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# The role of building violations on urban spatial development in Iran: an emphasize on Tehran metropolis socioeconomic factors

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## Abstract

Building code violations have negatively affected Tehran's spatial development significantly over the last three decades. This study was carried out to answer the question of what the status and factors of building violations and spatial changes were in Tehran's districts in the first decade 1990s and 2000s, when rapid urban development was at its peak. This study's statistical population included all buildings in the 22 districts of Tehran. In addition, the data and information for this study were gathered through library and documentary research. Furthermore, descriptive statistical methods were used to explain and interpret the data, and Geographic Information Systems (GIS) were used to represent the results. According to the findings, financial incentives were the most important motivators for committing these violations. One of the most important spatial developments in the Tehran metropolis during this time is the conflict between the Master Plan for the city and population growth, per-capita residential, commercial, and military land use. As a result, areas 1 to 7 and residential structures accounted for 56% of Tehran's total area of residential buildings and 41.8% of the city's population in 2001, respectively, a rise of 2.9% and 34.8%. Additionally, other public institutions increased the area of residential buildings and the population of this area by 46.5% and 42.5% during this time period, respectively, by violating building codes, particularly in area 4 of the city.

**Keywords:** Tehran metropolis, Building violation, Building permit, Urban spatial

## Introduction

In developing countries, it's typical to see illegal split of residential land and violations of building codes. These behaviours have substantial effects on the quality of urban life and put a tremendous pressure on public resources (Sarkheyli et al. 2012). In other words, it's crucial for urban development and planning to have regulatory processes for regulating land use development in accordance with development plans (Clarke 1994; Talkhabi et al. 2022). To establish the boundaries between areas of public and private land, these regulations are required. These actions have a huge impact on public services, as well

as the development of the built environment, and have important implications for the quality of urban life. Different terms have been used to describe different types of building violations in different societies, including “housing” or “illegal building,” “unauthorised accommodation,” “building or siting,” “uncontrolled building,” “unofficial building,” “unorganised building,” “unplanned building,” and “building without a permit” (Alnsour and Meaton 2009; Ioannidis et al. 2009; Rukwaro 2009; Kapoor and Blanc 2008;; Huchzermeyer 2004; Fekade 2000; Zegarac 1999). The definitions and frequencies of building violations depend on the laws and regulations that regulate many fields, such as real estate, finance, urban design, and architecture. Building violations do not apply to specific structures and can encompass everything from very high-quality structures to low-quality and low-level structures (Sarkheyli et al. 2012; Ghalehtemouri et al. 2021).

In Iran, Article 100 of the Municipal Law regulates urban development management (Islamic Consultative Assembly of Iran 1979). Landowners and developers in the city or its surroundings must get a permit from the municipality before beginning any construction, land segregation, or building, according to Iran’s “Article 100 of the Municipal Law,” which investigates building violations. Accordingly, a building violation can be a conduct that includes a building that is either unpermitted or does not conform to a permit provided by the municipality or another competent body, as stated in Article 100 of the Municipal Law. According to the law, there are 12 different forms of building violations, which are then stated in Table 1. Due to this, a wide variety of development, measures that exceed the permissible density, and land-use change are classified as building violations.

Since the imposed war with Iraq ended in 1989, Iranian government policy has placed a greater emphasis on rebuilding war-torn towns and cities. Thus, a certain level of economic liberalisation was included into Iran’s modernization process, and the policy of local government revenue self-sufficiency, particularly in metropolises and other

**Table 1** Types of building violations subject to article 100 of municipal law in Iran

Contrary code	Description of violations
1	Residential building in density limit with related use (illegal building with the permitted density limit)
2	Residential building exceeding the permitted density with related uses (building with illegal surplus density)
3	Non-residential building exceeding the permitted density with related uses (commercial, office, industrial)
4	Non-residential building in the limited density with related use (with the permitted density limit)
5	Illegal residential building with contradiction to land use
6	Illegal non-residential building with contradiction to land-use policies (land-use change)
7	Non-permitted building based on approved land-use regulations in the urban area (Construction of an illegal building)
8	Non-permitted building in contradiction to approved land use in the urban area (Construction of an illegal building)
9	Constructed building in the 25 years unreleased area
10	Eliminated parking spot
11	Non-compliance with Modification, Bevel, and Plan
12	Other (non-compliance with other urban planning rules)

(Islamic Consultative Assembly of Iran 1979)

non-conflict-affected cities, increased. The Iranian government aimed to cut back on public spending in the area of urban administration in accordance with the objectives of this programme and by putting the “economic adjustment” strategy into effect. Municipalities throughout the country therefore looked for alternative sources of income. Municipalities have taken the appropriate steps in this regard, including selling excess density and changing land use in both legal and unlawful ways (by agreement) (Kamanroudi Kojouri 2006).

Building violations and the “Land and Housing Game Exchange” have caused serious harm to Iranian cities over the past three decades. This results from the municipality’s decision to sell land use and density since the early 1990s (Kamanroudi Kojouri and Hoseini 2018). As a result, a sort of fictional inductive rent for land and houses in cities developed. Municipalities Inductive Rent is the name given to this sort of rent (Raisdana 2003). In addition, Sarkheyli et al. stated in 2012 that the majority of construction activities in Tehran are under the control of speculators who view it as a profitable industry. Additionally, they claimed that a sizable proportion of building breaches were committed by residents of higher socioeconomic classes.

Certain institutions and organizations have contravened urban development laws and regulations, primarily driven by financial incentives offered by municipal authorities (Ghamami 2008). This issue of non-compliance escalated significantly in various cities throughout the country, with Tehran being a prominent example (Kamrava 2005). Tehran holds a pivotal role in Iranian contemporary history, serving as a reflection of urbanization and the city’s transformation from a modest town during the Qajar dynasty to a thriving metropolis in the era of the Pahlavi dynasty, and subsequently experiencing fluctuations under Islamic governance (Irani 2014). Urban management, as a result, institutionalised this occurrence in the Iranian urban structure and generated a structural departure in the pattern of resource allocation of the urban economy (Rakodi 2001; Yazdani 2003). Due to Tehran’s unstable spatial organisation brought on by the absence of an effective “Master Plan” for spatial balancing, this trend developed there (Kamanroudi Kojouri 2005, Kamanroudi Kojouri 2006). What were the circumstances and reasons for building violations and spatial changes in Tehran metropolis districts in the 1990s and 2000s? This study aimed to discover the answer. Also included in this study’s objectives are the identification, characterization, and interpretation of the circumstances behind building violations and spatial changes in Tehran’s districts.

### **Fundamentals and conceptual model**

The impact of the natural urbanisation process on building violations, socioeconomic factors, flaws in the building rules and regulations, as well as improper urban management policies, can generally be categorised into four categories (Sarkheyli et al. 2012). In other words, politics, economics, culture, and nature all have an impact on the process of constructing and repairing the city. In general, politics (management) plays a significant role in building and reproducing space in developing countries (Kamanroudi Kojouri 2006).

One of the key tools supporting urban management is sustainable revenues. Public finance is typically used to bring up this issue (urban finance). The term “public finance” (sometimes known as “urban finance”) is frequently used to refer to methods of financial

earning, expenditure, and management of financial resources. Another prerequisite for sustainable urban development is the existence of sustainable sources of revenue. In addition, how much and in what ways the city's natural resources are used affects sustainable development in the urban economy. Protecting urban green space, water, and other resources, as well as the urban environment. Therefore, it is important to produce urban public goods and provide revenue in a way that does not degrade the environment's quality or the residents' quality of life. In other words, when urban management includes at least two crucial elements of sustainability and upholds the quality of the environment and urban area, its income is sustainable (Ghalehtemouri et al. 2022).

The four pillars of public finance are "decentralised finance," "local tax economy," "economy of municipal services," and "central government helping the municipality economy." Decentralized finance refers to decentralisation and giving local governments the financial authority of the federal government with the goal of providing the ideal number of public goods required in a particular geographic area. The local tax economy emphasises that people should pay for the creation and provision of local government services if they are to benefit from them. Regarding the economics of municipal services, this institution consistently offers a range of services to the people and collects the required fees from them. Assisting the municipality with government funding is one more approach to cover the cost of urban services (Ghorbani and Azimi 2013).

The first and second generations of this issue have been used to present the overall viewpoint on decentralised finance. First-generation decentralised finance advocates hold that the public sector should step in and try to promote societal welfare whenever the market fails since there are public goods involved. According to these viewpoints, decentralised levels of government (especially local governments) ought to rely more on taxes that are connected to the advantages of local public goods, including real estate taxes and paying for municipal services. In addition to other economic areas, the growing viewpoints of the second generation of decentralised finance also include those of politics and social sciences. On the other side, the central government takes on the role of an employer rather than giving the local government a budget, which restricts their ability to provide services through the budget in a flexible manner. This means that in addition to deciding the local budgetary restrictions, the federal government also controls how those funds are allocated among other costs. As a result, one of the key distinctions between the perspectives of the first and second generations is the central government's fiscal constraints (Andalib and Sabetghadam 2008).

