Model of an Action Plan Designed to Reduce Earthquake Damage: Urban Transformation[1]

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Abstract

Istanbul will suffer a major earthquake in the next thirty years.[2] The authoritative *Earthquake Master Plan for Istanbul* [3](IBB 2003) and geologists from the United States Geological Survey (CNN 2000) put the risk of a major earthquake in Istanbul at 62 per cent with a margin of error of 15 per cent in the 30 years starting from 2000. The potential for loss of life and property in such an earthquake obliges us to make the city's buildings and settlement plan safer against earthquakes, to reduce earthquake damage and to develop strategies for this purpose.

In this article, we outline and discuss an action plan to reduce the potential for earthquake damage and loss in Istanbul and consider the tools needed to implement the plan. Using the urban transformation method to bring the buildings and settlement areas at greatest risk up to an earthquake-resistant standard is also studied and discussed.

1. INTRODUCTION

The earthquake, which scientists say has a 62 per cent probability between 2000 and 2030 and a possible magnitude of 7.7 on the Richter scale, will result from activity in the Marmara Sea just south of Istanbul in a 200km-long section of the North Anatolian Fault that runs for 1500km East-West in parallel to the north coast of Turkey (IBB 2003, CNN 2000). Intensive discussions on various earthquake scenarios and the reduction of damage have been held since the Marmara earthquake struck in August 1999.

According to the Japan International Co-operation Agency, the physical reasons for such a quake are open to discussion but, if it occurs, some 223,000 people in Istanbul will either die or be injured and 3.7 million people will have their homes damaged to some extent (IBB 2003: 130-133). Earthquakes are a frequent occurrence in Turkey and cause considerable damage and loss. But, what makes this situation urgent is that Istanbul, the country's largest city, is under threat of a major earthquake.

Immediate action is needed to minimise the predicted earthquake's damage potential, estimates of which run to billions of US dollars. The social and physical environment must be improved to minimise this damage. In particular, suitable building codes must be developed and enforced.

[1] Written in 2005, but has not been published.
[2] International descriptors for earthquakes are as follows: 'strong' 6.0-6.9 on the Richter scale, 'major' 7.0-7.9 and 'great' 8.0 and above.
[3] The *Earthquake Master Plan for Istanbul* was prepared by four major universities (Bosphorus University, Istanbul Technical University, Middle East Technical University and Yıldız Technical University) and presented to Istanbul Metropolitan Municipality following the two earthquakes with a magnitude of over 7.0 on the Richter scale that occurred in the Marmara Region of Turkey in 1999.

In Istanbul, which has some 1,070,808 (DIE 2003) structures, the buildings and settlement areas at highest risk must be identified and brought up to a reasonable standard of earthquake resistance. Comprehensive urban transformation projects involving the reinforcement or demolition and reconstruction of buildings will be required.

2. RELATIONSHIP BETWEEN EARTHQUAKES AND URBAN TRANSFORMATION

The following factors play a major role in reducing earthquake damage in a country:

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: urbanisation and building construction that are contrary to urbanisation rules and zoning plans.

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 is called ‘urban renewal’ while the strengthening and improving of existing buildings to preserve them is called ‘sanitation’ or ‘revitalisation’. The urban transformation process is also called an enterprising and resource-creating tool of urban project and strategic planning. Urban transformation involves a change in the qualities of a whole city or a part of it and subjects the urban environment to an evolutionary or structural transformation (TEKELİ 2003). In this way, aside from the physical and social transformation of the urban space, integrated cultural and political transformation is also an aim of urban transformation.

Urban transformation provides wider perspectives on the issues related to planning, zoning, construction and urban management than does a more piecemeal approach. It is 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 organisations and local people, and leads to the harmonious integration of all urban functions (SÖKMEN 2003, BİLSEL, et al., 2003).

Earthquake damage is reduced if suitable measures are taken to prevent the development of risks; the cost of remedial work to reduce the magnitude of the risk is relatively high. Developing countries fail to take preventive measures because of the lack of adequate planning, zoning and building construction policies. The development and degree of risk is to some extent related to the economic, social, cultural and political structure of a country.

Urban transformation is one of the most important ways of solving issues arising where significant risk is already present (IIB 2003: 850-873). Implementation of an urban transformation plan that includes reinforcing and reconstructing unsound buildings can reduce risks by increasing earthquake resistance. Therefore, there is a direct relationship between earthquakes and urban transformation.

3. MODELS OF AN EARTHQUAKE-FOCUSED ACTION PLAN AND URBAN TRANSFORMATION

In 2000, the population of Istanbul accounted for 14.8 per cent of Turkey's total population. Istanbul is Turkey's largest province in terms of population and has a population density of 1753 people/km^2 settled in an area of 5712 km^2 (DİE 2003, Table 1).

