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Sports Infrastructure Standards and Their Role in Achieving Flexible Centers for Integrated Residential Neighborhoods

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ABSTRACT

Sports infrastructure is a type of infrastructure dedicated to various sports activities and practices. This research defines sports infrastructure as the essential physical and organizational structure required to facilitate sports activities. It is a crucial requirement in residential neighborhoods and a complementary element to the overall infrastructure. Its importance stems from its role in complementing neighborhood centers and its contribution to the social, economic, and cultural aspects of residential areas. Many residential neighborhoods suffer from weak and inefficient sports infrastructure. Despite its apparent presence, it fails to achieve its intended goals, whether in encouraging physical activity, promoting community health, or optimizing the use of allocated spaces. The main research problem is the weak understanding of the role of planning and design standards for sports infrastructure in achieving flexible centers for integrated residential neighborhoods. Therefore, this research aims to develop a comprehensive theoretical framework to include the concepts and values specific to neighborhood centers and the standards for sports infrastructure. The research hypothesis is that aligning local planning and design standards for sports infrastructure with international standards for achieving flexible centers for integrated residential neighborhoods. The descriptive analytical approach was adopted to extract primary and secondary terms and their possible values. These terms were then applied to Al-Amiriya, a neighborhood in Baghdad, chosen because it is experiencing growth and increasing population density, necessitating a study of its potential for integration and diversification of uses (residential, commercial, educational, sports, and recreational). The research revealed a discrepancy between the achievement of international standards and the achievement of local standards within the locally selected research sample.

Keywords: Flexible centers, Residential community centers, Sports infrastructure, Sports infrastructure standards.

1. INTRODUCTION

Infrastructure is a vital component of urban and economic development. It comprises the physical structures that provide essential services to the population. Its elements guide the

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economic development of society, and its quality influences the development of the existing urban area, either improving it or causing it to deteriorate to levels that are difficult to rectify **(Al-Saadi, 2011).** Neuman defined infrastructure as a set of services and facilities built above and below ground that support human development in settlements and form an infrastructure network **(Neuman, 2006).** Infrastructure is the main component that meets the requirements of human development and supports the provision of social, economic, and cultural services. It consists of facilities that exist above or below ground, and their presence is a strong indicator of a healthy, sound environment with social, economic, and political efficiency, and a condition for achieving urban well-being. Sports infrastructure refers to facilities and structures designed specifically for different kinds of sporting activities and exercises. The practice of sports requires an infrastructure of sports facilities with continuous funding for this infrastructure in order to continue its operation, as well as to provide services to visitors from the population, athletes, and others **(Al-Aboudi, 2016)**. It has become a fundamental element in the set of tools for economic development in foreign countries **(Chapin, 2002).** Supporters of sports projects have identified several economic and non-economic benefits from these facilities, including increased tax revenues, job creation, and community image building. For these reasons, sports facilities have become one of the most popular tools for economic development in some foreign countries. From this standpoint, the importance of research in building a knowledge base about the impact of sports infrastructure standards on achieving flexible centers for integrated residential neighborhoods becomes clear. The research assumes that aligning the planning and design standards of local sports infrastructure with international standards supports the development of flexible centers for integrated residential neighborhoods. To achieve the research objective, the following methodology was adopted:

1. Building a comprehensive theoretical framework on the relationship between planning and design standards for sports infrastructure and residential neighborhood centers.
2. Applying the extracted theoretical framework concepts to the Al-Amiriya neighborhood in Baghdad, one of the capital's districts.
3. Testing the verification of indicators in the selected case study is based on information extracted from the case study description for each concept. The concepts are assessed by checking if the criteria are verified or not. The descriptive analytical method was applied in analyzing the results.
4. Reaching conclusions, findings, and recommendations.

Standards are defined as the standard units of all kinds of services (health, education, recreation, sports, etc.), and they are the standard units that govern the built environment from a demographic, social, economic, or environmental perspective **(Babiker, 2019).** Standards are also defined as technical tools or measures used to determine the quantity and type of services proposed for future Localization into the urban environment, ensuring a balanced, sustainable, and livable environment. These standards define the spaces required for social services within the city's urban area, distributed across neighborhood/district/sector/city levels, and determined according to the number of residents served and their needs. These standards must possess a set of characteristics, the most important of which are: comprehensiveness, flexibility, applicability, integration, sustainability, continuity, relativity, and accuracy, they are prepared and designed for all services, activities, events, and facilities within the urban community without neglecting any aspect of these, such as planning standards for (land use ratios, educational services, health services, housing, religious services, and cultural services), Recreational services, sports

services, commercial services, public utilities and services, water, sanitation, electricity, telecommunications, gas, roads and transportation, parking, urban design, and site planning **(Al-Hajjami, 2012).** Since the residential neighborhood differs in population density to accommodate specific local conditions, the size is limited so that most residents are within proximity to its center, where daily necessities are available **(Berk, 2005)**. And as described, the neighborhood center is a main site in the center of the neighborhood for residents to meet and a center for multi-purpose activities that benefit everyone, of all different ages **(Al-Saad, 2013)**. This research aims to develop a comprehensive theoretical framework that includes the concepts and values specific to neighborhood centers and the standards for sports infrastructure

2. BUILDING THE THEORETICAL FRAMEWORK

2.1 The Principles for Design and Planning of Integrated Residential Neighborhoods

Integrated neighborhoods deal with ease of movement and the provision of building space for multiple uses in residential neighborhood centers **(Evangelopoulos, 2014)**. The availability of goods and services (e.g., diverse land uses) within residential neighborhoods enables residents to participate more effectively in the community **(Hardekar and Chakraborty, 2018)**. These neighborhoods have a center area or main street, and this area offers a variety of activities and services that meet the needs of the residents **(Abbas and Najat, 2019)**. Low density and decreasing diversity in residential neighborhoods lead to the creation of isolated residential areas, car-oriented environments, high infrastructure costs, and a loss of the social environment that fosters a sense of place and community. A study by **(Najat, 2019)** identified five principles of integrated residential neighborhoods to address the previously mentioned problems:

1. Compact neighborhoods are organized by the neighborhood around a clearly defined center and edges; thus, the neighborhood develops an identity and functions as a true community. The activities and mixed housing include residential, shopping, education, health, and entertainment, as well as religious activities within the neighborhood's geographical boundaries, concentrating mixed activities within a focal point, such as a center or main street that includes a diverse range of retail activities and various services.
2. The activities and mixed housing include residential, shopping, education, health, and entertainment, as well as religious activities within the neighborhood's geographical boundaries, concentrating mixed activities within a focal point, such as a center or main street that includes a diverse range of retail activities and various services.
3. The vital public space is pedestrian-oriented, in which buildings are elements that contribute to the spatial definition of streets, parks, and public spaces, while taking into consideration the human scale and the diversity of forms.
4. The interconnected street network, which supports short blocks and frequent intersections, is an important part of encouraging walking, along with sidewalks and landscaping that encourage walking and provide safe and comfortable routes for pedestrians and diversity of transportation modes and public spaces as venues for informal social and environmental interactions among residents, and affirming the existence of the 'Third Place' that allows residents to leave the private realm of home and connect with others, such as cafes and restaurants.
5. Integrated residential neighborhoods prioritize public spaces and appropriate civic buildings within the district, which helps create the community's identity **(Najat, 2019)**.

2.2 Design and Planning Principles for Resilient Residential Neighborhoods

The design and planning of residential areas and neighborhoods are guided by a set of criteria to facilitate structured decision-making. Consequently, the creation of flexible residential neighborhoods is also subject to specific criteria aimed at achieving desired characteristics. These can be summarized as follows **(Hussein, 2016)**:

1. Resilience and redundancy:

Resilience serves as a foundation for generating future alternatives, fostering greater diversity, and enhancing the capacity to adapt and respond to unforeseen and variable conditions. It facilitates both functional and spatial diversity, ensuring that existing components are not rendered vulnerable by a single geographical event. Diversity contributes to an equitable distribution of assets, promoting integration among different elements. This criterion is reflected in various planning and design features, including mixed-use development; short block structures that support dense intersections and pedestrian interaction; a variety of building ages and the concentration of clustered buildings; diversity in plot configurations and social services; varied land tenure systems and property values; a range of outdoor space typologies; and diverse infrastructure patterns alongside the decentralized distribution of resource reserves.

2. Standardizing structural units and adopting polycentrism:

This principle is grounded in the concept of built-in redundancy and the provision of redundant units. In this context, the urban environment—exemplified by residential neighborhoods—is composed of multiple centers that possess a degree of internal cohesion and connectivity. A flexible neighborhood is characterized by a high degree of autonomy, which endows it with a "safe-to-fail" property. This attribute compensates for any weak connectivity that may exist between its various centers. The multi-centric urban form enables individual units to enhance their functional efficiency, thereby facilitating self-organization. Moreover, this structure supports the emergence of collaborative networks among centers, which collectively process and manage disruptions and changes. This criterion is practically demonstrated through the implementation of flexible overhead and underground service networks within multi-centric residential neighborhoods.

3. Innovation:

This criterion is achieved through a focus on learning and experimentation. It posits that the mechanisms driving change and development are most effective when grounded in policies that are formulated and developed at the local level.

4. Tight feedback, adaptability, and internal organization:

This criterion is achieved through the reorganization of diverse and evolving urban elements and components. This is accomplished by fostering diversity among urban elements, including residential units, public spaces, facilities, and services, within multi-center residential neighborhoods.

5. The structure of an interconnected network, environmentally, economically, and socially:

The superstructure and substructure of built forms and services are environmentally integrated through networks of pathways and relationships that embody the principle of accessibility. This integration ensures convenient access to public transportation and promotes the sustainability of social spaces and areas.

6. Social capital:

The collective ability of the population to respond collectively to sudden changes and events, and to provide an opportunity for broad participation by users and entrepreneurs in decision-making processes.

2.3 Local Standards for Residential Neighborhood Design

A residential neighborhood is typically composed of four residential blocks, with each block accommodating approximately 1,600 to 2,440 housing units. Based on an average family size of six persons, the total population of a neighborhood ranges from approximately 9,600 to 14,400 residents. The neighborhood is designed to enable residents to meet their daily needs by accessing public services and facilities within walking distance. These amenities include schools, markets, cultural and social venues, places of worship, as well as health, recreational, and sports facilities, in addition to public transportation stops. **(Ministry of Construction, 2018)**. In general, a set of criteria is employed to guide design decisions throughout the urban planning and design process. According to the study by **(Abbas and Abdul Zahra, 2014),** these criteria are classified into three distinct types: qualitative criteria, quantitative criteria, and developmental criteria.

