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Evaluation of the Quality of Life. Case Studies of Modernist Housing Estates in Baluty, Lodz

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Abstract

While the theory of quality of life is primarily grounded in sociology and public health, urban form studies might contribute a vital ingredient. The condition and transformations of urban fabrics affect the well-being of local citizens. Spatial planning offers the potential to define norms that directly affect the cumulative nature of the development. Specifically, a noticeable shortage of research on Modernist housing estates makes decision-making challenging. Any neglect may lead to an irretrievable drop in living standards. Therefore, the ultimate goal of this study is to define the methods that can be applied to improve assessments of quality of life and liveability in Modernist structures.

Carrying out a morphometric analysis enables us to characterise urban form quantitatively. We apply a GIS-based multi-criteria analysis to spatial structures and patterns. The quantitative and qualitative spatial analyses are employed to recognise endogenous and exogenous features of urban form affecting the quality of life. First, we identify the essential elements of urban form to be evaluated, i.e. street, plot or building. Furthermore, we look at their unique constituents and the hierarchies to which they contribute. The physical characteristics of the indicated elements include their dimension, shape, volume, exposure and function. We combine planning indexes (FAR, BCR, GAR) following the SpaceMatrix method.

We apply the defined methods to comparatively evaluate modernist housing estates in the Bałuty district of Lodz, Poland. The need for such studies is urgent, as almost half of the city's residents live in blocks of flats. An examination of case studies enables us to reassess the methodology. From the point of view of planning practice, we recommend additional indexes to improve liveability.

Keyword: *quality of life; urban planning; urban form; morphometrics; housing estates*

Introduction

This study aims to define a quantitative method of improving assessments of quality of life (QoL) by focusing on urban physical studies. There is a strong need to increase liveability in Modernist structures, based on evidence-based attitudes in decision-making in the field of spatial planning, so the spatial scope of this study are two selected housing estates located in the Bałuty district of Lodz, Poland. Modernist housing estates are not as commonly discussed in terms of QoL as other types of estate.

An evaluation of QoL in modernist housing estates in Lodz is crucial in order to determine the liveability there, as the National Census of Population and Housing 2011 reveals that approximately half of the inhabitants of Lodz live in block housing estates (Szafrańska, 2010). Although they constitute a significant element of the housing stock of Lodz, there are no local plans of urban development being prepared that cover modernist housing estates. Specifically, a noticeable shortage of research and lack of spatial planning activities on modernist housing estates make decision-making challenging. This neglect may lead to an irretrievable drop in living standards.

This paper looks at efforts to carry our the explorative measurement of selected spatial features of the urban environment determining QoL in block housing estates. Carrying out such an assessment highlights spatial challenges and urban problems, as well as defining areas and ways in which liveability can be improved. This can then be translated into indexes contained in spatial planning documents (Berghauser Pont and Haupt 2009).

Background

Cities are the most complex human artefact and at the same time are adaptive systems. Finding solutions to measure and raise the living standards of a considerable number of dwellers, especially in modernist housing estates, is an urgent and crucial matter. Analysing the condition of the current physical form is essential in order to set spatial policy corresponding to the problems faced by cities. Quantifying the features of the urban environment is also vital when trying to understand what these numbers mean, how we can relate one to another, and how this affects people's liveability (Romice, Porta, and Feliciotti 2020).

While the theory of quality of Life is primarily grounded in sociology and public health, modernist urban form studies might contribute a vital ingredient to its scope from an urban morphology perspective. Typo-morphological research into the measurement of components of the built environment has been conducted by Meta Berghauser Pont (Berghauser Pont and Haupt 2009). Urban morphometrics as a systematic, measurable and comprehensive method for urban analysis to characterise and compare urban forms quantitatively has been used, among others, by Jacob Dibble (Dibble et al., 2015), Martin Fleischmann, Ombretta Romicea, Sergio Porta, Alessandra Feliciotti (Porta et al., 2011; Fleischmann, Romice and Porta, 2020; Romice, Porta and Feliciotti, 2020) and Alessandro Venerandi (Venerandi et al., 2017). Morphological measurements of physical characteristics of the built structure were also combined by Vitor Oliveira (Oliveira and Medeiros 2016; Oliveira, Medeiros, and Corgo 2020). They indicate the need for a quantitative spatial analysis for the purpose of the master planning process, or for its evaluation.

