

# The Impact of Geographical Components on the Spatial Expansion of Cities using the SWOT Model; Case Study of District 22 Tehran, Iran

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**ABSTRACT:** The present study has focused on identifying the geographical components, proper efficiency of the components in order to appropriate Spatial Development and to prevent probable risks. This research is a part of fundamental and functional researches and step in line with scientific analyses and in order to collect information therein, the approach of documents and records study, theses, books and publications, websites, statistics papers, different maps and photographs have been used, and in order to information analysis the SWOT model is used. Because of having geographical components such as favorable climate, suitable slope and topography, and the dominant wind direction of west to east, extensive wasteland and due to the development plan of network traffic in Tehran, District 22 will attract the future population of the city with more aggressively. Research findings indicate that by organizing and utilizing the power and capability of geographic components affecting the region, spatial expansion of the region can be directed, and further uncontrolled expansion can be controlled and by monitoring the area constructions related to lands located in watercourse and fault crossing zones, future directions of spatial development of the region can be determined.

**Keywords:** Spatial Development, Geographical Components, SWOT Model, District 22, Efficiency

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## INTRODUCTION

A geographical environment includes many geographical factors and components, each of which alone are worthy of great importance. The role and influence of these factors together guarantee the quality and condition of a geographical location. In fact, the factors such as land position trace the regional climate by being affected from angle of the sun, and prone the different locations for development and reconstruction. Meanwhile humans, with their unique features has had tried to create balance for a better life in their place and habitat. The role of land, climate etc. as the geographical components and their impact on the human choice of locating a suitable place to live is critical.

Understanding the geographical components and how to study them can improve the quality level of life in surrounding environment for humans. Change in performance of the geographical components often force humans to move and choose a new place to live that the obvious example of this claim is climate change of Siberia and migration of Aryan tribes which in fact, is considered as a milestone in the history of Iran civilization. The specific kind of geographical factors and different climates creates various ways of living in the geographical area. Iran typically has the most diverse physical, biological and livelihood geography so has passed through the numerous and widespread changes.

Each one of different patterns of physical development proposed about the cities have advantages and disadvantages but what is important meantime is to understand the factors affecting on the spatial development and use of the human experiences

considering the possibilities and limits of natural and human environment of a city.

District 22 is a relatively untapped area with wonderful environmental values which has created a unique opportunity for all sectors of urban development that by relying on national and international experiences and preserving indigenous values, one can place an innovative and successful pattern in front of the managers in all sectors of development. In addition to perform many of urban plans, the problems and issues which exist in other urban areas are much less in this area.

On this basis, in this research we deals with examination of geographical factors influencing the spatial expansion of Tehran with emphasis on district 22. For this purpose, in this study by using SWOT model the role of positive and negative components available in the region will be examined in order to spatial development of the region and we deals with that whether or not the capability and power of positive geographical components in the District 22 has caused the region to be chosen for further spatial expansion of Tehran and whether or not the lack of attention to negative geographical components in District 22 will make the area more prone of the occurrence of (natural and anthropogenic) disasters.

## Review of literature

In 1955, an American researcher, Ernest Burgess, by performing examinations on the city of Chicago and its spatial development provides a concentric model in spatial direction of the city. Burgess by having a special attention to the impact of weather conditions on the development and evolution of the population assumes the city expansion to be circular.

Peterman, the American sociologist, influenced by the climate issues has offered a new theory about England cities during which he considers the wind blows from the West and ocean to be effective in ecological segregation of citizens. This factor causes the western areas to be the cleanest and best area for residential units and the eastern areas to be the place of industrial sectors.

Other researchers have also conducted numerous studies in this area, such as Ziafaty with a paper examining Bokan city (2008), Parsanezhad examining the Zarghan City (2005), Habibi examining Sanandaj (2003), Zeinali Behnovee examining Babak City (2004), Bahrami examining Tehran (2004), and Arani examining Tehran (2007).

## MATERIAL AND METHODS

Type of research: This research is a part of fundamental and functional researches and step in line with scientific analyses and in this study the (descriptive - analytical) methods are used as follows:

- 1-Descriptive method: This method was chosen due to express the current situation of the region
- 2-Case and underlying method: the cause of selection of this method was due to the selection of an area for research.

