POLITIKA NAČRTOVANJA MESTA: NOVA STANOVANJSKA NASELJA NA DEGRADIRANIH OBMOČJIH V ZAGREBU

CITY PLANNING POLICY: NEW HOUSING DEVELOPMENTS IN ZAGREB BROWNFIELDS

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IZVLEČEK

Namen prispevka je pokazati politiko načrtovanja mest na področju preoblikovanja degradiranih območij, posebej preobrazbe teh območij v stanovanjska naselja. Rezultati raziskave treh izbranih primerov so pokazali, da preobrazba degradiranih območij v stanovanjska naselja prispeva h kakovosti življenja na regeneriranem območju ter njegovi umestitvi v širše območje, tudi z vidika trajnostnega razvoja na lokalni ravni. Razvoj novih stanovanjskih območij prispeva k boljšemu povezovanju prostora in dinamičnejši mobilnosti. Zasnova in načrtovanje novih stanovanjskih območij v skladu z organiziranimi programi, kot je hrvaški nacionalni program socialne stanovanjske gradnje, dovoljuje hitro in celovito izvedbo posegov velikih meril ter zagotavlja enakopravno socialno vključenost in kakovostne življenjske razmere. Območja, ki so bila prej monofunkcionalna, zaprta in nedostopna, tako postajajo večnamenska, odprta in dostopna ter so motor razvoja v širšem kontekstu. Preobrazba, ki temelji na aktivni urbani politiki, celovitem urbanističnem načrtovanju in projektiranju, prispeva k trajnostnemu razvoju na lokalni ravni in izpolnitvi aalborških zavez.

KLJUČNE BESEDE

Zagreb, politika načrtovanja mest, degradirana območja, razvoj stanovanjskih območij, hrvaški nacionalni program socialne stanovanjske gradnje, trajnostni razvoj

ABSTRACT

This paper aims to show the city planning policy for transformation of brownfield areas into housing developments. Research results of three selected case studies have shown that the brownfield area transformation into housing developments contributes to the quality of life in the area and the integration of that area into the surrounding space, and thus also to the aspects of sustainable development at the local level. New housing developments contribute to the better networking of space and dynamic mobility. Design and construction of new housing areas based on a programmes put in place, such as the Croatian Social Housing Construction Scheme allow rapid and integral implementation of large-scale interventions and provide socially integrated housing and high-quality living conditions. Areas that were once monofunctional, enclosed and inaccessible have become multifunctional, open and accessible thus representing a generator of development in the wider context. A transformation based on an effective city planning policy, comprehensive urban planning and design contributes to sustainable development at the local level, thus fulfilling Aalborg Commitments.

KEY WORDS

Zagreb, City planning policy, Brownfields, Housing Development, Croatian Social Housing Construction Scheme, Sustainable Development

1 INTRODUCTION

City development, gradual expansion and the transformation of its urban structure over the centuries has resulted in the dynamics of space and the dynamics of life, which have become the most prominent features of contemporaneity. The overall city area are characterized by complex dynamics of (a) physical and non-physical space, which could be considered on different levels through mobility dynamics, (b) structural and functional changes, (c) space use, (d) social interaction, (e) environmental networks and flows and (f) virtual mobility - information and the (g) financial investments (Gašparović, Petrović Krajnik and Hladki, 2015). The urban structure of Zagreb, like many other European metropolises, contains area called brownfields as of the end of the 20th Century, where the complex dynamics is visible.

There are many definitions of the term brownfields in the European context, among them standing out the definition prepared within the taskforce CLARINET (Contaminated Land Rehabilitation Network for Environmental Technologies, 2002). According to Ferber and Grimski (2002), brownfields are sites that have been affected by the former uses of the area and surrounding land; are derelict or underused; may have real or perceived contamination problems; are located mainly in developed urban areas; and require intervention to bring them back to beneficial use. This definition was amended based on the conclusions of the European expert network CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), which emphasise that these are areas which were: (a) under the influence of former users, (b) neglected or insufficiently researched, (c) mainly located in part or in whole in developed urban areas, (d) require an intervention that would restore them to useful use and (e) may have realistic or potential problems with pollution. Three main categories of brownfield sites were identified (Ferber and Grimski, 2001): (1) *brownfields in traditional industrial areas* - as a result of the massive employment decline in the coal, steel, and textile industries at the beginning of the 1980s and following structural changes in industry; (2) *brownfields in metropolitan areas* - as a result of persisting displacement pressures on peripheral areas during the urban sprawl process; and 3. *brownfields in rural areas* - as a result of abandonment of sites related to primary economic activities in agriculture, forestry and mining.

This paper focuses on the second type of brownfields – *brownfields in metropolitan areas*, located on city outskirts and resulting from economic and socio-political changes in the late 20th Century. These areas represent a huge potential for implementing urban strategies and policies, the implementation of which requires to conceive appropriate measures and instruments which are the basis for the complex task, the design of their further development.

Planning and development of brownfield areas was highlighted as one of the important elements of European cities on the path of achieving sustainable development at the 4th European Conference on Sustainable Cities & Towns in 2004 in Aalborg. Based on the *Aalborg Charter* (1994), in 2004 *Aalborg Commitments* were adopted addressing 10 themes[1] (2004) whose implementation contributes to the achievement of sustainability at the local level. Theme *Planning and Design* emphasizes the importance of strategic role for urban planning and design in addressing environmental, social, and economic, health, and cultural issues for the benefit of all. To contribute to sustainable development with regard to theme No. 5, the following must be implemented: (1) re-use and regenerate derelict or disadvantaged

