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PIPERA NEIGHBOURHOOD - VOLUNTARI CITY. PROBLEMS REGARDING INCONSISTENCY BETWEEN THE RESIDENTIAL DYNAMIC AND THE STREET NETWORK EVOLUTION BETWEEN 2002 AND 2011

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Pipera Neighbourhood - Voluntari City. Problems regarding inconsistency between the residential dynamic and the street network evolution between 2002 and 2011

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Les problèmes de la croissance résidentielle et l'évolution du réseau routier entre 2002 et 2011. La période de l'explosion immobilière a déterminé, seulement en dix ans, le doublage de la surface occupée par la zone résidentielle du quartier de Pipera. Le développement dans un rythme plus lent de la texture de la rue a déterminé l'apparition d'une série de problèmes dans les nouveaux quartiers de villas qui se réfèrent surtout à l'accessibilité difficile dans cette zone, mais aussi à l'infrastructure utilitaire. Pour représenter spatialement les zones avec des problèmes, on a réalise, à l'aide des techniques GIS, la Carte des discordances entre la dynamique résidentielle et celle du réseau de la rue entre 2002-2011. On a utilisé la relation de la soustraction entre l'évolution de la densité des maisons dans dix ans et l'évolution de l'accessibilité donnée par la texture de la rue. On a détermine l'accessibilité par le produit de la densité des voies et la qualité de celles-ci. Les zones avec des problèmes identifiés sur le terrain sont, surtout, les nouveaux quartiers des promoteurs immobiliers, avec une grande densité des villas.

Mots-clés : dynamique résidentielle, réseau de rues, accessibilité, Pipera, discordances, problèmes, géographie urbaine.

Probleme privitoare la incoerenţa dintre dinamica rezidenţială şi evoluţia reţelei stradale între 2002 şi 2011. Perioada exploziei imobiliare a determinat în doar 10 ani, dublarea suprafeţei ocupate de zona rezidenţială în cartierul Pipera. Dezvoltarea într-un ritm mai scăzut a tramei stradale a determinat apariţia unei serii de probleme în noile cartiere de vile ce se referă în principal la accesibilitatea greoaie în zonă dar şi la infrastructura utilitară. Pentru reprezentarea spaţială a zonelor cu probleme, s-a realizat cu ajutorul tehnicilor GIS, Harta discrepanţelor dintre dinamica rezidenţială şi dinamica reţelei stradale între 2002-2011. S-a utilizat relaţia de scădere dintre evoluţia densităţii caselor în cei 10 ani şi evoluţia accesibilăţii dată de trama stradală. Accesiblitatea a fost determinată prin produsul dintre densitatea drumurilor şi calitatea acestora. Zonele cu probleme identificate pe teren, sunt în mare măsură noile cartiere ale dezvoltatorilor imobiliari cu densitate mare a vilelor.

Cuvinte cheie: dinamică rezidenţială, tramă stradală, accesibilitate, Pipera, discrepanţe, probleme, geografie urbană.

1. INTRODUCTION

Motivation

Pipera neighbourhood, located in Voluntari city, in the vicinity of Bucharest [1], has registered an extremely accelerated urban dynamic during the last ten years, regarding the residential area; among the most spectacular national residential dynamic. The accelerated development has been most of the time uncontrolled [2], and it caused the appearance of many problems regarding urban planning, traffic control, water supply, electrical supply, etc [3].

The main cause is the faster expansion of the residential area than to the street network development.

Premises

There are three situations. Firstly, (Figure 1.a) the residential area grew at a much faster pace than the degree of accessibility which is given by the street network [4]. In this case, the street grid has gradually lost its service capability, generating different issues: the traffic became more difficult and the organization of the utilities system has become increasingly difficult as the layout of these systems often coincides with the streets arrangement.

In the second situation (Figure 1.b), the residence is in accordance with the dynamics of the street grid [4].

In the third situation (Figure 1.c), the pace of the street grid progress is more accelerated than the pace of the residence progress [4]. The third situation is the reverse of the first situation.

a) Situation 1

b) Situation 2

c) Situation 3

Figure 1. Three examples of residential evolution

a- The residential is evolving faster than the accessibility road index
b- The residential is evolving the same with the accessibility road index
c- The residential is evolving slower than the accessibility road index

Purpose

The purpose of our research is to quantify the discrepancies between the residential area growth and the street grid development in the last decade and to create the map which represents these discrepancies.

We must identify the areas in which the residential surface evolved more rapidly than the street network, in order to corroborate these areas with the urban geographic issues that we spotted. After that, we must write down several proposals to solve these issues, depending on the evolution tendency for the next years.

Data sources

In order to reach our goals, we shall start using the following data sources:

- Ortophotoplans (1:5000 scale) of the years 2002, 2007 and 2011, from the web application Google Earth, section Historic Images [5].
- Personal made maps and field observation for a complete and veridical research, in order to validate the data of the ortophotoplans.

Study Area

The Pipera neighbourhood is located in the western part of Voluntari city (Figure 2). A major part of the Băneasa Forest is located in the north-western part of the Pipera neighborhood [1]. To the south and west the neighbourhood borders the Bucharest city, and to the north it borders the village Tunari.

