ISSN 2518-170X (Online)
ISSN 2224-5278 (Print)

«ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ
АКАДЕМИЯСЫ» РҚБ

«ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ» РҚБ

ХАБАРЛАРЫ

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ
АКАДЕМИИ НАУК РЕСПУБЛИКИ
КАЗАХСТАН»

N E W S

OF THE NATIONAL ACADEMY
OF SCIENCES OF THE REPUBLIC
OF KAZAKHSTAN

SERIES

OF GEOLOGY AND TECHNICAL SCIENCES

1 (469)

JANUARY – FEBRUARY 2025

THE JOURNAL WAS FOUNDED IN 1940

PUBLISHED 6 TIMES A YEAR

ALMATY, NAS RK

NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

«ҚР ҰҒА» РҚБ Хабарлары. Геология және техникалық ғылымдар сериясы».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)
Меншіктеуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.).
Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігінің Ақпарат комитетінде 29.07.2020 ж. берілген **№ KZ39VPY00025420** мерзімдік басылым тіркеуіне қойылу туралы куәлік.
Тақырыптық бағыты: *Геология, гидрогеология, география, тау-кен ісі, мұнай, газ және металдардың химиялық технологиялары*
Мерзімділігі: жылына 6 рет.
Тиражы: 300 дана.
Редакцияның мекен-жайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., тел.: 272-13-19
http://www.geolog-technical.kz/index.php/en/

«Известия РОО «НАН РК». Серия геологии и технических наук».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и общественного развития Республики Казахстан **№ KZ39VPY00025420,** выданное 29.07.2020 г.

Тематическая направленность: *геология, гидрогеология, география, горное дело и химические технологии нефти, газа и металлов*

Периодичность: 6 раз в год.

Тираж: 300 экземпляров.

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28, оф. 219, тел.: 272-13-19

http://www.geolog-technical.kz/index.php/en/

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technology sciences.
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)
Owner: RPA «National Academy of Sciences of the Republic of Kazakhstan» (Almaty).
The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Social Development of the Republic of Kazakhstan **No. KZ39VPY00025420,** issued 29.07.2020.
Thematic scope: *geology, hydrogeology, geography, mining and chemical technologies of oil, gas and metals*
Periodicity: 6 times a year.
Circulation: 300 copies.
Editorial address: 28, Shevchenko str., of. 219, Almaty, 050010, tel. 272-13-19
http://www.geolog-technical.kz/index.php/en/

NEWS of the National Academy of Sciences of the Republic of Kazakhstan
SERIES OF GEOLOGY AND TECHNICAL SCIENCES
ISSN 2224–5278
Volume 1. Number 469 (2025), 155–168

https://doi.org/10.32014/2025.2518-170X.482

UDC 528.5:626

M. Nurpeisova[1]*, O. Kurmanbaev[2], Zh. Turegaliyeva[1], Zh. Nukarbekova[1], O. Baiturbay[1], 2025.
[1]Kazakh National Research Technical University named after K.I. Satpayev, Almaty, Kazakhstan;
[2]Al-Farabi Kazakh National University, Almaty, Kazakhstan.
E-mail: marzhan-nurpeisova@rambler.ru

INNOVATIVE TECHNOLOGIES IN THE URBAN PLANNING CADASTRE

M. Nurpeissova – doctor of technical sciences, Professor Kazakh National Research Technical University named after K.I. Satpayev, Almaty, Kazakhstan, https://orcid.org/0000-0002-3956-5442, E-mail: marzhan-nurpeisova@rambler.ru;
O. Kurmanbayev – PhD, Associate Profesor Al-Farabi Kazakh National University, Almaty, Kazakhstan,https://orcid.org/0000-0002-4867-6910, e-mail olzhas_ak@list.ru;
Zh.Turegaliyeva – PhD student, Kazakh National Research Technical University named after K.I. Satpayev, Almaty, Kazakhstan, https://orcid.org/0009-0008-6276-6198 E-mail: jan_nat98@mail.ru;
Zh. Nukarbekova – Lecturer Kazakh National Research Technical University named after K.I. Satpayev, Almaty, Kazakhstan, https://orcid.org/0000- 0002-1605-8907/ z.nukarbekova@satbayev.university;
O. Baiturbay – PhD student, Kazakh National Research Technical University named after K.I. Satpayev, Almaty, Kazakhstan, e-mail:o.baiturbay@satbayev.university, https://orcid.org/0000-0002-7654-2610.

Abstract. *The study aims* to apply innovative geodetic technologies in urban area surveying and develop GIS for urban land use information support. *Research methodology* – cadastral support of urban areas is achieved through geodetic works using modern technologies (satellite, electronic, and laser devices) and developing GIS to simplify data collection and processing of land and urban objects.

Results of the study. The article examines modern technologies for field and desk cadastral works. It highlights the connection of geodetic methods with spatial and geometric modeling for territorial development and cadastral analysis.

Scientific novelty. The study has developed and improved:

• innovative geodetic technologies for various urban applications;

• GIS concepts and geodata database structures for land users in small towns like Konaev and Alatau;

• algorithms and programs for key GIS components in the MapInfo environment;
• a methodology for creating thematic GIS for urban land use information support.

The novelty of the documents is confirmed by the Certificates of the Republic of Kazakhstan for copyright No. 52586 dated December 12, 2024, for a scientific work.

