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An Integrated Analysis of the Urban Form of Residential Areas in Romania

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Abstract: Romanian cities are facing two opposing patterns of urban development that are common worldwide: a significant number of small cities are undergoing a process of shrinkage, while large cities are experiencing dense urban sprawl. This study examines the framework of the current legislation and urban codes that impact the growth of Romanian cities. The aim is to establish a critical analysis of the current urban codes of residential areas in Romania and to create a framework for an integrated neighbourhood tool of analysis for Romanian residential areas, using urban form as a starting point. This direction starts from the fact that international documents such as the "New Leipzig Charter" recommend a resilient and environmentally friendly approach to urban development, while current Romanian normative documents on resilience and sustainability focus mostly on buildings, ignoring a broader vision that includes the urban scale of the neighbourhood or city while considering the multidisciplinary requirement for understanding urban morphology and phenomena. Existing urban legislation in Romania is characterised by several deficiencies resulting from the fragmentation of outdated regulatory bodies in the field of urban planning. Furthermore, this study has demonstrated that urban indicators can serve as a versatile tool for the assessment and enhancement of residential areas in the country.

Keywords: urban codes; urban morphology; residential area; urban development; built density; urban indicators

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1. Introduction

Urban phenomena and processes have been extensively studied in the scientific literature to understand their impact on urban life quality. Urban sprawl, in particular, has been associated with a decline in quality of life [1]. Issues such as low building densities with problematic values, the lack of functional diversity, lengthy commutes, and limited pedestrian accessibility in urban development directly contribute to problems such as poor health, environmental issues, low air quality, and high energy consumption resulting from private transport usage. These factors underscore the negative consequences of urban sprawl and highlight the importance of addressing them to improve the well-being of urban inhabitants [2,3].

It is a well-studied phenomenon globally that certain smaller cities are undergoing a process of contraction [4,5], while larger urban areas are expanding and growing at an uncontrolled, dense pace [6]. This trend is evident in the development of Romanian cities; whereas certain smaller municipalities are experiencing a decrease in population, larger urban centres are experiencing significant growth. Uncontrolled urban sprawl has led to monofunctional areas in growing cities of Romanian metropolitan regions [7], that feature single-family residential areas or densely built collective housing. Stoica et al. examined the growth of the built-up area within the metropolitan region of Bucharest utilizing Landsat data. Their analysis revealed a significant increase in the amount of newly developed

land, from 9822.3 ha in 2000 to 21,948 ha in 2018 [8]. These new development areas often border monofunctional areas occupied by industrial, commercial, or office buildings [8,9]. This has led to the problem of unplanned construction of new residential areas in the urban influence areas of growing Romanian cities [10]. The lack of general urban planning regulations aimed at the well-being of residents has favoured the construction of housing complexes that are purely profit-oriented [11–13].

The following study offers an urban-morphology-based examination of residential areas, investigating how urban planning codes in Romania have generated different levels of built density. In particular, we studied the Romanian phenomenon of dense urban sprawl. We focused on the emergence of new residential areas in Romania consisting of collective housing, although in the academic literature, urban sprawl is generally associated with low-rise and low-density housing [14].

The importance of this study is underlined in the context of the development of a new Code of Spatial Planning, Urbanism and Construction (CATUC) that aims to modernise and restructure the existing outdated legislative framework for urbanism. The oldest legislation on urbanism, currently in use in Romania, is Government Decision No 525 of 27 June 1996, approving the General Town Planning Regulation, while the most recent is Law No 350 of 6 July 2001, on spatial and urban planning. CATUC seeks to update these laws by revoking obsolete standards and shortening the building authorisation process. However, some public organisations and NGOs have raised concerns about the potential oversimplification of the process [15,16].

The research presented in this paper has two main objectives. The first objective involves the development of a critical analysis of the current urban codes of residential areas in Romania. We want to understand how the current codes affect the urban form and what are their shortcomings. The second objective places this study in a broader perspective: we aim to define a method of urban form analysis as part of a multidisciplinary tool for the analysis and urban design of residential areas, specifically adapted to the Romanian context. Such tools for analysis and planning can be used by different actors that are part of the development of residential areas: specialists, local authorities, investors, and residents, with the aim of not only creating new areas but also improving existing ones, tackling aspects such as the sustainable development of neighbourhoods and the solar potential of neighbourhoods [17,18].

2. Materials and Methods: The Development of Collective Housing and Residential Areas from the Perspective of Urban Form and Density

The methods of analysing the impact of urban codes on the development of residential areas consisted of several steps, as shown in Figure 1. First, by analysing statistical data (Figure 2), we established the focus of this research: residential areas formed by the collective housing typology. Thus, by analysing both the international and Romanian scientific literature, we established the types of urban form associated with the collective housing typology. This step represents the creation of a basis for the study of the current Romanian legislation. This allowed for an understanding of the issues that need to be critically analysed.

In the first phase of this research, we conducted an analysis of the structure of Romanian urban planning regulations from the perspective of residential areas, primarily studying the "Government Decision no. 525 of 1996 for the approval of the General Urban Planning Code," the "Law no. 350 of 6 June 2001, on territorial planning and urbanism," and the "Guide for the development and approval of local urban planning codes–Code G.M.-007-2000." In addition, we examined the related legislative acts in urban planning that address design and construction within residential zones.

