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Research paper

THE ROLE OF URBAN PLANNING IN THE PRACTICE OF ADDING LATERAL AND VERTICAL EXTENSIONS TO EXISTING RESIDENTIAL BUILDINGS

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Abstract

In the city of Skopje there are many existing residential buildings which have been subjected to lateral and vertical extensions. This research paper questions the role of urban planning in the practice of adding surface area and additional floors to existing residential buildings, while considering the concept of sustainable urban development.

The lateral and vertical extensions applied to existing residential buildings were analyzed through a case study, an urban block in Municipality of Karposh in Skopje. The urban block and its buildings were compared in different periods to define the amount of changes in terms of enlargements applied compared to the initial state of the buildings. To conduct the study, the geodetic survey map, Detailed Urban Plan, an on-site survey study by IZIIS, Google Maps and the cadaster GIS database served as information sources.

In the case of existing buildings, the Detailed Urban Plans do not clearly specify if the changes to urban parameters, such as surface area, number of floors, building percentage and coefficient of use, mean replacing the existing buildings with new ones or applying lateral and vertical extensions to the existing buildings. Viewed from the aspect of sustainable development, the practice of extensions over the long-term has negative impacts, such as reduced amount of natural light indoors due to enlargements, interference with the initial architectural value of the building (aesthetics), insufficient number of car parking spaces and increased seismic risk.

The main aim of this study is to increase awareness about the importance of applying the concept of sustainability in urban planning when dealing with the existing urban areas. The urban planners, decision-making authorities responsible for regulating the physical spaces and the citizens should be informed about sustainable urban development to achieve higher quality living environments.

Key words: *Extensions to Existing Buildings, Urban Planning, Sustainable Urban Development*

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1. INTRODUCTION

Urban planning of the existing urban areas is challenging to meet the requirements of the newer times. A significant problem is the need for more living space in the existing residential buildings. As a practical solution, on individual initiatives of the occupants, they decide to increase their living space by enclosing the balconies and converting them into rooms and in some cases adding horizontal extensions to the longitudinal facades of the buildings. The extensions are made also by adding floors to the flat roofs of the existing buildings [1;2].

Initially, the practice of adding extensions to the existing buildings was considered as against the regulations of the building law in Republic of North Macedonia. However, by mid-2000s the extensions to existing buildings became subjected to regular procedure of obtaining building permit. Also, the citizens were provided with the option to legalize the extensions built prior to the adoption of the new regulations [1]. According to the building law, the lateral and vertical extensions to the existing building should be made in line with the urbanistic parameters overseen within the urban plan [3].

Examples of lateral and vertical extensions to the existing buildings can be seen in almost every municipality within the City of Skopje. This research paper is based on the doctoral dissertation of the author [4] and it studies the role of urban planning in the practice of adding extensions, lateral and vertical, to the existing residential buildings through a case study urban block in municipality of Karposh. The case study urban block is analyzed at three different states, the initial state, the actual state and planned state. The initial and actual states of the urban block are based on a study report provided by Institute of Earthquake Engineering and Engineering Seismology (IZIIS) [2], while the planned state is based on the Detailed Urban Plan (DUP) prepared for region Z 08 in municipality of Karposh [5]. The urban planning system of North Macedonia consists of urban plans at different levels depending on the size of the area which is subjected to planning. The Detailed Urban Plans (DUPs) are prepared at municipality level for neighborhoods or districts [4, 6].

2. THE CASE STUDY URBAN BLOCK

The case study is mainly a residential urban block, and it is located in the municipality of Karposh in Skopje [4]. The area of the case study urban block is defined with the streets Nikola Tesla, Orce Nikolov, Ivan Agovski and Ruger Boshkovic. There are in total eight residential buildings distributed in the form of open urban block (Figure 1). The space between the buildings serves as green park areas and car parking lots. In the 1990s the trend of increasing the living space of the existing buildings started [1, 2, 4]. Six out of eight buildings in the case study were subjected to modifications such as lateral and vertical extensions. The building with identity number 1_1 remained as it was initially planned without application of any changes. Based on the geodetic layout of the DUP [5], at the initial state of the urban block building 1_6 was the same as building 1_5, however, a new building was built in 2007 and there are no changes applied to building 1_6 in the meanwhile. Also, in the DUP [5] the buildings 1_1 and 1_6 do not have any changes. Only the buildings that were subjected to changes in terms of lateral and vertical extensions were analyzed.

