



EARTHQUAKE PREPAREDNESS: EVALUATION OF URBAN TRANSFORMATION LAW IN TURKEY

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Abstract

Turkey was caught unprepared by the two massive earthquakes that hit the most developed regions in 1999. Their devastating effects caused large masses to question the earthquake resistance of existing structures and associated construction codes for new build. Although the Country promptly took several emergency preventive measures, the search for long term solutions could only accelerate after another massive earthquake that hit the city of Van in 2011. As a result, “The Law of Transformation of Areas under the Disaster Risks” (Law No. 6306) entered into force in 2012. The law aims to rehabilitate and renovate areas and built structures at disaster risk in order to create a healthy and safe living environment.

Since the law entered into force, many large scale transformation projects have been initiated in several Turkish cities. However, the implementation of this law was faced with fierce opposition by some segments of population. Opponents claimed that urban transformation law deviated from its main aim, as in practice the law found limited application in disaster prone areas due to market conditions. Moreover, concerns have been raised about social impacts and the legal structure of the law. These considerations complicate the effective implementation of such a vital and critical initiative.

The present study aims to evaluate the structure and application of urban transformation law using statistical data in order to identify the extent to which urban regeneration law has reached its objectives. In this concept, data from fourteen municipalities in Istanbul are obtained in order to assess its fitness for purpose and determine problem areas. Governments that are in the phase of constituting a law regarding urban transformation for increasing earthquake preparedness could benefit from the outcomes of this study. Furthermore, the transfer of experience among the research community will support the successful implementation of similar programs in future.

Keywords: earthquake preparedness; urban transformation; urban regeneration; Turkey.



1. Background

Turkey is located on the Alpine-Himalayan seismic belt, which is one of the world's most seismically active regions. Throughout its history, Turkey has experienced thousands of moderate to large devastating earthquakes that have resulted in significant number of deaths. Starting from 1950s, the developments in socio-economic structure of the Country led to a rapid urbanization and urban population growth. This in turn resulted in uncontrolled and unplanned urbanization and settlement areas that are more vulnerable to earthquake hazards [1,2]. It can be understood from the latest earthquake zoning map of Turkey that the 96 % of the total surface area of the Country is under earthquake risk and % 98 of its total population live in these areas. Furthermore; 42% of the total land mass and %43 of power plants are on a first-degree earthquake zone [3,4].

Awareness regarding earthquakes and the need for taking required precautions has been raised after the two most devastating earthquakes in 1999 that struck the eastern Marmara region in less than three months apart. The Izmit earthquake of August 1999 (Mw 7.6-AFAD; Mw 7.5 - UDİM) has been recorded in the world literature due to its devastating effects for Turkey. According to the official records; 17.479 people lost their lives, 43.953 were injured and 505 came permanently disabled. As for unofficial records; 50.000 people lost their lives and about 100.000 people were injured. Besides; out of 244.383 damaged buildings, 77.342 buildings collapsed or were heavily damaged [5,6]. Düzce earthquake in November 1999 (Mw 7.1-AFAD; 7.2 -UDİM) on the other hand, resulted in 845 deaths, 4948 injuries, collapse of 3.000-3.500 buildings and more than 20.000 damaged or heavily damaged buildings [7,8]. These two earthquakes had also a significant impact on the national economy; as the total cost of earthquakes are reported to be nearly US \$17 billion (TUSİAD-17, DPT (SPO) 15-19, world bank 12-17) [9].

The considerable number of lives lost and the damages encountered in the two earthquakes revealed that the earthquake resistance of the existing building stock was poor and thus concerns have been raised about the inadequacy of construction supervisions and the deficiencies of associated construction codes. Right after the earthquakes, all construction activities - including the previously licensed construction projects - were stopped in affected areas until new regulations were provided. Figure 1 shows the change in total number of construction permits in Turkey from 1995 to 2015. As it can be seen from the figure, sharp declines are observed in permits issued from 1999 to 2002, which approximates to a 43% decrease.

