

PERFORMANCE ANALYSIS OF EARTHQUAKE RESISTANT BASED URBAN TRANSFORMATION PROJECTS

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Earthquakes have often produced economic and social disaster. The last destructive earthquake on west side of the NAFZ is 1999 İzmit ($M_w = 7.4$). On August 17, 1999, a major earthquake occurred in the Marmara region, western Turkey, with a magnitude $M_w = 7.4$. The total observable length of the rupture was about 100km. The number of condemned buildings after the earthquakes amounted 23,400. There were 18,373 accounted deaths. First reason of this damage is inadequate design and low construction quality of buildings without control and supervision. The second important result is wrong urbanization policies of local and central government. Among the cities of the well developed and developing countries, it is possible to create urban surroundings resistant to earthquakes by comprehensive mitigation activities. Turkish Government has decided to perform many urban transformation projects in Istanbul in order prevent future seismic damages. However these projects have been started without detailed design and analysis. The aim of this study is to analysis performance of urban transformation projects in Istanbul. The feedbacks are collected from the sides of urban transformation projects such as landowners, constructors, officials, non governmental organizations (NGO). Especially Fikirtepe Urban Transformation Projects are analyzed with details. Based on studies on site and later analysis, the performances of urban transformation projects in Istanbul are evaluated.

Keywords: Urban, Transformation, Construction, Earthquake, Buildings, Performance, Regeneration.

1 INTRODUCTION

Turkey has been experiencing a great deal of changes in its urban structures over the last two decades, like in many other developing countries under rapid change in demographics. Rapid population increase combined with further industrialization caused massive immigration from rural to the metropolitan areas, which have resulted in increasing urbanization rates in Turkey. The urbanization rate in Turkey was around 25% until the early 1950s, increasing to 40% in 1980 and 65% in 2000. Turkey ranked third among countries with the highest urbanization rate in the world between 1980 and 2000. As of 2012, according to TURKSTAT, Turkey's urbanization rate has reached 77% as shown in Figure 1.

Not only population growth, but also migration from rural areas led to high demand for housing in the metropolitan cities. Burdened with all the problems of urbanization, cities became the subject of dramatic changes as squatter settlements, environmental

degradation and deterioration of existing infrastructure came into play. Turkey has experienced very destructive earthquakes in the past 70 years as shown in Table 1 listed by AFAD.

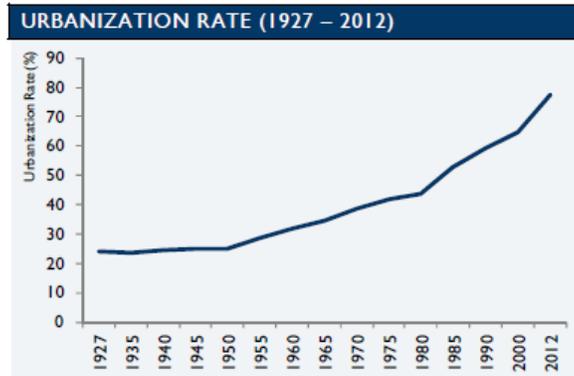


Figure 1. Urbanization rate of Turkey.

Table 1. Largest earthquakes in Turkey.

Year	Location	Magnitude	Life Losses
1939	Erzincan	7,8	32.700
1942	Tokat, Erbaa	7	3.000
1943	Samsun, Lâdik	7,4	4.000
1944	Bolu, Gerede	7,5	3.959
1966	Muş, Varto	6,7	2.396
1975	Diyarbakır, Lice	6,6	2.385
1976	Van, Muradiye	7,5	3.840
1999	İzmit	7,6	17.118
2011	Van	7,2	688

Earthquake performance of cities can be improved by changing the functional characteristics through urban transformation, land-use planning and increasing the quality and redundancy of the infrastructure. Almost all of these risk management measures are being implemented in Istanbul to prepare the city for a large earthquake that has an annual probability of occurrence of about 2%, one of the largest in the world. According to Istanbul Scenario Earthquake (Mw = 7.5) Losses (2009 Estimates), about 16,000 buildings were found to be damaged beyond repair (2%). About 40,000 (5%) buildings would be extensively and 150,000 (19%) buildings would be moderately damaged. The financial losses due to building damages caused by the scenario earthquake are estimated to be in the range of USD 12 Billion. Total Direct Losses will be about USD 40 Billion. The deaths were found to vary between 20,000 and 30,000. The Istanbul Metropolitan Municipality has commissioned the services of four leading Turkish universities for the preparation of the Earthquake Master Plan for Istanbul. The master plan aims for the planning of the activities in these fields, preparation of implementation programs, and identification of the responsibilities and responsible authorities for earthquake disaster mitigation activities. According to this study, new

