

Persian translation of this paper entitled:

مدل مفهومی جدید از تفکیک اراضی شهری در توسعه‌های مسکونی
با تاکید بر فضای باز (نمونه موردی : شهر زنجان)
is also published in this issue of journal.

The Expression of New Model of Urban Land Subdivision in Iran Emphasize on Open Space (Case study: Zanjan)

Mehran Faramarzi*

Hamid reza Ebrahimi**

Nasser Barati***

Abstract

Land as a non-reproducible commodity is of an incontestable value. Zoning or urban land division known as practical urbanization is one of the important measures of urbanization to protect land values. The main impetus behind this study is to know whether the checked zoning pattern can be optimized for new residential areas using the experiences from traditional residential textures Iran and the world. This analytical-comparative study attempts to develop an optimal zoning pattern and a new conceptual-operational model by comparing the dominant zoning patterns in Iran with those in the world. The results of the comparative research show that the zoning patterns that are widely used in new residential development suffer from some major problems and the proposed new pattern can be a suitable alternative.

Keywords

Residential Texture, Zoning, Zanjan, Urbanization.

.....
* . Ph. D. Candidate, Department of Art and Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran.
Mehran_Faramarzi2001@yahoo.com

** . Assistant professor in urban design, Faculty of Art and Architecture, University of Tehran, Tehran, Iran. hr.ebrahimi@ut.ac.ir

*** . Associate professor in urban design, international university of Imam Khomeini, Qazvin, Iran.
Corresponding author, naser.barati2012@yahoo.com

Introduction

Urban Sprawl and the need for land development caused by population growth have been major concerns of the urban development planners in the world and in Iran. Non-reproducibility of land highlights the necessity and significance of practical measures for urbanization. The concern of turning agricultural land into residential property regardless of its use justifies the measurements should be taken to protect the land. One of the major issues in urban planning is developing new urban areas. A brief look at the job description of consulting engineering services shows that different aspects of this issue (e.g. demographic, climatic, physical, cultural, and economic) has been extensively investigated. However, the contribution of such studies has not been incorporated into projects. One of the key issues in urban development is urban zoning known as practical urbanization. Today, macro-scale studies on the cities have failed to provide desirable zoning plans for residential development. This study is an attempt to replace the prevailing zoning models in Iran with an optimal model tailored to human needs.

Theoretical framework of research

Local land use law includes the policy for zoning. Zoning or dividing a land into smaller pieces is an important part of urban development projects. Zoning codes usually determine the minimum requirements for cities based on the dimensions of the zone. In zoning codes, the number and location of street gutters, street access points may be limited to specific zones. The regulation also determines the extent to which land should be withdrawn from adjacent neighbors (James & LaGro, 2008: 144). The Land Control Act is a set of rules designed to ensure the safety, comfort, and well-being of residents in large and small cities. The act attempts to provide not only the access to zones also promotes conditions for health care, parks and open areas (Department of Housing and Community Development, 2009: 2). Zoning includes the creation of a new zone or a set of zones that requires a legal act and it is comprised

of providing infrastructure services such as green space and mapping (Planning Commission, 2004: 3). Zoning is an essential process of dividing the mainland or dividing a building into several units or changing the range of a location. (RMA, 2013: 3). Though zoning is effective in addressing the environmental problems caused by the intensity and variation of land use, it may lead to dissatisfaction of residents by imposing restricting their right (Ibid: 3). Zoning requires the confirmation of sale and it should result in profitability of property value (including construction) and it sets limitations to the landlord or residents on how to use the land. The term zoning is conceptualized as a complex stage through which multiple land zones are created by diving and isolating land and the term includes the allocation of land to the road or street. In contrast, the term “division of land” or “dividing into smaller pieces” does not include the allocation of land to the road and access streets (See, 2000: 46).

The process of segregating urban areas (henceforth zoning): Zoning is a legal process for land isolation. In the final process of zoning, the range of private zones, public spaces, streets, and how to access them are specified. The ordinances controlling zoning includes the arrangement and ordering of the elements of the site development (e.g. the width of the streets, pavements, the shape of zones and blocks of urban facilities and facilities, open space, urban services); (James & LaGro, 2008: 310).

In the application for zoning submitted to the council by the stakeholders, four issues are concerned: 1. the new development must commensurate with the area. 2. It must meet the required standards. 3. Its negative effects should be minimum 4. It should not be a threat to the environment.

The basic steps in segregating urban areas are as follows: 1. Determining and defining the site's boundaries. 2. Designing the main streets. 3. Designing side streets. 4. Designing the residential blocks. The following steps are not based on extensive studies or not tailored to the socio-behavioral needs of residential neighborhoods:

1. Carrying out a land use survey and zoning the city. 2. Forming a team of expert. 3. Assessing the suitability of the land in accordance with the checklists. 4. Forming a committee for reviewing the plan. 5. Providing urban services. 6. Forming a team for finalizing the divisions. 7. Registering the map plans. 8. Preparing the site (Saskatchewan Ministry of Municipal, affairs, 2007: 1). Two aspects that have been emphasized in North American and Australian urban studies are the size and shape of urban blocks. These factors influence the urban movement patterns. In fact, blocks in the zoning process refer to street and building blocks (VIALARD, 2012: 2). In the description of engineering consulting services, the zoning is detailed under the heading of land preparation. In general, the description of services is 1- Carrying out city-scale studies focusing on climatic, physical, environmental and passive defense conditions. 2- Planning for construction in existing fields, including providing a detailed survey on ground preparation, topography, the patterns of spatial organization of the complex, and construction management practices. The description of the service does not include any basic studies or guidelines concerning the type and manner in which the urban areas are segregated (Ministry of Interior affairs, 1992).

