An Approach to the Green Area Parameter in Urban Transformation

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Abstract

In this study, the green area value is obtained from the feasibility reports which are made in 4, 6-hectare region that is declared as a risky area within the framework of the Law of Transformation of Areas Under Disaster Risk (No. 6306) and Implementation Regulation and the green area per capita (m2/person) is determined. In urban planning in which all of the land-use, social, technical infrastructure parameters need to be considered at the optimum level as a whole, according to this article; even if only the green area data is taken into consideration, the importance of making a transformation decision for the region is supported by the analysis. In this context; an analysis and calculation model has been proposed with the parameters defined in suggestion form which is bordered with the boundary value conditions in the light of international and national data. In the current situation, development plans' situation and the draft case, it is tried to compare the amounts of the green areas and to give an approach for the green area ratio per capita.

Keywords: Urban Transformation; Green Space; Social Facilities.

1. Introduction

The concept of open space is one of the important basic elements of urban texture and is defined as open spaces or vacant spaces outside the architectural structure and transportation areas. In other words, they are perceived as areas that have no potential for outdoor use and that have potential for any recreational use. For example, water surfaces, vegetation elements or very limited number of squares and transportation areas are defined as open areas [1]. In addition, green areas in the Planned Landscapes Type Zoning Directive; is defined the whole the play garden, children's ground, recreation picnic and coastal areas reserved for community use. [2].

Green spaces can be expressed as public spaces in urban areas in which generally social relations established and social solidarity developed. Usage forms and types of green spaces show variability as children's playground, recreation area, zoological garden, botanic park. The green area in a region or in a project area refers to the collective sum of all these areas.

The green areas created in the cities show significant differences from country to country, from city to city. The types of green spaces and their contents, the forms and size of the green spaces depend on:

- Population size,
- Characteristics of the settlement,

- The natural characteristics of cities such as topography, soil's ability and plant cover,

- Climatic conditions.

The green spaces in the city provide the necessary foot traffic assurance for people, especially by separating vehicle traffic from pedestrian recreation and residential areas [3]. Besides, the green areas softening the solid mold by the formal buildings and give an organic character to urban area [4].

However, unplanned designs result in proportionally deficient or inefficient, especially green areas of social infrastructure. In this study; the green area that is the basis for urban transformation decisions has been evaluated together with the results of local and universal applications.

The application of a mathematical model on finding the size of the green area per capita facilitates the development of urban specific criteria [5]. According to Polat, green area parameter; with the recommendation limit values set out in the light of international and national data is included in a relational matrix together [6].

In this method of study, a green area approach has been adopted with boundary values determined according to international and national parameters. In this context; in Istanbul, Bagcilar district an area of 4.6 hectares which is declared as risky within the frame of Law No. 6306 has been evaluated about the current green spaces and need of transformation focused only on the green areas. Thus, the need for green space in urban areas has been searched on universal and local platforms, and the ideal solution proposal has been tried to be reached [7].

2. Methodology

The green area diagram in Figure 1 shows the current situation in a project area and the boundary value criteria including the proposed model data base and the national, international and recommendation standards that are likely to be applied as a result of the application of the urban transformation application decision.
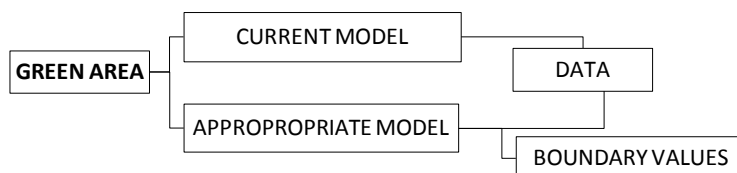

Figure 1. Green area diagram

In this analysis study; 3 current situations, 3 draft models of 6 total parameters are evaluated (Table 1).