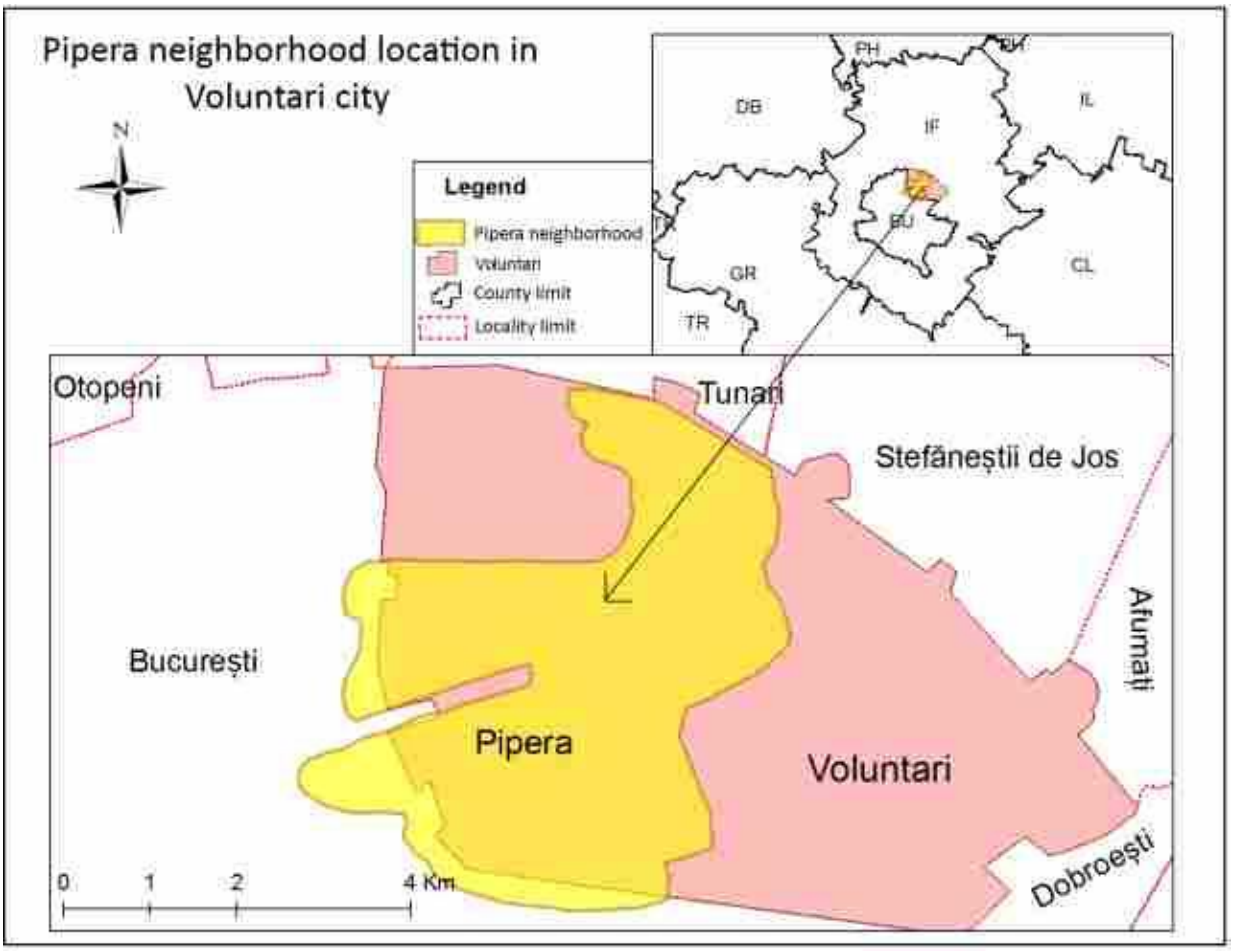


Figure 2. Study zone, geographical localization

In the past, Pipera was a village from the Băneasa-Herăstrău Township and after that it was part of the Colentina Township from the Ilfov district. Afterwards, when a big part of Colentina Township was included in the Metropolitan area of Bucharest [6], Pipera was no longer a locality and it became part of the village and township of Voluntari. Voluntari became a city in 2004.

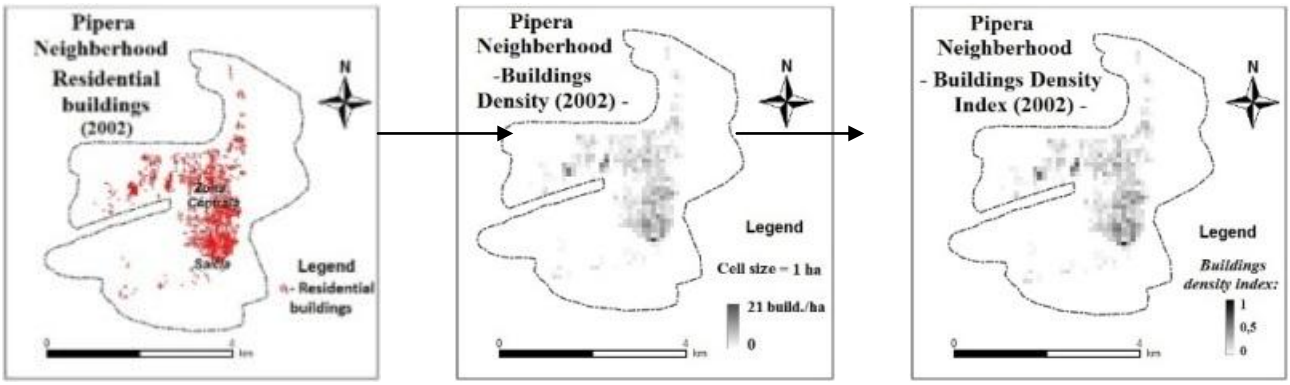
2. METHODOLOGY

This study has based on GIS instruments (ArcGIS 9.3, SAGA GIS, Quantum GIS and VTP). Using these instruments, the data was extracted from the ortophotoplans. The data was also obtained from our personal observations on the field. Afterwards, the data was manipulated and visualized in 2D and 3D [7]. The primary data was analised by using the GIS instruments, and the results were exported in the map format as it follows:

Firstly, we used the vector method for buildings (the dot format) for each three years (2002, 2007 and 2011) (Figure 3.a, Figure 5.a, Figure 7.a). We calculated the density of buildings (number of buildings/ HA) for the thrpee years (Figure 3.b, Figure

5.b, Figure 7.b) [8]. The density was divided to 26 (maximum value of the density) in order to get an indicator of density (Figure 3.c, Figure 5.c, Figure 7.c) with values between 0 to 1 [9].