2.3.1 Design Considerations for the Residential Neighborhood

When designing or developing any residential neighborhood, certain considerations and standards outlined in the urban and rural housing regulations must be observed. These include respecting the local character of the site and its surroundings to ensure that the neighborhood harmonizes with the topography, as well as with the prevailing urban and architectural character in terms of scale, proportions, relationships, masses, and spaces. Consistency in the form of buildings and facilities is essential, alongside an appropriate distribution of green spaces and urban areas. Open spaces should be provided at both public and private levels, ensuring they are proportionate and harmonious. An adequate provision of service facilities commensurate with the size of the neighborhood or residential area must be ensured. The nature of movement should facilitate ease and accessibility, with multiple transportation options available, while also addressing the needs of people with disabilities and providing a sufficient number of parking spaces. Furthermore, the architectural style must adhere to local traditions and heritage, and building materials, as well as architectural and urban details, should harmonize with and be integrated into the local character. The design must be compatible with land use regulations and ensure that the rights of neighboring areas to natural light, sunlight, and acceptable noise levels are not infringed upon. Neighborhoods and residential areas should be planned with the objective of reducing crime and fostering a sense of security among residents. They must achieve a high degree of aesthetic and urban design quality to create an environment that is both attractive and conducive to well-being. Principles of continuity, inclusion, and clear differentiation between public and private spaces are essential. Public spaces should be designed to achieve visual appeal, a high environmental standard, and environmental sustainability, thereby protecting and enhancing the surrounding environment. Furthermore, all buildings must adhere to established standards for contributing positively to the urban environment **(Ministry of Construction, 2018).**

2.3.2 Functional Considerations of Residential Neighborhood Elements

Local housing plans take into account the achievement of a high degree of functional relationships among the components and elements of the residential neighborhood. This contributes to the functional utility of these elements and enhances the overall quality of the residential environment. This principle is demonstrated through several measures: providing safe pathways that enable residents to access public facilities and public

transportation stations on foot from their residences; establishing a road network that ensures easy access to all residential units, alongside more direct and shared pedestrian routes that are segregated from vehicular roads; reducing through traffic originating from outside the residential area; situating high-density residential units in proximity to the neighborhood center; and locating public parks and green spaces adjacent to nurseries, kindergartens, and schools. The center of a neighborhood or residential area is designed to serve as a focal point for all roads and pedestrian walkways leading to public transportation stops and stations. Large parking areas should be situated on the perimeter of residential areas rather than within them. Planning standards are established to regulate various factors related to the scale of residential areas, including population size, number of housing units, housing types, planned density, public amenities, open spaces, and transportation routes. Regarding open residential spaces, such as children's playgrounds, youth sports fields, residential squares, and parks with green areas designated for relaxation, recreation, and play. These should be designed to integrate seamlessly with existing residential buildings in order to maximize their functionality. Playgrounds and recreational areas must be durable and robust to ensure their long-term use by residents. They should also be safe, comfortable, and designed to minimize disruption to neighboring residents. Furthermore, their design should be informed by the number of residential units they serve and their proximity to public amenities **(Ministry of Construction, 2018).**

2.3.3 Design Considerations for Shaping Service Spaces in the Residential Neighborhood

When designing public open spaces and green areas, we find that open spaces can vary in size and function, from nature reserves, forests, and public parks to squares, courtyards, playgrounds, shared spaces, semi-private spaces, and public gardens. The size and design of public spaces must be appropriate to the specific context and should be defined by appropriately sized buildings and trees facing them, and it must:

1. Public open spaces should be designed as important nodes within the spatial hierarchy, contributing to the creation of attractive and sustainable places regardless of their size or type. This approach facilitates social interaction and fosters a sense of place. It is appropriate to locate play areas and green spaces in proximity to residential neighborhoods or local nodes such as nurseries. Similarly, playgrounds, tennis courts, and similar recreational facilities should be situated near neighborhood centers, adjacent to large parks, or in conjunction with existing public open spaces. Public open spaces should be appropriately sited, preferably with a southern or western orientation, and should be overlooked by neighboring residences as well as roads and walkways frequented by passersby. Outdoor spaces should be endowed with a clear function, character, form, and definition through the use of distinctive boundaries formed by adjacent buildings, walls, fences, trees, and hedges. It is essential to plan and design open spaces so that they are attractive and usable by residents. This entails avoiding large, undefined areas, neglected negative spaces, or unusable land.
2. Taking into account several design considerations and standards, as follows: These spaces are designed to be appropriate to the number of residents and the nature of the age groups to accomplish the needs and requirements of the users. The design should also enhance the sense of security for users by providing good lighting and securing the boundaries of these spaces. The residential units should be supported by outdoor spaces suitable for the high temperature and take advantage of all the available site potential. They should also be landscaped using local trees to reduce the negative effects of the hot

and dry weather. They should be designed in a way that reduces visual and auditory pollution and integrates seamlessly with the residential units. The outdoor spaces should be designed in a way that gives added value to the place and enhances its architectural, cultural, and social character, thus increasing the quality of the residential neighborhood. The size of these spaces should be appropriate to the different components of the project. They should be characterized by easy and smooth accessibility, as they should be located so that they can be reached within a 10-minute walk from the residential units. They should also be close to transportation stations and bicycle paths. Regarding children's playgrounds, they should be monitored and supervised from residential units, provided they do not disturb other units. These spaces should offer a variety of options to meet all social, recreational, sporting, and other needs. A clear distinction should be established between public and private spaces, with all necessary measures implemented to prevent vehicular access. Furthermore, the design should ensure the efficient and sustainable environmental performance of resources within the playground **(Ministry of Construction, 2018).**

3. Neighborhood-level open spaces must include:
   - Open areas for sports, with at least one square meter per person. These can be located within the neighborhood youth center. Buildings within the youth center that exceed 5% of its total area are not counted as open spaces.
   - The neighborhood park should consist of (small playgrounds, recreation areas, entertainment areas, garden areas, cafeterias, service buildings, and areas designated for women or the elderly) **(Al-Dirawi, 2013)**.
4. A set of criteria must be considered when designing and managing urban public spaces to increase their flexibility, as outlined in the study by **(Sanei et al., 2018)**. These criteria include: increasing the permeability of urban space; focusing on accessibility and diversifying access patterns; providing varied and wide pathways to these spaces; designing spaces that can be expanded if needed and increase their capacity to accommodate different activities throughout the year; enabling the establishment of temporary markets at different times of the year; using adaptable urban furniture such as reversible seating; utilizing smart, multi-functional furniture; moving furniture to adapt its use and organize the space according to public needs; the ability to install awnings and portable roofs according to varying weather conditions throughout the year; fostering collaboration between buildings and public spaces to create an effective activity hub; the capacity to accommodate temporary exhibitions and sporting events with dedicated areas for installing metal barriers; involving the local community in decision-making through electronic applications or local surveys and the organization of activities, events, exhibitions, and celebrations; and employing site planning elements that respond to climate change, such as plant and water features. The different spaces are designed to accommodate various sports activities and street arts.

2.4 The Concept of Sports Infrastructure for Residential Neighborhoods and its Components

The term sports infrastructure refers to the facilities and spaces where people participate in sporting events. It can be defined as the physical and organizational infrastructure required to facilitate sports activities **(Wilson, 2014)**. This concept also relates to the accessibility and diversity of sports facilities within a given community **(Hallmann et al., 2012)**. The significance of sports infrastructure lies in its foundational role; adequate facilities are

essential for the practice of nearly all sports. For instance, indoor sports require specialized venues such as gymnasiums. People prefer running in green spaces over urban streets, so green spaces can also be considered part of sports infrastructure **(Wicker et al., 2009)**. In a complementary manner, sports services can be defined as organized efforts aimed at providing the necessary capabilities and resources—including facilities, activities, programs, and projects—to cultivate community members' athletic skills in a manner that is appropriate for the area's population density **(Authority for Urban Planning, 2014)**. Sports infrastructure services constitute a critical category of urban services, holding significant weight in land-use planning and design processes due to their substantial social and economic value. A comprehensive analysis of these services must extend beyond mere quantitative assessments to include a thorough evaluation of service quality. Consequently, the development of sports service centers should adhere to international standards and specifications to enhance the quality of services delivered to urban residents. These services are provided through a network of sports centers and facilities, encompassing various types of sports fields, including children's playgrounds located in primary schools, neighborhood centers, and residential areas; youth centers; main stadiums; and multi-purpose sports and social clubs. Although sports infrastructure services are frequently categorized under recreational services, it is important to recognize that recreation represents just one of the multiple benefits derived from participation in sporting activities and events. These benefits also include improved health and physical fitness, as well as social and economic advantages. Recreational services differ from sports infrastructure services in the following ways:

1. Recreational services are primarily based on leisure time, while sports infrastructure services are bound by specific and fixed schedules in most cases, such as daily training sessions, competitions, and official tournaments.
2. Recreational services have a significant impact on the psychological aspect of the individual, while the impact of sports infrastructure services goes further, such as the physical, social, and economic benefits for the person.
3. Recreational services require financial expenditures to obtain them, such as amusement parks and parks, as well as transportation and others, while most sports centers provide their services for free or almost free, such as youth and sports forums, sports clubs, halls and swimming pools, except in a narrow aspect related to private sector sports centers such as bodybuilding and fitness gyms and others.
4. Recreational services serve all age groups equally in terms of gender and age, but sports have their own rules regarding gender and age groups, as well as traditions and customs, especially in Arab societies.
5. Recreational services often do not require special buildings or facilities like sports infrastructure services, which require stadiums, halls, and swimming pools with specific specifications, dimensions, and locations **(Amin, 2018).**

These services suffer from a lack of interest, as they are often overlooked due to urban sprawl for commercial and industrial purposes and are neglected in many residential neighborhoods **(Al-Dulaimi, 2015b)**. Regarding sports facilities, they are defined as a group of buildings constructed by the state, private entities, or organizations through which sports activities are carried out, and recreational services are provided to their members. These include buildings, services, facilities, fields, and green spaces **(Authority for Urban Planning, 2014)**. The term "sports facilities" came to refer to any place equipped and prepared for practicing all kinds of sports and physical activities, whether open or covered. They vary in shape and size according to their purpose, including educational and training

sports facilities, competitive facilities, and so on. There are also sports fields for children, green spaces, public squares, sports clubs, and even sports cities. Interest in sports facilities began in 1890 when European countries allocated a portion of their budgets to building these facilities, constructing them according to internationally recognized technical and engineering standards **(Amin, 2018)**.