The subject of Lodz's spatial development in a morphological approach has been researched, among others, by Marek Koter (Koter, 1970), Małgorzata Hanzl (Hanzl, 2017; Hanzl et al., 2017) and Mariusz Lamprecht (Lamprecht, 2016, 2020), although they did not deal specifically with the areas of modernist block housing estates. The Polish scientists who have written about block housing estates, including modernist ones, as the subject of research include: Krzysztof Stefański, Błażej Ciarkowski (Stefański and Ciarkowski, 2018), Ewa Szafrańska (Szafrańska, 2010), Beata Komar (Komar 2014) and Barbara Szulczewska (Szulczewska, 2015).

There is an ongoing discussion about the need to identify and measure spatial and environmental dimensions to informed decisions to enhance the QoL of residents. The condition and transformations of urban fabrics, design and spatial relationships between physical features of the urban environment such as blocks, streets, buildings and parks affect the well-being of local citizens (Dibble et al. 2019; Enric and Oscar 2017). It has been proven that high densities have a negative impact on social, environmental and health issues (Berghauser Pont et al., 2020). Urban densification, building height and block sizes may affect other features of urban form that determine QoL, such as urbanity, walkability, biodiversity, daylight performance, air or noise pollution (Berghauser Pont and Haupt 2009; Romice et al. 2017). It assumes that some commonly used indicators in urban planning could be used to describe liveability.

Methodology

We apply a parametric and GIS-based multi-criteria analysis to spatial structures and patterns. The quantitative and qualitative spatial analyses are employed to recognise the features of urban form affecting the Quality of Life.

A detailed spatial analysis of spatial structures and their patterns requires research on various scales With this in mind, we first identify the essential elements of urban form to be evaluated, i.e. street, plot or building. Furthermore, we look at their unique constituents and the hierarchies to which they contribute. The physical characteristics of the indicated elements include their dimension, shape, volume, exposure and function. Then all the properties are aggregated to a sanctuary area. Table 1 lists the morphological properties of the built environment with reference to various scales. The table shows the method of calculating individual indicators and parameters, including the data necessary to obtain them.

Each estate (sanctuary area) is described through 27 physical dimensions, including demographic and land-use statistics, and then a comparative analysis is conducted. Then selected indices are converted and aggregated into urban blocks, with the results visualised using graduated symbology in QGIS (Figures 4-11). Thanks to GIS functionality, it was possible to use group stats to calculate statistics for feature groups in vector layers.

For this study, spatial data, including shapefiles with buildings, plots, biologically active surfaces and impervious terrains, were obtained from the Municipal Centre of Geodesic and Cartographic Documentation in Lodz. The gathered data required data cleansing using tools offered by Autocad Map 3d topology to delete duplicates. The number of inhabitants was estimated on the basis of the number of flats, assuming that there are three people to a household. The number of flats was estimated on the basis of the inventory of the number of staircases and the number of flats per floor. Sometimes it was helpful to count balconies in residential buildings.

Having measured all the indices, selected planning indexes (FAR, BCR, GAR) are combined on Spacemate – a diagram tool relating the multiple variables to measure and visualise the density and quality of neighbourhoods (Berghauser Pont and Haupt, 2009). We find it helpful to identify clusters defining different neighbourhoods, informing us of the quality of the assessed urban form, densities and typologies (Figure 12).

The list of spatial dimensions and the values of indicators in the table, as well as their visualisation in diagrams and charts, allows for a comparative analysis (Table 2). The examination of case studies enables us to reassess and improve the methodology.

Results

For the purpose of this exploratory reseach, selected fragments of modernist block housing estates (sanctuary areas) built in the 1980s – the times of the Polish People's Republic – were taken as a case study for applying the evaluation method:

- The Władysław Jagiełło housing estate in the area of Zgierska, Julianowska and Łagiewnicka Streets
- The Stefan Czarniecki housing estate in the vicinity of Zgierska, Inflancka and Marysińska Streets (Figures 1 and 2).

The sanctuary areas are defined as a urban fabric partition surrounded by main streets, in this research we present two sanctuary areas as the main unit of analysis and measurement (Dibble et al. 2015).

The many years of history since its allocation as a municipal factory settlement in the mid-nineteenth century, the prevailing order and the influence of various cultures, are all particularly visible in the spatial structure of Bałuty and have left their mark on the architectural form and building substance of the estate.

The cumulative way of building development and the coexistence of its various types constitute the Bałut space, which is diverse and exciting. The variety of architectural forms in the area of Bałuty gives the area a specific territorial distinctiveness.

Currently, the heterogeneous, patchwork landscape of Bałuty is made up of coexisting pre-war 2-5-storey tenement houses (most often in frontage layouts) and post-war, modernist block buildings 4 to 11 storeys high. It was assumed that the selected samples of Bałuty housing estates represent different morphological patterns.

