International Journal for Scientific Research (IJSR)
المجلة الدولية للبحوث العلمية
IJSR
Vol. (5), No. (11) November 2026 الإصدار (5)، العدد (11)

# Planning and Design of Green Sectors in (Al-Amerat First Residential Complex) According to the Concept of Human Behavior

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## Abstract

This study analyzes the reality of green spaces in the "Al-Amerat Residential Complex I" in Najaf Governorate by incorporating the concept of human behavior into urban design, alongside adopting environmental and social sustainability standards. The research aims to evaluate the alignment of green space design with human usage patterns and community interaction, using indicators derived from philosophical and psychological theories. The study employs digital analysis tools such as ENVI-MET, and LEED-ND, in addition to aligning with the Iraqi Urban Housing Standards manual. The research examines three alternative designs for green spaces, focusing on functionality, psychological comfort, and social interaction. The findings reveal that the first alternative characterized by the design of an interactive multi-generational environment between two schools is the most integrated and effective. It achieved the highest compliance with local and global standards, providing flexible and safe design solutions that enhance urban quality of life. The research recommends adopting the concept of human behavior as a fundamental approach in designing public spaces, increasing the proportion of green areas, enhancing community involvement in planning, and applying the first alternative as a pilot model reflecting sustainable design concepts and social interaction in the Iraqi urban environment.

**Keywords:** Sustainable Revitalization, Accessibility, Urban Sustainability, Historic Areas.

## Introduction

Green spaces are considered one of the most important elements of sustainable planning, as they enhance social interaction and improve mental health. In this context, the research addresses an analytical study of the (Al-Emarat First Residential Complex) in Najaf Governorate through integrating indicators of the human behavior concept when designing spaces within the complex and analyzing them using thermal comfort software ENVI-MET, the Iraqi Urban Standard, and the LEED-ND program. The study area is also analyzed using ISO analysis.

## Research Problem

The design of green spaces in the "Al-Emarat First Residential Complex" suffers from a lack of integration between the spatial configuration of these spaces and the human behavioral patterns of residents, which may lead to a decrease in their utilization level and a decline in their impact on social interaction.

- To what extent do green spaces affect improving mental health and reducing stress levels among residents?
- Do green spaces provide a suitable environment for family gatherings and community interaction?

## Research Hypothesis

Designing green spaces within the complex according to human behavior parameters will contribute to enhancing their utilization, supporting social interaction, and improving urban life.

## Research Objective

To analyze and evaluate the current state of green spaces within the complex according to human behavior indicators and propose an alternative that achieves sustainability and functional and social integration.

## Theoretical Framework (Human Behavior)

Among the concepts that emerged in psychology, but extend to encompass diverse fields, including philosophy and urban planning. Behaviorism is concerned with studying human behavior through observation and experimentation, making it a valuable tool for understanding how individuals interact with their environments. How can behavioral concepts be applied in urban planning, and how do these concepts intersect with philosophy.

## Behavior

Human-Environment Interaction is an interdisciplinary concept concerned with understanding human behavior and the reciprocal relationship between people and their surrounding environments. It has become an important area of research in urban studies and planning, employing observational and empirical methods to investigate how people perceive, experience, and interact with urban spaces [1] ‹Furthermore, human behavior depends on social justice in the distribution of services in the city. The more equitable the distribution of services, the greater the people's satisfaction with those services, in addition to the ease of access to them, which is a fundamental factor in achieving social justice. This in turn indicates that human behavior depends on the level of services provided in the city or region where they live. [2] Human behavior is a broad and complex concept that encompasses various forms of actions and activities. Its definition and interpretation may differ across scientific disciplines, reflecting the diverse ways in which behavior is understood and studied [3].

## Linguistic Root

The linguistic root for the verb (Salaka) in Arabic means walked or went through a certain path or followed a specific approach [4]. The Arabic root (Salaka) conveys meanings associated with following a path or pursuing a particular course of action. In behavioral studies, behavior can be examined through different dimensions, including individual human behavior and socially related behavior, which concerns an individual's interactions with the surrounding social environment [5]. Human behavior: are those actions and responses that people take towards other people, or towards animate beings, systems, artificial beings or their environments in general, which include systems or animate beings in addition to physical inanimate objects. Behavior is the response of animate beings to stimulant and inputs, whether internal or external, conscious or unconscious, public or hidden, and voluntary or involuntary [6]. Social behavior is the behavior of a human in relation to social requirements and needs, and towards the people that he belongs to, or towards other persons of his community and the social environment [7].The social behavior is defined as a behavior affected by surrounding people, collective behavior, or behavior controlled by others in the community [8]. It is also defined as any action that a person commits so that this action is connected to other person or a group of people, where it is possible to identify the mechanism in which this person interacts with these other people [9]. Hence, it is infeasible to predict the personal behavior through the identification of the situations that he's into or the environmental characteristics that produce those situations, therefore, it is impossible to deduce a clear abstract formula, such as behavioral maps, that translates materialistic properties of the environment to behavior produced by people in this environment. That proves the ineffectiveness of this entry in examining the relationship between environment and behavior [10].Social behavior includes actions and doings of people that are made and formulated by the community, as those are acquired and not inherent, i.e., the person is taught by his social surroundings, like family, school, street, childhood friends and other official or unofficial social constructs [11].