Regarding residential neighborhood centers, they should primarily contain sports infrastructure, including a sports club, an indoor gym, and open outdoor courts **(Al-Abed et al., 2022),** as follows:

1. Sports clubs: These are centers that include various sports activities such as football, basketball, and tennis, and some of them include halls for bodybuilding and light physical sports. They are often practiced by individuals over the age of 10 **(Al-Dulaimi, 2015b)**. Sports clubs are also independent entities that may be affiliated with the public or private sector and provide public services and benefits to develop the health, social, physical, and recreational capabilities of their members and affiliates during their leisure time **(Authority for Urban Planning, 2014)**. Moreover, it is a human heritage linked to human existence and the development of societies, and it helps shape one's personality and social and athletic behavior. The significant development in various fields of life has led to increased human awareness of the importance of practicing physical activities that improve physical, mental, and recreational health. To achieve this, specialized sports clubs have been established to practice these activities regularly and systematically. These clubs also work to enhance the cultural and social dimensions of individuals alongside the sports they practice within them. Sports activities within sports clubs are classified into two categories: team sports and individual sports. Team sports include activities such as football, basketball, volleyball, and handball, while individual sports include table tennis, gymnastics, bodybuilding, athletics, and light exercises such as aerobics, among others **(Al-Ajlan, 2011)**. Community sports clubs are crucial for providing sports in many countries, including Canada, Germany, Belgium, Scotland, the United Kingdom, and Australia. They not only offer sporting opportunities for residents but also provide spaces and opportunities within local communities for social programs such as fun gatherings and social celebrations. In addition to these programs, sports clubs take the lead in integrating young people and older adults into communities and helping to keep youth off the streets. In achieving this, sports infrastructure contributes to community building and is considered an important institution in many societies **(Wicker et al, 2013)**.
2. Swimming pools: These are places designated for water sports and swimming in particular. They may be designated for males or females separately or mixed, depending on the customs and lifestyle of the population. They are frequented at all times of the year, especially in the summer **(Authority for Urban Planning, 2014; Al-Dulaimi, 2015a)**. Swimming is a water activity that involves moving all parts of the body in a water environment, where the water pressure affects the body, causing physical and psychological effects **(Nasser and Mawloud, 2019).**
3. Outdoor playgrounds: These are outdoor spaces where various sporting activities are organized, especially matches such as football, volleyball, basketball, etc. These activities are organized by sports entities in the neighborhood or by a group of young people from the neighborhood on a personal basis to spend their free time **(Al-Dulaimi, 2015b)**. Outdoor playgrounds are also designated for children in residential neighborhoods. These are open spaces specially designed for children to keep them away from playing

in the streets and protect them from accidents and crimes that may occur. As a result, Children's playgrounds consist of large areas for various ball games and smaller areas containing sandpits and some play equipment such as swings, balance beams, and other simple devices **(Khadra, 2015)**.

2.5 Design Principles for Sports Infrastructure

Responsiveness and adaptability are among the most important design principles, aiming to mitigate the negative impacts of risks and keep pace with the effects of change through quantitative measures, diversification, and distribution of urban resources, and the development of effective alternative strategies. This is reflected in the principle of resilience and the quality of this infrastructure **(Alwan et al., 2018)**:

1. Space resilience: Sports infrastructure is flexible when it can mobilize a variety of resources and replace lost resources (iteration) promptly (speed), and the ability to continue operating in crises (strength) **(Wicker et al, 2013)**. The resilience of a sports infrastructure refers to the nature of the changes that occur in its spatial structures in response to various modifications. Spatial resilience lies in several elements, which are **(Alwan et al., 2018)**:
   - Spatial availability: that is, the existence of a physical area for developing spatial solutions that directly affect the potential for adaptation and change.
   - Spatial identity: that is, the presence of elements that preserve the nature of the system's function and its environment.
   - Spatial variation: that is, knowing the directions of change that occur in the system and evaluating their impact.
   - Spatial renewal: that is, change resulting from adaptation and restructuring of the system by providing options and alternatives for new uses characterized by innovation, creativity, and integration between fixed elements.

   The planning and design processes prioritize accessibility to sports infrastructure by ensuring convenient and safe access for pedestrians and public transport users, alongside guaranteeing land-use compatibility with surrounding facilities. Emphasis is placed on achieving harmony and integration with the broader environmental context, as well as incorporating adaptability to accommodate future needs. These principles guide design modifications within responsive frameworks, prioritizing pedestrian and cycling mobility, the use of environmentally friendly public transport, the enhancement of local identity, and the integration of community life with public spaces. A key objective is also to ensure that daily necessities are provided within easy reach of residents **(Alwan et al., 2018)**. Given that buildings in every era tend to decay and disappear, this phenomenon has been increasing recently, posing an economic problem for funders. Hence, the concept of flexible buildings emerged, as buildings capable of accommodating future changes in their functions, construction, and even forms **(Al-Bakri, 2008)**.
2. Quality of sports space: Through continuous urban development, sports infrastructure is subjected to spatial pressure, and thus the spatial quality of many sports facilities is reduced, which are often of poor quality, with no appropriate spatial planning, and single-function, unattractive, and anonymous architecture, poorly integrated into the residential neighborhood, hidden behind closed green areas, with little or no connection to public space and isolated from the surrounding urban areas **(Valle and Kompier, 2013)**.

2.6 Principles of Planning and Distributing Sports Services

The overarching objective in the planning and design of sports infrastructure sites is to cultivate a positive environment conducive to sporting activities. This approach facilitates the development of additional play spaces and ensures that appropriate events are situated in suitable locations, thereby guaranteeing their long-term sustainability within the surrounding context. Moreover, the potential of these sites for multi-functional use, enabling the concurrent development of recreational and cultural facilities, necessitates that planners, designers, and decision-makers adopt a comprehensive and dedicated approach to the development of sports infrastructure sites **(Al-Saadi, 2011)**. The planning and distribution of sports services among residential neighborhoods is based on studying the natural and human dimensions to identify the existing potential and challenges, and the needs of the users. Decisions are made based on a set of principles mentioned by **(Al-Dulaimi, 2015b)** as follows:

1. The services should be tailored to the residents of the neighborhood in terms of their ages and aspirations, and priority should be given to the largest proportions, i.e., activities suitable for children, youth, and then the elderly. Gender should also be taken into account, especially in Arab and Islamic societies, where it is preferable to separate activities for males from those for females.
2. Distributing sports services in a manner that is proportionate to the population concentration in the neighborhood and the urban structure, and in accordance with the requirements of sports activities in residential neighborhoods.
3. The planning of sports activities should be compatible with the prevailing nature, whether in terms of climate, topography, or the locations of water bodies, if any. The locations of these services should also be planned with the aim of exploiting all the potential that represents factors of attraction for them.
4. Adopting basic planning standards in planning sports facilities in harmony with different land uses, ensuring they are located away from natural and human sources of pollution, and that the planning of sports facilities is an essential part of the urban planning process in order to control their impact on the lives of residents. Sports facilities are distributed across the neighborhood or city level in a tiered configuration according to the size of the units and the level of services.

These levels are linked to the population using these facilities and are planned in a way that creates effective interrelationships between the building and sports facilities on the one hand, and other vital functions such as public services, roads, open social spaces, and others, in a manner that achieves integration between these elements. Integrated planning using hierarchy works to increase the effectiveness of service performance and to avoid duplication except when there is a population equivalent to the service, in order to achieve optimal use of it without affecting the quality of life and well-being of the community it serves. This ensures that the distance an individual travels from their residence to the service is commensurate with the services they receive, whether on foot or by car. Furthermore, it creates what are known as clustered service areas, structured hierarchically to reflect the division of the population into planning units of a size appropriate to the service, thereby increasing its efficiency and reducing usage costs for residents **(Mustafa, 2005)**.

2.7 Global Standards for Planning and Designing Sports Infrastructure

According to international standards in some foreign countries, two types of sports facilities must be available: indoor and outdoor, catering to the age group between 10-25 years old, including:

- Indoor sports facilities: Halls and centers for practicing basketball, volleyball, badminton, squash, indoor cricket, table tennis, physical games, and (indoor) football. It also includes many water sports such as aquatic exercise, hydrotherapy, and swimming, as well as fitness, yoga, and self-defense exercises.
- Outdoor sports: Sports facilities must be provided to meet the needs of various sports, most importantly: fields and tracks for athletics and running, and courts for football, hockey, baseball, tennis, basketball, handball, and dedicated golf courses **(Cronin et al., 2008)**.

The most important criteria for indoor and outdoor sports facilities are as follows:

1. Regarding children's play areas (Playgroups), the following must be observed:
   - It must be located within flexible meeting spaces situated within a multi-purpose community sports center with a minimum area of 0.8 hectares, or it may be located within schools.
   - A safe and easily supervised indoor and outdoor play area, a kitchen, restrooms, parking, and public transportation are required. A space of 100-200 m2 can accommodate the play needs of 10-40 children, and should also include 30 m2 for storage of play equipment **(Cronin et al., 2008)**.
2. As for indoor sports halls, the following must be observed:
   - The indoor spaces should be suitable for the number of users and specific to each sport practiced in indoor halls.
   - The ceiling height should be suitable for the type of sport practiced inside it.
   - It also requires an administrative area, a cafeteria, a weighing room, changing rooms, outdoor parking, and sports equipment storage facilities.
   - These halls should also be designed in a way that reflects the identity of the surrounding area and suits all age groups, especially young people, as well as being designed flexibly so that these halls can be used for national events and celebrations **(Cronin et al., 2008)**.
3. As for outdoor sports fields, they must:
   - It should include a list of the sports practiced and provide parking. Children's playgrounds should be separate from youth playgrounds and located away from surrounding roads, schools, and homes.
   - Providing adequate lighting, landscaping the areas surrounding the playing fields, especially those separating them from the outdoors to minimize their impact on and influence from the surrounding environment, as well as designing furniture that allows for multiple uses, and ensuring that the facilities are located within high-standard recreational areas, and are shared with a range of other sports infrastructure in addition to the functions of a traditional activity center (such as retail and commercial). The shared location may include integrating facilities under one roof, for example, an aquatics/fitness center with an indoor recreation center **(Cronin et al., 2008)**.

