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# SPATIAL INTEGRATION LEVEL OF HOUSING COMPLEX WITH THE CITY STRUCTURE. CASE OF RZESZÓW

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A b s t r a c t

In many Polish cities, the aspect of integration of urban structures is underestimated and new investments are not properly connected with the city. This article presents the results of a study with the main objective of assessing the level of spatial integration of residential areas. The study was carried out in several stages; it was based on classical and qualitative methods used in urban planning. The first stages of the research procedure focused on literature studies, a review of the area, and a diagnosis of the current state of three different housing complexes in Rzeszów. In subsequent stages, a set of criteria was created to determine the spatial integration level (SIL) of the residential developments under analysis. Research and application objectives were achieved by creating a clear and easily reproducible method to evaluate the level of spatial integration of residential areas. The research demonstrates the validity of a holistic approach to determining the scope of planning activities while based on a set of specific criteria that address integration issues.

Keywords: integration, spatial integration level, housing estates, Rzeszów

## 1. INTRODUCTION

Each city is a non-uniform system that undergoes a dynamic transformation, which is reflected in the physiognomy of its functional spatial structure [15]. Urbanization is both a process of transformation of existing tissue and spatial expansion that significantly impacts environmental resources and the condition of

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society. A city, despite the numerous crises and processes that affect it, can achieve a degree of stability and agreement [7]. To keep a city, which can be compared to a complicated organism, in balance, it is necessary that there be processes that integrate new structures with existing ones from the various stages of development of the city.

The function of the place of residence has been a basic function since the beginning of the history of cities. It is reflected in the highest share of residential development in the spatial structure of a city. It can take different forms, depending on a number of factors, such as location in a particular region of the world, the natural environment, culture, or location in the city. The nature of housing changes depending on the distance from the city centre: the further away from the city centre, the less integrated, dense, and compact the urban fabric becomes, gradually shifting to single-family and rural housing both within and outside the city's administrative boundaries. The advantages of residential development are diverse; the most basic are functional diversity, access to social infrastructure and services, access to recreation, and contact with nature. In all the zones of residential complexes, there are spaces and functions, as well as relations between buildings and social and public spaces. These influence quality of life [17].

The social and urban transformation process in postsocialist cities differs from that of capitalist cities [9]. In recent decades, housing construction (done mainly by developers and private capital) has been the dominant model for meeting the housing needs of Poles. The modernist concept of segregation of functions in the city is still well established in urban planning practice, although its application results in many dysfunctions of spatial and social nature [3]. Unfortunately, a planning system that is inadequate to the new political situation after 1989 is still in force, resulting in spontaneous implementation of housing substance, lack of regulations on optimal formation, and integration of implementation of new spatial-functional assumptions.

In a holistic approach, the need to create a high-quality residential environment, not only for individual housing developments, is not adequately rooted in public awareness or among city managers. On the one hand, it should be noted that formal solutions of residential architecture usually are on a satisfactory level; on the other hand, far too seldom is residential development properly integrated and constitutes an integrated element of the urban ecosystem. A prime example of urban disintegration is the fencing of new housing developments, which was only popular until recently. Other examples leading to the lack of cohesion and integration of the city are excessive densification, a deficit of public space and social infrastructure, a lack of greenery or domination of pavements, these types of solutions serve neither the inhabitants nor the urban system, giving rise to numerous pathologies, such as, for example, heat islands, a lack of

resistance to climatic anomalies, up to lowering the physical and mental health condition of city dwellers [10].

## 2. GENERAL OVERVIEW OF LITERATURE ON THE ISSUE

The starting point for the discussion of spatial structure integration will be an explanation of the very notion of ‘integration’. According to the definition featured in the Polish language dictionary PWN [14], it is 'a process in which a whole is made up of multiple parts'. In the definition of integration understood as a continuous, uncompleted process, emphasis is placed on creating a structure that consists of numerous components. In other words, integration is a dynamic process of the combination of elementary parts that are characterized by a capacity to form relations and links between each other, thus forming a larger whole. Integration understood as such is an excellent fit to describe urban development, which is also a continuous process with a dynamic that changes over time. Urbanization processes lead to the crystallisation of a city’s functio-spatial structure via the harmonization, incorporation, absorption, and integration of new elements and layers with existing ones.

The concept of integration of urban space can be found in various thematic areas of scientific publications, but due to the scope, only the most important positions devoted to urban planning and spatial planning will be presented in this paper. The issue of integration usually appears as one of many threads that are mentioned when analysing other urban processes such as revitalisation, synergy, transformation, programming, and steering of urban development.

Zuziak points out the differences between synergy and urban integration by performing extensive theoretical considerations at a high substantive level while synthesizing and generalizing [28]. His attention is directed to the problems of operational urbanism, urban development control systems, and spatial policy. He states that integration is one of the processes initiated in the city, the additional effect of which is often synergistic. He understands urban integration as a desirable action that induces a synergistic effect in response to signs of disintegration of urban structures, particularly visible in Polish cities. Unfortunately, urban development strategies usually focus on individual strategic projects, even though the links between them are relatively weak, limiting the possibility of integrating them and obtaining synergistic effects.

On the other hand, from the perspective of an architect-practitioner, Wrana proposes an authorial method of spatial integration of the structure of Lublin [24]. Its main goal is to achieve a compact fabric and composition of the public space network. The author proposes the creation of an "integrative architecture" which is about locating new single investments appearing in the structure of the whole city. These will improve its image and help the city regain its cohesion and

integrity. Szczerek's monograph is another interesting publication on the urban revitalisation of large-panel estates in Kraków [22]. Although the theme of urban integration is not as articulated as in the two previous publications, the problem of merging disintegrated housing areas that are the legacy of socialism is analysed quite extensively. Szczerek sees a special role in the process of revitalisation of dysfunctional blocks of flats in the merging (implicitly integrating) of public spaces inside the housing estates and connecting them into a network system at the level of the whole city.

