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Research paper

ANALYSIS OF INCLUSIVENESS AND ACCESSIBILITY OF SCHOOLYARDS: A COMPARATIVE STUDY OF THREE SCHOOLS IN THE CITY OF STIP

Vladica Nikolovska[1], Vaska Sandeva[2], Katerina Despot[3]

Abstract

This study analyzes the level of accessibility of schoolyards for people with physical disabilities, with a particular emphasis on the opportunities for independent and safe use of outdoor school space. The study was conducted through the analysis of three case studies of primary schools built during a period when accessibility was not a significant criterion in the design of educational facilities. The methodology is based on an assessment of key elements of accessibility, including access from a public area, entrance ground areas, yard movement, and providing a ground-to-facility connection.

An accessibility index is calculated for each case study, which allows for quantitative evaluation, comparative analysis of examples, and problem identification. The results show that the adaptations and renovations carried out contributed to improving the level of accessibility in all schools analyzed, but at the same time reveal the presence of residual architectural barriers. The most commonly identified deficiencies are inadequate parking spaces and access ramps that do not allow for fully independent use by persons with a physical disability.

The research suggests that despite the progress made, additional interventions are needed to align schoolyards with universal design principles and modern accessibility standards. The findings of the research can serve as a basis for planning future renovations and creating a more inclusive educational environment for all users.

Key words: *inclusive education, accessibility, universal design, primary school, physical disabilities*

[1] M.Sc., Teaching Assistant, University "Goce Delchev" – Stip, Faculty of Natural and Technical Sciences, North Macedonia, vladica.nikolovska@ugd.edu.mk, ORCid 0009-0004-1801-3130
[2] PhD, Full professor, University "Goce Delchev" – Stip, Faculty of Natural and Technical Sciences, North Macedonia, vaska.sandeva@ugd.edu.mk, ORCid 0009-0002-9780-8200
[3] PhD, Full professor, University "Goce Delchev" – Stip, Faculty of Natural and Technical Sciences, North Macedonia, katerina.despot@ugd.edu.mk, ORCid 0009-0003-5532-1127

1. INTRODUCTION

Designing and building an environment without architectural barriers allows for equal inclusion of all members of society. Today, the development of an inclusive environment is inextricably linked to the philosophy of universal design. This concept calls for the creation of an accessible built environment, in which everyone can develop their potential equally. School buildings, as the subject of this paper, should be designed or adapted in a way that will allow for easy, safe and independent use by all users—students, teaching staff, parents, and visitors—regardless of their age, size, capacity, or degree of mobility. When the principles of universal design are applied in school environments, architectural solutions do not separate people with disabilities through special adaptations. Instead, they create spaces that are accessible and usable for everyone as an equal part of the community. The schoolyard as a physical space that forms a link between the public space and the school building is one of the key segments in providing inclusive education.

In the global context of schools and their accessibility, which is the focus of this research, data from 2017 show that 88% of countries have laws that guarantee the right of children with disabilities to participate in education. However, only 33% of countries have schools that provide a physically accessible environment for these children. [1]

In North Macedonia, most schools were built in the 1960s and 1980s under different social and political conditions. Today, these buildings are still used for the same purpose, although educational needs and teaching approaches have changed over time. However, at the time these schools were designed and constructed, children with disabilities were mainly educated in special schools under separate legal regulations. As a result, accessibility and inclusion were not key considerations in school design. Based on this context, the research is guided by the following hypothesis: Schools built between the 1960s and 1980s, during a period when awareness of disability and inclusive education was limited, currently have architectural barriers that hinder the implementation of inclusive education.

To evaluate this hypothesis, the study examines the schoolyards of three primary schools in the city of Stip. Through field observations, photographs, and documentation of the schools and their surrounding areas, the level of accessibility will be assessed and compared. The analysis will help determine whether the hypothesis is confirmed or rejected, while the mapping of movement routes will identify existing barriers and accessibility challenges within the schoolyards.

