TREATMENT OF PEDESTRIAN COMMUNICATION ACCESSIBILITY IN THE PROCESS OF URBAN DESIGN: CASE STUDY OF INSTITUTE FOR ORTHOPEDIC SURGERY "BANJICA"

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Abstract. The pedestrian communication in exterior design of the Institute for Orthopedic Surgery "Banjica" was analyzed in terms of its physical accessibility for people who have some difficulty in mobility. Checklists were used for analysis of different elements that influence users mobility, as well as photo analysis for a clearer display of the established barriers to movement. The results showed the presence of a number of obstacles which hinder the movement of certain groups of users, therefore, the spaces of pedestrian communication were evaluated as partially accessible. It can be concluded that it is necessary to provide an accessible environment, arranged with respect to human diversity, to ensure to persons with disabilities, as well as for all other citizens, equal opportunities and participation in all social trends and activities, especially the ability to freely access to all health care institutions.

Key words: barriers, hospital facilities, people with disabilities, mobility, accessibility

1. INTRODUCTION

Problems in moving in open space, which people with disabilities, as well as all other users who have some difficulties in movement are facing, are multiple and complex, because inaccessible environment denies a basic human need - the right to move freely and undisturbed without any obstacles and barriers [1]. The causes of all movement difficulties and certain services utilization in a public environment, should not be sought in the inability of disabled people to move like other participants, or their inability to appropriately assess and respond to a certain situation, but in the absence of conditions, equipment and solutions that will enable them to have equal use of public space and its contents [2]. In order to achieve equal rights for all people, it is necessary to create an accessible environment.

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Accessibility is a general term used to describe the degree to which a product, device, service, or environment is available to as many people as possible. Accessibility can be viewed as the "ability to access" and benefit from some system or entity. Accessibility is often used to focus on people with disabilities or special needs and their right of access to entities [3]. In Serbia, the Law on Planning and Construction ("Official Gazette of RS", no. 72/2009, 81/2009) defines accessibility standards as "mandatory technical measures, standards and requirements of designing, planning and construction to ensure free movement and access for people with disabilities, children and the elderly "(Article 2 § 40). This regulation relates to the standards regulating the free movement and accessibility in terms of removing of architectural barriers. According to the Book of regulations on technical standards of accessibility ("Official Gazette of RS", no. 19/2012 of 13.3.2012. year), the accessibility is the result of application of technical solutions in design and construction of buildings, which can provide to people with disabilities and reduced mobility uninterrupted access, movement, stay and work in these structures on an equal basis with others.

The analysis of the Global Burden of Disease 2004 data for World Report on Disability, estimates that 15.3% of the world population (some 978 million people of the estimated 6.4 billion in 2004) had "moderate or severe disability", while 2.9% or about 185 million experienced "severe disability" [4]. It has been also estimated that more than a quarter of Europeans have some difficulties in movement, therefore an accessible environment is a necessity to a large group of people, not just for people with disabilities, because each of us at some point in our lives can come into a state of reduced mobility (pregnancy, broken arm or leg, movement with small children or large amounts of luggage, up to old age). Unfortunately, for a long period of time, it was believed that the disabled people are the cause of their difficulties alone, primarily due to reduced physical abilities and specific requirements during movement. With such point of view, the society did not take responsibility, that it should have, in creating an environment accessible to all. By legislation in our country, the conditions for creating an accessible environment are regulated, but unfortunately they are not applied consistently, even in new construction, or reconstruction of the buildings and spaces.

To change this situation, it is necessary to implement the accessibility standards in the construction of the external environment. The intent of accessible planning and design is to simplify the life of each individual by making the outside environment usable to more people [5]. The arrangement of the spaces should be done in accordance with the principles of universal design, and it is also necessary to adapt and reconstruct the existing facilities and their surroundings to make them accessible for everyone. One of the main priorities are the hospitals and other health institutions, because they are frequently visited by the people with limited mobility [6]. According to Balkans Primary Health Care Policy Project, accessibility to health care, in addition to affordability, availability of resources, courtesy of service providers, refers also to geographic accessibility, which determines how easily a user can physically get to the location of service providers. This is also applied to obstacles which prevent persons with disabilities (disability, handicap) to obtain health care services [7].

