



ORIGINAL ARTICLE

Effect of increasing building density on urban physical-space structure (case study: region one of Tehran municipality, Farmaniyeh neighborhood)

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ABSTRACT

The rapid growth of population in large cities and consequently, the need for housing widely from one side and avoid of urban horizontal spread on the other hand, has made necessary the construction of tall buildings as a solution to the problem of land to decrease the underlying ground by increasing the density and construction of tall buildings to settle larger population and to use free land for providing public open space and needed services. Tall buildings built in Tehran reveals the existence of numerous problems that is the effect of non-compliance with regulations concerning the location of urban planning and construction of these buildings in the city that lead to sell congestion or selling surplus building. The aims of this paper were to investigate the effects of density on the physical structure of the building in urban area, the per capita use of space and service and network communication. In the current survey, the Farmaniyeh neighborhood in the city of Tehran has been studied by SWOT method. Data collection was observation and photography. The results showed that the low number and levels of these uses in the neighborhood, the crowd due to the increasing density of buildings were also effective on per capita service and has reduced them, simultaneously. In addition, the ratio of mass and space in residential towers in the neighborhood were not considered. In addition, the imbalance of space in the neighborhood of Farmaniyeh that was the production of towers concentration at very low intervals and lack of observance of the criteria has been approved.

Keywords: per capita services, building density, real estate speculation, density and space

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INTRODUCTION

Construction density is of the categories that have been considered in the comprehensive urban plan and as a mean to control urban development and spatial balance. In these projects, construction densities have been predicted regarding to population density in the horizon of project and urban development polices and regarding to urban environmental, infrastructure and services capacities and social, economic and cultural characteristics are determined. Building density on one hand is related with urban physical characteristics and on the other hand has social, cultural, economic and environmental dimensions. Therefore, any changes in the building density can affect all mentioned aspects. Accordingly, if the growth and physical development of cities that one of its ways is to increase building density does not occur along with the creation of appropriate and adequate will lead to occur failures in various fields including utilities, infrastructure and other cases. In the field of density, different opinions and views in order to improve the quality of urban life has been proposed that in this paper, the viewpoints of some experts, such as Ebenezer Howard, Frank Lloyd Wright, Hillman weeding Jacobs and issues of urban density in several countries of world have been expressed [1].

Frank Loyd Wright

The proposed model of Broody Christy, the new urban horizontal and with very low density as a suitable environment for life proposed. In the mentioned project for every family, a parcel of land with an area of one acre was foreseen which created the environment with very low residential density. He believed that if skyscrapers are considered as an independent unit and deserves, could be proud but if it always does

not cross, with what is flowing in downward. If they do not design in open and green spaces, it would not be logical. Extreme altitude leads to ruin metropolises and nations because high buildings create shadow and civil rights of neighbors that are in the shadow are ignored. He presented the theory of tomorrow city for the decentralization of big cities. This idea suggests the possibility of scattered living in cottages of single-family. This plan did not prevent the development of large cities but has significant positive effects on confused and chaotic urban complexes [1].

Jane Jacobs

In his opinion, a high and heavy residential density, along with a compact urban structure is needed to meet variety and complete urban function. Jacobs knows urban sense of vitality and dynamism depends on dense and crowded of urban complex centers. Density and mixing of different uses and buildings plus a bustling and people activity, provides the ideal image of an urban center. Crowd centers of big cities are densely quality of urban environment living and have capacity of economic development for the community. He believes that should not fear of complexity and density of urban centers but by organizing and creating discipline should take advantages of its positive effects [1].

