

UNIVERSAL DESIGN AND PEDESTRIAN BRIDGE ACCESSIBILITY IN THE VARDAR RIVER CORRIDOR, GOSTIVAR (NORTH MACEDONIA)

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ABSTRACT

Urban river corridors represent vital linear public realms that structure mobility, leisure, and ecological continuity within cities. Yet small discontinuities particularly at pedestrian crossings can produce disproportionately large accessibility losses, effectively marginalizing groups such as persons with disabilities, the elderly, and cyclists. This study investigates accessibility along the Vardar River corridor in central Gostivar, North Macedonia, with a specific focus on the most intensively used pedestrian bridge and its integration into the wider riverside path network.

Employing a mixed-methods approach, field observations were combined with a trilingual survey of 100 residents aged 14–73. The analysis compared user experiences across age, mobility status, and bicycle use. Findings reveal pervasive barriers: 90% of respondents judged the bridge inaccessible overall; 100% considered it unsuitable for persons with disabilities; 76% reported inadequacy for cyclists (24% undecided, 0% “suitable”); and 73% found it problematic for elderly or pregnant users. Moreover, 88% of participants expressed a preference for ramped access over stairs, while 53% supported the construction of a new, universally accessible bridge.

The study concludes that deficiencies in the bridge network, rather than shortcomings in park amenities, constitute the primary barrier to equitable use of the riverfront. A context-specific design proposal is advanced ~30 m span, 2.5 m width, ≤8% ramp slopes with rest landings, tactile surfaces, and continuous handrails explicitly grounded in the Seven Principles of Universal Design and aligned with the European Accessibility Act (2019) and EN 17210 standards. Accessibility here is framed not as a supplementary feature but as a fundamental principle of contemporary urban public space.

Keywords: Accessibility, public space, river corridor, riverfront, pedestrian bridge, accessibility, universal design, Gostivar, North Macedonia

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Introduction

Urban river corridors function as critical public spaces that structure mobility, leisure, and ecological continuity in cities. Their accessibility to individuals of all ages and abilities is not a supplementary feature but a fundamental condition for social equity, public health, and environmental quality. Yet design shortcomings and infrastructural discontinuities particularly at pedestrian crossings frequently exclude vulnerable groups such as persons with disabilities, the elderly, cyclists, and parents with strollers from fully benefiting from these environments.

This study examines the accessibility of the Vardar River corridor in central Gostivar, North Macedonia, focusing specifically on the most intensively used pedestrian bridge that connects the two riverbanks and integrates with walking and cycling paths. While recent improvements including new paths, bicycle lanes, and children's playgrounds have enhanced the attractiveness of the riverfront, serious accessibility deficits persist. The pedestrian bridge, as a critical node in the corridor, remains a major barrier to equitable use.

To investigate this issue, a structured trilingual questionnaire (Turkish, Albanian, Macedonian) was administered to 100 residents, complemented by field observations. The survey, consisting of 11 items, collected demographic and behavioral data (age, disability status, bicycle use, and frequency of riverfront visits) as well as user evaluations of the bridge's accessibility against specific design criteria. (Vlora, 2022)

Accordingly, the study addresses the following research question:

“Do residents perceive the existing pedestrian bridge over the Vardar River to be accessible according to universal design standards?”

Two hypotheses guide the analysis:

- H1: The majority of participants believe that a new, accessible pedestrian bridge is required.
- H2: Regardless of age, physical condition, or bicycle use, most participants consider the existing bridge to be inaccessible.

The study adopts a user-centered perspective that is explicitly grounded in the Seven Principles of Universal Design (1997), which emphasize equitable use, flexibility, simplicity, perceptibility, tolerance for error, low physical effort, and appropriate size and space for approach and use. This

framework ensures that accessibility is conceptualized not merely as the removal of physical barriers but as the creation of environments that enable participation by all individuals regardless of age, ability, or physical condition. To situate the research within a broader policy context, the analysis is also aligned with European accessibility frameworks, most notably the European Accessibility Act (2019), which frames accessibility as both a legal obligation and a human right, and the EN 17210 standard, which provides technical guidance on accessibility and usability in the built environment.

Methodologically, data were collected through face-to-face interviews using a trilingual questionnaire designed to reflect Gostivar's multilingual and multicultural demographic profile. The survey incorporated both demographic and behavioral indicators, such as age, disability status, and bicycle use, along with user evaluations of bridge accessibility according to universal design criteria. The responses were then processed using Excel-based correlation methods, allowing for comparative analysis across different population groups and highlighting the relationships between demographic variables and perceptions of accessibility.