Open space in zoning

Zoning regulations in India have allocated some percent of urban areas in cities to open space.

For example, in each zoning scheme, 0.4 hectares or more is allocated for residential purposes, 10% of the total land area is dedicated to open space (Boob & Rao, 2014: 93). One of the main prerequisites for the approval of zoning schemes for cities in Australia is the provision of the public open space needed. (Town Planning Scheme, 2010: 1). The proposed public spaces in the city are 45% of the total land. This amount is allocated to streets and public spaces. The proposal was put forward by the United Nations Human Settlements (UN-Habitat). Thirty percent

of the space is dedicated to streets and sidewalks, and 15% is allocated to open space, green space and public services (UNHSP, 2015: 8). Studies on more than 40 cities show that only 7 cities have dedicated more than 20% of their urban areas in the central part of the city to the streets while less than 10% of the suburbs in Europe and North America are allocated to streets. Comparatively speaking, 25% of the urban cores are dedicated to the streets while this amount in suburban areas is less than 15%

In developing countries, less than 15% of the urban areas are devoted to the streets. These conditions are worse in urban suburbs reaching less than 10%. This reflects the inequity in Third World cities (8). In 2015, an article entitled “ Public Spaces and Private Spaces Open to the Public: Spatial Planning and Development Using Urban Design Guidelines presented guidelines for urban designing and categorized urban spaces as follows: 1. Public spaces (PS): They are publicly owned public spaces 2. Private spaces opening to Public spaces (PSOP) : They are privately owned public spaces. 3 Private space (PRS) They are privately owned private spaces. The article proposes that more than 15% of urban areas should be allocated to public space (PS). Based on studies reviewed in the light of theoretical foundations, we deduced four basic themes for zoning. The first theme which describes the quality of open space in the spatial segregation is related to the theory proposed by John Lang’s (1987). This theory highlights the importance of the hierarchy of open space. The second theme which is related to land allocation patterns reflects the theory was put forward by Kevin Lynch in 1987. The third theme is about the small amount of open and constructed spaces. This theme can be deduced from Edward Hall’s research (1966) and the fourth theme is related to the zoning process. The process has a distinct structure. The originality of this paper lies in thematic analysis and application of these theories to zoning. Although these theories have been referred to in projects sporadically, they have not been presented as guidelines (Table 1).

Table 1. Theories & Theoretician. Source: authors.

Theoretician	Theories
John Lang	Developing Public spaces in residential neighborhoods in agreement with the hierarchy of space , can increase informal interactions and enhance social networking. Factors such as the spatial relationships of residential units, the layout of public spaces and residential development plans are very important in defining social interactions (Al-Homoud, 2003: 169)
Kevin Lynch	<ol style="list-style-type: none"> 1.The placement of residential blocks along an access axis decreases the ambiguity in the type of segregation. This type of spatial segregation pattern is simple. 2. In the second zoning pattern, the row land plots are open to the end of the main street. the zoned plots significantly reduces the development cost and they stay far from the noise pollution and the danger of the main streets, but they would not be easily accessible anymore. 3.In the third zoning pattern, zoned blocks opening to open space are shared.This pattern encourages neighborly and friendly relations and are of social and visual values (Lynch and Hack 1986: 262), land along with open spaces are divided into five or more zones (Colley, 2005: 61-64).
Edward Hall	This theory is detailed in the book entitled the hidden aspect .The theory explains the distances between the spaces in the residential places. With reference to this description, classification of spaces in terms of these distances will be as follows. 1- Intimate 2- Personal 3- Social 4- Public distance. According to this view, personal and intimate distances form a percentage of the built-up spaces while the social and public distances are part of the open spaces. Hall (1966) is the only person who has explained human behaviors patterns and spatial needs quantitatively. Social distances and the human need for understanding spaces, based on his perceptual senses can be an important source for analyzing the extent and the type of space human needs. Therefore, in order to explain the concept and the new zoning model in residential development, two theories and their elements have been used as the basis for the model. By applying the theory of Edward Hall in the form of socio-behavioral theory, the needs of individuals in terms of space requirements can be identified. Hence, the spaces needed by human beings can be outlined in four-dimensions, intimate, personal, social and public spaces and presented in space cells.
Simmonds	In his book called landscape architecture, John Simmonds (1998) has explained how the process of residential development projects should be tailored to the needs of residents. The basic component of this process is zoning.

Zoning Features of Traditional Residential Textures in Iran

The course of evolution shows how the shapes of the residential zones are affected by different factors. The collective patterns are reflected by the central courtyard shapes. The logic and reasons for such a form are associated with the People’s socio-behavioral roles. These roles have been influenced by the needs of the community in those days. Until

the first Pahlavi, the traditional shapes and content of residential neighborhoods and the configuration of residential units remained intact (Fig. 1).

