JOURNAL OF BALKAN ARCHITECTURE

PROJECT PRESENTATION

DOI: https://doi.org//10.69648/GXPK8603

Journal of Balkan Architecture (JBA), 2026; 3(1): 49-68

jba.ibupress.com

Online ISSN: 2955-2524

Application: 20.03.2026

Revision: 19.04.2026

Acceptance: 10.05.2026

Publication: 15.05.2026

Rožmanec Matičič, N., Ćalović, D., & Čakš, T. (2026). Materiality in urban space: Student case studies on the experiential path to Rožnik Hill. Journal of Balkan Architecture, 3(1), 49-68. https://doi.org//10.69648/GXPK8603

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We declare no conflicts of interest.

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BALKAN JOURNALS

# Materiality in Urban Space: Student Case Studies on the Experiential Path to Rožnik Hill

**Nada Rožmanec Matičič, Dragan Ćalović and Tjaša Čakš**

*Abstract*

Through an analysis of a conceptual design of an experiential trail to Rožnik Hill, the study discusses the symbiosis between materiality in design and human perception. It examines how spatial planning co-shapes the human experience of the environment. The presentation of the student project of practical examples of design addresses the question of how we deepen our relationship and connection with nature.

The research focuses on a design that stems from location and the experience of space. The study is interested in how spatial planning can deepen ideas about social context, urban spaces, and landscape through the design process. The design approach in interventions uses the principles of sustainability through the application of sustainable materials and recycling. As proposed solutions to spatial problems, it encourages innovative, multifunctional design with various usage scenarios. Through the project, we want to show how space design can strengthen spatial awareness and contribute to the formation of cultural identity.

The research addresses broader questions directly related to materiality in the formation of rational, sustainable urban experiences. The results of the research highlight the challenge of converting the abstract meaning of the path into a tangible spatial experience, which is expressed through various reinterpretations of the location through the eyes of young designers. The meaning of recreation and relaxation can be experienced in various ways, which the research itself contributes through the multifaceted approach of creative urban space design.

*Keywords:* materiality, urban design, sensory engagement, site-specific design, connection with nature, relaxation, spatial experience

## Introduction

Ljubljana, as the macro-location of the study, is located in central Slovenia at the transition between the Alps to the north and the Dinaric Alps to the south. The quality of life in Ljubljana is high due to the preserved nature. The city is surrounded by hills covered with native forest, which make up 46% of the total area of the municipality. To the south lies the Ljubljana Marshes, the largest area of marsh meadows, featuring a system of hedgerows, forests, scrub, and water areas in Slovenia. Twenty percent of the total area of the municipality has the status of protected nature. Four landscape parks, numerous tree-lined avenues, parks, gardens, and majestic trees have been declared in the Municipality of Ljubljana. According to data (WHO), in developed European countries, as much as 50% of the population is exposed to a daily noise level above 55 dB(A) due to traffic. Residents are exposed to high levels of traffic noise (above 65 dBA) significantly less (14%) than the European average (20%) (Mestna občina Ljubljana, n.d.). The natural environment of Ljubljana influences the multisensory perception of space. Various green spaces affect the acoustic and microclimatic conditions of the space. The architectural interventions that are the subject of the study below are designed as a response to the environment in which they are placed. The main idea behind the design and placement of the object is to connect the user with the space through a multi-layered sensory perception of the space.

Architecture encourages a multisensory experience of space. The user‘s perception of space goes beyond the visual aspect. A thoughtful selection of materials with a reaction to light and the presence of scents shapes the character of the space (Meselhy & Malkawi, 2024). Architectural design is expressed through materiality, which affects the user‘s experience through sensory response with texture, weight, and thermal properties (Pallasmaa, 2012). An important architectural element is also light. It controls how spaces are presented to people, and it also influences their emotional responses and environmental conditions (Zumthor, 2006). The interplay of natural light and shadows creates a healthier atmosphere. Spaces with natural light feel spacious and energetic, while darker spaces encourage contemplation. Design decisions determine the choice of materials and the architectural language of the design. Architects who study multiple sensory elements can design environments that create deeper emotional connections between people and their built environments (Pallasmaa, 2012). With intentional design, architects create structures that change the way people experience the environments they inhabit (Zumthor, 2006).