Two English books are important publications on the integration of urban space. The first book edited by Haas is important, as it contains a great number of guidelines and design solutions in the spirit of New Urbanism [4]. These aim to shape traditional spatial forms that are friendly to all users. The transformation and integration of fragmented spatial structures in the spirit of New Urbanism is supposed to be a recipe for the revitalisation of cities, as well as for stopping the uncontrollable sprawl of suburbs [4].

In an equally comprehensive work, Boelens elaborates on the problem of the paradigm shift in urban planning that became entrenched in the 20th century [1]. The author criticises the stereotypical approach to the urban planning process controlled by the state system. It is inflexible and inefficient, which is confirmed by fragmentation at many levels, including spatial, social, cultural, and political. He pays particular attention to the need to reintegrate urban structures, but from a different perspective than before, that is, from the outside to the inside (from the general to the specific). He appreciates the search for alternative and proactive methods for creating visions for urban development. The author analyses experimental case studies on specific urban planning and planning practices such as in South Limburg in the Netherlands or in Buenos Aires and Sau Paulo. The publication contains highly suggestive and inspiring diagrams and graphics that illustrate directions for the integration of dispersed urban structures [1].

Studies on the spatial structure of cities are characterised by a very well-developed theoretical basis and a wide range of topics. This was conditioned by the multidimensional and complex process of urban spatial development, manifested by transformations of their spatial layout, diversity of functions, and territorial expansion. Therefore, the issue of the spatial structure of the city is of interest to many scientific disciplines. Taking into account the phenomena of layering and development of urban spatial layouts and the evolution of their morphology is reflected in multidisciplinary research [12]. Existing studies on the spatial structure of cities focus on the development of structures and monocentric, polycentric, clusters, or networks [16]. In the Polish literature, the issue of shaping spatial structures, including residential and public spaces, is also widely and richly represented. The topics of transformation and territorial expansion processes,

urban transformation and revitalisation, morphology, and multifaceted analyses of the quality of the residential environment are noteworthy [5, 7, 17,21,25].

According to Tołwiński, the main element that integrates a city is the composition of the urban environment, which "(…) coordinates, harmonizes and produces from factors and fragments a single compact organism, simple in its structure and legible in its uniform form" [23]. Korcelli, based on an analysis of functional layout concepts and models, concluded that the spatial structure of a city consists of a set of overlapping layouts, the most important being the places of residence, work, shopping, leisure, and social contact, which correspond to the essential spheres of human life and activity [8]. The mutual influence of these layouts creates the spatial form of a city, and changing one leads to the transformation of the others. From a structural perspective, a city can be described as the layout of existing and new structures. Even when a new development layout is placed in the middle of undeveloped land, it will generate significant development potential, as it leads to further integration of the urban form. Therefore, when investigating the relations between the latest urban structures and existing ones, we can expand our knowledge of the trajectories and layouts of development in an entire city [6].

The analysis of the state of the research allows the following conclusions to be drawn: the integration of urban structures is important both at the level of new investments and revitalisation activities, the built environment and its integration is a research topic which is dealt with by many research centres (their number is constantly growing). Integration is a topic that is taken up in studies on urban transformation, including revitalisation, but the problem is on the margins of consideration. In this case, it is difficult to identify the integration process with the revitalisation process. Determining the level of integration makes it possible to specify in which areas restructuring activities are desirable, which can be compared to revitalisation activities, but they do not refer to areas in a state of degradation or crisis. In contrast, they refer to new investments, expansion, or even construction. There is a lack of studies on the systemic approach to integration issues. The research presented on the level of integration fills a research gap. It consists of a holistic approach to the processes of integrating spatial structures, as well as the creation of a method for assessing the spatial integration level (SIL) of residential areas.

## 3. MATERIALS AND METHODS

The main objective of this article is to determine the level of integration of new residential developments in Rzeszów. The research procedure had several stages. It started with literature studies, identification, and analysis of current status, primarily spatial, but also infrastructural, cultural, and social. Methods and

techniques considered traditional for the academic discipline of architecture and urban planning were used in this study and included spatial analyses, field studies, and a review of the literature. A site visit was conducted and focused on the spatial location of the development, the layout, composition, architecture, the quality of the public spaces and the type of greenery, the access to mass transport and access to services. All this was investigated in the context of links with the surroundings.

The substantive scope of the notion of urban spatial structure integration can cover a wide range of aspects. The focus of this paper is the analysis of the relations of an area with the structure of the entire city in the following categories:

- urban composition;
- functions, type, and character of development;
- transport layout;
- public spaces;
- green areas.

In the specific relationship between the elementary spatial forms and the system integrated in the geometry of the entire city's layout, the urban composition plays a key role. The functioning of settlements can be considered proper when they fulfil the conditions for a healthy and attractive residential environment and are an integral part of the city's structure. Integrity means belonging to the urban system on appropriate levels and establishing appropriate relations with the rest of the city. Public space is an element that integrates the urban structure. Well-designed public spaces and greenery systems integrate them and harmonise the structure of the entire city [26]. It is therefore important to integrate the settlement with its surroundings, green and recreational spaces, and to provide convenient links to key public spaces such as the city centre or neighboring districts. Equally important is the support of mass communication, which allows access to other programmes in the city. A better consistency of the urban organism is a result of the density and efficiency of communication links. In improving these links, public transport and the availability of different means of transport are of primary importance.

Qualitative research in urban planning and architecture was used to assess the spatial integration level (SIL). Qualitative assessment made it possible to find the strengths and weaknesses of an area and plan a transformation process that would rationally improve its quality. Qualitative assessments of the built environment play an important role not only in improving the quality of life of residents, but also in improving the quality of planning and design and allowing the development of environmental knowledge and comparison of different areas. Qualitative research was carried out with a particular focus on specific problems and evaluation criteria, in this case, the level of spatial integration. After covering the necessary literature, qualitative research criteria were adopted to determine SIL. These were focused on the physical characteristics and functions of the study

area. SIL is established according to five main categories (Table 1). Each category was divided into a set of several to a dozen basic features (41 in total).