Practical significance lies in using the research results in dissertations, the educational process of Satbayev University, and by city authorities and commercial organizations to enhance management decisions and improve land use efficiency.

Keywords: land cadastre, urban cadastre, geodetic works, geodetic measurements, geoinformation technologies, master plan, polygonometry, land surveying, accuracy assessment.

М. Нұрпейісова[1]*, О. Құрманбаев[2] , Ж. Төреғалиева[1], Ж. Нукарбекова[1], О. Байтұрбай[1], 2025.

[1]Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университеті, Алматы, Қазақстан;

[2]Әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан.

E-mail: marzhan-nurpeissova@rambler.ru

ҚАЛАЛЫҚ КАДАСТРДАҒЫ ИННОВАЦИАЛЫҚ ТЕХНОЛОГИЯЛАР

М. Нұрпейісова – техника ғылымдарының докторы, Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университетінің профессоры, Алматы, Қазақстан, https://orcid.org/0000-0002-3956-5442, E-mail: marzhan-nurpeissova@rambler.ru;

О. Құрманбаев – Ph.D, әл-Фараби атындағы Қазақ ұлттық университетінің ассоц. профессоры, Алматы, Қазақстан, https://orcid.org/0000-0002-4867-6910, e-mail olzhas_ak@list.ru;

Ж. Төреғалиева – Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университетінің Ph.D докторанты, Алматы, Қазақстан, https://orcid.org/0009-0008-6276-6198, E-mail: jan_nat98@mail.ru;

Ж. Нукарбекова – Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университетінің лекторы, Алматы, https://orcid.org/0000- 0002-1605-8907 / z.nukarbekova@satbayev.university;

О. Байтұрбай – Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университетінің Ph.D докторанты, Алматы, Қазақстан, https://orcid.org/0000-0002-7654-2610, Email: o.baiturbay@satbayev.university

Аннотация. *Зерттеудің мақсаты* – қалалық аймақтарды түсірімдеуде инновациялық геодезиялық технологияларды қолдану және қалалық жерді пайдалануды ақпараттық қамтамасыз етуге арналған ГАЖ әзірлеу. *Зерттеу әдістемесі* – қалалық аумақтарды кадастрлық қамтамасыз ету қазіргі заманғы технологияларды (спутниктік технологиялар, электронды және лазерлік құрылғылар) пайдалана отырып, геодезиялық жұмыстарды жүргізе отырып жер және қала объектілері туралы ақпаратты жинау мен өңдеудің бүкіл технологиялық процесін жеңілдететін географиялық ақпараттық жүйені әзірлеу.

Зерттеу нәтижелері. Мақалада кадастрлық жұмыста өндірісте қолданылатын далалық және іс жүргізудің заманауи технологиялары қарастырылған. Геодезиялық қамтамасыз ету әдістері мен аумақтардың дамуын және кадастрлық жұмыстарды талдау үшін модельді кеңістіктік және геометриялық модельдеудің әртүрлі түрлерінің арасындағы байланыс көрсетілген.

Ғылыми жаңалығы. Жүргізілген ғылыми-зерттеу жұмыстарының нәтижесінде мыналар әзірленіп, өндіріске енгізілді:

• әртүрлі қалалық аймақтарға арналған инновациялық геодезиялық технологиялар;

• Қонаев және Алатау сияқты шағын қалалардағы жер пайдаланушыларды ақпараттық қамтамасыз ету үшін ГАЖ тұжырымдамасы мен геодеректер базасының құрылымы;

• -MapInfo ортасында ГАЖ негізгі компоненттерінің алгоритмдері мен бағдарламалары;

• қалалық жер пайдалану субъектілерінің топтарын тақырыптық ГАЖ ақпараттық қамтамасыз етуді құру әдістемесі.

Әзірленген құжаттардың жаңалығы Қазақстан Республикасының ғылыми шығармаға 12.12.2024 ж. берілген №52586 авторлық құқық куәлігімен расталады.

Практикалық маңыздылығы – зерттеу нәтижелерін Қ.И. Сәтбаев атындағы Қазақ ұлттық техникалық зерттеу университетінің (ҚазҰТЗУ) магистранттарының, докоранттарының диссертацияларында және оқу процесінде пайдалануында, сонымен қатар қалалық билік органдары, мен коммерциялық ұйымдардың басқару шешімдерін жақсарту, негіздеу және жерді пайдалану тиімділігін арттыру үшін қолдануға болады.

Түйін сөздер: жер кадастры, қала кадастры, геодезиялық жұмыстар, геодезиялық өлшемдер, геоақпараттық технологиялар, бас жоспар, полигонометрия, жерге орналастыру, дәлдікті бағалау.

М. Нурпеисова[1]*, О. Курманбаев[2], Ж. Турегалиева[1], Ж. Нукарбекова[1], О. Байтурбай[1], 2025.

[1]Казахский Национальный исследовательский технический университет имени К.И. Сатпаева, Алматы, Казахстан;

[2]Казахский Национальный университет имени аль-Фараби, Алматы, Казахстан.