Table 1: Population of Turkey and Istanbul

	1970	1975	1980	1985	1990	2000
Turkey	35 605 176	40 347 279	44 736 957	50 664 458	56 473 035	67 803 927
Istanbul	3 019 032	3 904 588	4 741 890	5 842 985	7 195 773	10 018 735
Share of Istanbul (%)	**8.5**	**9.7**	**10.6**	**11.5**	**12.7**	**14.8**

In the manufacturing sector, Istanbul accounts for 38 per cent of national added value. Great risks flow from having such a large proportion of Turkey's manufacturing facilities in an earthquake zone. The risk is aggravated by the fact that thousands of the factories involved were constructed against applicable laws and without reference to zoning plans or the migration people from villages to provincial centres (DİE 2003, Table 2).

Table 2: Distribution of Number of Households in Turkey According to Places of Settlement

Year	Provincial Centres	Provincial District Centres	Village	TOTAL
2000	7 344 751	2 969 688	4 755 654	15 070 093

In 2000, Istanbul had 2,277,030 households and they averaged a household size of 3.8 people. This indicates the high number of buildings in Istanbul (IBB 2003: 84, KESKİN, et al., 2003: 410). Paralleling the recent decrease in Turkey's rates of population increase and urbanization, there has been a decrease in the number people comprising Istanbul households. The problem is concentrated in the quality, rather than the quantity, of the houses.

In the near future, urban transformation projects creating safer and better living environments will replace intensive housing construction in Istanbul. Therefore, having largely completed its

urbanisation process, Istanbul will increasingly direct its efforts at improving building standards. But the size of Istanbul's population and the number of districts, streets and buildings (Table 3) indicate the sheer volume work that needs to be done.

Table 3: Population of Istanbul and Number of Districts, Streets and Buildings (General Census 2000), (DIE 2003)

	Population	Districts	Streets	Buildings	Flats
Istanbul	10 018 735	625	43 750	1 070 808	3 314 999

No matter how comprehensive the work to be done, the types of risk due to the threat of earthquakes should be well defined. In this respect, the first priority of this work would be to determine whether the settlement system and buildings are earthquake resistant. This, however, is not as easy as it appears. The potential economic loss from an earthquake is as difficult and complex to determine as is loss of life. Moreover, copious quantities of time, capital, personnel and equipment would be required to collect data and create a database and evaluate it. The following information needs to be collected for each of the 1,070,808 or so buildings in Istanbul:

1. Type of use
2. Number of stories
3. Number of inhabitants
4. Age and sex distribution of the inhabitants
5. Bearing systems employed in the building, and
6. Whether or not the building is to be protected according to a strategic plan.

To achieve this, an earthquake-focused action plan should be prepared and implemented.

3.1. Earthquake-focused Action Plan

An earthquake-focused action plan involves:

1. Taking co-ordinated multi-purpose measures against earthquake risk
2. Working in the long-term and in various stages
3. Making legal, administrative, financial and technical arrangements and establishing methods for collective action
4. Preparing sub-projects and implementation programs within the main programme, which is designed to enhance the quality of spatial and social life, and
5. Establishing the means and methods to initiate action: organisation, the establishment of partnerships, the preparation and execution of agreements that ensure the parties are supervised and act in unison.

The process of decreasing earthquake risk must be integrated and involve such stages as (IBB 2003):

1. Preparation
2. Reducing the potential for damage
3. Rescue and medical response, and
4. Improvements that feed off each other through generating sub-projects and implementation programs.

An earthquake-focused action plan should make recommendations and establish targets for each stage. Such work is highly comprehensive and costly. Therefore, in this article only the urban transformation stage will be discussed.

Fulfilling the aim of an action plan involves the investigation and implementation of policies and strategies. Strategic planning defines the priorities of action plans that integrate the whole processes of design, research, project preparing and implementation. Strategic planning is an integrated approach that aims to transform the economic, cultural and social facets of a city or its districts within a framework of modern planning (KONUK 2003, IBB 2003). If strategic planning also aims to reduce the loss of life and property due to earthquakes, to make buildings safe against earthquakes and to devise strategies directed towards this purpose, it should in addition cover the following points:

- Define land use for areas that are established as safe for construction through the examination of soil structure using geological, geotechnical and geodetic surveys
- Make the physical and social environment safe at minimum cost by efficient use of resources
- Solve social problems without prejudice to individual and public rights
- Renew public and private areas while protecting sites of historical, cultural or natural value
- Solve housing problems by building an adequate number of sound and sanitary houses
- Implement a building plots policy based on a modern, participatory, flexible and equitable system of land use, and
- Determine the construction requirements for earthquake-resistant buildings and supervise the production and use of building materials.