Zoning neighborhoods helps us consolidate the coherence system in our daily life. Given that time-space paths are likely to be repeated, actions work within the regions in which they are institutionalized and reproduced (Afrouz, 1998: 65). The concept of the neighborhood does not only take into account the



Fig. 1. Changes in Residential Block Shapes. Source: authors.

relationship between construction and individual, but also the relationship between the inherent characteristics of the people and the social processes in which they are involved. According to Dickens, the physical distances between individuals and the allocation of physical space to specific types of social activities will have an impact on the social processes and relationships (Afroh, 1998: 81). Studies conducted in traditional Iranian neighborhoods shows that changes in social-behavioral patterns have altered the configurations of the zones and their shapes. Changes as reported in historical documents have been caused by modernity. The old neighborhood zones were segregated just like a central courtyard rectangle. In the burned city, the largest sample was a 250-square-meter Urartian residential complex (18 hectares). The average number of zones in a residential area is 50. The household size is 6 people per zone. Hence, each residential area accommodated approximately 300 inhabitants. There is a residential area in the southwest of Khoy. This area is 27 km. In the northwest, this area is 65 * 50 meters in size, and the area is 140 * 90 or 120 * 250 *. In Orumiyeh, the area is 250 * 230 meters in size. These neighborhoods shares similarities in term of have social-behavioral forms and contents. This continuity and coordination arise from the hierarchy of public, semi-public, semi-private and private spaces (Mahyar, et al., 1997: 10-200). Studies on various samples of zones in traditional Iranian neighborhoods indicated that the shapes of the zones before the first Pahlavi era and at the beginning of the modernity period in Iran were either








a square or rectangle central courtyard. In addition, there was a certain balance between the open space and the space constructed. In other words, the ratio of open space to the space built in residential blocks fell in a certain range, but the ration was not necessarily equal. This study is an attempt to explain this issue by examining at least seven examples. To this purpose, the smallest element in the zoning process or land plots have been the focus of this study. The plots are influenced by the socio-behavioral needs of residents and are featured for their diversity (Table 2).

The study of residential blocks in Iran shows that the open and constructed ratios are not the same, but they fall within a certain range. The blocks were featured by diversity caused by vacant and filled spaces. The orientations in each climate have been proportional to latitude and maximum sunlight. The shapes of the residential blocks are in the form of a square or rectangle central courtyard. As the plans show, social-behavioral patterns of the lifestyle in the past are reflected by semi-private spaces, or the central courtyard of residential units. The collective patterns indicate the individual distances in this space. The pattern of these blocks actually has had a positive impact on social-behavioral patterns and has promoted more intimacy between members of a family or between the two families.

Spatial-behavioral analysis of traditional residential areas

In this section, we have attempted to analyze the typology of Iranian traditional residential areas and examine the social- behavioral patterns and physical

Table 2. The shape of patterns, the ratio of open and constructed spaces in traditional residential blocks in Iran. These are some of the samples analyzed (For more samples, see the Ph.D. thesis). - Note: adapted from the Culture of Iranian Architecture, Isfahan Houses.

Mass and space	Name	The ratio of constructed spaces	The ratio of open spaces	Pattern
	David's house	%77	%23	Square-central courtyard
	Dehdashti's house	%72	%28	Rectangular - central courtyard
	Aalam's house	%67	%33	Square-central courtyard
	Sartipi's house	%65	%35	Rectangular - central courtyard
	Zwolyan's house	%73	%27	Rectangular - central courtyard
	Labfa's house	%65	%35	Rectangular - central courtyard
	Marathipers' House	%75	%25	Rectangular - central courtyard

features of these areas. Our analysis shows that daily life of people in traditional Iranian neighborhoods has been based on the hierarchy of space and tailored to the needs of residents. We will analyze the samples of residential areas in Iran in terms of distribution and zoning patterns of open spaces and built spaces.





Analysis

By analyzing the studies of traditional Iranian residential areas, (for more samples see Appendix No. 3) we can identify boundaries for private, semi-private, semi-public and public areas. In addition to the average 9 square meters of residential land devoted to per person, one square meter is allocated to useful public spaces for social interactions (except access networks). The shape of residential units is square or rectangular with a central courtyard design. Analyzing some cases in the book entitled visual

documents of Iranian cities shows the traditional residential contexts maintain a balance between collective open spaces and other spaces. That is why socio-behavioral patterns have received attention in zoning these neighborhoods. In some instances, the range of open spaces is proportional to the number of residential blocks and the population. In other words, population density has a direct relation to the useful collective open spaces per capita and spatial-social equilibrium is not replaced by geometric equilibrium. However, in new residential neighborhoods, the priority is given to geometric equilibrium and symmetry. In traditional residential areas, the balance between the building density and useful collective spaces promoting social interactions is of great importance.

Analyzing the samples (for more samples see Appendix No. 3) shows that the number of collective

Table 3. Dispersion and zoning patterns of open and constructed spaces in traditional Iranian areas – These are some of the samples analyzed (For more samples, see Faramarzi's Ph.D. thesis). Source: authors.

Neighborhood pattern	Name of Neighborhood	shape of residential blocks	Spatial hierarchy	Useful open collective spaces	The collective space per residential land
	Dispersion and zoning patterns of open and constructed spaces in traditional Qazvin-Akhund- neighborhoods	Central courtyard	-Private -Semi-Private - Semi-Public - Public	%8	11.42
	Dispersion and zoning patterns of open and constructed spaces in traditional Khorasan neighborhoods. Robaty Bashrooyeh- Residential area	Central courtyard	- Private -Semi-private - Semi-Public - Public	%15	6.63
	Dispersion and zoning patterns of open and constructed spaces in traditional Zanjan neighborhoods	Central courtyard	- Private -Semi-Private - Semi-Public - Public	%15	6.6
	Dispersion and zoning patterns of open and constructed spaces in traditional Yazd neighborhoods	Central courtyard	- Private -Semi-Private - Semi-Public - Public	%7	12.3

spaces is determined in proportion to residential blocks. If the total number of public collective spaces is > 3 , the total number of useful collective space is >1 . For semi- public spaces > 3 , the total number of useful collective space is >1 and for the total number of the semi-private spaces >16 , the number of useful collective space is > 7).