The created set of criteria systematised the method for determining the SIL of each of the selected settlements. The tool used at this stage of the research is a four-level assessment scale based on the rating scale used in Landscape and Visual Impact Assessment studies [13]. In the next stage, a matrix with partial and overall integration levels was created for the settlements studied (Table 1). The integration level is calculated as the arithmetic mean of the points awarded for each of the detailed features in each separate category and can range from 0 to 3 points. The general rationale for assigning a value to a particular detailed characteristic was as follows:

- 0 point (negligible) – lack or insignificant level of characteristics that characterise the examined area in the considered criterion,
- 1 point (moderate) – a sufficient level of specific features which determine the level of integration is noticeable, but require a significant strengthening;
- 2 points (substantial) – good level of a set of qualities which influence the level of integration to a fairly good degree, but it is possible and even advisable to strengthen or develop them,
- 3 points (high) – traits that indicate a very good level of integration in a specific category. No intervention is required in the short and medium term.

Based on the earlier stages of the research procedure and expert engineering knowledge, scores were adopted for individual special characteristics grouped into five categories. For each category, a partial level of integration was calculated as an arithmetic mean. The final level of integration was also calculated as the arithmetic mean of the five partial levels of integration. Three sites were chosen for analysis, determined by their representativeness. Three diverse projects that differed in terms of location, construction time, architecture, and spatial layout were selected: 1. Słoneczny Stok; 2. Staromieście Ogrody; 3. Carpatia.

The study is a development and continuation of the research conducted for the Rzeszów City Development Bureau. The research project created a model interpretation of the spatial structure of Rzeszów in terms of structural elements such as nodes and corridors. The project also included an assessment of the development potential of the identified nodes and corridors [11]. Statistical data were referenced, but only to present general tendencies in housing resources at the provincial and city level. Unfortunately, spatial data were not available for smaller morphological units, which contributes to a lack of in-depth analyses using GIS tools. Reflecting on urban area integration also does not feature demographic, social, and economic phenomena, but the article is a starting point for further

studies on the subject matter associated with the formation of strong links between new projects and their respective cities.

## 4. HOUSING STRUCTURE IN RZESZÓW: OVERALL STATUS

Rzeszów is the largest city in south-eastern Poland, the capital of the Subcarpathian Voivodeship and the heart of the Rzeszów Functional Area. The beginnings of the dynamic development of the city and its industrial traditions date back to the interwar period and the construction of the Central Industrial Region [18]. Rzeszów is the seat of municipal and voivodeship governments, as well as of governmental and judiciary institutions. It is an economic, academic, cultural and leisure center of south-east Poland. It acts as a key center for the aviation, tech, chemical and construction industries, as well as commerce [20]. One crucial element from the standpoint of the subject matter under discussion is that Rzeszów belongs to the few Polish cities that have a consistently positive migration balance, alongside Warsaw, Kraków, and Wrocław. The clear influx of people from neighboring territories to Rzeszów consists mainly of young people who seek an attractive place to live and work, significantly improving the structure of the general ageing population [2]. All this is expected to stimulate the expansion of housing development.

The housing market in Rzeszów is dynamically developing and maintains consistent growth (Fig. 1). Despite this, the number of apartment units and the housing area per resident were observed to be lower than in the largest cities of Poland. Rzeszów is expected to catch up in this regard by increasing the amount of land assigned for housing development [2]. This is also indicated by the general situation on the housing market in Poland. According to GUS data, the number of residential buildings opened for use in 2020 increased by 7.7% compared to the year before. In Poland, the housing market has performed very well in the face of the pandemic [29].

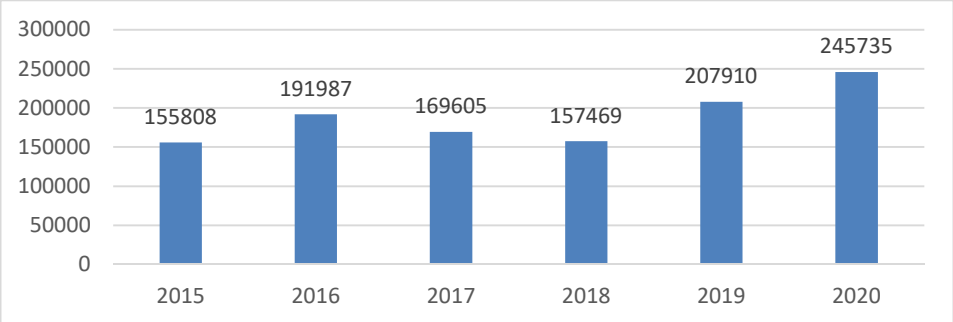


Fig. 1. Floor area of the usable residential unit made available for use in Rzeszów [m²], original work based on GUS data [30]

In 2020, the number of residential buildings made available for use in Rzeszów was 61, and increased relative to 2019, when 56 such buildings were built. The highest share in the overall stock of apartment units made available for use since 2015 is made up of units in new multifamily buildings and amounts to around 80%. The remaining 20% of the units available for use were part of single-family development (with the exception of 2018, when this share was 30% [30]. Interesting is that the largest number of apartment units sold in all Rzeszów Powiat was within the usable floor area range of 40-60 m2. Such units made up almost half of the total number of apartments. Larger units, between 60 and 80 $m^2$, came second. They amounted to around 30% of the overall stock. The lowest shares were those of the smallest units, up to 40 $m^2$ (around 15%), and the largest units, above 80 $m^2$ (around 8%) (Fig. 2).

The high density urban development in Rzeszów consists of three main components: historical development, which is a clearly spatially distinct area of the old town of the city featuring dense town blocks, and housing estates that consist of detached development (with service buildings) that located on the periphery of the old town development [11]. The main housing estates in Rzeszów include Nowe Miasto, Kmity, Baranówka, Grota Roweckiego, Tysiąclecia, Piastów, Dąbrowskiego, Pobitno, Krakowska-Południe, Andersa. Low-density development was found to predominate in the following estates: Staromieście, Miłocin, Przybyszówka, Staroniwa, Zwięczyca, Zalesie, Słocina, Wilkowyja, Załęże, Drabinianka, Bzianka, Biała.