Table 1. Green area data index

1	Current population (person)
2	Current green area (m²)
3	Current green area per capita (m²/person)
4	Appropriate population (person)
5	Appropriate green area per capita (m²/person)
6	Appropriate green area (m²)

3. Green Area in Project Area

Table 2 shows the green area data for the current situation. The green area data based on the current population (person) and green area (m2) obtained in the direction of the research report of the region where the urban transformation to be carried out is in the variable input column and the calculation and analysis results are shown in the output column as the area per person.

Table 2. Current model green area data

No	Type	Variable input	Output
1	Current population (person)	x	
2	Current green area (m²)	x	
3	Current green area per capita (m²/person)		x

The unit subjected for green area is quota per capita.

$$\frac{\text{Current Green Area (m}^2)}{0.00} \div \frac{\text{Current Population (person)}}{1,400.00} = \frac{\text{Current Green Area Per Capita (m}^2/\text{person})}{0.00} \qquad (1)$$

Since there is no green area in the project area, the current green area per capita is 0.00 (m²/person) as a result of Equation 1. The fact that 1,400 people living in the region do not have any green space reveals how much urban renewal is necessary even in this context. The presence of green spaces is of great importance in order to build up living quality, urban sustainability and more livable urban areas. From this point of view, it is obvious that it would not be an exaggerated approach to describe the characteristics of this city section where there are no green areas as consisting of only building stocks and roads (Figure 2).

Figure 2. Project area satellite photo

4. Green Area in Draft Model

The draft model analysis for the project area has been adopted after the determination of the necessity of the urban transformation is assumed as positive. In the green area data bank section of the draft model, the proper green area per capita (m²/person) data determined in accordance with the need of the region where the urban transformation to be performed is in the input column, the calculation and analysis results of the draft green area (m²) are shown in the output column. The draft population (person) data is an output data obtained as a result of the interaction between the project area (ha) and the draft density (person/ha) data, which is a parameter used in the green area calculations [8]. However, the values created from the national, international criteria and the suggestions are in the boundary value column. In suitability and condition columns, the limit value of the outputs and its relevant situations are shown (Table 3).

Table 3. Green area data of draft model

No	Type	Variable input	Output	Condition	Boundary value	Suitability
1	Appropriate population (person)	-	x	x	x	x
2	Appropriate green area per capita (m²/person)	x	-	-	-	-
3	Appropriate green area (m²)	-	x	x	x	x

Green area data of the draft model; has been scrutinized under the title of "international values" the general results of the literature researches are gathered together, "situation in Turkey" where the relevant laws and regulations in Turkey and the current situation results are collected. As a result of this data, the limit values suggested by the synthesis and interpretation of the data obtained in the world and Turkey have been determined. "Analysis on the project area" where the model applied and the values determined in the draft case integrated is compiled (Table 4).

Table 4. Boundary value references

No	Type	International	National	Suggestion
1	Appropriate green area per capita (m²/person)	√	√	√
2	Appropriate green area (m²)	√	√	√

Gedikli (2002) aims to find the size of the green area per capita, which should be determined by the individual and familial characteristics of the society. The study develops a mathematical model proposal which can be used in the evaluation of the size of the open green space that is per capita in the cities. In the study, it is argued that the amount of green area specific to each region should be determined according to the answers of the questions by conducting researches and surveys with social contents.

It can be said that the quality of life in an urban area has a fairly direct correlation with the per capita green space in the world cities that are developed and whose living standards are high. The amount of green space per capita is the basic element of social infrastructure. The more this value is increased, the more sustainable living spaces and the ideal city is to be approached in that place.

