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# Adaptation of Parks for People with Disabilities in Hill Terrain of Vladivostok

A Kopeva<sup>1</sup>, O Maslovskaia<sup>1</sup>, O Ivanova<sup>2</sup>, T Zaitseva<sup>2</sup>

<sup>1</sup>Professor, Architecture and Urban Planning Department, Far Eastern Federal University, 8 Sukhanova St., Vladivostok, 690900, Russia

<sup>2</sup>Associate Professor, Design and Technology Department, Vladivostok State University of Economics and Service, 41 Gogolya St., Vladivostok, 690014, Russia

E-mail: 457594@mail.ru

**Abstract.** The relevance of the study is determined by the need to create a sustainable, comfortable, safe, and accessible environment for people with disabilities (PWDs) in modern public open spaces (POS). Green parks are key elements of landscapes of POS and urban sustainability, improving the quality of the environment and life of society. Design, reconstruction of the landscape organization of green POS and, in particular, green parks, based on principles of Universal Design (UD), allow all city dwellers, including PWDs, have equal conditions in receiving positive emotions from communication with nature, comfortable rest, play sports to maintain self-confidence. Objects of study are green urban green parks in the hilly terrain of Vladivostok, requiring landscape adaptation for PWDs. The goal of the study is the development of an experimental project proposal for a green park in hill terrain based on UD design guidelines. To achieve this goal the study summarizes the theoretical sources for the use of principles of UD when forming green POS; analysis the availability of elements of an accessible environment in green parks in hill terrain of Vladivostok; performed the experimental projects for landscape adaptation of green parks for PWDs in hill terrain of Vladivostok, based on principles of UD.

## 1. Introduction

The relevance of the study is determined by the need to create a sustainable, comfortable, safe, and accessible environment for people with disabilities (PWDs) in modern urban public open spaces (POS). «Humanization of the urban environment is the central problem of the modern stage of Russian architecture because the current environment is characterized by shortcomings and contradictions» (Moor V, Erysheva E [1]).

Green parks are key elements of urban landscapes and urban sustainability (Rojas C and Páez A & 2 more [2]). Urban green parks which are the important parts of the urban ecosystem are important to improve the quality of life of a society especially where urbanization gradually increasing (Özen Turan S and Pulatkan M & 2 more [3]). Green POS have an emotional effect on people (Rahnema Sh and Sedaghatthoor Sh & 3 more [4]) and increase the aesthetic quality of urban areas (Lindemann-Matthies P and Brieger H [5]). Green POS improve the quality of the environment, promote social interaction and inclusion, contributing to «forming a cohesive society that does not refuse, or limit the participation of any of its individuals on the basis of his or her limited abilities» (Issa Abdou S M [6]).



Design, reconstruction of the landscape organization of green POS, and, in particular, green parks, based on principles of UD, allow all city dwellers, including PWDs, have equal conditions in receiving positive emotions from communication with nature, comfortable rest, play sports to maintain self-confidence.

Objects of study are green parks in hill terrain of Vladivostok, requiring landscape adaptation for PWDs. The goal of the study is the development of an experimental project proposal for a green park in hill terrain based on UD guidelines. The authors have collected, summarized, and analyzed information from literary and online sources. The main information on theoretical developments was obtained from domestic and foreign scientific journals, including those presented on the electronic library portal and the ScienceDirect multidisciplinary platform from Elsevier. A review of information sources revealed the state of scientific development of the problem. In this work, the authors relied on studies that examined the issues of the impact of urban public greening on health, social interaction and inclusion.

The authors studied research works that examined the effect of green POS on strengthening physical (Zhao X, Hou Yu, and Lv J [7]) and mental health (Wood L and Hooper P & 2 more [8]). Kabisch N and Kraemer R & 2 more [9] proved that green POS provides space for physical activity and social interaction, which is particularly relevant for vulnerable groups such as children and older people. Wang Q and Lan Z [10] claim that park green spaces beneficial for population health and thus should mitigate socioeconomic status. Hou C and Hou J & 5 more [11], Xu X and Sun Sh & 7 more [12] and Vieira J and Matos P & 8 more [13] in their works considered green POS as a source of a wide range of multiple ecosystem services to mitigate challenges from climate change and urbanization.

