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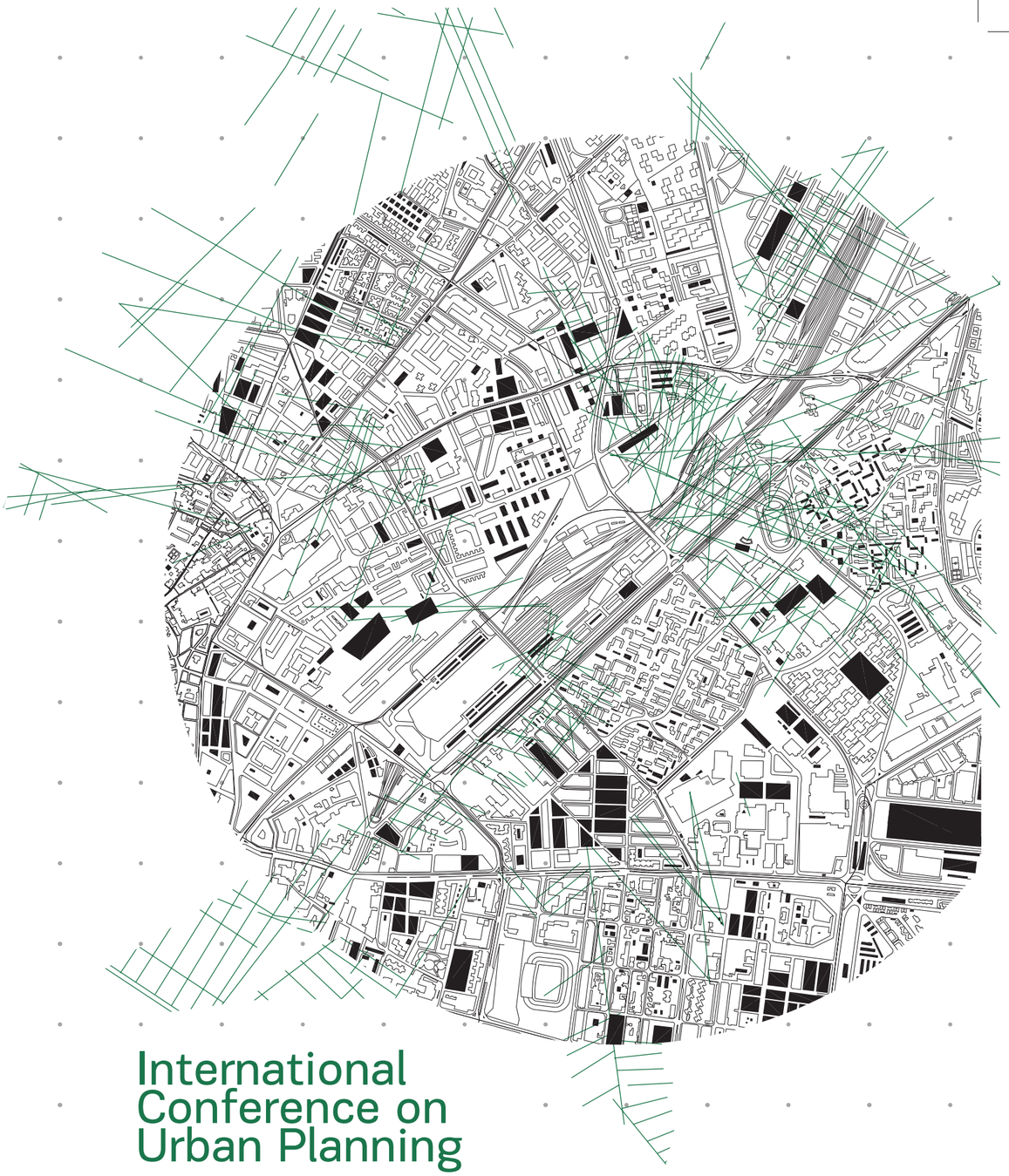

International Conference on Urban Planning

ICUP2025

PROCEEDINGS

Serbia, Niš, April 10-11, 2025

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DESIGN AND FUNCTIONAL CHARACTERISTIC OF PODIUM ROOFTOP GARDENS IN MULTIFAMILY RESIDENTIAL DEVELOPMENTS

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ABSTRACT

The rising cost of land has significant implications for both urban planning and architectural regulation and practice. Occupancy rates and building heights are constantly increasing, particularly in dense urban areas, affecting that contemporary residential developments often lack sufficient communal and green spaces. The development of podium-type buildings could address these challenges by expanding commercial spaces, thereby enhancing the profitability of construction projects, while facilitates the creation of elevated courtyard spaces, above the ground level, in a form of green roofs. Such spaces enhance spatial fluidity of open areas by removing secondary functions, such as pedestrian or bicycle transit, privacy concerns, and security risks, that often hinder ground-level open spaces.