Urban congestion problems in the world

In urban system of Australia due to the factors of high per-capita income and car ownership index and having vast territory of land, low congestion urbanization has created in Australia. While the average density of 19 cities in Australia in 1966 was 10.98 persons in hectare, in 1986 it declined to 10.61 persons per hectare. Population density index even in five large cities of this country was less than 20 persons per hectare and in the two last decades, it has also decreased (except for Sydney that shows partial increasing). The average separated residential parcel was 700 m² and based on another statistics it was about 1000 square meters. While the population density decreased between 1966 and 1986 in the Australian cities, but if the density in terms of the number of residential units on a square kilometer measures and compares, it can be said that Melbourne, Adelaide, Perth, Brisbane were faced with increasing density. In fact, the average occupancy rate of residential units in Australia has decreased from 3.43 persons per residential units in 1966 to 2.67 persons per residential units in 1966 in residential units and this one reason of increasing density [2]. The phenomenon of excess aggregate sales that created from late of 1981 following the policy of self-sufficiency of municipals of public budget, Tehran building density in different areas increased while the boom in sales of buildings led to change the density to an important tool of urban planning and became an economic tool to generate income for the municipality. As the major source of income of Tehran municipality was of the revenues from the congestion. In addition, the density of construction that took place in Tehran following the sales density policies, significantly increased the capacity of the different areas that proposed new services and facilities needs but since the main developments in the capacity of the population were not predicted, and only were on the basis of criteria, so the services, facilities needed capacities, had not been provided. The result of this policy at the time of lacking necessary facilities, created lots of problems for the city of Tehran that can mention to increase in population density out of registered rules of comprehensive plan in most parts of Tehran, spread and increase of constructions without paying attention to services capacities and urban infrastructure facilities, changing in urban green space uses and garden to residential uses and reducing urban green space per capita (considered as an aspect of urban services and the stylize of air as well), degradation and environmental pollution caused by the construction along and on the path of rivers and valleys in the northern part of the city, land speculation and increase of land and housing prices. Despite the importance of the density matter as one of the issues of urban planning, very few and dispersed researches in this area have been done than can mention to the project conducted by Azizi et al, 2000 in title of "the principles and criteria of urban density". Their results showed that urban density in comprehensive plans, in addition to not being able to organize the urban space but also creates problems for cities such as turmoil in suburbanization, urban landscape and centralism for various reasons, including their being non-local. Farmaniyeh neighborhood due to have good weather during the past few decades, has accepted a large population and the construction process has expanded in it. However, given the problem of congestion, such as pieces of fine, failure to comply with the principles and standards of comprehensive and detailed plans for the occupied level in some cases up to 85% occupancy level was observed and increase in building density up to 240% and lack of coordination and expansion of existing infrastructure and narrow passages, overall have caused physical and visual problems in texture [2,3]. This study aimed to determine the structure density at the criteria approved master plan of Tehran. To achieve this overall objective, open level, the level of employment in the building, the location of the building on the plot, differentiation and integration of components, networks of passersby and access roads and parking lots were studied. The questions examined in this paper were "what are the effects of density on building on urban environment and how increase in building density lead to turmoil in the building and space system". Assumptions that were examined in this study include "increase in building

correlate by reducing the efficiency of services uses, increase in building density effects on urban body and environment, and increase in building density leads to chaotic in space and mass system.

METHODOLOGY

This study, on the one hand was an applied research as its aim was to improve the situation of one phenomenon and on the other hand it was a fundamental research, because its goal was discovering the general characteristics and principles of one phenomenon. The method employed in this study was the evaluation of SWOT. Information required in the study was collected by literature and document reviews, field data, such as videos, photos and impressions of the current situation of study area.

Study area

Rostamabad (Farmaniyeh) is a neighborhood in four kilometers of east of Tajrish square and in three kilometers of Gholhak. This neighborhood has limited from south to Darous, from east to Ekhtiyariyeh and Pasdaran and from west to Chizar and Qeytariyeh. This neighborhood has divided into two parts including north Rostamabad (northern part) and south Rostamabad (southern) that after establishment of Sadr highway divided in two parts that its north part has located in northern part of the highway and the lower part in the region of four. Good weather during the past few decades has caused Farmaniyeh to accept more population and the construction process to increase day by day. Due to the congestion problems that existed in this area like small fine, failure to comply the principles and standards of comprehensive and detailed plans for the occupied level. in some cases, occupancy level up to 85% has been observed. And increase of building density up over 240% and lack of coordination and expansion of existing infrastructure, and narrow passages, overall have caused physical and visual problems in texture. Location of the study area and the land uses has been marked on the map (Fig. 1) [3].