Interventions along the trail to Rožnik Hill – from architectural interventions to urban design – emphasize sustainability through the use of local materials from Slovenia and innovative design approaches. The project addresses the challenges of rapid urbanization in relation to the preservation of natural heritage, tradition, and the use of local craftsmanship skills. The research offers insight into how a thoughtful selection of materials in projects can promote a sense of belonging and cultural identity. The research creates a model of sustainable design approaches that can be transferred to the broader context of urban design in cities in the Balkan region.

## Site Context and Regional Significance

Rožnik Hill is the green infrastructure of Ljubljana, the capital of Slovenia. The landscape park, part of which is Rožnik, northwest of the Ljubljana city center, includes Tivoli, agricultural areas, and the forested areas of Šišenski hrib and Koseški Bajer. The area covers 459 hectares.

The central topography characteristic of the area is a wooded hilly relief with the peaks of Rožnik, Šišenski Hill, and Debeli Hill. The most valuable areas include the natural reserves Mali Rožnik and Mostec. The forest merges with arable land and meadows to the west; the park ends at the Path of Remembrance and Friendship. A large area of Rožnik is forested, which is why it is recognized locally as a green urban park and a key center of biodiversity. Rožnik is a natural oasis in the urban environment, with a diverse range of plant and animal species. It also boasts a rich cultural heritage that reinforces the historical and cultural significance of the area (Nose Marolt et al., 2019).

Rožnik is one of the most popular walking and running spots in the Ljubljana countryside. Known as the wooded hill above Ljubljana‘s largest park, it is intertwined with macadam paths and trails. Most paths lead to the most popular destination among users: Cankar‘s Peak (the highest peak of Rožnik is Šišenski Hill, 429 m). The peak is named after the Slovenian writer Ivan Cankar, who lived in the building where the Rožnik restaurant is today between 1910 and 1917. The restaurant also features a memorial room dedicated to Cankar, in front of which stands his bust. Above the restaurant, on top of the hill, is the Church of the Assumption of Mary, which offers a view of the center of Ljubljana (Turizem Ljubljana, 2025).

**Figure 1**

*Tivoli Landscape Park, Rožnik and Šišenski hrib – panoramic view (Čeak, n.d.)*

The integration of the park into the Ljubljana urban fabric was heavily influenced by the architect Jože Plečnik. Tivoli Park was renovated between 1921 and 1939 according to Plečnik's plans for the central promenade, named after the painter Rihard Jakopič. According to the plans of Stanko Bloudek, the Ilirija swimming pool was built in 1929. Subsequent modernist layers also included sports infrastructure developed a ski jump at Galetovo and a sports park beneath Cekin Mansion in the 1950s. In 1965, the Tivoli Hall was built according to the plans of Marjan Božič, and it serves for sports and cultural events. Today's landscape typology of the park combines systematic gardening arrangements with functional sports and cultural infrastructure. The park's landscape design includes more than 80 native and exotic tree species. The park is recognized as a meeting point between the primeval forest and the geometrically precise urban park (Nose Marolt et al., 2019).

## Experiential Quality and the Identity of Urban Space

In modern urban planning discussions, urban planner Kevin Lynch states that a city is not defined by its physical structure alone. A city is defined by its experiential nature or „sense of place." The design should be a strong and legible structure that promotes the development of local identity on an emotional and experiential

level (Banerjee & Southworth, 1990). Although sight is considered the primary sense, the identity of a place is shaped by a determined by a multi-faceted spectrum of sound, touch, and smell. A „feeling" of the place is created by the combination of all these senses (Llewelyn-Davies, 2000).

