



Accessibility and Connectivity for Enhancement the Integrative Conservation of the Historic Urban Fabric of Mosul Old City

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ABSTRACT

The historic city of Mosul, with its unique urban characteristics, is one of the few cities that is still inhabited, but the recent war has made it lose important and large parts of its traditional fabric, especially its distinctive riverfront. This research deals with the principle of Integrative Conservation as a conservation approach that is characterized by interest in both the urban and human dimensions, and it can provide adequate means to accomplish the process of preserving the historic urban fabric in a way that meets the contemporary requirements of life and preserves the historic value. The research aims to explore what are the criteria for Integrative Conservation most affecting the vitality of the historic urban fabric on the riverfront of Mosul old city. This is followed by the methodology of analysing previous studies to determine the most important Integrative Conservation criteria, and it is assumed that the accessibility and connectivity criteria are the most influential on the vitality of the city, using the Space Syntax to measure its indicators.

1. Introduction

The twentieth century and beyond witnessed a significant change in the use of the term "conservation" in its original sense of preservation, to be a more complex system that requires precise and clear definitions of its terms. There are many an attempt to organize the term "restauro" and identified several categories, namely, consolidation; Recomposition through anastylosis As for the concepts of modern preservation, they are more diverse and include several approaches that are classified according to the degree of intervention, and they range from the investigation, legal protection, and interpretation, which do not support physical intervention, Preservation, Restoration,

Reconstruction, Recreation or Replication, Alteration [1, P95]. Ruskin criticized the approach of restoration, which destroys the historical authenticity of buildings, and advocated "Protection, Conservation, and Maintenance." William Morris (1834-1896) introduced the concepts of "conservative repair" and "avoiding deterioration by daily care." Geddes (1854- 1932) an intermediate approach between Faithful Restoration and Preservation called the "Surgical approach" which is a selective urban renewal approach that calls for minimal intervention that does not depend on the addition of new elements and follows continuous maintenance to increase the life of the building [2, P346]. One of the challenges is the diversity of conservation methods and currents such as Restoration, Sustainable

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Conservation, Preventive Conservation, Planned Conservation, and Integrative Conservation, as well as the complex destruction caused by disasters, which increases pressure on experts to conduct focused analyzes of the reality of the situation compared to the available capabilities, whether economic, social, or other. Heritage is a qualitative shift from the stage of celebrating heritage for itself only - as in the Venice Charter of 1964 AD - to an expansion of the concept of an architectural monument to include the surrounding context [3] see Figure1. The 1975 Amsterdam Declaration also emphasized the importance of integrated preservation of architectural heritage

and should be “one of the main objectives of urban and regional planning” [4]. The research aims to find out the effect of changing the characteristics of accessibility and connectivity as integrative conservation criteria on the structural characteristics of the historic urban fabric. Methodology of the research was descriptive analysis for preservation and aspects of integrative conservation and analysis of previous studies, as well as the methodology of the case study represented by analyzing the historic urban fabric of the riverfront of the old city of Mosul applying the space syntax as a measurement method.

