

URBAN MORPHOLOGY AS A TOOL FOR EXPLORING THE LAND USE IN RESIDENTIAL AREAS: EXAMPLE OF NEW BELGRADE

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The paper presents findings of research about the classification of New Belgrade's super-blocks using the typomorphology approach and the morphogenetic analysis of urban morphology in relation to land use. The example of New Belgrade is particularly interesting given the fact that the morphological patterns of land use within its super-blocks were created during the period of non-market economy in Socialism, and now it is possible to review the effect that the socio-political transition into Capitalism, which started in the 1990s, has had on its land use.

As a result, a data base with the typology of residential super-blocks of New Belgrade is created: from the perspective of urban land use there are four main morphological types (with the subtypes) taking into account the morphology of the position of the buildings on the terrain, and traffic (cars-pedestrian) flows. The morphogenetic analysis reveals that after the 1990s there are processes pointing to powerful influence of land policy driven by private interests. Research findings suggest that nowadays there are negative trends of using the land in super-blocks in New Belgrade - e.g. percentage of land occupancy by buildings is getting bigger and almost 100% of the un-built soil in the newly developed super-blocks is covered /paved.

Key words: urban morphology, urban land use, land policy, New Belgrade, Serbia.

INTRODUCTION

The subject matter studied in this paper is the morphological aspect of small-scale urban land use with New Belgrade residential super-blocks being the framework of the study. New Belgrade is the largest municipality of the City of Belgrade, the Capital of Serbia, which dominantly features the residential content of collective housing.

After a brief description of the theoretical debates regarding urban land, the paper will point out the position of urban morphology as an instrument for studying its use from the perspective of an architect/urban planner. This will be followed by a thorough explanation of residential super-block classification methodology as applied small-scale to the above described location of New Belgrade. The synthesis will include the morphogenetic overview of the findings from the perspective of historical development phases.

Residential super-block is defined as a "neighbourhood unit understood as a basic unit for which planning is undertaken" (Bogdanović, 1990), and the concept involved is that of a "city territory bordered with traffic facilities, with minimum

possible traffic within the unit itself, morphologically consisting of detached buildings with a diffuse layout" (Kostof, 1991).

THEORETICAL BASICS

Urban land use: practical and theoretical discourse

The practical discourse of urban land use involves a large number of activities with land parcelling and the management of land resources from the economic, social and environmental perspective, with direct consequences for urban morphology (Chapin, 1970; Vernez - Moudon, 2000; Gajić, 2004). From the perspective of practical discourse of urban land use and its implications for morphology, the contemporary topics also include: 1/underground construction; 2/high-rise buildings; 3/urban farms (urban agriculture) (Lovell, 2010).

The theoretical discourse of land use refers to the economic location theory (Alonso, 1964; Voigt, 2003; Walker, 2004) concluding that the outcome of socio-economic processes reflects, among other things, through structural and functional characteristics of land use. Within the conceptual approaches to urban planning, by understanding the role and criticism of land use, the following issues come up:

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zoning; activity patterns; use of IT systems, participation and impact on local planning; land use and sustainable development; integration of analytical support systems; integration of urban design and urban forms into planning processes with a holistic, integrative approach (Oliveira and Pinho, 2010; Berke *et al.*, 2006).

The recommendations and conclusions of the studies made by European professional teams for sustainable urban land use in the 2000s (Expert Group on the Urban Environment, 2001; Engelke and Vancutsem, 2010) indicate the importance of this topic: through the creation of goals and indicators, introduction of market mechanisms for control and implementation, integration with brownfield and transportation issues to the city networking with a goal to generate the databases of good practice.

The "Thematic Strategy on the Urban Environment" underlines the need for high-density and mixed-use urban patterns with the aim to avoid urban expansion as a way to reduce land exploitation and transport and heating requirements (Commission of the European Communities, 2006). However, Oslo conference about climate change and urban design organised in 2008 by the Council for European Urbanism, found that urban sprawl around the perimeter of the city had become invasive all over Europe. That makes significant studies of the land use in more dense, collective housing area.

