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# EXPLORING TRANSCAD SOFTWARE TOOLS TO ANALYZE URBAN FORM CHARACTERISTICS IN THE VICINITY OF SHOPPING CENTERS

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**Abstract:** This article describes the steps for database edition and analysis of some urban form characteristics attractive for pedestrian's trips in the shopping centers (brazilian designation for malls) neighboring inside the city of Campinas - SP. This study was carried through three shopping centers located in urban zone (Shopping Jaragua, Unimart, and Campinas Shopping). Some of these land uses and occupation characteristics had been identified by literature review (entropy index) and urban density (occupation density). These characteristics identification was based on the information available in City Hall taxes files registers (IPTU - referring to the year of 2006) surrounding the shopping centers used in this case study. The files database was explored using the tools of TransCAD software, a SIG-T (System of Geographic Information) applied to Transportation. A joint analysis of these characteristics can be useful for formularization of plans and politics of implantation

**Keywords:** Geographic Information Systems (GIS), TransCAD, Pedestrian's Trips, Urban Form, Malls, Shopping Centers.

## 1. Introduction

Currently a fact that comes being observed in the urban centers is the increasing index of non-motorized displacements for the individuals in the accomplishment of its daily activities, mainly in the great cities. This fact has demanded attention of local public managers in the formularization of strategies, goals and actions that promotes a comfortable and safe displacement for who uses these transportation modes (FIGUEIREDO and MAIA, 2006).

Among the non-motorized transport there are two outstanding modes, which many people has its displacements effects: pedestrian and bicycle. In Brazil, according to ANTP (2002) database, referring to the year of 2000 and obtained from origin and destination researches carried through some Brazilian cities, indicate the following estimated modal division of passengers displacements: (i) for the ways not motorized, the walked one represents 43.6% and bicycle 7.4%, that together they add 51% of trips e; (ii) for the motorized ways, the public transport represents 28.9%, automobile 19.1% and motorcycle 1%, representing 49% of the displacements.

Many reasons are pointed in the literature to justify the high index of motorized displacements: (i) the lack of financial resources in relative population rate to use motorized transport, either collective or individual it; (ii) the scarceness of public transportation offers the region of destiny or departure; (iii) the geographic distance

between the business and housing location should be short so there is no justification to use motorized transport; (GONDIM, 2003).

However, since 1980, in Brazil, it accented a growth in the number of large enterprises, built to hold a great diversity of activities and services, as offices, shopping centers (malls), large market-places, hotels, among others. These enterprises are called Trips Generators, which even attract or produce great number of trips, causing negatives effects in the road circulation in its vicinity and, prejudicing the accessibility of all region, besides aggravating the security conditions between pedestrians and vehicles (DENATRAN, 2001).

Inside of the context of Trips Generators, in this work, it is intended specifically to emphasize the shopping centers case. In this direction, the majority of these enterprises in Brazil have as main characteristic the fact to be located inside of the urban mesh, attracting, consequently, significant parcels of bus and pedestrian trips, besides the traditional automobile trips (PORTUGAL and GOLDNER, 1992).

In Brazil, it had been elaborated many works focusing the impacts caused for such enterprises in the road and transportation systems. However, the impacts related to such enterprises appear in a broad way in the urban form, mainly modifying the occupation and land valorization, over all in the enterprise area of influence (KNEIB, 2004).

The mapping, identification and posterior analysis of these alterations are of extreme relevance for the urban and transportation planning, being able to subsidize the government agencies in the decision process concerning territory management, understanding the reasons of the displacements carried through by individuals and the available infrastructure for its occurrence (FIGUEIREDO and MAIA, 2006).

In this context, the objective of this work is to present a survey of two urban form characteristics, the diversity of land uses (entropy index) and the urban density (occupation density) of three shopping centers vicinities in the city of Campinas - SP (Shopping Jaraqua, Unimart, and the Campinas Shopping), implemented with the aid of TransCAD software tools, GIS-T (Geographic Information System) applied in Transports. A joint analysis of the considered survey can be useful for transportation system managers in the identification of adequate areas for implantation of a shopping center and in the formularization of plans of implantation politics in more attractive areas to the pedestrians.

## 2. The Shopping Centers in Brazil

Malls, appeared in the beginning of the fifties in the United States, called initially commercial centers, are enterprises that offer, in a shared space, many products and services, besides activities of leisure and entertainment. These characteristics confer to malls a great attractive power, motivating an intense vehicles and pedestrian's movement in its immediacy, being able to cause an unbalance between offer and demand for road space and an unorganized urban space in these areas (PORTUGAL and GOLDNER, 2003).

The negative consequences appeared in the traffic fluidity and safety, caused by the implantation of larges enterprises, as shopping centers was one of the factors that had motivated a brazilian federal traffic agency to study the land use problem. In fact, the activities of implantation and operation of these trip generating poles commonly cause impacts in the road circulation, requiring a systemic approach of analysis and treatment that simultaneously taken in account its undesirable effects in the people

and vehicles mobility and accessibility and the demand increase for parking in its area of influence (DENATRAN, 2001).

Thus, the localization of these enterprises consists in an increasing focus of concerns, mainly in respect to the functional planning of the road system. Still it can be distinguished, other collateral effect proceeding from these trip generating poles, as for example, alterations in the land uses standards in their vicinities, since in general these enterprises attract a series of other complementary activities in these areas.

The set of brazilian shopping centers presents a quality level that equalizes to the one of the developed countries. Since the inauguration of the first unit, in 1966 in São Paulo, the brazilian sector of shopping centers presents a notable growth.

The Shopping Centers Industry counted in 2006 with 315 shopping centers, being 304 in operation and 11 in construction. Of this total 103 are concentrated in the State of São Paulo (ABRASCE, 2007).

## 2.1. Area of Influence

The Trip Generating Pole area of influence "*represents the physical delimitation of the reach of the attendance of the biggest part of its demand*" (SILVEIRA, 1991). On studies related to shopping centers, the terms "*area of influence*" or "*area of market*" normally is defined as that one where it gets the biggest ratio of continuous clientele, necessary for constant maintenance of the enterprise (URBAN LAND INSTITUTE, 1971).