2.8 Standards for Planning and Designing Neighborhood Playgrounds

Children's play areas should be separate from those for young adults, and each type of playground has its own specific design considerations. These are outlined below:

1. Planning standards for children's playgrounds: When planning and designing play areas for children, a set of standards must be considered, namely:
   - These playgrounds are designated for children aged 4-12 years.
   - An area ranging from 0.4 to 1.67 m^2 per person is allocated, depending on the population density of the residential area. The service area should not exceed 100 to 275 meters, which is the longest distance a child travels from their home to reach the playground. Regarding services, safe pathways must be provided to ensure children can reach these playgrounds from their homes, either on foot or by bicycle. The playground should also be located away from traffic and dangerous intersections, and ideally within public parks to maximize its use by the largest possible number of children **(Mustafa, 2005)**. The children's playgrounds also contain four main areas, including:
   - The area equipped with play equipment requires approximately 400m2 for every 70 children.
   - An open area designated for running sports, and an area for sitting and playing quiet games. We need 50m2 for every 15 children.
   - A designated area for bicycles and rollerblades, as well as a walking path, must be paved with a suitable material. Additionally, there should be extra space for observation and landscaping to enhance the aesthetic appeal of the playground **(Mustafa, 2005).** Regarding the location of the playground, it must be chosen according to a set of controls and standards, ensuring it is at least 10 meters away from residential buildings. It must have access to water, electricity, and sewage services, and the soil must be suitable for installing equipment and planting various types of plants. Furthermore, all public safety requirements must be met during the design and construction phases, and all necessary accessibility features for children with special needs must be provided **(Mustafa, 2005).**
2. Youth outdoor sports fields:

These playgrounds require an area ranging from 0.4 to 2.5 m2 per person, depending on the population density of the area. Therefore, the playgrounds should be:

- These playgrounds are placed in the middle of the residential neighborhood so that the walking distance does not exceed (800-1200m) of the residential units they serve, and tall trees are used behind the fence to block the playing area.
- These sports fields typically include various sports such as football, tennis, basketball, volleyball, and handball, with a 10-meter distance between different playing areas. They should also be equipped with indoor halls for specific sports like gymnastics, boxing, bodybuilding, and wrestling. Ideally, the design should be flexible, allowing for use in other sports or for hosting sporting events, depending on changing circumstances. These fields should also include both indoor and outdoor swimming pools of varying shapes and sizes, along with changing facilities and restrooms. Generally, the fields should be equipped with adequate lighting and parking spaces sufficient for the number of users.

2.9 Ministry of Construction and Housing Standards

Residential facilities situated within residential neighborhoods are subject to a set of design considerations that reflect the distinctive nature and character of these facilities. They must be commensurate with the anticipated population of the neighborhood, determined by the number of residential units available. Facilities located in adjacent areas may also be utilized, provided that they are within a reasonable distance. Furthermore, these facilities must be designed and planned in a manner that accommodates future development and expansion. This infrastructure aims to provide services at an appropriate, acceptable, and highly

efficient level that meets the requirements of the current and future residents of the developed residential area. These facilities include various types of educational, commercial, health, administrative, sports, recreational, and other service buildings. Several design considerations must be taken into account when designing these facilities, namely: (that they be compatible with the size of the population in the residential neighborhood, as the size of the facility depends on the number of residents to whom the service is provided, located within an acceptable distance of all activities and easy to use by people with special needs and easily and smoothly accessible by means of transportation alternative to the car, that they be compatible with the surrounding land uses, road network, infrastructure and environment). The standards for residential facilities are concerned with a set of provisions, including (floor area and required land area, size of each type of facility, radius of the circle served, design elements, general location, equipment, and devices). It is recommended that this structure be located within residential areas that have the same maximum access distance and meet the needs of the residents, as the service center includes the community hub and the place where people gather and help them to socialize, and it must be located within a civic or local center. Note that these services can be provided to residential communities smaller than the sector or residential neighborhood if they are not available within the areas near these communities, and other facilities can be added according to the specific needs of each residential area.

Regarding children's play areas, the following must be taken into consideration:

- The primary play area for young children should be a private, safe space close to the home, taking into account the needs of different age groups.
- Play areas should be positioned so that they are not indirectly visible from homes, and should not be positioned in a way that causes disturbance to residents, especially the elderly **(Ministry of Construction,2018)**.

Youth and sports centers are subject to several standards, namely:

1. The age group served is (12-25) years old, and represents (21.14%) of the urban population in Iraq.
2. The net area is (0.05m2) per person for the general population or (0.24m2) per person for the age group.
3. The built-up area is (0.063m2) per person for the general population or (0.30m2) per person for the age group.
4. The land area is (0.36m2) per person for the general population or (1.70m2) per person for the age group.

A youth center can serve a population of 38,400–57,600 (sector size) or two youth centers, each serving 19,200–28,800 residents. It is recommended that youth and sports centers include the following spaces and functions: a multi-purpose hall, social and cultural activity areas such as meeting rooms, arts and crafts rooms, and game rooms, a library, a studio, lecture halls, and a sports complex encompassing various sporting activities, along with management and services. The location of youth and sports centers is subject to several considerations, including:

- Proximity to open recreational areas.
- There can be joint use with cultural centers (as a cultural complex can be formed).
- As for the design elements, youth centers should be built with no more than two floors of buildings, in a way that achieves the consolidation of cultural, recreational, and youth activities, providing suitable internal equipment and facilities, and functional and spatial

interdependence between the internal and external sports, recreational, and youth facilities **(Ministry of Construction,2018).**

- youth and sports centers are conventionally designed as a unified complex formed by a grouping of contiguous buildings **(Najm,2008).**

2.10 Theoretical Framework

Table 1, parts 1 and 2, illustrates the summarized theoretical framework.

Table 1. Parts 1 and 2, the summarized theoretical framework

Part 1: Planning-Design Considerations					
Concepts for achieving an integrated residential neighborhood		**Global standards**	**Indicators**	**Local standards**	**Indicators**
Planning and design considerations (X)	**Multiple centers for the residential neighborhood (X1)**	**multi-center urban form (X1-1) a**	One center for the residential neighborhood	**Neighborhood center as a service and facility Center (X1-1)b**	One center for the residential neighborhood
			A center extending along major arterial streets		Expansion and extension of mixed-use
		Self-regulation ability (X1-2)a	It provides integrated mixed-use housing and activities	**achieving functional Sufficiency (X1-2)b**	Mixed uses are available (housing, education, shopping, entertainment, sports, etc.)
			It provides services and goods for daily needs		Serves residents' daily needs and nearby neighborhoods
	resilience of spaces in the residential neighborhood (x2)	**Spatial and functional diversity (X2-1) a**	design the Spaces for diverse activities, expandable	**Diversity of functional and spaces (X2-1)b**	Allocating specific spaces within the community events program for future development purposes
			The ability to change the function of spaces or accommodate new function		Spaces usable for various events to serve residents
	Respect the local character of the site(x3)	**Respecting local character in varying ways**	Harmony with the topography of the place and the prevailing architectural	**Respecting the local character of the site and surroundings**	Harmonization with topography and contextual character (scale,

		(X3-1)a		**(X3-1)b**	proportion, relationships)
			Accepting ideas and projects that differ from the prevailing pattern.		The ability to accept ideas different from the dominant architectural style and to harmonize and integrate with the local style
	Parks and gardens are available for the residential neighborhood (X4)	**Design considerations for parks and gardens (X4-1)a**	Neighborhood Residents Service	**Design considerations for parks and gardens (X4-1)b**	It is used by people of all ages in the residential area
			Service radius within neighborhood: 400–500 m		The service area is more than 800 m
			The area allocated to it is no less than (10000-7000)m^2		The area allocated to it is no less than (7200) m^2
			The area per person served in the neighborhood shall not be less than 1 m^2		The area per person served should not be less than 0.75 m^2

Part 2: Design principles

Sports infrastructure concepts		**Global standards**	**indicators**	**local standards**	**indicators**
Design principles (Xx)	**Sports centers provide (Xx1)**	**At least one sports center (Xx1-1) a**	Multi-purpose community sports and events center	**One sports center for the residential neighborhood (Xx1-1)b**	**One sports and youth center per residential neighborhood.**
			Swimming pools are available		Provide at least one swimming pool
			Outdoor sports stadiums		Outdoor sports stadiums
		Evaluating the effectiveness of sports services (Xx1-1)a	Indoor and outdoor sports facilities are available	**Effective functional performance of sports services (Xx1-2)b**	The variety of Sports buildings and activities within the sports institution is available
			Integrated, important location within the movement network		Choosing the right location for sports facilities
	resilience of sports spaces (Xx2)	**Spatial and functional resilience (Xx2-1) a**	Ample reserve areas are available for future expansion.	**Spatial and function resilience (Xx2-1)b**	Spaces are available to design and provide new sporting events
			The possibility of using sports spaces for various sports activities		Flexibility in using the sports space for various sporting events and activities

	A modern center with a distinctive design (Xx3)	**The formal structure of the sports center (Xx3-1) a**	The sports center harmonizes with its surroundings in scale, height, and mass	**The formal characteristics of the sports center (Xx3-1) b**	Aligning buildings and sports facilities with the environment in proportions, height, and mass
			Maintaining urban scale with buildings distinguished by form and size.		Appropriate urban scale via distinctive, locally expressive building form and size
			Moving away from the single, massive sports center		The sports center is represented by a group of buildings
	design considerations for sports infrastructure (Xx4)	**Design considerations for sports centers (Xx4-1) a**	The age groups served are (10-25) years old	**Design considerations for sports centers (Xx4-1) b**	The age groups served are (12-25) years old
			The radius of the serviced area ranges between (800-1200) m on foot		The service range is (800)m on foot
			The sports center's land area should be between 8,000 and 10,000 m^2		The land area for the sports center must be at least 8000 m^2
			The net area per person should be at least 0.4 m^2		The net area per person must be at least 0.24
			One sports center per 8,000–10,000 people		Providing one sports center for every 9600-14400 people
			Community sports centers: max two floors		Sports centers typically have no more than one or two floors
		Indoor sports halls provide (Xx4-2) a	Two multi-purpose sports halls with accessories, 2000 m^2 total	**Indoor sports facilities are available (Xx4-2) b**	It provides more than one multi-purpose sports hall, each min. 222 m^2
			Halls: separate or with community centers		Sports halls: separate or integrated with the sports center
		playgrounds are available (Xx4-3) a	Playgrounds for ages 4–12	**Children's playgrounds are available (Xx4-3) b**	Spaces for ages 6–11
			Service area: 100–275 m		Radius of the circle served (200-300)m
		Open fields are available for youth and sports (Xx4-4)a	Serves all residents aged over 13 years	**Open fields are available for youth and sports (Xx4-4) b**	Reserved for ages over 12 years
			located at least 10 m from residential buildings		Located 15 m from residential buildings
			Often located in the neighborhood center		Central, or near parks/public open spaces