2. THEORETICAL ASPECTS OF ARCHITECTURAL ACCESSIBILITY

The principles, policies and practices in education for persons with disabilities, according to the Salamanca Declaration, are that they "must have access to regular schools that should meet their needs by applying a child-centered pedagogical approach", stressing that "a fundamental principle of an inclusive school is that all children should learn together, whenever possible, regardless of the difficulties and

differences that may exist. Inclusive schools must recognize and respond to the diverse needs of their pupils, addressing their different learning styles and speeds and providing quality education for all, through appropriate curricula, organizational setups, instructional strategies, resource application and through partnerships with local communities." [2]

In an architectural context, inclusivity is terminologically related to universal design. Universal design aims to create spaces that can be used by everyone, regardless of their physical or cognitive abilities. Although the terms "design for all" or "equitable design" had been discussed earlier, the term “universal design” was first introduced by architect Ronald Mace in the 1980s. Mace, who founded the Center for Universal Design in Raleigh, North Carolina, believed that environments designed to meet the needs of people with disabilities could also improve usability for everyone. Based on this idea, he developed the concept of universal design, also known as inclusive or barrier-free design, which aims to create spaces that can be used by all people regardless of their abilities. Ronald Mace defined universal design as the design of products and built environments that should be usable to all people, to the greatest extent possible, without the need for adaptation or specialized design. [3]

Today, the definition of universal design is included in the text of the United Nations Convention on the Rights of Persons with Special Needs. In that text, universal design is defined as the design of products, environments, programs, or services for use by all people to the highest possible extent, without the need for customization or specialized design. [4]

Basic strategies that can improve the accessibility of children with disabilities to the school building include providing sidewalks with designed curb ramps, creating smooth and obstacle-free pathways, and installing protective barriers or curbs in areas with level differences or steep slopes. These features help ensure safe and independent access for children with disabilities while also improving safety and convenience for all users of the school environment. [5]

3. NATIONAL ACCESSIBILITY REGULATIONS AND CRITERIA FOR ANALYSIS

To meet the criteria for architectural accessibility of schoolyards, the analysis is based on the requirements defined in The Law of Construction and Design Standards and Regulations, as well as the provisions of the Regulations on the technical characteristics and dimensions of the route for the movement of persons with body handicap and visually impaired persons [6]. This regulation prescribes technical characteristics for the dimensions of sidewalks and paths for the movement of people with physical disabilities as the target group of this paper.

According to Regulations on the manner of ensuring unimpeded access, movement (horizontal and vertical), residence and work of persons with disabilities to and in buildings with public and business purposes, buildings for residential and commercial purposes, buildings for residential and business purposes [7], schools should provide continuous and barrier-free access for people with reduced mobility from the public area and the schoolyard to the school building. Table 1 defines the criteria in accordance with the previously mentioned applicable legal requirements.

Table 1. Table of defined criteria and sub-criteria for the level of accessibility of the schoolyard

	Criteria	Sub-criteria	Technical Normative	Legal/Regulatory Reference
1	**Public Access** (Street to Courtyard)	Parking for people with disabilities	Min 1 parking place 370 x 500 cm (or 5% of the total) located closest to the entrance	*Articles 38 and 50, the Rules of Procedure ...* [7]
		Sidewalks and ramps of rabbis	Gradient ≤5%, width 180 cm, at a crossing with the track the rim to be replaced by a ramp with a gradient of max 8.33%	*Articles 2 and 3, the Technical Regulations;* [6] *Article 193, Urban Planning Rulebook* [8]
2	**Entrance Ground Areas** (Courtyard Entrance)	Entrance gate width	Net width of entrance gate min 90 cm	*The Rules of Procedure ...* [7]
		Architectural barriers to entry	Absence of thresholds, chains or metal barriers, permissible floor displacement max 0.5 cm	
3	**Yard Movement** (Internal pedestrian paths)	Type and quality of substrate	Sturdy, flat and non-slip surface, free of damage and uneven pads of 0.5 cm	*Articles 2 and 3, the Technical Regulations ...;* [6] *Article 193, Urban Planning Rulebook* [8]
		Longitudinal and transverse slopes	Maximum longitudinal inclination 5% (1:20), maximum transverse inclination 2%	
4	**Link Schoolyard - Facility (**Main Entrance)	Access ramp	Slope 5% - 8.33%, width 120 cm	*Article 10, the Rules of Procedure ...* [7]
		Grips & Protective Edges	Double-sided handlebars at two heights of 60 and 90 cm, edge of the ramp min 5 cm	

Using these criteria and sub-criteria, the accessibility of the schoolyards of three selected primary schools in the city of Stip will be analyzed. Quantitative-qualitative comparative analysis will be conducted by evaluating each criterion and sub-criterion according to the following three levels:

0 – complete absence / non-compliance with legal norms

1 – partial compliance

2 – full compliance

A score of 0 indicates the absence of the analyzed element or its non-compliance with legal requirements, a score of 1 indicates partial compliance, meaning that the element is present but does not fully meet the prescribed accessibility standards (e.g., a ramp without the required width, slope, or handrails), while a score of 2 indicates full compliance with all applicable accessibility regulations and standards. The calculation of the level of accessibility of the schoolyards of the elementary schools analyzed will be performed using the general equation:

$$accessibility\ index = \left(\frac{scored\ points}{maximum\ possible\ points}\right) \times 100$$

In this way, the resulting percentage shows the level of accessibility of the schoolyard and allows the identification of accessibility deficiencies, as well as a comparison of the three analyzed schools. No weighting factors were applied in the calculation of the accessibility index and all criteria contributed equally to the final score. This approach was adopted because each analyzed element represents an essential

component of an accessible schoolyard, and the absence of any criterion may create a barrier to use, ensuring a transparent, simple, and comparable assessment of accessibility.

4. CASE STUDY – THREE PRIMARY SCHOOLS IN THE CITY OF STIP

The town of Stip is located in the eastern part of the Republic of North Macedonia and there are five primary and six secondary schools, one for children with disabilities and one university. This paper covers three primary school case studies to analyze the architectural accessibility of the schoolyard.

The location of the three schools is in the town of Stip (Figure 1), as follows:

1. "Vancho Prke" Primary School, in the center of the city, next to the Otinja River, opposite the town square.
2. "Tosho Arsov" Primary School, in the urban settlement 8th November.
3. "Dimitar Vlahov" Primary School, in the urban settlement Senjak.

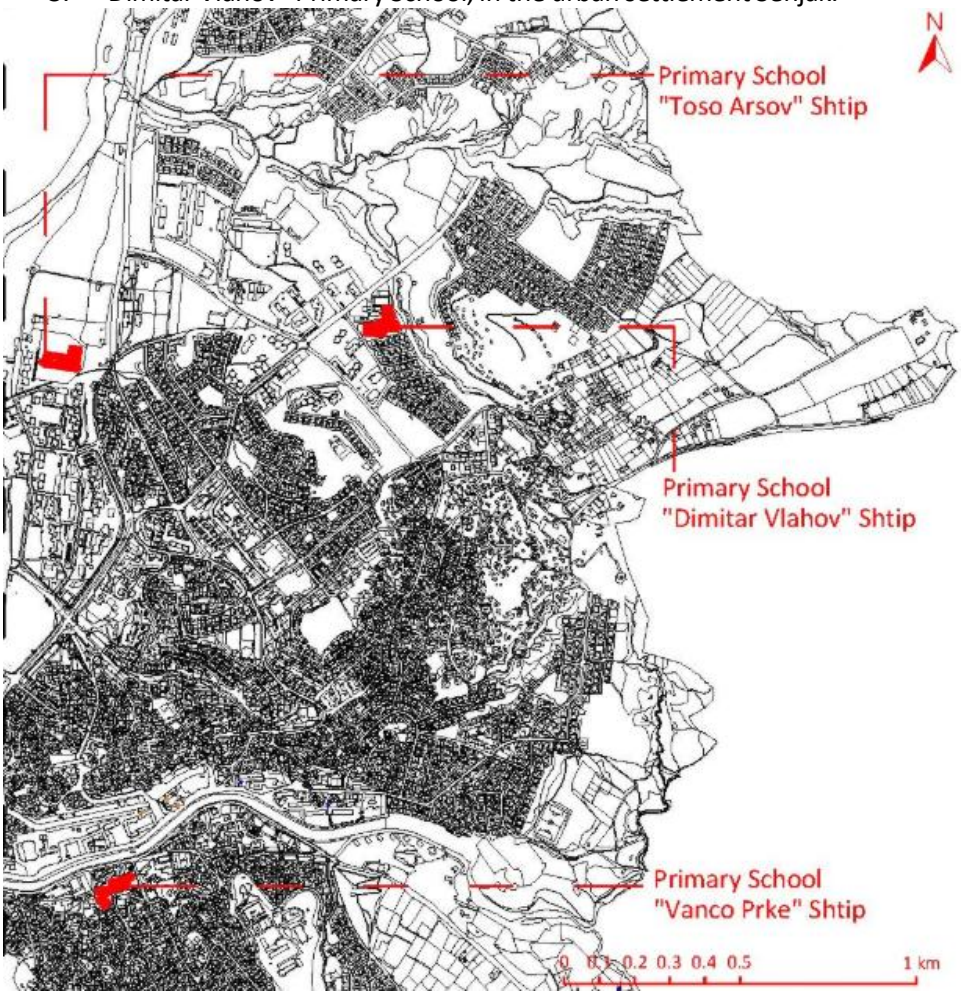


Figure 1. Location of the analyzed primary schools, author

Table 2 provides general data for each of the schools analyzed in this paper.