The first strategic objective of the Strategy for improving health care quality and patient safety ("RS Official Gazette," no. 55/05, 75/05- correction, 101/07 and 65/08) is to improve the availability and accessibility of health care to sensitive population groups (people with disabilities, disadvantaged persons, etc.) while ensuring quality standards and providing technical and safety conditions, particularly for people with disabilities [8].
In order to respect the mentioned laws, strategies, goals and recommendations, it is necessary that all hospital outdoor spaces must be designed to be physically secure and accessible to people of all ages and abilities, thus contributing to their positive psychological perception [9]. It is necessary to arrange space which may assist in generating a supportive, inviting, secure and non-threatening atmosphere of the outdoor hospital surroundings that discharges negative reminiscences, experiences or assumptions on how unpleasant the stay in a hospital may be [9]. Accessible hospital environment is necessary to three users group: patients, employees and visitors. The patient group consists of various categories depending on type of patients’ disabilities, their length of stay and physical and psychological needs. Employees, varying from the medical to administrative and supporting staff, are a critical group of users since they spend every working day within the hospital environment. Visitors as the third user group are also in need of positive distractions while spending time with their family members or friends [9].

This paper explores the accessibility of open space of Institute for Orthopedic Surgery "Banjica" in terms of its physical accessibility for the people with limited mobility - disabled, the elderly, visually impaired, children, etc. Institute for Orthopedic Surgery "Banjica" in Belgrade, was founded in 1957, while the first patient was received in the 1961st, launching with the treatment of young patients with osteo-articular tuberculosis and polio. Today, the Institute surgically treats and heals injuries of bone and joint system of all pathology and ages. The experience in alloarthroplastics, pediatric hip surgery, spine and bone tumors surgery and treatment of sports injuries is well known and recognized worldwide [10].

2. MATERIAL AND METHOD

In this paper we have identified barriers that prevent or hinder free movement and orientation of the users. The analysis of accessibility of the pedestrian communications of the external arrangement of complex of the Institute for Orthopedic Surgery "Banjica" has been made, according to availability for users - people with disabilities and all other users who have mobility problems (patients, pregnant women, elderly people, obese people, children, etc.). Pedestrian communication that are the subject of this study (Figure 1) are the most frequent paths and sidewalks that connect the entrances to the complex with entrances to the building, parking lots and access roads to the economic part of the complex. Analyzed area was divided into several parts: position 1 - the sidewalk on the left of the entrance to the complex from Mihajla Avramović Street; position 2 - the sidewalk on the right of the entrance to the complex from the same street; position 3 - the sidewalk that connects the main entrance to the complex with the secondary entrance to the building; position 4 - a sidewalk leading to the parking lot; position 5 - the main communications in the economic part of the complex.

For the identification and analysis of accessibility it was used the following:

A) Check-lists

In the first phase the field research was carried out, it included the analysis of the location with regard to the formerly given criteria. The checklists were produced in order to analyze in detail different elements of the pedestrian areas in open spaces. During the site tour the checklists were filled in by answering the previously prepared questions. They were answered with impartial and competent consideration of specific problems (quality of paving, the orientation of the user, urban furniture and equipment, water drainage,
vegetation along the course and maintenance and hygiene), as well as the direct measuring of the different elements in the analysis (the dimensions of the pedestrian areas, determining the slope of the pedestrian area etc.).

B) Photo-analysis (photos of the current state with the main problems identified)
For a clearer view of the analyzed elements of the checklists, photographs of existing conditions were used with a brief textual description of the identified problems. Also, symbols were used for graphical presentation of the individual elements of the analysis.

C) Evaluating accessibility
In the next phase of the research, the collected data were systematized, and the results were compared to the standards regulated by the law, those dealing with the design of the accessible environment – Book of regulations on technical standards of accessibility ("Official Gazette RS, No. 19/2012). After that, for each analyzed position, the evaluation of accessibility was made. Five categories for evaluating the accessibility were emphasized: grade 1 - inaccessible to all users, grade 2 - partially accessible (accessible only to users who have no difficulty in moving), grade 3 - partially accessible (accessible to users who have no difficulty in moving and small group of users who have difficulty in moving), grade 4 - partially accessible (accessible to users who have no difficulty with movement and for most users who have difficulty in moving), grade 5 - accessible to all users.

D) Proposed reconstruction
After analyzing the factors that influence the accessibility, for each position, the proposal for the reconstruction of space according to the accessibility standards required
by law, was made. With graphical items, all positions that need to be reconstructed were illustrated, as well as the method of reconstruction.

In the last phase, the conclusions of the research were given through the synthesis of the results.