In this article, the authors also relied on the following studies:

the studies, which examined the directions of increasing consumer properties of the living environment based on modern concepts of greening the environment (Vavilova T [14, 15]);

the studies from foreign and Russian researchers, which examined the using of UD principles when organizing the environment for PWDs (Clarkson PJ and Coleman R [16]; Bendixen K and Benktzon M [17]; Carvalho de Souza S and Duarte de Oliveira Post A P [18]; Hussein H [19]; Leontyeva E [20]; Lazovskaia N [21]; Panova N [22]; Kopeva A, Ivanova O and Zaitseva T [23]; Kopeva A, Ivanova O and Maslovskaja O [24]; Gromak I, Kopeva A and Maslovskaja O [25]);

the studies on the impact of accessibility as a crucial element reflecting the potential availability of urban green POS, for urban sustainability and well-being of urban population (Gupta K and Roy A & 3 more [26]; Kabisch N and Strohbach M & 2 more [27]; Wüstemann H, Kalisch D and Kolbe J [28]; Perry M A and Devan H & 4 more [29]; Xing L, Liu Ya and Liu X [30]; Xie B and An Z & 2 more [31]; Khalifeh Soltani S H, Abbas Mohamed Yu and Bin Awang M [32]);

the studies dedicated to defining techniques and design elements that facilitate PWDs orientation in urban environment (Ivanova O, Kopeva A, Khrapko O & 12 more [33]; Kopeva A and Ivanova O & 2 more [34]; Kopeva A, Ivanova O and Maslovskaja & 5 more [35]; Khrapko O, Kopeva A and Ivanova O [36, 37]; Khrapko O and Baranov V & 15 more [38]; Khrapko O and Golovan E & 2 more [39]);

the studies revealing elements of gardening and the assortment of plants that can play the role of natural landmarks for visually impaired peoples (Hussein H [19]; Sholukh N and Nad'iarna A & 2 more [40]; Kopeva A, Khrapko O and Ivanova O [41]; Ivanova O, Kopeva A and Khrapko O [42]; Dvoryanuk A [43]; Maidanov A [44]);

the studies, which suggest methods for forming a green POS in hill terrain, including the conditions of Vladivostok: (Krogus V [45]; Krogus V, Abbott D, Pollit K [46]; Babenko A, Gavrilov A and Erysheva E & 5 more [47]; Kopeva A, Ivanova O and Khrapko O [48]; Kopeva A [49]; Khrapko O, Kopeva A and Ivanova O [50]; Khrapko O and Koldaeva M & 2 more [51]; Khrapko O, Savin S and Kopeva A [52]; Kopeva A and Khrapko O [53, 54, 55]; Kopeva A and Nedolujko V [56]).

When designing and reconstruction the landscape organization of green POS, and, in particular, green parks, based on principles of UD, it is especially important to take into account the needs of different user groups. Main opinions for green POS made by different user groups of urban green

parks were revealed in the studies: Özen Turan S and Pulatkan M & 2 more [3]; Wu K-C and Song L-Ya [57]; Ojeda-Revah L, Bojorquez Ie and Osuna J C [58]; Nordh H and Østby K [59]; Hassan Atwa S M, Gamal Ibrahim M & 2 more [60]. The understanding of the main barriers for inclusive use of green POS and, in particular, green parks. set out in the studies: Sikorska D and Łaszkiewicz E & 2 more [61]; Biernacka M, Kronenberg Ja and Łaszkiewicz E [62]; Biernacka M and Kronenberg Ja [63].

## 2. Methods

At the stage of collecting and studying the source data, the following methods were used. At the stage of determining the degree of knowledge on the problem, a method of systematization of theoretical sources (domestic and foreign scientific publications, including journals presented on the E-library portal and Elsevier's multidisciplinary ScienceDirect platform) was used.

The project proposal for the formation of an accessible environment of urban green parks in Vladivostok was preceded by work on assessing the accessibility and convenience of use of two large parks in the hilly terrain of Vladivostok. The analysis of the condition of the territories was carried out according to 48 parameters based on the requirements of the normative and technical documentation for the provision of an accessible environment for low-mobility groups, set out in SP (Set of Regulations) 59.13330.2016, SP 35-105-2002, GOST (State Standards) R 50918-96, GOST R 52131-2003, GOST R 52875-2007, GOST R 52871-2007, GOST R 51630-2000. The data were analyzed with the use of descriptive statistics.

At the pre-project stage of the study applied methods such as observation, photo-fixation, filling in the "Object Passports" of each surveyed territory. When creating project proposals for the two large parks in the hilly terrain in Vladivostok method of experimental design has been applied.