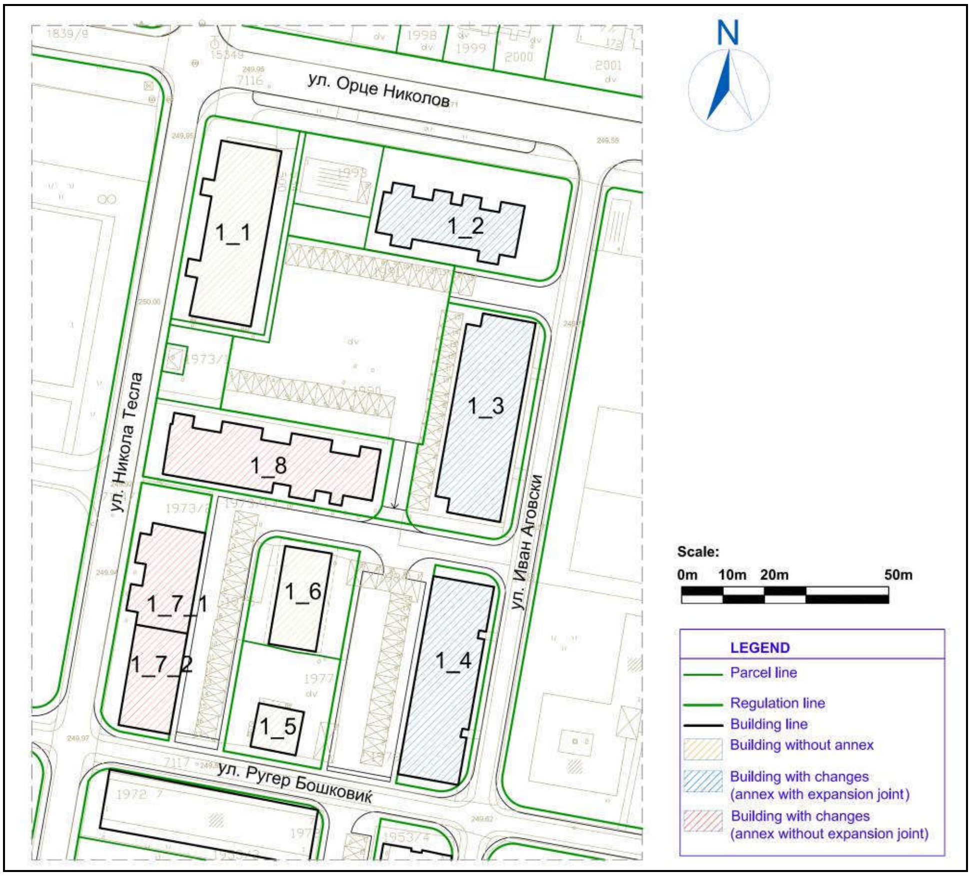

Figure 1. Case study urban block. Source: graphical presentation in AutoCAD [4] based on geodetic data of DUP [5]

3. METHODOLOGY

The selected case study is a small-scale representative example of the practice of adding lateral and vertical extensions to the existing buildings to increase the dwelling area [4]. To understand the role of urban planning in this practice of applying changes to existing buildings the case study was analyzed according to three states of the buildings:

- Initial state which represents the original state of the buildings
- Actual state, buildings are presented in their current state with extensions applied
- Planned state, representing the buildings according to DUP

Two main sources of input information were used for constructing the layouts of the buildings in different states, an on-site survey study conducted by IZIIS in 2013 [2] and the Detailed Urban Plan (DUP) [5]. The DUP was prepared in 2015 for zone Z08 [5] where the case study urban block is located. However, this plan later in 2015 was abolished by the municipality of Karposh [7]. The study conducted by IZIIS [2] was a rapid visual screening method for evaluating the seismic stability of the buildings. In the report of this study for each of the buildings there is information about the year of construction, number of floors, approximate total-built area, changes applied to the original building and information about the structural system and its material [2]. As additional resources were used the Google Maps

[8], the cadaster GIS database [9] as well as field visits were made to have more thorough information about the buildings.

First, the case study buildings were analyzed at their different states from the aspect of urban planning parameters, such as height, ground floor area and total built area.

Second, the structural system and material of each building was categorized into a taxonomy definition. The difference in the structural system and material between the existing buildings and their extensions was analyzed.

