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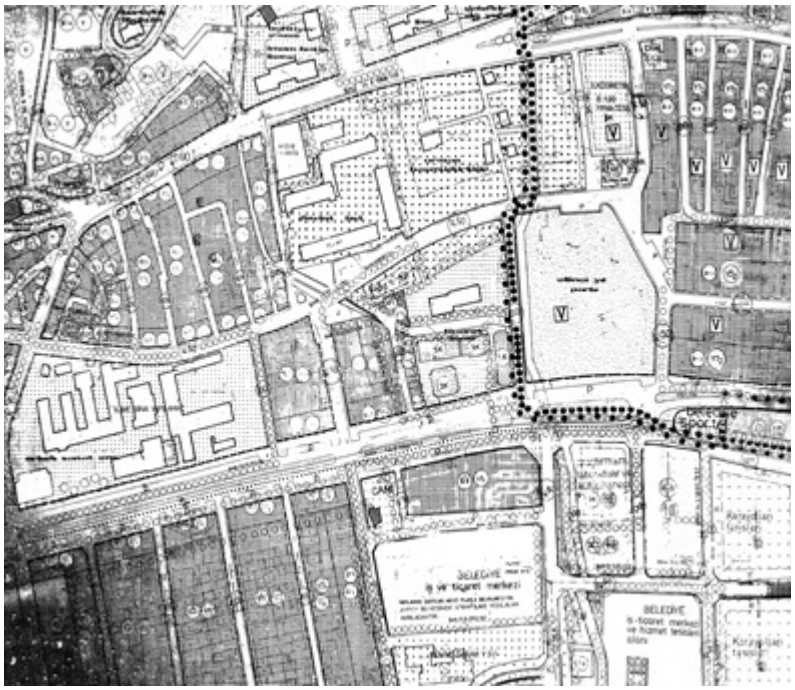

ANALYSIS OF THE FIRST URBAN REGENERATION AREA IN KOCAELI

AFTER GÖLCÜK EARTHQUAKE BY USING ZONING PLANS

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ABSTRACT

Rapidly growing cities following The Industrial Revolution remained insufficient to fulfill today's necessities. Also, natural disasters such as earthquakes, floods or unsound structures have affected the development of cities adversely. Although natural disasters can be unpredictable, the issue of preparing cities for natural disasters, planning cities and regulating laws accordingly are becoming increasingly crucial. Urban regeneration activities are one of these preventions taken in this purpose. It is observed that countries such as Turkey, faced with natural disasters intensively, suffer from serious physical, financial and moral losses. Therefore, urban renewal activities have gained importance in Turkey after The Gölcük Earthquake (7.4Mw) and The Düzce Earthquake (7.2Mw) in 1999. The first urban regeneration project in Kocaeli where was one of the cities experiencing hard collapses of these earthquakes is about to be completed. Research of the principles of urban sustainability and resiliency in urban regeneration practices, which are priority issues due to natural disaster risks, has come into prominence. It is important not only to make urban areas more resistant to disasters but also to design according to social, economic and ecological criteria to make more livable. In this study, social, health, green, transportation and educational areas of the first urban regeneration area in Kocaeli were examined in terms of the basic needs of the city. For this purpose, pre and post-project zoning plans are analyzed and transferred to the GIS. The areal changes in the above-mentioned needs are evaluated for changing population density and their sufficiencies are compared.

KEYWORDS:
Geographic Information Systems; Sustainability; Urban Regeneration; Zoning Plans, Natural Disaster Risk.

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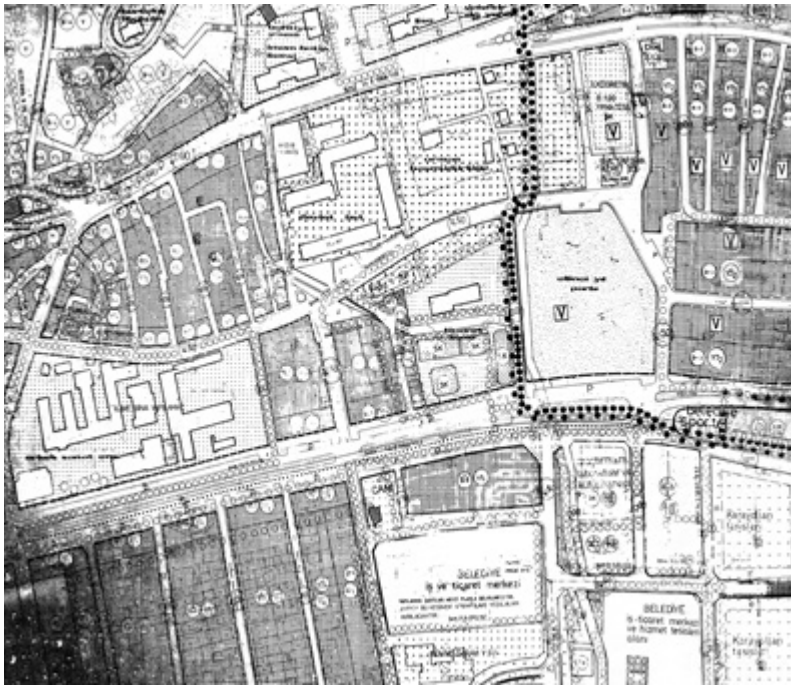

城市改造区内区域划分规划的变化分析

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摘要

工业革命之后，城市的迅速发展已经无法满足当今的需求。此外，地震、洪水等自然灾害和低质量建筑为城市的健康发展带来了负面影响。据观察，土耳其等遭受过大范围灾害的国家在物质、金融和道德领域受害颇深。因此，在经历1999年的格尔居克（Gölcük）地震（7.6Mw）和迪兹杰省（Düzce）地震（7.2Mw）之后，城市改造变得愈发重要。科贾埃利（Kocaeli）是在地震中严重受损的城市之一，其首个城市改造项目于2009年完成。在科贾埃利，很多城市改造项目已经完成并持续进行。由于灾害风险，对城市重建实践中的可持续性原则的审查也变得尤为重要。城市设计不仅要能够抵御灾害，还要满足社会、经济、生态等方面需求，这已衍生为一个重要课题。
该研究将依据城市的基本需求对科贾埃利第一和第二城市改造区（约770000平方米）的医疗、绿化、交通、教育和社会区域进行调查。为此，我们通过向地理信息系统转移的方法，对项目前后的区域划分规划进行分析。根据人口密度的变化对上述需求的区域变化进行了评估，并对其充分性进行了比较。

关键词:
地理信息系统; 可持续性; 城市改造; 区域划分规划

1. INTRODUCTION

Although natural hazards are unpredictable, the issue of preparing cities for disasters, taking necessary preventions together with laws and regulations, and planning cities in this direction has become an increasingly critical and major subject in our country and the world. A proper urban system is a city that not only supplies the social, economic and environmental needs of the inhabitants but also protects them against potential risks and achieves crisis management in case of a natural disaster or other serious conditions. The concept of resilience is an approach that has emerged to accomplish and sustain such an urban system. There are various definitions of resilience in the literature according to different purposes and different needs of cities (Molavi, 2018; Saunders & Becker, 2015). A resilient city is a city that can have the ability to recover after a disaster, maintain its balance and proceed with its urban activities as soon as possible (Papa, 2012). Essential preventions should be taken to ensure that cities are damage in the minimum possible way from disasters and crises. Resilient cities are planned and developed by considering all these risks and conditions and can use and manage all the required tools within this scope. Major tools for cities to be resilient and prepared for all risks and disasters can be listed as laws and regulations, zoning plans, disaster risk management practices, construction control services, insurances, infrastructure information systems, urban regeneration projects, etc. (Andres & Strappazzon, 2011; Benson, 2016; Godschalk, 2003; Meerow, Newell, & Stults, 2016). One of the most effective methods is the urban regeneration projects to reduce risks of the unplanned cities in disasters risk areas. Urban regeneration can be defined as a comprehensive integration of the vision and action to solve the many-sided problems of urban areas that are lacking to improve economic, physical, social and environmental conditions (Ercan, 2011; Zheng, Shen, & Wang, 2014). Increasing energy consumption and carbon dioxide emissions in cities due to increasing population also accelerates the functional, economic and aesthetic aging process in urban tissue. Along with unplanned settlement, urban sprawl causes the destruction of natural areas and deterioration of the quality of environmental life (Mohamed, Baharum, Senawi, & Salleh, 2016; Ulubaş Hamurcu & Aysan Buldurur, 2017). Taking all this into consideration, it has become important to plan cities in a sustainable way and to regulate urban regeneration activities according to the sustainability criteria.

