

Specialized topographic maps: types and content, methods and technologies of creation

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Abstract:

Topographic maps of Russia represent the basis of the state cartographic fund of the country.

However, the understanding of the natural resource potential of the territory, the preservation of natural and cultural heritage, and solving navigation tasks has led to the use of topographic maps, the content of which goes beyond multi-purpose universal maps. Environmental problems are currently a priority. These reasons led to the division of topographic maps into universal and specialized, focused on certain groups of consumers.

What is a specialized topographic map? The authors define them as maps created on the basis of universal topographic maps within their accuracy and in a single technological cycle with them, with the addition of content or its directed unloading for a specific area of use (while maintaining the image of a complex of basic topographic objects).

The fundamental condition for the creation of specialized maps is not to violate the historically established type of universal topographic maps, which is determined by the display of external visible elements of the landscape.

It revealed a demand for specialized maps after analyzing domestic and foreign mapping experience.

Domestic and foreign maps are used to ensure environmental safety, inventory of natural resources, monitoring of technological processes, and prevention of critical situations. We give examples of directions for using specialized maps and requirements for their content in Table 1.

Table 1. Directions for the use of specialized topographic maps of Russia and requirements for their content (examples)*

Application industries	Basic requirements for the content of maps	Directions of use	Scales of maps and plans
Reclamation and water management	High fidelity terrain display Contour interval up to 0.25 m Height mark density - up to 80 per 1 sq.dm Elevation labels for: all bridges; water intake and drainage facilities; inlet and outlet channels; pumping stations; Height marks of water edges and along thalwegs every 5 cm of the map Displaying the boundaries of the projected reservoirs Separation of swamps by passability Characteristics of forest belts: width and number	Engineering survey Design Ameliorative construction Routing of channels and pipelines Identification of flood boundaries	1:50 000 1:25 000 1:10 000 1:5 000 1:2 000 1:1 000 1:500

Application industries	Basic requirements for the content of maps	Directions of use	Scales of maps and plans
	of rows of trees Signatures of the heights of communication lines and power lines (lower and upper wires)		
Geological intelligence service	Increased requirements for depicting the morphology and dynamics of meso- and micro-relief forms Display: - outcrops (in quarries, cliffs, landslide slopes); - mine workings and developments with the characteristics of the mining material; - wells and their characteristics; - a detailed drawing of the hydrographic network, especially in closed forest areas; - zones of wedging out and exits to the surface of groundwater; - generalized - building and planning of settlements, road network.	Prospecting and exploration, preliminary and detailed exploration Design of mining enterprises Field development Design of geological survey routes Selection of well laying sites Defining the boundaries of geological objects	1:25 000 1:10 000 1:5 000 1:2 000 1:1 000

*We show fragments of the pivot table due to the limited scope of the abstract.

Agreements are made with customers on specialized maps' content, reporting materials, and final products. But in the considered direction of mapping, there are also theoretical aspects that we have not met in the scientific literature.

Examples of theoretical developments are:

- categories and limits of maps specialization;
- problems of transferring the necessary thematic information without violating the type of a universal topographic map;
- development of optimal methods and technologies for creating specialized maps, etc.

In our research, the theoretical side of creating maps is the scientific substantiation of a certain type of maps that is relevant for solving modern problems of the country's economic sectors and environmental safety. At present, the following types of specialized topographic maps and photo maps have been developed and substantiated by the team of authors:

- for forestry and related industries;
- for oil and gas purposes (design, construction and operation of underground gas storages in rock salt)
- for hydropower design, construction with an assessment of the ecological state and recreational use of the territory;
- for environmental protection using the example of bog massifs;

The development of each type includes:

- the system and structure of the content of the maps (with illustrations of symbols and samples of maps);
- methods for creating maps;
- geoinformation technologies for creating maps with author's specialized software, 3D models of underground gas reservoirs, images of geological and technological models, results of work in programs, etc.

Technologies involve the creation of specialized topographic maps in a single technological cycle with the universal topographic maps, provided that the most expensive processes are performed once.

The report is supposed to give a generalized idea of the types, methods and technology of creating specialized maps, to present the theoretical problems associated with them and to describe the concept and its implementation in the developed new type of map for environmental purposes for the territories of hard-to-reach, specific wetlands, remarkable for the scale of biospheric functions (on the example of the continental bog and the UNESCO Biosphere Reserve on the shelf of the Caspian Sea). In this way, our abstract and presentation will differ from the reports of 2019 and 2021 devoted to ensuring the requirements for the design, construction and operation of underground gas storages in rock salt and other sectors of the economy.