Table 2. Table with general data for the examples analyzed

Attribute	School Name	Location	Year of construction	Yard area (m^2)
U1	"Vancho Prke"	The center of the city	1962	5141
U2	"Tosho Arsov"	8th November, Stip	1977	12792
U3	"Dimitar Vlahov"	Senjak, Stip	1982	3963

Access to the schoolyard of U1 is provided through four entrances from three access streets. The access streets of this school have a higher frequency of traffic, and the highest frequency is in front of the main entrance to the schoolyard where a protective fence has been installed. There is no parking space within the schoolyard, but the nearest parking area is used in front of the main entrance to the schoolyard. The entrances are open, without entrance gates, and have sufficient width to allow access to the schoolyard. However, only one entrance (the main entrance) enables unobstructed movement through the schoolyard and access to the school facility. The other three entrances contain architectural barriers (stairs) for people with disabilities, which limit movement within the courtyard. The pedestrian paths in the schoolyard are made of interlocking concrete pavers that meet the requirement of a solid, flat, and non-slip surface. An access ramp has been provided to the main entrance of the school, enabling access for people with physical disabilities. However, according to technical standards, fully independent movement is not possible due to deficiencies in the design and construction of the handrail. The ramp was additionally installed as an improvement measure to enhance accessibility conditions within the school for people with physical disabilities. The previous and current conditions are presented in Figure 3.

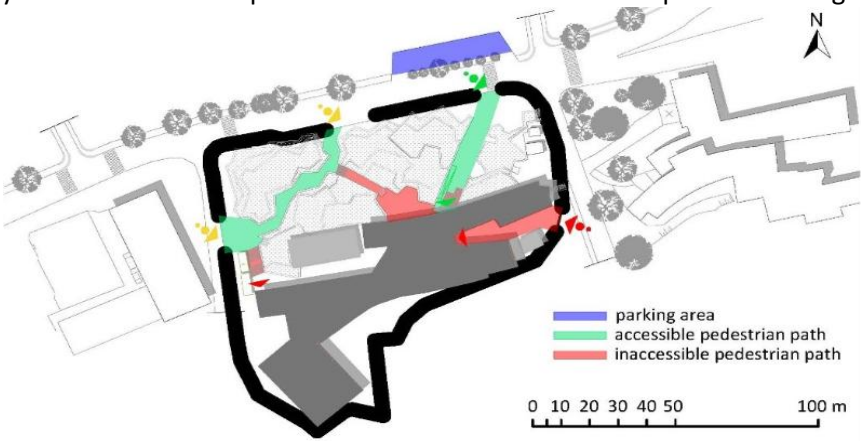


Figure 2. Accessibility of example U1, author



Figure 3. Photos before and after adaptation of example U1

The U2 school has access from an access street in urban settlement 8th November, which does not have a very high frequency of traffic. There is no parking space in the schoolyard, and parking is provided with parking spaces next to the entrance, which are also used by the residents of the surrounding residential buildings. The schoolyard is flat, without displacement, which allows free and unhindered movement for everyone, including those with physical disabilities. The pedestrian paths are made of interlocking concrete pavers, providing a solid, flat and non-slip surface. Entrance to the school facility is on the same level as the courtyard, which gives equal freedom of use to all users. This solution for entry without level differences was made later, because in the basic design from 1977, there was a level difference resolved by stairs (Figure 5).