"Public space is for living, working, walking, and playing. Its value cannot be measured by economics or mathematics; it must be felt with the soul."
Enrique Penalosa

Urban Open and Green Spaces

Urban open and green spaces function as integral components of the urban fabric, complementing and enhancing the built environment. Beyond shaping the physical structure of a city, they act as balancing elements that mediate between different land uses and contribute to overall urban livability. Such spaces may arise through deliberate planning and design or evolve organically as a result of spontaneous development.

Their quality and distribution are influenced by a range of factors, including topography, climate, political decisions, architectural traditions, and most critically the social, cultural, and economic characteristics of the urban population. As public spaces, they address diverse community needs, providing opportunities for recreation, social interaction, and cultural expression. Examples include city and neighborhood parks, urban forests, botanical gardens, zoos, fairgrounds, exhibition grounds, boulevards, medians, and sports facilities. (GÜL, 2001)

Physically Accessible Urban Open Spaces

Although contemporary cities are fundamentally built for all individuals, the needs of persons with disabilities are often overlooked. However, access to urban outdoor spaces and the built environment is critically important for people with disabilities not only from a physical standpoint but also in terms of full social participation. Equal engagement in public life is directly linked to one's ability to benefit from essential rights and services.

Accessibility is not only essential for individuals with permanent disabilities but also for those with temporary or limited mobility, such as the elderly, pregnant women, and parents with young children. In this context, interventions initially designed for people with disabilities ultimately benefit a much wider range of users by facilitating broader participation in everyday life.

A physical disability in itself does not necessarily constitute a social barrier; however, insufficient or flawed spatial planning can turn a personal condition into an accessibility issue. Therefore, designing the physical environment to be accessible to all is a fundamental requirement for creating inclusive and equitable urban spaces (Bekci, 2012).

The design of accessible environments for people with disabilities is based on a series of anthropometric (body measurements) and ergonomic (user comfort) principles. These rules are guided by specific physical criteria to ensure that spatial design remains user-friendly and inclusive.

Within this context, the following fundamental criteria should be taken into account:

Space: An unobstructed and adequately sized maneuvering area must be provided to ensure comfortable use of wheelchairs and other mobility aids.

Surface: Ground surfaces should be smooth, slip-resistant, and free of obstacles that may hinder movement.

Width: Pathways, ramps, and entrance areas must be sufficiently wide to allow for two-way passage and safe navigation.

Height: Heights in functional areas must be designed to ensure both visual and physical accessibility, without creating barriers.

Signage: Directional, informational, and warning signs must be placed clearly, accessibly, and in an easy-to-understand format.

Urban Furnishings: Adequate and appropriate urban furniture (such as seating, railings, and lighting) should be provided to support the space's function and accessibility.

Designs and implementations that adhere to these criteria enable public open spaces to be used freely and independently by all individuals, thus contributing to the creation of an inclusive environment. (OLGUN, 2014)

In urban open spaces, walkways are not merely physical connectors between locations; they also serve as critical public infrastructure elements that guide users, provide rest opportunities, and ensure circulation between various activity zones. Ensuring that these paths are accessible to all users is particularly vital for the equal participation of individuals with disabilities in urban life.

According to the European Accessibility Act (2019) and Universal Design Principles, internal park pathways should be adequately wide and supported by ramps with slopes ranging from 5% to 8%. These ramps enable independent mobility for wheelchair users and also facilitate safe usage by individuals with temporary mobility limitations, such as elderly citizens and parents with strollers.

Stairs within parks often act as physical barriers to access. Therefore, ramps should be prioritized over stairs wherever possible. In cases where stairs are necessary, they must be designed in accordance with international accessibility standards such as TS 9111, ADA, and similar guidelines, ensuring proper step height, tread width, and handrail configuration.

Pathway surface materials should be selected by considering climate conditions and expected foot traffic, favoring surfaces that are non-slip, textured, drain efficiently, and provide auditory or tactile feedback while walking. Suitable surface types include:

- Tactile surfaces made from thermoplastic polyurethane, aluminum, or stainless steel,
- Paving slabs made of concrete, granite, or basalt,
- Natural wooden floor coverings,
- Stabilized and leveled gravel paths.

Finally, any irregularities that may pose a safety risk along the routes must be avoided, and the entire pathway system should be equipped with sufficient lighting to enhance user safety. This design approach not only improves accessibility for individuals with disabilities but also creates a comfortable and secure spatial experience for all users. (Çelik, 2015)



Figure 1 An example of a ramp and staircase used in urban open spaces (url 1)

Universal Design

"Our public spaces are only as functional as we allow them to be." — Candy Chang

Universal design is a holistic design approach that aims to ensure the highest possible level of interaction with the environment for all users, regardless of differences in age, gender, or physical and cognitive abilities. In other words, it is a set of principles developed to enable all individuals whether disabled or non-disabled, young or old, temporarily or permanently limited in mobility to share the same public space under equal conditions and with the same ease of use.