According to decentralized finance models, the only way to reduce monopoly rent in society is through downsizing. This is the rationale behind why cutting the government budget is regarded as the most crucial piece of policy for all-around government downsizing. In many economic domains, these approaches have actually been unsuccessfully implemented under technocratic and non-participative development patterns (Kamran et al. 2020). Urban management is one of these examples. City administrators essentially put monopoly rent permits to urban areas and profit from this rent on the agenda when faced with structural limits and hurdles to setting charges and taxes. Urban management is one of the areas where, according to neoclassical economists' beliefs, shrinking the size of the government does not result in a decrease in monopoly rent and an increase in economic efficiency. New theories of development stress how reducing government

(using a non-participative development model) increases monopoly rent and economic inefficiencies. This non-participatory development model manifests in areas where there is a lack of social and class awareness, a lack of strength in the organization of social strata, and a lack of robust civic institutions (Yazdani, 2001).

Sundaresan (2017), conducted research on the relation between building code violations and urban planning in Bangalore, India. He came to the conclusion that a network of private interests, political interference, and governance failures caused planning to violate building codes and harm the public interest. In 1998, O'Hare et al. (1998) et al., looked at policies and the poor housing situation in Mumbai, India, and concluded that migration and rapid population increase were significant reasons. The rapid expansion of the low-wage informal sector and high-cost enterprises were promoted by previous urban development strategies. Additionally, subsidized transportation systems made it possible for urban dwellers to live and work. Additionally, a poor and ineffective urban planning system, a lack of public investment, and restrictions in the real estate and rental markets all contributed to the informal housing problem that plagued the poor in this city. Tseng et al. (2009), looked into Taiwanese city of Tainan's building code infractions. On the one hand, it was determined that people's ignorance of the significance of building standards in sustaining the urban environment was the primary cause of these infractions. On the one hand, there wasn't enough room, which was another issue. According to Ioannidis et al. (2009), who investigated informal structures in Greece's Eastern Attica region, unplanned development and the emergence of informal structures are the result of a confluence of social, economic, legal, and administrative variables.

In 2009, Alnsour and Meaton investigated the factors affecting non-compliance with residential norms in the Jordanian city of Old Salt. Three socioeconomic categories (family size, household income, public awareness, and assets), administrative measures (administrative culture, oversight, and implementation), and the ambiguity of residential rules were used to categorise these aspects. The rise in housing demand was accompanied by difficulties like the number of large households, low income levels, poor public awareness of planning and building laws, and a shortage of housing financial facilities. This type of development violated planning rules because of the rise in housing demand brought on by the impact of these economic and social conditions. Many scholars, including Tipple (2000), Fekade (2000), and Erbas and Nothaft (2005), have validated this effect, particularly with regards to reducing the cost and duration of building. Local organisations and the government are primarily responsible for using residential standards in this type of building. As a result, monitoring and regulating the application of planning criteria can be done very effectively through corporate culture and urban management techniques. Municipal culture, according to Post (1996), is crucial for managing and regulating urban development and ensuring adherence to these standards. Arimah and Adeagbo (2000) assert that it is essential to adapt or dualize three variables, such as planning, implementing, and supervising, particularly when there are administrative and personal interests involved.

After conducting study in Mexico City, Ramos (2019) came to the conclusion that profitable interactions in the framework of the economy were to blame for the city's recent spatial development. Real estate and urban land policies were the foundation for this problem since ineffective urban management and planning might serve

as a springboard and exacerbate its effects. Zhai et al. (2018) research examined rent-to-price ratios, house rents, and property prices in 30 Chinese cities. The findings of that research indicated that the ratio of rent and the price of land and housing is a key indicator in identifying the real estate market condition. In that study, the dynamics of this ratio and the variables influencing home prices from 2008 to 2013 during a five-year period were examined. There appeared to be a strong correlation between rent and home prices. By distinguishing the Centre, middle, and new contexts, (Manganelli and Murgante 2017) examined the dynamics of urban land rent in sizable Italian cities in 2017. The findings showed that the urban land rent is a result of a significant difference between the market price and the cost of producing land, which causes urban sprawl. Additionally, according to research by Boob and Rao (2012), unauthorized construction results from poor urban management that disobeys the laws and guidelines governing urban development control. According to Alnsour and Meaton's research, one of the key causes of building violations is the ambiguity of construction regulations and standards. As a result, management strategies including administrative culture, methods for construction monitoring, and how to put building regulations into practise were suggested. In accordance with residential building requirements, these three actions were considered to be significant attitudes.

Romano et al. 2021 studies of illegal building and Italy's national land policy in the year 2021 led them to the conclusion that, despite the fact that these activities fall under a variety of categories, they do not ultimately have any notable outcomes. The inadequacy of the administrative, regulatory, and technical agencies to address this particular infringement is highlighted by this. The impact of building violation costs on final and rental pricing in the city of Chicago was researched by (Bartram 2019). He held the opinion that while the cost of correcting building problems raises rent, it does not significantly affect a home's final selling price. In 2019, Alishaqee and Albazzaz looked at how the quality of life in Baghdad's Atifiya neighborhood was affected by building code violations and the split of unofficial residential land. They came to the conclusion that this activity significantly affected the quality of life. Additionally, the public service network became unsuitable and reduced open and public areas, placing enormous strain on urban infrastructure. Building infractions in the Taiwanese city of Tainan were investigated by Tseng et al. 2009. It was discovered that failure to comply with legal permissions and technical regulations were the most common breaches. Because of this, the majority of the violators were prepared to pay the fine. A sort of rent and examples from urban land were given by Raisdana in his 2003 study on urban land rent in Iran. These rents were referred to as "paving rent" or "Induction rent of municipalities". In his opinion, towns and governmental entities produce this kind of rent by imposing limitations, offences, and taxes, or by making concessions that give rise to absolute rent suspicion, exclusive rent, or differential rent. In this method, social classes that rely on money might get approval to enhance density by erecting multi-story structures in exchange for paying the required sum of money. Their land will be able to produce more goods in this way (more residential units).

Based on this, reducing government with a technocratic, non-participative development paradigm is one of the main causes of building breaches in cities. In this instance, public and private sector actors worked together to commodify urban area and to

generate unstable earnings through monopoly rent, stock market, and building violations. Numerous effects and instabilities in the physical-spatial, socioeconomic, natural-ecological, and political-management dimensions result from these circumstances (Fig. 1).

## **Spatial scope, data and research method**

### **Spatial scope of research**

The geographical scope of this research is Tehran metropolis. This city is located at 51°17' to 51°33' east longitude and 35°36' to 35°44' north latitude. The city of Tehran, with an area of 730 km<sup>2</sup> and a population of about 9.5 million people, is the capital, the largest and most important city of Iran from political, economic and social points of view. This city is divided into 22 districts and 370 neighborhoods (Fig. 2).

