ARCHITECTURAL-PLANNING PRINCIPLES OF SOCIAL HOUSING DESIGN IN CENTRAL ASIA

Xasanov Azamat Ozadovich
PhD. professor v.b., Toshkent arxitektura-qurilish universiteti,
"Arxitektura" fakulteti dekani
Jabborova Kumushxon Farrux qizi
"Arxitektura" kafedrasi magistranti, Toshkent arxitektura-qurilish universiteti,
O'zbekiston, Tashkent

Annotatsiya. *Mazkur tadqiqot Markaziy Osiyo ijtimoiy turar joylarning tarixiy rivojlanishi va zamonaviy arxitektura-shaharsozlik tamoyillarini tahlil qiladi. Maqolada an'anaviy hovli-mahalla tizimi, Sovet davri mikrorayonlari va mustaqillik davrida bozor iqtisodiyotiga asoslangan qayta qurish jarayonlari o'rtasidagi bog'liqlik yoritilgan. Ko'p qavatli uy-joy massivlarining iqlimiy moslashuvchanligi, seysmik barqarorlik va energiya samaradorligi masalalari, shuningdek, shaharsozlikda an'analarni saqlab qolish va zamonaviy talablarni uyg'unlashtirish masalalari tadqiq etilgan. Tadqiqot natijalari asosida samarali turar joylarning arxitekturaviy tipologiyasini, an'anaviy mahalla infratuzilmasini va shaharsozlik tizimlarini integratsiya qilish bo'yicha tavsiyalar ishlab chiqilgan.*

Аннотация. *Данное исследование анализирует историческое развитие социального жилья Центральной Азии и современные архитектурно-градостроительные принципы. В статье освещена взаимосвязь между традиционной системой дворовой махалли, микрорайонами советской эпохи и процессами рыночной реструктуризации периода независимости. Изучены вопросы климатической адаптивности, сейсмической устойчивости, энергоэффективности и сохранения традиций при формировании городской среды. Разработаны рекомендации по интеграции архитектурной типологии, традиционной инфраструктуры «махалли» и градостроительных систем.*

Abstract. *This research analyzes the historical development of social housing in Central Asia and contemporary architectural and urban planning principles. The article highlights the relationship between the traditional courtyard-mahalla system, Soviet-era microdistricts, and market-driven reconstruction processes. Issues of climatic adaptability, seismic resilience, energy efficiency, and tradition preservation are examined. Recommendations are developed for integrating housing typology, mahalla infrastructure, and urban planning systems.*

Keywords: *mikrorayon, mahalla, courtyard housing, seismic resilience, climate adaptation, post-Soviet construction, national architectural identity, Central Asia.*

Kalit so‘zlar: *mikrorayon, mahalla, hovlili turar-joy, seysmik xavfsizlik, iqlimga moslashish, postsovet qurilishi, milliy me'moriy uslub, Markaziy Osiyo.*

Ключевые слова: *микрорайон, махалла, дворовое жильё, сейсмостойкость, климатическая адаптация, постсоветское строительство, национальный архитектурный стиль, Центральная Азия.*

Introduction. Housing design in Central Asia is shaped by a layered interaction between: (i) vernacular courtyard-based dwelling and mahalla settlement logics; (ii) Soviet industrialized mass housing organized through the mikrorayon; and (iii) post-Soviet reforms combining market-led redevelopment, renovation programs, and new master-plan governance tools [1–7]. Social housing principles address not only unit plans, but also the planning unit (courtyard compound, mahalla, mikrorayon), the delivery system, and performance imperatives rooted in hot-dry continental climates and seismic risk [1, 4, 5, 8–10].

The Soviet Microrayon Legacy. Soviet-era residential planning repeatedly used the mikrorayon as a bounded, self-sufficient urban unit bundling housing with everyday services and public space [4, 6]. A typical microrayon contained apartment residences together with schools, food stores, retail shops, a community center, and often a workplace, while several mikrorayons combined into a larger rayon organized around shared institutions such as parks and cinemas [4]. The planning unit measured 10–60 ha, composed of 3–4 residential groups around courtyards, with outer streets carrying transit and inner streets providing residential access [11].

