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Research Article

Development of Mass Housing and Structural Systems in Sumgait's Second and Third Residential Areas

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Abstract

The development of microdistricts in Sumgait, Azerbaijan, during the 1960s marked a pivotal shift in urban planning, reflecting broader Soviet trends. These residential complexes, larger and more integrated than traditional block structures, aimed to optimize living conditions through functional zoning and the strategic placement of educational and recreational facilities. This study examines the planning, infrastructure, and architectural nuances of Sumgait's early microdistricts, focusing on their innovative design principles, challenges, and legacy.

Key planning features included the row alignment of residential buildings, semi-enclosed courtyards, and central locations for schools and gardens, which promoted community cohesion and functional integration. However, the lack of fencing and the dispersed placement of service facilities highlighted shortcomings, including inefficient land use and delayed infrastructure development. Moreover, the absence of coordinated parking solutions and the proliferation of individual garages and cars disrupted the intended harmony of green spaces and pedestrian safety.

Comparative analyses with practices in other Soviet and European cities underscore the evolving balance between residential needs and service systems. Recommendations emphasize integrated placement of service facilities, cooperative design of public institutions, and innovative parking solutions to enhance urban living standards. By addressing these issues, Sumgait's microdistricts could serve as models for sustainable urban development, aligning with contemporary principles of efficiency, green construction, and community-oriented design.

Keywords: Architectural Planning; Industrial City; Public Area; Factory; Territory

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Araştırma Makalesi

Sumqayıt'ın İkinci ve Üçüncü Konut Bölgelerinde Toplu Konut Gelişimi ve Yapısal Sistemler

Malahat EYNULLAYEVA[*], Tarana QULIYEVA[**]

Öz

1960'lı yıllarda Azerbaycan'ın Sumqayıt kentinde mikrorayonların (mikrobölgelerin) gelişimi, kent planlamasında dönüm noktası niteliğinde bir değişimi temsil etmiş ve daha geniş Sovyet eğilimlerini yansıtmıştır. Geleneksel blok yapılardan daha büyük ve bütünleşik olan bu konut kompleksleri, işlevsel bölgeleme ve eğitim ile dinlenme alanlarının stratejik yerleşimi aracılığıyla yaşam koşullarını iyileştirmeyi amaçlamıştır. Bu çalışma, Sumqayıt'ın erken dönem mikrorayonlarının planlama, altyapı ve mimari özelliklerini inceleyerek yenilikçi tasarım ilkeleri, karşılaşılan zorluklar ve kalıcı miraslarını ele almaktadır.

Temel planlama özellikleri arasında sıralı konut binaları yerleşimi, yarı kapalı avlular ve okullar ile bahçelerin merkezî konumlandırılması bulunuyordu; bu da topluluk bütünlüğünü ve işlevsel entegrasyonu teşvik ediyordu. Ancak, çitlerin bulunmaması ve hizmet tesislerinin dağınık biçimde yerleştirilmesi, verimsiz arazi kullanımı ve gecikmiş altyapı gelişimi gibi eksiklikleri ortaya çıkarmıştır. Ayrıca, koordine edilmemiş park çözümlerinin olmaması ve bireysel garajların ile araçların artışı, yeşil alanların ve yaya güvenliğinin hedeflenen uyumunu bozmuştur.

Diğer Sovyet ve Avrupa kentlerindeki uygulamalarla yapılan karşılaştırmalı analizler, konut ihtiyaçları ile hizmet sistemleri arasındaki dengenin evrimini vurgulamaktadır. Öneriler, hizmet tesislerinin bütünleşik yerleşimi, kamu kurumlarının ortak tasarımı ve yenilikçi park çözümleri aracılığıyla kentsel yaşam standartlarının iyileştirilmesini önermektedir. Bu sorunların ele alınmasıyla birlikte, Sumqayıt mikrorayonları sürdürülebilir kentsel gelişim için bir model teşkil edebilir ve verimlilik, yeşil inşaat ve topluluk odaklı tasarım gibi çağdaş ilkelerle uyum sağlayabilir.

Anahtar Sözcükler: Mimari Planlama; Endüstri Şehri; Kamusal Alan; Fabrika; Bölge

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INTRODUCTION

Urban planning and residential development underwent profound transformations in the mid-twentieth century, particularly with the emergence of microdistricts (mikrorayons) as an innovative model for structuring urban space (Sinitsyna, 2023). Originating in the Soviet Union in the 1960s, this planning concept was conceived as a response to the accelerating processes of industrialization and urbanization, as well as to the urgent demand for mass housing provision (Engel, 2024). In Azerbaijan, cities such as Sumgait, Baku, Ganja, and Mingachevir adopted the microdistrict model as a modern alternative to the traditional perimeter block system (Giedion, 1984). In comparison with quarter-based layouts, microdistricts were intended to ensure a more rational use of interstitial urban land, facilitate the coordinated placement of educational and social infrastructure, and improve overall residential functionality while maintaining economic efficiency. The emergence of this model was also closely linked to technological shifts in construction practices, particularly the introduction of prefabricated large-panel housing systems. Industrialized building methods enabled rapid and standardized production of residential units, which significantly reduced construction time and costs. As a result, the microdistrict became not only a spatial planning concept but also a product of construction rationalization and centralized economic planning. This technological dimension further reinforced the uniformity of architectural solutions and strengthened the state's capacity to implement large-scale urban expansion programs within a relatively short period.