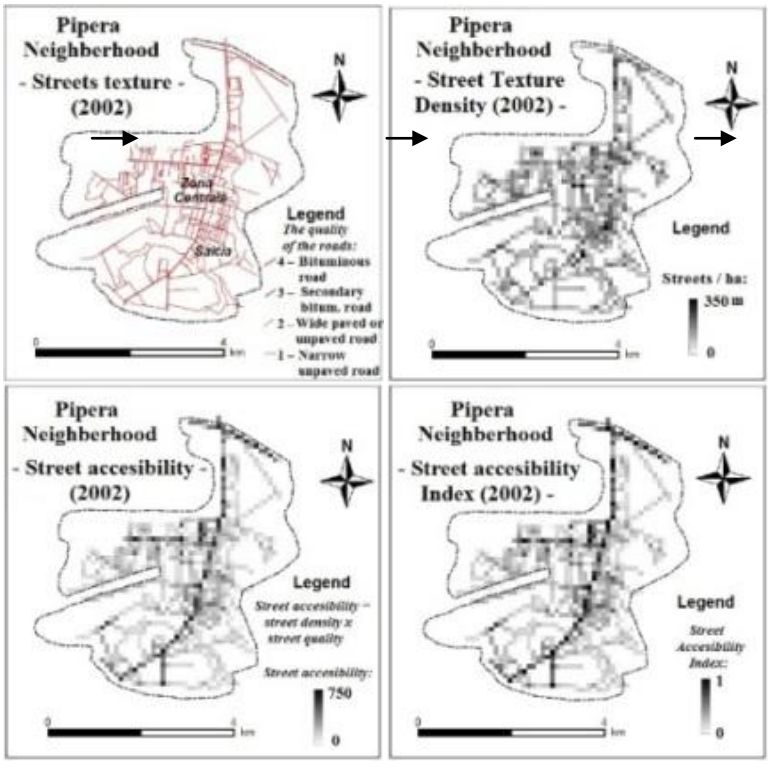
Furthermore, we used the vector method for the roads (the line format) for the three years (2002, 2007, and 2011) (Figure 4.a, Figure 6.a, Figure 8.a). We calculated the density of the roads (length of road/HA) for the three years (Figure 4.b, Figure 6.b, Figure 8.b). By multiplying the quality of the roads (1-4) with their density we obtained the road accessibility (Figure 4.c, Figure 6.c, Figure 8.c). By dividing the raster to 750, the road accessibility indicator with values between 0 and 1 was obtained (Figure 4.d, Figure 6.d, Figure 8.d).



a. *b.* *c.*

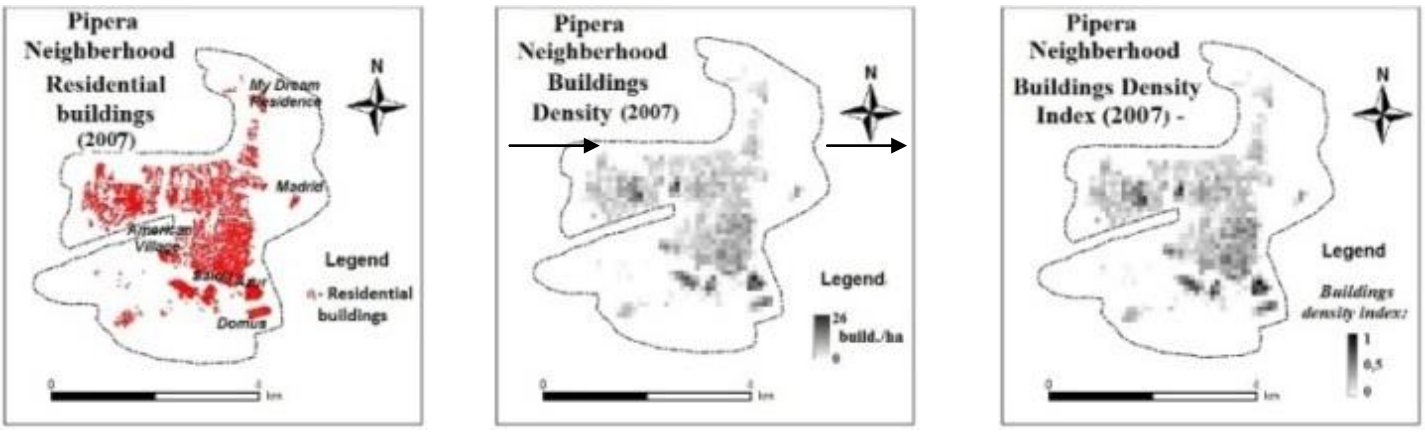
Figure 3. Obtaining the building density index (2002)

a. b.



c. d.