### Research process

Survey steps of this study are as follows:

- 1-Review of existing literatures and research background
- 2-Collect the information and data related to the study area, which includes document reports, detailed plan studies of the area, maps, statistics and desired information in the field research.
- 3-Organizing and analyzing the information and data and extracting the results
- 4-Preparing the written report

### A) The Method of data collection

The desired information was collected from three main ways which are:

- 1-Library studies of reports and articles, and search the Internet and Maps
- 2-Statistical analysis of the existing documents in related organizations
- 3-Field Research

Library studies were used in the theoretical fields and survey of geographical components related to different cities of Iran and spatial expansion and development of Tehran and also the libraries of various universities and the consulting engineers of companies and Statistical Center of Iran were used and another part of the work was conducted as the usual field research, such as interviews with Urban Development Department officials of district 22 municipality.

### B - Field studies

In order to achieve more complete information as well as practical use of research results, field studies have been conducted in the area. These studies include the observations of district body, interview with municipality

officials of the district and provide photos from different parts of the district.

### C - Method of information analysis

Using AutoCAD and Excel software, the intelligence data are organized through the tables and graphs and to provide conclusions and recommendations, the SWOT model is used.

### Introducing the District 22

District 22 in the North West of Tehran and with an area of 10,000 hectares was established with the aim to eliminate service deficiencies of the West scope of Tehran as well as accommodate a part of the Tehran population. The area is surrounded by the Alborz Mountains of 1800 from the north, Tehran-Karaj Freeway from the South, to the Karaj area of shielding from the West and from the East to Ken watercourse. This area is about twice of the greatest district of Tehran and contains 10% of the total area of the capital.

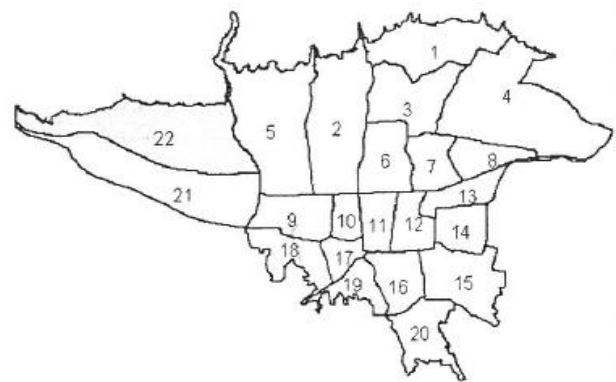


Figure 1. Location of District 22

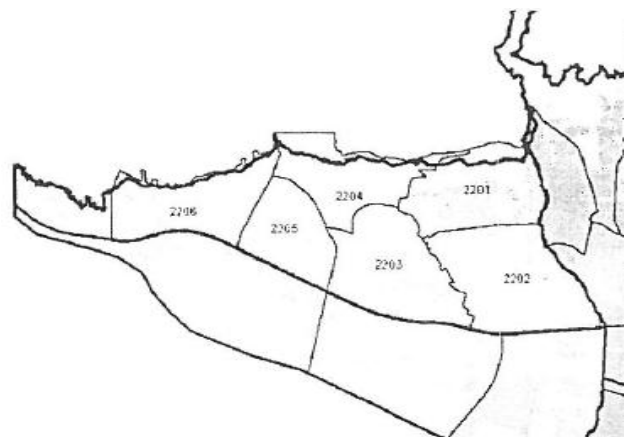


Figure 2. Areas of Municipality in District 22

### Natural components of district 22

Height: The land is located at an altitude of 1100 to 1400 meters above sea level.

The land slope: land slope is less than 5%; the only exception is in the middle part of the southern region of Chitgar Park with a slope of 5% to 25%.

The area faults: consists of north Tehran fault, Chitgar Forest Park fault, Keshar-Verdij fault, Porkan-Verdij drift, the average faults with lengths of 2 to 10 km, and minor faults shorter than 2 km.

Temperature: The maximum temperature is 44°C and the minimum is -15°C, the warmest months of year

are July and August and the coldest months are December and January.

**Humidity:** Maximum monthly relative humidity was 74% in December, and the minimum of this parameter was to 31% in August.

**Rainfall:** average amount of annual rainfall in altitude of the area is 383.2 mm that the maximum amount of rainfall reaches to 608.10 mm and the minimum reaches to 206.7 mm which depending on altitude and the amount of rainfall in the region is variable.