3. RESULTS AND DISCUSSION

The research adopted a descriptive-analytical measurement approach to select the research sample, to verify the theoretical framework's concepts, and to study the relationship between its components. This method is based on case study analysis, using information and

illustrative diagrams from official sources regarding the research samples. The analysis process includes (a general description of the case based on the sources, case analysis according to the specific terms of measurement, reliance on diagrams, figures, and information, and then measuring the verification values for each of the indicators). The analysis process will be carried out through:

1- General description of the research samples, which includes general information about the case study, explanations, and a description of the case study center, diagrams, and figures for it

2- Measurement Form: The measurement will be qualitative, including a test of the verification of indicators in the selected case study that was filled out by the researcher based on the information extracted in the description of the case study, and for each item. The items are evaluated by measuring the verification of the criteria or not, based on direct marking on the measurement form, and according to the selected research samples, based on the symbol (1) to indicate the verification of the value of the variable, and the symbol (0) to indicate the non-verification.

3- Measurement Method: The research relied on the method of frequency percentages to extract the results to find the value of the items of the measurement form, and it was extracted according to the following equations using the (Microsoft Excel) program, and accordingly, the results were approximate, as explained in Appendix A.

$$X/\sum X * 100\% = \text{Percentage of verification values} \quad (1)$$

Where the variable X represents the frequency of verified categories for the item

4- Choosing the practical study area

The local study area is located within the Al-Mansour Municipality district on the Karkh side of Baghdad Governorate, west of the city. The Al-Amiriya area, specifically within the Karkh side, was chosen to test the main research hypothesis. This area is experiencing growth and increasing population density, necessitating a study of its potential for integrating and diversifying uses (residential, commercial, educational, sports, and recreational). It includes the sites where the first youth and sports centers were established, as well as modern sports centers and various sports facilities. Information about the residential area and its services is readily available from official sources. The area comprises residential blocks (628, 630, 632, 634, 636, 638, and 640). Regarding housing patterns, horizontal units predominate, with vertical units present in a very small portion of the area. Table 2 shows the number of residential units in each block (Baghdad Municipality, Al-Mansour District Directorate), as illustrated in **Figs. 1 and 2** and **Table 2.**

Table 2. Number of residential units in the Al-Amiriya neighborhood. (Baghdad Municipality, Al-Mansour District Directorate)

Housing unit number		Number of housing units
1	628	267
2	630	776
3	632	666
4	634	572
5	636	1313
6	638	1050
7	640	391

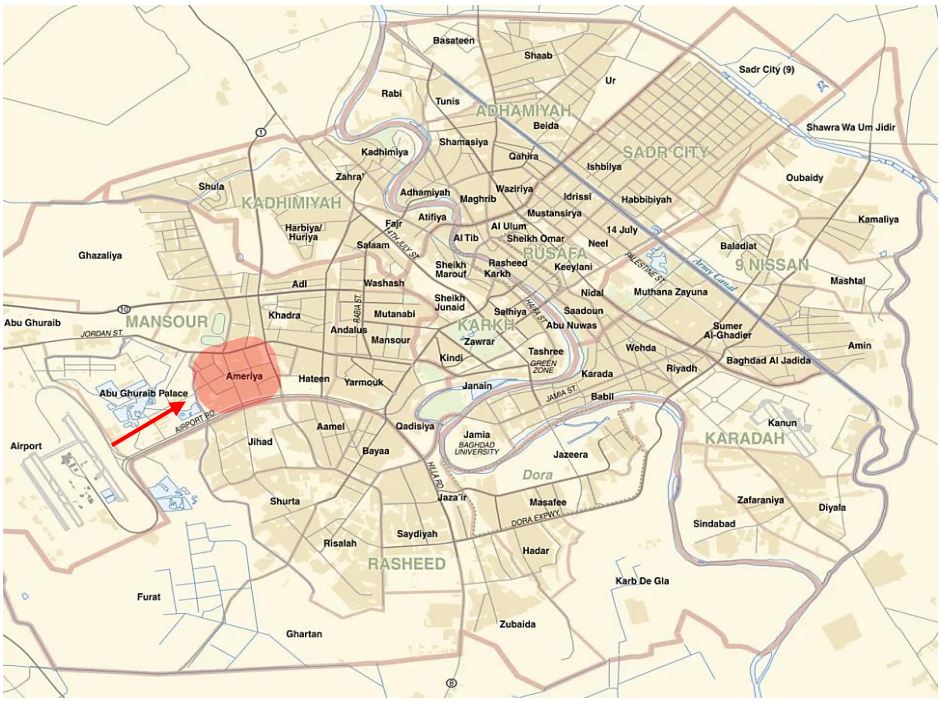


Figure 1. The study location within the Baghdad Governorate map. Source: Baghdad Municipality, Al-Mansour District Directorate

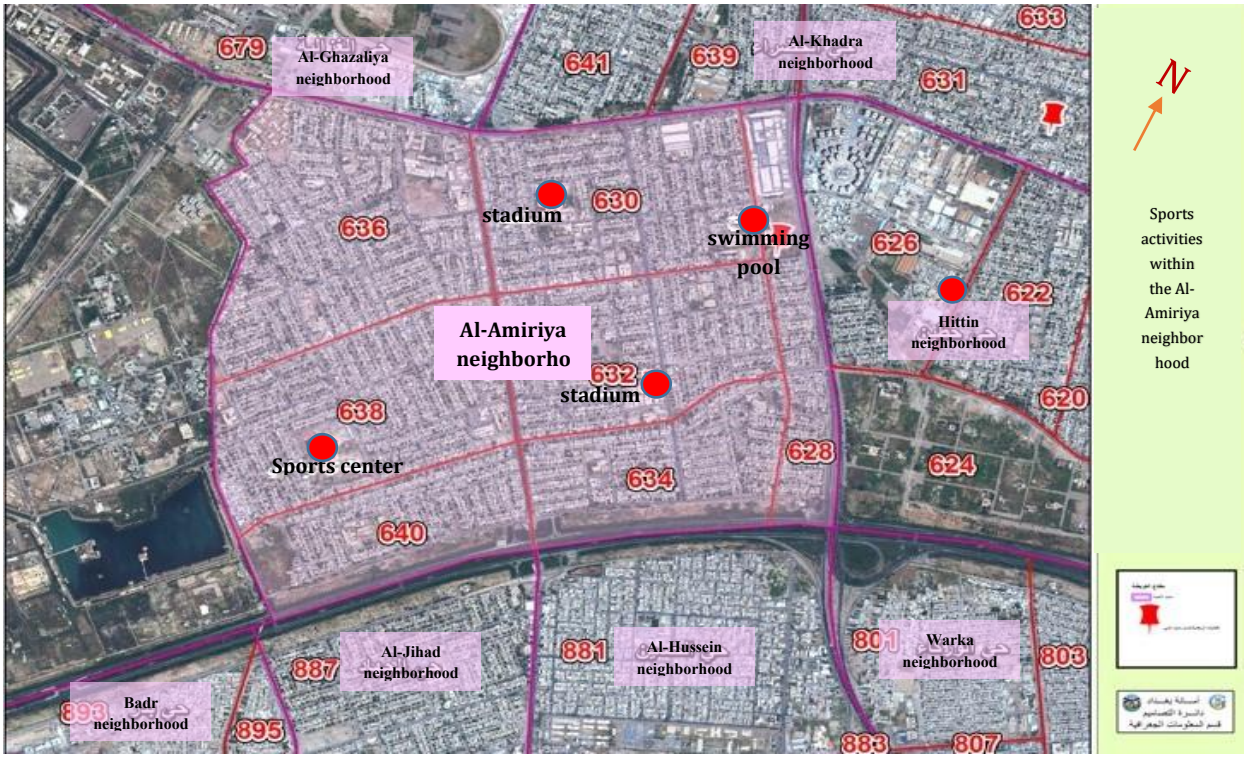


Figure 2. Sports activities in the residential neighborhood of Al-Amiriya, (Baghdad Municipality, Design Department, GIS Section)

The neighborhood is distinguished by its strategic location, bordered to the north by Abu Ghraib Street, which leads to the Abu Ghraib area and western Iraq, to the south by Airport

Street (Baghdad Road), and to the east by the expressway coming from the Al-Bayaa area. The Al-Amiriya neighborhood has four entrances: the northern entrance from the Abu Ghraib Road side, which is a main entrance to the area in addition to the entrance on Al-Munathama Street; the southern entrance from the Al-Jihad neighborhood on the Airport Road side; and the eastern entrance, which is a secondary entrance from the Embassies Bridge on the expressway, as illustrated in **Fig. 3.**

The neighborhood is characterized by its diverse activities and functions, whether commercial, recreational, or sporting. Along its main arterial streets, some have been transformed into commercial thoroughfares, while others have become commercially driven. This influences the development of the neighborhood center and its integration with the rest of the district. Among these arterial streets is the main Al-Amal Al-Shaabi Street, in addition to other secondary streets such as Al-Munathama Street, Al-Asal Street, and Al-Mudheef Street (Baghdad Municipality,Al-Mansour District Directorate)

Figure 3. The boundaries of the study area, the main traffic network surrounding it, and its four entrances

4. RESULTS OF THE PRACTICAL

1. Results related to the term (multiple centers for the residential neighborhood) (X1)

- The results of the application within the term (multiple centers for the residential neighborhood) (X1) showed that the variable (X1) increased through the increase in the values of the global standard (self-regulation ability) (X1-2) a and the local standard (functional sufficiency achieved) (X1-2) b, which was achieved at a rate of (100%), while the rate of achievement of the global standard (multi-center urban form) (X1-1) a and the local standard (the center around which services and facilities are gathered) (X1-1) b reached (50%). The verification rate for the item (multiple centers for the residential neighborhood) (X1) reached 75% in relation to the global standard and the local standard (75%), As illustrated in **Fig. 4**.