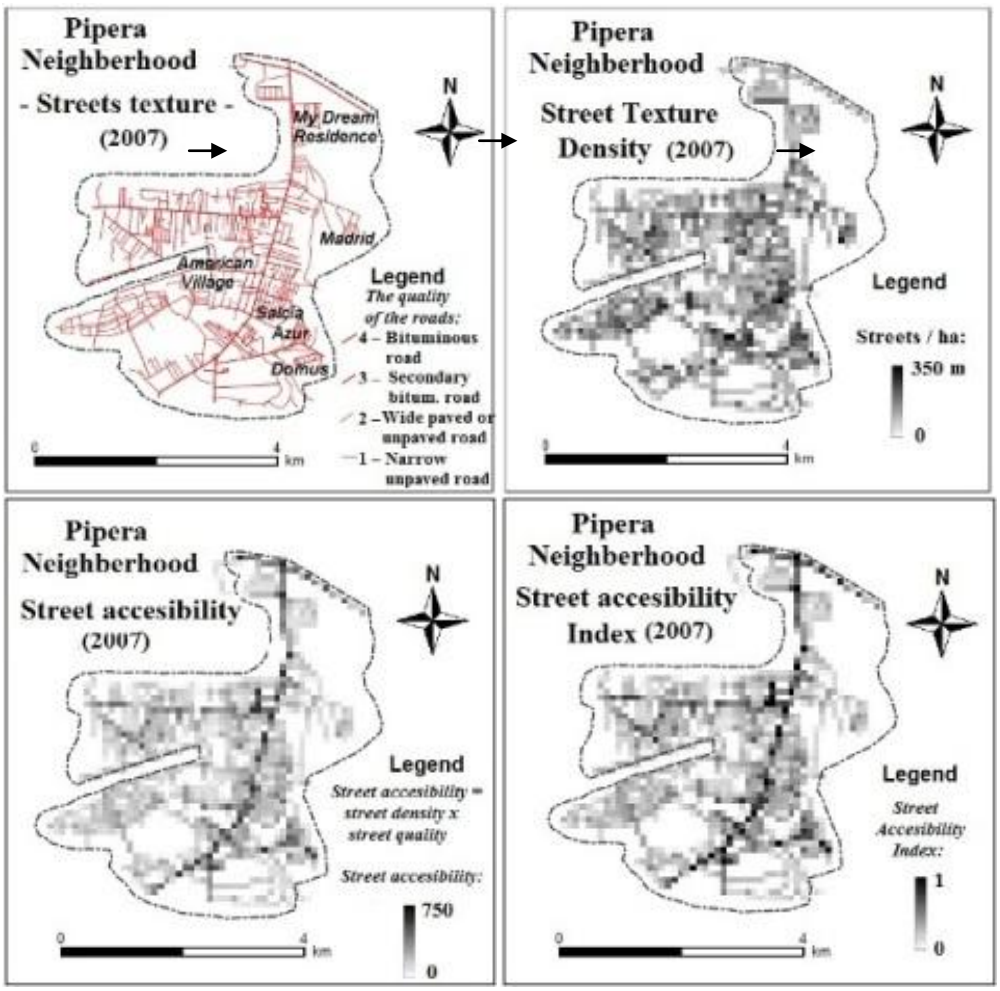
Figure 4. Obtaining the accessibility road index (2002)



a. *b.* *c.*

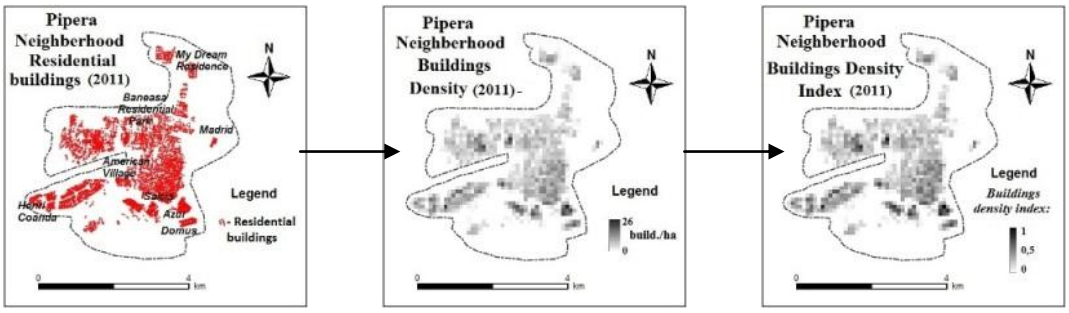
Figure 5. Obtaining the building density index (2007)

a. b.



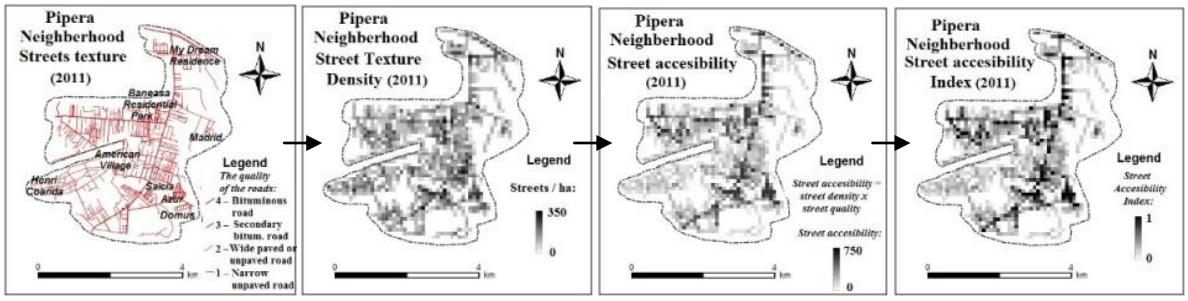
c. d.

Figure 6. Obtaining the accessibility road index (2007)



a. *b.* *c.*

Figure 7. Obtaining the building density index (2011)



a. *b.* *c.* *d.*

Figure 8. Obtaining the accessibility road index (2011)

By substracting the buildings density indicator for the year 2002 from the buildings density indicator for the year 2011, we obtained its dynamics.

By substracting the road accessibility indicator for the year 2002 from the road accessibility indicator for the year 2011, we obtained its dynamic during this period (Figure 10). By substracting the street network dynamics from the residential dynamics (Figure 9 - Figure 10), we created the map of differences between the dynamic of the residential and the dynamic of the road accessibility (see also Results).