According to Silva (2006), the limits of these areas are determined by factors such as: enterprise nature, enterprise size, accessibility, physical barriers, type of land use of its vicinity, limitations of trip time and distance, downtown and main competitors distances, external competition and other economic factors that influence in the power of attraction and competition of the enterprise (as the marketing, for example). It is known, however, that some of these characteristics vary in function of time, as the competition and the urban configuration of the city. The subdivision of the area of influence becomes important to discriminate the region that more direct receives the impact from the TGP and, for the TGP commercial cases, for example, the commercial dependence limit region.

In the majority of the studies that deal with the definition of the area of influence of an enterprise it is calculated and geographically represented with the objective of a physical delimitation of an area whose road and transportation system will be impacted by the traffic generated by the enterprise (KNEIB and SILVA, 2005). The authors stand out that, for the definition of the area of influence, only influences related to the enterprise trip generation are considered, not contemplating other decurrent impacts of its implantation, as the area that suffer alterations from the implantation of the enterprise, either in the urban structure, with prominence for the land use and occupation, either in the road system and the circulation, with prominence for the trip generation.

Usually the area of influence is divided in three categories: primary, secondary and tertiary. However, the criteria for delimitation of these categories vary between authors. The limits of these areas can be determined by factors such as: trip time and/or distance, physical barriers, accessibility, downtown distance, among others.

To allow a better accessibility visualization of a shopping center in function of trip time and distance, is recommended by some authors the contour lines and

isochronous tracing when possible (KNEIB et al, 2006). The Isochronous are lines of equal times, marked, for example, of 5 in 5 minutes until the time of 30 minutes. They are traced through the shopping center main access routes in the normal flow periods, avoiding the peak hours or periods without movement, being still observed the speed limits of speed of the way. The contour lines are equal lines of distance, generally traced of 1 in 1 kilometer, as a circle, whose center is the shopping center. Normally, a range of 8 kilometers is traced for the case of shopping centers.

It is important to stand out that the tracing of contour lines in the context of pedestrian trips vary in accordance with the maximum customers walked distances to the enterprises, being possible to divide the area of influence in primary, secondary and tertiary for the pedestrians. In this way, it is possible to verify if the vicinity area of the enterprise possess walked adequate conditions (sidewalk presence, maintenance of the sidewalk, pedestrians strips, stop points of public transport, diversity of land uses), factors that can influence the pedestrian trips demand.

Specifically in this article, the identification of the urban form characteristics standards and/or variations, suggests the tracing of contour lines of 500 in 500 meters until a limit of 3 km. For this boundary-value, was not considered research *in loco* or methodological severity, but only evidences in literature. The short trips have been object of several urban transport politics that aim to attract the car users (MACKETT, 2003). Although the definition of short trip varies between authors (some works consider as short trips until 8 km), this value of 3 km was considered for the conditions of a Brazilian city of the size of Campinas - SP, as the walked maximum limit, to analyze the land use and occupation and the urban density in the vicinities of the enterprises.

## 3. The Urban Form Characterization Variables

The literature that analyzes the trip behavior related to the built environment has considerably increased in the last decade (MOUDON et al, 2005; POLZIN, 2004). The basic premise of these studies is that the local characteristics of the urban form can influence the trip behavior in three basic ways: (1) reducing the number of motorized trips; (2) increasing the parcel of motorized trips and (3) not reducing the trip distances of motorized vehicles.

There are many published works that deal with the integration between the urban form and the accomplishment of pedestrian trips. AMANCIO (2005) presents a extensive revision of these works. It is verified, in these studies, that the concept of urban form is multidimensional. Many variables are used to describe the urban zones characteristics.

Some studies analyze the urban form using variables related to the density, the diversity of land uses and the drawing of the ways (CERVERO and KOCKELMAN, 1997). Other works still include dimensions related to the infrastructure quality for pedestrians and bikers, to land uses mix and to the quality of the public transport system of the zone (FERREIRA and SANCHES, 2001).

On the basis of revised literature, is presented to follow the variables that can be used to characterize the physical form of an urban zone and the way as these variables can intervene with the accomplishment of the pedestrian trips.

For this article, the variables that characterize the urban form are grouped in 2 categories, in accordance with the aspects of urban density and diversity of land uses.

### 3.1 Urban Density related Variables

Frequently, the population density measurement and non-residential uses are considerate in literature to analyze the trip behavior (CERVERO and KOCKELMAN, 1997). Places with high densities are associates to a bigger concentration of residential activities as well as commercial, what would provide to the region inhabitants the possibility of accomplishment of its daily tasks using non-motorized modes of transport (pedestrian or bicycle).

One of the advantages of this variable use is the easiness with that these information can be collected for its estimate. (CERVERO and KOCKELMAN, 1997; DAAMEN and HOOGENDOORN, 2003; HANDY and CLIFTON, 2002).

The selected variable in this work to represent the aspect of an urban zone density was to the occupation density, whose value is gotten by (Equation 1).

$$DOc = \frac{Ac}{As} \tag{1}$$

Where: *DOc* is the occupation density (constructed area/area of the quarter or sector); *Ac* is the constructed area in (ha); *As* is the area of the quarter or sector (ha).

### 3.2. Land Uses Diversities related Variables

The diversity (mixture) of land uses refers to the synergy created by the proximity of the residential activities, of commerce and services, diminishing the distance between the trip origin and destination. Some studies indicate that the increase of the diversity of land uses stimulates the substitution of car trips for pedestrian trips (CERVERO and KOCKELMAN, 1997; HANDY and CLIFTON, 2002).

A variable used in many works to measure the diversity of land use is the Entropy Index. This index evaluates the balance in the distribution of constructed area in the different categories of land uses inside one determined region and can be estimated through (Equation 2): (CERVERO and KOCKELMAN, 1997)

$$E_i = \frac{-\sum_{j=1}^{k} (p_{ji})(\ln\ p_{ji})}{(\ln k)} \tag{2}$$

Where: $E_i$ is the entropy index in census sector *i*; $p_{ji}$ is the parcel of the constructed area occupied by the land use *j* in sector *i*; *k* is the number of categories of considered land uses.