### **Data and research method**

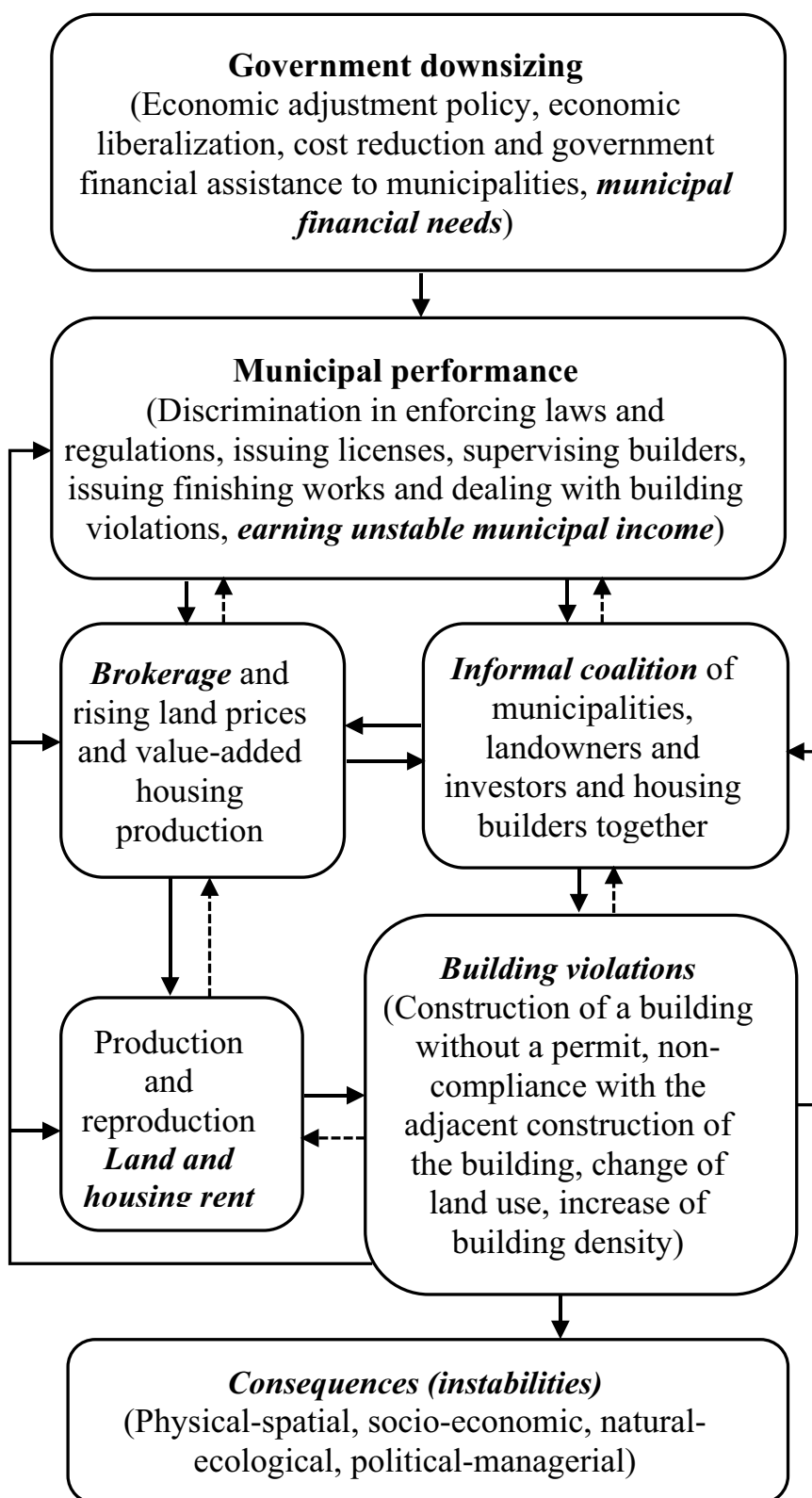
The entire construction and building stock in the 22 districts of Tehran in the 1990s and 2000s served as the statistical population for this study. Additionally, the material and data needed for this study were gathered through archival and library research. The municipality organisational reports and the audit findings of the third and fourth stage housing in Tehran were the most significant sources and materials used in this study. The data and information of this study were described and interpreted using the descriptive statistics approach, and descriptions and interpretations were represented using Geographic Information Systems (GIS). The most significant result of this study is a classification of Tehran metropolis areas based on the frequency of building violations and spatial changes in those areas. Tehran's second Master Plan from 1996 was contrasted with the districts' peculiarities in order to define and interpret the spatial changes in the city. The variables and indicators of this research are listed in Table 2.

The link between independent and dependent variables in this study was examined using the Pearson correlation coefficient test in the SPSS statistical package. The Pearson torque correlation coefficient, often known as the Pearson Correlation, is the most frequently used statistical gauge of bivariate correlation. "r" stands for this kind of correlation's abbreviation. The Pearson coefficient demonstrates how closely quantitative variables are related linearly. When the variables are parametric, or have a normal distribution and are at a distance/relative level, the Pearson coefficient is most frequently used. The fact that each variable is made up of a number of sequential variables, or so-called compression scales, makes this apparent when the variables are of the quasi-interval type (Meyers et al. 2016). The relevance and direction of the variable's association are established before the strength of that relationship is assessed. To interpret the strength of the relationship between the two variables, several divisions are given. One of them is the divisions listed below (Table 3).

## **Results and discussion**

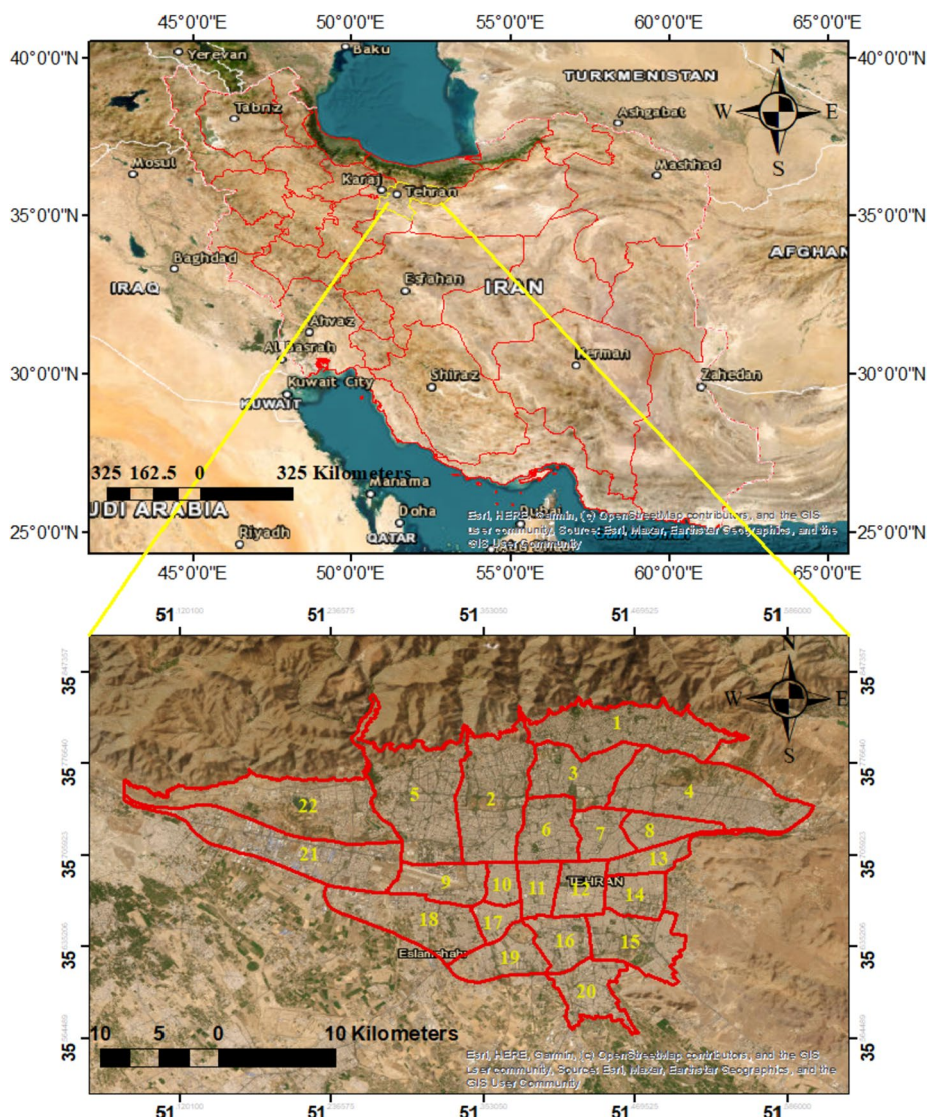
### **Status of building violations**

In all regions of the Tehran metropolitan, the frequency of building violations was examined. Government properties, private properties, and all building violations are mentioned in Table 1. Additionally, the geographic perspective of the entire



**Fig. 1** Conceptual model of research





**Fig. 2** Location and districts of Tehran (municipality of Tehran)

**Table 2** Independent and dependent variables and indicators of the research

Variable types	Indicators
Independent variables:	The area of the residential building in building permits
1. Building violations committed by public institutions	The area of surplus density in building permits
2. selling surplus building density by the municipality	The area of building violations committed by public institutions
Dependent variables:	The available area of residential building
1. The area of residential buildings	The available area of commercial land
2. population	The available area of military land
	The available population

**Table 3** How to interpret the relationship intensity in Pearson correlation

Intensity of relationship	Interpretation
0.8 to 1	Very strong relationship
0.6 to 0.8	Strong relationship
0.4 to 0.6	Medium relationship
0.2 to 0.4	Low (or weak) relationship
0 to 0.2	Lack of a relationship or an insignificant relationship

(Meyers et al. 2016)

**Table 4** The share of the total area of all types of building violations in Tehran between 1997 and 2008

Types of Building Violation	Area (%)
Residential building in density limit with related use (illegal building with the permitted density limit)	18.06
Residential building exceeding the permitted density with related uses (building with illegal surplus density)	21.2
Non-residential building exceeding the permitted density with related uses (commercial, office, industrial)	3.01
Non-residential building in the limited density with related use (with the permitted density limit)	1.21
Illegal residential building with contradiction to land use	0.60
Illegal non-residential building with contradiction to land-use policies (land-use change)	47.59
Non-permitted building based on approved land-use regulations in the urban area (Construction of an illegal building)	0.01
Non-permitted building in contradiction to approved land use in the urban area (Construction of an illegal building)	3.64
Constructed building in the 25 years unreleased area	0.48
Eliminated parking spot	0.10
Non-compliance with Modification, Bevel, and Plan	0.01
Other (non-compliance with other urban planning rules)	4.09
<b>Total</b>	<b>100</b>

(Deputy of urban planning and architecture of Tehran municipality 2009)

metropolis is covered in this study. Unfortunately, at the time this study was being conducted, there were no reliable and complete statistics and information available about the elements, genres, and geographic distribution of construction sites in Tehran between the 1990s and 2000s. However, Tehran and its environs have statistics and information available on the quantity and scope of building violations committed by governmental institutions in the 1990s, as well as the quantity and scope of building breaches and their causes in the 2000s. It was therefore impossible to compare and assess the pattern of building infractions between the two decades, despite the fact that these two decades in this case were independently analysed in terms of both governmental and general variables. Table 4 shows that between 1997 and 2008, “land-use change,” “Residential building exceeding the permitted density with related uses (building with illegal surplus density),” and “Residential building in density limit with related use (illegal building with the permitted density limit)” accounted for the

majority of all building violations in Tehran (86.5%). The imbalance in the city's use of space has been most significantly impacted by these infractions in recent years.

