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Spatial Integration analysis and the Definition of Historical Buildings in their urbancontext

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Abstract

Historical buildings are a unique product and an important witness to the society they represent, encompassing all its economic, social, and political dimensions. The changes facing cities have revealed challenges in the areas surrounding buildings of historical value, affecting the definition and perception of these buildings within their new urban context. Given the significance of historical buildings in general, and Iraqi khan in particular, within the memory of society, as well as their distinctiveness within their urban context and the potential for their integration with it—since khans possess high flexibility for re-utilization in multiple social and economic functions alongside their visual value—they will be considered as a case study.

The research problem is defined by the lack of clear theoretical indicators for spatial integration that can be used to define historical buildings within their urban context. The aim of the research is to find comprehensive theoretical indicators for spatial integration by defining historical buildings within their urban context. The research hypothesizes that the spatial integration of a historical building depends on the fulfillment of indicators that define the building's condition within its urban context.

The theoretical framework of the research is based on analyzing previous studies and proposals that address the definition of buildings within their urban context, with the aim of identifying measurable indicators given the diversity of cases and locations of historical buildings within their urban context. The

historical building will be defined through its location and its identity as an urban element. Core maps of the locations of these buildings and their relationships to the surrounding area will be created using specialized analytical mapping programs such as GIS and Space Syntax, accompanied by an evaluation form to assess the current state of these buildings within the urban landscape.

The research adopts a descriptive methodology, a questionnaire, and the application of programs to evaluate the spatial integration of historical buildings to define them according to their condition, highlighting their spatial formation. The research aims to identify and measure the role of spatial integration in the contemporary urban fabric in redefining the historical building as an element within its urban context. Based on this, the evaluation will enhance the comparison process between each case of historical buildings within their urban context. The research concludes that the definition of historical buildings within their urban context depends on spatial integration variables, which determine the building's identity within one of the following conditions: edge formation, situated along movement paths, forming historical sectors, landmarks, or nodes.

Keywords: Urban context, spatial integration, historical buildings, urban fabric, mental image elements of the city, core maps.

*** Theoretical Study**

In order to understand the research problem and its terminology, it is essential to present the most important previous studies. The extraction of indicators requires an examination of the research concepts as follows:

Introduction

The visual image in the user's mind is formed through movement and navigation within the urban area and its various visual components. This image influences the user's perception through organized cognitive processes, creating a mental impression of the urban area that can be either positive or negative, depending on the visual components. This impression affects the user's behavior within the urban space and directs their movement inside it. To clarify the research problem, it is essential to present some previous studies that define historical buildings within their urban context. The addition and integration of certain buildings within an existing fabric clearly impact the property of integration, as even a minor change in

location or spatial network shape can lead to significant changes in the characteristics of the spatial system. The choice of site at the local level has a considerable impact on the property at the global level. Several factors affect spatial characteristics, including building shape, the function added, the size of the added function, and the location of the function (Hillier & Vaughan, 2007).

Some studies have proposed strategies for reconstructing the built heritage to remain a fundamental landmark capable of adapting to the present and coexisting according to its requirements (Gharib & Abushal, 2020). In another study, a weakness was found in the spatial composition of the current urban fabric of cities, leading to changes in spatial behavior during the movement of the recipient between components of the urban fabric (Al-Kanani, 2021).

In a study by Nattika Kornticha in Thailand, it was noted that historical areas around the world are affected by development and processes driven by globalization, sometimes neglecting historical context (Kornticha, 2019). According to another study, the spatial signature of functions within architectural composition affects the clarity of the mental image and the ability to distinguish the composition as a spatial function (Haqi Ismail & Al-Khafaji, 2020).

Rapoport posits that historical centers integrate personal culture and human behavior with their architectural fabric (Al-Maghari, 2015). Kevin Lynch provided a clear definition of the mental image of the city, describing it as the mental perceptions held by its inhabitants (Lynch, 1960). Another study discussed the challenges of designing new buildings within a context of historical value, requiring adherence to specific controls and standards (Al-Sharbin, 2020). Other studies have shown that contextual integration elements include visual, functional, locational, and spatial integration (Muhammad, 2022). Spatial perception also plays an undeniable role in activities that characterize behavioral patterns (Manley et al., 2021).

Research Problem, Objective, Hypothesis, Methodology, and Significance

*** Research Problem**

Urban fabric changes have impacted the values of spatial integration, leading to an increased need to redefine historical buildings within their urban context.

*** Research Objective**

This research aims to identify and measure the role of spatial

integration within the urban fabric in redefining historical buildings as elements within their urban context.

*** Research Hypothesis**

The redefinition of historical buildings is determined by indicators that define the building based on its relationship with its urban context. This definition is linked to changes in spatial integration values in accordance with modifications in the morphology of the surrounding urban fabric.

*** Research Methodology**

The research relies on the theoretical framework and previous theses defining buildings within their urban context to extract measurable indicators for each case of historical building signatures in their urban context. This involves mapping the spatial relationships of these buildings using analytical mapping programs such as GIS and Space Syntax, alongside a theoretical assessment form to evaluate their current state in three dimensions. Historical buildings will be defined by their location as (node, landmark, path, edge, sector), which in turn will determine their spatial integration within the urban context.

*** Significance of the Research**

This research develops a quantitative analysis method capable of defining historical buildings based on their conditions while addressing their spatial composition. The aim is to analyze how these buildings are positioned and integrated into their urban surroundings, studying practical cases that reflect the interactions between historical buildings and their architectural and social contexts. Consequently, this evaluation will enhance the comparative analysis of each historical building within its urban context. To achieve a deeper understanding of how to protect these buildings and enhance their integration with the changing urban environment, this research gains future importance in guiding efforts to preserve urban heritage in alignment with urban developments.

*** Urban Definition of Historical Building**

To arrive at indicators of spatial integration and to define buildings within their urban context, it is necessary to examine some theses and studies that clarify the relationship between spatial integration and the signatures of buildings in their urban settings. Studying how urban space is organized within a city provides insights into the forms of urban context and the transformations occurring within it. Below are some

theses and studies relevant to this concept:

Lynch (1960) emphasized the integration between conceptual structure, spatial structure, and actual site use in the urban fabric of historical centers. He noted that the lack of this integration leads to a disconnect. Lynch described spatial integration as a cohesive and transparent physical framework comprising five elements: nodes, paths, edges, landmarks, and districts, which collectively create a vivid mental image.

The fundamental physical elements that constitute a city include:

1- Paths: These are the main channels of movement through which the mental image is formed. They vary from place to place according to their functions. Characteristics include the need for continuity, ensuring that the path network represents a single, connected, and continuous channel for observers, achieved through properties such as guidance, sequence, gradation, and dynamic formations.

