

Enhancing the Quality of Urban Space by Pedestrian Grid Design Using Space Syntax Technique: A Case Study of the Historical Neighborhood of Jolfa in the City of Isfahan (Iran)

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ABSTRACT: One of the common problems of the contemporary urbanization worldwide has its origins in its excessive loyalty to the vehicular movement overlooking the maintenance and organization of walkways spaces and pedestrian movement. This, it turn, has led to the disintegration of the social and cultural and visual values in the urban spaces and the decrease of its performance and efficiency. It is noteworthy that the presence of pedestrians in the cities is advantageous to enhancing the social interactions of the citizens. To design paths conforming to the pedestrian movement in the urban fabric, due to their public use, requires flexibility, variation in the activities and spaces, the provision of urban safety and sense of belonging to the space the same factors which will consequently result in the promotion of the quality of the routes, the enhancement of social relations and interactions and the flourishing of the urban life. This research intends to study the enhancement of the urban space by pedestrian grid design using space syntax technique in the historical neighborhood of Jolfa, the Armenian quarter in the city of Isfahan (Iran).

KEYWORDS: Isfahan, urbanization, safety, Pedestrian Grid Design, Armenian quarter.

1 INTRODUCTION

Industrial revolution and machine invention have made critical changes in the spatial configuration of the cities and how to use it. The growth in the vehicular movement and transit-oriented development of the urban space has caused the collapse of valuable urban fabrics such as historical places and buildings. This has been accompanied by the displacement of the values in the urban space i.e. moving and mobility instead of stop and immobility in such a way that it has led to the decline of quality elements of the urban space including collectivity, co-presence, vitality, safety etc. . According to medical findings, social interactions have positive bearings on the individual health. However, unfortunately nowadays, excessive devastation and construction on the pretext of resurrection following a quantitative approach has led to bodily disintegration and consequently, sense of alienation of the people towards each other. Accordingly, due to such conflicts, urban fabric has failed to preserve its semiotic load it has gained during its long history unlike the past times. The emergence of the youth generation unaware of the fabric and the entrance of outsiders with different cultures and insights have caused weakening of social bonds of the fabric leading to inhabitants' indifference, alienation and finally their lack of sense of belonging. Conducting research on issues such as which factors are embedded in the quality of the urban space (focusing on pedestrianways)? How can the quality indicators of the environment be improved by pedestrian grid design? Which features of the walkways and urban spaces act as attractors of the tourists? May be somehow effective for the recovery of the urban fabric? [9].

2 URBAN SPACE

As one of the spatial elements of the cities, urban space is formulated and transformed along with the history of a nation during different periods. This element embodying various cultural, economical, social and political activities had always pulsated with the heart of the history of the city deciding the fate of the city. To put it differently, it has always been of remarkable significance as one of the basic components in the structure of the city. Urban pedestrianways as one of the indicators of the urban space are designed in such a way that be located in the everyday passways of the people without requiring going a long distance for using them locally. Due to their potentiality for creation of urban and collective spaces along their length and at certain intervals as joints, pedestrian axes may be helpful for removing the existing vacuums in the urban life and the resolving the lack of interactive space. [1, 3]

3 THEORETICAL PERSPECTIVES ON THE URBAN ENVIRONMENT QUALITY

Apart from focusing on the concept of quality and its meaning, ideas found for it among the theories on the quality of urban environments are triple. Emphasizing on the “objective” nature of the thing, the first group of the theories have regarded the quality of urban environment as an attribute and construct intrinsic to the bodily environment and existing independently of the observer. For the second group which focuses on the “subjective” or “abstract” dimension of the individual, urban design quality is deemed as a matter of mental phenomenon and taste constructed by the observer with no relevance to the bodily structure and attributes. Finally, the third group defines urban environment quality as a “phenomenon” or “event” formulated in the course of interaction between bodily and tangible characteristics and observer’s cultural patterns and codes and mental capabilities. Experimentalist theorists including Lynch, Eppliard, Leng and Nether are among the major advocates of such a view of the urban environment quality. Kevin Lynch has emphasized on the existence of a mutual association exploring the effect of urban environment quality on the life quality of the city inhabitants. As he argues, if urban planning and design is to be useful, it must be able to promote the quality of human life through enhancing the bodily environment quality [2, 8].