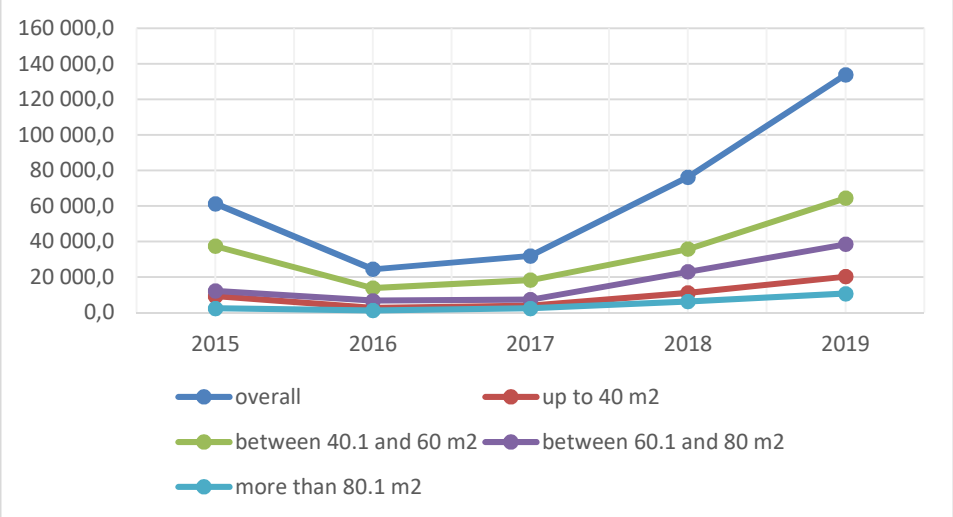


Fig. 2. Usable floor area of apartment units sold in Rzeszów Powiat, primary market [$m^2$], data for 2020 were unavailable at the time of writing, original work based on GUS data [30]

# 5. CHARACTERISTICS OF SELECTED HOUSING DEVELOPMENTS AND ASSESSMENT OF THEIR SPATIAL INTEGRATION LEVEL (SIL)

## 5.1. Słoneczny Stok

The Słoneczny Stok housing complex is located in the eastern part of Rzeszów and is a part of the Przybyszówka housing estate, between the streets of Błogosławionej Karoliny and Iwonicka, in an area where housing construction has intensified in recent years due to significant reserves of undeveloped land and an attractive location. The distance between Słoneczny Stok and the historical city center is approximately 5 km (60 minutes on foot, 20 minutes on bicycle), with the S19 (Via Carpatia) expressway to the west of the complex. The expressway is not linked with Błogosławionej Karoliny Street.

The urban composition of this section of Przybyszówka can be described as freely distributed layouts of individual housing estates without clearly defined urban interiors. Błogosławionej Karoliny Street is a linear compositional element that integrates successively built real estate development projects from varying periods. This street is also a major link that integrates the compositionally diverse and distinctive development layouts with each other and with the central sections of the city. Two areas stand out through geometrically defined spatial layouts, in which buildings are organized concentrically around a quarter of a circle: one delineated by the arch of Biecka Street and the second, smaller one, delineated by Balgrodzka Street, whose meandering course integrates new and old development (Fig.3). Unfortunately, the course of Baligrodzka Street is not continued northward, which would potentially integrate Słoneczny Stok with single-family development along Ustrzycka Street. A significant territory occupied by allotment gardens between Wołyńska, Wyspiańskiego and Strzyżowska streets and the extensive grounds of the Staroniwa Military Shooting Range is a distinctive element of the urban composition around Słoneczny Stok. Unfortunately, these areas are not integrated into the layout of neighboring public spaces.

The entirety of the Przybyszówka estate features diverse development ranging from buildings in allotment gardens and row single-family houses to four- and five-story multi-family residential buildings, some even having twelve or more stories. Older blocks around the housing estate typically have four or five stories, but buildings with twelve stories began to appear more frequently. Single-family detached and row residential buildings are located primarily along Ustrzycka, Wadowicka, and Magurska streets and their access roads. From the south, Błogosławionej Karoliny Street is abutted by extensive and still undeveloped urban wasteland and fields. In terms of composition and height, it is difficult to find any deliberate concept of tying in with neighboring development,

which could result in an integration of the urban composition inside the housing estate and in a broader spatial context.

To the north of Błogosławionej Karoliny Street and towards the city center, the surroundings of Słoneczny Stok feature a very good programmatic offering in terms of social infrastructure and commercial premises. The immediate vicinity of the complex includes a primary school, a kindergarten, and a daycare. Another primary school and daycare are located about 900 m from the center. Here, on Iwonicka Street, there is also the "Włącznik" Community Center and a branch of the Voivodeship Public Library. There is an active sports club at a distance of around 700 m from Słoneczny Stok and features uncovered tennis courts. In addition, at a distance of around 1.2 km, there are a number of health centers and a church. In general, the ground floors of residential buildings in the area typically feature a variety of commercial premises (drugstores, small physicians' offices, restaurants, coffee shops). This diversity, saturation, and close proximity to commercial and retail uses, as well as educational facilities means that the area is functionally well integrated with its immediate surroundings.

Fig. 3. View of the development of the Słoneczny Stok housing complex on Błogosławionej Karoliny Street. Photo by A. Martyka.

All individual housing estates in the vicinity of Błogosławionej Karoliny Sreet display the highest degree of integration in terms of transport solutions, both in the context of internal links and those with the city center. Meanwhile, there is a complete lack of integration with other zones of the city. There are no roads and pedestrian connections. Vehicular transport, which was found to be the most

privileged, has at its disposal a very good and elaborate network of access roads and a significant number of parking lots near each housing block. A bicycle and pedestrian path was found to run only along the northern side of Błogosławionej Karoliny Street. One can also use a bicycle path to reach the Resovia Stadium. The area is also relatively well served by bus transport along Błogosławionej Karoliny Street (eight bus lines) and with a cul-de-sac towards the end of Iwonicka Street (two bus lines) [31]. The transport situation can potentially improve in the future after the construction of an overpass above the local railway, which is currently a spatial barrier that is difficult to cross. The new connection between Wyspiańskiego Street and Hoffmanowej Street is expected to significantly improve the integration of existing and newly built housing estates along Błogosławionej Karoliny Street with the city center using both public transport and pedestrian and bicycle circulation. The developed area along Błogosławionej Karoliny Street is well integrated with Krakowska Street via an elaborate road layout, while to the north the street grid is underdeveloped and there is no connection with Staroniwska Street.