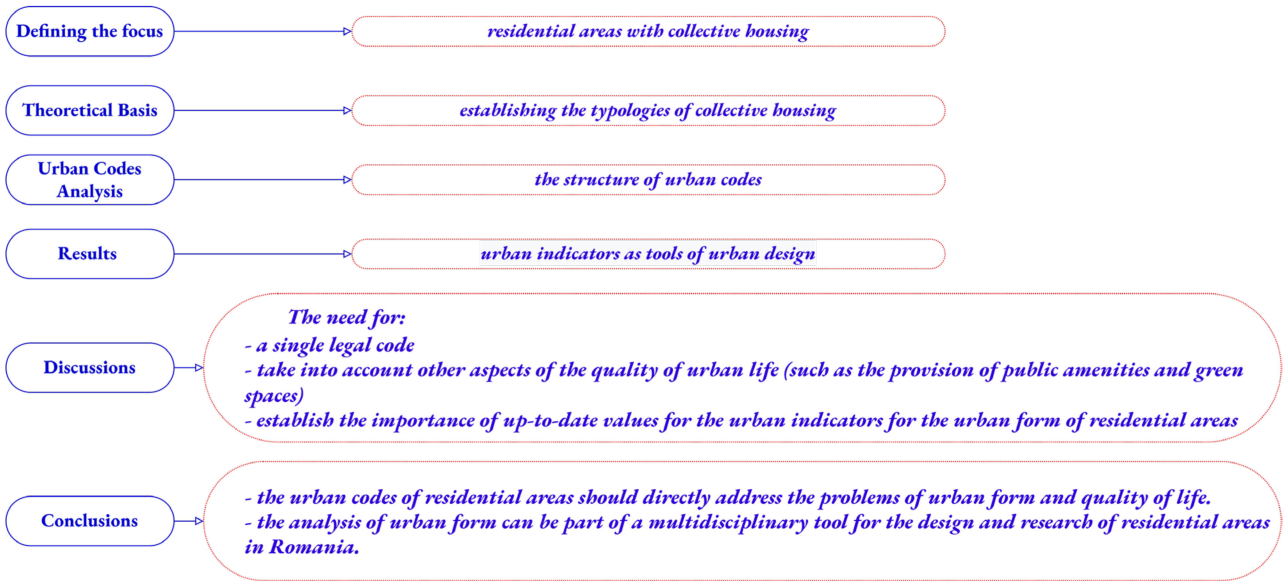

Figure 1. Concept map of the logical path in researching the impact of urban codes on the residential areas in Romania.

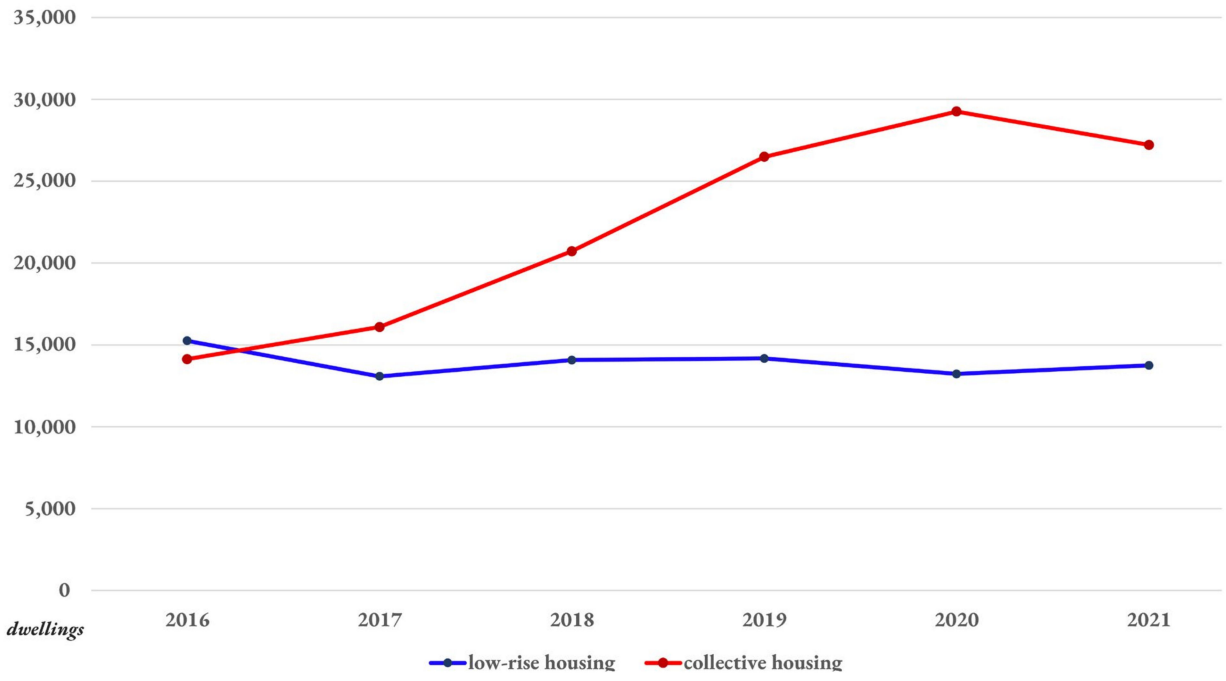

Figure 2. Survey of new housing construction, using data from the Romanian National Institute of Statistics. The red colour shows multi-family buildings, and the blue colour shows buildings with a maximum height of three storeys.

2.1. Collective Housing and Urban Density in International Scientific Literature

According to the Romanian National Institute of Statistics, an analysis of the housing stock shows that more than 50% of the new dwellings in Romania consist of blocks of flats with more than three storeys, reflecting the prevalence of collective housing typologies in the form of new residential areas [19]. The initial research directions in this chapter encompass the exploration of the theoretical framework surrounding collective housing [20] and the examination of existing Romanian legislation concerning urban planning codes specifically for residential areas [13].