The conceptual framework of the Rožnik experiential trail project is based on the theoretical background of architect Peter Zumthor. In accordance with his views, the materials used in the project not only play a functional role but also act as mediators, drawing the user into the ambient experience of the natural and forested space of Rožnik.

Zumthor defines architectural practice as an interactive process of exploration, based on self-reflective dialogue. It is understood by Zumthor as finding answers to spatial problems through design. His pedagogical approach focuses on the conscious exploration of personal history of living and interaction with architecture. His approach is based on the assumption that understanding the architecture originates from the individual's living experience, which he experiences through the entire spectrum of human emotions. The effective design approach does not only follow from rational knowledge, but from the link between the senses and intellect. The essence of Zumthor's thinking is the image of the built environment. The materials are not seen as a medium for the transmission of ideas, but as real, physical substances that occupy space through their presence. They are important due to their physical properties: texture, weight, and the interaction of the surface with light and shadow. As Zumthor states, through this ‚anatomy of construction,' the work transcends utility and expresses itself as a strong, tangible atmosphere (Zumthor, 2010). The space fully utilizes its potential only when its surfaces are included in the user's sensory dialogue (Zumthor, 2006).

Based on Zumthor's insights, the conceptual design of a project for an experiential path on Rožnik Hill through the design approach develops the concept of "urban materiality". This can be understood as a set of comprehensive elements that are connected to the location on a conceptual level. These are the topographical characteristics of the territory, the socio-historical dimension, and the construction of the implication of the materials used in the spatial intervention. The intertwining of individual project elements creates an experiential component of the project that blends with the city – it operates on a physical, symbolic, and experiential level simultaneously.

## Case study - The Path of Remembrance and Comradeship (PST)

The conceptual design of the Rožnik path is a symbolic transfer or re-interpretation of the language of the Path of Memories and Comradeship (PST). The Path of Memories and Comradeship is a linearly designed landscape architectural monument that is 32.5 kilometers long, linearly designed, and surrounds the city of Ljubljana, which during World War II had been surrounded by barbed wire. The spatial concept of the monument is based on the traces of the former Italian barbed-wire fence that surrounded the city during the period from 1942 to 1945. The original defense system consisted of 206 forts and guardhouses that surrounded the city of Ljubljana and turned it into a sort of prison. After the war, the area was transformed into a memorial site, which nowadays symbolizes the resistance of the local population and the activities of the underground movements of the Liberation Front.

**Figure 2**

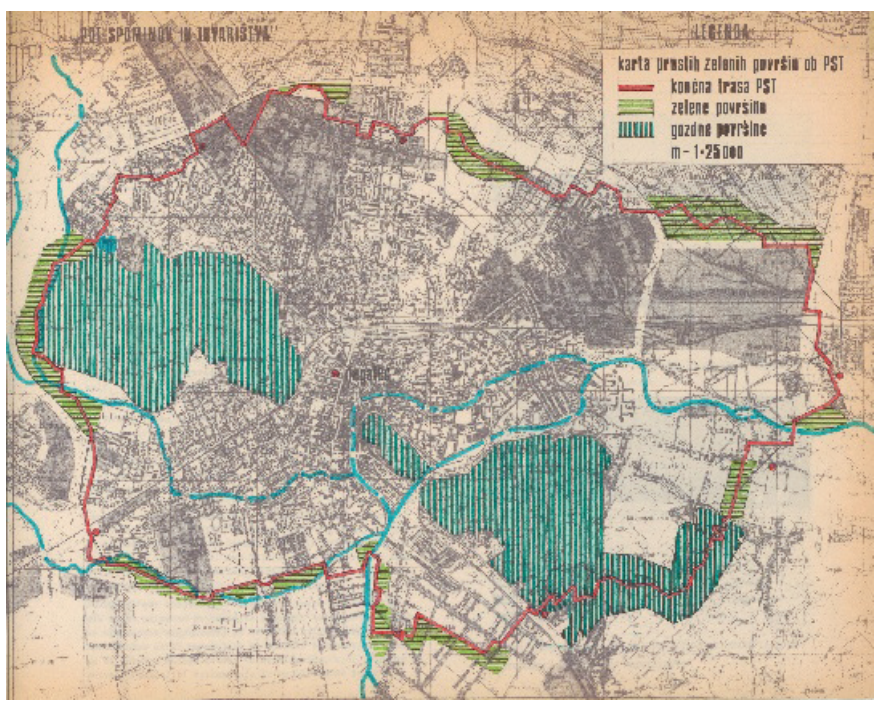
*Octagonal pillars (monument) and a bench (urban furniture) along the Path of Remembrance and Comradeship (Društvo Zeleni prstan, 1980)*