Current urban regulations allow podium-type buildings only in the form of high-rise housing, limiting their application in cities like Niš to a few individual cases. However, Western practices suggest that, when properly designed and organized, this typology could have a much broader impact on residential development.

Keywords: *podium courtyard, podium gardens, common open spaces, multifamily housing, residential development*

1. INTRODUCTION

Progressive urbanization, that characterizes the last few decades of urban development, has led to the rapid expansion of cities and densification of existing urban fabrics. Within urban areas, the residential function represent the dominant type, occupying the largest portion of urban territory — approximately 70% (Dinić Branković & Mitković, 2019). These circumstances have resulted in such contemporary housing models that are increasingly focusing on the residential typologies that enable higher housing densities. This trend is further influenced by the constant increase in urban land prices. Consequently, contemporary housing construction has increasingly adopted typologies and structures that maximize residential densities through higher land-use efficiency (e.g., greater occupancy rates) and increased building heights. One such typology is the podium-type building.

1.1. Podium type buildings

Podium construction, also referred to as pedestal or platform construction, typically involves multiple stories of residential or commercial space positioned atop a single or multi-story podium (base). This base often accommodates commercial amenities, but may also serve as a parking facility. The roof of the podium is frequently designed as a landscaped garden, providing a shared outdoor space for the adjacent residential or commercial structures. These podium gardens function as viable alternatives to traditional ground-level open spaces, contributing to the integration of green infrastructure within dense urban environments.

This architectural approach enhances the economic efficiency of limited urban land by combining substantial commercial spaces with high-quality residential environments enriched with greenery and communal amenities. Depending on the spatial configuration of structures atop the podium, podium rooftop gardens can be categorized into three distinct types: (1) linear, (2) courtyard, and (3) complex podium rooftop gardens (Figure 1).

(a) linear podium rooftop gardens (b) courtyard podium rooftop gardens (C) complex podium rooftop gardens

Figure 1: Classification of podium rooftop gardens

Podium-type construction is typically associated with high-rise developments, featuring one or more towers positioned atop a podium structure (Figure 2). In such cases, podiums generally range from four to six stories in height. The height of the podium may vary, and podium gardens can be incorporated at multiple levels. The podium structure is designed for mixed-use functions, whereas the towers may accommodate either residential or commercial purposes.

Figure 2: High-rise podium-type construction, example of Arborescence Apartments / WY-TO architects + Crespy & Aumont Architectes
Source: https://archello.com/jp/news/alison-brooks-architects-references-classic-berol-eagle-pencil-in-design-of-mixed-use-development

However, throughout North America and Western Europe, this typology is also applied in the form of mid-rise residential developments. In such cases, podium structures typically consist of a one- or two-story base, with upper levels designed as three- to four-story residential buildings. The upper structures may be arranged in various configurations, including parallel blocks, U-shaped blocks, or multiple blocks positioned atop the base. While the podium level serves as a mixed-use space, the upper structures are designated for residential purposes.

Granville1500 Housing (Figure 3) exemplifies a mid-rise, podium-type student housing development in Los Angeles, United States. The podium structure consists of a single-story base, incorporating mixed-use facilities for social and commercial purposes along its outer perimeter, directly engaging with the surrounding streetscape. The inner section of the podium is designated as a parking facility.

The residential complex comprises three wedge-shaped buildings, each featuring distinct floor plans. These structures are interconnected by narrow bridges on the upper floors. The open spaces at the podium level, situated between the residential buildings, form passageways with seating areas and small, landscaped courtyards. Additionally, the largest platform within the development accommodates a communal swimming pool, enhancing the shared amenities available to residents.

a) Street elevation b) Podium garden

c) Ground floor level d) Podium garden level

Figure 3: Mid-rise podium-type construction, example of Granville1500 Housing / Lorcan O'Herlihy Architects
Source: https://www.archdaily.com/1019377/granville1500-housing-lorcan-oherlihy-architects

2. METHODOLOGY

This paper examines the planning and design principles governing the organization of podium open spaces within multi-family housing developments. It explores the potential benefits of podium gardens in enhancing housing quality and identifies design strategies that can encourage the effective use of these open spaces.