Energy analysis of the new model and current model This analysis includes: 1- Getting a normal light through the panels exposing the daylight. 2. The accessibility of residents to useful collective spaces at the neighborhood to reduce the use of personal vehicles. This is achieved by decreasing the access radius and is shown in the sample (Fig. 2).

In this comparison, the goal is to calculate the total

light panel surfaces for the natural light. The light is transmitted to the vertical surfaces through the openings in the main panels. In the new zoning model, residential densities for two primary blocks of the house (five floors) and the density for the rest of unit is 120% (two floors). In the checked pattern, for the blocks which are 225 square meters, the construction density is 120 percent. This value is the same as residential units in the new model.

Implementation of the Conceptual-Operational Zoning Model in the Study Area

In this section, a new conceptual model is implemented in the residential area of Golshahr Kazemieh Zanjan. This area is one of the largest new

residential developments in Iran. Currently, phases 1 to 4 have been completed and phases 5 to 8 have been prepared and zoned. The study area is located in the eastern side of Zanjan city. Golshahr Kazemieh Residential area is the largest residential area in Zanjan city. From the north and east, it is connected to the proposed northern highway and from the south it is limited by the northern belt and Punak residential neighborhood and in its west, Andisheh residential neighborhood is located (Fig. 3).

Spatial-Economic Analysis of Zoning Patterns

In urban development, one of the important issue influencing zoning patterns is stakeholders' and landowners' profits. They seek to gain the most benefit from their land plots. That means the existing land plots should include the largest number of residential blocks, otherwise, the stakeholders, such as housing cooperatives, would refuse to agree for land segregation, or in case they agree, they would

not be satisfied with it. Analyzing the zoning patterns of urban blocks in residential areas reinforce this idea that checked designs are not economically cost-effective because of terms of the limited number of residential blocks. This hypothesis can be tested through the model making technique using AutoCAD software. To this purpose, the area of open spaces and the number of residential blocks should be calculated.

Phase 8 of Kazemieh Golshahr

The current zoning model and the proposed zoning pattern developed for the 8th phase of Golshahr Kazimierz by the consultants are presented in the following table and their physical specifications are detailed. Though the zoning pattern is a combination of checked and U-turn pattern, it has been implemented entirely as a checked pattern. In this range, as in Z-7-1 range, the building masses are not loaded. Horizontal (East-West) and Vertical (North-

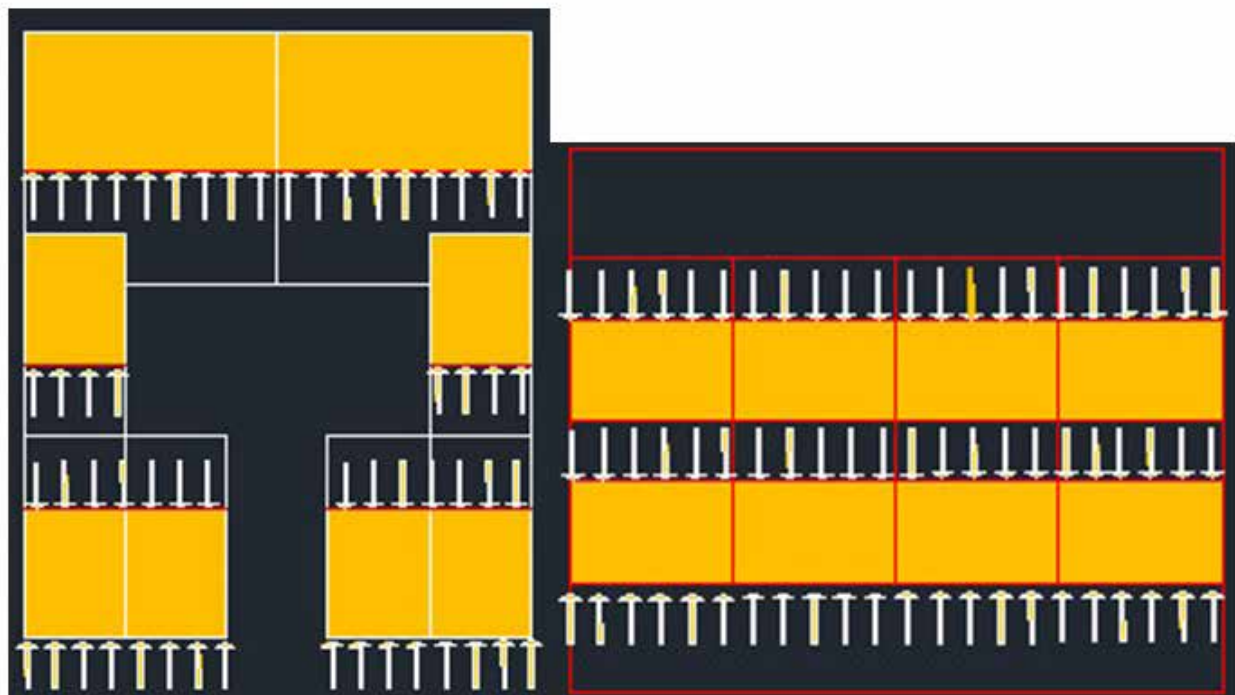


Fig. 2. Comparison of the total light panels in checked pattern and current zoning model. Source: authors, 2006.

