State assessment of urban environment taking into account the development of engineering systems

N V Bakaeva[1], T M Novikova[2], T L Kuznetcova[3]

[1]Department of Urban Planning Research, National Moscow State University of Civil Engineering, 26, Yaroslavskoye Shosse, Moscow 129337, Russia
[2]Department of expertise and management of real estate, mining, Southwest State University, 94, 50 Let Oktyabrya Street, Kursk 305040, Russia
[3]Department of theory and history of state and law, Southwest State University, 94, 50 Let Oktyabrya Street, Kursk 305040, Russia

E-mail: abe-tatyana@yandex.ru

Abstract. In conditions of urban environment land resources have special importance as a valuable natural resource. This happens in our country in conditions of market economy development and formation. Cadastral and economic valuation of urban land is a part of inventory and urban planning policy. This research is based on the principle of market value, when the amount of land fees depends on the advantage of city position in the territory of the Russian Federation economic district and cadastral quarter on the plan of the city and the level of engineering systems development. The object of the research is Kursk. It is a regional center of Central Black Soil Region. The level of engineering systems development is an evaluation criterion.

1. Introduction
Land resources are a valuable natural resource for any country in the world. Urban planning and agriculture show poor land use due to low costs. Financial management of land resources is one of the main tasks of the State Land Cadastral of the Russian Federation. [1-7].

2. Research methods
Inventory and economic valuation of urban land is an integral part of inventory and urban planning policy. It should be defined in the development of urban land database. Ranking of the city territory according to a number of factors is an important component of urban planning policy. Normative price of land in combination with some factors characterizing the city is the research base. Kursk city is an object the research. It is a regional center of the Central Black Soil Region of the Russian Federation. Its population is about 500 thousand people.

There are various methods of urban land valuation (method of expert land assessment, method of analogues, method of integrated economic assessment of land by major factors, method of land estimating by one dominant factor and others). The principles of land valuation were firstly established by Governmental Decree No. 112 in 25th February 1992. There are factors which can make score cadastral valuation for all categories of urban areas in qualitative and quantitative combination [8-12].

The following factors can be used as valuation factors:
1. Historical and architectural importance of the territory;
2. Geographic position on the city map;
3. Development of social and household infrastructure;
4. Development of engineering systems and utility systems;
5. Transport characteristics of territories;
6. Ecological conditions of territories;
7. Proneness to natural hazards.

Cadastral value calculation is carried out according to the formula approved by the standards (1):

$$CV = CVSI_{lp} \times S_э \tag{1}$$

where S is the plot area, $CVSI_{lp}$ is the specific indicator of the land plot cadastral value.

Table 1. Methodological approaches to the calculation of the cadastral value of plots.

Urban settlements	Permitted use No	Rural settlements
Statistical model development or Market valuation	1	Alternative valuation on the basis of PU and US relations
		Statistical model development
	2	
	3	
	4	
	5	Alternative valuation on the basis of PU and US relations
	6	
	7	
	8	
	9	
	10	
Market valuation	11	Market valuation
	12	
Alternative valuation on the basis of minimum CVSI for Urban settlement (US) with permitted use (PU) 9	13	
Alternative valuation on the basis of the mean CVSI of forestry fund	14	Alternative valuation on the basis of the mean CVSI of forestry fund
Alternative valuation on the basis of CVSI of agricultural lands	15	Alternative valuation on the basis of CVSI of agricultural lands
Nominal value	16	Nominal value
Statistical model development or market valuation	17	Alternative valuation on the basis of PU and US relations
*Permitted use types definition		

No	Types of permitted use (PU)
1	Land plots for high-rise residential development
2	Land plots for private house building
3	Land plots for garage and parking areas