#### ***Building violations in the 1990s***

Some governmental organisations and institutions failed to adhere to the laws and regulations of urban development because Tehran's urban management neglected the city's capacity and sold building density beginning in the early 1970s. As a result, numerous military and public properties underwent considerable construction. The Supreme Council of Urban Planning and Architecture of Iran simultaneously approved that these military areas had to be moved outside the city limits owing to zoning regulations. Additionally, these lands need to be designated for municipal services. The territories beyond Tehran's designated city, particularly in the district 4, were developed into high-density apartments during this era (Ghamami 2008). Up until 2001, district 4 in Tehran's metropolis was home to about 83.07% of the city's illegal government construction (Kamanroudi Kojouri 2005). These circumstances highlight the strength and influence of public organisations in local affairs as well as the municipality's inability to hold them accountable for their acts during the process of Tehran's sustainable spatial development.

#### ***Building violations in the 2000s***

In total, the Secretariat of the Article 100 Commissions found around 3.5% violations for each building permit given in Tehran between 1997 and 2008. Some of these offences were also settled by the metropolis municipalities' internal commissions, and they were never taken into account by Article 100 commissions. The majority of these violations (56.98%) and buildings with excess permissible density (24.21%) were caused by land-use changes. Tehran had a decline in the number of structures being built outside of the legal limits between 2001 and 2008. However, compared to 2005, its area rose by 12.26% in 2004. (Deputy of urban planning and architecture of Tehran municipality 2009). As a result, this trend suggests that the excess authorised density violation was surpassed by the land-use change violation, at 56.98%. Furthermore, the northern districts of Tehran are where the majority of these violations occurred, in districts 1 to 5. These areas had higher economic rent, such as higher land rent, higher inductive rent, higher differential rent, and more value-added in the production of housing (Kamanroudi Kojouri 2014).

#### **Factors of building violations**

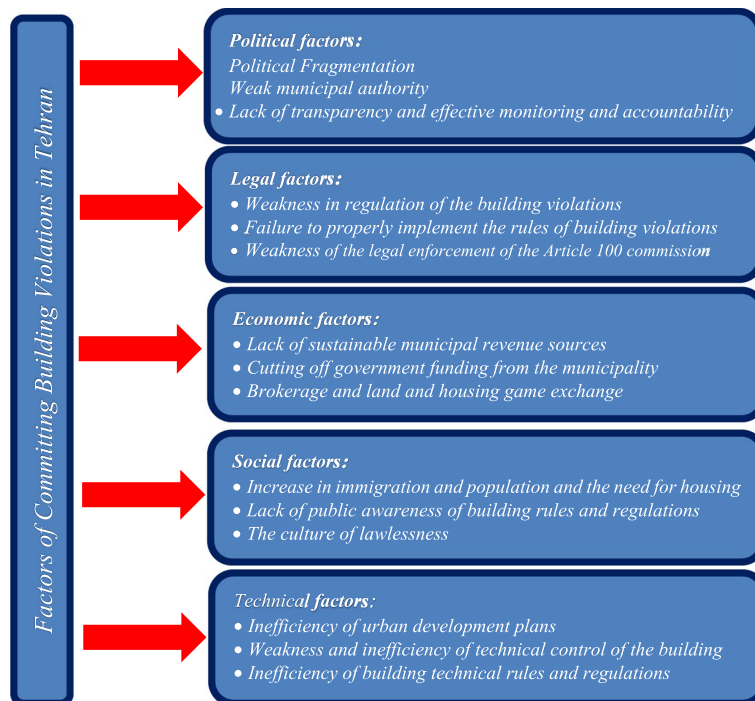
The government was given the authority to distribute the budget among the nation's municipalities in accordance with paragraph (a) of Note 52 on the country's budget in 1983 and the Ministry of Interior-Assistance to Municipalities statute. A minimum of 50% of this money should also be given to provincial and non-central municipalities. The government was also required to submit a bill to the Islamic Consultative Assembly under paragraph (b) of that law within a maximum of 6 months, allowing Iran's towns to achieve complete economic self-sufficiency through a three-year plan (Kamanroudi Kojouri 2006).

Governmental assistance to the municipalities under that statute initially started to drop from 1983 onward, declined rapidly between 1986 and 1990, and was essentially

terminated after 1991. But nothing was done to put the note’s paragraph (b) into practise. As a result, the nation’s municipalities began selling excess density and altering land use to make money and make up for the reductions in national resource allocation (Johnston et al. 1986; Lefebvre 1991; Sarkheyli et al. 2012;). As a result, this trend facilitated and promoted the housing industry, which in turn intensified the exploitation of lands and homes as a stock exchange.

Construction and land-use change are two elements that have affected compliance with building standards in many different cities around the world, particularly in developing countries. For instance, in African cities, the most important causes are poverty, a lack of understanding, and inadequate enforcement of regulations (Arimah and Adeagbo 2000) While in the Middle East’s Arabian countries, these problems include a lack of skilled labour, ignorance of building codes, severe rules, and a lack of regulatory procedures (Alnsour and Meaton 2009). On the other side, these elements are imbalanced regional economic growth and political problems in Eastern Europe (Zegarac 1999).

Although lack of awareness, lifestyle changes, the need for more living space, the scarcity of land, and the requirement to extend high-rise construction in order to accommodate more people were effective in committing these violations in Tehran (Madanipour 1998), the profitable performance of construction practitioners and speculators, political fragmentation, weak municipal authority, lack of municipalities’ revenue sources, and the weakness of citizenship culture played a more fundamental role. In addition to the aforementioned elements, the towns’ lack of economic self-sufficiency and incapacity to make up for the absence of local revenue streams also contributed to the worsening of building infractions throughout these two decades (Fig. 3).



**Fig. 3** The most important factors of building violations in Tehran

Additionally, a 2009 survey of Tehran residents revealed that “making more profit” was the top motivation for breaking the law. This element has a greater impact than any other known human explanation on excess density violations and land use change. This information illustrates the profitable and more expensive urban land rent strategy used by owners or builders to commit building code breaches in this city (Deputy of urban planning and architecture of Tehran municipality 2009). As a result, selling surplus density, land-use change, vertical expansion, and the uneven shape of Tehran’s northern parts are all directly related. The spatial changes that are the subject of this article’s examination are represented by this image (this place), which offers a window into the Tehran metropolis’s core political, legal, social, and economic issues (Fig. 4).

#### Monetization from building violations

According to Azizi (2003), the early 1950s introduction of oil revenues into the nation and subsequent entry into the land and building market had a significant impact on urban density and performance. Lands surrounding the city and its suburbs were frequently exploited for business. The 1989 law, which addressed the financial independence of the towns, as well as the introduction of building density sales, caused a change in the money-making strategies of the municipalities. Municipalities started issuing permits for higher building density as a result. Given that municipalities, particularly Tehran’s, viewed violation fines as revenue sources, Sarkheyli et al. (2012) explored this.

Building infractions and fines for them became one of the primary sources of income for municipalities in large cities, particularly Tehran. As a result, from 2001 to 2008, construction infractions such as “Residential Building with Surplus Density in Related Use,” “Land-Use Change,” and “Non-Residential Buildings with Surplus Density in Related Use” accounted for the largest portion of Tehran’s municipal revenue. Additionally, the maximum fine was determined by the average penalty income per infraction and the “land-use change.” (Deputy of urban planning and architecture of Tehran municipality 2009).