In the literature, universal design is often discussed alongside concepts such as design for all or barrier-free design. Its core philosophy is to meet the needs of diverse user groups not through separate solutions, but through a single inclusive design approach that accommodates everyone simultaneously. In this respect, universal design offers a paradigm that

extends beyond the physical environment to include access to information, digital services, transportation infrastructure, and all aspects of public service.

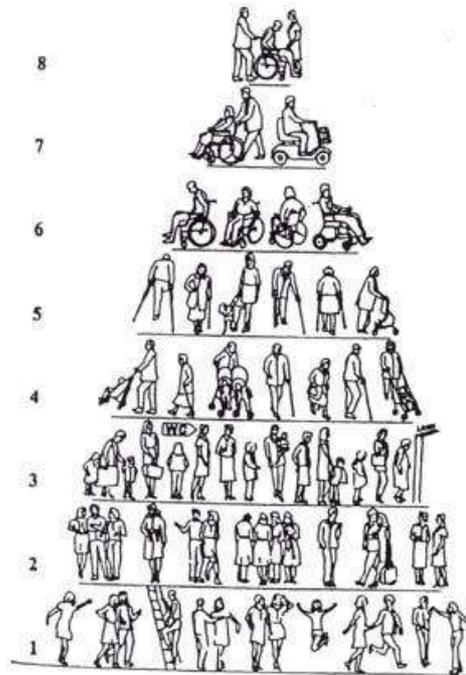


Figure 2 Universal Design risk scale (url 2)

This approach is more than a rising value in contemporary urbanism and architecture it represents an institutional response to today's societal demands for equality and inclusion. Universal design principles embody a shared vision that can be applied across various disciplines, including architecture, urban planning, communication technologies, transportation systems, product development, and graphic design.

In the context of public space, universal design seeks to create environments that are not only accessible to people with disabilities but also functional and safe for older adults, pregnant individuals, parents with strollers, young children, and anyone experiencing temporary physical limitations. Ultimately, this approach promotes not just spatial access, but also social participation, community integration, and respect for individual rights. (SHAKOURI, 2014)

The principles of the right to life, the right to freedom, and the protection of human dignity, guaranteed at the constitutional level, also require that urban spaces and infrastructure be organized in accordance with these

same principles. Therefore, ensuring accessibility in public spaces is not merely a matter of design but is directly related to the protection of human rights. (Korbajram & Hoca, 2021)

City of Gostivar (North Macedonia)

Geographical Location

Gostivar is a significant urban center located in the northwest of North Macedonia, within the administrative boundaries of the Polog region. Positioned near the border with Kosovo, the city holds a strategically important location in terms of transportation, lying along major routes that connect it to surrounding cities such as Tetovo, Skopje, Ohrid, and Debar. Additionally, Mavrovo National Park one of the region's most prominent natural tourism destinations is situated approximately 20 kilometers from the city center.

The city lies at the foothills of the Šar Mountains, where the Vardar River originates. The river's source is located in the village of Vrutok, near Gostivar, at an altitude of 683 meters. These geographical features contribute to the city's rich natural landscape and offer it a favorable position in terms of water resources.

Gostivar is also notable for its multicultural structure. According to the 2017 census, the total population of the municipality, including surrounding villages, is 81,042. The city's demographic composition primarily consists of Albanians, Macedonians, and Turks. This ethnic diversity plays a vital role in shaping the social fabric of the city and introduces a wide range of dynamics to the use of public spaces. . (Vlora, 2022)

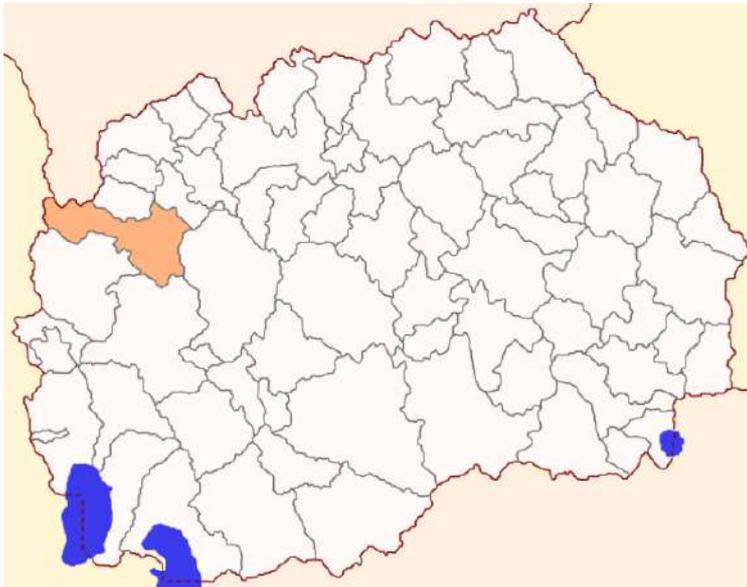


Figure 3 The location of Gostivar on the map of North Macedonia (url 3)