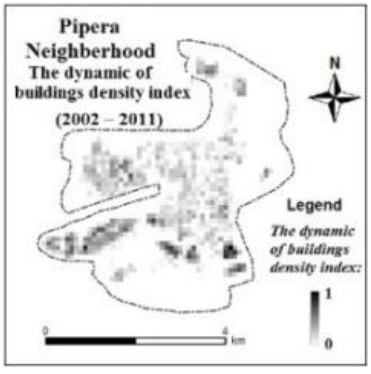


Figure 9. The dynamic of the building density index; obtained like this building density index (2011) - building density index (2002)

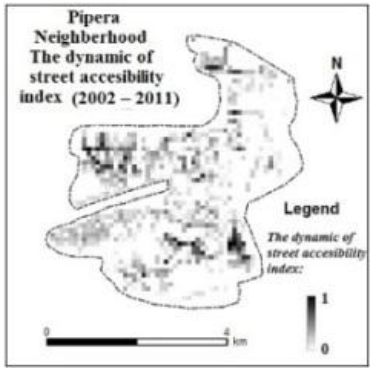


Figure 10. The dynamic of the accessibility road index; obtained like this: accessibility road index (2011) - accessibility road index (2002

Besides the GIS analysis method and digital cartography, we used the observation method, mapping and field analysis, the evolution charts method, the 3D modeling method [10], the comparative method (between the map of differences made in the GIS program and the major issues of urban geography).

3. RESULTS. PROBLEMS. DISCUSSIONS

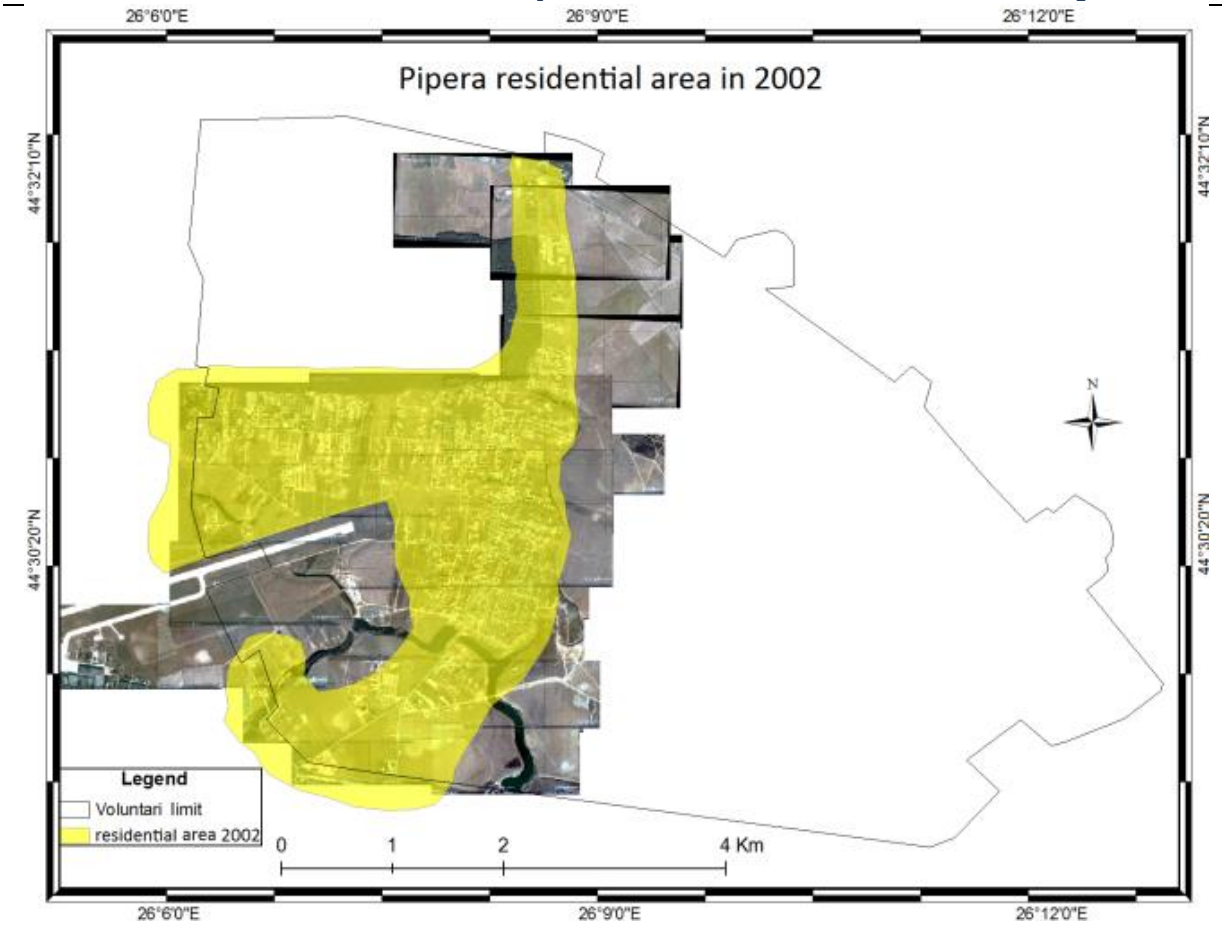
As a result of its favourable position in the Northern part of Bucharest and near to the Băneasa Forest, with a fast connection to the Ring Road and the DN 1 Road (the most travelled road in Romania), the Pipera Neighbourhood knew the biggest dynamic expansion of residential space in the entire country in the past 10 years. So, if in the year 2002 the residential area occupied a surface of 10, 8 km^2, in only 10 years its surface almost doubled [11], reaching 19 km^2 (Figure 11). The largest increase occurred between the years 2002 and 2007 (in the year 2007, the area of the neighbourhood was 16, 7 km^2). The slowing of the growth after year 2007 can be attributed to the economic crisis. The excessive growth in the first period was due to real estate development, in all Romania.

We created the map of the discrepancies between the residential dynamic values and the street network dynamic values during 2002-2011 (Figure 12). Further more, we created a map of the main problems of urban geography (Figure 14) in order to corroborate it with the first map.

Discrepancy index values were classified into five classes. Surfaces which correspond to the first and second class values are characterized by a faster evolution of the density and quality of its streets, comparing to the evolution of residential dynamics. These areas represent between 1% and 6% of the total analyzed area. In these areas, given the greater expansion of the road network, one can construct buildings in streets endurance limit.

