CADASTRAL FOR UTILITIES IN MUNICIPAL AREA MOȘNIȚA NOUĂ

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Abstract

In the following paper we aim to present the importance and necessity of a municipal cadastral plan because it serves as a starting point for many projects, especially in the field of architecture and civil engineering, for example obtaining building authorisation. By municipal cadastre we refer to the management of the municipal networks that serve the development of a city, networks such as the potable water supply, the sewage, the natural gas, the heating, the electric cable, the telecommunications, or other types of municipal networks. In this project, we have also included a presentation of the methods and stages used for the execution of such a project realized in a district of Mosnita Nouă, Timiș county.

***Key words**: Cadastre, GIS, Mapping, Municipal networks Orthophoto*

INTRODUCTION

Definition of municipal cadastre

Urban networks represent technical utilities serving buildings, social and cultural complexes, institutions, economic agents, as well as technical industrial networks in urban areas, and can be located both above and below ground. A specific information system must be set up for municipalities to systematically record the technical and qualitative aspects of underground and above-ground facilities in the perimeter of the urban area. It must be constantly maintained and updated in line with the actual situation. The work presented represents a project of building cadastral survey realized during our courses at the University, having as study area ATU MOSNITA NOUA (Figure 1).

The importance of the municipal cadastre in ATU (administrative territorial unit)

The purpose of the information system for building networks is to provide real and quality information, to manage localities efficiently by using an informational system based on cadastral data for decisions, to create a standard content for network plans, road maps and centralized statements, to establish single criteria for the evaluation, verification and acceptance of works and products concerning the building network fund.

Figure 1. The area under study

Linking the building cadastre with the informational system

The building network informational system should be linked to the real estate fund informational interview system because there is a better management and coordination of activities that lead to a high standard of living in a locality (Manea, 2007).

The general cadastre deals with the technical aspect and refers to the recording of real estate belonging to this field in order to establish by measurements the shape, position and configuration of the properties for registration in the cadastral documents and in the Land Registry, obtaining digital cadastral plans.
The component of the specialist evidence is made up of elements belonging to the quality aspect as well as other technical characteristics:

- the recording and inventory of building networks by type of network (Figure 2 and Figure 3);
- determination of the position in the plan and the layout of the main and distribution network routes;
- planimetric determination of buildings and technical installations;
- determination of the dimensions of significant elements or points (manhole covers, gratings, ducts in a manhole, etc.).
- information sheets (road sheets, single sheets, standard sheets);
- information on the nature of the materials of construction of the pipes and their diameters;
- information on the condition of the networks;
- information on flow rates, capacities.

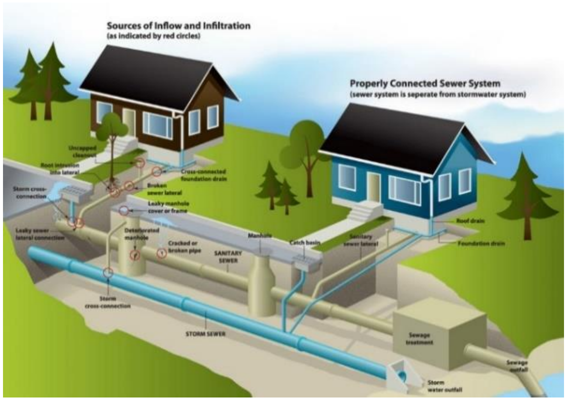

Figure 2. Sewerage Network

Figure 3. Water Supply & Distribution System

Classification
Building networks are structured by levels (roads, building elements, landscaped areas) as follows: drinking water supply network, sewerage network, natural gas network, district heating network, electric cable network, telecommunications network, or other types of building networks (Musat, 2022).

