Barrier-free Environment as an Indicator of Sustainable Development of the City. Priorities and Experience in Samara (Russia)

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Abstract. An attempt to systematize the experience of creating a barrier-free environment in Samara, one of the megacities in Russia, has made. In the course of work, field surveys carried out. The following priority areas for the implementation of universal design methods identified: housing, social infrastructure and a set of elements of urban utilities. In them, the consumer properties of buildings and territories have a decisive influence on the overall assessment of the quality of the urban environment. The examples are given and the difficulties of creating a barrier-free environment in new residential compounds and universities, as well as in the objects of the municipal sphere of the city analyzed. The conclusion that the process of introducing the principles of formation of a barrier-free environment has a rather low pace has made. This is not in line with the city's sustainable development objectives. The question of the development of local urban planning regulations and design standards, which will allow the transition to the massive use of the principles of universal design, has raised.

1. Introduction

A comfortable urban environment design is one of the priorities of modern urban planning policy in the Russian Federation. Its principles and techniques are consistent with the UN sustainable development goals [1]. The concept of "universal project (design)", which is used in the UN Convention on the rights of persons with disabilities, is included in the text of the design regulations in force in Russia - SP 59.13330.2016 "Accessibility of buildings and structures for people with limited mobility". According to this document, low-mobility groups of the population include people "experiencing difficulties in independent movement, obtaining services, necessary information, or when navigating on location". They have physical, sensory, or intellectual disabilities. Despite the fact that until now the term "universal design" has not been widely used in Russian professional urban planning and architectural design, it used in compliance with the requirements that are associated with the implementation of the needs of low-mobility groups of the population. The environment in which their interests taken into account called "barrier-free". This environment is necessary for many people. For example, necessary measures apply to senior citizens aged 60 years and older, whose number in
Russia according to the Federal state statistics service tops 32 million people (2019), to preschoolers and younger students, which total is more than 18 million people, to pregnant women, the number of which annually reaches 400–525 thousand people, and also to disabled people of working age, whose total number is approximately 5.2 million.[2]. Russian sociologists have found that approximately two-thirds of disabled people (60.0 %) and non-disabled people (61.7 %) recognize that providing an accessible environment is an urgent and important state task [3].

2. Materials and methods
The issues of creating a barrier-free environment have closely studied in the world and in Russia since 1960–70. In order to identify traditional and new approaches, an extensive theoretical and methodological base investigated in the course of the activity. Above all things, the fundamental works of the founders of universal design (S. Goldsmith – 1963, R. Mace – 1974, O. Herwig – 2008) and theorists of barrier-free environment design (C. Harrington – 2005, O. Heiss, C. Degenhart, J. Ebe – 2010) examined. In Russia, the issues of adaptation of architectural solutions to the needs of people with disabilities given attention in the Soviet times (K.Yu. Kalmet – 1990, V.K. Stepanov – 1989). The topic developed at the beginning of the 21st century in the works of sociologists (E. G. Leontieva – 2001, Yu.P. Shestopalov – 2011, E.K. Nabershchina – 2013, A.A. Nikonova – 2016, etc.), of architects (E.G. Molotkova – 2005, A. N. Teryagova – 2006, S.G. Korotkova – 2010, V.O. Mosin – 2011, A.A. Shvalieva – 2013, L.V. Zheknakova – 2017, L.A. Tsvetkova – 2017, N.V. Kasper – 2018, etc.) and of builders (O.V. Proskurina – 2004, E.V. Bruma – 2014, R.N. Istratov – 2014, A.R. Slyusarev – 2016, K.E. Safronov – 2017, etc.). In total, more than 70 works on the theory and practice of forming a barrier-free environment studied, analyzed and systematized during the research. The focus was on current articles made in the second decade of the 21st century.

3. Results

3.1. Living environment
The primary criterion for the accessibility of the living environment is the availability of unhindered access and movement. Developers of projects of new residential compounds in Samara of the "elite" and "comfort" categories use two schemes: with ramps at the entrances to the building (Figure 1 – a, c), or without them (Figure 1 – b). The first scheme used more often. This is relevant for reasons of climatic characteristics and the universal purpose of devices. For example, a ramp is the only way for the elderly and parents with strollers to climb independently. In Russia, regulatory restrictions apply to the slope and the maximum height of one ramp rise, to the area of entrance and intermediate areas for rest and turning, as well as to the height and structure of fences. The second scheme used less frequently. Its advantage lies in the complete absence of barriers, and disadvantage is the increased maintenance costs in the winter.

