Scientific Bulletin of Politehnica University Timisoara
Transactions on HYDROTEHNICS

Volume 68(82), Issue 1, 2023

DIGITAL MAP – A PREREQUISITE OF SMART CITY

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Abstract: The combination of technologies and efficient urban planning makes up the smart city concept. Over the last 20 years, the geomatics industry has provided city planners with invaluable geospatial data that has helped them understand the environmental, social and economic profiles of buildings, streets and entire neighbourhoods. Smart cities, with their endless source of live sensors, will simply accelerate the process. In this actual context, combining the geomatics and smart cities technology industries will provide mutual co-benefits. Processing this vast amount of geo-linked information is the next frontier in efficient urban planning, enabling city officials diagnose and predict current and future urban phenomena. In essence, the smart city concept is based on geospatial data to enhance the understanding of complex urban systems. It is important that city manager scan quickly obtain relevant information about the urban infrastructure and urban services, as well as stakeholders (citizens) feedback.

Keywords: geomatic, urban development, smart city, digital map.

1. INTRODUCTION

By the year of 2050, about two-thirds of the world's population will live in cities. As the urban population continues to grow, demand for services and pressure on resources will increase. This will put issues such as energy, water, waste, mobility and other essential utilities of the city's prosperity and sustainability under a big challenge.

The last decades pressured the cities all over the world to become smarter and to develop smart initiatives in order to keep up with the global trends. Nevertheless, the pace to reach this objective is very different from one country to another. For the urban areas from the post-communist block, the race to smartness started late and run into a series of obstacles related to financing, understanding, and stakeholders' involvement. [1], [2], [3]

In recent years, both in our country and at the European level, from the point of view of urban planning and land use, a trend of decentralization of housing, trade and offices has appeared, simultaneously with the migration of the population from rural to urban areas. Analysing the data published by the National Institute of Statistics in Romania, it is observed that urban areas are increasingly crowded, and the design of a spatial system is necessary. It is becoming apparent that information continues to change over time and space, putting decision makers face to face with the challenge of finding a solution for better planning to maintain community services at the highest possible level and stimulate development sustainable in the context of "Smart Cities". [4]

The 'smart city' concept aims at developing a comprehensive system that uses geospatial data to enhance the understanding of complex urban systems and to improve the efficiency and security of these systems. This geospatial data concerns (i) the urban built environment such as infrastructure, buildings and public spaces, (ii) the natural environment such as biodiversity, green spaces, air quality, soil and water, and (iii) urban services such as transport, municipal waste, water, energy, health and education.

Smart cities also outline a more interactive and responsive city, safer public spaces and the ability to manage to react to the needs of the elderly population. [5]

The concept of smart city also includes the management of the real estate and building cadastre in the territory and the digital maps necessary for the planning and decision-making process of urban development, as well as for the realization and maintenance of cadastral works.

The creation of the Urban Data Bank, as an information system, is based on data from the general cadastre, the real estate cadastre, the building cadastre, water Supply and sewerages and other sectors of activity, which serve to formulate the global strategies of the localities in correlation with the development programs of the administration local, at all levels.

2. MATERIALS [6]

CGT Engineering SRL – Joint Laboratory for Applied Environmental Geotechnology of the University of Siena, represented by President Dr. Filippo Bonciani and Technical Director Prof. Eros Aiello together with S.C. Engsoft SRL, represented by the sole associate Dr. Filippo Catanzariti, have developed the GEOSTRU brand by investing in various specialized programs.

For years, CGT Engineering SRL has been conducting studies, research and designs related to geological, geomorphological, geotechnical, seismic, structural and environmental aspects using various advanced software programs in these fields, according to the documents of various scientific publications

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and the works carried out.

SC Engsoft SRL has developed advanced software systems and has a primary interest in encouraging the acquisition of applied and in-depth knowledge of geology, geomorphology, geotechnics and seismic studies in the field of structural engineering, aimed at identifying and defining multiple types of risk, in relation to national regulations and international in terms of existing and future constructions; also by using existing dedicated software that is to be updated or expanded or designed from scratch.

Carrying out the work of this consortium also involves making a useful contribution for educational purposes.

