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A METROPOLITAN MUNICIPALITY PREPARES FOR THE WORST: İSTANBUL EARTHQUAKE MASTER PLAN

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SUMMARY

The Metropolitan Municipality of Istanbul has commissioned a comprehensive earthquake master plan to be made in anticipation of a magnitude-7+ earthquake. The antecedents of the plan and its contents are described from a city official's perspective.

INTRODUCTION

In Turkey crafting the legal and financial instruments for disaster management is the responsibility of the central government. Yet, disasters and their impacts are local, and are best managed at the level where all stakeholders reside. The two major earthquakes that occurred in the Sea of Marmara region during 1999 have served as reminder to all local governments there that preparedness measures that extend beyond immediate post-disaster relief services must be examined and put into force.

In response to a request from the Government of the Republic of Turkey, the Government of Japan decided to conduct "The Study on A Disaster Prevention/Mitigation Basic Plan in Istanbul Including Seismic Microzonation in the Republic of Turkey" [1], and entrusted the study to the Japan International Cooperation Agency (JICA). The Study Team organized by JICA conducted the study in the following steps.

Step 1: Existing data collection, analysis and evaluation to identify the study issue
Step 2: Site investigation on ground condition, population, building conditions, and others
Step 3: GIS database development and analysis of data
Step 4: Analysis of earthquake motion
Step 5: Estimation of seismic hazard and damage
Step 6: Compilation of hazard maps, seismic microzoning maps
Step 7: Detailed examination on urban disaster prevention and mitigation plan

This report was completed in December 2002, and has served as the background document for the plan that is described in this paper. Parts of this paper have been excerpted from [1].

[1] Deputy Secretary General, Metropolitan Municipality of Istanbul

The City and Its Earthquake Potential

Istanbul city, which is located in the western part of Turkey, has been developed first as the capital city of the Eastern Roman Empire and then Ottoman Turkey for more than fifteen centuries. After the collapse of the Ottoman Empire, Istanbul has continued to grow as one of the biggest cities in the Middle East, representing a center of economic, industrial and tourist destination of the modern Turkey. The city has a population of ten million today.

Geologically, Turkey is located at the boundary area where the Arabian Plate and African Plate move north towards the Eurasian Plate. A large scale fault line called North Anatolian Fault (NAF) extends more than 1,000 km long from east to west in the northern territory of Turkey and historically, many strong earthquakes have occurred along this fault line. In recent times (1939 and 1992), very strong earthquakes have occurred in Erzincan, a city that is situated in the eastern part of Turkey. More than 30 thousand died in the earthquake of 1939 while 700 people perished in 1992. There was heavy damage to property, including the collapse of a number of buildings and infrastructures.

On August 17, 1999, an earthquake disaster called Kocaeli earthquake occurred around Izmit and Adapazari, located 90 and 125 km east from Istanbul, respectively. Recorded at a magnitude of 7.4, this earthquake caused tremendous damage to human lives and properties in the area. Another strong earthquake with M 7.2 occurred on November 12, 1999 along NAF near Düzce. More than 1000 people died or suffered serious injuries during that event.

Seismologists have noted [2] that the epicenters of strong earthquakes seemingly migrate from east to west along the NAF and they point out the possibility of another big earthquake hitting Istanbul where the western edge of the NAF is situated. In order to manage the potential earthquake disaster in Istanbul, it is necessary to prepare a seismic disaster prevention/mitigation plan, emergency rescue plan and restoration plan of the earthquake stricken area from middle to long-term points of view. However, as of 1999 the Metropolitan Municipality did not have an integrated seismic disaster prevention/mitigation plan. Therefore, as a first step the Government of Turkey requested the Government of Japan to conduct an initializing study as part of a technical cooperation program.

The task required a close and productive cooperation between the JICA research teams and human and information resources of the city administration. An administrative and a scientific advisory committee were created to provide guidance in the conduct of the project. Its scope covered all 27 metropolitan municipality districts plus the aggregated areas of Silivri, Büyük Çekmece and Çatalca that have effectively become incorporated into the greater city. In Figure 1 the study area is shown.

RECOMMENDATIONS FROM THE JICA STUDY

The 650-page JICA report [1] is the first comprehensive document related to the earthquake disaster preparedness of an urban agglomeration in Turkey. It has provided an assessment of the current state of the city, analyzed the possible consequences of the "scenario" earthquake, and listed a wide range of recommendations for the follow-up stages including measures to strengthen vulnerable buildings and critical infrastructure components. Short and medium term measures included the following:

(1) *Retrofitting of Hospitals*

The total number of hospitals in the city is 635. These are built and managed by different entities such as national agencies, SSK, universities, the private sector, and the military. An earlier survey conducted on hospital buildings resistance against a high intensity earthquake for hospitals in Izmir and Istanbul had concluded that the structural capacity of the surveyed hospitals was quite vulnerable and retrofitting was recommended. Given the critical role played by hospitals in disaster situations this type of assessment and necessary retrofits were recommended with increased priority.