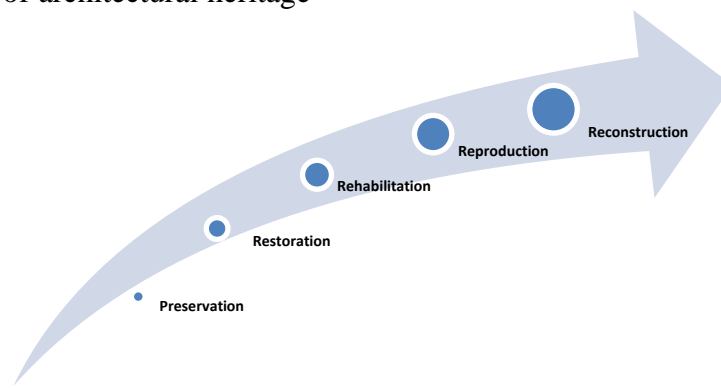


Figure 1. Intervention degrees from lowest to highest

2. Conservation of the historic urban fabric

The urban fabric is defined as a composition of a group of urban formations consisting of building blocks and urban spaces [5]. The pattern of the relationship between them indicates the pattern of the relationship between man and place, as the mass represents the material side and space represents the spiritual side. The urban fabric represents the interaction between several economic, social, and urban systems with each other with a distinct interconnected relationship that gives each fabric its unique characteristics [5]. The challenges in today's cities are not limited to the modern fabric, but their effects extend to be more influential on the traditional fabric, which is already suffering from a decline and low level of services. Rapid urbanization and high levels of pollution in the air, and the severity of climate changes cast a shadow over historical cities and the mechanisms for dealing with them and

preserving the urban landscape in them was one of the most important axes of the recommendations made by UNESCO in 2011. The recommendations reflected the need to increase attention to develop an integrated strategy that integrates urban conservation and development in parallel with considerations of society, environment, economy, and culture [6, P1]. The diversity that exists in the methods of preservation as well as in the different urban fabric patterns requires an accurate and clear understanding of choosing the appropriate conservation method for the characteristics of each urban area subject to deterioration. It goes beyond it to comprehensive planning, developing worn-out areas, and preserving historical areas by following comprehensive plans that are sensitive to the social, economic, and urban characteristics of the local urban environment and integrate with its positive outcomes [7].

3. Integrative conservation

According to Ellin (2009), the concept of Integral is identified as: essential to perfection, not lacking in anything essential, formed as a unit with another part. while Integration is defined as forming, coordinating, or integrating into a unified whole; combining with something else; To put an end to segregation and achieving equal membership in the society or organization; Class cancellation. while perfection is defined as adherence to artistic or moral values; non-corruption; safety; complete and unfragmented quality or condition; completed [8, P1].

The phrase "Integrated Conservation" was first coined in the Amsterdam Declaration in 1975 AD, and represented a real turning point in the field of preservation, management, and promotion of urban heritage and cities. The definition of integrated conservation refers to the processes of economic, social, and environmental development in historical sites that integrate conservation and planning, and management tools [9, P1]. The concept of integration represents an intellectual shift from the opposing dualities in Western thought, such as "soul/body, mind/emotion," and from the competition model based on the principle of "win/loss" to a model of integrating them through interdependence, which does not mean removing the boundaries as much as They are permeable and permeable, and the continued interest in diversity and interdependence may provide a different clarity of vision, and a sensitive clarity of ecological complexity, providing a new and pluralistic vision for it [8]. Integrative conservation deals with a set of interrelated and interacting features such as the features of the environment, the local economy, institutional networks, and cooperation with experts, stakeholders, and the local community [10]. There are many international charters and agreements that were adopted in the last century, as these charters led to the consolidation and development of conservation principles and methods. During that period, the idea of protection changed from artistic heritage and antiquities to ancient historical cities that require an integrative preservation that takes into

account the role of the community to harmonize the urban renewal process with the protection of the architectural, cultural and historical values of the site [11].

It can be said that integrative conservation is the preservation of the tangible and intangible heritage aspects in a way that enhances the social and economic aspects within administrative frameworks aimed at enabling local communities to actively participate in the preservation process from the early stages of planning to the stage of occupancy, monitoring, and evaluation.