Tools of urban morphology in analysing land use - from the perspective of an architect/urban planner

Almost every urban-morphological study addressed the use of land in the studied area to some extent, be it through the method of occupation, travel patterns and/or through ownership status (from the mid-20th century morphogenetic studies conducted by Conzen in the UK (Conzen/revisited, 2009), through typomorphology introduced by Caniggia in Italy (Cataldi *et al.*, 2002), to the Space Syntax group's contemporary studies about the links between physical and social city that are defined through travel patterns (Hillier and Stuty, 2005; Stonor, 2006; Vaughan, 2007). Rofo developed analyses for studying the theory of spatial foundations of urban neighbourhoods in which morphogenesis is used to define the relationship between the form and ownership patterns (Rofo, 1995). Typomorphology method developed by Gil and his team for a residential block in Lisbon primarily deals with the data on land use (Gil *et al.*, 2010) in the same way in which Salat and his team studied Toledo (Salat, 2010).

General opinion is that in urban morphology analysis, land is included as a constitutive element – and became a link between individual elements (parcels and houses) and a wider urban context (Đokić, 2007; Lloyd-Jones and Erickson, 2007; Whitehand and Larkham, 1992).

THE EXAMPLE OF NEW BELGRADE: DESCRIPTION OF LOCATION AND LAND POLICY

Description of the location of New Belgrade, Serbia

New Belgrade is the largest municipality of Belgrade, the Serbian Capital that reflects many aspects of the issue of urban land and land policy planning in the previously

socialist-oriented society, within the process of transition into capitalism.



Figure 1. Position of New Belgrade in the city of Belgrade (http://www.isocarp.net/data/case_studies/748.pdf)

As an urban structure, "planned on the principles of modern urbanism and the paradigm of "functional city" (Blagojević, 2014), New Belgrade was built in the period after the World War II on an area between the historically independent cities of Zemun and Belgrade, of approx. 4074 ha flood-prone and marchland undeveloped land at the confluence of rivers the Sava and the Danube (Figure 1). By the mid-1960s, the construction of New Belgrade was fully fledged and that was the time it acquired its contemporary shape (Blagojević, 2004; 2007).

Today New Belgrade is a well-developed municipality of Belgrade, with the population of about 236 thousand, with a considerable potential for development which is at this time considered only in economic sphere – through increased prices of real estate and land and large investments in the construction of primarily business, residential-business, and commercial facilities (NBG, 2008; Politika, daily news, 2008). Up till now, the plans for this location have largely followed and supported the economic growth. Expert research in other areas relevant for sustainable development of this part of the city (analyses and studies of economic growth implications and relations with the environmental, social, and morphological spheres) is still poorly represented in planning activities.

New Belgrade – morphological characteristics of the urban structure of the total area

According to the size, regularity and compactness of the main network/block structures, three different units may be distinguished in the global context: 1 - "central zone of regular blocks", mostly square-shaped (400x400m and 400x550m), 2 - "the Danube shore with elongated blocks" (210x350m to 350x600m), and 3 - "the Sava shore with mega blocks" (rectangular: 800x800m, 700x800m and elongated ones: 550x700m, 360x800m) (Gajić and Dimitrijević-Marković, 2006), (see Figure 2).

Genesis of the developments in Serbian/Yugoslav land policy (from 1948 onwards)

The attitude towards land policy in ex-Yugoslavia has continuously evolved in the period after the WW II. National experts in this field demonstrate that urban land legislation became autonomous in relation to urban planning legislation: "... they have changed places – higher determinants and instruments arising from the land-laws were used for urban planning..." (Krstić and Pajović, 1987).



