



# Designing a Conceptual Pattern to Integrate Urban Spaces Network with the View of “New Urbanism”, Using F’ANP Model, Case Study: District 6 of Tehran\*

Parisa Roshani<sup>1</sup>, Kyoumars Habibi<sup>2\*\*</sup> and Zahra Sadat Saeideh Zarabadi<sup>3</sup>

<sup>1</sup> Ph.D. Candidate of Urban Planning, Department of Urban Planning, Faculty of Art and Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran.

<sup>2</sup> Associate Professor of Urbanism, Department of Urban Planning, University of Kurdistan, Sanandaj, Iran.

<sup>3</sup> Associate Professor of Urban Planning, Department of Urban Planning, Faculty Art and Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran.

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**ABSTRACT:** In response to the failure of modernist approach in the new urban ideas, attention to the public spaces in cities has become as a basic necessity in terms of planning and urban design. Study on the concept of urban space as a structural element in the cities, is developing and expanding. Multiple authors have done many studies in this area, and the results indicate that urban areas play a key role in the urban structure and life of its inhabitants while they have become paramount in increasing the integrity of the city. The main purpose of this study is forming a conceptual model of an integrated network for urban spaces in the process of decision-making. Undoubtedly, such networks which strengthen the structure of city and make it integrated; bring about the socio-economic growth and prosperity for inhabitant. Therefore, the present study seeks to explore the factors influencing the interconnected urban spaces network in addition to propose a conceptual model for shaping it. The research is exploratory-explanatory and uses meta-analysis method for its planning process. Moreover, for analytical evaluation of case model, F’ANP model is employed. The main approach in this analysis is based on the movement of “new urbanism”. The research results reveal that urban spaces are located in a logic network in form of transects in order to achieve spatial integrity, continuity in the transverse sections of the city must be maintained, which is provided in the form of a continuity matrix. Summing up, in compare with the different researchers views, 9 indexes of spatial integrity were obtained include combination of social, functional, physical and visual aspects of theorists.

**Keywords:** Urban Spaces, Network Logic, Spatial Integrity, Urban Transect.

## INTRODUCTION

Study on the concept of urban space as a structural element in the cities, is developing and expanding. Multiple authors have done studies in this area, and the results indicate that urban areas play a key role in the urban structure and life of its inhabitants while they have become paramount in increasing the integrity of the city. Public spaces can be considered as important elements to increase cohesion and urban systems, natural facilitators

to create and maintain a strong local centrality, which can improve the quality of the superior environment and economic competitiveness and enhance the sense of citizenship. Hence, the processes of planning, designing and construction of urban spaces should be considered in an accurate way to find a good solution to solve the structural problems in urban pattern, such as the lack of integrity in cities that contains a spatial breakdown.

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\*\* Corresponding Author Email: habibi\_ki@yahoo.co.uk



## PROBLEM STATEMENT

Traditional urban system in the country represents the integration of urban space, in general, and operation when it comes in to details, so the result of this designing is formation of lively and dynamic urban spaces in the metropolitan system of many old cities of country. Certainly traditional spaces can be considered as an interconnected set formed in the particular hierarchical system and bonded together coherently (PourJafar & Ismailian, 2013, p. 66), while the designing with an attitude of modernism has destroyed the old valuable urban spaces with their integrated structure. Relying on the postmodern principles of developed countries, the applied Post-modern Patterns are just confined to the designing of small spaces and they have failed to reform the expected and requisite spatial integrity of the spatial structure of cities. Unfortunately, superficial attention to the design of separate urban spaces regardless of spatial integrity as a subsystem of metropolitan system have brought some problems in term of lack of capability in mentioned areas to create the legible and flourished local metropolis. Uncertainty of the status of urban spaces in different levels of decision-making on the one hand and the lack of an adequate theoretical basis in term of a coherent and consistent planning and design, on the other hand have been a key factor in the failure of the current design of urban spaces. In response to the failure of modernist approach in the new urban ideas, attention to the public spaces in cities has become a basic necessity for planning and urban design (Varna & Tiesdell, 2010, pp. 575-576). Several fruitful studies have been done in

this issue. Urban spaces can be considered as a significant element which is not only able to increase cohesion and urban systems, but also able to create and maintain a strong local center, improve the quality of environment and economic competitiveness, and enhance the sense of citizenship (Stiles, 2010, pp. 9-12). Therefore, the main objective of this paper is proposing a conceptual model with essential theoretical basis for integrating urban spaces. Therefore, in the present study primarily urbanism literature, in the field of urban integrity, is studied analytically based on context analysis technique and urban integrity criteria, extracted consequently, which are integrated with urban spaces in a conceptual model to provide desired pattern. Then, using FANP model, the proposed conceptual model is employed in the 6 municipal district of Tehran.