3. RESULTS

3.1. Barriers in the pedestrian communication

Analysing the pedestrian communications, numerous barriers were identified (Figures 2 and 3): a bad position and maintenance of urban furniture and equipment - not accessible benches (Figure 2 - A); bad positions of flower pots that reduce the space for pedestrian movement (Figure 2 - B); protective pillars represent a fixed barriers to the movement (Figure 2 - C); inadequate obliques curbs (Figure 2 - D); the green areas that go along the pedestrian areas are not taken care of properly (Figure 2 - E); the branches of the trees that line the pavement stick out and reach the pedestrian area, therefore, they reduce the pedestrian area and prevent the pedestrians from walking freely (Figure 2 - F); the grass area extends to the paths and pavements due to irregular taking care and obstruct the mobility of the users (Figure 2 - G); inadequate built ramp - big slope, bad paving material, without edge protection, handrails are not set by the standards (Figure 2 - H); staircases are not built to the standards – between the landing and stairs on the bottom and the top there is no contrast in colors; missing handrails (Figure 2 - I); improperly parked cars on the sidewalk (Figure 2 - J); poor signalisation and visibility of information (Figure 2 - K); differences of leveling prevent the continuous movement (Figure 2 - L).

3.2. Evaluation of accessibility of pedestrian communication

Comparing collected data with conditions from the Book of regulations on technical standards of accessibility [11], the following problems of accessibility have been identified:

- Insufficient width of pedestrian communications. According to the Book of regulations, the article 33 states that width of sidewalks and pedestrian paths should not be less than 180 cm, extremely 120 cm, while width of passage between immobile obstacles should not be less than 90 cm.

- Inadequate maintenance of sidewalk. The article 33 states that surface of sidewalk should be clean, flat and slide proof.

- Inadequate maintenance of green spaces. The article 34 states that lower branches of tree which are near the sidewalk should be at least 250 cm apart from sidewalk.

- High margin of sidewalk. The article 38 states that in order to circumvent the altitude differences of sidewalk and road one should use oblique curbs, with maximum slope of 10%, a minimum width of 120 cm; at the oblique part of the curb set tactile warning in case of a minimum height of 3 cm; set up tactile warning field at least 40 cm wide, with width of sloping part of at least 45 cm and a maximum slope of 20%.

- Irregular build ramps. The article 7 states that ramp slope should not be more than 1:20; smallest clean surface of ramp for one direction passage is 90 cm; ramps should be equipped on both sides with two level handrails (70 and 90 cm); surface should be clean, flat and slide proof; if ramps are predicted for frequent use for visually impaired people, surface of ramps could be in light, strong colors to provide good contrast.
Impractical stairs. The article 8 states that surface of upper side of stairs should be in contrast color in regarding to ford, between resting place and stairs should be color contrast as well as on top and bottom of the stairs. Surface of ground should be 50 cm apart from the beginning of descending leg of stairs and should have different tactile and visual proprieties than ground.

Inadequate maintenance and the position of street furniture. According to article 32, the bench should have a seat at a height of 45 cm and handrails at a height of 70 cm above the walking paths; next to benches provide the space of 110-140 cm width to accommodate wheelchairs. Also, according to article 34, on the main corridor of pedestrian movement do not set poles, billboards or other obstructions, and existing ones clearly mark.

Based on collected data, analyzing results and comparisons with the standards prescribed by law, it was found that the area is partially accessible (grade 3), since the use is not provided equally to all persons regardless of their ability of movement and orientation (accessible to users who have no difficulty in moving and small group of users who have difficulty in moving).

Fig. 2 Barriers in the pedestrian communication
3.3. Recommendations for increasing the accessibility of pedestrian communication

After the analysis, the identification of a number of problems that hinder the movement in the area of hospital was made. Following interventions are proposed to
increase the accessibility of pedestrian communications (Tables 1 and 2): reconstruction of pavement, installation of prefabricated ramps, reconstruction of the stairs and ramp, reorganization of urban furniture, maintenance of greenery.