## Limitations of Human Behavior

The origin of the human behavior can be traced back to its elementary dimensions, encompassing economical, social or environmental conditions such as breaking of a war, a famine, disease spread or even adaptation to a quiet environment. Place and time dimension: includes effects that a person faces in his personal character at specific time and place, leading to prevent him from certain behavioral acts [12]. Human dimension: Personal abilities are part of the limitations on human behavior. It includes knowledge and skills required to perform certain procedures [13]. Ethical dimension: ethical factors like rules, beliefs and values play a rule in behavior that stems from these beliefs and specific leanings [14]. Social dimension: Social and demographic variables play a rule in behavior. Such factors include educational level, cultural race, income, as well as the circle of friends and family [15].

## Human Behavior Can be Classified to

Personal behavior: defined as all actions performed by a person that reflect his character as well as all knowledge, culture and inherited values that connect to him with past experiments. The environment (whether natural, architectural, social, or cultural) is considered as the most important element that has direct influence on personal behavior. Therefore, it is safe to infer that there are clear effects of the personal culture and traditions on human behavior [16]. Collective behavior: is defined as the agreement of ethnically, theologically or geographically united people have on a general way of expression. Therefore, there is an influential force on the collective behavior that represents the cultural features of the society. It leads to a feeling of homogeneity and belonging to the faction, where the person agrees with them in opinion and faculty, namely, public opinion [17].

Social behavior: The behavior of solitary people or groups together represent a collection of activities that are performed in spacial environment. Humans, solitary or in groups, deal with the surrounding environment through behavior that reflect humane character [18]. Social resilience is the ability of groups or communities to adapt to stress and a changing environment. This resilience depends on social capital and the capacity of individuals to participate in crisis response. This is achieved through trust, cooperation, and the participation of individuals in decision-making and policy-making processes. Resilience is not a physical quality, but rather a product of individuals' responses to social systems and spaces. Therefore, urban planning and design in which citizens participate in decision-making and provide their feedback leads to more cohesive and integrated social behavior [19].

## Philosophical Theories about Human Behavior

### 1. Molecular Theory:

Molecular theory can be traced to several thinkers. However, Plato is considered as the most prominent phylosophers who dealt with the concept of ethical behavior from molecular perspective. His works, like “The republic”, deals with various components of the psyche and their effects on behavior [20].

### 2. Pragmatism:

Pragmatism is the philosophical view that pertains to the notion that values and traditions should be evaluated based on their practical results and their influence on the ability to adapt to the reality. In this theory, adaptive behavior is considered as the behavior that can achieve positive results while adapting to the variable surrounding conditions [21].

### 3. Social Darwinism:

This theory is based on Charles Darwin’s ideas about evolution and natural selection. Social philosophers influenced by Darwin consider adaptation as the key for survival. They also think that individuals that are able to adapt with their social and economic environments will survive and become successful and prosperous [22].

**4. Instinct theory:**

This theory is attributed to several thinkers; however, Sigmund Freud is considered as one of the most prominent who discussed instinct. Freud considered instincts as part of his theory about human motives, where he made distinctions between life instincts (Eros) and death instincts (Thanatos) [23].

**5. Social Learning theory:**

This theory is attributed to the psychologist Albert Bandura. He attempted several researches about the mechanism in which individuals acquire behaviors through observation and simulation [24].

**6. Free will theory:**

The theory of free will is considered as one of the most important philosophical theories that explain voluntary behavior. This theory insists that individuals have the ability to make independent decisions that specify their fortunes in life based on their own choices without being forced by external or internal factors like instincts or social conditions [25].