2- Edges: These boundaries gain emphasis and strength, making them easier to distinguish or see from a distance. The area behind them assumes a distinctive character and clearly separates or connects the area with its surroundings. Characteristics of edges include being visually clear, continuous in form, difficult to penetrate with movement, and can be natural boundaries (e.g., rivers, natural corridors, hills) or artificial boundaries (e.g., green belts, bridges, highways). They can also manifest as abrupt ends, such as linear paths or walls separating two areas, or as gradual transitions fading into another area, potentially indicated by variations in building uses, facade shapes, or building heights.

3- Landmarks: These are distinctive buildings or elements within the city. They are characterized by uniqueness and individuality, contrast with their surrounding fabric, clear overall shape, notable details and general design, ease of perception and visibility, visibility from both distant and close perspectives, and confirmation of their belonging to the surrounding fabric despite their distinctiveness. Their visual appeal can include shape, facades, color, and height, as well as their significance in the memory of users; they may serve as monuments or statues (Al-Salihi, 2016).

4- Nodes**:** These represent mental anchor points that gain their character and distinctiveness from the unity, integration, and continuity of various elements, along with the

concentration of activities and movement. Nodes are characterized by being memorable places that do not overlap with other elements in perception. They guide decision-making in movement. Examples include squares, highways, plazas, road intersections, and movement corridors, which serve as active centers of movement and gathering in urban spaces. They can also be focal points, such as central shopping areas.

5- Visual Districts: These are areas with a homogeneous character that can be distinguished by the continuity of evidence with shared qualities. The physical characteristics of districts are measured by their continuity and the uniformity of facades in terms of color, materials used, shape, details, urban spaces, symbolic meanings, building uses, activities within, the community's demographics, and the topography of the land. Each district has a unique name, and they may form a cohesive fabric or be distinct from other areas, making them enclaves (Majid & Rashid, 2014).

From the study, it can be concluded that spatial integration forms a cohesive and transparent physical framework composed of five elements: nodes, paths, edges, landmarks, and districts. The characteristics of these elements include:-

1- Paths: Emphasize continuity, guidance, sequence, gradation, and dynamic formations.

2- Edges: Are visually clear, continuous in form, difficult to penetrate, can be natural or artificial boundaries, and can manifest as abrupt or gradual transitions.

3- Landmarks: Are distinguished by uniqueness, contrast with the surrounding fabric, clarity in shape, notable details, ease of perception, and their visual appeal and significance in the memory of users.

4- Nodes: Are characterized by their guiding function in decision-making, serving as active centers of movement and gathering.

5- Districts**:** Are defined by formal continuity, visual and functional homogeneity, similarity in topography, and cohesive or distinct fabrics.

6- Schulz (1971) noted that identifying the physical elements of the mental image structure of urban scenes is closely related in meaning, and the perception of the overall structure (fabric) is through its individual parts: nodes, paths, and landmarks. The study concluded that the physical elements for perceiving urban scenes and fabric include

nodes, paths, and landmarks (Al-Hinkawi & Suleiman, 2018).

7- Appleyard (1980) focused on the concept of building clarity and recognition, emphasizing the importance of physical shape attributes. He noted that clear boundaries are crucial in distinguishing the shape of a building from its urban surroundings (Appleyard, 1980).

The study concluded that the clarity and recognition of buildings depend on their physical shape attributes, particularly clear edges.

8- Salingaros (2000) highlighted the importance of nodes and edges in defining urban form, stating that nodes represent intersections of movement axes and host various daily activities. He noted that nodes possess multiple connections that do not conform to the straight axes typical of modern cities. The significance of nodes lies in the integration of movement paths, similar to traditional cities. Edges were described as the means by which different models are connected through their outer boundaries rather than their internal elements (Salingaros, 2000).

The study concluded that nodes and edges define a building within its context, with nodes characterized as points of movement convergence that host daily activities and multiple connections, while edges separate different models both visually and conceptually.

9- Moughtin (2003) defined urban scene clarity as the way one perceives and understands the urban environment, which in turn influences reactions towards that environment. This clarity relates to the qualitative characteristics of place, which give the city its identity, the movement of people and their choice of movement paths within a specific urban setting, the vibrancy of the urban environment due to mixed-use and diverse functions, and the visual aspects of the city scene connected to its spaces, streets, facades, surfaces, ground levels, architectural monuments, and street furniture **(**Moughtin, 2003).

The study concluded that urban scene clarity is linked to the qualitative characteristics of place, along with the streets and urban landmarks.

10- The proposals of Charles Jencks (2005-2011) highlight some ancient cities that have retained their known forms, showcasing taller buildings like central churches or clock towers, while less prominent structures include libraries and schools. This general hierarchical arrangement in traditional cities reflects a respect for

the diversity and historical forms of buildings. Traditional monuments hold a prominent place in the city, serving significant functions. In contemporary contexts, such monuments can symbolize a wide range of meanings and inspire awe towards their structures (Jencks, 2005).

The study concluded that landmarks play a crucial role in enhancing the urban context, with some being very prominent due to their height, while others are recognized through their meanings.

11- Al-Kinani (2006) emphasized that the characteristics of integration and cohesion in traditional architecture and urban fabric reflect a natural unity stemming from complex social patterns. The urban structure of residential sectors consists of a cohesive fabric, primarily composed of similar-sized blocks that appear sequenced and homogeneous in design within their overall framework. Buildings within these sectors are generally of equal heights, forming a cohesive structural mass akin to a "tight building" (Wahdat Shakir Al-Hankawi & Nada Abdul-Maeen Hasan, 2014)**.**

The study concluded that historical buildings in these sectors share characteristics of a cohesive fabric, consistent block sizes, and uniform heights.

12- Al-Bakri (2012) noted that urban landmarks or architectural monuments consist of material elements prominent in daily life. Some of these arose from political factors (like palaces) or religious influences (such as places of worship). Historical landmarks are those architectural elements within the urban fabric that hold a significant visual presence in collective memory (Hiam Majid Al-Bakri, 2012).

The study concluded that historical landmarks are identified as prominent urban elements within the city's fabric, significant in collective memory.

13- Edmund Bacon (2012) discussed the importance of contemporary monuments' connection to urban spaces, comparing them with historical monuments. He argued that these architectural formations represent a junction between mass and space. By defining this critical point, one can understand how humans interact with their environment. The study analyzed how contemporary monuments integrate with the prevailing urban context, emphasizing their connection to the skyline and the need for spatial connections that enhance aesthetic design and

functionality within the urban structure (Bacon, 1997; translated by Taha Al-Douri, 2012).