Figure 2. New Belgrade, 2013
(Source: Google-Earth)

Land policy in the period of the **1940s and 1950s** in Yugoslavia focused on the issues related to the nationalisation of urban land (1958), and in the **1960s** the focus shifted to the legislation to strategically pave the way to the establishment of common - public ownership of land (1965, 1968.). The land policy of Yugoslavia in the **1970s** saw no major developments with regard to urban land. As for the land policy in the **1980s**: "preparing the land for construction becomes an important activity of the communal economy... whilst the construction of the cities is being increasingly more shaped by the partial interests". (Krstić and Pajović, 1987).

According to urban sociologist Sreten Vujovic, the change of social-political system, with the aggravating circumstances resulting from the disintegration of the country and the wars in the territory of former Yugoslavia in the **1990s**, introduced the country into a slow transition process (Vujović, 1996). Throughout this period, urban planning legislation attempted to establish the rules of management and control in the newly-created conditions, but its implementation was predictably slowed down. Local experts warned that "...the drive to have power and dominate the space became the essential ambition in the cities of Serbia." (Stojkov, 1997).

The land policy related legislation established the *Law on Expropriation* (1995) and the *Law on Land Survey and Catastre and Entering of Rights on Real Estate* (1992); the legislator made the development of land parcelling plans become a legal requirement (*Regulation on common rules for zoning and subdivision*, 1998). The ownership of land was the critical issue in this period, and the need to render the return of nationalised property through the restitution, was constantly present. Today (2014) currently applicable *Law on Planning and Construction* (2009), defines the urban land in all forms of ownership and primarily addresses the issues of financing the development, selling and leasing the public land, and the obligation to have the right to use converted right into the ownership right.

It may therefore be concluded that the turning point towards the individual – partial interest emerged in the **1980s** within the idea of non-market economy of socialist self-management was finally implemented in the market economy concept in Serbia in the **2000s**.

MORPHOLOGICAL ANALYSIS OF LAND USE IN RESIDENTIAL SUPER-BLOCKS IN NEW BELGRADE

Methodology

Whitehand identified three important areas within which modern morphogenetic research is conducted: 1) Micromorphology (analyses at the level of a single parcel); 2) The relations between morphological periods and different typologies (synthesis of morphogenetic and typomorphology approaches); and 3) Connections between decision-making and urban forms (perceiving morphological characteristics from the perspective of different needs/interests of those involved) (Whitehand, 2001).

The method applied in this paper leans on the second above mentioned area – a synthesis of morphogenetic and typomorphological approaches (see Table 1) in the following way:

Stage 1 - *Typomorphology: Identification of the morphological types of land use* (follow the classification against **direct - visible** effects of spatial use, concerning relations between land/2D, buildings/3D and flows on the terrain/4D).

Stage 2 - *Morphogenetic analysis* (identification of common characteristics of, in the previous stage identified morphological types of land use, through a prism of genesis of space – through the analysis of the morphological consequences of land policy 'dictate' and the 'dictate' of, in the time actual, urban trend). Results are the identification of: 1-common characteristics of specific types; 2-development phases (with a chronological differentiation of what type belongs to what phase) and the 3-perspective of how they are connected in the space.

Table 1. Header of the table with data required for urban-morphology analysis

Super block/No.	Surface (ha)	Spatial Picture/global morphology structure 3D	Buildings/No. of storeys	Flows pedestrians cars /4D	Relations buildings pedestrians cars /2D:3D	Uses (primary school + dominant non-residential)	Density of uses (inhabitants per ha)	% occupancy	% water permeability
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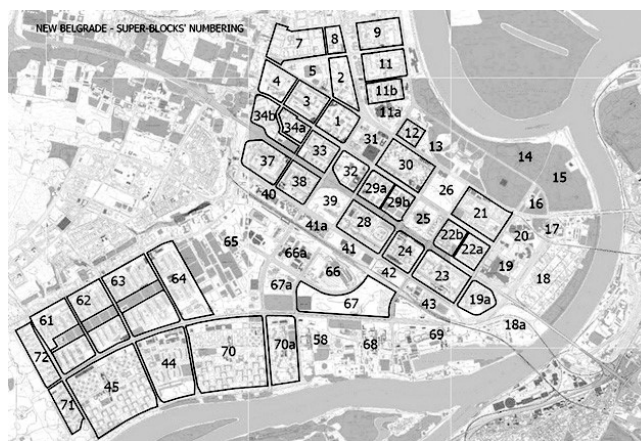


