



## Assessing Tehran's Urban Structure Effects on Non-Compliance with FAR Regulations

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**ABSTRACT:** Building contraventions have become one of the important dilemmas of many cities like Tehran. The wide aftereffects of the contraventions and the large cost of removing their negative effects, make the reduction of the possibility of their occurrence essential. This paper tries to find the reasons and roots of building contraventions in order to prevent their occurrence through appropriate planning, legislation and decision making. In this paper, it is supposed that some urban conditions and location characteristics could result in more opportunities for the occurrence of building contraventions. Therefore, it tries to find the relationship between Tehran's urban structure and the most dominant kind of building contravention in Tehran, FAR contravention. To study the relationship, the effects of physical, social, economic and functional factors describing Tehran's urban structure on the occurrence of FAR contravention is surveyed using the correlation method. The results showed that the majority of factors are related to FAR contravention with confidence coefficient of 99% and 95%. Among them, the main factors are residential per capita, average building price, residential land use area, transport network area, total residential building floor area and the average residential plot area. Therefore, specifying the effects of various factors on the occurrence of building contravention causes their prevention to be more feasible.

**Keywords:** Urban Structure, Building Regulation, Building Contravention, FAR, Tehran.

### INTRODUCTION

Building contraventions have become one of the important dilemmas of many cities in the world like Tehran. In fact, one of the urban management concerns in cities like Tehran is finding suitable solutions to lower the contraventions. Thus, the identification of the causes of the building contraventions and finding the factors affecting their occurrence is the first step to respond the dilemma.

Building regulations are adopted to assure the quality of life in a city and respect civil rights. Building bylaws and regulations determine what is permitted to be built (Sarkheyli et al., 2012). They are building standards or the operational tools of master plans that non-compliance with them might have wide social, economic, physical and spatial effects.

Beheshtiravi (1993) defines building contravention

as non-compliance, disregard, disobeying, breaking the urban construction law. Zangiabadi et al. (2010) point to the major aftereffects of building contravention in the urban sprawl growth, growing unsafe building, slum and shanty areas, landscape destruction and imbalance between vertical density, population density and etc.

Ignoring the illegal building activities, getting fine, imprisoning and obligation to destroy or modifying the violation parts of buildings are some of the methods applied by urban management in different communities against the owner of building contravention. In Tehran, the municipality is responsible for controlling building contravention through obligation to destroy or modify the unauthorized part of building or getting fine from the owner of the land and building. However, Tehran municipality is still envisaged with a large number of building contraventions. Thus, the most effective way to control the contraventions might be replying to the major causes of the contraventions.

In this paper, it is supposed that some urban characteristics cause more opportunities for occurrence of building contravention. Based on this assumption, we

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try to discover the causes of the most numerous kind of building contravention in Tehran, FAR contravention.

### FAR CONTRAVENTION

Floor Area Ratio (FAR) is the most important tool among the tools used to regulate or guide urban development. FAR values mainly determine the density or intensity of development of an area. In fact, density measures the degree to which a space or area is filled with people, residential structures or built-up floor area. And FAR conveys a sense of the bulk or mass of a structure and is the ratio of total building floor area to the area of the plot.

Therefore, FAR contravention could be defined as building in an area more than the limits specified in terms of permitted building density or FAR regulations. Azizi

(2002) stated that any change in building density results in tangible and short-term effects on society and physical structure of the city. The social, cultural, environmental effects of decisions about building density overshadow the quality of life of residents in local scale. Moreover, amenity of buildings, accessibility, shading, and traffic are influenced by this. In addition, he points to the aftereffects of non-compliance of density limitations as the imbalance of population density, destroying the spatial order and main structure of the city, destruction of gardens and green spaces as the sources of respiratory and exacerbation of social and cultural issues of neighborhood residents.

Reviewing literatures about building contravention, there are various kinds of building contraventions; that some of them lead to non-compliance with FAR regulation (Table 1).

**Table 1. Types of Building Contravention**

Type of Contravention	Cities or Countries in Which the Contraventions Have Been Reported
Adding illegal storey and terraces to building	Turkey (Kahraman et al., 2006), Tehran (Diargah, 2010)
Construction of auxiliary and concomitant objects such as garage, stores, shades, closet, etc.	Belgrade (Zegarac, 1999), Tehran (Diargah, 2010), Old Salt, Jordan (Alnsour & Meaton, 2009)
The building contraventions causing the FAR regulation to be ignored.	Ibadan, Nigeria (Arimah, Adeagbo, 2000), Tehran (Diargah, 2010)
	Belgrade (Zegarac, 1999)
	Belgrade (Zegarac, 1999), Ibadan, Nigeria (Arimah, Adeagbo, 2000), Tehran (Diargah, 2010)
Building without development permit	Jakarta (Winayanti, 2004), Greece (Ioannidis et al., 2009), Benin (Ogu, 1999), Tehran (Diargah, 2010, volume3)



