GEOSPATIAL DATA MANAGEMENT RELATED TO EXPROPRIATION WORKS

Alexandra-Paula FRENŢ, PhD. Student Eng., Technical University of Civil Engineering Bucharest,, Romania, alee.frent@yahoo.com
Ana Cornelia BADEA, Prof.Habil.PhD. Eng., Technical University of Civil Engineering Bucharest, Faculty of Geodesy, Romania, anacorneliabadea@gmail.com, ana.badea@utcb.ro
Petre Iuliu DRAGOMIR, Prof.PhD.Eng., Technical University of Civil Engineering Bucharest, Faculty of Geodesy, Romania, petreiuliu.dragomir@gmail.com

*   **Abstract**: In recent years, it is necessary to involve as many specialists from different fields as possible, who need significant data interoperability to carry out expropriation projects, due to the increase in complexity of projects in the field of road infrastructure.*

*   The realization of these projects is strongly influenced by the integration of geospatial data using GIS (Geographic Information System) technology. There is the possibility of managing these geospatial data in GIS for the efficient exploitation of the data obtained from the measurements within the road infrastructure projects, through surveying methods, using total stations respectively GNSS receivers. GIS have a very important contribution in the evidence, management and planning of processes through the automated workflows. The applicability of GIS is significant in cadastre, utilities, urbanism, land planning, taxes, city halls and regional and national institutions. The data managed in GIS can have geospatial reference, so that data and phenomena can be exploited, analyzed, and interpreted in a spatial context.*

*   The expropriation aims to carry out works of national, county, or local interest. The expropriation procedure is the legal operation that has as main effects the forced transfer of an asset from the private property of natural or legal persons to the public property of the expropriator, followed by the payment of a compensation to the affected assets owners. In this article, a case study was approached for a public utility work of national interest "Oradea Ring Road Connection (Calea Sântandrei Roundabout) – A3 Highway (Biharia)" which is located on the administrative area of Oradea.*

*   **Keywords**: GIS, geospatial data, expropriation, DSM, 3D view*

1. Introduction

        The topic addressed in this article is to highlight the advantages offered by the data management related to the expropriation works in GIS.

        The expropriation procedure for public utility works is extremely necessary for the development of a country, being one of the paths to a healthy economic and social development, which leads a community to prosperity, only through works of public utility, through modernization, development, and construction of modern road networks. [7]

        The legislative basis on which the expropriation operations are based is complex. The law underlying the expropriation process for the cause of public utility, necessary to achieve objectives of national, county, and local interest, is law 255 of December 14, 2010, which was adopted by the Romanian Parliament and published in the Official Gazette with the number 853 dated December 20, 2010.

According to article 1, paragraph (1), of law 255/2010, "This law establishes the legal framework for taking the necessary measures for the execution of: construction, rehabilitation and modernization works of roads of national, county and local interest..." [1]

As works of public utility are defined the following:

- construction, rehabilitation and modernization work of roads and parking lots of national, county and local interest,
- construction, rehabilitation, and extension of the public railway infrastructure,
- the works necessary for the development of the metro transport network and for the modernization of the existing network,
- works for the development of airport infrastructure, as well as of the naval transport infrastructure.

The expropriator is established according to the objective of the work. Thus, in the case of objectives of national interest, the expropriator is the Romanian State, in the case of county interest objectives the expropriators are the counties and in the case of local interest objectives the expropriators are the municipalities, cities or communes.

The buildings in the public property of the administrative-territorial units, affected by the expropriation procedure, according to the law, pass into the public property of the state and into the administration of the expropriator within 30 days from the moment of notification of the administrative-territorial unit. [1]

These buildings may be transferred, after the completion of the expropriation procedure, to the property of the public units and to the administration of the representatives of the local administration, but they are not alienated during the existence of the public utility works. [2]

In the case of affected buildings owned by the public or private property of the state and in the administration of public institutions, autonomous administrations or other research and development institutions, the transfer of the property right is made by Government Decision within 15 days from the moment of approval of the technical and economic indicators of the work to be used for public use. [1]

The assets in the private property of the administrative-territorial units will be transferred in accordance with law no. 255/2010, after recording the individual amounts. [2]

In the case of forested lands affected by the expropriation procedure and in the public property of the state, the transfer of the right of administration is made according to law no. 255/2010.

