

The Relations between Earthquake and Planning for Istanbul

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SUMMARY

Many of the settlement areas in Istanbul are located on the first degree earthquake zones. The inhabitants who live in multistorey buildings are seriously being threatened by the earthquake risk. The mitigation works which hadn't taken enough attention in the past is attached importance after Izmit-Golcuk earthquake, and the risks, loss estimations, causes and solutions are started to be researched. The most detailed study that has been carried out in this subject is Istanbul Earthquake Master Plan (IEMP) Project.

The problems which are related to planning encountered during the study and solutions for those problems are the main topics of this paper. Some of the important suggestions discussed in this paper are legal and administrative arrangements, monitoring of the planning hierarchy, detailed definition of the risks and local precautions.

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1. INTRODUCTION

Turkey is one of the countries who encounters with the natural based events which can be turn into disasters. Geological and topographic status, socio- cultural structure, economical conditions and settlement habits of Turkey are important factors for that turn. When the damage status caused by disasters are considered, distribution is portioned as 64% earthquake, 16% land slide, 15% flood, 4% fire, 1% meteorological based other disasters such as avalanche, storm and underground water level increase (TBMM, 2003). Due to the damage statistics based on the life loss caused by natural disasters show that the higher percentage belongs to earthquakes. This portion is equal to the 2/3 of the total life loss caused by disasters. Therefore, the disaster and earthquake terms seem synonym in Turkey (Ergunay et al., 2003).

18.28% ratio (between 1999-2000) of the annual population growth, especially, has reached to the highest values in big cities (41.79% in Antalya, 33.09% in Istanbul, 28.62% in Bursa, 27.04% in Kocaeli) of Turkey (SIS, 2000). Since those cities have insufficient technical and social infrastructures, they are come across with the uncontrolled settlements. Therefore, risk has been dramatically raised, since Turkey has the high frequency of destructive earthquake occurrences due to the geological status. According to the earthquake region maps of Turkey, 70% of the total population lives on the first and the second degree earthquake zones which cover the 66% of the total area. When the earthquakes occurred in last 109 years are considered, they were caused approximately 100.000 dead and 550.000 collapsed or heavily damaged buildings (Table: 1, Figure:1).

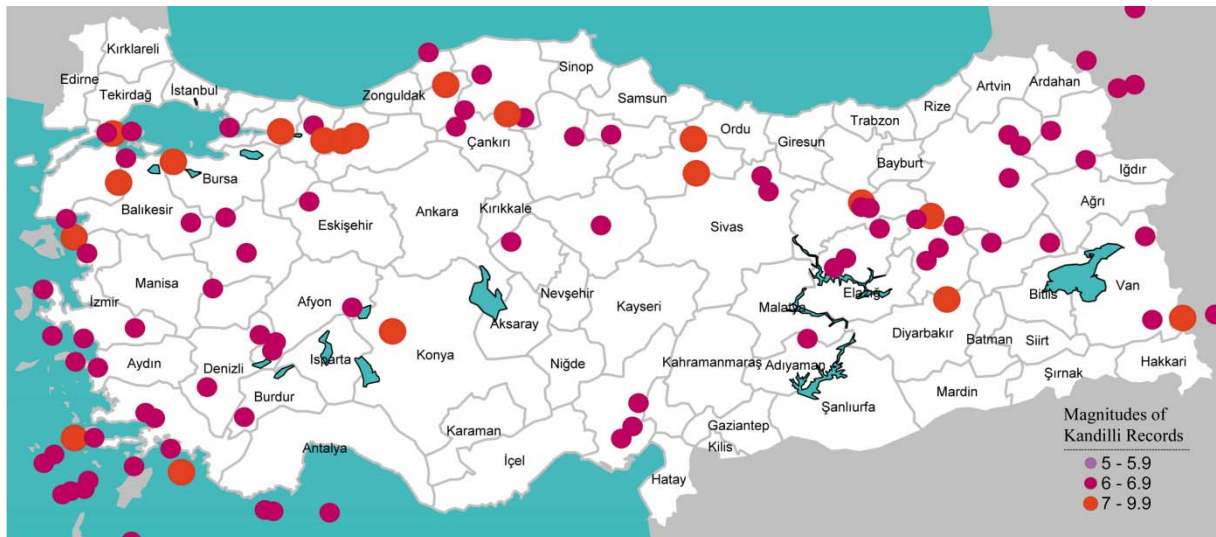


Figure 1: Damaging Earthquakes in Turkey (between 1900-2005)