At the same time, housing policies and residential planning models of the mid-20th century were deeply shaped by the ideological foundations of different welfare state regimes. Comparative housing research demonstrates that state approaches to housing provision vary significantly depending on political-economic systems and welfare ideologies. Esping-Andersen's (1990) welfare state typology distinguishes between liberal, conservative-corporatist, and social-democratic regimes, each of which produces distinct housing systems and spatial outcomes. As shown in the work of Hoekstra (2003), applying Esping-Andersen's (1990) typology to housing policies reveals how state-market relations, redistribution mechanisms, and ideological priorities are reflected in residential typologies and urban form. In social-democratic contexts such as the Netherlands and Sweden, strong public intervention coexists with institutional pluralism and municipal autonomy, whereas in liberal regimes, housing provision is more market-oriented. In contrast, in socialist systems such as the Soviet Union, housing was removed from market mechanisms and treated as a universal social right provided and regulated exclusively by the state.

In this regard, housing served not merely as shelter but as a strategic instrument of social engineering. Through the allocation of standardized apartments and the design of collective open spaces, the state sought to promote egalitarian social relations and to reduce visible socio-spatial inequalities. The absence of private land ownership and speculative development fundamentally shaped the morphology of socialist cities, differentiating them from Western urban environments characterized by market-driven land values and differentiated residential hierarchies.

Therefore, the microdistrict model cannot be understood solely as a technical or architectural solution; it represents the spatial embodiment of a specific ideological and institutional framework. The Soviet microdistrict reflected the principles of a centralized socialist welfare state, in which housing policy served as an instrument of social equality, the collective organization of everyday life, and state control over urban development. By situating the case of Sumgait within this broader theoretical debate on housing regimes and welfare state typologies, the analysis gains a clearer conceptual foundation and allows for a more systematic comparison with Western European post-war housing models (Flynn & Montalbano, 2024).

Moreover, the microdistrict structure illustrates how urban form can serve as a mechanism of governance. The concentration of educational, commercial, and cultural facilities within predefined service radii created predictable daily movement patterns and reinforced neighborhood-based social interaction. Such spatial organization contributed to the formation of relatively self-sufficient

residential units, reducing dependence on distant urban centers and aligning with broader principles of planned economic distribution.

The microdistrict planning model was based on the development of large-scale residential complexes ranging from approximately 23 to 35 hectares and designed to accommodate populations of 7,300 to 20,000 residents. These complexes were structured according to the principles of functional zoning, with residential buildings organized into grouped formations around semi-enclosed courtyard spaces. Public facilities including schools, kindergartens, and landscaped green areas were systematically integrated into the internal structure of the neighborhood unit. Particular emphasis was placed on the separation and regulation of pedestrian and vehicular circulation, the climatic orientation of buildings to ensure favorable environmental conditions, and the creation of a cohesive social environment supported by centralized public services (Tsenkova & Nedović-Budić, 2006; Varga-Harris, 2015).

Despite its innovative conceptual foundations, the microdistrict model encountered significant implementation challenges, particularly in relation to service infrastructure provision, parking organization, and the integration and maintenance of green spaces. Delays in the construction of social and commercial facilities, insufficient improvement and landscaping of courtyard areas, and ineffective traffic management practices have limited the realization of the model's intended functional and social objectives (Alekseyeva, 2019; Marsden, 2006). These shortcomings remain evident in cities such as Sumgait, where the dispersed location of service amenities and the rapid growth of private vehicle ownership have intensified spatial conflicts and contributed to the gradual deterioration of the residential environment.

This article examines the historical evolution, planning principles, and contemporary challenges associated with the development of microdistricts in Sumgait. The study pursues the following objectives:

- to analyze the structural and spatial organization of microdistricts, with particular attention to their original planning concepts;
- to identify the socio-economic and environmental factors influencing their present-day functionality;
- to evaluate deficiencies in service distribution, green space planning, and transport management;
- to formulate recommendations for the optimization of urban planning strategies, drawing upon both local experience and relevant international practices.

Through a critical assessment of these dimensions, the article aims to contribute to broader debates on sustainable urban development and to propose context-sensitive strategies for adapting the microdistrict model to contemporary urban conditions.