The surfaces which correspond to the third class are characterized by a discrepancy between optimal growth and dynamics of the residential streets. The areas in this class can handle new construction only if the road network expands. The extravillan areas without outroads or residential areas are included in this class also, so these areas occupy the largest part of the whole neighbourhood, about 80%.

The areas which are included in the 4^{th} and the 5^{th} class are characterized by a faster residential dynamic than the streets dynamic, and they were represented on the map in orange and red colors. They represent especially the new residential Neighbourhoods that were built after the year 2002 (Figure 13). Here, because of the great density of houses which are poorly served by a network of roads, there is a risk that special services of the ambulance, fire man or policeman can be inefficent, as they



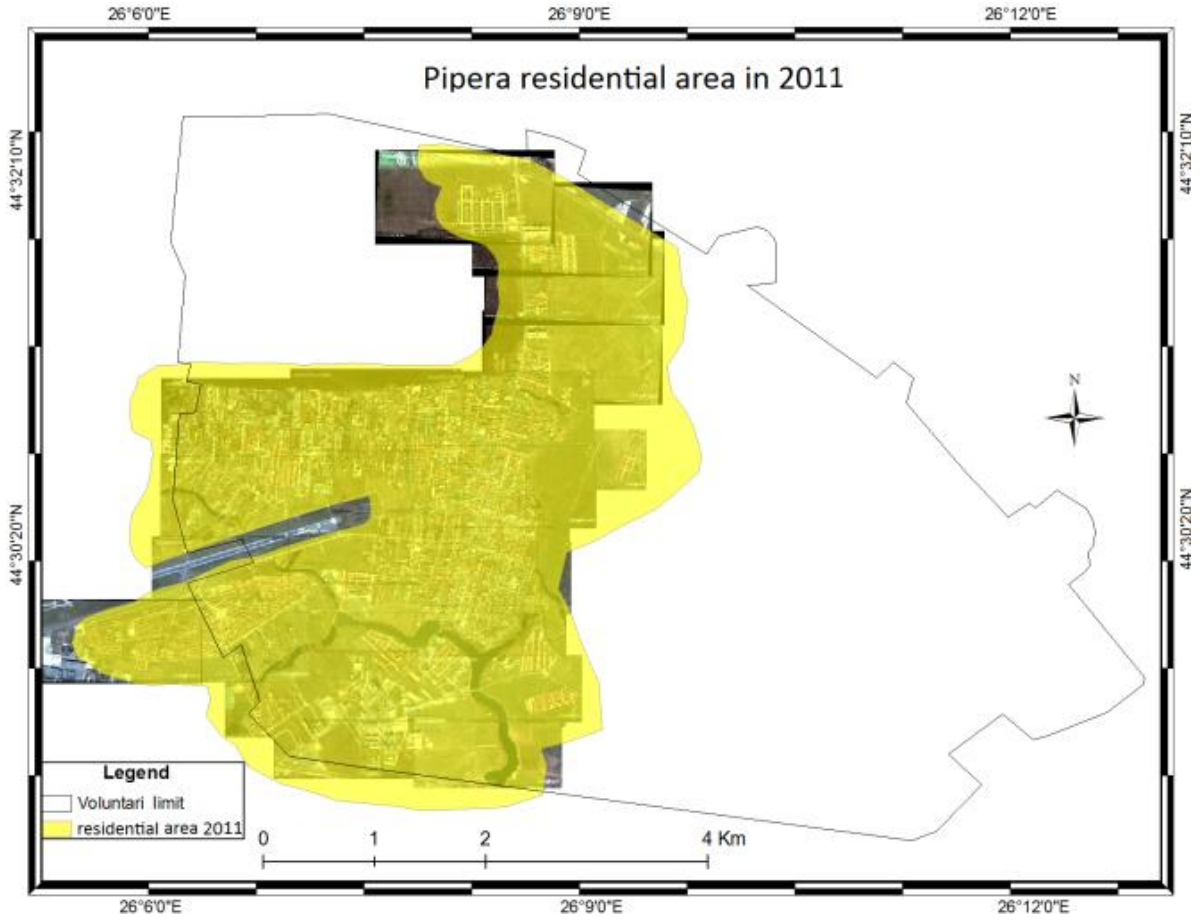


Figure 11. The evolution of the Pipera residential area (years 2002 and 2011)