It is also established that the legal acts that end after the date of displaying the decision on the amount of compensation are hit by absolute nullity, there being no longer the possibility of changing the destinations of the buildings expropriated from outside the built-up area land to built-up area, nor the transition from the public to the private one of the administrative-territorial units.

There is a possibility that, during the expropriation procedure, changes may be found from the initial situation. This fact is highlighted in a table with the technical-economic indicators and is corrected by the expropriator. An annex to the decision is drawn up, containing the table with the buildings, respectively the expropriated persons. The effect of rectification [1] is that the expropriator is obliged to re-consign the amounts of money for expropriation under the amended judgment.

Law no. 255 of December 14, 2010, is the basis of the realization of the stages of expropriation process.

The expropriation procedures are as follows:

- approval of the technical-economic indicators of the works of national, county or local interest.

- for the buildings that are part of the expropriation corridor, the individual amount representing the payment of compensation is established.
- the list of owners of the buildings that are part of the expropriation corridor is displayed.
- the ownership is transferred.

2. Materials and Methods

Mapsys 10 and ArcGIS Pro 2.7 software products were used to integrate and exploit geospatial data related to the expropriation works.

Mapsys 10 is a software developed specifically for cadastral works, being designed by GEOTOP. GIS cadastral databases can be created in a structured way with its help.[11]

There are graphic, topological, data analysis and representation functions. Users have the possibility to use functions for geometry, verification, correction, georeferencing and data collection.

The communication with other CAD or GIS systems can be done through the Geospatial Data Abstraction Library (GDAL) interface, thus being allowed the transfer of vector GIS data through the most known data formats. The GIS database can be synchronized with other GIS systems or with other specialized reporting and record-generation applications. [11]

ArcGIS Pro is a GIS software developed by ESRI, with data visualization, advanced analysis, and authorized data maintenance in 2D, 3D, and 4D. It supports data sharing with Esri products such as ArcGIS Online and ArcGIS Enterprise and allows users to work throughout the ArcGIS system through Web GIS.[6]

ArcGIS Pro offers the ability to combine multiple data sources to create smart and good-looking maps. It allows analyzing 2D, 3D and 4D data, to examine relationships, make predictions and make the best decisions possible. [6] At the same time, the rapid sharing of projects and information can be achieved within the organization, online or through mobile applications.

An important advantage for users is the interface that is very accessible also for unexperienced users, being made from the ribbon menu, views, and panels. ArcGIS Pro uses a horizontal ribbon menu at the top of the app window, displaying and organizing the main and child menus.

The geospatial data integrated and exploited in GIS were concentrated around a section of the public utility work of national interest "Oradea Ring Road Connection (Calea Sântandrei Roundabout) – A3 Highway (Biharia)" which is located on the administrative area of Oradea. (figure 1) The data was organized within a database in ArcGIS Pro. (figure 2)

The database also included the following layers: expropriation corridor, studied section, affected buildings and neighboring buildings, affected constructions and neighboring constructions, built-up area limit and administrative unit boundary.

