The Principles of the Formation of the Environment of Pedestrian Spaces in the Context of Modern Urban Planning from the Standpoint of Sustainable Development

E Wagner¹, E Avdeeva², K. Chernikova³

¹E Wagner, Reshetnev Siberian State University of science and technologies, Ave. of the newspaper the «Krasnoyarsk worker», 31, Krasnoyarsk, Russia
²E Avdeeva, Reshetnev Siberian State University of science and technologies, Ave. of the newspaper the «Krasnoyarsk worker», 31, Krasnoyarsk, Russia
³K. Chernikova, Reshetnev Siberian State University of science and technologies, Ave. of the newspaper the «Krasnoyarsk worker», 31, Krasnoyarsk, Russia

E-mail: e.v.avdeeva@gmail.com

Abstract. Architectural environment of pedestrian spaces is the main platform from which a person perceives the urban space and interacts with it. A well-functioning system of pedestrian space is a multi-level structure efficiently organized at the local level, Integrated at the regional and incorporated at the federal levels. Thus, the strategic policy in pedestrian space systems development shall rest on the hierarchic and multidimensional approach. On this basis we developed a multilevel system of construction principles for pedestrian spaces including basic and general principles as well as the system performance principles for any of the area planning levels. Continual quality improvement of the architectural environment of pedestrian spaces based on these principles implementation lets us develop the comfortable, safe, attractive and healthy urban environment decreasing time and material inputs both for current and future generations of its residents and brings along the sustainable development of the society and cities.

1. Introduction

The rapid development of technical capabilities for the movement of people on personal transport and their constant communication at a distance leads to the reorganization of the system of spatial mobility of cities and the degradation of pedestrian spaces. The architectural environment of pedestrian spaces is the main platform with which a person perceives the city space and interacts with it, and pedestrian movements, being the basic element of "sustainable mobility", lose their functions. As a result, there is a disruption of social and ecological balance, a decrease in the economic efficiency of small and medium-sized business servicing, an imbalance of socio-cultural aspects in the form of a decrease in security, outflow of local population and destruction of existing social ties, which together creates significant obstacles to sustainable development of society and cities.

In recent years, Russia is actively forming guidelines in the direction of humanizing the urban environment. The priorities are comfort, safety, attractiveness and continuous improvement of pedestrian spaces, which are tools for improving the quality of life in cities and a means of addressing the social, economic and environmental aspects of their sustainable development.
2. Scientific significance
The system of principles for the formation of pedestrian spaces, allows us to identify and generalize the patterns of structure, development and functioning of the architectural environment of pedestrian spaces in the structure of the existing urban development. The basis for constructing its classification model is based on two methods: typological and hierarchical. The typological component unites two groups of principles: the basic one - the principle of constant cyclic perfection, reflecting the essence of quality management and universal principles that promote the development of pedestrian spaces in a given direction at each hierarchical level. The hierarchical component includes the principles allowing to form effectively functioning pedestrian spaces at the local level - the level of a separate fragment of the pedestrian space, taking into account more global approaches at the regional level of the pedestrian system of the region, agglomeration, regional settlement systems, the country's resettlement system.

Each principle occupies a fixed place in the system and represents a part of the general structure that allows to form an effectively functioning architectural environment of pedestrian spaces, reflects a strategy aimed at stable, timely, purposeful quality improvement. The implementation of the principles ensures an increase in the results of work with a decrease in time and material costs and allows the formation of a comfortable, safe, attractive and healthy urban environment for both modern and future generations of residents.

Examples of cities in which the formation of the architectural environment of urban open spaces was carried out using one or more of the similar principles presented in this classification show the achievement of significant results in the form of effectively functioning pedestrian areas (pedestrian streets, city trade and pedestrian zones, etc.), attracting a significant number of visitors - in Russia, Germany, France, Singapore and other countries.

3. Basic and universal principles for the formation of pedestrian areas and ways to implement them, aimed at improving the sustainable development of cities
The creation of new or reconstruction of existing architectural and town-planning facilities from the construction of a building or the expansion of a road in the historical center of the city to the construction of large microdistricts on its periphery significantly influences (improves or disrupts) the architectural environment of pedestrian spaces, formed in a specific system, with a certain structure of pedestrian processes. Therefore, in order to make adequate decisions, it is necessary to assess the risks, existing or potential pedestrian activity, i.e. determine the efficiency of the use of open pedestrian areas at the moment, as well as the factors and conditions that determine the prospects for their development.