The major areas in which the GeoStru company offers software solutions are:

- Structures: calculation and design of reinforced concrete, steel and wood structures.
- Geotechnics: stability analysis of natural slopes, excavation fronts, anthropogenic slopes, slippery slopes, verification and design of reinforced concrete, gravity walls, gabion walls, rafter walls, verification and design of bulkheads, verification and design of foundation piles, verification and design of reinforced terrain, verification and design of stone slope reinforcement.
- Local seismic response: one-dimensional, two-dimensional local seismic response analyzes and multi-level simulation studies are performed; we can perform full or partial analysis such as research and import of accelerograms in standard formats.
- In situ tests: interpretation of dynamic and static penetrometry tests.
- Geophysics: Interpretation of MASW, Refraction, DownHole, HVSR tests.
- Geology: liquefaction checks, rock mechanics analysis.
- Hydraulics: checks under conditions of uniform and permanent movement of river sections, hydrological processing of watersheds.
- Hydrology: hydrological processing.
- Topography: high-resolution digital aerial photogrammetric surveys, aerial photogrammetry, made with totally digital technologies, characterization, qualification and measurement of territorial elements.

2.1. GEOSTRU MAPS

GeoStru digital map can be accessed from the company page, from the Web Services section. There is also a mobile application developed for the Android operating system, but at the moment, its available features are specific to the field of geotechnical engineering, namely: reinforced soils and rods/nails for passive bars. (Figure 1).

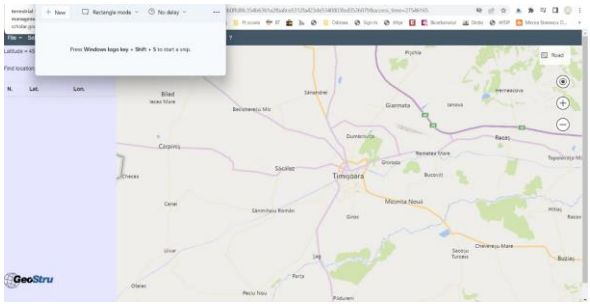

Figure 1**.** Geoapp view – city of Timișoara map

At the moment, the digital map comprises in 3 layers: Road, Aerial and Bird's Eye. (Figures 2, 3 and 4). [7]

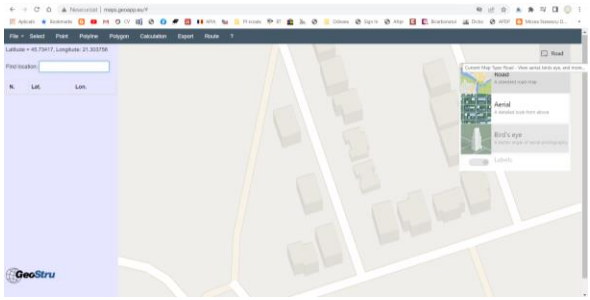

Figure 2. Geoapp screenshot for highlighting the available layers

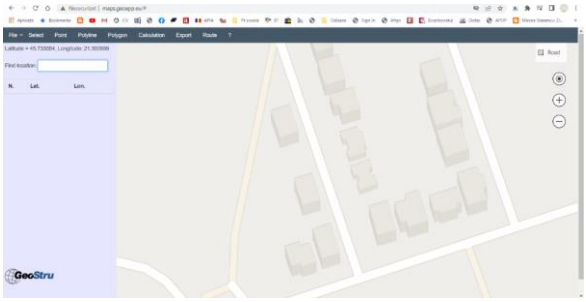

Figure 3. "Road" layer in GeoApp

Figure 4. "Aerial" layer in GeoApp

The digital map includes drawing tools: points, polylines and polygons, so the figures below show how to create a property boundary using the Polyline command. The geographic coordinates of the entered points are displayed in the legend positioned on the left side of the window. (Figures 5 and 6).

Figure 5. Creating a property boundary using the Polyline command

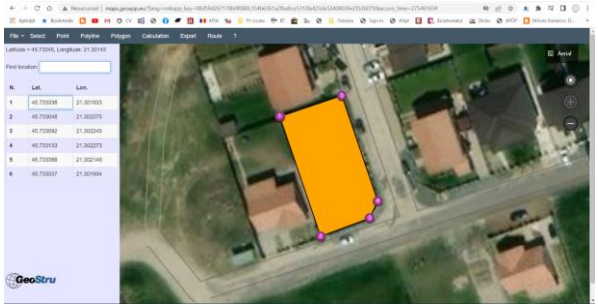

Figure 6. Using the Polygon command to select the contour of the studied property

3. CASE STUDIES BASED ON GEOAPP

Next, 2 case studies will be presented developed by using GeoStru digital map.