He has proposed a model including 5 functional aspects which in his opinion covers all the main axes of the quality of a city along with two super-criteria i.e. efficiency and justice being considered as the comprehensive model version for the quality of the city. These aspects are as follows:

- 1-Vitality: Provision of the possibility of human’s biological and sociological survival in the urban environment;
- 2- Sense (meaning): Abstract functioning and meaningfulness of urban places;
- 3-Adaptability: Conformity of the urban form with various activities and behavior patterns;
- 4-Accessibility: Provision of ease of “physical penetration” into different sections of the urban fabric;
- 5- Control and monitoring: Provision of the possibility of selection and intervention made by citizens in issues related to the management and usage of public area of the city.

The existing mode of the quality

Individual’s subjective domain

Thing’s objective domain

The qualities related to the subjective domain are embedded within one’s ego.

Desirable qualities

Capacity qualities

The qualities related to the “objective domain” are object-oriented attributes that are subjected to the mind as an “external entity” interacting with outside events

Hardly quantifiable and measurable

Ugly-beautiful

Desirable-undesirable

Measurable

Weight, height, speed [7, 6].

4 SPACE SYNTAX THEORY

Everything is both the product of its past and the producer of its future. Space syntax theory has stemmed from this statement. If urbanization is regarded as a phenomena trying to resolve urban problems and promote the qualitative level of the life of the citizens, it must be said that urban problems have arisen when following the excessive growth of the cities and the development of the urbanization, urban constructors made their desirable changes to the body of the city but they could not reach their desirable results. In fact, urban architects, designers and authorities could not predict the behaviors and changes of their own city due to their insufficient knowledge and cognition about the environment and society.

Developed and originated in the late 1970s, space syntax theory was introduced by Bill Hillier and Julienne Hanson at University College of London to tackle such problems.

The axial map helps us to divide the urban spaces into convex spaces in all of which the accessibility and visibility principles are established i.e. every point taken within each space is visible and accessible to all other points within the same space.

The following picture shows how space syntax theory has been used [4, 5].

The Analysis of Isfahan's Jolfa Neighborhood.