Vardar River

The Vardar River is the longest and most water-rich river in North Macedonia. Originating from the village of Vrutok near the city of Gostivar, the river holds significant geographical and cultural importance for the country. Vardar is notable not only for its physical characteristics but also for its presence in cultural memory it famously inspired the folk song “Vardar Ovası,” which is also well known and cherished in Turkey. (Havva Saban, 2024)

The river stretches a total of 388 kilometers, with 301 kilometers flowing through North Macedonia and the remaining 87 kilometers through Greece. It empties into the Aegean Sea near Thessaloniki, forming part of a major river system that eventually connects to the Black Sea. With an average flow of 174 m³/s, the Vardar River has historically played a central role in shaping human settlement and development along its course.

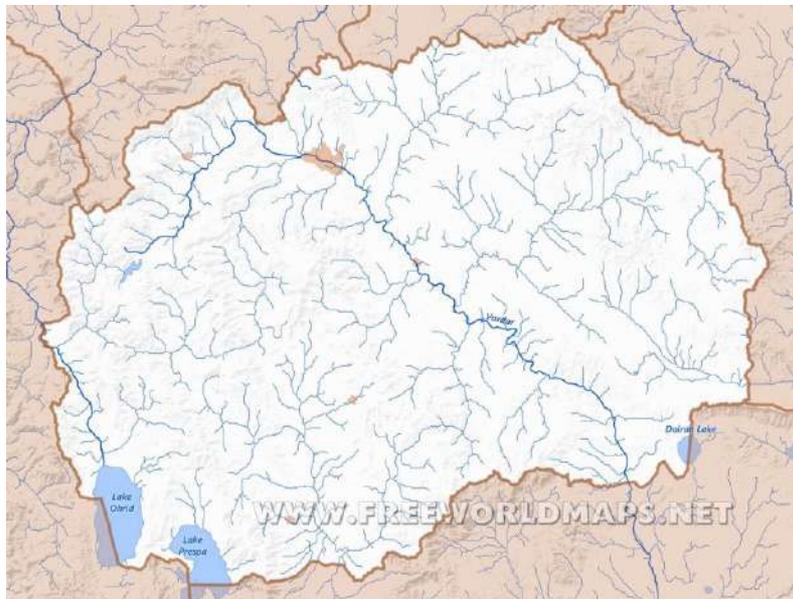


Figure 4 The Vardar River (url 4)

Starting in Gostivar, the Vardar flows through several of North Macedonia's major cities, including Skopje, Veles, and Gevgelija. In Skopje, the river passes through the very heart of the capital, effectively dividing it into eastern and western parts. Numerous settlements have developed along its banks, making the river a key factor in both the historical growth of cities and the spatial organization of urban public spaces.

The Position of the Vardar River in Gostivar

The Vardar River originates from the village of Vrutok near Gostivar and flows directly through the city, making it one of the region's most important natural assets. Unlike in many other cities where rivers play a central urban role, the Vardar did not historically serve as a focal point in Gostivar. This is primarily due to the frequent flooding in the past, which led to the development of settlements at a distance from the river. However, in recent years, the area surrounding the Vardar River has become one of the most heavily used public open spaces in Gostivar. Both sides of the river are now lined with parks and green spaces.



Figure 5 Gostivar / The Vardar River and its surroundings

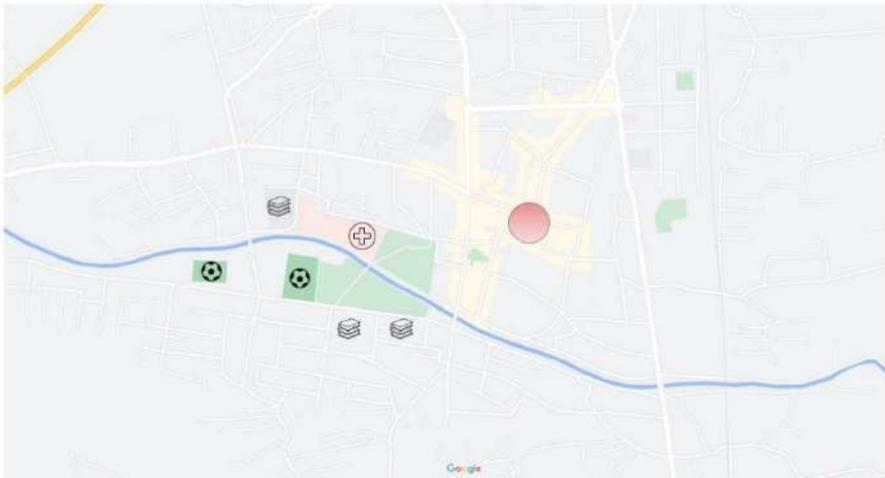


Figure 6 Significant structures located around the Vardar River (created by the author)