- The term (availability of sports centers) (Xx1) is related to the term (multiple centers per residential neighborhood) (X1). The results of the application for the research sample showed a high level of achievement of the local standard (one sports center per residential neighborhood), b which reached 100%, while the percentage of achievement of the global standard (at least one sports center) (Xx1-1) was lower, which was 67%. As for the global standard (achievement of effective performance of sports services) (Xx1-2) a and the local standard (effective functional performance of sports services) (Xx1-2) b, they were achieved at equal percentages of 50%. The results of the application within the term (multiple sports centers) (Xx) showed a high percentage of achievement of the local standard, which reached (80%), and a low percentage of achievement of the global standard, which reached (60%), as illustrated in **Fig. 5**.

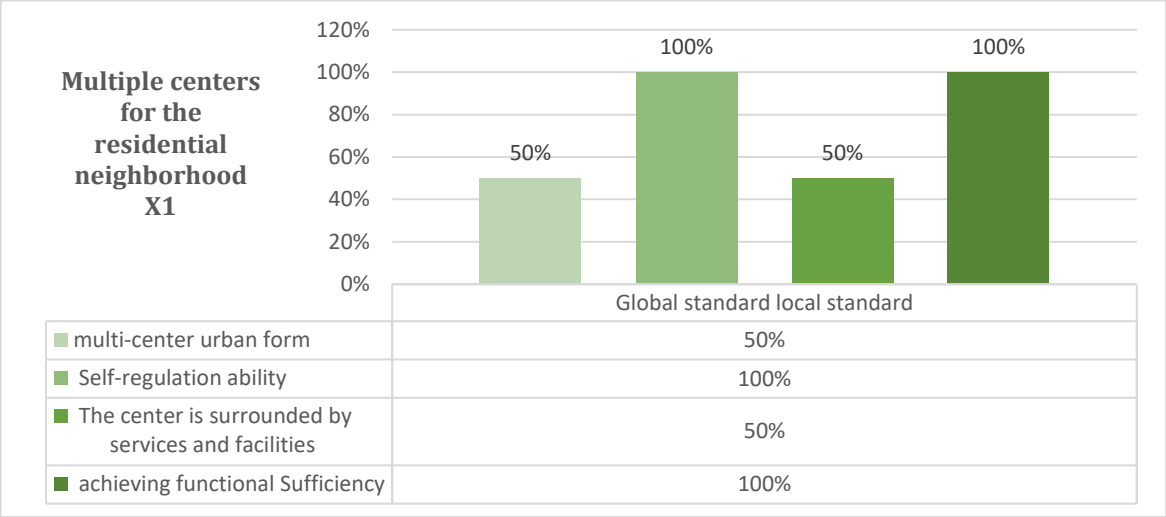


Figure 4. Results related to the multiplicity of centers in the residential neighborhood

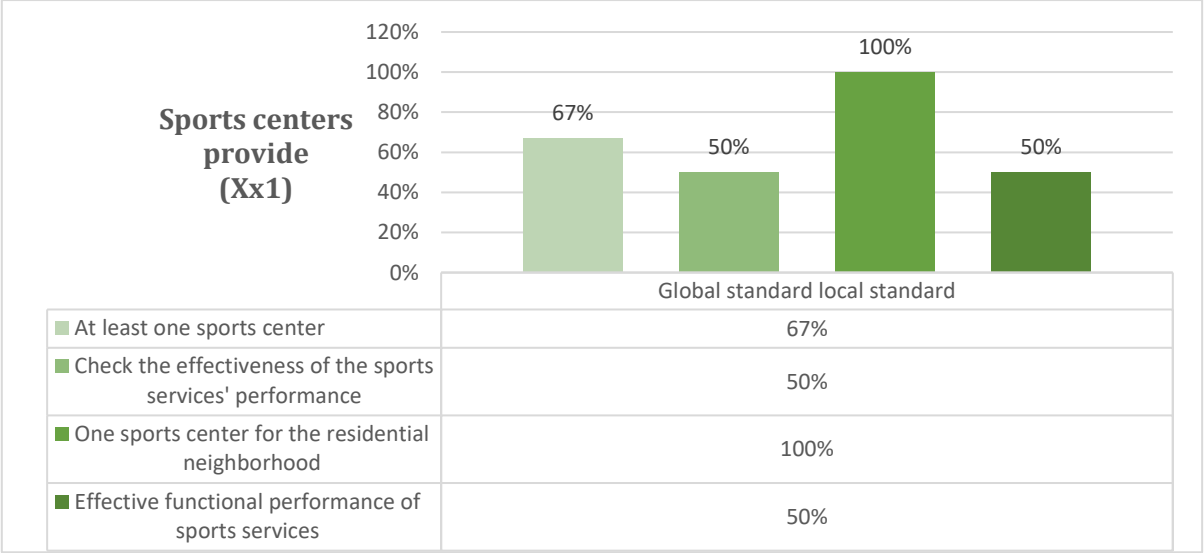


Figure 5. Results related to multiple sports centers

2. Results related to the unit of spatial resilience in the residential neighborhood (X2)

- The results of the application within the term (flexibility of spaces in the residential neighborhood) (X2) showed that the global standard (spatial and functional diversity) (X2-1)a was achieved at a rate of (50%) through the indicator of the availability of spaces for different activities that are capable of future expansion, and the local standard (diversity of spaces and functions) (X2-1)b was achieved through the indicators of allocating specific spaces within the community events program for future development and the possibility of using spaces for different activities to provide wider services to residents at equal rates of (100%). The results about the item (flexibility of spaces in the residential neighborhood) (X2) showed that the rate of achievement of the item is (50%) with respect to the global standard and (100%) with respect to the local standard, as illustrated in **Fig. 6**.
- The term (resilience of sports spaces) (Xx2) is related to the term (flexibility of spaces in the residential neighborhood) (X2). The results of the application showed that the global standard (spatial and functional flexibility) (Xx2-1) a was achieved at a rate of (50%) through the indicator of the availability of large reserve areas within sports buildings for future expansion, while the local standard was achieved at a rate of (100%) through the indicators of the availability of spaces within sports spaces to design and provide new sports activities and flexibility in the use of the sports space for different sports activities. The results about the resilience of sports spaces in the residential neighborhood (Xx2) showed that the local standard was achieved at a high rate of (100%), while the global standard was achieved at a lower rate of (50%), as illustrated in **Fig. 7**.

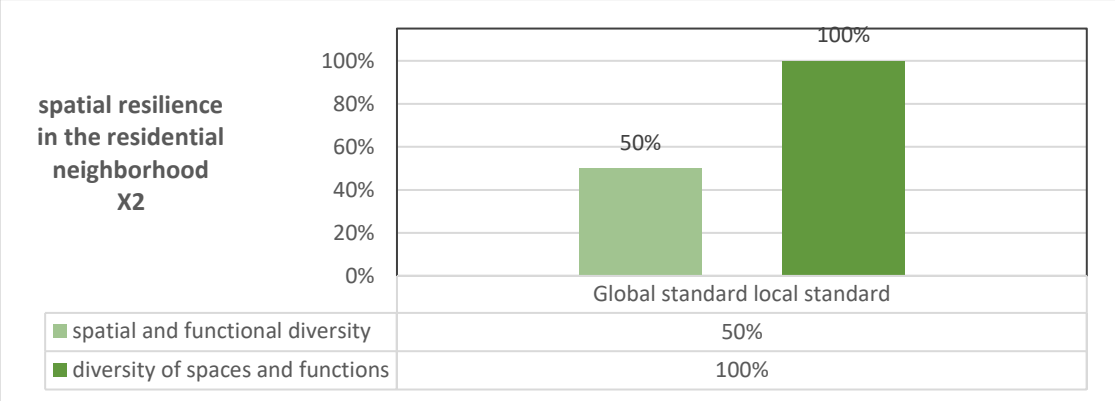


Figure 6. Results related to spatial resilience in the residential neighborhood

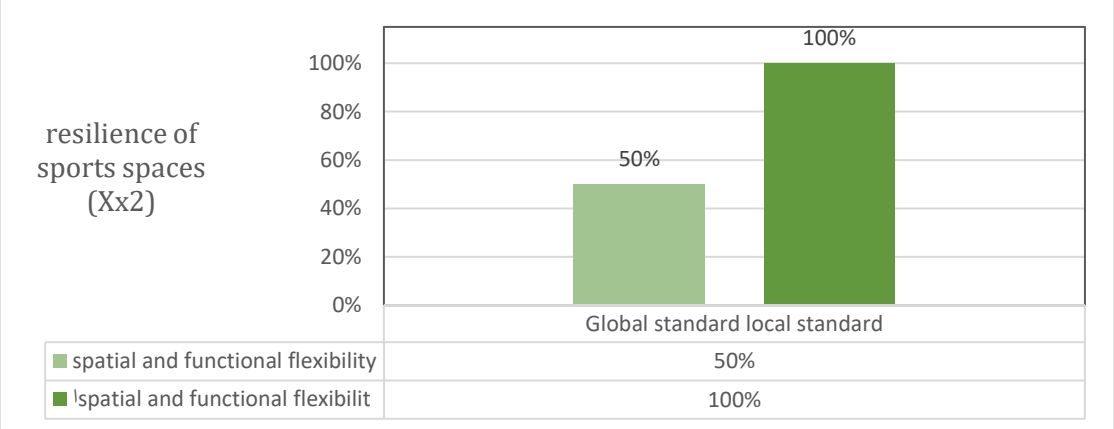


Figure 7. The related results to the resilience of sports spaces

3. Results related to the term (Respect for the local character of the site) (X3)

- The results of the application within the term (Respect for the local character of the site) (X3) showed the achievement of the global standard (Respect for the local character in varying ways) (X3-1)a through the achievement of the indicators of harmony with the topography of the place and the prevailing architectural style and the acceptance of the existence of ideas and projects that represent a departure from the prevailing style, and the achievement of the local standard (Respect for the local character of the site and the neighborhoods) (X3-1)b through the indicators of harmony with the topography of the place and its cultural and urban character in terms of scale, proportions, relationships, etc.) and the possibility of accepting ideas different from the prevailing architectural style, and harmony with the local character and integration with it is possible in equal proportions that reached (50%), and the results with regard to the item (Respect for the local character of the site) (X3) in the residential neighborhood showed the achievement of the global standard and the local standard at a rate of (50%), As illustrated in **Fig. 8**.
- Results associated with the term "modern center," which has a distinctive appearance (Xx3). The results of the application within the term (a modern center that is formally distinguished) showed that the global standard (formal composition of the sports center) (Xx3-1) a and the local standard (formal characteristics of the sports center) (Xx3-1) b were achieved with equal percentages of (67%), as illustrated in **Fig. 9**.