E-mail: marzhan-nurpeissova@rambler.ru

ИННОВАЦИОННЫЕ ТЕХНОЛОГИИ В ГОРОДСКОМ КАДАСТРЕ

М. Нурпеисова – доктор технических наук, профессор Казахского Национального исследовательского технического университета им. К.И. Сатпаева, Алматы, Казахстан, E-mail: marzhan-nurpeissova@rambler.ru, https://orcid.org/0000-0002-3956-5442;

О. Курманбаев – PhD, ассоциированный профессор Казахского Национального университета

им.ал-Фараби, Алматы, Казахстан, e-mail: olzhas_ak@list.ru, https://orcid.org/0000-0002-4867-6910;
Ж. Турегалиева – PhD докторант, Казахского Национального исследовательского технического университета им. К.И. Сатпаева, Алматы, Казахстан, E-mail: jan_nat98@mail.ru, https://orcid.org/0009-0008-6276-6198;
Ж. Нукарбекова – лектор Казахского Национального исследовательского технического университета им. К.И. Сатпаева, Алматы, Казахстан, E-mail: z.nukarbekova@satbayev.university, https://orcid.org/0000- 0002-1605-8907;
О. Байтурбай – PhD докторант, Казахского Национального исследовательского технического университета им. К.И. Сатпаева, Алматы, Казахстан, E-mail: o.baiturbay@satbayev.university, https://orcid.org/0000-0002-7654-2610.

Аннотация. *Цель исследования* – применение инновационных геодезических технологий при межевании городских территорий и разработка ГИС, предназначенной для информационного обеспечения городского землепользования. *Методика исследования* – кадастровое обеспечение городских территорий достигается проведением геодезических работ с использованием современных технологий (спутниковые технологии, электронные и лазерные приборы) и разработкой геоинформационной системы, упрощающей весь технологический процесс сбора и обработки информации о земле и городских объектах.

Результаты исследования. В статье рассмотрены современные технологии полевых и камеральных работ, применяемых на производстве в кадастровых работах. Показана связь методов геодезического обеспечения с разными типами пространственного и геометрического моделирования, анализа развития территорий и кадастровых работ.

Научная новизна. В результате проведенных научных работ разработаны и внедрены в производство:

• инновационные геодезические технологии для различных городских сфер;

• концепция ГИС и структура базы геоданных для информационного обеспечения землепользователей в условиях малых городов, таких как Конаев и Алатау;

• алгоритмы и программы основных компонентов ГИС в среде MapInfo;

• методика создания тематической ГИС для информационного обеспечения групп субъектов городского землепользования.

Новизна разработанных документов подтверждена Свидетельством РК на авторское право №52586 от 12.12.2024 г. на произведение науки.

Практическая значимость заключается в использовании результатов исследования в диссертационных работах магистрантов, докторантов, в учебном процессе Казахского Национального исследовательского технического университета (КазНИТУ) имени К.И. Сатпаева, а также они могут быть использованы органами городских властей и коммерческими организациями для совершенствования и обоснования управленческих решений, повышения эффективности землепользования.

Ключевые слова: земельный кадастр, городской кадастр, геодезические

работы, геодезические измерения, геоинформационные технологии, генеральный план, полигонометрия, межевание земель, оценка точности

The research was carried out with the financial support of the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant no.AR23489269).

Introduction. Maintaining a city cadastre is not possible without conducting geodetic works, the tasks of which are: geodetic surveys, design work and transfer of projects in kind, geodetic support of land management and cadastres. The cadastre is a collection of information about the natural, legal, economic, economic and spatial location of real estate objects, presented in accordance with certain requirements. The geodetic basis for maintaining the urban cadastre and real estate is the State geodetic network (GGS), created in accordance with the procedure established by the Government of the Republic. The cartographic basis of cadastral works are maps, plans created in forms and scales determined by the regulatory authority in the field of cadastral relations (On approval..., 2015). For the maintenance of the real estate cadastre, local coordinate systems established in relation to cadastral districts are used with the parameters of transition to a unified state coordinate system defined for them.

The planned location of the boundaries of the land plot is characterized by flat rectangular coordinates of the centers of boundary markers calculated in the local coordinate system. For any land surveying, it is necessary to perform geodetic works on surveying the boundaries of land plots. To do this, in accordance with the instructions, a preliminary technical design for the production of topographic and geodetic works is drawn up. In such a project, the most rational and modern methods of performing geodetic works based on modern technologies and satellite coordinate determination systems should be used. In this regard, the research topic is relevant.

Research methodology. The theoretical foundation of the research is based on the works of both domestic and international scholars, which explore the experience of developing geoinformation systems in the field of urban management and planning, as well as technologies for creating information and geoinformation systems. To address the tasks set, methods and approaches of systems analysis, mathematical statistics, and the design of geographic information systems and databases were applied**.** Cadastral support of urban areas is achieved through geodetic works using modern technologies (satellite, electronic, and laser devices) and developing GIS to simplify data collection and processing of land and urban objects.

Results and discussion. The purpose of the research is to study the application of modern geodetic technologies in surveying urban areas.

During the research, the following tasks were set:

-to get acquainted with the complex of engineering and geodetic works performed during land surveying;

-to study modern technologies of field and desk work used in production in cadastral institutions;

-to investigate the accuracy of determining the flat rectangular coordinates of boundary markers and the area of the land plot.

To date, there are various technologies for performing cadastral surveys.

Shooting with traditional equipment. The use of modern total stations, laser scanners, greatly simplifies the shooting process (Bardadyn, 2019; Kraeva, 2017; Balkizov, 2021; Nurpeisova, et al., 2023). But when shooting large territories, objects far from each other, the time to complete the work is long, to reduce it it is necessary to use a large number of devices and field crews, which is unacceptable. The most effective way is to use traditional equipment in conjunction with GPS receivers.