The annual average number of frost days is 9.36 days.

The area prevailing wind is generally westerly (7 months a year) and then the winds of north and northwest have greater blowing percentage (the speed of 14 kilometers per hour).

**Watercourses:** 3 watercourses consists Ken, Chitgar, and Vardavard blow in the northern and southern direction of the area which has a wider catchment than the others. Ken watercourse is the longest watercourse in Tehran. Ken valley is located in northeast of Tehran and Ken river comes from Alborz North Heights and flows in its direction. This river covers 5 areas of Tehran Municipality, which includes areas of 5-22-9-21-18. It's the most waterfall river which passes through Tehran. It has high soil permeability and low water-holding.



**Figure 3.** Watercourse with neighborhoods boundary



**Figure 4.** Faults with neighborhoods boundary

#### **The human components**

1.39% of the total population of Tehran (4.53% men -96.46% women) resides in this region.

#### **The migration to region**

21.23% of people residing in the area belonging to other cities; 67.69% of people belonging to other areas of

Tehran (9-5-17-18); 10% of residents were already in the area.

#### **Habitation**

More than 98.5 percent of the housing units are built of durable materials; more than 99% of the buildings are less than 30 years old.

#### **Most of the employment opportunities in the service sector**

13.2% of unemployed or jobseekers; 32.98 percent are studying, 6.88% are retired and finally about 13.08% are households; Most of the area population is between the age group of 15-65 years which is equivalent to 61.8 percent of the entire population.

#### **Quality status of economy**

13.8% of households have good living conditions, 68.46 percent are average and 18.46 percent have poor economic conditions.

#### **The most prominent structural elements of the region (with urban, extra-urban and transnational uses)**

1-Sports Centers (Azadi Stadium, Chitgar Equestrian Club and Arena, Iran Khodro Stadium)

2-Proposed Lake Basin (Chitgar extensive pit located in the north of Chitgar park and the center of area)

3-Green spaces (Chitgar forest parks, khargosh, Letman and Vardavard Valley)

4-Military centers (garrisons and factories of army and corps, shooting Gallery, Faculties of Military Sciences)

5-Research and Higher Education Centers (organizations of forest and Rangeland, genetics, Construction Jihad, the development of polymer Sciences and technology, veterinary and botanical gardens Network, oil industry, meteorology)

#### **Azadi sports stadium**

This set, which founded over 30 years ago and in its kind and time was of the well-equipped sports sets in Middle East, is located in this region. This set is located near the Ken River on one hand and on the other hand placed on the periphery of Tehran - Karaj freeway. By establishment of stadium and holding sports competitions at the transnational and extra urban level, the Olympic Village was also formed in the region with a residential identity.

#### **Chitgar Park**

With an area nearly 1,400 ha, the park is considered as the largest entertainment center in West Tehran for years. Overall, the area where Chitgar Park is located, depending on its different spots has many features and topographies and with same ratio, its slope volatility is high and start from zero and reaches to eighty percent. The main stretch of park is placed in east - west direction and mound forms the major Topographies.

Man-made lake (under construction), central lake with an area about 355 ha and a capacity of 35 million cubic meters of water is predicted in master plan and detailed plan approved by the District 22 as a body of

water feeding the underground aquifers and a stylized source for air in the area of the West of Tehran.

#### **Sources of lake water supply**

About 80% is provided from water site of Ken watercourse and the rest from the flowing waters of the middle and surface sphere of the area. And also the main source of lake water is considered from Ken watercourse which after construction of diversion weir of Ken watercourse, water is transmitted through the closed water transmission channel with a length of 6 km and maximum flow rate of 1.2 cubic meters per second. Reservoir volume of the lake is about 10000000 cubic meters and in order to prevent the outflow of water, a embankment dam with a length of 1400 m and a width of 6 m and a height of 18 meters will be constructed on the south side of the lake.

#### **Current situation of communication network in District 22**

- The most important east - west highway of Tehran (freeways of Tehran-Karaj, Shahid Hemmat and Resalat).
- The most important thoroughfare of Iran history (Tehran-north highway) and Tehran - Karaj Metro route are passed through the District 22.