## Comparable Examples

**1. High Line Park, New York, United States:**

A high leveled linear park stretching 1.5 miles in length and goes up 30 feet above street level. It includes a green pathway and a railway line constructed over central New York railway on the western side of Manhattan in New York city. High line park was originally an elevated railway line built around the thirties to facilitate goods transportation throughout Manhattan. After decades of neglect, it was transformed into a public park due to the efforts of local residents and environment activists. It was opened through multiple stages between years 2009 and 2019 [26]. The design of High line was the fruit of cooperation of James Corner Field Operations, Diller Scofidio + Renfro and Piet Oudolf. The deserted motive was redesigned as a <living system> inspired by several specializations including natural view engineering, urban design and environment. Since opening its doors at 2009, High line became a symbol of modern natural view engineering [27]. Natural and planned attraction factors Include natural plants inspired by the green cover that had grown over the abandoned rail lines covered with pebbles which swing and combine with planted areas and 120 types of plants, including mass creating weeds, cactus, and a grove of trees that creates shadows in the afternoon. There are, also, wooden chairs made of sustainable wood taken from a recycling forest in an effort to maintain the biological diversity in addition to creating movement pathways that allow for a varying experience while walking in the park. Artistic and cultural attraction factors there are several factors of cultural attraction in the park which solidify social communication and social sustainability. Such projects like the artist Spencer Finch's "The River That Flows Both Ways" project: 700 glass slate reflecting the colors of Hudson River according to pictures taken a minute apart. There is also the vocal complex of Steven Vitillo (2010): Combining the sounds of bells from all around New York. Another is "The Life with Natural Scenery" of Sarah Suzi: An iron and wood sculpture designed in the shape of

animal's shelter like birds and butterflies. Also, there is "The Allowed Space" of Kim Beck: Three large sculptures that looks like huge empty advertisement boards that can be seen from the south end. These among others represent attraction factors available in the park [28].

**2. Millennium Park" Project – Chicago, United States:**

Situated at Chicago city in the American Illinois state. Was opened in 2004 costing around 500 million dollars. The park is considered as one of the most important landmarks of Chicago. It is a famous entertainment and tourism center that holds many artistic landmarks such as the "Cloud Gate" and "The Crown Fountain" as well as the Jay Pritzker Pavilion theater designed by world famous architect Frank Gehry [29].

The target was to rehabilitate an abandoned industrial urban region and transform it into an interactive green region that supports psychological health, social interaction and sustainable environment. This project is considered as an example of green areas planning according to human behavior. Millennium Park is not just a mere beautification project, rather, it was designed based on studies of environmental psychology and human behavior in order to achieve direct advantages to residents and visitors via :

1. Supporting psychological luxury through merging nature with art and music to create an environment that stimulate positive feelings and reduce anxiety. Visitors can sit and relax in large open green environment in the middle of a crowded urban environment.
2. Encouraging physical activities and social interaction through designing wide cycling, walking and running pathways in addition to various entertainment facilities, including musical concerts and theaters.
3. Stimulate senses and interaction with nature through inserting sensory elements like the interactive fountain, which displays dynamic images of of residents faces and thrusts water in response to people movement, in addition to Laundry musical park, which provides an extraordinary vocal experience that supports sensory interaction.
4. Making the design sustainable and environmental friendly by utilizing green roofs over buildings in the neighboring region to enhance air quality and reduce ambient temperatures, and rain water management systems that recycle the water for plants hydration.
5. Creating multi-purpose areas by designing various parts of the park to accommodate numerous needs such as relaxation regions, kids' areas, artistic display areas, and places of meditation and social communication [30].

**3. Misherib Oasis – Doha (Qatar):**

The Doha Oasis is a multi-purpose project in the middle of Misherib district at the heart of Doha. Thanks to the visionary strategic view of the owner company, the Doha Oasis project was designed to be extraordinary in every aspect. The project represents a qualitative jump in the engineering and construction standards of the region. The project includes buildings and facilities of various utilities

over an area of 470 thousand square meters, constructed on a land of 73 thousand square meters area. The project is decorated by the eye-catching elliptic shape main building.

Misherib project represents a redevelopment of the middle city region of Doha becoming the first wholly sustainable district, where green areas were merged to support psychological comfort and social interaction bringing the middle area of the city back to life: The project aims to revitalize the city's middle region and make it an attractive lively center. Supporting sustainability: The oasis was designed to be an example of sustainable growth, which reflects a commitment to environmentally responsible practices. Providing a suitable environment for residents: The oasis aims to improve the quality of life by providing active wide green areas for residents and visitors. The design interacts with local climate by utilizing narrow shadowed pathways and heat resistant plants to encourage walking and reduce automobile usage, in addition to merging green areas between buildings and providing parks and public areas that aid in strengthening social interaction between residents and visitors, while emphasizing sustainability through utilizing intelligent irrigation technologies and water conservation techniques, thus supporting environmentally responsible behavior. Regarding the design of the green areas, they are distinguished with the variability of the environments, where the oasis contains varying regions that include small gardens, sitting areas, and fountains allowing visitors to entertain a wonderful dynamic and natural experience, in addition to the naturally shadowed areas that create a comfortable place throughout the year. The architectural elements, were a merging of modern architecture with classical local culture of the country of Qatar. Environmental sustainability was guaranteed through the usage of sustainable building materials in the oasis development, in addition to water and energy saving technologies. Additionally, the oasis hosts numerous cultural and artistic activities which supports social interaction and promotes social participation.