## RESEARCH METHODOLOGY

This is a qualitative study conducted in two parts: theoretical and practical. To serve its purpose, it is categorized as fundamental and applied research. Regarding to this, the two approaches have been applied: interpretative and positivism. Using context analytical technique and meta-analysis, the first approach, interpretative, identifies and classifies desired research factors. In the practical section, the research become positivism-oriented. The main goal of this approach is assessing the impact of applying factors in the analysis spatial space. For this, ANP model is combined with Fuzzy logic in GIS tool. Moreover, Delphi technique is used in order to rate and prioritize the factors (Table 1).

**Table 1. Chart of Methodology**

Sphere	Approach	Method	Technique	Way
Theoretical	Interpretative	Meta-Analysis Comparative Analysis	Context Analysis	Taking Notes
			Delphi	Survey
Practical	Positivism	Segmental Survey	ANP	Assessment Check List
			Delphi	Fuzzy Logic in GIS Survey

## RESEARCH LITERATURE

Urban space and urban integrity have been an interest of many researchers particularly in the social and economic realms. However urban spaces integrity has been less considered in the 20th century. In 1965, 1977, 1987 and 2000, Alexander conducted a study in urban areas, in which he focused on urban integrity especially in the physical-perceptual aspects (Alexander, 2000, p. 33).

Roger Trancik is another researcher who has discussed this issue more special. In 1986, he discussed about space homogenization and necessity of integrity in his book, *The Missing spaces*. Some others in this era have mentioned an integrity in their studies. Since 2000, it has been more attention to this issue. Salingarus in 2000, Nan Ellin in 2006, Carmona in 2014, New Urban planners in 2014 and Im Sik Cho in 2015 are some of researchers who have discussed it more specialized. Nevertheless, no



study has been done in the case of urban space network integrity.

In association with the history of urban spaces and new urbanism movement, many studies have been done;

the table below represents the recent modeling of urban spaces according to the New Urbanism approach (Table 2).

**Table 2. Introduction of Urban Spaces with New Urbanism Approach**

Subject	Main Space	Detail Space
Civic Space	Thoroughfare	Path-Passage Rear Lane-Alley Road-Street Avenue& Con Nectar Drive Boulevard High Way Pedestrian Mall Commercial Street (Loop)
	Squares	Pocket Space Sports field Playground Quadrangle Square Plaza
	Promenades	Walkway
Natural Open Space	National Park-See Front-Canals	
Public Open Space	Green Space	Green Close
	Public Garden	Community Garden Allotment Garden
	Urban Forest	
Interchange Space	Rail Stops	Light Rail Regional/Commuter Rail Rail Rapid Transit/Heavy Rail
	Bus Stops	Bus Rapid Transit Bus Transit Buses (outside core pedestrian centers)
	Bicycle Lane	Bicycle Trail Bicycle Path Bicycle Lane
	Pedestrian	
	Level Crossings With the Ability to Stop and Interactions	

(Smart Cod of the New Urbanism, 2009; the Lexicon of the New Urbanism, 2014)

Although many studies have been done in the field of urban spaces and new urbanism, no research has been yet done as integrating the network of urban spaces.

**THEORETICAL FRAMEWORK**

***Introduction of Urban Space Integrity Indicators***

With assistance of Fractal and Gestalt theories, the whole complexity which is the most noteworthy factor in an integrated space is introduced by Alexander (Alexander, 1987, pp. 12-18). In his point of view the integrity would become meaningful if the space institutionalized in a structural system. The requisite of being such a system is a network logic which covers whole complexity including streams and nodes (Alexander, 1965, pp. 59-60). The other expert, Rogers Trancik believes that “the



public space connection theory is derived from a set of routes which are responsible for linking urban spaces and creating consecutive spaces. These routes are in form of streets, pedestrians, open spaces, linear spaces or other connective elements that connect different parts of the city, therefore individual elements of the city are changed into a coherent framework in a hierarchical system” (Trancik, 1986, pp. 93-85). As described by Tavassoli, continuity of spatial integrity, neighborhoods and urban closeness, the mixture of buildings with urban elements are the most influencing factors in creating integrated spaces (Tavassoli & Bonyadi, 1991, pp. 18-25). Many structuralists have argued that urban planning should pay enough attention and value to the spatial network connective elements in an urban framework. Notably, they emphasize on large-scale spatial space network design as a connective element of city body which is an important factor in the spatial integrity (Tavallaye, 2002, pp. 8-18). According to Lynch, a coherent and transparent framework that comprised of five elements of node, line, edge, sign and zone has been able to create vivid mental images. Lynch insisted on conceptual coherence to the urban landscape and its tangible forms. From his point of view, urban designer is responsible for creating of visual unity in responding to integrate mental images and composition in design (Lynch, 2004, p. 89). Spaces are connected to provide wide corridors to allow movement of air masses and weather species as described by Bucys. He considered logical connection of species of urban open spaces. He argued that the cohesion between urban green spaces and other urban spaces lead to environmental sustainability (Bucys, 2012, p. 5). From Carmona viewpoint, nature of contemporary public spaces directly is affected by their complexity of social- economic content which created accordingly and consequently the interactional results. Moreover the use of public space network idea in the design of urban scale, a neighborhood or urban area, leads to readability and ability to gain perception and orientation toward urban spaces. This results in a way that the urban structure of city and neighborhood would be integrated and eventually the urban areas would be strengthened. (Carmona, 2003, pp. 87-93). As Ana Julia and colleagues said: “ urban spaces integrity only makes sense in a grid which has two spheres: (1) in the physical aspect, various urban elements and their connections would be considered and (2) in the application aspect, population as user of different sectors of the urban and interactions would be regarded” (Ana Júlia et al., 2010, p. 8). Consideration of people-oriented ways rather than car-oriented ones, maintaining the

