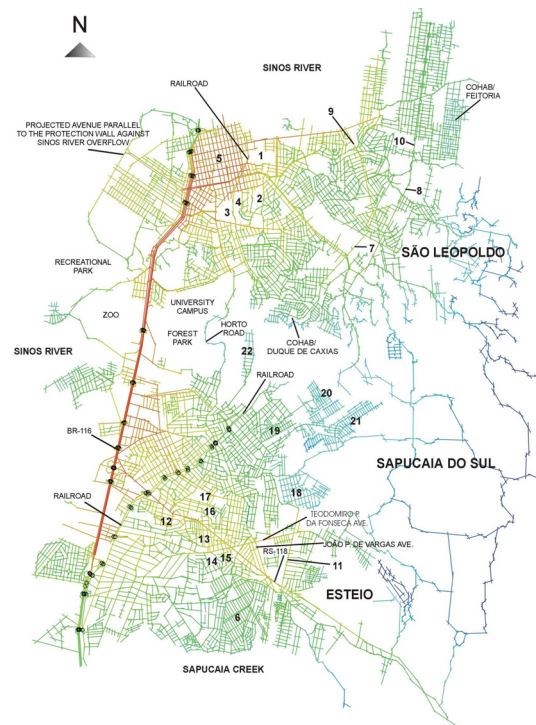


Figure 7: Spatial configuration of Esteio, Sapucaia do Sul and part of São Leopoldo, representing 1990 occupation plus subdivisions projects. Global integration (source: UGALDE, 2002)

Parallel lanes to BR-116, a State road (RS-118) and the surface metro influenced the accessibility pattern and integration of MRPA. Viaducts and pedestrian ramps built over BR-116 and over the railroad (unlink marks of AXMAN software) were not sufficient to recuperate integration level existing before the consequent railroad and highway isolation. However, that was not the case of São Leopoldo, where the metro was elevated and connectivity could be improved.

On the other hand, RS-118, for not being isolated as BR-116, caused an integration gain between spaces of Esteio central area and the east part of the municipality. In Sapucaia do Sul, intersection RS-118/Teodomiro P. da Fonseca Ave. concentrated more integrated axial lines.

The incorporation of illegal settlements to the south of Esteio and northeast of Sapucaia do Sul, caused depth gain due to axial fragmentation. Specifically in Esteio, streets generated in the first subdivision, which were well integrated and potential arterials, were interrupted to the east. **COHAB/Santo Inácio (6)**, for example, twisted the grid because of an electric energy transmission line, and eliminated possibilities of better connections with the east side of town.

Subdivisions in Esteio e Sapucaia do Sul, located to the west of BR-116 are confined between the highway and Sinos River. They are also separated from each other by industrial plants. However, in São Leopoldo, due to more possibilities of crossing BR-116 and higher connectivity between them, they are more integrated to the rest of the city.

The projected subdivisions incorporated to the system after 1990 are indicated by numbers. Indústrias (7), Dr. Arthur Ebling (8) and Alta Tensão (9) avenues as well as the extension of Integração Ave. (10), in São Leopoldo, were projected by the municipality urban planning department aiming to form a ring avenues to improve integration in periferic neighborhoods.

The analysis shows that subdivisions for low-income families designed in the east side of Esteio tend to be segregated once Américo Vespúcio Ave. (11), coming from Sapucaia do Sul and having integration potentiality, was interrupted by the administration of Esteio, indicating a total lack of planning articulation between the two municipalities.

In general sense, subdivisions of vacant sites in Esteio and Sapucaia do Sul (12,13, 14,15, 16 and 17) contributed for global integration. However, some of them brought wrong solutions for street continuity, like Loteamento Charrua (16), where a deflection proposed by the developer, for one of its streets, eliminated the possibility of a less deformed and interrupted grid in that sector (Figure 8).