4. Previous studies

Several previous studies that dealt with the concept of integration in the urban fabric or integrative conservation were analyzed to reach the detailed criteria and indicators required to achieve aspects of this approach. such as John Mullen's 2000 study of port development in both Portugal and the United States by adopting a proactive integrative conservation approach whose values are manifested in concentrated physical development, mixed-use, diverse housing, preservation of historic architectural value, preference for walking and mass transportation, and the promotion of public-private partnership. However, it did not specify the characteristics and criteria for integrated conservation and the style of achieving partnership between the public and private sectors [12]. Costa's 2002 study, classified integration into two types: integration at the city level and its factors which are Compatibility, investment regulation, management model, Ambient context, public-private relationship, and integration at the site level and its factors which are accessibility, connectivity, permeability, social quality, Continuation. However, the classification of accessibility as integration at the site level requires reconsideration, as it affects the city level, and the connectivity criterion, which is an alternative to the kinetic and visual continuity criterion [13]. Nan Allen's 2006 study proposed several characteristics of urban integration, namely Hybridity, Connectivity, Porosity, Authenticity, and Vulnerability. Some

characteristics require re-definition and renaming, such as Hybridity, which refers to the merging of contradictions, while the word Diversity is preferred as it represents the integration of different activities [8]. Bige Study 2014 proposed Quality criteria for the production of contemporary public space are Publicity, Accessibility, Continuity, legibility, Permeability, Vitality, Authenticity, Attraction, Satisfying Belonging, and Enduring, comfortableness and security, locality, sustainability, environmental education, exploration and experience, safety and health, quality of materials, and to contribute to the development of the local economy through the development of the city center as a point A pivotal attraction driven by a design process involving the local community [14], Despite presenting quality standards for the production of contemporary public space, it needs to be reclassified and organized due to the overlapping of some concepts. He also mentioned concepts that represent a challenge in itself, such as originality and its indicators, and the failure to clarify the mechanisms of a partnership between the public and private sectors. Bahraldin Study 2020 The vision presented functional features, from affordable housing, mixed-use, facilitating accessibility, adopting the river transport system, enhancing pedestrian and bicycle paths, and included

suggestions about cultural heritage, but it did not provide a clear strategy for preserving it, while providing viable environmental solutions [15].

3. Criteria for integrative conservation

According to the analysis process that was carried out on previous studies, and the recommendations of international conventions related to urban conservation, especially the strategy of Integrated Conservation, a number of criteria and indicators have been identified as criteria and indicators for integrated conservation, and as shown in the table.1, since Authenticity represents the first incentive for the conservation process, and the Social Quality is It is concerned with the requirements of the occupants of the urban agglomeration, and Resilience is necessary to ensure the continuity of city life through successive and changing periods of time in line with the diversity accompanying this change, and the criteria of Affordable Housing to enable the weaker groups of society to remain in their original environment, while the criteria of Accessibility, Connectivity and Permeability are practical and applied criteria that are directly related The process of urban planning and design of urban agglomerations. Thus, this research focuses on the criteria of Accessibility and Connectivity, As shown in Table 1.

Table 1: Criteria and indicators of integrative conservation

Criteria code	Criteria	Indicators
A	Authenticity	Keep on the original design
		Integration with the setting
		Using local materials
		Quality of work and using local workmanship
		Preserving relations with the place/sense of belonging
S	Social quality	participation in the decision-making
		The connection between population and place
		Promote volunteer work
		Strengthening local identity
R	Resilience	Resilience of transportation
		Resilience of using the existing structures
		Resilience of investment opportunities
		The ability to restore collective memory
C	Accessibility	Safe access to events
		Respect privacy
		Relatively short arrival time
		Low cost of access

		Correlation between sectors
		Continuity of motion axes
		Continuity of visual axes
O	Connectivity	Possibility of participatory activities
		Preserving the human scale
		Attention to associated places that affect the identity of the original place
		Attention to associated elements found elsewhere but affecting the identity of the original place
F	Affordable housing	Housing ownership (owned/rented)
		Public-private partnership
		Opportunities for jobs and employment
		Access to public services (schools, hospitals, public parks, quality of transportation systems)
		Livelihood for vulnerable groups in society
		Stimulating local crafts and industries
		Quality of municipal services
		The Efficiency of saving energy in houses
D	Diversity	Safety (low crime rate)
		Diversity of use
		Environmental diversity
		Social diversity
P	Permeability	holistic integration
		positional integration

Accessibility: It is the opportunities available for safe and easy access to housing and public services and for all individuals and communities covered by development programs. It is important that the streets plan for adults and children, elders and youth, and the place must be designed to find a relationship between functions and places by achieving smooth movement, functional through the ease of attracting people to practice healthy exercises by walking and cycling, safety, and vitality by promoting a pattern of movement that improves Enhancing opportunities for economic continuity of local commercial and social enterprises, protecting the environment [16, p107-117].