The path was marked in 1957 by architect Vlasto Kopač along the route of the former barbed wire fence. Two years later, six stone obelisks with reliefs by sculptor

Božo Pengov were placed at the checkpoints on the entrance roads. From the liberation of the city until 1962, 102 memorial stones in the shape of an octagon were placed along the path to mark the positions of the occupier's bunkers. The path is 4 meters wide and made of natural gravel. It passes through different spatial units and typologies, ranging from residential areas, agricultural land, and the edge of the forests to the green infrastructure of Ljubljana. PST is a monument in motion with everyday recreational use. The use of natural materials, recurring architectural marks, and urban equipment as an architectural design language establishes a visual identity throughout the monument area (Koželj, 2020).The idea of designing urban equipment for the design of the experiential trail to Rožnik Hill is based on the existing urban equipment of the Path of Memories and Comradery and draws inspiration from its design and spatial elements.

**Figure 3**

*Plan of The Path of Memories and Comradeship: Monument to Ljubljana – a Hero City as an Element of Urban and Horticultural Planning of the City (Omersa, 1980)*



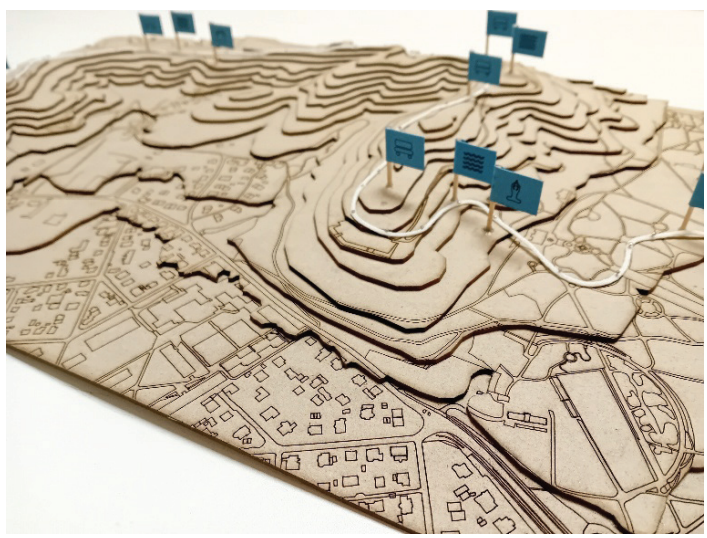
## The Rožnik Experiential Trail: Conceptual Framework and Student Interventions

The Rožnik Experience Trail is designed as a series of spatial interventions. The trail starts at Tivoli Park and ends at Cankar's Peak on the Rožnik Hill. The route passes through forest and meadows. The natural environment for the relaxation path is chosen primarily to encourage psychological recovery and sensory engagement through recreation for the user. Architectural interventions are placed in a way that the user moves from a densely populated urban edge to a peaceful environment according to their spatial needs. The effects of fast city life are mitigated by sensory experiences through spatial planning as they pass through interventions.