As shown in the historical photograph in Figure 8, one side of the river previously featured only a narrow pedestrian sidewalk, while the opposite bank consisted of a neglected park area with visible surface deterioration and uneven ground. However, over the past 5–6 years, significant improvements have been made—new walking paths, bicycle lanes, children's playgrounds, and seating areas have been constructed. These enhancements have transformed the riverbanks into one of the city's key focal points for both social interaction and physical activity. Today, the area surrounding the river is not only a route for daily circulation but also a preferred space for rest and mental relaxation. (Havva Saban, 2024)



Figure 7: A photograph from 2014 showing the Vardar River and its surroundings (L. Menga archive, 2015)

Despite this transformation, the spatial interventions made along the river still exhibit significant shortcomings in terms of accessibility. In particular, crossing from one side of the river to the other has become nearly impossible for individuals with physical disabilities and those using strollers. The currently used bridge does not comply with architectural accessibility standards; it includes 11 short yet steep steps and lacks both a ramp and an elevator system. The nearest alternative crossing point is approximately 2 kilometers away. This situation directly violates the principle of equal access for citizens using both sides of the river.



Figure 8: The current state of the Vardar River and its surroundings (url 5)



Figure 9: The present condition of the Vardar River (L. Menga archive, 2023)

Moreover, as seen in Figure 10, although bicycle lanes have been constructed along both sides of the river, these lanes are not integrated with the bridge connections. Cyclists are either forced to carry their bikes over the stair-equipped bridge or travel several kilometers back to use the next available crossing.

Although there are a total of four bridges within the city, observations indicate that none of them are designed to accommodate individuals with special accessibility needs. This condition contradicts the principles of Universal Design, the European Accessibility Act (2019), and broader EU policies aimed at ensuring equal access to public spaces for all.

Bridges over the Vardar River

In the most heavily used section of the river within the city, there are a total of four bridges. As shown in Figure 11, only one of these bridges (Bridge 2) is located at the center of the park area, where user density is highest. Bridges 1 and 4 are situated relatively far from the actively used parts of the park, while Bridge 3 lies outside the park boundaries and does not provide direct support for user access.

For this reason, Bridge 2 has become the most frequently used crossing point among park visitors. However, as noted in the previous section, this bridge is inadequate in terms of accessibility. Its narrow and steep stair design prevents passage for individuals with physical disabilities, elderly users, parents with strollers, and cyclists.

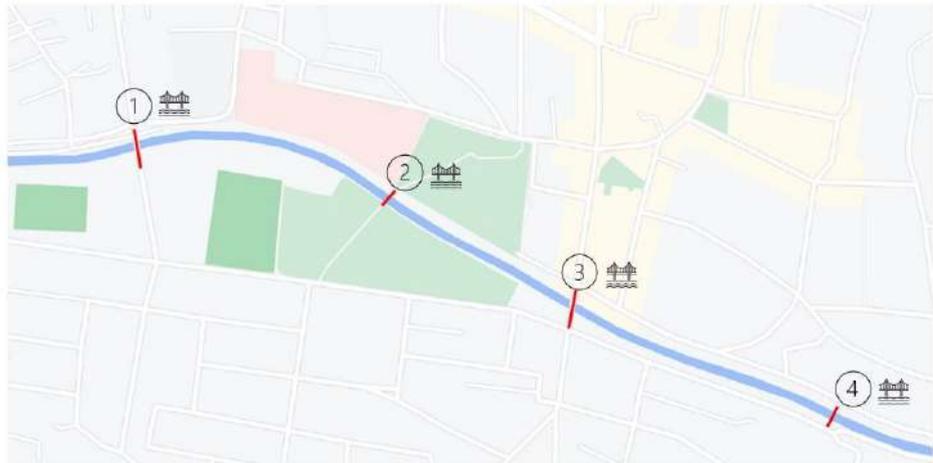


Figure 10: Bridges located on the Vardar River

Bridge 1

Bridge 1, located within the city, was primarily designed to serve vehicular traffic and is only marginally used by pedestrians. As shown in Figure 12, pedestrian access is available from only one direction, where a single accessibility ramp is located. However, there is no corresponding pedestrian infrastructure on the opposite side of the bridge no stairs, ramps, or pathways are present. As a result, crossing the bridge becomes highly challenging for individuals with physical disabilities or those using bicycles. While limited passage is technically possible via the existing ramp, this solution does not meet established accessibility standards and cannot be considered safe or inclusive.