METHODOLOGY

This paper analyzes the planning structure and spatial characteristics of microdistricts developed within the second and third residential districts of Sumgait. The research focuses on mass housing projects implemented in the second half of the twentieth century, particularly during the 1960s. It seeks to evaluate the long-term impact of the microdistrict model on the city's urban environment.

The study is grounded in a qualitative research design and employs a sequential combination of several methods. In the first stage, the formation of the microdistrict concept and its practical implementation in Sumgait were examined from a historical perspective. To this end, archival materials, master plans, architectural drawings, normative and technical documentation, and relevant scholarly sources were systematically analyzed. The original planning schemes of Microdistricts No. 1 and No. 4 were selected as the primary case studies for detailed examination (Figure 1).

Figure 1. Sumqayit's 1st and 4th Microdistricts from the Soviet Era

In the second stage of the research, the planning and architectural characteristics of the selected microdistricts were systematically analyzed. This phase focused on the spatial configuration of residential buildings, the formation and typology of courtyard spaces, the distribution of public facilities, transportation linkages, and the organization of green areas. Attention was given to the climatic orientation of buildings and the structure of pedestrian circulation, to assess the coherence and functionality of the original planning solutions.

In the third stage, field research was conducted to evaluate the current condition of the microdistricts. On-site observations enabled the identification of discrepancies between the initial design concepts and current use patterns. The organization of pedestrian and vehicular movement, parking conditions, the state of public spaces, and the quality of landscaping were systematically documented, including photographic recording to support the analytical findings.

At the final stage, a comparative analytical framework was employed. The planning practices observed in Sumgait's microdistricts were compared with analogous residential developments in other Soviet cities, as well as with selected contemporary European urban planning models (Kovács & Herfert, 2012). This comparative perspective facilitated the identification of both structural strengths and systemic weaknesses and informed the formulation of recommendations consistent with current urban planning principles.

Thus, the research was conducted through an integrated methodological approach combining historical-documentary analysis, spatial and architectural evaluation, empirical field observation, and comparative analysis. This comprehensive framework enabled a more nuanced understanding of the developmental trajectory of Sumgait's microdistricts and provided a robust basis for evidence-based recommendations regarding their future transformation.

EVOLUTION AND CHALLENGES OF MICRO DISTRICT PLANNING

Microdistrict No. 1, initiated in 1961, was designed to accommodate approximately 7,300 residents and was characterized by a clearly defined planning structure consisting of row-arranged residential buildings and strategically located public facilities. The spatial configuration sought to create an integrated residential environment by coordinating the incorporation of green spaces, housing blocks, and service institutions (Aksenov et al., 2019; Likhachova, 2019).

As urban expansion progressed, subsequent microdistricts increased both in territorial scale and population capacity, resulting in more complex planning solutions. These included a clearer functional differentiation between residential and service zones, as well as the allocation of dedicated areas for recreational and educational facilities. However, despite these advancements, difficulties emerged in ensuring effective coordination between housing and service infrastructure.

Shortcomings in traffic organization and the placement of essential utilities limited the overall efficiency of the spatial structure. Such issues continue to be relevant to contemporary discussions on the sustainable development and modernization of large-scale residential environments (Abbood et al., 2021; Engel & Rogge, 2024).

In the development of three- and four-section five-story residential buildings, clear consideration was given to local topographical and climatic conditions, reflecting principles previously applied in the city's earlier block-based development The community center of the microdistrict was located along the transverse axis, with direct access to the district street, serving residents within an approximate service radius of 0.5 km.

Microdistrict No. 4 (designed by N. Mamedbayli), whose construction commenced in 1963, differed compositionally from Microdistrict No. 1. Its planning structure was based on the principle of situating residential buildings along the periphery while concentrating service facilities in the central zone. Housing groups were organized around semi-enclosed courtyard spaces, forming a cohesive spatial composition. The architectural ensemble included two principal housing types: five-story stone buildings and large-panel three- to four-section buildings, complemented by isolated point buildings ranging from three to nine stories. This combination generated a varied and visually dynamic urban environment (Figure 2). The absence of enclosing perimeter structures further reinforced spatial openness, allowing residential buildings and landscaped green areas to function as an integrated and unified composition (Gehl, 2010).

Soviet-era residential buildings of Sumgait

Modern-era residential buildings of Sumgait

Figure 2. Soviet-era and modern buildings of Sumgait

The territory of subsequent microdistricts, particularly within the second residential district, gradually expanded to approximately 35 hectares, while the projected population increased from 8,000 to nearly 20,000 residents. Despite this quantitative growth, the overall dimensional and planning parameters of the microdistrict unit remained largely unchanged. Within this framework, pedestrian safety and accessibility to the microdistrict center were partially ensured, notably through the placement of a two-story supermarket building serving as a focal point of daily services. The planning

structure of these relatively large urban formations, characterized by a free internal layout, was influenced by the absence of significant topographical variation or natural boundaries within the designated territories (French & Hamilton, 1979).