## 3. Results

Based on the study of theoretical sources, a case of the inclusive design was formed. This case is consisting of requirements that are necessary to promote the inclusive use of the park. Compliance with the requirements was the basis for recommendations on the sustainable landscape design of a green park on complex terrain. A pre-project analysis of the territories was carried out - an assessment of the availability and ease of use of green parks based on SP (Set of Regulations) and GOST (State Standards). The pre-project analysis and recommendations formed the basis for the experimental design proposal. Results are experimental project proposals for landscape organization and landscaping with adaptation for people with disabilities - two large parks in a hilly area in Vladivostok, differing in functional purpose.

## 4. Discussion

Green POS and, first of all, green parks, is an environment for spending leisure time, which can be used by the entire population of the city with minimal financial costs. According to Wu K-C and Song L-Ya [57], "inclusive design in public parks aims to equalize usage by all sectors of society". In modern conditions, the solution of problems of disability and low mobility of citizens is becoming one of the priority areas in the social policy of Russia. The Russian state made commitments to the international community to respect the rights of persons with disabilities worldwide, established by the United Nations Convention on the Rights of Persons with Disabilities. According to the provisions of the Convention, the main indicators of accessibility are an obstacle-free environment with a universal and adaptive design. In Russia, a number of construction norms and rules have been developed for the planning of urban and rural settlements, residential and public buildings and structures, in which design standards are fixed in compliance with the requirements for an accessible environment. Today, around the world, there is a transition from a "medical model" of attitude to these population groups - to a social one, from the creation of "reasonable accommodation" for people with disabilities - for UD, which will allow PWDs to visit any buildings and territories regardless of physical restrictions. Universal is the design of objects, settings, programs, and services, designed to

make them as much as possible suitable for use for all people (Kopeva A, Ivanova O and Zaitseva T [23]).

Based on the study of theoretical sources (Özen Turan S and Pulatkan M & 2more [3]; Wu K-C and Song L-Ya [57]; Ojeda-Revah L, Bojorquez Ie and Osuna J [58]; Nordh H and Østby K [59]), «a case for inclusive design» [57] was formed. This case is consisting of requirements that are necessary to promote the inclusive use of the park: safety as a «shield from disturbing surroundings» [19]; accessibility as a presence of «autonomous access» [58]; maintenance.

The main barriers to the inclusive use of green POS are physical ones. Vladivostok is a city with a special relief, which is the main physical barrier that creates difficulties in moving not only for PWDs, but also for healthy people. Adapting a complex terrain to create an accessible environment requires large financial investments and special techniques for organizing an urban environment. This is the main difference between green POS adaptation measures in the conditions of the difficult terrain of Vladivostok, rather than in the flat territories of the cities of central Russia.

In 2016, the program “Formation of a comfortable urban environment” was launched in Vladivostok, within the framework of which the improvement of urban public territories is carried out. Since 2017, the Department of Design and Technology of VSUES has been carrying out work to examine the current state of the city’s recreational territories and formulate project proposals for their adaptation for PWDs (Kopeva A, Ivanova O and Maslovskaja O [24]; Kopeva A, Ivanova O and Maslovskaja & 5 more [35]; Kopeva A, Khrapko O and Ivanova O [41]; Ivanova O, Kopeva A and Khrapko O [42]).

The main approaches to the formation of an accessible urban green park in hill terrain were preceded by work on assessing the accessibility and convenience of use of two large parks in hill terrain in Vladivostok: Minniy Gorodok park and Nagorny park.

Territories were evaluated by the following parameters: the number of potential barriers; the possibility of minimum / maximum adaptation of the object; the greatest difficulties and the scope of the proposed work when adapting for PWDs. Functionality was also revealed as well as popularity; transport accessibility; historical significance; state of improvement; the presence of elements of an accessible environment. During the pre-project analysis, photo-fixing of the existing situation was carried out. “Object Passport” was filled out for each project, where the presence or absence of elements of the accessible environment was recorded. The main detected parameters of the accessible environment of the studied territories included: the availability of parking spaces for PWDs, the condition of the coverings of paths and platforms, the availability of accessible recreation areas, bathrooms, ramps, markings, information signs and other devices. The result of the work was experimental design proposals for landscape organization and improvement with adaptation for PWDs two large parks in hill terrain in Vladivostok: Minniy Gorodok park and Nagorny park.

