

INFLUENCE OF PRIVATE OPEN SPACES ON THE QUALITY OF LIVING IN LOW-RISE HIGH DENSITY HOUSING

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Danijela Milanović, Ljiljana Vasilevska

Faculty of Civil Engineering and Architecture, University of Niš, Serbia

Abstract. *In contemporary theoretical approaches and practice, low-rise high density housing is recognized as appropriate housing model for solving spatial, social, economical and environmental problems in many urban situations. In addition to investigation of basic characteristics of this type of housing, the research focus is on analyzing benefits of implementation of private open spaces, which are recognized as one of main elements of low-rise high density housing. The research relies on the analysis of relevant literature and best practice examples.*

Key words: *low-rise high density housing, private open space, quality of living*

1. INTRODUCTION

A series of socio-economic changes that have occurred in recent decades, caused the whole set of spatial and economic problems, as well as problems related to environmental protection in many cities. The following problems have been identified as the most significant: 1) deterioration of the central city area and 2) an uncontrolled spatial expansion of cities, caused by the growth and spread of suburbia and urban sprawls, often at the expense of quality agricultural land. In contemporary theoretical approaches and practice low-rise high density housing (further in the text LRHDH) is recognized as an appropriate type of housing for solving these problems in many urban situations. In addition to other characteristics of LRHDH, one of the basic features is application of a wide range of open space, with their specific planning and design treatment.

This paper deals with the open space typology with an emphasis on ownership structure, including relationships between public, semi-private and private open space in the organization of this specific type of housing. The focus is the role, significance and design of private open spaces that are located within a building in order to increase the

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Corresponding author: Danijela Milanović

Faculty of Civil Engineering and Architecture, University of Niš, 18000 Niš, Aleksandra Medvedeva 14, Serbia

E-mail: danijela.milanovic@gaf.ni.ac.rs

quality of living. In this regard, a key research question in this paper is: how different types of private open space affect the quality of housing and living?

The comfort of occupants as a result of existing private open space within dwellings and/or buildings is examined through two key aspects: 1) physiological needs (protection against noise, wind, thermal comfort, etc.) and 2) socio-psychological needs (protection from view of neighbors, clean perspective, safety, security, the availability of visual control, the availability of various forms of social interaction, etc.). 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.

In addition to considering the definition and importance of LRHDH, this paper relies on a typology of open spaces in the context of their content, role and ownership, and analyzes aspects and principles of their organization with the focus on private open spaces.

2. DEFINITION AND IMPORTANCE OF LOW-RISE HIGH DENSITY HOUSING

LRHDH has emerged as an alternative model for solving housing problems in the 70s of the last century, mostly emerged as a consequence of application of two hitherto dominant, mutually opposed models: 1) individual housing - sprawls and the suburbs, and 2) residential towers, as the primary model of social housing.

According to Sauer (1970), LRHDH means areas with the following characteristics: 1) density of 350-550 inh/ ha; 2) maximum number of floors of residential buildings up to three stories; 3) compact physical structure and urban composition; 4) a high degree of individuality and privacy of residential units, which is achieved by clear identification of space and implementation of appropriate urban planning and architectural elements and forms at the ground level, input and access party; 5) elimination of space without clearly defined territorial specificity, especially through the privatization of space that is in direct interdependence with residential units on the ground floor of buildings; and 6) application of a wide range of open spaces. The most important projects that determined the emergence and genesis of LRHDH as a new, alternative model of housing in the second half of the twentieth century are: Halen, 1961, Bern, Switzerland; Penn Landing Square 1969, Philadelphia, United States; and Marcus Garvey Village housing complex 1973, Brooklyn, United States.

