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# Topographic and Geodetic Survey for Samarkand's Administrative Boundaries: Survei Topografi dan Geodesi untuk Batas Administratif Samarkand

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**General Background:** Administrative and territorial boundary delineation is vital in the effective governance and economic planning of urban regions globally, with digital technologies increasingly integrated into these processes for accuracy and efficiency. **Specific Background:** In Uzbekistan, the city of Samarkand's administrative boundaries are undergoing significant realignment as part of a broader initiative to incorporate strategic urban centers and enable digital land management across administrative zones.**Knowledge Gap:** Existing methods lack precise integration with digital geospatial frameworks, leaving a gap in high-resolution topographic data essential for clear administrative delineation. **Aims:** This study seeks to develop and apply an accurate, digitally supported methodology for determining the boundaries of Samarkand's administrative units using advanced geodetic and topographic techniques. **Results:** By utilizing the CREDO DAT program, this study achieved precise boundary coordinates through the automated processing of survey points, and further analysis was conducted using the Panorama program for detailed map orientation. **Novelty:** This research presents a unique approach by integrating CREDO DAT with geospatial tools in administrative boundary demarcation, enabling accurate and reproducible results that surpass traditional methods in efficiency and scalability. **Implications:** The findings support the strategic planning of Samarkand's infrastructure and resource allocation while also laying the groundwork for applying similar methodologies in other urban regions, advancing Uzbekistan's digital transformation efforts in land management.
**Highlights:**

- Digital tools enhance accuracy in administrative boundary mapping.
- CREDO DAT and Panorama software streamline data processing for precise mapping.
- This method supports effective urban planning and resource management in Samarkand.

**Keywords:** Administrative Zones, Border, Territory, District, City

## Introduction

In the world and in various regions, great importance is attached to achieving economic efficiency through the use of digital technologies[1]. With the help of digital technologies, a number of works are being carried out to develop science, as well as eliminate problems in each area, based on scientific foundations[2]. In particular, it is important to carry out land management, geodetic, cartographic and cadastral fields by digital technologies, promptly obtain information and manage land resources, improve the methodology for determining the boundaries of administrative-

territorial units based on digital technologies[3]. Currently, digital technologies and geospatial data are widely used in the world to provide accurate and reliable information about the administrative territory, determine the boundaries of territorial units, and solve problems related to territorial boundaries[4].

The decrees and decisions adopted in our republic include digitalization of all sectors of the country's economy and further improvement of the quality of public services, as well as rational and efficient[5] use of land resources, proper organization of land management and land monitoring, and features of the boundaries of administrative-territorial units[6]. Comprehensive measures are being taken to determine and accurately maintain land records and certain results are being achieved. The Development Strategy of the Republic of Uzbekistan "New Uzbekistan" for 2022-2026, including "determining the content of open data in the state register and the introduction of a publicly accessible geoportal based on open data, as well as providing information to the state and the economy, defines important tasks of the National Geographic Information System to develop the procedure for submission to government bodies and individuals and legal entities."

In the implementation of these tasks, it is important to conduct scientific research to improve the method of determining the boundaries of administrative-territorial units based on digital technologies in the field of rational and efficient use of land resources[7], accurate land accounting. The Decree of the President of the Republic of Uzbekistan dated April 28, 2020 No. PQ-4699 "On measures for the widespread introduction of the digital economy and e-government" provides for the introduction of a geographic information system (GIS) in the Republic of Uzbekistan. Karakalpakstan and the regions, information" The tasks of integration with the E-Government system have been defined. Based on the above, it becomes relevant to conduct scientific research[8] on the creation of digital maps linking the boundaries of territorial units to a single coordinate system, based on the use of digital technologies in determining the boundaries of administrative-territorial units[9]. The resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 299 dated April 23, 2018 and other regulatory legal documents related to land management, geodesy, cartography and cadastral sphere serve as a certain level of basis for this dissertation research[10].

## Method

The methodology for this study employed a combination of topographic and geodetic mapping techniques to define the administrative boundaries of Samarkand’s territorial units. Utilizing digital technologies, such as the CREDO DAT program, allowed for precise calculations of survey points, incorporating horizontal and vertical angles, and distances based on tacheometric surveys. The program automated data processing to produce comprehensive topographic maps by calculating coordinates, direction angles, and side lengths of geodetic reference points. Additionally, the Panorama program was used to finalize and orient topographic plans by loading JPEG-format maps and configuring them with relevant classifiers. This methodological approach facilitated accurate administrative boundary delineations by integrating geospatial data, enabling reliable map orientation for various stakeholders.

## Results and Discussions

The border of the lands to be transferred from the Pastdargom district of the Samarkand region to the city of Samarkand, from A to B borders with the lands of the Samarkand district, from B to V borders with the lands of the city of Samarkand, from V to G borders with the lands of the Samarkand district. the lands of the Samarkand region, from G to D, the lands of the city of Samarkand border, from D to E with the lands of the Samarkand region, from E to Y with the lands of the city of Samarkand, from Y to A borders with the lands of the Pastdargom district description is as follows:

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**a. Date**

| № | District name | N umber of community gatherings of the neighborhood | T otal number of objects being added | The total area of land occupied by residential and non-residential facilities. | of which | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | N umber of house holds | total land area ( hec ) | construction site ( hec ) | The number of non-residential objects | total land area ( hec ) | construction site ( hec ) |
| 1 | Pasdargom district | 7 | 4502 | 629 , 99 | 4239 | 414,39 | 91,84 | 263 | 215,59 | 41,33 |

**Table 1.** ***About the real estate objects added from the districts of Samarkand region in order to turn the city of Samarkand into a major tourist area***

The starting point 1 is the intersection of the western side of the M-37A highway (the border line runs 20 meters from the axis of this road) and the border lines of the Pastdargom district and the Samarkand district (in WGS-84 coordinates). , north latitude coordinates 39° 43' 038.435", east longitude coordinates 66° 52' 19.417").