Connectivity: There is a positive correlation between the degree of street integration and the size of pedestrian traffic in it. Streets that can be easily accessed from different lanes mean that they are more integrated, which will attract more pedestrians. Better connectivity leads to shorter paths to the destination, reduced transportation and movement distances, and achieves efficiency and timeliness. And the

communication is kinesthetic or visual, or both together, and it may be functional [17, p2].

The research aims to find out the effect of changing the characteristics of accessibility and connectivity criteria on the structural characteristics of the historical urban fabric.

The research assumes that accessibility and connectivity criteria are the most important among the criteria of integrative conservation, being the most influential on the historic urban fabric because of their direct association with the physical form.

4. Research methodology

The research followed the method of descriptive analysis of preservation and aspects of integrative conservation and analysis of previous studies, as well as the methodology of the case study represented by analyzing the historical urban fabric of the riverfront of the old city of Mosul applying the space syntax as a measurement method. The rest of the criterion of integrative conservation were neutralized, and the criterion of accessibility and connectivity were adopted.

5. Case study

Applying the space syntax analysis to the urban fabric of the riverfront, including the most important areas, as well as analyzing the scenarios for establishing a cornice in the Kleiaat area on the riverfront in Mosul old city to show the extent to which the potential proposals comply with the criteria of integrative conservation of accessibility and connectivity to provide alternatives compatible with the particularity of the area. Two proposals were presented, one based on the construction of a continuous cornice along the riverfront, and the other assuming the construction of a discontinuous cornice, in addition to defining the locations of the main movement nodes on the riverfront.

6. The riverfront of the old city of Mosul

The Tigris River used to run alongside the ancient city of Nineveh, and during the Umayyad era, the course of the river was diverted along the city of Mosul (the western fortress) to facilitate the supply of water to the city [19]. The river front was the main commercial outlet for Mosul, as goods were transported from Diyarbakir, Mosul, and Baghdad by Aklak [20]. Today, it is represented by the area that extends between Nineveh Bridge and the Fifth Bridge, and its length is approximately 1.22 km. It represents the heritage area of the Tigris River, which is an integral part of old Mosul, with its traditional houses adjacent to the river, with a unique local style and various uses, as in Figure 2. The city was subjected to great destruction after the last war 2014, as shown in Figure 2, which shows the destroyed buildings, those with severe damage, and those with moderate damage.