4	Land plots included in dacha, horticultural and gardening associations
5	Land plots for shopping facilities, public catering and personal service facilities
6	Land plots for hotels
7	Land plots for business and commercial office buildings
8	Land plots for recreation and medical recreation facilities
9	Land plots for manufacturing and administrative buildings, industrial structures and facilities, utilities, facilities for material and equipment, food supply, sales and storage
10	Land plots for power stations, and their auxiliary facilities
11	Land plots for harbors, railways, marinas, airports, aerodromes, airport buildings
12	Lands plots of water bodies in circulation (In Kursk region, there are no land plots of this type of the permitted use in the valuation object list)
13	Land plots for resource development, railway tracks, motorways arrangement, man-made water ways, quays, jetties, railroad precincts, easement areas of roads, water ways, pipelines, cable lines, radio relay links and aerial lines of communication, broadcast system lines, overhead electric lines of structural components and facilities, facilities required for operation, maintenance, construction, redevelopment, repair works, development of above-ground and underground buildings, facilities, structures of transport, power and communication facilities, placement of above-ground facilities and infrastructure for satellite communication, space and military facilities
14	Land plots of areas and facilities of special protection, urban forests, miniparks, parks, urban gardens
15	Land plots for agricultural use
16	Land plots for streets, avenues, squares, walks, boulevards, gateways, lanes, driveways, blind alleys and reserve lands, land plots occupied with water bodies taken out of circulation or with limited circulation according to the laws of the Russian Federation
17	Land plots for administrative buildings, educational, scientific, public health, social service facilities, physical culture and sport facilities, culture, arts and religion facilities

We use methodology of cadastral valuation of land resources on several factors. The territory of Kursk city is estimated by 10-point scale and is preliminary divided into cadastral quarters (isochronous, contour) on the scale of the map. Integral score valuation is the result of the research. It is calculated by formula 2:

$$S = \sum_{i=1}^{n} Fi * Ki / \sum_{i=1}^{n} Ki \qquad (2)$$

where S- value of the territory in scores; Fi- value in scores on each factor; Ki – input of *i* factor into value of the territory in %; i - factor number.

3. Research results

Input is the degree of factor influence on a certain cadastral quarter. The impact of each factor on presented categories of land use is described in Table 2. 4 factors were formulated for Kursk city on the basis of available statistical and cartographic material.

Table 2. Impact of factors on different categories of the land use.

No	Factors	Categories of land use		
		Dormitory suburb	Industrial	Commercial area
1	Development of engineering and utility systems	30%	50%	30%
2	Level of social infrastructure	15%	9%	10%
3	Transport characteristics of	30%	30%	35%
4	Ecological conditions	25%	11%	25%
Total		100%	100%	100%

The distribution of major types of engineering systems is generally related to number of storey in a building with some local exceptions. According to chosen methodology 10 is the maximum score. This is the territory where cadastral quarters with all engineering systems are located. The valuation scale has been done on this basis. Table 3 shows an example of the valuation. [13-17].

Table 3. Valuation scale of engineering structures and systems of the city.

No	Engineering structures and systems	Valuation in scores
1	Territories have all the engineering systems	10
2	The territory has water supply, sewerage, heat supply, gas supply, electricity supply but there is no phone line	8
3	The territory has water supply, sewerage, heat supply, electricity supply, gas is imported (liquefied in cylinders and there is no phone line)	6
4	The territory has only water supply, sewerage and electricity	4
5	The territory has only electricity supply, water supply is through	2
6	Territory has only electricity supply	1

