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Original Contribution

TYPES OF SPECIALIZED MAPS AND REGISTERS IN INVESTMENT PROJECT DESIGN

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Abstract: *Specialized maps and registers are an important source of spatial and thematic information in spatial planning and investment project design. The aim of this study is to systematize the main types of specialized maps and registers used in the surveying, design, construction, and operation of investment projects. The study examines specialized maps and registers related to real properties, technical infrastructure, perennial crops, surface waters, subsurface natural resources, terrain, and sites and territories subject to special legal regimes. Examples of the visualization of technical infrastructure data through the Geographic Information System of Shumen Municipality are also presented. The analysis highlights the importance of specialized maps and registers for providing up-to-date and spatially referenced information for the preparation and implementation of investment projects.*

Key words: *Specialized maps, Specialized registers, Specialized cadastre, Investment project design, Technical infrastructure, GIS.*

1. Introduction

Specialized maps and registers constitute an important component of the spatial information system in the Republic of Bulgaria. Their creation, content, and maintenance are regulated by the Cadastre and Property Register Act (CPRA), which establishes the main requirements for the creation and maintenance of specialized maps, registers, and information systems, as well as their relationship with cadastral data. Pursuant to Article 32 of the CPRA, government authorities, municipalities, utility companies, and other legal entities, according to the nature of their functions, organize the collection and updating of specialized data on real properties and create and maintain specialized maps, registers, and information systems [1].

2. Related work

Previous studies have examined the structure, content, and main principles for the creation and maintenance of specialized maps and registers as part of the spatial information system. The relationship between cadastral maps and registers and specialized maps and registers has also been analyzed, along with the possibilities for using geographic information

systems for the processing, visualization, and maintenance of specialized spatial data. Other studies have focused on the creation of specialized maps and registers for specific types of sites and territories. The present study extends this research by systematizing the main types of specialized maps and registers according to their purpose and application in investment project design.

3. Problem description and results

The Cadastre and Property Register Act does not provide a detailed classification of the individual types of specialized maps and registers, but rather establishes the general requirements for their compatibility with the cadastral map and cadastral registers. For the purposes of the present study, and in accordance with the current regulatory framework and the application of specialized cadastre in investment project design, specialized maps and registers are grouped into the main categories most commonly used in the surveying, design, construction, and operation of investment projects.

The first group comprises specialized maps and registers of additional characteristics of real properties. They represent a type of specialized map and register proposed in the present study, through which the basic cadastral information can be supplemented with spatial and attribute data describing the functional condition, use, and development characteristics of real properties. The specialized map may include information on land use, types of fences, pavements, elements of technical infrastructure, site development elements, perennial vegetation, small architectural structures, and other spatially identifiable objects and characteristics. The specialized register supplements the graphical information with descriptive and technical data on the represented objects, such as type, purpose, material, condition, dimensions, and other characteristics depending on the specific object.

The next group includes specialized maps and registers of energy infrastructure. They contain basic cadastral and specialized data on energy facilities forming part of the electricity transmission and distribution networks. These maps represent the boundaries and numbers of land parcels and buildings, the boundaries or outlines of independent units within buildings or technical infrastructure facilities, as well as the relevant administrative and territorial boundaries. The specialized data cover high-, medium-, and low-voltage linear energy facilities, including the axes of overhead and underground power lines, collectors and cable duct systems, the locations and numbers of poles supporting overhead power lines, voltage levels, dispatch designations of high-voltage power lines, cable installation methods, and the locations of cable manholes, electricity meter panels, cable distribution cabinets, and distribution boxes. Site-based energy facilities are also represented, including the locations and fences of substations, the locations of switching stations and transformer substations, their designations, and voltage levels. The specialized maps also represent the easement zones of overhead and underground high-, medium-, and low-voltage power lines, as well as zones of restrictions affecting land parcels [3].

The specialized registers contain technical and descriptive data on energy facilities. For overhead and underground power lines, data are maintained on the unique identification code, ownership document, type of power line, rated voltage, dispatch designation, the starting and ending points of high-voltage power lines and their branches, as well as information on their decommissioning. For electrical substations, switching stations, and transformer substations, the registers contain data on the unique identification code, ownership rights, type and dispatch designation of the facility, voltage level, and decommissioning. The registers also include data on the legal basis for the establishment of easement zones and restrictions, the type of restriction, the beneficiary in whose favor it has been established, and the period of its validity.

The application of geographic information systems for the representation of electricity infrastructure can also be observed in the GIS of Shumen Municipality. In addition to the locations of power lines, the system provides information on individual facilities, including data on line type, voltage, material, operator, and other characteristics. An example is presented in Fig. 1.