The theme of sustainability is a system including economic competitiveness, the improvement of environmental performance and balanced social integration. In this regard, in order to achieve the ecological, economic and social targets the definition of the participants responsible for continuous control is substantial for sustainability. The private sector, national, regional and local actors and nongovernmental organizations can be considered to be involved in a sustainability issue (Ulubaş Hamurcu & Aysan Buldurur, 2017). The development of urbanization in harmony with environmental principles is directly related to the sustainability of urban planning policies (Hemphill, Mc Greal, & Berry, 2004; Noor, Asmawi, & Abdullah, 2015; Peng, Lai, Li, & Zhang, 2015; Wheeler, 2004). Nowadays, low energy consumption, efficient use of renewable energy sources, compliance with ecological principles of land use, and participation of people in decision-making processes are increasingly important issues to ensure this harmony. Industrialization and development movements are inadequate due to the continuous increase in population; raw material consumption is increasing rapidly and environmental and economic problems are arising. The growing population in cities increases demands on services such as transportation, infrastructure, waste management, and this case causes pressure on urban planning and the environment (Anderson, 2013; Gölbaşı, 2014; Newman, 1999; Nijkamp & Pepping, 1998; Shen, Jorge Ochoa, Shah, & Zhang, 2011).

In the 1950s, the urbanization actions accelerated with the increasing migration from villages to cities in Turkey. The agricultural activities decreased and demand for industrial activities has developed in this period. The increasing population caused unplanned urbanization and the squatters to occur in the cities ((Demir & Yılmaz, 2012; Genç, 2014; Güzey, 2016; Kaya, 1989; Sağlam, 2016). For many years, the governments tried to solve the urbanization problems with various zoning and construction amnesties. However, it can be said

that these amnesties and new laws did not provide enough benefits to cities and they have even made the problems more unsolvable ((Türker Devecigil, 2005; Uzun, Çete, & Palancıoğlu, 2010; Uzun & Şimşek, 2015)). Gölcük (7,4 M_w) and Düzce (7,2 M_w) Earthquakes in 1999 have caused a compulsive awakening in the whole country in terms of urbanization (Tolon & Mızrak, 2017). Especially, these earthquakes caused huge damages to the Marmara Region known as Turkey's industry zone. Kocaeli was one of the damaged cities too. Kocaeli is still one of the most important industrial cities in Turkey and it is located on a zone of high seismic risk. In addition to the urbanization problems that have become totally unsolvable in industrial cities of Turkey, these earthquakes made clear that people and their lives are vulnerable to disasters. As a consequence of all, the urban regeneration idea has become a necessity.

Zoning plans are designed to fulfill the needs of cities for the future with various land use functions ((Demiroğlu & Karakuş, 2012). Zoning plans are critically momentous in the development and orientation of cities in accordance with the principles of urbanization. However, when we look at Turkey, after the 1950s, it was unlikely possible to plan rapidly growing cities in Turkey. Cities developed with their internal dynamics and tried to find their own solutions for the needs of that time. Then, governments tried various solutions with these zoning plan arrangements suitable for these spontaneous urbanization models. These methods which shed no light on the future were also far from adapting to the circumstances of the time. Urban regeneration and legal arrangements provide the opportunity to fully regulate old zoning plans and unplanned urbanization. "The first urban regeneration area" in Kocaeli was announced in order to eliminate housing deficiencies, to increase earthquake-resistant construction and to solve transportation problems by providing access to mass housing constructed after the earthquake. In this study, zoning plans before and after the Gölcük earthquake are compared in "the first urban regeneration project" of Kocaeli. First, briefly, the history of Turkey's urbanization is described and the changes in land use functions are analyzed in a GIS model.

2. THE URBANIZATION HISTORY AND LEGAL REGULATIONS IN TURKEY

Urbanization process in Turkey, despite some differences, is similar to other underdeveloped or developing countries. Until the 1950s, agriculture-based economies generally defined the basis of relations of production in the country. Therefore, until the 1950s, it cannot be mentioned about intense urbanization for Turkey. Nevertheless, for the establishment of the modern city of the Republic of Turkey, Municipal Law No. 1580 was issued in 1930. The Law which was one of the first important urbanization laws of the Republican history mandated the development of zoning plans by municipalities for all settlements which had a population more than 2000 (Resmi Gazete, 1930).

Urbanization has gained momentum with the industrialization movements supported by foreign capital in the 1950s and the investments in major cities of the country. Other factors accelerating urbanization can be listed as the expansion in the road network and transportation facilities, and the opportunities in education and health services in certain urban areas. Immigration from rural to urban areas accelerated, because of the changes in social, political and economic relations in the society. People who migrated from villages to cities firstly built houses called "squatters" on public lands. Squatters were generally lacked infrastructure services such as electricity, water (Genç, 2014; Uzun & Şimşek, 2015). In order to prevent problems caused by rapid urbanization, Zoning Law No. 6785 entered into force in 1956 (Resmi Gazete, 1956).

In the period between 1960 and 1970, it became clear that squatter settlements, which were seen only as construction and sheltering problems, were also a socioeconomic problem. The existence of squatters was formally adopted in the first time by the state with Squatter Law no 775, which was issued in 1966 (Resmi Gazete, 1966). It was aimed to improve the existing squatter settlements and to prevent the construction of new squatters by this law. For this purpose, governments gave title deed to the squatter owners and provided infrastructure services. These applications actually legitimized the squatters and accelerated the construction of new squatters. Because actual socio-economic problems such as injustice in the distribution of income have

not been solved, to solve the squatter problem was impossible. "The amnesty laws" supported the permanence of the squatter problem. Law No. 2981 issued in 1984 was one of "the amnesty laws" (Resmi Gazete, 1984). It was tried to solve the problem by granting ownership rights to those who settled illegally in public areas with this law.

On 3 May 1985, the new Zoning Law No. 3194 entered into force to ensure the convenience of the settlements in urban areas according to planning, science, health, and environmental conditions. With this law, extensive planning and development affairs were enforced in the cities by the municipalities (Resmi Gazete, 1985). Unfortunately, it was impossible to solve the problems of urbanization in major cities by this law completely. As a result, from the 1950s to the 2000s, the social and economic problems caused by the rapidly changing relations of production and the rapid urbanization have not been sufficiently solved, hence irregular and not-resilient urbanization emerged overall the country.