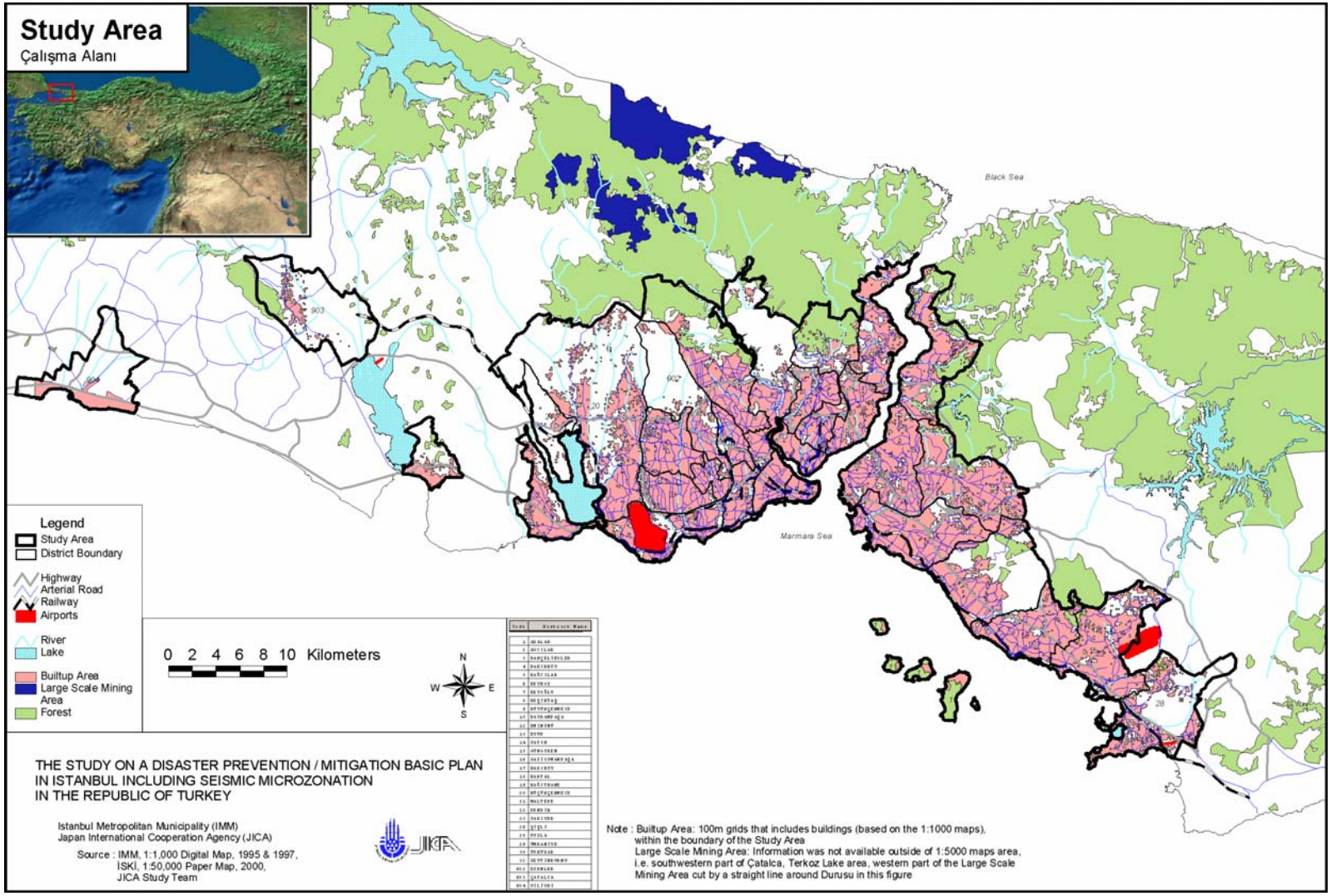

Figure 1. The Study Area

(2) *Retrofitting of School Buildings*

A retrofitting project for school buildings in Istanbul has been started already but the implementation ratio is not very high. According to the JICA study, the total number of schools is 2,252, of which some 300 buildings were constructed using the new school building design standard established in 1997. The Study Team conducted a preliminary diagnosis of the earthquake resistance of two sample school buildings based on design drawings. The result showed that even a new building design standard was not enough to prevent pancake-like collapse of school buildings. Their review and retrofit were urgently urged.

