



The Concept of Urban Capacity and Removal Processes-City Center Al-Najaf Al-Ashraf a Model

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Abstract

This study focused on the urban transformations resulting from the removal processes taking place in the urban fabric of sacred city centers, under the pretext of increasing urban capacity due to the density of use, which leads to the removal of important parts of the traditional urban fabric and adding them to the public urban space.

To determine the amount of usage densities that the area can accommodate represented by the case study, which is the center of the holy city of Najaf: the study was based on using a quantitative measurement approach to test the hypothesis using a multivariable density measurement tool. A space matrix capable of measuring densities, accessibility, and diversity in the fabric during three time periods, a historical period 1900, 1990, and the current time 2024, to know the amount of changes that have occurred in the fabric. A qualitative measurement tool, which is a random sample questionnaire, was used to measure perceived density to find out which fabrics within the city center are more accommodating of congestion. The research has found that high and advanced accessibility through an integrated fabric with high connectivity that makes the city spaces work as one space leads to an increase in flows. It works to reduce the momentum in the city center and thus preserve the traditional urban fabric that must be emptied for pedestrians, as it represents the only fabric with The human scale at the level of the city as a whole (i.e. a fabric that is comfortable for pedestrians) also represents the identity of the area, and to accommodate the densities, the percentage of building density must be increased outside the traditional fabric.

Keywords: Capacity, Density, Urban Space, Space Matrix

1. Introduction

Traditional and Islamic cities suffered in particular, as they witnessed a high density of visitors throughout the year, especially during the days of millions of visitors, including the holy city of Najaf. Many urban transformations led to changing the nature of the fabric, and the pretext for development projects was to increase the capacity of public urban space. Taking the removal of the traditional urban fabric as its approach. Which led to the disappearance of important parts of the fabric, affecting its integrity and accessibility. Therefore, the question was: "Why do developers take the removal of traditional fabric as their approach? "Absorptive capacity was the main hidden factor behind the removal process and development projects, so the hypothesis was: "The decision to remove or dictate that occurs within the public urban space of the holy city centers depends on the carrying capacity compared to the density of that space." These transformations negatively affect the performance and identity of the place, and therefore the performance was in exchange for the identity. The goal of the research was "to evaluate the carrying

capacity of the intensity of use of the public urban space of the Najaf city center."

2. Literature review

Soltani and others. 2020 [1] study the stressed necessity of finding solutions to the problem of absorbing and managing population densities. By transforming them into sustainable cities with high densities, the density of use was studied in terms of two main indicators. The first is the constant physical density, which was studied through the multivariate scale. Space-mate. The other indicator is accessibility, as the spatial structure of the street network was analyzed using Space syntax to study the morphological characteristics of street layout and built form.

Study (Boblcova and others (2017) [2] The study shows an increase Absorption of Moving densities of place and generating vitality. The aim of this paper is to identify the basic variables of spatial form that increase the carrying capacity of moving densities. is used space syntax to measure the size of openness or accessibility, either to measure Density and Diversity



between lands is measured using some variables related to density space-mate. These two methods were applied as a measure based on the region (i.e., the fabric as a whole) and the other based on location (plots of land). Specifications of plots of land that tolerate diversity and change over time were reached. Among them are plots of land.

Study (Mashhoodi and Pont (2011) [3] this study is about increasing urban capacity intensity of use. There are three relevant indicators of urban form are selected: density, accessibility and diversity. The selected indicators are measured through methods space matrix and space syntax. In this study, a comparison made between mixed-use and single-function blocks. The residential density in a cycling neighborhood (radius 1,000) is related to the density of commercial services in the same radius or less, but to the density of cultural and recreational services in a higher radius. It has been proven that multi-use blocks have a higher accessible density and thus the three indicators influence each other.