[1] *1. Governance; 2. Urban management; 3. Natural common goods; 4. Responsible consumption; 5. Planning and design; 6. Better mobility; 7. Local action for health; 8. Sustainable local economy; 9. Social equity and justice; 10. Local to global*

areas; (2) avoid urban sprawl by achieving appropriate urban densities and prioritising brownfield site over greenfield site development; (3) ensure the mixed use of buildings and developments with a good balance of jobs, housing and services, giving priority to residential use in city centres; (4) ensure appropriate conservation, renovation and use/reuse of our urban cultural heritage; (5) apply requirements for sustainable design and construction and promote high-quality architecture and building technologies (The Aalborg Commitments, 2004)

Writing on the brownfield redevelopment and sustainability has been interdisciplinary in nature (architecture and urban planning, economics, sociology etc.) Brownfield regeneration has become a mayor policy driver in many developed countries (Dixton, Raco, Catney and Lerner, 2007). Bagaeen, S.G. (2006) argues that the challenge in brownfield sites (especially military sites) will be to guarantee competitive advantages that can transform these sites into reliable economic opportunities while looking after the interests of all the parties involved. Dixon, T. (2007) stress that in UK there is a clear attempt to interlink "sustainable development" and "sustainable brownfield" policy agendas. Vojnović, I. (2014) points out that limited understanding of the science behind sustainability and the lack of commitment and apprehension by governments are two variables that limit our advancement toward the sustainability condition.

This paper aims to show that city planning policy of structural and functional transformation of brownfield areas on city outskirts into housing developments contributes to integration of the area into the wider context and to the overall quality of life, thus also contributing to the aspects of sustainable development at the local level. It wishes to show that once monofunctional, enclosed and inaccessible zones used for specific purposes have become, as a result of transformation based on effective city planning policy, comprehensive urban planning and design, multifunctional, physically open and accessible to users of the surrounding area, and that they represent a generator of development in their context.

2 METHODOLOGY

Criteria that housing developments had to fulfil in order to be taken into consideration as a case study within this research were: (1) brownfield area, (2) housing development drafted in accordance with the Croatian Social Housing Construction Scheme (The Act on State-Subsidized Residential Construction 2001, 2004, 2007, 2009, 2012) and (3) beginning of transformation after the year 2000, based on architectural design competitions (Figure 1).

Representation of the structural and functional transformation of selected case studies and their impact on the wider spatial context are based on the established analysis model. The analysis model includes following elements: (1) land use and built-up area before transformation process, (2) selected area and its surroundings in the new planning documentation, (3) national public architectural competition awarded project and legally binding land use plan, (4) accessibility of the area by public transport, and (5) new structure, facilities, density and footprint of the housing development.

In order to collect the necessary data for the analysis of housing development, field research was carried out, the spatial planning documentation in the period before and after the transformation was analysed, the awarded plans and projects and urban planning documentation (elaborated based on the competition) were analysed, as well as the public transport network and built structure visible on Croatian basic maps and aerial photos in the period before and after transformation.

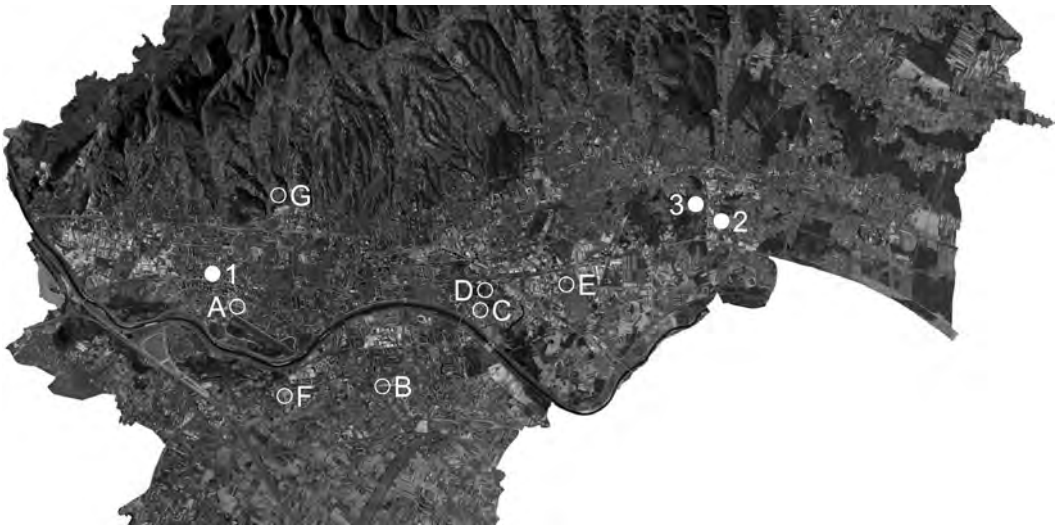

Figure 1: Zagreb's housing developments after the year 2000.
1 Špansko Oranice (CSHCS, competition in 2003, realised), 2 Novi Jelkovec (CSHCS, competition in 2003, realised), 3 Sopnica South (CSHCS, competition in 2007), A Vrbani III (competition in 2004, realised), B Podbrežje (competition in 2006), C Borovje-Tigrovi (competition in 2006), D Borovje-Savica (competition in 2006), E Munja (competition in 2006), F Blato-East (competition in 2007), G Müllerov breg (competition in 2010)

For the purpose of this research graphical illustrations and tables of the elements of the analysis model were made. In order to understand the overall changes in the physical structure of the selected areas, a graphical representation with parallel aerial photos before and after the transformation process and the award-winning competitions for the subject areas was made (Figure 2). In order to deepen the analysis of individual elements of the model and to enable their further quantitative analysis, graphical representations of land use and built structure before and after the transformation process were made (Figure 3 and Figure 4), which served as a basis for quantitative comparison presented in tables (Table 1 and Table 2). For the purpose of perceiving changes in a wider spatial context, directly or indirectly related to the transformation process, a graphical representation of the spatial planning documentation of the City of Zagreb in the period before and after the transformation process was made (Figure 5). The graphical illustrations and tables of the parameters for housing development are presented in parallel to perceive changes within specific area and between selected areas.