Subsequently, this study delves into the tools utilised within the profession, specifically urban indicators, and their consequential influence on built density. By considering built density as a multifaceted phenomenon at various scales and variables, not only will it lead to a distinct interpretation of urban indicators associated with residential areas, but it will also facilitate comprehension of the direct ramifications of certain urban design decisions on residents' quality of life [21]. In order to understand residential areas, it is necessary to explore the types of urban form generated by the residential function.

The association between urban form and city-specific factors can account for the varying definitions of urban form and the diverse typologies observed within the housing function at an international scale. In the analysis of collective housing, two distinct directions have been observed: studies that concentrate on examining the diversity of urban form [22,23], and studies that emphasise the impact of housing typologies [20,24–29]. In the Romanian context, the subject is extensively studied and defined in various ways, with different research efforts investigating housing typologies from historical, cultural, or economic perspectives [30–35].

Housing typology involves the classification of building types based on design, function, use, and circumstances. Chey's work established correlations between typology, form, social change, and urban development, considering important factors such as social demographics and the legislative impact on form, land use, and sustainability. Chey's research identifies 12 urban form types for housing buildings, categorised according to historical, geographical, and typological criteria. The general types of collective housing include the perimeter block, linear block, block edge, solitary building, space-enclosing structure, and high-rise tower [24].

An alternative approach can take into account the study of building density within housing typologies from an urban design perspective. Berghauser Pont and Haupt propose the use of three types of indicators to describe a multivariable understanding of density: Floor Space Index for intensity, and Ground Space Index for compactness and network density [21]. The equivalent urban planning indicators in Romanian practice are FSI and BCR, respectively. The differences in assessment that may occur are related not only to the choice of reference areas [21], but also to the way in which legislation at the national level regulates the assessment of building areas, such as gross floor area or footprint.

Fernández Per et al. as part of the *a + t research group* conducted an extensive study of building density that involved the analysis of "generic" typologies derived from existing architectural case studies, providing a comprehensive exploration of the issue. Thus, they identified the following generic urban forms of collective housing and the associated urban indicators, defined for a site of 100 × 100 m [36]:

- Point buildings: with FSI = 1.44, BCR = 24%, and height: 6 storeys;
- Double slab: with FSI = 1.8, BCR = 30%, and height: 6 storeys;
- Slab: with FSI = 1.65, BCR = 15%, and height: 11 storeys;
- Closed urban block: with FSI = 3.84, BCR = 64%, and height: 6 storeys;
- Urban block with towers: with FSI = 3.10, BCR = 88%, and height: 3.52 storeys;
- Plinth with towers: with FSI = 1.16, BCR = 36%, and height: 3.22 storeys;
- Tower: with FSI = 1.89, BCR = 9%, and height: 21 storeys.

Fernández Per et al.'s study acknowledges the diverse range of housing types and establishes a connection between urban form, built density indicators, and the influence of building typology on its relationship with the site and surrounding unbuilt space [26], showing similar morphologies to those identified by Chey [24]. For the present study, it is worth mentioning the generic urban forms identified by Fernández Per et al., which are analysed using two urban indicators, BCR and FSI, together with the average height of the buildings [26]. The extensive research on built density conducted by the *a + t research group* revolves around the impact of built density on the city, from a sustainable lens [26,28]. This research method is valuable due to its examination and analysis of urban form using urban indicators. In addition, the approach of disseminating and presenting concepts such as building density and urban indicators through concrete examples and

explanatory games [37,38] has potential for adoption in the Romanian context, facilitating better understanding by non-specialists.

2.2. Collective Housing in Socialist Romania, Different Types According to Scale

In the context of the socialist period in Romania, Derer (1977) identifies influential factors shaping housing typology, including the high demand for housing, industrial development, new building technologies, social criteria, and the need for rapid construction [20]. Type designs [32], chosen for their ease of construction, resulted in diverse collective housing categories, *point, slab, or tower with H, T, L, or U sections*, arranged as shown in Figure 3. However, a problem emerged with the neglect of the local context, leading to "matchbox" buildings, negatively impacting both architectural and urban aesthetics and residents' perceptions [39].

Figure 3. Typologies of residential complexes found in Romania: (**a**) cluster, (**b**) estate, (**c**) microraion, and (**d**) neighbourhood. Source: Derer 1985 [20].

At the urban design scale, the collective housing layout generates variants that must be adapted to the context, considering the landscape type: compositions such as rectangular, loose, linear layout, enclosed layout, or compact layout. The latter was a dense residential complex with limited open spaces, suggested to be designed near "large planted areas" by Chițulescu, Sandu, and Derer [40].

The present study examines residential complexes through an analysis of urban form and the use of urban indicators, without considering the historical–political context of developments during the socialist era in Romania. Notable research works show the impact of political decisions on architecture as a profession [35] and on the development of new housing in Socialist Romania [41].

2.3. Development of New Residential Areas

According to studies of the housing stock in Romania by the National Institute of Statistics, in 2021 in the urban area, dwellings in buildings with a height of three storeys or more will account for 64% of all newly built dwellings [19]. Figure 2 illustrates the increase in the proportion of dwellings in apartment blocks.

This figure should be considered alongside studies of urban sprawl in Romania. For example, the rapid development of Bucharest is having a significant impact on the surrounding area, where the lack of coordination between different territorial units is leading to uncontrolled urban expansion of monofunctional areas [8,42], such as the residential areas.