From point 1, 5600 meters in the south-east direction from point 1, taking into account turns along the current border of the Pastdargom district and the Samarkand district. It connects with point 2 (coordinates of north latitude 39° 45' 28.930 inches, coordinates of east longitude 66° 55' 45.195 inches).

From point 2, taking into account the turns along the current border of the Pastdargom district and the city of Samarkand, it connects with point 3 in the southern direction at a distance of 5858 meters (coordinates of northern latitude 39° 40' 21.568", east longitude). coordinates 66° 55' 38.676").

From point 3, the border line connects with point 4, located at a distance of 583 meters in the southern direction (coordinates of northern latitude 39° 40' 9.673", coordinates of eastern longitude 67° 58' 29.117") taking into account turns along the current border of the Pastdargom and Samarkand districts.

From point 4, along the current border of the Pastdargom district and the Samarkand district, taking into account the turns from the northern side of Narpay street, it connects from point 5 located at a distance of 855 meters in the west-northwest direction (coordinates of the northern latitude. 39° 45' 19.440 inches, coordinates of the eastern longitude 67° 51' 54.693 inches).

From point 5, located at a distance of 855 meters in the west-northwest direction (coordinates of north latitude. 39° 45' 19.440 inches, coordinates of east longitude. 67° 51' 54.693 inches).

From point 6, taking into account the turns along the current border of the Pastdargom district and the city of Samarkand, it connects with point 6, located at a distance of 2538 meters in the west-northwest direction (coordinates of the northern latitude 39°40'34.021", coordinates of the eastern longitude 66°55'25.926").

2813 meters in the southeast direction from point 6, taking into account the turns along the current border of the Pastdargom district and the city of Samarkand.

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**Figure 1.** *The border of the city of Samarkand*

### b. Computer Programs Used in the Design of a Topographic Map Plan. The CREDO DAT Program

The CREDO DAT program is designed to automate the camera processing of engineering and geodetic field measurement data[11]. Before using the program, it is necessary to determine the coordinates of the geodetic base points created on the surveyed land plot in the (hu, n) system. Based on the coordinates of the identified survey points and field measurement data (results of tacheometric survey - horizontal and vertical angles[12], horizontal distance), the CREDO DAT program calculates all tachometric plans, horizontal projections of measured distances, relative angles of inclination, calculates heights and offsets. from plot points. In this process, the program calculates the coordinates of the survey points based on horizontal projection of the sides of the survey points and corrected horizontal angles[13].

Based on the adjusted distances and coordinates, a catalog of coordinates of the survey points of the land plot, points of topographic objects is calculated[14]. As a result of equating the measurement results, the following information is obtained:

a. aligned coordinates of base points;

b. lengths of sides;

c. directional angles of the directions of sides;

d. horizontal and vertical coordinates of cartographic objects;

e. values of the accuracy assessment of the root-mean-square errors in determining the horizontal and vertical coordinates of the survey control points.

Panorama program. The final stage of creating a topographic plan is carried out in the Panorama program and is performed as follows:

The deciphered photo plan is taken from the special department. Its category is determined by the scheme and its price is determined. After that, the photo plan is scanned. The scanned map is saved in the computer's JPEG format. After that, each photo plan's nomenclature is written in the JPEG format. After these tasks are completed, the map is oriented. For this, the Panorama program will be opened. In this program, the orientation file of the 1:2000 scale map is entered and a plan is created. A classifier is added to the plan[15]. The classifier is a file made up of conventional symbols, that is, the thickness, color, length and diameter of the conventional symbols are specified in it. Then the name and scale of the map are entered. Then the coordinates are loaded. When loading coordinates, the coordinates southwest, northeast "Y", southwest, northeast "X" are loaded and the plan is ready. The finished plan is placed under an empty rectangular frame. We enter the file into this frame and add "JPEG", that is, a raster. Our raster falls on one edge of the frame, we "move" to bring the square corner of the raster closer to the square corner of the frame. For the transition, the four corners of the first raster are marked with a cross. After this, the four corners of the frame are shown, then the raster is inserted into the frame and the map with the orientation of 1:2000 is ready for drawing.

## Conclusion

When determining the territorial unity and administrative-territorial borders of our republic, we understand that the border lines of subjects are determined and marked with special signs.

In order to determine the administrative-territorial boundaries, a commission was established by a special order of our state and extensive work is being carried out. The composition of this commission consists of representatives of all relevant ministries, committees and departments, including representatives of geodesy and cartography.

I reviewed and analyzed the tasks of providing geodetic-cartographic data, quickly created, high-quality and high-precision maps and geodetic data to representatives of the field of geodesy and cartography.

Boundary lines determined according to the procedure are drawn on special administrative-territorial maps and it is considered an official legal document.

Topographical maps of administrative-territorial structures of subjects are created in the Republic of Uzbekistan and serve as a data-information guide.

The main task of these topographic maps is to provide state bodies with uniformity and complete information. Topographic maps serve to provide government bodies with the administrative-territorial structure of the territory or subject, territorial management, information about who the administrative-territorial belongs to, providing subjects with means of transport and other tasks. .

Administrative-territorial topographic maps are reliable, accurate to scale, and the technologies of creating maps were analyzed in order to show subjects the modern territory of the administrative-territorial territory.

In addition, geodetic support was studied to determine the territorial unity and administrative-territorial boundaries of subjects.

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