According to Table 5, violations for “Residential building exceeding the permitted density with related uses (building with illegal surplus density),” “Illegal non-residential



**Fig. 4** Building density and abnormal morphology in the north of Tehran

**Table 5** Share of all types of building violations from the amount of fines in Tehran from 2001 to 2008

Type of Violation	Violations (%)
Residential building in density limit with related use (illegal building with the permitted density limit)	0.88
Residential building exceeding the permitted density with related uses (building with illegal surplus density)	47.95
Non-residential building exceeding the permitted density with related uses (commercial, office, industrial)	9.52
Non-residential building in the limited density with related use (with the permitted density limit)	0.18
Illegal residential building with contradiction to land use	0.07
Illegal non-residential building with contradiction to land-use policies (land-use change)	36.66
Non-permitted building based on approved land-use regulations in the urban area (Construction of an illegal building)	0.01
Non-permitted building in contradiction to approved land use in the urban area (Construction of an illegal building)	0.73
Constructed building in the 25 years unreleased area	0.25
Eliminated parking spot	3.32
Non-compliance with Modification, Bevel, and Plan	0
Other (non-compliance with other urban planning rules)	0.43
<b>Total</b>	<b>100</b>

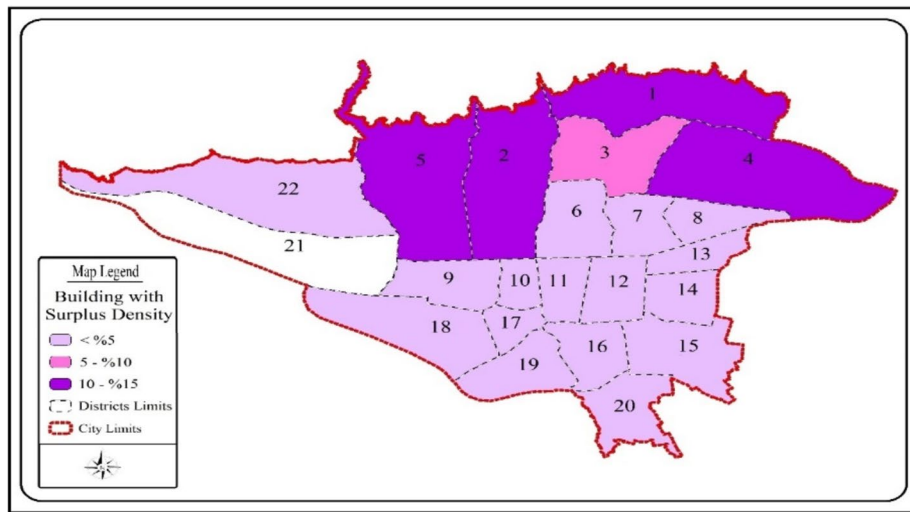
(Deputy of urban planning and architecture of Tehran municipality 2009)

building with contradiction to land-use policies (land-use change),” “Non-residential building exceeding the permitted density with related uses (commercial, office, industrial),” and “Eliminated parking spot” are, in order, responsible for the largest portion (97.45%) of the total amount of fines for building violations. The correlation between Tehran’s municipal revenues and building violations can be shown by comparing Tables 1 and 2.

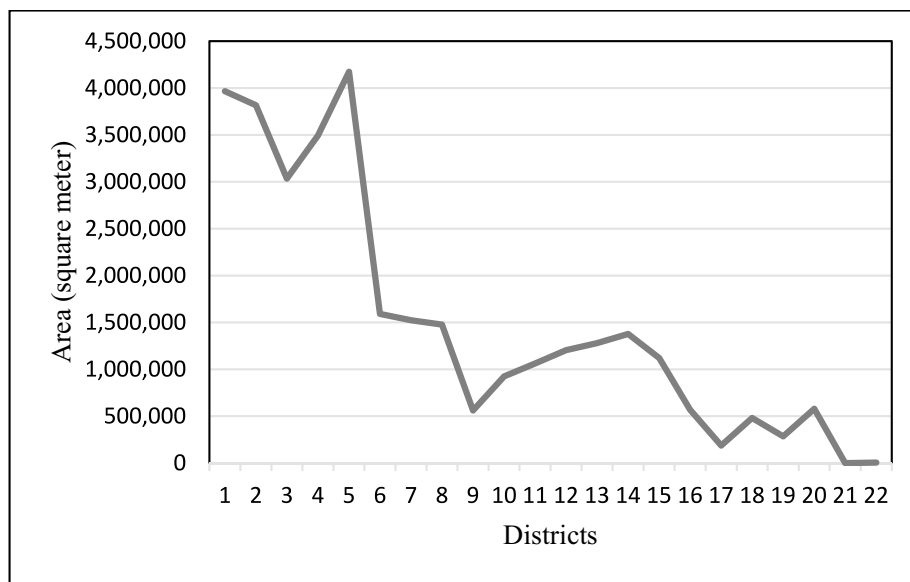
### Selling surplus building density

As previously indicated, it was determined that 67% of building permits were awarded to northern regions (1 to 5 districts) of Tehran since these areas have higher economic and land rent and construction is also the primary activity of people with higher incomes (Sarkheyli et al. 2012). It is noteworthy that the Tehran metropolitan issued over 185,000 building permits between 1993 and 2002. (Deputy of urban planning and architecture of Tehran municipality 2003c).

Only 13.3% of permits and 28.6% of the area of permits were only for renovations, whereas 45% of permits and 64.5% of the area of permits were for demolition and renovation. At the end of this time period, the percentage of demolition and renovation permits exceeded two-thirds of the total number of building permits. Surplus density breaches were found in 117,028 permits during this time, accounting for 63.24% of total permits. The highest area and density ratio of these permits, as shown in Figs. 5 and 6, was in district 5, accounting for 12.8%, 12.1%, and 11.7% of the lands and spaces, respectively. Additionally, this problem was exacerbated by open areas and higher value-added in dwelling building (ibid).



**Fig. 5** Distribution map of the area of buildings with surplus density in Tehran districts between 1991 and 2001



**Fig. 6** The area of building permits with surplus densities in Tehran districts since 1992–2002

**Spatial changes**

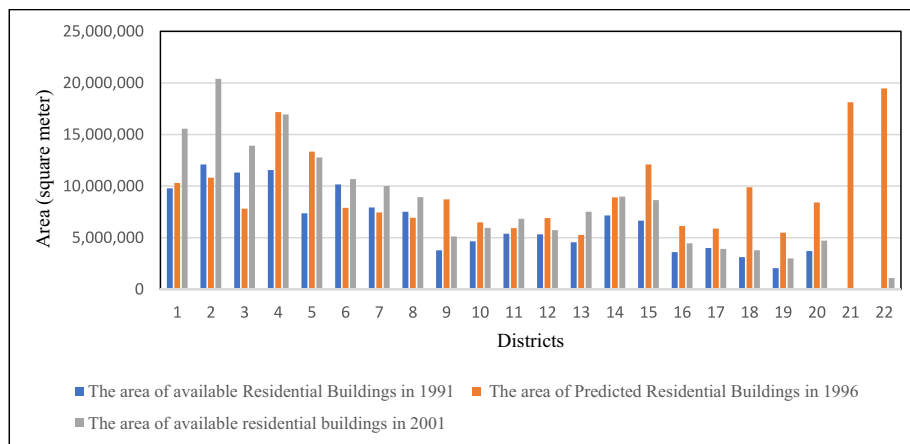
Building violations are one of the most major factors contributing to Tehran’s urban growth, according to a 2009 assessment by the deputy of urban planning and architecture of the Tehran municipality, which had a big impact on the unmanageable vertical and horizontal growth of the city. Overall, breaking construction codes has a number of spatial repercussions, including inferior buildings and infrastructure, an imbalance in amenities and population density, and a mismatch between urban functions. Unfortunately, there were no specific statistics or information available to analyse the connection between these infractions and their spatial implications in Tehran. As a

result, the change in the area and per-capita size of residential structures, commercial and military uses, and population of Tehran during the past 20 years will be examined in more detail per district. Additionally, a comparison between these elements and Tehran’s second Master Plan, authorised in 1996, will be made later in this article.

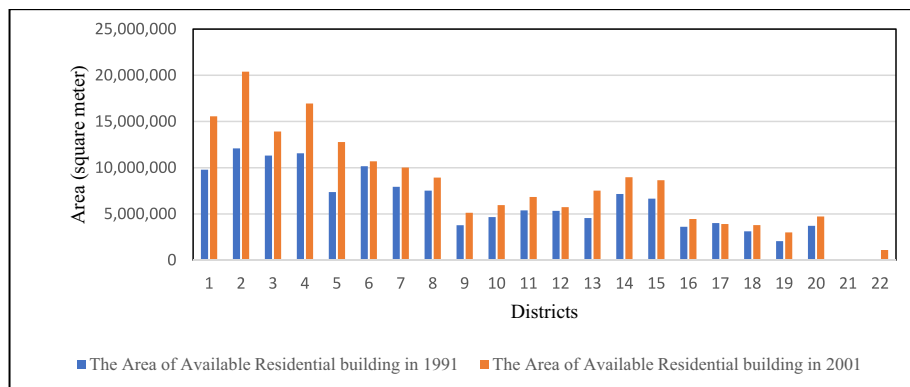
**Change in the area and per-capita residential buildings**

From 131,770,256 square metres in 1991 to 179,013,818 square metres in 2001, the overall area of residential buildings in Tehran increased by 35.85%. This growth ratio ranged from 5.20% in district 6 to 73.46% in district 5, with district 6 recording the lowest value. Except for district 17, Tehran’s districts experienced growth in the region and per-capita residential building levels between roughly less than 10% and more than 80% throughout this time, as illustrated in Fig. 7.

Figure 8 shows that as a result of this tendency, residential building areas in 12 districts in 1996 ranged from 12.41% to 66.87% less than those predicted under the second Master Plan. In eight districts, this tendency also resulted in residential building areas that ranged from 1.62% to 61.97% larger than those indicated by the second Master Plan (Atek 1992 & Tehran Municipality, 1996, 2002).



