

# RESEARCH OF EXACTNESS OF CONSTRUCTION OF HORIZONTAL SURVEY NETWORK FOR LAND INVENTORY OF SETTLEMENTS

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**Keywords:** cadastral shooting, shooting planned position of landmarks devoted many publications in network area of land landmarks. scientific journals today.

Problem

In [5] These results accuracy of the coordinates of

In complex systems work on the creation of the State landmarks of land in the cities of Republican and regional Land Cadastre occupy an important place Geodetic and subordination (excluding the impact of density of Cadastral work performed for the purpose of mapping removal contour plot). It was established that the land settlements, establishing and securing their borders size  $P \leq 1000 \text{ m}^2$  value of the mean square error of inventory of land, housing and industrial fund and others. determining the coordinates of landmarks should not

One of the basic materials inventory information is exceed 1-3 cm. Indicate that land larger than  $1000 \text{ m}^2$  accurate materials and documents inventory, which there are logical problems with regulatory harmonization depends mainly on the accuracy and detail of cadastral precision tolerances definition of space.

zniman.

The issue of accuracy coordination of land plots in the

To implement cadastral zniman created the basis for an inventory of land devoted to the work [6]. Precision planned film density points that would ensure conducting coordinate boundaries of the land proposed to set survey work.

depending on the required accuracy of its area.

Mathematical foundations of cadastral zniman known are:

Justification errors relative position of adjacent points limits of land in the land inventory given in [15].

- State geodesic network;
- Bit geodetic networks thickening;
- Surveying geodetic network.

In [3] the questions the accuracy of the planned position of landmarks taking into account the mean square errors of adjacent points limits. It is claimed that

Scenes geodetic network created, usually by laying the accuracy of the coordinates of landmarks, which is theodolite traverse or moves between points with known based on the accuracy of the scale of planning and coordinates.

cartographic materials currently can not serve as a

In some cases coordinate rotation angles boundaries reliable criterion of accuracy of cadastral mapping and landmarks land can be made of the items specified objects.

methods of angular and linear-angular serif. In all these cases should be independent dual control determine the coordinates of points.

The study of the accuracy of the areas of land in view of the number of contour points dedicated work [7]. It is shown that the accuracy of the land area increases with

According to [8.14] to ensure the required accuracy of increasing density removal contour plot.

the accounting unit display areas margin of error points shooting justification and landmarks nearest points regarding state geodetic network, geodetic network thickening, local geodetic networks shall not exceed:

In [11] indicated that the typical land in conditions of urban areas should be considered land with the number of turning points  $n = 4$  and the area of  $P = 200-600 \text{ m}^2$ , which can be found on the magnitude of the required

- In the cities of Republican and regional subordination - 10 cm;
- In other cities and towns - 20 cm;
- In villages - 40 cm.

accuracy for the position of landmarks plots rectangular shape. The optimal standard deviation position turning point for off-site geodetic framework can be considered as having no more than 5 cm.

As you know, the error planned paragraphs set basis part of the error position landmark land.

In [1] the position of landmarks land set basis points relative offered to determine with accuracy of 1.7 cm.

Thus, there is a problem installing the required accuracy of paragraphs planned shooting justification. zniman methods of angular and linear serif.

The established requirements to the cadastral parameters

Analysis of recent studies and publications relating to resolve this problem,

In [2] shows that large cities with high cost land position limits most massive land (up to 2 hectares)

The issue of necessary and sufficient accuracy of land areas depending on their size, shape, scale, planning and items Urban geodetic network.

should determine the mean square error of 5 cm relative

cartographic material location within the various political subdivisions, as well as the accuracy of the planned grounds and landmarks in the inventory of land

Question accuracy planned paragraphs shooting

settlements discussed in [4]. Established that the design(contour)  $n_P = 4$  points can be calculated by the formula rationale methods shooting serif (direct angular, linear,[13]: angular, linear) method provides the highest accuracy linear-angular serifs.

$$m_p = m_t \sqrt{P} \sqrt{(1+k^2)/2k}, \quad (3)$$

where P - the area of land;  
k - coefficient of elongation plot.

Remaining part of the overall problem  
Not given due attention to accuracy of construction planned for substantiation required accuracy of the areas of land in the cadastral survey.

From formula (3) we have:

$$m_t = \frac{m_p}{\sqrt{P} \sqrt{(1+k^2)/2k}}. \quad (4)$$

The Problem  
Study accuracy planned paragraphs set basis and landmarks, depending on the required accuracy of the areas of land, taking into account their size, shape and density of the location of points of the contour plot.