The principles of quality management of the architectural environment of pedestrian spaces, developed in accordance with the ideology of ISO 9000, are universal, as they are aimed at improving the quality of the architectural environment of pedestrian spaces and are the basis for the strategy for their formation at all spatial planning levels. The principle of continuous improvement reflects the cyclical nature of the activity aimed at improving and is the basic principle of the formation of a comfortable, effectively functioning pedestrian space system. Its implementation allows to constantly improve the quality level of the architectural environment of pedestrian spaces, improving it in accordance with the changing needs of users (users) and environmental properties [18].

Universal principles: The principle of customer orientation includes an analysis of the opportunities and needs of visitors to pedestrian areas. Involvement of residents in the evaluation and discussion of pedestrian spaces projects allows to consolidate in the public consciousness the importance, necessity and reality of creating a comfortable pedestrian system environment, and to local authorities and representatives of design organizations to demonstrate their orientation to the needs of city residents. The principle of making objective decisions based on reliable facts provides the formation of the goals of reconstruction of the architectural environment of pedestrian spaces as an interrelated model that combines the aspects of pedestrian traffic and recreation that determines the priority of tasks and ways to improve and improve the functioning and quality of pedestrian spaces on the basis of detailed
analysis of the existing situation. The principle of finalization and control of results allows you to monitor the effectiveness of implemented activities, the rationality of the distribution of material resources and time resources, the adequacy of decisions taken, and the completeness of execution of design decisions.

4. Principles of the formation of pedestrian systems at various hierarchical levels

It is established that an effectively functioning system of pedestrian spaces is a multi-level structurerationally organized at the local level, interconnected at the regional level and united at the federal level. Consequently, strategic concept in forming pedestrian spaces systems must rely on hierarchical and interdisciplinary approach (theory architecture [13; 14], urban [2; 3; 4; 5; 6; 7; 11; 12] and urb-o- videocology [1; 9; 14; 16; 17]) and should be developed on the upper territorial-planning level - the level of pedestrian areas systems, consistent with the long-term development plans at the subregional level - the level of pedestrian systems of cities and agglomerations, and worked out in detail at the local level - the level of arch textual environment of pedestrian areas of streets, residential yards, districts. Proceeding from this, we substantiate the basic principles of the functioning of pedestrian space systems for each territorial-planning level.

The upper level is the pedestrian systems of the regions and subjects of the Russian Federation. When developing the program of sociological research it was established that the sector of pedestrian mobility in the sphere of mobility is determined by the following conditions: "desires" and "opportunities" of people, as well as factors and conditions that shape the environment. At the same time, the physical and material capacities of the main part of the population for a certain period of time (within the relatively stable development of the region) are relatively "permanent", while their "desires" and "possibilities" (factors and conditions) of the environment are "variables" changes in which entail changes in the indicators of real mobility. Thus, having developed mechanisms - the principles that contribute to the redistribution of demand, it is possible to increase the sector of pedestrian modes of movement and movement on public transport in the general system of mobility [8].

The principle of sustainable mobility. Sustainable mobility represents a system of modes of movement, where environmentally safe and compact modes of transportation are priorities. Analysis of successful pedestrian systems in European and other countries has shown that the mechanisms of success in this area are laid down at the level of the national policy of states in the field of the formation of population mobility systems [10]. Orientation of the population mobility system taking into account the hierarchy of priorities "pedestrian → public transport → cycling> personal vehicles" and redistribution of modes of transportation in favor of bicycle and pedestrian traffic will improve the quality of life of the population. Thus, the upper territorial-planning level, the main instruments for implementing the principle of sustainable mobility are: consolidation of priorities and the dominant role of sustainable environmentally friendly way to travel in the mobility system of the population, the development of strategic vision and long-term plans for development of the system of pedestrian spaces on the regional and local levels.

The principle of creating "environment opportunities" for the development of sustainable mobility. Analysis of international experience of urban development based on the sustainable mobility concept has shown that in order to reduce excessive use of private vehicles, there are two main areas that reflect the essence of this principle: first, it is necessary to create conditions that minimize the constant use of a personal vehicle, such as an increase in comfort and speed and safety of movement by other means: cycling, pedestrian, public transport, and secondly, the conditions in which to use Maintenance vehicle burdensome as to limit the parking spaces and the high cost of its contents.