Advantages of the oasis Improve psychological health: The abundance of green areas and quite provide positive influence on psychological health of the visitors. Supporting society: The oasis operates as a social center. People gather in there, supporting social relationships. Sustainability: The oasis represents an example of sustainable urban development, where it participates in reducing environmental footprint of the whole city [30].

## Materials and Methods

Study Area (Al-Amerat First Residential Complex) in Najaf Al-Ashraf Governorate. It is in the northwestern part of Najaf Al-Ashraf city near the Olympic Stadium and is 2.5 km away from the main road (Najaf-Karbala). Project implementation began on February 13, 2016, through cooperation between Al-Jusur Al-Aliya Company and Casso Group at a cost of $240 million, covering an area of 320 dunums with 1,411 residential units suitable for three economic categories (300m², 250m², 200m²). The total area of Al-Emarat First Residential Complex reached 320,000 square meters with a population of 8,466 residents, including 33,807 square meters of green and recreational spaces, representing 10.55%, while 64,260 square meters constitute restricted areas as (figure 1). According to the mentioned standards and Iraqi standards for 2018 issued by the Ministry of Planning, the

individual's share reached 6.5 square meters per person.

Population = 8,466 residents (number of residential units × average family size (6.5))

Green areas = 33,807 square meters, Served population = 33,807 / 6.5 = 5,201 individuals

Ratio = Served population / Total population = 5,201 / 8,466 × 100 = 61%.

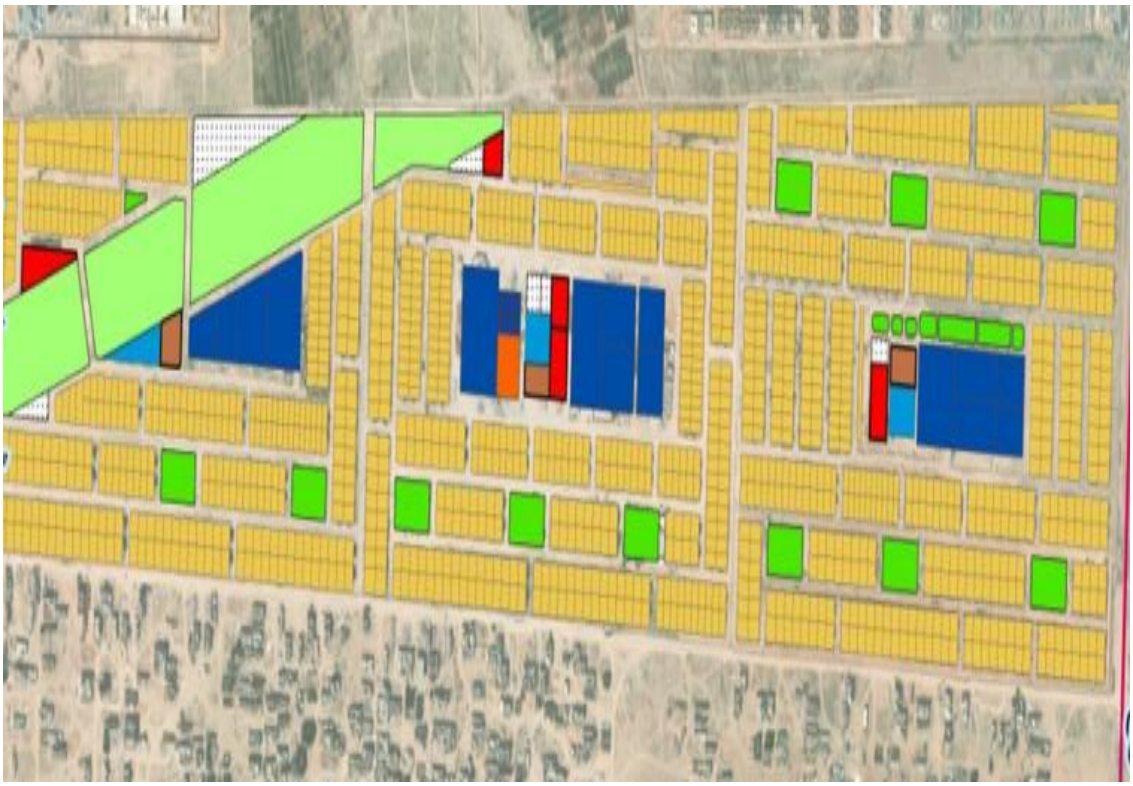


Figure (1): Land use of Al-Amerat First Residential Complex

**The First Proposed Alternative Design:**

Converting the street separating the schools and green space into a "safe school pedestrian street," so that it is designated only for students to cross directly from schools to the park.

