Scientific research of urban-planning traditions of the medieval Bukhara

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Abstract. The article covers the main urban-planning and architectural activities of the urban-planning traditions of medieval Bukhara, the stages of their formation and evolution from antiquity to the XX century. The characteristics of architecture and urban planning that constitute the processes of the emergence and development of the first cities are considered. Typological features and stages of development of the city of medieval Bukhara, proposals for changing the city are presented. The practical significance of the research results, the developed design solutions for the preservation, reconstruction and modernization of historical cities and the improvement of the processes of modern interpretation of areas are stated. Such methods of scientific research as historicity, substantiation of source study, scientific comparative analysis of archival materials, chronological-systematic analysis, scientific approach to the problem have been implemented in work. Based on available archaeological, written, historical, scientific and archival materials, as well as systematization of information about the city of Bukhara, the first urbanization processes and the first model of the city have been identified.

1 Introduction

One of the ancient cities of Central Asia, as well as one of the largest and most famous trading crossroads on the Great Silk Road is Bukhara. The city, which is closely related with the most important stages in the evolution of world civilization, has gained worldwide fame for its rich and unique history, formed over thousands of years, and this history has made a great contribution to the development of cultural, educational, spiritual and religious values.

At present, the preservation of the structure of historic sites, as well as effective implementation of monuments of architectural and artistic value are extremely relevant in the reconstruction and modernization of cities worldwide. In this regard, a need to repair important centers, complexes, shrines, architectural monuments in historical cities, restoration of the buildings and structures discovered during archaeological excavations has raised.

Scientific research devoted to the origin, evolutionary development, preservation, reconstruction and modernization of urban-planning systems, determination of the genetic basis of cities, restoration of territories dating back to the Middle Ages, mutual harmonization of historical and modern buildings in order to define the protection zone of monuments, to

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create tourist routes, engineering networks, to improve road infrastructure etc. continues to rise in importance [1,2,3].

These research assume ensuring the sustainability of ancient cities, studying the processes of creation and development of the first cities, new scientific approaches in the history of urban planning, clarifying the planning structure of cities and identifying their influence on the development of modern urban planning and culture, increasing the tourism potential of historical sites, as well as the effective implementation of architectural monuments, and mentioned tasks still remains one of the urgent.

State inventory of real estate objects of material cultural heritage of the Bukhara region that have received state protection includes: 287 archaeological monuments, 31 madrassas, 105 mosques, 14 mausoleums, 133 architectural ensembles (with contents), 15 caravanserais, 4 Tims (trade rows) and Toks (arches), 18 historical sights, 122 ancient houses, 83 architectural monuments and 17 monumental sights. As has been said, "Objects of cultural heritage are the priceless wealth of the nation, therefore our duty is to preserve them and pass them on to future generations". At present, experts have not developed comprehensive scientific research of the trends in the formation and development of historical cities, the principles of their reconstruction, as well as the most optimal concepts of the adaptation of historical cities to modern requirements, which causes a number of difficulties in the modernization of cities.

Nevertheless, until 1930, new construction in the areas located southeast of the city wall, in the direction of the road to Kagan was carried out without a plan.

The general layout of the reconstruction and development of Bukhara carried out by Moscow State Institute for Urban Design (head architect D.S. Meyerson) in 1931-40 was the first serious attempt at a scientific approach to the planning organization of the city.

According to the project, the territory of the city was divided into a small network of rectangular intersecting streets, the development of which was supposed to be predominantly low-rise.

In 1965, based on the general layout, a detailed design project for the center of Bukhara was completed (architects A.M. Aleksandrovich and I.S. Zhukovsky). The main feature of this document is the linking of modern buildings with historical architectural monuments, which are actively involved in shaping the appearance of the designed city.

Our research is carried out in the frame of the implementation of individual tasks defined in the Decree of the Government of the Republic of Uzbekistan "On measures for the preservation and protection of historical monuments of Bukhara" No. 191 dated September 11, 2007, as well as other regulations related to this field.

Degree of study of the problem. Research into the history and culture of urban planning in Central Asia, including Uzbekistan, has lasted more than 200 years. In the past period, many research have been devoted to one or another aspect of the development of the city of Bukhara. The treatise by Abu Bakr Muhammad ibn Jafar an-Narshahi (1800) "History of Bukhara", as well as the works of O.A. Sukhareva, L.I. Rempel (1900's), scientists of Uzbekistan as M.K. Akhmedov, T. Sh. Mamatmusaev [4] (2000's) and others on urban planning served as important sources for our research.