The entropy index can vary between 0 (homogeneity, exists only one type of land use in the quarter) and 1 (heterogeneity, the quarter is occupied for equal percentages of all the considered land uses).

## 4. Geographic Information Systems Applied to Transportation

Currently the computational programs classified as Geographic Information Systems (GIS) are the best tools for the reach of solutions of data organization problems in spatial models. Conceptually a GIS is defined by a set of hardware, software, geographic data and human resources that integrate them in a mapping function and database management, with the objective of capture, analyze, store, update, manipulate and visualize any geographically referenced information. An important aspect related to the GIS use is the database quality used in the system feeding

(PETROLA, 2004).

The GIS application is observed in areas as urban planning, geography, environment, statistics, forest, operational research, engineering, cartography, architecture and urbanism, transports, among others. The GIS tool for application in the Transportation Engineering field is called Geographic Information Systems applied to Transportation (GIS-T). The GIS-T use is observed in the areas of transportation planning and infrastructure (RORATO and WIDMER, 2004).

The main GIS-T developed and used specifically for the planning, management, operation and analysis of the transportation systems characteristics is the TransCAD. According to Caliper (2000), the TransCAD is the only computational tool classified as a GIS tool and that contains transportation planning, modeling and logistic applications.

The TransCAD spatial database manager stores the geographic data using a topological database structure. This structure defines the space localization and relations between points, geographic lines, areas and other entities. Some resources of the program facilitate the creation of thematic maps, the creation of dynamic arcs segmentations, the graphs edition, the geographic data edition (digitalization), the importation and the automatic conversion of coordinates in formats TIGER, DLG, DXF, SPOT, LANDSAT. Also it is possible import and export data files of the Lotus type, dBASE, American National Standard Code for Information Interchange, and Excel. Another available resource is the use of the TransCAD connected to a receiver of GPS for dynamic allocation of resources (CALIPER, 2000).

## 5. Data Collection and Analysis

An analysis of some urban form characteristics attractive to the pedestrian trips in shopping centers vicinities was carried through in the city of Campinas - SP. Campinas is a city with approximately 1 million of inhabitants (IBGE, 2000). The study was carried through in three urban shopping centers in Campinas and the data for the research was collected in level of contour lines traced of 500m in 500m until a 3 km limit, being the center of the circumference each one of the enterprises. The data had been mapped and analyzed using the available TransCAD software tools, a GIS-T (Geographic Information System for application in Transports).

The choice for TransCAD software was made by three reasons: a) due to availability, since the Department of Geotechnics and Transportation of the College of Civil Engineering of the UNICAMP possess an academic license for use of the program; b) the easiness of use and for the possibility of importation of some types of archives; c) the database related the urban form variables used in this study is mounted in a compatible format with the TransCAD geo-referenced model, needing only small adjustments.

Basically in the data survey step a digitalized cadastral database was used. This database refers to the land uses diversity, by using the information contained in a real estate cadastre (IPTU), year 2006 base, yielded by the Secretary of Planning (SEPLAMA) of the Campinas municipal government. Through this information, it was possible to carry through the analyses and to obtain the entropy index and occupation density for each one of contour lines traced in each one of the studied enterprises.

To follow it is presented the database assembly and the tracing of contour lines of the enterprises vicinities.

### 5.1. The Database Assembly

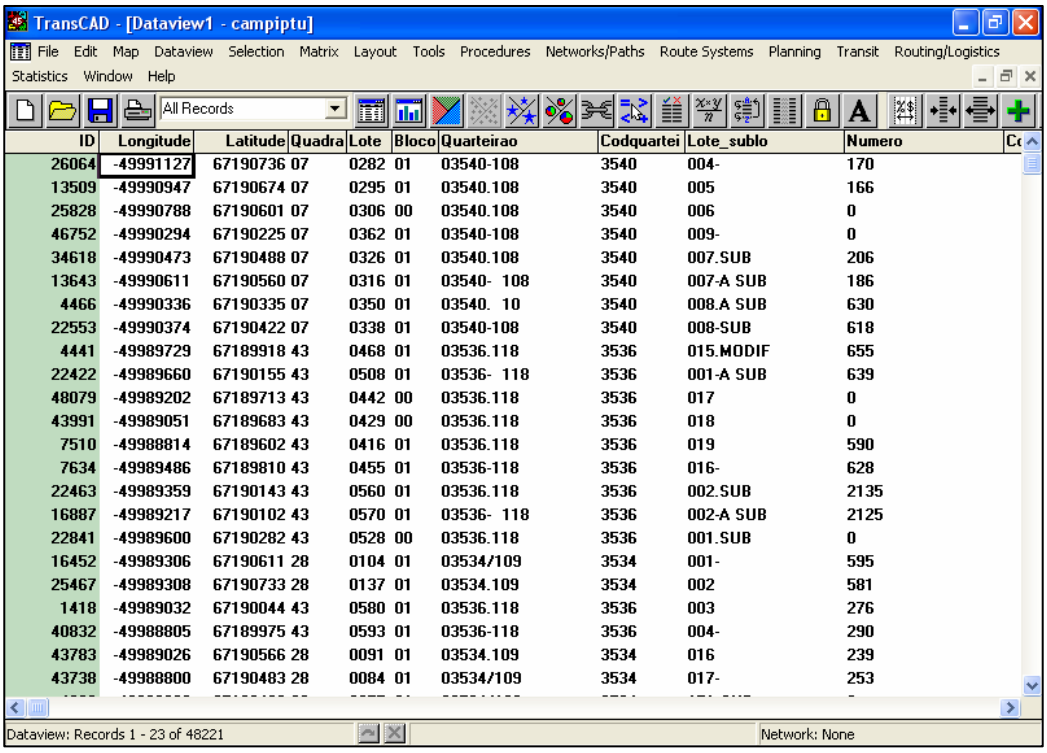
The digitalized real estate cadastre database of the three enterprises yielded for the SEPLAMA were in the format of a buffer of 3 km of ray in the vicinities of each enterprise, built as a MAPINFO software file extension in the real estate level. As an example, in this section the steps of map assembly and the Campinas Shopping database will be presented here only, for the fact of being a similar procedure for the others two enterprises.