Other building contraventions	Informal urban land occupation	Turkey (Kahraman et al., 2006), South Africa (Huchzermeyer, 2004), Sub-Saharan Africa (Fekade, 2000), Mexico city (Aguilar, 2008)
	Lack of basic utilities (kitchen, bathroom, toilet, etc.)	Ibadan (Arimah, Adeagbo, 2000)
	Changing the purpose of the building	Belgrade (Zegarac, 1999)• Ibadan, Nigeria (Arimah, Adeagbo, 2000), Sao Paulo & Johannesburg (Few et al., 2004), Sub-Saharan Africa (Fekade, 2000), Tehran (Diargah, 2010)
	Illegal dwelling construction	Belgrade (Zegarac, 1999)
	Poor ventilation and insulation	Ibadan, Nigeria (Arimah, Adeagbo, 2000), Old Salt, Jordan (Alnsour, Meaton, 2009), Sao Paulo & Johannesburg (Few et al., 2004)
	Informal subdivision of residential and commercial buildings lands	Sao Paulo & Johannesburg (Few et al., 2004), Sub-Saharan Africa (Fekade, 2000), Jakarta (Winayanti, 2004)

In other words, adding illegal storey and terraces to building, construction of auxiliary and concomitant objects such as garage, stores, shades, closet and etc., non-compliance with plot coverage and occupancy ratio, changing the outline of a building, deviation from the setback line and building without development permit may lead to increase in the total floor area built in a plot and so lead to FAR contravention.

As urban planners try to set FAR regulations according to location differences and characteristics, the number of FAR contravention might be associated with spatial differences and urban structure.

### URBAN STRUCTURE AND ITS EVALUATION FACTORS

Generally, urban structures could be assessed through the study of urban morphology. M.R.G. Conzen, the father of urban morphology of Anglo-Saxon, considers the components of urban form in three structures including: plan, texture and land use. The components could be interpreted in five major parts: plan (macro form, network plan, and detailed category), segmentation, texture (age, style and the height of buildings, open or public spaces and etc.), land use (the function of different parts of the city), site (topography, streaming water, vegetation) (Allain, 2009, p. 14).

There are various approaches to urban structures. Sometimes, urban structures are considered regarding to the transport network of cities. Some scholars like *Homer Hoyt* have considered urban structure regarding

to the economical condition of residents, their income level and functions of different districts of cities. *Edward Ullman* and *Chauncy Harris* have focused on the functional structure of cities and *E. W. Burgess* use the social and economical factors to describe urban structure. In addition, *Shieh* (2010) explains that the spatial and physical structure of cities is affected by environmental, economic, social, physical, managerial, legal and technical factors. On the other hand, some urban scholars like *Sitte*<sup>1</sup>, *Kerier*, *Alexander*<sup>2</sup> and *Tavassoli*<sup>3</sup> look at the urban structure from the aspect of urban design and consider the physical relations between buildings, urban functions including transport networks, open and public spaces, building densities, sub-cultures of residents and population density.

Today, understanding the spatial structure and form of cities could be one of the main factors in success of urban planners and related experts in the improvement of urban environments (Rahnama & Abbaszade, 2008, P. 99). In this paper, the urban structure could be defined through the characteristics of physical, social, economic and functional structures of cities. In other words, the physical and functional form of urban development including building density (FAR), the average floors of buildings in different parts of a city, fine or coarse grained texture, the spatial distribution of green spaces or arid areas, the transport network area, the land use of different parts of city, the spatial distribution of population including their specific social and economic characteristics are considered in this study.



## RELATIONSHIP BETWEEN URBAN STRUCTURE AND BUILDING CONTRAVENTION

There are not many surveys conducted related to the causes of building contraventions and most of them have identified the causes of building contravention in general, without focusing on a specific kind of building contravention. Sarkheyli et al. (2012) have summarized the causes of building contraventions mentioned in the surveys in four issues, including the natural process of urbanization, social and economical factors, defect of building regulations, and by-laws and unsuitable and inefficient urban management's activities. Some of the surveys have addressed all of the issues as the reasons of building contraventions, while some focus only on one or a few of them.

Besides, the general characteristics of societies would widely affect on the number of building contravention. The unsuitable physical condition resulted from building contraventions would lead to the intensification of unbalanced condition in a neighborhood or the whole city in various aspects including social, economic, physical, environmental and functional characteristics of cities.