The original definition has retained its basic determinants to date, with a correction of a few of them, especially those related to the housing type and number of floors. So, today both in theoretical approaches and in practice, this type of housing often imply buildings with up to five floors. Based on numerous case studies in Europe as well as the four key factors in the successful planning of LRHDH, we could single out the following: 1) the location and the "spirit" of the site; 2) successful urban planning policy; 3) effective management policy, and 4) quality urban planning, urban and architectural design [1]. Application of LRHDH has brought a large number of advantages, such as: increased value of land and real estate, mixed use of the space (application mix-use concept - housing, shops, services), attractive and energy efficient buildings, safer streets and attractive outdoor spaces, as well as the ability to create a sense of belonging and identity. On the other hand, there are many limitations to the application of this type of housing,

such as: mistrust and conflict of interests, institutional inertia, lack of capacity and the inability to respond adequately to the challenges of designing. There are many comprehensible differences between countries in the recommendations for the implementation of this kind of housing, caused and shaped by different institutional, systemic and planning framework. However, several common recommendations, criteria and principles can be recognized and identified. In addition to the criteria such as long-term economic and social sustainability, different forms of public-private partnerships in the implementation and management of these areas, or the use of mix-use concept, some of the most important criteria in the treatment of open spaces are: 1) generous standards in open space designing; 2) providing of private gardens for the apartments on the ground floor and 3) the application of the spacious terraces and balconies when there is no possibility of designing private gardens.

3. TYPES OF OPEN SPACE IN LOW-RISE HIGH DENSITY HOUSING

Open space is one of the basic factors of sustainability of LRHDH from the social as well as economic and environmental development point of view. There are three disciplinary approaches to the open space: 1) for designers it is a factor of public health both in terms of recreation and respiration; 2) for political scientists public space is an immaterial space of debate; it is thus a model for political discussion or at least a space of conviviality; 3) for sociologists public space is a place accessible to anybody and reflects a notion of basic equality, social freedom of circulation and anonymity [1]. The literature suggests that three interrelated elements constitute a definition of open space: physical properties [2]; the activities onsite, such as recreation [3]; and user perception [4]. The importance and role of open space can be also seen through: 1) the appropriate urban composition and architectural expression, appropriate characteristics of the physical structure; 2) the characteristic scheme of spatial organization; 3) the typology of open space in relation to its purpose; 4) typology of open space in relation to the ownership structure – its share and characteristics caused by relations between public, semi-private and private open spaces.

3.1. Typology of open space

Typology of open space in LRHDH can be seen through its purpose and with respect to its ownership structure (Table 1). The focus of research in this paper is the typology of open space in relation to the ownership structure, particularly the observation and analysis of private outdoor space within homes and/or buildings, as one of recognized and significant types of open space from an ownership's point of view.

LRHDH leave a special mark on the city landscape, while open spaces contribute significantly to the sense of belonging and identity of the area. According to the ownership structure, open spaces can be identified as: 1) public; 2) semi-private and 3) private (Fig. 1). Public open spaces (Table 1) are: river fronts, large lawns directly connected to the housing area, pedestrian paths, access roads with restricted motor traffic as well as the borders of open space, tree-lined and adequate movables, playgrounds. The semi-open space may include: atriums, courtyards, playgrounds. The private open spaces are: private courtyards on the ground floor flats, terraces and balconies and roof terraces -

all of them are architectural and functional elements within the buildings themselves or in their immediate surroundings. The last type is especially in the focus of this research.

Table 1 Typology of open space

Typology of open space in low-rise high density residential areas	
Ownership structure	Purpose
Public	Public parks Park; Park within the neighborhood unit; The inner courtyard
	Streets Pedestrian paths Streets without motorized traffic or with reduced traffic
	Green areas and linear parks
	Shoreline
	Common open spaces Residential buildings courtyards; Playgrounds; Inner courtyards
Semi-private	Atrium/patio Inner courtyards
Private	Private garden for the apartments on the ground floor; Balconies and terraces; Roof terraces/gardens

Source: [1]