Implementation depended on industrial standardization; housing construction was carried out almost entirely according to standard designs, with the I-464 (Khrushchyovka) series dominant — low-cost concrete-panelled or brick apartments typically 3–5 floors, assembled at remarkable speed (a five-story building in 12 days once foundations were prepared) [8, 12, 13]. In Bishkek, the model produced strong community life centered in shared yards and public spaces [14], but in Kazakhstan the same logic generated monotony and a total lack of local or regional identity, with buildings poorly connected to street environments [15].

Traditional Dwelling Typology and the Mahalla. Traditional Central Asian housing is strongly courtyard-centered, treating the courtyard as both a climatic and social engine. The courtyard provides a desired microclimate by increasing airflow and improving ventilation, while the planning logic of layered thresholds (Berun/Darun — external and internal zones) creates privacy gradients structured around interior space rather than street exposure [1]. In Samarkand courtyard houses, the aiwan functions as a shaded semi-outdoor social space, and

almost every house reserves at least one room exclusively for receiving guests — making hospitality a core programmatic driver [9, 17].

The courtyard plan is also adaptable over time: rooms are accessed via the courtyard rather than corridors, enabling successive additions as household needs change [9]. At the neighborhood scale, the mahalla is built from courtyard-house modules, with the Uzbek house connecting to the city not directly but through an intermediary sequence — city → street → alley → courtyard → iwan → room [2, 3]. Regional variations in Uzbekistan include Bukhara, Ferghana, and Khiva styles, with distinct orientations toward enclosed courtyards or open gardens, and cultural norms requiring separation between representative visitor-facing areas and everyday private zones (ichkari/tashkari) [18, 19].

Climate and Seismic Adaptation. Climate-responsive planning relies heavily on spatial form. Courtyard houses produce favorable summer microclimates through orientation, thick adobe walls, ventilation systems, and shady courtyards with gardens or water basins — traditional mud-brick homes in Tashkent were observed to be four or five degrees cooler in summer than adjacent Soviet-era districts [17]. Multi-storey planning guidance for Uzbekistan recommends using 7–9-storey buildings as windbreaks along microdistrict edges where dusty-wind days exceed 20 per year, and open courtyard sides should be directed toward prevailing summertime winds [26].

Seismic adaptation combines structural-system selection, materials strengthening, and governance tools. Uzbekistan's new regulatory measures require design based on regional accelerograms and automated monitoring for load-bearing structures in high-hazard categories [25]. A prefabricated low-rise housing concept adapted for Kazakhstan was evaluated under magnitudes 8–9 and found capable of withstanding considerable seismic deformations [24]. At the regional scale, the Earthquake Model for Central Asia (EMCA) project developed a probabilistic seismic hazard model combined with a multi-resolution residential building-stock exposure model [10].

Family Structure and Social Organization. Household structure and social life are key spatial-programmatic drivers in Central Asian housing. Planning of Samarkand courtyard houses starts from the need to accommodate multiple generations — with separate heated spaces for grandparents, married sons' families, and unmarried daughters — while the courtyard serves as the main social arena from spring to autumn [9]. Studio-type apartment layouts conflict with cultural norms, as they expose sleeping areas to guests, contradicting expectations of privacy [28]. At the neighborhood level, the mahalla functions not only as a territorial unit but as a way of life and a place where state and society interact locally [3].

Post-Soviet Housing Transformation. Post-Soviet housing transformation brought a structural shift in delivery: state-financed construction entered crisis as industrial housing

enterprises collapsed and delivery shifted toward individual entrepreneurs and smaller design specialists [5]. In Almaty, investor-profit-oriented developments replaced core urban-planning principles, introducing 12–16-storey tower blocks that raised concerns about social cohesion with surrounding Soviet-era neighborhoods [6]. In Kazakhstan, renovation is preferred over demolition to avoid eviction and destruction of established social connections [29], while Tashkent's master plan defines reconstruction and renovation zones with rules for densification tied to socio-economic need and infrastructure capacity, and requires replacement of unsafe or non-seismic-resistant buildings [7, 31].