There are no local activity centers that would integrate the social life of the local community within the housing complexes along Błogosławionej Karoliny Street. The space in front of the library and community center could potentially play such a role, but is currently occupied by an extensive parking lot. The smaller housing complexes are not fenced and the spaces between buildings are well landscaped and maintained. There are a considerable number of typical playgrounds. Along a waterway that is a tributary of the Przyrwa River, regulated with open work concrete slabs, whose escarpments are secured with a concrete railing, a park with a dearth of small trees and a pond was placed. There is no tall greenery in the developed area, so no additional shade is provided, and the urban heat island effect is not countered, which means that there are no elements that would integrate the greenery of the complexes to speak of. Currently, the urban greenery deficit is compensated for by allotment gardens, the firing range, and the extensive green areas located to the south.

## 5.2. Staromieście Ogrody

The Staromieście Ogrody housing complex is located in the northern part of Rzeszów, between Krogulskiego Street and Lubelska Street, which itself used to be the main road leading to the Rzeszów-Jasionka Airport. The complex is located at a distance of approximately 3.5 km from the historical center of Rzeszów and is the oldest among the cases under analysis, but has been successively extended to include additional town blocks.

The housing complex itself has a well-defined block-based composition and is organized along the directions set by the Lubelska and Krogulskiego streets,

which intersect at a right angle. To the west of Lubelska Street there is a low-rise plant development, also in an orthogonal layout, and further east there is the meandering bed of the Wisłok River, which forms a vivid spatial landmark and a major ecological corridor for both the city and the region overall. Unfortunately, the waterfront of the Wisłok River at the level of the complex is not accessible to residents. It is separated from the remainder of development by industrial zones. Further east of Wisłok there is a low-rise technical development, namely a thermal waste treatment plant and a wastewater treatment plant. To the south of Krogulskiego Street there is a patch of amorphously composed single-family residential development. Both Lubelska and Krogulskiego streets do not form urban interiors typical of a city street, as the development along them is significantly set back from their respective carriageways. Lubelska Street merely integrates the north-eastern and central zones of the city in terms of composition and transport, while to the north it links with the Rzeszów-Jasionka Airport.

The development consists predominantly of four-story buildings with usable attics, which form legible town blocks (Fig. 4). Later development has continued this principle. Further to the north-west there are newer buildings of five and sometimes six stories. Their composition refers to earlier development, although it is not the product of some larger urban planning vision. The spatial layout results from the arrangement of the boundaries of the plots that were made available for development. This is why a new access road was not compositionally integrated with the development, as it runs at a different angle from the orientation of the buildings, which follows the boundaries of the plot.

Fig. 4. View of the development along Gromskiego Street. Photo by J. Figurska-Dudek

The areas in the vicinity of Staromieście Ogrody feature highly diverse functions, ranging from some that cause nuisance, such as a wastewater treatment

plant, a thermal waste treatment plant, or a heat and power plant, as well as manufacturing and storage facilities, to eco-friendly ones such as allotment gardens and low-density housing. In terms of social infrastructure, one of the residential buildings features a privately owned kindergarten, a branch of the Voivodeship and Municipal Public Library, a private language school, and doctor offices. The closest public school and kindergarten are located at a distance of around 1 km, to the south-east of Krogulskiego Street, amidst a single-family housing development. There is a large network of grocery stores near the complex. This is why it can be stated that the area is internally well-integrated in terms of function.

In terms of transport, the complex is very well integrated with other areas of Rzeszów. Residents have access to very good public transport and cycling links. Along Lubelska and Krogulskiego streets there are bus stops served by ten bus lines and one bus line, respectively. Bicycle and pedestrian paths are on both sides of these streets. The nearest planned stop of the Subcarpathian Rzeszów-North Commuter Rail is at a distance of around 1.2 km (around 20 minutes on foot and 7 minutes on bicycle) [31]. The complex features a considerable number of parking spaces. They are located along access roads, wherever possible, as dictated by road safety. Interestingly, the layout of the internal roads is prepared for an extension of development in the city area.

One of the strengths of the complex is proximity to some family-run allotment gardens. Due to the changing spatial policy, there is a chance that they will not be redeveloped in the future. There is no local center with a public space in the complex, but there is potential to activate community life in the form of the library branch. Landscaped semipublic spaces are within housing blocks, typically with a paved square in the center. There are no tall trees between the blocks, while those on neighboring undeveloped plots and the area of the allotment gardens compensate for this to a degree. There is a playground with standard equipment and a lack of greenery, on a fenced-off site, directly near a complex of parking spaces along an access road. Public space, including green areas on the estate, shows a degree of integration both within the estate and in connection with nearby areas, primarily because there is a lack of comfortable and safe pedestrian paths, leisure areas, and social spaces. Areas that could act as such, especially directly near building entrances, are occupied by parking lots. Reorganization and improvement of the continuity of pedestrian circulation spaces and the liquidation of even a couple of parking spaces at key points could significantly enhance the quality of the housing environment.

### 5.3. Carpatia

This complex differs significantly from the previous two cases. At the time of writing this article, it was still under construction, on a site in the periphery of the city, in an agricultural area. It is located to the south east of the city, in the administrative limits of the Zwięczyca housing estate, near the 9 Dywizji Piechoty Voivodeship Road, which is a completed fragment of the planned southern ring road of Rzeszów. The distance from the city center, measured along a straight line, is around 5.5 km.