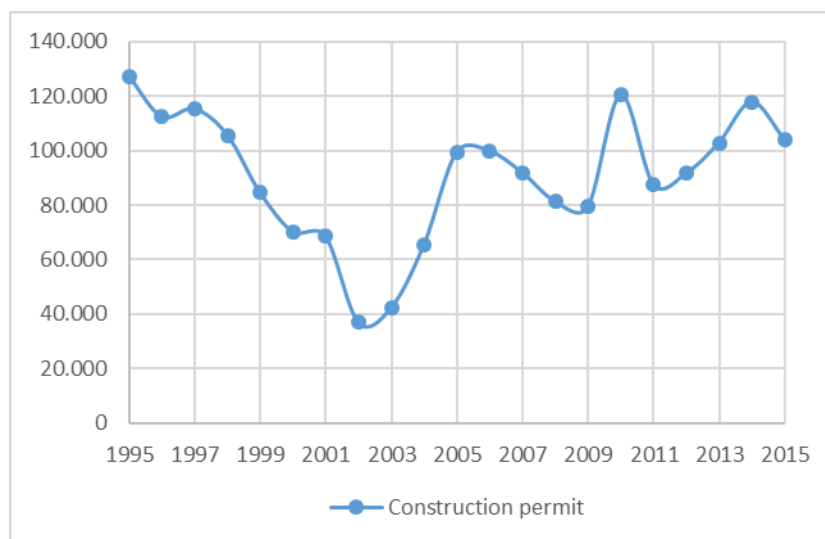


Fig. 1 - The change in total number of construction permits in Turkey between 1995 and 2015



Istanbul, which has been one of the most affected regions, involves almost one-fifth of the total population and one-half of the industrial potential of Turkey. In addition; the risk and the impact of the earthquake has increased due to its high population, faulty construction practices and land-use planning, inadequate infrastructure and environmental degradation [10]. In this regard, the study conducted by Parsons et al. in 2000, [11] right after the two earthquakes, it was estimated that the probability of a destructive earthquake ($MMI^* \geq VIII$) to occur in Istanbul within 30 years was 62+15% and within the next decade as 32+12%.

As a part of a basic disaster prevention plan for Istanbul, the Japan International Cooperation Agency (JICA) in coordination with Istanbul Metropolitan Municipality (IMM), developed four scenarios for earthquakes. According to the most probable scenario; for a model earthquake of $M_w=7.5$ near Istanbul, the estimated number of deaths and heavily damaged buildings would be 73.000 and 50.000 respectively [12]. In order to minimize the risks and devastating effects; first comprehensive mitigation report of earthquake master plan of Istanbul (EMPI) was developed in 2003 by a consortium of four leading Turkish universities upon the request of IMM. Based on the JICA report; the plan aimed to provide a national earthquake strategy through the identification of actions for the mitigation of earthquake risks and losses, and of methods and principles to be applied. EMPI was the first step towards the concept of urban transformation. In 2009; departing from recommendations in EMPI, IMM has started an urban regeneration pilot project in Zeytinburnu District of Istanbul, which had been identified as one of the most risky areas [10].

After the two major earthquakes, several regulations have been enacted; besides, some modifications have been made in current regulations. According to Prime Ministry Crisis Management Center (BKYM) (2000) [13]; 38 laws, 28 decrees, 6 codes, 17 circulars and 9 notices were entered into force from August 1999 until July 2000. Although numerous regulations were enacted; majority of them focused on corrective actions for the outcomes of disasters and regulatory measures for new construction. Apart from revisions in the Turkish Earthquake Design Code in 2007, modifications have also been made in Construction Zoning Law. 4708 numbered Construction Inspection Law which entered into force in 2001 for 19 provinces has later been expanded to cover all provinces. This law is aimed to ensure that construction projects are completed in accordance with the existing zoning law and standards, in order to provide the security of life and property.

The most recent massive earthquake that struck the city of Van in eastern Turkey 12 years after the earthquakes of 1999 caused the Country to face the earthquake fact again; however at the same time it also enabled the evaluation of studies and regulations that had been put into practice since 1999. These two earthquakes on October 2011 ($M_w=7.1$) (AFAD 7.1; UDIM 7.2) and November 2011 ($M_w=5.7$) (AFAD 5.6; UDIM 5.7) resulted in more than 600 deaths, nearly 2.000 injuries and collapse or heavy damage of 48.689 buildings [14]. Thus, the devastating consequences revealed the inadequacy of measures taken since 1999.