Previous studies conducted in the Romanian context have highlighted the adverse consequences of this form of development [43]. Dense sprawl has resulted in traffic issues [44], the depletion of green infrastructure [45], and the emergence of new residential areas with substandard housing conditions [30]. By examining Bucharest as a case study using satellite imagery and field studies, two types of new residential developments were observed:

- Densification of existing residential areas: this involves the construction of semi-collective or collective residential buildings either within low-rise housing areas or within existing housing estates.
- New residential areas often located on the outskirts or in the metropolitan area of the city, characterised by mono-functionality, quite often lacking the amenities and public and green spaces [46] required for the population they contain.

Both cases pose challenges such as excessive strain on existing infrastructure and amenities, diminished green spaces [6], and subsequent impacts like urban heat island effects and vulnerabilities to environmental hazards such as flash floods [47].

Similar to the international classifications of collective housing types, national legislation plays a significant role in shaping residential areas. In order to understand the housing landscape in Romania, the following sub-section examines the legislative aspects that influence the development of residential areas.

3. Results: Analysis of Urban Codes' Structure and Urban Design Tools in Romanian Practice

To understand how urban codes act, we have to understand the difference between them and individual acts. While non-regulatory acts affect a limited number of legal subjects, urban codes have broad application, impacting many individuals. Urban codes govern the law's implementation for society or specific categories, while individual acts apply the law directly to specific individuals [48].

In the legal domain, there is debate regarding the right to build as an individual right, yet non-compliant construction carries consequences that extend beyond the individual, impacting the well-being of many. This chapter provides a brief overview of the planning regulations framework in Romania and its connection to residential areas. The objective is to identify and define the key factors directly influencing the building density of residential areas. The initial phase involved analysis of current legislation in the field of urban planning (shown in Figure 4 with red circles), guides, norms and legislation in related fields affecting the urban planning process.

3.1. Romanian Legislative Background for Urban Development of Residential Areas

In Romania, urban codes are composed of General Urban Planning Codes (GUPCs) and Local Urban Planning Codes (LUPCs) that are regulated by several bodies of legislation. The General Urban Planning Codes (GUPCs) is a normative act of broad generality. It represents a unified system of technical and legal rules that supports the preparation of territorial planning documents, urban planning, and local urban planning codes. GUPCs establish codes regarding land occupation and the placement of buildings. Its application takes into account the private interests of citizens alongside the collective interests by protecting both private property and the public interest.

GUPCs are authorised and defined through "Government Decision 525/1996 which approves the General Town Planning Codes" [49]. The definition was later expanded upon by "Law 350/2001 on territorial and urban planning" [50]. As a result, these two legislative acts form the regulatory framework that outlines the provisions of the GUPCs. Considering the planning of residential areas, GUPCs address key characteristics for specific urban codes, including building amenities, functional compatibility, land occupancy, percentage, orientation, location, plot arrangement, fencing, green spaces, and parking provisions [51]. Comprising 40 legislative articles encompassing "technical, legal, and economic rules," the GUPCs are organised into four chapters and accompanied by annexes 1–6. The "Guide To The Preparation And Approval Of Local Urban Planning Codes, GM-007-2000" (GM-007-2000) offers a comprehensive overview and visual examples of the General Town Planning Codes, serving as a resource for the development of Local Urban Planning Codes, as shown in Figure 4 [52].

LUPCs represent the set of urban codes that are created together with urban planning documents, General Urban Development Plans (GUDPs) and Zonal Urban Development Plans (ZUDPs). The guidelines for the design of the LUPCs are set out by GM-007-2000. GM-007-2000 defines and exemplifies concepts such as building amenities, the compatibility of functions, building coverage ratio (BCR), layout, site, parcelling and subdivision, enclosures, and borders.