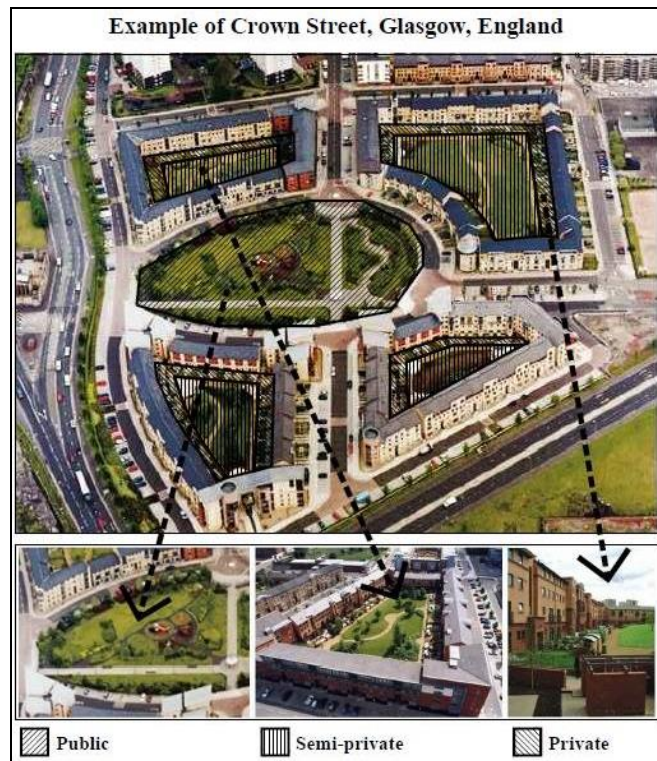


Fig. 1 Types of open space to the ownership structure

3.2. Aspects and components of quality of open space

The quality of open space in LRHDH can be seen from the following aspects: 1) design and comfort; 2) differences in its usage and morphologic characteristics; 3) safety and 4) the ability to achieve various forms of social interaction [1]. Each of these aspects has its own characteristics that are shown in Table 2, and the focus of this research is on the role, importance and the architect's approach to private open space within the building in order to increase the quality of comfort. Open space should provide safety of all users, and in this regard they should be secured with active and passive surveillance for a better security. A well planned and designed physical structure is one of the most important measures in terms of safety, affiliation and caring for open spaces (cleaning, maintenance and repair), which are key factors for residents and users of the space.

In order to achieve a better urban and architectural design of open space in LRHDH, high level of safety and a sense of identification, some of the key principles are: 1) the correspondence of the site in the wider spatial context, 2) various purposes and contents of open space and clear hierarchical relation, 3) different ownership, 4) generosity in the size and layout of open space, whether they are private, semi-private or public space, 5) accessibility of open areas, 6) social integration and equality, 7) the quality of the natural environment and 8) ecologically sustainable design and construction.

Table 2 The aspects and components of open space in LRHDH

Aspect	Components
Design and comfort	The content and size of space Microclimate Physical characteristics Accessibility
Diversity and abilities	Frame/ the scope of potential purposes Attractiveness and accessibility for different user groups
Safety	Visual surveillance Physical characteristics Maintenance of public open spaces Accessibility
Social interaction	Purpose Accessibility Design and comfort

Source: [1]

4. PRIVATE OPEN SPACE IN FUNCTION OF INCREASING QUALITY OF LIVING

The positive relationship between people and their environment is one of the priorities in terms of sustainability. Residential buildings are considered viable if they are designed in accordance with local cultural heritage, life, climatic characteristics of the location and environment is [5]. If this preference applies to the concept of LRHDH, it can provide a real answer and the solution for the many socio-economic and demographic changes, especially non-population pressure certain cities are exposed to.

Designing buildings for multifamily housing is a particular challenge for urban planners and architects in terms of achieving a comfort in multi-storey buildings that should be as close to living conditions in family homes and, therefore, should be as close as possible to the principles for designing individual houses [6]. Both experts and residents agree that the high quality of private open space is very important [6]. Many people, who often change their place of residence, suggest that they almost never accept the flats without open space, which clearly indicates that the private open space - "domestic garden" is an important aspect of the quality of the apartment and residential environment [7]. Private outdoor space can initiate users' identification with their living environment. By providing a greater degree of flexibility in relation to the interior of the apartment and the possibility for conducting day to day activities, private open space contribute to the perception of extra space within the apartment. With maximum architectural variation, one of the main criteria for the organization of LRHDH is the implementation of different types of private open space within the housing. Their diversity is reflected both in function and design. As for the design and organization of private space, the application of the principle of hierarchy and flow of space is clearly recognizable - to establish a connection with other open areas. This principle can be recognized even in the pioneering LRHDH projects and it remained in contemporary architectural approaches and examples of good practice (Fig. 2A-D). As the dominant forms of private open space, in order to increase the comfort of living, the following occur: 1) *private garden for the apartments on the ground floor*, 2) *terraces and balconies* and 3) *roof terraces*.