3.1. Analysis of the Urban Parameters at Different States of the Buildings

The buildings in the case study urban block to which extensions were applied were analyzed at three different time periods from aspect of the following urban planning parameters:

- Height
- Ground floor area (m²)
- Total built area (m²)

The buildings with their identity numbers and urban planning parameters at the three different states, initial, actual and planned, are presented in Table 1.

Table 1. Comparison of urban planning parameters at different states of the buildings.

ID	State / Urban parameter	Initial state	Actual state	Planned state (DUP)
1-2	Height	5 (G + 4)	7 (G + 4 + 2 RF)	6 (G + 4 + 1 RF)
	Ground floor area (m²)	408	408	510
	Total built area (m²)	2040	2830	3060
1-3	Height	5 (G + 4)	7 (G + 4 + 2 RF)	6 (G + 4 + 1 RF)
	Ground floor area (m²)	626	770	850
	Total built area (m²)	3130	5390	5100
1-4	Height	5 (G + 4)	8 (G + 6 + 1 RF)	8 (G + 6 + 1 RF)
	Ground floor area (m²)	620	724	724
	Total built area (m²)	3100	5792	5792
1-5	Height	2 (G + 1)	2 (G + 1)	6 (G + 4 + 1 RF)
	Ground floor area (m²)	117	117	296
	Total built area (m²)	234	234	1776
1-7	Height	5 (G + 4)	6 (G + 4 + 1 RF)	6 (G + 4 + 1 RF)
	Ground floor area (m²)	658	745	745
	Total built area (m²)	3290	4470	4470
1-8	Height	5 (G + 4)	6 (G + 4 + 1 RF)	6 (G + 4 + 1 RF)
	Ground floor area (m²)	495	750	750
	Total built area (m²)	2475	4500	4500

In the table the letter “G” stands for ground floor and letters “RF" stand for roof floor. The initial state represents the buildings how they were originally planned and constructed. The geodetic information within the DUP [5] served for understanding what the original version of the buildings in terms of length and width was. The height of the buildings at initial state was obtained from the IZIIS report [2].

The actual state is based mainly on the IZIIS report [2], while Google Maps [8] and cadaster GIS database [9] information was used as additional resources. The square meter areas of the buildings, both at initial and actual states, were defined according to the geodetic information of the DUP [5]. Although there is a gap of 12 years between the time of conducting the study by IZIIS [2] and today, the buildings have not been changed in the meantime.

The planned state of the buildings is solely based on the information present in the DUP [5]. The DUP was prepared in 2015 [5], however it was abolished the same year by the Municipality of Karposh [7].

Analyzed from the aspect of height of the buildings, initially most of the buildings were designed and built as five floors high buildings consisting of a ground floor and four floors. All the buildings presented in Table 1 were added on one or two roof floors in the period following after 1981. Building with id 1_4 was added two regular floors plus a roof floor. The ground floor area at most of the buildings was increased because of the lateral extensions. As consequence of the changes applied, enlarged dimensions of the buildings and increased heights, the total built area was increased. The DUP includes almost all the changes applied to the urban parameters and allows greater increase of the ground floor and total built area. Exception are the buildings 1_2 and 1_3 where the height given by DUP is smaller than the actual state of the buildings.

Figure 2 presents these changes to urban planning parameters at the different states of the buildings with figure-ground relationship as well as sections through the urban block. The buildings grow in width and height. This causes the open spaces to be reduced and the distances between the buildings become smaller.