Kamyar (2008) in his book "Urban Law" mentioned two important factors affecting urban crimes. The first factor points to the special relationships between citizens and the social structure of a city. The second factor relates to the physical form of a city. According to him, on one hand, cultural conflicts which is the result of immigrations, weak cultural foundations, no sense of belonging to cities, changing values and norms may increase the urban crimes including building contraventions. On the other hand, inappropriate or unplanned physical form of the urban spaces, narrow passages, high densities in urban areas, brown fields and arid lands among developed lands, irregularity among buildings, inadequate space between buildings, unsafe and unsanitary condition of buildings and urban spaces can create a convenient setting for urban crimes including building contraventions. In other words, crimes occur in response to complex interactions between social, economic, political, physical, and psychological and environmental factors (Appiahene, 2002).

Overall, some parts of the large cities are faced with more non-compliance with building regulations comparing to others. In other words, the concentration of building contravention in some parts of cities points to more convenient opportunities for building contravention in the places. Sarkheyli (2010) discusses that non-compliance with building regulations occurs more significantly in some parts of cities involving with

more social-economical problems like poverty and lack of awareness. For example, marginal and slum areas that mostly settle the low income, low literacy and not absorbed households in the suitable urban occupations are the major parts of large cities envisaging with the building contravention problem in different levels in developing countries.

The chance to find cheaper land and construct low-cost building provide opportunities of non-compliance with building contravention specifically in some urban areas like urban fringes, unsuitable, unplanned and without necessary services urban areas. Moving to fringes or to pre-urban areas (cheap land prices) is one of the causes of informal housing according to the study of Fekade (2002) in Sub-Saharan Africa. On the other hand, better environmental conditions in some urban areas and the lower costs of land occupation and development provide building contravention's opportunities. Ioannidis and Psaltis (2009) point to better environmental condition, lower prices of agricultural land parcels and low profit from agricultural products, as the causes of informal and unplanned development and the destruction of large agricultural lands in Greece.

On the other hand, the social-economic characteristics of a place identifying the people, community groups and activities who are settled there can be effective on the provision of suitable settings for urban crimes such as building contravention. According to Alnsour and Meaton (2009), social-economic factors including household size, household income, public awareness and finance are the effective factors in the extent of compliance with building regulations in Old salt, Jordan. In addition, according to Arimah and Adeagbo (2000), poverty, literacy and lack of awareness are mentioned as the causes of unauthorized buildings in Ibadan, Nigeria. Likewise, Huchzermeyer (2004), Zegarac (1999) and Fekade (2000) mention the inequitable urban structure, unequal access to the urban economy and unbalanced development of the city and spatial segregation as the reasons of building contravention. In addition, the A100CTM (2001) stated housing needs as the most important reason of building contravention in Tehran. Also, obviously the quantity and quality of housing needs are different in different parts of a city depending on their social and economic characteristics.



**METHODOLOGY**

To convey the relationship and effect of Tehran’s location characteristics and FAR contravention, the statistics about FAR contravention have been collected from Article 100 Commission of Tehran Municipality (A100CTM) which is legally responsible for handling building contraventions in the city. In this paper, the total areas of FAR contravention in various municipality districts (1 to 20) from March 1998-March 2009 are considered as the amount of FAR contravention in Tehran.

As it was mentioned, location characteristics of a city can be explained depending on four general factors

including social, economic, functional and physical characteristics as the first level factors and some indexes defined to explain the substantial characteristics of a city are applied in the second level (Table 2). One of the reasons for selecting the indexes was the possibility and accessibility of their attributes in each urban district. The data about the social, economic and physical characteristics of Tehran’s districts are achieved from Statistical Centre of Iran, Tehran’s Master and Detailed Plans in 2006 and the data about urban land use as functional characteristics of Tehran, are achieved from the census workshop in 2002. The data collected are from the municipal districts (1 to 20).

**Table 2. The Factors and Indices Explaining Tehran’s Urban Structures**

First level	Social	Economic	Physical	Functional
Second level	Population size	Average building price	Numbers of dwelling unit	Residential land use area
	Population density	Average rent	Average residential FAR	Commercial land use area
	Household numbers	Average land price	Average floor	Official land use area
	Persons per household	Employed population	Percentage of non-resistant buildings	Green space area
	Average residential dwelling area	Car ownership ratio	Percentage of semi-durable buildings	Transportation land use area
	Ownership of dwelling ratio		Average residential plot area	Arid land area
	Residential per capita		Total residential building floor area	

Bivariate analysis, applied in this study, is the simplest form of analyzing relationships of two variables (FAR contravention and each index describing Tehran’s structure). There are two commonly used bivariate analysis—correlation and regression. It is important to notice that correlation is used to determine if there is any relationship between two variables. Regression is used to determine how independent variable(s) affect a dependent variable (Wang & Hofe, 2007, p. 30). In this research, beside interpreting Tehran’s urban structure and the distribution of FAR contravention through maps made by ArcMap software, the relationship (intensity and their sense) of the indexes and FAR contravention are calculated through Pearson Correlation method.