The group-based arrangement of residential buildings, typically organized into four to six clusters, facilitated visual connectivity among residents and supported the efficient landscaping of courtyards and the allocation of spaces for recreation, sports, educational facilities, and everyday services.

Thus, within a unified structural scheme combining internally organized open spaces and perimeter residential development, a functional division of territory by designated uses was clearly articulated. The residential zones, consisting of several semi-enclosed courtyards, provided a relatively favorable environment for children and elderly residents, as they allowed for the placement of playgrounds and recreational areas near housing. Moreover, the grouped configuration enabled optimal building orientation to mitigate wind exposure and ensured convenient pedestrian access to schools, retail outlets, and service facilities (Figure 3).

However, this planning approach also imposed limitations. The standardized structure restricted flexibility in modifying the typology and distribution of playgrounds and sports grounds, as well as in adapting equipment placement within landscaped areas. Approximately 50% of the microdistrict territory was occupied by institutional facilities such as schools, kindergartens, and supermarkets, whose land allocations ranged from 0.5–0.8 hectares up to 2.5 hectares per facility. This substantial land consumption constrained opportunities for alternative spatial reconfiguration and limited the adaptability of the internal environment.

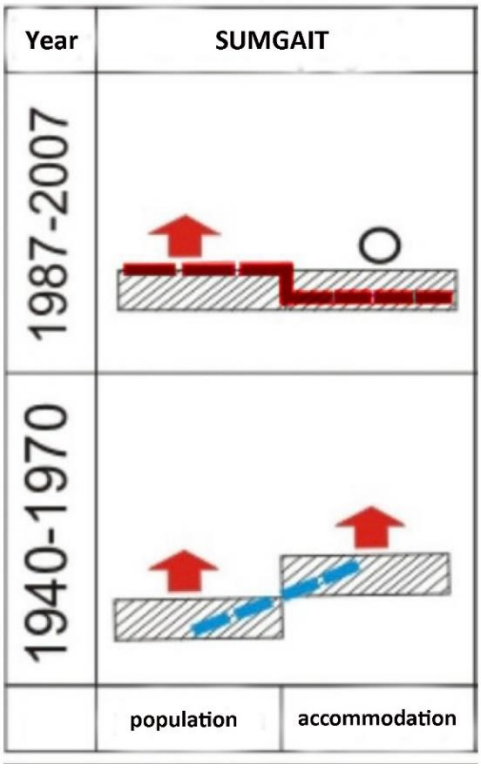

Figure 3. Dynamics of development of residential construction of population of Sumqait city (Reference: Eynullayeva, 2011)

In addition to the facilities located along the periphery, primarily concentrated near the public center and represented by a supermarket and several service establishments, many other public and commercial functions (such as small shops, canteens, cafés, and household service units) developed in a largely spontaneous and uncoordinated manner. At the same time, there were instances in which service premises were integrated into the ground floors of residential buildings, thereby ensuring direct accessibility within the residential zone and minimizing the service radius for

neighborhood residents. While this arrangement improved convenience, the functional requirements of such facilities, including the provision of storage areas and service access for delivery vehicles, necessitated truck entry into intra-block pedestrian spaces, thereby reducing the comfort and safety of the residential environment.

Furthermore, delays in the construction of service infrastructure are linked to the completion of residential buildings and to the failure to carry out timely courtyard improvements and landscaping, further deteriorating living conditions, a pattern that, in some cases, persists to the present day (Plotnikov, 2019). Consequently, the dispersed and autonomous placement of primary service units throughout the microdistrict can be regarded as largely ineffective. These facilities often lacked a comprehensive range of goods and services while occupying significant portions of territory and operating within inconsistent accessibility radii.

By contrast, the experience of many European cities indicates that the integration of public service facilities into the ground floors of residential buildings along major perimeter streets, combined with a systematic and repetitive distribution of service functions, represents a more efficient and spatially rational approach to the organization of retail and consumer services within residential areas (Gutnov, 1985).

Experience from cities such as Baku, Ganja, Nakhichevan, Mingachevir, and Shirvan demonstrates that service infrastructure is frequently situated outside the boundaries of individual microdistricts, often concentrated around public transport hubs. These observations highlight broader patterns in the organization of urban services and inform the development of strategies for the integration of housing and service facilities, as well as for the design of new residential forms with differentiated levels of accessibility and visitation.

Educational institutions, such as schools and kindergartens, require dedicated land parcels, often including surrounding access routes with a minimum width of four meters. When these institutions are sited independently, they occupy substantial portions of microdistrict territory. By contrast, cooperative or clustered placement of such facilities can maintain or even reduce the overall land requirement, thereby freeing space for green areas or enabling the densification of new residential development, ultimately contributing to an increase in the city's housing stock.