Fig. 1. Integrated Analysis of Jolfa neighborhood

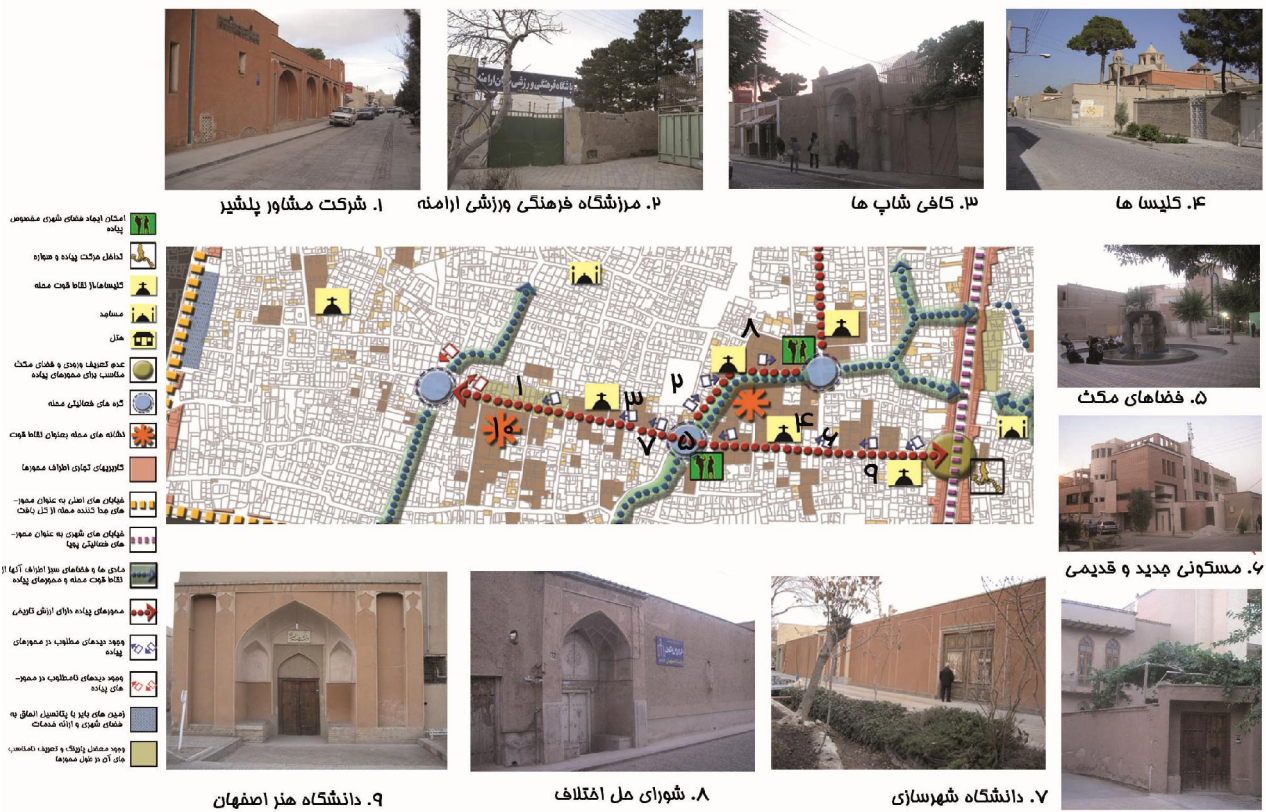


Fig. 2. Marked Functionality Analysis of Sangtrashha Axis [11]

4.1 CONCLUSIONS BASED ON THE PERFORMED ANALYSES

Putting together the results of the analyses, an integrated analysis of the neighborhood was achieved presented below in detail. The most remarkable part in this analysis was the position of historical axis of *Sangtarashha* in the Jolfa neighborhood. *Sangtarashha* axis as the historical pedestrian-based route with meta-quarter and even meta-urban services (due to the existence of the universities) is currently functioning at best. The passage of Shayej irrigation canal through the axis, rich historical background, marked functions, pedestrian stop spaces etc. all are among the potentialities of this axis. As it is evident in the above analysis, given its prominent potentialities, *Sangtarashha* axis despite all designs made for it (pavement, repair and resurrection of the walls, etc.) suffers from remarkable weaknesses so that it can be claimed an optimum design can be yielded by handling them. [13]

4.2 THE ANALYSIS OF JOLFA NEIGHBORHOOD USING SPACE SYNTAX TECHNIQUE

Based on analyses, it was revealed that *Sangtarashha* axis is a historical-functional route of prominent value. Now, to complete the analyses and understand the communicative role as well as the integration degree of the axes of this neighborhood, space syntax technique is used.

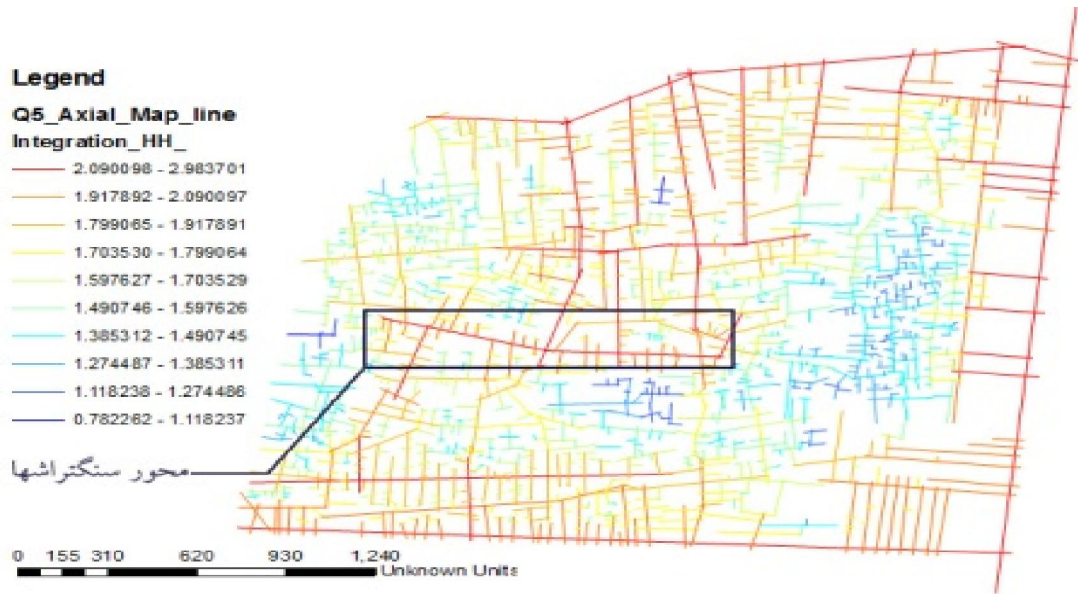


Fig. 3. Radius-N integration map in the previous fabric of the neighborhood before constructing new avenues