4. Conclusions

Territories with the same scores are combined into zones taking into account the scale. The most affordable development of engineering infrastructure is by numbers of storey in a building. Map symbols are marked on the map of numbers of storey in buildings of the city (Figure 1). [1-3,7-9, 18,19].
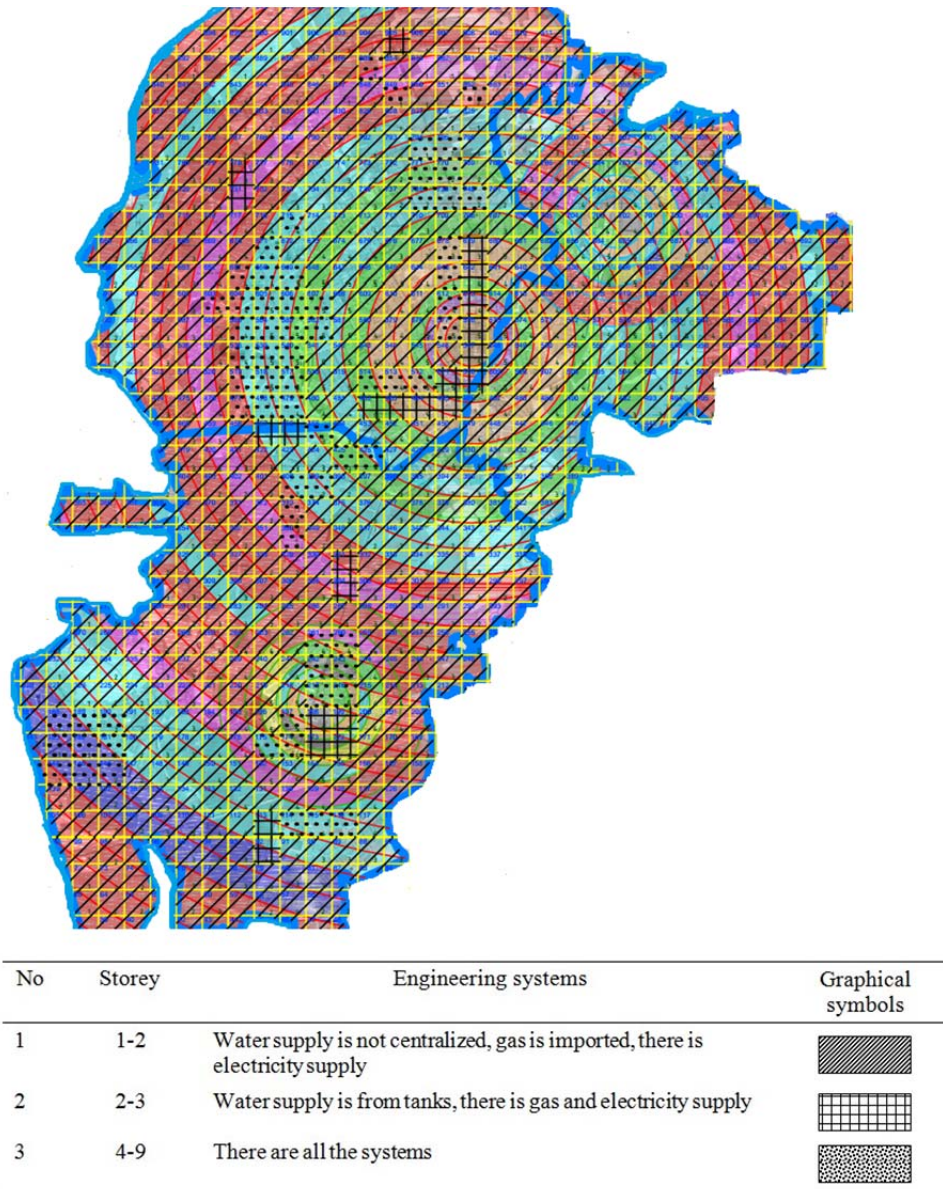

No	Storey	Engineering systems	Graphical symbols
1	1-2	Water supply is not centralized, gas is imported, there is electricity supply	
2	2-3	Water supply is from tanks, there is gas and electricity supply	
3	4-9	There are all the systems	

Figure 1. Map of number of storeys in Kursk.

Assessment of Figure 1 contours was done on the basis of obtained analytical data of engineering systems development in Kursk. The results can be used in comprehensive economic assessment of the land of Kursk city.