Its function: Direct and safe connection between schools and the park without the need to cross vehicle traffic.

Its design: A wide pedestrian pathway equipped with rubber or colored stone flooring to attract children. Equipped with umbrellas or shaded trees on both sides. Contains educational ground markings (letters, numbers, drawings). Low plant fencing on both sides to guide movement and prevent slipping into the public street as (figure 2).



(a) Design green space into zones



(b) Children's play zone and family rest zone

Figure (2): The First Proposed Alternative Design

Table (1): LEED-ND analysis for The First Proposed Alternative Design

| Possible Points | Indicator Type | Indicators | Main Category |
|---|---|---|---|
| **28 Points** | Prerequisite + Points | Site selection, proximity to services, environmental protection, connectivity | 1- Spatial Intelligence |
| **8** | Up to 10 points | Credit - Smart site and land use | |
| **1** | 1 prerequisite + up to 2 points | Credit + Prerequisite - Environmental protection and sensitive areas | |
| **4** | Up to 7 points | Credit - Proximity to public transport | |
| **2** | Up to 3 points | Credit - Community connectivity | |
| **2** | Up to 3 points | Credit - Reducing impacts on natural sites | |
| **44 Points** | Prerequisite + Points | Density, walkability, mixed-use, accessibility, overall design | 2- Lifestyle and Urban Design |
| **1** | Up to 2 points | Credit - Density and compaction | |
| **6** | 1 prerequisite + up to 6 points | Prerequisite + Credit - Walkability and pedestrian comfort | |
| **5** | Up to 5 points | Credit - Mixed-use | |
| **2** | Up to 2 points | Credit - Accessibility to public spaces | |
| **3** | Up to 4 points | Credit - Contextual architectural design | |
| **2** | Up to 4 points | Credit - Urban fabric and network distribution | |
| **4** | Up to 7 points | Credit - Reducing reliance on cars | |
| **1** | Up to 1 point | Credit - Participatory planning practices | |
| **31 Points** | Prerequisite + Points | Energy, water, materials, green buildings | 3- Green Infrastructure and Buildings |
| **4** | 1 prerequisite + up to 5 points | Prerequisite + Credit - Certified green buildings | |
| **1** | Up to 3 points | Credit - Use of renewable energy | |
| **3** | Up to 5 points | Credit - Water use efficiency | |
| **1** | 1 prerequisite + up to 4 points | Credit : Prerequisite - Stormwater management | |
| **3** | Up to 4 points | Credit - Sustainable materials and waste reduction | |
| **2** | Up to 2 points | Credit - Indoor air quality and health practices | |
| **6 Points** | Points Only | Innovative solutions, exceptional performance, active participation | 4- Awareness and Innovation |
| **4** | Up to 5 points | Credit - Innovation in design or operations | |
| **0** | 1 point | Credit - Reliance on LEED AP ND certified design team | |
| **4 Points** | Points Only | Local environmental priorities set by the state or region | 5- Regional Priorities |
| **Total: 63** | | | |

## The Second Proposed Alternative Design:

First: Design Idea Title of the Idea: "Organized Open Space – A Safe Sports and Educational Environment in the Heart of the Residential Community" This design is based on logical division and visual clarity to organize activities in a structured way, allowing all groups to use the space easily. It emphasizes the clarity of pathways and the allocation of areas for physical activity, play, seating, and shaded zones, while keeping the space open and visually and spatially secure as (figure 3).



(a) Design green space into zones



(b) Children's play zone and family rest zone

Figure (3): The Second Proposed alternative design

Second: Does Design Reflect the Concept of Human Behavior?

1. Clear and Easily Understandable Organization: A regular geometric design that is easy to comprehend and suitable for all age groups.
2. Functional Allocation: Spaces include a playground, seating areas, green surfaces, and a water feature, addressing various needs.
3. Good Visual Oversight: The space is open and easily monitored, enhancing the sense of security, particularly for children.
4. Ease of Access: Multiple intersecting pathways facilitate movement and reduce barriers.

Third: Project Planning Idea (The Educational Street – A Street for Education and Environmental Interaction). Instead of eliminating vehicle traffic, the street separating the schools and the park is transformed into an "educational multifunctional street." It integrates light vehicle traffic (e.g., exclusively for school buses) with pathways for environmental education. A low-speed street specifically designed to serve:

- School buses.
- Safe crossing paths for children.
- Environmental and artistic educational activities on both sides of the street.
- A prominent pedestrian walkway within the street paved with educational drawings (plants, planets, environmental symbols).
- Educational display boards about water, energy, and recycling placed on both sides.
- Small educational kiosks or a mini educational garden beside the sidewalk.
- Vehicle speed is strictly limited (10–15 km/h) with clear speed bumps.