The green space data is one of the main arguments of planning thought. This parameter is the dominant characteristic of the amount of social infrastructure in a project area. As shown in the green area data interaction diagram, the green area (m²) is the first factor affecting the total area of social infrastructure (Figure 3).
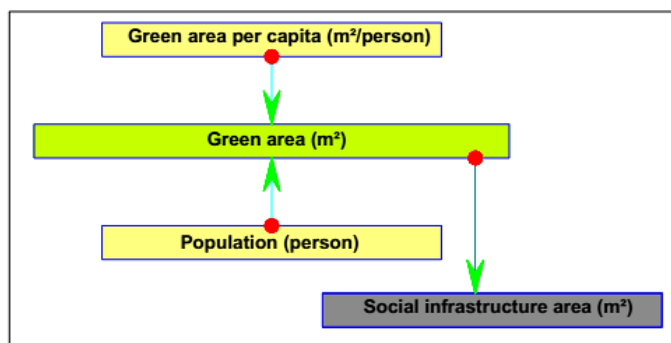

Figure 3. Green area data interaction diagram

According to Table 5, which indicates the amount of green area per person by the countries, it is seen that the green area in the western society is watching higher values. In countries where the quality of life is high, such as the United States, England and Australia, the amount of green space is 10 m²/person while 3.5 m²/person in the Netherlands, 3.0 m²/person in Italy and 0.21 m²/person in Iran and it is calculated as 6.02 m²/person in average. These values show the average of the cities equivalent to metropolitan cities in Turkey such as Istanbul or the standards in the regulations of these countries.

Table 5. Current green spaces per capita by country

Country	m²/person	
USA	10	[9]
Germany	5.8	[10]
Austria	6	[10]
France	5	[11]
Sweden	7.8	[11, 12]
Netherlands	3.5	[11]
England	10	[11, 13]
Italy	3	[10, 11]
Portugal	5	[14]
Australia	10	[15]
Iran	0.21	[16]
Average	**6.02**	

In some important European cities, the amount of green space per capita is listed in Table 6 [17, 18]. While the green area up to 19.90 m²/person in Hague, it is seen that in Munich and Copenhagen there is also a significant amount of ratio (11.60 m²/person). In the chart, Ankara (1.00 m²/person) and Istanbul (2.10 m²/person) are observed to be the lowest. Moreover, the green areas of the two largest cities of Turkey are easily understood from the calculations that contribute to keeping the world average (7.17 m²/person) below 10 m²/person.

Table 6. Green spaces in European cities

City	m²/person
Hamburg	10.30
West Berlin	10.70
Bonn	2.40
Hannover	6.50

Stuttgart	5.70
Munich	11.60
Graz	6.00
Linz	5.50
Odense	7.20
Copenhagen	11.60
Amsterdam	2.50
Rotterdam	4.60
Hague	19.90
Ankara	1.00
Istanbul	2.10
Average	**7.17**

According to the World Cities Culture Forum; the green area ratio in Istanbul is 2.20% while the average of the world's major cities is 21.10% and the average of the major cities in Europe is 23.83% (Table 7). In fact, it is 54.00% in Moscow, 47.00% in Singapore and 46.00% in Sydney. The cities below 5% are generally in the Far East such as Tokyo (Japan), Taipei (Taiwan) and Shanghai (China) [19].

Table 7. Percentage of public green space (parks and gardens)

City	Percentage (%)	Year	Continent
Amsterdam	13.00%	2015	Europe
Austin	15.00%	2015	America
Berlin	14.40%	2011	Europe
Bogotá	4.40%	2013	Colombia
Brussels	18.80%	2015	Europe
Buenos Aires	8.90%	2013	Argentina
Dubai	2.00%	2015	Middle East
Edinburgh	16.00%	2009	Europe
Hong Kong	40.00%	2014	Asia
Istanbul	2.20%	2015	Asia
Johannesburg	24.00%	2002	Africa
London	33.00%	2013	Europe
Los Angeles	6.70%	2012	America
Madrid	35.00%	2014	Europe
Melbourne	9.00%	2015	Oceania
Montréal	14.80%	2013	America
Moscow	54.00%	2013	Asia
Mumbai	2.50%	2011	Asia
New York	27.00%	2010	America
Paris	9.50%	2013	Europe
Rio de Janeiro	29.00%	2013	South America
Rome	34.80%	2014	Europe
San Francisco	13.70%	2012	America
Seoul	26.60%	2015	Asia