Fig. 4. Integration map in the previous fabric of the neighborhood before constructing new avenues

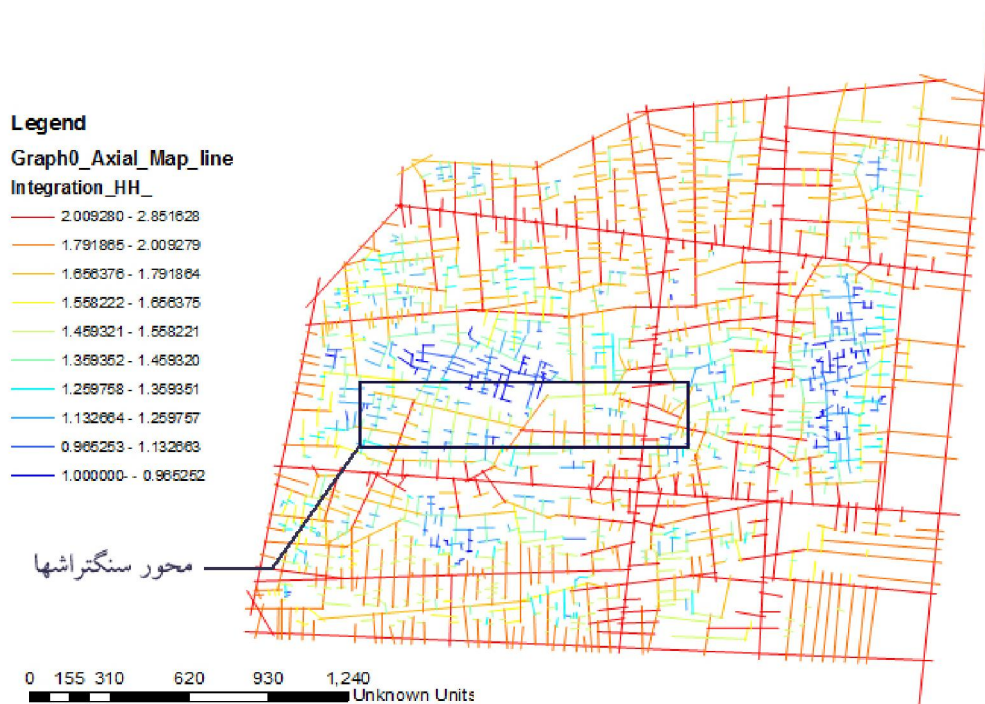


Fig. 5. Radius-N integration map in the current fabric

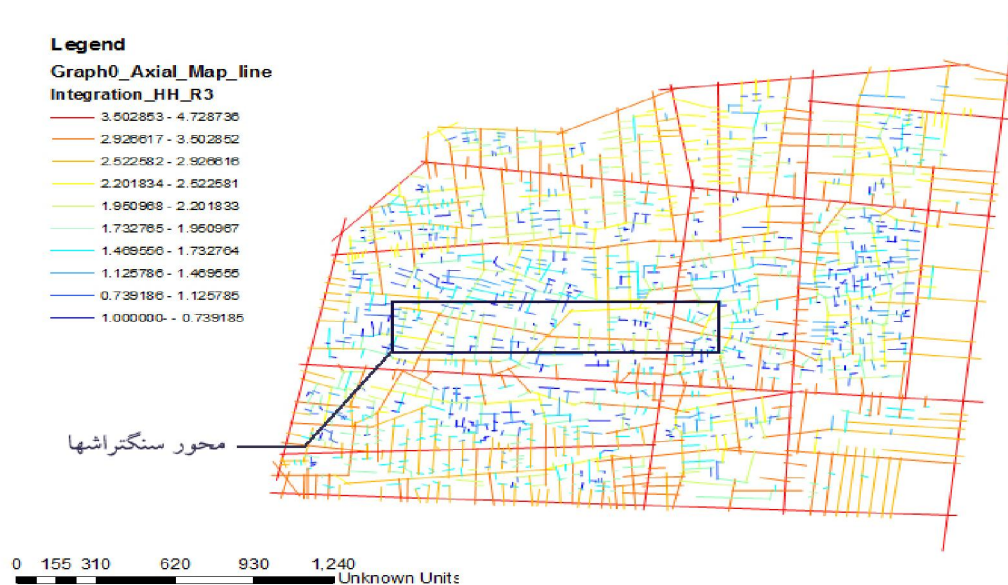


Fig. 6. Radius-3 integration map in the current fabric

Table 1. The mean values of the integration degrees obtained from the old and current maps of the entire zone and the Sangtarashha axis