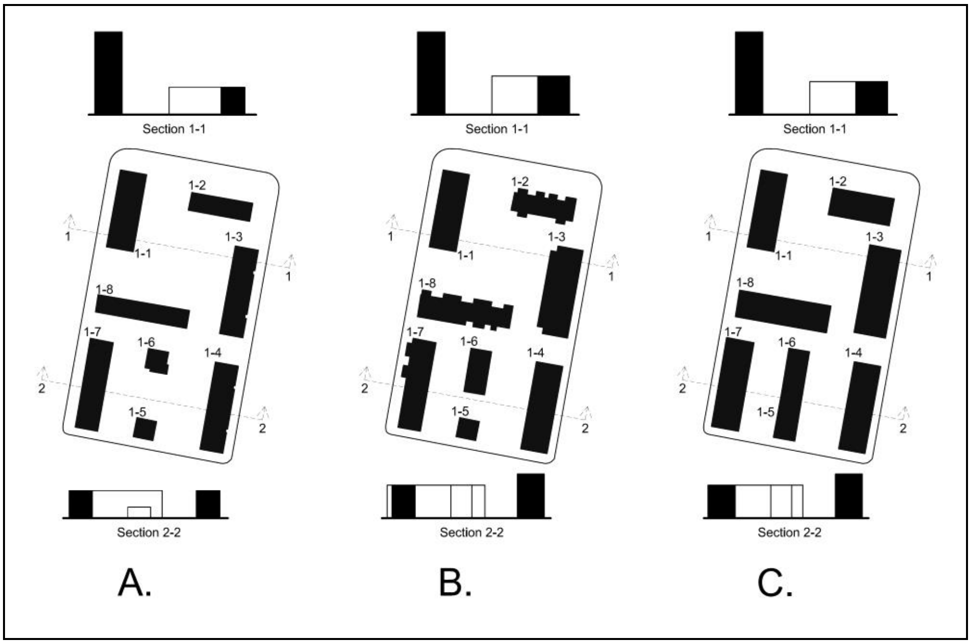

Figure 2. Figure-ground relationship of the case study at different states (A: initial state, B: actual state, C: planned state). Source: graphical presentation in AutoCAD based on geodetic data and urban parameters of DUP [5]

3.2. Analysis of the Taxonomies at Different States of the Buildings

A comparison was made between the structural system and material characteristics of the buildings and their extensions (Figure 3). For this analysis the actual state of the buildings was considered. Each of the buildings was categorized according to a certain taxonomy which serves to define the structural characteristics important for seismic stability. For defining the taxonomy of the buildings, the Global Earthquake Model [10] taxonomy definition was used.

Figure 3: Building 1_8 with lateral and vertical extensions. Source: photos by K. Edip.

The taxonomy information is important to relate the structures to selected fragility and vulnerability functions. The fragility function shows how much damage a structure can endure, while the vulnerability function relates to how much losses, in terms of economic and human losses, a structure may cause depending on the structure's response to earthquakes [11]. The taxonomy definition was based on the data of European Seismic Risk Model 2020 (ESRM20) [11] where wide range of fragility and vulnerability functions were developed for the taxonomies of buildings characteristic of the European countries. The taxonomies of the case study buildings consist of information regarding the material of the structural system, the type of the lateral load resisting structural system, the level of ductility or alignment with the seismic design codes and number of floors [4].

In Table 2 the buildings are shown as taxonomy of building representing the initial state of the building and taxonomy of extension part which defines the characteristics of the structure added to the building.

Table 2. Taxonomy of buildings and their annexes

ID	Taxonomy of the buildings	Taxonomy of the extension part
1-2	MCF_LWAL-DUL_H5	CR_LDUAL-DUM_H7
1-3	MCF_LWAL-DUL_H5	CR_LFM-CDM-10_H6
1-4	MCF_LWAL-DUM_H5	CR_LFM-CDM-10_H6
1-5	MUR-CL99_LWAL-DNO_H2	No annex
1-7	MCF_LWAL-DUL_H5	CR_LFM-CDM-10_H6
1-8	MCF_LWAL-DUL_H5	CR_LFM-CDM-10_H6

The explanation of the taxonomies used in Table 2 is as follows:

- MCF_LWAL-DUL_H5: confined brick masonry, load bearing wall, low ductility, five floors high.
- MCF_LWAL-DUM_H5: confined brick masonry, load bearing wall, moderate ductility, five floors high.
- MUR-CL99_LWAL-DNO_H2: unreinforced brick masonry, load bearing wall, no ductility, two floors high.
- CR_LDUAL-DUM_H7: reinforced concrete, dual frame-wall system, moderate ductility, seven floors high
- CR_LFM-CDM-10_H6: reinforced concrete, frame, medium seismic design code, coefficient of lateral force, six floors high

The urban block is an old area and most of the buildings were constructed in the 1950s. It is important to note that before the 1963 Skopje earthquake the seismic forces were not included in the design of the structures [12]. The “Provisional Technical Regulations for Construction in Seismic Regions” [13] was the first seismic design code in the country [12, 14, 15] while the updated modern version of the seismic design code, the “Regulations with Technical Norms for Construction of Buildings in Seismic Regions” [16] was adopted in 1981 [14,15]. Starting from 2020 the Eurocode 8 was adopted in N. Macedonia [17].