Table 4. The number of Hierarchy of Useful Collective Spaces in Iranian Traditional neighborhoods. Source: authors.

Samples of Study	Number of Semi-Private Collective spaces	Number of Semi-Public Collective spaces	Number of Public Collective Spaces	The Total Number of Useful Collective Spaces
Sample 1	16	5	1	22
Sample 2	7	5	3	15
Sample 3	8	4	2	14
Sample 4	16	6	3	25



Fig. 3. Study area - Golshahr Kazemiyeh. Source: Armanshahr’s consultant engineers, 2009.

South) access networks for this range are 4265 and 1494 meters, respectively. In total, the internal network (li) is 5759 meters and the total network of external (le) is 2629 meters. Main arteries limiting this range with the cross section of north, south, east and west are 20, 20, 20, 30 meters respectively (Table 7, Fig. 4).

Analysis: Comparing the current zoning pattern and proposed zoning pattern show that the current zoning pattern is checked pattern. However, the patterns proposed by the consultant are checked patterned and U-turns. These types of zoning patterns widely used by architects reduce social interactions and destruct social-behavioral patterns of inhabitants of residential neighborhoods. In the proposal put forward by the consultant, only the safety of the residents has been a major concern and the U-turns

with a maximum 60 square meters in size have been used to increase safety and reduce traffic flow. Hence, such spaces cannot be considered as useful collective spaces or serve as a platform promoting the social interactions of the inhabitants, but only reduce traffic load and facilitate the movements of vehicle users.

Zoning Model

The proposed zoning model is developed based on the theoretical framework studied. The first step in developing the model is aligning the zoning patterns with behavioral patterns. Such alignment that is observed in the traditional residential neighborhoods has been used in this model. The second step is maximizing sunlight by selecting orientations appropriate to the traditional texture. The third step in presenting the land differentiation model is to

Table 5. Characteristics of the Residential Development Plan. Source: Armanshahr’s consultant engineers, 2009.






Regulations	Characteristics of residential development plan
Comprehensive Regulation plan	The Golshahr kazemyeh area is located in Zanjan Municipality Zone 2 and according to the detailed plan; it is a part of the five-code area. This zone covers all areas located between the 22nd Bahman highway and the Zanjan metropolitan area in the north, east and west. Its area is 2990.8 hectares (Armanshahr Consultant Engineers, 2009: 5). Considering that a minimum zone proposed for this area is 250 square meters, the average size of this zone is 200 square meters in Golshahr kazemyeh area. The net and gross housing densities proposed for vacant land in the plans are 278 and 155 people per hectare. The proposed density of population in Golshahr area of Kazimierz was 110 people per hectare. In comprehensive plans, the future density of the population is defined 100 people per hectare with a per capita of 100 square meters per person (Naghsh Piraesh’s consultant engineers, 2002: 38).
Open space regulations	In Zanjan's comprehensive plan, open space typology and their relationship with each other and their hierarchy in Zanjan have been less focused on. However, the total ratio of open spaces to built spaces has been emphasized and this value is two to three. This ratio is proposed for low and medium residential densities. For the net densities, this ratio changes for the benefit of open space and become three and two. The Open Space regulations in the plan are as follows: Minimum amount of open space should be determined based on the number of units in residential blocks. In order to increase the quantity and quality of private green spaces, an open space in each residential building (yard) should be allocated to green spaces and trees. Creating an open staircase (in the form of a ladder) in the courtyard for accessing the roofs of one-story buildings is allowed. The minimum area of the backyard for letting the light in the rooms and main spaces in one-story residential units is 6 m ² with a minimum width of 1.5 m. For each floor being added, the minimum 0.5 meters should be added to its useful width (Armanshahr, 2009: 37).
Occupancy level regulations	It is recommended that the occupancy level for all buildings should be predicted based on the northern section of the land. In the case that land is east-west stretched, the level of occupancy needs to be calculated for its western part. The occupancy level of the residential blocks with the density less than 60% is calculated and in the middle and special densities, the occupancy level was low.

provide the maximum economic per capita, which is being considered by employers, including housing cooperatives, in this regard (Fig. 5).

Analysis of historical documents and images show that (Table 3) related to residential areas show that the zoning pattern of neighboring units promotes face-to-face interactions among the residents of that area. However, a linear zoning pattern that leads to the creation of chess patterns reduces such interactions. In so doing, a space shared by inhabitants has been eliminated. That may explain why the semi-public spaces have been disappeared

and the expected behavioral patterns are missing in this place. The amount of the semi-private space between the residential blocks is 450 square meters for ten plots of land. This land plot can be useful semi-private space that is small in size and because it is located between the plots can be considered as a cumulative space. Also, in the case of a three-dimensional design, it is of value from the environmental and social perspective for the residents because it would be a platform for social interactions. If the high-density zoned plots are located within the zoned primary cell (Fig. 6),

Table 6. Economic justification of zoning patterns based on the amount of available open space. Source: authors, 2006.