Within microdistrict layouts, careful consideration of traffic organization is critical. The presence of internal and external transportation infrastructure, including block garages or, in some cases, entire clusters of garages can significantly constrain land use within neighborhoods. Moreover, the utilitarian design, unremarkable form, and construction materials of these garages negatively affect the visual and experiential quality of internal spaces, reducing the perceived comfort of the residential environment (Gubkin, 1949).

Additionally, the narrow width of many internal passages, designed primarily for one-way traffic, forces vehicles to circulate extensively around the microdistrict in order to access individual buildings, creating inconvenience for residents and further complicating traffic flow (Figure 4).

The recent rapid increase in private vehicle ownership has placed considerable pressure on microdistrict spaces. Parking often occupies portions of green areas and sports grounds, and in some cases, vehicles completely dominate these spaces. Their presence narrows pedestrian pathways, limits opportunities for courtyard improvements, poses safety risks to children at play, and contributes to localized air pollution (Gagarina, 2023).

The scarcity of dedicated parking within residential courtyards has forced many residents to utilize on-street spaces, often alongside vehicles belonging to private shops, firms, and service establishments. This situation generates conflicts with public transport operations and undermines the functionality of pedestrian zones. Constructing multi-story or terrain-adaptive (manege) garages could substantially relieve intergroup spaces of box garages, improve site maintenance, and enhance the architectural quality of residential environments through expressive forms and façade treatments.

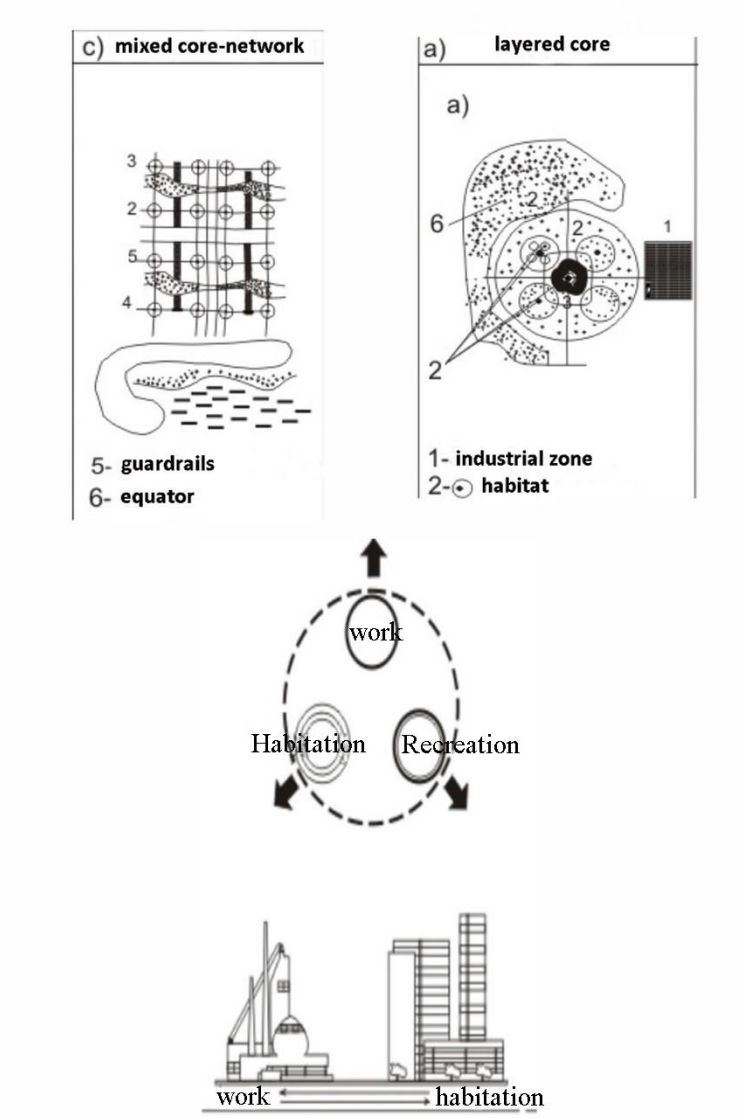

Figure 4. System structural design schemes of Sumgait city (Reference: Eynullayeva, 2011)

Another unresolved issue in the microdistricts of Sumgait is the dispersed and uncoordinated placement of outbuildings. Utility and service facilities, including boiler houses, laundry, garages, repair workshops, garbage collection points, yard toilets, transformer substations, gas distribution cabinets, and janitor rooms are scattered across the territory, with no centralized utility yards. This lack of spatial organization reduces efficiency, complicates maintenance, and diminishes the overall coherence of the residential environment.

The vast majority of household and utility facilities in Sumgait's microdistricts are constructed in a scattered and uncoordinated manner, often resulting in cluttered spaces. This situation is exacerbated by limited access to garbage collection vehicles, which further hinders proper maintenance and sanitation. In contrast, the experience of Russian cities provides a positive example: in certain residential microdistricts, a dedicated block section is allocated for utility and service facilities at the junction of two residential building ends, enabling more efficient organization and maintenance (Andrusz et al., 1996).