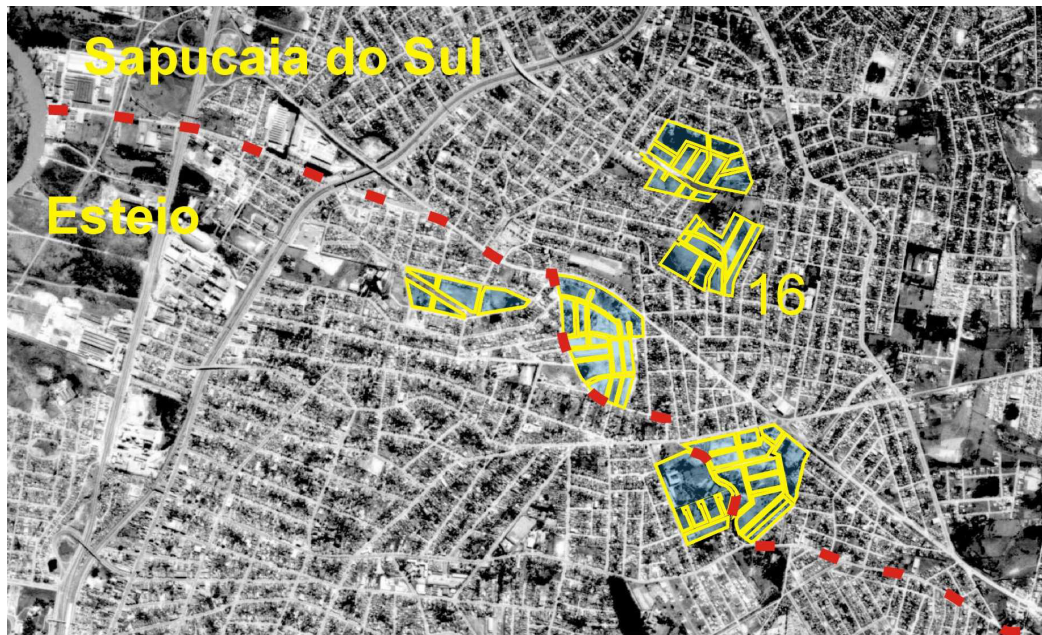


Figure 8: Subdivision projects for vacant sites in the conurbated grid of Esteio and Sapucaia do Sul. The red dotted line divides the two municipalities (UGALDE, 2002)

Subdivisions for low-income families located in the northern part of Sapucaia do Sul (18, 19, 20, 21 and 22) represent spatial depth gain and segregation, mainly because of few connections to preexisting city.

4. São Leopoldo and Sapucaia do Sul conurbation

The two sectors of the configuration, represented by São Leopoldo and Esteio/Sapucaia do Sul are still linked through a few spaces, among which BR-116 is truly the most important one. Since the referred large areas between them will probably not be subdivided it can be admitted, based on the centrality principle (Hillier, 1996 p.290), the maintenance of a significant gain of space depth for global configuration. A possible connection could happen between the forest park (C) and military area (E), in Figure 6, through subdivision S-22. However, its designer, developer and the environmental authorities, because of a creek, decided to interrupt the street that would permit the necessary continuity. Other connections have been searched for through streets parallel to the railroad.

Subdivision of properties located in the middle east of the system could increase possibilities of a better integration. However, this is a more declivitous site with environmental restrictions for urban occupation and agricultural use. Under such circumstances, property prices are low, which favours low income and informal settlements, usually established without any project or regulations. This process has already started and tends to become critical. Authorities must pay more attention to the spatial segregation that is happening there.

A large amount of financial resources have been invested in the project of a new highway (RS-010) to be constructed aiming to reduce vehicle fluxes along BR-116 (Figure 9). The

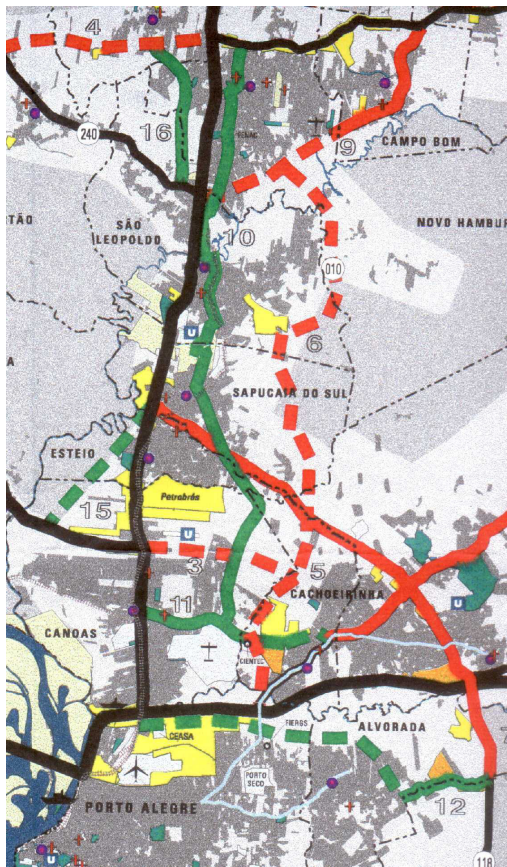


Figure 9: Metropolitan road system. Vertical dotted line, in red, corresponds to RS-010 layout (source: METROPLAN, 2000)