3.1 COMPARATIVE STUDY TO DETERMINE THE ROUTE BETWEEN THE FACULTY OF CONSTRUCTION IN TIMIȘOARA AND A CERTAIN BUILDING

We proposed a comparative study to determine the route between the Civil Engineering Faculty located in Timișoara municipality, no.2, Traian Lalescu Street, and a residential building located in Moșnița Nouă locality, SIRUTA code 157834 (Figure 7).

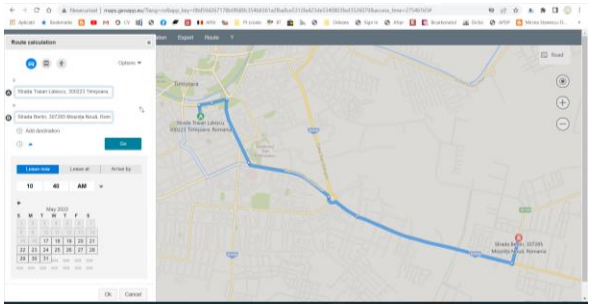

Figure 7. Route calculation from GeoApp

In the GeoStru digital map, the route between the 2 points of interest is displayed, but it has the disadvantage that it does not estimate the required travel time and does not give the user the opportunity to position a point to identify the exact address, but only calculates with addresses based on postal codes that it has implemented. (Figure 8).

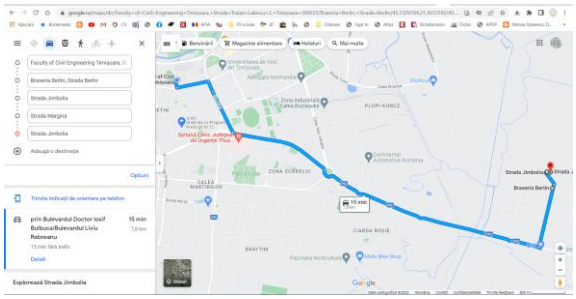

Figure 8. Route calculation between the Civil Engineering Faculty and the building using Google Maps application [8]

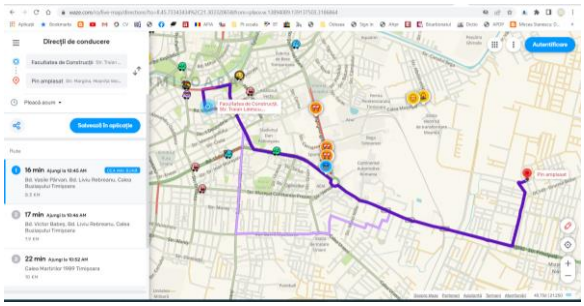

Figure 9. Route calculation between the Civil Engineering Faculty and the residential building using Waze application [9]