Furthermore, in order to understand the similarities and differences between selected examples, their comparative analysis was made, based on the set analysis model, graphical illustrations and tables, and elements of the Aalborg Commitments themes (2004) especially on the theme Planning and design (re-use and regenerate derelict or disadvantaged areas; avoid urban sprawl by achieving appropriate urban densities and prioritising brownfield site over greenfield site development; ensure the mixed use of buildings and developments with a good balance of jobs, housing and services (giving priority to residential use in city centres); apply requirements for sustainable design and construction and promote high-quality architecture and building technologies), Better mobility (increase the share of journeys made by public transport, on foot and by bicycle) and Social equity and justice (secure good quality and socially integrated housing and living conditions). The comparative analysis was made based on

the following elements: (1) Planning and realization, (2) Land use and public transport before and after transformation, (3) structural transformation, (4) Social housing programme, (5) Spatial and urban planning documentation changes, (6) Relation to the surrounding area. An integral table (Table 2) gives the results of comparative analysis of selected examples.

Finally, the relation between the results of research and the elements of the themes of *Aalborg Commitments* were analysed in order to confirm the hypothesis and possible impact of interventions in the context of achieving sustainability and sustainable development at the local level (Table 3).

3 HOUSING DEVELOPMENTS IN ZAGREB AFTER THE YEAR 2000

At the beginning of the 21st Century, planning and partial construction of new housing developments begins in Zagreb, as a result of development in the last decades of the 20th Century. After Croatian independence in 1991, the country was struck by the War of Independence (1991 - 1995) which caused large destruction, including 11% of the housing stock (Bobovec, 2000: 2). Due to specific political and economic conditions, intensity and volume of economic activities was significantly reduced, while the post-war economic recovery had been slow, with a pronounced stagnation in housing construction. The pre-war shortage of housing in major cities, especially in Zagreb, was further emphasized with the arrival of people from war-torn areas. Increased demand for flats in Zagreb was not accompanied by a clear vision and an effective implementation of housing construction, which was one of the major causes of individual construction of residential buildings (Zlatar, 2014: 154). They were built on mainly small and inadequate plots and in areas without planning documentation that would ensure clear urban concept of conservation and development, as well as quality housing. Planned housing developments in Zagreb in the 1990s were also absent because of new market conditions after the War of Independence in which large pre-war construction companies with experienced professionals and operative infrastructure failed to find successful models of independent activity, while private entrepreneurs had neither knowledge nor sufficiently-developed operative infrastructure (Mlinar, 2009: 160). There were no programmes or models for housing construction like the pre-war model of Socially oriented housing construction that marked the 1980s to provide a sufficient number of good quality flats nor was the housing market regulated (Bobovec and Mlinar, 2013: 142). The Ministry of Public Works, Reconstruction and Construction prepared and started implementing the Act on State-Subsidised Housing Construction (2001). Following the adoption of the Social Housing Construction Scheme in late 2001 and the adoption of the City of Zagreb Master plan in 2003, urban and architectural competitions were launched for new housing developments of Španski-Oranice, Novi Jelkovec, Vrbani III, Podbrežje, Borovje-Tigrovi, Borovje-Savica, Munja, Blato East, Sopnica South, and Müllerov breg (Mlinar, 2013: 36). Housing developments were planned as transformations of what were brownfield areas at the time, or as developments of greenfield sites, in locations in which construction of new housing developments was planned according to the spatial and urban planning documentation. Competitions were funded by state and city institutions and carried out by the Croatian Architects Association and The Zagreb Society of Architects.

Out of a total of ten public competitions held, three housing developments were realised (Španski-Oranice, Novi Jelkovec and Vrbani III), while the construction of the remaining seven was halted by the financial crisis that hit Croatia in 2008. According to the newly adopted Social Housing Construction Scheme, housing developments were planned for Španski-Oranice, Novi Jelkovec and Sopnica South.