(Berghauser Pont and Haupt, 2010) [4] this reference has been updated True to measure Actual density of the urban area whether it is building density or usage density. He confirmed that the last one depends on the density constructivism for the area and accessibility, it is represented on a two-dimensional diagram representing the DNA of the urban area, it is capable of measuring: coverage ratio, building area ratio, open space ratio, heights, and network density as able to measure diversity, uniformity and daylight. Bonta classified the methods of measuring density into physical density based on standards and performance and perceived density linked to the individual's feelings and expectations. The study confirmed that the coverage ratio has a higher impact on creating vitality and transforming the area into urban fabric than the built-up area ratio.

Book (Kim, Dovey, 2016) [5] focuses on three main indicators of quality: density, diversity, mix, and accessibility Which increases space capacity for users. It was called DMA urban areas. Density was known as one of the main elements to Urban quality is the amount of concentration of activity, population, and buildings in an area, which shortens distances and facilitates reaching the desired goal. He divided it into three categories: building density, population density, and public places. He sees that the building area ratio is one of the most important elements controlling density.

3. The capacity, urban density and good performance of urban space:

The goal of urban design and planning is to focus on accommodating the increase in density and creating dense green cities, it has good performance [6]. Carrying capacity is defined as "the maximum number of people who may use urban space at the same time, without causing destruction of the physical, economic, social and cultural environment. The capacity effected on the quality of life, there are a relationship between capacity, crowding and good performance. Urban capacity is a threshold or standard good performance

of public urban space. Thus, the capacity represents the container of density, and it is its reflective mirror.

We conclude, according to what was presented in the definition, that there is a material aspect (physical density) related to tangible physical entities such as the environment and people, any fixed densities (structural density) and moving densities (use density) it is measured according to certain standards Quantitative measurement methods. There is a psychological aspect related to people's perception and the extent of their psychological understanding of density (perceived density), and it is measured by the community questionnaire. There are three types of density: physical density, perceived density, and crowding. Some of them see crowding as part of perceived density, while others see it as a type of density. After crossing the threshold of density, crowding is generated (Churchman, 1999, p390) [7].

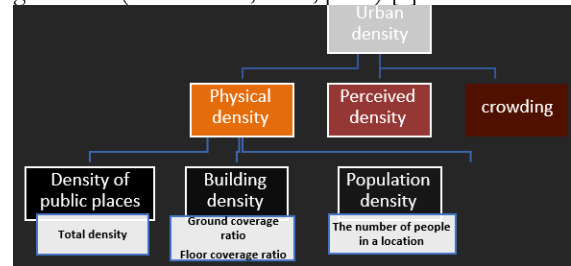


Figure (1): Explains the types of density:
(Source: researcher)

A-Perceived density: The subjective experience of feeling crowded is based on their interaction with the environment, and is influenced by environmental, cultural, and social factors. "It is a complex concept that involves the interaction of perception with tangible elements" [8], [9]

B-Actual (physical) density: It means the relationship between a specific area and the number of people or entities in that area, whether buildings, green areas, or other things. It affects the productivity and performance of the urban environment [10]. divided it into three types: Structural density (related to fixed physical elements) and population density intensity of use (related to moving physical elements, people or cars) and public places. He sees that the building area ratio is one of the most important elements controlling density [11].

C- Crowd concept: It is a real use case determined by the number of people and the surface that accommodates these people if we compare it with the perceived crowding that is shaped by psychological constructs [12]. we find that there are several variables affect absorption density leads to a feeling of crowding. They are characteristics of the physical environment (structural density) and situational characteristics (intensity of use) and the social environment (perceived density) associated with characteristics of the participating individuals (their culture, race, affiliation) [13],[14].

• Measuring capacity as a function of density and influencing factors:

1- Measuring capacity as a function of intensity of use:

It is associated with situational environmental characteristics) [15]. It combines physical features and variables that affect accessibility. The first

environmental features that affect accessibility is urban capacity. It is a number users and location[16]. Personal space of the individual is 1.2, it is considered a good standard with excellent flow on occasions (such as the Olympic Games or Hajj) [17]. Bonta showed that user density is related to building density and accessibility by knowing the area of open space (using a multivariable building density measurement tool (space mate by dividing it by the number of moving densities (people or cars) and knowing the standard or space that must be provided for each of them, we will be able to determine the presence of crowding or not, meaning whether the number of users is within the capacity or not. [18].