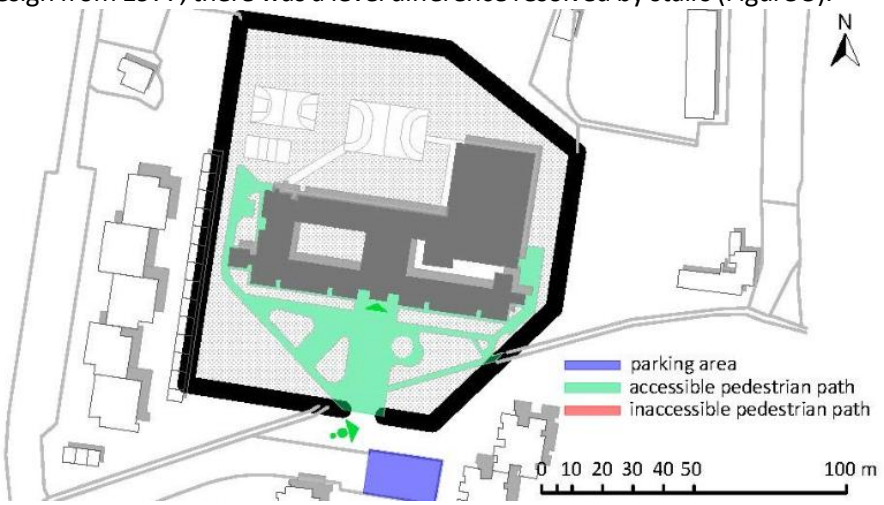


Figure 4. Accessibility of example U2, author

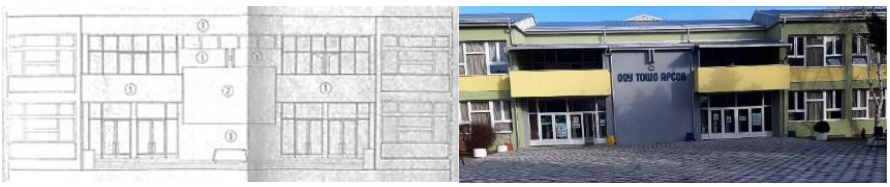


Figure 5. Photos of located adaptations to improve accessibility of example U2

The U3 school has access to the courtyard through three entrances from two access streets. Around the schoolyard, a protective fence is installed. There is no parking space within the schoolyard, but the nearest parking spaces located near the main entrance to the schoolyard are used, which are also used by the residents of the surrounding residential buildings. Entrances are closed with entrance gates that are wide enough to allow access to the schoolyard for people with disabilities. The two main entrances to the building are connected to access ramp, which provide entry to the school and allows free and unimpeded movement for persons with disabilities. The entrance on the north side provides access to the courtyard; however, it does not allow direct access to the school building due to the presence of architectural barriers for people with physical disabilities. Barriers are steps that solve the level differences of the ground, as that entrance is at a significantly lower level than the rest of the yard area.

The pedestrian paths in the schoolyard are made of interlocking concrete pavers that meet the requirement of a solid, flat, and non-slip surface. An access ramp is provided at the main entrance to the school, which allows free and independent movement of people with physical disabilities towards the entrance to the school. The two ramps leading from the main entrance to the courtyard area and the ramp connecting to the school facility were later constructed to increase the accessibility of the school for people with disabilities (Figure 7).

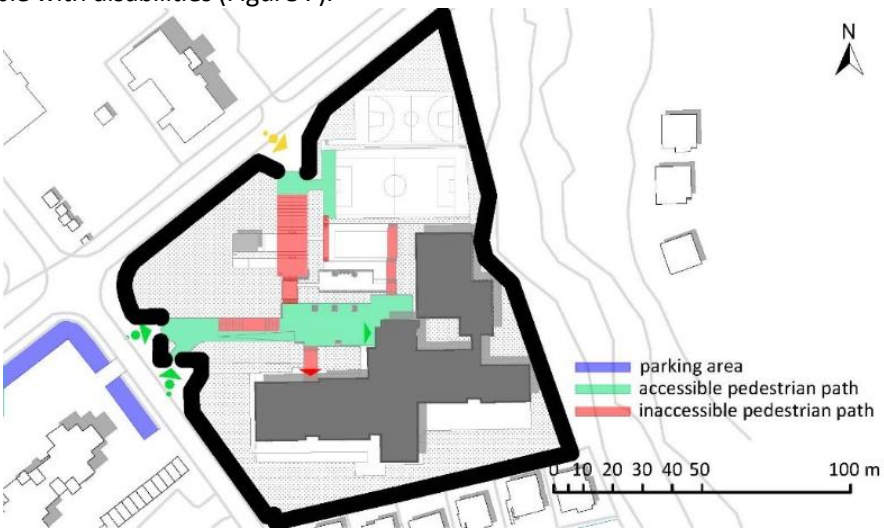


Figure 6. Accessibility of example U3, author



Figure 7. Photos of example U3

5. COMPARATIVE ANALYSIS AND DISCUSSION

The evaluation of the accessibility level of the three analyzed schoolyards was conducted by evaluating the selected criteria and sub-criteria according to the technical norms defined in Table 1. The analysis is based on the current state of the schoolyard with the changes and adaptations undertaken during the period of its operation. Table 3 shows the quantitative evaluation of the criteria according to the degree of fulfillment for the three examples analyzed.