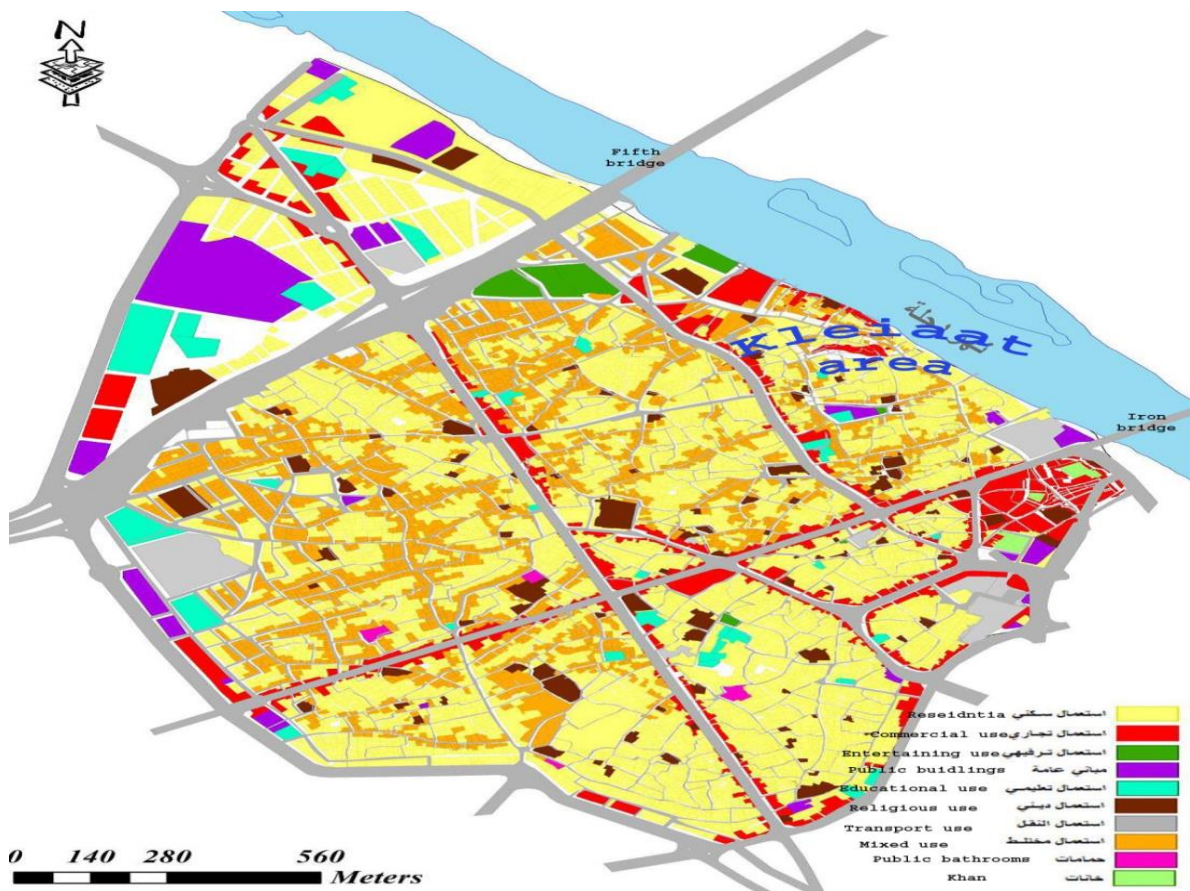


Figure 2. Land uses in old Mosul [18]

7. Results and discussion

An analysis of (Space Syntax) was carried out using (Depth Map) program. The rules of space synthesis represent a theory and a mathematical method for analyzing spatial relationships by transforming quantitative measures into graphic representations that provide a clear spatial understanding of the social organization in population settlements by showing the effect of the urban fabric pattern on the social relations between the settlement members:

Connectivity: It is a fixed positional measurement, and it represents all direct connections that connect each street to its immediate neighborhood. A street with many side streets has a high connection value, but a street with few connections has a low connection value [21].

Global integration: represents the degree of accessibility of all other streets in the urban fabric, taking into account the total number of directional changes in movement. Holistic integration analysis calculates the extent to which the axial line of a street is spatially integrated with respect to all other streets in the system. The fewer direction changes, i.e. visual steps, from the street to reach all locations in the system, the higher the value of the holistic integration of the street, and vice versa. The greater the length of the axial line and the greater

its connection with other axial lines, the greater the value of its integration and vice versa. The more integrated the street, the shorter the topological distance to all other streets in the urban system[21].

Local Integration: The evaluation of local integration consists in calculating the average value of the depth for all streets within a given compositional radius. For the topological radius, the integral numbers must be chosen because the radius number represents the number of synthetic steps as no topological or synthetic fractions can be taken[21].