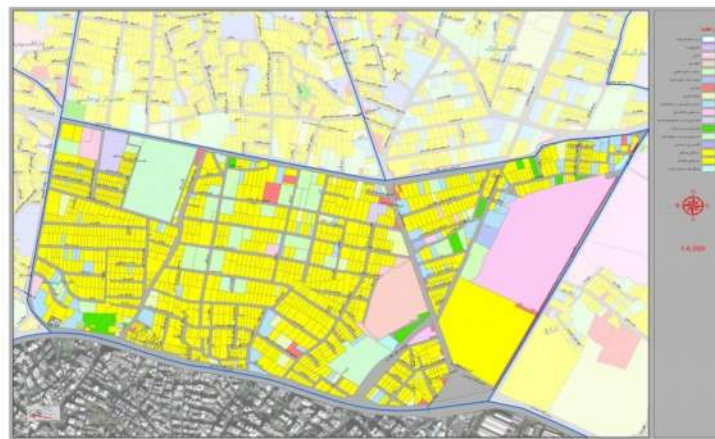


Fig 1. Map of land uses

RESULTS

Evaluation of physical-spatial effects of increase of building density in Farmaniyeh neighborhood. The results showed that more parcels were four-story or more and with low width of streets, and by creating shadows on opposite buildings have led to their improper light and inducing fear and insecurity for pedestrians. On the other hand, due to improper distribution of numbers of different floors in tissue has caused heterogeneity and visual disturbances and discontinuities in the skyline in the area. By the way, because of not paying attention to principles and standards of detailed and comprehensive plan the neighborhood has encountered by parcels small grain and lack of heterogeneity and expansion of current infrastructures and narrow wide passages. Table 1 and 2 shows the results of investigating the effects of increasing building density on urban form and landscape in Farmaniyeh neighborhood using SWOT method.

TABLE 1: THE STUDY OF URBAN FORM IN THE NEIGHBORHOOD FARMANIYEH USING SWOT METHOD (AUTHORS)

Threats	Opportunities	Weaknesses	Strengthens
- danger of increasing building density in the area -danger of improper access to area	-possibility of parcels integration -possibility of improvement of passersby network -possibility of adjacent concords in future projects	-creating heterogeneity in texture -lack of concordance with adjacent -narrow wide of urban passersby -compressed texture -high level of land occupation	To be northern-southern of most buildings in the area

TABLE 2: STUDY OF URBAN LANDSCAPE IN FARMANIYEH NEIGHBORHOOD USING SWOT METHOD (AUTHORS)

Threats	Opportunities	Weaknesses	Strengthens
-danger of continuity in small grain and compressing in old parts of the area -danger of increasing building height process	-possibility of construction or reforming the old parts of tissue -possibility of increasing green spaces to increase visual aesthetics of the area	-high raised buildings have hidden the urban symbols -heterogeneity in sky line -limitation and blocking of visual corridors with present of high buildings -no concordance and preserving visual relation between old and new constructions	-presence of urban symbols

Evaluation of a building density in Farmaniyeh neighborhood

In the study of building density at the current situation of study area, a total number of 1469 parcels that covered about 242,260 square meters and regarding that the total square of built building in these parcels were 574,701 square meters, the average building density in the neighborhood have determined equivalent to 167 percent. Due to presence of high old and distressed parcels in the area, it is predicted that this percentage increases in the future years simultaneously (Figs 2,3).Regarding to congestion problems in the area like to being small grain of parcels, and not paying attention to principles and standards of detailed and comprehensive plans in the case of occupation in some cases occupancy level has been observed up to 85% (<http://www.my-tehran.ir/> accessed: noy 2014) (Tables 1-3).



Fig 3. Massive construction were dominant on other around buildings and open space (reference: the authors).