2 Methods and materials

The purpose of research is determining the principles of architecture and urban planning of the stages of formation and development of Bukhara from ancient times to the beginning of the 21st century.

The main tasks arising from the purpose of research are the following:

- determination of the first processes of urbanization and the first model of the city based on available archaeological, written, historical, scientific and archival materials of Bukhara and systematization of gained information about the city;
- study the structure of historical cities and identify changes in them;
- development of a classification of compositional formation of the first cities;
- identification of the parts and characteristics of continuously developing cities, development of effective methods for using traditional forms in modern urban planning;
- identification of the ideas for using the positive aspects and models of the structure of historical cities in modern urban planning;
- development of recommendations for the reconstruction of historical cities.
- development of projects aimed at developing tourism based on historical urban planning;
- preservation of the historically established structure in ensuring the sustainability of cities;
- creation of mechanisms for adapting ancient cities to the requirements of modern transport and engineering infrastructures;
- creation of a database on various indicators of historical cities, including location, time of origin, territory and planning solution;
- assurance of the quality of urban reconstruction in order not to lose the value of the structure that has been formed over centuries and to make the smallest changes;
- creation of a unified system for the restoration of the protected zone of the territory of architectural monuments;
- establishment of the standards for the use of traditional or appropriate materials and technologies in reconstruction;

As the object of research was identified the Bukhara city, which was created from ancient times and still continues to develop. The subject of the research is the ways of emergence and development of urban planning, architectural and planning solutions and urban laws in the Bukhara city.

Methods of research. Such methods of scientific research as historicity, source study, scientific comparative analysis of archival materials, chronological systematic analysis, as well as scientific approach to the problem have been used in our work. The research was carried out based on archival materials, most of which are being introduced into scientific sphere for the first time.

3 Results and discussion

Based on the above, the authors have developed 21 architectural and urban planning attributes of the Bukhara city in its preserved state [5-8] (Fig. 1):

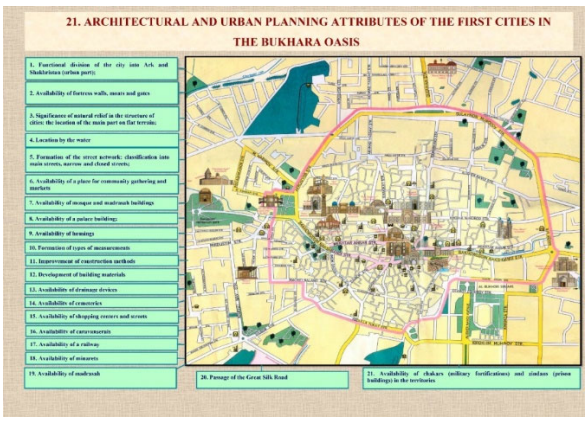

Fig. 1. Architectural and urban planning attributes constituted the Bukhara city.

1. Functional division of the city into the Ark (citadel) and the urban part of Shahristan (part of city that is out of citadel) according to V.V. Bartold. This developed concept of the city is very common in Central Asian urban planning. In 967, Bukhara was a city in which feudal relations began to develop at that time, the city began to fragment, there was no territorial unity, it was divided into three parts, namely Ark, Shahristan and Rabot. According to scientists, cities of the IX-XII centuries are characterized by a three-part topography, namely Ark (citadel), Shakhristan (ancient city, residential districts) and Rabat (craft districts) [9];

2. Availability of fortress walls, moats and gates (by the V-VI centuries proto-cities gradually turned into cities, and castles into city citadels). In the Middle Ages, cities consisted of three parts (ark, city and rabat), and in large cities each of them was surrounded by separate fortress walls. In the XIX century, the total length of the wall of the Bukhara city fortress was 12 km, height was 10 m, and base thickness was 5 m. In the upper part of the wall there were passages 2 m wide, which were used to carry defensive weapons by the wall. The fortress wall consisted of 116 small towers and 11 two-tower gates, in some areas there are places intended for shooting, and the upper part of the wall was made of sharp tips (dandona);

3. The importance of natural relief in the structure of cities: the location of the main part on flat terrain. Bukhara is located at 39°43' north latitude and 64°38' east longitude. The climate of the city is subtropical, continental, that is, summers are hot, winters are quite warm, the average temperature is +15.1°C, in July +29.5°C, in January -0.6°C. Narshakhi in his book “History of Bukhara” [9] describes the following story of the origin of the city: “...in ancient times, on the site of Bukhara city there were lakes, reed fields, and thickets. Many birds and animals lived here.”