#### **Impact of geographical location role the on the spatial expansion of District 22**

Alborz heights in the north of the area (high-gradient) and Ken watercourse in the East and the highway in the south of area are of the natural and artificial factors limiting the development of the region, Vardavard village is the western limit of the region to separates Tehran and Karaj spatial bodies and prevents and integrate these two cities as well as the high extent of the area that can accommodate high density population. Thus District 22 has a good position to continue spatial development in Tehran in the terms of geographical location, and the area development in future, due to the natural and artificial limiting factors which encompass the area, will be controllable.

#### **Impact of the height and slope role in spatial expansion of District 22**

Area position at high altitude will result: in more favorable climates, high humidity, and partially offset of the District Water shortages.

The slope of the land in District 22 in most places is gentle and less than 5% and therefore most land the area have suitable slope for spatial, residential, roads and utilities settlements and there is possibility of using a large surface of area for construction and the variety of grade lines will cause the variety of perspectives.

#### **Impact of fault role in spatial expansion of District 22**

The fault boundary (rupture) of District 22 due to the large area in 3 District has subjected to very severe desolation and affected by the major faults in northern Tehran, medium faults of Chitgar Forest Park and minor faults of Garmdareh and Kazem Abad. In terms of the seismicity and its related devastation is very susceptible

and in case of ignoring the banning and restriction of construction in the boundary of fault will be considered as deterrent factor in the area development and resulted in loss of capital.

#### **The impact of climate role on spatial expansion of District 22**

Among the meteorological parameters, the high amount of rainfall in the region in order to provide District Water shortages and high levels of humidity to adjust the area air are of the favorable factors in area climate, and the most important factor effecting the climate in District 22 is its prevailing wind (west wind) that will prevent the contamination of area. Climates of District 22, is of the most important factors in attracting population and developing in order to region spatial expansion.

#### **The impact of soil role in the spatial expansion of District 22**

The soil permeability is high and water-holding is low which this feature provides sewage disposal in the ground and also the resistance of construction excavation is suitable.

#### **The impact of watercourse role in spatial expansion of District 22**

3 watercourses namely Ken, Chitgar, and Vardavard flow in northern and southern direction of the area which has wide catchment. Ken watercourse is the main source of water supply for artificial lake and supplying the lake water itself will increase the area humidity and cause the favorable climate in the region. These watercourses have been limiting edges and boundaries of districts and urban neighborhoods.

#### **The impact of the role of groundwater and Chitgar Park and Lake in the expansion of District 22**

Groundwater is the main source of water supply in the area and exploiting them is done by deep wells. Creating an imbalance between groundwater resources and increasing trend of water consumption with population increase, the accumulation of contaminants factors in groundwater of the area, increasing the trend of decline in groundwater levels and increasing the waste production considering the population increase can be considered as the negative effects of the role of these waters in the region.

#### **The impact of Chitgar Park and lake in spatial expansion of District 22**

It will cause the increment in the ecological potential of the region, attracting tourism, private sector investment, creating jobs, contribute to economic growth and development, creating beautiful landscapes, response to the physiological and psychological needs of citizens, and according to the position of the lake and direction of the prevailing wind in Tehran will result in stylized air and the raise in humidity.

#### **Impact of the Green Space role in spatial expansion of District 22**

Green space capita in District 22 is more than the average of green spaces in Tehran (An area of 4,000 hectares in the foothills overlooking District 22 is

intended for this use) which will result in stylized air of area, prevent flooding in the area and attracting population in Tehran and (according to the proximity of District 22 to the Central Alborz Protected Area) will cause the elimination of existing and adapted plant species in the area, wildlife species migrate to other areas due to changes in habitat conditions and reduced plant diversity.

### The impact of population role in spatial expansion of District 22

Due to the potential of the lands and the possibility of creating infrastructures and developing building mass and high immigration process of the area it can be said that district 22 has the ability of Tehran population overflow. Since the one of the objectives of creating district 22 was Tehran's development and population settlements in the area, therefore the implementation of regional development and population growth will have significant positive and negative effects in the district:

- 1-Increased immigration process to the area
- 2-Increased problems of future area population about supply the required water
- 3-Expansion of communication networks in the region and positive impact on the ease of access to Tehran
- 4-Changing the pattern of employment in the area
- 5-Prevent the unprincipled distribution of land uses, particularly residential use
- 6-Increased property values in the area
- 7-Increased tourist activities in the area
- 8-Provide the urban infrastructure required for those living in the area