The collected spatial data, urban indicators and their visualisation in the form of diagrams are included in the Appendix.

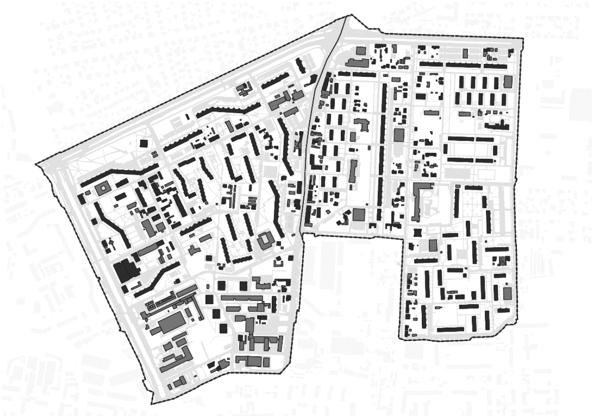

Figure 1 Plan of the selected housing estates (the one to west is the Władysław Jagiełło housing estate, and to the east is the Stefan Czarniecki housing estate)

Figure 2 An aerial view of the selected housing estates

Discussion

From the literature review, it follows that existing QoL assessment schemes (such as Monocle and the Mercator Global Liveability Index) do not refer to environmental and spatial issues and do not integrate density measures, a millennium ecosystem assessment or iso norms and other important variables related to space in measutring and evaluating QoL (Hanzl, Misiak, and Grela 2020). Many QoL assessment schemes refer to the whole city as an analysis unit, while the scale of neighbourhoods and housing estates are neglected. Following Urban morphology and using typo-morphological research and urban morphometrics in the measurement of components of the built environment to describe and compare urban forms quantitatively seems to bridge this gap. We consider the quantification of urban form as a key to understanding and designing spaces with a high QoL of residents, particularly in block housing estates. So conducting evidence-based spatial planning using morphometrics may enhance the evaluation of quality of life in modernist housing estates. By applying 'urban morphometrics' to evaluate the quality of life in modernist housing estates in spatial and environmental dimensions, we hope to contribute to research on urban form and enhance planning workshop at the local level.

We conducted the explorative measurement of certain spatial features of the urban environment determining QoL in selected block housing estates. Firstly, we did all the measurement to selected sanctuary areas – housing estates as a whole (Table 1), but the similarity of the results and the difficulty in judging the relative impacts on QoL of residents led us to the decision that aggregating the work to the level of urban block is a better idea. To this end, we divided the research area into 39 urban blocks and measured (Table 2), mapped and visualised all the popularly used urban indicators, such as floor area ratio, block coverage ratio, biologically active surface ratio and open space ratio (Figures 3-11). Then we combined these well known indexes so that we can see how the dots – the urban blocks – are distributed on a Spacemate Diagram (Figure 12). We found this helpful when identifying clusters defining different neighbourhoods, and informing us of the quality of the assessed urban form, densities and typologies.

The applied quantitative method using urban indicators and measurements of the physical properties of urban environment needs more testing. The method needs to be improved after its application on an extended set of housing estates.

The selected area of research is a kind of patchwork of different types, densities and heights. This means that we should perhaps reject the outliers that don't fit the standfard pattern. Obviously, it is necessary to investigate more housing estates in the same way, but it also seems that there is a need to consolidate the quantitative assessment presented in this paper with a Public Participatory GIS-based survey, as a qualitative contribution that could enable us to validate ther results, make them more explicit and show a more objective picture of liveability in a modernist housing estate. Social assessment could help verify which of the selected spatial components of QoL the residents find to be more or less important (Hanzl, Misiak and Grela, 2020).

Spatial planning in Poland offers the potential to define norms that directly affect the cumulative nature of the development. In Polish local spatial development plans, which are the only binding local legal acts, there are a number of commonly used indices, such as Building Coverage Ratio (BCR), Floor Area Ratio (FAR), and Green Area Ratio (GAR). The catalogue of indicators and parameters used in Polish legislation is not closed, so it is possible to extend the set of indexes.

It is obvious that green spaces affect the urban climate, and so there is a desire to reduce the negative impact of urban investments on the natural environment, thereby ensuring better living conditions in the city by: lowering the temperature in areas of block housing estates (urban heat island), improving air quality, increasing natural diversity there, among others (Lee and Maheswaran 2011; Badach and Raszeja 2019). When observing new investments in Lodz and other Polish cities, a clear tendency to shape greenery in a minimalist way was noticed. This is because the minimum indicator of the biologically active surface set out in binding local spatial plans of development is not sufficient and does not affect the quality of green structures. It is even worse in areas not covered by local plans, which is generally the case with the modernist housing estates of Lodz.