4. Location by the water. A large river formed in the mountains near Samarkand. This river was named Mosaf (now Zarafshan). The waters of the river were very abundant and flowed to Farab (to the present valley of the Amu Darya) and sank there into the sands. The places that were once a lake (the site of the modern city of Bukhara) gradually became covered with silt, and people, especially from Turkestan, began to come and settle around the lake. Abu Bakr Narshahi provides information about reservoirs, prosperous villages, works and watersheds that irrigate the oasis. In the VIII-XII centuries, the entire oasis was supplied with water through irrigation networks such as Karmana, Shopurkom, Somjon, Baikonrud, Farovizi Ule, Komi Daymun, Arvon, Kayfur, Rudi Zar. There were about 100 pools in the city and about 250 pools outside the city. The city of Bukhara is alluvial, built on layers of soil (“History of Bukhara” [9]). Of the large number of pools, only three have survived to date, and two of them (Lyabi-Khauz and Bolo-Khauz) are located in the city center area. From the old irrigation system, only the Shahrud canal running through the center of the “old” city is fully functioning.

5. Formation of the street network: main wide streets, narrow and closed streets. In the VII-VIII centuries the territory of Bukhara was about 30-35 hectares (currently about 10 thousand hectares). The city center was located around the present Toki-Zargaron. This part of the city was located inside a wall with 7 gates and was called Shakhristan. The streets of Shakhristan are laid out in a checkerboard pattern. Building cities in this way is an ancient tradition of the East. The streets stretched to the four cardinal directions. This is more clearly visible around Taki-Zargaron of modern Bukhara.

6. Availability of highly developed crafts (pottery, blacksmith, textile, construction, stone and leather districts);

7. Availability of sites and markets for gathering the population (five domed commercial buildings of the Chorsu type were built at the main intersections: Toki Ordfurushon, Toki Zargaron, Toki Telpakfurushon, Toki Tirgaron, Timi Abdullakhan);

8. Availability of mosques and madrasah buildings (according to Abdurauf Fitrat, in Bukhara there were about two hundred madrassas, which were divided into higher, middle

and lower categories, 31 madrassas, 105 mosques, which were rebuilt in 1514 on both sides of the minaret. Kalon Mosque (Great Mosque) and Miri Arab Madrasah that built in 1530-1536 are Arabic buildings);

9. Presence of palace buildings (133 architectural ensembles with composition). As a result of the study of our great ancestors and attention to our historical cities, many monuments that were partially destroyed have been radically restored, reconstructed and preserved for future generations.

10. Availability of residential buildings (100 old houses built in the XIX century);

11. Formation of measurement types. In times when general units of measurement did not exist, people used to measure the amount of something depending on their needs. Before the worldwide introduction of the metric system in 1918, the following units of measurement existed in the countries of Central Asia: markhala, farsakh, (farsang), kamnerez, tanob, batmon, pud, isbat (finger), kuloch, tutam, enli, karich, misqal, shibir (karich), pota, satih, chilla, talent, tasuy, turmusa, ukiya, unsia, ziro, suyam, akirim, pakir, mii, dakhsar, nimcha, shair, etmai, esirak, dona, etc. These units of measurement, representing different values, have long served as a means of measurement among our peoples;

12. Improvement of construction methods. According to M.K. Akhmedov, in the construction of Bukhara complexes of the XVI-XVII centuries, “paired” and “double” methods of madrasahs and mosques, traditional for Central Asia, “were the first to be used in pairs”, when it was necessary to place buildings close to each other and with parallel axes in creating complexes[10]. During the reign of Abdullah Khan Shaybani, that is, in the XVI century, the wooden porch emerged as a permanent symbol in the architecture of mosques. An example of this is the Baland mosque and the Khanqah mosque of Khoja Zainuddin with a porch in the shape of the “Г”. According to V.L. Voronina, [11] the design of the porch in the form of the “Г” is typical for Bukhara. In the second half of the XIX century, Central Asia, especially Uzbekistan, encountered European and Russian cultures, which were considered the most advanced at that time. Russian architects adapt European city models to the Turkestan region, and cities are formed in a radial-ring plan (Fig. 1). The look of Samanid Mausoleum changes depending on the lighting, the colors and outlines of the mausoleum. 18 types of brick were used in the construction of this building;

13. Development of building materials (a special mixture prepared for the construction of the tower is prepared from mulberry powder, grape juice, black chicken eggs, camel hair and milk). The work [12,13,14] presents the results of a study of the historical solution of the Ismail Samani mausoleum and the Kalyan minaret, as well as modified solution based on local gypsum developed for their restoration. It was proven that the structure of the latter is practically no different from the structure of the mortar of national architectural monuments. At the same time, the strength of the solution is sufficient and meets the requirements of existing building codes. A deep and comprehensive study of the building materials used in their construction allows developing identical modified solutions for preserving the significance of architectural monuments and their effective restoration.