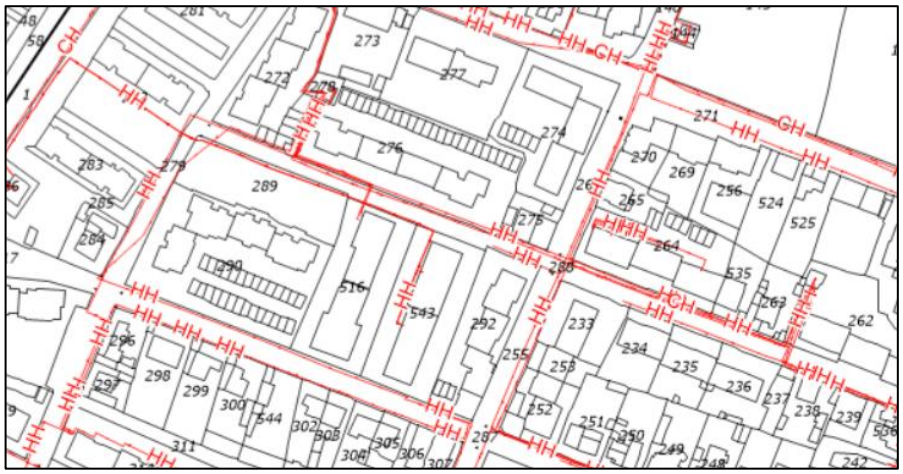


Fig. 1. Power Line Network of Shumen Presented in the GIS of Shumen Municipality
Source: GIS of Shumen Municipality

Specialized maps and registers of water supply and sewerage infrastructure are of particular importance. Specialized maps of water supply infrastructure represent water supply networks, including transmission and distribution pipelines and their branches, as well as the associated facilities – water intake structures, catchments, wells and boreholes, drinking water treatment plants, pumping stations, reservoirs and storage tanks, water towers, water meter and valve chambers, shut-off valves, fire hydrants, air valves, drain valves, pressure regulators, and other facilities ensuring the operation and management of the water supply system [11].

A practical example of the representation of water supply infrastructure is provided by the GIS of Shumen Municipality, which visualizes the routes of the water supply network and the main characteristics of its individual elements. A fragment of the water supply network of Shumen is presented in Fig. 2.



Fig. 2. Water Supply Network of Shumen Presented in the GIS of Shumen Municipality

Source: GIS of Shumen Municipality

For sewerage infrastructure, the routes of sanitary, stormwater, and combined sewer networks are represented, together with the main and secondary sewer collectors and their branches. The associated sewerage facilities are also shown, including inspection and junction manholes, stormwater inlets, sewage pumping stations, overflow structures and outfall channels, retention and control facilities, structures for crossing natural and artificial obstacles, discharge points, as well as wastewater treatment plants and their main associated facilities. The specialized maps represent the spatial location of pipelines and facilities, the characteristic points of the networks, and their main technical characteristics, as well as, where applicable, easement strips and the related restrictions.

The GIS of Shumen Municipality also maintains data on sewerage infrastructure, allowing the location of the network and the characteristics of its individual elements to be traced. An example of the representation of these data is presented in Fig. 3.



Fig. 3. Sewerage Network of Shumen Presented in the GIS of Shumen Municipality
Source: GIS of Shumen Municipality

The specialized registers supplement the graphical information with technical and descriptive characteristics of the individual elements of the water supply and sewerage infrastructure. They may contain data on the type and purpose of pipelines and facilities, material, diameter or cross-section, length, installation depth, elevations of characteristic points, year of construction, and other characteristics depending on the type of facility. For sewer pipelines, data on slope, direction of flow, and invert elevations of pipes and manholes may be included, while for water supply networks, data on operating pressure and the associated valves and facilities may be provided.

Specialized maps and registers of gas supply infrastructure also form part of the technical infrastructure. They represent the routes of transmission and distribution gas pipelines, pipeline branches, and associated facilities, including gas pressure regulating stations and points, gas metering stations and points, compressor stations, valve assemblies, shut-off, regulating and safety valves, condensate collectors, cathodic protection devices, monitoring and measuring points, and other facilities ensuring the operation and management of the gas supply system. The spatial location of gas pipelines and facilities, characteristic points of the network, as well as easement zones and the related restrictions are also represented.

Data on gas supply infrastructure are also available in the GIS of Shumen Municipality. The system enables the visualization of the routes of the gas pipeline network and the available characteristics of its individual elements, as shown in Fig. 4.



Fig. 4. Gas Pipeline Network of Shumen Presented in the GIS of Shumen Municipality
Source: GIS of Shumen Municipality

The specialized registers maintain technical and descriptive data on the individual elements of gas supply infrastructure. They may contain information on the type and purpose of the gas pipeline or facility, material, diameter, length and installation depth of the pipelines, operating pressure, year of construction, and other characteristics depending on the type of facility. For associated facilities, data may be included on their type, purpose, technical parameters, and operational condition.

Specialized maps and registers of electronic communications networks, facilities, and the related physical infrastructure are also used in investment project design. They contain basic cadastral, spatial, and technical data on electronic communications network facilities, including location, type of network and facilities, technical characteristics, and other information related to their construction and operation [4].