integrity of public transport and its continuity in all urban transects, defining of public spaces in each section and its relation with appropriate space to the other transects scale can produce required visibility in the spatial organization of cities as New Urbanism movement theorists believed (The Lexicon of the New Urbanism, 2014, pp. 12-18). Nan Ellin recognized the unity, integration and connectivity, Porosity, authenticity, vulnerability as five significant characteristics of integrated urbanism (Ellin, 2006, pp. 18-23). Salingarus introduces eight principles for urban integrity and believes that in a conventional compound system, such as a biological organism or a large computer program, the basic rules of composition are followed in the way that the components are connected and work exactly (Salingarus, 2000, p. 292). Im Sik Cho and colleagues believe that integrated urban spaces are formed from three levels framework of hardware, software and organization that relation between them will create cohesion. Moreover he introduced criteria including accessibility, connections, edges and etc. as indicators of integration (Im Sik Cho et al., 2015, pp. 153-163). In conclusion, studies demonstrate that characteristics such as: hierarchy, continuity, permeability (Couplings), integration (Porosity), internal dependence, Organization, Decomposition, Diversity and persistence of Boundaries (edge) are presented as Space integrity indicators in the most theories.

### ***Introduction of Urban Spaces Integrity Characteristics***

Analysis method and Delphi technique are used in order to identify integrity indicators of urban areas. Summing up the opinions of masters in this field and using 3-stage Delphi questionnaires, the views of local theorists are summarized and analyzed (Table 3).



**Table 3. Urban Spaces Integrity Characteristics**

Code/Main Element	Agreements		Frequency
	Yes	No	
Dependency	95.7	4.3	Versatility (23)- Composition (22)- Flexibility (24)- Socialization (19)- Schedule (21)- Activity (18)
Hierarchy	90.7	9.3	Activities Time (21)- User Groups- Space Type (25)
Coupling	94.2	5.8	Location on the Ground (19)- Group Linkage-Spaces-Wall- Sky Line- Communications (17)- Activity (15)
Porosity	67.3	32.7	Communicative Permeability- Functional Permeability (19)- Porosity Morphology- Social Permeability
Compatibility	50.50	49.5	Responsive Spaces to the Social Need- Time Managment (8)- Capacity
Decomposition	52.77	47.3	Walls (15)- Floor (15)- sky Line (12)- Spaces- Time-Activity- Line of Sight- Communication Network
Continuity	100	00	Building, Monument and Space Relationship- Functional Connection- Green Space Continuity- Functional Time Continuity- Space Continuity- Network Continuity (4)- Accessibility- Walls
Boundaries Legibility	73.5	26.5	Compatibility (15)- Functional- Social- Spatial- Time -Flexibility, Legibility, Edge Continuity
Diversity	88.4	11.6	Complex Use (14)- functional Type and Intensity- Spatial Diversity (24)- Social Diversity- Composition(9)- Flexibility

It should be noted that apart from the aspects of morphology, spatial, functional and intuitive that are more physical nature; these indicators are also involved in social and perceptual aspects and cover their sub-indices. For example, socialization in the coupling and diversity indices has the highest score and in the other characteristics is in priority of second to fourth.