14. Availability of water intake devices. Water treatment facilities and water towers. The water tower of the Shukhov system is located next to the Ark citadel in the Bukhara city (Uzbekistan). In 1920, construction of a water pipeline began in Bukhara, now known as the Old Bukhara Water Canal. The water tower, built in 1927 according to Shukhov plan, became part of this water supply system. The construction of a water pumping station in Bukhara was completed in 1929, and already at the beginning of the next year the first city water supply system began operating in the city.

15. Availability of cemeteries. A quarter of the territory of the city was occupied by ancient cemeteries, rising above the ground thanks to multi-tiered burials. There are 21 active cemeteries within the city. Their total territory is 63.43 hectares. Almost all cemeteries are

located directly in residential buildings without observing regulatory sanitary protection zones for housing.

16. Availability of shopping centers and streets. The rulers and residents of the Bukhara Emirate paid great attention to trade. The development of crafts and manufacturing in the Emirate provided the basis for the further expansion of permanent trade relations. In the second half of the XVIII century, much attention was paid to the construction of caravanserais in many cities of the Bukhara Emirate, which served to further strengthen trade relations. From the end of the XVIII century to the beginning of the XIX century, the trading cities of Russia (mainly Orenburg and Astrakhan) began to play an important role in the foreign trade relations of the Bukhara Emirate.

17. Availability of caravanserais. Russian merchant who came to Bukhara to trade in 1820 testified that at that time there were 13 brick caravanserais in Bukhara. N. Khannikov, [15] who arrived in Bukhara in 1840-1842, recorded that there were 38 caravanserais in the city, of which 24 were brick and 14 wooden. At the beginning of the XX century, the total number of caravanserais in Bukhara was more than 70. Currently, 14 caravanserais have preserved.

18. Availability of a railway (the first railway was built from the territories that belonged to the Bukhara Emirate; on February 26, 1888, the first train entered the territory of Bukhara).

19. Availability of towers. Kalon minaret, forever imprinting the name of Arslonkhan, completed in 1127. The height of the tower is 47.5 meters, the depth of the base is lower the ground level of 10 meters, the tower can be climbed by 105 steps, and the city can be viewed through 16 windows at the top;

20. Passage of the Great Silk Road. The history of ancient Bukhara is closely related to the Great Silk Road, which crosses all of Central Asia. The first settlements appeared at the beginning of the 2nd millennium BC, the city developed and grew rich thanks to merchants from Persia, India, China and Russia who traveled east from the Caspian Sea and further beyond its borders. The geographical position of the city, which on the one hand borders the desert, and on the other hand the developed agricultural regions of Uzbekistan, allowed Bukhara, as an important route, to contribute to the development of the Great Silk Road. The oasis-city of Bukhara is located in Central Uzbekistan near the Zarafshan river along its lower course. Merchants stopped in Bukhara before setting off on their journey through the Kyzyl-Kum (Red Sand) and Kara-Kum (Black Sand) deserts. Being one of the prosperous medieval cities of Central Asia, Bukhara was not only a center of international trade, but also a center of spiritual, cultural and religious importance. Trade caravans plying along the Bukhara section of the Silk Road enriched themselves with locally produced goods. Bukhara was famous for textiles; the fleece of Karakul lambs (karakulcha), silk, cotton, leather, carpets, clothing, as well as gold embroidery and metal products were in great demand. Many of these crafts are still practiced today.

21. Availability of chakars (military fortifications) and zindans (prison buildings) in the territories. In order to protect the Bukhara oasis from external attacks, all its agricultural lands were surrounded by a defensive wall stretching for several hundred fars. This wall was built between 782-831 and was known as “Kampirak”.

4 Conclusion

Practical significance of the research results will serve to improve the quality of developed design solutions for the preservation, reconstruction and modernization of historical cities and improve the processes of modern interpretation of areas. The city has largely been preserved in the form in which it was formed in the XVII century. The change was mainly due to construction density. The territory of the city within the fortress wall remained as it was then, in the XVII century. Based on the research tasks set, it is advisable to scientifically

study each of the 21 architectural and urban planning attributes that functionally constitute the Bukhara city.

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