9-Meet the needs of residents in the area, such as health, educational and commercial centers

### The impact of communication ways role available in spatial expansion of District 22

District 22 by having high communications power Consists of three east - west axes (Tehran - Karaj highway, the stretch of Hemmat and Resalat highways),

Two north - south axes (stretch of Azadegan ring road, north Freeway and the continue of Tehran second ring road); Stretch of three south - north Arterial axes along with the intercity train line of Tehran - Karaj, will establish a good network for connection of District 22 with Tehran and thus the district has cleanest air among 22 districts of Tehran and will result in decentralization of the most populous areas of Tehran and the negative effects include: 1-Impact on the natural state by creating communication networks in Residential Towns; 2-Fundamental changes in the natural landscapes of the area

### SWOT model evaluation in District 22

SWOT evaluation technique is used to identify internal strengths and weaknesses and external opportunities and threats facing a system. Here we have used this model practically to illustrate the strengths and weaknesses and the opportunities and threats of Tehran District 22 and according to the tables of this model we have discussed the analysis and evaluation of the role of available geographical component in the area in order to spatial expansion of the that area. First stage of the findings, provide the internal factors matrix of the area is as follows.

**Table 1.** Evaluating the strengths and weaknesses caused by internal factors (Source: The author, 2012)

Row	Factor	Coefficient (weight)	Rank (Score)	Final score
1	The appropriate and varied slope and topography of the area	0.1	4	0.4
2	Having extensive forest parks to reduce pollution	0.07	4	0.28
3	Artificial lake, the factor of reducing the pollution and increasing the humidity of the area	0.05	3	0.15
4	Position of the area in Alborz mountain range that causes increased rainfalls	0.05	3	0.15
5	The area self-sufficiency in the terms of green space and its impact on pollution and creating a beautiful landscape	0.07	4	0.28
6	Watercourses of the area as green axes and the use of their water for shortages caused by the area water	0.07	4	0.28
7	Impact of natural factors along with communication factors in the good quality and price of land and employment possibilities	0.05	3	0.15
8	Potential of lands in terms of regional extent and the possibility of creating infrastructures	0.08	4	0.32
9	High immigration process	0.1	4	0.4
10	The possibility of construction and design appropriate with the natural components	0.06	4	0.24
11	Having high potential of flooding and erodible of soil	0.04	2	0.08
12	Having instability potential in area natural range	0.01	1	0.01
13	Lack of utilization of area' natural potential to attract revenue and employment out of the area	0.04	2	0.08
14	Lack of properly locating the land uses based on ecological capability of the area	0.01	1	0.01
15	lands slopes above the 5% (Chitgar Forest Park)	0.03	1	0.03
16	The lack of area being reach to the population threshold	0.03	2	0.06
17	The lack of area being reach to the threshold of creating employment at level of self-sufficiency	0.02	1	0.02
18	The lack of bringing out the annoying industry from the residential context	0.02	1	0.02
19	The lack of being coordinated in upper plans in the field of area body development	0.02	1	0.02
20	Lack of collection and treatment facilities of sewage and solid waste	0.03	2	0.06
Sum		1	52	3.08

Based on the final score, the matrix of strengths and weaknesses (3.08) is greater than 2.5. According to what presented in theory, the score of 2.5 to 4 indicate the strength and suggests that District 22 of Tehran, in terms of being affected by the geographical components

available in the region for spatial expansion has a good condition.

The second stage of findings is to provide external factors matrix of the area in the following Table 2.

Given this information, the area final score in evaluation of the external factors is the number 2.57, which indicates that area is in average situation in the terms of these factors.

According to the external and internal factors Tables, the difference is 0.61 in the favor of external

factors, which indicates that the area situation with regard to internal factors is much better than external factors and also in terms of external factors opportunities is much better than the threats. The following tables show the final score of each of the internal and external factors and their combination.