The study concluded that both contemporary and historical landmarks must relate to the skyline and connect with each other through spatial linkages.

14- Janet Abu-Lughod (2014) observed that traditional cities developed their public pathways by allocating residential cells and serving pathways as boundaries and edges of these cells. Unlike these pathways, continuous internal routes serve as main thoroughfares leading to city gates, often appearing as linear centers for trade and industry. Traditional markets seamlessly integrated with public routes, while secondary pathways connected residential areas, enhancing the integration of spaces with built forms (Mohammed Mahdi Hussein, 2008).

The study concluded that pathways illustrate the relationship between residential sectors and help form urban nodes and edges, achieving overall cohesion within the urban fabric.

Summary of Theoretical Studies:-

1- It is evident that the definition of historical buildings is determined by indicators that define the building based on its relationship with its urban context.

2- The cases of defining historical buildings in their urban context are (forming an edge – located on movement paths – forming historical sectors – landmarks – nodes)

* General Framework of the Research

Through theoretical studies, some of the most important indicators for defining buildings in their urban context have been identified. See Table 1:

Table 1: Indicators for Defining Historical Buildings in Their Urban Context

(Researcher, 2024)

Definition of Spatially Integrated Historical Buildings in Their Urban Context	Measurement Indicators	Level of Intervention	Measurement Method
Nodes	- Integration with the environment	Whole (Fabric)	(Diagrams)
	- Direction in decision-making for movement		
	- Continuity of movement		
	- Concentration of activities and movement		
	- Formation of squares / highways / intersections	All urban scenes	Checklist of indicators (direct observation)
Paths	- Continuity of movement along the axis	Whole (Fabric)	(Diagrams)
	- Direction of movement through it		
	- Spatial and movement gradient		
	- Visual continuity of the axis	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Visual direction of movement through it		
	- Existence of a dynamic formation of the path		
Edges (Boundaries)	- Existence of a separating line between two contrasting areas	Whole (Fabric)	(Diagrams)
	- Emphasis on access opportunities or enhancing its functional importance (specific use)		
	- Visual clarity	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Continuity of shape		
	- Difficulty of movement penetration		
	- Formation of natural / artificial boundaries / gradually fading into another area		
Landmarks	- Contrast between the element's facade and the surrounding elements' facades	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Variation in shape		
	- Variation in scale		
	- Color distinction		
	- Visual prominence		
	- Symbolic attraction		
Districts	- Area with homogeneous character (shared attributes)	Whole (Fabric)	(Diagrams)
	- Simplicity of formation		
	- Contrast with all parts of the city		
	- Continuity of building forms		
	- Visual direction		
	- Areas separated from others	Whole (Fabric)	(Diagrams)
	- Functional continuity of buildings		

* Practical Study

In order to apply the research indicators, programs and measurement methods will be identified for those indicators, along

with the study area, followed by practical application as follows:

*** Site Measurement Form (Urban Scene)**

A specific form has been prepared for measuring urban scene indicators to assess the state of the three khanat in the urban scene of the study area within the perceptual dimension. The form observes the presence or absence of indicators to define that khan in its urban context. The questionnaire includes a set of indicators for the spatial integration of the building, derived from theoretical studies defining buildings in their urban context. A value of (1) will be placed before each indicator observed in the urban scene of the khan, and a (0) will be placed before the indicator that is not available.

*** Fabric Measurement Form (Using Diagrams through Space Syntax, GIS)**

A specific form has been prepared for measuring fabric indicators to evaluate the state of the three khanat in the urban fabric of the study area within the structural dimension. This form observes the presence or absence of indicators to define that khan in the urban fabric. The questionnaire includes a set of indicators for the spatial integration of the building, derived from theoretical studies defining buildings in their urban context. Axial maps of the location of those buildings and their relationship to the surroundings will be drawn using specialized analytical mapping programs such as GIS and Space Syntax. A value of (1) will be placed before each indicator observed in the urban scene of the khan, and a (0) will be placed before the indicator that is not available or is weak.

After extracting the results of both forms, the average of the indicators for each case of the building's signature in its urban context will be calculated. Any value that is greater than or equal to (0.5) will be considered compliant with that case.

Clarification of the Programs Used in Measuring Indicators:-

1- GIS (Geographic Information System)**:** This is a computer-based system that collects, maintains, stores, analyzes, outputs, and distributes spatial data and information. These systems work on gathering, entering, processing, analyzing, and presenting spatial and descriptive information for specific objectives. They aid in planning and decision-making related to agriculture, urban planning, and residential expansion, in addition to reading the infrastructure of any city by creating what are called layers.

This system allows us to input geographic information (maps, aerial photos, satellite images) and descriptive information (names, tables), process it (clean it from errors), store it, retrieve it, query it, analyze it spatially and statistically, and display it on a computer screen or on paper in the form of maps, reports, graphs, or through websites. (Al-Karawi, 2023)

2- Space Syntax**:** This program is based on a number of theories and tools that contribute to analyzing spatial form using mathematical calculations and equations. The founder of this theory is Professor Bill Hillier at University College London, who began working on it in the late 1970s. Professor Bill sought to create a tool that helps planners understand the social impacts on their designs before they are implemented, and also to measure the performance of existing urban spaces in an attempt to choose the best possible developmental solutions. The idea simplifies space into smaller components (buildings and streets) that can be analyzed as a network of options, which contributes to explaining the relationship between the space and these components within a social use framework. The Space Syntax theory measures urban space based on three fundamental points: 1. Spatial integration 2. Choices 3. Depth of distance, which collectively provide an overall measurement of the space to be measured**.** (Pafka et al., 2020)

*** Study Area**

The area is located in Iraq, Baghdad, specifically in the Old Rusafa Center. It encompasses the region connecting Khan Marjan, Khan Al-Zarour, and Khan Al-Mudallal for antiques, as illustrated in the accompanying image.

Figure 1: Study Area (Researcher, 2024)

Reasons for Choosing the Site:-

1- The study area is a primary center and an archaeological, commercial, and tourist landmark that attracts various community groups, distinguishing Old Baghdad and its heritage. It contains several old khans that are neglected and others that may not be utilized correctly.

2- The area showcases a diverse commercial and tourist landscape.

3- The strategic nature of the area is significant, as historical centers

represent not only the physical structure but also the complete life of a community, including its social relationships, customs and traditions, traditional crafts, and all existing functions.

4- The importance of historical buildings in general, and Iraqi khans in particular, in the community's memory, and their distinctiveness within their urban context and potential for integration is crucial. Khans possess a high degree of flexibility for repurposing into multiple social and economic functions, alongside their visual value, making them a suitable case study.