Figure 11: Bridge No. 1 (L. Menga archive, 2023)

The section of the riverbank between Bridges 1 and 2 has been a central focus of recent public space improvement projects led by the Municipality of Gostivar. This area now includes a variety of physical and social amenities such as walking and jogging paths, children's playgrounds, and outdoor fitness equipment

A particularly noteworthy aspect of these improvements is the inclusion of design elements specifically tailored for users with disabilities. For instance, playgrounds feature swings and exercise equipment accessible to children with physical impairments. This approach reflects a broader understanding of accessibility one that goes beyond mobility to encompass participation and experiential inclusivity in public space planning. (Arici, 2024)

However, the lack of accessible crossing bridges in the vicinity limits the integration of these facilities with the opposite riverbank and disrupts the continuity of public space. As a result, despite the improvements, the area remains confined to a narrow linear corridor along one side of the river and fails to evolve into a holistic and inclusive access system.



Figure 12: The works carried out between Bridges No. 1 and No. 2 (L. Menga archive, 2022)

Bridge 2

Bridge 2, located at the very heart of the city's most actively used public space, serves as the primary pedestrian crossing between the two banks of the Vardar River (Figure 15). While it physically connects the parks and walking areas on both sides of the river, the bridge poses significant accessibility challenges despite its central location.



Figure 13: Bridges on the Vardar River: Bridge No. 2 (created by the author)

As seen in Figure 16, the bridge features a total of eleven steps, each varying in height and width. This irregular stair configuration creates a substantial barrier for individuals with physical disabilities, cyclists, parents with strollers, and elderly users. Architecturally, the riser design does not conform to accessibility standards, resulting in both visual inconsistency and safety concerns. Figures 15 and 16 further illustrate that although continuous bicycle lanes have been constructed along both riverbanks, the bridge itself lacks any form of integration with these lanes. This discontinuity forces cyclists either to carry their bikes up the stairs or to travel nearly 2 kilometers to the nearest alternative bridge.



Figure 14: Bridge No. 2 (L. Menga archive, 2023)

Additionally, as seen in Figure 16, various structural components have been added to the bridge over time, which has not only increased the static load but also disrupted its architectural coherence. All of these observations clearly indicate that the bridge is inconsistent with

fundamental principles of urban public accessibility, both in physical and functional terms.



Figure 15: Bridge No. 2 (L. Menga archive, 2023)



Figure 16: Bridge No. 2 (L. Menga archive, 2023)

Bridge 3

As shown in Figure 18, Bridge 3 was primarily designed to accommodate motor vehicle traffic. Although sidewalks are present on both sides technically allowing partial pedestrian use access to these sidewalks is only possible via staircases. There are no ramps or accessible pedestrian entrances.



Figure 17: Bridges on the Vardar River: Bridge No. 3 (created by the author)

This makes the bridge effectively inaccessible for individuals with physical disabilities, parents using strollers, and cyclists. In its current form, it can only be used by pedestrians with full physical mobility, thereby presenting a physical barrier that contradicts the principles of inclusive design.

Furthermore, the clearance height beneath the bridge is approximately 170 cm, and the limited lighting in this area poses both ergonomic and safety concerns for those using the underpass (Figure 18). As a result, despite its central location, the bridge fails to ensure functional accessibility and disrupts the spatial continuity of the urban public realm.



Figure 18: Bridge No. 3 (L. Menga archive, 2023)

Bridge 4

As shown in Figure 19, Bridge 4 is one of the most easily accessible pedestrian bridges over the Vardar River. Due to its flat design with no elevation changes, access to the bridge is provided through level ground, allowing users to approach and cross without encountering physical barriers. This feature makes the bridge particularly accessible for individuals with physical disabilities, cyclists, and parents with strollers.

Importantly, this bridge was not initially part of a formal urban development plan but was instead constructed out of necessity driven by the needs of the surrounding population. In fact, among all four bridges along the river, only Bridges 1 and 4 provide feasible crossing options for individuals with mobility challenges or bicycles. Bridges 2 and 3 are not physically suitable for these user groups.

Although Bridge 4 represents the most successful example of accessibility, its location on the periphery of the city center limits its effectiveness in meeting the daily needs of users. This highlights the fact that accessibility in urban design must be assessed not only in terms of physical features but also in relation to spatial positioning and ease of access within the urban fabric.