**Fig. 7** Comparative chart of the total area of available residential buildings in 1991, predicted in 1996, and the area of available residential buildings in 2001 in Tehran districts

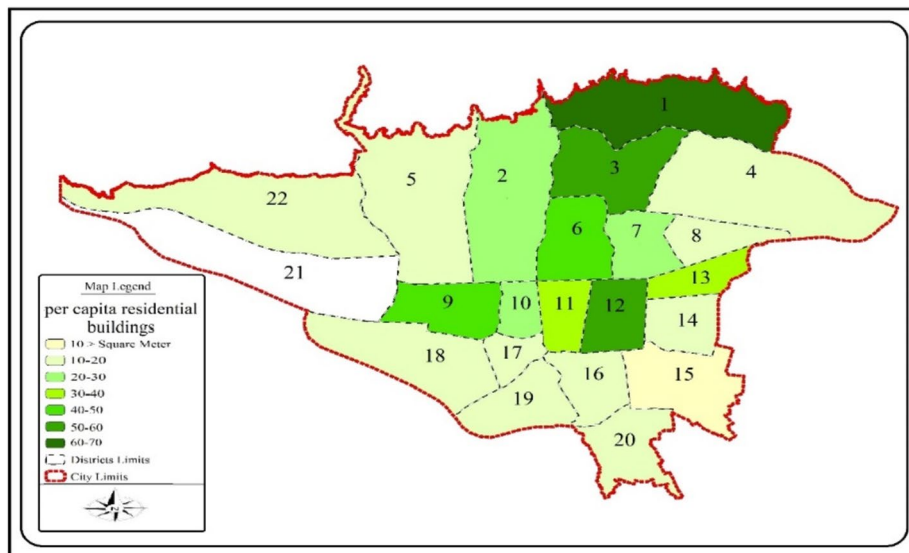


**Fig. 8** The total area of residential buildings of Tehran’s districts in 1991 and 2001

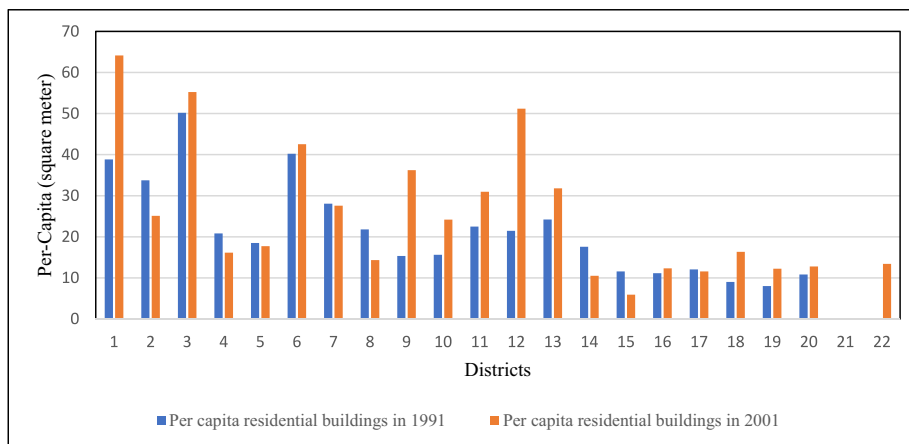


In Tehran, the number of residential structures per person increased by 17.37%. Eight districts in Tehran saw a per-capita residential building drop ranging from 1.68% to 48.97%, while 12 districts saw a rise ranging from 5.85% to 138.69% between 1990 and 2000. (Tehran Municipality Statistics, Information and Computer Services Organization, 1995 & 2003).

As seen in Figs. 9 and 10, Tehran’s Master Plan’s goals were at odds with the area of per-capita residential buildings since they were built without a comprehensive programme for spatial balancing. As a result, the residential area per person in 15 districts ranged from 4.33% to 59.31% in 1996, which was less than expected. In contrast, the per-capita residential building density in five districts ranged from 9.76% to 89.73%, exceeding the estimate made in Tehran’s preservation and organisation plan, which was adopted in 1991.



**Fig. 9** Distribution map of per-capita residential buildings in Tehran’s districts in 2001



**Fig. 10** Comparative diagram of the per-capita residential building of Tehran’s districts from 1991 to 2001

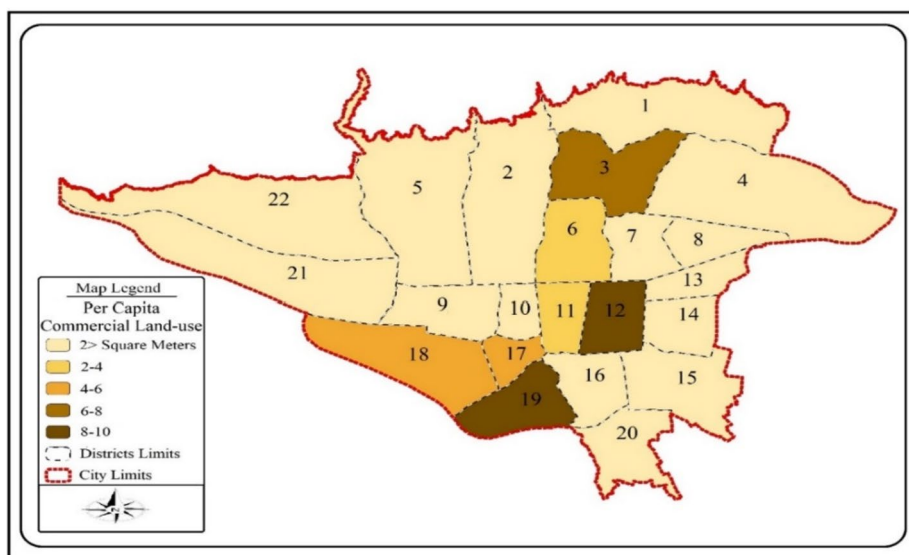
**Change in the area and per-capita commercial land-use**

Till 2001, Tehran’s commercial land use expanded by 131.66% beyond the anticipated amount in the 1996 Master Plan. This growth was mostly the result of changes in land use, particularly the conversion of residential to commercial land use in key districts. In this metropolis, the ratio of commercial land usage to total land use was 2.31% in 2001. This percentage varied by district, ranging from 0.10% at the lowest to 13.90% at the highest (a 13.80% difference) (Deputy of urban planning and architecture of Tehran municipality 2003).

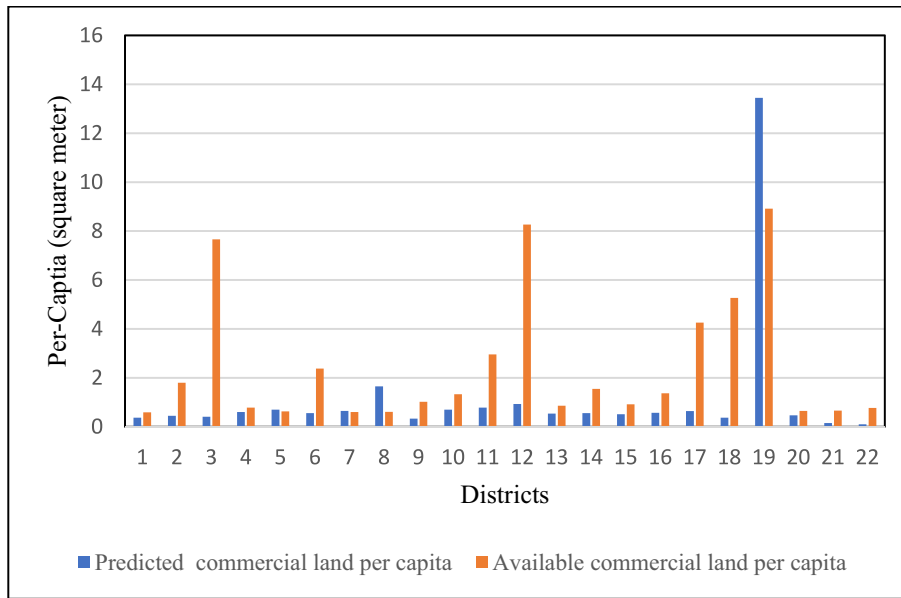
Tehran’s per-capita commercial land use in 2001 was 1.18m<sup>2</sup> (136/44%), above the 1996 Master plan’s anticipated ceiling. While districts five, seven, eight, nine, and 19 saw a reduction in commercial use per person ranging from 9.84% to 62.88%. Other districts, on the other hand, had growth from 29.68% to 1760.86%. Tehran’s per-capita commercial lands ranged from 0.6m<sup>2</sup> in district 1 to 8.9 and 8.3m<sup>2</sup> in district 19 and 12, respectively, as shown in Figs. 10 and 11. It is evident that some districts have a significant amount of differentiation (Figs. 11 and 12).