	The mean value of global integration(Rn-Integration)		The mean value of local integration (R3-Integration)	
	Whole area	Sangtarashha axis	Whole area	Sangtarashha axis
Before construction of the new avenues within the last 30 years	1.588	1.32	1.860	3.41
Current status (after construction of the new avenues)	1.593	1.98	1.867	3.14

The results of the space syntax analysis for this zone have been presented in the above table showing the degree of integration of the spaces constituting this zone. Integration map plays a significant role in understanding the behavior patterns of the constitutive elements of the city. Based on the results of numerous researches, there is a high correlation between the value of integration throughout the city and various events in the city including pedestrian movement. Since space syntax is also responsive to even trivial changes and modifications made in the structure of the city representing them in mathematical and graphical forms, this technique can be used at historical bodily transformations analysis step as a guide tool for design, design step and consecutive steps (to monitor what effects the design will have on the general structure of the region). In the integration map, the lines whose colors are closer to red represent the spaces of greater integration. Spaces of greater integration enjoy greater spatial connectivity with the whole of the city. Hence, it can be inferred that these spaces attract the highest number of movements due to their greater visibility within the overall fabric (high integration). As it is evident in the obtained maps, there has been a decrease in the integration of the historical axis of *Sangtarashha* following the construction of new streets. The integration of new streets with the whole city, however, has increased and consequently, with more movements along them. Of course, it is noteworthy that this inference does not mean that *Sangtarashha* axis currently has no function in the structure of the neighborhood, but it still exists as an influential element in the structure of the city. This claim can be justified by the reddish color of the first half of this axis. The degree of integration in the second half has decreased that given its strong performance and marked applications, when designing this problem must be taken into account and resolved [17].

4.3 PRESENTING DESIGN ALTERNATIVES

Analyses performed on the area in question using space syntax technique, the values of the degree of integration and the area’s weaknesses in this regard guided the author for design purpose. Accordingly, considering the respective principles and criterion, here two alternatives for design are proposed. Then, using space syntax technique, that alternative which is found to be of a greater integration value shall be selected for design purpose. This alternative will be discussed in detail.

It is worth mentioning that design alternatives merely present a general layout and structure without going into required particulars. Furthermore, it must be noted that some of the items proposed towards achieving the goals are integral to both alternatives i.e. they form the underlying basis of all the alternatives with having trivial differences [1, 16].

4.4 THE PROPOSED DESIGN ALTERNATIVES

Here, firstly, the map of proposed changes in the axes within the zone and its pedestrian-based route has been represented. Then, using space syntax software, the degree of integration of the axis with the whole fabric has been calculated at radius of n and 3 [18, 13].

4.4.1 DESIGN ALTERNATIVE NO. 1



Fig. 7. Design Alternative no. 1: Proposed Modifications in the Axes within the Area and Selection of Pedestrian-based Route