1. Electronic total stations.

Total stations are used at almost all stages of engineering and geodetic surveys. Among the devices of the same class, total stations of the TTS3300 (Trimble) and SET500/600 (Sokkia) series are popular. The capabilities of total stations are significantly expanded by non-reflective rangefinders, which have a very extensive scope of application (Fig. 1, a).

2. Laser scanning (ground and aerial - UAV) is a promising technology. But at the moment it is quite expensive and requires the participation of highly qualified personnel. Laser scanning is a method.

It allows you to create a digital model of the surrounding space, representing it as a set of points with spatial coordinates (Fig. 1, b). As a result of laser scanning and digital aerial photography, digital products are obtained: spatial relief models, topographic plans and maps, orthophotographs and spatial models of engineering facilities.

3. The Global Navigation Satellite System (GNSS) is a system that can be used to obtain coordinates at any point on the Earth's surface by processing satellite signals (Fig. 1, c).

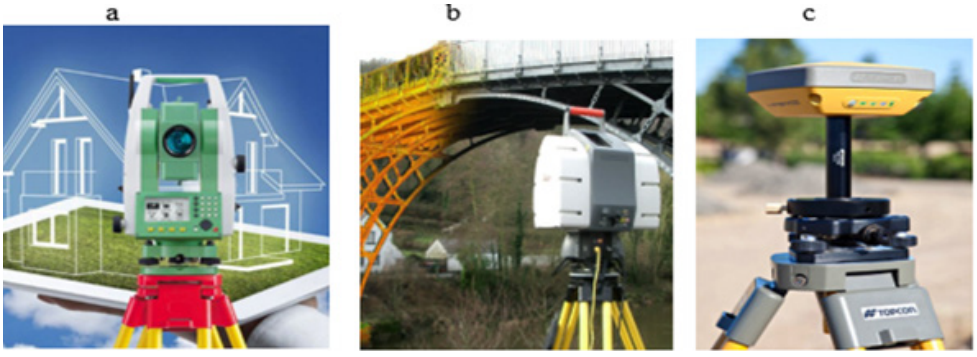

Fig.1 – a-electronic total station; b- laser scanner; c-satellite system

Any GNSS consists of three segments: space, ground and user. The space segment is represented by a constellation of satellites transmitting information about their position in orbit; the ground segment consists of non-mobile stations that monitor and control the position of satellites, as well as their technical condition; the user segment is people of various professions using satellite receivers to determine their location on the Earth's surface. To perform work in the districts, it is advisable to use dual-frequency GPS equipment, since single-frequency has a relatively small range and is effective only in cities where the distance from the base station is small.

During the production of the land management project, the General Plan of the city is the main urban planning document defining the conditions for the formation of the living environment, the directions and boundaries of the development of settlement territories, zoning of territories, the development of engineering, transport and social infrastructure, etc. The main structural element in the development of a residential building layout project is a microdistrict, and in industrial zones – a block block of industrial buildings and structures. The elements of residential and industrial buildings are limited by red lines. The detailed planning project is an urban planning documentation developed for parts of the territories of urban settlements.

When conducting these works, urban polygonometry is a reference geodetic network. In large cities, it is laid between triangulation points, and in small towns, where the development of triangulation is not envisaged, polygonometry is the only support network (Zolotova, et al, 2008). Polygonometry is used not only for the production of large-scale surveys, but also for such works as:

a) transfer of urban planning and development projects to nature;

b) breakdown of routes of urban underground networks (water supply, sewerage, gas pipeline, telephone, electricity and heating, etc.);

c) transfer and control of red lines; current verification of buildings and structures under construction in industrial, civil and residential construction;

d) special survey related to urban landscaping and engineering equipment;

e) design and construction of the subway, canals and bridges.

Polygonometry projects for built–up and undeveloped areas are being developed taking into account the possibility of further thickening it to perform surveys on a scale of 1: 500 and on the basis of them - various marking works for construction. The projected passages must be laid depending on the scale of the survey carried out in this area, taking into account the requirements of the instructions. As a rule, polygonometry of the 4th class (1st and 2nd categories) is created in settlements.

Polygonometry is a method of creating planned geodetic networks, which consists in building a network of passages in which all angles and sides are measured (Table 1).

Table 1- The main characteristics of geodetic networks created by the method of polygonometry

		4th grade	1-digit	2-digit
1	Maximum stroke length, km	15	5	3
2	The maximum perimeter of the polygon, km	30	15	9
3	Maximum length of the sides, km	2	0,8	0,35
4	The number of sides during the polygon	15	15	15
5	Relative stroke error	1/25000	1/10000	1/5000

The reference boundary network (RBN) is a special-purpose geodetic network created for the coordinate support of the State Land Cadastre, state monitoring of lands, land management and other measures for the management of land resources in Kazakhstan.

The boundary survey network is a geodetic network of condensation created for surveying land plots, land inventory and other work on the creation of the state cadastre of real estate objects (Methodical...., 2003).