Table 1. Earthquakes between 1894 and 2003 caused high life loss (NEC, 2002)

Date	Location	Magnitude	Dead/Damaged Building
10.07.1894	Istanbul	7.0	474/387
08.11.1901	Erzurum	6.1	500/10.000
28.04.1903	Malazgirt	6.7	2.626/4500
28.04.1903	Patnos	6.3	3.560/12.000
04.12.1905	Malatya	6.8	500/5.000
09.02.1909	Menderes	6.3	500/5.000
03.10.1914	Burdur	7.1	4.000/17.000
24.01.1916	Tokat	7.1	500/5.000
18.11.1919	Soma	6.9	3.000/16.000
06.05.1930	Hakkâri	7.2	2.514/3.000
26.12.1939	Erzincan	7.9	32.962/116720
20.12.1942	Niksar	7.0	3.000/32.000
26.11.1943	Tosya	7.2	2824/25.000
01.02.1944	Gerede	7.2	3.959/20.865
17.08.1949	Karlıova	7.0	450/3.000
19.08.1966	Varto	6.9	2.394/20.007
28.03.1970	Gediz	7.2	1.086/9452
22.05.1971	Bingöl	6.7	878/5.617
06.09.1975	Lice	6.9	2.398/8.149
24.11.1976	Çaldıran	7.2	3840/9552
30.10.1983	Horasan	6.8	1.155/3.241
13.03.1992	Erzincan	6.8	653/6.702
17.08.1999	İzmit-Gölcük	7.4	16986+/-~500000
12.11.1999	Düzce	7.2	845/~18000

The cities in Turkey with high population growth ratio are spreading untidily with the serious problems such as uncontrolled land use and construction, insufficient infrastructure and services, authorities and responsible parties with insufficient knowledge and education, environmental defects. As a result of this situation, disasters cause more life loss and demolition. Unfortunately, Turkey has realized that truth after 17.08.1999 Izmit-Golcuk earthquake. 1999 earthquake affected mainly dense urban areas, caused high life loss and serious economical collapse. Istanbul is the one of those cities who lived that experience and it is being expected to come across again.

2. ISTANBUL AND BUILDING PROBLEMS

The percentage of the damage ratio that has occurred in 1999 earthquake in Istanbul were composed of 5% heavily damages, 20% medium damages and 16% slightly damages. There were 3073 heavily damaged, 13.339 medium damaged and 12.455 slightly damaged buildings after the incident. Totally 454 person died mainly (274 body) of whom are from Avcılar District and 1.880 persons were injured (UCTEA, 2000). Istanbul is located at the bottom of the North Anatolian fault line, and she is the most crowded city in Turkey with approximately

10 million population (SIS, 2004) where approximately 1915 person on a kilometer square. There are several factors like uncontrolled and unplanned urban development that are threatening the life sources of urban life while it is also increasing the possible earthquake risk on Istanbul Metropolitan area boundaries. Nevertheless, there are several problems in the metropolitan area, based on the effects such as prior development characteristics, urban functions and population density, dangerous flammable and explosive function areas and living which lie one inside the other. It is being expected to face negative conclusions after a possible earthquake in Istanbul. Especially, those conclusions are being expected as collapse of economical infrastructure caused by the social and physical losses. According to The Red Cross report prepared by Bogazici University (BU), it was revealed that approximately 100 million square meters building area to be heavily damaged or beyond. Nevertheless, economical values of those structures are expected to be 20 billion dollars according to the 2003 costs of building units (YTU, 2003-1).

Some problems in Istanbul are as follows (YTU, 2003-2):

- There are 724609 buildings according to the year 2000 data, and 80% of the buildings -that has actually been in use- have no building usage permissions.
- Although the buildings on the social housing areas are less risky from the building standard conformances point of view, there are high risks for some social house instances due to the location decisions based on the land formation deformations.
- The low technical quality is a very common problem for the buildings that has been built through the building cooperatives.
- The main problem in the areas that are in the unplanned category which was illegal at the beginning is low construction quality. Some of those areas have become legal after the renewed development plans.
- Since the processes like renovation of the historical places are expensive processes, Historical Business Center Area (from Historical Peninsula to Galata and Golden Horn) is in the high risk group.
- Some of the industrial structures are located in the dense settlement areas or close to the natural sources.
- Some of the unplanned areas are located in the natural environment or in the most valuable areas from the arrival point of view.