(3) *Retrofitting of Public Facilities, City Hall, and Governmental Buildings*

Istanbul City Hall has now been completely retrofitted. This is a good example for a typical public facility. Functions of public facilities such as municipal city halls, district offices, fire stations, and governmental buildings must be maintained, and the facilities must be utilized as centers for emergency rescue operations, or as disaster management centers. The report suggested that earthquake resistance of existing public facilities should be checked, and necessary retrofitting or reconstruction plans should be implemented by relevant agencies.

(4) *Retrofitting of Bridges*

The study collected data on 480 bridges (but not the suspension bridges over the Straits of İstanbul) that was put into bridge inventories. As a result of the analysis, 24 bridges were calculated as having a higher possibility of collapse and two bridges constructed as viaduct structures were calculated as having a higher vulnerability to the earthquake. A prioritized retrofitting for these facilities was recommended.

(5) *Retrofitting of Port Facilities*

In the light of experience of the Kocaeli earthquake that affected the port facility of Izmit improvements in the deep sea port of Haydarpaşa were suggested.

(6) *Retrofitting of Lifelines*

In Istanbul City, urban utilities such as gas, water, electricity, sewage and telecommunication systems are operated by city-owned companies. Based on the feasibility study, an introduction of automatic shut down systems or the gas distribution network should be discussed.

(7) *Construction of Disaster Management Center*

The Disaster Management Centre of Istanbul City, code named AKOM, was constructed in 2001 and installation of the necessary equipment related to disaster information collection and dissemination systems has now been completed. Construction of another disaster management center is planned by the Governorship of Istanbul province. In order to manage a large-scale earthquake disaster, these centers should be networked effectively with district offices or other disaster-related offices by secure telecommunication systems. These telecommunication systems must be maintained and operated at the time of an earthquake disaster occurrence to collect damage information, dispatch necessary orders for rescue operations, and communicate with each related agency. Therefore, construction plans of disaster management centers, including the main centre, back-up centre, and district centre, should be discussed.

(8) *Campaign for Raising Awareness on Disaster Prevention*

The report concluded that an earthquake disaster prevention awareness campaign for citizens of Istanbul City should be held continuously through community-based information dissemination, rescue operation drills, and through the recognition of mutual help in cooperation with community organizations, NGOs, the municipal administration, and academic researchers.

Medium- to long-term measures listed in the study included the following.

(1) *Master Plan for Earthquake Disaster Prevention*

Damage estimation and analysis of urban problem areas were conducted by the JICA Study. Structural problems of buildings were also analyzed. However, the study accuracy was still in the macro level, showing fairly detailed aspects of earthquake damage distribution covering the whole study area and recommendations for improvement of existing conditions for earthquake disaster management, including urban planning and institutional aspects. Based on these study results, a detailed earthquake disaster prevention plan such as district-wise plan for Istanbul City should be formulated. In this case, building statistics should be improved to assist in classifying more detailed categories for structures. Population data should also be improved as to clarify day time and night time variations. The report recommended that this master plan should be deeply related to future land-use zoning to secure enough open spaces, road networks, environmental protection areas and locations of public facilities. Detailed plans should be examined and formulated for the following: the location of evacuation sites and routes, review of road network priority for emergency operations, necessary emergency storage supplies, community participation for rescue operations, medical equipment emergency systems, and emergency communication systems. The İstanbul Earthquake Master Plan is in response to this recommendation.

(2) *Formulation of Urban Redevelopment Plan Aimed at Earthquake-Resistant City*

In addition to developing a detailed earthquake disaster prevention master plan, a redevelopment plan for higher damage estimated areas should be formulated based on a detailed area redevelopment plan as a model case. The methodology and concepts for this detailed area redevelopment plan should be prepared by joint collaborations between municipality and community organizations, with the approach of providing for the improvement of existing urban conditions to create an earthquake-resistant urban area. This detailed urban redevelopment plan should be applied to an area of extremely high population density on the European side first. JICA refrained from making concrete proposals in this regard because of their unfamiliarity with domestic legal framework.

(3) *Promotion of Research on Earthquake-Resistant Buildings*

Basic research on earthquake-resistant buildings including structure, material, and design standards should be promoted by the academic sector. If regulations for stronger building structures against earthquakes could be standardized in earthquake-prone areas, damage will be largely reduced. From this point of view, more research and recommendations concerning building structures and materials should be promoted by research institutes. Based on these activities, building code and design standards must be improved. The private sector engaged in housing should also be involved in these activities.

(4) *Establishment of Credit System for Earthquake-Resistant Housing*

A long-term credit system by the government should be discussed to enhance and provide incentives to the people living in earthquake hazard prone areas. Special low interest rates for this credit scheme should be prepared for this purpose. Also, property taxation should be reviewed and improved to help those engaged in housing and construction.