The central hypothesis of this research, supported by contemporary urban planning and architectural literature, posits that the implementation of podium-type residential developments—particularly within the dense urban fabric of Niš—can contribute to an overall improvement in housing quality. Accordingly, the primary objectives of this study are: (1) to explore the advantages of podium open spaces, both in terms of increasing green urban areas within residential neighbourhoods and fostering social cohesion by strengthening community bonds, and (2) to establish urban planning and architectural guidelines for the design of podium garden open spaces in multi-family housing developments.

This paper analyses podium-type developments with a particular focus on the spatial organization and design of open spaces at the podium level, by using a literature review as its primary methodological approach. To illustrate the benefits of podium gardens, the study examines a best-practice example selected for its ability to effectively demonstrate the advantages of this residential typology. The findings from this analysis serve to highlight the potential applications of podium-type developments within the urban zones of Niš.

Furthermore, the study includes an analysis of the current urban planning regulations in Niš to assess the feasibility of integrating this residential typology into the existing urban fabric. This evaluation also outlines the

potential for podium-type developments to contribute to the future residential growth of the city and to foster the creation of higher-quality housing environments.

With a population of approximately 260,000 inhabitants (2011 Census), Niš is the third-largest city in Serbia and a representative example of a medium-sized post-socialist city. The post-socialist transition period has had a profound impact on Niš's urban landscape, characterized by increasing urban density and a reduction in public open spaces and green areas.

3. BENEFITS OF PODIUM GARDENS

Common outdoor spaces are a fundamental factor in the sustainability of multi-family housing, offering social, economic, and environmental benefits (Milanović & Vasilevska, 2018). In contemporary residential developments, podium gardens have emerged as highly desirable features, providing a wide array of advantages to residents. Shared and green open spaces enhance the quality of life by offering both functional and aesthetic benefits, which significantly elevate the living experience. There are numerous benefits of having common open spaces on the podium level.

Land efficiency. Elevating common outdoor areas to the podium level enables housing developments to optimize land use. The higher occupancy rates allowed by podium structures facilitate more efficient land utilization. By developing the podium structure across multiple levels, substantial commercial space can be integrated, thereby improving the economic efficiency of new housing projects. Additionally, these non-residential spaces can offer additional amenities without compromising the comfort of residential areas.

Ambient value. Podium gardens serve as distinctive architectural elements, enhancing the visual appeal of residential buildings and adding value to the living environment. These spaces often feature landscaped greenery, water features, and even artistic installations, which contribute to the overall ambiance and aesthetics of the development. Shared outdoor spaces on the rooftop podium level often benefit from improved views and increased natural light. Elevated podiums can offer scenic vistas of the surrounding area and allow more sunlight to reach residential units.

A Safety and Privacy. As podiums are elevated, the podium gardens create a safe and secure environment away from street-level traffic and potential hazards. This elevation enhances safety, especially for families with children. Additionally, podium offers residents more privacy compared to ground-level amenities. Shared amenities, green and recreational areas are shielded from public view, giving residents a private and serene environment and thus influence the enhanced privacy.

Improved shared open space. The podium structure provides additional space for recreational activities, promoting a healthy and active lifestyle. Many podiums feature amenities such as swimming pools, fitness areas, and children's playgrounds, among others, enhancing residents' access to diverse recreational options.

Social value. Podium gardens function as communal spaces where residents can interact and cultivate a sense of community. Shared areas such as gardens, seating zones, and multipurpose spaces encourage social interactions among neighbours. These spaces, intended for use by a single residential group, positively influence the strengthening of social bonds. The frequent presence of familiar individuals and children fosters the development and reinforcement of established social connections.

4. DESIGN PRINCIPLES IN ORGANIZATION OF PODIUM GARDENS

This section summarizes the design features relevant for the development of green and common open spaces on the podium rooftop level. The usage comfort of podium rooftoop gardens within dwellings is examined through two key aspects: 1) physical needs (for leasure and recreational activities, protection against noise, wind, etc.) and 2) socio-psychological needs (protection from view of neighbors, safety, security, the availability of visual control, the availability of various forms of social interaction, etc.). (Milanović & Vasilevska, 2018). Examples of good practice have shown that from the social and utilitarian aspects, only those solutions that bring these two aspects into balance can be considered successful.