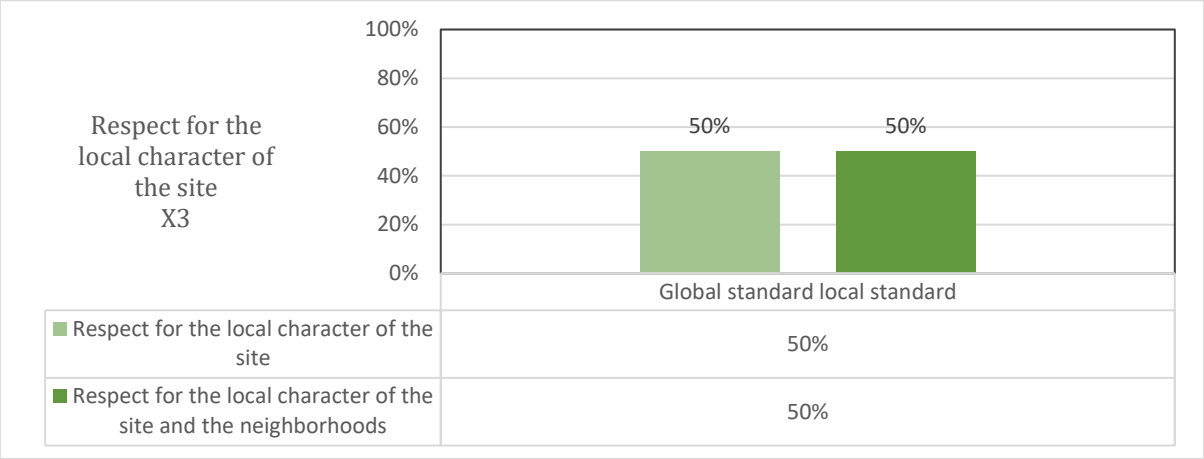


Figure 8. Results related to respect for the local character of the site

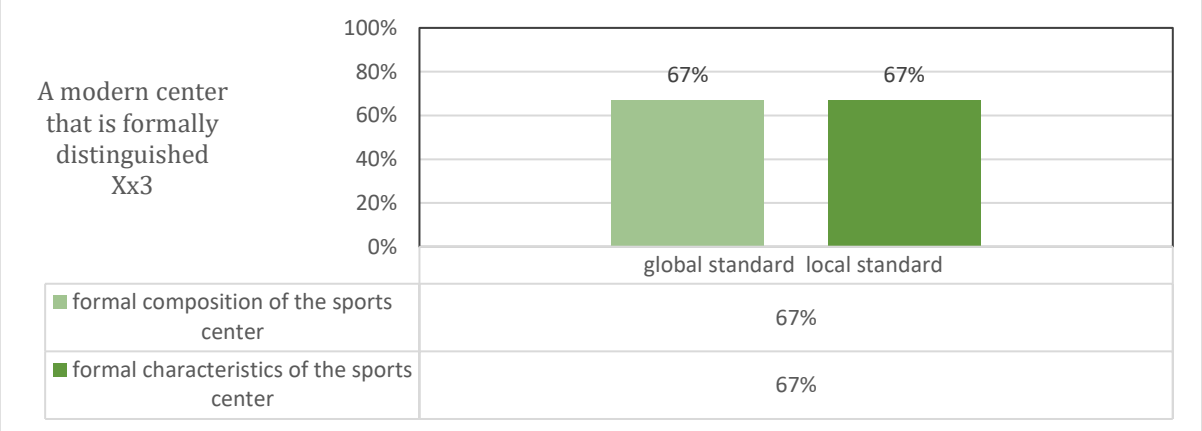


Figure 9. Results related to a modern center that is formally distinguished

4. Results related to the term "provision of parks and gardens for the residential neighborhood" (X4)

The results of the application for the term (Availability of parks and gardens in the residential neighborhood) (X4) showed that the global standard (Design Considerations for Parks and Gardens) (X4-1) a was met at a rate of (75%) by serving all residents of the residential neighborhood, with a radius of (400-500) m within a single neighborhood, and an area of no less than (1) m^2 per person served. As for the local standard (X4-1) b, its achievement rate was similar to that of the global standard by ensuring the use of these parks and gardens by all ages in the residential neighborhood, with a service area of more than 800 m^2, and an area allocated to no less than 0.75 m^2 per person served. Regarding the item (Design Considerations for Parks and Gardens) in the residential neighborhood, the results showed that the achievement rate of the global standard (X4-1) a and the local standard (X4-1) b was similar, at 75%, as illustrated in **Fig. 10**.

- The results of the application within the term of "Design Considerations for Sports Infrastructure" (Xx4) showed that the international standard "Design Considerations for Sports Centers" (Xx4-1) a and the local standard (Xx4-1) b were met equally at a rate of 33%.
- The results of the application showed that the international standard "Availability of Indoor Sports Halls" (Xx4-2)a and the local standard (Xx4-2) b were not met. The results of the application showed that the international standard "Availability of Children's Playgrounds" (Xx4-3)a and the local standard (Xx4-3) b were met equally at a rate of 50%. The results of the application showed that the international standard "Availability of Open Fields for Youth and Sports" (Xx4-4)a was met at 67% for both samples, and the local standard (Xx4-4) b was met at 100%. The application results regarding the item (design considerations for sports infrastructure) (Xx4) showed that the percentage of compliance with international standards was 39%, while the rate of compliance with local standards was 46%, as illustrated in **Fig. 11**.

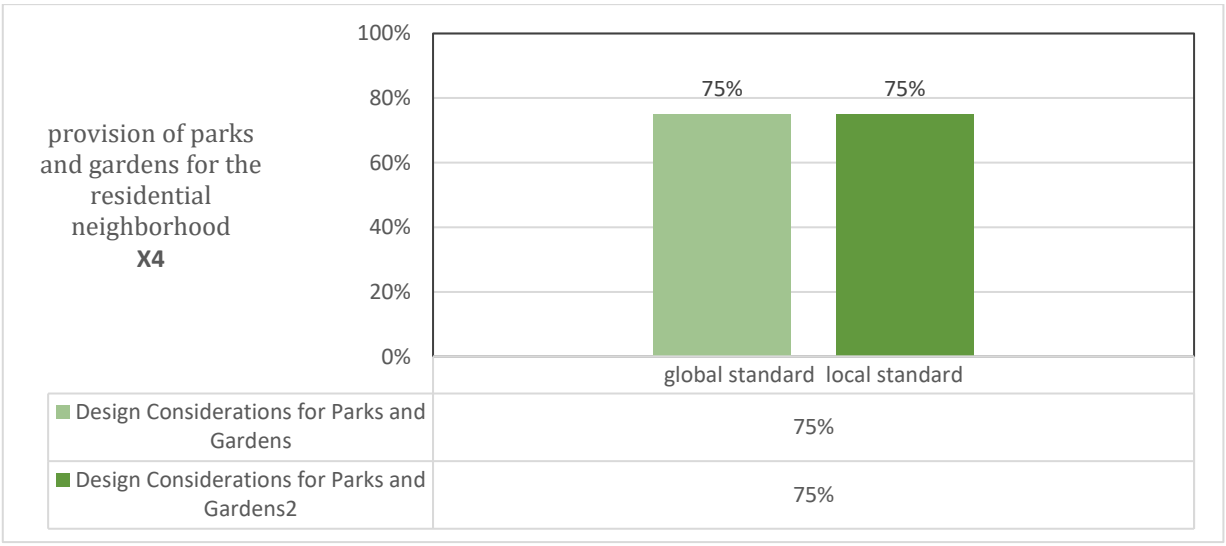
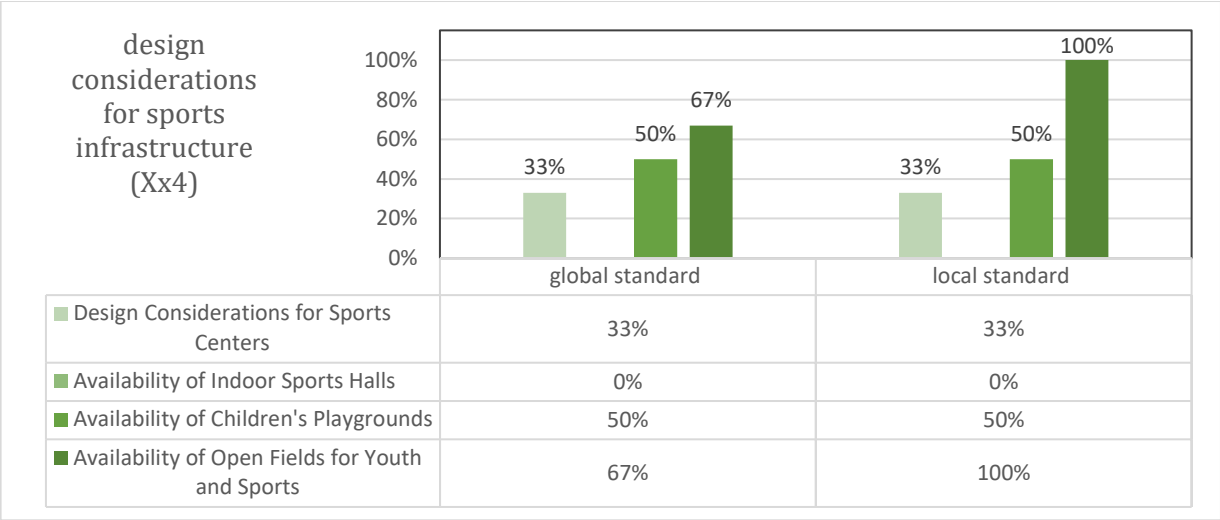


Figure 10. Results related to provision of parks and gardens for the residential neighborhood



	global standard	local standard
Design Considerations for Sports Centers	33%	33%
Availability of Indoor Sports Halls	0%	0%
Availability of Children's Playgrounds	50%	50%
Availability of Open Fields for Youth and Sports	67%	100%

Figure 11. Results related to design considerations for sports infrastructure

5. CONCLUSIONS

The research developed a scale to measure alignment between global and local sports infrastructure standards, aiming to create a flexible urban center for integrated residential neighborhoods, and found general discrepancies between them. Convergences included indoor/outdoor facilities, diverse activities, spatial flexibility (reserve areas, adaptable spaces), formal composition (harmony with surroundings in proportions, heights, and masses while avoiding a single massive structure), land area (8,000–10,000 m^2) or more, building height (two floors or less), serving children (4–12 years), and youth playgrounds (age 12 and above, central location, setback more than setback >15 m from residential buildings), though the local standard additionally emphasized local identity. Divergences appeared in sports center provision (global: one multi-purpose center per 8,000–10,000 people; local: one per neighborhood), age groups (global: 10–25 or 12–25 years; local: 6–30 years), service radius exceeding 800–1,200 m due to peripheral locations, lack of transport integration, insufficient net space per person (less than required), lack of multi-purpose and event sports halls (global requires at least two halls), and walking distances exceeding the limits specified in both standards, while outdoor swimming pools aligned closely with the local standard and outdoor sports fields satisfied both standards, and the global minimum setback requirement of ten meters was exceeded in practice (being greater than 10 m).