3. LEGAL REGULATIONS IN TURKEY AFTER GÖLCÜK EARTHQUAKE IN 1999

The Gölcük earthquake in 1999 caused a moral and economic collapse firstly but then caused an awakening in the overall country. As a result of this earthquake, 18373 people lost their lives; 285211 houses and 42902 workplaces were damaged (Wikipedia, 2019). These extreme damages have taught the reality which unplanned urbanization puts human life at risk, especially in disaster risk areas. The earthquake revealed that the country was not prepared at a sufficient level for many issues. For example, transportation and telecommunication nets were collapsed. Search and rescue works were inadequate. It was understood that there was no proper insurance system. Generally, emergency legal arrangements were always entered in the force in order to bind up wounds after every earthquake in the country (Şengün, 2007). In this regard, the Decree-Law no 574 was issued, immediately after the earthquake. However, this earthquake affecting the whole of Turkey expressed the necessity of some radical changes for this time. Renewal of urban areas which are collapsed and not resistant to earthquakes became the main topic. There were a few urban transformation projects in Turkey until that day and the projects could usually be applied by special laws. An example was the "Dikmen Valley Urban Transformation Project", which was adopted in 1990 in the capital city, Ankara (Demirci, 2004). Another example was the "Northern Ankara Entrance Urban Transformation Project" implemented with the special law no 5104 in 2004 (Resmi Gazete, 2004). Especially, it can be said that the purpose of the "Northern Ankara Entrance Urban Transformation Project" was a physical transformation. Until that date, there was still no clear legal regulation which defines urban transformation's purposes and control mechanisms. Article 73 with entitled "Urban Transformation and Development Area" of the "Municipal Law" No. 5393, which entered into force in 2005, provided a major expansion. This article authorized municipalities to implement urban transformation in order to rebuild older parts of the city, to create housing, commercial, industrial and social areas, to take precautions against earthquake risk, to preserve the historical and cultural structure of the city. Unfortunately, many projects based on this article have received negative criticisms that urban transformation has diverged from its renewal and conservation purposes. Following the Van earthquake where 644 people lost their lives in 2011 according to Disaster and Emergency Management Presidency (AFAD)(AFAD, 2014), the necessity of regulating a specific law to reduce the losses before the disaster has become the main topic again. Finally, Law No. 6306 on "Transformation of Areas under Disaster Risk" was published on 16 May 2012. This law sets out the principles of improvement, re-settlement, and renewal in order to create healthy and safe living spaces in disaster risk zones (Resmi Gazete, 2012a). Unfortunately, this law has caused many discussions and many of its articles have been rescinded or rewritten.

Besides legal regulations related to urban transformation, some other important regulations have been entered into force after the earthquakes in 1999. "Building Inspection Law" No. 4708 which came into force in 2001 can be given as an example (Resmi Gazete, 2001). The purpose of this law is to ensure the construction of structures conforming to standards for safety of life and property. Also, one of the important regulations is

the "Regulation on Buildings to be Constructed in Seismic Zone" which were arranged in 2006 but entered into force one year later (Resmi Gazete, 2006). This regulation includes many crucial changes to build resistant-constructions against earthquake. Unfortunately, this regulation was started to be implemented in some provinces, and it was decided to implement it all over the country after the Van earthquake in 2011. Another regulation is the decree-law no 587 named as "Compulsory Earthquake Insurance" was entered into force in 1999 (Resmi Gazete, 1999). This regulation was rearranged as "Disaster Insurances Law" No. 6305 in 2012 (Resmi Gazete, 2012b).

4. STUDY AREA

Kocaeli with a surface area of 3397 km2 is located in Marmara Region of Turkey. The population of the city in 2018 has exceeded 1,9 million according to the Turkish Statistical Institute (TUIK, 2018). The city is located on an important road connecting Asia and Europe and has a natural harbor; İzmit Gulf which is a busy sea route. Because Kocaeli with important industrial institutions and an advanced economy is one of Turkey's largest industrial cities, pays the most tax contribution in Turkey. According to data from TUIK in 2015, while the average daily income of all provinces is 58 TRY, this value is 85.6 TRY for Kocaeli (TUIK, 2015). However, the earthquake (7.4 M_w) which was the epicenter of Gölcük on August 17, 1999, caused extreme damages in Kocaeli and surrounding cities. A lot of people lost their lives and houses and business sites were damaged by this earthquake. These heavy losses affected the whole country as much as Kocaeli. The restoration of economic and social damages was not really easy. Even it can be said that the earthquake had negative effects on the 2001 economic crisis all over the country. The negative cases have revealed that the government, society and cities should have taken legal, physical and social preventions against natural disasters. After the earthquake, many laws in terms of urbanization and construction have been enacted to prevent and reduce disaster damages. The Decree-Law no 574 was issued on 31.08.1999, immediately after the earthquake. The law has given the authority to determine the new housing areas and to build the mass housing quickly in the provinces damaged by the earthquake to The Ministry of Environment and Urbanization. For this aim, a total of 43053 houses were constructed in these provinces.