Legibility: It is a measure between integration at the city level and the values of connectivity, that is, the relationship between holistic and local integration, the closer the correlation coefficient (R2) to 1, the higher the level of clarity of the system [21].

7.1 Space syntax results

The analysis of the historical urban fabric of the riverfront of the old city of Mosul using the program (UCL Depthmap 10) resulted in several values of Global and local integration, as these values were measured as well as the connectivity values of major areas on the river front that represent gates to enter the river frontage, As shown in Figure3, in addition to the heartland of the urban fabric there, Table 2. shows the values that have been reached.

Table 3: Results of the Global and local integration analysis of the riverfront (author's)

Local integration		Global integration		Location	
Connectivity	Degree of Integration	Connectivity	Degree of Integration		
143	5.71	129	2.72	Nabi Gerges Street	1
220	6.23	29	2.46	Al-Maydan Fish market	2
53	4.6	64	1.89	The connection of the river's edge with the houses	3
96	5.27	237	2.31	Bab Al Shat Street	4
49	5.07	67	2.51	Al-Qalaa Bath Street	5
50	4.7	65	1.27	center of urban fabric of the riverfront	6
0.594656		0.473807		Legibility (R2) of 1	



Figure 3. Global Integration Analysis Scheme

Through the values in Table 3, we note that the area of Nabi Gerges Street, Al-Maydan Fish market, the connection of the river's edge with the houses, Bab Al Shat Street and Al-Qalaa Bath Street have high integration values at the global and local levels, this means that it has a high accessibility that makes the area not need improvements and additions to the urban fabric for the purpose of increasing accessibility.

As for the area of contact between the river's edge and the residential buildings, it has medium integration values at the global level, and lower integration values at the local level, which means that the inclusive side enhances accessibility to a medium degree, see Table 3. And that the intervention in it is very limited to improve the accessibility aspect, and it may be by activating the river transport without modification at the level of the urban fabric.

As for the area of the central urban fabric of the riverfront, it is of low integration at the global level, but with high integration at the local level, see Table 3. This reinforces the proposal that there is no need for improvements at the level of the urban fabric.

We note that the connectivity at the edge of the river and the center of the urban fabric is medium or within the lower half, which confirms the Authenticity of the establishment of the city according to a conservative social logic that enhances the privacy of the housing units at the level of the urban fabric.

With regard to the legibility of the system, at the global level, it is a little less than half. At the local level, it is more than half. See Table 3, which indicates a state of balance in the issue of legibility that dispenses with major interventions and planning additions that change the essence of the urban fabric, but requires simple measures such as Organizing sign boards and maps (Where am I) as well as restoring distinctive landmarks in the city that serve as important orientation points within the traditional urban fabric.

By analyzing the space syntax of the Kleiat area, it was found that the spaces with high integration (the nucleus of integration) were represented by the axes of connection with the historical centre in addition to the main penetrating axes in addition to the system of the surrounding streets created, while the isolation nucleus appears in the deep internal spaces, especially the axes leading to the river [22]. On this basis, the node sites were selected along the axes of high integration and linked to the new walkway along the river as shown in Figure 4. Two alternatives to this proposal can be proposed based on the establishment of a cornice that allows the access of cars and pedestrians to the riverfront, where the best between them is evaluated based on knowing the effect of each on the structural characteristics of the area by conducting an analysis of the rules of space syntax at the level of the main traffic arteries on both sides of the city of Mosul, and the focus is On the characteristic of the degree of integration, which represents a measure of the extent of relative asymmetry within the space system (the most integrated spaces are the most penetrating and moving and therefore can be called (more noisy spaces) as they approach the main open axes to public activities (mostly commercial) and isolated spaces are (mostly commercial spaces). Quieter) tends to be quiet and stable and located within quiet residential areas. The other characteristic is positional control which represents the degree of choice that the space provides for movement to it from the spaces directly adjacent to it [23].