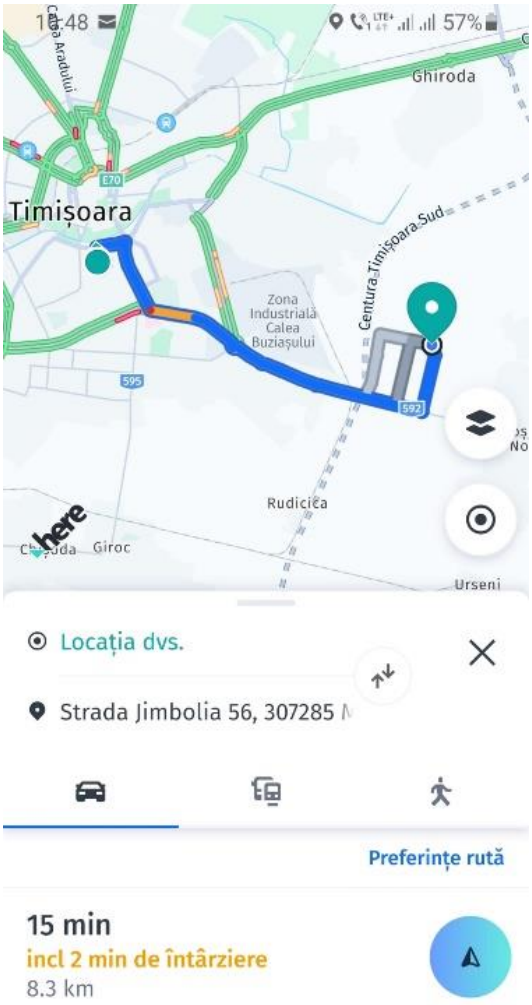

Figure 10. Route calculation between the Civil Engineering Faculty and the residential building using Here WeGo application [10]

As can be seen from all 3 functional applications, the estimated travel time of the route between the Civil Engineering Faculty and the residential building considered in the study, is similar, i.e. 15-16 minutes.

3.2 GEOSTRU MAP/ETERRA DATA COMPARISON

To begin with, we identified the residential building in the National Agency for Cadastre and Land Registration (NACLR) geoportal using its cadastral number, as can be seen in the figure below. (Figures 11, 12, 13 and 14).

Figure 11. Identifying the estate in NACLR geoportal [11]

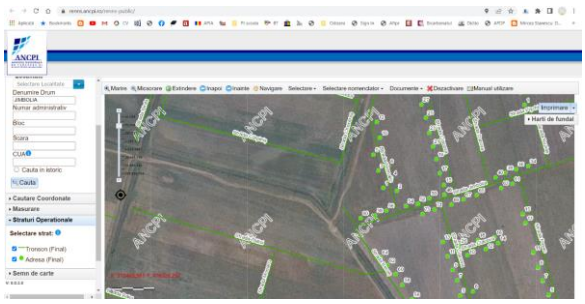

Figure 12. Identifying the estate in Electronic National Registry of Street Nomenclature, ANCPI [12]

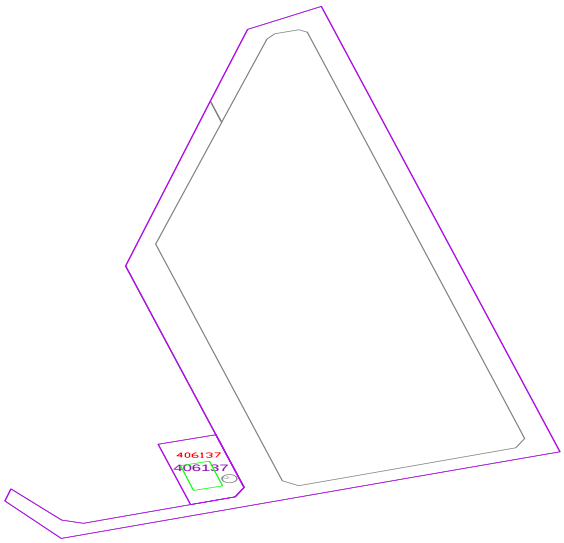

Figure 13. Downloading the estate's spatial data from eTerra application

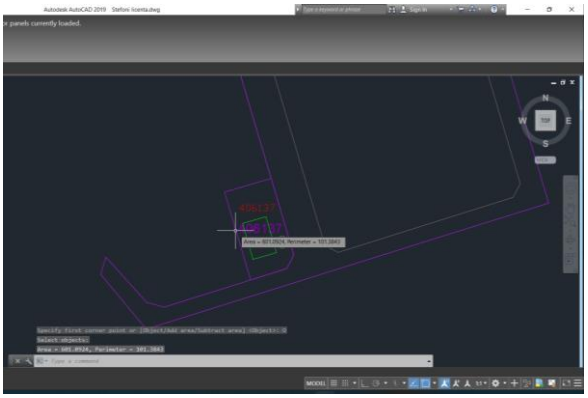

Figure 14. Inquiring the estate's area in AutoCad application

Considering the fact that for the issuance of the construction permit, the scaled plan used by both the architect and the builder is required, we have highlighted in the figures below a relatively easy way by which we can carry out an elevation study of an area of interest using only GeoStru Maps. (Figure 15).