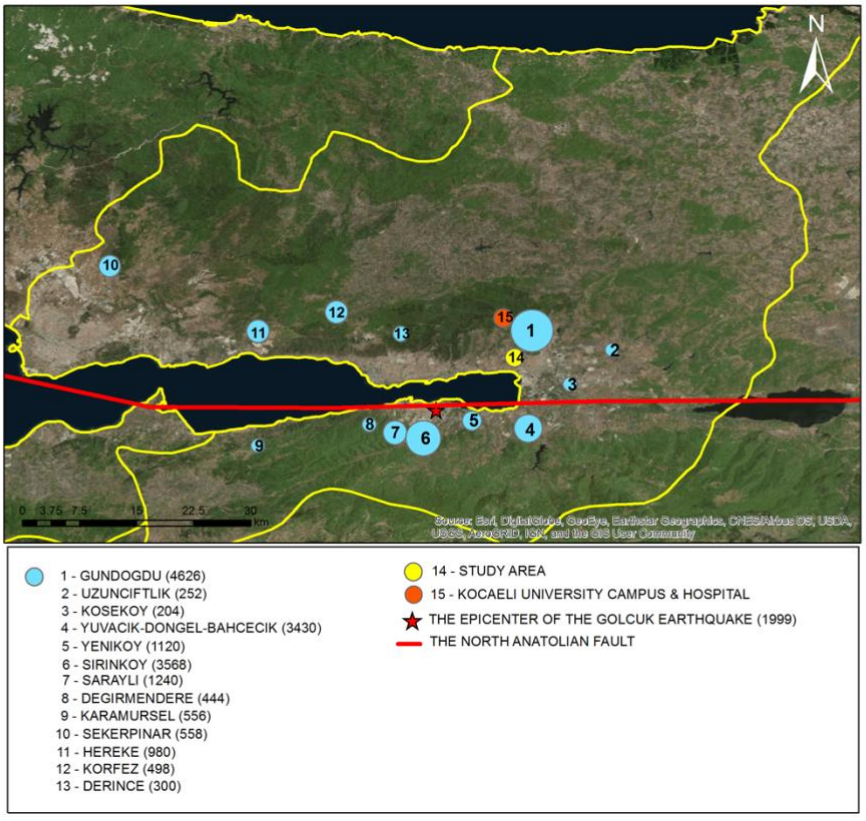

Fig. 1 Distribution of mass housing in Kocaeli after Gölcük Earthquake

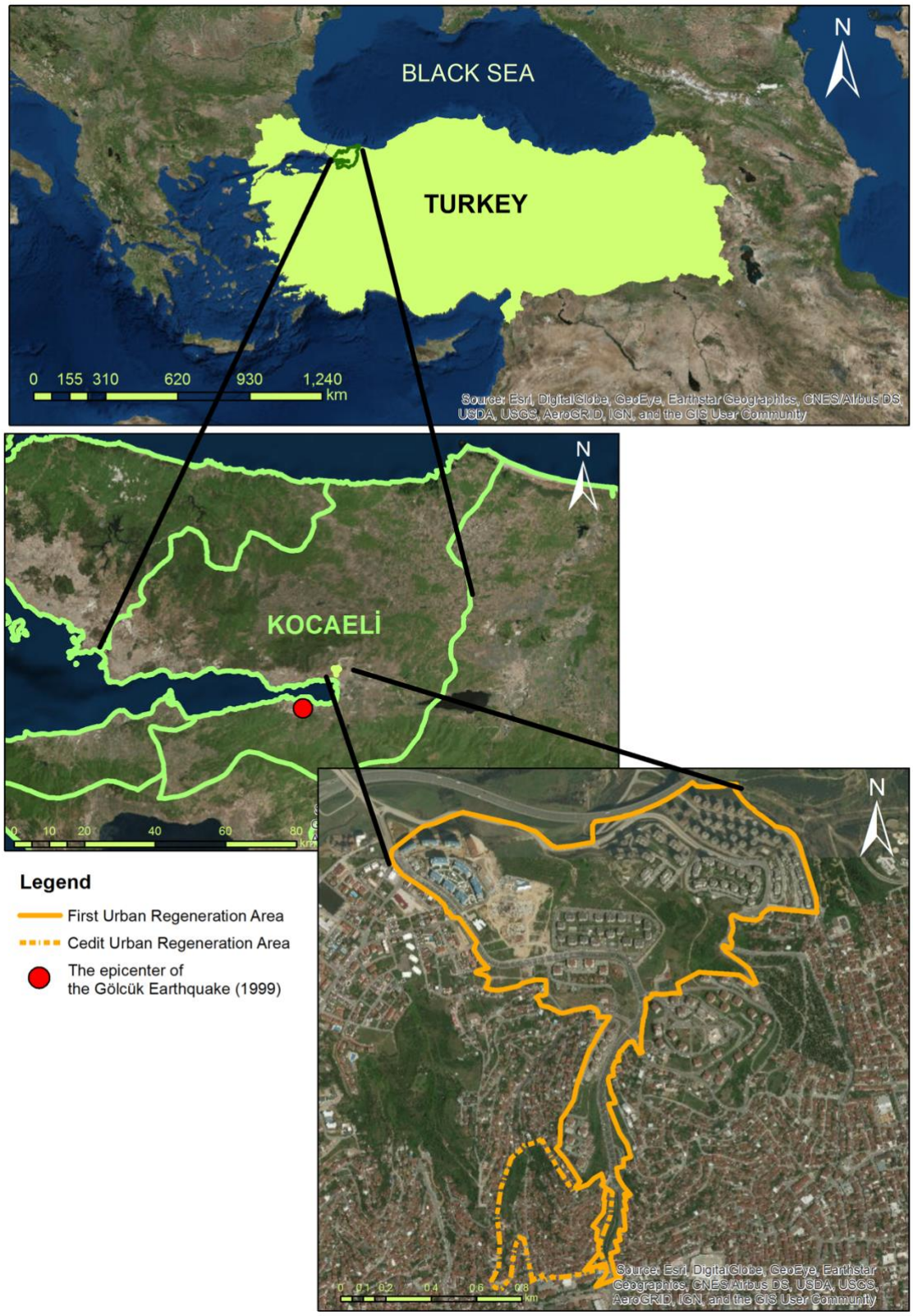

Fig. 2 First Urban Regeneration Area in Kocaeli and Cedit Urban Regeneration Area

The number of houses within Kocaeli province is 17776 (Kömürlü & Öztekin, 2007). Fig. 1 shows the distribution of these houses in Kocaeli. The main elements of this planning can be listed as follows: canalizing cities towards solid ground, reducing the density of old urban areas (Şengün, 2007) solving the sheltering problems, building earthquake-resistant constructions. Despite these optimistic approaches, it should be

known that some new problems had arisen. These problems can be listed as transportation and infrastructure problems, problems with social facilities and creation of new unearned income areas. After two major earthquakes (Gölcük & Düzce in 1999) in Turkey, the processes of urban transformation have been started for improvement of city resilience against natural disasters. In this context, various urban renewal projects have accomplished and continue to be achieved in Turkey, especially Kocaeli. The decision on the practice of the "First Urban Regeneration" in Kocaeli was taken in 2005 and the area was expanded with an additional decision in 2006 (Fig. 2). Because there was no other legal basis for urban transformation in those years, the legal basis of the "First Urban Regeneration" in Kocaeli is Article 73 of The Law No. 5393, named Municipal Law. Following the enactment of the Law on "Transformation of Areas under Disaster Risk" No. 6306 in 2012, urban transformations in Kocaeli have been started to be applied on the basis of this law. Examples of such projects are the Gölcük Denizevler Urban Regeneration and the Cedit Urban Regeneration Projects. According to the decision of the Ministry of Environment and Urbanization in 2015, Denizevler Neighborhood was defined as a risky area based on Article 2 of Law no 6306. For the local people, earthquake-resistant new constructions were built in Sivritepe approximately 3.5 km to the northwest of Denizevler (Fig. 3). The project is about to be completed in 2019. Similarly, Cedit Neighborhood was also defined as a risky area based on Law no 6306 in 2015, but the project has not been implemented yet. The Cedit Project is the neighbor of the study area and is shown in Fig. 2.

Fig. 3 Denizevler Urban Transformation Area and Sivritepe New Houses Area

The study area which is the first urban regeneration area was determined to be about 770000 m^2 with the final decision taken in 2010. The construction was mostly completed, and the remaining parts are about to be completed by 2019. Fig.2 2 shows the satellite image of the study area. Fig. 4 shows the view of the area in 2007 (left) and 2018 (right). First urban regeneration area is located at the city center. 4626 houses, Training and Research Hospital of Kocaeli University and new campus of the university were built to the north of the project area, after these earthquakes, as shown in Fig. 1.

The zoning status of the project area was generally planned as detached and three-story, before the regeneration. Some buildings were allowed to build two-story. However, as explained in the previous section, it can be said that due to consecutive construction amnesties and shanty settlement, it was not according to the legal situation of construction in the region. As a result, the area is one of the areas that have been built and then subjected to the legal process in Turkey.

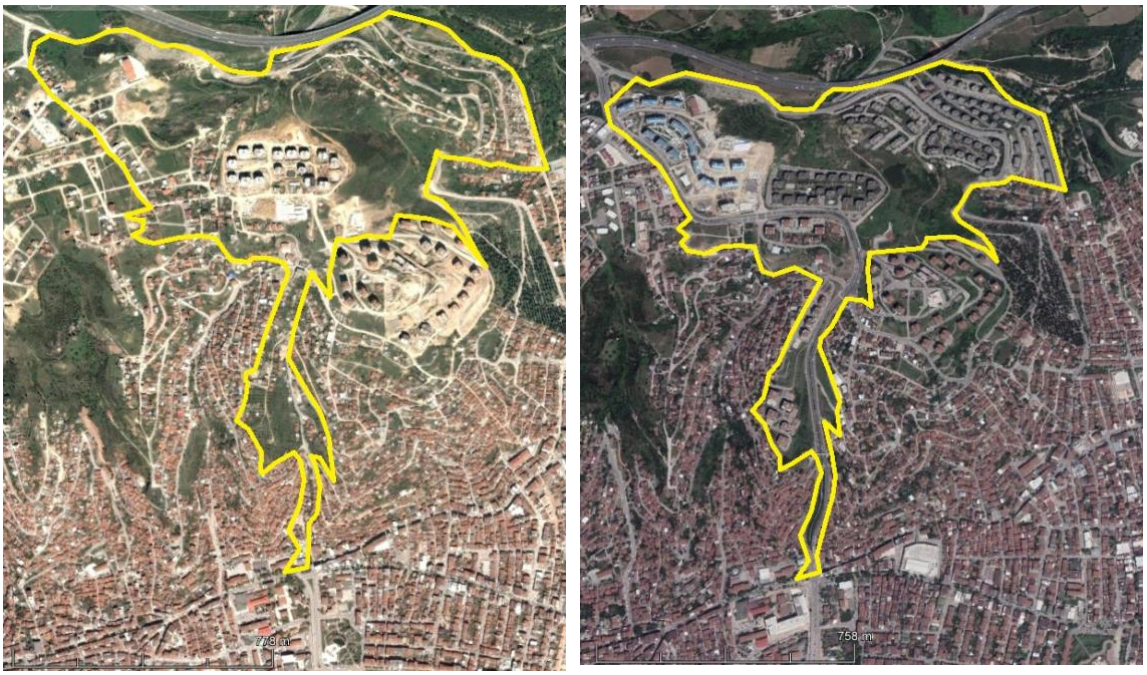

Fig. 4 Study area highlighted with the yellow line, in 2007 (left) and in 2018 (right)

5. ANALYSIS WITH THE DESIGNED GIS MODEL

In the first step of this study, it is aimed to detect the change of different usage functions in the zoning plans, before and after urban regeneration project. For this aim, the old and new zoning plans are transferred to the geographic information system using the ArcMap 10.1. The land use functions in the plans are divided into 11 different classes as shown in Tab. 1. There was no area for the Cultural Facility, the Technical Infrastructure Facility, and the Trade classes in the old zoning plan. It is seen that these classes are included in the new zoning plan after the urban regeneration. On the other hand, it is determined that the area of approximately 1,2 ha, which was excluded of the zoning (non-zoning area) because of geological reasons in the old zoning plan, was evaluated as road and green area in the new zoning plan. Also in the study, the Green Area class in the old zoning plan contains the total of six sub-classes which are the Children Playground, the Area to be Reforested, the Park, the Green Area, the Cemetery Area and the Highway Area. Similarly, the Green Area class in the new zoning plan contains three sub-classes in the form of the Area to be Reforested, the Green Area and the Highway Area. Fig. 1 shows that there is a highway in the north of the urban regeneration area. There are areas that the General Directorate of Highways expropriated and woodland around the highway. For this reason, these areas are included in the Green Area class. The Cemetery Area in the old zoning plan

was designated as a reserve area but was not used as a graveyard in those years. Hence, the Cemetery Area is also included in the Green Area class.