Fig. 8. Space Syntax Analysis on Alternative no.1 with a movement radius of n

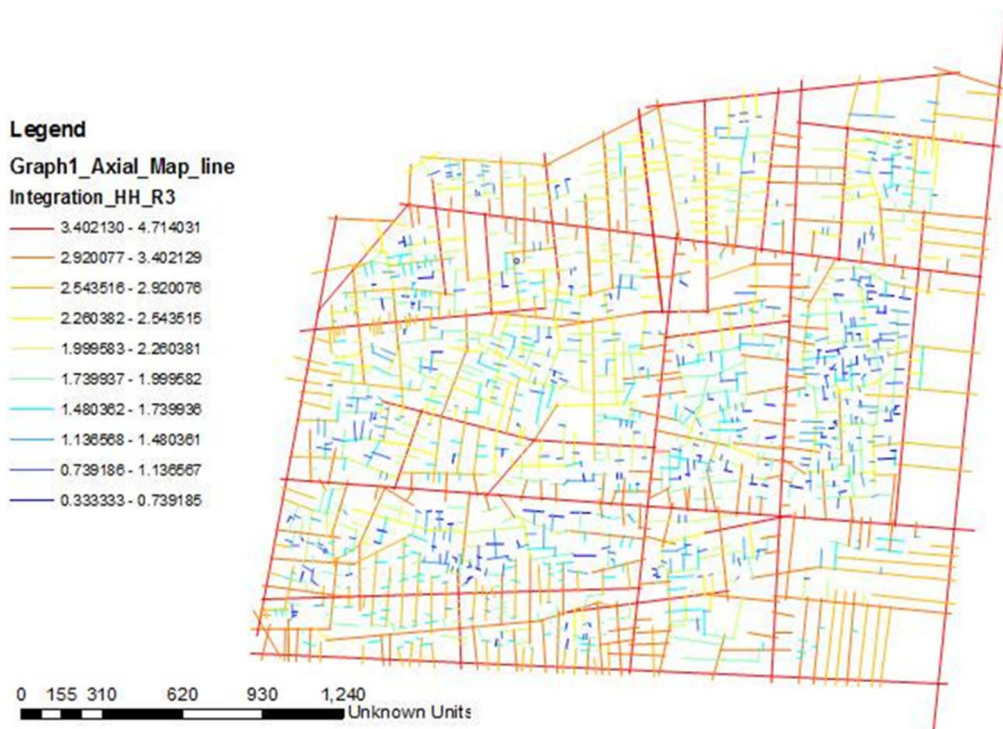


Fig. 9. Space Syntax Technique Analysis on Alternative no.1 with a Movement Radius of 3

4.4.2 DESIGN ALTERNATIVE NO.2



Fig. 10. Alternative no.2 for the design: Proposed modifications in the axes within the area and Selection of Pedestrian-based Route

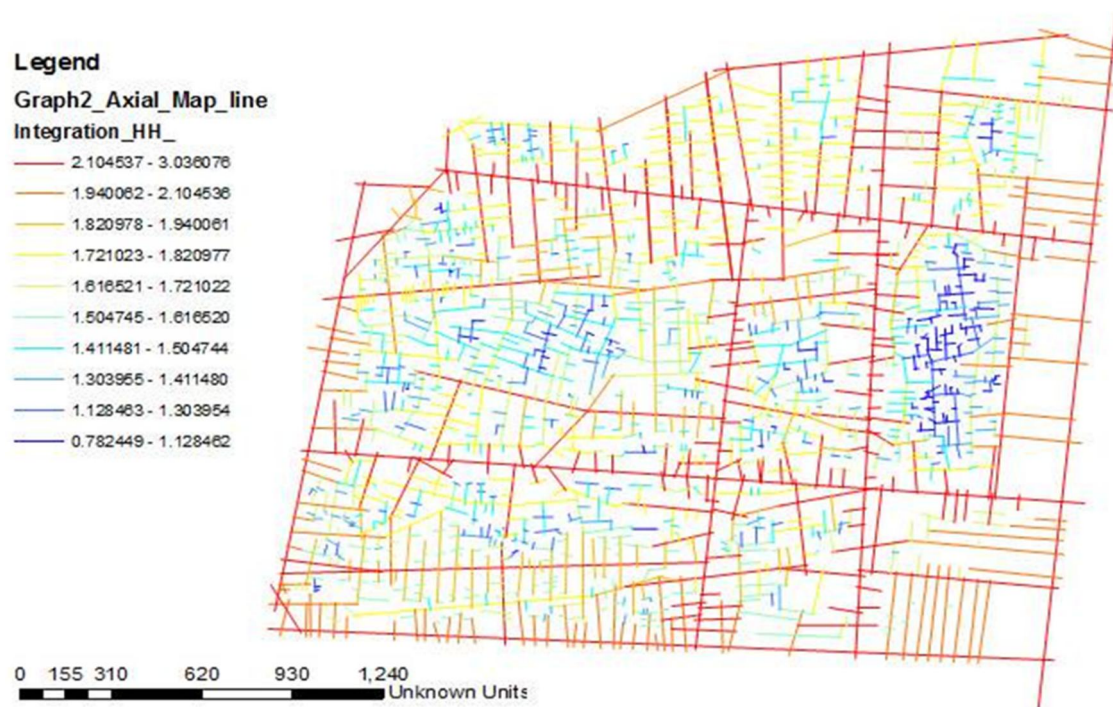


Fig. 11. Space Syntax Analysis on the Alternative no.2 with a Movement Radius of n