According to the scientists, creation of spatial integrity in the city association requires the use of above characteristics in the connected network of urban spaces. Carmona in 2010 has suggested a new typology of urban spaces studied and classified in aspects of performance, perception and possession. Indeed, all the twenty identified types of urban spaces set in the four categories which include continues string of totally public spaces to private one (Carmona, 2010, 169, p. 2). Column spaces in Fig. 2, is representative of this type of category. However, the urban space contains two spheres: index, content and structure (form). According to Barnett, it is important that each space is defined according to its environmental characteristics (Barnett, 2014, p. 49). The Space has the following subsections such as socialization, time, Functional and Identity (Carmona, 2014, pp. 169-170). The importance of this subject is that when the integrity

of urban space happens that each of these spheres has a logical connection with other spheres and integrity establishes with the entire complexity (urban space in a certain scale). On the other hand, every space is set in a logical network with other urban spaces and integrity is maintained with complete complex at the scale of a city. Since the spatial continuity of urban spaces is the most crucial factors for integrity, the principles of New Urbanism movement are used In order to create the requisite context.

***Introduction of Open Spaces in Urban Transects***

In New Urbanism, city is divided into six transects in accordance with their charter theoretical basis. Transects start from pristine areas outside the suburbs and end with the inner core of the city. What is important is maintaining the continuity of the open spaces from transect number 6 to 1 that is the basics of its idea in special and planning in general. Fig. 2 shows the public open spaces introduced in each of transect. Codes used to facilitate represent of their locating. The codes are the first letter of the English name of each space located in its own transect (Fig.1).

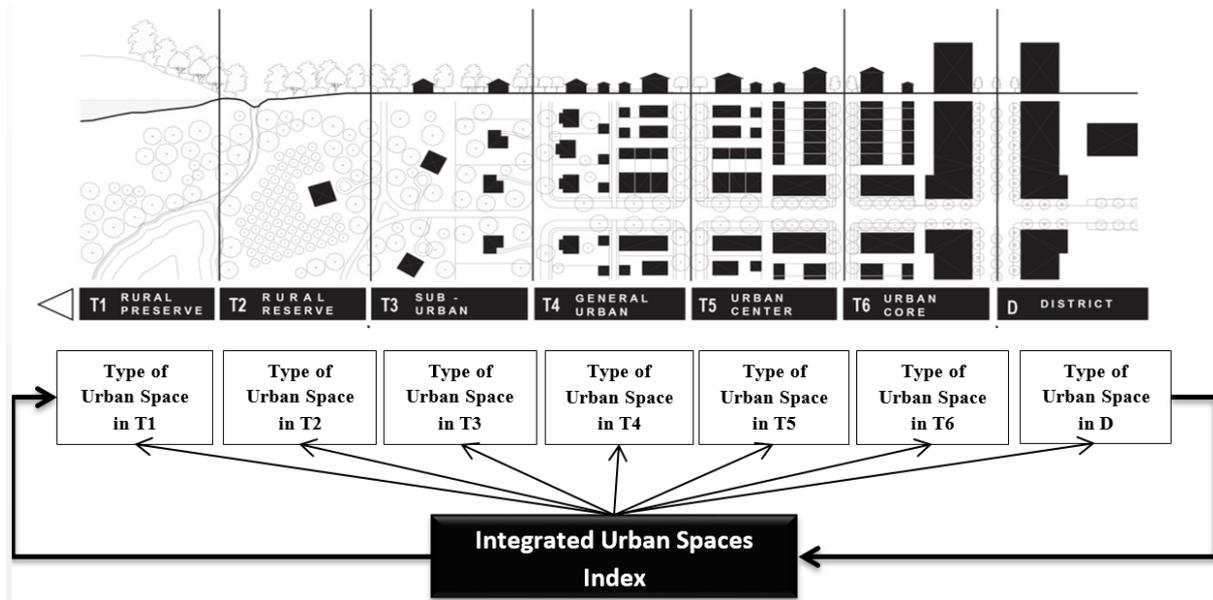


Fig. 1. The Relationship between Urban Spaces and Urban Transect  
(The Lexicon of the New Urbanism, 2014)

### Conceptual Model Interacting with Study Approach

In order to create integrity within the network of urban spaces, the position of each space per transects is presented through pie chart (Fig. 3). Therefore, transects are identified in the diagram from 1 to 6. Since the city is an open system and transect entrance continues cyclic from one to another, transects move rotary. Constantly moving from the suburbs to the city center and vice versa could be seen in the pie chart. The available urban spaces of any transect is shown in the inner layers of diagram. The inner transects have the most urban areas according to their position. What is general between spaces and is common in all, is its characteristics. Therefore, in the inner layer, spaces defining characteristics are on a rotating basis. The entire spaces network is covered by these characteristics

(Identity, performance, time, socialization, and Physical). According to the theoretical foundations, it is apparent that the urban spaces specified indicators are not the same as characteristics of spatial integrity. So Delphi qualitative survey method was used to determine the importance of spatial integrity indicators in dealing with urban spaces. For this purpose, a questionnaire was developed in which it is asked a group of technical experts for the priority of each index. After collecting agreed opinions and prioritize them accordingly with the views, the importance of each indicator of spatial integrity to the urban space ones was found. Table 4 presents the obtained preference.