Shanghai	2.80%	2014	Asia
Shenzhen	45.00%	2013	Asia
Singapore	47.00%	2011	Asia
Stockholm	40.00%	2014	Europe
Sydney	46.00%	2010	Oceania
Taipei	3.60%	2014	Asia
Tokyo	3.40%	2011	Asia
Toronto	12.70%	2012	North America
Vienna	45.50%	2014	Austria
Warsaw	17.00%	2015	Europe
Average of the Biggest Cities of the World	21.10%		World
Average of the Biggest Cities of the Europe	23.83		Europe

Spatial Planning Regulations in Turkey include a chart of green spaces by population groups in urban areas (Table 8). According to this table green area per capita is set as 10 m²/person under the headings of children's park, park, Botanical Park, zoological garden, promenade and recreation area [20].

Table 8. Green spaces per capita

Population		0- 75,000		75,001- 150,000		150,001- 500,000		501,000 +	
Field of Infrastructure		m²/person	Min Area	m²/person	Min Area	m²/person	Min Area	m²/person	Min Area
Social and Open Green Spaces	Children's park Park Botanical Park Zoological Garden Promenade Recreation	10.00	-	10.00	-	10.00	-	10.00	-

Green areas are getting smaller and smaller every day and the green area per capita is decreasing both in terms of quantity and quality in Istanbul. Thus, the city is transforming toward being a concrete city by its high population density and being over crowded.

Table 9. Green spaces by districts of Istanbul

District	m²/person
Adalar	0.50
Bakırköy	1.19
Beşiktaş	1.22
Beykoz	0.38
Beyoğlu	0.28
Eminönü	0.66
Eyüp	1.02
Fatih	0.43
Gaziosmanpaşa	0.10
Kadıköy	0.79
Sarıyer	1.64
Şişli	1.06
Üsküdar	0.20
Zeytinburnu	0.03
Average:	**0.63**

In Table 10 the values obtained by Akdoğan (1972), in the districts of Ankara in the context of the researches on qualifications and planning principles of children's playgrounds are tabulated and these values are identified quite low as in Istanbul (average: 1.02 m²/person) [21].

Table 10. Green spaces by districts of Ankara

District	m²/person
Altındağ	1.22
Çankaya	0.78
Merkez	0.92
Yenimahalle	2.16
Average:	**1.02**

According to the literature researches and taken into consideration the current situation in the world, there is a consensus on the green area per capita being determined as around 10 m²/person. This value contributes to the high human living standards. However, it can be said that this value is far from applicability for the large cities like Istanbul which has high density and the great majority of the green areas has already been consumed.

As in the case of Bağcılar Kemalpaşa region, which has been subjected in this study in the frame of all these data and opinions, the Appropriate green space coefficient and the Appropriate green space boundary value have been tried to be determined below under the domination of high density, distorted construction. especially for the areas which are not protected area and historical area.

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- Appropriate green area per capita (m²/person): The green area per person, which is idealized, is determined as a value close to the limits of the regulation that should be applied in Turkey. However, the choice of a higher value is useful for the human living conditions of the project field. The green area is a calculated as m² per person, as well as it can be determined as a percentage of the urban area. (In Table 8, the green area has been represented as percentage to the urban area). In this context; taking into consideration the international values and existing conditions in Turkey, the green area per capita considered in the appropriate situation is minimum 8.00 m²/person.
- Appropriate green area boundary value (m²): It is the value which is defined as the green area coefficient multiplied by the number of population in the region.

Also in this study; considering the great role of green area in urban planning, two separate threshold values are determined in addition to the above-mentioned limit value for the green area coefficient. According to this;

- According to the 1st subsidiary boundary value: A green field value lower than the existing amount of green space during the new planning study should not be selected for the case. Although this is not a very common situation for Turkey, it has been tried to make this recommendation considering that there might be special circumstances.
- According to the 2nd subsidiary boundary value: It is recommended that not to select below the percentage of the world and European cities in Table 8. In this case, the green area corresponding to the second subsidiary boundary value; it is thought that it would be more appropriate to identify an area that is not smaller than 23.83%, which is the green area average of Europe's largest cities.