Since some of the data was available in MapSys, in order to create the database in ArcGIS Pro with the aforementioned layers, it was necessary to convert them as shapefile data. Data downloaded from the e-Terra3 platform were also used. It was necessary to modify the attribute tab in order to add more information, in order to be able to perform analysis, graphs, queries using the database made. [4] ,[5]
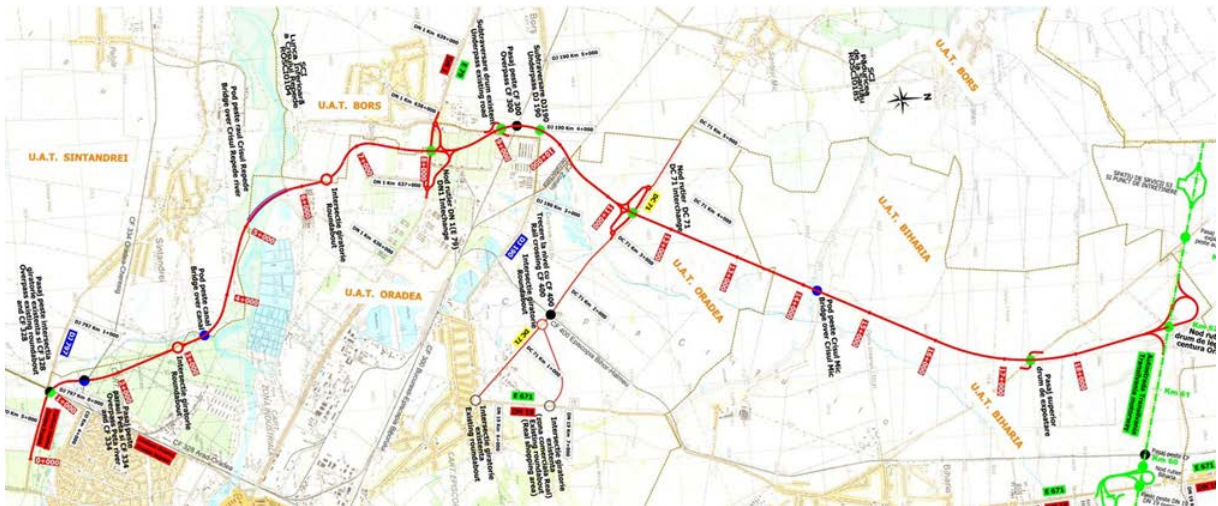
Figura 1 – The route of the work of national interest "Oradea Ring Road Connection (Calea Sântandrei Roundabout) – A3 Highway (Biharia)"
Source: https://zmo.ro

Figura 2 – Integrating data into ArcGIS Pro

For the 3D visualization of geospatial data, it is necessary to use the digital elevation model (DEM). [4],[5] Unlike the DEM, the surface digital model (DSM) represents the surface of the Earth and all objects above it made by man or nature. [8] (Figure 3)
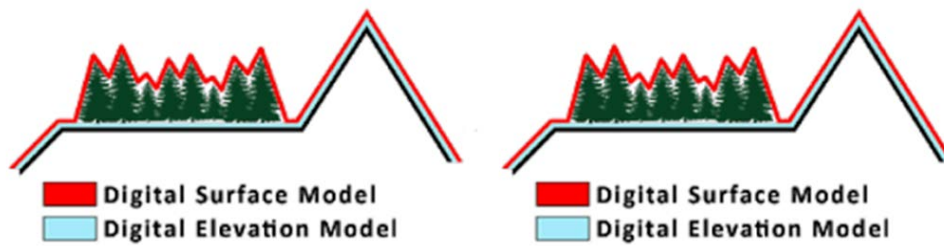
Figura 3 – DSM vs DEM
Source: https://thinkinfi.com

3D digital models help to understand and explain complex urban scenarios, especially since changes occur in built-up areas due to urban expansion.

The surface design can be used for visualization, disaster management, navigation, vegetation management, urban planning to check how a proposed building can affect the panoramic view.

3. Results and Discussion

To highlight the geospatial data with the help of graphs, it was necessary to modify the table of attributes, adding additional data, such as: "ID" of the building (cadastral number, topographical number, field, parcel), the total area of the building, the expropriated area, the category of use, the destination and the type of the building.