Due to the progressive degradation of the cultural landscape of Bałuty, it would be recommended to introduce local law for the entire estate as soon as possible. From the point of view of planning practice, we recommend additional indexes to improve liveability and to regain the natural balance in the city.

Biotope Area Factor – the proposed index would complement the biologically active surface and, in a way, add a third dimension to it, thus increasing the quality of the shaped space or plot in an aesthetic, environmental and economic context. It could consider the biologically active area, forcing the investor to take additional activities to enrich the green space development, e.g. the use of permeable surfaces covered with vegetation, or a requirement to compensate concrete surface areas by ensuring new plantings of trees. This indicator has been successfully implemented in Berlin, Seattle and Malmo (Szulczewska, 2015).

Conclusions

Measuring morphometrics in modernist urban estates is certainly a challenge, as it is essential to select and compile appropriate metrics suited to the specific circumstances of Polish modernist housing estates, their scale, complexity and heterogeneity. Shaping the spatial policy of an estate requires coordinated actions supported by an in-depth diagnosis taking into account multicultural urban structures and an assessment of spatial patterns. Combining qualitative methods and tools such as GIS, morphometrics, satellite data, and national databases with the Public Participatory GIS-based survey in evaluating the quality of life may improve evidence-based decision-making in spatial planning, research on urban form and enhance planning workshops at the local level.

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APPENDIX 1

Table 1 Physical dimensions of the liveability of urban forms (variables aggregated to sanctuary areas)

Scales	The physical characteristics	Description	Reference	The Władysław Jagiełło housing estate	The Stefan Czarniecki housing estate	RESEARCH AREA
Sanctuary area	Base land area (A)	Area of aggregation	(Berghauser Pont and Haupt 2009)	65.29 ha	54.88 ha	120.17 ha
	Base land perimeter	Perimeter of aggregation		3.67 km	3.32 km	5.51 km
	Footprint (ha)	The area covered by all buildings		10.2ha	7.63 ha	17.82ha
	Gross floor area (F) Building floor area	The total floor area of the buildings in the block (the footprint multiplied by the number of storeys)	(Berghauser Pont and Haupt 2009; Porta et al. 2011)	50.13ha	33ha	83.12ha
	Coverage (GSI) Building Coverage Ratio (BCR)	footprint (ha) / area of aggregation (ha)) The ratio of the area covered by all the buildings in the sanctuary area on the area of the sanctuary area	(Berghauser Pont and Haupt 2009; Porta et al. 2011)	0.16	0.14	0.15
	Building Intensity (FSI) Floor area ratio (FAR)	gross floor area (ha) / area of aggregation (ha)	(Berghauser Pont and Haupt 2009)	0.77	0.60	0.69
	Spaciousness (Open Space Ratio)	the amount of non-built space at ground level per square metre of gross floor area	(Berghauser Pont and Haupt 2009)	0.57	0.86	0.69
	Permeable area/surfaces (m2)	Total area of permeable terrain in the block	(Porta et al. 2011)	28.73	28.54	57.68
	Green Area Ratio (GAR)	biologically active surface rate		0.44	0.52	0.48
	Impermeable surfaces impervious surfaces	Total area of impermeable terrain in the block		26.12 ha	18.66 ha	44.46 ha
	Imperviousness	Impermeable surfacesarea (ha) / area of aggregation (ha)		0.56	0.48	0.52
Block	Average block perimeter	Measure of the average block perimeter length	(Romice, Porta, and Feliciotti 2020)	0.67 km	0.59 km	0.63 km
	Average block area	Measure of the average block area	(Romice, Porta, and Feliciotti 2020)	2.39 ha	2.04 ha	2.22 ha
	Number of blocks			19	20	39
	Block density	Count of the number of blocks by area unit.	(Romice, Porta, and Feliciotti 2020)	0.29	0.36	0.32
Building		Number of housing buildings		117	174	291
	Building density	n/ha Number of housing buildings on the area of the block (in hectares)	(Porta et al. 2011)	1.79	3.17	2.42
	Average building height	All buildings	(Berghauser Pont and Haupt 2009)	8.51 m	6.87 m	7.60 m
	Average housing building height			14.59m (max. 38.7 m)	10.98m (max. 33.43 m)	12.42 m (max. 38.7 m)
	Average Number of storeys (L)			5 (max. 12)	3 (max. 11)	4 (max. 12)
Street Public space	Network length (l)		(Berghauser Pont and Haupt 2009)	12.58 km	9.12 km	20.96 km
	Network density (N)/ Street density	Total length of streets by area unit Based on metres of network (length) per square metre of ground area (surface)	(Berghauser Pont and Haupt 2009; Romice, Porta, and Feliciotti 2020)	0.019	0.017	0.017
Demographic statistics	Number of inhabitants			17007	13869	30876
	Population density	the number of people or households in an area / inhabitants per hectare People per ha	(Berghauser Pont and Haupt 2009)	404	304	353
	Number of dwellings			5669	4623	10292
	Dwelling density	the number of dwellings in an area / dwellings per hectare	(Berghauser Pont and Haupt 2009)	135	102	118
	Urban Footprint (m2 per inhabitant)	the total amount of land needed for housing fabric, urban greenery and working areas divided by the total amount of inhabitants	(Berghauser Pont and Haupt 2009)	38.39	39.57	38.92

