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LARGE-SCALE ENGINEERING AND TOPOGRAPHIC PLANS.

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Abstract: This article describes in detail the ideas of large-scale engineering exploration and topographic plans.

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INTRODUCTION.

Large-scale topographical plans are prepared on a scale of 1:5000, 1:2000, 1:1000 and 1:500. Large-scale plans are drawn up by enterprises to solve topographic and geodetic tasks of national purpose (surveys). In addition, individual ministries, departments and organizations can create network, specialized engineering-topographic plans to solve specific problems. Tasks in a specific field are land surveying, forestry, canal, land surveying, cadastre and other topographical plans.

The main large-scale plans are drawn up in full accordance with the current rules and topographical guidelines, in the listed scales, with all objects, contours and images, relief elements are determined in accordance with the current conventional symbols.

Specialized plans are drawn up taking into account the technical requirements of departmental instructions and manuals for topographic-geodetic work, construction norms and rules, and other regulatory documents. A large group of specialized large-scale surveys are topographic surveys performed for the purposes of design, construction and technical operation of engineering structures [1-5].

MAIN PART.

Depending on the purpose, research engineering and topographical plans are allocated for the selection of construction sites and detailed design of structures or for choosing the best option for the route; execution plans drawn up during the construction of facilities for completed objects or construction stages; inventory plans include industries or departments created for the purposes of accounting for elements and objects of economic activity. In addition to the above, an increasing amount of large-scale research is occupied by cadastral plans of private and public property with buildings, land, water and forest land, their detailed descriptions, cost and quality assessment.

During engineering-geodetic surveys for construction, topographical photography of the territory is carried out by the following methods: horizontal, high (vertical), scaled, tacheometric, surface leveling, ground phototopographic, stereotopographic, combined aerial phototopographic, satellite geodetic equipment (GPS reception and others), as well as a combination of different methods [6-11].

As a rule, engineering-topographical plans and main pipelines should be drawn up on the basis of aerial photo-photographic materials during studies on the development of urban planning and project documents for the construction of large industrial enterprises, railways and highways, main canals. The topographic survey of the land should be carried out in the following cases, the use of aerial photography is not economically feasible, it is not possible to implement it, or the aerial phototopographic method does not provide the necessary accuracy of drawing up plans.

During research on the construction of railways and highways, main canals and main pipelines, ground topographic surveying is carried out, as a rule, on sections of these linear structures and at crossings and intersections. Engineering and topographic plans can be presented in graphic form or in the form of digital views (digital engineering and topographic plan).

The results of topographic research can be presented in the form of topographic and geodetic materials for the preparation of the city cadastre and other cadastres, engineering-geodetic data banks, as well as in the form of geographic information systems (GIS) of settlements and related enterprises. Degree. Digital engineering topographic plans are created on the basis of automated methods (by transferring data from electronic storage devices of geodetic instruments) or by digitizing the graphic image of plans and subsequent vectorization of raster files obtained after scanning plans [12-17].

The accuracy of the digital engineering and topographic plan should not be lower than the accuracy of the engineering and topographic plan in graphic form at the appropriate scale. Information digital engineering topographic plan must comply with the current symbols for topographic plans. When creating engineering and topographic plans for areas up to 20 km2, as a rule, a square layout with frames of 40 × 40 cm is used for plan sheets of 1: 5000 and 50 × 50 cm. 1:2000, 1:1000 and 1:500 scale plans.

A plan sheet on a scale of 1:5000 should be taken as a basis for the scheme, its nomenclature should be indicated by Arabic numerals. It fits on four sheets of scale plan. The nomenclature of 1:2000 is formed by adding one of the first four initials of the Russian language to the nomenclature of the plan sheet on the scale of 1:5000. Alphabet - A, B, C, G (for example, 14-B).

A 1:2000 scale plan sheet corresponds to four scale sheets.

1:1000, indicated by Roman numerals (I, II, III, IV) and sheet 16 of the plan at a scale of 1:500, indicated by Arabic numerals (1, 2, 3 ..., 16).

The nomenclature of the 1:1000 or 1:500 scale plan sheets shall consist of the nomenclature of the 1:2000 scale plan sheets and the corresponding Roman.

Figures for a plan sheet at a scale of 1:1000 or Arabic numerals for a plan sheet at a scale of 1:500 (for example, 14-B-IV or 14-B-16).

The topographical plan is distinguished by its accuracy, detail and completeness, it reflects the situation and the land.

The values of the average errors (errors) in the position on the plans of objects and the ground contours with exact contours relative to the nearest points should not exceed 0.5 mm, in mountainous and forested areas - 0.7 mm [18-22].