**URBAN STRUCTURE OF TEHRAN**

Spatial distinctions in Tehran which derives from the first transformation period of the city, Madanipour (2002) explained it during 1861-81 and after the destruction of old walls of the city, is one of the major and obvious characteristics of Tehran in different aspects including land and building price, social, cultural and economical relationships existed in the city. The distinctions are obvious in the social-economic, cultural and functional differences and classification gaps between northern and eastern districts of Tehran. Taleghani (1992) believes that emigration has been a significant factor in the increase of Tehran’s population and the city’s spread. The considerable extent, which is the result of natural



population growth, emigration and gradual merger of main city with rural places and suburbs, includes various structures in different districts.

The study of population dispersion in Tehran's districts showed the imbalanced population distribution in the city. During the recent decade (2001-2010), most people have been resided in the northern and eastern districts that provide more and better housing opportunities (most of dwellings have been built in northern and eastern districts of Tehran). In recent years, as a result of urban degradation in central and original parts of the city and the gradual incompatibility of the areas for residence, severe air pollution problems, overcrowded and busy streets and urban spaces, more commercial and workhouse land use demands in the city centre have led to the decrease of residences in the areas (Sarkheyli, 2010, p. 64). However, the study of population density distribution in the city (Fig. 2) shows the higher population density in central districts. To explain the social inequality among Tehran's districts, average persons per household in the districts can be pointed. So, while the districts located in southern and eastern boundaries of the city have the highest average persons per household (4 pph<sup>4</sup>), the measures in the northern and central districts of the city are the lowest (3.1 to 3.4 pph). In addition, to explain economic inequality among the districts, land and building prices can be mentioned. The prices are significantly higher in northern districts of the city (Fig. 3).

The central districts include organic and traditional textures. There are still narrow passages and non-resistant buildings built by clay and mud in the districts. Depending on the studies done for the new master and detailed plans of Tehran, the highest percentages of non-resistant buildings has been reported in the central districts. Also, the non-durable buildings' percentages in southern districts are more than the percentages in the northern districts. The northern and western districts of the city mostly involve new and modern buildings with good quality. Regarding to the study, the most stable buildings are located in the north-east of Tehran (Fig. 5). Furthermore, in some marginal districts specially the eastern and southern districts, there are areas which are mostly unorganized and are the results of informal and illegal constructions which have begun in about 1960<sup>th</sup> decade and followed till 1996. The social-economic and physical conditions of the districts are not appropriate. In addition, the similar slum areas are found in smaller extents near the urban streams and some inconvenient places within urban areas (Sarkheyli, 2010, p. 63).

The comparison between the average building densities in various Tehran's districts (Fig. 4) shows

higher building density in central and eastern districts. Regarding to the average floor in the districts, the highest heights are related to the northern districts while the districts located in the south-west and north-east have the least heights. On the other hand, although the central districts involved fine grained textures (the average size of residential plots is less than 300 square meters), the textures forming the northern districts have larger plots (the average size of residential plots in the districts is more than 400 square meters). In addition, the districts located in the south except districts 19 and 20 involving large industrial areas, have smaller parcels than the northern districts.

The study of land use distribution in Tehran shows that the most areas devoted to the residential land use belonged to northern districts while there are large areas devoted to industrial and workshop activities in the south-east of Tehran and the residential area in the districts is not significant. In addition, the official activities are mostly located in central districts, the commercial activities concentrated in the old center of the city (district number 12) and services activities are considerable in the east and north of Tehran respectively (Fig. 6 and 7). The green and arid land areas of central districts are much less than other districts and the area devoted to the transportation network in central part of the city is the least.

Therefore, the spatial distinctions in Tehran have formed the setting in which building contraventions like FAR contravention occurred. Thus, the setting may be implicated to the spatial distribution of FAR contravention in the city. As it is shown in the following, the status of FAR contraventions in Tehran and its spatial distribution can be seen.