Figure 1. Residential compounds in Samara: a, b – "Imperial", construction company Novoe Vremya LLC, 2017–2018; c – "Zhelyabovo.rf", Drevo development company, 2016–2020.
Currently, one of the problems of creating a barrier-free environment in Samara is associated with the choice of material for covering the ramp and fencing. They depend on the class of housing comfort. Therefore, only in luxury homes (comfort classes "elite" and "business") a smooth surface is selected, without roughness, with optimal adhesion of the soles of shoes or the wheel of a wheelchair. This does not fully comply with the principles of sustainable development, which are guided by the maximum extension of the life cycle of mass objects (comfort classes "economy" and "business") [4].

In recent years, open spaces solutions have changed strongly. In the courtyards and on the streets adjacent to houses, places for personal vehicles of disabled people placed in the immediate vicinity of the entrance to a residential or public space, as a rule, no further than 50 m. The width of the parking zone for a disabled person's car increased compared to the standard one. Signs on the road and sidewalk, as well as on vertical surfaces Used. In addition, places of rest, waiting and related services become more accessible due to the reducing of the curb at the entrances to the courtyard areas. Tactile means installed in advance perform a preventative function (Figure 2).

![Figure 2. Adequate parking for personal vehicles of disabled people, recreation areas and yard area (residential compound "Zhelyabovo.rf").](image)

Improving the quality of the architectural environment of housing in Samara achieved not only by meeting the requirements of accessibility, safety and convenience, but also by being informative. In modern residential compounds of different comfort classes, information tools that correspond to the physiological characteristics of different groups of the population used. For example, the buttons for calling and moving the elevator made large, with flat-convex numbers that duplicated in Braille.

3.2. The facilities of social infrastructure
Socialization of people with disabilities is one of the priorities of sustainable development and a recognized method of increasing the stability of public relations [5]. The key to solving this problem is to adapt educational facilities for their needs. Universities play a special role. In the State program "Accessible environment" by 2025, it planned to increase the share of adapted higher education institutions to 30 %. Let's look at some solutions implemented in Samara universities.

In the new designing and construction of educational facilities, as well as in the conditions of reconstruction, priority given to the accessibility of the building. The path should be unobstructed both outside and inside the building, and access to all spaces necessary for mastering the training program – classrooms, laboratories, a library and a media library, as well as rooms that provide physiological needs and services – a dining room, bathrooms, cloakroom, are convenient. On the lower floors of buildings, the creation of training areas for flexible use to reduce travel paths is possible. The width of transit communication spaces (at least 1.5 m), the ability to make turns and the dimensions of doorways (at least 1.2 m) are important. An important role played by the area and equipment of sanitary facilities for wheelchair users. If a disabled person needs help, then provide an enlarged room. To help people with visual impairments, a good color contrast between the floor and the wall and between the walls and the ceiling must be create. The floor covering should not be slippery or have steps. The room speaker should not create reverberation or excessive silence.
Special parking spaces of enlarged width must be provide on the territory. The main entrance must be marked with information (identification) signs and signs made using a special design. Entrance groups must be equipped with platforms and ramps with the specified parameters. Automatic or semi-automatic doors recommend to installing.

In Samara universities, the following methods used: optimization of parking placement, creating a barrier-free connection between parking and the entrance to the educational building, equipping ramps of the main entrance and lobby, neutralizing barriers to movement to the educational premises. For example, in the buildings of the Samara State Technical University, the entrance groups are equipped with exit ramps, sufficient entrance areas arranged, and there are ramps in the lobbies in some cases (Figure 3).

![Figure 3](image)

Figure 3. Entrance groups to the Samara State Technical University educational buildings – a, b, and the ramp in the lobby of the building number 12.

The study showed that the elimination of barriers is the most difficult point for adapting university spaces, since the dimensions of the transit rooms in many existing buildings are insufficient, and the main vertical communications are stairs. Therefore, it is not possible to use lifts or lifting platforms. Unfortunately, if the barriers not removed, then making other changes becomes meaningless.

3.3. The facilities of municipal infrastructure

Municipal facilities play a special role in the life of the city. Elements of transport and pedestrian infrastructure, gas stations, bathhouses, dry cleaners, ambulance stations, veterinary clinics, fire stations and other belong to them. Their features are complex technical solutions or technological processes, a high level of fire danger, round-the-clock operation in some cases, close interaction between humans and special vehicles, etc.