The path program includes a relaxation pavilion, a greenhouse integrated with a community library, outdoor reading nooks, innovative seating systems, water fountains, public restrooms, and a retreat unit. Each intervention reflects a holistic approach to the materiality of the project, which is reflected through the user's experience with the environment and sustainability. The placement of the points in the space is based on views or surroundings of the location, oriented towards the Kamnik-Savinja Alps and the Ljubljana Basin.

**Figure 4**

*Conceptual model of the Experience trail to Rožnik Hill, with marked points along the path (Faculty of design, 2024)*



The path from Tivoli to the top of Rožnik is marked by a 300-meter elevation difference, which the user can cover in approximately 40 minutes. At the threshold of the city, the interventions use materials and design that are reminiscent of the regional identity. As the climb progresses, the design of the urban furniture and structures changes, using textures and materials that blend into the forest environment.

By incorporating the selection of materials into the environment, the path encourages a gradual transition from the urban fabric to the natural environment. The main goal that the project aims to deepen through interventions is to deepen human relationships with nature. An in-depth relationship with nature leads to the recreation of cultural identity in spatial interventions through this connection.

## Relaxation Pavilion

The design of the meditation pavilion represents an architectural intervention at the beginning of the experience trail to Rožnik Hill. As an architectural intervention, it is recognized as a mediator between physical activity and the user's psychological well-being. The project addresses the modern need for creating intimate spaces by establishing a yoga studio. The interior design, with its selection of materials, encourages the user's sensitivity and emotional well-being.

The main task of the pavilion is to create an environment in which the user can relax. The project attempts to achieve this by directly integrating the interior and exterior spaces of the pavilion. Through the metaphor of connecting with the surroundings and awareness, the visitor is enabled to make a gradual transition from the city center to the natural environment.

**Figure 5**

*Exterior of Relaxation Pavilion: wooden and stone functional unit (Faculty of Design, 2024)*

The material design of the pavilion is based on combining warm organic and cool industrial elements. The pavilion's structure combines natural and industrial materials: wood, stone, and concrete. Natural materials are used to ensure user comfort and a direct biological connection with nature. Industrial materials are primarily used to establish the stability of the structure and as a contrast to the landscape. The fluidity of the interior and exterior of the building is created with the help of glazed surfaces that erase the boundary. A large percentage of the pavilion's glass surfaces allows natural light to enter the building, providing users with a direct visual connection to Tivoli Park.

The pavilion is spatially designed from two functional units. The pavilion is entered from a concrete platform that opens onto Tivoli Park. From the concrete platform, the user moves into an enclosed, introverted volume where meditation and relaxation take place. The main architectural element of the pavilion is the movable wooden panels, which are conceptually designed to resemble the flow of water. The user adjusts the level of privacy and exposure to sunlight in the space using movable panel elements installed on the glass surfaces of the pavilion. The interaction of light with the wooden sliding panels in different lighting conditions creates various shadows in the interior of the space (chiaroscuro), which introduces a sense of movement into the static structure of the architecture. The interior furniture ele-

ments of the wooden part of the building are designed from bleached wood, which creates a contrast to its exterior.

The Tivoli Castle is located in the immediate vicinity of the pavilion, so the architectural intervention takes advantage of both the historical and recreational significance of the area. The pavilion is located at a strategic node of the Tivoli City Park, which serves as the green infrastructure of Ljubljana. The pavilion is placed on a support, and the wooden functional unit is elevated from the ground. The architectural design takes advantage of the topographical environment, so the design blends with nature.

**Figure 6**

*Interior of Relaxation Pavilion: Yoga studio (Faculty of Design, 2024)*

## Quintessence

The design of the experience trail to Rožnik Hill upgrades the landscape by subtly integrating public facilities into the natural environment. The project, in terms of urban equipment, proposes a series of drinking fountains and public toilets that emphasize the ecological and cultural importance of regional water sources. It thematizes the water identity of the Slovenian landscape. Urban furniture is placed at strategically important locations in the space based on the user's needs, depending on the steepness of the climb.