In accordance with applicable regulatory documents [10,14] mean square error  $m_P$  determine the area of land in the cities of republican and regional submission should not exceed  $1 \text{ m}^2$ , and the relative -  $1/1000$ .

When  $m_P/P = 1/1000$  in the formula (4) is written as:

$$m_t \leq \frac{\sqrt{P} \cdot 10^{-3}}{\sqrt{(1+k^2)/2k}}. \quad (5)$$

The main material  
As indicated in the formulation of the problem, according to regulatory documents [8,14] margin of error of turning points of land boundaries and landmarks nearest points regarding state geodetic network in the cities of republican and regional submission should not exceed 0.10 m.

Similarly (including this condition), formula (2) takes the form [4]:

$$m_L \leq \frac{\sqrt{P} \cdot 10^{-3}}{\sqrt{2[(1+k^2)/2k]}}. \quad (6)$$

As follows from [9], the highest price in towns with land size  $P = 500-1000 \text{ m}^2$ , which meet the regulatory requirements to accommodate many types of commercial and business activities.

The magnitude of the error associated with precision scale! 500, adopted basic scale cadastral zman in settlements.

To do this, calculate the mean square error  $m_L$  planned paragraphs shooting justification for the required accuracy of the areas of land the size of  $500-1000 \text{ m}^2$ .

The scale removal is the original setting for the accuracy plans, and for the accuracy of the area.

The calculation results  $m_L$  navedeni in the table.

For graphics (paper) plans and maps accuracy geodetic networks calculated based on the accuracy of the scale (0.1 mm), and the margin of error taken twice (0.2 mm) Scale plan or map.

P, m <sup>2</sup>	m <sub>L</sub> , M				
	= 1	= 2	= 3	= 4	= 5
500	0,016	0,014	0,012	0,011	0,010
600	0,017	0,015	0,013	0,012	0,011
700	0,019	0,017	0,014	0,013	0,012
800	0,020	0,018	0,015	0,014	0,012
900	0,021	0,019	0,016	0,014	0,013
1000	0,022	0,020	0,017	0,015	0,014

In connection with the electronic plans and maps of the term "precision scale" practically loses its essence, as in this case, the accuracy of cadastral mapping objects does not depend on the accuracy of scale, and the accuracy removal [12].

taking into account the density removal contour plot (at  $n_P > 4$ ) Formula (5) and (6) we write according as

As the results of research, even such a large scale as 1: 500 in many cases can not ensure the required accuracy of the planned position of landmarks land, and hence the accuracy of their relevant areas.

In accordance with the principle of equal exposure[7]: errors paragraphs set basis and errors geodetic reference landmark to write the set basis points [3]:

$$m_t = \sqrt{m_L^2 + m_k^2}, \quad (1)$$

where  $m_t$  - mean square error of the planned position relative to the nearest landmark set basis points;

$m_L$  - mean square error of paragraph crew planned basis;

$m_k$  - mean square error of a geodetic reference landmark paragraph crew bases (coordination error).

From equation (1) we have:

$$m_L = m_k = \frac{m_t}{\sqrt{2}}. \quad (2)$$

Mean square error  $m_P$  determine the area of land close to the rectangular shape, with the number of turning

Accuracy planned paragraphs set basis to ensure the required accuracy of the areas of land ( $m_P \leq 1 \text{ m}^2$ ,  $m_P/P = 1/1000$ ) size  $P = 500- 1000 \text{ m}^2$  in the towns of republican and regional submission should not exceed 1- 2 cm.

## Conclusions

The formula for evaluation of accuracy planned paragraphs set basis and landmarks can be used in coordination of land plots sized  $P \leq 1000 \text{ m}^2$  is the most

common in market transactions with the land, and - nesutsilnyi inventory of land settlements.

### Referencys

1. Bryn' M. Ya. O parametrakh kadaastrovoy s'emky horodskykh ob'ektov nedvyzhymosty / M. Bryn', P. Veselkyn, V. Kalhunov // Suchasni dosyahnennya heodezychnoyi nauky ta vyrobnytstva: Zb. nauk. prats'. – 2011. – Vyp. I (21). – s. 271-272.

2. Bryn' M. Ya. O tochnosti opredelenyya planovoho polozhenyya mezhevykh znakov uchastkov urbanyzyrovanykh zemel' / M. Bryn' // Heodeziya, kartohrafiya i aerofotoznmannya: Zb. nauk. prats'. – 2007. – Vyp. 69. – s. 164-167.