**Table 2.** Evaluating the opportunities and threats caused by external factors (source: The author, 2012)

row	Factor	Coefficient (weight)	Rank (Score)	Final score
1	Tehran monsoon wind direction (generally West to East)	0.1	4	0.4
2	Adjacency of the area from East with the Ken river	0.04	3	0.12
3	Ability to attract Tehran population overflow and the trend of area high immigration	0.06	4	0.24
4	Area being surrounded between natural potential and stable edges (mountain, watercourse, highway)	0.06	4	0.24
5	Doing wide research activities in the field of organizing the floods and offset the shortages of District water	0.04	3	0.12
6	Vardavard village as the west limit of area and an obstacle for the development of the area	0.05	3	0.15
7	Ability to create a semi-autonomous area from Tehran and placement in the west of metropolis sphere (clean air stream threshold)	0.04	3	0.12
8	Adjacency of the area from the north with Alborz mountains, a hard barrier against the physical spread of the area	0.05	3	0.15
9	Having a special communication place	0.04	3	0.12
10	The area role in spending leisure times and its recreational identity	0.06	3	0.18
11	Establishment on the main faults of Tehran north	0.1	2	0.2
12	Being away from Tehran and service dependency to the Tehran metropolis	0.05	2	0.1
13	Topographical problems to implement some of the designed passages	0.04	1	0.04
14	Mismatch of high population potentials with some of the development policies	0.04	1	0.04
15	Insufficient knowledge of relevant organizations with regional development of area natural distinction aspects and special conditions	0.05	2	0.1
16	Proximity to Alborz mountains 1400-1800 and protected areas (at risk of vulnerability)	0.03	1	0.03
17	Problems of land and housing ownership possession by individuals, organizations and cooperatives	0.03	1	0.03
18	Uncertainty of Proposed development plans, the factor of employees being half - employed and disruption in distribution network of municipal services	0.02	1	0.02
19	The lack of being coordinated in upper plans in the field of area body development	0.05	2	0.1
20	Lack of collection and treatment facilities of sewage and solid waste	0.04	1	0.04
Sum		1	48	2.57

Opportunities

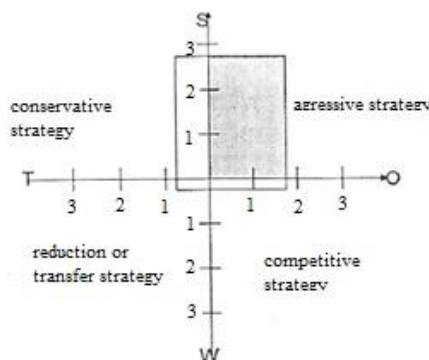
Threats

**Table 3.** The combination of internal and external factors

External Factors		Internal factors	
Threat (T)	Opportunity (O)	Weakness (W)	Strength (S)
0.73	1.84	0.43	2.56

**Table 4.** The composed of the sum of the coefficients (Source: The author, 2012)

(SO)	(WT)	(ST)	(WO)
4.49	1.16	3.38	2.27



**Figure 5.** Evaluation of internal and external factors of SWOT

As is clear the internal factors strengths are more than their weaknesses and the opportunities of external factors are more than their threats.

Based on the above data, the SWOT chart is drawn a follow in the district.

As can be seen in the combination table above which is obtained from summing of the internal and external scores the largest obtained number is related to SO factors which are strengths and opportunities for the region. In this situation District 22 have to use an aggressive strategy for more use of strengths and opportunities and according to SWOT model, this strategy is when the organization trying to take advantage of more external opportunities and be able to benefit external events and trends by use of internal strengths.

## CONCLUSION

District 22 by having:

1-The environmental potential: most area lands being empty and untapped, gentle slope, suitable topography, rich nature and suitable perspective, Alborz slopes, located in West of metropolis range (clean air stream threshold)

2-The communication power: the most complete network of freeways and highways

3-Population potential: the area being permit immigration has very good position to continue spatial expansion of Tehran. Accurate identification of these opportunities and strengths and appropriate utilization of them will result in appropriate area spatial expansion and also identifying the risk factors such as faults, high erodible of soils and the risk of flood will reduce the negative effects caused by these components in the area and prevent of one-dimensional and a harmonic development in the area. But considering all these programs in the field of organizing the geographical components and benefiting from the components potential in order to area expansion, problems and shortcomings, such as increased immigration followed by increase in area population, industries available in the area, shortage of facilities and municipal services, and load increases addition to communication ways will change the area in long term which in the absence of planning and proper management, the area with its unprincipled development will become a undesirable center of contaminants and purely residential and thus the last opportunity for the continuous development of Tehran will be lost.

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