(post 2000) buildings in Istanbul are in general being built much better than the existing building stock. That's why; the Istanbul Metropolitan Municipality of Istanbul pursues programs on Urban Development, Rehabilitation and Transformation, where the focus is transformation projects for highly vulnerable building districts as well as master projects for rehabilitation and transformation of most risky zones. In this paper properties of the Urban Development, Rehabilitation and Transformation projects are analyzed and discussed.

2 URBAN TRANSFORMATION IN TURKEY

Urban transformation is an enterprising and resource-creating tool that enables the realization of sustainable strategic planning. Since Istanbul suffers a high risk of earthquake damage, the cost of reducing the potential damage will be high. Turkey's economic conditions limit the capital resources available for activities to reduce earthquake damage, so public institutions will need to take the lead in such a major urban transformation. The primary goal of urban transformation projects is to eliminate infrastructural and superstructure deficiencies by cleaning up urban spaces from illegal settlements. Nevertheless, urban transformation projects have a social dimension as well. In such projects, informing the local people about the issue concerned, cooperating with the local people and participation of the people are extremely essential for the project to result in success (Karadağ and Mirioğlu 2012). The requirement for urban transformation in less developed and developing countries is based on processes of the unplanned growth of cities, squatting, illegal building, urban sprawl, and clarification of the social problems caused by them (Özden 2008). The most fundamental factor requiring urban transformation in Turkey is squatting. The squatting areas which increased with the urbanization movements that particularly commenced as of the 1950s have now reached dimensions to threaten both the planned urban fabric of the cities in which they are located and urban livability. The ongoing migrations to cities and the fact that squats and the squatting population.

2.1 Urbanism Properties of Istanbul

At present, Istanbul is more modern than many major cities of the world in many respects. This is due to the new investment in the latest technology, and to the concentrations of wealth and affluence that made it possible. Since the cities' rapid progress into modernity only began a few years ago, it is no wonder that most modern available technologies were brought into the city. However excessive, unplanned, uncontrolled construction without protecting green areas threatens future of the city.

The total area of Istanbul City is 5343 km². According to last census, Istanbul's population is 14,160,000 inhabitants (2013), its population grows at a rate of 3.45% mostly accounting for the countryside migrations shown in Figure 2. The presence of squatters, mass transportation and solid waste disposal are some of the most critical problem of the city administration phases, further challenged by the increasing irregular and illegal urbanization.

Istanbul is identified as Turkey's economic capital. Main sector of the economy relates to provision of services and utilities (60%), manufacturing accounts for the 35% and the primary sector only for the 5%. When 1999 Marmara earthquake hit the

Marmara Region, in Istanbul, Avcilar (in south-west) and Tuzla (in south-east) were the most affected districts with collapsed buildings. In Istanbul 1-2% of the buildings were damaged, 454 people were killed and 3600 people were injured because of uncontrolled and illegal settlements (Erdik *et al.* 2000).

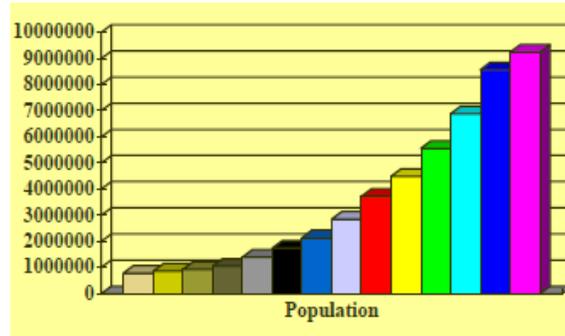


Figure 2. Population change of Istanbul for each 5 years between 1930-2000.

2.2 Relationship between Earthquakes and Urban Transformation

The following factors play a major role in reducing earthquake damage in a country (Köktürk 2007): 1) A high level of economic development; 2) A balanced distribution of income; 3) Minimal inter-regional differences in economic development and growth; 4) A nationally balanced population distribution; and 5) Implementation of a suitable urbanization policy.