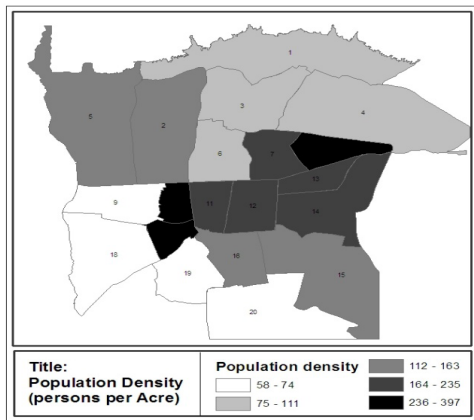


Fig. 2. Population Density in Tehran's Districts (Persons per Acre)

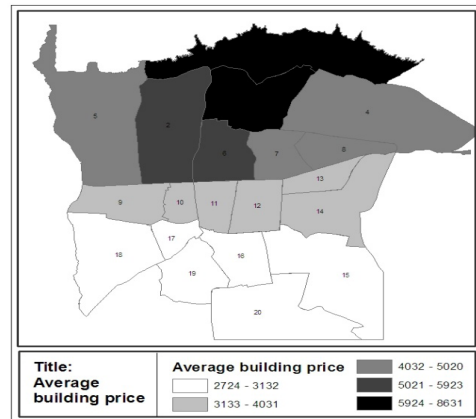


Fig. 3. Average Building Price (Thousands for Each Square Meters)

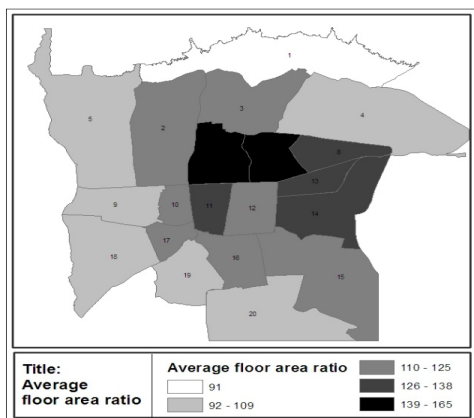


Fig. 4. Average Floor Area Ratio (FAR) In Tehran's Districts

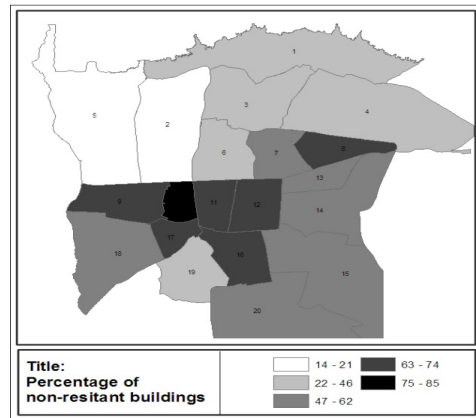


Fig. 5. Percentage of Non-Residential Buildings

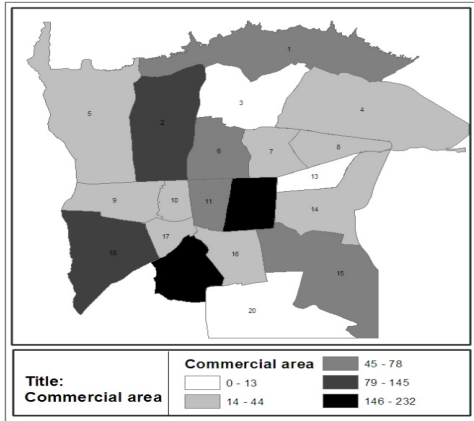


Fig. 6. Spatial Distribution of Commercial Land Area

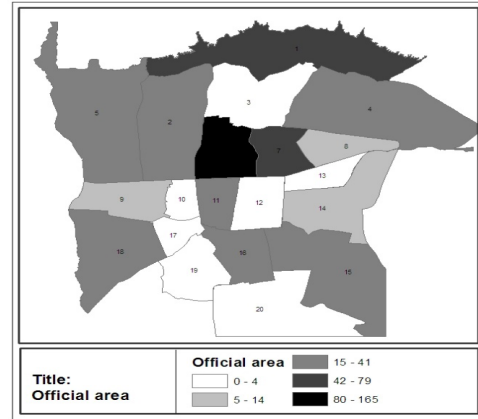


Fig. 7. Spatial Distribution of Office Land Area (Thousand Square Meters)

### *Non-compliance With FAR Regulations in Tehran*

The evolution of cities, the necessity to organize and control urban development and the appearance of planning approaches during 60th decade cause the first regulations about city and city life to be adopted in Iran. Therefore, some regulations about setback, roads' development, their widening and their pavements were proposed (Diargah, 2010). In parallel to the city's evolution horizontally and vertically and the increase of necessity to control urban growth, some limitations in building and construction such as FAR, land use limitations and boundaries for development were determined in different urban zones through urban plans. Vertical growth of the city, the expansion of living in apartments and tall buildings, the raise of new interactions in urban life and the IT development have caused urban lifestyle and urban elements to change. Thus, construction supervision, the provision of necessary parking lots, elevators for apartments, healthy facilities for buildings, respect to neighbor's rights through regulations have been vital. After the increase of the complexity of urban issues, new regulations and limitations have been passed for growth control of the city by urban management. FAR and land use regulations, the two substantial regulations proposed in the final stages of urban planning, imposed the major limitations on urban buildings and constructions. The regulations have been changed as planning approaches

and management methods shift.