5- The selected khans are historically and culturally significant, and their structural condition is good, facilitating their integration with modern infrastructure.

6- The area is historical overall, with the introduction of new elements and buildings that may have slightly altered the original urban fabric. Therefore, the current state will be studied to understand its spatial integration with recent changes in the urban structure.

*** General Information About Selected Khans**

To gain a better understanding of the study area and the selected khans, the research provides general information about these khans as follows:-

1- Khan Murjan: This is one of the important preserved buildings that has been rehabilitated several times to meet contemporary requirements. It is considered one of the most beautiful khans in Iraq due to its exquisite architecture and brick decorations. It is located between Al-Samawal Street and the Bazaar Market, opposite Khan Murjan Mosque. It was established in 1358 AH by Amin al-Din Murjan to serve as a residence on the first floor and for commercial transactions on the ground floor. Over time, its function changed to that of a goods storehouse, which led to its deterioration, as one of its spaces was used as a stable for horses and a kitchen for the Ottoman army, causing damage to its walls due to fire. According to Nashwa Abdel Aziz, the lack of proper care for the khan building and insufficient financial resources for its maintenance led to its abandonment by the end of the 19th century, compounded by severe humidity from groundwater and the flooding of the Tigris River during winter. The spread of moisture throughout the building caused damage to the decorative brick façade and the falling of painted wall panels. At that

time, it was under the authority of the Religious Endowments Directorate, which made several modifications to its original shape and architecture. Subsequently, the Directorate of Antiquities and Heritage acquired it, attempting to restore it to its former state, but they faced difficulties with the khan's entrance, leading to the opening of another door as the entrance and closing the original door. It became a museum of Islamic antiquities in 1937 after being restored, but it was closed later due to humidity and groundwater issues.

From 1358 until the end of the 19th century, neighboring structures encroached upon it, and new buildings unrelated to the khan were erected. It also suffered from natural issues such as groundwater and humidity during winter and the floods of the Tigris River, compounded by economic difficulties during this period. In the early 20th century, it was used for storing various types of goods, and some of its walls cracked and developed fissures. From 1936 to 1960, it belonged to the Ministry of Endowments and was rented by the Directorate of Antiquities, which converted it into a museum for Islamic antiquities after restoration. In this period, the floor level of the building was lower than that of adjacent land, prompting the opening of a new door on the southern side as an entrance while the main entrance was closed. Since 1960, the Directorate of Antiquities has owned it and leased it to contractors for use as a tourist restaurant. Currently, the khan is neglected, with no active function, and significant groundwater and humidity issues persist, necessitating careful preservation efforts (Al-Sanbali, M. M., & Abdul-Baqi, S. M. (2022)).

Figure 2: Khan Murjan (Al-Sanbali, M. M., & Abdul-Baqi, S. M. (2022))

*** Khan Al-Zarour**

Khan Al-Zarour is one of the ancient khans located in the Bazaar Market near Khan Murjan. It is considered one of the oldest khans after Khan Murjan, built by the Ottoman Sultan Selim II in 974 AH, as noted by the inscription above the eastern entrance. It is square-shaped, with each side measuring 40 meters, featuring a large central door and an open courtyard. It serves as a model for khans that extend back to the Abbasid era and currently houses wholesale fabric merchants, with some rooms used as fabric storage. Previously, it was known as "Khan Al-Dukma Al-Kabir" and was renamed Khan Al-Zarour due to the

sale of threads, buttons, and silk sewing materials. The khan remains operational and contains several old shops owned by the Baghdad Endowments (Harb, T. (2021)).

Figure 3: Khan Al-Zarour (Researcher, 2023)

*** Khan Al-Mudallal for Antiques**

Khan Al-Mudallal is located in Baghdad's Al-Midan Square, situated within a market dedicated to selling antique, vintage, and rare collectibles. The small shops and stores in Khan Al-Mudallal are known for their diverse selection of antiques, attracting collectors and enthusiasts of stamps and other memorabilia. As one of the oldest khans in Baghdad, it is 112 years old and has witnessed numerous historical events in Iraq. Originally, Khan Al-Mudallal functioned as a hotel where the legendary Umm Kulthum performed in 1932 during her visit to Baghdad, along with many other prominent Iraqi and Arab artists. It still retains copies of photographs from those concerts. According to records, it was established in 1906 and initially known as the "Al-Hilal" hotel. However, the site fell into neglect despite its status as a historical and heritage location. In 1991, the Baghdad Municipality undertook its restoration, transforming it into a commercial complex that now houses numerous shops on both the ground and upper floors, specializing in antiques, heritage collectibles, folklore items, and old coins and stamps (Daoud, M. (2024)).

Figure 4: Khan Al-Mudallal for Antiques (Researcher, 2023)

*** Results of the Practical Side of the Study**

Measuring Research Indicators:-

To measure the research indicators, some were assessed using programs such as Space Syntax and GIS, while others were documented through on-site observation and photography as follows:

Measuring Research Indicators (via diagrams using Space Syntax and GIS):-

1- Analysis of Land Use Areas and Ratios (to measure the indicator of the continuity of buildings functionally in the vicinity of the khans and the existence of areas separated from others):

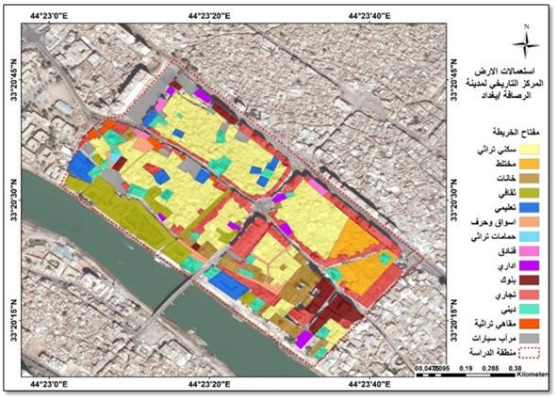

Figure 5: land uses within the study area (Researcher, 2023)

The map shown in Figure (5) illustrates land uses within the boundaries of the study area. It is evident that there is a diversity in the level of functions, achieving the most variety in the urban surroundings of Khan Al-Mudallal for antiques. Due to the historical nature of the area and its characteristics, the uses range from heritage residential to mixed-use, which includes both commercial and residential purposes. In addition to the khans, there are heritage facilities such as cafes, markets, baths, and hotels, alongside cultural activities represented by museums and historical sites. The area also accommodates commercial uses, banks, administrative functions, and educational institutions. The following table outlines the ratios and areas of land uses as follows:

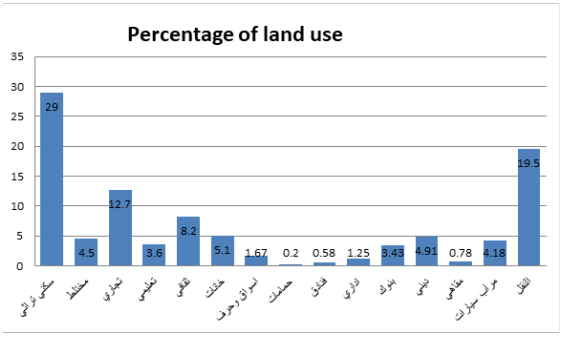

Figure 6: the percentage distribution of land uses (Researcher, 2023)

It is evident that there is functional continuity in the urban surroundings of Khan Al-Zurour, with a diverse range of functions observed in Khan Al-Mudallal, followed by Khan Al-Merjan. Additionally, there are areas that are somewhat disconnected, particularly residential sectors surrounding Khan Al-Zurour, in contrast to Khan Al-Mudallal and Khan Al-Merjan, which exhibit interconnected areas.

No physical boundary was noted in the surroundings of Khan Al-Merjan and Khan Al-Mudallal from their urban context, while a non-material functional separation was observed in the vicinity of Khan Al-Zurour.

2- Measurement of Activity and Movement Concentration Index: This is measured using the Kernel Density analysis method, which is one of the spatial analysis techniques within the

Spatial Analyst tools. Kernel Density calculates the density of point data around each cell represented as a point. The analysis is presented as a smoothly curved surface overlaying each phenomenon (activity, use), represented by a point. The surface value is highest at the point itself and decreases as the distance from the point increases, reaching zero at a specified radius. The density in each resulting point cell is calculated by summing all density values, measured in a specific area unit such as square meters, hectares, or square kilometers, while overlapping the center of the point cell (Silverman, 1986).

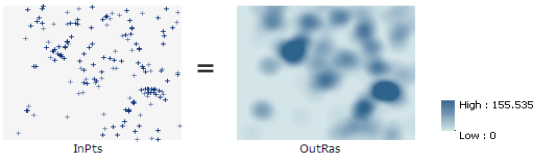

Figure 7: Kernel Density analysis method based on the input data within a GIS environment (Silverman, 1986)

The aim of selecting and applying the kernel density analysis method is to understand the density of distribution and spread of various activities within a specific spatial area compared to other phenomena in the same location. The results are illustrated in a raster format, where the color gradient and numerical values range from the lowest to the highest. The highest values are located near the selected activities, while the values decrease as the distance from the activities increases. Thus, the outcome of this analysis provides a visual representation of the distribution and concentration of certain activities or phenomena in a given area. The objective of applying this analysis to the study area is to measure the density of activities occurring near the khans (Silverman, 1986).

Upon applying this analysis to the activities located near the khans within the study area, the results led to the following map:

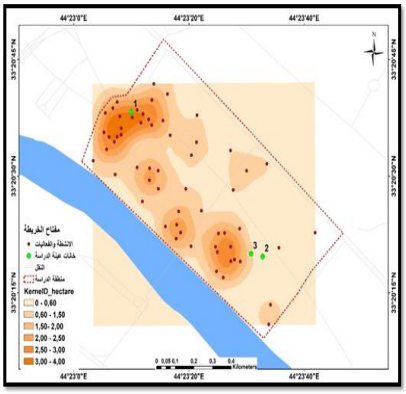

Figure 8: A map showing the Kernel Density analysis of activities located near the khans (Researcher, 2023)

The results of applying the density analysis method, as shown in figure (), can be analyzed for the activities located near Khan Al-Mudallal, Khan Al-Zarour, and Khan Marjan. As the color gradient increases, the density of activity distribution, measured in units of area per hectare, also increases.

We observe a high density of activities near Khan Al-Mudallal (Khan 1), while both Khan Al-Zarour

(Khan 2) and Khan Marjan (Khan 3) fall into a color category indicating lower activity density. This pattern of analysis highlights the spatial positioning of Khan Al-Mudallal, which is situated close to attractive functional activities that enhance the density of the surrounding events.

3- Measuring Global Integration: Global integration analysis is an important indicator for measuring the degree of overall symmetry at the urban structure level of the study area. Overall symmetry represents the extent of the area's "connection" to the city's public street network. Through this analysis, we can determine the depth levels of different parts of the urban structure relative to the outer environment, indicating how various parts of the city interact and communicate with each other. This is illustrated in the color gradient shown in figure (9), where the results range from red, indicating the highest connectivity, to blue, indicating the lowest connectivity. This analysis of global integration is conducted using the Depthmap software, as depicted in the following figure:

Figure 9: the Global Integration analysis of the urban structure of the study area (Researcher, 2023)

The results are presented using Geographic Information Systems (GIS), as shown in the following figure:

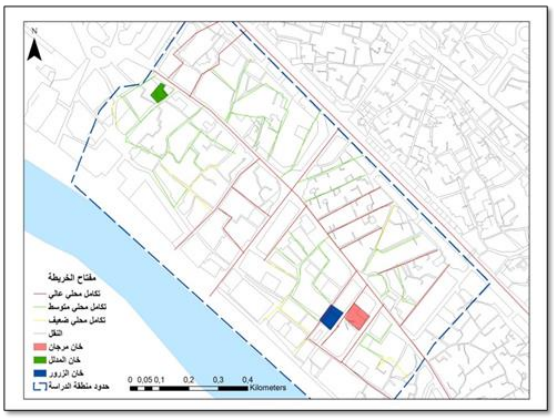

Figure 10: the levels of Global Integration of the urban structure in relation to the location of the study khans (Researcher, 2023)

To clarify the analysis results concerning the location of the khans within the boundaries of the study area, it is evident that Khan Al-Mudallal is situated adjacent to Al-Rasheed Street, indicating high global integration. In contrast, both Khan Murjan and Khan Al-Zaroor

are located amidst the organic streets of the neighborhood, which exhibit weak global integration. The paths connecting them represent a moderate level of integration.

This indicates that Khan Al-Mudallal has a high degree of connectivity with its urban surroundings, being linked to important main streets, which allows for easier access compared to both Khan Murjan and Khan Al-Zaroor.

4- Measuring Local Integration: Local integration analysis provides an explanation for the symmetry in the structural relationships between spaces, offering a clearer understanding of the urban fabric and its local connectivity. The results of this measurement range from red, indicating the highest levels of connectivity, to blue, representing lower connectivity. Local integration focuses on the interaction between nearby points within the urban network.

It is assessed based on how well a specific point integrates with other nearby points within a certain range (typically a few urban units). This measurement allows for a deeper understanding of how sub-areas or neighborhoods interconnect and how certain spaces or streets can act as "attractors" for pedestrian or local traffic.