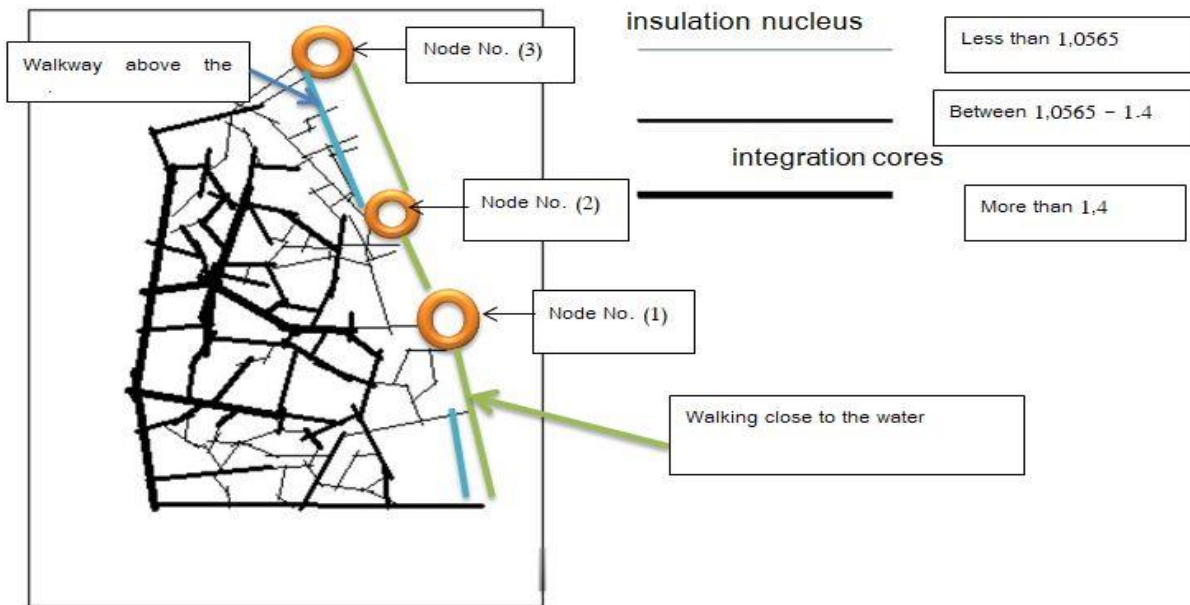


Figure 4. Determining the locations of the nodes on the riverfront

Table 3: Discussion of the results of the analysis of the holistic and positional integration of the river interface

Local integration				Global integration				Location	
Description	Connectivity	Description	Degree of Integration	Description	Connectivity	Description	Degree of Integration		
within the top quadrant	143	within the top quadrant	5.71	within the top quadrant	129	within the top quadrant	2.72	Nabi Gerges Street	1
within the top quadrant	220	within the top quadrant	6.23	within the lower quarter	29	within the top quadrant	2.46	Al-Maydan Fish market	2
within the lower half	53	within the lower half	4.6	within intermediate values	64	within intermediate values	1.89	The connection of the river's edge with the houses	3
within the upper half	96	within the top quadrant	5.27	within the top quadrant	238	within the top quadrant	2.31	Bab Al Shat Street	4
within the lower half	49	within the top quadrant	5.07	within intermediate values	67	within the top quadrant	2.51	Al-Qalaa Bath Street	5
within the lower half	50	within the upper half	4.7	within intermediate values	65	within the lower quarter	1.27	center of urban fabric of the riverfront	6
0.594656				0.473807				Legibility (R2) of 1	

The first alternative: Is represented in the establishment of a continuous cornice extending from the Nineveh Bridge in the south towards the Fifth Bridge in the north, as shown in the spatial analysis, Figure 5. Where the results of the analysis showed that the continuous

corniche and in the case of its establishment, is property of integral= within the highest (50) values out of a total of (237) readings, As for the positional property of control = within the lowest (50) value.