According to Tehran's master plan in 1970, there were different FAR bylaws (from 80% to 180% depending on the parcels' location), lot coverage (usually 50% or 60%) and land use regulations in different urban zone. According to the municipalities' law, passed in 1966, the official responsible for building contravention's investigation is A100CTM. However, because of the temporary shifting the responsibility to criminal courts during 1983-88 and the court's inattention to the consequences of building contravention and the importance of respecting building regulations, most of the building contraventions like illegal land use change, illegal building in the fields maintained for green spaces or such necessary public land uses, illegal commercial units, buildings without building permit outside the city boundaries have been compromised by the court.

That municipalities in Iran became financially independent from government, land shortage became an acute problem, Tehran's first master plan outdated, Supreme Council of Architecture and Urban Planning approved some regulations about tall buildings in order to direct urban growth more vertically and limit its sprawl in 1990, municipality's disagreement about Tehran's reorganization plan in 1991, let Tehran municipality find the sale of more FAR and various land use permits as the feasible way to supply its costs. In other words, the municipality tried to get income by selling building bylaws. The FAR sale was done without enough





investigation about the footprint of more FAR on the city, the consideration of factors such as respecting privacy, necessary day lighting of urban spaces, the provision of facilities, infrastructures and services needed for the more persons residing, working or visiting such places. The increase of construction tendency and the profitability of construction industry accelerated the illegal trends to the extent that more than 30 million square meters of extra FAR were sold in Tehran during 1996-1992 and about 4 million square meters of extra FAR were sold only in 2002 (Hamshahri Daily Magazine, 2003).

Overselling extra FAR and other bylaws in Tehran and emerging the serious consequences of non-compliance with building regulations in different aspects, including urban landscape, traffic and urban transportation, over-capacity usage of urban infrastructures and critical arterial networks, resulted in passing two bills, bill number 269 and 329, by Supreme Council of Urban Planning and Architecture and Article 5 Commission of Tehran Municipality, in order to regulate the extra FAR selling trend (Diargah, 2010). By ignoring the building regulations in common urban constructions and the disagreement of Tehran municipality and some owners about the price of extra FAR resulted in more than 1.5 times of FAR contravention during 1997-91. In addition, in parallel to the FAR contravention, illegal land use change and construction without building permit, large amounts of parking lot deficits contravention were reported to Tehran municipality.

In 2002, the trend of selling FAR and other building bylaws were abandoned according to the mayor's decision and the next year, bill number 329 was modified in order

to prevent irregular and excessive horizontal growth of the city. According to the bill, the transfer of extra FAR should be done depending on the building's registration number and related building permit (Diargah, 2010). However, the bill could not resolve the city problems about building densities and also led to more visual disturbances in some areas, existed polarized urban spatial structure, decrease of renovation's opportunities in degraded fabrics and the drastic reduction of constructions. But during the next years, the former selling trend continued through various pretenses and temporary guidelines.

In current decade, the most occurring building contraventions in Tehran include FAR contravention, illegal land use change, parking deficit and construction without building permit, respectively.

FAR contravention, considered in this paper, is the dominant building contravention in Tehran. 46376 FAR contraventions have been reported to A100CTM during March 1998 to March 2009. It means that averagely 40 % of the constructions in the city during the time have involved the contravention. FAR contravention has been occurred in various areas from two square meters to more than 5000 square meters. The contraventions in Tehran include adding illegal floors, illegal extension of floors, illegal transformation of parking lot supplied in ground level to residential application, illegal transformation of underground, stores and open spaces to residential application, decrease of patio dimension, balcony or staircase and their transformation to residential application, increase the occupied area of a plot more than the legal size (Sarkheyli, 2010, p. 83).