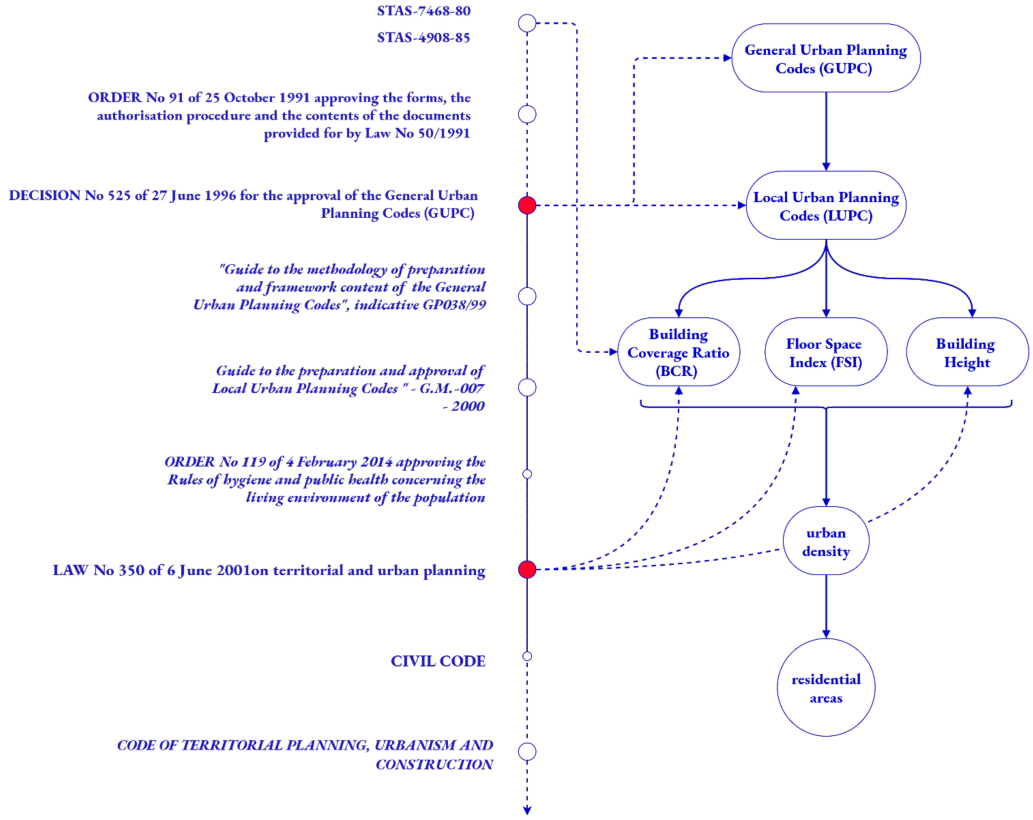

Figure 4. Analysis of changes and evolutions in urban planning legislation and related regulations.

3.2. Romanian Urban Indicators–Tools for Urban Design

Romanian legislation defines the urban indicators building coverage ratio (BCR) and floor space index (FSI) as specific working tools for urban design. In this research, we aim to establish the current legislative context in which these indicators are regulated and whether there are special mentions in the case of residential areas [50]. Even though BCR and FSI define built density, the Romanian legislation does not provide an explicit definition for this concept, although it is referenced in certain normative acts [53].

There are public documents that present the complexity of urban indicators for residential areas, such as the "Methodological guidelines–framework 'Building density in residential areas–BCR and FSI'," issued in 1995 by the Ministry of Public Works and Spatial Planning. As a result, the guide identifies six overarching factors that affect BCRs and FSIs, reflecting similar concerns identified in international research [21]. The guidelines propose using morphological homogeneity and primary functions as criteria to reference land area. Therefore, urban density is affected by the reference land area, the height regime, the levels of functionality and comfort, the urban morphology, the size and profile of the city, the environmental factors, and the factors governed by local planning regulations [54]. As far as urban indicators are concerned, although the FSI was used before 1996, together with the BCR as an urban indicator, Iancu noted the lack of definition or use in urban codes of the FSI in GD 525/1996 [13].

3.2.1. Building Coverage Ratio (BCR)

BCR is defined in Annex 2 of Law 350/2001, as the ratio of the built-up area to the plot area, as illustrated in Figure 5. The built-up area includes the ground-level construction, but it excludes certain elements like uncovered terraces that extend beyond the facade, platforms, and access stairs, but also underground constructions. It also includes certain balconies and loggias based on their proximity to the ground level. Regarding residential areas, GD 525/1996 defines the maximal values of BCR based on the typology of housing [49]:

- Exclusive residential area with buildings of a maximum of two storeys high, BCR $\leq$ 35%;
- Residential area with buildings higher than three storeys, BCR $\leq$ 20%;
- Predominantly residential area (housing with associated amenities), BCR $\leq$ 40%.

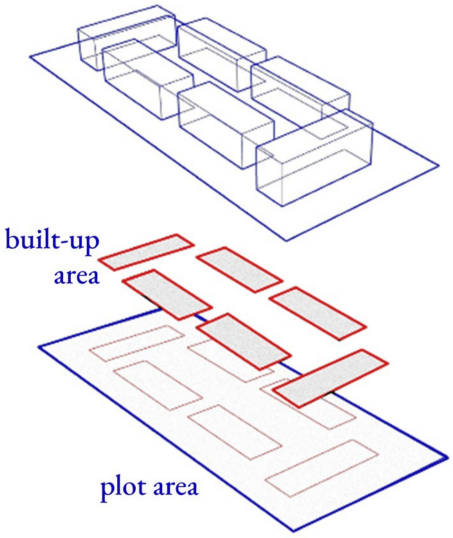

Figure 5. Diagram of the surfaces considered for Building Coverage Ratio (BCR) calculation, according to Law 350/2001 [50].

Thus, the GUPCs set a maximum range of BCRs that urban planning documents and their LUPCs must take into account, along with the types of urban fabric in each context in which they work [49].

3.2.2. Floor Space Index (FSI)

The floor space index (FSI) is defined in Annex 2 of Law 350/2001 as the ratio between the total area of all floors to the plot area, shown in Figure 6. Similar to BCR, there are certain exceptions to the calculation of the total floor area: basements with a height of up to 1.80 m; basements dedicated to vehicle parking, technical spaces, or civil protection; balconies, loggias, open terraces, non-circulating terraces, and awnings; as well as non-reusable bridges, pedestrian paths, external staircases, and protective pavements.

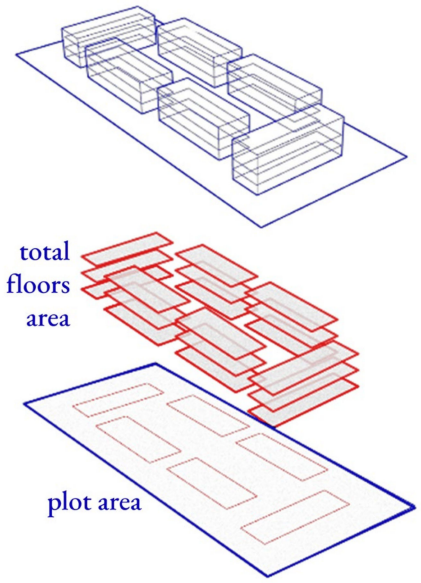

Figure 6. Diagram of the surfaces considered for Floor Space Index (FSI) calculation, according to Law 350/2001 [50].