Additionally, the planning and organization of green spaces and the strategic placement of sports facilities within microdistricts warrant particular attention. Effective allocation of these communal areas is essential to ensure recreational opportunities, promote social interaction, and enhance the overall quality of the urban living environment.

RESULTS AND DISCUSSION

The study identified several key findings concerning the development and functionality of microdistricts in Sumgait. The original planning of these microdistricts adhered to principles of functional zoning and the group arrangement of residential buildings, aiming to enhance urban living quality (Aliyev, 2019). Residential blocks were organized around semi-enclosed courtyards, creating communal spaces conducive to recreation and social interaction, particularly for children and the elderly. Building orientation was optimized to respond to local climatic conditions, providing wind protection and facilitating efficient pedestrian circulation. Moreover, integrating essential public facilities including schools, kindergartens, and green spaces, within the central zones of microdistricts improved accessibility and reinforced community cohesion. At the same time, the long-term sustainability of such planning solutions depended heavily on consistent maintenance, institutional coordination, and adaptive management mechanisms. In the absence of regular modernization and infrastructural upgrades, even well-designed spatial configurations gradually lost functionality. The transition to a post-socialist economic system introduced new patterns of property ownership, informal commercial activity, and individualized transport behavior, all of which altered the original logic of microdistrict organization. These transformations underscore the importance of viewing microdistricts not as static historical artifacts but as dynamic urban systems requiring continuous adaptation.

Despite these intentions, several challenges emerged in the practical implementation of the planning principles. A primary issue was the scattered placement of service facilities, which often failed to adequately meet residents' needs. While the inclusion of services on the ground floors of residential buildings reduced travel distances, the inconsistent distribution of such facilities limited their overall efficiency and functionality. In addition, green spaces and courtyard layouts were frequently compromised by the increasing presence of parked vehicles, which encroached upon areas originally intended for recreation and landscaping (Andrusz, 1984). These challenges, compounded by delays in courtyard construction and improvement, reduced the effectiveness of these areas as communal and recreational spaces. In Azerbaijan, particularly in Sumgait, the Soviet-era model of microdistricts is a vivid spatial embodiment of the state-centred welfare concept and ideology of collective living, which corresponds to the socialist welfare regime with a strong emphasis on the state as the main producer and distributor of housing (in contrast to the hybrid or liberal models described in Esping-Andersen's typology and its application to housing policy, for example: Hoekstra, 2003).

From a broader theoretical perspective, the spatial structure of Sumgait's microdistricts reflects the characteristics of a socialist welfare regime in which housing policy was centrally planned and ideologically embedded. Unlike liberal welfare regimes, where housing is largely commodified and market allocation dominates, or conservative-corporatist systems, where housing provision is mediated through occupational or family-based structures, the Soviet model was grounded in universal state provision. In terms of welfare state typologies inspired by Esping-Andersen (1990), the Soviet approach constituted a distinct state-socialist variant, characterized by decommodification of housing and full state control over production, distribution, and spatial organization.

From a broader theoretical perspective, the microdistrict can be interpreted through the lens of modernist urbanism and the functionalist paradigm that dominated mid-twentieth-century planning theory. The principles underlying microdistrict planning resonate with the ideas articulated in the Athens Charter and with the broader movement toward rational, standardized, and health-oriented urban form. Functional separation of residential, industrial, and recreational zones, hierarchical road networks, and the prioritization of light, air, and greenery were not exclusively socialist innovations but part of a global modernist discourse. However, while Western European implementations of modernist planning often operated within mixed economies and private property frameworks, the Soviet adaptation institutionalized these principles within a fully centralized planning apparatus. This distinction significantly affected both implementation mechanisms and long-term spatial outcomes.

Theoretically, the microdistrict may also be examined through the concept of state-led spatial production. Drawing upon Lefebvre's notion that space is socially produced and embedded within relations of power, the socialist city represents a particularly explicit case in which spatial organization was directly shaped by political ideology and administrative command structures. In this context, urban form functioned as a regulatory instrument: standardized apartment sizes, uniform building typologies, and predetermined service radii were designed to structure everyday practices and reinforce collective modes of living. The microdistrict thus embodied a normative vision of social life, where spatial proximity was expected to foster solidarity while minimizing socio-economic differentiation.

At the same time, welfare state theory provides an additional analytical layer for understanding divergences between socialist and Western housing models. While Esping-Andersen's (1990) typology primarily addresses capitalist welfare regimes, its conceptual emphasis on decommodification and stratification remains analytically useful. In socialist systems, housing was almost fully decommodified: allocation was based on administrative distribution rather than market exchange. This level of decommodification exceeded that of social-democratic regimes yet paradoxically coexisted with chronic shortages and limited consumer choice. Consequently, the microdistrict reflects a unique configuration in which spatial equality was prioritized over diversity, and standardization replaced competition as the dominant organizing principle.