Sense of community. Creating a sense of community is a significant element in enhancing the social quality of living environment. The development of a sense of community is greatly influenced by the enhancement of social interactions. Since podium gardens provide a comfortable environment for people to meet their neighbours, they can contribute to fostering positive relationships among users. Research by Lai Man Liu & Youngchul Kim (2017) reveals that the most significant aspect of these spaces, according to their users, is

socialization, and they express a desire for more people to use the podium gardens. An increased number of users makes podium gardens more social and, consequently, enhances the sense of community.

In order to attract more users to the podium garden, some design features must be present on site. The most important ones is given in the continuation of the paper.

Physical features. As the potential for social interactions increases with the rise in physical contact within a space (Unger & Wandersman, 1985; Huang, 2006), the existence of shared spaces within residential areas that initiate and support interactions among residents has a positive impact on the quality of housing. This primarily refers to the creation of spaces that are welcoming to a broad spectrum of users, equipped with seating areas and greenery, as the main features that promote social interactions (Figure 4). The presence of seating furniture has been identified as the most significant element for the development of social activities, as it allows for prolonged stays in the space, thereby increasing the potential for social interactions (Carr et al., 1992; Huang, 2006).

Spaces for children play a significant role in establishing social interactions and forming stronger social bonds (Gleeson & Sipe, 2006). They usage is very intensive, as the need for outdoor activities is most pronounced among the youngest. Additionaly, these spaces not only initiate interaction among children, but also foster contact between the individuals supervising them (Huang, 2006; Farida, 2013; Krellenberg et al., 2014).The way these spaces are used—frequent visits by the same children and, consequently, the same parents—positively influences the further development and strengthening of the established social connections.

The third element significant for the quality of interactive spaces is the presence of greenery. Research has shown that the higher intensity of use of shared spaces has been recorded in areas richer in greenery (Barbosa et al., 2007), thereby increasing the potential for social activities (Sullivan et al., 2004) and fostering stronger social cohesion among residents (De Pooter, 1997; Skjaeveland & Garling, 1997; Huang, 2006).

Figure 4: Design features of podium rooftop gardens

Visibility. The visibility of the podium plays a crucial role in promoting a sense of safety (Lai Man & Youngchul, 2017). A podium garden should be highly visible from the surrounding apartments. This relates to the visual angle and the distance from the surroundings. Better visual connective and visual integration influence that residents can more easily use the podium space. Children's playgrounds, for instance, should be clearly observable from the surrounding residential units, especially those on higher floors. Furthermore, areas with low visibility or covered areas in the podium gardens often experience safety and hygiene issues. Improving public monitoring and avoiding hidden space in podium gardens can enhance safety and security. Visual connections between different functional spaces in podium gardens should also be considered. The height of plantings and fences should be adjusted to avoid view obstructions. Transparent materials can be used for fences to maintain openness and visibility.

To further ensure safety and accessibility, podium gardens should be adequately illuminated to maintain high visibility and facilitate public monitoring. Daylight admission is crucial for the overall environment of the podium garden. Transparent materials can be selected for a canopy to control weather conditions. Furthermore, pedestrian-scale lighting can be installed to illuminate the podium gardens at night, promoting safety during evening hours. The more visible the podium space is, the safer and cleaner it will be.

Accessibility. Properly accessible podium garden can attract more users and enhance social activities and interactions. If the podium garden is more accessible more people will go there and more social activities will take place. In particular, podium gardens should be easily noticeable, with clear guidance to direct people to

the space. Ideally, podium gardens should be located near residential units, offering residents multiple route options for accessing the garden, thereby encouraging interactions and enhancing community engagement. As more people become active in the podium garden, residence have greater chances of developing community interactions. Podium gardens designed in such manner increase the people sense of community.

5. PODIUM TYPE BUILDINGS IN SERBIA, THE CITY OF NIS – IMPLEMENTATION AND POSSIBILITIES

5.1. Common open spaces in residential areas in the context of current urban regulation

One of the most frequently debated issues, concerning new housing developments in Serbia, is the absence of common outdoor spaces, both in peripheral suburban areas and in urban infill projects.