The proposed action plan should be in agreement with the fundamental principles and priorities of strategic planning. Therefore, its preparation should be based on, among other things, the identification of the following:

1. Districts where earthquake losses would be concentrated
2. Districts at risk
3. Areas suitable for temporary housing after an earthquake
4. Principles to standardizing the present diversified state of ownership and planning, and
5. Infrastructural inadequacies.

3.2. Urban Transformation Models

Urban transformation is an enterprising and resource-creating tool that enables the realization of sustainable strategic planning.

For an action plan to be feasible, the concrete realities of a city must be considered when determining priorities and preparing sub-projects and implementation programs. Urban transformation is a modelling of study groups and detailed work with the participation of all local actors. The following should be determined for this model:

- The project development and land-use decisions that need to be taken and the principles of building density, reinforcement and demolition
- The type and range of participation in projects and the partnerships to be involved
- The land ownership, valuation and zoning rights of individuals and corporations in the project area
- The value the projects will create and the principles of how they will be shared, and
- The investment and capital resources required.

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. It inevitably follows from this that such activities will need to be undertaken as a national strategy development plan.

In the *Earthquake Master Plan for Istanbul* it is stated that (IBB 2003: 705, 866, 915):

> "…against the risk of earthquake, the adoption of multidimensional integrated implementations based on a systematic structure of urban risks is not a way of conduct of study known and tested world wide and in Turkey…"

In fact, there are no examples of urban transformation action plans, sub-projects and programs implemented in areas of high earthquake risk. So, the methods suggested for this purpose may not be sufficiently recognized or tested.

Therefore, in this article, the action plan to reduce earthquake damage and the suggestions concerning urban transformation and its implementation are modelled in the light of experience gained from urban transformation and renewal work extensively employed in Turkey and abroad. As the cost of urban transformation and renewal is high, the use of many different organizations, including those from the public- and private-sector, is considered. Ensuring the participation of local people in the project is particularly recommended for the success of the program (SÖKMEN 2003: 50, KESKİN, et al., 2003: 402, IBB 2003: 700).

The financing and management models implemented and recommended for urban transformation and renewal works in Turkey and abroad are as follows:

1. A company is founded with the participation of building plot owners, the municipality and an enterprising private sector. The shares of the company belong these three partners, but the municipality and private sector representatives undertake the company management
2. A building co-operative is founded by the 'owners' of illegal shanty houses built on public land. Separate from this, a project development company is founded with the participation of the municipality and private sector. The co-operative is represented in the management of the development company, which provides project design, consultancy and supervision services to the private sector to carry out the construction work.

The project design and construction work may be carried out by the development company or contracted out.

The private sector will find these urban transformation projects attractive and feasible because of changes made in the zoning plans to increase zoning rights and add commercial functions.

To realise these models, many implementation methods are devised:

- Construction against acquisition of an independent unit – the owner transfers ownership of an independent unit to the builder
- Sharing of the value the project creates
- Construction against the transfer of ownership or operation of commercial functions created in the project area to the builder, and
- The sharing of the total construction area available in the project zone.

The municipalities do not finance the projects but they do prepare or amend zoning plans. Various means are sought to enable the urban transformation projects to be self-financed. In this process, the private sector is interested only in those transformation or renewal projects that are located in city centres and are attractive because of their high rental potential.

4. IMPLEMENTATION TOOLS AND CONCLUSIONS

For an action plan and urban transformation project to be successful, strategies and policies have to be produced and developed for two types of areas:

1. Areas with High Potential for Damage in an Earthquake – these are areas that surveys find completely unsuited for settlement and so must (along with water basins and river beds where building is in any case illegal) be fully evacuated and cleared of buildings.
2. Zones of High Risk Located in Settlement Areas. Evacuation and removal or reinforcement of buildings in these areas must also be carried out.

In acceptable settlement areas, improvements to the buildings, infrastructure and social facilities will be necessary to ensure the correct functioning of the model.

Under the urban transformation model, the tools to be employed in the above mentioned areas are as follows:

- Transfer of zoning rights
- Exchange of ownership
- Enhancement of density
- Expropriation
- Land Subdivision
- Condominium or ownership of individual unit
- Establishment of funds to improve the living conditions of local people
- Providing project or financial aid and allocation of building plots to individuals for the construction or reinforcement of buildings, and
- Mortgages.

These tools need to be evaluated according to the characteristics of the particular urban transformation model.

In the implementation of any one of these models the legally valid holding of right, while for liquidation of real estate, an real estate valuation carried out on objective criteria will be important. In recent years, the valuation of real estate has been recognized in the field of Real Property Investment Partnerships as a concept of increased importance.