(5) *Institutional System Improvement for Disaster Management*

The JICA report correctly identified that the concept of disaster prevention should be introduced into the land-use system of the Development Act. The building code should mention other aspects, such as materials, and should cover comprehensive aspects regarding disaster prevention. A “Disaster Law” should introduce basic concepts of mitigation efforts that can be undertaken before a disaster occurs to reduce damage. Emergency aid regulation should include civic organizations and public relations on disaster information. The report emphasized the administrative measures necessary for an effective disaster mitigation policy, but its tools were not defined in any detail.

METROPOLITAN MUNICIPALITY PERSPECTIVE

Municipal awareness of the heavy toll of a large magnitude earthquake and its immense consequences had led to the creation, in 2000, of the Disaster Coordination Center for the Metropolitan Municipality. Istanbul Metropolitan Municipality Disaster Coordination Center (AKOM is its Turkish acronym) was established to address the necessity to establish a communication channel within the municipality, by an order from the mayor's office and authorization by the Municipal Assembly. The initial members of the centre were the fire department, health department, the water and sewage corporation and the gas distribution corporation. Planning, mapping, and other departments joined later to form the current organization. The object of AKOM is to coordinate tasks among organizations within Istanbul Metropolitan Municipality. The organization structure of AKOM is shown in Figure 2. In AKOM, organizations are included by importance, unlike the service groups of the Governorship Disaster Management Centre. The chairman of AKOM is the deputy secretary general of the metropolitan municipality. The vice chairman of AKOM is the department head of the fire brigade. Related municipal companies are included via the shareholders department. Some key organizations in AKOM, such as water or gas vending companies are also represented in the Disaster Management Center that has been created within the Istanbul governor's office. AKOM has its own new building equipped with state-of-the-art technology. Currently AKOM's operational budget comes from the fire brigade, but AKOM will eventually have its own budget.

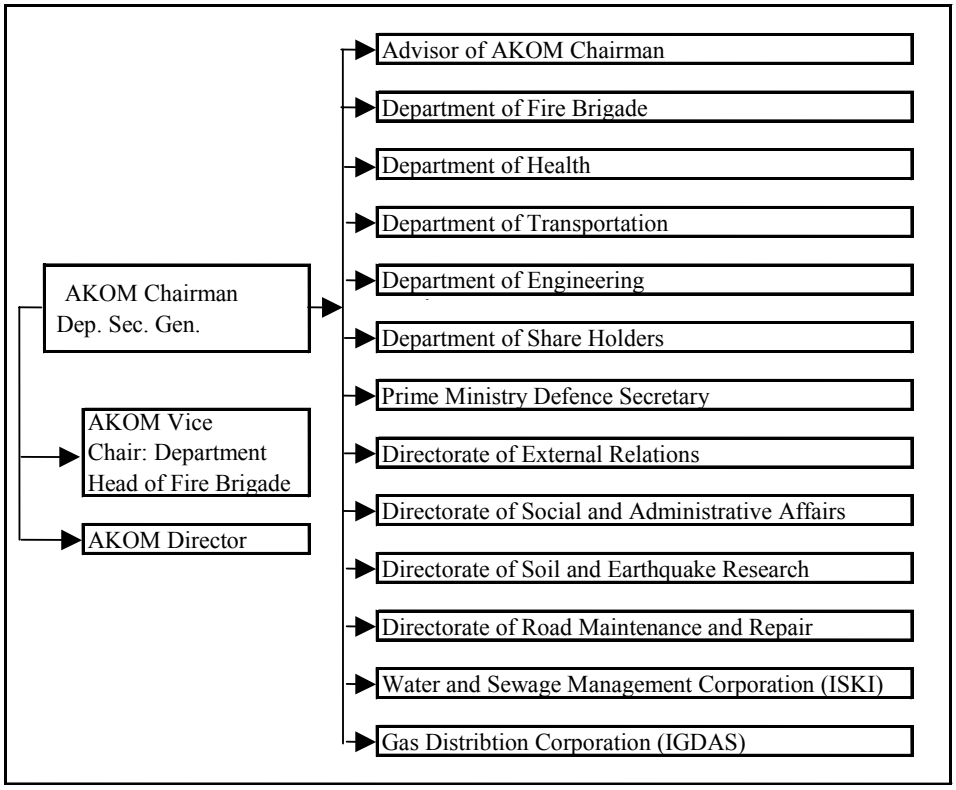

Figure 2. Organizational Structure of AKOM

The above diagram shows that AKOM is a post-disaster response tool, and has no mitigation role. This function was to be handed to special units formed as per the recommendations of the Master Plan.

CITY GOVERNMENT DECISION

Preparing for, and coping with, any form of risk is faced with uncertainty and can be controversial and complex. Already, the yet-to-occur earthquake near Istanbul has become accepted as fact, and a popular subject of discussion among scientists and the public. While no earthquake scenario is intended as any form of prediction, and the actual event may show substantial differences from the anticipated event if it happens, it serves as a basis for planning and development of preparedness measures.