3. Doslidzhennya tochnosti vidobrazhennya kadaastrovykh ob"yektiv / M. Dutchyn, Ye. Il'kiv, I. Syrotyn'ska [ta in.] // Novi tekhnolohiyi v heodeziyi, zemlekorystuvanni ta pryrodokorystuvanni: Mater. VI mizhnar. Nauk.-prakt. Konf. (m. Uzhhorod, 24-27 zhovtnya 2012 r.). – s.65-67.

4. Doslidzhennya tochnosti pobudovy planovykh znimal'nykh merezh pry inventaryzatsiyi zemel' naselenykh punktiv / M. Dutchyn, T. Hrytsyuk, Ye. Il'kiv, [ta in.] // Naukovyy visnyk Uzhhorods'koho universytetu. Seriya: Heohrafiya. Zemleustriya. Pryrodokorystuvannya. – Vyp. 3 - 2014. – s.48-53.

5. Dutchyn M. Do pytannya tochnosti vyznachennya koordynat mezhovykh znakov zemel'nykh dilyanok pry kadaastrovykh znmannyakh / M. Dutchyn, O. Hera, I. Syrotyn'ska // Heodeziya, kartohrafiya i aerofotoznmannya: Zb. nauk. prats'. – 2013. – Vyp. 77. – s. 85-88.

6. Dutchyn M. Do pytannya tochnosti koordynuvannya mezh zemel'nykh dilyanok pry inventaryzatsiyi zemel' / M. Dutchyn, O. Hera // Heoinformatsiynny monitorynh navkolyshn'oho seredovyshcha GNSS i GIS-tekhnolohiyi.- Alushta (Krym).- 2013. – s.90-92.

7. Dutchyn M. Doslidzhennya tochnosti vyznachennya mezh zemel'nykh dilyanok z vrakhuvannyam kil'kosti konturnykh tochok ta yikh roztashuvannya / M. Dutchyn, I. Bida, H. Mel'nychenko // Suchasni dosyahnennya heodezychnoyi nauky ta vyrobnytstva: Zb. nauk. prats'. – 2009. – Vyp. I (17). – s. 301-308.

8. Instruktsiya pro vstanovlennya (vidnovlennya) mezh zemel'nykh dilyanok v naturi (na mistsevosti) ta zakriplennya yikh mezhovymy znakamy / Zatv. nakazom Derzhkomzemu Ukrayiny # 376 vid 18 travnya 2010 r.

9. Kadastr naselenykh punktiv: pidruchnyk / M. H. Stupen', R. Y. Hul'ko, O. Ya. Mykula, N. R. Shpik. – L'viv: «Novyy svit – 2000», 2004. – 392 s.

10. Kerivnyy tekhnichnyy material z inventaryzatsiyi zemel' naselenykh punktiv (nazemni metody) / HKNTA.- K.: HUHKiK, 1993.

11. Markuze M. Yu. Otsenka tochnosti opredelenyya ploshchadey zemel'nykh uchastkov zastroennykh terrytoryy: avtoref. dys. kand. tekhn. nauk: spets. 05.24.04 «Kadastr y monitorynh zemel'» / M. Yu. Markuze. – M., 2000. – 85 s.

12. Ostrovs'kyy A. Problema pidvyshchennya tochnosti matematychnoyi osnovy elektronnykh kart ta planiv / Ostrovs'kyy A., Moroz O. // Heoinformatsiynny monitorynh navkolyshn'oho seredovyshcha GPS i GIS-tekhnolohiyi.- Alushta (Krym).- 2007. – s.1-5.

13. Perovych L. M. Osnovy kadastru (chastyna I): navchal'nyy posibnyk / L. M. Perovych, B. I. Volosets'kyy. – Kolomyya, 2000. – 130 s.

14. Polozhennya po zemel'no-kadaastroviy inventaryzatsiyi zemel' naselenykh punktiv.- K.: Derzhkomzem, 1997. – 12 s.

15. Ryabchiy V. Vyznachennya seredn'oyi kvadratnykh pokhybky vzayemnoho polozhennya kutiv povorotiv mezh zemel'noyi dilyanky / V. Ryabchiy, V. Ryabchiy // Suchasni dosyahnennya heodezychnoyi nauky ta vyrobnytstva: Zb. nauk. prats'. – 2012. – Vyp. II (24). – s. 137-141.

### Research of exactness of construction of horizontal survey network for land inventory of settlements

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The questions of exactness of determination of the horizontal position of survey's basis points and boundary marks for providing of necessary exactness of definition of land plot area in the cities of republican and reg