National Identity and Regional Architectural Style. Central Asian housing repeatedly uses design and planning tools to produce regional or national character. Since 1973, Tashkent standardized panel-style housing complexes incorporated Uzbek decorative traditions — ganchi, pandjara, and mosaic tile — covering large parts of facades and side walls [35]. Tashkent is now developing a citywide standard to harmonize building exteriors into a unified architectural style incorporating national character, while planning governance limits construction volumes in mahallas to preserve historical appearance [33, 36]. A contemporary Tashkent masterplan proposes a "15-minute city" framework inspired by the mahalla rather than rigid zoning, with districts differentiated by material palette, scale, and layout drawn from Uzbek vernacular [34]. Kyrgyzstan's 105 series embedded vernacular identity differently: its staircase-window sun visors modeled on the mashrabiya (traditional lattice window) were integrated into standardized mass housing elements [12].

Contemporary and Sustainable Design Approaches. Contemporary housing performance principles emphasize energy efficiency, climate-adaptive form, and low-carbon materials. In Uzbekistan, energy-efficient alternatives for rural housing could consume 64%–76% less heating energy than standard rural housing, and building code reforms require approximately 30% reduction in heating energy consumption [39, 40]. Specific approaches include basalt fibre mineral wool insulation, near-zero-energy measures (improved orientation, air-tight envelopes, shading elements), and climate-friendly construction replacing conventional materials with locally available timber, straw, and clay to reduce embodied carbon [41, 42, 44]. Tashkent's revised master plan requires at least 30% of territory in large-scale renovation projects to be dedicated to green spaces and targets 10,000 additional hectares of green space city-wide by 2045 [33, 43].

Comparison of Planning Logics

Planning logic	Dwelling & open-space form	Social infrastructure & access	Governance & identity instruments
Mikrorayon	Medium/high-rise buildings around courtyards; 10–60 ha unit [11]	Self-sufficient: residences + schools + stores; transit/access road hierarchy [4, 11]	Standard series; industrial precast capacity expansion [8]
Courtyard house & mahalla	Courtyard as key climate/social element; iwan; layered thresholds [1, 3]	Neighborhood from courtyard-house modules; intermediary mahalla streets [2, 3]	Volume limits in mahallas; heritage agency coordination [36]
Post-Soviet master-plan redevelopment	Replacement of unsafe/non-seismic structures; reconstruction & renovation zones [7, 31]	Densification based on socio-economic need and infrastructure capacity [7]	City standards with national character; seismic governance via accelerograms [25, 33]

Synthesis and Conclusions. Central Asian social housing design principles represent a tension-managed combination of standardized mass-delivery frameworks, culturally legible spatial organization, and performance governance tuned to climate and seismic risk. Five cross-cutting principles emerge from the evidence:

1. The Soviet mikrorayon establishes a replicable neighborhood unit combining housing, schools, road hierarchy, and open-space courtyards through standardized prefabrication — but is associated with monotony and weak street-level connectivity [8, 11, 15].

2. Traditional courtyard and mahalla logics show enduring principles for climate moderation, privacy gradients, and multi-generational living — including airflow, transitional sequences from street to iwan, and incremental adaptability [1, 3, 9].

3. Climate and seismic adaptation constitute a core planning-performance layer: wind-aware edge placement, envelope thermal choices, and code-based seismic governance using accelerograms and monitoring [15, 25, 26].

4. Post-Soviet transformations shift delivery from state industrial capacity to fragmented entrepreneurs, with policy emphasizing renovation over demolition and master-plan categorization of reconstruction zones tied to infrastructure capacity [5, 7, 29].

5. National identity is treated as an explicit design output — through facade regionalization, hybrid material assemblages, citywide design standards, and governance tools limiting construction in mahallas to preserve historical appearance [17, 33, 35, 36].

The strongest cross-cutting lesson is that Central Asian social housing improves when planning aligns three scales simultaneously: the dwelling's internal social logic (privacy, hospitality, multi-generational accommodation), the neighborhood's daily-service and public-space system (mahalla or mikrorayon), and the city's infrastructure and resilience governance (transport, green-space targets, and seismic code requirements) [4, 9, 11, 17, 25, 33].

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