Although earthquakes are known to be natural disasters; their destructive effects such as damages and loss of lives mainly stem from poor seismic resistance of existing building stock. Therefore, an urgent need for urban renewal emerged on the areas under risk, which required the examination of existing building stock and demolition, regeneration or rehabilitation of vulnerable buildings. Thus, studies on urban transformation as a tool within the scope of earthquake preparedness came to the forefront. As a result, an important step was taken by the Turkish government and Law no. 6306 called "Law on Regenerating Areas under the Risk of Natural Hazards" has entered into force in May 2012. The aim of the law is to rehabilitate and renovate areas and built structures at disaster risk in order to create a healthy and safe living environment. After that, many large scale transformation projects have been initiated in several Turkish cities.

In the present research, the structure and application of the recent urban transformation law is evaluated using statistical data in order to identify the extent to which urban regeneration law has reached its objectives and to identify problem areas. For this purpose, the scope of the law is briefly explained in the next section. Then, data and method are explained and findings are presented. Finally, results are discussed and conclusions are provided.

* MMI = Modified Mercalli Intensity Scale



2. Transformation of Areas under Disaster Risk Law

As stated before, the destructive effects of 1999 Marmara and 2011 Van earthquakes influenced the legal structure of urban transformation. “The Law of Transformation of Areas under the Disaster Risks” (Law no. 6306) has been enacted in May 2012, six months after Van earthquake. A new process of earthquake-focused urban transformation has started on 5 October 2012 in Istanbul’s Esenler district with a “demolition ceremony” [15]. The main purpose of this law is to determine the procedures and principles to constitute healthy and safe living environments on risk zones, reserve building areas and unqualified risky building areas. In other words, this law aims renewal, rehabilitation/improvement, preservation-conservation and regeneration of these risky areas. In order to reach this goal, the legal structure has given full authority to the Ministry of Environment and Urbanization, TOKI and municipalities for regeneration [16].

Urban transformation process has five general steps [17]. The first step is the identification of high risk zones and reserve building areas, which are in essence different concepts. Reserve building areas are new residential areas allocated for transferring residents of risky areas and for generating income from new users. The Ministry of Environment and Urbanization is responsible for taking decisions on reserve building areas. Risk zone approvals on the other hand are given by the cabinet. TOKI and municipalities has to present technical reports, history of disasters in the area, maps and other necessary documents to the cabinet for a thorough evaluation before its accepted as a risk zone.

Once risky areas are identified, the second step is to detect unqualified and risky buildings. The law also regulates how risky buildings should be identified. According to the law, risk detection reports may be prepared by universities, firms and governmental institutions. Detailed procedure for the preparation of risk identification reports is defined in Law no. 6306 application regulation [17]. Application regulations also define licensing procedures for firms and required qualifications of engineers willing to undertake such tasks.

The application for risk identification reports can be done in two different ways. The law enables property owners to apply for reports for an individual building. In this route, property owners refer to universities or authorized firms in order to obtain a risk identification report. Alternatively, the Ministry of Environment and Urbanization could ask property owners to take a risk report for their buildings. If the owners fail to apply for a report, then the Ministry or other authorities prepare the report. Once a risk report is prepared, it is then sent to Urban Transformation Directory where the reports are controlled for any revisions needed and finalized. In the third step, owners could raise any objections to these reports. If there is a need, the Directory gives 15 days for a new risk report delivery. In some cases, building owners could demand the strengthening of their building. In that condition, strengthening projects should be submitted to the related Directory for review and confirmation.

The fourth step is the demolition of the risky building. It is essential to negotiate with owners in demolishing risky buildings and other applications on the risky and reserve areas. The owners of the buildings that are evacuated by agreement or tenants in same position have the right of rent allowance or bank credit support. Demolishing permit is issued by the Municipality after all residents leave the building and electricity, water and natural gas contracts are cancelled. The Directory demands that the owners to get the building demolished in minimum 60 days. If the buildings are not demolished within this period, another notice will be sent by the administration. Administration gives a new time period not less than 30 days. If the owners again fail to demolish the building than the building will be demolished by the administration.