Table 3. Table with general data for the examples analyzed

Criteria		Sub-criteria	U1	U2	U3
1	**Public·Access**·(Street·to·Courtyard)	Parking·for·people·with·disabilities·(according·to·technical·regulations·Table·1)	0	0	0
		Sidewalks·and·ramps·of·workers·(according·to·technical·standard·Table·1)	1	1	1
2	**Entrance·Ground·Areas**·(Courtyard·Entrance)	Width·of·the·entrance·gate·(according·to·the·technical·standard·Table·1)	2	2	2
		Architectural·barriers·to·entry·(according·to·technical·regulations·Table·1)	2	2	2
3	**Yard·Movement**·(Internal·Trails)	Type·and·quality·of·substrate·(according·to·technical·standards·Table·1)	2	2	2
		Longitudinal·and·transverse·slopes·(according·to·technical·standards·Table·1)	1	1	1
4	**Link·Schoolyard·-·Facility**·(Main·Entrance)	Access·ramp·to·the·entrance·(according·to·technical·regulations·Table·1)	1	2	1
		Handles·and·protective·edges·(according·to·technical·regulations·Table·1)	1	2	2
		Total	**10**	**12**	**11**

The calculation of the schoolyard accessibility index of the primary schools analyzed using the defined general equation is:

$$\textbf{U1} - accessibility\ index\ (I_1) = \left(\frac{10}{16}\right) \times 100 = \mathbf{62.5}\%$$

$$\textbf{U2} - accessibility\ index\ (I_2) = \left(\frac{12}{16}\right) \times 100 = \mathbf{75.0}\%$$

$$\textbf{U3} - accessibility\ index\ (I_3) = \left(\frac{11}{16}\right) \times 100 = \mathbf{68.8}\%$$

The analysis showed that the achieved accessibility level in all three examples was a result of various adaptations and interventions implemented in each of the analyzed cases. This leads to the conclusion that facilities built at the end of the 20th century do not fully meet the needs of people with physical disabilities, and that significant improvements in accessibility have been achieved through additional interventions, especially in terms of continuity of movement and the reduction of physical barriers. However, the analysis shows certain shortcomings that still limit the full implementation of universal design principles. The weakest point is the parking spaces for persons with disabilities, in which there is a complete absence from the boundaries of the schoolyard, and according to the Norms and Standards for School Premises, Equipment and Teaching Aids for Primary Schools in the Republic of North Macedonia, they should be present as an integral part of the schoolyard [9]. In addition, examples U1 and U3 show deviations from the standards regarding the technical characteristics of the access ramp, making them unsafe for independent use. Therefore, it can be concluded that the implemented adaptations have contributed to a higher level of accessibility, but additional interventions are still needed to ensure a fully inclusive and independently accessible environment.

6. CONCLUSION

Schools built between 1960 and 1980 were designed during a period when issues related to accessibility and the inclusion of people with disabilities were not sufficiently represented in architectural and urban practice. As a result, many of these buildings still contain architectural barriers that limit or prevent equal use of educational spaces. Although measures have been taken in recent years to improve accessibility through various adaptations and reconstructions, the analysis shows that these interventions are often partial and do not provide complete independence in the use of space.

The study shows that despite legal regulations, adaptations and interventions implemented, the average accessibility index in the schoolyards analyzed is 69%. This confirms that improving physical accessibility should not be limited to meeting minimum technical requirements but should be based on a comprehensive approach that will ensure equal opportunities for all users. In this direction, additional interventions aimed at removing the remaining barriers and improving the quality of the access environment are needed. Such measures will contribute to the creation of a more inclusive, safer and more accessible educational space, which will meet the needs of all students and visitors regardless of their physical abilities.

Although the analyzed schoolyards in Stip represent only one segment of the overall school environment, the results indicate similar challenges to those identified in the international literature discussed above, particularly regarding the partial compliance of certain elements with accessibility standards. This confirms that the need for systematic improvement of accessibility in outdoor educational spaces represents a current issue not only at the local but also at the international level.

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