In accordance with the TransCAD software tools were possible to open and at the same time to export the Mapinfo format cadastral database. This was done using the command (*File_Open - File of Types - Mapinfo Interchange (.mif)),* only standing out the care with the correct choice of UTM referring coordinates of Campinas, thus not prejudicing the geo-referenced cadastral database. Figure 1 shows the real estate cadastre map already exported to TransCAD software and part of the blocks map, near to the enterprise.

A copy of the blocks map of Campinas in AutoCAD software extension was available in the Department of Geotechnics and Transportation (DGT). This map was exported through the command (*File_Open - File of Types - AutoCAD DXF (dxf)*) to the TransCAD software.


Figure 1 Municipal Real Estate Cadastre Database Map (real estate)

Figure 2 presents as an example, part of the database (*Dataview*) of the digitalized real estate cadastre map.




| ID | Longitude | Latitude | Quadra | Lote | Bloco | Quarteirao | Codquartei | Lote_sublo | Numero | Cc |
|---|---|---|---|---|---|---|---|---|---|---|
| 26064 | -49991127 | 67190736 | 07 | 0282 | 01 | 03540-108 | 3540 | 004- | 170 | |
| 13509 | -49990947 | 67190674 | 07 | 0295 | 01 | 03540.108 | 3540 | 005 | 166 | |
| 25828 | -49990788 | 67190601 | 07 | 0306 | 00 | 03540.108 | 3540 | 006 | 0 | |
| 46752 | -49990294 | 67190225 | 07 | 0362 | 01 | 03540-108 | 3540 | 009- | 0 | |
| 34618 | -49990473 | 67190488 | 07 | 0326 | 01 | 03540.108 | 3540 | 007.SUB | 206 | |
| 13643 | -49990611 | 67190560 | 07 | 0316 | 01 | 03540- 108 | 3540 | 007-A SUB | 186 | |
| 4466 | -49990336 | 67190335 | 07 | 0350 | 01 | 03540. 10 | 3540 | 008.A SUB | 630 | |
| 22553 | -49990374 | 67190422 | 07 | 0338 | 01 | 03540-108 | 3540 | 008-SUB | 618 | |
| 4441 | -49989729 | 67189918 | 43 | 0468 | 01 | 03536.118 | 3536 | 015.MODIF | 655 | |
| 22422 | -49989660 | 67190155 | 43 | 0508 | 01 | 03536- 118 | 3536 | 001-A SUB | 639 | |
| 48079 | -49989202 | 67189713 | 43 | 0442 | 00 | 03536.118 | 3536 | 017 | 0 | |
| 43991 | -49989051 | 67189683 | 43 | 0429 | 00 | 03536.118 | 3536 | 018 | 0 | |
| 7510 | -49988814 | 67189602 | 43 | 0416 | 01 | 03536.118 | 3536 | 019 | 590 | |
| 7634 | -49989486 | 67189810 | 43 | 0455 | 01 | 03536-118 | 3536 | 016- | 628 | |
| 22463 | -49989359 | 67190143 | 43 | 0560 | 01 | 03536.118 | 3536 | 002.SUB | 2135 | |
| 16887 | -49989217 | 67190102 | 43 | 0570 | 01 | 03536- 118 | 3536 | 002-A SUB | 2125 | |
| 22841 | -49989600 | 67190282 | 43 | 0528 | 00 | 03536.118 | 3536 | 001.SUB | 0 | |
| 16452 | -49989306 | 67190611 | 28 | 0104 | 01 | 03534/109 | 3534 | 001- | 595 | |
| 25467 | -49989308 | 67190733 | 28 | 0137 | 01 | 03534.109 | 3534 | 002 | 581 | |
| 1418 | -49989032 | 67190044 | 43 | 0580 | 01 | 03536.118 | 3536 | 003 | 276 | |
| 40832 | -49988805 | 67189975 | 43 | 0593 | 01 | 03536-118 | 3536 | 004- | 290 | |
| 43783 | -49989026 | 67190566 | 28 | 0091 | 01 | 03534.109 | 3534 | 016 | 239 | |
| 43738 | -49988800 | 67190483 | 28 | 0084 | 01 | 03534/109 | 3534 | 017- | 253 | |

Figure 2 Part of the Dataview of the Municipal Real Estate Cadastre Database Map

This (*Dataview*) contains the following information: Latitude and Longitude of each property, the block and allotment numbers of each real estate, the real estate number, the block, the allotment area, the allotment dimensions (front and rear), the real estate area and the its use, being: A - Residential Horizontal, B - Residential Vertical, C - Commercial Horizontal, D - Commercial Vertical, E – Industrial and F - Shed.

For the entropy index calculation in this work, four types of land uses had been adopted, are they: - A - Residential, B - Commercial, C - Industrial and D – Others, for these last ones to represent a relatively lesser parcel regarding the first ones. With the real estate cadastre map and its respective dataview, a deriving errors correction of the archive exportation process was done.

The next step was the contour lines tracing of 500m in 500m until the limit of 3 km in the enterprise vicinity. Initially a new layer was created using the commands (*File_new - Geographic_File - Área_Geographic_File*) and contour lines were traced using the command (*Tolls - Geographic _ Analysis - Bands*). Figure 3 shows the tracing of the 6 contour lines.