Another relevant theoretical dimension concerns the relationship between scale and governance. Microdistricts were conceived as relatively self-sufficient planning units, typically structured around walking-distance access to schools, childcare facilities, local retail, and green areas. This corresponds to Clarence Perry's "neighborhood unit" concept, yet the Soviet model expanded the scale and standardized it across vast territories. The result was a replicable urban module that could be reproduced in different climatic and regional contexts with minimal modification. Such scalability was instrumental for rapid industrial urbanization but also led to morphological uniformity across cities of the Soviet Union and its republics, including Azerbaijan.

Furthermore, contemporary urban theory invites a reassessment of microdistricts in light of resilience, adaptability, and sustainability debates. Although often criticized for monotony and spatial rigidity, microdistrict layouts possess latent structural advantages: generous open spaces, clear pedestrian hierarchies, and separation from heavy traffic corridors. These characteristics align with present-day calls for walkable neighborhoods, green infrastructure integration, and child-friendly urban environments. Therefore, rather than interpreting microdistricts solely as relics of a centralized past, they may be conceptualized as spatial frameworks with adaptive capacity. Their transformation depends less on radical morphological restructuring and more on governance reforms, participatory planning mechanisms, and infrastructural reinvestment.

In post-socialist contexts, including Sumgait, the transition to market-oriented systems introduced hybrid spatial dynamics. Privatization of housing units altered maintenance responsibilities, fragmented ownership structures, and weakened centralized management mechanisms that had previously ensured uniform upkeep. Theoretical discussions of path dependency are therefore relevant: inherited spatial configurations continue to shape contemporary development trajectories, constraining and enabling certain policy choices. Understanding microdistrict evolution thus requires integrating welfare regime theory, post-socialist transition studies, and spatial production theory into a coherent analytical framework.

By situating the microdistrict within these intersecting theoretical debates—modernist functionalism, decommodification and welfare regimes, state-led spatial production, and post-socialist path dependency—the study establishes a multidimensional conceptual foundation. This theoretical synthesis allows the empirical case of Sumgait to be interpreted not merely as a localized planning phenomenon, but as part of a broader historical and institutional trajectory linking ideology, governance, and urban morphology.

In Azerbaijan, particularly in the city of Sumgait, the microdistrict model developed during the Soviet era exemplifies a spatial manifestation of a state-centered welfare system and the ideology of collective living. The standardized residential blocks, centralized service facilities, extensive green spaces, and pedestrian-oriented planning observed in the second and third residential areas of Sumgait were guided by Soviet socialist principles of equality, collectivism, and state control. These planning decisions reflected not only technical and functional requirements but also the state's broader objective of structuring daily social life and influencing collective behavior through spatial organization.

This approach contrasts sharply with social housing models in Western Europe. For example, Sweden's Million Programme, implemented during the 1960s–1970s, although state-driven, emphasized individual living quality, architectural diversity, and the active role of local municipalities. Similarly, in the United Kingdom, council housing primarily aimed to meet the needs of individual families, functioning within a social security framework rather than as an instrument of ideological control. In comparison, the residential environment in Sumgait's microdistricts was shaped according to a more centralized, normative, and ideologically driven planning framework.

As comparative housing scholarship suggests, including the application of Esping-Andersen's (1990) framework to housing systems, Western European welfare states demonstrate varying degrees of market integration, municipal autonomy, and tenure diversity. In contrast, the Soviet housing system eliminated tenure pluralism and subordinated architectural typologies to centralized norms. Consequently, the microdistrict became not only a planning unit but also a material expression of a specific welfare ideology.

The role of the state in housing production within the Soviet model was characterized by treating housing not as a market commodity but as a fundamental social right. Within the socialist welfare framework, the state served as the primary producer and allocator of housing, aiming to fulfill the population's minimum housing needs through mass-produced and standardized residential environments.

In this model, collectivism was reinforced through spatial organization. Microdistricts were designed around centralized public services, shared open spaces, and uniform residential buildings, thereby fostering a collective lifestyle. Individual expression was largely confined to the interior of private apartments, while standardized planning limited personal choice and emphasized social equality.

As a result, Soviet housing policy sought to balance collective welfare with individual needs through the deliberate use of spatial design. This approach provides a significant theoretical and historical foundation for contemporary discussions on urban planning and the relationship between social policy and spatial organization.

Traffic and parking management have also emerged as critical challenges in microdistricts. The rapid growth of private vehicle ownership has placed considerable strain on existing infrastructure, with insufficient parking capacity forcing residents to park along roadways. This situation not only disrupts traffic flow but also compromises pedestrian safety, particularly for children playing in courtyards. The narrow width of internal access roads within microdistricts further exacerbates these problems, as vehicles are often required to navigate circuitous routes to reach their destinations. Additionally, the presence of box garages and scattered outbuildings diminishes both the aesthetic and functional quality of microdistricts, occupying valuable space and undermining the architectural cohesion of the residential environment.