Finally, the mentioned Preference factors is added to the inner layer of pie chart, which represents the conceptual relation between the spatial integrity factors, urban spaces and paper study approach.

Table 4. Prioritization Indicators of Integrity in Dealing with the Characteristics of Urban Spaces

Title	Physical	Sociality	Identity	Time	Functional
Continuity	1	1	1	1	1
Diversity	2	7	3	2	2
Organization	3	3	2	3	4
Hierarchy	4	2	4	4	3
Dependency	5	6	5	5	5



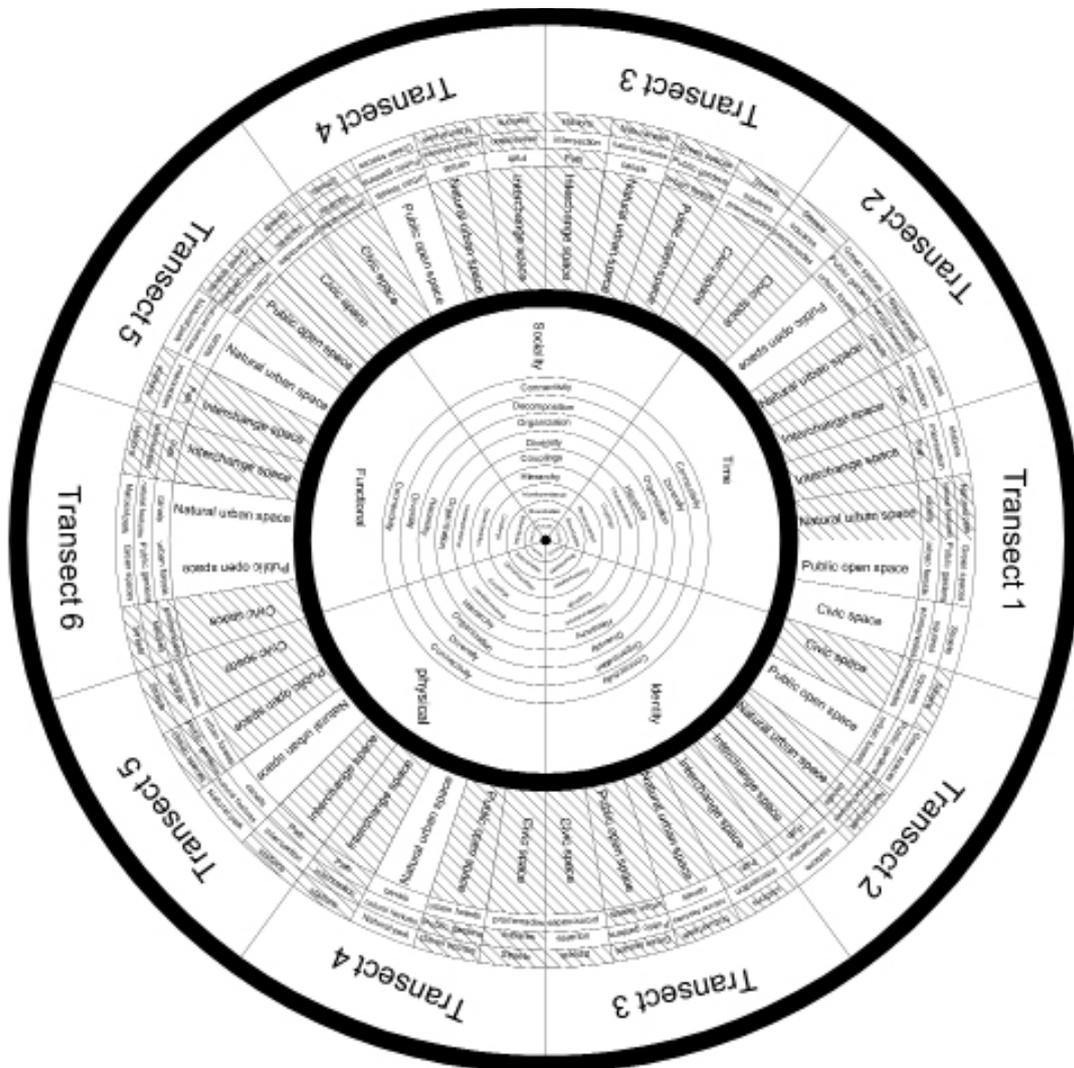


Fig. 3. Conceptual Model Combined with Urban Transects

The circular model is a complex and coherent model of integral components which are effective and joined together with the interrelationship between them and the environment. A complete model is in the form of a continuous stream that gradually taking shape. Every time it changes and adapts to environmental conditions, at each level of complexity, it is arranged moderately and in an entire view, it is completely arranged which leads to create conceptual network. The coherence between urban spaces and whole complex (city system) is formed through spatial integrity indicators in the innermost layer.