Thus, the areas of the buildings subject to expropriation were highlighted according to the categories of use. (Figure 4)
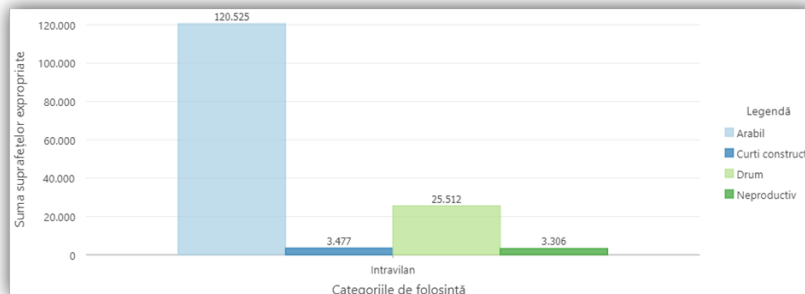

Figure 4 – Expropriated areas in the study area according to the categories of use

Four categories of use subject to expropriation can be observed within the section studied, and the category of use with the largest area subject to expropriation is "arable".

There were analyzed the categories of use belonging to the private or public domain and how much of the expropriated area will be compensated by the expropriator. (Figure 5)
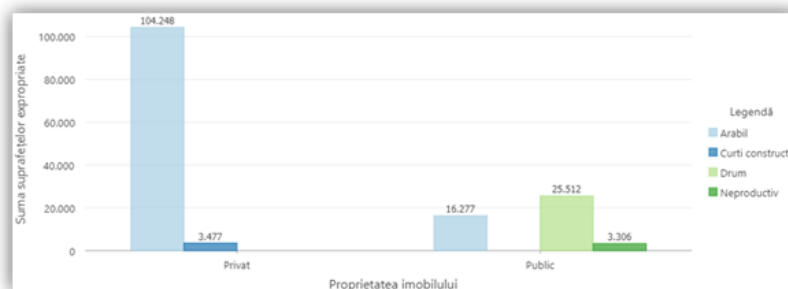

Figure 5 – Areas expropriated according to the categories of use and the private or public domain of the buildings
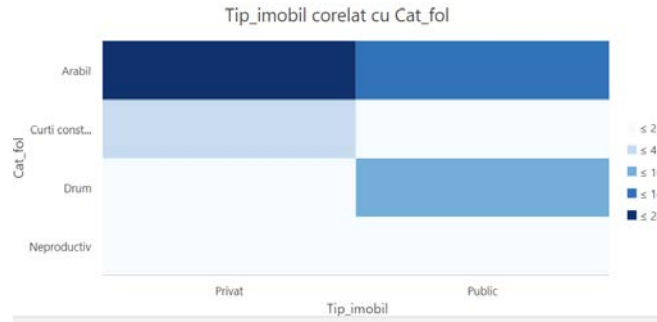
Figure 6 – Type of ownership (public or private property) of buildings affected by expropriation correlated with the category of use
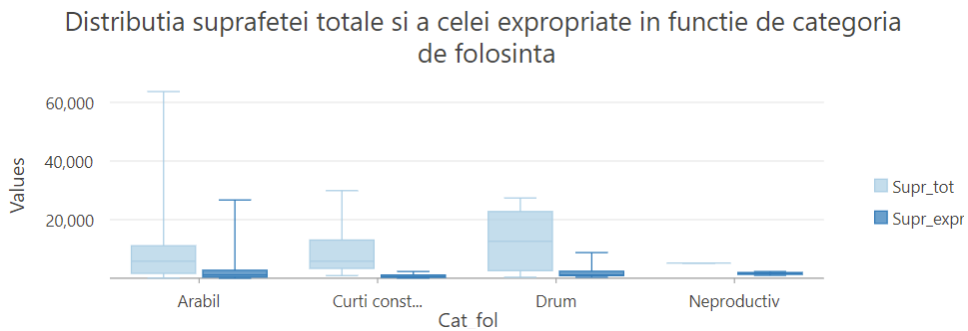

Figure 7 – Distribution of the total and expropriated area according to the category of use

It is noticed that the expropriated area afferent to the category of use "construction yards" belongs entirely to the private domain of natural or legal persons and will be compensated according to the law.