Land surveying is a complex of works to establish, restore and consolidate the boundaries of a land plot on the ground, determine its location and area. The boundaries of the land plot are established on the ground in the presence of a representative of the city (settlement) administration, the owners, the owner (user) of the delimited and adjacent land plots or their representatives, whose powers are certified by powers of attorney issued in accordance with the established procedure. The results of the establishment and coordination of boundaries are formalized by an act signed by the owner of the delimited and adjacent land plots, the city (settlement) administration and the engineer – land surveyor – producer of works. After fixing the boundary markers on the ground, their planned position is determined using a GPS receiver.

The location of the boundaries of land plots is subject to mandatory coordination with interested parties in accordance with the established procedure if, as a result of cadastral work, the location of the boundaries of the land plot in respect of which the relevant cadastral work was performed has been clarified, or the location of the boundaries of adjacent land plots, information about which is entered into the state real estate cadastre, has been clarified.

The subject of coordination with the interested person when performing cadastral works is to determine the location of the boundary of such a land plot, which is simultaneously the boundary of another land plot belonging to this interested person. The interested person has no right to object to the location of parts of the borders that are not simultaneously parts of the borders of the land plot belonging to him, or to coordinate the location of the borders on a reimbursable basis.

The agreed boundaries of land plots are fixed with boundary markers that fix the location of the turning points of the boundaries of the land plot on the ground. The need to establish long-term boundary markers is determined by the customer of the survey. He also approves the type of boundary mark from among the samples recommended by the contractor. An outline is drawn up for a boundary mark

(signs) that belongs to three or more land plots and if there are at least three clearly identifiable objects within 40 meters (elements of buildings, structures, structures, power transmission poles, etc.) (Sulin, 2010; Zhdanova, 2015).

The planned position of the boundaries of the land plot on the ground is characterized by flat rectangular coordinates of the centers of boundary markers calculated in the local coordinate system. The surveying of land plots for various purposes of land is carried out with an accuracy not lower than the accuracy given in the following Table 2.

Table 2 -Normative accuracy of land surveying [2]

№	Land grading	Average square error M_t of the position of the boundary marker relative to the nearest point of the initial geodetic base, not more than, m.	Permissible discrepancies in the control of land surveying, m	
			ΔS_{per}	f_{per}
1	Lands of settlements (cities)	0,10	0,2	0,3
2	Lands of settlements (settlements, rural settlements); lands provided for personal subsidiary farming, gardening, gardening, suburban and individual housing construction	0,20	0,4	0,6
3	Industrial and other special purpose lands	0,50	1,0	1,5
4	Agricultural lands (except for the lands specified in paragraph 2), lands of specially protected territories and facilities	2,50	5,0	7,5
5	Forest fund lands, Water fund lands, Reserve lands	5,00	10,0	15,0

Satellite, geodetic, photogrammetric and cartometric methods provided for in the technical design are used to determine the flat rectangular coordinates of boundary markers. The heights of boundary markers are determined in accordance with the requirements of the work assignment. The area of the land plot is calculated from the coordinates of the turning points of the boundaries of the land plot. The area of the land plot, the boundaries of which are described by reference to geographical objects, is calculated with an accuracy not lower than the graphical accuracy of the cartographic material, the numerical scale of which is equal to the numerical scale of the corresponding cadastral map (plan) of the land plot (territory).

Currently, there is a need to create an automated system for the urban cadastre based on modern computer technologies as a single complex for obtaining complete information. When creating an automated system, the task is divided into the development of separate types of software: organizational, technical, software, information and, including cartographic. At the same time, the requirement of compatibility of the cartographic system with other components is mandatory. The greatest interest is aroused by new GIS technologies that ensure the efficiency,

completeness and reliability of information about the existing state of the urban environment within a particular city territory. GIS is a system of technical and software tools, technological, organizational, methodological and information support designed to collect, accumulate, store, process, display, analyze, present and disseminate information about spatial objects. Cadastral works are necessary to describe a real estate object as an object of law. Thus, performing cadastral work, real estate objects are created as an object of civil rights, according to the Land Code of the Republic of Kazakhstan (Land Code ..., 2015; Zolotukhin, 2021).

The strategic objectives of the economic and social development of the Republic of Kazakhstan are defined by the program document "Kazakhstan-2030", which provide for the acceleration of scientific and technological progress based on the creation of innovative technologies for the production of high-quality competitive products. In the field of land cadastre management, tasks are solved on the basis of the latest technologies using remote sensing and GIS data.

The development of the methodology of the system approach has led to the emergence of a new, more advanced and purposeful methodology for solving problems of large and complex dynamic systems in the form of object-oriented analysis, design and programming, which began to take shape only in the last two decades.

The main requirements and applied issues of the methodology of object-oriented analysis, design, programming and their information support and database construction are given in the works (Cheremitsyna, 2004). They formulate the basic concepts of the object-oriented approach, provide basic recommendations for creating structures, concepts, technologies, principles of modeling objects and processes, as well as information flows and databases in large, complex and dynamic systems. Land management and cadastral works are formed and operate in a certain environment, which, in relation to the cadastre system, is considered as internal and externa (fig.2) environments and have their own set of properties. The cadastre system and the environment are organically linked and interdependent (Author's certificate, 2024; Nurpeisova, et al., 2024).

Therefore, an important step in creating a system of geoinformation technology for automated land cadastre management is the development of its concept. Like any system, this system includes many hierarchically arranged and interconnected objects and other structural and functional units of integrity, which together form the unity of the components of the system. Such a system should be clear and precise with a relatively simple internal structure. The development of a systematic approach to the preparation of data for automated information systems (AIS) for the organization and management of land management and cadastral works is an urgent task, the solution of which is essential for the formation of a unified information and communication space for land management and cadastral works.