### TERRITORY UNDER STUDY

Evaluating the conceptual model, FANP model is used in the district 6 of Tehran. The model is combined

of Fuzzy Logic and ANP. The district 6 is very significant not only for its strategic location which is an important part of the city's main skeleton, but also for its functional structure of urban spaces. The study area is placed in 5 and 6 urban transects (downtown).

### RESEARCH FINDINGS

ANP Network Forming: First of all, objectives, criteria and sub-criteria have been introduced in order to evaluate (Zebardast, 2014, p. 33). The purpose is assessing integrity of urban space that is classified to three categories: features of integrity, characteristic of urban space and urban space types. However the urban space divided into major streets, squares and other spaces (Fig. 4).

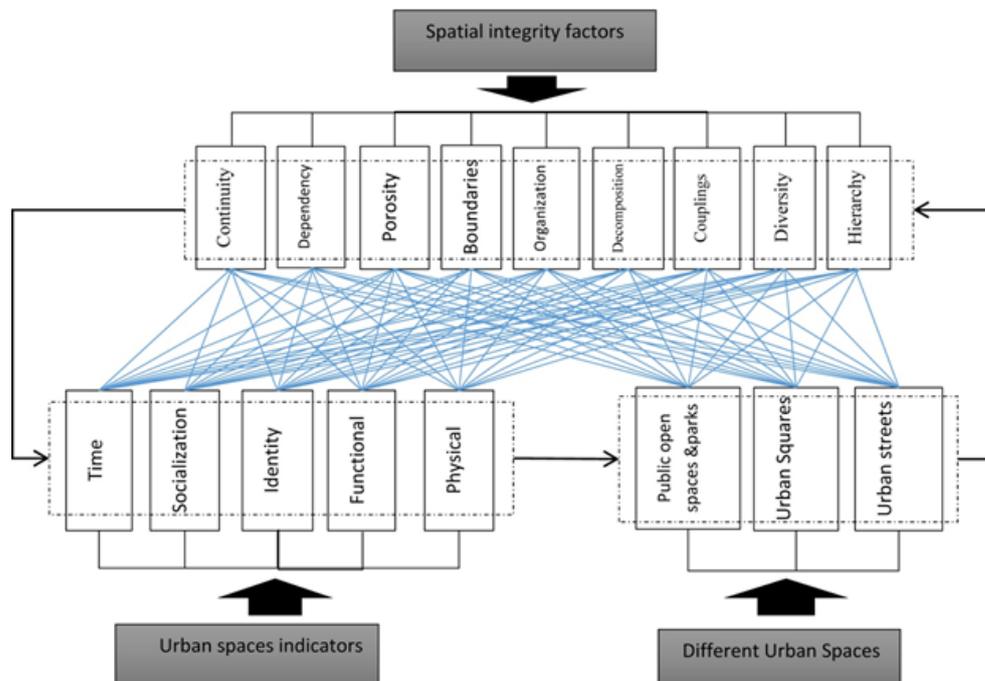


Furthermore, more than 20 matrixes and tables of urban space indicators and integrity interact with each other. To determine the rating, information about criteria and sub-criteria was summarized in the tables to compare the current situation and plan. The table's data have been assembled from project consuler, the employer and the people respectively. Information is gathered through the assessment check list. In these check lists indicators of urban spaces integrity is defined and classified. Moreover for each characteristic evaluation measures have been introduced. According to these measures, urban spaces

of the area have been assessed and scored. Notably this information summarized in more than 15 tables is as a result of analysis of the current situation and design studies including reports and maps of the current situation and the plan and field visits. Each weight is achieved from the interaction of integrity characteristics and urban spaces. The normal weight is multiplied by importance factor of each current situation attribute and final weight is achieved by studied urban spaces according to evaluation check list (Table 5).

**Table 5. Weighting the Integrity and Urban Space Indicators Interacting with Each Other**

Integrity Indicators	Title	Normal Weight	Urban Space Characteristics	Title	Normal Weight
	Couplings	0.09414		Socialization	0.21117
	Decomposition	0.07125		Time	0.08113
	Porosity	0.01804		Connection Functional	0.25554
	Diversity	0.1531		Activity Functional	0.14192
	Organization	0.1585		Identity	0.10265
	Hierarchy	0.13832		Physical	0.2076
	Boundaries	0.0464			
	Dependency	0.09833			
	Continuity	0.22191			