Comparative analysis with urban models from other cities highlights alternative strategies for addressing these challenges. For instance, situating public service facilities along the periphery of residential areas on main thoroughfares has proven effective in many European cities, as it reduces spatial conflicts within neighborhoods while enhancing service accessibility. Likewise, consolidating utility functions into designated zones can improve the efficiency of waste management and other

essential operations, thereby freeing additional space for green areas or future residential development.

These findings highlight the necessity for a more integrated and adaptive approach to urban planning in Sumgait's microdistricts. Interventions such as the construction of multi-story parking facilities, the strategic positioning of public service units, and the enhancement of landscaping can substantially improve the quality of the living environment. By drawing on both local experiences and international best practices, urban planners can refine the microdistrict model, ensuring that it meets contemporary urban demands while advancing sustainability objectives.

CONCLUSION

The microdistricts of Sumgait were developed as a spatial manifestation of Soviet urban planning ideology and the state-centered welfare model. Within a centralized planning system, this approach integrated standardized residential buildings with educational, cultural, and recreational facilities to provide mass housing within a relatively short timeframe. As a fundamental residential unit, the microdistrict was designed around the principle of pedestrian accessibility to essential services and framed housing not as a market commodity but as a component of social provision. This reflected fundamental differences in welfare regimes: in the Soviet model, the state dominated as the sole organizer of housing and infrastructure, while in Western European welfare states (according to Esping-Andersen's (1990) typology), public intervention was combined with municipal structures and market mechanisms.

In its initial phase, this approach offered notable advantages, particularly in terms of functional zoning and the proximity of social infrastructure. However, the development trajectory of Sumgait's second and third residential districts reveals discrepancies between the original planning intentions and current conditions. Delays in completing service infrastructure, insufficient parking capacity, traffic congestion, and the reduction of green spaces have adversely affected the quality of the living environment. Furthermore, the uncoordinated placement of public and auxiliary facilities has undermined spatial coherence, demonstrating the limited adaptability of a rigid and standardized planning model to evolving socio-economic conditions.

From a comparative perspective, fundamental differences emerge between the Soviet microdistrict model and post-war social housing policies in Western Europe. In the Soviet system, the state acted as the sole organizer and provider of housing and social infrastructure. In contrast, within Western European welfare states, public intervention functioned alongside municipal governance and market mechanisms. Comparing these models provides valuable insights into how ideological and institutional frameworks shape urban space.

Nevertheless, several core principles of the microdistrict model remain highly relevant for contemporary urban planning. The proximity of services to residential areas, the organization of pedestrian networks, and the integrated structure of neighborhood units correspond closely with current concepts of sustainable urban development. Future strategies should therefore focus on reorganizing and adapting the existing structures rather than replacing them entirely.

In this context, integrating service facilities into the ground floors of residential buildings, implementing multi-level parking solutions, and optimizing transportation systems could mitigate spatial fragmentation. The consolidation of educational, sports, and public service facilities into functional clusters, along with the systematic preservation and expansion of green spaces, would enhance the overall quality of the residential environment. Moreover, effective management of utility and service zones would prevent informal encroachments and improve both environmental and visual conditions.

In conclusion, the microdistricts of Sumgait should be viewed not only as products of a historical planning model but also as urban structures with significant potential for contemporary

transformation. By addressing existing deficiencies while adapting core spatial principles, these residential areas can achieve more sustainable, functional, and livable urban environments.

Future urban strategies should therefore balance preservation and innovation. Rather than pursuing large-scale demolition or radical restructuring, planners may adopt incremental regeneration approaches that respect the original spatial framework while introducing flexible mixed-use functions, environmentally responsive design solutions, and participatory planning mechanisms. Strengthening community involvement in the redesign of courtyard spaces, improving pedestrian connectivity, and incorporating climate-sensitive landscaping strategies would further enhance resilience and social vitality. In this way, the historical legacy of the microdistrict can be reinterpreted as a foundation for forward-looking urban development grounded in sustainability, inclusivity, and spatial efficiency.

DECLARATIONS

Ethics committee approval

The authors affirm that all the processes were conducted in line with the copyright regulations for intellectual and artistic works, research and publication ethics. As this study does not involve direct human participation or data that requires ethics committee approval, approval from the ethics committee was not obtained.

Contributions of authors

Malahat Eynullayeva: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing - original draft, Writing- review & editing.

Tarana Quliyeva: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing- review & editing text

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Artificial intelligence tools were used solely for language editing and improvement of the English text (grammar, spelling, and clarity). AI tools were not used for content generation, data analysis, interpretation of results, or development of the scientific arguments. The author assumes full responsibility for the content of the manuscript.

Data Availability

The authors declare that the data used in the study are explicitly provided in the manuscript.

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