For urban transformation to be successful, self-productive and intelligent financing models need to be developed by stimulating national and international markets. Municipal, and public and private lands need to be opened to the real estate market and, to achieve this, a real estate investment partnership should be founded. As regard the financing model, the solutions must not become a burden on the state and, in particular, they should be self-financing. The most significant recommendation made for this purpose is the establishment of an Earthquake Preparation Fund. This recommendation must be included in the establishment of an earthquake insurance system.

There is a reality that must not be forgotten here: each urban transformation project has conditions and models specific to that particular project. For this reason, instead of developing copies of previous models, there is a need to reflect the differences between countries and implementation areas in the models we develop.

The earthquake that is expected to hit Istanbul and its attendant potential for loss and damage are a significant issue on Turkey’s agenda. 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

organized and those involved must without delay obtain the financial means for the necessary measures.

In Istanbul's zones of highest risk of loss and damage, renewal and improvement works should be carried out within the framework of strategic planning, action plans and urban transformation projects. These areas must be brought to a safe condition through evacuation or reinforcement of structures.

Those evacuated will have to be resettled in safe areas and solutions to socio-economic and other problems, including psychological ones, must be devised and the quality of the social and physical environment must be enhanced as a matter of priority.

The risk we face cannot be reduced solely by economic measures. Social transformation is also an inevitable part of the solution.

References

BİLSEL, S. Güven - POLAT, Erkan - YILMAZ, Neşe, 2003, **Değişim-Dönüşüm Sürecinde "Kimlik Arayışları" ve "Kentsel Yenileme" Kavramı** ('Searching for Identity' and the Concept of 'Urban Renewal' in the Process of Change-Transformation), Urban Transformation Symposium (11-13 June 2003), TMMOB Chamber of Urban Planners, Istanbul Branch Publ., ISBN: 975-395-602-9, Istanbul, pp: 53-64.

CNN, 2000, http://archives.cnn.com/2000/NATURE/04/28/istanbul.quake.enn.

DİE, 2003, **2000 Genel Nüfus Sayımı: Nüfusun Sosyal ve Ekonomik Nitelikleri** (General Census 2000: Social and Economic Characteristics of the Population), Prime Ministry, State Statistical Institute (DİE) Publ. No: 2759, March 2003, Ankara, 305 pages.

IBB, 2003, **İstanbul İçin Deprem Master Plan** (Earthquake Master Plan for Istanbul)**,** Metropolitan Municipality Planning and Zoning Department, Soil and Earthquake Examination Directorate, 7 July 2003, ix+1334.

KESKİN, Devrim-SÜRAT, Öykü-ÖZGE, Yıldırım, 2003, **Londra'nın Sürdürülebilir Kentsel Yenileşme Deneyiminden, Türkiye ve İstanbul Özelinde Yenileşme Çalışmalarında Nasıl Faydalanılabilir?** (How can London's Sustainable Urban Renewal Experience be used in the Urban Renewal Works to be Carried out in Turkey in General and in Istanbul in Particular?), Urban Transformation Symposium (11-13 June 2003), TMMOB Chamber of Urban Planners, Istanbul Branch Publ,, ISBN: 975-395-602-9, Istanbul, pp: 398-413.

KONUK, Güzin, 2003, **Kentsel Rönesans/Uyanış, Kentsel Gelişmeyi Yönlendirmede Planlama İlişkisi İçinde/Kentsel Tasarım Bakış Açısından/Kentsel Regenerasyonun Yeri** (The Place of Urban Regeneration in Terms of the Relationship Between Urban Renaissance / Revival and Planning in Guiding Urban Development, and from the Standpoint of Design), Urban Renewal and Urban Designing, 14th International Urban Designing and Implementation Symposium (28-29-30 May 2003), Mimar Sinan University Publ., ISBN: 975-7634-58-1, Istanbul, pp: 62-63.

SÖKMEN, Polat, 2003, **Kentsel Dönüşüm İçin Kaynak Yaratıcı Sürdürülebilir Bir Planlama Çerçevesi** (The Framework for Resource-Generating and Sustainable Planning for Urban Transformation), Urban Transformation Symposium (11-13 June 2003), TMMOB Chamber of Urban Planners, Istanbul Branch Publ., ISBN: 975-395-602-9, Istanbul, pp: 47-51.

TEKELİ, İlhan, 2003, **Kentleri Dönüşüm Mekanı Olarak Düşünmek (Considering Cities as a Space for Transformation)**, Urban Transformation Symposium (11-13 June 2003), TMMOB Chamber of Urban Planners, Istanbul Branch Publ., ISBN: 975-395-602-9, Istanbul, pp: 2-7.

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