Figure 3. Official numeration of super-blocks in New Belgrade (residential super-blocks are bordered)

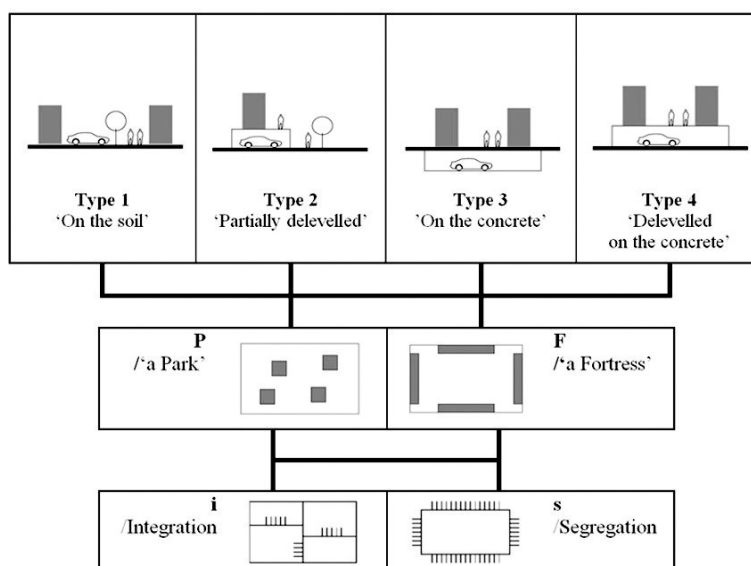


Figure 4 The matrix for identification of the typology of land use in the residential superblocks of New Belgrade

Typomorphology of New Belgrade

For the *typomorphological approach* to land use, the main criteria were adopted for classification against **direct - clearly visible** effects of spatial use (see Figure 3 and Figure 4):

- 1 - the relation between type of pavement/land cover and the buildings (2D:3D),
- 2 - spatial picture defined by the facilities/buildings on the terrain (3D presentation of the super-block),
- 3 - flows – pedestrians: cars – travel across the terrain (4D pedestrian and vehicular flows).

Based on the criteria of pavement type and the space use by levels (2D:3D), it is possible to create a matrix with four main types (see Figure 4): TYPE 1 'on the soil', TYPE 2 'partially delevelled', TYPE 3 'on the concrete', and TYPE 4 'delevelled',

on the concrete'. Each of the four main types may have different varieties taking into account two more criteria: 1/ the criterion of morphological structure made by buildings in super-block (3D/are they freestanding according to the peripheral streets so a view from them gives an impression of 'a park', or are they parallel with the peripheral streets so that a view from them on the super-block gives an impression of 'a fortress'); 2/the criterion of pedestrian/vehicle flows (4D/are they segregation/vehicular traffic is restricted to the peripheral streets/or integration/vehicles travel across the inside of the super-block/) (see Figure 4).

Findings of typomorphological analyses

When typological matrix was used to study the residential super blocks of New Belgrade, the following types were noted:



Figure 5. Overview of Type 1 - "On the soil"; dominant subtype: Park integration/Super-block 1 (Source: Google Earth)

Factography for TYPE 1 - "On the soil":

- Presence: 65% out of the total (24 out of 37).
- The subtypes 'Park' and 'Fortress' - almost equally (13:11); Park_integration is dominant (11), there are: Park_segregation (2); Fortress_integration (5); Fortress_segregation (6).
- Size: 5.5-64ha; mostly present super-blocks are of 11-20ha (75% out of all of this type).
- % occupancy: small (0-33%)
- % water permeability: between 30-50% and 50-80%
- Buildings: mix of storeys (lamellas 4-8 + skyscrapers 11-20)
- Uses: primary school in every + non-residential uses in less than 15% of all of this type
- Density: 280-450 inhab/ha
- Built in: 1940s to 1960s (rarely, 1970s and 1980s).