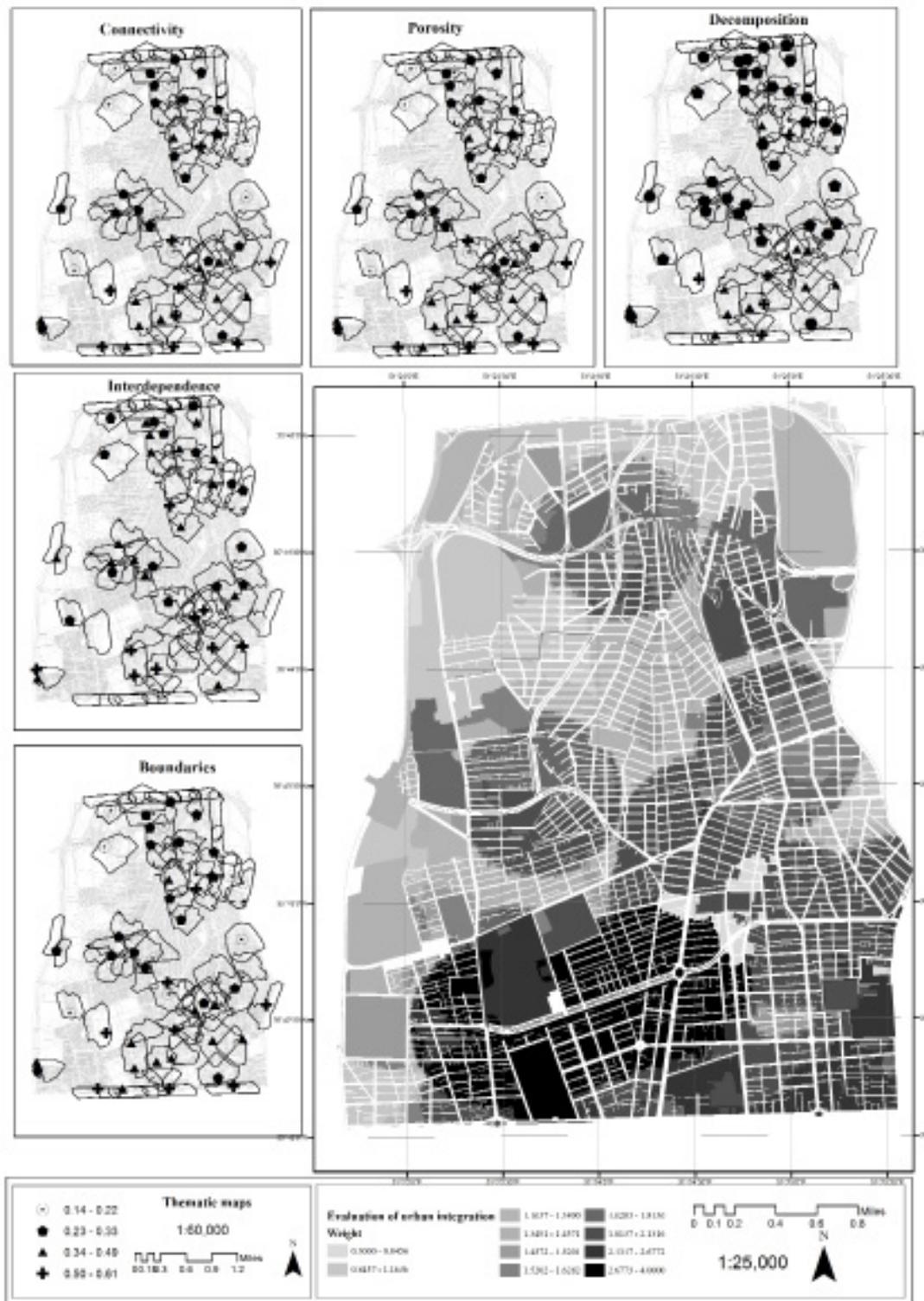
**Fig. 4. Introducing Network ANP**



The map of urban spaces integrity assessment can be achieved by taking the following steps. Since urban spaces integrity indicators have both qualitative and quantitative nature in the measurement, it is firstly required to homogenize them to be evaluated. Therefore using fuzzy logic all of the indicators have been equivalent between 0 and 1 value. For this purpose 53 squares, 22 Metro Station, 118 green and open space, 150 Exchange environment and part of pavement of Valiasr and Keshavarz Blvd, along with streets in four general categories of first grade arteries to local access, are observed and adjusted according to the check list, finally they have rated and placed in the following formula. Urban Space and integrity indicators are marked

with “ $\alpha$ ” and “ $\beta$ ” indexes respectively. Total index is represented that the integrity indicators have priority over urban space characteristics (Table 4), so Delphi technique is used in order to recognize the importance of these indicators. It is conducted by five experts at home and abroad who have done studies on urban integration. This results are presented in the following formula. Overlapping nine integrity criteria with six ones besides to their combination with a variety of urban spaces of 6th district of Tehran leads to create urban spaces integrity map. In the map Points 4 and 0.3 represent the most and the least integration respectively. Fig. 5 shows the spatial integrity map and some of the characteristics evaluation in the range (Fig. 5).