A) Private open space with different purposes and design - balconies and private garden for the apartments on the ground floor; B) Protruding balconies as an element of social sustainability in architectural design; C) The roof terrace as an element of open space for the apartments on the top floor; D) The roof terrace as a private space of all tenants of multi-family buildings

Fig. 2 Different types of private open space –
Examples from Vienna neighborhoods, Austria

Private garden for the apartments on the ground floor as the type of open space is nearly always present in LRHDH. This type represents a buffer zone for the ground floor apartments, providing a higher degree of privacy, with a clear boundary between private and a semi-private open space (Fig.2A). According to their function and style, they are closest to the gardens of individual houses. They are in most cases directly connected to the apartment through the living room, which can often be designed as the entrance area to the apartment, which increases the quality of living. Residents get perception of the yard as an extension of living space to perform many daily activities. In our conditions it is often considered that the apartments on the ground floor have a lower quality compared to the apartments on the higher floors [8], but on the basis of researches and interviews with tenants, it can be concluded that the application of individual yards improves quality of apartments on the ground floor and even leads to a higher level in comparison to the apartments on the upper floors. By applying the concept of this kind of private open space, ground floor flats could become interesting to families with children (room for outdoor play, which is visually connected with the interior space to allow parents to control children) and elderly (direct connection and access to the outside).

Terraces and balconies are one of the most implemented private open spaces in LRHDH. This space provides a sense of individuality and association with open space and the environment which affects the overall perception of the comfort of the apartment. Balconies and terraces are valued as a space for outdoor living as well as a buffer zone between residential interior and external influences, primarily noise, wind, overheating, dust. Therefore it is very important to understand and pay attention to that when designing the protection from these impacts. Residents often use this space for hobbies, everyday activities, reading or just resting. In the LRHDH, this element gains importance because it is often associated with the external identification of users with their apartments as well as a space for interaction with neighbors and the environment. Surface area of terraces and balconies is getting bigger with a view to increasing flexibility through the use of alternative flat space that allows users to make contact with the environment without leaving the residence. Application of generous standards in dimensioning terraces and balconies offers unique design features, which become a part of the distinctive architectural expression and design of buildings (Fig. 2A,B). This treatment of terraces and balconies reduces the number of tenants' remarks such as too small a space, too warm and insufficient privacy and the like.

The roof terrace, as an architectural and structural element in the LRHDH has got different design variations. It is recognized in two ways: 1) as an element of open space for the apartments on the top floor and 2) as a private space of all tenants of multi-family buildings. Solving functional problems of the top floor apartments in the form of duplexes or apartments with setback façade level, private outdoor space, as an element of open space for the apartments on the top floor, is obtained in the form of roof terraces for various purposes, which contributes to improving the quality and comfort of apartments, which are often seen as inferior. However, with this treatment of flat roofs, flats are becoming more luxurious compared to other (Fig. 2C).

As a private functional space for all tenants of the building, a flat roof is designed for various activities such as rest, recreation, socializing, playing with children, growing plants - urban farming, which is gaining importance in recent decades. In this way, their quality is improved from the standpoint of functionality, sustainability, and social

integration of tenants. A flat roof as an element in a LRHDH gave a whole new dimension to the concept of a flat roof as an element that contributes to the creation of heat islands in apartment blocks because it is very often performed as a green roof, thus reducing many negative climatic conditions. Once considered as an unusable open space, a roof terrace as a type of private open space, got its usefulness and qualitative value (Fig. 2D).