MATERIALS AND METHODS

RENNS

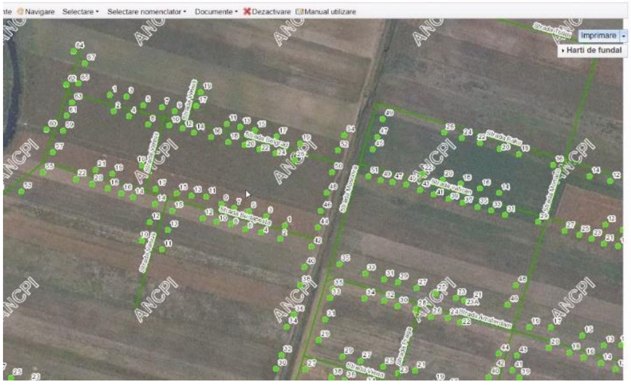

Figure 4. Street nomenclature of Mosnita Noua

The RENNS (Figure 4) is used to manage the street nomenclature, streets and administrative addresses, as well as their geometry. The management of streets and addresses is done through flows defined in the system. Only users with the proper roles can manage streets and administrative numbers. RENNS is available to users in municipalities, local councils and allocation commission members.
The RENNS product provides information about the project as well as its related modules, which can be accessed as application links for managing, validating, administrating and publishing street classification content. The RENNS portal and the public access module of the street nomenclature were used to consult information related to the ATU Moșnița Nouă.
The public component materializes in a web portal and allows users to consult and use information about "Streets", "Address numbers" and additional address information managed by the system, as well as a series of functionalities made available within the application. The RENNS portal is addressed to a wide range of users such as: - The general public, through web interfaces accessible from common browsers; - IT systems in other public institutions, based on

standard web services; - Local public authorities (RENNS, 2022).

Even though RENNS is a useful software, it needs to be updated frequently, which is why it was also necessary to collect data on field and consult other platforms (eTerra, NACLR).

NACLR and eTerra

The National Agency of Cadastre and Land Registry (NACLR) is a Romanian governmental organization with legal personality, subordinated to the Ministry of Regional Development and Public Administration.

ETerra is a national property registration system and manages information on properties and their owners, optimising the collection of building data for the urban cadastre.

We consulted the Eterra website to collect the necessary data to identify the height regime, the properties and the geometry of the buildings for the Mosnita project (Figure 5 and Figure 6).

Figure 5. Eterra Mosnita Noua interface

Figure 6. Geoportal NACLR

GNSS

A satellite navigation system, also called Global Navigation Satellite System (GNSS), is a stand-alone system that calculates the geospatial position of objects on the ground or in space using signals received from navigation satellites or so-called pseudosatellite (ground-based relays with similar functionality). Such a system also helps to orient or guide vehicles, ships in the open ocean, rockets etc.

To define a position, the receiver must receive signals (position and time) from at least 4 satellites simultaneously. Small differences between the signals are then used to determine the receiver's position.

The GNSS determinations realized for our project in Mosnita Noua, took place over a period of 3 days and for a more accurate positioning we stationed 1minute at each point, with continuous measurements (Figure 7).

Figure 7. GNSS determinations in Mosnita Noua

Position determinations refers to obtaining the coordinates (absolute or relative) of certain interest points in a specified reference system from satellite observations (measurements). Satellite observations consist of various types of measurements made between the satellite receiver on the ground or near the ground and one or more satellites in circum-Earth orbits.

The satellites play an active role by sending out signals that are received by specialised instruments (receivers) that decode this signal. After decoding the signal, the information needed to determine the receiver's position is extracted from it (Herban et al., 2012).

Global Navigation Satellite Systems (GNSS) are systems that enable highly accurate determination of position in a geocentric reference system at any point on, near or beyond the Earth's surface using artificial Earth satellites.

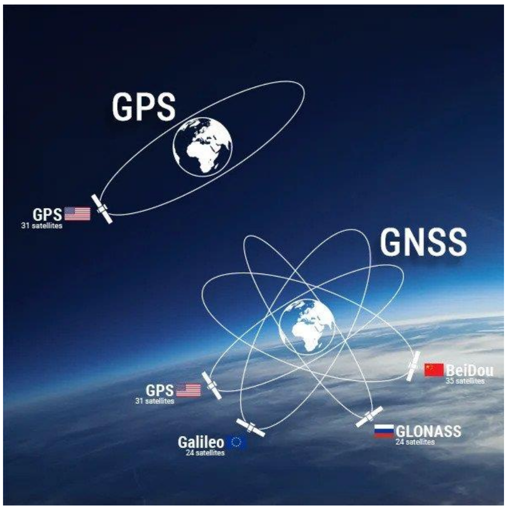

Figure 8. GNSS System

Currently the most popular GNSS systems are NAVSTAR GPS (USA), GLONASS (Russia), Galileo (European Union), BeiDou (China), NavIC (India) and QZSS (Japan). There are no major differences between these GNSS systems in terms of operating principles and technology. Each system includes three segments: the space segment (satellites), the control segment (monitoring and control stations) and the user segment. (Figure 8)
ROMPOS® uses Galileo, NAVSTAR GPS and GLONASS global positioning systems.

Galileo
The Galileo system has 22 operational satellites on 3 orbital planes inclined at 56°. This system was launched in 2011, becoming operational in 2016 and completed in 2020.
GALILEO is inter-operable with NAVSTAR GPS and GLONASS. The reference and coordinate system used is the ETRS (European Terrestrial Reference System).