**Table 1** Proposed reconstruction of stairways, ramps and paving

<table>
<thead>
<tr>
<th>INTERVENTIONS THAT ARE RECOMMENDED</th>
<th>GRAPHICAL DRAWINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>reconstruction of stairways - position 5</strong></td>
<td>![Stairway Reconstruction Drawing]</td>
</tr>
<tr>
<td>• set up a profile-slip strips on each tread</td>
<td></td>
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<tr>
<td>• set tactile warning at the beginning and end of the stairs</td>
<td></td>
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<tr>
<td>• forehead steps should be contrasting color compared to the tread</td>
<td></td>
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<tr>
<td>• double level handrails placed continuously along the whole length of the stairs, on both sides</td>
<td></td>
</tr>
<tr>
<td><strong>reconstruction of ramps - position 5</strong></td>
<td>![Ramp Reconstruction Drawing]</td>
</tr>
<tr>
<td>• set the resting place on the half length of the ramp</td>
<td></td>
</tr>
<tr>
<td>• set a solid, even and slip resistant paving</td>
<td></td>
</tr>
<tr>
<td>• at the beginning and the end of the ramp place a tactile panel in paving</td>
<td></td>
</tr>
<tr>
<td>• set double level handrails on both sides of the ramp</td>
<td></td>
</tr>
<tr>
<td>• set a protective curbs at the edge of the both sides of ramp</td>
<td></td>
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<tr>
<td><strong>reconstruction of paving - positions 1, 2, 3 and 4</strong></td>
<td>![Pavement Reconstruction Drawing]</td>
</tr>
<tr>
<td>• on the entire length of sidewalk place pavement that is firm, smooth and slip-resistant - positions 1 and 2</td>
<td></td>
</tr>
<tr>
<td>• on the entire length of sidewalk place tactile guiding panels - positions 1, 2, 3 and 4</td>
<td></td>
</tr>
<tr>
<td>• existing ramps properly mark in the area of crossing from sidewalk to road - positions 2, 3 and 4</td>
<td></td>
</tr>
<tr>
<td>• lowering the curbs at crossing points from sidewalk to road - position 2, 3 and 4</td>
<td></td>
</tr>
<tr>
<td>• mark the oblique curbs in the area of crossing from sidewalk to road - position 1</td>
<td></td>
</tr>
<tr>
<td>• extend the sidewalk min. 50 cm to the greenery (or the entire length of the sidewalk) - position 3</td>
<td></td>
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<tr>
<td>• damaged curbs replaced with new ones - position 4</td>
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Table 2 Proposed reconstruction - street furniture, greenery maintenance, installation of mounting ramp

<table>
<thead>
<tr>
<th>INTERVENTIONS THAT ARE RECOMMENDED</th>
<th>GRAPHICAL DRAWINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• all the benches set on tiled platform next to each bench leave a free space of 110-140 cm to accommodate a wheelchair protective pile near the green area position 1) remove (immovable obstacle in the movement) remove flower boxes that are set on the sidewalk, because it reduced the space reserved for pedestrian movement • to whole length of the sidewalk set protective pillars along the curb in order to prevent illegally parked cars</td>
<td>![Drawing 1]</td>
</tr>
<tr>
<td>• cut the branches of trees along paths, so they do not exceed the surface of the pavement lawn near the sidewalk maintain with constant cutting, to avoid exceeding to the area designated for pedestrian movement lower branches of plants cut at a height of at least 2.5 m from the surface on which pedestrians moves</td>
<td>![Drawing 2]</td>
</tr>
<tr>
<td>• as it is not enabled continuous accessible path to the entrance to the building (change of level between the approach path and entrance to building), it is recommended to place mounting ramp</td>
<td>![Drawing 3]</td>
</tr>
</tbody>
</table>

4. CONCLUSION

Respecting the basic human rights, the society should provide favorable conditions in the public space, particularly in access to health care, so that all people have equal and independent use of services. Quality improvement in health services for people with disabilities, as well as for all other citizens, among other, includes a physical accessibility of health care - the ability of
undisturbed, barrier-free usage of pedestrian communications, enters to facilities, walks, parking spaces, and information which should be clear and understandable to all people.

Analyzing the results of our research it can be concluded that the open spaces of the Institute for Orthopedic Surgery "Banjica" in Belgrade were not constructed according to the standards of accessibility and have been evaluated as partially accessible. Since the health facilities are very important for all people, they should be restored and adapted, so that all users, regardless of their abilities, could have equal opportunities to approach the health institutions.

Physical accessibility of hospitals, health centers, rehabilitation centers, etc., should be imperative in the design, planning and construction, along with compliance with legal requirements and obligations and ensuring quality standards and technical and security conditions.

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PRISTUPAČNOST PEŠAČKIH KOMUNIKACIJA U INSTITUTU ZA ORTOPEDSKO-HIURŠKE BOLESTI "BANJICA"

Ana Gačić

U Institutu za ortopedsko-hirurške bolesti "Banjica" izvršena je analiza pešačkih komunikacija prema fizičkoj dostupnosti za korisnike umanjene mobilnosti. Korišćene su ček liste za analizu različitih elemenata koji utiču na kretanje korisnika, kao i fotoanalize za jasniji prikaz ustanovljenih barijera u kretanju. Rezultati su pokazali prisustvo brojnih barijera koje otežavaju kretanje pojedinih grupa korisnika, pa je stoga prostor pešačkih komunikacija ocenjen kao delimično pristupačan. Zaključeno je da je neophodno omogućiti pristupačno okruženje, uvećano uz uvažavanje ljudske raznolikosti, kako bi se osobe sa invaliditetom, kao i svim ostalim građanima, obezbedile ravnopravne mogućnosti i učešće u svim društvenim tokovima i aktivnostima, a naročito mogućnost da neometano pristupe ustanovama zdravstvene nege i zaštite.

Ključne reči: barijere, zdravstvene ustanove,osobe sa invaliditetom, mobilnost, pristupačnost.