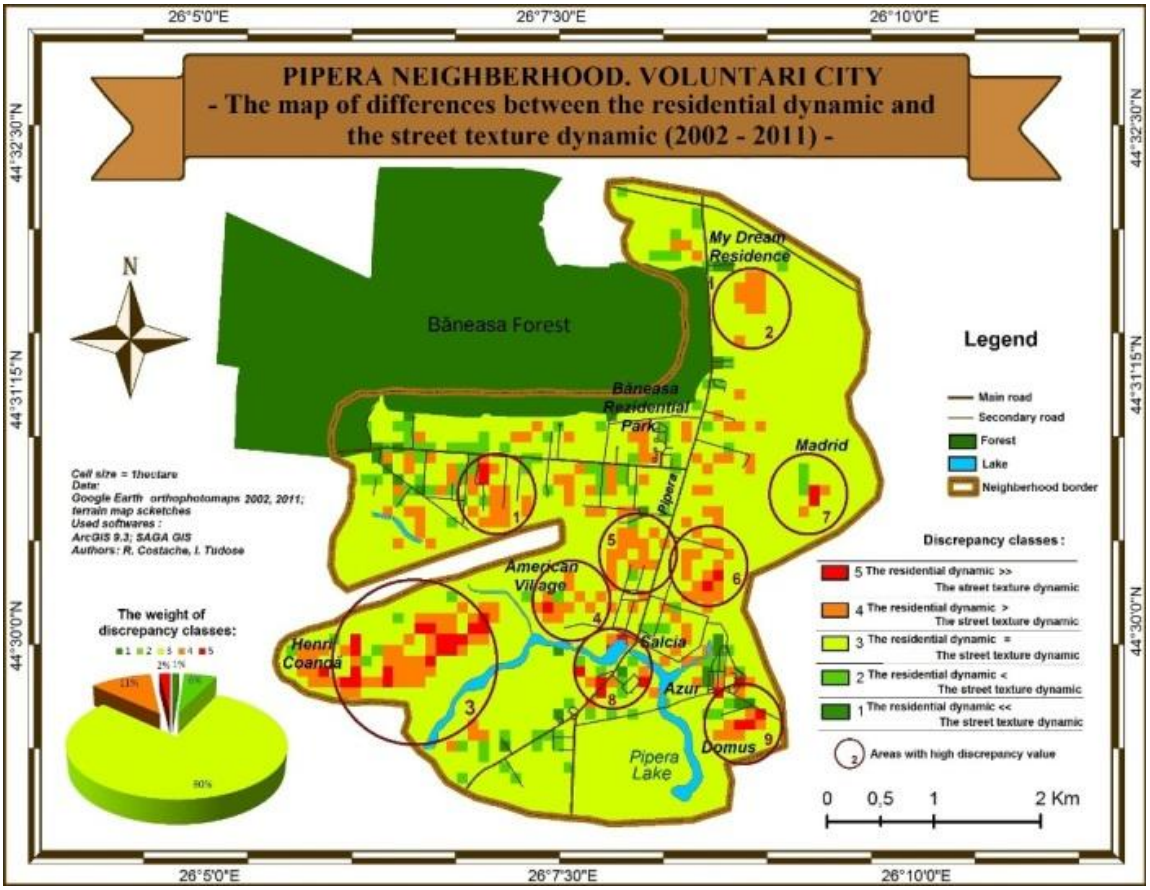


Figure 12. The map of differences between the residential dynamic and the dynamic of the road accessibility

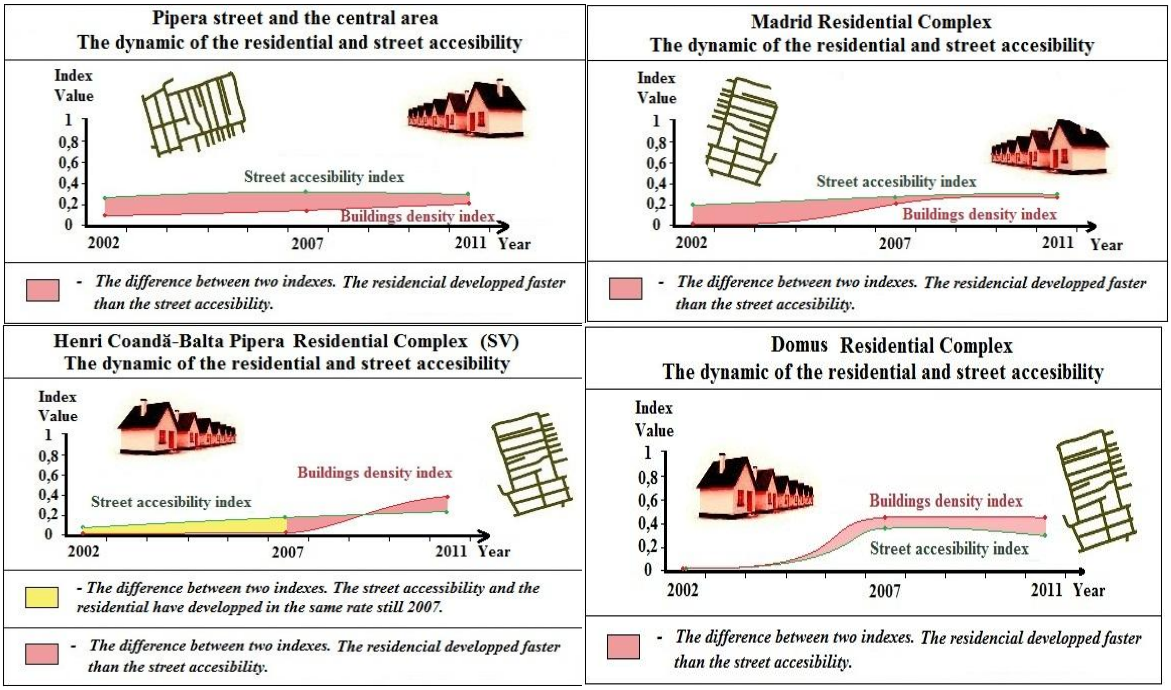


Figure 13. Graphics that shows the differences between the residential dynamic and the road network

could arrive too late, so the damages could be more severe. Also, the narrow streets represent an index of the inaccessibility in these areas.

Another general problem in the Pipera neighbourhood, which correlates with both excessive dynamic residency and improper sized streets network, is the supply of utilities. In this part we can include the oversized sewerage network in comparison with the increased necessity of utilities in the residential area. We must say also that the sewerage problem must be resolved by the contractor, as the neighbourhood sewerage is insufficiently developed.

The lack of a proper sewerage network in the newly built neighborhoods and the incapacity of the septic tanks to support the pluvial water, given the impermeable surface, were the main reasons why some buildings were flooded in the year 2005 [12].

In the Domus neighbourhood (Figure 15) the houses density is 26 homes/ha, so these are basically unified. From our observations on the field, the streets are narrow, so the parking spaces are no sufficient, and the accessibility in this area is very hard. Moreover, because of the narrow houses, humidity has become a problem, as a result of the lack of solar radiance on the soil.