The fifth step is constructing new buildings. After the demolition of the risky building, as the property is turned into land with the minimum two thirds of the owners’ approval, owners could either choose to sell their share or construct a new building. If owners evocate their buildings by agreement, ministry could make housing allowance starting from the date of evocation. Ministry provides two types of financial support for dwelling owners. Owners could either choose to take credit or rent support from ministry. Rents are determined according to Turkish Statistical Institute’s annual Consumer Price Index. In 2016, rents were determined as 795 TL per month in Istanbul [18]. The rent allowance is provided for a maximum of 18 months. In case the owner prefers to take credit, then a %4 credit loan support for a maximum of 100,000 TL, two years of grace and maximum ten years credit back payment conditions apply. If preferred, these credits could be taken by contractors instead of owners and banks would pay the credit to contractors with progress payments.



3. Findings and Discussion

In the present research, a wide range of sources have been investigated in order to identify the total number of building permits provided in the scope of the new Urban Transformation Law. In the first phase, Turkish Statistical Institute database was examined. While the total number of building permits could be obtained from Construction and Housing statistics, no data was available for building permits provided solely under the Urban Transformation Law. Thus, the authors contacted Ministry of Environment and Urbanization. As a result, a need for requesting information from each of the 39 Municipalities of Istanbul emerged.

Thus, a written application was submitted to each of the 39 municipalities in Istanbul. Research scope was explained and the total number of permits issued under the Urban Transformation Law were requested. Both the number of buildings and dwellings were demanded due to the widely used “flat for land” type contracting in the Country. Contracting in the “flat for land” basis requires that the contractor and dwelling owners in an existing building agree on the demolition and construction of a new building. The difference from a traditional construction contracting emerges in the payment of the contractor. The contractor is not paid in cash, instead additional dwellings emerging from increased floor area ratios become the property of the contractor. Thus, in practice, the number of dwellings in an area usually increases while the floor area of each dwelling presumably gets smaller.

14 municipalities out of the total of 39 responded to the written application. While eight municipalities among all provided both building and dwelling numbers, only building numbers could be obtained from six municipalities. The remaining municipalities provided no information stating that data was not available for building permits issued particularly under Urban Transformation Law. As a result, the authors analyzed data gathered from 14 Municipalities; namely Arnavutkoy, Avcılar, Bahcelievler, Besiktas, Beykoz, Beylikduzu, Beyoğlu, Cekmekoy, Kadıkoy, Kucukcekmece, Umraniye, Sancaktepe, Sultanbeyli and Zeytinburnu. As the majority of these municipalities did not provide dwelling numbers, the data showing the number of building permits is analyzed.

Once the data was collected, the research proceeded with the identification of risk degrees of municipalities in terms of the number of risky building predictions under the most probable scenario provided in the JICA report. JICA report presents data for 30 municipalities. As not all municipalities provided data on the use of the law, only data for related municipalities were gathered from the report.

Table 1 shows the total number of building permits issued by selected Municipalities, permits provided under the Urban Transformation Law (Law no. 6036) and the shares of the latter in total number of permits. As it can be seen from the table, since today, Arnavutkoy followed by Kucukcekmece, Kadıkoy, Bahcelievler and Cekmekoy had the highest number of building permits issued under Law no. 6036. Data obtained from Beykoz and Sultanbeyli Municipalities on the other hand demonstrate that negligible numbers of building permits are issued using the law under consideration. Compared with JICA earthquake risk zones provided in Table 2, results reveal that these findings are, in general, not compatible with risk rankings of selected Municipalities except Bahcelievler and Beykoz. For example Zeytinburnu, which ranks first in earthquake risk zones only ranks 8th in the numbers provided for permits issued under Law no.6036. Similarly, another high risk region, Avcılar ranks 10th in a total of 14 Municipalities examined. Thus, as far as the number of building permits are concerned it can be concluded that the law does not fully serve its purpose in practice.