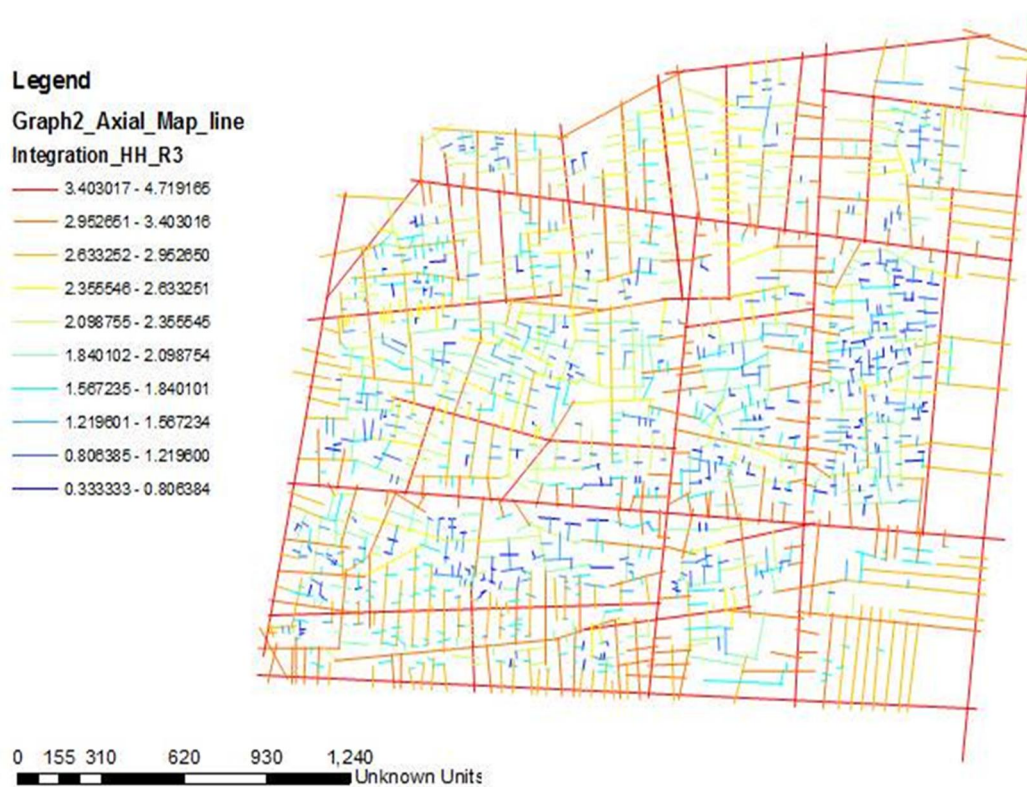


Fig. 12. Space Syntax Analysis on the Alternative no.2 with a Movement Radius of 3

4.5 EVALUATION OF DESIGN ALTERNATIVES BASED ON SPACE SYNTAX TECHNIQUE ANALYSES

Table 2. The Mean Values Obtained for the Integration for the Design Alternatives of the Area and the Sangtarashha Axis

	Mean Value of Global Integration (Integration Rn)		Mean Value of Local Integration (Integration R3)	
	Whole Area	<i>Sangtarashha</i> Axis	Whole Area	<i>Sangtarashha</i> Axis
Design Alternative no.1	1.569	1.992	1.897	3.184
Design Alternative no.2	1.631	2.06	1.922	3.289

As it can be inferred from the results of the analyses, alternative no.2 enjoys a higher mean global and local integration. As a result, it is selected as the best option. In this way, an axis was selected that could be connected to the main axis with the lowest changes required. Hence, it contributes to the urban permeability, legibility or way-finding and social safety. The selected alternative enhances the functionality and vitality of the area. However, this is not sufficient and the quality of the urban space needs to be promoted. Therefore, based on mentioned criteria, this axis has been designed and its details are discussed [9].

4.6 PRESENTING DETAILED DESIGN ZONE

Detailed design for the optimal alternative has been defined from the beginning of *Sangtarashha* axis and *Shahid Rahimi* alley up to the end of the axis (its intersection with *Vahid* Street). It is noteworthy that the goal of this research is to promote the quality of the end section of the axis [2].