4.1. Overview of regulations for design of private open space

Minimal surfaces, minimal dimensions, architectural treatment in terms of private open space in developed countries are defined by regulations and other state and local legal recommendations. In addition to the minimum area, minimum dimensions of open space, the front door, and then the same for people with disabilities, are also determined. For example, the Australian standards and guidelines for the design of residential houses, development of modern housing models including LRHDH, should contribute to the creation of a private open space that is accessible, attractive, safe and comfortable for its users [9].

Table 3 Areas of private open space in residential buildings

Apartments structure /number of rooms/	S	1	1.5	2	2.5	3	3.5	4	4.5	5
Serbian standards for minimal surfaces for balcony/terrace (m ²)	-	1.0	1.3	2.0	2.0	3.0	3.0	3.0	3.0	3.0
English national standards for social housing (m ²)	-	-	-	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Republic of Ireland (m ²)	-	-	-	5.0 (1.5m)	-	7.0 (1.8m)	-	9.0 (2.0m)	-	-
Recommendation (m²)	2.0	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0

Source: [8]

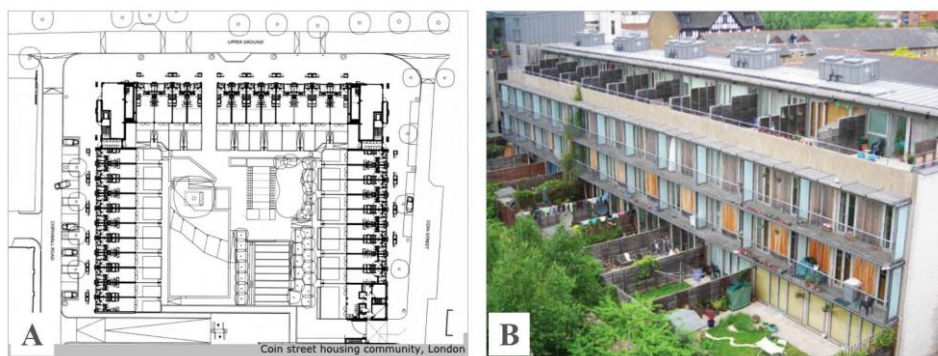
However, in our *Act for the design of residential buildings and dwellings* from 2012, private open spaces in dwellings are defined only through their minimum surface that is in relation to the standards in developed countries much smaller and it does not recognize the element of private garden for the apartments on the ground floor [10]. Thus, the Act provides the minimum area of 1m² to 3m² of terraces, balconies and loggias, depending on the structure of the apartment (Table 3). On the other hand (Table 3), it is evident that in England the recommended surface of private open space is two times bigger in the largest apartment (two and three bedroom apartments-Serbian nomenclature) and it ranges from 4m² to 6m². The situation is similar in comparison of our rules and regulations to those of the Republic of Ireland, where the minimum size of private open space ranges from 5m² to 9m², where their minimum depth is also defined. It is often the case that acts and recommendations for the design of residential buildings at the city level are much stricter than the state regulations.

6. EXAMPLES OF GOOD PRACTICE

In order to recognize importance of LRHDH, as well as private open space within them, the paper analyzes best practice examples from London, England, which is facing a dramatic housing crisis [11].

6.1. Iroko housing complex, Coin Street Community Builders, London

The project is a winning Competition design by the consulting company Haworth Tompkins Architects for low-rise apartment block, primarily intended for social housing. High density of population, particularly children, can cause huge social problems. The concept of Iroko complex is simple and clean solution for three housing tracts around a semi-open space, with a total of 59 housing units of different structures (Fig. 3A). The architectural treatment is in accordance with the environment, the facade fronts facing the street are lined with brick in contrast to the facade facing the inner courtyard where the final wainscoting is of wood. Buildings are designed as galleries with housing units for at least two levels. The designers have fully recognized the potential of the location when they set three residential tracts that converge with their functional solution towards central semi-private open space: sports field, children playground, greenery. In this way, all apartments on the ground floor have private outdoor space/gardens, as well as all apartments from the upper floors have terraces and/or balconies overlooking the inner courtyard, which is very important from the aspect of social interaction between neighbors (Fig. 3B). The tenants have recognized good concept of LRHDH, because they often emphasize in their statements that it is unbelievable how many inhabitants live in the place and at the same there is no sense of overcrowding [12], which is result of existence of large surfaces of private open space and semi-open spaces, especially those for playground. This is the proof that in the process of urban and architectural design, urban planners and architects have to be careful when determining the purpose of public and semi-private open space in a way that does not jeopardize the tenants safety and privacy.