3.2.3. The Correlation between BCR, FSI, and the Height of the Buildings in Romanian Residential Areas

Even though current legislation does not provide through the GUPCs the maximal values for FSI, the guide "Density of buildings in residential areas BCR and FSI" suggests using a practical tool called the value grid of indicators, presented in Table 1. These values are calculated for future stages and incorporate the necessary areas for parking, green spaces, and urban hygiene objectives, in contrast to the existing normative values [54]. The Urban Density Guide, which predates GD 525/1996, demonstrates a distinct correlation between housing typology, urban indicators, and height regulations. Subsequent regulatory acts [49] offer a simplified version with values that deviate from the guide's recommendations and lack support from research considering future sustainable and resilient urban development of the Romanian cities [55].

Table 1. Value grid of indicators BCR, FSI, and building height from the guide "Density of buildings within the residential areas BCR and FSI–1995" by Ministry of Public Works and Spatial Planning—Urban and Spatial Planning Series/Framework methodologies for the preparation of urban planning documents—Volume 12. P.17 [54].

Typology	Urban Indicators	Number of Storeys					
		1	2	3	4–5	6–8	Over 8
Detached houses	**BCR**	20–40%	20–35%	20–30%	-	-	-
	FSI	0.2–0.4	0.4–0.7	0.6–0.9	-	-	-
Semi-detached or row housing	**BCR**	25–35%	25–35%	25–35%	-	-	-
	FSI	0.25–0.35	0.5–0.7	0.75–1.05	-	-	-
Collective housing with necessary amenities	**BCR**	-	-	20–35%	22–30%	20–30%	18–25%
	FSI	-	-	0.75–1.05	0.9–1.5	1.2–2.4	1.6–2.5
Neighbourhoods and complementary functions	**BCR**	-	-	22–32%	20–30%	18–25%	16–20%
	FSI	-	-	0.6–1.0	0.8–1.5	1.1–2.0	1.3–2.0
Central areas	**BCR**	-	-	33–40%	20–25%	28–32%	25–30%
	FSI	-	-	1.0–1.2	1.2–1.7	1.8–2.6	3.0–3.5

4. Discussions

4.1. Romanian Legislation on Residential Areas and the Impact of Urban Codes on Urban Form

Even though GUPCs are defined by two main legislative bodies, we have not identified any specification on how the minimal norms can be applied in LUPCs, or whether the local codes can enforce new, further limiting rules within a city. Currently, this aspect holds greater significance due to the outdated nature of the GUPCs in relation to the present condition of Romanian cities. Furthermore, the codes present in GUPCs present ambiguous phrases that permit reinterpretation, with negative effects on the urban form. Another issue identified was the compatibility of functions in the newly developed residential areas in Romania. GUPCs provide the need for the establishment of dominant functional areas and their complementary functions that should lead to the elimination of dysfunctions in the city. On the basis of empirical observations and scientific articles, it seems that the development of residential areas in Romania is characterised by mono-functionality, with all the problems that this type of growth entails [8,56,57]. This lack of complementary and necessary amenities to the housing function can have an impact not only on the quality of life of residents, but also on the quality of the environment [2,58,59].

A further concern we identified relates to the GM-007-2000s suggestion of locating polluting facilities in areas other than residential zones or outside the city. This recommendation is deemed outdated compared to international documentation and legislation. In the context of climate change, discussions at the EU level revolve around the removal of pollutants rather than their placement in areas where residential functions are absent [60].

In the case of the urban indicators associated with the residential areas, we have observed that while maximum BCR values are presented for three types of housing typologies, the values of the occupancy percentages allocated for technical and sanitary equipment

or urban amenities are missing. For example, in GD 525/1996, educational, health, or sports facilities have defined surfaces, according to the number of people for whom they are built, with percentages allocated to buildings, green spaces, and urban amenities [49]. This problem also affects the parking lots and necessary access points. On the one hand, the law is outdated regarding the current situation of the number of cars/dwellings with one allocated parking space for 2–10 apartments [49]. However, an increase in this number risks leading to unsustainable developments where parking lots occupy more land than the functions for which they were built. From the perspective of sustainable mobility methods for residents, the guideline is deemed outdated in its approach to establishing an effective integrated public transportation system along with active modes of mobility, such as bicycle lanes, scooters, and other, similar means [61,62].

The final observation we consider important for the residential areas and GUPCs is the requirement of green and planted spaces in residential areas. GM-007-2000 establishes a minimum provision of 2 sqm per resident for residential areas, although it does not specify the specific type of housing where it applies [51]. Moreover, it does not explicitly delineate the type of green space to be considered, its placement, whether in private courtyards or public parks, or the maximum allowable distance between green spaces and residential units. It should also be noted that this value falls significantly below the recommendations set forth by the European Commission, which advocates for an allocation of 26 sqm per resident. This problem is critical in Romanian cities, where there does not exist a consensus regarding the reporting and measurement processes employed with regard to green area per resident [43].