The results of the analysis indicate that the urban area under study integrates well with high-straightness axes, showing a correlation with the global integration of the main streets of similar importance. This is illustrated in the color gradient shown in the accompanying figure, which represents the results of the local integration analysis using the Depthmap program as follows.

Figure 11: Analysis of Local Integration gradients of the urban structure in the study area (Researcher, 2023)

The results were presented using Geographic Information Systems (GIS), as shown in the following figure.

The map shown in the figure (11) illustrates the results of the local integration analysis within the urban structure of the study area. Overall, the historical center of Rusafa demonstrates good global integration, while also exhibiting

symmetry among urban spaces. The local integration indicates a value close to global integration, encompassing key vital streets, such as Al-Mutanabbi Street, which bisects the study area, and Al-Rasafi Street, which runs across it. However, the distinction lies in the organic streets that connect the various spaces, representing high local integration, as observed around Khan Al-Zurour and Khan Marjan. In contrast, Khan Al-Madallal exhibits medium symmetry in its surrounding spaces along the organic streets, while showing high symmetry along Al-Mutanabbi and Al-Rasafi Streets.

5- Measurement of Flow (Choice Analysis):The choice analysis method is an indicator that reflects the degree of connectivity between urban spaces and the permeability of adjacent spaces. It operates directly on main roads, meaning it measures the flow of movement between different parts of the urban fabric as a whole. Spaces with a high choice indicator are the most preferable, representing the shortest paths leading to activities that connect various parts of the urban fabric with its surroundings. Strongly connected streets are indicated in yellow or red, while those with low connectivity are shown in blue or green. The Choice method measures traffic flow (Pafka et al., 2020). The Al-Rasafi street, located near Khan Al-Madlal, represents the highest choice and is part of Al-Rashid street, as shown in the following figure, which represents the results of the choice analysis using Depthmap software.

Figure 12: the analysis of choice degrees of the urban structure in the study area (Researcher, 2023)

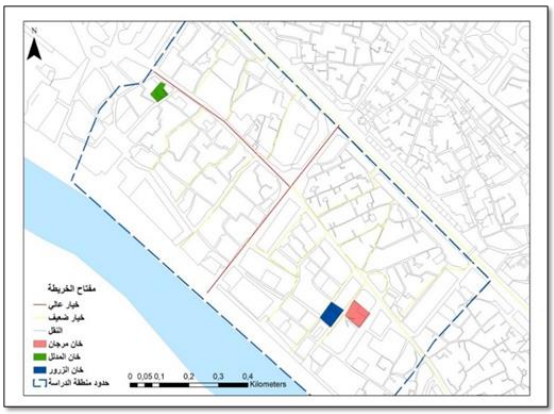

Figure 13: The choice analysis of the urban structure in relation to the location of the study khans (Researcher, 2023)

The results of the choice analysis have been presented using geographic information systems, as shown in the following figure 13:

Through the map shown in figure (13), which illustrates the results of the choice analysis, Al-Rasafi street, parallel to Khan Al-Madlal, demonstrates the highest choice level, providing the most movement options and access to adjacent areas. This street achieves the highest visual and movement connectivity, alongside a portion of Al-Rashid Street near Khan Al-Madlal. In contrast, other pathways exhibit weak choice indicators.

6- Measuring Traffic Flow (Continuity of Movement, Spatial and Movement Gradients): Based on analytical maps in GIS 10.8.2 ArcMap and a comparison with urban planning data, it was found that the highest traffic flow in the urban area of the khans is on Al-Jumhuriya street, with 4,500 vehicles passing through between 7-9 AM according to urban planning data. This is followed by Al-Mutanabi street with 4,000 vehicles, while Al-Rasafi street, which overlooks Khan Al-Madlal, has the lowest traffic at 2,000 vehicles. Additionally, mechanical transport is nearly nonexistent in the side streets of the historic area or is limited to simple machines and bicycles around Khan Marjan, and is almost absent in the vicinity of Khan Al-Zurur, as shown in figures (14) and (15).

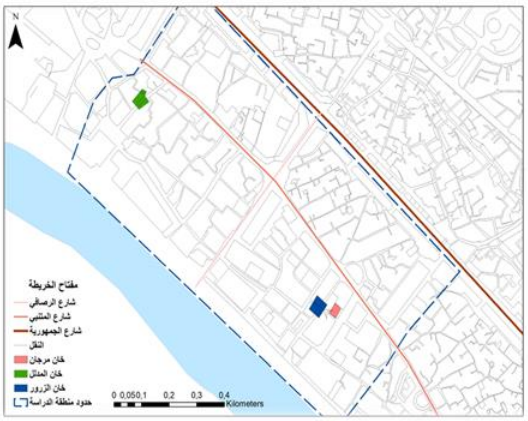

Figure 14: The most important vital streets and khans within the boundaries of the study area (Researcher, 2023)

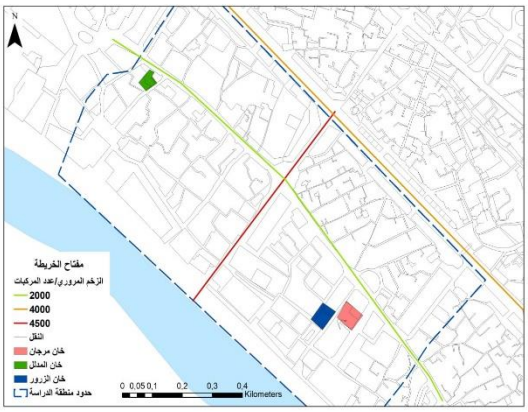

Figure 15: Traffic volume in the vital streets and khans within the boundaries of the study area (Researcher, 2023)

It is observed that there is a continuity of movement around Khan Al-Madlal, followed by a weaker movement in the vicinity of Khan Marjan and Khan Al-Zurur. Additionally, there is a spatial and movement gradient in the urban environment surrounding Khan Marjan and Al-Zurur, characterized by a flow that transitions from general to specific (more permeable to less permeable). This can be attributed to the shape of the streets

and the organic structure of the surrounding urban environment.

Measurement of Research Indicators (Through Site Observation):

1- Khan Al-Mudallal: The site was visited, and observations were gathered along with photographs of the khan and its surroundings as follows:

Figure 16: the urban scene of Khan Al-Mudallal (Researcher, 2024)

Indicators of presence or absence were identified in the urban environment surrounding Khan Al-Mudallal. It was found that the khan is located near a square or junction, and it is situated on a path characterized by continuity that visually directs movement. Additionally, there is a dynamic formation of this path (indicators of movement). In terms of the urban scene, the khan exhibits formal continuity (as an edge indicator) and continuity in building forms (as an indicator of sectors or neighborhoods). Meanwhile, other indicators of the urban scene were either absent or present only in very low percentages.