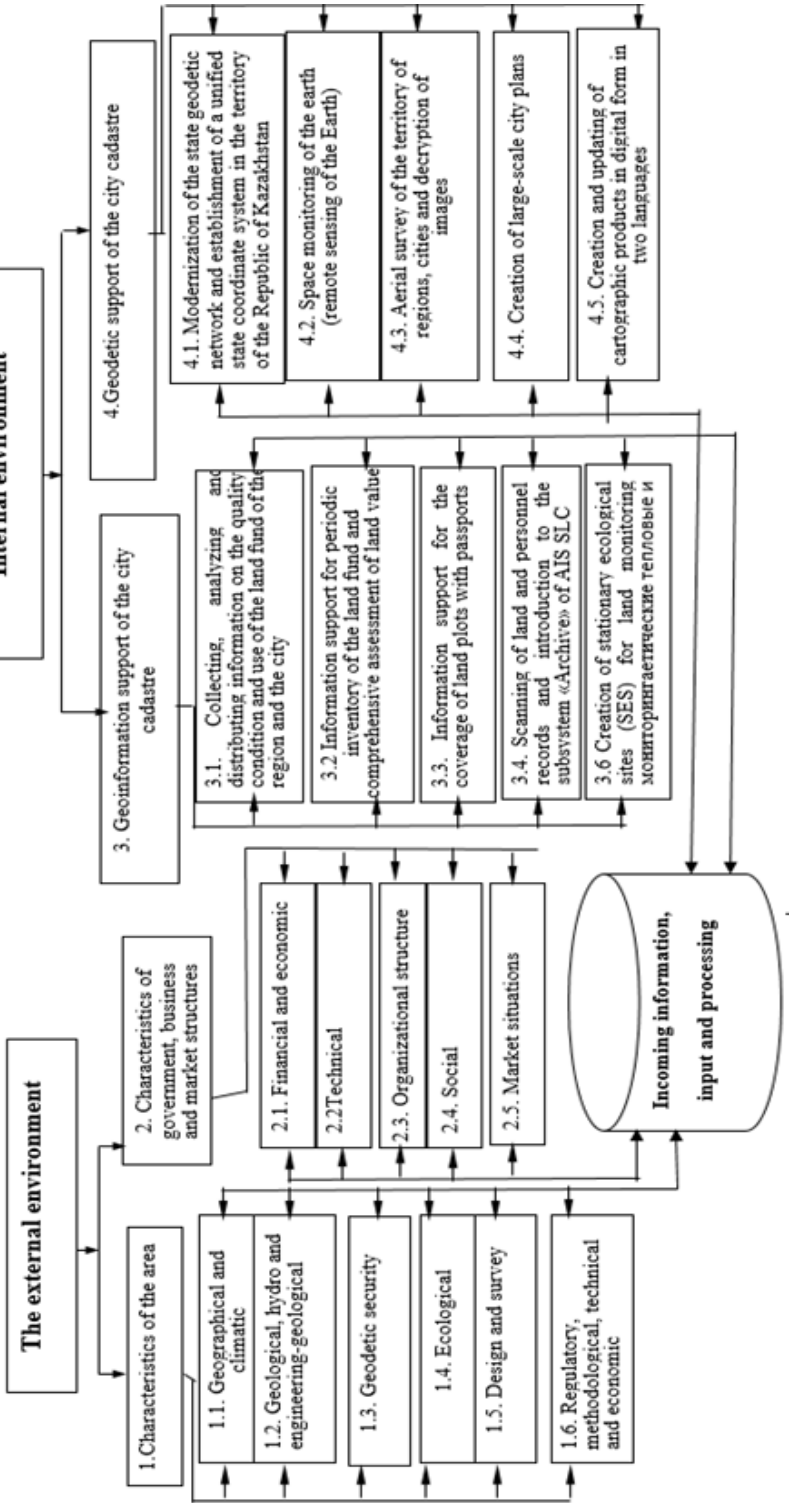

Figure 2 - Functional diagram of GIS

The considered structure of GIS information support for urban land use (ISUL) includes three subsystems:

The data collection subsystem provides the formation of the following data set: geospatial data of the city territory, including the cadastral division scheme, land boundaries, data on functional zoning, layers of ecological status, engineering communications, etc.;

The subsystem of preliminary data processing is designed for: converting, coordinating and linking cartographic and semantic data of the land cadastre into the format of the GIS ISUL program; converting and processing documents in order to create reference materials; creating and converting topographic and thematic maps of the city. Performs periodic updating and filtering of newly received data.

The GIS subsystem of information services for urban land use entities implements algorithms for user interaction in the complex analysis of information, provides a substantive dialogue with the system, allowing you to request the necessary information and provide it in a convenient form for use (Nurpeisova, et al., 2024).

GIS ISUL was created in the MapInfo environment and uses its rich toolkit.

Thus, we believe that an important step in creating a system of geoinformation technology for automated land cadastre management is the development of its concept. Like any system, this system includes many hierarchically arranged and interconnected objects and other structural and functional units of integrity, which together form the unity of the components of the system. An object-oriented system should be clear and precise with a relatively simple internal structure.

