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THE USE OF THE GIS MODEL ON THE IMPLEMENTATION OF URBAN CADASTRE

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Abstract: The development of a GIS model that includes both information on real estate cadaster and water supply networks is an efficient one. The paper presents the stages of making such a model, starting from field measurements, to structuring the database and custom layouts. Today's large volume of data requires information to be centralized into tables that are then attached to graphical entities. In the analysis it was considered that the main components of the real estate cadaster system are the field, the parcel, the owner, and for the water supply network distribution networks, hydrants and manhole. GIS programs aim to specifying properties on custom layouts on structural and functional areas. Autocad and ArcMap software allow you to get themed maps on specific system domains. The study model can be simple to complex and can be generalized for any hydro-urban system (urban localities, rural localities, industrial areas, etc.).

Introduction

In view of the continuous evolution of cities and towns, a GIS model combining real estate and land registry information for water supply systems is essential and is of interest both locally and nationally. If we consider countries such as Turkey, the United States of America, the Netherlands, they have managed to combine the two branches of the cadaster.

GIS models for a real estate cadaster can expand and include the real estate segment with the different types of networks: gas networks, telecommunication networks, sewerage networks, electricity networks. In this paper we have studied

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the joining between the real estate cadaster and the water supply network (Burrough, P.A., 1986).

Table 1. Essential questions of GIS application

Issue	Questions	Interpretation
Identification	What's at ….?	This question identifies the location of the object by coordinates, address, postal number
Location	Where is ….?	This question seeks to locate the object exactly with its details
Trends	What has changed …..?	The question seeks to detail changes over time
Characterization	What are the properties ….?	This question seeks to identify certain properties of objects
Particularities	Which is the most …?	This is a complex analysis of an object
Causes	Why …?	This question provides information on the occurrence of a particular phenomenon
Prediction	How it will be over …?	This question determines the evolution of objects / phenomena over time
Modeling	What would happen if …?	This question follows the anticipation of a certain event.

As Badea Ghe., Badea A.C., (Badea Ghe., Badea A.C., 2013) mentions, the spatial element is defined by two components:

— With the help of the position is defined the shape and topology of the object represented by geometric elements such as dots, lines, polygons, pixels is defined by position.

— Using descriptive data to provide information about attached graphics.

Each object is reported to a particular reference system and is defined by four types of attributes (Badea Ghe., Badea A.C., 2013):

— Metrics, they describe the geometry and the position, length, perimeter, surface properties, such as the length of a distribution pipe.

— Graphs represented by numeric codes useful for representing the map, conventional signs, different thicknesses, types and colors of the lines, for example the distribution pipe is represented by the blue color and the brown sewer.

— Descriptive text type these can be parcel numbers, section, owner's names, pipe diameters, street names.

1. PRESENTATION OF STUDY AREA AND WORKING METHOD

The Aviation plateau area is located in the eastern part of Iasi and is delimited:

— In the side of North Marginei street;
— In the side of East Marginei street, Obreja street, Holboca street, Aviatiei street;
— In the side of South Aterizaj street;
— In the side of West Aurel Vlaicu street, Holboca street, Aeroportului street;

From a geomorphologic point of view, the studied area is located in the Jijia-Bahlui Depression, the relief consists of an alternation of ridges, depressions, plateaus, slopes of different shapes and inclinations, narrow valleys and meadows.

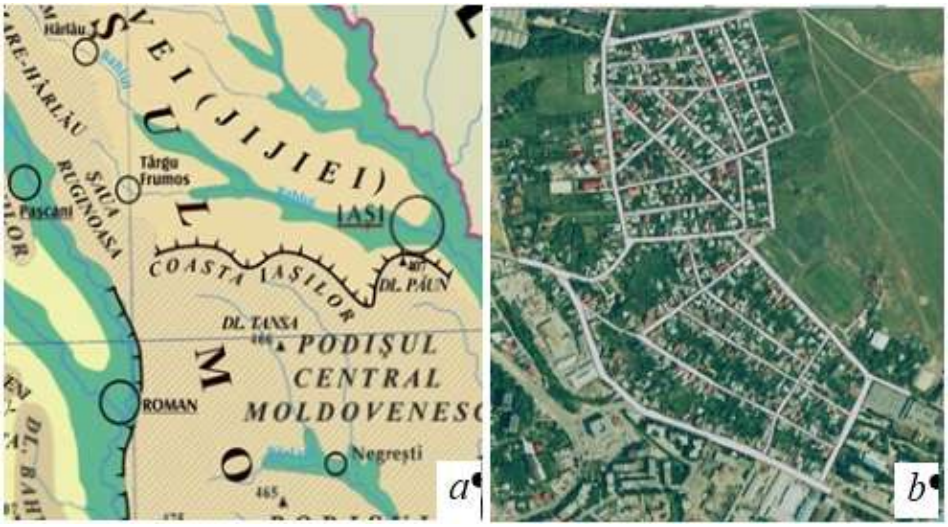

Fig. 1. Map of the study area: a - Relief map (www.geotutorials.ro); b - Study area delimitation

The delimitation of the study area was done by georeferencing the cadastral plans and adapting them to the orthorectified imagery of Iasi, graphic representation by digitizing contours as well as based on the GPS measurements made in the area.