Figure 6. Overview of Type 2 - "Partial deleveling"; dominant subtype: Park segregation/Super-block 29a (Source: Google Earth)

Factography for TYPE 2 - "Partial deleveling":

- Presence: around 22% out of the total (8 out of 37).
- The dominant subtype - 'Park' (6:2); Park_segregation (6); one of each "Fortress" subtypes (Fs, Fi).
- Size: 10-42ha (central zone: 10-20ha; on the river Sava's side: 24-42ha).
- % occupancy: small (0-33%)
- % water permeability: between 30-50% and 50-80%
- Buildings: mix of storeys (lamellas 4-8 + skyscrapers 16-20)
- Uses: primary school in 38% + non-residential uses in 50% of all of this type
- Density: 350-569 inhab/ha
- Built in: 1970s and 1980s.



Figure 7. Overview of Type 3 - "On the concrete"; subtype: Park segregation/Super-block 67
(Source: Google Earth)

Factography for TYPE 3 - "On the concrete":

- Presence: 2 super-blocks (5% out of the total). One is Park_segregation and the other is Fortress_segregation
- Size: 11ha (super-block 32) and 19ha (Super-block 67)
- % occupancy: big (66-100%)
- % water permeability: around 0%
- Buildings: levelled no. of storeys
- Uses: no primary schools + dominant presence of non-residential uses (trade, business, church)
- Uses: primary school in 38% + non-residential uses in 50% of all of this type
- Density: 400-450 inhab/ha
- Built: after year 2000.



Figure 8. Overview of Type 4 - "Delevelling on the concrete"; subtype: Fortress segregation/Super-block 12
(Source: <http://ilicd.tripod.com>)

Factography for TYPE 4 - "Delevelling on the concrete":

- Presence: 3 super-blocks (8% out of the total). All of them are Fortress_segregation.
- Size: 6-9 ha
- % occupancy: big (66-100%)
- % water permeability: around 0%
- Buildings: levelled no. of storeys
- Uses: no primary schools + dominant presence of non-residential uses (trade, business)
- Density: around 530 inhab/ha
- Built in: the 1990s.

Morphogenetic synthesis in the context of the genesis of New Belgrade

Taking into account the indirect (not clearly visible) effects of using the urban land (density of use, occupancy percentage, water permeability of the site surface, uses) and findings of typomorphological analyses (types of super-blocks), a synthesis made through the *morphogenetic approach* revealed some characteristics shared by all of the above identified morphological types of land use when they are looked at from the prism of the genesis of the area (see: Figure 9 - Synthesis map).

The 1950s and 1960s

Almost 50% of the territory of New Belgrade was built in this period. Super-blocks TYPE 1 "On the Soil" are most present, with overall characteristics: small (0-33%) percentage of building occupancy, medium to high percentage of water permeability (30-50% to 50-80%), buildings with mix of storeys (lamellas 4-8 + skyscrapers 11-20), medium density (280-450 inhab/ha) and presence of primary school in every + non-residential uses in less than 15% of all of this type.