Conclusions.

1.The introduction of modern geodetic technologies in the land cadastre makes it possible to obtain spatial data for large territories with high efficiency, and also makes it possible to obtain from this data the diverse information necessary for effective management of land resources, quickly and with high accuracy. In the future, this information serves as the basis for the creation of land information systems.

2. An analysis of the problems of urban land use of the geoinformation system for information support of urban land use subjects was carried out, information needs, the structure of land users, and sources of information for creating this GIS were assessed. Based on the results of the analysis, the structure of the urban land use system was proposed.

3. Methodological approaches to the creation of thematic GIS information support for groups of urban land use subjects are considered. A GIS concept and geodatabase structure have been developed to provide information to land users in small towns.

4. Scientific novelty. Innovative geodetic technologies for various urban areas

and the GIS concept for information support of land users have been developed and introduced into production, the novelty of which is confirmed by Certificate of the Republic of Kazakhstan No. 52586 dated December 12, 2024 for a work of science

References

Author's certificate of the Republic of Kazakhstan. No 52597 dated December 12, 2024 for a work of science. Creation of a conceptual GIS model in the land registry. Authors: Nurpeisova, M., Turegaliyeva, Zh., Nukarbekova, Z., Baiturbay, O.

Balkizov, A.B., Balkizov, V.A. Ehkologizatsiya agropromyshlennogo kompleksa kak osnova ehkologo-ehkonomicheskoi ehffektivnosti khozyaistvovaniya. V sbornike: inzhenernoe obespechenie v realizatsii sotsial'no-ehkonomicheskikh i ehkologicheskikh programm APK. Materialy Mezhdunarodnoi nauchno-prakticheskoi konferentsii. Kurgan, 2021. S. 179-183.

Bardadyn, M.S. The perspective of the application of innovative technologies in the cadastre and cadastral activities. In the collection: management of land and property relations. Proceedings of the XV International Scientific and Practical Conference. 2019. pp. 92-96.

Zolotova, E.V., Skogoreva, R.N. Urban cadastre with the basics of geodesy. textbook // Architecture-S. M.: 2008. – 176 p.

Zolotukhin, D.A., Barsukova, G.N. Innovatsii v zemleustroistve. V sbornike: Sovremennye problemy i perspektivy razvitiya zemel'no-imushchestvennykh otnoshenii. Sbornik statei po materialam III Vserossiiskoi nauchno-prakticheskoi konferentsii. Otv. za vypusk E.V. Yarotskaya. Krasnodar, 2021. S. 130-135.

Kraeva, O.N. Application of innovative geodetic technologies in cadastral activity. In the collection: The best student article of 2017. Collection of articles by the winners of the VI International Scientific and Practical Competition. 2017. pp. 305-307.

Methodological recommendations for bringing land management objects to the land survey. - No. 396. - M., 2003. - 38 p.

Neumyvaykin, Yu, K. Land cadastral geodetic works / Yu.K. Neumyvaykin, M.I. Persky. Moscow : Kolos, 2006. 256 p.184

Nurpeissova, M., Mingzhasarov, B., Burkhanov, B., Kyrgizbaeva, D. Influence of meteorological factors on the accuracy of monitoring results// News of the National Academy of Sciences of the Republic of Kazakhstan-Series of Geology and Technical Sciences, №5, 2023.-C.102-108. https://doi.org/10.32014/2023.2518-170X.292

Nurpeisova, M., Dzhangulova, G., Kurmanbaev, O., Sarsembekova, Z., Ormanbekova, A. Creation of geodetic reference network for monitoring transport interchanges in seismic//NEWS of the National Academy of Sciences of the Republic of Kazakhstan series of geology and technical. 2024. No.4. pp.209-223. /.https://doi.org/10.32014/2024.2518-170X.4364

Nurpeisova, T., Madimarova, G., Abdigalieva, S., Turegalieva, Zh. Application of modern technologies in the land registry//Proceedings of the MNPC "Prospects for the application of digital technologies in rational and safe subsurface use".Tashkent: TASHSTU, 2024.pp.46-50.

On approval of the Rules for maintaining and providing information and (or) information from the State Urban Planning Cadastre of the Republic Kazakhstan. Order of the Minister of National Economy of the RepublicKazakhstan dated March 20, 2015 No. 244. Registered with the Ministry of Justice of the Republic of Kazakhstan on May 22, 2015.

Sulin, M.A. The modern content of the land cadastre: textbook. so-so / M.A. Sulin, V.A. Pavlova, D.A. Shishov. Saint Petersburg: Prospekt Nauki, 2010, 271 p. (in Russian).

The Land Code of the Republic of Kazakhstan dated June 20, 2003 No. 442-II (with amendments and additions as of 06/15/2015

Cheremisina, E.N. Geoinformatics, geoinformation technologies in subsurface use. Moscow: VNIIgeosystem, 2004, pp.3-10

Zhdanova, R.V. Primenenie innovatsionnykh tekhnologii v kadastrovoi deyatel'nosti. V knige: Kadastrovaya deyatel'nost'. Varlamov A.A., Gal'chenko S.A., Avrunev E.I. uchebnik dlya studentov vysshikh uchebnykh zavedenii, obuchayushchikhsya po napravleniyu podgotovki 21.03.02 «Zemleustroistvo i kadastrY». pod obshchei redaktsiei professora, doktora ehkonomicheskikh nauk, chlena-korrespondenta RAN A.A. Varlamova. Moskva, 2015. p. 199-213.