	Zoning pattern	Total area of land (m ²)	Residential block area (m ²)	Collective open spaces	Number of residential blocks
Checkedred		7200	200	0	20
loop		7200	200	0	20
Deadend		7200	200	1400	20
Backyard		7200	200	2000	20
Cumulative		7200	200	1000	20

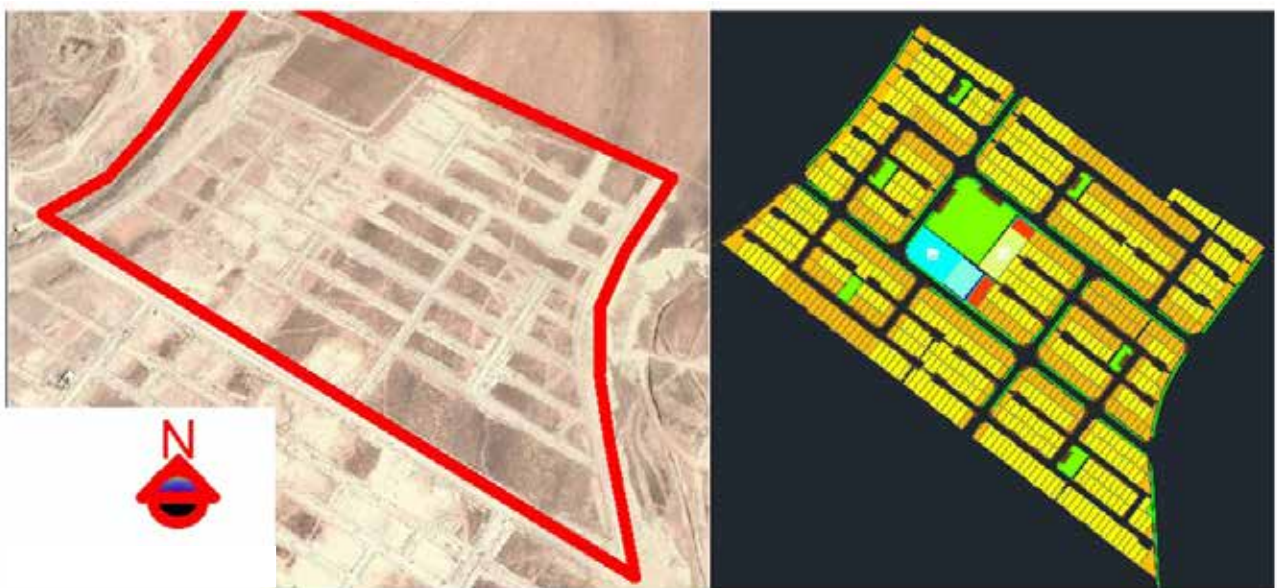


Fig. 4. The figure on the right is the Arial photo of the study area and the figure on the left is the plan proposed by the consultant. Source: Google earth 2016.

Table 7. Physical Characteristics of the Residential Phase 8 of Golshahr Kazemieh Zanjan. Source: authors, 2006.

Study area	Ratio of Foundation aea	Ratio of Constructed area	Ratio of open spaces	Network density	Total area of residential units	Total open spaces	Total area of residential land
Phase 8 of Golshahr Kazemieh Zanjan	0/67	0/68	0/46	0/01	164600	108612	279012

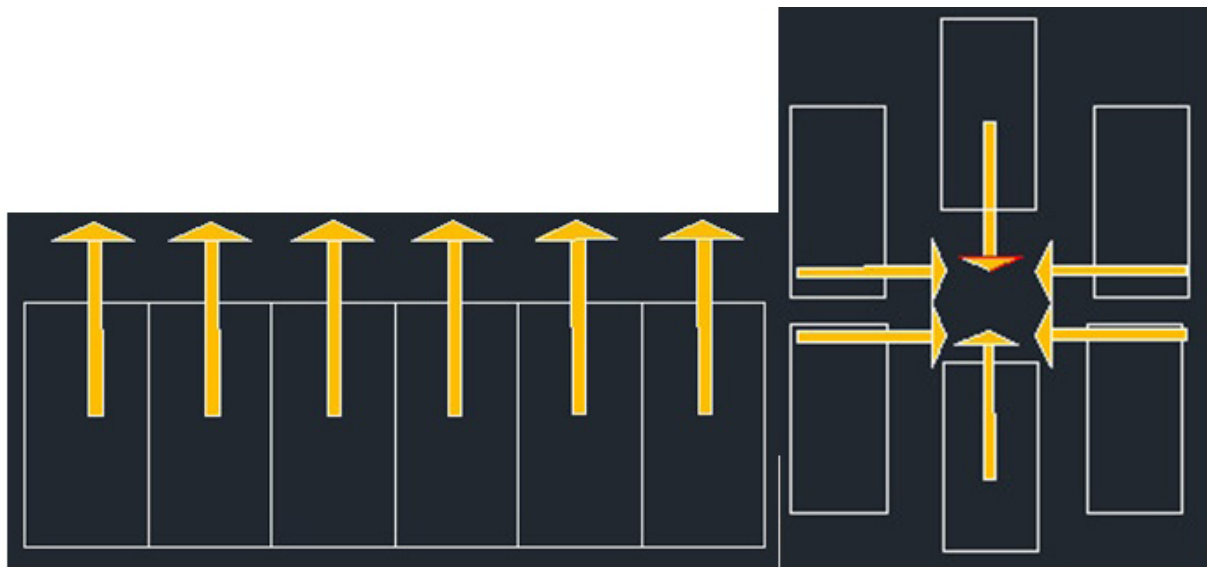


Fig. 5. Primary Zoning Pattern observed in Traditional and Modern residential neighborhoods. Source: authors.