TABLE 3: FUNCTION AND PER CAPITA OF DIFFERENT USES OF SERVICES (AUTHORS)

Comparison	Recommended per capita	Current per capita	Per capita recommended by comprehensive plan	Kind of uses
Non favorable	-	-	0.05	cultural
Non favorable	0.43	0.7	1.5	Educational
Non favorable	0.01	0.02	0.07	Sport
Partially favorable	0.06	0.1	0.08	Religion
Non favorable	0.10	0.17	1.7	Green space
Non favorable	-	-	0.2	Parking
Partially non favorable	4.04	6.5	6.8	passersby
Favorable	0.01	0.02	0.05	Industrial
Non favorable	0.12	0.2	0.12	Commercial

DISCUSSION

According to the theory of centralism, Wright believes that if skyscrapers do not design in green and open spaces, it would not be reasonable and high altitude leads to ruin the nations and metropolises as it will create shadow and neighborhood civil rights that under this shadow will be ignored. He presented the theory of tomorrow city for the decentralization of big cities (Bashiri and Attarzadeh, 2008) that shows the evaluation of study area, heterogeneity in the skyline, obstruction and restriction of the visual corridors that is in accordance with proving first hypothesis. Following the theory of integration density, Jane Jacobs believes that consolidation will lead to benefit from the various services and creates several open spaces and also presents environmental with more urban services. However, evaluation of study area and proofing the second hypothesis shows that increase of building density reduces the per capita of municipal services that were inconsistent with the theory. According to the theory of compact city, Hillman believes that living in high densities have impacts on the lives of people that are not necessarily negative and is a way to reduce short-haul traffic and pollution as well that regarding to the third hypothesis and using defined SWOT expressed in the result table it can be concluded that increase in buildings densities lead to reduce passage width and improper access that was inconsistent with the idea of compact city of Hillman.

About first hypothesis, it seems that one-dimensional look to the category of building density can has irreparable negative consequences and harmful effects on the body and the urban environment. By proving hypotheses 2 and 3, the first hypothesis proved too. As all factors about differences created among rules and principles of urbanization with that has happened in Farmaniyeh neighborhood, is the result of one dimension attitude toward the density issue as an income tool for municipality and housing developers that has increased the population capacity of the neighborhood, simultaneously and has reduced the efficiency of municipal services. Furthermore, the imbalance of spatial in the neighborhood that was the result of high-rise residential towers accumulation at very low distance and lack of attention to registered rules and principles. Of another finding of unilateral policy was selling excess congestion in the city, and consequently, in Farmaniyeh neighborhood. So, the first hypothesis was confirmed. In terms of the proposed master plan for tall building, several factors have to be considered simultaneously that proper precautions were taken due to the tall building and maintaining a balance between mass and space. If the area of the plot in relation to building height (number of stories) and also in relation to the occupied area of open space be observed, not only the construction of any high-rise building would be done in accordance with the principles, but also the spatial inequality in the area would be maintained. But, if any buildings constructed out of principles and items such as occupancy level standards and open space level in relation to parcel size and number of stories repeated and not regarded, in the study area the balance between space and mass would be ruined. Accumulation of a large number of towers that in their construction, relevant regulations have not been considered and have increased the ration of atmosphere to space and have ruined spatial balance. About the second hypothesis, it seems that increase in building density in the study area has been done out of principles and rules of municipality in a way that has led to decrease the service uses and communication networks in the area. The results of the evaluation of the status of communication networks and services uses in Farmaniyeh neighborhood showed that in addition to low levels and numbers of land uses in the area, increasing the population density result of increase in buildings per capita also effect on service per capita and has reduced, simultaneously. As the study, area has encountered disadvantage in case of services. Therefore, the second hypothesis of the research proved. About the third hypothesis, it seems that increase in building density in the study area was taken outside of town planning principles and measures and resulted in the lack of organization in space and atmosphere. Assessments made in the context of atmosphere and space in residential towers proved this result that the master plan rules for higher buildings that respecting to principle creates favorable ratio of space and atmosphere, have not been respected in Farmaniyeh neighborhood in a way that there was about 70% differences in 4 of the 5 criteria. Therefore the third hypothesis proved.