We observed that the legislative acts do not form a unified body of laws. This can limit the easy access to desired information regarding urban development, for non-specialists and citizens. There is a need of establishing a singular corpus of specialised laws dedicated to the field of urbanism [63]. Another noteworthy observation derived from this research pertains to the absence of a clear definition of the concept of "residential areas" in the existing legislation, despite the normative acts that reference them. While GM-007-2000 provides specific regulations outlined in GD 525/1996 concerning residential areas [51], there are significant omissions or outdated provisions regarding building density, housing density, the ratio of built area to green space, the sizing of utility infrastructure, and the necessity and sizing of urban amenities.

4.2. The Impact of Urban Codes on Urban Form

Analysing the urban indicators used in planning practice in Romania, we identified certain problems relating to legislative definitions, calculation, and interpretation. BCR and FSI are defined by Law 350/2001 as "specific urban planning tools for design control." Although FSI is not defined in GD 525/1996, it is mentioned in GM 007-2000 together with BCR, alignment, and building height as a set of mandatory values. Thus, the guide insists on the importance of associating these indicators, rather than their singular use in urban design. The approval of a new development is conditional on the BCR not exceeding the upper limit set by the GUPCs. Thus, the setting of the BCR cap is based on the GUPCs, on the use of the land as defined by the GUDPs, and on the conditions of location on the land established by the LUPCs [51].

For residential areas, the guide presents the percentages established by GD 525/1996 as follows: low-rise residential area with a height regime of up to 2 storeys—35%, residential area with a height regime of more than 3 storeys—20%, and residential areas "with associated facilities"—40%. It can be seen that this Government Decision is vague, lacking a reference to housing typology or other urban indicators in relation to the urban indicator BCR. GM-007-2000 also specifies the possibility of making exceptions on the basis of planning documents approved by the local public administration [51]. However, the importance of considering the BCR indicator, together with the FSI and the height of the building, as "a set of mandatory values in the permission of building execution", is underlined but oftentimes disregarded.

The guide also presents another important element for residential areas, which influences the typology of the urban fabric: the location of buildings in relation to their alignment [51]. Article 23 outlines the guidelines for positioning buildings in relation to the established alignment, taking into account urban typology, heritage preservation areas, and hygiene regulations. Exceptions may be made in cases where the new building needs to align with an existing structure that does not meet the height–distance requirement of the opposite alignment or as determined by Zonal Urban Development Plans (ZUDPs). It should be noted that the guidelines detail the need to set the height of the building in relation to the distance from any point of the building façade on the opposite elevation, based on hygiene rules. Thus, $H \leq D$ is recommended, where H is the height of the building on the opposite elevation and D is the distance from the building on the opposite elevation (Figure 7).

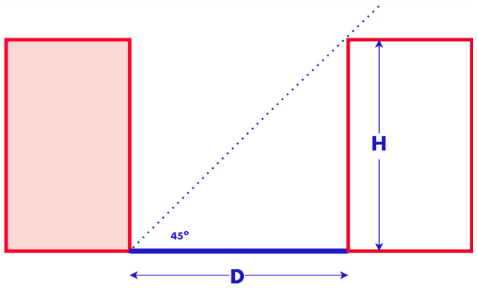

Figure 7. Establishing the height of the building in relation to the building on the opposite alignment. Source: adapted from GM-007-2000 [51].

The positioning of buildings on the plot, along with the alignment, plays a crucial role in determining the urban fabric typology. Article 24 establishes a connection between the building's location, the Romanian Civil Code, and fire safety regulations. Obtaining a building permit requires compliance with mandatory minimum distances from plot boundaries and ensuring "minimum distances required for fire intervention" [51]. Thus, the placement of the building on the site will be based on:

- The minimum distance between buildings and between property lines: This is set according to the LUPCs. If it is not specified, the minimum distance specified in the Civil Code is taken into account [64].
- The View Easement from the Civil Code [64].
- The positioning of buildings on a plot is influenced by additional regulations known as the "Public health and hygiene rules concerning the living environment of the population," which consider factors such as sunlight and lighting. These rules encompass various requirements, such as ensuring a minimum of one and a half hours of sunshine during the winter solstice, maintaining appropriate visibility conditions including sky coverage and privacy, implementing measures for fire and noise protection, complying with the specific characteristics of the area, and facilitating the coherent development of the urban fabric [52].

One inconsistency we noted is the distance between two buildings: while the Civil Code stipulates a minimum distance of 2 m between the balconies or windows of the new building and the boundaries of the neighbouring land—in total, a minimum of 4 m between buildings [64]—the guidelines stipulate a distance half the height of the tallest building, but not less than 3 m [51].

The guide emphasises minimal setbacks, which should be supplemented by local standards for "urban comfort" as defined in the General Urban Plan [51]. However, specific rules for housing building placement on plots are not specified. This ambiguity, along with the potential 20% increase in FSI through a ZUDP, has resulted in cases of semi-communal housing built on plots intended for individual one-story dwellings.

The height of buildings is not directly regulated in the general planning code, but in each individual case, the new building must consider the average height of neighbouring

buildings, the characteristics of the area, and must not exceed the height of the immediately neighbouring buildings by more than two storeys. Also in the guide, Article 31 of GD 525/1996 is linked, for obtaining the building permit, to the BCR, orientation with respect to cardinal points, location, alignment, external appearance, parking, and provision of building equipment [49].

Both BCR and FSI, as defined by Law 350/2001, have exceptions regarding the construction of new buildings on plots that already contain buildings or on subdivided vacant plots from already developed land. In the case of a construction project on a plot that contains existing buildings, the urban indicators are calculated by adding the areas of the new building to the areas of the existing buildings. Similarly, in the case of a new construction on a subdivided plot from a developed land, the considered urban indicators will be calculated in relation to the original ensemble of the land, once again by adding the areas of the new building to the areas of the existing buildings [50]. Also, according to Law 350/2001, Article 32, paragraph 5, it is possible to modify the values of the urban indicators established by the GUPCs and LUPCs through ZUDPs [50].