The design concept is based on the hydrographic diversity of the region, characterized by rivers, lakes, waterfalls, and underground caves. Design of drinking fountains revives the connection between humans and water sources. Its shape reminds the user of natural heritage and is a metaphor for the direct relationship between human beings and nature.

For the production of water fountains and toilets, Karst limestone is used. The use of materials for the project t is symbolic of the main connection that the new interventions have with the geological environment. By incorporating indigenous materials into the urban furniture project, it respectfully complements the natural environment in which it is placed.

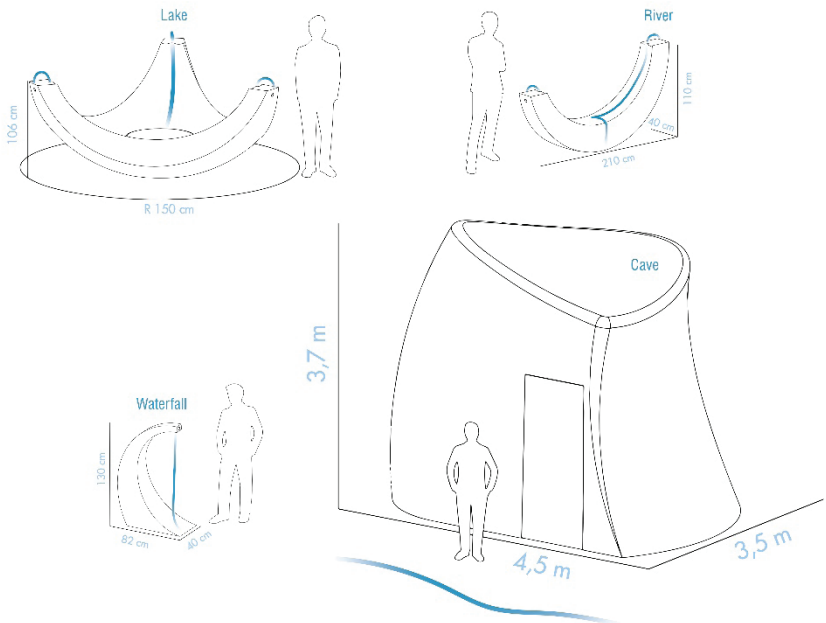
An integrated design approach to urban planning was used in the design of urban equipment. Public spaces recreated by urban furniture use their symbolic value to reinforce awareness of the importance of natural landscapes. The design represents a sustainable model of urban equipment design, as it contributes to the spatial identity through a tribute to natural heritage. The design of the urban equipment of the drinking fountains and public toilets was based on natural water bodies – the 4 key water ecosystems of Slovenia: waterfall, river, lake, and cave. Natural water phenomena shape the structure of the landscape and water ecological processes uniquely.

The Waterfall represents the movement of water in an upright position. The River represents the continuous flow of water, circulating through the landscape. The symbolic meaning of the lake represents the peace and stability of the water body. The cave represents an ecosystem where water flows into hidden underground spaces.

The Alpine Lake Fountain is located at the beginning of the path near the relaxation pavilion. It is made of natural stone and embodies the serenity of Alpine lakes in Slovenia. These are usually placed in the background of mountain peaks in a panoramic sense. Due to its representative image, it has a monumental effect. The choice of placement is, for this reason, at major architectural interventions on the path. The design and placement of the fountain embody the peaceful character of high-mountain waters. It serves as a source of drinking water and at the same time as a meeting point for visitors to socialize.

**Figure 7**

*The Alpine Lake Fountain, The Creek Fountain, Cave facilities, and Waterfall Fountain - dimensions (Faculty of Design, 2024)*




The location of the Creek Fountain is on the flat sections of the path, rising to the top. The sculpture is made of natural materials found in the area to match the environment. It depicts Slovenian rivers. Its use and placement were inspired by the river's flow through the valley. Rivers bring peace, and a sense of natural water flows. Its use is to offer refreshment while ascending to Rožnik.