With the submission of the JICA report we resolved to have a plan that would guide the metropolitan municipality government towards its realization. Many of the issues raised by the background report are indeed beyond the competence of the authority of the municipality, and require the involvement and active support of the national government. The drawing up of the master plan that would serve as a road map detailing the policy options for each problem area appeared feasible with the active participation of four universities that would form a consultancy group, and organize the study was the option we adopted. One institution from Ankara, Middle East Technical University, and three from Istanbul, namely Istanbul Technical, Boğaziçi and Yildiz Technical Universities were engaged as research resources for the master plan. Contract negotiations were initiated during the Fall of 2002, and the work got underway in January 2003, shortly after the JICA report became available.

CONTENTS OF THE MASTER PLAN

The scope of Earthquake Master Plan for Istanbul comprises work to be done in the following areas:

- Assessment of current situation
- Seismic assessment and rehabilitation of existing buildings
- Urban planning issues
- Legal issues
- Financial issues
- Educational issues
- Social issues
- Risk and disaster management issues

This list would be complemented by specific programs aimed at planning of the activities in these fields, preparation of implementation programs, and identification of the responsibilities and responsible authorities for earthquake disaster mitigation works to be carried out in Istanbul.

Taking into account the high seismic risk of Istanbul and findings of the preceding study for Istanbul Metropolitan Municipality (IMM) under Japanese International Cooperation Agency (JICA) auspices, preparation of a master plan for Istanbul which will include the assessment of existing building stock, infrastructure, urban and public facilities in the light of available geological and geotechnical data, the determination of short, medium and long term measures and strategies for earthquake preparedness of Istanbul, the identification of legal, technical, financial and social responsibilities, including implementation plans at selected pilot project areas was requested by IMM. An important aspect to be covered by the Master Plan is decided to be the assessment of seismic vulnerability of existing building stock in Istanbul, the development of seismic retrofitting methods and the determination of technical, social, administrative, legal and financial measures to be taken in order to be able to implement such methods. In the Master Plan the works to be done in these fields are examined and the recommendations about the measures to be taken are given.

Earthquake disaster mitigation efforts for Istanbul should be multi-disciplinary and have a broad vision. These efforts will be pioneering examples of Urban Development Projects and Local Transformation Programs, or total "Action Planning" for Turkey. The four universities which took part in the project have set up several working groups consisting of expert faculty members, and approached the project with such a perspective and studied in detail the works to be done for earthquake preparedness of Istanbul. The apparently unavoidable possibility of the occurrence of a major earthquake that will affect Istanbul, necessitates the determination of existing conditions with respect to pre and after earthquake disaster preparation and management methods to be employed. The expected effects of an earthquake on physical and social environments must be assessed quantitatively. The works done in this aspect are complied in the "Existing Situation" chapter.

The available seismic data and risk assessment reports comprised the basis for the seismic risk assessment for Istanbul. Both deterministic and probabilistic approaches are employed in seismic risk assessment studies. The available information about buildings, urban infrastructure (transportation, natural gas, water, electricity, and telecommunication networks) and industrial facilities are evaluated with respect to seismic performance and social losses. The main goal in assessment of seismic safety of building type structures in Istanbul is to predict the probability of earthquake damage on an individual building basis and especially to determine the probability of building damage that will cause human casualties and the area distribution of such buildings. The seismic assessment of buildings is proposed to be done in three stages. The first stage inspection/evaluation works are also referred as "street survey" and correspond to preliminary assessment. The goal of these works is to make a preliminary grading of all buildings in Istanbul with respect to their seismic performance, and therefore to collect limited data on buildings by visual inspection from outside which can be processed in a rational manner for seismic assessment. This will enable to set priorities for second stage assessment at both individual building basis and regional basis.

In the second stage assessment, starting with the high priority buildings and regions, more detailed investigation/evaluation works will be executed for seismic assessment of buildings. The goal of these works will be to make reliable performance evaluations which will enable to reach final decisions on as many as possible number of buildings and leave as few as possible number of buildings for third stage detailed assessment.

The third stage investigation/evaluation works will comprise especially high rise residential and office buildings and public buildings, and will be carried out by registered expert engineering firms in accordance with specified methods and performance criteria and will include detailed engineering analysis. For the first and second stage assessment more than one method of investigation/evaluation based on alternative approaches are recommended. The validity and suitability for use of these methods are proposed to be checked at a pilot study area, and compare the results with each other and those of more sophisticated methods known to yield more reliable results. Several methods are proposed for seismic strengthening of buildings. These methods are compiled under "simplified strengthening" and "comprehensive strengthening" headings. The simplified strengthening methods are proposed to be applied on a larger number of buildings.