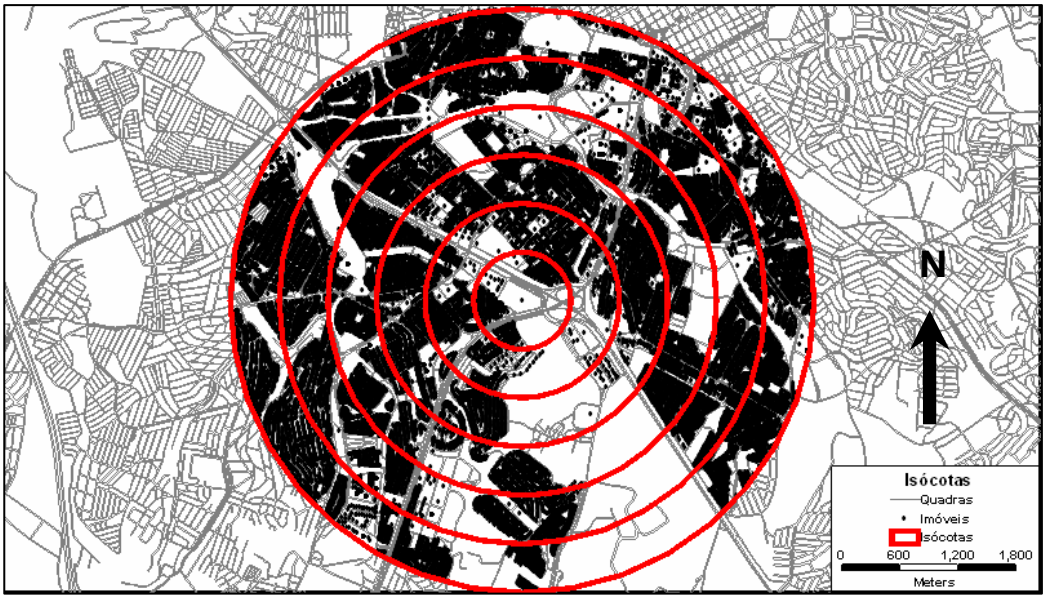



Figure 3 Distance contour map

**5.2 ATTAINMENT OF THE URBAN FORM INDICATORS**

In this section it will be presented the data treatment procedure used for the entropy index and the occupation density attainment. For demonstration of the used commands, the Campinas Shopping procedures will be presented here only, being similar for the other enterprises.

Initially a form filtering was done to segregate for each one of the contour lines the land uses. For this purpose, the tool (*Selection - Selection_by_location*) on real estate cadastre layer was used. As an example, Figure 4 presents only the real estates contained inside the 1 km contour line and Figure 5 shows part of the information contained in the database (*dataview*) of all six contour lines traced.

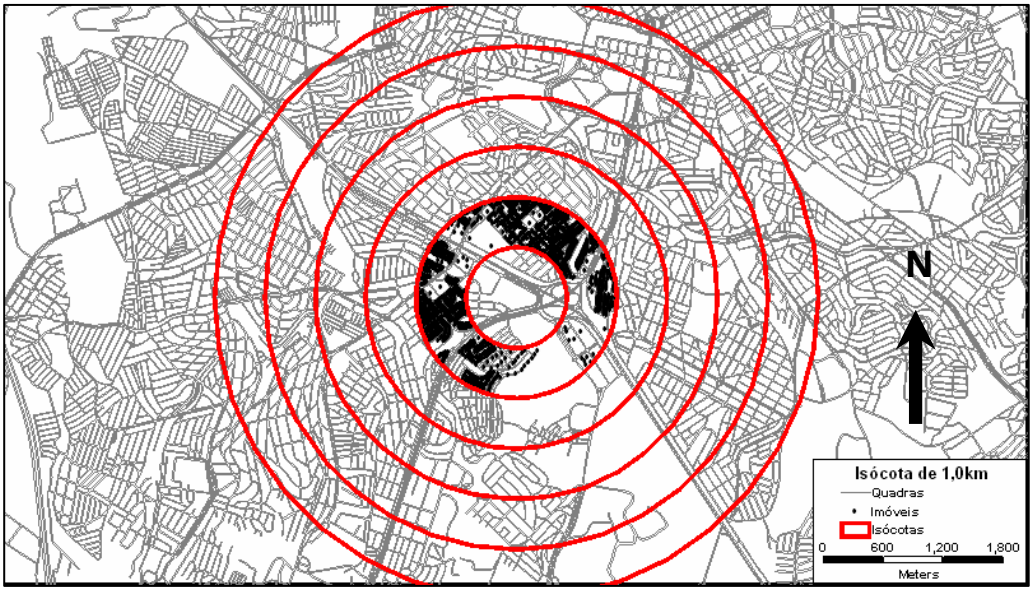
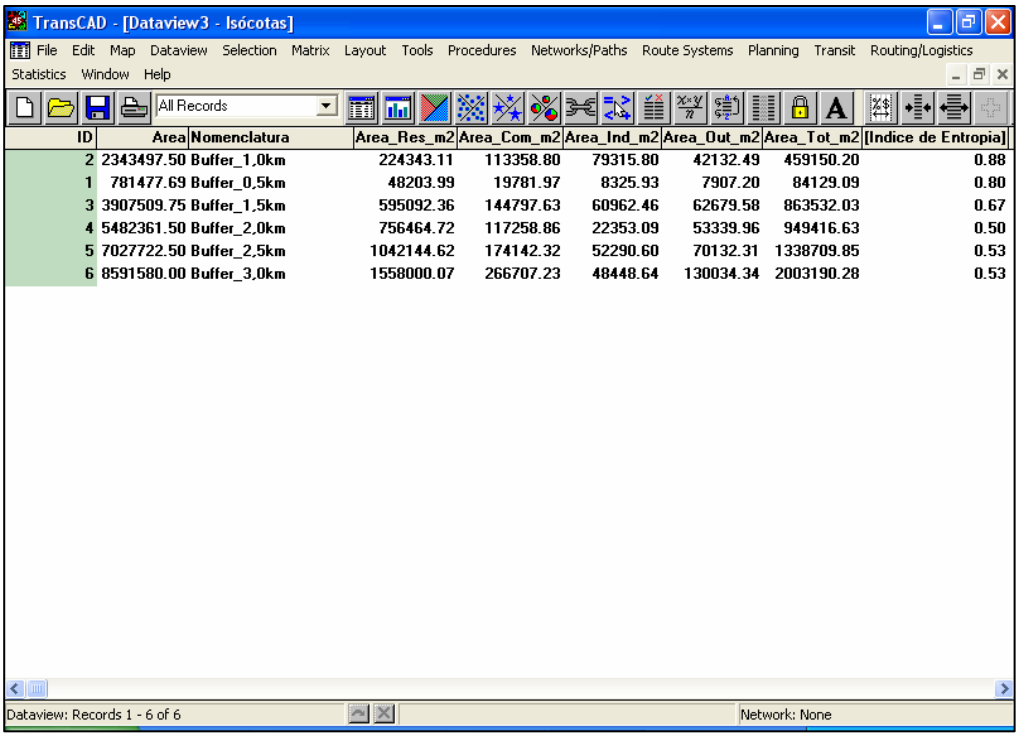