In terms of composition, function, and continuity of public space, the project is expected to not be integrated with the surroundings, as its site is surrounded by extensive fields in a layout, with granular plots typical of the region, with sporadic instances of single-family housing development. The territory of the housing complex is directly adjacent to a single-family building with an agricultural section. Further away (around 1 km), from the north and south, there is single-family development with a loose layout that is crystallised along the road network formed by meanderin Staroniwska, Zawiszy Czarnego, and Karkonoska streets, as well as their access roads. From the west, the spatial composition is predominated by orthogonal low-rise industrial and storage development organized along Przemysłowa Street. The vicinity of the housing complex also features the Rzeszów Zwięczyca municipal cemetery—at a distance of around 400 m.

The Carpatia housing complex is to consist of two high-rise, seventeen-story buildings, directly adjacent to the existing road, while deeper inside the plot, there will be several detached seven- and five-story buildings (Fig. 5). The area is directly integrated with the 9 Dywizji Piechoty voivodeship road and thus with the Via Carpatia (S19). This means that residents will be able to easily leave the city limits. When one analyses the transport layout in the context of integration with other parts of the city, it can be observed that there are no other road links with the center and the neighboring developed areas of the Staroniwa, Zawiszy Czarnego or Zwięczyca housing estates. In terms of public transport, the situation of local residents will also be far from comfortable. The closest stop, served by two bus lines, is at a distance of 1.2 km. The closest planned stop of the Subcarpathian Rzeszów-South commuter rail is located at a distance of about 2.5 km [31].

Fig. 5. View of the first high-rise building of the Carpatia housing complex that is being constructed. Photo by J. Figurska-Dudek

The promotional brochure for the housing complex indicates that the site around the planned development will include transport areas and parking lots located between the road and the areas in front of the two high-rise buildings, under a high-voltage overhead power line, and between lower buildings, in addition to paved paths and a rather large square. The complex is advertised as a place for active residents, which is probably why open-air gyms, sports pitches, and a bicycle path along the project site were planned. The path is to connect to an existing route along 9 Dywizji Piechoty Street.

Behind the rhythmically sited blocks of the complex, there will be a pitch/tennis court and a series of squares with playgrounds. What is interesting is that they will not be integrated with pedestrian paths and will be accessible by walking on a lawn. From the east, along the buildings, there will be a park with tall greenery, deep inside of which there will be a paved square. When investigating the integration of the various types of public spaces planned within the complex, signs of integration can be found in the arrangement of spaces 'in-between'. However, it is still a case of an unintegrated spatially and functionally complex, and the ground floors of its buildings will not feature any additional uses. The surroundings are attractive in landscape terms, as the complex is situated as if it were an island surrounded by green areas.

## 5.4. Assessment of the integration level of analysed settlements

The study has been summarised in a table that shows the evaluation of the individual characteristics of the selected areas (Table 1).

Table 1. Assessment of the spatial integration level of selected housing estates in Rzeszów by categories and basic features.

| CRITERIA DETERMINING THE LEVEL OF INTEGRATION | SPECIFIC FEATURES | ASSESSMENT | | |
|---|---|---|---|---|
| | | 1. Słoneczny Stok | 2. Staromieście Ogrody | 3. Carnatia |
| **urban composition** | reference and continuation of the estate's spatial layout to that of the neighbouring developments | 0 | 1 | 0 |
| | soundness of the geometry of the spatial system | 2 | 2 | 1 |
| | a spatial arrangement as part of an overall planning vision | 0 | 0 | 0 |
| | presence of compositional axes | 1 | 1 | 1 |
| | diversity of development structure — random or planned | 1 | 2 | 1 |
| | spatial order | 1 | 2 | 1 |
| | **arithmetic average** | 1 | 1,4 | 0,8 |
| **functional structure / mix-use** | saturation of the surroundings with education services | 3 | 2 | 0 |
| | saturation of the surroundings and the area with health facilities | 2 | 2 | 0 |
| | small and large commercial and service buildings | 3 | 3 | 0 |
| | Accessibility to services within a walking distance, attractiveness of use – everything is relatively close | 3 | 2 | 0 |
| | functions that trigger socialising | 2 | 1 | 0 |
| | presence of cultural facilities at the local and the city-wide level | 1 | 1 | 0 |
| | existence of a local centre strengthening social ties, sense of identification and identity of inhabitants | 1 | 1 | 0 |
| | **arithmetic average** | 2,14 | 1,71 | 0 |
| **public transport** | frequency and number of public transport stops | 2 | 2 | 1 |
| | quality and safety of access from the housing estate to public transport stops | 3 | 2 | 1 |
| | distance to public transport stops | 3 | 2 | 1 |

| | | | | |
|---|---|---|---|---|
| | variety of means of public transport: buses, minibuses, railways | 2 | 2 | 2 |
| | number and continuity of cycle paths within the neighbourhood | 2 | 2 | 2 |
| | number and continuity of cycle paths leading out of the area | 2 | 2 | 1 |
| | **arithmetic average** | 2 | 1,83 | 1,17 |
| **public space** | continuity of public space within the area | 2 | 1 | 0 |
| | continuity of public space beyond the settlement boundaries | 1 | 1 | 0 |
| | access to areas directly adjacent to the estate | 0 | 0 | 0 |
| | access to the city centre | 2 | 2 | 1 |
| | formal diversity of public space | 2 | 1 | 0 |
| | functional diversity of public space | 2 | 2 | 0 |
| | attractiveness of the architecture enclosing the public space | 1 | 1 | 1 |
| | arrangement, facilities and equipment 'for all' | 1 | 1 | 1 |
| | clarity of the hierarchy of spaces (private, social, public) | 2 | 2 | 1 |
| | clarity of the composition of public space | 1 | 2 | 1 |
| | elements that give the estate individual characteristics which are relatable for residents | 3 | 2 | 1 |
| | elements that give the estate its urban character | 2 | 1 | 0 |
| | **arithmetic average** | 1,62 | 1,31 | 0,54 |
| **green and recreational areas** | continuity of green areas within the area | 2 | 1 | 1 |
| | continuity of green areas beyond the settlement boundaries, connections to green corridors in the green system of the whole city | 2 | 1 | 2 |
| | presence of greenery in the area | 3 | 1 | 1 |
| | accessibility to green areas and water banks | 3 | 1 | 1 |
| | the way green areas are arranged | 2 | 1 | 0 |
| | level of maintenance of greenery | 2 | 1 | 0 |
| | formal greenery diversity | 1 | 1 | 1 |
| | functional greenery diversity | 2 | 1 | 0 |
| | amenities and use of green spaces - recreational functions | 1 | 1 | 0 |
| | the presence and quality of pedestrian routes in the green area | 2 | 1 | 0 |
| | arithmetic average | 2 | 1,1 | 0,6 |
| **Spatial Integration Level (SIL)** | | **1,75** | **1,47** | **0,62** |