The principle of the formation of worldviews (beliefs) that increase people's motivation for movement in ways that are priority in the system of sustainable mobility. It was found that the main methods of work on the formation of the "aspirations" of residents and promote the ideas are as follows: firstly, the implementation of them in the training programs of children's institutions, and second, high-quality social advertising in the media, in the third place, the personal example of the people concerned
authorities, authors of projects and people whose business (investment) depends on the effectiveness of the functioning of pedestrian spaces. The results of sociological studies of pedestrian spaces in the system of mobility, will determine the nature of the functioning of the system of mobility of the population, the distribution of demand across all means of transportation, to identify internal causes of the formation of the prevailing style of "actual mobility" and to justify appropriate measures to adapt it to the conditions stimulating redistribution of user demand for the benefit of "Sustainable mobility" [8].

The regional level is the architectural environment of the city's pedestrian system.

The principle of spatial and administrative decentralization and differentiation of objects is to create conditions for the simultaneous development of separate but interrelated objects, the establishment of "responsible" for the process of creation and the results of the execution of design decisions. This will significantly accelerate the processes of formation of the architectural environment of the pedestrian spaces system at different territorial levels and their integration into a single system. Assessment of the condition and reconstruction of the entire city is a rather difficult task, a long and costly process, while each individual fragment can be assessed and transformed (within the overall program) in real time and with a rational budget. This will allow to form a large number of separate, independently developing fragments, while maintaining and improving close ties between themselves and other regions (following the example of Germany's experience).

The principle of continuity of the network creates the prerequisites for the formation of a single continuous, successfully functioning pedestrian system, accessible to all categories of residents.

As practice shows, the continuity of pedestrian links is one of the basic conditions for the effective functioning of all urban spaces, therefore all fragments of pedestrian spaces need to be combined among themselves and elements of transport infrastructure, ensuring accessibility to public transport stops and passenger transport hubs for all categories of citizens. Proceeding from this, the pedestrian system should represent a dense, continuous, ramified pedestrian network with a high level of access to all objects of each category of the population.

The principle of quality control by residents and specialists ensures the creation of a mechanism that forms direct and reverse links between citizens, specialists and representatives of the administration (housing and communal services) responsible for making project decisions, as well as conducting independent expert examinations and internal audit of projects and implemented design solutions.

At present, it is difficult for the townspeople to independently initiate the re-planning of their "own" pedestrian spaces. A mechanism is needed that can form a link between the citizens and representatives of the administration (housing and communal services) responsible for making design decisions. The support of the local authorities for the initiatives of the residents will enable them to find the most rational ways for combining disparate fragments of pedestrian areas, to choose places for laying roads, etc.

The local level is the architectural environment of pedestrian spaces.

As a result of the studies, the indicators were revealed and the degree of their influence on the formation of the architectural environment at the local level was established. At the top position on the contribution to the creation of a comfortable pedestrian environment are indicators that characterize the current state of the architectural environment of pedestrian spaces and the potential for conditions for the formation and comfortable implementation of pedestrian processes. At subsequent levels - indicators that describe the means to achieve the goal, as well as indicators that assess the additional conditions that contribute to the continuous improvement of urban pedestrian areas in accordance with the regulatory framework of architectural and urban planning and additional wishes of direct users of these spaces. When reconstructing the existing architectural environment of pedestrian spaces, an increase in the efficiency of its use is ensured by conditions, the achievement of which depends on the performance of certain social measures, while observing the following principles:

The principle of fitness provides the creation of conditions for the implementation of the main processes (walking, standing, sitting) due to the formation of an ergonomic pedestrian environment,
based on the physical and psychological characteristics of the human body of all categories of citizens. This will ensure the comfortable implementation of the basic pedestrian processes, the presence and movement of all categories of citizens in the given territory (through the creation of ramps, the calculation of the time of traffic lights, uniform illumination of the natural spectrum, etc.).

The safety principle ensures the creation of conditions that hamper and prevent the emergence of additional negative processes (violation of road accidents, hooliganism, etc.) and is a socially significant approach to the organization of the architectural environment of pedestrian spaces, the implementation of which allows minimizing the possibility of committing illegal actions. This principle allows architectural solutions to solve social problems: to protect pedestrians from crime, vehicles and other risk factors of the urban environment. Technical devices and architectural methods such as visibility of the space, differentiation of the movement of cars and pedestrians, restriction of the speed of transport with special structures (security islands and traffic areas, "lying policemen", etc.), fencing of construction sites will increase the safety of pedestrians.

The implementation of the principle of positivity allows you to create conditions that stimulate the development of additional positive processes (communication, shopping, games, sports, etc.). It consists in the formation of an environment that provides pedestrian social opportunities: communicate, receive positive emotions and comfortably spend time on the pedestrian space. Means that allow generating additional positive processes in pedestrian areas are: the formation of psychological comfort (spatial and visual); the creation of an architectural infrastructure at a high technical level; Urban and videoecological activities aimed at improving the state of the environment.