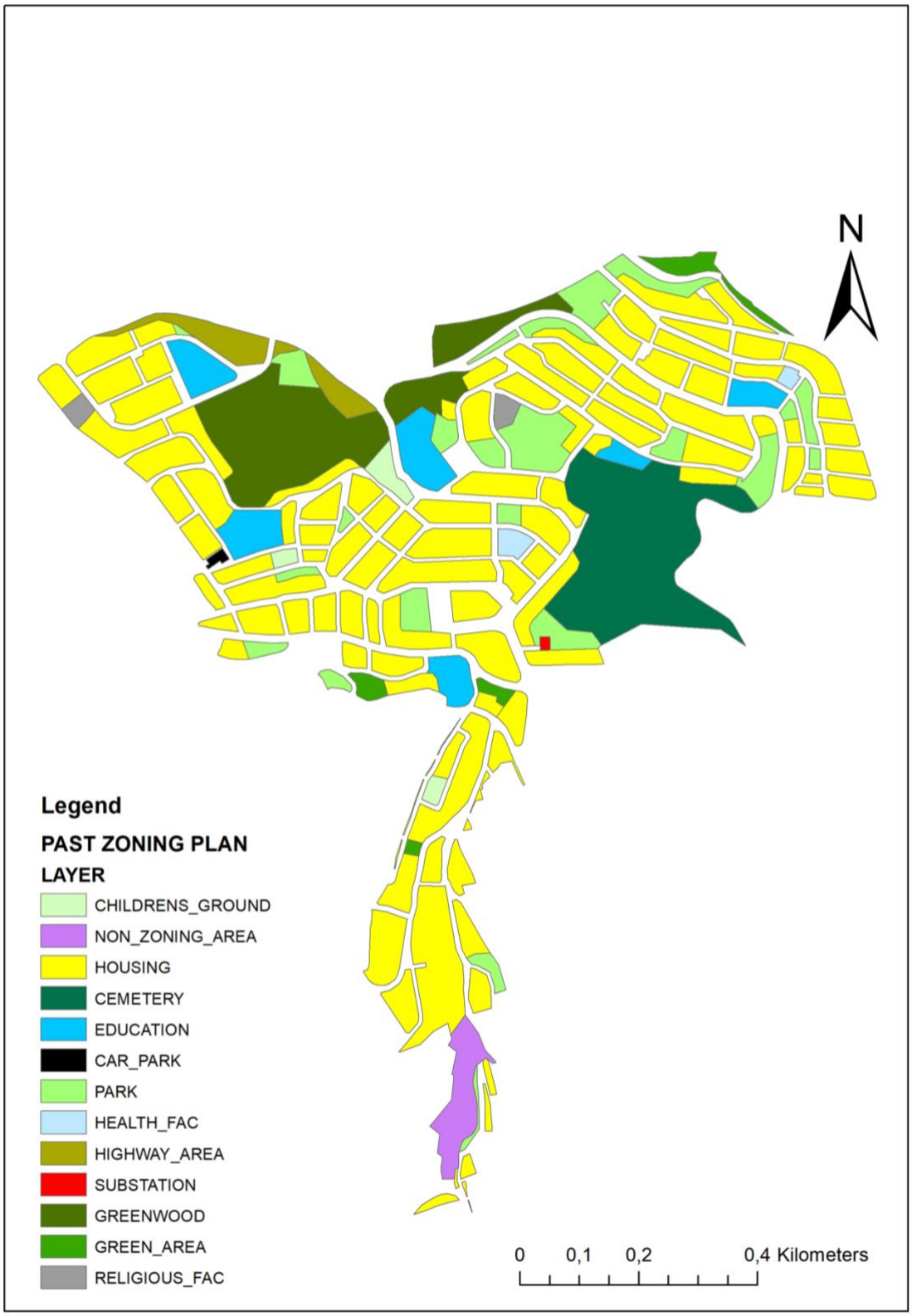

Fig. 5 Distribution of land classes before the urban regeneration

Fig. 5 and Fig. 6 show the geographical information system and the distribution of land classes formed with old and new zoning plans. A graph of the ratio of land classes to the total size of urban regeneration area is given in Fig. 7. It is seen that the percentage of the Housing Areas is preserved as size when Tab. 1 and Fig. 7 are examined. There were 729 parcels in the area before the urban regeneration. However, as can be seen

from the satellite image of 2007 in Fig. 4, it cannot be said that the area had dense housing. The major reasons for this situation are that transportation and infrastructure services were not sufficient. Despite that, it is understood that about 4100 buildings could be built in this area according to the old zoning status. According to 2016 statistics, the average population per household is 3,5 in Kocaeli (TUIK, 2017). In this case, it is predicted that the estimated population of the area could reach about 14500 according to the old zoning plan.