Market-oriented urban policies significantly influence the management of such spaces, often leading to their marginalization and degradation due to their lack of direct profitability. Investor binding regulation impose high occupancy rates while only nominally defining common and green outdoor areas, without mandating their actual implementation. Furthermore, inadequate on-site oversight in enforcing the provisions outlined in project documentation exacerbates this issue, resulting in the majority of new housing developments lacking communal outdoor spaces. Paradoxically, contemporary multifamily housing projects exhibit a marked decline in residential quality compared to earlier socialist-era housing models.

A potential solution to these challenges is the adoption of podium-type construction, a housing model that integrates high occupancy rates with substantial common outdoor areas. This approach could enhance the quality of new residential developments in Serbia, particularly in the city of Niš.

5.2. Podium type buildings in the context of urban regulation

Podium buildings represent a new residential typology in Serbia. This typology is introduced in the local legislation framework a few years ago, as a form of high-rise housing model. In particular, in the urban planning regulation, currently applicable in the city of Niš, the high rise building are defined as followed: “A high-rise building consist of the following parts: 1) The Base (Podium) of the high-rise building (B), 2) The Body of the high-rise building (T) and 3) The Top of the high-rise building (V).

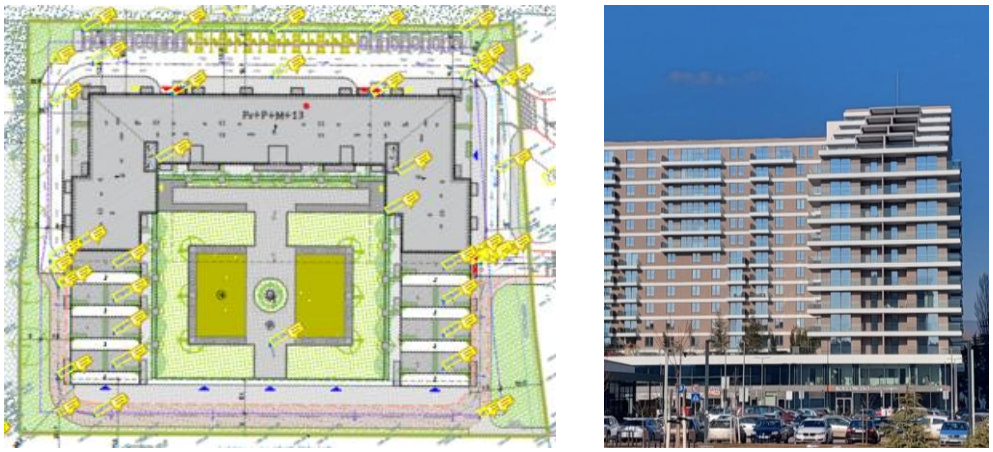
Applicable regulation defines the minimum plot requirements for this typology – the surface area of 5000m², and minimal street frontage of 50m. The Base (Podium) of the high-rise building (B) should consists of a single volume structure, either as single story or multi-story structure, with maximum height of 18m. Space inside the base is intended for commercial activities, or an above-ground garage, and a green roof garden. The Body of the high-rise building (T) comprises the structure above the Base (Podium) of the high-rise building (B), designed for multi-family housing with accompanying technical facilities. The Top of the high-rise building (V) can be specially designed with open and semi-covered spaces, as well as technical and auxiliary spaces. Above this, it is planned to install the necessary antennas and other technical poles and mechanisms. Total height of the building should not exceed 50m.

Regarding the maximum coverage ratio, the horizontal projection of the podium (base) at ground level constitutes 60% of the total plot area, while the high-rise building (tower) occupies 30%. A minimum of 30% of the total plot area must be allocated to shared and green spaces. The calculation of these percentages includes both shared open and green spaces at ground level and the green roof atop the podium. Considering these values, it can be inferred that the rooftop podium surface accounts for up to 30% of the total plot area, while unbuilt land at ground level comprises up to 40%. This suggests that the implementation of podium-type buildings can achieve a significantly higher proportion of overall outdoor space compared to traditional residential blocks, thereby enhancing the quality and functionality of communal areas.

