UDC 625.72

ISSUES OF IMPLEMENTING LARGE-SCALE SPECIAL TOPOGRAPHIC SURVEYS

A.I. Karshiboev, A.A. Khakimov, J.Sh. Khikmatilloev
Tashkent State Transport University, Tashkent, Uzbekistan;

Abstract. Large-scale special topographic surveys that are widely used to solve various engineering tasks in construction, design and other industries. Special attention is paid to the need to ensure high accuracy when creating topographic plans and maps. The main stages of surveying are described, including collection and processing of materials, creation of geodetic networks and plan maps, as well as methods of process automation and use of modern geodetic tools. Also important in the study are the requirements for survey accuracy and the plans created on their basis, with an indication of standards and allowable deviations.

Keywords. Large-scale topographic surveys, geodetic networks, engineering topographic plans, survey automation, survey accuracy, digital topographic plans, geodetic tools, planning and cartographic materials

Large-scale topographic plans and maps are widely used in solving various engineering problems, i.e. in construction and design work, engineering and topographic surveys, construction work and in many other industries. Therefore, it is important to carry out large-scale topographic surveys and ensure their accuracy when creating large-scale topographic plans and maps.

When carrying out large-scale topographic surveys according to the basic rules and requirements given in sources [3, 4], the following are performed:

- topographic-geodetic, cartographic aerial photography, etc., carried out in previous years. collection and development of materials;
- inspection and assessment of the area to be surveyed;
- creation (development) of reference geodetic networks (plan networks of 3 and 4 classes and densification networks of 1 and 2 classes, leveling networks of II, III and IV classes);
- creation of geodetic networks for plano-altitude surveying;
- engineering-topographic surveys;
- creation and publication of engineering topographic plans, cadastres and thematic maps and plans;
- chamber processing of materials;
- preparation of technical report.

To perform topographic-geodesic works, the technical assignment and technical project or work program serve as the basis for this work.

Scales and elevations of relief profiles of topographic surveys are established depending on the purpose and application of topographic plans, as well as accuracy requirements of subsequent engineering works. In addition, local gradients shall be taken into account when restoring elevations of relief profiles.

Topographic survey objects include real property, structures, and detailed features:

- quarter boundaries;
- capital buildings and structures;
- underground utility lines;
- underground and aboveground transit utilities;
- contours of perennial woody plants and other objects.

The survey of details on the territory is performed in scale 1:500 according to the requirements specified in the sources [3,5] for the conducted territory. The survey may be carried out by geodetic methods, using point or combined methods. The chosen survey method should aim at obtaining digital plans as far as possible.

Engineering topographic plans can also be presented in graphical or digital form (digital engineering topographic plan).

Digital engineering topographic plans are created using automated methods (data transfer from electronic devices of geodetic instruments) or by digitization of graphic images on the plans and vectorization of raster files obtained after their scanning.

The accuracy of digital engineering topographic plans shall not be lower than that of graphical engineering topographic plans. The data of digital engineering topographic plans shall correspond to the current conventional signs accepted for topographic plans.

When performing topographic surveys using electronic total stations, the measurement results are saved and accumulated in the memory of the device.

When performing tacheometric survey, the density of survey base points shall ensure that tacheometric moves are made in accordance with the technical requirements specified in Table 1

Table 1

Shooting scale	Maximum road length, m	Maximum length of lines, m	Maximum number of lines on the road
1:5000	1200	300	6
1:2000	600	200	5
1:1000	300	150	3

1:500	200	100	2

Spaces between points of total station moves (survey heights) and picket points, as well as distances between picket points shall not exceed the values specified in Table 2.

Table 2

Shooting scale	Height of relief profile	Maximum distance between pickets	Maximum distance from tool to rail when surveying terrain	Maximum distance from tool to rail when surveying contours
1:5000	0.5	605	250	150
	1.0	80	300	150
	2.0	100	350	150
1:2000	0.5	40	200	100
	1.0	40	250	100
	2.0	50	250	100
1:1000	0.5	20	150	80
	1.0	30	200	80
1:500	0.5	15	100	60
	1.0	15	150	60

At the same time surveying of newly appeared objects (contours) and changes in relief, as well as registration of field measurements and desk materials shall comply with the requirements for ground topographic survey.

When creating digital engineering topographic plans based on planning and cartographic materials, the following methods can be used to transfer details and relief in their original form: automated, photomechanical, mechanical, optical and graphic.

At present, the most effective of the above methods is the automated one, in which the images of the originals are transferred on the basis of a digital terrain model using graph builders and plotters;

Topographic plans created on the basis of topographic surveys may comply with the following requirements:

- The deviation from their theoretical values in the length of the sides of a coordinate grid with 10×10 cm squares should not exceed 0.2 mm. The difference of sums of side lengths of three or more squares shall not exceed 0.3 mm;
- The average square error of the image of objects and contours on the plans compared to their original cartographic material shall not exceed 0.5 mm;
- When creating plans on the basis of survey materials on a large scale, it is necessary to carry out generalization, i.e. generalization of insignificant details, selection of significant objects and exclusion of less important contours.

Today, when performing surveys on a large scale, the use of modern geodetic tools and technologies can improve the accuracy of contour point determination and enhance the quality of the desktop description. This includes construction of a coordinate grid, fixation of main points and accurate contours by coordinates, direct recording of contour values, and elimination of errors associated with paper deformation during plan drawing.

The use of specialized graphic software improves the accuracy of topographic survey plans. Nevertheless, despite modern tools, scientific research on field measurements and scientific justification of survey accuracy remain topical tasks today.

Conclusions. The implementation of large-scale special topographic surveys is crucial for addressing various engineering tasks, such as design and construction. Ensuring the high accuracy of topographic plans and maps is vital, which is achieved by strictly adhering to the stages of surveying, including the creation of geodetic networks and material processing. The use of modern geodetic tools and automation technologies significantly enhances the quality and precision of the resulting data. However, despite technological advancements, ongoing scientific research aimed at improving the accuracy of field measurements and justifying survey methods remains essential and necessary.

Literature:

1. Bakanova, V.V. Krupnomasshtabnye topograficheskie syomki. M., Nedra, 1983. 182 p.
2. Fokin, E.I. On the Accuracy of Depicting Objects and Land Contours on Maps. — Geodesy and Cartography, 1974, №6, p. 48.
3. Instruction on Topographic Surveying at Scales 1:5000, 1:2000, 1:1000, 1:500. M., ,,Nedra’’., 1982.
4. Special Topographic Plans for Construction in Large Scales, SNQ 1.02.19-09.
5. Survey of Geodetic Networks (Construction of Planar and Height Geodetic Networks in Engineering-Geodetic Research for Construction), SNQ 1.02.18-09.