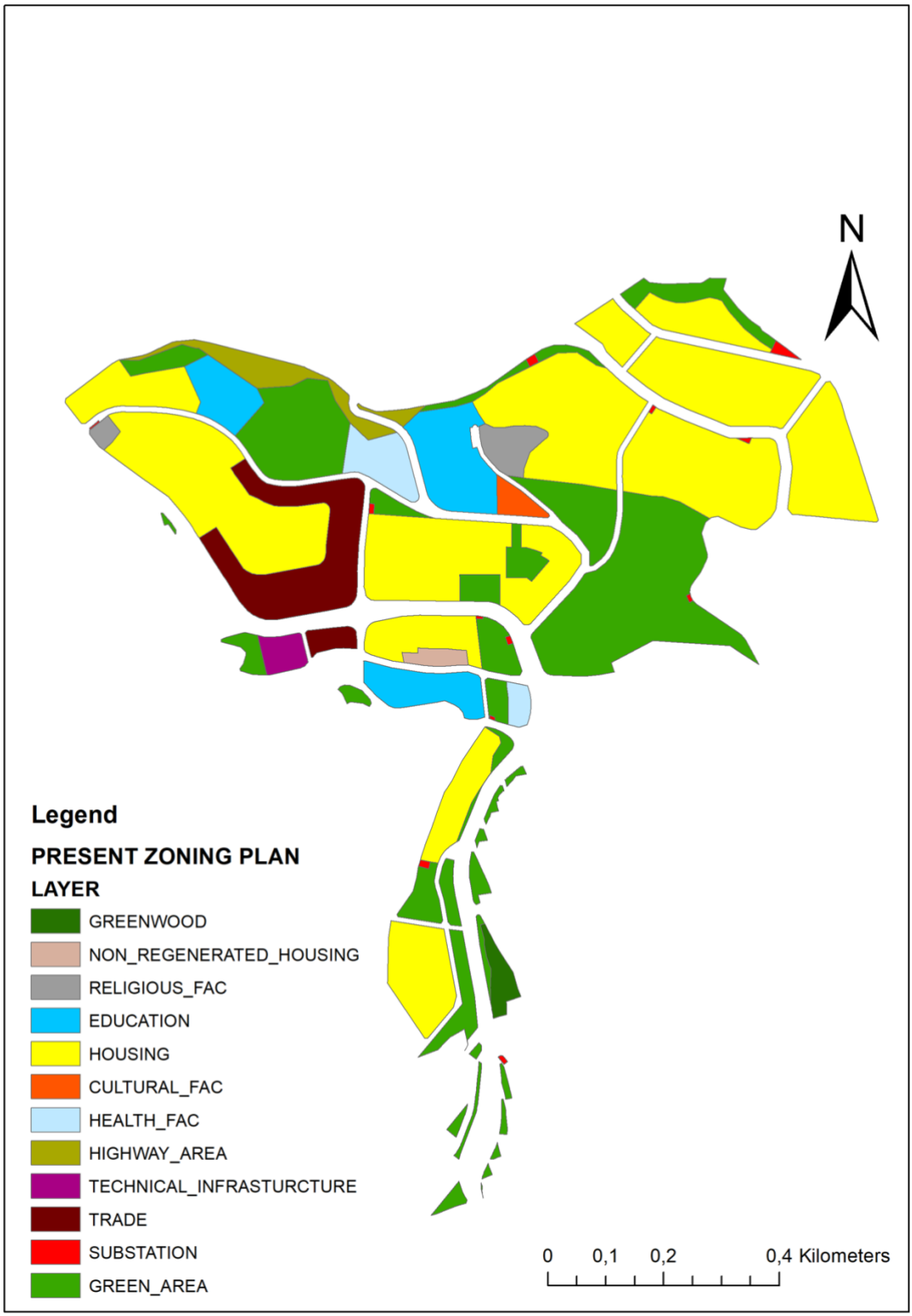

Fig. 6 Distribution of land classes after the urban regeneration

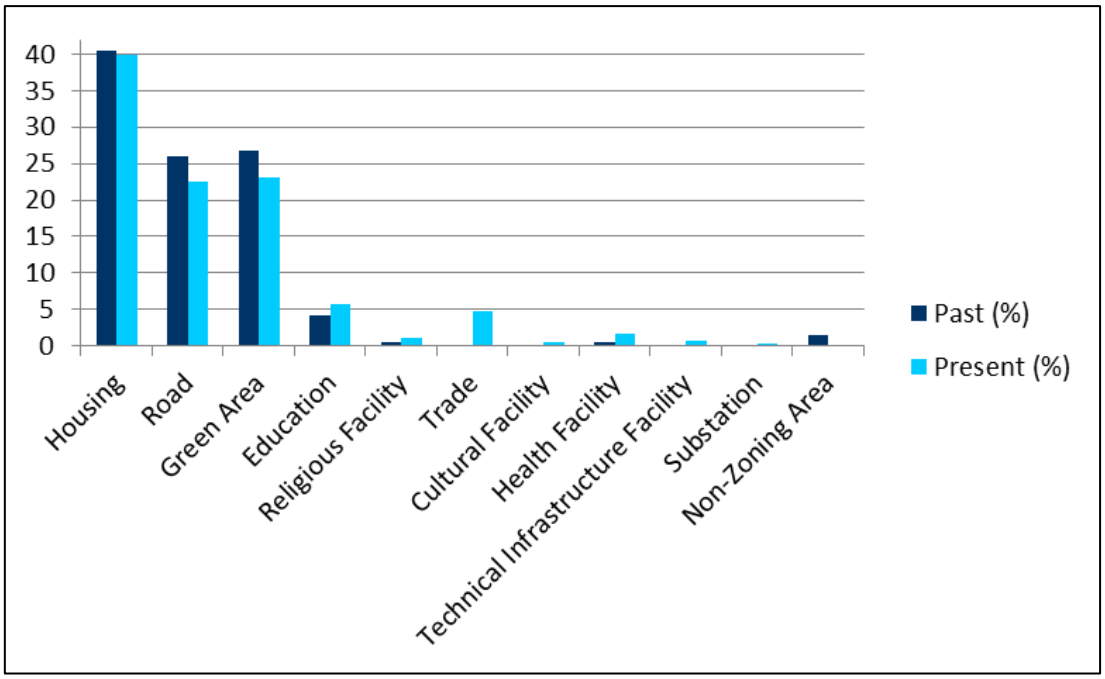

Fig. 7 The ratio of land classes to the size of total urban regeneration area

LAND FUNCTION	PAST (M^2)	PAST (%)	PRESENT (M^2)	PRESENT (%)
Housing	311,383.93	40.50	306,959.45	39.92
Road	199,968.54	26.01	172.637.47	22.45
Green Area	206,318.44	26.83	176,877.24	23.00
Education	32,169.16	4.18	43,633.24	5.67
Religious Facility	3,659.52	0.48	8,788.68	1.14
Trade	0,00	0.00	37,154.60	4.83
Cultural Facility	0,00	0.00	3,575.00	0.46
Health Facility	3,219.62	0.42	12,593.57	1.64
Technical Infrastructure Facility	0,00	0.00	4,625.00	0.60
Substation	372.48	0.05	2,036.42	0.26
Non-zoning Area	11,788.97	1.53	0.00	0.00
TOTAL	768,880.67	100.00	768,880.67	100.00

Tab.1 Changes in land use functions

As a result of the urban regeneration project, a total of 104 buildings were planned in the areas for housing. The construction permission to build has been increased to between 8 and 13 storey in the new zoning plan. When the whole project is completed, the total number of houses will be 4,906. In this case, the population in the area can be expected to be around 17,000. As a result, although there is a slight decrease in housing areas, the estimated population growth rate in the area is 1.17 and this ratio is predicted not to increase the population excessively.

Although the Education areas were 6 parcels before the urban regeneration, there are 3 parcels in the study area after the regeneration. However, it is seen that the Education areas increased 1.36 times. The increase in the area is greater than the possible population increase. In the Religious Facility areas, the number of parcels was not changed at the end of the urban regeneration, while the areas increased 2.40 times. It can be said that this increased rate is higher than the estimated population growth rate. Similarly, while the number of parcels of the Health facility areas remains the same, the increase in the area at the end of urban regeneration is calculated as 3.91 times. In the old zoning plan, the area that determined for the Substation

was only 1 parcel; but 12 parcels are determined for the Substation area which there is an increase of 5.47 times in the new zoning plan. Especially, the rates of increase in religious and Healthy facilities and Substation areas were found to be quite high compared to the estimated population growth rate.

When the changes in Green areas in old and new zoning plans were examined, it is determined that green areas decreased 0,86 times after the urban regeneration contrary to other land use functions. Similarly, there is also a 0.86 times decrease in the roads. Interpretation of these changes in land use functions as only increasing and decreasing will be insufficient for urbanization. The positive or negative effects of increasing or decreasing changes in a sustainable city model should be detected with many parameters.

6. RESULTS AND DISCUSSIONS

Turkey suffered from heavy losses after the earthquakes in the Marmara region and it is understood that the cities were not resilient and prepared for natural disasters. For this purpose, various preventions on the subjects such as laws and regulations, zoning plans, disaster risk management practices, construction control services, insurances, and urban regeneration projects have been implemented after 1999. However, there have been various differences and disruptions in the implementation of these preventions among cities. For example, the "Building Inspection Law" No. 4708 was not implemented throughout the country until 2011. It is also known that some buildings are still not sufficiently inspected according to this law. Similarly, insurance of structures against natural disasters is compulsory according to Law No. 6305, but insurance process could not be extended throughout the country. In addition, this law is used to warrant only material damages after an earthquake. Whereas, this law should also guarantee the financing of the projects to reduce damages before natural disasters.

The primary goal in many urban regeneration projects in our country has been to produce earthquake resistant mass houses. Resilient and sustainable urban designs have turned into secondary goals. Therefore, urban regeneration projects have been frequently observed in areas where there are no settlements. Such projects can be interpreted as opening new areas for settlements or creating new unearned income areas. In recent years, urban regeneration applications have been accelerated in areas under disaster risk or in areas where disaster risk structures exist according to the law no. 6306. However, there are still many areas and constructions under disaster risk in our cities. The number of earthquakes (M_w>6.0) in The Marmara Region have been 17 in the last 400 years. In addition, according to scientific studies, the probability of a major earthquake in only the Marmara Region for the next 30 years is about 50% with an optimistic perspective (Bohnhoff et al., 2013; Murru et al., 2016; Paradisopoulou et al., 2010; Parsons, 2004). Therefore, it is urgent to regenerate the areas under disaster risk as soon as possible.