A) Functional organization of the ground floor; B) The representation of all types of private open spaces

Fig. 3 Iroko buildings - Coin Street Community Builders, London, England

6.2. Adelaide Wharf, West London

Adelaide Wharf is one of the most important steps in resolving a dramatic housing crisis in London and traditionally isolated areas of the city. Architects A. Hall and M. Morris used modern architectural designing model to create low-rise high density apartment block with 147 dwellings, structures of one-to four-room apartments, which contributed to the urban and architectural quality of the area. The apartments are intended for the private sector but also for social housing, which is in the designing approach treated equally. The bordering of the lot by channels, streets and a park, determined the design of the building to be three residential tracts in the shape of the letter U, facing the interior patio with emphasized entranceways and the vistas on the ground floor level (Fig. 4A). The inner courtyard as a type of semi-private outdoor space is intended to be used by all tenants. The use of geometric lines, lines of movement through the courtyard, created a series of smaller spaces for different purposes: for leisure and/or playground. Ground floor apartments are the biggest and through private courtyards are connected to the internal open space. Accentuated by greenery, the private yards of the ground floor flats are physically and visually separated and isolated from the view and noise from the inner courtyard. Each apartment on the upper floors has a balcony which is a distinctive architectural element and achieves the identification of tenants with their housing (Fig. 4B). Balconies of smaller apartments are big enough to meet the requirements of private open space for different purposes. Vertical and horizontal dislocation of balconies of one tract represents protection from excessive sunshine and thus from overheating of the interior, while for the other tract it is decreasing shadowing of space. Adelaide Wharf is a high-quality and sustainable solution to LRHDH. The organization itself, the location and the space is an innovative prototype for future housing solutions.



A) Functional organization of the ground floor; B) Emphasized hanging balconies and orientation towards the inner courtyard

Fig. 4 Adelaide Wharf, West London, England

6.3. Beaufort court, Lillie Road, London

Beaufort Court is another example in a series of LRHDH cases in London with 65 apartments intended for market and social housing. Architectural work of Feilden Clegg Bradley Studios is an innovative and energy efficient with generous functional organization. Organization of the housing block is in three tracts with a public open space for sports activities (Fig. 5A). The units have different structures from single to multiple rooms. The sustainability of the building from the point of social interaction of tenants is achieved by the application of all three types of private open space (Fig. 5B). The generous dimensions of these areas significantly influenced the increased comfort of the housing units. For residential tract of higher floors, private courtyard apartments on the ground floor are facing the central recreation ground and increased privacy of these areas is achieved by denivelation of the ground. Private gardens for the apartments on the ground floor in one wing are organized on the back of the building and are not mutually partitioned which affects the very usability of space. All units have spacious balconies facing the inner courtyard (Fig. 5B). By setting back the flats on the top floor of the heights tract, spacious private roof terrace are obtained. The existence of a green roof contributed to the increase in thermal comfort.



A) Functional organization of the ground floor; **B)** The representation of all types of private open space; private courtyard on the ground floor flats positioned towards the sports field

Fig. 5 Beaufort Court, Lillie Road, England

7. CONCLUSIONS

LRHDH represents an alternative housing model both to sprawls (low density housing areas) and high-rise buildings and public housing (high density areas). However, analysis and practice show that density itself does not appear to be an issue - there is no such thing as an optimum density, and density alone is not the key to successful housing. Many other factors contribute to this, such as good urban and architectural design, and quality of housing management. Cultural and social factors also contribute to whether high-rise living is a success or a failure.