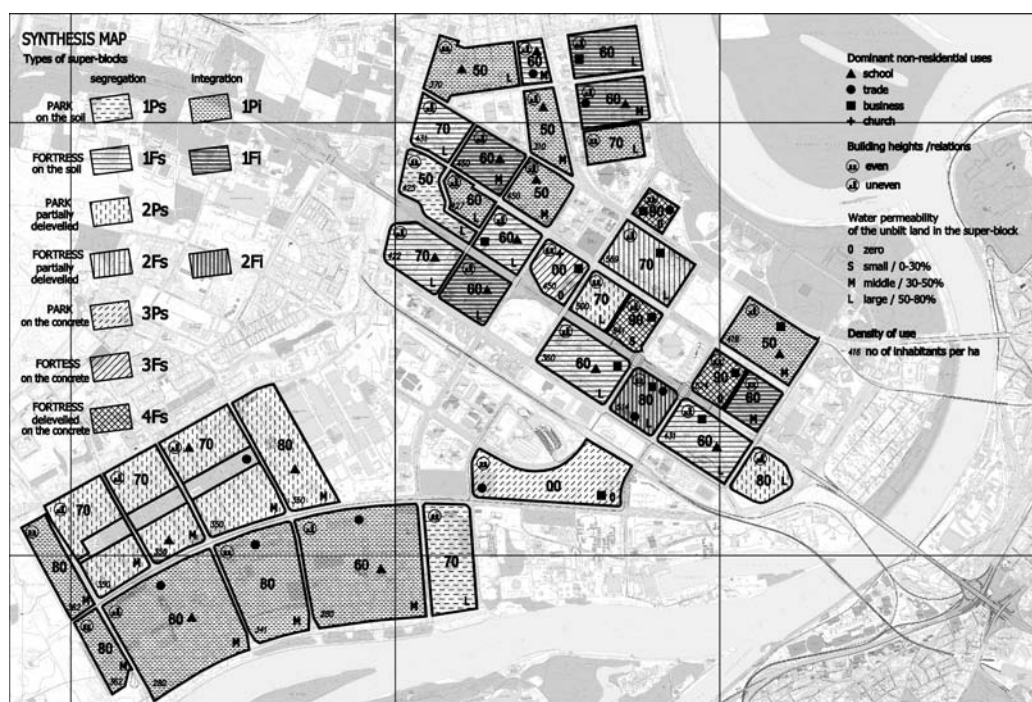


Figure 9. Synthesis map with the built period
(number in the super-block represents a decade of the 20th century; "00" is for the first decade of the 21st century)

The 1970s and 1980s

In the 1970s, the development of the area on the Danube side was completed and before the end of the 1980s, almost 85% of the total number of residential super blocks now existing in this territory was already built. Super-blocks TYPE 2 - "Partial delevelling" are most present, with overall characteristics: small (0-33%) percentage of building occupancy, medium to high percentage of water permeability (30-50% to 50-80%), buildings with mix of storeys (lamellas 4-8 + skyscrapers 16-20), medium to high density (350-569 inhab/ha) and presence of primary school in 38% + non-residential uses in 50% of all of this type. Majority of the super-blocks featured a considerable segregation between vehicular and pedestrian traffic. The land use concept was such that this segregation is still retained today.

The morphological approach to land use in super-blocks in the 1980s reveals a traditionally based pattern of 'streets' and 'squares' and smaller distance between same height buildings, something that wasn't seen in the morphology of New Belgrade before.

The 1990s and 2000s

New Belgrade urban structure generally suffered significant changes during this period, which was primarily reflected in the fact that non-residential facilities were built, particularly in the period after 2000. Residential units were built in much smaller number, they were much smaller in size than before and commercial and business facilities were substantially represented. All in all, the construction in this period accounts for about 15% of the up till now built residential capacity in New Belgrade.

Super-blocks TYPE 3 and TYPE 4 are present 'on the concrete' (underground garages with pedestrian traffic and free public spaces on garage roof), with overall characteristics: big (66-100%) percentage of building occupancy, paved land without water permeability, same height buildings, medium to high density (400-530 inhab/ha) and with no primary schools + dominant presence of non-residential uses (trade, business, church). Segregation of vehicular and pedestrian flows is inherent to this type.

Characteristically, this period of constructing the residential units of New Belgrade lacks contemporary approaches; any concerns about sustainable development are missing, although they were seriously tackled elsewhere in the world after the 1990s. Contemporary criteria on energy efficiency are also rarely taken into consideration. For the first time in the history of New Belgrade, the topics such as title issues and private investors are present. According to Blagojević, "Most of the central New Belgrade territory has no history of private ownership and no history of nationalization and confiscation of private property, and, therefore, there is no restitution of land pending regulation. Today, New Belgrade is the capital's frontier where leasing-state owner land has no legal strings attached and thus is up for grabs" (Blagojević, 2014). Private interest now became dominant in the area of urban planning and land policy and it is obvious that it was not the dominant professional standards, but rather the effect of land policy, spurred on by the transition process in the country that had implications in all spheres of life, that essentially shaped the residential construction (related to land use as well) in New Belgrade.