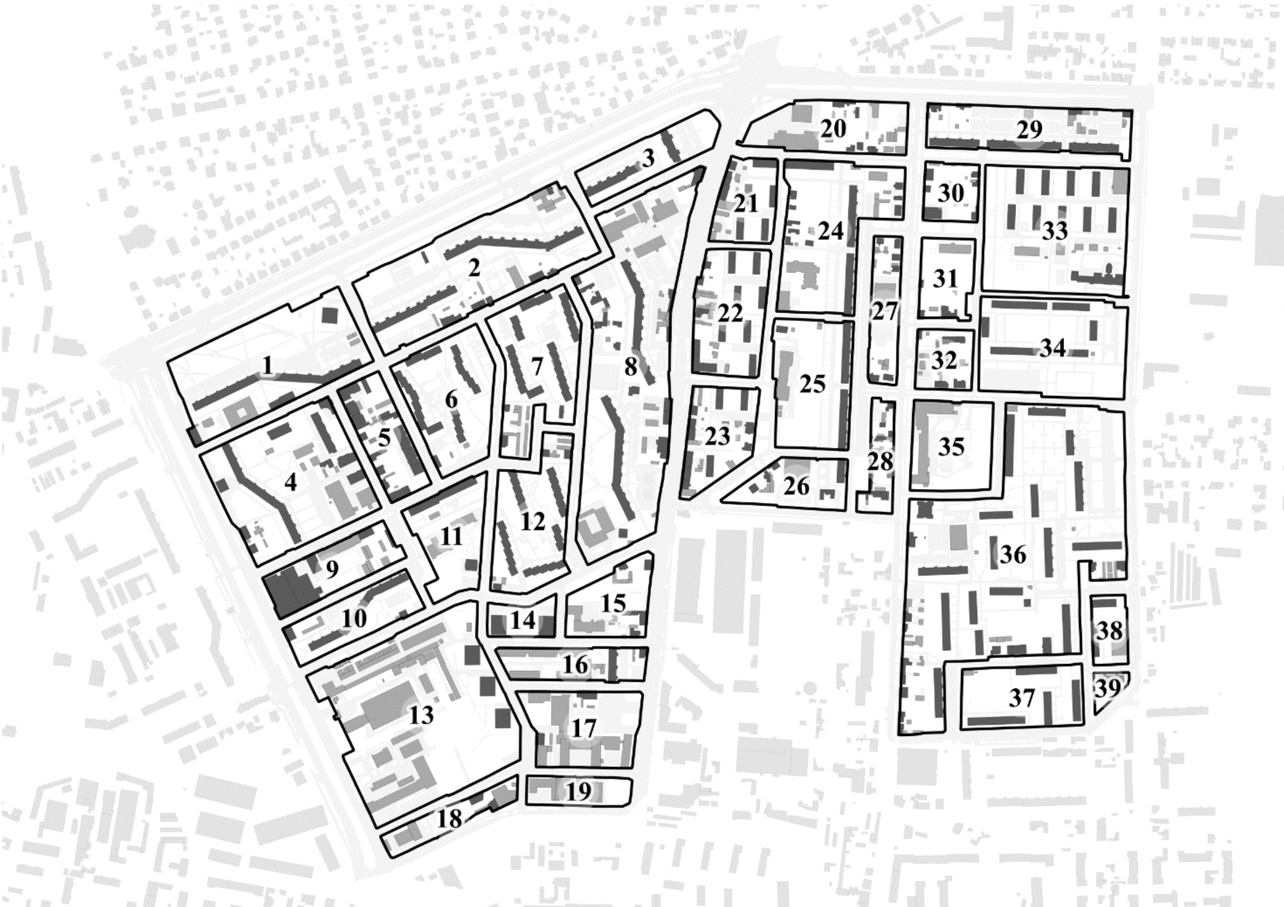

Figure 3 The aggregation of selected sanctuary areas into 39 urban blocks

Table 2 Data of the 39 urban blocks

HOUDING ESTATE	NO.	BLOCK AREA	BLOCK PERIMETER	AVERAGE NUMBER OF STOREYS	MAX. NUMBER OF STOREYS	BCR	FAR	OSR	GAR	IMPERVIOUSNESS	POPULATION DENSITY	DWELLING DENSITY
Władysław Jagiełło' s housing estate	1	3.76	0.86	3.73	12	0.16	1.29	0.65	0.55	0.45	444	148
	2	4.39	0.98	2.22	12	0.16	1.19	0.71	0.51	0.49	471	157
	3	1.32	0.55	12	12	0.13	1.61	0.54	0.50	0.50	956	318
	4	3.94	0.80	2.52	12	0.20	1.11	0.72	0.55	0.45	437	146
	5	1.33	0.51	2.23	6	0.33	1.16	0.58	0.54	0.46	454	151
	6	2.32	0.62	3	5	0.16	0.74	1.14	0.60	0.40	487	163
	7	2.46	0.78	2.75	5	0.20	0.85	0.94	0.62	0.38	432	144
	8	6.78	1.44	2.02	12	0.20	1.06	0.75	0.43	0.57	312	104
	9	1.40	0.56	3.5	12	0.47	2.91	0.18	0.36	0.64	345	115
	10	1.37	0.55	4.4	12	0.21	1.99	0.40	0.55	0.45	910	304
	11	1.56	0.58	5.5	12	0.17	1.18	0.70	0.62	0.38	516	172
	12	2.22	0.69	2.6	5	0.21	0.88	0.90	0.61	0.39	563	188
	13	6.32	1.07	1.78	11	0.25	0.70	1.07	0.47	0.53	94	31
	14	0.56	0.33	11	11	0.22	2.47	0.32	0.46	0.54	713	236
	15	1.23	0.46	1.67	4	0.20	0.51	1.57	0.61	0.39	122	41
	16	1.11	0.54	2.3	11	0.42	1.02	0.57	0.35	0.65	269	89