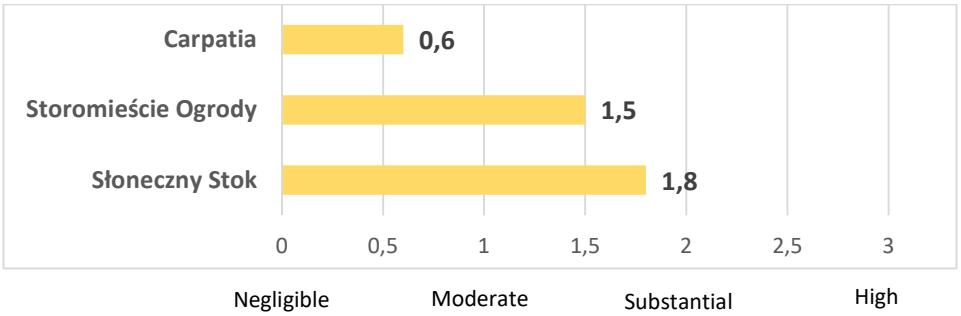


Fig. 6. Spatial Integration Level (SIL) of settlements in the context of its minimum and maximum value, by A. Martyka

The results of the study indicate that the Słoneczny Stok estate achieved the highest level of integration, reaching the substantial level (1.8 points) (Fig. 6.). On the other hand, the development of Staromieście Ogrody scored exactly half of all possible points (1.5) and was placed between Moderate and Substantial levels. Carpatia achieved the lowest level of integration with only 0.6 points between Negligible and Moderate; however, this level is not satisfactory. The construction of the integration index, which is composed of detailed features grouped into several categories, and their assessment make it possible to indicate in which specific areas the usage of city's spatial policy should be implemented in order to improve the quality of life of the residents in those settlements.

## 6. DISCUSSION AND CONCLSIONS

Research on the measurement of the level of spatial integration of urbanised areas covers the holistic issues by assessing the multifaceted process of integrating the defragmented spatial structure. Unfortunately, this causes high social, economic, and ecological costs. The results of the research and the matrix that presents the level of integration are a clear tool for the transformation of these areas and better integration with the spatial and functional structure of the city. Although Zuziak emphasizes the need for a strategic and holistic approach to the city's spatial policy, it is so general and synthetic that the interference of urban structures is left in the background without being analysed in more detail [27, 28]. On the other hand, the ideas of merging the city's structure with the implementation of point objects with public functions seem to be short-term ideas that do not prevent the chaotic overflow of development and disintegration and balancing of development. The most holistic approach is represented by urban revitalisation studies, but their field of interest are dysfunctional areas in a state of marked stagnation and degradation that require urgent remedial action. In a situation

where we are dealing with a fairly new residential area that is in good condition, such recommendations for remedial action tend to be downplayed.

Unfortunately, the model in which a planned housing complex interfaces with public space is not common. The housing complexes analysed in this study largely ignored the value of the surrounding spaces and generally outright prevented their formation. There was an absence of public space that would crystallise continuous layouts of urban spaces [19]. There was also a deficiency in suitable green areas. Greenery should be planned systemically so that it forms a network and penetrates the urban structure. Nature is an ecosystem that functions due to strong internal links, and not a loose collection of singular, isolated elements. Implementing public space and green space systems in Polish cities faces numerous obstacles. The varied ownership structure of land, an inconsistent planning system, and scattered legislation hinder the formation of cohesive layouts that form an integral part of urban tissue. All of this contributes to poor quality housing environment and generates high social and economic cost. Therefore, a strategy of building a public space system, green infrastructure, and network transport systems with suitable development layouts should play an essential role in the integration of urban structures and development harmonization [25].

### 6.1. General conclusions

The spatial-functional analysis and the determination of the level of spatial integration allows a general conclusion to be drawn. The level of integration of the areas examined requires remedial action. When doing so, the correct development of buildings, uses, the street grid, and public and green spaces must be taken into account. Relations with the surroundings and dependencies between nearby areas are crucial (Fig. 7). The form of the town block can potentially be the best solution, as it allows the creation of public space, streets, squares, and green interiors while providing a basis for links between these spaces and integration with adjoining areas. A well-organized public space system, with proper hierarchy, aesthetics, and symbolism, integrates and harmonizes the structure of an entire city, while also integrating urban life. It is also an indicator of the quality of life in the city [16].

In terms of urban composition, relations should be established with the main development directions of the neighbouring areas. The clarity of the composition minimises the feeling of confusion and lack of orientation, prevents uncoordinated spilling over of the development, but also organises the hierarchy of public spaces. In shaping a higher level of integration, it is also important to educate (create new and strengthen existing) nodal public spaces and green spaces that would be part of the city system [11].