CONCLUSIONS

Land use analysis in which urban morphology tools are applied, is an instrument that helps architects/urban planners to understand the processes in which urban units came into existence and, in doing that, it also helps to provide the data needed to direct, follow and manage these processes in the future. This paper presents an urban morphology based method for analysing a small-scale urban land use in multifamily residential area on the example of New Belgrade, the largest municipality of Belgrade, the capital of Serbia. "By virtue of its location, modern infrastructure and development potential, New Belgrade finds itself at the centre of contemporary post socialist/communist socio-political and economic transition of the metropolis and its region, thus undergoing profound socio-spatial transformations" (Blagojević, 2014). These transformations represent a testing ground for various research, and in this paper it is the land use in New Belgrade from the viewpoint of urban morphology.

As a result, a data base with the typology of residential superblocks of New Belgrade was created: from the perspective of urban land use there are four main morphological types and there are the subtypes which take into account the resulting morphology of the position of the structures on the terrain (a park, a fortress) and traffic, cars-pedestrian flows (segregation, integration). The morphogenetic analysis of previously identified morphological types revealed the predominating trends in the genesis of this area with regard to land use: in the period after the 1990s, private interest extended its dominance to the spheres of urban planning and land policy. Dominant professional standards are no longer essential in shaping the multifamily residential construction (and related land use) in New Belgrade, but the impact of land policy, driven by the transition process in the country that affected all spheres of life.

Findings suggests that nowadays there is a negative trend of using the land in super-blocks in New Belgrade, concerning urban morphology: percentage of land occupancy by buildings is getting bigger, while the percentage of water permeability of the undeveloped land inclines toward zero (almost 100% of the un-built soil in the newly developed super-blocks are covered/paved), Previous morphological concept of buildings with mix of storeys - skyscrapers and lamellas, is changing after the 1990s, by building levelled - same storey buildings on the whole super-block territory. As for the uses - there is a lack of social aspect - with no new primary schools and kindergartens, but a dominant presence of non-residential uses (trade, business, church).

It is important to stress that the purpose of typomorphology (the first component of the proposed methodology) is to create a database that would be required in further work and that, as such, it is not about criticising the types, but only about analysing the spatial development with the goal to create the typology. In accordance with the urban morphology's basic interests, and that is "to establish relationships between complex development processes and the urban form, grounded on the knowledge and understanding of the existing built environment, its specific

forms and previous development" (Niković *et al.*, 2014), the research of land use in New Belgrade in the future should particularly focus on the second component of the proposed methodology, the morphogenetic approach, with further elaboration and possible new 'readings'/interpretations and supplementation of analyses with new information/data (related to the accessibility of uses, construction coefficient, the number of parking lots, the free space/population number ratio, etc.)

Lj. Blagojević argued for a balance between the processes of urban change towards a market economy and the need for the protection and preservation of the modernist architectural heritage "to be found in the appreciation of the urban landscape quality of the modern city and its housing blocks, and in the perspective of ecological urbanism" (Blagojević, 2012). It may be concluded that by planning for extensive free/green surfaces in super blocks at the early stages of New Belgrade construction, the society had somewhat unreasonably spent the land /the space/ which at that time seemed immense and affordable considering that the land was not burdened with the existing development or with the title issues. Today, on the other hand, we are in a stage when the land is used/paved 100 per cent and this did not lead to better quality areas (in which the user is comfortable and which provides all necessary elements of the sustainable use of urban land). It could be said that while at the very start we may have had the situation of space wasting, we still ended up with the space that is either (over)used or not worth using (that lacks the qualities, such as liveability, sustainability and energy efficiency).

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