Figure 19: Bridge No. 4 (L. Menga archive, 2023)

Survey Study and Evaluation of Findings

Purpose and Methodology of the Survey

Within the scope of this study, the accessibility of the park areas surrounding the Vardar River in the city of Gostivar was evaluated based on user experiences. The primary aim of the research is to determine whether the existing pedestrian bridge that connects both banks of the river adequately meets users' accessibility needs.

The study seeks to answer the following research question:

“Do participants consider the existing bridge over the Vardar River to be suitable according to accessibility criteria?”

Based on this question, two main hypotheses were developed:

- H1: The majority of participants believe that there is a need for a new and accessible bridge over the Vardar River.
- H2: Regardless of age, physical condition, or cycling habits, most participants consider the current bridge to be inaccessible.

Taking into account Gostivar's multicultural and multilingual population, the survey was prepared in three languages Turkish, Albanian, and Macedonian and conducted through face-to-face interviews. The collected data were processed using Microsoft Excel and supported with correlation analysis, enabling both qualitative and quantitative evaluations.

Participant Profile and Findings from the Data Collection Form

A total of 100 individuals participated in the survey, ranging in age from 14 to 73. Among them:

- 48% stated they regularly use a bicycle.
- 5% reported having a physical disability.

A significant number of respondents indicated that they visit the Vardar River area at least 2–3 times per week.

These findings confirm that the area surrounding the river is an actively used public space and that the needs of cyclists, in particular, must be taken into account in urban design decisions.

Accessibility Assessments and Key Findings

Responses to the question “Is the current bridge over the Vardar River accessible?” reveal several critical insights:

- 90% of participants stated that the bridge is not suitable in terms of accessibility.
- 100% of participants believed the bridge is not appropriate for individuals with physical disabilities (none selected “Yes” or “Undecided”).
- 76% said the bridge is not suitable for cyclists; the remaining 24% were undecided. No one found the bridge appropriate for cycling.
- 73% of participants indicated that the bridge is not suitable for pregnant individuals and elderly users; 27% responded as undecided.
- When asked whether the bridge should be ramp-based or stair-based, 88% expressed a preference for a ramped design.

Regarding the necessity of a new bridge:

- 53% answered “Yes”,
- 38% were undecided,
- 9% answered “No.”

These results clearly show that the majority of users believe the current bridge does not meet accessibility needs and that the idea of a new, accessible bridge is widely accepted within the community.

Evaluation of Survey Results

When the survey findings are evaluated together with the physical observations conducted on-site, it becomes evident that the public spaces surrounding the Vardar River in the city center of Gostivar suffer from significant accessibility deficiencies. In particular, the lack of a safe and barrier-free passage between the two banks of the river for individuals with physical disabilities, elderly users, pregnant individuals, parents with strollers, and cyclists limits the functional use of the area as a public space and undermines the principle of social inclusion.

The current bridge designs are incompatible with universal design principles and established accessibility criteria. Stair-only access, the absence of ramps, and the remote location of the bridges from the main

park areas mean that these infrastructure elements are effectively usable only by a limited segment of the population. The vast majority of survey participants were aware of these limitations, indicating not only the inadequacy of existing structures but also a clear demand for the construction of a new, accessible pedestrian bridge. Based on the collected data, the need for a ramp-equipped pedestrian bridge in the most frequently used section of the river has become essential. This proposed design should not be seen merely as a physical intervention, but as a strategic step toward creating a more inclusive, accessible, and integrated public life in Gostivar.

Accordingly, the following section presents a detailed proposal for the location and architectural features of the new bridge, designed in line with universal design principles and aimed at eliminating physical barriers.

Proposed Pedestrian Bridge Project

Factors Considered in the Bridge Design

In urban spaces, physical environmental arrangements such as pedestrian paths, crossings, sidewalks, and ramps, along with public urban furniture, are not only essential for circulation but also serve as critical elements that shape social participation. When these elements are not designed ergonomically, safely, and in accordance with universal standards, they can severely limit the ability of individuals with physical, cognitive, emotional, or social differences whether congenital or acquired to access public life. In this context, spatial inadequacies may function as an invisible form of discrimination.

The proposed pedestrian bridge design was developed with specific attention to the following guiding frameworks: the Universal Design Principles, the European Accessibility Act (2019), and EU urban policy frameworks promoting equal public access for all. The bridge was designed by benefiting from the principles of modern architecture, with an emphasis on minimalism and the use of contemporary materials. Inspired by Le Corbusier's approach, particularly his integration of ramps to ensure fluid circulation, the design prioritizes both functionality and accessibility while reflecting the aesthetic clarity of modernist architecture. (Menga, 2022) These standards advocate for a fully inclusive design approach that not only addresses the needs of individuals with permanent disabilities, but also of the elderly, pregnant women, parents with strollers, cyclists, and those with temporary mobility limitations.