Three faculty members from the Master Plan project team have been invited by the Ministry of Construction and Settlements to participate in the works to add the principles and provisions related to seismic strengthening of buildings to the Turkish Earthquake Code. The comprehensive approach to earthquake mitigation in Istanbul would be preparation of a Contingency Plan based on the definition and elimination of risk sectors in all fields related the city and social life, and implementation of Action Plans at regions of high priority which are indicated as high risk areas in the contingency plan. There are several risks generated from the natural conditions as well as building and land use practices. These risks are

needed to be defined within a limited number of sectors. Their interaction and damage potentials are to be analyzed, and methods and measures are to be developed to reduce their risk levels. For each sector, Risk Management techniques and methods should be developed and the operational duties of responsible agencies should be clearly defined. For each risk sector, certain legal and administrative arrangements, and implementation methods for reduction or elimination of risks are to be developed. A narrow and single disciplinary approach to the problem, with conventional urban planning concepts and tools will be insufficient and invalid. Conceiving that measures within ordinary administrative and legal structure will be sufficient would be underestimating the dimensions of the situation.

Within the scope of urban planning studies a Strategic Plan for Disaster Mitigation in Istanbul (SPDMI) has been developed. This plan's secondary goal will be the improvement of natural and urban environmental quality, and this also supports the main goal of diminishing the destructive effects of a possible major earthquake. For this purpose SPDMI is prepared in such a way that it will serve as a road map for IMM in taking measures against the earthquake problem.

SPDMI focuses on the following points:

- Conceptualization of strategic planning
- The problems and potentials of Istanbul Metropolitan Area
- A road map including strategies, planning instruments, and priorities at various levels
- Institutional and legal considerations

The problems in Istanbul concerning the earthquake risk range from the poor quality or depreciation of buildings from an engineering point of view to the poor urban environment generated by social, economic and physical deterioration as well as uncontrolled urban growth and an inflexible planning system which remains incompatible with the dynamics of the city. In this context, alternative implementations vary respectively on a palette of solutions including reinforcement, reconstruction of individual buildings, preservation of historical urban fabric, regeneration of urban areas, creating new settlements or alternative urban centers within a regional perspective, etc. The approach to the disaster (earthquake) problem must be holistic in nature, i.e. comprising economic, political, social and cultural visions, and strategic in application, i.e. flexible and relying on the effective participation of various actors. To this end, it is attempted to aforementioned tools within a broad planning framework. Earthquake risk mitigation works are closely linked with the legal structure at every stage. All efforts towards the risk mitigation will be implemental only as far as they are described in the legal framework. With this respect, first the problem areas in the Turkish legal system are identified. Especially the laws concerning planning and building rules are examined taking into account the new law proposal, and recommendation are produced for additional clauses for risk mitigation. The study of legal issues have focused on problems encountered in Istanbul, identification of the problems, the solution of such problems and the recommendations about changes in the existing laws and new laws needed to implement the proposed solutions. In addition to discrepancies and problems in legal structure, a fundamental problem is recognized to be the deficiency in enforcement of the laws, and recommendations are developed to enhance enforcement including effective inspection and participation concepts.

An important aspect of the Master Plan has been the determination national and international financial resources needed for all pre-and post-earthquake work on mitigation and risk management, and also to design a financial model for a properly coordinated allocation of resources. Given the fact that the currently available resources for this purpose are very limited, the first step need to be the identification of the areas of need and estimation of the total demand for financing. The following summary of list of work seems to require financing:

Pre-Earthquake:

- Studies on earthquake vulnerability and safety
- Technical investigation and strengthening (or re-location) of public structures (hospitals, schools, key government buildings, infrastructure, bridges, dams, etc.)
- Technical investigation and strengthening (or re-location) of private buildings (residential, commercial and industrial buildings)
- Other related works mentioned in the Master Plan.

Post Earthquake:

- Provision of shelter, food, medical and social services to people
- Technical investigation, repair and reconstruction of public and private buildings and structures.

First of all it should be recognized that the more successful the pre-earthquake plans and their implementations are, the lower will be the financial burden after the earthquake. Moreover, the allocation of funds before an earthquake occurs is certainly needed for humane reasons, and also technically easier. This fact is fully considered in the development of the financial model. The basic principles of the financial model are made to be compatible with the current social and economic facts of the city of Istanbul and also of the country.

The organizational structure expected to carry out the pre- and post-disaster management activities has been critically evaluated and suggestions for improvement are investigated. For this purpose, the current legal structure and organizations are evaluated, distribution of authority among the central and local government bodies is analyzed, responsibility and coordination mechanisms are identified, and the problems and insufficiencies in the system have been determined. In addition, disaster management models that are operational in other countries are analyzed and parts of these models that can be adopted to the Turkish system have been integrated into the proposed model. Furthermore, the model included the findings of in-depth interviews with administrators and individuals involved in disaster–related organizations and a field survey that were conducted with citizens in two neighborhood areas.