NAVigation Satellites with Time And Ranging – Global Positioning System (NAVSTAR – GPS)
The GPS space segment consists of 32 satellites in 6 orbital planes inclined at 55° at an altitude of 20230 km. The revolution period of the satellites is 11hours and 56minutes. The positioning accuracy for the civil segment has been increased from about 100m to 13m by suspending the SA (Selective Availability) technique. The reference system used is WGS84 (World Geodetic System 1984).

GLObal NAvigation Satellite System (GLONASS)
The GLONASS space segment comprises a total of 24 satellites in 3 orbital planes inclined at 64.8° at an altitude of 19100 km. The revolution period of the satellites is 11 hours and 16 minutes. From the 24 satellites projected, 16 satellites are currently operating. Each satellite has an atomic clock that generates a frequency from which the two carrier waves are formed. The transmitted signals are similar to the GPS system. The level of accuracy of the Russian GLONASS system is comparable to that of the NAVSTAR GPS system. In Romania, GLONASS can be used to complete the GPS constellation. The reference system used is PZ90.

Figure 9. Drone overflight

Workflow
The field works, after the realization of the geodetic and elevation networks, consist in collecting the necessary elements to survey the components of the urban networks, which appear on the surface, using the method of the polygonal traversing survey. and drone survey.
In case there are topographic or cadastral plans at scale 1:500 or 1:1000 for the elaboration of the complete technical building plan, the elements of planimetry concerning the street layout, plots with cadastral number and main beneficiaries will be taken from them. (Figure 9)
In case there are no such plans, the above-mentioned plan elements will be collected by measurements on the ground at the same time as the urban network elements are surveyed.

For manholes, the planimetric position of the centre of the manhole cover, its elevation and the elevation of the invert, as well as the manhole relief and its diameter shall be determined using a plotting compass, and the dimensions and diameters of the pipes leading into the manhole shall be determined using a wooden triangle mounted at the end of a wooden graded stake or stud.

The routes of the urban networks, in plan, are obtained by joining the covers of the manholes, or of the cable draw pit chambers, with conventional lines. The routes of the building networks, in the vertical plane, are obtained in the longitudinal profile using the manhole covers.

There are two methods for obtaining urban network routes, in plan and in elevation: the direct method and the indirect method. The direct method - consists of surveying the position of the network during its survey (before the trench is filled).

It allows high working speed and accuracy to be achieved. The planimetric and altimetric position of the characteristic points (covers, vents, valves, pipes, etc.) is determined from the points of the planimetric and geometric levelling paths of the order V.

Objectives

The objective of the urban network information system is the following: to provide real and quality information; to manage the localities efficiently using an information system based on cadastral data for decisions; to create a standard content for urban network plans, road maps (unique and standard) and central statements; to define unique criteria for the evaluation, verification and acceptance of works and products concerning the urban network fund.

RESULTS AND DISCUSSIONS

Implication/Benefits

Direct management of cadastre functions will allow local authorities: improve the integration of the technical and administrative functions of the cadastre;

- improve knowledge of land and buildings and therefore optimise the taxation process;
- to improve the process of alignment between cadastral and urban data;
- provide the public with a more user-friendly, functional and efficient service because it is physically delivered locally.