In order to achieve an urban-urban GIS model for the Aviation plateau area, the text information was attached to the graphical information. Thus, by means of cadastral plans, measurements, orthorectified imagery, the study area was

delineated. After the cadastral plans were aligned, the digitization of the stable elements in time, that is to say the roads that delimit the area, digitized the parcels, then the buildings. These were compared with the existing records in the area and then adapted to them.

The location of the water supply network in the area and the specific structures related there were provided by SC APAVITAL IAŞI.

The creation of the GIS model involved the correlation of the information provided by SC APAVITAL IAŞI with the information gathered from the cadastral plans and the OCPI Iasi database. After the correlation of the graphical information follows the attachment of the textual information and the structuring of the patterns on specific layers of work.

The GIS model is composed of the real estate cadaster and utilities, that is to say, the water supply network in the Aviation plateau.

From the cadastral point of view for the division of the Aviation area, layers such as road, sector, immobile, parcel, building were used. These are defined by the use category, plot number, area, coordinates, cadastral number where appropriate.

The specialized technical works for the systematic inventory of buildings in the Aviation plateau area were made by following the workflow.

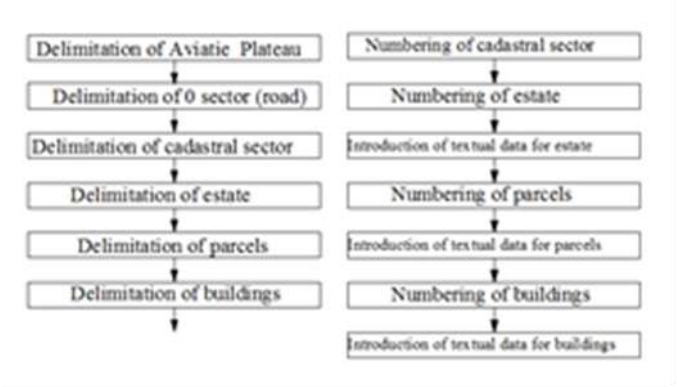

Fig. 2. The steps of layer creation for GIS model

The water supply network in the study area is made up of the distribution network, manhole, fittings, valves and hydrants. Each component has different information attached and is represented differently. For example, pipes that form a water supply system are of different types: supply, distribution, main, crossings, etc., they receive specific codes to be added more rapidly to the GIS model and to be recognized by field specialists.

The pipes have different materials, a unique location and are characterized by different technical parameters, geometric parameters, functional parameters, technological parameters, technical parameters.

Each of the characteristic statues have in turn attached information of interest, as follows:

−the technical parameters are composed by those who designed the water supply network in the area, those who executed the works and the year of commissioning of the power system in the Aviation plateau area.

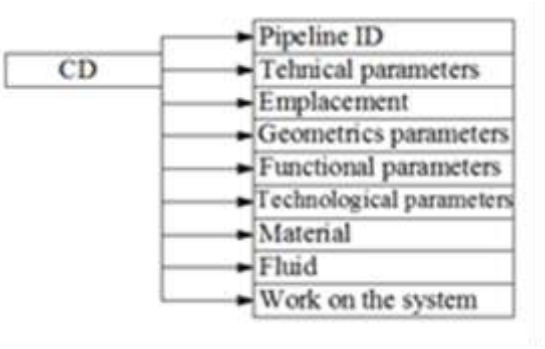

Fig. 3. Characteristic layers of distribution pipes

— the location of the water supply network is determined by the locality, in this case the city of Iasi, the street name on which the network is located, the parcel number, the sector of the locality, the field photos for better monitoring and the stereographic coordinates to easily be identified in the field.

— geometrical parameters determined by the outer diameter of the pipes having Dext code, inside diameter denoted by Dint, thickness (G), length of the pipe that is usually determined automatically in the program in which the GIS model is made, elevation which is marked Z or H, the profile.

— functional parameters, namely flow (Q), speed (V), pressure (P), roughness (n).