Most of the buildings built in the period before 1963 were made of masonry load bearing structures, while the use of reinforced concrete increased after 1981 [4]. Based on the definition of the seismic design code levels and ductility levels in ESRM20 [11], in the case study there are buildings considered as low code designed according to seismic code of 1964 and buildings with moderate code designed according to seismic code of 1981 [4]. The ductility level of structures is also related to their year of construction with regard to the seismic design codes [4]. The method of implementing the extensions is also important for the seismic stability of the buildings. Extensions can be applied with the use of expansion joints or directly to the existing structure, without the use of expansion joints [4].

4. DISCUSSION OF THE RESULTS

While the occupants of the older residential buildings require enlargement of their dwelling space by adding extensions, the quality of life drops which is contradicting to the concept of sustainable development. The needs of today's generation should be fulfilled while having considerations also for the needs of the future generations [18]. The current generations make changes to their built living environment which will have an impact on the future generations.

The DUPs prepared for existing urban areas when referring to existing buildings contain a dilemma, if the new urban planning parameters mean adding extensions to the building or should be interpreted as rebuilding a new building by demolishing the existing one [4]. Beside the urban plans the building law also supports the practice of adding extensions to existing buildings [3].

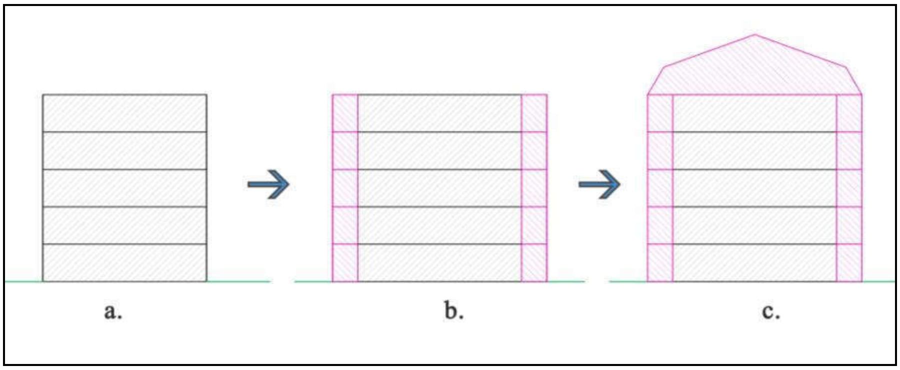

Figure 4. Schematic presentation of the extensions applied to existing buildings presented in section views (a: original building, b: horizontal extension, c: vertical extension). Source: drafted by K. Edip.

From architectural point of view, by increasing the surface area of the buildings the depth of the rooms increases. This causes a reduced amount of sunlight in the rooms. Initially buildings were designed according to standards and norms to meet the requirements for quality housing. Changes to buildings, such as lateral and vertical extensions (Figure 4) cannot be foreseen in the initial architectural project. Viewed from the aesthetical aspect, the initial form of the building is changed and the material difference between the existing and later added part is obvious. There is no harmonization of the materials when adding extensions, the only purpose is obtaining a greater amount of square meter space.

The number of occupants per dwelling can increase thanks to the enlarged space, however, this brings with it also problems related to car parking spaces. Especially in the case of Skopje where the only means of public transport are the buses, most of the residents rely on private car ownership.

Another, important problem which should not be neglected is the seismic stability of such buildings with extensions. Skopje is situated in a seismically active region where earthquakes with magnitudes ranging between 4 and 6 degrees can happen any time [19]. The scientific researchers from the field of earthquake engineering agree that such interventions to the existing buildings require detailed analysis and should be very carefully implemented since they might affect the seismic stability and safety of the existing buildings [20].

5. CONCLUSION

Although extending the existing buildings might be more economical and faster way for obtaining greater living space than building a new building, in the long term it has much more negative influences on the overall quality of the living environment. In the first place the urban planners and decision makers should be informed about the long-term consequences of the lateral and vertical extensions to the existing buildings. At the same time, awareness about the importance of applying the concept of sustainability in urban planning should be increased at urban planners, decision makers and the general public. This study suggests that in the existing urban regions, the Detailed Urban Plans should not allow changes to the urban planning parameters of the existing buildings. However, this idea should be supported also by the building law in order to be implemented.

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