References

[1]   Abelyasheva T M 2003 Methodological approaches to the examination of urban environment conditions *Proceedings of the IV regional* (Kursk) pp 66–68

[2]   Abelyasheva T M 2001 Evaluation of the ecological state of the territory of the city of Kursk. *Proceedings of the Voronezh state pedagogical University* **251** 147–150

[3]   Akulshin A A, Shcherbakov V I, Kulmedov B M 2019 Treatment of waste and drainage water by biosorption method in Voronezh region *International Conference on Construction, Architecture and Technosphere Safety (Materials Science and Engineering)* **687** 044031

[4]   Bakaeva N V, Novikova T M 2015 Cadastral valuation of lands according to the level of the irtrans port accessibility y *Biosphere compatibility: human, region, technologies* **1(9)** 72–79

[5]   Bredikhin V V, Bredikhina N V, Aksentieva Yu Y 2019 Analysis of the development process of the territorial productive and technological potential of the region's construction organizations *Journal of Applied Engineering Science* **17(3)** 395–398

[6]   Novikova T M 2015 Cadastral valuation of the level of social infrastructure and amenities development of the city of Kursk *Proceedings of the SWSU* **6(63)** 116–120

[7]   Novikova T, Khaustov V, Guseinov T 2018 Cadastral Valuation Based Upon The Environmental Factors Using The City Of Kursk As An Example *Journal of Applied Engineering Science* **16(1)** 104–106

[8]   Shleenko A V, Annaev A Yu, Chernyaeva A I 2019 Development Of Real Estate Objects Of Cultural Heritage *Proceedings of the SWSU* **3(23)** 74–85

[9]   Shleenko A V, Volkova S N, Sivak E E 2019 Assessment Of The Quality Of Land Resources And Their Alternative Use In The Implementation Of Land Development Programs *Proceedings of the South-Western state University* **4(23)** 84–92

[10]   Akulshin A A, Shcherbakov V I, Uchaev A S 2019 Selection of well screen parameters as aspect of water well design *International Conference on Construction, Architecture and Technosphere Safety (Materials Science And Engineering)* **687** 044018

[11]   Novikova T M, Guseinov M A 2017 The history of the development of land legal relations in Russia *Jurisprudence and law enforcement practice. State and development trends* (Ufa) pp 45–48

[12]   Akulshin A A, Shcherbakov V I, Kuznetsova N V, Bienkowsk N, Shchukina T V 2017 Biogas Uninterrupted Production Process Intensification *Journal of Applied Engineering Science* **15(4)** 471–473

[13]   Shcherbakov V, Akulshin A, Chizhik K, Tolstoy M 2018 Design Of Interacting Wells For Optimization Of Investments And Operating Costs While Constructing Water-Diverting Structures *MATEC Web of Conferences* pp 03037

[14]   Khaustov V V, Ignatenko I M, Kruglova L E, Karnjushkin A I, Shleenko A V 2019 CARST Marble On Tyrnyauz Deposit International *Journal of Engineering and Advanced Technology* T. 8 6 Special Issue 2. 1103–1106

[15]   Bakaeva N V, Shleenko A V, Volkov S N, Sivak E E, Pashkov M I 2017 Dynamics Of Interaction Development In Socio-Ecological Systems News of higher educational institutions *Technology of the textile industry* **1(367)** 24–29

[16]   Bredikhina N V, Khaustov V V., Kruglova L E, Huseynov T A 2019 The impact of flooding on the operational reliability of real estate in the Kursk region *Journal of Applied Engineering Science* 17(2) 213–216

[17]   Bredikhina N V, Yezhov V S, Semicheva N E,. Pakhomova E G, Emanuel Solomon 2019 To the question of improving energy-saving and environmental characteristics of urban buildings *Journal of Applied Engineering Science* **17(4)** 550–554

[18]   Kuznetsova T L, Lukashova V E 2016 Analysis Of Legal Activity In The Sphere Of State Regulation Of Ensuring The Uniformity Of Measurements In Russia In The XIX - Early XX Centuries *Agricultural And Land Law* **12(144)** 12–14

[19]   Volkov S N, Sivak E E, Shleenko A V, Belova T V 2016 Levels Of Transformation Of The System And Bifurcation Points In The Objects Of Research *Vestnik of Kursk state agricultural Academy* **7** 77–80