3. THE MITIGATION STUDIES CARRIED OUT AFTER THE IZMIT-GOLCUK EARTHQUAKE

There are various studies that have been carried out for increasing the earthquake safety after Izmit-Golcuk earthquake. Those are directly or indirectly related to City of Istanbul .

National Earthquake Damage Reduction Strategy

The strategy was constituted in accordance with the Prime Ministry Circular at 21 March 2000 date and 2000/9 count. That national strategy was published as “National Earthquake Damage Reduction Strategy Report” of National Earthquake Council. It was prepared according to a strategy report, and it includes long and short term earthquake damage reduction studies, comprehensively. Study was collected under two sections; risk management (pre-earthquake preparation works), disaster management (studies after the earthquake). The topics about the Turkey’s earthquake problems are considered one by one and after determination of the condition, proposals with the reasons for required applications of the topics are presented in the report.

The topics mainly held in the report are as follows (NEC, 2002):

- Earthquake data infrastructure and national seismic network.
- Earthquake safety of settlement areas, national and local development policy.
- Earthquake safety of structures.
- Mitigation of existing structures.
- Education and organization.
- Usable resources.
- Legal arrangements etc. (Constitutional precautions, Law of Disasters, Development Law and Legislations)

However, the report was criticized, since the precautions were defined as principles, it did not include the studies about the earthquake damage reduction, human factor was neglected, it did not define any strategy for settlements and it neglected the importance of Istanbul.

3.1 The Study on A Disaster Prevention/ Mitigation Basic Plan in Istanbul

Respect to the arrangement between Istanbul Metropolitan Municipality (IMM) and Japan International Cooperation Agency (JICA) which was sealed by the Council of Ministers with the 2000/1885 count, The Study on A Disaster Prevention/ Mitigation Basic Plan in Istanbul including Seismic Microzonation in The Republic of Turkey was started in 2001. In this project, it was aimed to examine the buildings and the possible damage possibilities of infrastructures by sampling based on district for the determination of the areas which have high risk in a macro level. The study was completed in 2002 after the data collection process such as existing data (maps, soil, building, and population etc. information), field observations (boring, geological-geophysics-geotechnical measurements, and sample buildings); data processing in GIS environment; evaluation and interpretation of findings. It was aimed to use and develop the knowledge gained from the study in projects for earthquake damage reduction.

The processes realized during the project are as follows (IMM, 2002):

- Administrative organization about the development and the disaster laws; existing organizational system related to the disaster management were brought up. The authorizations and tasks of the central administration, Governorship, IMM, District Municipalities about the disaster management were examined, and lawful, organizational proposals for enhanced disaster management and the disaster management plan proposal were brought up.
- The present condition of the natural situation with the topography, geology, geotechnical and earthquake data; social situation with the population, building, road, bridge and infrastructure data; flammable- explosive establishments were derived for the earthquake disaster management.
- Calculations of the damages based on sub-districts and life losses based on the districts were made according to the scenario earthquakes.
- Vulnerability for the buildings, important public facilities, infrastructures, bridges, roads, seaports and harbors was determined. Then, fire and traffic problems were held and some proposals were made.
- Buildings and their structures were analyzed from the vulnerability aspects, some precautions were proposed for the weak structures for strengthening. Some of the proposed precautions are special for the preserved areas. Urban regeneration is one of the precautions.
- Proposals for landuse and regulations, similarly, some explanations about the earthquake resistant construction were made.
- Consequently, short, middle and long term precautions for mitigation were proposed.

3.2 World Disaster Report

In 2002, World Disaster Report of Federation of the Red Cross and the Red Crescent Associations, Turkey was involved in a large section. It was focused on the general situation of the buildings in Turkey. It was emphasized in the report that, however, there had been some rules since 1939 in Turkey, they had not applied and the building auditors were ignorant. It was also underlined in the report that the ignorance was affecting the engineers and the architectures.