**Change in the area and per-capita of military land-use**

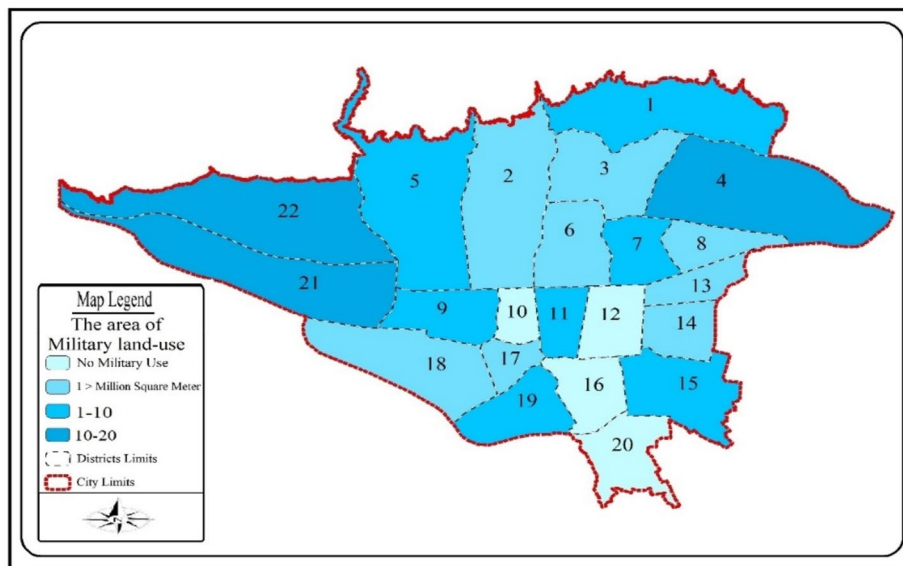
Tehran’s military land use in 2001 covered 56,293,666 square metres, or 8.46% of the total area of the city. The military land use area in Tehran’s second master plan from 1996 was estimated to be 11,471,200 square metres spread over nine districts. However, when compared to the Master Plan’s objectives, the area of military land use in 2001 increased by 390.74%. Figures 13, 14, and 15 show that by 2000, Tehran had roughly 10 additional districts with significant non-projected military use in addition to the nine predicted districts. Region 4, which contained unoccupied land, saw a lot of these rises (Geographical Information Centre of Tehran 2003; Municipalities of Tehran’s Districts, 2003).



**Fig. 11** Distribution map of the per-capita commercial land in Tehran’s districts in 2001



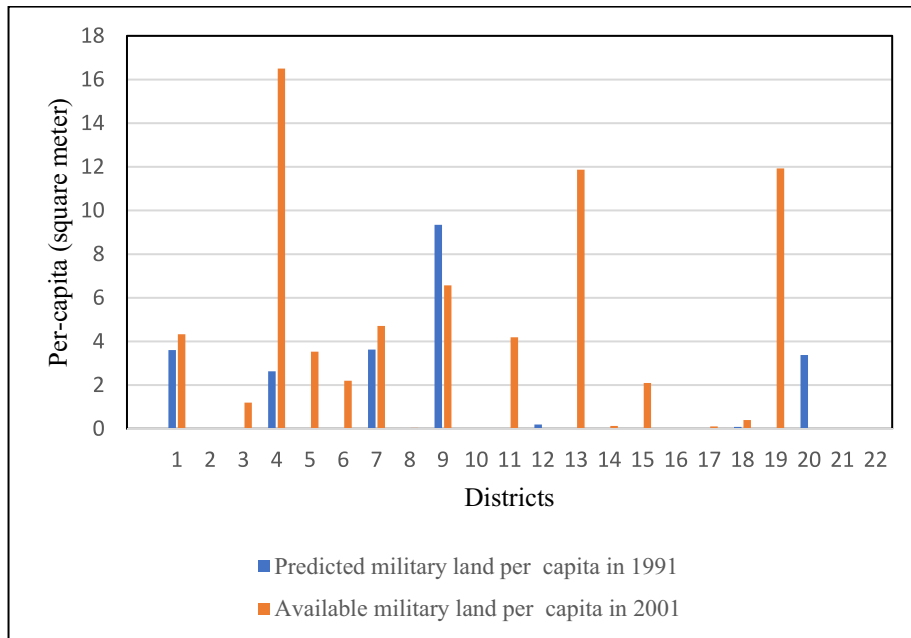
**Fig. 12** A comparison between the available and the predicted commercial land per capita in 2001 and 1996, respectively, in Tehran’s districts.



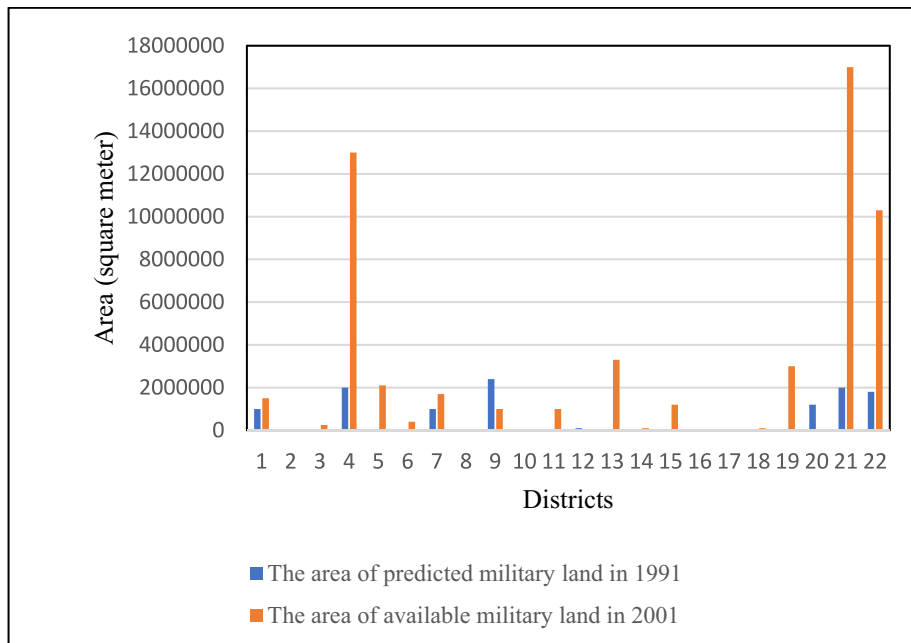
**Fig. 13** The area of Military land-use in Tehran’s districts in 2001. Geographical Information Centre of Tehran 2001

**Population changes**

According to Figs. 16 and 17, eight districts in Tehran saw population declines between 4.23% and 33.35% during the 1990 and 2000 decades, while 12 districts saw population increases ranging from 1.35% to 54.71%. The demographic changes did not match the demographic objectives of Tehran’s master plan, it may be inferred from the statistics (Geographic Information Centre of Tehran 2001). Districts that experienced a decline in per-capita land-use were those where the population growth ratio was between 1991

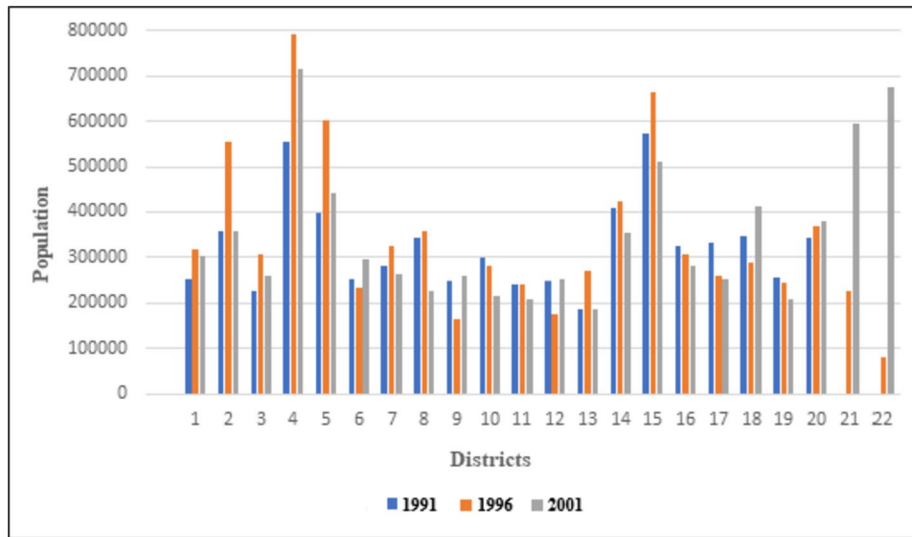


**Fig. 14** The available military land-use per capita in 2001 and the predicted for 1996 in Tehran’s districts. Geographical Information Centre of Tehran 1990 and 2001