To measure connectivity, it is done by: the number of intersections divided by the area Open OSR per hectare The minimum network connectivity is 1.2 intersections per hectare, while a good amount that achieves greater effectiveness is 2.5 intersections per hectare [19].

2- Measuring capacity in terms of structural density:

It is associated with characteristics of the physical environment ground coverage ratio GSI and the percentage of built-up area FSI and open space OSR and network density N, it is measured with a density quantification tool Space matrix. The balance between built and open spaces (H/W) It is the percentage responsible for the feeling of tightness, containment, or loss (physical density). Bonta also showed the effect of the relationship between built and open spaces affecting the angle of incidence of daylight and thus the thermal stress of the area, so he developed a law to measure the intensity of daylight [20].

$$DF_i = 50^\circ \cos \alpha_i$$

DF_i = Daylight factor at the facade DF_i ≠ 0
α_i = the angle of obstruction at the facade.

Figure (2): shows the equation for measuring daylight intensity (Source:(Berghauser Pontand Haupt, 2010)

Also, the ratio(H/W) it affects the recipient's feeling in relation to the height of the building and the width of the street. A ratio of 1:1 at an angle of 45 represents complete enclosure, a ratio of 1:2 at an angle of 30 is the minimum sense of enclosure, and a ratio of 1:3 at an angle of 18 represents the least amount of enclosure. Source[21]:

3- Measuring capacity in terms of perceived density:

It is related to characteristics of the social and cultural environment [22],[23]. and is linked to the interaction of the characteristics of attendees with the social status of the destination. As the organization of interactions socializing and choosing the frequency and duration of personal contact reduces the feeling of crowding. It is measured by a random sample population questionnaire.

The Case Study :(The old city of Najaf)

Was selected as a case study with an area of 60 hectares that is 600,000 square meters this is because it is one of the traditional Arab Islamic cities [24]. That to attest Many expansions result to Increased visitor density and crowding. During different historical eras. It is in order to modernize the transportation network to Car accommodation and the sixth wall that

surrounded the city was demolished and replaced with the first street, Al-Soor Street. Modern geometric streets were also opened and imposed on the fabric after the removal of traditional buildings and historical monuments. Then A ring road was built surrounding the shrine and the process of adding more straight geometric roads within the fabric continued until a tragic urban demolition operation took place in 1990 by removing an entire urban section, including all historical buildings. From Al-Amara neighborhood, for what is now known as the city of visitors [25].

Latest expansion she (Fatima Al-Zahra courtyard where it will be the main entrance to the shrine is on the eastern side only, while the exit gate is located on the western side. This new division will support the longitudinal structure more than supporting the center as the main concept, there will be Service, administrative and cultural buildings, the maximum height of which is the administrative building is 5 floors, while the rest are at an average height of 3 floors. Private parking, as it will be there A tunnel designated for the entry and exit of private cars into the Holy Shrine [26].

The project established a general framework for the historical part. They are as follows: The shrine must remain a visual focus in the city, and the height of the buildings in the historic center must not exceed three floors. The buildings must take into account the historical architectural style and heritage values of the city. Service systems must be strengthened, and sources of visual pollution that affect the city must be removed. Urban city scene, but lack of strict policies Led to violations occurs and these points are not observed, causing further distortion) [27]

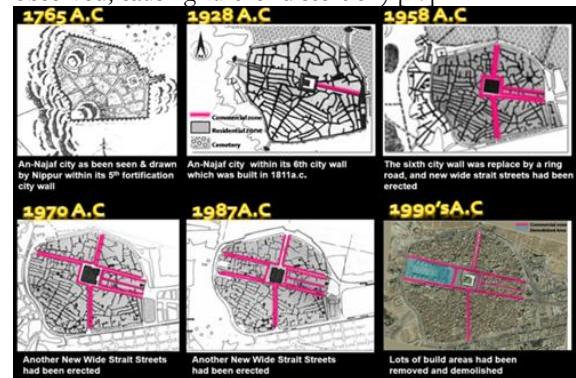


Figure (4): Urban transformations that took place in the region (Farhan, S., Akef, V. and Nasar, Z., 2020, p827)

4. Methodology:

The research adopted the analysis and quantitative measurement approach using measurement tools (spacemate) to measure the carrying capacity of usage intensity. The qualitative measurement tool, which is the random sample (community) questionnaire, was also adopted.