The project proposal “Reconstruction of the Minniy Gorodok park with adaptation for PWDs in Vladivostok” was accomplished in 2018. The park area is 37 hectares. The territory of the park is oriented from the north-east to the south-west and is located in the glen between the hills. The difference in the marks of the park territory to other districts ranges from 1 m in the south to 20 m in its north. In the past, the territory of the park was a military facility with an extensive mine-artillery economy of the military port and the fortress of Vladivostok. The cascade system of three artificial reservoirs performed fire-fighting functions and supplied the population with water. Today, most historic wartime buildings are in ruin. The territory of Minniy Gorodok is the only vast natural forest that has been preserved within the city, where 50 species of local trees, shrubs, and vines, 7 red-book species grow. In 1985, based on natural vegetation, the largest park in the city was laid here. The children’s movie theater “Pinocchio”, “Ferris wheel”, exhibition hall, chess club, and cafe were built. Since the 2000s the park is desolate. However, the area with ponds is still an attractive place for recreation for citizens and visitors. Transport routes run along the long western border of the park; there are three public transport stops on this stretch.

After conducting a survey of the park, it was concluded that this area is largely not accessible for PWDs. Public transport stops are not equipped in accordance with the requirements. Descent to the

territory is difficult, the central staircase is in disrepair. There is no equipped car park. The routes along the territory are not adapted for PWDs, hard surfaces are partially destroyed, there are no toilets, lighting, resting places with benches along the routes.

The project provides for some measures to adapt the territory of the park of Minniy Gorodok for PWDs. In the northwestern part of the site, a pathway for PWDs crossing tram tracks was planned to enter the territory. Parking lots for PWDs, bathrooms, rest areas with seating, markings, tactile tiles, and necessary information signs for PWDs are provided. The pedestrian zone would be increased due to the construction of additional promenade embankments, which have a curved shape of a stylized wave, along the coastline of all lakes in the park. The stairs to the embankments are duplicated by ramps with the safety fences. The comfortable recreational places with benches and sunshades were designed. The replacement of road surfaces was planned. The rent of special water equipment for walking PWDs on the lakes, with equipment ramps, descent to the water was projected. The walking area was also increased due to the organization of paths with fences on the water surface. The project aims to maximize the restoration and preservation of the flora and fauna of the territory.

The project proposal "Reconstruction of the Nagorny (Mountain) park with adaptation for PWDs in Vladivostok" was accomplished in 2019. The Mountain Park is located on Shilkinskaia street next to a large "sleeping" quarter and in proximity to the transport ring that regulates several highways with public transport stops. The territory of the park has a complex relief, especially pronounced on the southeast slope. The upper viewing platform of the park is located at around 169.2 meters above sea level. The area of the park is 7.8 hectares. Nagorny park is one of the few places in the city where a small natural green massif interspersed with outcrops of rock is preserved. For more than 50 years, the park has been a popular recreation area for citizens but then fell into decay. Despite this fact, the viewing platform in the park is still the hallmark of Vladivostok, and it offers a beautiful view of the city and the sea.

The motto of the project is "Bright Spiral". The following zones are provided on the territory of the park: parking; entrance zones; viewing platforms; children playground; sports playground; walking trails with a bike path; picnic area; art objects zone. Parking is organized for 60 cars with 8 parking spaces for PWDs, and equipped with the markings, and road signs. Three entrances to the park are planned. Cafes, medical posts, and information boards should be at each entrance. Particular attention is given to equipping and filling viewing platforms. The seats and the sound art object in the form of the Ocean allegory, which makes melodious sounds under the influence of the wind, are designed on the upper terrace. Downhill ramps or stairs are designed to access the lower platform. The outlines of the ring and spiral roads are laid so that it is possible to increase the length of walking routes. The several recreation areas along the walking trails equipped with sanitary cabins, including special units for PWDs, benches, urns, emergency call buttons, information desks for signposts for orientation in the park are intended. The rooms for mother and baby are designed. Fences should be installed along the entire length of the road and stairs. This project has been carried out in accordance with current regulatory documents for the PWDs.

## 5. Conclusions

Adaptation of green POS for relaxing, walking, playing sports for PWDs who will be able to spend time on a par with everyone is a step on the path to global change in society. Creating an accessible environment at the design stage on the principles of UD will exclude further measures for their adaptation. Green parks in hill terrain give unique recreation opportunities to all peoples, without exception. Project proposals for the adaptation of green parks in hill terrain in Vladivostok are the basis for further theoretical research and practical design developments to create barrier-free spaces for green parks in hill terrain not only in Vladivostok but also in other Russian cities in similar conditions.

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