$$\begin{aligned}
 \text{integrated} &= \sum_{i=1}^{n=9} w_{i\beta Anp} \beta_i \rightarrow \left\{ \begin{array}{l} \beta_1 = (a_2 + a_3 + a_4 + a_5) \\ \beta_2 = (a_1 + a_3 + a_4 + a_5 + a_6) \\ \beta_3 = (a_2 + a_4 + a_5 + a_6) \\ \beta_4 = (a_1 + a_2 + a_3 + a_4 + a_5 + a_6) \\ \beta_5 = (a_4 + a_5 + a_6) \\ \beta_6 = (a_1 + a_2 + a_4) \\ \beta_7 = (a_2 + a_3 + a_4 + a_6) \\ \beta_8 = (a_3 + a_4 + a_6) \\ \beta_9 = (a_2 + a_3 + a_4 + a_6) \end{array} \right. \quad a_i \\
 &= w_{iAnp} \text{fuzzy}_i
 \end{aligned}$$





In order to quantitative evaluation of indices resulted of qualitative analysis, multivariate linear regression model is used. In this model, the results of a case study analysis of indices were evaluated. The dependent variable of this study is spaces integrity and independent variables of multiple indexes including: coupling, hierarchy, porosity and etc. The regression results of error of 5 percent and probability of 95 percent not only

rejected the null hypothesis that there is no relationship between the dependent and independent variables but also has proven a research assumption based on the existence of relationship between the dependent and 9 independent variables.

The results indicate that the relationship between dependent and independent variables with a correlation coefficient of 0.98 per cent (Table 6).

**Table 6. Correlation between Variables**  
Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error Of The Estimate
1	0.988 <sup>a</sup>	0.976	0.959	0.01811761

The results of the analysis of 18 sub regions of sixth district also indicate that the 15th sub region has the most urban spaces integrity with a score of 0.62195 Located in the south and the lowest spatial coherence is in the second sub region with a score of 0.25533 in the northwest region.

Due to the limited resources and time, urban spaces integrity indices has been put to the test in just one district of Tehran, the regression results has proven spatial cohesion indicators with a high probability. Certainly in the general policies it is required that all regions to be integrated appropriate to presented conceptual model in 6 transects of New Urbanism.

## CONCLUSIONS AND SUGGESTION

Studies reveal that the urban spaces integrity have been discussed by different theorists who proposed various ideas and views. What can be seen among the views about urban space integrity is that the integration of urban spaces could be implemented in an integrated systematic network. For this purpose urban spaces must be defined in different scales from city neighborhood to the large scale and should be connected logically and hierarchically. According to the Fig. 2, Carmona has introduced full coverage of open spaces including positive, negative, obscure and private. In another study a combining form of public green spaces, public parks and public gardens is considered as urban spaces (Carmona, 2014, pp. 5-9). In order to create environmental sustainability in cities, these spaces must be linked directly with other static and dynamic urban spaces (Development Bureau, 2012, p. 18). Researchers have agreed at two significant spheres of urban spaces: 1- structural, 2- content including implication, time, performance, socialization, which are defined in this study as indicators of urban spaces. Nine

indicators of continuity, hierarchical, and couplings have been introduced for spatial integrity. Definitely Integrity of urban spaces depends on the characteristics interaction in an integrated network. On the other hand new urbanism has defined a city in various intersects in which different urban spaces are clustered (Rahnama et al., 2013, pp. 28-32). With combination of the above theories and New Urbanism approach in which cohesion and integrity index is the connectivity reason, the integrated network is formed that links urban spaces of the city in different scales. (Fig. 3). In the “community living” approach in New Urbanism, it is emphasized on the positive urban spaces, including natural urban spaces, public open spaces, civic spaces and the exchange spaces as the nodes in the network. In this approach, walking and livability of the neighborhood and create a friendly environment for pedestrians is particularly concerning. Moreover, it is focused on maintaining of walk-oriented communication along with ride, so to create integrity in urban spaces network, the connection between pause spaces such as squares, parks, etc., is happened through the ways in which rail and bus network, pedestrian and bicycle are the main factors of connection. Indeed intersections in the central and transit stations in all intersect would be major nodes and exchange points (Rahnama et al., 2012, pp. 196-198). In New Urbanism approach, each space has its own place that is hierarchically connected to each other. The current research is in an effort to make decision for developing a conceptual model. The indicators of proposed model are in the context of city and they have interaction with each other. Proposing distinct design, especially in the aspects of physical-space for each space indicator in the future research could open doors for many urban problems.

Summing up, in compare with the different researchers views, 9 indexes of spatial integrity were obtained that included of combination of social, functional, physical and visual aspects of theorists.



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