Unfortunately, in Samara and the Samara region, the group of objects for sanitary and utility purposes is the least consistent with the idea of a barrier-free environment. Equal conditions for people with different health opportunities rarely provided in those places. Most often, access to veterinary clinics, public baths, and ambulance substations is unavailable or difficult for people with limited mobility (Figure 4 – a, b). This happens in the design and construction of new facilities and in the reconstruction of existing buildings. Some progress has made in modernizing the transport infrastructure. Several barrier-free underground pedestrian crosswalks constructed in Samara in the run-up to the 2018 FIFA world Cup (Figure 5).

Often, obstacles to creating a barrier-free environment caused by the mode of operation of certain types of such objects. For example, access to fire stations is restricted due to security requirements, and the public can only get into one room where instructions are given. At the same time, the organization deprived of the opportunity to employ people with disabilities. However, individual facilities designed and built over the past 15 years are more in line with the new requirements than those that built earlier. Positive examples include the Ministry of Emergency Situations Specialized fire and rescue unit, which started operating in 2019. It is characterized by a more rational functional
zoning, the presence of staff service facilities (heating and eating room, staff rest room, classrooms, etc.), the use of modern materials and structures, and the introduction of systems that ensure the optimal functioning of the object. The interaction scheme of spaces and design tailored to the need of improvement of information content, ensure unobstructed access to fire extinguishers, simplification of paths of movement between personal spaces and a garage for fire equipment.

Figure 4. Entrances to public infrastructure facilities: a-bathhouse; b-ambulance station.

Figure 5. Underground pedestrian crossing.

All positive examples have appeared recently and now they are an exception to the general rule. The analysis of the condition of numerous operated buildings of earlier periods showed the need for full their adaptation to modern requirements. For this purpose, it is necessary to implement innovative systems and technologies that allow solving new social problems – involving disabled citizens into active life [7].

4. Discussion

In the Russian Federation, the term "barrier-free environment" and its equivalent – "accessible environment" applied to open spaces and buildings in which the conditions for the unhindered presence and movement of people with limited mobility met [6]. As part of the implementation of the National Project "Formation of a Comfortable Urban Environment", these parameters taken into account when measuring the quality index of cities and historical settlements, which makes it possible to clarify the degree of "favorable" or "unfavorable" living conditions [7]. In 2011, the State program "Accessible environment" launched, and in the end of 2019, its action extended until 2025. The measures envisaged are inseparable from the concept of "humaneness" [8]. They are used to priority objects – residential and public buildings (social infrastructure – education, health care, social assistance and rehabilitation), roads and elements of transport services, workplaces, electronic and emergency information and communication services.

It should be noted that a number of difficulties in certain regions arise due to the recommendatory nature of the regulations adopted at the federal level. Each region has its own natural and town-planning features, a peculiar socio-demographic structure. The lack of regional standards that take into account the local specifics does not allow making the process systematic and more manageable [9].

The issues of promoting universal design methods and creating a barrier-free environment are associated with adjusting the training tasks for students of architectural and design universities and faculties in Russia. It is known that the items devoted to the understanding of the social context by students, the acquisition of knowledge that allow them to comply with ergonomic and spatial requirements, focus on the principles of equality and access to architectural objects, are included in the UNESCO Charter on Architectural Education [10]. Teaching the basics of universal design has already entered the curricula of architecture schools in different countries of the world [11]. In Russia, serious attention is paid to various aspects, however, individual developments have not yet turned into a system. For example, scientists from Vladivostok raised the issue of the peculiarities of organizing a
barrier-free environment on difficult terrain [12], in Voronezh attention paid to open pedestrian and recreational spaces and areas near social infrastructure facilities [13], in Samara the question of creating barrier-free university campuses raised [14] and in Novosibirsk an attempt made to move to a broader concept – "universal architecture" [15].

5. Conclusions
At the moment, regulatory requirements for territories, buildings and structures designed and built in Russia are imposed on the implementation of a complex of architectural planning, engineering, technical, ergonomic, structural and organizational measures aimed at ensuring accessibility and safety for people with limited mobility. They corresponds to the tasks of sustainable development and increasing comfort of the urban environment.

The techniques used to create a barrier-free environment largely follow the principles of universal design. In practice, this allows you to create comfortable conditions for the use of the environment and objects for any residents, without infringing on anyone's rights. Nevertheless, in Samara, the process of introducing the principles of the formation of a barrier-free environment is rather slow. Consequently, the solution of urgent tasks to ensure social justice and the safety of the operation of the territory postponed for the future, the pace of improving the quality of life of the population and the attractiveness of the city for investment are decreasing. One of the ways to solve the problem can be consider the development and implementation of local urban planning regulations and design standards. They will allow the transition to the massive implementation of the principles of universal design in practice and create a comfortable barrier-free environment throughout the city.

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