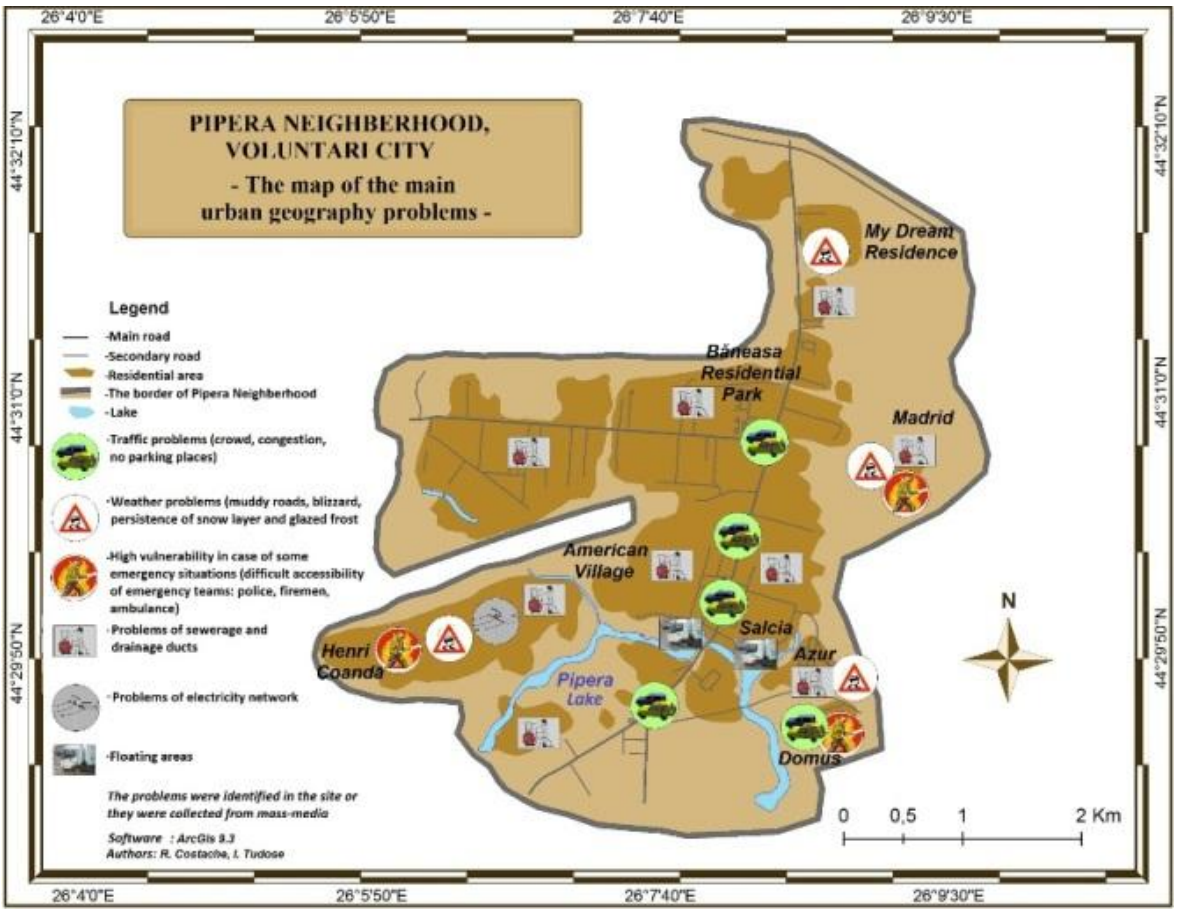


Figure 14. The map of the major urban geographical problems

Figure 15. The Domus Neighborhood-3D visualization

The economic crisis from the last years, the lack of collaboration between the authorities and the developers, corroborated with the general problems of heavy accessibility in this area have caused the lack of buyers of the apartments and villas newly built.

A very good example is the Henri Coandă Neighborhood built by the ANL, that is located half in the Pipera Neighborhood and half in the city Bucharest-sector 1. This area of 119 ha, where approximately 1100 villas were built or are being built, was inhabited by only 20 families in the year 2011 (from the 'România Liberă' paper) [13]. In this area the infrastructure is scanty. The streets are not asphalted, the gas, sewerage and water supply network is lacking, and the neighborhood is not connected even to the electricity utilities. The stray dogs are also a big problem, as the area lacks of street illumination. The authorities from Voluntari and Bucharest put the blame on the old land owners dispute on retrocession.The under dimensioned street network, comparing to developed residential area, often creates traffic problems. These problems appear on the Pipera Road, which has only one lane in each direction, especially at night and in the morning, when traffic jams are created.

Residents' access to public transportation is difficult because of the large distance between some areas in the neighborhood and the Pipera Road. Transportation in this district is held by mini bus companies.

4. CONCLUSIONS

The main urban problems (related to traffic, sewerage, water supply, energy supply etc) usually appear in the areas where the residential dynamic is faster than the street network dynamic. It is the case of the areas 1-9 which are represented on the discrepancies between the residential dynamic and the street network dynamic map. This fact proves that many of the existing urban problems today are caused by

uncontrolled urban growth during the last decade. This hazardous development refers is caused by the existing imbalance between the rapid growth of residential areas on and their service capacity (which is given by the street network). When speaking of real estate development, the road infrastructure should have kept the same pace of development. Nowadays, these problems would have been considerably reduced (sewerage, water supply, energy supply, traffic) because all of these are part of an overlapping network that coincides with the traffic access route.

The differences between the residential dynamic and the roads accessibility dynamic map (2002-2011) was realised in the GIS application by quantifying the two developments (the buildings and the streets). The map of the major urban geographical problems (2010-2012) can be considered the effect of the first map, because most of the current problems regarding urban geography overlap the orange and red areas.

Preventive measures must be a priority in order to avoid further aggravation of the situation in the Pipera neighborhood: slowing or reducing real estate development especially in the problematic areas (circled in the fig 12).

Remedial measures are necesary: widening access roads and constructing detours.

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