An additional advantage of podium-type structures in the provision of common outdoor spaces within residential blocks lies in their treatment of unbuilt land. In traditional residential blocks, even when a significant percentage of land remains unbuilt, these areas are only partially designated for outdoor leisure activities. Due to direct street access, such spaces are often repurposed for parking lots, access pathways, and other infrastructural elements, which can diminish their aesthetic and functional value. In contrast, podium-type structures elevate outdoor areas, effectively segregating them from vehicular circulation and enabling their exclusive organization as communal gardens and leisure spaces. This suggests that, regardless of surface area, the actual potential for high-quality outdoor spaces is greater in podium-type developments compared to traditional residential blocks.

The Complex Planet Residence is the first and, to date, the only podium-type building constructed in Niš. However, in the time of the research this development remains unoccupied (Figure 5). Designed as a mixed-use complex, it features commercial facilities on the ground level. The podium structure, which is two stories high, accommodates commercial spaces along its eastern and southern sides, while a two-level parking area is located at the rear. Rising above the podium is a U-shaped, 12-story residential tower. The podium's roof serves as an outdoor space, partially allocated as private gardens for the apartments situated at this level, while the central open area is designed as a communal green space featuring leisure amenities and a children's playground.

The total plot area is 12,103 m², with a total building height of 49.95 meters—comprising a 9.36-meter-high, two-story podium base and a 13-story residential tower. The base structure covers 57% of the total plot area, while the horizontal projection of the tower accounts for 30%. In accordance with urban planning regulations, at least 30% of the plot area must be designated as open and green spaces, with a minimum of 10% of that area in direct contact with the ground. The conceptual design of open and green spaces is structured into four spatial units: a) ground-level spaces adjacent to commercial areas, b) perimeter green zones, c) a communal green rooftop garden on the podium level and d) private green rooftop terraces on the podium level, designated for individual residential units.



(a) site plan (b) elevation

Figure 5: Residential complex Planet Residence, Nis, Serbia

The on-site conditions are highly favourable, with 10% of the green space situated along the periphery of the block, featuring high vegetation, and 50% of the green outdoor space integrated into the podium-level green roof. The communal green roof area, designated for public use, comprises 40% of the total plot area, while private gardens associated with individual apartments account for 12%. The podium garden, intended for public use, is conceptually designed as an elevated condominium-style open space on top the podium. It includes shared amenities for all building residents, such as a park, children's play area, and recreational spaces. As the most secluded and tranquil section of the open and green spaces within the development, this area is designated exclusively for pedestrian use. The green rooftop terrace is constructed on a reinforced concrete slab, with designated planting areas designed as roof gardens featuring a substrate depth suitable for growing grass and low shrubs. As the central open space within the semi-atrium configuration of the high-rise structure, the rooftop garden naturally serves as a visual focal point and a key element of the landscape design. Additionally, a designated area on the rooftop terrace has been allocated for a sculpture or spatial installation, although this feature has yet to be installed. The private green rooftop terraces, directly linked to residential apartments, function as active green roofs that require intensive maintenance. Consequently, these spaces have been strategically positioned in areas where residents are directly responsible for their upkeep, ensuring their long-term sustainability and usability.

5. CONCLUSION

In Niš, as well as in Serbia, podium-type construction represents a relatively new approach to residential development, as do podium rooftop gardens as a form of communal outdoor space. Given the scarcity of public outdoor areas within the urban fabric of Niš, the development of residential podium constructions with integrated podium gardens has the potential to enhance the balance between public and private residential spaces, while improving overall residential conditions. Furthermore, podium gardens, as shared outdoor

spaces, can foster social interactions, enhance community cohesion, strengthen social bonds, and promote a sense of community.

To ensure that podium gardens reach their full potential, their spatial organization must meet specific requirements concerning the physical features of the site. Foremost among these are the inclusion of leisure and resting areas equipped with seating furniture, children's play equipment, and green spaces. Well-designed podium gardens not only enhance housing comfort but also contribute to the overall improvement of the neighbourhood, fostering a more socially engaging and liveable environment.

Current local urban planning regulations define podium-type structures exclusively for high-rise residential developments. However, Western urban planning practices demonstrate that this typology can be applied more broadly. By adjusting urban parameters related to minimum plot size and building height, mid-rise podium-type developments could be incorporated into local planning regulations. As this typology represents a novel residential form in the local context, conducting an analysis of residents' satisfaction with such dwellings and their associated communal spaces would provide a valuable foundation for future urban planning decisions regarding the implementation of podium-type structures.

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