However, these results should be interpreted with caution as the population density, concentration and size may vary among Municipalities. In order to overcome such misinterpretation, shares of building permits provided for Law no. 6036 in the total number of permits issued by Municipalities are also presented in Table 1. The emergent ranking of Municipalities from highest to lowest shares are demonstrated in Table 3.

Table 1 - Data gathered from selected municipalities



Municipality		2012	2013	2014	2015	Total
Arnavutkoy	Total no. of permits	378	432	718	666	2194
	Law No. 6036	112	400	413	499	1424
	Share (%)	29,63%	92,59%	57,52%	74,92%	64,90%
Avcilar	Total no. of permits	318	240	571	288	1417
	Law No. 6036	0	14	173	135	322
	Share (%)	0,00%	5,83%	30,30%	46,88%	22,72%
Bahcelievler	Total no. of permits	325	318	561	383	1587
	Law No. 6036	0	87	389	373	849
	Share (%)	0,00%	27,36%	69,34%	97,39%	53,50%
Besiktas	Total no. of permits	73	54	48	53	228
	Law No. 6036	7	13	32	32	84
	Share (%)	9,59%	24,07%	66,67%	60,38%	36,84%
Beykoz	Total no. of permits	30	14	34	6	84
	Law No. 6036	0	0	1	0	1
	Share (%)	0,00%	0,00%	2,94%	0,00%	1,19%
Beylikduzu	Total no. of permits	413	465	1040	753	2671
	Law No. 6036	0	7	171	211	389
	Share (%)	0,00%	1,51%	16,44%	28,02%	14,56%
Beyoglu	Total no. of permits	139	167	109	115	530
	Law No. 6036	0	6	61	98	165
	Share (%)	0,00%	3,59%	55,96%	85,22%	31,13%
Cekmekoy	Total no. of permits	503	620	595	553	2271
	Law No. 6036	0	36	375	399	810
	Share (%)	0,00%	5,81%	63,03%	72,15%	35,67%
Kadikoy	Total no. of permits	144	221	490	557	1412
	Law No. 6036	137	165	257	521	1080
	Share (%)	95,14%	74,66%	52,45%	93,54%	76,49%
Kucukcekmece	Total no. of permits	669	770	1164	730	3333
	Law No. 6036	0	0	610	619	1229
	Share (%)	0,00%	0,00%	52,41%	84,79%	36,87%
Umraniye	Total no. of permits	708	657	666	664	2695
	Law No. 6036	0	0	320	448	768
	Share (%)	0,00%	0,00%	48,05%	67,47%	28,50%
Sancaktepe	Total no. of permits	1242	1040	1241	1472	4995
	Law No. 6036	0	0	0	611	611
	Share (%)	0,00%	0,00%	0,00%	41,51%	12,23%
Sultanbeyli	Total no. of permits	9	25	124	246	404
	Law No. 6036	0	0	2	22	24
	Share (%)	0,00%	0,00%	1,61%	8,94%	5,94%
Zeytinburnu	Total no. of permits	152	186	215	149	702
	Law No. 6036	0	126	189	109	424
	Share (%)	0,00%	67,74%	87,91%	73,15%	60,40%



Table 1 - Percentage of damaged buildings and rank of selected Municipalities in the report by JICA (2002) [12]

Municipality	%	Rank
Zeytinburnu	34	1
Avcılar	29,7	2
Bahcelievler	29,2	3
Buyukcekmece*	23,9	4
Kucukcekmece	20,1	5
Beyoğlu	18,7	6
Kadikoy	12,3	7
Besiktas	9,8	8
Gaziosmanpasa**	8,7	9
Catalca**	6,8	10
Umraniye***	6,3	11
Beykoz	4,5	12

*Beylikduzu Municipality in Table 1 is separated from Buyukcekmece in 2009 (Law no.5747)

**Arnavutkoy Municipality in Table 1 is separated from Catalca and Gaziosmanpasa in 2009 (Law no.5747)

***Cekmekoy and Sancaktepe Municipalities are separated from Umraniye in 2009 (Law no.5747)

Table 2 - Ranking of Municipalities based on Law no.6036 implementation rates.