Almost all the area in the category of "arable" use belongs to the private domain of natural or legal persons and will be compensated according to the law.

The 3D visualization of the analyzed situation was made, applying a vertical exaggeration, and also using the shading function.

To have the volumetry of the constructions, one option is to add the height of the buildings for the layers "Neighboring constructions" and "Affected constructions" and then extrusion them. (Figure 7)
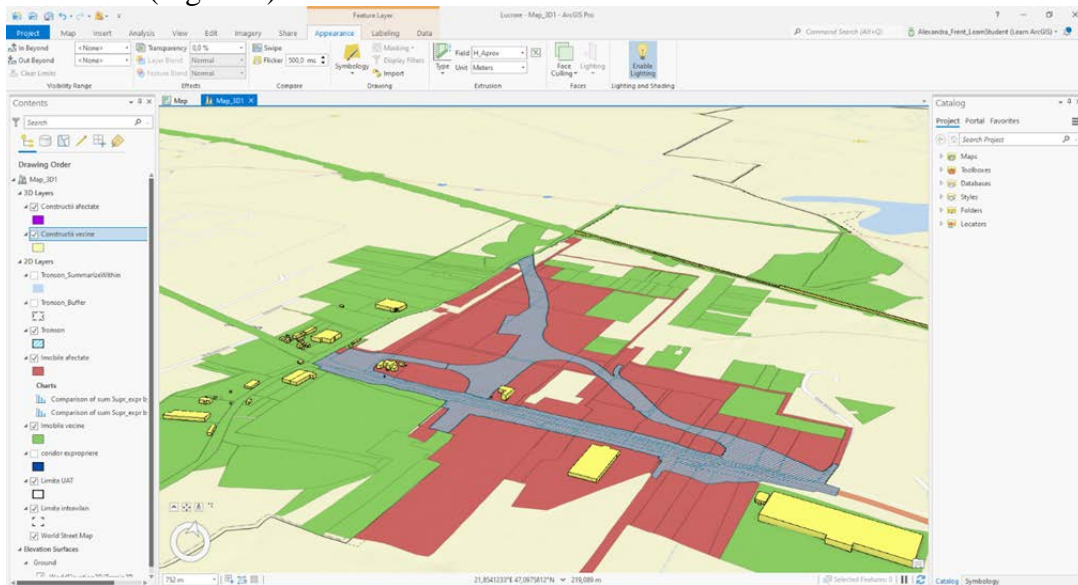

Figure 8 – 3D Scene

4. Conclusions

The expropriation procedure is regulated by constantly changing and improving legislation, as it involves works of the utmost importance.

The process of expropriation represents:

- legal operations by which the real estate owned by natural or legal persons passes into the public property of the State,
- technical operations to establish the affected areas and to identify the buildings within the expropriation corridor,
- real estate valuation operations, with compensation for expropriated persons, the individual sum granted to the owners differing depending on the use of the land, the category of use, the total area of the building and the area superimposed with the expropriation corridor.

It was possible to analyze more quickly the buildings depending on the categories of use and the public or private domain in GIS, the affected areas were analyzed, various graphs can be made that can be the basis for informing the population in the area. These analyses are of great help in going faster through the expropriation stages.

At the same time, the 3D visualization of the studied area can be shared with the expropriators and the administrative-territorial units in the help of informing the public for an overview of the work of public interest.

On the basis of the case study carried out on the public utility work of national interest "Oradea Belt Link (Calea Sântandrei Roundabout) – Autostrada A3 (Biharia)" and the results obtained from the observations carried out, it can be appreciated that going through the expropriation stages with the help of a GIS software represents a great advantage, both in achieving the stages much faster, through the possibility of creating a detailed GIS database, as well as in informing the affected citizens, thus providing them with an overview of the location of the expropriation corridor and the effects that the expropriation will have on the area under study.

A proposal for further development may be the designing of a web platform in which to find the expropriation works, which would greatly improve the existing transparency regarding this type of situations.

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