2- Khan Murjan: The site was visited, and observations were collected along with photographs of the khan and its surroundings as follows:

Figure 17: the urban scene of Khan Murjan (Researcher, 2024)

The presence or absence of certain indicators in the urban environment of Khan Murjan was assessed. It was found that the khan is situated along a dynamically formed pathway characterized by continuity that visually directs movement (indicators of movement paths). The khan stands out due to its unique shape, symbolic appeal, and the contrast between its facade and those of surrounding elements. It features a distinctive roof compared to the surrounding buildings, as well as an entrance that differs in scale from the nearby structures (these are indicators of Khan Murjan's status as a landmark situated along a movement route).

3- Khan Al-Zaroor: was visited, and observations were made along with photographs taken of the khan and its surroundings as follows:

Figure 18: the urban scene of Khan Al-Zaroar (Researcher, 2024)

The presence or absence of certain indicators in the urban surroundings of Khan Al-Zaroor was identified. It was found that the khan is situated in an area characterized by homogeneity and shared traits, where most buildings consist of residential units or storage for goods, especially fabrics. This creates a cohesive sector that performs similar or closely related functions. The urban landscape of this area is marked by simple formation and formal continuity, reflecting indicators of sectors or neighborhoods. Additionally, the khan is located on a dynamically formed path that is continuous; however, this path does not visually direct movement due to its lack of clarity in form and difficulty in accessibility, indicating characteristics of movement pathways.

*** Results and Discussion**:

The indicators measuring integration at the level of urban fabric and landscape revealed the following:

regarding Khan Al-Mudallal, the results indicated the following:

Table 2: Definition of Historically Integrated Buildings Spatially in Their Urban Context(Researcher, 2024)

Definition of Spatially Integrated Historical Buildings in Their Urban Context	Measurement Indicators	Level of Intervention	Measurement Method
Nodes	- Integration with the environment	Whole (Fabric)	(Diagrams)
	- Direction in decision-making for movement		
	- Continuity of movement		
	- Concentration of activities and movement		
	- Formation of squares / highways / intersections	All urban scenes	Checklist of indicators (direct observation)
Paths	- Continuity of movement along the axis	Whole (Fabric)	(Diagrams)
	- Direction of movement through it		
	- Spatial and movement gradient		
	- Visual continuity of the axis	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Visual direction of movement through it		
	- Existence of a dynamic formation of the path		
Edges (Boundaries)	- Existence of a separating line between two contrasting areas	Whole (Fabric)	(Diagrams)
	- Emphasis on access opportunities or enhancing its functional importance (specific use)		
	- Visual clarity	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Continuity of shape		
	- Difficulty of movement penetration		
	- Formation of natural / artificial boundaries / gradually fading into another area		
Landmarks	- Contrast between the element's facade and the surrounding elements' facades	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Variation in shape		
	- Variation in scale		
	- Color distinction		
	- Visual prominence		
	- Symbolic attraction		
Districts	- Area with homogeneous character (shared attributes)	Whole (Fabric)	(Diagrams)
	- Simplicity of formation		
	- Contrast with all parts of the city		
	- Continuity of building forms		
	- Visual direction		
	- Areas separated from others	Whole (Fabric)	(Diagrams)
	- Functional continuity of buildings		

From the above, we conclude that Khan Al-Mudallal is situated at a node and movement path, as the location of the khan meets all the indicators of a node. Taking the average of the node indicators results in a score of (1), representing the

strongest realization of a node condition. For the movement path, the average indicators around Khan Al-Mudallal yield approximately (0.9). In terms of the khan being a landmark, the score is (0), while the edge condition scores (0.16) and the sector condition scores (0.14).

Figure 19: The situation of the signature of Khan Al-Mudallal (located at a junction and pathway) (Researcher, 2024)

* Khan Murjan

Its results showed the following

Table 2: Definition of Historically Integrated Buildings Spatially in Their Urban Context (Researcher, 2024)

Definition of Spatially Integrated Historical Buildings in Their Urban Context	Measurement Indicators	Level of Intervention	Measurement Method
Nodes	- Integration with the environment	Whole (Fabric)	(Diagrams)
	- Direction in decision-making for movement		
	- Continuity of movement		
	- Concentration of activities and movement		
	- Formation of squares / highways / intersections	All urban scenes	Checklist of indicators (direct observation)
Paths	- Continuity of movement along the axis	Whole (Fabric)	(Diagrams)
	- Direction of movement through it		
	- Spatial and movement gradient		
	- Visual continuity of the axis	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Visual direction of movement through it		
	- Existence of a dynamic formation of the path		
Edges (Boundaries)	- Existence of a separating line between two contrasting areas	Whole (Fabric)	(Diagrams)
	- Emphasis on access opportunities or enhancing its functional importance (specific use)		
	- Visual clarity	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Continuity of shape		
	- Difficulty of movement penetration		
	- Formation of natural / artificial boundaries / gradually fading into another area		
Landmarks	- Contrast between the element's facade and the surrounding elements' facades	All urban scenes (building facades)	Checklist of indicators (direct observation)
	- Variation in shape		
	- Variation in scale		
	- Color distinction		
	- Visual prominence		
	- Symbolic attraction		
Districts	- Area with homogeneous character (shared attributes)	Whole (Fabric)	(Diagrams)
	- Simplicity of formation		
	- Contrast with all parts of the city		
	- Continuity of building forms		
	- Visual direction		
	- Areas separated from others	Whole (Fabric)	(Diagrams)
	- Functional continuity of buildings		

* Conclusion for Khan Marjan

From the above, we conclude that Khan Marjan is situated on a movement path and serves as a landmark, as its location meets most of the indicators for movement paths and landmarks. When calculating the average for the node indicators, the result is 000, indicating the weakest realization of a node condition. For the path indicators, the average in the vicinity of Khan Marjan is approximately 0.70.70.7. The status of Khan Marjan as a landmark is 0.50.50.5, while the status for edges and sectors is 000, representing the weakest realization for edges and sectors.