Safety:

The use of "traffic calming" elements such as:

- Speed bumps.
- Raised curbs.
- Colored and visible pedestrian crossings.

Table (2): LEED-ND analysis for The Second Proposed Alternative Design

| Possible Points | Indicator Type | Indicators | Category |
|---|---|---|---|
| **28 Points** | Prerequisite + Points | 1- Spatial Intelligence | |
| **- Site selection, proximity to services,** | | | |
| **environmental protection, connectivity** | | | |
| **4** | Up to 10 Points | - Smart site and land renewal | |
| **1** | 1 prerequisite + up to 2 Points | - Environmental protection and public areas | |
| **4** | Up to 7 Points | - Proximity to public transportation | |
| **2** | Prerequisite (Credit) [Spans 2 columns] | - Linked with community satisfaction | |
| **2** | Up to 3 Points | - Reducing impact on natural sites | |
| **44 Points** | Prerequisite + Points | 2- Lifestyle and Urban Design | |
| **- Density, livability, mixed-use utilization,** | | | |
| **accessibility, general design** | | | |
| **Credit** | | | |
| **1** | Up to 2 Points | - Density and compaction | |
| **3** | 1 prerequisite + up to 6 Points | Prerequisite (Credit) [Spans 2 columns] | |
| **- Livability and comfort** | | | |
| **2** | Up to 5 Points | Credit | |
| **1** | Up to 2 Points | - Mixed-use diversity | |
| **1** | Up to 4 Points | Credit | |
| **- Accessibility to public spaces** | | | |
| **2** | Up to 7 Points | Credit | |
| **1** | Up to 1 Point | Credit | |
| **31 Points** | Prerequisite + Points | 3- Green Infrastructure and Buildings | |
| **- Energy, water, materials, urban civil flow** | | | |
| **Prerequisite (Credit) [Spans 2 columns]** | | | |
| **2** | 1 prerequisite + up to 5 Points | - Green building and sustainabilities | |
| **Credit** | | | |
| **0** | Up to 3 Points | Credit | |
| **2** | Up to 5 Points | Credit | |
| **1** | 1 prerequisite + up to 4 Points | Credit Requirement [Spans 2 columns] | |
| **1** | Up to 4 points | | |
| **2** | Up to 2 points | - Reducing waste | |

| | | | |
|---|---|---|---|
| **- Wastewater treatment** | | | |
| **- Stormwater management** | | | |
| **- Sustainable materials and waste reduction** | | | |
| **- Indoor air quality & health practices** | | | |
| **8 Points** | Bonus Points | 4- Innovation and Awareness | |
| **Innovative solutions, consultancy, active participation** | | | |
| **2** | Up to 5 Points | Credit | |
| **0** | | Credit | |
| **- Innovation in design or services** | | | |
| **1** | 1 point | - Reliance on specific design | |
| **LEED AP ND** | | | |
| **- Local environmental priorities set regionally** | | | |
| **- Regional priorities** | | | |
| **Total** | 37 | | |

**The Third Proposed Alternative Design:**

First: Design Concept of the Project. The park design relies on a clear axial organization centered around a circular focal point, with a systematic distribution of pathways and activities. The focus is on simplicity and symmetry, making the space easy to understand and navigate for all groups. The inclusion of the five-a-side sports field encourages physical activity, while the large green spaces and beautified areas provide zones for relaxation and social interaction. Key Features of the Concept:

- A clear geometric organization that facilitates movement and reduces visual clutter.
- The five-a-side sports field supports sports and group activities.
- A good balance between vegetated, open, and shaded areas.
- A well-distributed arrangement of central points and pathways contributes to ease of movement.

Planning Concept of the Alternative "Green Multi-Use Movement Loop" Transforming the streets surrounding the park into a circular green multi-use loop that connects schools and residential neighborhoods while integrating quiet transport modes, pedestrians, bicycles, and cars in a flexible and safe design as (figure 4).



(a) Design green space into zones



(b) Children's play zone and family rest zone

Figure (4): The Third Proposed Alternative Design

**Key Elements of the Concept:**

Surrounding Streets Become Shared Streets:

- No elevated curbs, but a unified flat design.
- Mixing pedestrian, bicycle, and vehicle movement with limited speeds (maximum of 15 km/h).
- Using varied surfaces (colored bricks, textured concrete paving) to distinguish between pathways.