Until the earthquake, Kocaeli has continued growth of along the seashore. There have been many reasons for this situation from the past to the present. These reasons can be listed such as the rugged topography outside the coast, the factories, and seaports located along the coast and the country's main railway and highway transportation line at the seashore. In general, because the ground along the coast is not suitable for the settlement, earthquake damages have occurred in these areas mostly. It was aimed for deceleration of spontaneous growth of the city immediately after the earthquake. For this purpose, the largest of the mass housing areas were built in Kocaeli under the decree-law no 574 is in the northern part of the city center. Total of 4626 houses was built in the northern part for disaster victims (Kömürlü & Öztekin, 2007). In addition, Training and Research Hospital of Kocaeli University and new campus of the university were built to the north of this area as shown in Fig. 1. This planning and structuring raised the problem of transport between the city center and the north of the city. The project, which is discussed in this study is the first urban regeneration project in Kocaeli after the earthquakes in 1999 and it is about to be completed now. The basic aim of the project was to establish a transportation system between the city center and new northern settlements and to support the development of the city towards the north. This purpose was provided with Gazanfer Bilge

Boulevard, which is an important artery as shown in Fig. 3. Other objectives of the project were to build earthquake-resistant structures in the project area and to perform more resilient and sustainable planning for the project area.

It can be said that there are significant improvements in the functions of Education, Religious, Cultural, Health Facilities, Trade, Technical Infrastructure, and Substation after the regeneration when the analysis mentioned in Chapter 5 is interpreted. This case is an indicator of sustainability which explains the increase of access to education, health and infrastructure services for the dwellers in the area. There is a 0.86 times decrease in the roads, which does not actually mean that transport services are getting worse. The old transport network consisted of narrow streets ranging in width from 6 to 12 meters in the area. Although the area is 2.5 km away from the city center, it had difficulties in transportation. This is why the area was not preferred for settlement before the urban regeneration project. A 30-meter wide boulevard and a 20-meter wide street constructed after the regeneration provide access to the north of the city as well as the area. The expansion of roads will also be able to provide significant contributions to search and rescue operations during natural disasters. On the other hand, the slope in the new boulevard is up to 15% due to topographical difficulties. This situation brings some risks to transportation. As a result, it is not enough to interpret roads only through areal size changes. Similar discussions can be made for a 0,86-times change in green areas. The advantages or disadvantages of the newly designed green areas compared to the old ones should be revealed with many parameters. For example, the pros and cons of the change in green areas should be discussed according to flora and fauna or the usage of children, elderly people, young people, etc. before and after the regeneration. For this reason, it is a necessity to analyze all this information of the settlement in terms of resiliency and sustainability with GIS models. GIS constitutes the first phase of the study. It is aimed to analyze the sustainability of each of the land use functions with various parameters in future studies.

From past to present, it is a certain truth that the various zoning and construction amnesties cannot solve the problems of urban sprawl in Turkey and especially in industrial cities such as Kocaeli. For this reason, Law no. 6306 on Transformation of Areas under Disaster Risk which went into effect in 2012 is an important step towards providing more modern and healthy living areas to cities and people although it has caused many controversies. The urban renewal projects in Turkey have been the subject of various discussions for these aspects since then. Displacing people from their habitats, forcing them to live in high-rise buildings, or getting unearned incomes through constructions are the main topics of the discussions (Demirkol & Bereket Baş, 2013). The pros and cons of urban renewal projects should be made analyzable according to many parameters. The importance of Geographic Information Systems is undeniable for monitoring, analyzing or establishing new models of the effects of spatial changes on the sustainability and smartness processes. The main thing is that not only the reconstruction of habitats but also the changing land functions can be monitored, analyzed and improved.

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REFERENCES

AFAD. (2014). *Müdahale, İyileştirme ve Sosyoekonomik Açıdan 2011 Van Depremi*. Retrieved from https://www.afad.gov.tr/upload/Node/17944/xfiles/mudahale_-iyilestirme-ve-sosyoekonomik-acidan-2011-van-depremi-raporu_2_.pdf

Anderson, L. (2013). *Measuring Sustainable Cities: An approach for assessing municipal-level sustainability indicator systems in Sweden*. Uppsala University, Uppsala. Retrieved from http://www.diva-portal.org/smash/get/diva2:658303/FULLTEXT01.pdf

Andres, L., & Strappazzon, G. (2011). Natural hazard management and sustainable development: a questionable link - T. *Revue de Géographie Alpine*, (95–2), 40–50. https://doi.org/10.4000/rga.136

Benson, C. (2016). Promoting Sustainable Development through Disaster risk management. *ADB Sustainable Development Working Paper Series*, (41), 1–29. Retrieved from https://www.adb.org/sites/default/files/publication/182652/sdwp-041.pdf

Bohnhoff, M., Bulut, F., Dresen, G., Malin, P. E., Eken, T., & Aktar, M. (2013). An earthquake gap south of Istanbul. *Nature Communications*, *4*(1), 1999. https://doi.org/10.1038/ncomms2999

Demir, H., & Yılmaz, A. (2012). Measurement of urban transformation project success using the analytic hierarchy process : Sulukule and Tepeüstü -Ayazma Case Studies , Istanbul. *Journal of Urban Planning and Development ©*, *138*(2), 173–182. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000110.

Demirci, M. (2004). *Kent Planlamada Uygulama Anlayışına Eleştirel Bir Yaklaşım Dikmen Vadisi Projesi Örneği*. Ankara Üniversitesi, Ankara.

Demirkol, S., & Bereket Baş, Z. (2013). Kentel dönüşümün, 6306 Sayılı Yasa kapsamında hak ve özgürlükler açısından ele alınması. *TBB Dergisi*, *108*(108), 27–40.

Demiroğlu, D., & Karakuş, C. B. (2012). Geçmişten günümüze Sivas kent planlarının alan kullanımları yönünden karşılaştırılması. *İnönü Üniversitesi Sanat ve Tasarım Dergisi*, *2*(4), 1–13. Retrieved from http://dergipark.ulakbim.gov.tr/inustd/article/view/1027000034/1027000033

Ercan, M. A. (2011). Challenges and conflicts in achieving sustainable communities in historic neighbourhoods of Istanbul. *Habitat International*, *35*(2), 295–306. https://doi.org/10.1016/j.habitatint.2010.10.001

Genç, F. N. (2014). Gecekonduyla mücadeleden kentsel dönüşüme Türkiye'de kentleşme politikaları. *Adnan Menderes Üniversitesi, Sosyal Bilimler Enstitüsü Dergisi*, *1*(1), 16–30. https://doi.org/https://dx.doi.org/10.30803/adusobed.188800

Godschalk, D. R. (2003). Urban Hazard Mitigation: Creating Resilient Cities. *Natural Hazards Review*. https://doi.org/10.1061/(asce)1527-6988(2003)4:3(136)

Gölbaşı, İ. (2014). Kentsel planlama deneyimlerinin plan başarı ölçütleri çerçevesinde karşılaştırılması ve değerlendirilmesi - İstanbul örneği. *Planlama Dergisi*, *24*(1), 18–25. https://doi.org/10.5505/planlama.2014.65375

Güzey, Ö. (2016). The last round in restructuring the city: Urban regeneration becomes a state policy of disaster prevention in Turkey. *Cities*, *50*, 40–53. https://doi.org/10.1016/j.cities.2015.08.010

Kaya, M. (1989). Gecekondu sorunu ve Gecekondu Kanunu. *Türkiye Barolar Birliği Dergisi*, (6), 860–891. Retrieved from http://tbbdergisi.barobirlik.org.tr/m1989-19896-1047

Kömürlü, R., & Öztekin, K. (2007). Kalıcı deprem konutlarında üretim sürecinin örgütlenmesi, sorunları ve çözüm önerileri. In *International Earthquake Symposium Kocaeli 2007, 22-26 Ekim 2007* (pp. 679–694). Kocaeli. Retrieved from http://kocaeli2007.kocaeli.edu.tr/kocaeli2007/TAM_METIN_NUMARALI-SIRALI-PDF/679-694.pdf

Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. *Landscape and Urban Planning*. https://doi.org/10.1016/j.landurbplan.2015.11.011

Mohamed, N. A., Baharum, Z. A., Senawi, A., & Salleh, N. A. (2016). Investment Constraints in Urban Regeneration: Property Developers and Local Authorities Perspective. *MATEC Web of Conferences*, *66*. https://doi.org/10.1051/matecconf/20166 IBCC 2016 600063

Molavi, M. (2018). Measuring Urban Resilience to Natural Hazard. *Tema. Journal of Land Use, Mobility and Environment*, *11*(2), 195–212. https://doi.org/http://dx.doi.org/10.6092/1970-9870/5485

Murru, M., Akinci, A., Falcone, G., Pucci, S., Console, R., & Parsons, T. (2016). M ≥ 7 earthquake rupture forecast and time-dependent probability for the sea of Marmara region, Turkey. *Journal of Geophysical Research: Solid Earth*, *121*(4), 2679–2707. https://doi.org/10.1002/2015JB012595

Newman, P. W. . (1999). Sustainability and cities: extending the metabolism model. *Landscape and Urban Planning*, *44*(4), 219–226. https://doi.org/10.1016/S0169-2046(99)00009-2

Nijkamp, P., & Pepping, G. (1998). A Meta-analytical Evaluation of Sustainable City Initiatives. *Urban Studies*, *35*(9), 1481–1500. https://doi.org/10.1080/0042098984240

Papa, R. (2012). Editorial: resilient city. *Tema. Journal of Land Use, Mobility and Environment*, *5*(2), 5–6. https://doi.org/10.6092/1970-9870/1156

Paradisopoulou, P. M., Papadimitriou, E. E., Karakostas, V. G., Taymaz, T., Kilias, A., & Yolsal, S. (2010). Seismic Hazard Evaluation in Western Turkey as Revealed by Stress Transfer and Time-dependent Probability Calculations. *Pure and Applied Geophysics*, *167*(8–9), 1013–1048. https://doi.org/10.1007/s00024-010-0085-1

Parsons, T. (2004). Recalculated probability of M ≥ 7 earthquakes beneath the Sea of Marmara, Turkey. *Journal of Geophysical Research: Solid Earth*, *109*(B5). https://doi.org/10.1029/2003JB002667

Resmi Gazete. (1930). Belediye Kanunu. Retrieved from http://www.resmigazete.gov.tr/arsiv/1471.pdf

Resmi Gazete. (1956). İmar Kanunu. Retrieved from http://www.resmigazete.gov.tr/arsiv/9359.pdf

Resmi Gazete. (1966). Gecekondu Kanunu. Retrieved from http://www.mevzuat.gov.tr/MevzuatMetin/1.5.775.pdf

Resmi Gazete. (1984). İmar ve Gecekondu Mevzuatına Aykırı Yapılara Uygulanacak Bazı İşlemler ve 8785 Sayılı İmar Kanununun Bir Maddesinin Değiştirilmesi Hakkında Kanun. Retrieved from http://www.resmigazete.gov.tr/arsiv/18335.pdf

Resmi Gazete. (1985). İmar Kanunu. Retrieved from http://www.resmigazete.gov.tr/arsiv/18749.pdf

Resmi Gazete. (1999). Zorunlu Deprem Sigortasına Dair Kanun Hükmünde Kararname. Retrieved from http://www.resmigazete.gov.tr/arsiv/23919_1.pdf

Resmi Gazete. (2001). Yapı Denetimi Hakkında Kanun. Retrieved from http://www.resmigazete.gov.tr/eskiler/2001/07/20010713.htm#2

Resmi Gazete. (2004). Kuzey Ankara Girişi Kentsel Dönüşüm Projesi Kanunu. Retrieved from http://www.mevzuat.gov.tr/MevzuatMetin/1.5.5104.pdf

Resmi Gazete. (2006). Deprem Bölgelerinde Yapılacak Binalar Hakkında Yönetmelik. Retrieved from http://www.resmigazete.gov.tr/eskiler/2006/03/20060306-3.html

Resmi Gazete. (2012a). Afet Riski Altındaki Alanların Dönüştürülmesi Hakkında Kanun. Retrieved from http://www.resmigazete.gov.tr/eskiler/2012/05/20120531-1.html

Resmi Gazete. (2012b). Afet Sigortaları Kanunu. Retrieved from http://www.resmigazete.gov.tr/eskiler/2012/05/20120518-4..htm

Sağlam, S. (2016). 1923-1950 yılları arasında Türkiye'de kent ve kentleşme olgusu. In *Istanbul Journal of Sociological Studies* (Vol. 0, pp. 257–274). https://doi.org/10.18368/IU/sk.09525

Saunders, W. S. A., & Becker, J. S. (2015). A discussion of resilience and sustainability: Land use planning recovery from the Canterbury earthquake sequence, New Zealand. *International Journal of Disaster Risk Reduction*, *14*, 73–81. https://doi.org/10.1016/j.ijdrr.2015.01.013

Şengün, H. (2007). Marmara depremi'nde Bayındırlık ve İskân Bakanlığı çalışmaları ve hukuksal sorunlar. In *TMMOB Afet Sempozyumu* (pp. 57–82). Ankara. Retrieved from https://www.tmmob.org.tr/sites/default/files/dea61eed4bceec5_ek.pdf

Shen, L. Y., Jorge Ochoa, J., Shah, M. N., & Zhang, X. (2011). The application of urban sustainability indicators - A comparison between various practices. *Habitat International*, *35*(1), 17–29. https://doi.org/10.1016/j.habitatint.2010.03.006

Tolon, M., & Mızrak, K. C. (2017). Development of disaster management in Turkey: from 1999 Kocaeli Earthquake to 2011 Van Earthquake. *International Journal of Engineering Science and Management*, *1*(4), 145–151. Retrieved from http://dergipark.gov.tr/download/article-file/395426

TUIK. (2015). İllerde Yaşam Endeksi Gösterge Değerleri. Retrieved April 15, 2019, from http://www.tuik.gov.tr/PreTablo.do?alt_id=1106

TUIK. (2017). Türkiye İstatistik Kurumu, İstatistiklerle Aile, 2016. Retrieved March 14, 2019, from http://www.tuik.gov.tr/PreHaberBultenleri.do?id=24646

TUIK. (2018). Yıllara Göre İl Nüfusları. Retrieved April 15, 2019, from http://www.tuik.gov.tr/UstMenu.do?metod=temelist

Türker Devecigil, P. (2005). Urban transformation projects as a model to transform Gecekondu areas in Turkey: The example of Dikmen Valley - Ankara. *European Journal of Housing Policy*, *5*(2), 211–229. https://doi.org/10.1080/14616710500163390

Ulubaş Hamurcu, A., & Aysan Buldurur, M. (2017). Sürdürülebilir kentsel dönüşüm için performans göstergeleri. *Planlama Dergisi*, *27*(3), 222–235. https://doi.org/10.14744/planlama.2017.30074

Uzun, B., Çete, M., & Palancıoğlu, H. M. (2010). Legalizing and upgrading illegal settlements in Turkey. *Habitat International*, *34*, 204–209. https://doi.org/10.1016/j.habitatint.2009.09.004

Uzun, B., & Şimşek, N. Ç. (2015). Upgrading of illegal settlements in Turkey; the case of North Ankara Entrance Urban Regeneration Project. *Habitat International*, *49*, 157–164. https://doi.org/10.1016/j.habitatint.2015.05.026

Wikipedia. (2019). Gölcük Depremi. Retrieved March 14, 2019, from https://tr.wikipedia.org/wiki/1999_Gölcük_depremi

Zheng, H. W., Shen, G. Q., & Wang, H. (2014). A review of recent studies on sustainable urban renewal. *Habitat International*, *41*, 272–279. https://doi.org/10.1016/j.habitatint.2013.08.006

IMAGE SOURCES

Fig. 1: Generated by authors using ArcMap 10.1.

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Fig. 7: Generated by authors using Microsoft Office Excel.

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