Figure 4 1 km contour line




| ID | Area | Nomenclatura | Area_Res_m2 | Area_Com_m2 | Area_Ind_m2 | Area_Out_m2 | Area_Tot_m2 | [Indice de Entropia] |
|---|---|---|---|---|---|---|---|---|
| 2 | 2343497.50 | Buffer_1,0km | 224343.11 | 113358.80 | 79315.80 | 42132.49 | 459150.20 | 0.88 |
| 1 | 781477.69 | Buffer_0,5km | 48203.99 | 19781.97 | 8325.93 | 7907.20 | 84129.09 | 0.80 |
| 3 | 3907509.75 | Buffer_1,5km | 595092.36 | 144797.63 | 60962.46 | 62679.58 | 863532.03 | 0.67 |
| 4 | 5482361.50 | Buffer_2,0km | 756464.72 | 117258.86 | 22353.09 | 53339.96 | 949416.63 | 0.50 |
| 5 | 7027722.50 | Buffer_2,5km | 1042144.62 | 174142.32 | 52290.60 | 70132.31 | 1338709.85 | 0.53 |
| 6 | 8591580.00 | Buffer_3,0km | 1558000.07 | 266707.23 | 48448.64 | 130034.34 | 2003190.28 | 0.53 |

Figure 5 Part of the Dataview of the Distance contour map

It is possible to observe in Figure 5 that all the real estate for each one of six contour lines traced had been segregated in accordance with each category of land use plus the total area, nothing more than the addition of all the types of uses in square meters. For the calculation of the two urban form indexes (occupation density and entropy index) was inserted the formularizations described in items 3,1 and 3,2, through the command (*Edit - Fill - Formulate*), available in TransCAD software.

To follow the results obtained through thematic maps for the two urban form indexes of the three studied enterprises are presented.

### 5.3 Entropy Index

### - Campinas Shopping Center

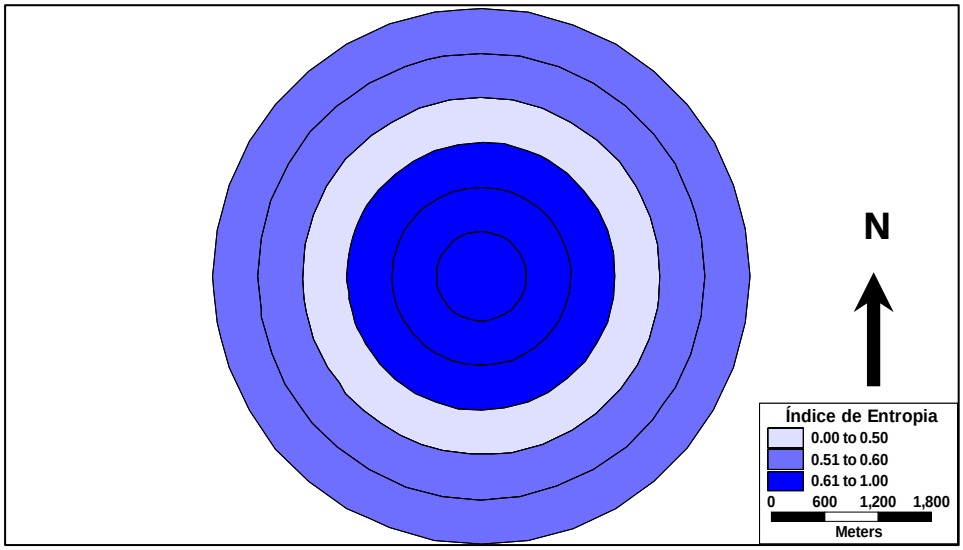



Figure 6 Entropy Index in the Campinas Shopping Center

It is observed in Figure 6 that contour lines of 0,5 km to 1,5km presents a bigger

mixture of land uses (more darkened tonality) becoming more homogeneous with passing of the distances. This is the behavior of the land use in the enterprise immediate vicinity, mainly being a bigger residences and commerce concentration.