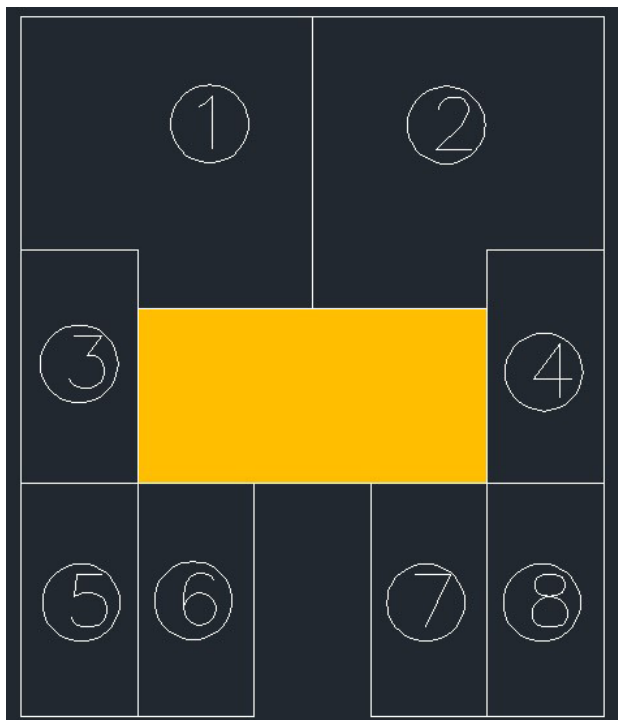


Fig. 6. Proposing the primary cell for the new zoning model. Source: authors.

the open space dedicated to these plots can, be combined with the semi-private space between the plots, become larger and in so doing they can reinforce social-behavioral patterns in this area. The smallest unit in urban zoning, called zoning land plots cell have been the focus of this study and used for designing zoning model. Certainly, such a cell alone can not be used as the proposed model. The final model of zoning in a neighborhood should be evaluated by putting these cells together (Fig. 6).

Proposed Zoning Model as an alternative for the existing one

This zoning or segregating land use model has been developed from the separation cell model. The model incorporates the desired aspects of the expected conceptual-operational model. The total number of semi-private spaces in the total area is 65 zones with 450 square meters in size. Semi-public

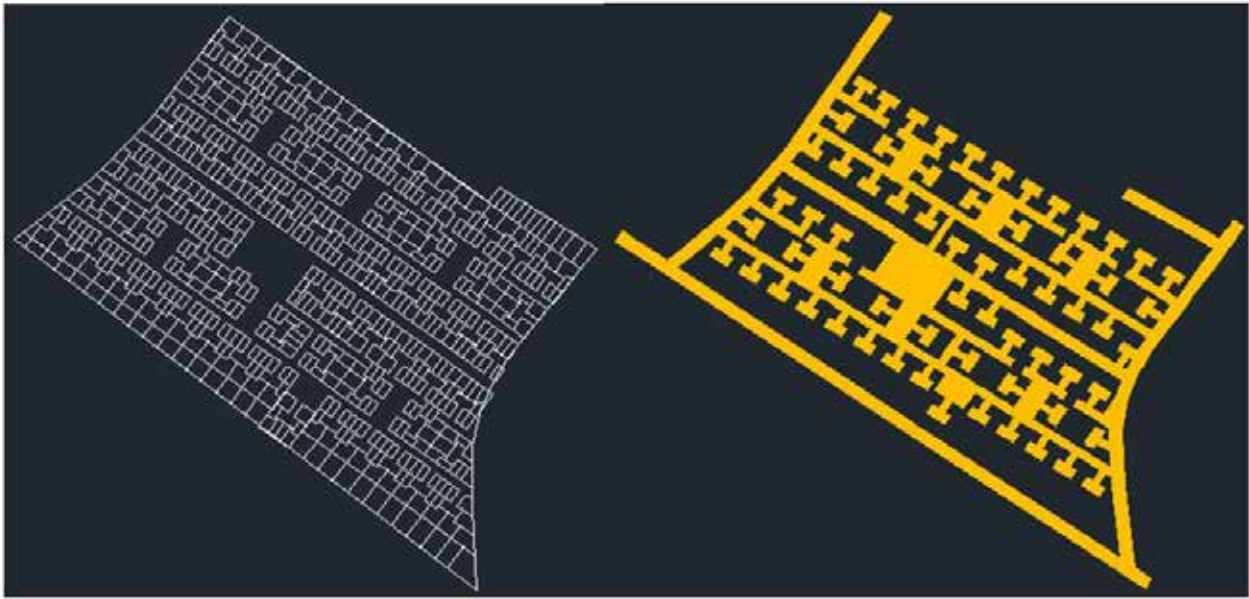


Fig. 7. The figure on the right is the new zoning model in the study area developed based on the zoning conceptual model shown on the left. The access network in new zoning model. Source: authors.

spaces include 7 zones with 1,600 square meters, and there is a single-use public space with 6,000 square meters. The proposed urban spaces can address social-behavioral needs in this area. The correct layout of the collective zones, and the reduction of the linear layout is one of the factors promoting face-to-face interactions and increasing the sense of community in new residential neighborhood.

To reduce energy consumption, the use of motor vehicles has been reduced. It is noteworthy that the access distance of residential blocks to the first collective space has been reduced from 168 meters in size to 20 meters. The maximum distance to the neighborhood service is 130 meters in the new model. The distance in the existing zoning pattern was 325 meters (Fig. 7).