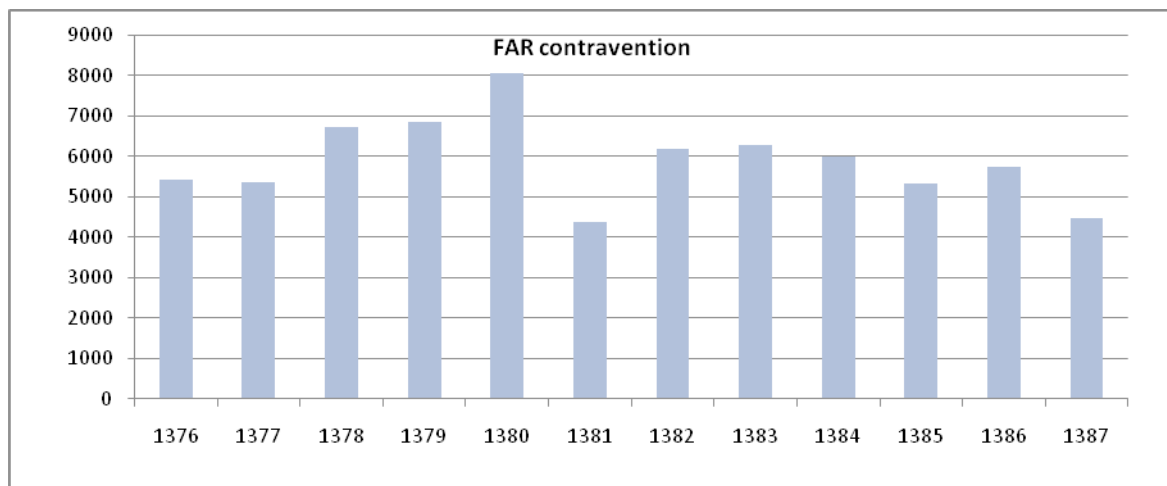


Fig. 8. The Number of FAR Contravention Reported to Tehran Municipality (March 1998-March 2009)



The amounts of FAR contravention are considerable in all the urban districts except central districts of the city (Fig. 7, 8). The study of the area of FAR contravention

in Tehran's districts shows that the average areas of FAR contravention in northern districts are higher than southern districts.

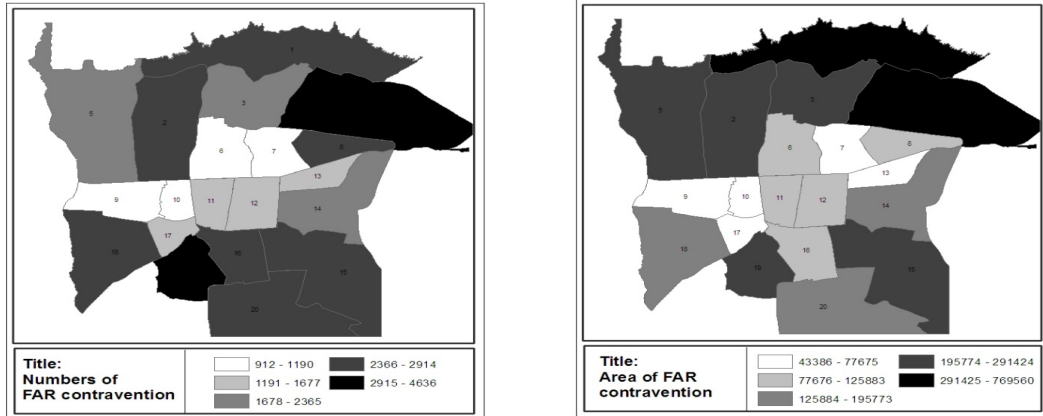


Fig. 9, 10. Distribution Pattern of the Numbers and Total Area of FAR Contravention in Tehran

## RESEARCH FINDINGS

Correlation analysis of urban structure indexes regarding social, economic, physical and functional characteristics with FAR contravention is shown in table 3. According to the table, the most important indices related to the total area of FAR contravention are residential land per capita, average building price, employed population in construction industry, residential area, transport network area, total residential floor area of buildings, average size of residential plots.

In addition, some indexes including population size, number of households, average size of dwellings, percentage of building ownership, average rental price, employed population, green space area, arid area, number of dwellings, average floor area ratio (FAR), percentage of non-resistant buildings, percentage of semi-durable buildings are correlated with FAR contravention with confidence coefficient of 95%. The negative correlation coefficient means the inverse relationship and the positive coefficient means in line relationship.



**Table 3. The Correlation between Indexes Describing Tehran’s Structure and FAR Contraventions**

	First level	Second level	Pearson Coefficient
	<b>Factors and indexes describing urban structure</b>	Social	Population size
Population density			-0,432
Household numbers			0.519*
Persons per household			0.108
Average residential dwelling area			0.537*
Percentage of building ownership			0.522*
Residential per capita			0.645**
Economic		Average building price	0.609**
		Average rent	0.499*
		Employed population	0.519*
		Average land price	0.324
		Car ownership ratio	0.438
Functional		Residential land use area	0.786**
		Commercial land use area	0,009
		Official land use area	-0,021
		Green space area	0.535*
		Transportation land use area	0.672**
		Arid land area	0.536*
Physical		Numbers of dwelling unit	0.523*
		Average residential FAR	-0.556*
		Percentage of non-resistant buildings	-0.48*
		Percentage of semi-durable buildings	0.467*
		Total residential building floor area	0.602**
		Average residential plot area	0.65**
		Average floor	0.237

\*\*Correlation is significant at the 0.01 level.

\*Correlation is significant at the 0.05 level.