Well-designed private outdoor space in LRHDH should seek to achieve comfort and greater degree of user privacy by controlling the intensity of their interactions with neighbors, in addition to fulfilling their personal social and cultural preferences and activities [13]. The feeling of comfort for the tenants can be viewed through the following aspects: 1) physiological needs (protection against noise, wind, thermal comfort, etc.) and 2) socio-psychological needs (protection from view neighbors, clean vistas etc.), which must be in balance. To achieve the greatest possible comfort it is primarily important to have a sufficient number of private open spaces, noise and wind protection, as well as protection from view of neighbors, but with vistas to the environment.

In the physical sense, a private open space is an extension of the living space to the outside environment and provides an access to the outside with a certain degree of privacy and territorial control. Usually, they are directly and immediately connected with the housing units, mostly through the living room. Use of this type of open space must be viewed through the structure of the family itself, i.e., users and their needs, which points to a variety of private open space purposes: psycho-physical relaxation, drying laundry, plant growing, playing with children, working space, etc. Therefore, the challenge in designing LRHDH is even greater if we acknowledge the fact that the urban planners and architects do not know the future users of flats, which is a variable category (changing the owner of the apartment, an increase of family members, flats, etc.). It may be noted that the Serbian regulations do not recognize multifunctionality of private open space regarding users and contents. That raises the question of the usability of such a type of open space, as well as its treatment in terms of increasing comfort and quality of living. An outdoor space should be facing the nature, internal, semi-public and public space, with as small as possible vistas onto the roads and transport, in order to reduce the feeling of overcrowding and create an impression of privacy.

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SOURCES OF ALL ILLUSTRATIONS

Fig. 1 Authors based on following sources:

<http://www.czwg.com/works/crown-street-regeneration-project>

http://www.pinsdaddy.com/gorbals-leisure-centre_xqBRME0HpB6eYlr2l4TZQdn3xvr7tlEVY17TxZeEJ8s/

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Fig. 2 Authors

Fig. 3A [https://image.slidesharecdn.com/aurkezpena-100309151659 phpapp02/95/aurkezpena-6-728.jpg?cb=1268148154](https://image.slidesharecdn.com/aurkezpena-100309151659-phpapp02/95/aurkezpena-6-728.jpg?cb=1268148154)

Fig. 3B <https://i.pinimg.com/564x/7c/ba/bd/7cbabd0aeaaa51bb2ff02b5d00704c3a.jpg>

Fig. 4A

<https://www.ahmm.co.uk/resources/res.aspx?p=/FCF175F18A83EC9F832D303E3393C083C234259939195E302B7EB87E2AEDA43A/ground-plan.gif>

Fig. 4B http://www.akt-uk.com/medias/images/diaporamas/76/adelaide-wharf-03_1180x580.jpg

Fig. 5A https://fcbstudios.com/assets/imgsupl/Feilden_Clegg_Bradley_Studios-Beaufort-Court-London-02-Site-Plan.jpg

Fig. 5B https://fcbstudios.com/assets/imgsupl/feilden_clegg_bradley_studios-beaufort_court-london6.jpg

UTICAJ PRIVATNIH OTVORENIH PROSTORA NA KVALITET ŽIVOTA U STANOVANJU NISKE SPRATNOSTI-VELIKE GUSTINE

U savremenim teorijskim pristupima i praksi, stanovanje niske spratnosti-velike gustine prepoznato je kao odgovarajući model stanovanja za rešavanje prostornih, socijalnih, ekonomskih i ekoloških problema u mnogim urbanim situacijama. Osim sagledavanja osnovnih karakteristika ovog tipa stanovanja, fokus istraživanja je na analizi značaja i prednosti implementacije privatnih otvorenih prostora, koji su prepoznati kao jedan od glavnih elemenata stanovanja niske spratnosti-velike gustine. Istraživanje se oslanja na analizu relevantne literature i primera dobre prakse.

Ključne reči: *stanovanje niske spratnosti-velike gustine, privatni otvoreni prostori, kvalitet života*