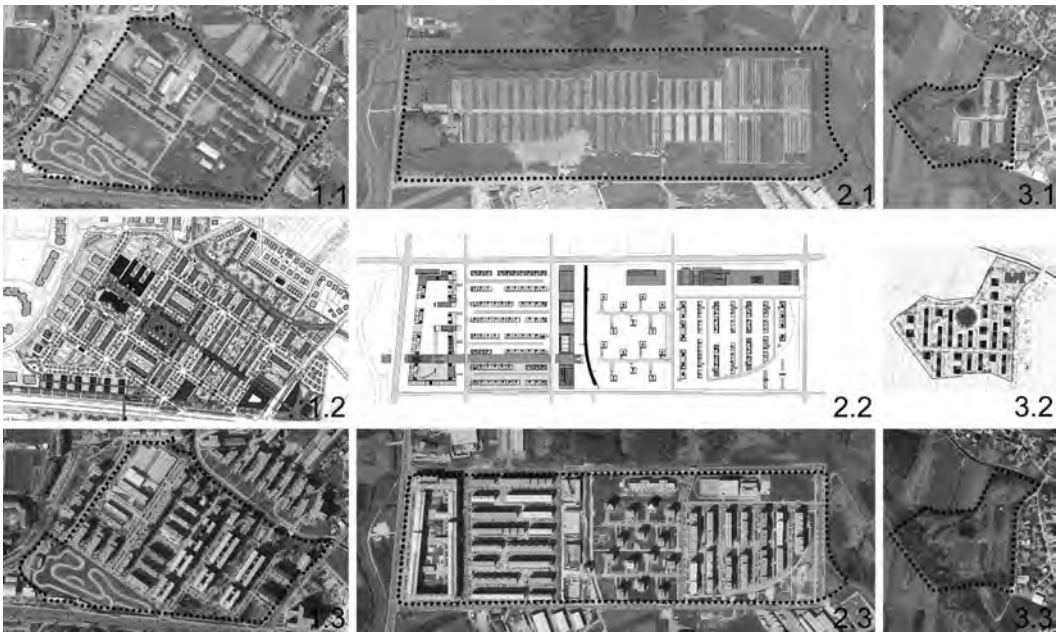

Figure 2 Comparative illustrations of selected areas – Aerial photo before and after planned transformation and urban planning and architectural solutions.
Špansko-Oranice: 1.1 Aerial photo (2003), 1.2 awarded project (2003), 1.3 Aerial photo (2012)
Novi Jelkovec: 2.1 Aerial photo (2003), 2.2 awarded project (2003), 2.3 Aerial photo (2012)
Sopnica South: 3.1 Aerial photo (2003), 3.2 awarded project (2007), 3.3 Aerial photo (2012)
Source: 1.2, 2.2 and 3.2 Mlinar (2013)

4 CROATIAN SOCIAL HOUSING CONSTRUCTION SCHEME

Croatian Social Housing Construction Scheme (CSHCS) began in the late 2001 as one in a series of organized housing construction programmes that were implemented in Croatia under certain conditions and at certain periods. Before it, the best-known programme was the Programme of socially oriented housing construction from the 1970s. The main features of the CSHCS were its scope and multi-level implementation, using experiences from the implementation of the Housing Care Programme for Victims of the War of Independence, launched in 1996, the goal of which was primarily to secure housing for as many victims of the war as possible. Other people were not included in the programme and were left to the free housing market, which faced a growing demand for housing units, driving prices up and making them less and less affordable to an average buyer. With the CSHCS the aim was to solve, in a relatively short time, two extremely complex tasks, the first being to provide the required number of housing units in all of Croatia, ensuring the quality of urban life and housing, and the second to preserve the space from uncontrolled use. The aim of the CSHCS is to meet housing needs and improve the quality of housing for a wider number of citizens, as well as to improve construction, enabling Croatian citizens to buy flats under more favourable terms than the ones offered on the market with a guaranteed quality of construction and completion of work within set deadlines. As part of the implementation of the CSHCS, needs were identified and project programmes prepared based on which architectural competitions were carried

out, enabling the selection of the best design solutions. During the ten years of the implementation of CSHCS, in Croatia 5.553 apartments (of which 2.102 apartments in the City of Zagreb) were built in 173 residential and residential-commercial buildings (Bobovec and Mlinar, 2013: 145), as well as one complex of ground-level and one-storey row houses. In addition to individual buildings, the CSHCS also included the already mentioned three housing developments in Zagreb: Španski-Oranice, Novi Jelkovec and Sopnica South.

5 STRUCTURAL AND FUNCTIONAL TRANSFORMATION OF SELECTED BROWNFIELDS INTO HOUSING DEVELOPMENTS AT THE BEGINNING OF THE 21ST CENTURY IN ZAGREB

This paper analyses in detail the three selected areas on the outskirts of the city of Zagreb: Španski Oranice, Novi Jelkovec and Sopnica South (location 1, 2 and 3 on Figure 1), which meet the set criteria according to the set analysis model explained in the chapter *Methodology*.

5.1 Španski Oranice

The Španski Oranice area is located in the South-West of Zagreb. Before the transformation of the area (19.18 ha), most of the land was used for military purposes, housing the Prečko military complex[2]. The area South-West of the complex was used by a kart centre and a car wash. Due to specific military use, 15.74 ha of land was enclosed by a fence. Between 1942 and 1978 in the Španski-Oranice area, 43 buildings were built for military use and 4 for karting centre and car wash. The total built-up area covered 11.21 % of the whole Španski Oranice area.

Under the purchase agreement between the Republic of Croatia – Ministry of Defence and the City of Zagreb, the Ministry handed the military complex over to the City of Zagreb in 2002. According to the Zagreb Master plan (2003) the Španski Oranice area was designated for the transformation into an area of mixed - predominately residential use. In the immediate contact zone are areas designated for mixed - predominantly business uses, a protective green area, sport and recreational use, and water and water resources. In 2003, a national public architectural competition for the housing development at the location of the Španski Oranice military complex in Zagreb, for the CSHCS, was held (The Zagreb Society of Architects). The awarded project from the Zagreb City Planning Office served as the basis for Detailed urban plan for the housing development. The urban planning solution and the detailed urban plan are marked by an orthogonal urban grid laid out following the grid of the former military complex, synchronised with the asymmetric boundary of the coverage area by asymmetric peripheral blocks, layout of buildings, and their slanting gables. A great deal of attention was paid to the park landscaping concept based on the formation of pedestrian-only squares and streets. Pedestrian areas are intersected by a continuous system of relatively smaller, yet connected park areas enabling the connection with a wider spatial context (Šimpraga, 2014).

The Southern side of the area is adjacent to the city's main East-West expansion direction (Zagreb Avenue). The residential area is connected by public transport – bus lines – to the transport terminal Ljubljanica in the Western part of the city. There are plans to build new light-rail routes North and East of the Španski Oranice area to complement the current tram system.

[2] *which was unique due to its peripheral vegetation and landscaped areas within the complex.*

The housing development is shielded from Zagreb Avenue by a stretch of park area and planned commercial buildings. The park potential of the Vrapčak creek is not fully utilized, but it is emphasised by slanting and indented gables of the surrounding residential buildings. A total of 32 residential buildings with 1,586 flats for housing approximately 4,758 residents were built (83 flats per ha, 250 residents per ha) (Mlinar, 2013: 37). A kindergarten and primary school were also built, with plans for the construction of commercial buildings. Some residential buildings have commercial spaces on the ground floor. The total built-up area covers 22.83 % of the whole Španska Oranice area.