The key dimensions and proportions of the design are based on internationally recognized Universal Design Principles and European accessibility standards:

- The proposed bridge is approximately 30 meters long and 250 cm wide, allowing simultaneous passage for a pedestrian, a cyclist, and a wheelchair user.
- The highest point of the bridge reaches 120 cm, accessed via ramps with an 8% slope, in accordance with the European Accessibility Act and EU accessibility regulations.
- For ramp segments longer than 10 meters, flat resting landings of at least 250 cm have been provided, and at directional changes, 150x150 cm turning spaces are included.
- The bridge surface is made from hard, stable, non-slip, and low-texture materials, ensuring smooth and continuous transitions without thresholds or level differences. Surface unevenness is limited to a maximum of 2 cm.
- In all height transitions exceeding 20 cm, dual-side ergonomic handrails are installed for user safety and comfort.
- As shown in Figure 23, the bridge is integrated into the existing landscape with minimal environmental intervention and designed to connect directly with existing pedestrian pathways.

The aim of this design is to contribute to an inclusive urban life scenario in Gostivar, where public spaces can be used under equal conditions by all. The bridge is not only conceived as a means of physical passage but as a spatial representation of accessibility, equity, and social integration.



Figure 21: Proposed Bridge - render1



Figure 22: Proposed Bridge - render2

In the bridge design, one of the main objectives was to ensure that people with physical disabilities and cyclists can use the bridge simultaneously in a safe and comfortable manner. To achieve this, the proposed bridge has been designed with a width of 250 cm, allowing unobstructed two-way passage and preventing congestion or user conflict (Figures 21–22).

The 8% slope implemented in the design was selected not only to comply with international accessibility standards, but also to respond to local environmental conditions. Prior to reaching this point in the city, the Vardar River passes through several settlements, and at times, its water level can rise to the upper edge of the stone embankments along its banks.

In such cases, a bridge built at ground level would be at risk of flood-related damage.

Additionally, there is a risk of solid waste or natural debris being carried downstream at high speed and impacting the bridge's substructure. Therefore, placing the bridge above the river's natural flow level is considered essential for its structural durability, and an elevated sloped design was adopted as a preventive measure.

Throughout the bridge, 90 cm-high dual-sided metal guardrails have been installed to enhance safety and provide support for users who may need to hold on while crossing. Metal safety barriers have also been planned along the riverbanks, ensuring maximum safety for both daytime and nighttime use.



Figure 23: Proposed Bridge - render3



Figure 24: Proposed Bridge - render4

CONCLUSION

The physical structure of cities is shaped not only by buildings and roads but also by public spaces, which directly influence individuals' ability to participate in social life, their freedom of movement, and their overall quality of life. Yet in contemporary urban design, public spaces are often planned around a "normative user," resulting in the exclusion of groups such as persons with permanent or temporary disabilities, the elderly, parents with strollers, and cyclists. In such cases, design itself becomes a subtle but persistent form of discrimination.

The case of the Vardar River corridor in Gostivar illustrates this problem clearly. Field observations and survey data converge on the same conclusion: the city's pedestrian bridges particularly the second bridge, which is the most frequently used fail to meet universal design principles and remain inaccessible by design. Among the 100 survey participants, the vast majority judged the bridge unsuitable for persons with disabilities, elderly and pregnant individuals, and bicycle users. Notably, no respondent considered the bridge to be accessible for individuals with physical disabilities. These findings demonstrate that access to basic public infrastructure an essential urban right is effectively denied to significant segments of the population.

In response, this study developed a context-specific bridge proposal with a 2.5 m clear width and ramp gradients not exceeding 8%, enabling safe and independent passage for wheelchair users, cyclists, and other vulnerable groups. The design draws on the European Accessibility Act (2019), the Seven Principles of Universal Design (1997), and the EN 17210 standard, grounding the intervention in internationally recognized accessibility frameworks.

The proposal was formally presented to the Municipality of Gostivar in 2021, where it was also communicated to the public. Although the project was acknowledged and publicly discussed at the time, it has not yet been implemented. This situation reflects the broader challenges of translating accessibility-oriented research and design proposals into realized urban interventions.

Ultimately, this research underscores that creating inclusive public spaces extends beyond compliance with technical requirements. Accessibility should be recognized as an ethical responsibility and a fundamental principle in the pursuit of equitable and sustainable urban environments.

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