The cave facilities are placed along the route at points where users need functional support along the way. This is a service facility that supports the operation of public space. They are constructed from terrazzo, which is made from the remains of natural stone that was originally used to make fountains. The interior design is inspired by caves, which is reflected in the dark atmosphere and ambient lighting. The interior design mimics the mystery and depth of underground spaces with its design.

The Waterfall Fountain is placed at the end of the route, representing the culmination of the experience. Serves as the last source of refreshment for hikers on the route. The position of the fountain in the environment symbolizes not only phy-

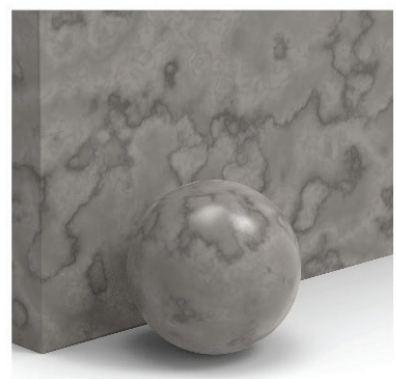
sical regeneration but also the experience of visiting the waterfall. Since it is not easy to access the waterfalls in their environment, there is a focus on the ambient experience, which is reached at the end of the route.

*The* selection of material for the design of urban equipment is based on a comparative analysis of samples of indigenous limestone from the Kras region. In collaboration with experts from the local stone industry, three types of stone were selected based on geological properties, durability of the material, and availability of resources in the area: Lipica Fiorito, Repen, and Kopriva.

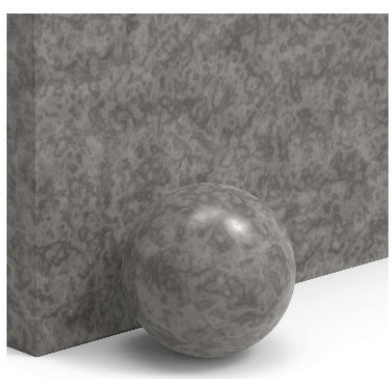
**Figure 10**

*Krast Lime Stone & Krast Terazzo: Samples (Faculty of Design, 2024)*

Natural stone Lipica Fiorito – Alpine Lake Fountain



Natural stone Repen – Creek Fountain



Natural stone Kopriva – Waterfall Fountain

Kras Terrazzo – Public facilities

Lipica Fiorito is a stone from the Karst group, which has been used for a long period of time, including the Roman period. The stone is characterized by its light grey tones with clear pink shades, which are caused by the presence of rudist fossils from the Cretaceous period. Lipica Fiorito can be used for both interior and exterior design due to its long-lasting properties. Repen is one of the densest and strongest grey limestones in the world, as the fossil structure enables the stone to have high resistance to weathering, making it suitable for exterior structures with high loads. Kopriva is a local version of Repen. The stone is characterized by its uniform texture and light grey base with darker fragments of shell fossils uniformly distributed (Marmor Sežana, n.d.).

The choice of materials for each fountain was based on the assessment of block dimensions and the availability of natural resources. The assessment helped to rationalize the design vision in light of practical limitations. The largest sculpture, The Alpine Lake Fountain, was planned to be made of Lipica Fiorito karst stone due to its availability in formats. The medium-sized fountain, The River Fountain, was intended to be made of Repen stone, given its structural integrity. The rarest stone, Kopriva, was used for the smallest fountain, The Waterfall Fountain. The material was intended to give a unique look in a compact form with its characteristic fossil pattern.

**Figure 9**

*Drinking Fountain collection; Krast stone (Faculty of Design, 2024)*

As a sustainable aspect, the design of the project utilizes the reuse of stone remnants that were used for smaller fountains. In the process of recycling, stone remnants from smaller fountains are reused in the design of public restrooms and mixed into concrete aggregate. A new composite material, provisionally named Krast Terazzo, has been created. The process of material processing has transformed potential waste into a new, sustainable building material through an innovative design approach.