Various precautions for Turkey were ordered for reducing the life loss to a minimum in a possible earthquake. First, it was suggested to strengthen the critical buildings such as hospital, school, and to establish the own rescue teams for every region (NEC, 2002).

3.2.1 The Earthquake Risk Analyses of Istanbul Metropolitan Area

In the project which was carried out by BU and supported by American the Red Cross, the earthquake risk was defined in a macro level (BU, 2002). Istanbul was divided in to 400 m to 600 m cells and risks were defined respect to the earthquake scenarios that were designed according to the building count, ground condition, some properties in the sub-areas etc. data.

3.3 Istanbul Earthquake Master Plan (IEMP)

IEMP study was started in 2002 and completed at the end of 2003. It was carried out by coordination of Yildiz Technical University (YTU), BU, Middle East Technical University and Istanbul Technical University. In this study, all the local and national strategies, principles, bases, responsibilities, authorizations about the topic were defined after examination of the technical, administrative and legal structure about the earthquake.

The main scope of IEMP is to reduce the damage effect of a possible earthquake in Istanbul. Therefore, it can be named “Istanbul Disaster Effect Reduction Strategic Plan (IDERSP)”. The secondary scope of IEMP is improving the quality of natural and urban environment.

IEMP YTU settlement working group determined avoiding from the new risks as base topic and focused onto revision of planning and structure system for that. In this concept, the following strategies are constituted (YTU, 2003-2):

- Defining the new planning level as “National Spatial Strategy Plan” which should be developed by Prime Ministry State Planning Organization (SPO) for Turkey’s planning system in order to define the spatial basis of the developments of social and economical.
- Istanbul’s functional area which covers the 200 kilometers band on East-West direction from the Black Sea on the North to the Marmara Sea on the South is being grown up crossing the adjacent city boundaries. Therefore it is necessity to make a specific region plan for Istanbul Metropolitan Area. In this context, developing a complete model around all existing local plans for Istanbul.
- Preparing Istanbul Metropolitan Area Master Plan and IDERSP using the maps showing the physical, cultural and natural thresholds which are prepared by specialist organizations.

Besides, after analyses of the existing databases (JICA, BU-Red Cross and IMM GIS), primary areas are defined respect to the risk indicators and the other city planning parameters in order to create disaster resisted areas and to present applicable strategies as follows (Figure 2).

Nevertheless, it is emphasized that the planning decisions and defining the priorities are insufficient, since the risk level was in the sub-district level (JICA) and cell (BU-Red Cross) were very large with 400m x 600m dimensions. With this respect, the context of the risk map which should be prepared in the macro level was defined (Batuk et al., 2004). At last, inspecting the IEMP strategies for new detailed risk maps and evaluating those united decisions were accepted as the basic strategies as well.