Figure 20: the status of Khan Murjan's signature (a landmark located on a movement path) (Researcher, 2024)

* Khan Al-Zaroor

Its results showed the following:

Table 3: Definition of Historically Integrated Buildings Spatially in Their Urban Context (Researcher, 2024)

Definition	Measurement Indicators	Intervention Level	Measurement Method	Evaluation Mechanism	Result
Nodes	- Integration with surroundings	Whole (Fabric)	(Plans)	High (1) / Low (0)	(0)
	- Guidance in movement decisions		Strong Option (1) / Weak Option (0)	(0)	
	- Movement continuity		Presence (1) / Absence (0)	(0)	
	- Activity and movement concentration		Strong Concentration (1) / Weak (0)	(0)	
	- Formation of squares / highways / plazas / intersections	Whole Urban Scene	Direct Observation Checklist	Presence of One Option (1) / Absence (0)	(0)
Paths	- Continuity of the axis in movement	Whole (Fabric)	(Plans)	Presence (1) / Absence (0)	(0)
	- Guidance of movement through it		Weak Option (1) / Strong Option (0)	(0)	
	- Spatial and movement gradation		Presence (1) / Absence (0)	(1)	
	- Visual continuity of the axis	Whole Urban Scene	Direct Observation Checklist	Continuous (1) / Non-continuous (0)	(1)
	- Visual guidance of movement through it		Presence of Guidance (1) / None (0)	(0)	
	- Presence of a dynamic formation of the path		Presence (1) / Absence (0)	(1)	
Edges (Boundaries)	- Presence of a clear boundary between two distinct areas	Whole (Fabric)	(Plans)	Presence (1) / Absence (0)	(0)
	- Confirmation of accessibility or enhancement of functional importance		Presence (1) / Absence (0)	(0)	
	- Visual clarity	Whole Urban Scene	Direct Observation Checklist	Presence (1) / Absence (0)	(0)
	- Shape continuity		Presence of Continuity (1) / None (0)	(1)	
	- Movement penetration difficulty		Difficulty (1) / Easy Penetration (0)	(1)	
	- Presence of natural / artificial / gradually fading boundaries		Presence of One Option (1) / Absence (0)	(0)	
Landmarks	- Contrast between the element's facade and surrounding facades	Whole Urban Scene	Direct Observation Checklist	Presence of Contrast (1) / None (0)	(0)
	- Difference in shape		Presence of Difference (1) / None (0)	(0)	
	- Difference in scale		Presence of Difference (1) / None (0)	(0)	
	- Color distinctiveness		Distinct (1) / Not Distinct (0)	(0)	
	- Visual presence		Presence (1) / None (0)	(0)	
	- Symbolic attractiveness		Presence of Symbolic Attractiveness (1) / None (0)	(0)	
Neighborhoods	- Area with homogeneous characteristics	Whole Urban Scene	Direct Observation Checklist	Presence (1) / Absence (0)	(1)
	- Simplicity of formation		Presence (1) / Absence (0)	(1)	
	- Contrast with all parts of the city		Presence (1) / Absence (0)	(0)	
	- Continuity of building forms		Presence (1) / Absence (0)	(1)	
	- Visual guidance		Presence (1) / Absence (0)	(0)	
	- Areas separate from others	Whole (Fabric)	(Plans)	Separate (1) / Connected (0)	(1)
	- Functional continuity of buildings		Functionally Continuous (1) / Functionally Diverse (0)	(1)	

From the above, we can conclude that Khan Al-Zarour is situated within sectors, as its location meets most of the indicators for sectors (neighborhoods) while being on a very weak movement path. The average for movement path indicators is approximately (0.42), while for sectors it is around (0.72). The edge indicators yield a result of approximately (0.33). Furthermore, the condition of Khan Al-Mudallal as a landmark or node is assessed at (0), which reflects the weakest realization of both node and landmark conditions.

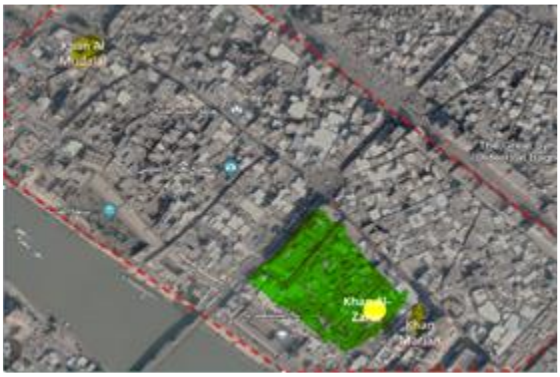

Figure 21: The status of Khan Al-Zaroor's signature (located within sectors) (Researcher, 2024)

* Conclusions and Recommendations

In historical centers, urban identity integrates physical and behavioral dimensions within an architectural framework rich in symbolic significance. The spatial integration model of the urban fabric emphasizes the characteristics of location, impacting the definition of a building within its urban context more significantly than its physical form.

Any slight alteration in the urban fabric and spatial network surrounding a historical building leads to notable changes in spatial

system characteristics. Moreover, the addition of new structures within an existing fabric has a clear impact on integration properties, thus altering the identity of the element, even if the building itself undergoes little to no change.

The definition of historical buildings is determined by indicators based on their relationship with the urban context. The conditions of placing historical buildings in their urban context manifest as: edge formation, placement along movement paths, formation of historical sectors, landmarks, and nodes.

The highest degrees of integration in spatial system characteristics occur within complete historical sectors, where minimal changes affect the spatial integration of the original historical building's location. Consequently, the location of physical elements is more important than their form, and additions or deletions within an existing fabric have a significant impact on integration, which in turn determines the degree of preservation of the existing historical building's identity.

Khan Al-Mudallal possesses multiple advantages that lead to high results according to spatial integration indicators at the urban fabric level, including its proximity to activities and its location in an area attractive to many historically-oriented activities, in addition to its closeness to Al-Mutanabbi Street. On a broader level, it is well integrated with its urban surroundings, classifying the khan as a node since it meets all node indicators.

Khan Marjan is an important landmark in the region; however, due to its weak visual clarity and accessibility issues, it requires the development of surrounding movement networks. This can be achieved through improved signage and redesigning paths to enhance visibility and attractiveness, thereby guiding visitors towards the khan. Activating the squares around the khan and transforming them into vibrant public spaces could improve spatial integration and strengthen communication between the khan and the urban environment, thus revitalizing its role as a significant landmark in the area.

Khan Al-Zarour, situated within sectors and on a very weak movement path, suffers from low visual clarity and accessibility challenges. To improve the khan's visual clarity, it is suggested to redesign the facades and entrances connected to it, including the removal or modification of visual obstructions

like deteriorating buildings of lesser historical importance or unsuitable barriers. Additionally, suitable lighting should be used to draw attention to and highlight its features. Improving access to Khan Al-Zarour can also be achieved by developing and rehabilitating pathways and streets leading to it, along with enhancing visual guidance through clear signage and directional aids to facilitate pedestrian movement towards the khan and increase its spatial integration with the urban environment.

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