Fig. 13. Presenting Detailed Design Zone

Proposed Design

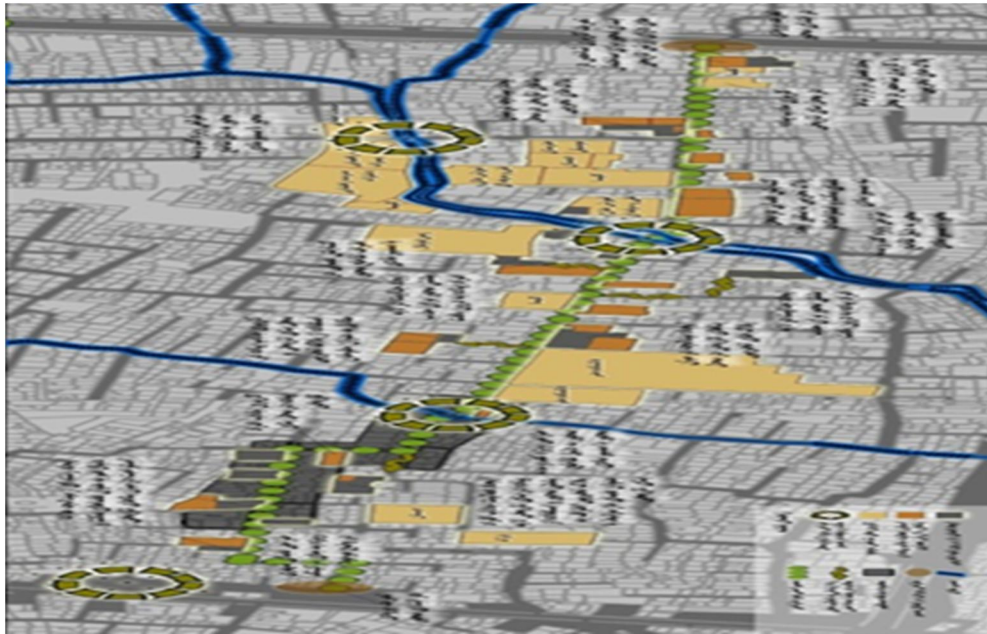


Fig. 14. *The Proposed Plan for the Design Zone*



Fig. 15. *The Area after Direct Intervention*

5 CONCLUSION

Having a valuable historical background, Isfahan's Jolfa neighborhood is of unique and distinctive attributes as evidenced by 13 churches existed in this neighborhood. Having various cultural functions besides providing localized and globalized services, this neighborhood acts as a tourist attractor or magnet. Old houses with a change in their applications are functioning at best. The existence of small nodes and squares in the neighborhood with service centers all around them is one of the extant historical attributes of this neighborhood with high rate of pedestrian movement.

Unfortunately, like other historical neighborhoods, Jolfa neighborhood has experienced new transformations and alternations among which construction of new streets without paying attention to the remained historical axes, inappropriate bodily changes, not identification of the status of the historical axes and their cutting can be mentioned. Given the obtained analyses, *Sangtarashha* axis is the strongest historical axis of Jolfa neighborhood embedding significant local and global functions. Besides, it is clear from the results of space syntax technique analysis that the first half of this axis has a greater integration with other spaces of the fabric, while the second half is of a lower integration. Given the high potentialities existing within it, it seems necessary to devise some strategies to improve the connectivity of this axis with other urban spaces. This can be attributed to the fact that the status of a space in the macro-structure of the city is the primary factor which has a bearing on the entrance of the pedestrian as well as tourists into an urban space.

Using space syntax technique and integration analysis, the present research tried to render a design for pedestrianway for the Jolfa neighborhood with the purpose of promoting its integration. The greater the degree of integration, the higher visibility, accessibility and pedestrian movement rate in the selected route. This, in turn, is accompanied by an increase in the tourist attraction. Furthermore, tourists' requirements in the urban space have been taken into account in the design, some of which are as follows: giving consideration to climatic comfort, welfare facilities' flexibility at different times, to the space's attractive functions on suitable intervals in the urban spaces and passways and variety and diversity of the activities, to the roads and appropriate accessibilities to and from the space, to the cleanliness and beauty of the view given the audience's desires, etc. These are all among parameters which are effective for promoting the quality of pedestrian-based urban space leading to the continuity of tourists' attraction to the urban space. Accordingly, a design was presented for promoting the quality of pedestrian urban space [4, 5, 6].

ACKNOWLEDGMENT

This article has been extracted from author's Master thesis. Therefore, special thanks are due to university's authorities and all those who have assisted him in conducting the research.

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