Fig. 5. Fiber-Optic Cables in Shumen Presented in the GIS of Shumen Municipality
Source: GIS of Shumen Municipality

The specialized maps represent the routes of underground and overhead electronic communications networks, cable duct networks, manholes, collectors, poles, antenna facilities, communication towers, base stations, and other elements of electronic communications networks and the related physical infrastructure. They also show the boundaries and identifiers of land parcels and buildings, the spatial location of networks and facilities, characteristic points along the routes, as well as easement zones and restrictions, where applicable.

A practical example of the representation of elements of electronic communications networks is the information on fiber-optic cables available in the GIS of Shumen Municipality, included in the "Underground Utilities and Facilities" group. The location of the fiber-optic cables is visualized through the "Fiber Optics" layer, as shown in Fig. 5.

The specialized registers contain identification, technical, and descriptive data on the individual elements of electronic communications networks and the related physical infrastructure. They maintain data on the type and purpose of the network or facility, the unique identification code, technical parameters, construction method, main operational characteristics, and other information required for the identification and maintenance of the facilities.

A separate category comprises specialized maps and registers of perennial crops. They contain spatial and descriptive data on areas occupied by perennial agricultural crops, including orchards, vineyards, berry plantations, nurseries, and other perennial crops. The specialized maps may represent the location, boundaries, and area of the plantations, as well as their spatial distribution within land parcels. Depending on the type of plantation, they may also include information on plant species, varietal composition, planting pattern and density, year of establishment, and other characteristics related to the condition and use of the plantations.

Vineyards occupy a particular place within this category, as the creation of a specialized map and register of vineyard holdings is regulated by law. The specialized vineyard map contains basic cadastral and specialized data, including grapevine varieties, planting density and year of planting, soil and climatic characteristics, and the form of management of vineyard parcels. The basic unit of the specialized map is the vineyard holding, while vineyard parcels are linked to the identifiers of the corresponding land parcels. The register of vineyard holdings contains identification and descriptive data on the holdings, vineyard parcels, and wine grape producers [5].

Specialized maps and registers of surface waters constitute an important component of specialized cadastre in investment project design. They represent the location, boundaries, and spatial extent of rivers, lakes, reservoirs, canals, and other surface water features, as well as the boundaries of surface water bodies. Different categories of surface waters are represented, including rivers, lakes, transitional and coastal waters, as well as artificial and heavily modified water bodies [6].

The specialized registers contain data on the type and category of waters and water bodies, their location, main characteristics, ownership, and condition. They may also include data describing the quantitative and qualitative characteristics of the waters, the extent to which they have been studied and utilized, as well as other characteristics related to the management and protection of water resources. The combined use of specialized maps and registers provides spatial and descriptive information on surface waters and supports their management, protection, and use, as well as spatial planning and investment project design.

Specialized maps and registers also include those relating to subsurface natural resources. They contain information on the spatial location of mineral deposits, their boundaries, and the individual sections defined within them. Deposits subject to registration

include those established as a result of approved commercial discoveries of subsurface resources, deposits currently in operation, undeveloped deposits, and deposits where extraction has been discontinued. The boundaries of deposits are determined according to natural and technological conditions, while individual deposits and sections are identified by the relevant codes. The map is compiled on the basis of topographic plans and vertical projections at appropriate scales and represents the spatial location and boundaries of the deposits.

The register of mineral deposits contains identification and descriptive data on deposits of subsurface resources, including an identification code, the name and location of the deposit, the type of subsurface resource, data on reserves and resources, the status of the deposit, and other information related to its exploration and utilization. The identification code ensures an unambiguous link between the information contained in the specialized map and the register. Specialized cadastral data make it possible to determine the location and spatial extent of mineral deposits and are relevant to spatial planning and infrastructure design [7].

The digital terrain model constitutes an essential element of investment project design. Specialized data on the relief of the Earth's surface represent the landforms, elevation, and characteristic features of the terrain. Relief is represented by contour lines, elevations of characteristic points, conventional symbols for characteristic and disturbed terrain forms, as well as by a digital terrain model. These data enable the determination of terrain elevations, slopes, aspect, and configuration and provide the elevation information required for spatial planning and investment project design [9, 10].

A separate category comprises specialized maps and registers of sites and territories subject to special legal regimes. These include immovable cultural heritage assets, archaeological sites, protected territories, protected areas, sites related to mining activities, as well as other sites and territories for which the regulatory framework establishes special regimes for protection, development, or use. Information on such sites and territories is essential for the preparation and approval of investment projects, as it enables the identification of the applicable restrictions, regimes, and conditions for the implementation of investment proposals [8].

4. Conclusion

Regardless of their thematic focus, all specialized maps and registers perform a common function – they provide up-to-date, reliable, and spatially referenced information required for spatial planning, investment project design, construction, and operation of technical infrastructure. Under current conditions, they are created and maintained predominantly in a digital environment through geographic information systems, which enables the efficient exchange of spatial data, updating of information, and integration of different thematic information systems into a unified environment for territorial management.

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