Thus, most of the indices considered for the description of social, economic, physical and functional structure of Tehran are correlated with FAR contravention with confidence coefficient of 99% and 95 %.

In other words, according to the relationship between social structure of Tehran and FAR contravention, the FAR contravention is higher in the districts with higher population and higher household. Also more FAR contraventions have been reported to Tehran municipality in the districts with higher average area of dwellings, percentage of building ownership and residential per capita. While the population and household numbers are correlated with FAR contravention, the population density and the average persons per household in Tehran's districts are not correlated with FAR contravention. That is because in the districts with more population and households, the occurrence of FAR contravention is more probable. Correlation of the average area of dwellings and residential per capita with FAR contravention shows that the FAR contravention might lead to the increase of residential per capita and the average area of dwelling units. On the other hand, the correlation could be explained through the more actual demand (more than permitted limits ) of the households living in the districts with higher average area of dwelling units and residential per capita.

Regarding to the relationship between Tehran's economic structure and FAR contravention, the average building price, rent price and employed population are positively correlated with FAR contravention. Thus, the districts in which the building's construction is more profitable, more FAR contravention have been reported.

Among the indexes related to Tehran's functional structure, the residential area, green space area, arid area and transport network area have been correlated to FAR contravention. That is, in the districts with higher residential area, green space, arid and transport network area, more actual and illegal demand for increasing floor area ratio have been reported.

Finally, the Tehran's physical structure is related with FAR contravention because of the correlation between the related indices including numbers of dwelling units, average residential FAR, percentage of non-resistant buildings, percentage of semi-durable buildings, total residential building floor area and average residential plot area. Therefore, more FAR contraventions have been reported from the districts with larger numbers of dwelling units and higher total residential building floor area. There are two explanations for this: Firstly, the larger amounts of FAR contravention reported to Tehran municipality from 1998 to 2009 in the districts is

the reason of the increase of numbers of dwelling units and total residential building floor area. Secondly, the more demand for building (construction) and residence in the districts have led to more possibility of FAR contravention.

According to the negative correlation between average residential FAR and percentage of non-resistant buildings and FAR contravention, in the districts having less average residential FAR, more opportunities existed for the FAR contravention and in the districts having more old and unsuitable and non-durable buildings, less FAR contravention have been reported. That might be the result of law tendency to building (construction) in degraded urban fabrics, because construction in the districts is more complicated and less profitable comparing to others. Also, the higher percentage of semi-durable buildings and the average residential plot area (the coarse-grained textures) have been seen in the districts with more FAR contravention. It could be explained through the law tendency to building (construction) in fine grained districts.

## DISCUSSION AND CONCLUSION

According to the research findings, Tehran's structure is related with FAR contravention. In other words, some parts or districts of the city have more potential for the occurrence of FAR contravention. Understanding the relationship between FAR contravention and urban structure could be a helpful guidance for urban management to control and limit the building contravention.

In fact, building contraventions could be defined as the illegal reactions of the citizens regarding to the building regulations. So, building contraventions are the results of the citizen's unanswered demands related to housing or any urban construction.

On the other hand, the comparison between the research findings of studies about building contravention in Tehran and other cities shows a different trend in Tehran. In other words, while in cities like Old Salt, Istanbul, Benin, Ibadan, the building contraventions have been more likely occurred in the districts with lower economic and social level, in Tehran, the FAR contravention have been reported largely in the districts with higher social and economic level (higher land and rent prices and residential per capita and residential dwelling area).

The different trend could be attributed to recent urban management's policies and high profitability of building construction in Tehran. That the urban plans have not been updated regularly and adequately and



the FAR regulations have been used as the economic tools for money supply in Tehran municipality cause the different trend. In addition, the low average lifetime of buildings and high tendency to construction in some districts of the city and also the degradation of central districts and a large numbers of internal migration from the central parts to western, eastern and northern districts have caused a number of citizens having inadequate skills to be employed in construction activities. That is one of the reasons why Tehran's citizens do not respect and accentuate to building bylaws and comply with building regulations and standards.

Also, one of the results of this paper is the verification of inefficiency of building regulations and bylaws especially FAR bylaws in Tehran. Failure to update urban plans and building regulations and bylaws, lack of attention to the differences of urban zones, various potentials and different demands and also confining to the only spatial division of Tehran (three parts including north, middle and south) in setting the FAR bylaws are the major reasons of large amounts of FAR contravention. Therefore, according to the specific characteristics of Tehran and its polarized structure, it is necessary to apply flexible and fluid FAR bylaws to increase the efficiency of building regulations.



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## ENDNOTES

- 1- Urban Structure According to Art Introduction, 2009
- 2- Pattern Language, 2008
- 3- Urban Design, The Art of Renewing Urban Structure, 2009
- 4- Persons per household