Municipality	%	Rank
Kadikoy	76,49	1
Arnavutkoy	64,90	2
Zeytinburnu	60,40	3
Bahcelievler	53,50	4
Kucukcekmece	36,87	5
Besiktas	36,84	6
Cekmekoy	35,67	7
Beyoglu	31,13	8
Umraniye	28,5	9
Avcılar	22,72	10
Beylikduzu	14,56	11
Sancaktepe	12,23	12
Sultanbeyli	5,94	13
Beykoz	1,19	14

Combined evaluation of Tables 2 and 3 reveal that while the rankings appear more compatible compared to assessments based on number of building permits issued under the law, still there are several mismatches. First, while Kadikoy Municipality ranks seventh in the risk report by JICA, it ranks first in the law implementation rates by 76,49%. This means that although the region is not highly risky in terms of damaged buildings, an overwhelming majority of all permits are provided under the law. Second, Avcılar, which is a high



risk Municipality according to the forecasts presented by JICA, appear in the last rows of the implementation ranking list provided in Table 3. Third, Buyukcekmece region which included Beylikduzu Municipality at the time when JICA models were developed in 2002, appears to be another region where obvious variations between the two rankings can be observed. While it ranks 4th among high risk zones, only 14,56% of building permits are provided under the law. Lastly, Arnavutkoy Municipality which was a part of Gaziosmanpasa and Catalca regions at the time when the report by JICA was prepared, is the second region that has benefited from the law (64,90%). In contrast, Gaziosmanpasa and Catalca only rank 9th and 10th in the risk zone list provided in Table 2. However, only tentative conclusions can be drawn from the last two findings about Beylikduzu and Arnavutkoy Municipalities as these were not analyzed as separate Municipalities but parts of wider regions at the time when JICA report was prepared.

The rate of the use of law seems to be quite consistent with the riskiness for the remaining Zeytinburnu, Bahcelievler, Kucukcekmece, Beyoglu, Besiktas, Umraniye and Beykoz Municipalities. The most prominent differences that occur in the regions such as Kadikoy, Arnavutkoy, Avcilar and Beylikduzu can be attributed to market forces. As stated before, the only profit opportunity for private developers that incur demolition, construction and other costs is the price of flats on the widely used 'flat for land' basis. Failure to sell these dwellings at a profit might run the companies in financial difficulty. Thus, high rates of use of the law, in particular in Kadikoy, can be attributed to the relatively high property prices and popularity of the region. The case of Arnavutkoy on the other hand is slightly different, though it is still the market forces that shape the increased use of the law. A new large-scale airport and part of the ongoing Northern Marmara Motorway Project that will provide access to the new third bridge on Bosphorus Strait, thus to Asia are all located in the Arnavutkoy district. Thus the attractiveness of the region is increased. Thus, results reveal that high property prices and regional attractiveness are two main drivers of market forces that lead to increased interest of private developers. Thus, governments should consider new structural and financial incentives for those high risk regions that lag behind others in implementation.

4. Conclusions

This paper aimed to evaluate the extent to which "The Law of Transformation of Areas under the Disaster Risks" (Law no. 6306) in Turkey has reached its objectives since it entered into force in 2012. For this reason, municipal data regarding the number of permits issued under the law and the total number of permits were collected. These were then compared to regional riskiness levels in order to identify whether the use of the law concentrates on risky areas.

Results revealed that while the ranking results were compatible for almost half of the regions under consideration, several mismatches occurred between the levels of riskiness and the usage of the law. A close examination into the latter demonstrated that such variations can mainly be attributed to the market forces prevailing in the widely-used 'flat-for-land' basis construction. Findings prove that regions with high property prices and increasing popularity are preferred by private developers as their only profit opportunity is the price of flats on the current 'flat for land' basis.

Governments that are in the phase of constituting a law regarding urban transformation for increasing earthquake preparedness could benefit from research outcomes by taking preventive measures for stimulating the private demand in most risky areas. In this concept, financial allowances introduced by the law may also set an example for increasing the attractiveness of those regions that fall far behind in implementation levels albeit their high riskiness. Furthermore, the transfer of experience among the research community may also be beneficial for the successful implementation of similar programs in the future.

5. References

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