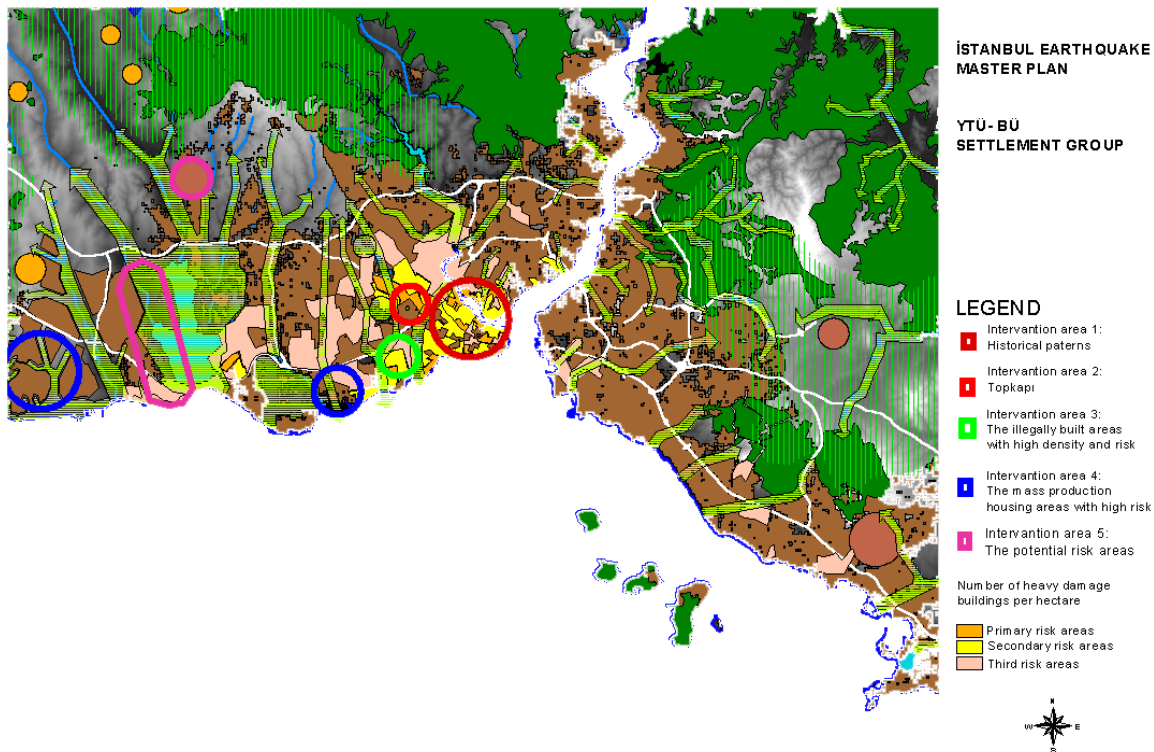


Figure 2: Primary Intervention Sub-areas (YTU, 2003-2)

Urban re-development and definitions of the project area are two important strategies and it is constituted from four ordered steps:

- Researches on the identification of local dynamics in the selected strategic areas.
- Preparation of the strategic plan drafts by IMM and publication of the plan for the widespread discussions.
- Feed back of editing, objections and alternatives provided by the local municipalities, related groups, civilian social groups etc.
- Official production of the settlement strategic master plan.

Three types of project application typologies are suggested by YTU team.

- The Urban Regeneration Trigger Zones: Those are the zones which have high potential and tendency for triggering the regeneration and the radical changes in metropolitan scale. It should be conformed to the high level plans like master plans, and should be encouraged with the detailed planning approach by Metropolitan Administration.
- The Local regeneration zones: Those are the zones which are expected to have positive results of the re-development actions in the local level. They should be encouraged, especially in risk areas, for the development and regeneration with the rationalist and effective planning strategies.

- The Regeneration Zones: Those are the zones which have lower risk and fewer problems from the urban facility and structure quality point of view. Main scopes in those areas are to improve the environmental quality and enhance the post-disaster conditions.

The approach of the municipality to the application of IEMP was based on the integrity for decision making, but it was also based on flexibility of application of strategies.

The success of IEMP is dependent upon the recent planning concepts of recent organizational mechanism, administrative comprehension and behavior of the urban participants for the implementation. Therefore, the proposal in IEMP includes new organizational arrangements such as SPO region units, Land Improvement Administrative Office, urban regeneration and investment union, public auditor.

Institutional re-organization, naturally, needs the legal arrangements. Therefore, IDERSP also includes some suggestions for the constitutional, developmental, urbanization and local administration laws. First, the law system sections related to the disaster risk was examined. By detecting the errors, the lacks and gaps in the lawful arrangements, basic problems were determined. The studies of the law arrangements were held by the way of investigating the real instances for Istanbul. Besides, it was given the high priority to the arrangements, auditing and participation concepts through supporting the applicability which was found one of the main problem in the law implementation.

As far as the main problems in the law concerned from the disaster point of view, following results are revealed:

a. Organizing and responsibilities

- Constitutional fundamentals are not being executed.
- Organization is complex, and there are confusions in the tasks and authorizations of the institutions.
- The relationships between the central and the local administrations are weak with regard to either guiding or auditing.
- The role and authorization of the central administration is too comprehensive.
- The central administration is insufficient at preparing data entering for the plans and preparing the end product like the other tasks.
- The responsibilities and the authorizations of the local administrations in risk defining and disaster damage effect reduction are insufficient. Since there are uncertainties for the top management to define the principle, policy and standard, tasks of the local administrations are undefined.
- There is no supporting or guiding in the system for the participation of the civilians and local administrations in the disaster risk reduction plan and the program of the central management.