Therefore, it will be one of the most integrated spaces, that is, the most penetrating and moving, which will negatively affect the factor of privacy and tranquillity that characterizes the area. The second alternative: It is represented by the establishment of a cornice on a limited scale that extends from the side of the Nineveh Bridge along with the length of the municipality garage (near Al-Maydan Fish market). After it, it stops at a certain distance and ends with an anchorage for boats (A), while on the side of the fifth bridge it extends near the Sheikh Al-Shatt Mosque and ends there with an anchorage for boats (B), Figure 6.

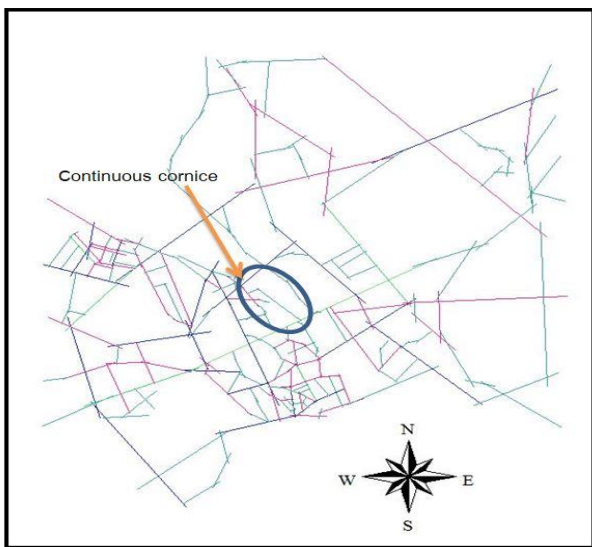


Figure 5. Analysis of space syntax rules for a continuous cornice

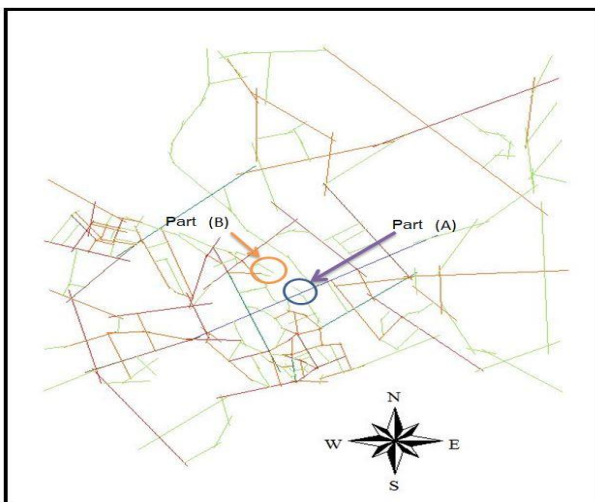


Figure 6. Analysis of space syntax rules for discontinuous cornice

8. Conclusions

The criteria of accessibility and connectivity are among the criteria whose effects appear most clearly on the structure of the urban fabric, which works to change structural characteristics of the urban fabric. Access to the riverfront area does not need planning or design additions if it is re-planned with the same layout of its old alleys, and this is confirmed by the rules of space analysis. It needs simple procedures such as organizing sign boards and maps (Where am I), as well as restoring the distinctive landmarks in the city, which act as directive points within the traditional urban fabric. The Authenticity of establishing the city according to a conservative social logic that enhances the privacy of housing units at the level of the urban fabric. The intervention is very limited to improve the accessibility aspect, and it may be by activating river transport without modification at the level of the urban fabric. Organizing the relationship between the historical fabric and the river is an essential part of the reconstruction of the riverfront, through the exploitation of river transport and the establishment of a movement contract on the riverfront along the axes of high integration. In addition, the establishment of a continuous cornice will negatively affect the structural and social characteristics of the area, while the establishment of a non-continuous Corniche will create opportunities for diversity in use without affecting the accessibility, connectivity and permeability criteria of the region.

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