5.2 Novi Jelkovec

The Sopnica – Jelkovec area is located in the South-East of Zagreb. Before the transformation, the entire area of 33.2 ha was used from 1966 for economic - industrial purposes. Due to its specific use, the area was enclosed by a fence (25.51 ha) and available solely for industrial purposes. It contained the total of 62 structures (57 buildings), with the administration building at the main entrance. The buildings were laid out in an orthogonal grid, with the longer side of each building facing North-South. The total built-up area covered 25.39 % the whole Sopnica – Jelkovec area.

In the late 20th Century the pig farm's location was deemed inappropriate from the urban planning and ecological aspect. The Sesvete Master plan (2003) classifies the entire Novi Jelkovec area as mixed-use. In the immediate contact zone are area designated mostly for economic use, except for the green area – the city park with forest and protective green areas located towards the sport and recreation zone, and towards the residential area. In 2003, a national public architectural competition for the housing development at the location of Sopnica-Jelkovec (today Novi Jelkovec) in Sesvete (33.20 ha), for the CSHCS, was held (The Zagreb Society of Architects). The awarded project of the group of authors from the Institute for Urban and Spatial Planning at the Zagreb Faculty of Architecture served as the basis for the development of the Detailed urban plan for the housing development, that divides the elongated area into four subsections (*Megastructure, Fingers, Forest Park* and *Ellipse*), i.e. urban blocks which may be used as a basis for the structural and functional transformation and urbanisation of the surrounding abandoned area.

The Western side of the Novi Jelkovec area is adjacent to the Ljudevit Posavski Street, which connects two important parallel expansion directions – Slavonia Avenue in the South and Zagreb Road in the North. The housing development is connected by public transport – bus lines – with three terminals of the City of Zagreb, Dubec and Sesvete in the Eastern part of the city and the Central train station in the city centre.

Novi Jelkovec contains a total of 54 residential buildings, with 2,733 flats (Mlinar and Šmit, 2008: 120) for housing approximately 8,199 residents (82 flats per ha, 246 residents per ha) (Mlinar, 2013: 37). The structures either completed or under construction include: two kindergartens, primary and secondary school, cultural centre, indoor swimming pool, playgrounds, sports grounds, clinic, veterinary clinic and department store. The overall built-up area of Novi Jelkovec covers 23.19 % (completed and under construction 21.87 %). The housing development were designed as part of the CSHCS; however, the construction and sale of flats were mostly organised by the City of Zagreb according to the so-called Zagreb model (149 flats are included in the CSHCS (Agency for Transactions and Mediation in Immovable Properties, 2015), but it should be noted that these are individual residential units within buildings).

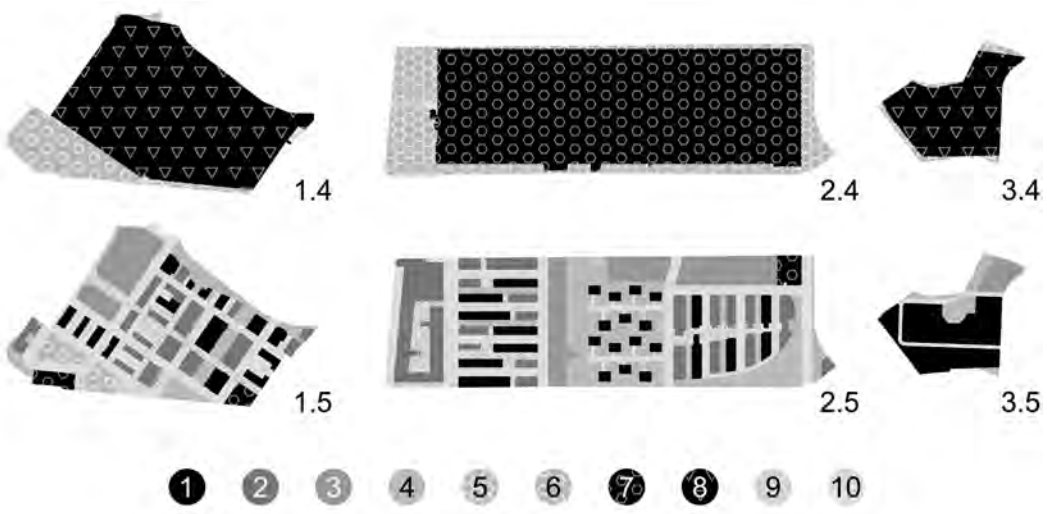

Figure 3: Comparative illustrations of selected areas – land use before and after transformation.
Španska-Oranice: 1.4 land use before transformation, 1.5 land use after transformation
Novi Jelkovec: 2.4 land use before transformation, 2.5 land use after transformation
Sopnica South: 3.4 land use before transformation, 3.5 land use after transformation
(1- Residential use, 2- Mixed use, 3- Public and social use, 4- Public green area, 5- Protective green area, 6- Sport and recreation use with construction, 7- Economic use – industry / business, 8- Special use, 9- Infrastructure, 10- Infrastructure – pedestrian-only streets and squares)

5.3 Sopnica South

The Sopnica South area is located in the Eastern part of Zagreb. Before the transformation, Sopnica South (5.81 ha) was used from the 1960s as a military warehouse. Due to its specific use, the area was enclosed by a fence (5.32 ha) and available solely for military purposes. From 1959 to 1988 a total of 11 structures were constructed (including 7 buildings) used as warehouses. The buildings were grouped and located near a small natural lake, with the longer axis facing North-South. The total built-up area of the Sopnica South covers 11.19 %