Developing countries like Turkey suffer from a fundamental problem: urbanization and building construction that are contrary to urbanization rules and zoning plans. In addition to this supervising (by municipality or ministry of construction) quality of construction is unacceptable. It is tempting to take the resulting unplanned and unhealthy shanty areas that are at high risk of earthquake damage and merely reinforce the buildings as needed. However, this approach is inadequate because: 1) The lack of a legal basis for reinforcing those buildings constructed contrary to zoning legislation and plans; 2) The difficulties of reinforcing buildings constructed in great density and adjacent to one another; and 3) The possibility of reinforced buildings then suffering earthquake damage, which is a cost increasing factor.

Therefore, it is recommended (IBB 2003) that activities to reduce earthquake damage should cover many interlinked activities such as strategic planning, administrative planning, legal arrangements and financial modelling. Urban transformation serves as one of the most important action plan models in this process. In this context, the demolition or reconstruction of dilapidated or unsound buildings to preserve them is called “urban renewal” while the strengthening and improving of existing buildings to preserve them is called “sanitation” or “revitalization” (Tekeli 2003). An action plan that enables the realization of projects to improve urban spaces in accordance with real-estate policies and their ownership arrangements, with the participation of the public and private sectors, civil organizations and local people, and leads to the harmonious integration of all urban functions (Bilsel *et al.* 2003). Urban transformation is one of the

most important ways of solving issues arising where significant risk is already present (IBB 2003).

3 FIKİRTEPE: URBAN TRANSFORMATION PROJECTS EXAMPLE IN ISTANBUL

Fikirtepe urban transformation project is one of the most controversial projects. Fikirtepe is located at the most risky seismic zone. In addition to seismic risk, soil has liquefaction capacity. Fikirtepe is situated in a location that was once in the periphery of city but became an integrated part of urban settlement and gained increasing land ratings. The area is about 909.253 m². There are 17.728 dwellings with 47.655 populations. As shown in Table 2, only %3 of the buildings are in good condition (satisfy the latest code requirement). The %65 of those buildings are reinforced concrete, %34 of them is masonry. Many of those building are illegally constructed buildings without any architectural or structural project. Unfortunately those illegal buildings got residential permits before elections as election promise by politicians without any technical consideration. So their status became semi-legal or semi-illegal. %95.5 of the buildings are private, %4.5 is public ownership. The location of Fikirtepe is very attractive. Because location is very close to Metrobus and metro (main transportation) lines which make this place valuable.

Table 2. Building conditions in Fikirtepe.

Building Condition	Number	Percentage %
Good	208	3,28
Middle	2342	36,93
Bad	3759	59,28
Damaged	32	0,5
Total	6341	100

The population concentration in Fikirtepe is 364 person/ha as gross and 445 person/ha as net value. Average habitation duration is between 40-60 years. Today, complains are rising from people living in Fikirtepe. According to our survey results, their main complains are: 1) Unclear points in their contracts between them and construction companies; 2) Lack of supervision by ministry and municipality; 3) Speed of project; 4) Expensive monthly revenues after completion of project; 5) Insufficient rent support; 6) Projects lead to the separation of community according to their socio-economic classes, ethnic backgrounds and cultural choices; 7) Unbelievable prices of new projects.

4 CONCLUSION

Urban regeneration and transformation in Turkey, which is a nationwide issue considering the scale and required financing, is expected to support growth in the construction and real estate sectors in Turkey. The earthquake that is expected to hit Istanbul and its attendant potential for loss and damage are a significant issue. Regional planning and macro-level solutions need to be developed to counter this threat. To

achieve this, the utilization of resources must be extremely well. However transformed areas must be designed with social and green areas. If just concrete quality is increased, we will lose future because next generations will have to live without well planned and designed city opportunities. Those transformation project managers have to consider habitants' complaints and objections to the project in order to protect social peace. Instead of applying same model and project to everywhere, a unique project which considers all technical and social properties of the region must be designed with participating with inhabitants. In addition to this laws and legislations must be revised according to existing experiences. Municipality and ministry have to supervise projects and protect inhabitants against strong and well organized construction companies.

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