	17	1.87	0.58	2.71	11	0.32	1.10	0.62	0.25	0.75	32	11
	18	0.82	0.52	1.56	4	0.27	0.42	1.74	0.44	0.56	117	39
	19	0.72	0.40	2	3	0.42	0.62	0.94	0.32	0.68	0	0
Stefan Czarniecki' s housing estate	20	1.75	0.63	1.18	2	0.24	0.32	2.38	0.48	0.52	26	9
	21	1.13	0.43	2.53	11	0.31	1.18	0.58	0.47	0.53	568	189
	22	2.00	0.58	2.2	5	0.23	0.81	0.95	0.57	0.43	400	134
	23	1.46	0.51	1.84	5	0.28	0.82	0.88	0.54	0.46	384	128
	24	3.11	0.83	2.33	11	0.20	1.12	0.71	0.63	0.37	457	152
	25	2.25	0.63	3.3	11	0.16	1.16	0.72	0.63	0.37	445	148
	26	1.14	0.49	2.18	11	0.24	0.63	1.21	0.50	0.50	210	70
	27	1.02	0.53	1.05	2	0.23	0.23	3.35	0.53	0.47	21	7
	28	0.71	0.46	1.12	2	0.25	0.30	2.50	0.60	0.40	72	24
	29	2.09	0.77	2.59	11	0.22	1.62	0.48	0.38	0.62	678	226
	30	0.75	0.35	1.29	3	0.21	0.39	2.03	0.73	0.27	153	51
	31	0.98	0.43	1.25	2	0.13	0.21	4.14	0.83	0.17	21	7
	32	0.80	0.36	1.17	3	0.18	0.23	3.57	0.57	0.43	56	19
	33	4.07	0.83	2.65	5	0.16	0.55	1.53	0.62	0.38	301	100
	34	3.19	0.74	4.43	5	0.11	0.54	1.65	0.65	0.35	338	113
	35	1.64	0.51	1.6	4	0.17	0.65	1.28	0.57	0.43	0	0
	36	10.20	1.68	2.9	11	0.16	0.93	0.90	0.59	0.41	406	135
	37	1.70	0.55	3.67	5	0.17	0.84	0.99	0.74	0.26	370	124
	38	0.59	0.32	3	5	0.32	0.96	0.71	0.47	0.53	357	119
	39	0.24	0.22	11	11	0.16	1.81	0.46	0.73	0.27	816	275