Orthofotoplan

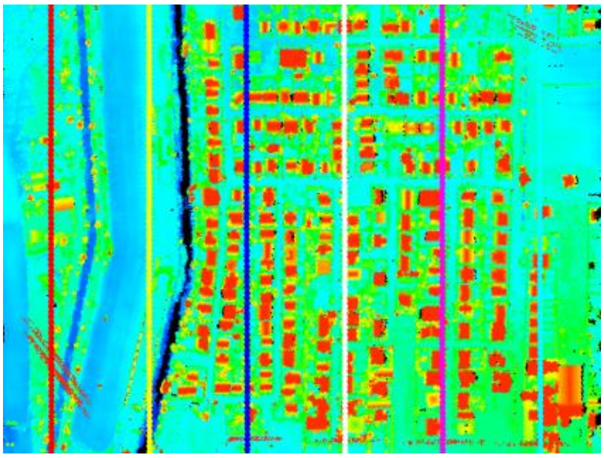

Figure 10. Orthophotoplan top view of Mosnita Noua

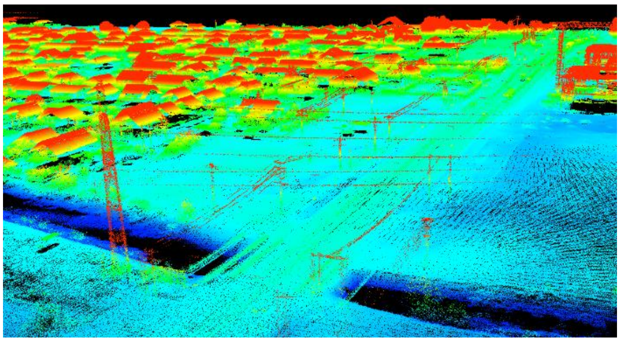

Figure 11. Orthophotoplan 3D view of Mosnita Noua

An orthophoto is an aerial photograph or satellite imagery geometrically corrected ("orthorectified") such that the scale is uniform: the photo or image follows a given map projection. Unlike an uncorrected aerial photograph, an orthophoto can be used to measure true distances, because it is an accurate representation of the Earth's surface, having been adjusted for topographic relief, lens distortion, and camera tilt (Figure 10) (Figure 11), (Moscovici et al., 2019).

Situation plan / Urban plan

Following the steps listed above, the result is a site plan, which shows the exact information and details of the building network.

We realized this plan for ATU Mosnita Noua in AutoDesk AutoCad (Figure 12).

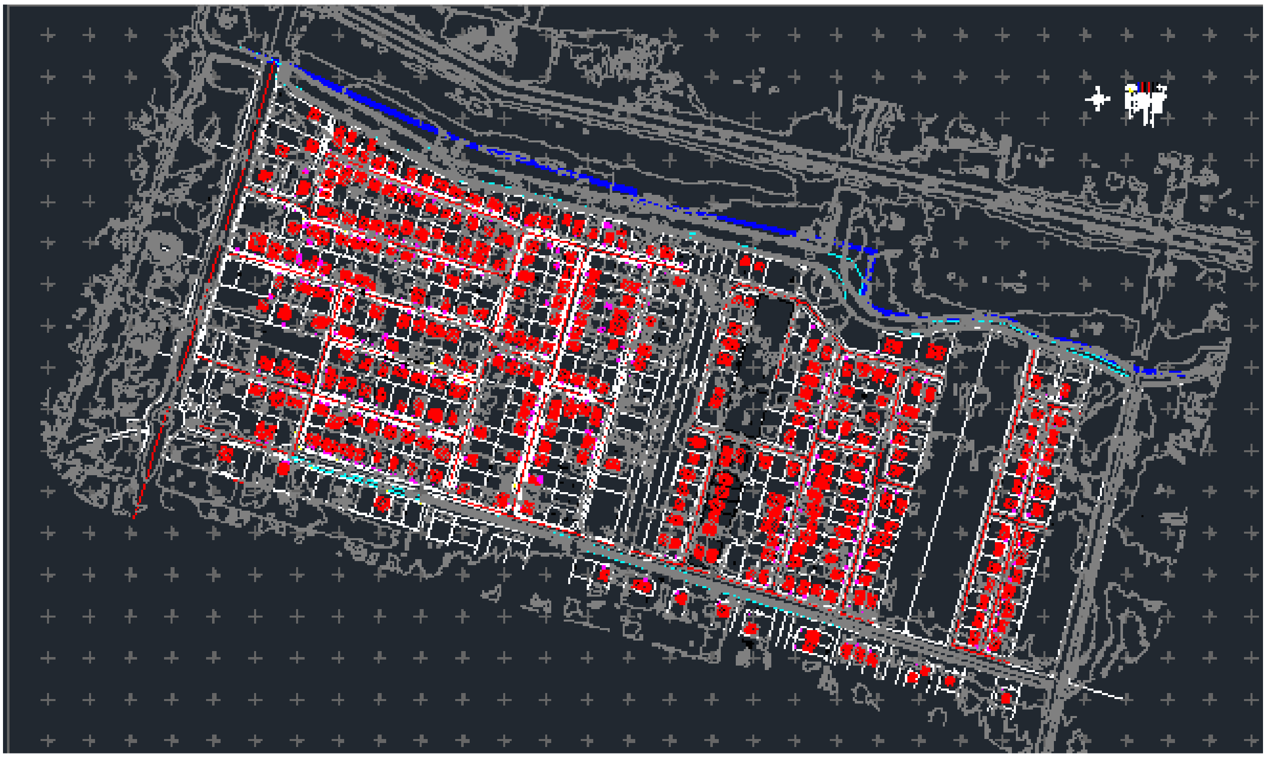

Figure 12. Urban Network Plan of Mosnita Noua

Parallel to Iceland – Saskatoon

The City of Saskatoon has visions of heated sidewalks, while they're a reality in Reykjavik. Imagine a city with snow-free sidewalks all winter long without having to be plowed or shovelled. This isn't a magical land it's Iceland, and the City of Saskatoon is looking towards it and a few other Scandinavian countries for inspiration (Figure 13), (Cbc, 2022).