CONCLUSIONS AND RECOMMENDATIONS

Building density as one of the important issues in urban planning and as a control tool for urban development and balancing space is proposed. Increase in building density effects on the urban environment and has vast physical and spatial effects. Therefore, one-dimensional approach to the issue of congestion causes irreparable damage to the urban body and environment. Extra density sales only in case of income for the municipality is of one-dimensional view to density matter that has created non favorable results including reduction in area and open space per capita levels and risks and problems resulting lack of attention to proper distance between buildings. If increase in building density, levels and urban services uses do not add in comparison to increase in population density, shortage in urban

services and reducing the existing services efficiency would be the inevitable result of increase in density. Proper combination between space and atmosphere such as respect to the appropriate ration of space and atmosphere, respect to putting distance between high-rise buildings and presence of enough open spaces for each building lead to create cohesion in the urban fabric and can create a favorable environment. Failure to observe this phenomenon at the time of the accident can cause risks to residents. Since the building density relates with concepts such as the level of occupancy, number of floors and area of open space, therefore has decisive effect on the amount of open and occupied spaces. So, one of the important effects of changes in structural density, would be changes in land use and at the next stage, changes in how the space will be used. So, the building density can be considered as an important tool in organizing urban physical and spatial areas. In some cases, the effects of increased building density, in the area of the city due to its special features will benefit from considerable sensitivity. In such cases, it is necessary to determine the density amount and height of buildings for each segment separately with regard to the conditions and characteristics of the piece and also regarding to the placement way, height and other characteristics of adjacent structures. Frequent changes in the balance of atmosphere and space have significant effects on the urban landscape and body and construction of high-rise buildings in inappropriate distance and very little distance with each other will ruin the spatial and atmosphere balance. Therefore, as building density distribution in case of creating spatial balance at urban level is very important, at local level it also has considerably importance. Tended to increase building density in some neighborhoods of Tehran including Farmaniyeh neighborhood is result of environmental, social, and cultural attractions, of these neighborhoods and land value. Because the proceeds from the sale of excess density in the areas have not used to improve neighborhood services needs and have met the needs of whole areas of Tehran, so have faced these neighborhoods with crises. If this trend of increase in density and reduction in per capita in the long term continues, it can be predicted that all values, attractive qualities of construction and population in these neighborhood decline and gradually disappear. Review and emphasizing on unfavorable effects of increase building density does not mean ignoring the strengths and weaknesses of the concept of saving in land use, infrastructure costs, more and better productivity of them as well as the diversification to urban environment. This point should not be forgotten that if the increased building densities carry out by considerations of physical, economic, and social characteristics would have many benefits. What is problem in this case is uncontrolled increase of building density without providing appropriate facilities[4-11]. Based on the findings and results the following recommendations are presented:

1. Any change in the density of construction requires a thorough planning process that related to understanding the basic principles and criteria of structural density. In this regard, having enough information about the spatial-physical effects (increase or decrease) of changing in building density in each range for planning is essential.
2. Changes of density of buildings are of the tools of diversification to urban environment. Use of these tools requires consideration of all environmental, social, cultural and clear policies and appropriate criteria.
3. The effects of increased building density when combined with increasing population density, takes a broader dimension. Therefore, it is necessary to control the various effects of population density by respecting to building density control regulations that have a restrictive effect on the number of residential units as an indicator of population capacity.
4. Accesses to urban services are of important elements in determining the quality of urban life in every interest area. Since building density can effect on function and service uses per capita, therefore, in deciding in the case of increasing building density, efficiency of service must be considered.
5. The most important determining factor in building density in Tehran is dependence of municipal revenue to income source of sale of congestion. So one of the important solutions to the problem of building density in Iran is gradual decrease in dependence of municipal revenue to this income source. In this regard, the need to create a healthy and sustainable sources of income for urban management entity seems absolutely necessary.
5. Since the metropolis of Tehran in recent years has undergone a major transformation in the field of spatial- physical resulting from uncontrolled increase of building density, preparing a comprehensive plan for the metropolitan of Tehran that considers all aspects related to the issue, would be an important step, in order to avoid the problems to continue [4-11].

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