— technological parameters that fall within the category of geotechnical characteristics, so this layer is determined by the category of earth on which the pipe is bent, the depth of burial, the sand layer where appropriate, the moisture of the land and the seismic area.

— the material has sub categories the type of material, the type of joint, the standard length of the material as well as the specific strength.

— the fluid flowing through the distribution networks is characterized by density, temperature, type, kinematic viscosity coefficient, chemical conductivity.

— the works carried out are also of particular importance in the model and have attached information on the year of rehabilitation, the type of rehabilitation, the

company that carried out this work as well as photographic releases from the field with the situation before rehabilitation and after rehabilitation.

2. RESULTS OBTAINED IN THE STUDY AREA

The digital plan of the study area is composed of several layers that have attached information that facilitates the performance of analyzes in the Aviation plateau. Layers that compose the GIS model are:

— Characteristic layers of the water supply network: hydrants, valves, fittings, manhole.

— Characteristic layers of the real estate cadaster: buildings, plots, land, road.

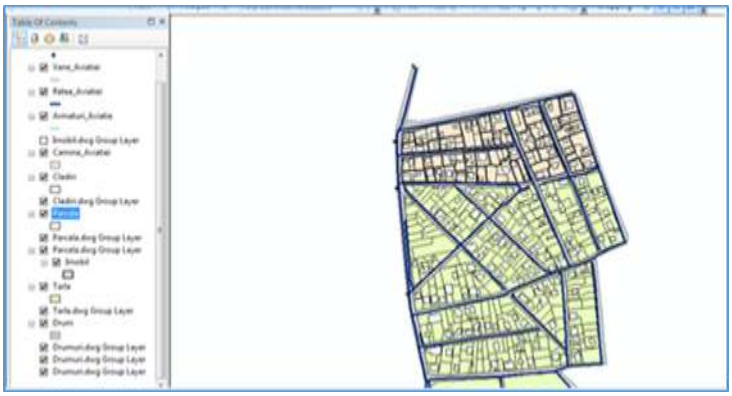

Fig. 4. The digital plan of the study area

Polygon graphic objects representing an immobile can be attached to several parcels (numbered within that building), and to a polygonal graphic entity representing a parcel can be attached several constructions, also numbered within the plot, as shown in figure 5.

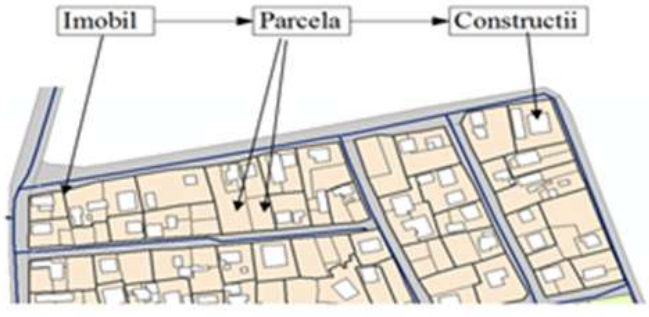

Fig. 5. Structure of data attached to the GIS model

Queries and thematic maps can be done on separate layers or in combination with other layers.

From the cadastral point of view, different types of analyzes can be made depending on the textual data attached to the GIS model. One of the analyzes that can be carried out are those based on the land use category. The area under study has a total of 338 parcels, the predominant ones are those with the use of construction yards (CC), followed by those with arable (A) and vineyard (V). Thus, as required, it is possible to create graphs and thematic maps for the study areas.

Fig. 6. Map of land use categories: a - Map of the study area; b - Detail in the study area

Table 2.The text data attached to the "Road" layer

FID	Locality	Street	Covering type	Road type	Identifier
0	Iași	Aviației	Asphalt	DS	354
1	Iași	Aterisaj	Asphalt	DS	890
...	...	...	...	...	...

For the GIS model in the Aviation plateau area for the layer named "Road", the text data are presented in table 2.

Aviation plateau can be monitored using the GIS model based on textual data attached to graphical entities, so the following pipeline, hydrant, and manhole network analyzes have been made.

— Identifying problem of manholes according to the notes field of the text data

attached to the model. Thus, in the study area there are 15 manholes and one of them is reported as a lack of cover.