Based on the decision by the Central State Administrative Office for State Property Management, Ministry of Defence handed over the Sopnica warehouse to the Agency for Transactions and Mediation in Immovable Properties in 2009. According to the Amendments of Zagreb Master plan (2006) the Sopnica South was turned from a special-use area into mixed-use - predominantly residential zone. The area is surrounded by protective green areas, except for the Eastern side where the area is a continuation of the existing construction designated for mixed, predominantly residential use. In 2007, a national public architectural competition was held (The Zagreb Society of Architects). The winning design is made by a group of authors from the x3m: arhitektura+urbanizam studio (The Zagreb Society of Architects, 2016), which retained the existing lake as the focal point. In between residential buildings, playgrounds and sports grounds are planned. The plan included 22 residential buildings in an orthogonal grid, with a total of 400 flats for housing approximately 1200 residents (68 flats per ha, 206 residents per ha) (Mlinar, 2013: 41). Residential buildings with square and rectangular layouts, stretching along the longer axis

in the North-South direction. Buildings along the lake and pedestrian areas were envisaged to contain commercial and service spaces in the ground floor. In the North-East section of the coverage area a kindergarten was planned. The total built-up area will amount to 18.28% of the whole Sopnica South area.

Table 1: Share of land use in selected areas before and after transformation.

	Španska-Oranice				Novi Jelkovec				Sopnica South			
	before		after		before		after		before		after	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Residential	-	-	2.07	10.80	-	-	3.69	11.11	-	-	3.74	64.38
Mixed-use – predominantly residential	-	-	2.78	14.50	-	-	5.94	17.90	-	-	-	-
Public and social	-	-	2.20	11.46	-	-	4.07	12.26	-	-	0.59	10.15
Economic - business	-	-	0.65	3.38	-	-	0.42	1.27	-	-	-	-
Infrastructure	0.13	0.68	6.36	33.14	0.11	0.33	8.50	25.6	-	-	0.59	10.15
Pedestrian-only streets and squares	-	-	1.69	8.80	-	-	2.17	6.53	-	-	-	-
Public parks and landscaped areas	-	-	2.43	12.66	-	-	8.41	25.33	-	-	0.89	15.32
Sport and recreation	3.09	16.10	1.01	5.26	-	-	-	-	-	-	-	-
Special use - Military	15.57	81.14	-	-	-	-	-	-	5.21	89.67	-	-
Economic - Industry	-	-	-	-	25.51	76.84	-	-	-	-	-	-
Protective green area	0.40	2.08	-	-	7.58	22.83	-	-	0.6	10.33	-	-
TOTAL	**19.19**	**100**	**19.19**	**100**	**33.20**	**100**	**33.20**	**100**	**5.81**	**100**	**5.81**	**100**

6 COMPARATIVE ANALYSIS OF SELECTED EXAMPLES OF BROWNFIELD TRANSFORMATION

In the context of achieving sustainability and sustainable development at the local level, the comparative analysis of selected transformation examples is based on elements of the *Aalborg Commitments*, as well as the set analysis model.

Planning and realisation

Španska Oranice and Novi Jelkovec housing developments were realized according to urban planning and architectural competitions and spatial planning documents, i.e. detailed urban plans on the former brownfield area. The Sopnica South housing development was shelved partly due to the outbreak of the 2008 financial crisis and partly due to unresolved ownership issues, although an urban planning and architectural design competition was held as the basis for its execution, providing high-quality urban and architectural design solution on the former brownfield area. Španska Oranice housing development

was planned to be constructed in two stages because of the concession for the operation of the karting centre - land currently occupied by the karting centre will represent the second stage of construction.

Table 2: Results of the comparative analysis of selected areas.

Elements of comparative analysis	Housing development		
	Španško Oranice	Sesvetska Sopnica/ Novi Jelkovec	Sopnica South
Planning and realization			
Brownfields	+	+	+
Urban planning and architectural competition	+	+	+
Detailed urban plan	+	+	-
Realization	+	+	-
Land use and public transport before and after transformation			
Land use before	special - military	industry	special - military
Accessibility of the area before	-	-	-
Public transport lines before	+	-	-
Land use after	multifunctional	multifunctional	multifunctional
Accessibility of the area after	+	+	+
Commercial and service facilities in ground floor of buildings	+	+	+
Public and social facilities	+	+	+
Buildings for business purposes	+	+	-
Landscape areas	+	+	+
Public areas of high standard	+	+	+
New public transport lines	-	+	-
New system of public transport in immediate vicinity	+	-	-
Structural transformation			
Aesthetic and construction value of existing structure before	-	-	-
Built-up area before	2.15 ha 11.21 %	8.43 ha 25.39 %	0.65 ha 11.19 %
Built-up area after (planned)	4.38 ha 22.83 %	7.69 ha 23.19 %	1.06 ha 18.28 %
Built-up area after (realisation)	3.51 ha 18.30 %	7.26 ha 21.87 %	- -
Housing units density	83 flats/ha	82 flats/ha	68 flats/ha
Population density	250 inh./ha	246 inh./ha	206 inh./ha
Diversity of new structure	+	+	+
Social housing programme			
CSHCS	+	+	+
Total number of flats	1,586	2,733	400
Spatial and urban planning documentation changes			
Master plan – changes in land use on the site	+	+	+
Master plan – changes in land use on immediate vicinity	+	+	+
Relation to the surrounding area			
Consolidation of surrounding area	+	-	-
Benefit for surrounding area	+	+	+

Land use and public transport before and after transformation

Two selected areas were used for special purposes – military complex and military warehouse, whereas one was used for industrial purposes. One of the areas also contained an area of different use – sport and recreation (karting centre). All three areas were enclosed by a fence and available solely to specific users. The areas in question were accessible from the main traffic development axis. Before the transformation, only one area (Špansko Oranice) had a good traffic connection via public transport – bus lines.