Spacemate & spacematrix: spacematrix A 3D chart representing three different scales (FSI (also referred to as Land Area Index) and GSI (Ground Coverage). (Network density N) as key indicators and (OSR Open space ratio) and the (L building height) as secondary indicators, these metrics work together to classify the urban environment. Since three-dimensional

representation is difficult to implement, the authors decided to return to a two-dimensional classification of this model called BS pacemate combines GSI & FSI as well as OSR & L. It links the practical need to capture the full complexity of phenomena with simplicity of representation [28].

Table (1): shows the main variables of the measurement tool Spacematrix Researcher based on [29].

Built-up area ratio (FSI)	Coverage ratio (GSI)	Network density (N)
$FSI_x = F_x / A_x$ $F = \text{gross floor area}$ $A = \text{area of aggregation}$ $x = \text{aggregation (lot, island, fabric of)}$	$GSI_x = B_x / A_x$ $B = \text{footprint}$	$N_x = (L_i + (L_e / 2)) / A_x$ $L_i = \text{length of interior network (m)}$ $L_e = \text{length of edge network (m)}$ $A_x = \text{area of fabric (m}^2\text{)}$

5. Results of the practical study:

The center of Najaf city was studied for the years 1900, 1990, and 2024, as shown in Figure (5). The measurement tool works with averages. Each grouping is the average value of its components, and it is a measure to measure the homogeneity of the fabric or not. If the repetition is absolute for all its components, the homogeneity is pure. For the traditional fabric that has not been manipulated, there is a kind of relative homogeneity, as we notice the percentage of coverage and the heights of the buildings being equal. Whether at the level of the building, the island, or the fabric as a whole. But as a result of the development processes that took place and as a result of many interventions in this fabric, it turned into a less homogeneous fabric.

6. Measuring network density (N):

By measuring the network density to determine the robustness of city planning, it was found that the traditional fabric consists of small blocks with a size of less than 50 m and an alley width of 2-3 m. Network density $N=0.04$. The fabric has witnessed interventions that led to its distortion, namely the construction and widening of streets, so we notice that there are wide streets that are foreign to the system. As for the year 2024, the Haram area became considered a large-scale network with a grain width of 200 meters and a street width of 16-20, with a grid density. $N=0.01$.

7.Measuring connectivity:

We mentioned that it is measured by dividing the number of intersections by the area in hectares, and we have concluded that the connectivity in 1900 is 2.9, as the number of intersections was 174. However, in 1990, the number of intersections became 151, and dividing it by the area of the city center in hectares is 60, it becomes 2.5, which is the same connectivity in reality. Zone 2024

Daylight measurement: By measuring the network density, daylight performance can be measured based on the equations previously mentioned. It has been shown that the intensity of

daylight in the area the upper sanctuary and at the outer wall $50=DF$ in 1990, it is similar to daylight in an open field. However, in narrow alleys with a height of 2 floors and a street width of 2 meters, daylight is 30% as intense as it was in the Holy Mosque area.

Measuring coverage ratio (GSI):

From measuring the coverage percentage, it became clear that the best fabric is the traditional fabric, where the coverage percentage is between 60-80%, which is what Bonta specified. In the lower right part of the area is designated as very urban on the plan, as shown in Figure (5). As an environment that encourages walking and its spaces are characterized by vitality, it reduces heat stress. The area that was developed has a coverage rate of approximately 54%In 2024.