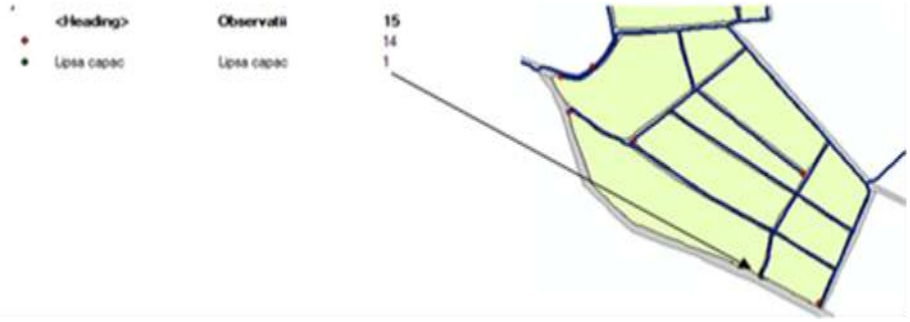

Fig. 7. Identifying problem homes

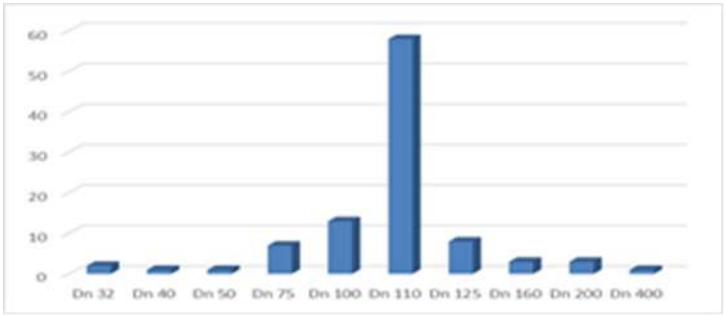

Fig. 8. Diagram of pipeline diameters in the Aviation

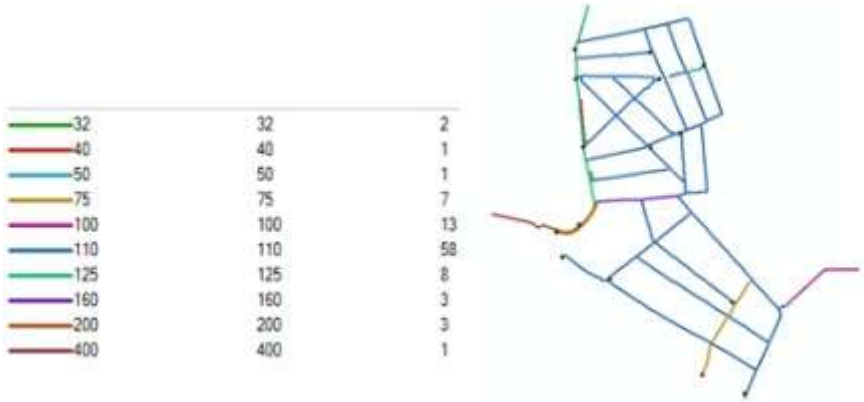

Fig. 9. Thematic map according to pipe diameters in the Aviation plateau

– Identify the diameters of the water supply network in the study area. As can be seen in figure 8, distribution pipes with Dn 110 are predominant, followed by those with a diameter of 100.

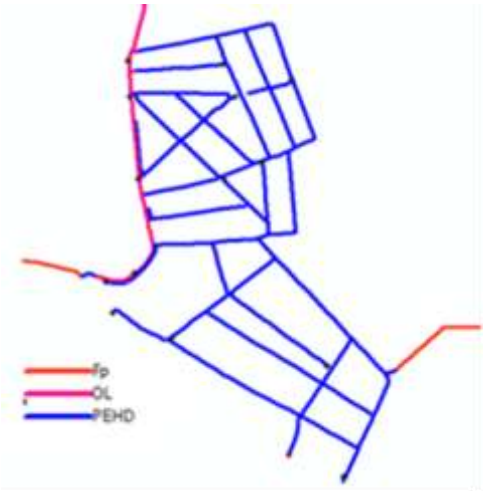

Fig.10. Thematic map according to pipeline materials in the Aviation Plateau

— Identify the materials that are part of the water supply network in the study area. As can be seen in figure 10, PEHD pipes predominate.

Conclusions

The implementation of a water supply network GIS system ensures the most efficient management and exploitation of the potential of the area, based on technical, economic and legal data.

Modeling water supply systems through GIS facilitates the process of querying data, shortens working time, reduces maintenance, upgrading and rehabilitation costs by combining textual and graphic data. GIS monitoring models have become monitoring tools present in water-channel companies, but their development and use differs across Romania, and cooperation with other utility systems as well as the land cadastre is at a relatively early stage.

GIS monitoring models use queries that create digital maps and reports to facilitate channel-to-water communication with authorities and customers, leading to a correct management of water distribution at water flow, pressure and water quality demanded by the consumer.

The modeling of GIS water systems that combines textual and graphic data facilitates the process of querying data, shortens working time, reduces maintenance, upgrading, and rehabilitation costs.

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