Conclusion

Analysis of historical documents and images show that the current zoning pattern of urban areas in Iran has not been based on the social-behavioral model and has overlooked the needs of residents. An example of such negligence could be the hierarchy of collective open space which is designed only for reuniting people. The quantitative analysis of the data shows that the single-use useful collective space in traditional residential houses is between 8% and 15% of the total residential area while this amount in the analyzed samples is 4%. In addition, the distribution of the space rarely tailored to the needs of the residents. In other words, the modern samples include only private and public space. However, in the traditional samples there are private, semi-private, semi-public and public spaces. The conceptual model of this research has been developed after reviewing and analyzing traditional Iranian residential areas, available quantitative and qualitative models of collective spaces, and the needs of today's employers in urban segregation. Essentially, today's needs should be considered in relation to the economy of land and space and energy. The conceptual model was piloted in the study area. As shown, the checked patterns are not responding to the socio-economic and the spatial needs of residential residents. The proposed model is based on social - behavioral patterns which are driven from human needs. It also takes into account contemporary needs, the employer's economic concerns and the issues of maximizing natural light.

Analysis of traditional residential neighborhoods in Iran- Socio-behavioral spaces- Defining quality condition of open and constructed spaces, semi-private, semi-public and public collective spaces in form of central courtyard- New zoning model based on traditional residential neighborhoods in Iran- The quantitative amount of useful

collective spaces per meter of zoned land plots. Defining quality condition of open and constructed spaces- Energy and climate component based on traditional Residential neighborhoods. Traditional orientations of blocks and extension of blocks-Network access density. The maximum number of zoned blocks expected by the employers- Economic benefits of land plots- spaces based on the needs of employers (Table 8).

Based on what has been discussed, the zoning conceptual model implemented in the study area is more desirable than existing patterns (checkered pattern) and the proposal of the consultants (checkered-U-turn).

Table 8. Conceptual-Operational Zoning Model. Source: authors, 2006.

Zoning pattern	Spatial hierarchy derived from Socio-behavioral the traditional texture patterns	The ratio of open spaces promoting social interactions			Residential land area	Variety of blocks in terms of area	Variety of blocks in terms of area	Network density	Orientation of parts
		Semi-private	Semi-public	public					
Existing Zoning pattern	Private-public	-	-	/040	164600	Only 200 square meters	Construction density for – a two to three story building	01/0-Network 10 and 12 meters	15 degrees south east
		0/04 total							
New Zoning pattern		0/02	/040	/150	187807	-400-300-200 700-600 square meter blocks	Construction density for – a to five story building	A 01/0 - 10-12-16 –meter network	Aligned with the traditional texture-south and north light
		0/16							

Reference list

- Afrouh, I. (1999). *Space and social inequality (Developing a model for spatial segregation and its consequences)*. Tehran: Tarbiat Modares University Press.
- Al-Homoud, M. (2003). *Functional distance effect on social interactions in multi- family housing in Jordan*. Volume 30.(2).165-188.
- Barati, N., Ebrahimi, H., & Faramarzi, M. (2013). *Investigating the relationship between urban land division and urban area quality in new urban development*. Armanshahr, 169-180.
- Boob, N & Rao, M. (2014). Zoning within Plot–An Approach to Land Sub Division to Control Violation of Development Control Rules. *International Journal of Multidisciplinary and Current Research*, (2): 90-98.
- Department of Housing and Community Development. (2009). *An overview of the subdivision control law*. Massachusetts. Available from: <http://www.mass.gov/hed/docs/dhcd/cd/zoning/overviewofthesubdivision.pdf>.
- *Development Management Information Guidline Series*. (2012). chapter 5: subdivision of land, City of Cape Town.
- Faramarzi, M., Barati, N., & Ebrahimi, H. (2013). The concept of zoning in new urban development. *Manzar*; (23), 3-10.
- Mehryar, M., Fatahollah., S., Fakhari, F. & Ghadiri, B. (1977). *Visual documents of Iranian cities in Qajar period*. Tehran :Shahid Beheshti University Press.
- Hall, E.T. (1966). *The Hidden Dimension*. Sydney: Anchor Books.
- James, A. & Lagro, Jr. (2008). *Site Analysis: A Contextual Approach to Sustainable Land Planning and Site Design*. Hoboken, New Jersey: John Wiley & Sons, Inc.
- Lynch, K. (1972) : *The openness of open space* /Art of Environment /Alden Ellis.
- Lynch, K. (1987). *Site Planning*. Cambridge: The M.I.T Press.
- Saeed Nia, A. (1999). *The green book of the municipality, Ministry of interior affairs, deputy of civil affairs coordinator, center of urban planning studies*. (4), Tehran.
- Saskatchewan Ministry of Municipal affairs.(2007). *A step by step to subdivision*. Saskatchewan
- Transit Zoning Code. (2010). *Street pattern concept, specific development*. California: Santa Ana.
- UNHSP. (2015). Public space. *United nation conference on housing and sustainable urban development*. Nairobi, 14 April 2015.
- Uzun, B. (2009). *Using land readjustment method as an effective urban land development tool in turkey*. *Survey review*, 41 (311): 57-70.
- Vialard, A. (2012). *Measures of the fit between street network, urban blocks and building footprints, Proceedings of Eighth international space syntax symposium*. Santiago: Chile.