A Green Loop Surrounding the Site:

- Rows of trees planted along the surrounding streets to provide shade and reduce heat.
- Shaded pedestrian walkways and continuous bicycle paths to encourage active mobility.

Strategically Distributed Parking:

- Short-term parking near schools.
- Long-term parking near residential neighborhoods.
- Integration of green parking to facilitate rainwater drainage.

Distinctive Crossing Points:

- Raised crossing points directly in front of schools.
- Clear ground markings (decorative and educational) to ensure students cross safely.

Table (3): LEED-ND analysis for The Third Proposed Alternative Design

| Possible Points | Indicator Type | Indicators | Primary Category |
|---|---|---|---|
| **28 Points** | Prerequisite + Points | Site selection, proximity to services, environmental protection, connectivity | 1- Spatial Intelligence |
| **6** | Up to 10 Points | Credit - Smart site and land use | |
| **1** | 1 Prerequisite + Up to 2 Points | Credit + Prerequisite - Environmental protection and sensitive areas | |
| **3** | Up to 7 Points | Credit - Proximity to public transport | |
| **2** | Up to 3 Points | Credit - Connecting to the surrounding community | |
| **2** | Up to 3 Points | Credit - Reducing impacts on natural sites | |
| **44 Points** | Prerequisite + Points | Density, walkability, mixed-use, accessibility, general design | 2- Lifestyle and Urban Design |
| **1** | Up to 2 Points | Credit - Density and compaction | |
| **3** | 1 Prerequisite + Up to 6 Points | Credit + Prerequisite - Walkability and pedestrian comfort | |

| | | | |
|---|---|---|---|
| **3** | Up to 5 Points | Credit - Mixed-use diversity | |
| **2** | Up to 2 Points | Credit - Easy access to public spaces | |
| **1** | Up to 4 Points | Credit - Contextual architectural design | |
| **3** | Up to 4 Points | Credit - Urban fabric and network distribution | |
| **4** | Up to 7 Points | Credit - Reduced dependency on cars | |
| **1** | Up to 1 Point | Credit - Participatory planning practices | |
| **31 Points** | Prerequisite + Points | Energy, water, sustainable materials, green buildings | 3- Green Infrastructure and Buildings |
| **2** | 1 Prerequisite + Up to 5 Points | Credit + Prerequisite - Certified green buildings | |
| **0** | Up to 3 Points | Credit - Use of renewable energy | |
| **2** | Up to 5 Points | Credit - Efficient water usage | |
| **1** | 1 Prerequisite + Up to 4 Points | Credit + Prerequisite - Stormwater management | |
| **2** | Up to 4 Points | Credit - Sustainable materials and waste reduction | |
| **2** | Up to 2 Points | Credit - Indoor air quality and healthy practices | |
| **6 Points** | Points Only | Innovative solutions, exceptional performance, active participation | 4- Awareness and Innovation |
| **3** | Up to 5 Points | Credit - Innovation in design or operations | |
| **0** | 1 Point | Credit - Reliance on LEED AP ND certified design teams | |
| **2 Points** | Points Only | Locally defined environmental priorities | 5- Regional Priorities |
| **Total** | 46 Points | | |

**Selecting the Best Alternative:**

After conducting a comprehensive analysis of the three design alternatives for the "First Princesses Residential Complex" project, using a multi-criteria decision analysis methodology and evaluating them based on a set of design, planning, environmental, and behavioral indicators, as well as matching these alternatives with the Iraqi Urban Housing Standards Manual and LEED ND standards, it was concluded that the first alternative is the most optimal, integrated, and effective option.

The first alternative achieved:

- The highest weighted score in the numerical analysis of various indicators,
- Clear alignment with environmental sustainability and climate planning standards,

- Significant compliance with urban greening standards in terms of density, diversity, and smart tree distribution,
- Fulfillment of most of the Iraqi housing manual requirements, particularly about gradient spaces, providing areas for the elderly and children, and safe pathways.

This alternative is also distinguished by its ability to provide improved thermal comfort, enhance social interaction within open spaces, as well as clear functional organization and high flexibility for future usage.

Therefore, selecting the first alternative is not only based on its aesthetic and architectural excellence but also relies on clear scientific and methodological foundations that make it the best model to achieve a sustainable, comfortable, and safe urban environment that serves all age groups within the project.