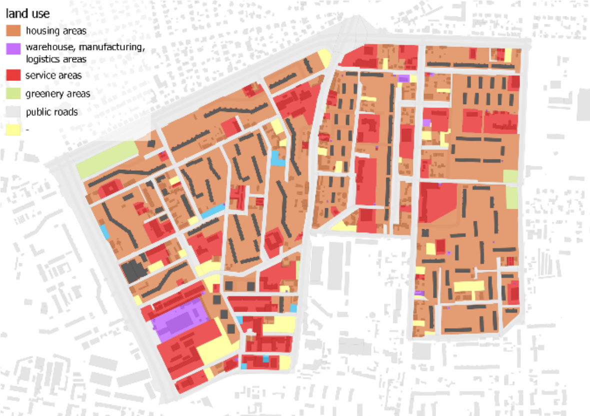

Figure 4 Land use

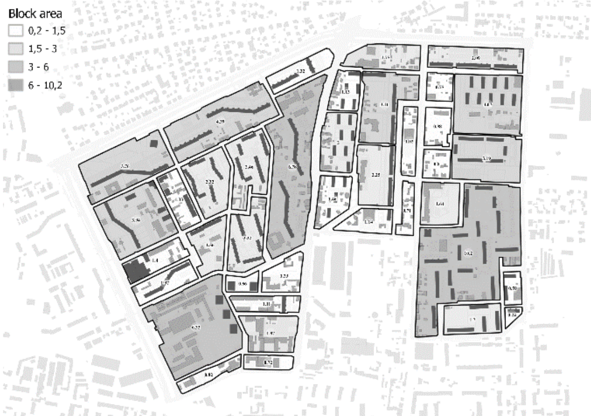

Figure 5 Block areas

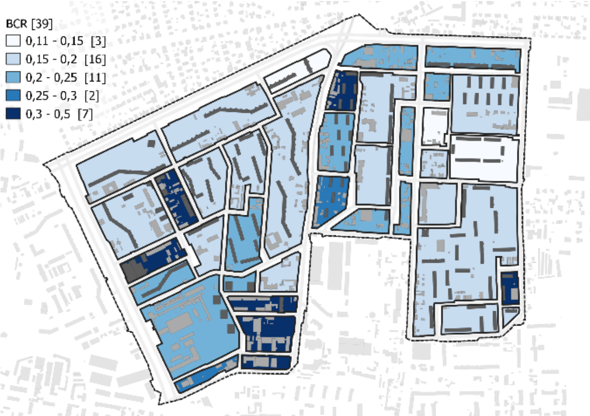

Figure 6 Building Coverage Ratio

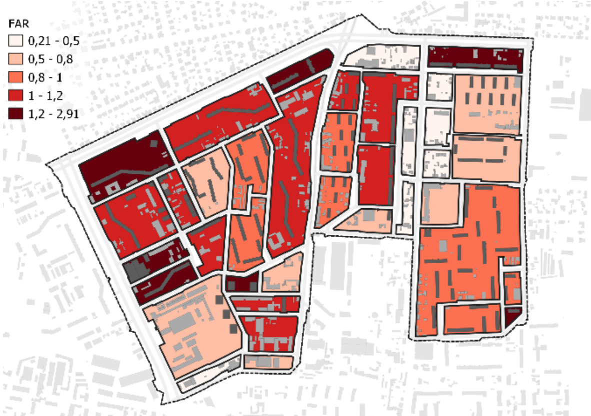

Figure 7 Floor area ratio

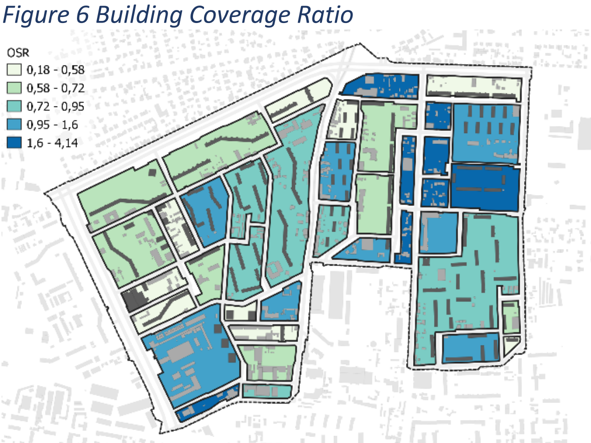