Study of the historical development of textile: We notice In Figure (5) The historical development of the year 2024 that took place in the fabric, which is shown by the arrow, is the opposite of density. We notice that the compact or combined fabric dates back to 1765, with a high coverage rate, narrow alleys, and low heights representing the human scale, and it is the best type of fabric according to Jacobs and Bonta. Then we reach the Al-Haram area, which represents the current development of the area. We notice a diversity in densities and coverage rates over different time periods.

Types of buildings: we note in Figure (5) traditional weaving represents a type Compact type. As for the Holy Mosque area in 1990, it represents the point type. All buildings are still of the type, Low-rise type. All the criteria mentioned were adopted from Bonta's book [30].

Measuring the capacity of urban spaces for users: From the measuring tool space mate it is possible to extract the percentage of open space according to the reality of the state of the region in 2024, which is equal to 0.327, and by multiplying it by the area of the specified city center, 600,000 m², we extract the area of open space as 196,200 m². The number of visitors on normal days reaches more than 1.2 square meters per person, which is considered an excellent standard for flow in crowds. As for Arbaceen (visits, it reached more than 12 million <https://shiawaves.com/arabic/news> within 20 days in the year 2023, meaning 600,000 people per day. It will appear that a person has 0.327 square meters, and according to international standards, it is considered an average value with a weak flow [31].

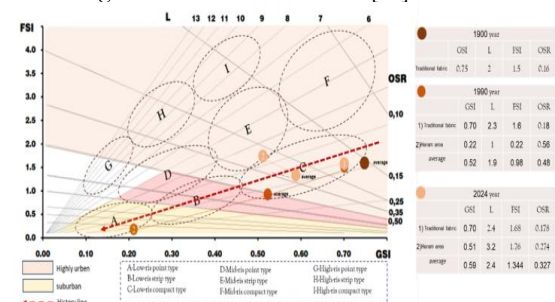


Figure (5): shows the types of tissues in the center of the city of Najaf on a plan pacemate for the years 1900, 1990, and 2024, the types of buildings according to Martin and March, and the type of



urban fabric. (Researcher: results of the applied study)

As a result of weak or almost non-existent access, cumulative numbers are added that may in fact reach double the number or more. Therefore, the accessibility and use of public transportation and its diversity (buses, railways, and metro) must be improved in order to reduce cumulative numbers and increase the speed of movement and emptying of densities to reach a larger area per person. Also, the city's spaces are linked to each other and work together, so people are in fact spread throughout the city as a whole and not limited to it. They are located in the city center. A survey was also conducted which concluded that the best fabric for movement during the day and the most accommodating of moving densities is traditional fabric.

8. Conclusion

We conclude that the best types of networks are the traditional fabric with narrow alleys and small granules, as they are characterized by high accessibility to pedestrians due to the multiplicity of options due to the large number of intersections. That is, high connectivity, it has the ability to change its uses and provide diversity by merging the granules together with the possibility of maintaining high accessibility. It is considered a tissue enhancer, Punta Male the environment with narrow streets and small granules represents improved texture very urban.

Traditional fabric is considered one of the best types of fabrics because it has a coverage rate of 60-80%, and therefore it is a very urban fabric that encourages vitality and access to city spaces, according to Bonta. It also reduces thermal stress because it allows only 30% of daylight to reach. And hot regions give flexibility to the distribution of moving densities throughout the hours of the day without exception.

The removal processes transformed the fabric into an open field with high daylight intensity and thus higher thermal potential. It also led to the removal of important parts of the fabric and a reduction in the number of intersections and thus a decrease in connectivity. We also note that the streets that were cut were considered extraneous to the fabric, reducing its homogeneity.

Because the area is very urban, accessibility can be increased by providing diverse public transportation, which leads to increased flow and reduced cumulative numbers of visitors, thus reducing the space that must be available per person. The highly urban area is an environment that makes public transportation successful, reducing the consumption of greenhouse gases, pollution, and carbon dioxide, and is considered a sustainable area.

9. Competing Interests:

The authors have no competing interests to declare.

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