The City of Saskatoon has visions of heated sidewalks, while they're a reality in Reykjavik.

Saskatoon's City Centre Plan proposes heated sidewalks in the downtown area. Not only would it make walking easier and avoid back aches from shovelling, it would also save the wintry city money (Orkustofnun).

On the volcanic island of Iceland, ground water from the earth's crust is used to heat Reykjavik homes. The water is between 100º and 300ºC.

The runoff water, which is about 30ºC, is then piped into plastic tubing inside the city's streets and sidewalks. Although there aren't any volcanoes on the Canadian prairies, Hjalmarsson said it's still possible to develop heated sidewalks in the city (Figure 14).

The city's plan says that sidewalks could be heated through connections with nearby public buildings or through the recapture of waste energy. It says that warmed pavement could also be incorporated with existing sidewalk infrastructure and they would be located in "strategic locations," such as City Hall Square.

Figure 13. Heated Sidewalks in Saskatoon

Figure 14. Heated Sidewalks in Saskatoon

Case study Italy, Florence (Lombardy)

The underground infrastructure network consists of street lighting, electricity, water, gas, sewerage (Figure 15) (Figure 16).

In order not to end up with problems, which may affect the city's building networks, for example: irrational use (Figure 17) excavation incidents, unauthorized construction, management of interferences, increased pollution, random occupancy, the following criteria will be addressed: directive Arrangement of technological systems underground, Application of law 26 (Management of local services of public interest, Rules on waste management, energy, use of underground resources and water resources) and Inspire Directive (Infrastructure for Spatial Information in Europe) (E. Falcomatà, 2022).

Figure 15. Organisation of infrastructure networks in Florence - Italy

A project coordinated by the Lombardy Regional Authority has been implemented in this city to address the issues listed above and will be carried out in the following stages: feasibility study, cost assessment and model testing.

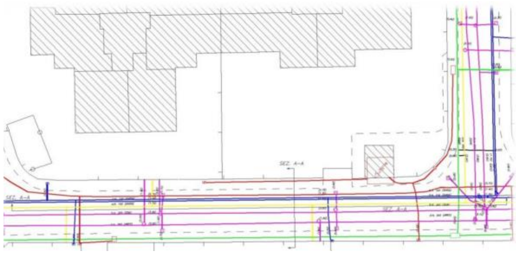

Figure 16. Urban Network plan in a part of Florence

Figure 17. Irrational use in middle of a street from Florence - Italy

In this application different mapping methods will be used (digital slit-plotting (Figure 18), GPR - Ground-penetrating radar standard or 3d complex), where the obtained data will be processed and 2d-3d WebGIS will be used.

-ground scanning

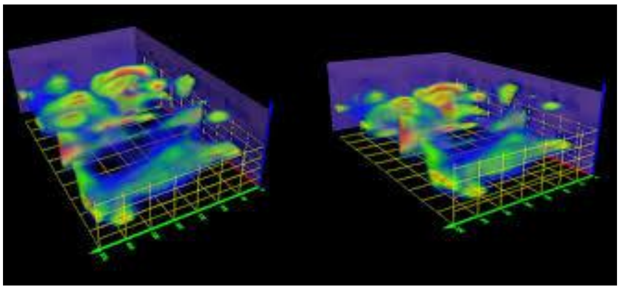

Figure 18. Ground penetrating radar

Eventually, a public portal will be obtained, containing all data sets for information exchange between utilities and authorities.

-WebGIS 2d and 3d portal (Figure 19).

Figure 19. WebGIS 2d interface

CONCLUSIONS

In conclusion, we can say that such a plan is very important, first of all for identifying the municipal network when building permissions are needed in areas where there are no buildings already in existence, and also where changes are made to the network or certain unpleasant situations arise. These plans help specialists in different fields, such as architecture, civil engineering, construction, to more easily identify problems in case of unexpected situations.

The need for a utility networks database in order to manage more efficiently the problems that may occur (cracks, blockages, leaks, power cuts, wire breaks) and for new utility connections for future constructions in the area is also answered by such an approach such the one presented.

At present, the building cadastre is under development in our country, and the authorities should keep track of their regular updates.

The implementation of the building cadastre in every ATU and the introduction of these data in a national GIS is a necessity for their recording, management and monitoring.

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