**- Shopping Jaraguá**

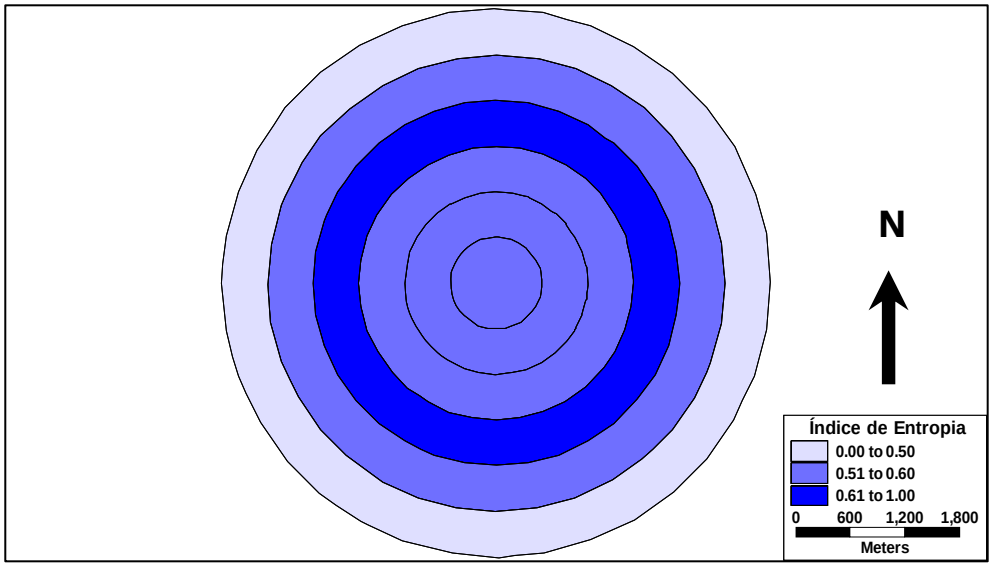



Figure 7 Entropy Index in the Shopping Jaraguá

Figure 7 shows an entropy index in contour lines of 0,5km to 1,5km relatively lower than the previous enterprise. This can be easily explained by the fact of the Shopping Jaraguá to be located next the Campinas central region and to present a bigger percentage of residences in its vicinity.

**- Shopping Unimart**

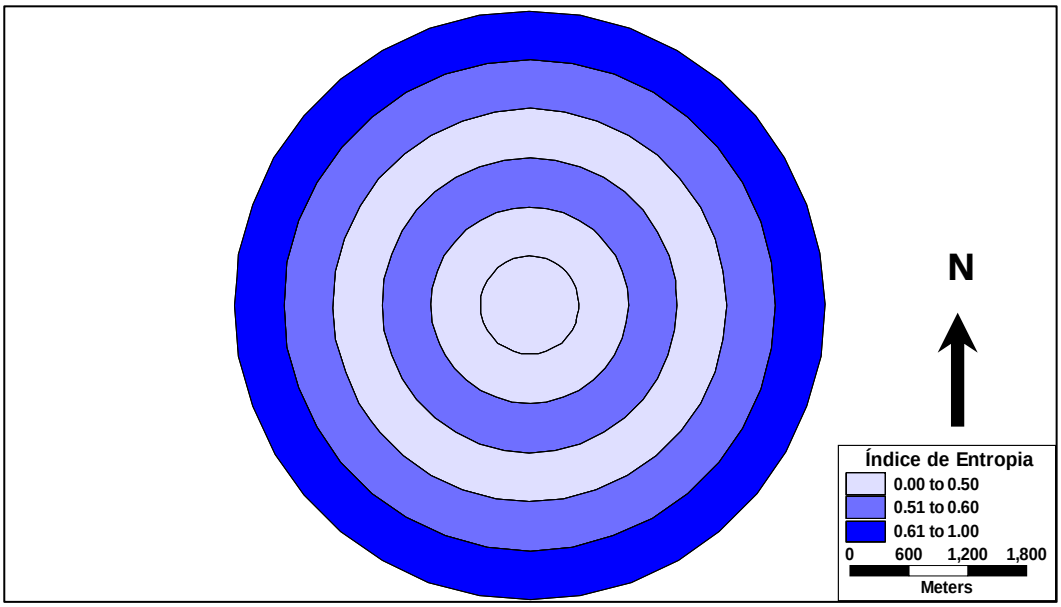



Figure 8 Entropy Index in the Shopping Unimart

Figure 8 shows a entropy index in contour lines of 0,5 km to 1 km lower than the previous enterprises. This fact occurs due this shopping to be located in a typically residential block, with few commercial and industrial areas.

### 5.4 Occupation Density

**- Campinas Shopping Center**

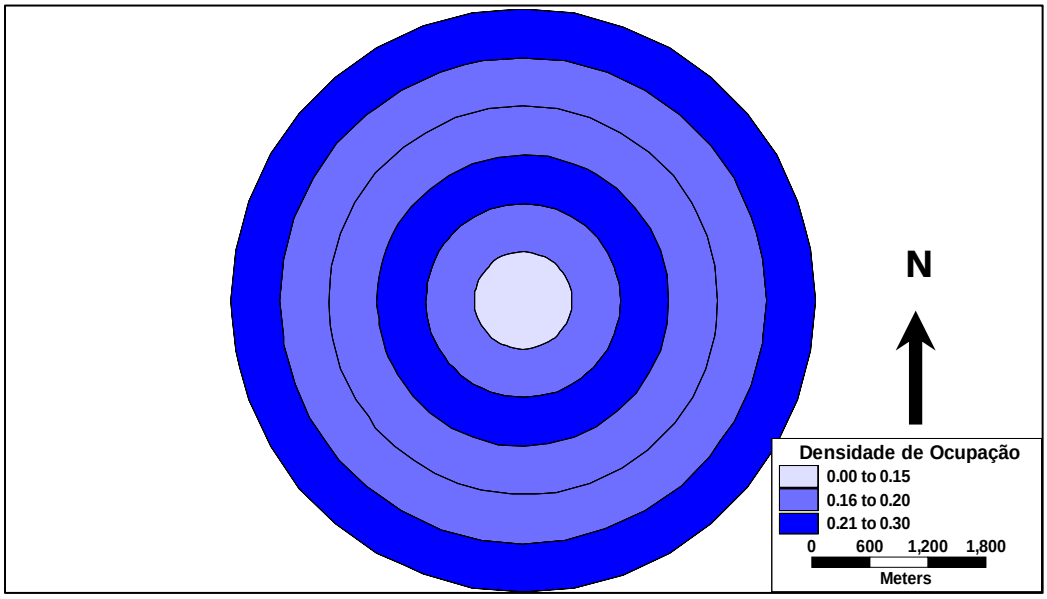



Figure 9 Occupation Density in the Campinas Shopping

Can be observed in Figure 9 that in contour lines of 0,5 km to 1,5km occurs a gradual increase in the occupation density, showing an increase in the constructed area in the enterprise vicinity, although that the density varied only between 0 and 0,30, or either, it has low constructed area in relation the area of contour lines.