The average errors in the relief survey relative to the nearest points of survey justification should not exceed the height:

• 1/4 of the accepted height of the relief section at slope angles up to 2°;

• 1/3 of the accepted height of the relief plot, at angles of slope from 2° to 6° for plans. Scales 1:5000, 1:2000 and 2° to 10° for 1:1000 and 1:500 scale plans;

• 1/3 of the accepted height of the relief section when the relief is cut from 0.5 m. Scale plans 1:5000 and 1:2000.

In the Guide to Topographic Photography, as in other NTAs for topographic photography, the mean error is for convenience and simplicity in estimating accuracy. It works based on practical experience in topographic control. Although in SP 11-104-97 and SNiP 11-02-96, as well as in [19] there is a "Theory of Errors" for the transition from average errors to root mean square errors, a coefficient of 1.4 is used is used. This justifies the value of the coefficient equal to 1.25.

Plan accuracy is defined as the total root mean square error in plan and elevation of the described points of the situation and terrain.

It is determined by the mean square error of the planned position of the points, a well-known formula

$$mr = \sqrt{m_x^2 + m_y^2},$$

Here m_x va m_y - mean square measurement errors on the abscissa plot and the ordinates of the points. Received

$$m_x = m_y = m_к \ olamiz: \ m_T = m_k\sqrt{2}.$$

In general, point coordinate errors include errors in the construction of a planned basis, errors in survey measurements and graphic constructions, and errors due to the deformation of plates or photo paper. Geodetic grounding, often with an error of no more than 0.1 mm on the plan; are ignored and errors in the position of plan points are considered relatively. The nearest geodetic reference points are determined [23-26].

Error for plans of areas with capital development according to experimental data $m_к$ = 0,2 mm and plans for less built-up areas m_k = 0.3 mm. Therefore, according to the formula (5.2), the accuracy of the plan:

$$m_T = (0.2 \div 0.3)\sqrt{2} = 0.3 \div 0.4\ mm$$

The accuracy of plans obtained by different topographic and photogrammetric methods varies slightly, but does not exceed those recorded. Borders are 0.3÷ 0.4 mm.

The accuracy of the relief image is determined by the errors in the location of the contour lines on the plan. These errors can be divided into two groups:

1. Altitude errors are slightly dependent on the angle of inclination of the ground. These errors are the determination of the heights of the picket points, the generalization errors of the relief due to the homogeneity of the slopes between the pickets, the effect of small irregularities of the earth's surface.

2. Elevation errors resulting from the planned shift of contour lines and the associated ground slope. These are errors in the planned position of picket points, interpolation of heights, drawing contour lines. From the slope of the earth, these are errors in the planned position of picket points, interpolation of heights, drawing contour lines [27-29].

According to the research, such errors are the first groups, generalization of the relief and the effect of "topographical errors", depending on the nature of the land and the distances between the picket points. These errors are random in nature and can be determined by the following formula:

mH=a+btgv

here m_H - mean square error in determining the heights of points along horizontal lines;

v - the slope angle of the ground;

a and b are parameters reflecting the influence, respectively, of the first and second groups of errors and plans determined by the method of least squares as a result of processing the materials of experimental studies and are calculated for certain scales and sections of the relief. For example, 1:2 000 with a relief section of 0.5 m for a scale plan m_H WJY formula is obtained.

At an angle of inclination of the earth up to 3° m_H = 0,12 m gives.

According to research [21], it can be assumed that the mean square error of the relief image in a flat field is equal to one fifth of the section. Relief, i.e. m_H = 1/5h hour. From here we solve the inverse problem, finding the minimum terrain section for a given minimum error of the terrain image, i.e.

$h_{min} = 5m_H$

For example, for the most accurate large-scale surveys, we take m_H = 0.10 m and get the smallest part of the relief equal to 0.5 m. When choosing a relief part, in addition to the accuracy of the image, it is necessary to take into account the ease of use of the plan in the design and various calculations. It is believed that on steep slopes it is necessary to lay between the contours at least 5 mm, and on gentle slopes no more than 20 mm [1-3].

CONCLUSION.

In short, the detail of the plan is characterized by the level of similarity described in it. Numbers to the contours and elements of the earth, that is, the degree of generalization of the image. The larger the scale of the plan, the higher the detail. Errors associated with generalizations of images and less generalizations, generalizations of clear contours in large-scale studies should not exceed the plan. 0.5 mm, and architectural details 0.3 mm. Within these limits, it is allowed to correct curved contours, borders and exits of buildings.

The completeness of the plan means the degree of saturation of its image with necessary and possible situational objects and relief elements, it is necessary to design on the scale of the adopted plan and the relief part. The completeness of the plan is expressed by the minimum size and distances between relief features and must be described on the plan.

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