Earthquake information infrastructure studies have been carried out under five main headings:

- Standards
- Data layers
- Software, hardware and network infrastructure
- Data collection and updating, and
- Reliability of data and computer systems.

Developing and adhering to standards is of utmost importance in the design of information systems. Large systems such as urban information system or a disaster information system necessitate the coordination and information sharing of many institutions. In many cases, a distributed information system formed by different databases may be appropriate. In order for this work without problems, it is essential that standards be used, developed and adhered to. The data layers that should be present in a disaster information system are discussed under the heading “functional classification”. “Software, hardware and network infrastructure” alternatives on geographical information systems, database systems, server hardware, and network infrastructure of a disaster management system are presented and some recommendations are made.

Procedural and technological suggestions on the management of the data over time and updating of data are presented in the section of "data collection and updating". The reliability of data and computer systems are discussed, information about reliable hardware and software, and backup procedures are presented.

For earthquake disaster mitigation and preparedness public education and awareness campaigns and community organizations are very important. In Turkey, education of public disaster preparedness and disaster mitigation has been under the responsibility of the central government (department of civil defense, department of education). Local governments and non-governmental organizations are not given to play a sufficient role in these issues.

Education about earthquake risk is offered in primary and high schools, but there is no systematic education program for general public. Development of standards for public education and community organizations, reaching the public at large, active participation of public, training the trainers and production of training materials are the important issues. Within the scope of educational and social studies for earthquake disaster mitigation, the works to be done to increase public awareness and preparedness to improve response and rehabilitation abilities, and thus increase the capacity of local communities to overcome effects of disasters are evaluated and suggestions are made. Risk and Disaster Management model proposed in the Master Plan does not only consider the post-earthquake response actions to mitigate the negative effects of the disaster, but it also considers the planning phase to manage the activities effectively. The proposed model is prepared to cover four stages of disaster management (risk mitigation preparation and planning, response and recovery) Response dominated emergency management model is focused on four main actions:

- Coordination
- Incident Command System
- Resource Management
- Training

The emergency management model incorporating the above components and the training requirements are presented.

CONCLUSIONS

Istanbul Metropolitan Municipality has had a team of experts prepare for it an ambitious and unique master plan for earthquake mitigation that will shape many of its actions during the next 10-20 years. The purpose and scope of the Master Plan was to provide a methodology for getting into action and a framework for the involvement of the whole society in 'risk analysis and management'. This proactive approach brought the exclusive description of clusters of risks, or 'Risk Sectors' in the Istanbul metropolitan area, for which independent risk analyses could be conducted, and methods for their management identified. Secondly, not only risks that are directly related to the natural seismic activity, but its indirect effects and related human-made risks in the city were taken into consideration within a comprehensive framework. Thirdly, parties involved in each risk sector were assigned with specific tasks of risk management. This called for the vision of agreements and protocols between these parties in collective and organized action. For this reason the plan is considered as a grand 'Social Contract'. Stakeholders in each risk sector are thus to be activated in relation to a general 'road map' that combines all action in independent risk sectors, indicating a long-term mobilization.
Altogether 13 risk sectors and methods of risk management in each sector have been described within the plan framework:

- Macro-form Risks (location of infrastructure, transportation systems, and mega land-use decisions; absolute size and form of settlements)
- Risks in Urban Texture (grouping of buildings, density, plot coverage, road width, building height, car-parks, combinations of local elements, etc)
- Risks Related to Incompatible Uses (minimum proximity standards, buffer zones, continuity of homogeneous uses; mixed use buildings)
- Risks of Productivity Loss (structural safety, process safety, infrastructure and labor safety, robust input-output relations, etc.)
- Risks in Special Areas (shores subject to probable tsunami, areas subject to liquefaction and landslides, down-stream basins of dams, etc.)
- Open Space Scarcity Risks (areas required for emergency functions)
- Risks Related to Hazardous Materials (relocation and supervision of premises that store and process hazardous materials, financial and other penalties)
- Vulnerabilities in Historical and Cultural Heritage (structural and environmental retrofitting programs covering official and civil agents like school communities and tourism firms)
- Risks in Lifelines (measures in infrastructure, access roads, sea and air traffic)
- Risks in Building Stock (retrofitting of residential, official, commercial building stock)
- Risks Related to Emergency Facilities (structural, management, and location-related risks in facilities like hospitals, schools, fire stations, etc.)
- External Risks (terrorism, sabotage, climatic extremes, etc.)
- Risks of Incapacitated Management (deficient infrastructure, expertise, programs, etc.)