Figure 8 Open Space Ratio

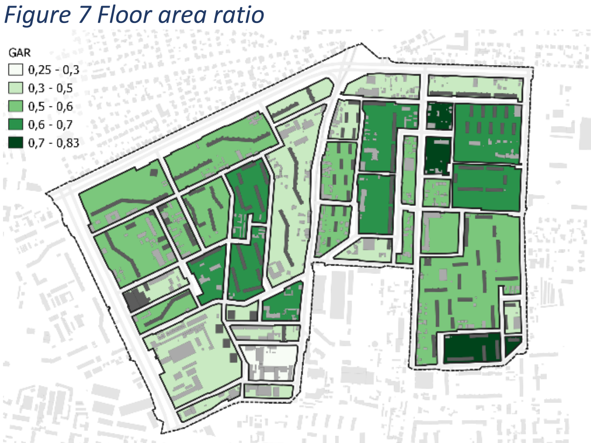

Figure 9 Green Area Ratio

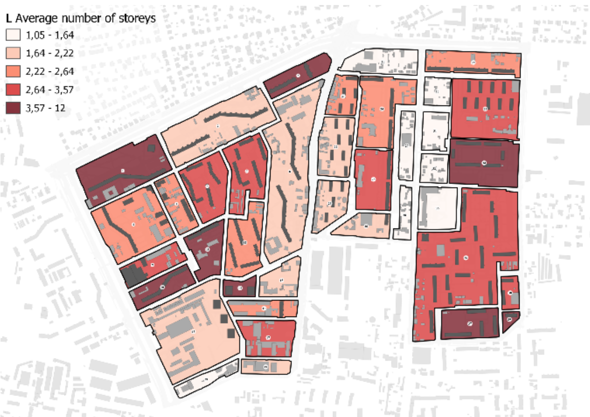

Figure 10 Average number of storeys

Figure 11 Population density

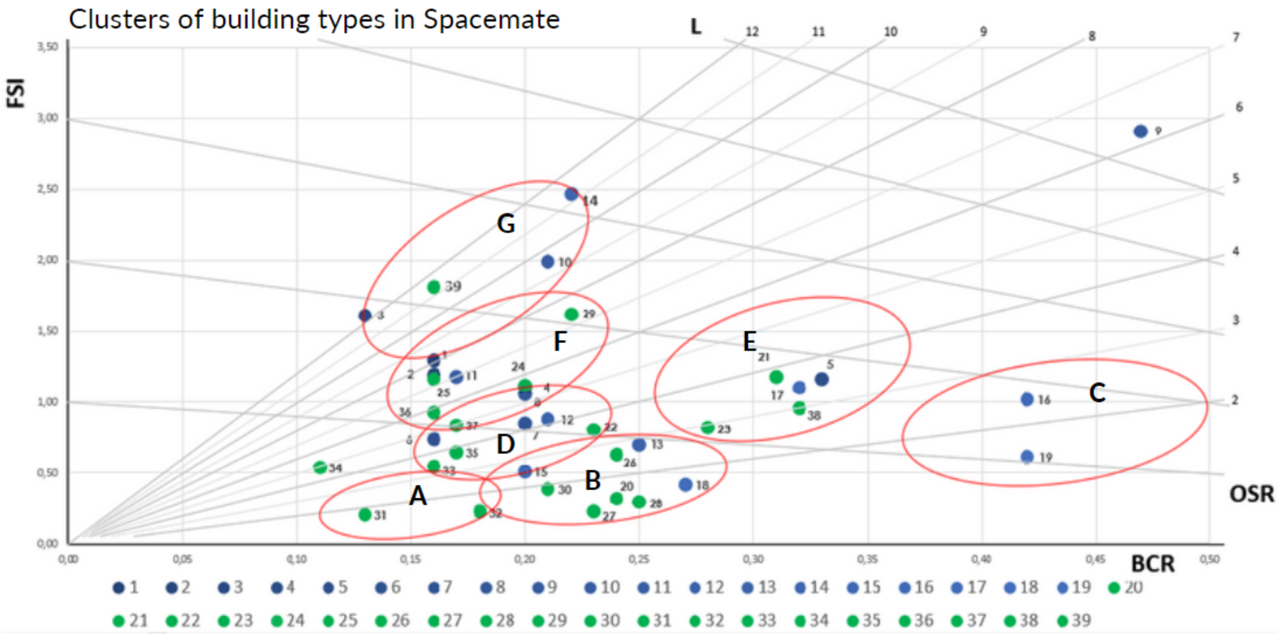

Figure 12 Urban blocks positioned in the Spacemate