In the project area where the model is applied, the green area coefficient is chosen as 10.00 m² /person. Population value is included in the calculations as the value of the population in the region at the current situation.

The green area per capita for the project area has been chosen as 10.00 m²/person.

$$\frac{\text{Appropriate population (person)}}{1,400} \times \frac{\left(\frac{m^2}{\text{person}}\right)}{10.00} = \frac{\text{Appropriate green area } (m^2)}{14,000.00} \quad (2)$$

Appropriate green area per capita= 10.00 m²/person ≥ 8.00 m²/person (√)

Appropriate green area boundary value= Appropriate population (person) x Appropriate green area per capita (m²/person)

11,442.47 m² = 1,400-person x 8.00 m²/person

14,000.00 m² ≥ 11,442.47 m² (√)

In equation 2, according to the stated limit value (8.00 m² per person); 14,000.00 m² area obtained by selecting 10.00 m² green area per person is greater than 11,442.47 m² the appropriate green area boundary value.

- 1st subsidiary boundary value:

Appropriate green area (m²) ≥ Current green area (=0.00 m²)

14,000.00 m² ≥ 0.00 m²

- 2nd subsidiary boundary value:

Appropriate green area ratio = 14,000.00 / 46,000.00 = 30.43%

Appropriate green area ≥ Green area average of Europe's largest cities

30.43% ≥ 23.83%

Also; according to the research reports of Bağcılar Municipality and in the current implementation, the area allocated to the green area is 7,857.66 m² and the amount of green area per capita is calculated as 2.62 m² in a possible transformation study of 4.6 hectares with a population of 1,400 people [22].

5. Results and Discussions

In this study, 6 parameters specific to the green areas of the current and draft situation in the project area are emphasized. An evaluation and comparison are tried to be made by making calculations and analyzes. A project area of 4.6 hectares in the Bagcilar District Kemalpasa quarter, which is declared as a risky area within the frame of Law No. 6306 with 1,400 habitants is investigated. The green area is obtained from the research reports and the green area per capita is determined.

In Table 11, a comparative table is created by bringing together the current situation of the project area, the draft model and the values obtained according to Bağcılar Municipality's current plan principles where the risky area is located. The green area parameter which belongs to the social infrastructure data and is essential to the mathematical model, is analyzed. The results of the project area which needs urban transformation are compared below to the boundary values determined in draft model:

Table 11. Green area data comparison chart

Area	Current situation			Current planning code			Draft model			Cond.	Boundary Values		
	m²	(%)	m²/person	m²	(%)	m²/person	m²	(%)	m²/person		m²	(%)	m²/person
Green Area	0.00	0.00%	0.00	7,857.66	17.03%	2.62	14,000.00	30.43%	10.00	≥	11,442.47	-	8.00

According to the table above green area, non-exist at all in current situation, covers the area of 14,000.00 m² in the appropriate situation (draft model). That is, 31.00% of the whole project area is allocated to the green area. The green area per capita is optimized as 10.00 m²/person. In the development plans of Municipality, the green area is 7,857.66 m² with 17.03% of the project region and 2.62 (m²/person) per capita. The amount of green space per person, which is 0.00 (m²/person) in current and 2.62 (m²/person) in current planning codes obtained from Bagcilar Municipal Development Plan Implementation, are very lower than the limit (boundary) value (8.00 m²/person).

6. Conclusion

As a result; in the light of the green area parameter which is calculated and analyzed within the scope of the urban transformation model; the green area which is not exist in the current situation is calculated as 14,000.00 m² and it is taken as 10.00 (m²/person) per capita. One of the most striking parts of the Development and Implementation Plan is that the green area is taken at a very low level in a newly planned area as 2.62 m²/person. In the context of these analyzes and evaluations, the amount of green space which is inadequate in the present case and the most important measure of social infrastructure concept, has been increased to the appropriate and adequate level.

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