After the structural and functional transformation, these areas became multifunctional, with emphasis on residential construction. Two housing developments are a combination of residential use and mixed, predominantly residential use, whereas one is of exclusively residential use. Ground floors of residential buildings in all three selected areas contain a certain amount of space used for commercial and service purposes. All three housing developments either contain or plan to construct facilities for public and social use, primarily for the residents, as well as for the residents of neighbouring housing developments in need of such amenities. In two of the housing developments, there are plans for the construction of buildings intended for business purposes, but they are yet to be realised. All new housing developments contain a large portion of public landscaped areas and are characterized by landscaping design, which significantly improves the quality of life. The proportion of areas designated for infrastructure and pedestrian-only areas and squares clearly demonstrates that the selected areas are equipped with public amenities of the highest standards. All three examples of housing developments feature well-balanced different uses of space.

For the purposes of the new housing development in one of the selected areas (Novi Jelkovec), new bus lines were introduced connecting it with three main bus terminals. According to the current spatial planning documentation, for one of the selected areas (Špansko Oranice) there are plans to construct a new system of public transport – light rail, to complement the existing tram network and provide better access from a broader city area.

Structural transformation

The analysis of structure of the selected transformed areas shows that all three areas were already built up. In one of the area construction began as early as the 1940s, whereas in the other two it began in the late 1950s and early 1960s. The built structures in selected areas were rationally constructed, functional, and orthogonal. The structures in all three areas were without any aesthetic or construction value (barracks, production plants, warehouses etc.) and were thus suitable for complete removal, to enable further structural and functional transformation.

After the structural and functional transformation, the selected areas now feature diverse structures. Novi Jelkovec is an area dominated by various structures ranging from dense city block, rectangular-layout buildings, and small square-layout "towers". The Sopnica South area is in the immediate vicinity and features rectangular and square-shaped buildings located in landscaped areas. Špansko Oranice features structures with rectangular layouts and residential buildings of specific typology, transitioning from classic residential buildings with verticals, to buildings with galleries. Buildings in all three areas were rationally constructed, functional, and orthogonal. When compared based on their previous use, two areas previously used for military purposes now have a larger footprint than the area previously used

for industrial purposes. All three selected areas have achieved or plan on achieving population density appropriate for collective residential housing.

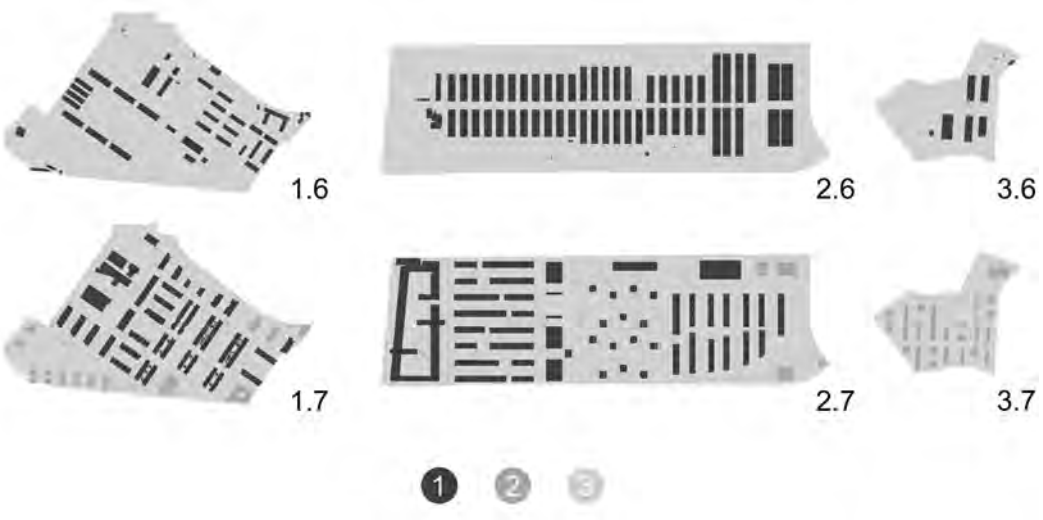

Figure 4: Comparative illustrations of selected areas – built structure before and after transformation.
Špansko-Oranice: 1.6 built structure before transformation, 1.7 built structure after transformation
Novi Jelkovec: 2.6 built structure before transformation, 2.7 built structure after transformation
Sopnica South: 3.6 built structure before transformation, 3.7 built structure after transformation
(1- built structure, 2- structure planned for building, 3- selected area)

Social housing programme

All three housing developments were planned and designed according to the Croatian Social Housing Construction Scheme, enabling the construction of a complete housing development, controlled quality construction, and socially integrated housing and living conditions. In addition, by applying this social housing program, flats in the analysed housing developments were more available to a greater number of potential buyers who could not afford flats in the then market value since it was at least one third higher than the price of a flat built according to the CSHC. The highest number of newly built flats was in Novi Jelkovec (2,733), then in Špansko Oranice (1,586), and the least in Sopnica Jug (400 flats were planned).

Spatial and Urban Planning Documentation Changes

A comparative analysis of selected areas from the 2003 Master plan, and the 2013 amendments to the Master plan, clearly shows that two areas underwent a change in use. The detailed urban plan designated the Špansko Oranice area for public and social use, whereas the purpose of the Sopnica South area was converted from special use to mixed, predominantly residential use. The use of the Novi Jelkovec area remained unchanged.

In the immediate vicinity, West of the Sopnica South area, the protective green area has been converted into mixed use area to enable the further construction expansion. North of the Špansko Oranice area, i.e. the Vrapčak creek, the Pavlenski put residential complex was built which uses the accompanying

facilities of Španska Oranice housing development. South-East of the Novi Jelkovec area, the protective green area has been converted to economic – business use to accommodate further building expansion intended for business purposes.