course, to the east of the system, was chosen to be totally detached from occupation with very few connections with it. Traffic engineers know that 90 % of vehicle movement in BR-116, have origin and destination inside MRPA. However, they are not conscious that an important amount of it is correlated to configuration. The present study argues, based on Penn et al (1998), that the new highway probably will not decrease BR-116 movement as expected, as long as a few connections along RS-010 will not make it participate on the routes chosen by the population majority, for spatial cognition reasons.

On the other hand, the option for constructing a highway totally detached from the city should be better discussed, since it is possible to attach a consistent urbanistic proposal, transportation and integration functions of roads. Besides allowing movement itself, they have the capacity to increase opportunities, social relations and development.

5. Final considerations

In Brazilian literature, the land subdivision theme is mostly approached under the social and economic point of view, regarding housing deficit, land market, urbanization costs, land property and illegal occupancy. Urbanistic aspects are treated with quantitative dimension parameters, functionality concepts, geometric arrangements and infrastructure patterns.

Configurational studies are still not very much known by subdivision designers and public authorities responsible for projects approval, who are still very influenced by modernist planning and design principles. The lack of knowledge of effective instruments for spatial analysis and its results until the 80s made agents unconscious of the effects of local decisions on global organization of urban systems.

Space Syntax demonstrates clearly that each new subdivision corresponds to new local spaces (axial lines) which are integrated to the pre-existing city. From that moment on, the approach must be relational, global and systemic. Therefore, in configurational terms, locality cannot be identified as a specific subdivision, neighborhood, or municipality.

Although local integration can be identified, it does not mean that highly local integrated spaces have no importance to global integration. In MRPA, these spaces clearly emerged in 1970 limited to 3 topological steps. However, in 1990, local integration shyly appeared limited to 5 steps. This was tested but not exposed here due to the extension limit given to the present paper.

Centrality and linearity principles (Hillier, op. cit.) could be clearly verified in the case study. Visual analysis of global integration shows that the evolution of configuration, from 1970 to 1990 and afterwards, didn't change its great dependence on BR-116. Apparently, axial fragmentation and low ringiness causing depth gain, indicates that the authorities' performance in controlling and articulating the different land subdivision projects towards a better integrated metropolitan space must be criticised.

On the other hand, the possibility of subdividing central properties showed in Figure 6, should be better discussed. The forest park, for example, could allow at least some strategic street links as well as the university campus being able to contain public streets within.

After a presentation to Metropolitan and Regional Planning State Foundation - METROPLAN, public organization in charge of the metropolitan land subdivision in the State of Rio Grande do Sul - the study motivated a review on concept of accessibility and its consequences on space integration and urban development. New guidelines have been given to developers in order to improve space quality for the metropolitan citizen.

References

Hillier, B., Penn, A. & Dalton, N., 1992, "Milton Keynes: Look back to London", *The Architects Journal*, 15, April, 1992, pp. 42-46, London.

Hillier, B., Penn, A., Hanson, J., Grajewski, T. & Xu, J., 1993, "Natural movement: or configuration and attraction in urban pedestrian movement", *Environment and Planning B: Planning and Design*, 1993, volume 20, p. 29-66.

Hillier, B., 1996, *Space is the machine*, Cambridge, Cambridge University Press.

METROPLAN, 2000. Programa de complementação da malha viária metropolitana, Porto Alegre, METROPLAN.

Penn, A., Hillier, B., Banister, D. & XU, J., 1998, "Configurational modelling of urban networks", *Environment and Planning B: Planning and Design*, volume. 25, p. 59-84.

Ugalde, C. M., 2002, O parcelamento do solo na Região Metropolitana de Porto alegre; efeitos das decisões locais no espaço urbano regional, Dissertação de Mestrado, Universidade Federal do Rio Grande do Sul, 2002.

Villaça, F., 1998, *Espaço intra-urbano no Brasil*, São Paulo, Studio Nobel.

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