Besides devising measures for such risks, the Master Plan proposes multiple methods of reducing or altogether avoiding risks. These may cover land-use management tools, constraints on building, special financial incentives for relocations or retrofitting, community activism, removing of obstacles in enforcement, levying of new taxes, etc.

The Master Plan has introduced a set of administrative and legal recommendations. These proposals even if expressed in the various parts of the reports could be grouped in three fundamental areas:

- Administrative and Organizational Issues
- Physical Planning and Property Rights
- Resources Generation and Management

More specifically these are either related with existing laws, or proposed as new regulations attached to these laws. A list of such recommendations is listed below indicating what specific laws have to maintain what kind of functions:

Development Law

- Obligation of preparing Micro-Zonation Maps
- Obligation of preparing Contingency Plans
- Powers of Project Area Management
- Extending the operational content of Articles 18. & 39. of the Development Law
- Partnership Model for Rehabilitation
- Development Right Tranfer or Exchange
- Obligation to protect documents

Obligatory Earthquake Insurance

- Separate Pool for Mitigation investments
- Retrofitting of Public Buildings
- Municipal role in the adoption of insurance policies and eligibility to credits

Property Taxation

- Enhanced tax rates for high risk buildings
- Deductions from insured and subervised buildings

Law of Deeds

- Registration of property in high risk areas, buildings constructed under supervision, retrofitted buildings
- Rapid public purchase of property in areas of high risk

New Regulations:

- Microzonation reports and mapping and their use in Plan preparation; standards in building technical infrastructure
- Safety in building furnishing; Safety standards in Urban Risk Sectors

Others:

- Other provisions in various city laws, supervision of plans and buildings, terms of proficiency, training
- Formation of Local Community Administrations

The expectation is that the city administrations (IMM, municipalities, and the Governorate) together with the stakeholders in the management of each risk-sector draw the necessary protocols in which responsibilities and tasks are identified with reference to the overall Contingency Plan that integrates all risk sectors. The plan outlines also the type of Action Planning recommended, as a set of activities to take place especially in high risk areas of Istanbul, by means of comprehensive local rehabilitation projects directly involving the residents of the area. Such processes are expected to be initiated by means of a few local projects guided by local and international expertise in pilot areas.

The plan also contains recommendations on:

- Methods of procurement and use of resources
- Revisions in legal provisions and devices
- Formation of Local Community Administrations
- Public education and local community training

It should be stressed that the Master Plan is not any of the following:

- An operation confined to the ‘retrofitting’ of specific buildings in the metropolitan area; Rather, the urban environment is considered in its totality, with its life-lines, emergency facilities, land uses and management processes.
- A conventional ‘development plan’ describing simply some future physical state, employing the devices of physical rearrangements; Rather, EMPI has to generate tools to monitor organizational tendencies and processes.
- An exercise in strict confines of existing ‘legal and administrative constraints’; Rather, proposals are made for the development of new methods and tools of enforcement, and the revision of existing legal frameworks.
- A ‘one-shot’ undertaking; Rather, sustainable mechanisms and institutions for a safer and more robust city and resilient communities are to be introduced.

- An excuse to allow further expansion of the city, generating new waves of demands over the forests and water basins; Rather, it is a comprehensive methodology for upgrading the existing built-up areas in safety and quality, and protecting the natural assets.

Thanks to the availability of a most valuable GIS database comprising information on each building in the city, even though late in the project, that it has been possible to carry out demonstrative analyses in many of the Risk Sectors. Risk analyses for premises in which hazardous substances are processed, or risks in special locations as water-front, down-stream valleys of dams and areas with landslide potential could be determined. Furthermore, local efficiency of emergency facilities like hospitals could be assessed. This database could constitute the basis of a Comprehensive Contingency Plan for the city, and a source for carrying out most of the project packages described in the plan. Such analyses have been reproduced and indicated on plans of the city.

The other contribution of EMPI is the description of Project Packages which could be independently tendered for their procurement of research, preparation of projects and carrying out implementation.

Currently, the World Bank is in the process of developing a project for Istanbul. It is expected that the World Bank projects for Istanbul take into consideration the approach and reasoning in the Master Plan, and hopefully do not contradict or compete with the projects described therein, and if possible, aim to spread the available resources to the projects described within the plan, generating a more effective overall impact.

Implementation of the Plan

Various activities will have to be followed in line with the recommendations advanced in EMPI:

- Information Dissemination and Promotion Campaigns
- Formation of Action Platforms with Private Sector and NGOs
- Administrative Cooperation and Coordination Protocols
- Cooperation of Related Parties in Risk Sectors thorough Protocols
- Tendering of Project Packages described in the Contingency Plan
- Initiation of Pilot Action Plans
- Formulation of Legal and Administrative Changes Required and Monitoring
- Procurement of Resources for Implementation
- Public Relations and Information Engineering

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