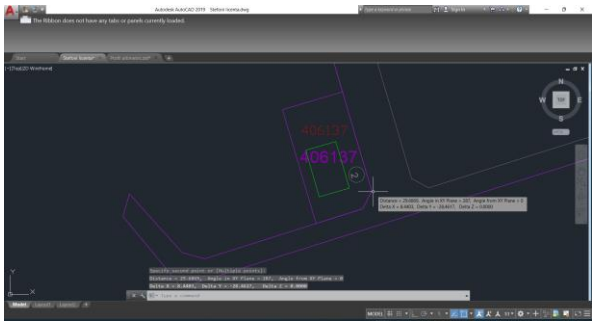

Figure 15. Real estate frontage query – 29,70m

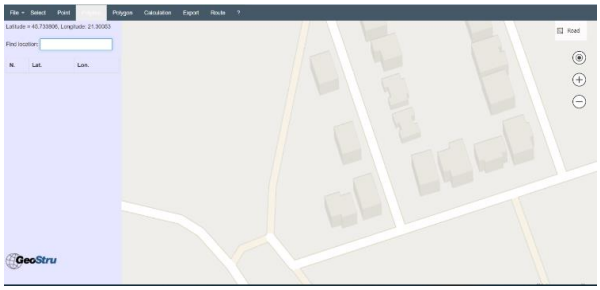

Figure 16. Identification of the property studied in the GeoApp

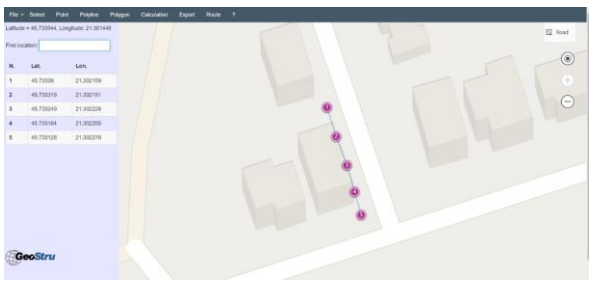

Figure 17. Positioning a polyline inside the area of interest to create an altimetric profile

After choosing on the map the points necessary to create the altimetric profile (Figure 17), the application allows selecting the Section command from the Calculation column to display the altimetric profile of the polyline just drawn (Figure 18).

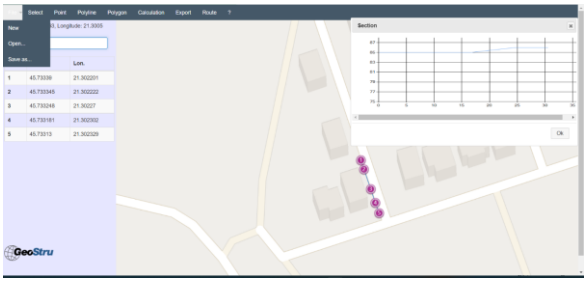

Figure 18. Altimeter profile calculation result

The results obtained in order to calculate the altimetric profile can also be exported in DXF format for further processing (Figure 19).

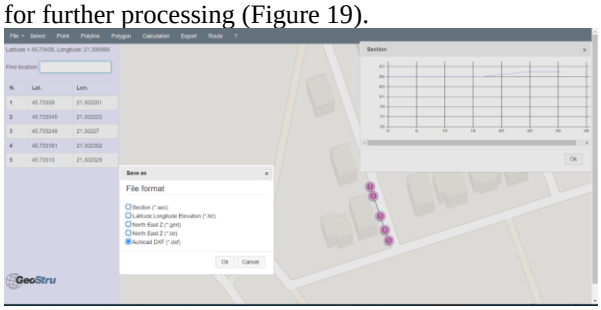

Figure 19. Execution of the data export command

4. CONCLUSIONS

The smart city concept is developing very quickly around the world, because it provides a comprehensive digital environment that improves the efficiency and security of urban systems and reinforces the involvement of citizens in urban development. This concept is based on the use of geospatial data concerning the urban built environment, the natural environment and urban services.

The successful implementation of a smart city project requires the development of a digital system that can manage and visualise the geospatial data in a user-friendly environment. The geographic information system (GIS) offers advanced and user-friendly capabilities for smart city projects.

Considering the current context in which the maximum optimization of the land is desired, the geodetic engineer has an important role in urban development as he provides the material basis necessary to identify the optimal solutions regarding territorial systematization, by surveying on the field the geospatial data necessary to update the digital maps. [13]

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