The ZUPD can set new regulations for building rules, area function, maximum height, BCR or FSI, building setback from the alignment, and distances from the plot's side and rear boundaries. This makes it possible to make exceptions to the application of the maximum indicators set by the GUPCs and LUPCs on the basis of planning documents approved by the local public administration. The lack of a clear specification of the mandatory and minimum nature of the rules set out in the GUDPs has allowed these exceptions to be made [13]. Hence, it is plausible to surpass the FSI imposed by the GUDPs by 20% using ZUDPs. The imprecise phrasing of the regulatory statute might result in FSI values being exceeded by more than 20%, as certain functions could impose diverse values for urban indicators, such as those related to "zoning for areas of economic interest, industrial parks, technology parks, supermarkets, hypermarkets, business parks, service areas, and similar entities" [50].

5. Conclusions and Further Research Directions

Understanding urban form as part of a complex urban system [65], in which urban indicators not only affect the way land is consumed, but also have a direct relationship and connection with the density characteristics mentioned above, we can consider that urban regulations, through urban indicators, have the ability to influence the quality of urban life of the city's inhabitants. Specifically, from the perspective of urban design, urban indicators have the ability to influence the density of buildings, which affects the ratio between residential complexes, unbuilt spaces allocated to green spaces, public squares, playgrounds, public amenities, and urban services.

It follows that the tools that underpin the planning profession, as technical aspects, are not enough, we need understanding of the profession, communication, and collaboration with local communities, and certain housing policies that limit the speculative tendencies of real estate investors. Thus, in the Romanian context, we have identified a major issue: the urban planning regulations of residential areas are outdated in the current economic, social, and cultural context. These shortcomings present different possibilities of using exceptions for speculation by real estate developers, resulting in new residential areas developed with a high density, lacking the provision of public amenities (educational, health-related, cultural, sport facilities, and leisure [66]) and open or green public spaces. Our recommendations include the need of updating the policies regarding housing to respond to the current needs of the population, following a balance of dwelling density while acknowledging the importance of provision and connectivity to natural urban spaces [67].

Although the GUPCs contain minimal regulations, the determination of the values of the concrete urban planning indicators in the urban planning documents should take into account not only these minimal limits imposed by the GUDPs but also the decision of the specialists who prepare the LUPCs documents related to the documents. In the LUPCs of Romanian towns and cities, there is a general lack of obligations and fixed limits that cannot be subsequently modified by ZUDPs drawn up at a later date [13]. There are, however, a

few GUDPs in which LUPCs have rules regarding prohibitions on changes to regulations imposed at a neighbourhood level, often present in the case of protected built areas. The obligation to comply with urban planning indicators is required not only because of the need to achieve architectural and urban planning coherence, but also because of the need to put the good of communities above the profit of the real estate market [68]. Considering that the current legislative loopholes in Law 350/2001 and Government Decision 525/1996 allow for the construction of projects based on private investors' greed with high built density levels, further simplifications of the code, seen in CATUC, will only leave more room for these exclusively profit-oriented practices, which exclude the solutions of specialists in quality-of-life improvement projects.

During the analysis of urban codes and built density of residential areas, we observed a lack of definition and standardisation of size for public urban amenities and public spaces related to residential areas, whether we are talking about low-rise housing or collective housing estates. Even though these elements should be standard for urban codes, as can be observed in documentation from the socialist period [20,69,70], current legislation presents incomplete or outdated standards [49,51], whereas the draft of future urban codes eliminates the standard from the legislative body, leaving regulations for local administrations and developers of local planning codes [71]. Guide GM-007-2000 recommends the establishment of new amenities in instances where existing ones are insufficient to accommodate the needs of new housing projects based on built density. Such amenities may be developed through public–private partnerships [51]. However, the specific responsibilities and services to be provided to future residents remain undefined, and these decisions are to be made by municipalities. GD 525/1996 prohibits the authorisation of constructions without the provision of public infrastructure based on built density [49]. Although, the Bucharest metropolitan area presents numerous examples of dense residential areas built without the provision of much-needed public amenities [10,56].

To address this issue, our recommendation in the Romanian context is to review and regulate the public urban amenities required for the function of housing, based on urban density. Thus, a further research direction will consider the sizing of urban amenities on the basis of built density as an integral part of the methodology for the analysis tool for neighbourhoods and residential areas in Romania.

In line with the multidisciplinary approach, our further research will include aspects of urban housing design that integrate sustainable objectives. These will include aspects that relate to urban functions related to housing: from urban amenities to aspects concerning active mobility. They will also tackle technical aspects of sustainability and resilience, such as the solar potential of new or existing residential areas in relation to urban density, using case studies.

In the Romanian context, urban form is regulated not only by the urban planning documents but also adjacent legislation and with references to the city. However, the adaptation to the context and to the good of the community is left to investors, owners, and local administrations, with a negative impact on the quality of life. There is, however, a potential of applying and learning from examples of good practice, such as those researched by Hajer et al. with the role and interaction between all actors involved in the development of residential areas, with a focus on community and sustainable development issues [2]. Therefore, the role of professionals (urban planners, architects, and engineers) needs to be reconsidered, from the familiar one of responding to the demands of investors and, implicitly, the market, to that of working with the local community to help implement projects that promote just, resilient, and "liveable" cities.

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