Table (4): ENVI-MET analysis for the study area and the three alternatives in summer and winter

| Relative Humidity | Wind Speed | Temperature | Description |
|---|---|---|---|
| **Min: 15.01%** | Min: 0.00 m/s | Min: 39.42°C | Current Situation (Summer) |
| **Max: 16.25%** | Max: 5.21 m/s | Max: 41.04°C | |
| **Min: 79.41%** | Min: 0.18 m/s | Min: 7.16°C | Current Situation (Winter) |
| **Max: 89.17%** | Max: 4.76 m/s | Max: 8.15°C | |
| **Min: 18.54%** | Min: 0.32 m/s | Min: 29.71°C | First Alternative (Summer) |
| **Max: 36.90%** | Max: 3.96 m/s | Max: 36.68°C | |
| **Min: 80.68%** | Min: 0.40 m/s | Min: 7.75°C | First Alternative (Winter) |
| **Max: 91.71%** | Max: 3.91 m/s | Max: 9.10°C | |
| **Min: 21.82%** | Min: 1.96 m/s | Min: 33.12°C | Second Alternative (Summer) |
| **Max: 27.05%** | Max: 3.51 m/s | Max: 35.65°C | |
| **Min: 82.66%** | Min: 1.98 m/s | Min: 7.16°C | Second Alternative (Winter) |
| **Max: 93.46%** | Max: 3.34 m/s | Max: 7.82°C | |
| **Min: 23.13%** | Min: 1.88 m/s | Min: 33.20°C | Third Alternative (Summer) |
| **Max: 28.26%** | Max: 3.51 m/s | Max: 35.66°C | |
| **Min: 82.61%** | Min: 1.71 m/s | Min: 7.17°C | Third Alternative (Winter) |
| **Max: 93.47%** | Max: 3.51 m/s | Max: 7.83°C | |

## Conclusion

### 1. Results:

1. The superiority of first alternative (multiple generations park): The evaluation procedure, by using multi-criteria decision analysis methodology, proved that first alternative is the optimal choice for implementation. It achieved the highest favorable score of (4.48) compared to the second (3.56) and third (4.31) alternatives. This dominance is due to its functional completeness and its ability to provide attendance to needs of various age groups through waving pathways and distribution of interactive activities.

2. Achieving temporal and climatic comfort: Simulation results obtained from (ENVI-MET) software showed that the first alternative aided effectively in improving the micro -climate. Temperature degrees went down considerably at summer time, reaching between (29.71ºC) and (36.68ºC), compared to current reality, where temperature degrees reach (41.04ºC), which further supports the assumption that environment-based design enhances quality of life.
3. Reinforcing social interactivity and human behavior: The results proved that merging "the safe pedestrian school street" in the first alternative solves the problem of disconnection between educational spaces and green landscapes, hence, encouraging positive social behavior and providing safe environment for students and their families, which fully conform with behavioral theories reviewed earlier.
4. Compliance with planning standards: The chosen alternative achieved high compliance with Iraqi standards of urban residence, especially in the "spaces gradation", "safe pathways" and "providing areas for elderly and children" criteria, with fulfillment degree of 100% in most of them. It also achieved a good compliance with LEED-ND standards for sustainability.
5. The importance of space organization in behavior guidance: The comparison showed that designs that depend on organic shapes and continuous paths (as in the first alternative) encourages curiosity and action (child curiosity) more that strict engineering designs, therefore, supporting psychological and athletic health of the residence.

**2. Recommendations:**

The following recommendations are based on the results of this study:

1. Reliance on the "first alternative" for implementation: It is recommended to apply the suggested "first alternative" at Al-Amirat residential complex, as it provides the ability of reducing temperatures according to scientifically proven means while achieving social and environmental sustainability. Emphasis should be on implementing "school foot path street" as a core factor for safe connection.
2. Inserting human behavior pointers in building codes: It is necessary to update local planning criteria to include "human behavior pointers" (such as psychological security, social interaction, age inclusive) as primary requirements when designing residential complexes. The design with only abstract area proportions for green landscapes is not satisfactory.
3. Applying the traffic calming strategy: This study recommends applying the idea of transforming streets that separate between schools and public parks to associated streets or safe walking pathways in residential districts by utilizing various paving materials road bumps in order to reduce vehicles speeds and encourage pedestrian movement, as suggested in the first and second alternatives.

4. Using native and sustainable types of plants: Insisting on using native plants that can adapt to the local atmosphere of Najaf cities' hot and dry weather, in order to guarantee sustained green landscapes and reduce water consumption, as proved viable by successful international experiments like "Millennium Park" and "Misherib Oasis".
5. Early adoption of atmospheric simulation software: Giving credence to software simulation (such as ENVI-MET) as a primary tool of early planning for residential projects in Iraq, not as a late evaluation tool, in order to guarantee treatment of heat islands phenomena prior to execution.
6. Reinforcing multidisciplinary nature of open landscapes: Designing green areas to be "multi-use spaces", incorporating areas for sport activities, relaxation and cultural activities in order to ensure their continuity of hosting residents throughout the day, raising the social security level and reducing carelessness.

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