The principle of multifunctionality promotes the development of processes of interaction of pedestrians with the environment (inputs and outputs from buildings, interaction with objects of street trade, etc.) and consists in creating a multifunctional environment by filling a rational number of architectural objects for various purposes: educational institutions, residential buildings, service facilities, food, leisure, offices, public transport stops, landscaping objects and other places for free and working hours at any time of day, e.g., weekdays and the seasons of the year. The principles of the organization of the architectural environment of pedestrian spaces represent a strategy for improving the efficiency of pedestrian spaces and improving their quality, the implementation of which is most effective at the level of pre-project analysis of pedestrian spaces. This will make it possible to create a comfortable, safe, attractive environment conducive to the sustainable development of cities.

5. Conclusion
Results of the analysis of theoretical studies, regulations, complex factors and requirements for the built environment of pedestrian space as the basis for the classification model of principles of formation of the architectural environment of pedestrian space that allows us to generalize regularities of the development, structure and functioning of the architectural environment of pedestrian space in the pedestrian system structure different territorial planning levels. The application of the system of principles will make it possible to create a comfortable, safe, attractive and healthy environment of pedestrian spaces for both present and future generations of residents.

References
[1] Buchanan C 1963 Traffic in Towns (London: HMSO) 227 p
[2] Hannover City 2020 ksw architekten + stadtplaner bda dwb srl dasl Hannover 2010
[3] Kronach barrierefrei 2023: Barrierefreie Erschließung der Festung Rosenberg, Schober architekten Architektur + Stadtplanung, Kronach 2015
[4] Leeuwarden Waterfront Master Plan (Leeuwarden) 2014
[5] Masterplan Emscher-Zukunft 2020 Essen Emschergenossenschaft 2006
[6] Städtebaulicher Masterplan Innenstadt Köln 2025 Freischlad + Holz im Auftrag der Stadt Köln Stadtplanungsamt 2012
[7] Wisselsoor Studioninedots DELVA Landscape Architect Utrecht 2015
[8] Wagner E A 2013 Mesto velo-peshehodnyh prostranstv v sistem e mobil'nosti naselenija krupnoj aglomeracii (na primere Krasnojarskoy aglomeracii) Zhurnal Gradostroitel'stvo CNIIP gradostroitel'stva RAASN (Moskva) 3(25)

[9] Koshkin D F 2000 Principy koloristichekoj organizacii ob'ektov dizajna arhitekturnoj sredy Dis. na soisk. uchenoj step. kand. arhitektury (Kazan')

[10] The official website of Bogota, Colombia Portal de la Ciudad de Bogotá (Portal de la Ciudad de Bogotá) URL: www.bogota.gov

[11] The official website of the company "Romantischer Rhein Tourismus" Romantischer Rhein Tourismus GmbH (Rheinsteig) http://www.rheinsteig.de

[12] Preobrazovanie goroda Strategicheskiy masterplan Permi KCAP Architects&Planners, HOSPER Systematica, Pöyry, Tavernor Consultancy, Faktorn, MAU «Bjuro gorodskih proektov» (Perm') 2010

[13] Priadko I P, Orlina K V 2014 Transport v gorode: organizacija bezbar'ernoj i komfortnoj arhitekturno-planirovnoj sredy dlja malomobil'nyh grup naselenija Urbanistika 1

[14] Puchkov M V 2014 Gorod i gorozhane. Obshhestvennye prostranstva kak moderator povedenija ljudej Arhitekton: izvestija vuzov 45 URL: http://archvuz.ru/2014_1/4

[15] Terjagova A N 2010 Arhitekturno-gradostroitel'nye principy preobrazovaniya gorodskoj sredy v bezbar'ernoe prostranstvo dlja malomobil'nyh grup naselenija Vestnik Volgogradskogo gosudarstvennogo arhitekturno-stroitelnogo universiteta Serija: Stroitel'stvo i arhitektura 18

[16] Tetior A N 1999 Ustojchivoe razvitie goroda. 4.1 Kom. po telekommunikacijam i sredstvam massovoj inform (Pravitel'stva Moskvy)

[17] Filin V A 2006 Videojekologija Chto dlja glaza horoshno, a chto – ploho M: izd. «Videojekologija»

[18] GOST R ISO 9000-2008 Sistemy menedzhmenta kachestva Osnovnye polozhenija i slovar' (M.: Izd-vo Standartinform)