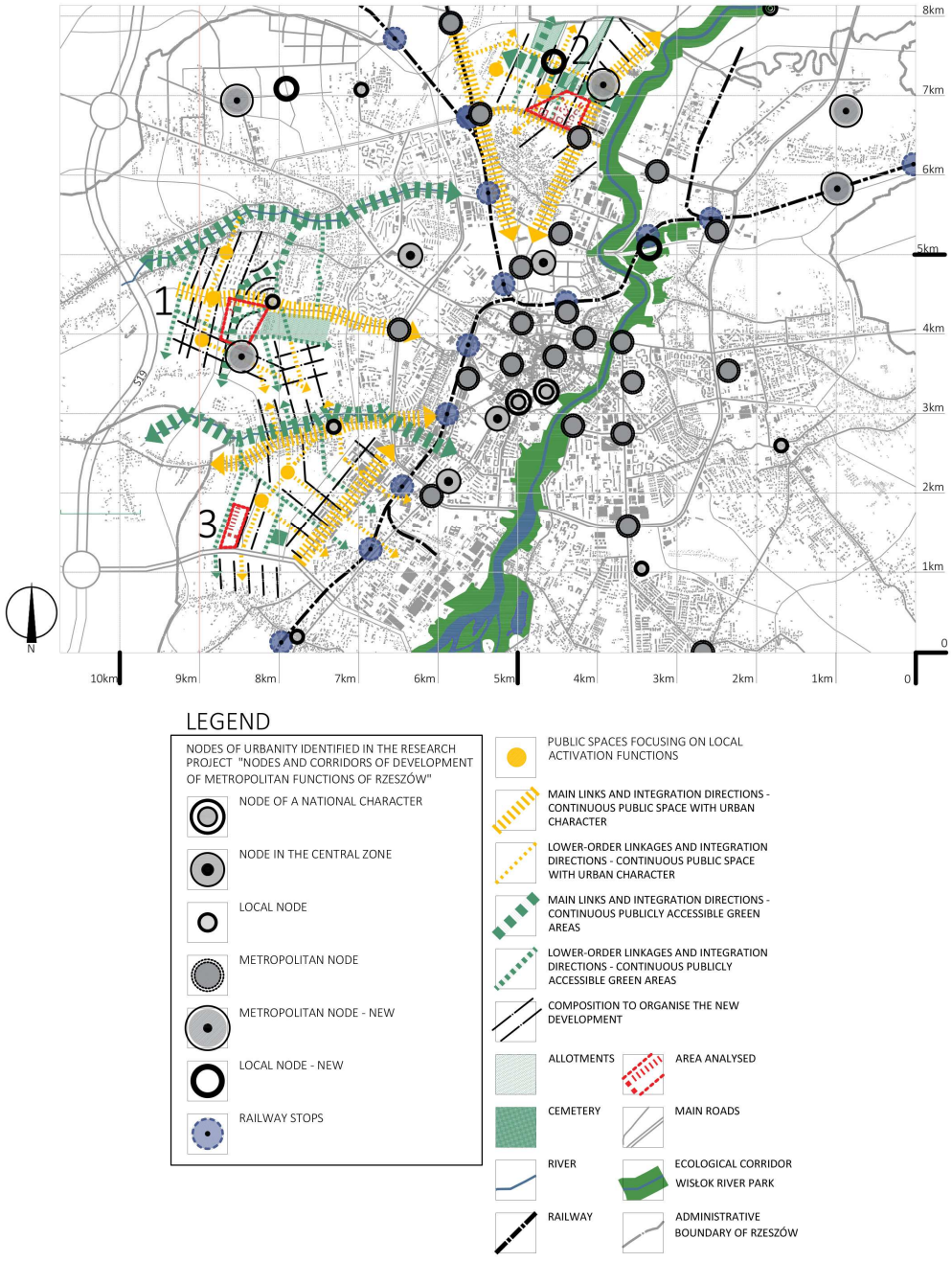


Fig. 7. Directions for the integration of the analysis housing complex with the city structure. 1 - Słoneczny Stok, 2 - Staromieście Ogrody, 3 – Carpatia, by A. Martyka

## 6.2. Extensive conclusions

A matrix presenting the points awarded to detailed features in each of the categories (Table 1) is the most complete and clear reference for the application of desirable actions. These would improve the level of spatial integration of each settlement. Only those features that were awarded 3 points do not require any corrective actions. On the other hand, features awarded 0 points require the most coordinated actions and a long-term spatial policy. That includes the preparation and implementation of new strategic importance planning studies such as the City Development Strategy and the Study of Conditions and Directions of Spatial Development.

The graphic diagrams are detailed proposals that show the main directions for integrating the area with the neighborhood and the city (Fig. 8,9,10). These are highly generalised spatial proposals in the form of an action plan and recommendations. These two should be incorporated into urban development projects and subsequently into local plans to increase the level of integration of the areas concerned.


Fig. 8. Directions for the integration of the analysed settlements with the city structure. 1 - Słoneczny Stok housing complex. Note: The legend is presented in Fig. 7, by A. Martyka

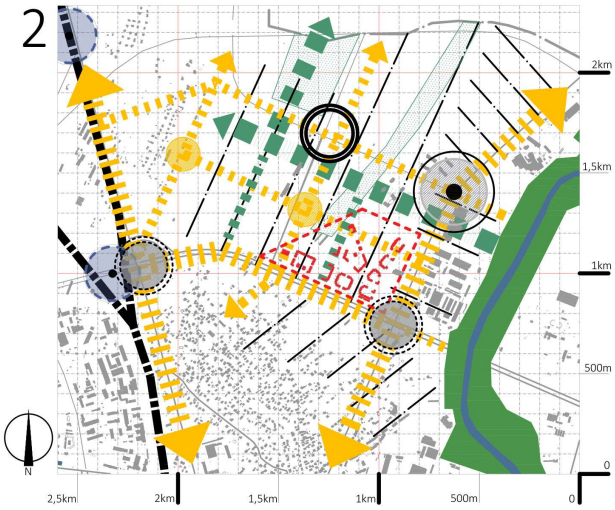


Fig. 9. Directions for the integration of the analysed settlements with the city structure. 2 - Staromieście Ogrody housing complex. Note: The legend is presented on Fig. 7, by A. Martyka


Fig. 10. Directions for the integration of the analysed settlements with the city structure. 3 - Carpatia housing complex. Note: The legend is presented on Fig. 7, by A. Martyka

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