**- Shopping Jaraguá**

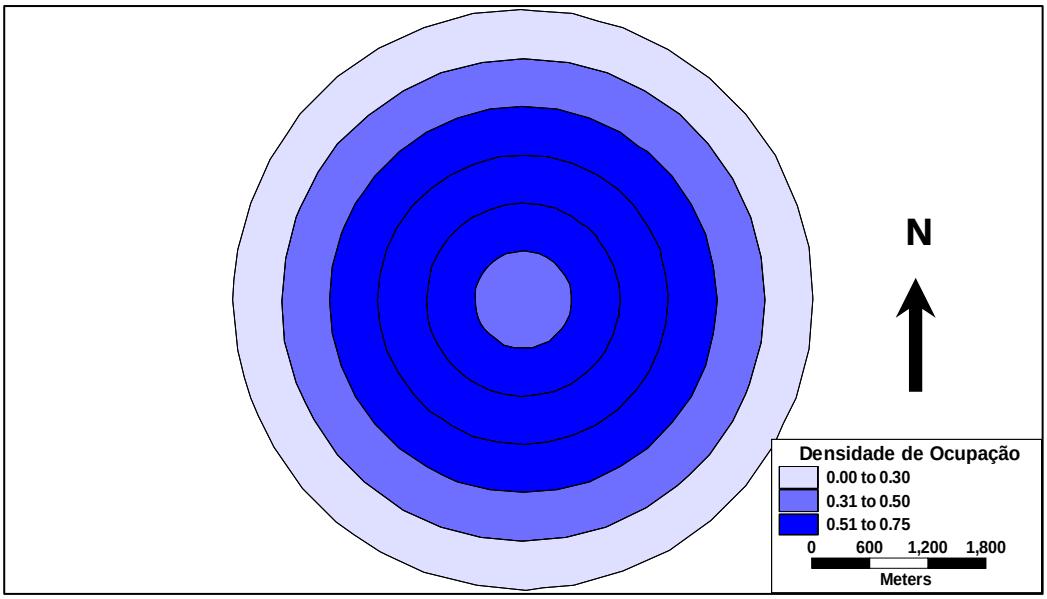



Figure 10 Occupation Density in the Shopping Jaraguá

Figure 10 shows that the occupation density varied between 0,0 and 0,76, relatively higher than the other enterprises. The 0,5 km contour line presents a density relatively lower than the other contour lines, increasing this index in the 1 km to 2 km contour lines. The occupation density of this enterprise is relatively higher than the

other ones, due to its proximity to the center of the city.

**- Shopping Unimart**

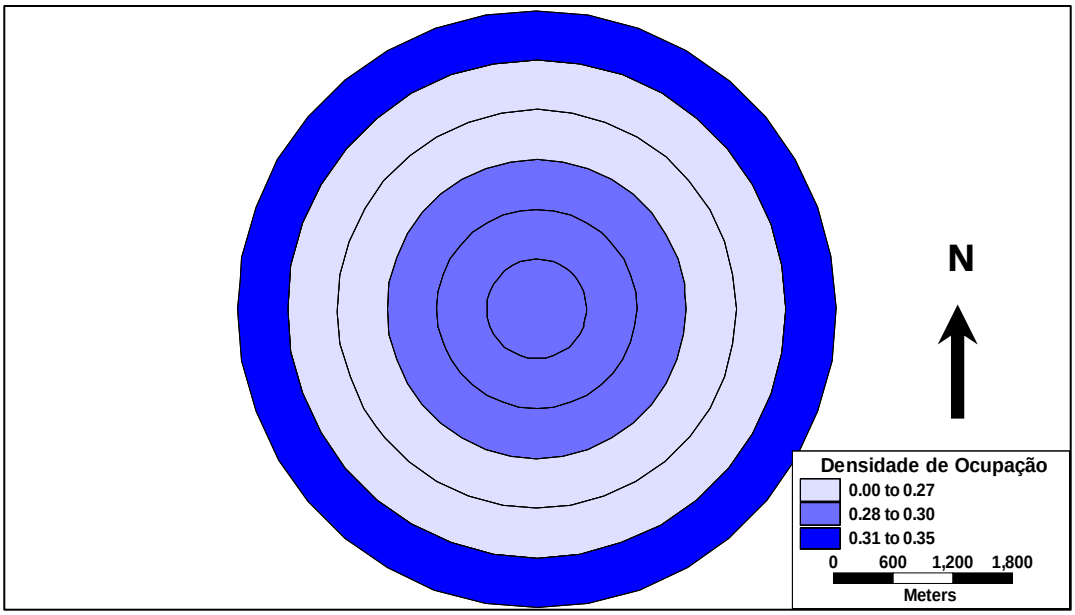



Figure 11 Occupation Density in the Shopping Unimart

According to Figure 11, this enterprise occupation density varied of similar way to the Campinas Shopping (0,0 to 0,30), standing out only one similarity in 0,5km to 1,5km contour lines where the density varied in the order of 0,28 to 0,30, showing a low occupation of the enterprise vicinity.

## 6. CONCLUSIONS

The main objective of this article was to show the edition and analysis steps of two urban form characteristics attractive for pedestrian's trips in some shopping centers neighboring inside the city of Campinas - SP by means of Geographic Information System tools (TransCAD software).

The thematic maps produced from the surveys to compose the two urban form indexes database, present satisfactory and suitable results with the reality. The entropy index is suitable being higher for the Campinas Shooping and Shopping Jaraguá and having a fast drop in the Shopping Unimart, due to the fact that the two first enterprises are located in central areas with a more land use diversity and the Shopping Unimart is located in a basically residential block. Regarding to the occupation density it was expected that Shopping Jaraguá presented a higher index in relation to the others, since it is located next the central area, which presents a denser constructed area.

The research whose some initial results are described in this article, continues in development and will have to result in the proposal of a procedure that encloses these and other urban form indexes and that is capable to estimate the number of pedestrian trips to shopping centers that present vicinity areas attractive to pedestrian trips and that supplies subsidies to the public administration directing its transportation plans.

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