**Figure 10**

*Public Facilities; Krast Terazzo (Faculty of Design, 2024)*

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## Canopy of Reading Joy

The conceptual design of the open library is located at the end of the experiential path. It establishes a public space that organically connects with the natural environment and offers the visitor a peaceful retreat from the noise of the urban environment. The space has a dual function: it is intended for users to socialize and for the transfer of knowledge. It is intended for students and passers-by who are looking for an intimate space to study. The location at the edge of the forest at the very end of the path deepens the user‘s contact with nature. The rational spatial organization, placing reading zones on the ground floor level and social interaction areas on the upper floor, and thoughtful ambiance, favors a tranquil atmosphere. The design encourages intellectual concentration and emotional well-being.

**Figure 11**

*Exterior of Open Library; geometric shape of the building (Faculty of Design, 2024)*

The primary goal of the functional design was the building‘s year-round adaptability to weather influences. The building‘s use in winter takes advantage of its introverted nature. By closing the impermeable facade envelope, the functionality of the object focuses on insulation and user comfort. In terms of design, this is expressed through interior design, with the application of wood in the interior, textiles, and warm ambient lighting. In this case, the interior design functions as a microclimate space to protect against the cold. The building is used in the summer with the idea

of natural ventilation, as the building can be opened almost entirely. The approach with microclimate in mind, the design extends the life of the building and emphasizes its multifunctional use in all weather conditions.

The library's spatial plan is based on the floor plan of the number 8, which symbolizes infinity and the transmission of knowledge. The shape of the number eight is simplified in design through geometrization for easier practical application. Although these two forms are geometrically shaped, the conceptualization of the fluid form of the number is concretized by transferring the form into the floor plan design. The selection of geometric shapes also stems from the idea of creating contrast, which is a leading theme in the design of the project.

The architectural expression of the design is a modern interpretation of Plečnik's heritage, directly linking to the National and University Library (NUK). The design of the facade of the library, which can be opened at the corners, takes up Plečnik's motif of the window as an open book. The project symbolically reinterprets this both through its aesthetic design, as it metaphorically unites the function of the building with its content. The spatial elements of the corners of the building, reminiscent of an open book, are used as intimate reading niches that have a directed view into the natural environment. This design approach allows users to retreat to an intimate space dedicated to reading and learning while remaining in direct contact with the natural environment. The contrast between the exterior and interior is created by a different selection of the colors of the same material. The exterior is designed with dark wood, while the interior is designed with light wood.

The design of the building as a simple, geometric shape creates contrast with the natural environment, with the aim of making the building stand out from the environment. The building is designed minimally with both exterior and interior design. It enables the flexibility of space and individual spatial elements, allowing the space to adapt to different usage scenarios. During different uses of space, it emphasises providing a sense of privacy and peace, from individual study to social interaction of the user.

**Figure 12**

*Interior of Open Library; wood interior with Ambiental lighting (Faculty of Design, 2024)*

## Conclusion and Materiality Guidelines

The experience trail to Rožnik Hill, with the application of innovative design approaches, highlights the importance of materiality in the creation of modern urban spaces. The study has confirmed that architectural interventions with the application of sustainable practices and local materiality create a greater emotional connection between the user and the environment. An integrative urban planning concept considers environmental awareness as an emotional aspect of the user. It makes it possible to transform the natural potential of the environment into a new context that increases the cultural identity of the place. Considering the above-introduced urban interventions, the guidelines for materiality in urban spaces highlight the importance of local and renewable resources for the minimization of environmental impacts and the creation of genius loci. The principles of urban design must include the application of materiality, which the user perceives visually through all the layers of sensations, to enrich the user experience in the created urban solutions. Therefore, it is not for aesthetic or visual purposes; it has a cultural and social message that, in the long run, encourages the creation of high-quality urban environments. Design principles should allow adaptability to user needs over time, while also expressing respect for nature and the historical context of the city.

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