Declaration of Competing Interest

The author declares that she has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

concepts for achieving integrated residential neighborhood		Global standards	indicators	Check the value (0-1)	local standards	indicators	Check the value (0-1)
Planning and design considerations (X)	Multiple centers for the residential neighborhood (X1)	multi-center urban form (X1-1)a	One center for the residential neighborhood	0	Neighborhood center as a service and facility Center (X1-1)b	One center for the residential neighborhood	0
			A center extending along major arterial streets	1		Expansion and extension of mixed-use	1
		Self-regulation ability (X1-2)a	It provides integrated mixed-use housing and activities	1	achieving functional Sufficiency (X1-2) b	Mixed uses are available (housing, education, shopping, entertainment, sports, etc.)	1
			It provides services and goods for daily needs	1		Serves residents' daily needs and nearby neighborhoods	1
	Verification rate for the term			75%	Verification rate for the term		75%
	resilience of spaces in the residential neighborhood (x2)	Spatial and functional diversity (X2-1) a	design the Spaces for diverse activities, expandable	1	Diversity of functional spaces (X2-1)b	Allocating specific spaces within the community events program for future development purposes	1
			The ability to change the function of spaces or accommodate a new function	0		Spaces usable for various events to serve residents	1
	Verification rate for the term			50%	Verification rate for the term		100%
	Respect the local character of the site(x3)	Respecting local character in varying ways (X3-1)a	Harmony with the topography of the place and the prevailing architectural style	1	Respecting the local character of the site and surroundings (X3-1)b	Harmonization with topography and contextual character (scale, proportion, relationships)	1
			Accepting ideas and projects that differ from the prevailing pattern.	0		The ability to accept ideas different from the dominant architectural style and to harmonize and integrate with the local style	0
	Verification rate for the term			50%	Verification rate for the term		50%
	Parks and gardens are available for the residential neighborhood (X4)	Design considerations for parks and gardens (X4-1)a	Neighborhood Residents Service	1	Design considerations for parks and gardens (X4-1)b	It is used by people of all ages in the residential area	1
			Service radius within neighborhood: 400–500 m	1		The service area is more than 800 m	1
			The area allocated to it is no less than (10000-7000)m2	0		The area allocated to it is no less than (7200) m2	0
			The area per person served in the neighborhood shall not be less than 1 m2	1		The area per person served should not be less than 0.75 m2	1

concepts for achieving integrated residential neighborhood		Global standards	indicators	Check the value (0-1)	local standards	indicators	Check the value (0-1)
Verification rate for the term				75%	Verification rate for the term		75%
ports infrastructure concepts		Global standards	indicators	Check the value (0-1)	local standards	indicators	Check the value (0-1)
Design principles (Xx)	Sports centers provide (Xx1)	At least one sports center (Xx1-1) a	Multi-purpose community sports and events center	0	One sports center for the residential neighborhood (Xx1-1)b	One sports and youth center per residential neighborhood.	1
			Swimming pools are available	1		Provide at least one swimming pool	1
			Outdoor sports stadiums	1		Outdoor sports stadiums	1
		Evaluating the effectiveness of sports services (Xx1-2)a	Indoor and outdoor sports facilities are available	1	Effective functional performance of sports services (Xx1-2)b	The variety of Sports buildings and activities within the sports institution is available	1
			Integrated, important location within the movement network	0		Choosing the right location for sports facilities	0
	Verification rate for the term			60%	Verification rate for the term		80%
	resilience of sports spaces (Xx2)	Spatial and function resilience (Xx2-1) a	Ample reserve areas are available for future expansion.	1	Spatial and function resilience (Xx2-1)b	Spaces are available to design and provide new sporting events	1
			The possibility of using sports spaces for various sports activities	0		Flexibility in using the sports space for various sporting events and activities	1
	Verification rate for the term			50%	Verification rate for the term		100%
	A modern center with a distinctive design (Xx3)	The formal structure of the sports center (Xx3-1) a	The sports center harmonizes with its surroundings in scale, height, and mass	1	The formal characteristics of the sports center (Xx3-1) b	Aligning buildings and sports facilities with the environment in proportions, height, and mass	1
			Maintaining urban scale with buildings distinguished by form and size.	0		Appropriate urban scale via distinctive, locally expressive building form and size	0
			Moving away from the single, massive sports center	1		The sports center is represented by a group of buildings	1
	Verification rate for the term			67%	Verification rate for the term		67%
	design considerations for sports infrastructure (Xx4)	Design considerations for sports centers (Xx4-1) a	The age groups served are (10-25) years old	0	Design considerations for sports centers (Xx4-1) b	The age groups served are (12-25) years old	0
			The radius of the serviced ranges between (800-1200) m on foot	0		The service range is (800)m on foot	0
			The sports center's land area should be between 8,000-10,000 m^2	1		The land area for the sports center must be at least 8000 m^2	1
			The net area per person should be at least 0.4 m^2	0		The net area per person must be at least 0.24	0
			One sports center per 8,000–10,000 people	0		Providing one sports center for every 9600-14400 people	0
			Community sports centers: max two floors	1		Sports centers typically have no more than one or two floors	1

concepts for achieving integrated residential neighborhood		Global standards	indicators	Check the value (0-1)	local standards	indicators	Check the value (0-1)
		Verification rate for the term		**33%**	**Verification rate for the term**		33%
		Indoor sports halls provide (Xx4-2) a	Two multi-purpose sports halls with accessories, 2000 m^2 total	**0**	**Indoor sports facilities are available (Xx4-2) b**	It provides more than one multi-purpose sports hall, each min. 222 m^2	0
			Halls: separate or with community centers	**0**		Sports halls: separate or integrated with the sports center	0
		Verification rate for the term		**0%**	**Verification rate for the term**		0%
		playgrounds are available (Xx4-3) a	Playgrounds for ages 4–12	**1**	**Children's playgrounds are available (Xx4-3) b**	Spaces for ages 6–11	1
			Service area: 100–275 m	**0**		Radius of the circle served (200-300)m	0
		Verification rate for the term		**50%**	**Verification rate for the term**		50%
		Open fields are available for youth and sports (Xx4-4)a	Serves all residents aged over 13 years	**1**	**Open fields are available for youth and sports (Xx4-4) b**	Reserved for ages over 12 years	1
			located at least 10 m from residential buildings	**0**		Located 15 m from residential buildings	1
			Often located in the neighborhood center	**1**		Central, or near parks/public open spaces	1
		Verification rate for the term		**67%**	**Verification rate for the term**		100%

معايير البنية التحتية الرياضية ودورها في تحقيق مراكز مرنة للأحياء السكنية المتكاملة

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الخلاصة

تشكل البنية التحتية الرياضية أحد أشكال البنية التحتية التي تختص بالأنشطة والممارسات الرياضية المختلفة، عرفها البحث على انها البنية الاساسية المادية والتنظيمية المطلوبة لتسهيل القيام بالأنشطة الرياضية وواحدة من المتطلبات المهمة في الاحياء السكنية وعنصرا مكملا للبنية التحتية وتأتي أهميتها في كونها من العناصر المكملة لمراكز الاحياء السكنية ودورها في الجانب الاجتماعي والاقتصادي والثقافي. تعاني العديد من الأحياء من ضعف في فعالية وكفاءة هذه البنية ، على الرغم من وجودها الظاهري. حيث لا تحقق الغايات المرجوة منها في تشجيع النشاط البدني، أو تعزيز الصحة المجتمعية، أو الاستفادة المثلى من المساحات المخصصة لها. من هنا برزت مشكلة البحث الرئيسية المتمثلة بـ "ضعف التصور حول دور المعايير التخطيطية والتصميمية للبنية التحتية الرياضية في تحقيق مراكز مرنة للأحياء السكنية المتكاملة"ولهذا هدف البحث الى بناء اطار نظري شامل يتضمن طرح المفردات والقيم الخاصة بمراكز الاحياء ومعايير البنية التحتية الرياضية. تمثلت الفرضية بأن مطابقة المعايير التخطيطية والتصميمية المحلية للبنية التحتية الرياضية للمعايير العالمية تسهم في تحقيق مراكز مرنة للاحياء المتكاملة . اعتمد البحث المنهج التحليلي الوصفي لاستخلاص المفردات الرئيسية واستخلاص المفردات الثانوية وقيمها، ثم تطبيقها على حي العامرية في بغداد كحالة دراسية كونه في نمو وزيادة في الكثافة السكانية ويحتاج الى دراسة امكانية التكامل فيه، وتنوع في الاستعمالات (سكني، وتجاري، وتعليمي، ورياضي، وترفيهي)، وأظهرت نتائج الدراسة الميدانية وتحليل البيانات وجود تباين *بين* تحقيق المعايير العالمية والمعايير المحلية المتحققة في العينة البحثية المنتخبة محلياً.

الكلمات المفتاحية: البنية التحتية الرياضية، معايير البنية التحتية الرياضية، مراكز مرنة، مراكز احياء سكنية متكامل