CONTENTS

Zh.M. Aitulova, B.O. Yessimov, T.A. Adyrbaeva, E.S. Dubinina, M.E. Kurbanbayev
SYNTHESIS OF IMPORT-SUBSTITUTING BLUE ULTRAMARINE BASED ON MINERAL RAW MATERIALS FROM UNIQUE DOMESTIC DEPOSITS.....6

M.R. Aktayev, L. Akbayeva, Y. Pangaliyev, N.A. Baubek
RESEARCH OF THE CHARACTERISTICS OF UNDERGROUND AND SURFACE POLLUTION OF LAKE KISHKENSOR ON THE TERRITORY OF THE SEMIPALATINSK TEST SITE.....19

G.Zh. Bulekbayeva, O.G. Kikvidze, A.U. Tabylov, A.Z. Bukayeva, N.B. Suyeuova
DEVELOPMENT OF A METHOD FOR CALCULATING THE ONE-DIMENSIONAL PROBLEM OF PLASTIC DEFORMATION OF THE DEPOSITED LAYER DURING THE RESTORATION OF FLAT SURFACES OF PARTS.....34

Y.G. Gilazhov, M.Z. Muldakhmetov, A.Sh. Kanbetov, D.K. Kulbatyrov, E.B. Zhunussova
STRENGTHENING OF SOILS BASED ON OILED SOIL.....47

B.S. Ermakov, O.V. Shvetsov, S.B. Ermakov, S.A. Vologzhanina
INVESTIGATION OF THE INFLUENCE OF CAST MICROSTRUCTURE ON THE OPERABILITY OF THE CROWN OF A QUARRY EXCAVATOR.....59

Y.Kh. Kakimzhanov, K.T. Kyrgyzbay, S.M. Zhumatayev, T.A. Bazarbayeva, G.T. Kunypiyaeva
ASSESSMENT OF SOIL CONTAMINATION OF THE WEST KAZAKHSTAN REGION WITH HEAVY METALS AS A RESULT OF INDUSTRIAL ACTIVITY.....72

K.Ye. Kaliyeva, Ye.D. Zhaparkulova, A.R. Vagapova, M.S. Nabiollina, L.M. Ryskulbekova
THE INFLUENCE OF CLIMATIC AND ANTHROPOGENIC FACTORS ON THE HYDROLOGICAL REGIME OF THE BASINS OF THE SHU-TALAS RIVERS.....91

O.A. Kolenchukov, V.A. Fayfer, V.V. Bukhtoyarov
PREDICTION OF THE REMAINING SERVICE LIFE OF PUMPING UNIT ELEMENTS BASED ON REGULARIZATION OF RECURRENT NEURAL NETWORKS.....107

A.M. Mikayilov, F.M. Jafarova, A.Z. Hajiyeva
THE GROUPING OF MILL LANDSCAPES BY DESERTIFICATION FACTORS AND RISKS.....128

L.M. Mustafa, I.K. Ablakatov, B.M. Baiserikov, M.B. Ismailov, V.R. Zhumakanova
RESEARCH ON ARMOR STEEL TECHNOLOGY AND WAYS TO IMPROVE ITS MECHANICAL PROPERTIES.....140

M. Nurpeisova, O. Kurmanbaev, Zh. Turegaliyeva, Zh. Nukarbekova, O.Baiturbay
INNOVATIVE TECHNOLOGIES IN THE URBAN PLANNING CADASTRE.....155

Ya.N. Parshakova, A.O. Ivantsov
DEVELOPMENT OF A METHOD OF WATER TREATMENT IN THE PROCESS OF PREPARATION FOR UTILISATION OF PRODUCTION WASTE.....169

B.T. Ratov, V.L. Khomenko, Z.G. Utepov, Ye.A. Koroviaka, A.A. Seidaliyev
BLADE BIT DRILLING IN KAZAKHSTAN: ACHIEVED RESULTS, UNRESOLVED ISSUES.....182

G.K. Umirova, E.M. Toleubekov, S.K. Muratova, A.K. Isagalieva, Z.N. Ablesenova
THE EFFICIENCY OF A COMPLEX OF GEOPHYSICAL METHODS BY EXAMPLE OF THE ATASU ORE DISTRICT.....202

O.G. Khayitov, L.S. Saidova, A.A. Umirzokov, M.A. Mutalova, N.M. Askarova
RATIONAL TECHNOLOGICAL SCHEME FOR TRANSPORTING ROCK MASS FROM DEEP QUARRY.....218

Publication Ethics and Publication Malpractice
in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the Cross Check originality detection service http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of Sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of Sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайтах:
www:nauka-nanrk.kz
http://www.geolog-technical.kz/index.php/en/
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Директор отдела издания научных журналов НАН РК *А. Ботанқызы*
Редакторы: *Д.С. Аленов, Ж.Ш.Әден*
Верстка на компьютере *Г.Д.Жадыранова*

Подписано в печать 15.02.2025.
Формат 70x90$^{1}/_{16}$. Бумага офсетная. Печать – ризограф.
14,5 п.л. Тираж 300. Заказ 1.

РОО «Национальная академия наук РК»
050010, Алматы, ул. Шевченко, 28, т. 272-13-19