b. Planning

- One of the main reasons of the lack of auditing is not functional planning hierarchy.
- There are inconsistencies between the plan definitions, contents, scales of law and regulations.
- There might be obstacles and ruining effects for working of the planning system, since the central administration has strong wardship authorization which is being used for separated decisions.
- The planning system is insufficient for preventing the existing and new risks, and it is not responding to the urban dynamics.
- The planning is accepted as an unearned income and obstructing tool by some people. The feedback mechanism of unearned income to the public which is created by the plans is not taken place in the law.
- The application tools are not enough for providing the facility areas, obstructing building on the areas with high disaster risk, etc.
- The application tools are defined in the legal plane for providing the applications for the risk reduction and creating the investment possibilities.
- The density, standard of facilities and readjustment share are closely interactive parameters. Since, the templates related to the connectivity is not taken place in the regulations, there are obstacles in front of the improving the living and the healthy criterions.
- The Development Exemption Laws enacted for the settlements which are not conforming to the amendment plans and improvement development plans are became tools for accepting the risk and the risk creation instead of the risk reduction.

c. Building

- Since the legal building procedure is so hard and needs long time for the bureaucratic constraints, it is being caused people to try to build illegally instead of the legal buildings.
- In spite of the legal arrangements after 1999 earthquake, there is no healthy and effective building auditing system, yet.

In IEMP, following proposals are developed for the summarized problems above:

- In order to collect the plans under an umbrella, an additional law is offered for the Constitution. A second law for the Constitution is that the mitigation responsibility is an exact provision for Government.
- The horizontal and vertical connections between integrity of the development and planning system of the institutions are defined. Paragraphs offered to take place in the Development Law are arranged as institutions, responsibilities of the institutions and the new institutions and their responsibilities.
- While the determination of the disaster risk and development of the solutions duties are given to the local administration's responsibilities; determination of the criterion of

risk defining, auditing and constitution of programs and strategy plans for the risk reduction responsibilities are given to the committees which are suggested to be founded.

- Applications of establishment of the plans by participation and transparent system are developed.
- Responsible institutions for auditing and preparing the maps and documents which are required to be prepared in different scales for determination of the disaster risks or dangers as the system entries, are defined.
- The public auditing system and preparation of the plans with participatory process are offered. Thus, it is aimed to minimize the events which might be brought to the courts by reducing the disagreements.
- Institutional proposals are taken place in the lawful arrangement which creates the financial possibilities for applying the plans for the risk reduction, prevention and sustainability.
- It is emphasized that the abrogation of the Development Exemption Law and the Amendment Development Plans is one of the most important points for the risk reduction.
- The building auditing system draft law is offered.

4. CONCLUSIONS

So far, big development differences between the regions are appeared as the results of the region development policies which are not conformed, region plans which are not made in Turkey. Therefore, the investments and population is heaped in particular regions unsystematically; untidy, improper and unsafe cities are appeared. Shortly, the main problem for the place is originated from the absence of the settlement and urbanization policy in Turkey. The things like the lack of settlement and urbanization policy, definition of the principles and goal, affected the applications to be short term solutions.

Nowadays, the necessity of revision of the approaches for urbanization is revealed because of those problems, the economical and spiritual losses, conforming the process for EU and changes in the world. Therefore, a reform process has been started about the Development Laws by Turkish Republic Government by 2003. First, some changes are applied to the existing 3194 numbered Development Law in the EU conforming process. Additionally, by 2004, The Ministry of Public Works and Settlements has started studies to change the Development Law completely. Especially the results of the studies which are applied for the earthquake safety are considered in the prepared draft laws. Building auditing, urban regeneration applications, development application methods, region planning, spatial strategy planning, wholeness of plans, disaster preventions and earthquake safety studies are considered and new sentences are being offered for the draft of the law.

IMM has started a pilot project in Zeytinburnu District which is the one of the squatter's houses zone in Istanbul. That area has also dense illegal buildings and high earthquake risk. Respect to the offered goals in IEMP, the studies for implementing the strengthening,

enhancing and reconstructing programs are started in March 2003 in high risk zones and Zeytinburnu District as the local action plan.

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