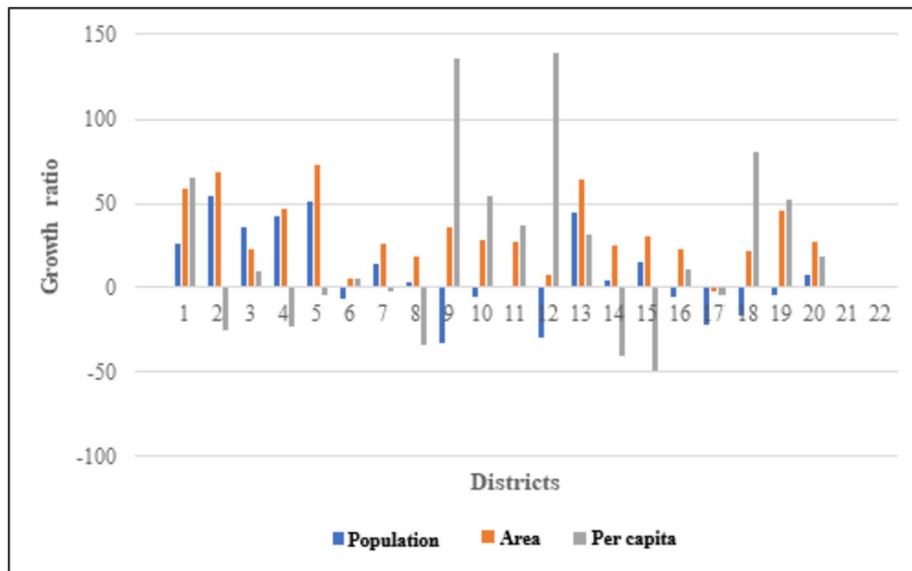


**Fig. 15** The area of available military land-use in 2001 and the Predicted for 1996 in Tehran’s districts

and 2001 and higher than the area growth percentage of each land use (Kamanroudi Kojouri 2005). Therefore, Tehran districts faced changes in capacity, mobility, and population burden as a result of selling surplus building density, building violations, and land-use change.



**Fig. 16** Comparative population chart of Tehran's districts in 1991, 1996 and 2001



**Fig. 17** Population growth rate, the area and per-capita residential building of Tehran's districts from 1991 to 2001

(Mulligan and Crampton 2005) created population aggregation clusters for cities in 2005, cutting them down into 10 clusters, and categorising the population growth of those cities into three groups: “Extremely fast-growing cities,” “Very fast-growing cities,” and “Moderately fast-growing cities.” Tehran is listed as one of the Cluster 7 cities and as one with “very rapid growth.” Therefore, it can be concluded that Tehran is experiencing both urban vertical sprawl development and large population growth with the use of these pieces of information and acquired data. This pattern is briefly shown in Fig. 18.



**Fig. 18** Building's density and urban vertical sprawl in the north of Tehran

**Table 6** Pearson correlation test results (correlation of research variables and indicators)

Indicators	correlation		Sig. (–tailed)	
	2001	1991	2001	1991
The total area of the building structures based on issued permits (independent variable) and the total available area of the residential building in Tehran (dependent variable)	.853**	.728**	.000	.000
The total area of the building structures based on issued permits (independent variable) and the available population (dependent variable)	.563*	.257	.012	.273
The total area of surplus building density based on issued permits (independent variable) and the total area of the available residential building in Tehran (dependent variable)	.930**	.830**	.000	.000
The area of surplus building density based on issued permits (independent variable) and the available population in Tehran (dependent variable)	.497*	.196	.031	.408
The area of building violations committed by public institutions (independent variable) and the existing area of the entire residential building in Tehran (dependent variable)	.388	.383	.091	.096
The area of building violations committed by public institutions (independent variable) and the available population (dependent variable)	.028	.541*	.910	.014

\*\* Correlation is significant at the 0.01 level (2-tailed)

\* Correlation is significant at the 0.05 level (2-tailed)

**Variability correlation test**

In this section, the relationship between the dependent variable and its indicators (the available area of residential buildings, the available population) and the independent variable and its indicators (the total area of the building structures based on issued permits, selling surplus building density, and building violations committed by public institutions) in Tehran metropolis's 22 regions was calculated in the years 1991 and 2001 using the "Pearson correlation test" in the SPSS software. According to the findings of this test

(Table 6), there is a significant and direct (positive) relationship between the total area of the residential building permits issued by the municipality and the total area of the residential buildings that are currently available in Tehran in 1991, with a high degree of confidence (99%) and less than 0.01 error. Additionally, a relationship between these two variables existed in 2001 with a low value and a relationship that had a high confidence level (99%) and low error level (less than 0.01). Tehran's available population in 1991 and the overall area of the building structures based on issued permits do not significantly correlate. The association between these two variables, however, is significant, direct (positive), and quite strong in 2001, with a 95% confidence level and an error level of less than 0.05.

The correlation test of selling surplus building density between the total area of the building structures based on issued permits and the available demographic factors in Tehran from 1991 to 2001 is easier to understand. With a 99% confidence level and an error level under 0.01 in 1991, there is a significant, direct (positive), and to a large degree association between selling surplus building density and the available residential buildings in Tehran. With a 99% confidence level and an error level less than 0.01, the relationship between these two variables in 2001 is also significant, direct (positive), and significant to a large extent. However, in 1991, there was no discernible correlation between the density of excess buildings for sale and the available population. Additionally, there is a significant, direct (positive) association between these two variables in 2001, as well as a high level of confidence (95%).

Between 1991 and 2001, there was no discernible correlation between the available area of residential buildings in Tehran and building violations committed by public entities. For 1991 and 2001, the value of this association was 0.383 and 0.388, respectively, which was low and direct (positive). The fact that 1991 marked the initiation, identification, and registration of these violations, and that their volume was first minor before steadily increasing until 2001, accounts for the lack of a meaningful association. On the other hand, the severity of these infractions and the resulting bodily and societal impacts varied across Tehran. For instance, Region 4 was the scene of 85.8% of these violations. In 1991, there was a 95% association at a correlation level of 0.014 between building violations committed by public facilities and the population that was present. Building violations and population in 2001 did not significantly correlate because the correlation level was equivalent to 0.910.

By providing permissions and selling violated building density, the municipality, specifically in districts 1 to 7, was responsible for the rise in residential construction and Tehran's population between 1991 and 2001, according to the results of this study's correlation test. Naturally, the rate of this growth differed throughout Tehran's 22 districts. As a result, areas 1 to 7 and residential structures accounted for 56% of Tehran's total area of residential buildings and 41.8% of the city's population in 2001, respectively, a rise of 2.9% and 34.8%. Additionally, other public institutions increased the area of residential buildings and the population of this area by 46.5% and 42.5% during this time period, respectively, by violating building codes, particularly in area 4 of the city.

## Conclusion

Wide-ranging development, selling building density, and changing land use are only a few examples of building breaches in Iran that go against the permits. In Tehran, between 1997 and 2008, land-use change (56.98%) and over permissible density (24.21%) accounted for the majority of violations. The majority of these violations took place in Tehran's northern districts, particularly in 1 to 5, where the cost of land and building houses is higher. Fines for building violations provided the majority of the revenue for the Tehran municipality between 2001 and 2008. Additionally, the majority of these incomes were tied to "Constructed non-residential building exceeding the permissible density with related uses," "Land-use Change," and "Residential building beyond the permitted density with related uses."

From 1991 to 2001, the spatial imbalance of Tehran metropolis was made worse by the Tehran Municipality, which used a demand-oriented approach rather than a development- and program-oriented approach when issuing permits and selling surplus building density in districts with higher land economic rent and housing value (districts 1 to 7). Additionally, the technical, legal, social structure, and function of the municipality in Tehran gradually deteriorated between the years of 1991 and 2001 as a result of unsustainable revenue from selling surplus building density. This strategy made money and trading more important than reasoning and engineering techniques, which led to the municipality becoming an ineffective organisation. Government agencies entered the sphere of land and housing and engaged in building violations during this time because to the municipality's metamorphosis into a seller of urban space within the context of government downsizing policies and financial self-sufficiency.

Owners, builders, construction investors, and the municipality formed an unofficial partnership during this process, and there was a dearth of adequate control and timely government involvement. Because there was no effective Master Plan for spatial balance, even if Tehran's urban management implementation in 1991 and 2001 increased the area and public land-use per capita, there was no establishment of per-capita distribution of utilities and services. Tehran's spatial development was therefore unsustainable. Tehran's vertical expansion was also sparked by building violations, and many of the city's public services and facilities deteriorated as a result of the uneven population growth and its stress on capacity and mobility.

It is necessary to review, improve, modify, and integrate urban management to prevent and reduce building violations and their consequences. As a result, the following three measures can be implemented:

- (1) On the technical aspect: updating and streamlining urban development plans and building rules and regulations, and reforming the organizational structure, human and financial resources of the municipality and the cities' Islamic Council;
- (2) On the social aspect: development of local and organizational governance and joint administration of urban affairs and municipal organization;
- (3) On the legal aspect: Reviewing and updating the regulatory mechanisms and enforcing urban practice rules.



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**Authors' contributions**

Mousa Kamanroudi Kojouri: Author supervisor and the main advisor.  
Kamran Jafrpour Ghalehtemouri: Co-Author and methodology development.  
Mahla Kiadarbandsari: Data collection, analysis,

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