Relation to the surrounding area

The Novi Jelkovec area is separated from the surrounding housing development – by protective green area in the East and by existing economic construction in the South. Due to its specific position and isolation within the economic zone, the area is mostly its facility-oriented. Due to a well-defined surrounding urban structure, and the use of pedestrian pathway networks and landscaped areas, Španska Oranice is integrated into and connected to a wider area. The Sopnica South area is a direct extension of the existing housing construction, thus forming a larger unit whose residents could use the facilities of the newly-planned housing development and further stimulate the development of the area. All three housing developments favourably affect the surrounding area with its urban structure and facilities. The wider urban context of Španska Oranice is consolidated, while the other two examples are the non-consolidated city areas.

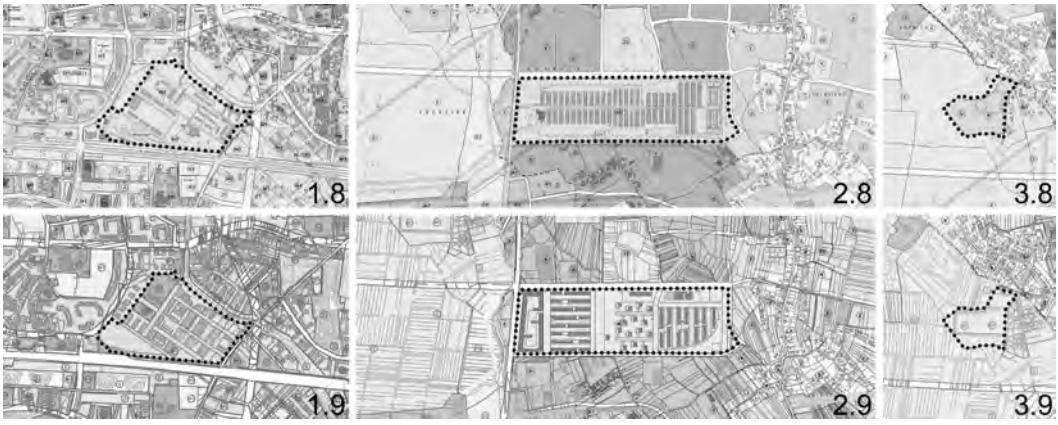

Figure 5: Comparative illustrations of selected areas – Master plan before and after transformation.
Španska-Oranice: 1.8 Zagreb Master plan (2003), 1.9 Zagreb Master plan (2013)
Novi Jelkovec: 2.8 Zagreb and Sesvete Master plan (2003), 2.9 Zagreb and Sesvete Master plan (2013)
Sopnica South: 3.8 Zagreb and Sesvete Master plan (2003), 3.9 Zagreb and Sesvete Master plan (2013)

7 CONCLUSION

City planning policy for structural and functional transformation of Zagreb brownfield areas on the city outskirts into housing developments with all the accompanying facilities and a good balance between the various uses of space contributed to integration of the area into the wider context and to the overall quality of life. One of the important integration factors is the use of space in the immediate vicinity of specific area. Planning and construction of a housing development in predominantly economic zone (Novi Jelkovec) leads to a much longer process of integration into the surrounding context than in the case of integration in the context of a residential and mixed-use area where the structure is already partially or almost completely defined (Španska Oranice).

Construction of new housing developments stimulates the introduction of new public transport lines (Novi Jelkovec) and the development of new public transport systems (Španski Oranice), which contributes to space networking, creates dynamic mobility and stimulates the use of public transport. Design and construction of housing developments based on organized programmes, such as the CSHCS, enables qualitative outcomes in urban planning, architectural and construction terms, allows rapid and integral implementation of large-scale interventions in the area and provides socially integrated housing and living conditions.

Transformation of the area does not necessarily lead to an increase in the percentage of the built structure. It primarily depends on the land use and facilities in the selected area before and after the transformation (Novi Jelkovec).

Table 3: Relation between selected themes of Aalborg Commitments and elements of comparative analysis.

Selected themes of *Aalborg Commitments* with their elements	Elements of comparative analysis					
	Planning and realisation	Land use and public transport before and after transformation	Structural transformation	Social housing programme	Spatial and urban planning documentation changes	Relation to the surrounding area
PLANNING AND DESIGN						
re-use and regenerate derelict or disadvantaged areas	+	+	+			
avoid urban sprawl by achieving appropriate urban densities and prioritising brownfield site over greenfield site development	+		+			
ensure the mixed use of buildings and developments with a good balance of jobs, housing and services (giving priority to residential use in city centres)		+			+	+
apply requirements for sustainable design and construction and promote high-quality architecture and building technologies	+		+	+		
BETTER MOBILITY						
increase the share of journeys made by public transport, on foot and by bicycle		+				+
SOCIAL EQUITY AND JUSTICE						
secure good quality and socially integrated housing and living conditions	+	+	+	+	+	+

Areas that were once monofunctional, enclosed and inaccessible due to specific use have become, as a result of transformation based on effective city planning policy, comprehensive urban planning and design, multifunctional, physically open and accessible to users of the surrounding area. They represent a generator of development in the wider context which can be seen from the changes in their immediate vicinity (construction of Pavlenski put residential complex which uses the accompanying facilities of Španско Oranice housing development; conversion of the protective green area into mixed use area in order to enable the further building expansion towards the Sopnica South area; conversion of the protective green area into economic – business use to accommodate further building expansion South-East of the Novi Jelkovec area).

Comprehensive transformation of Zagreb brownfields into housing developments contributes to sustainable development on the local level, thus fulfilling Aalborg Commitments - especially theme 5 *Planning and Design*, theme 6 - *Better mobility* and theme 9 - *Social equity and justice* (Table 3).

The effects of the transformation of Zagreb brownfields into housing developments show results of an action on the local level that have multiple positive impacts and benefits in the wider spatial context on the path of achieving sustainable development.

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