



TURKISH COURT OF ACCOUNTS

HOW WELL IS ISTANBUL GETTING PREPARED FOR THE EARTHQUAKE?



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Summary and Recommendations

Summary

1. After 17 August earthquake that caused significant loss of life and property, scientists warned against a big earthquake likely to strike Istanbul, which attracted public attention to possible Istanbul earthquake.
2. It is expected that possible earthquake would cause severe damage in Istanbul. The reason for this assumption is that the number of building in Istanbul is high, a part of which are unlicensed and illegal and those with licenses are constructed without performing their ground studies. Adding to these, building inspections and controls are not effective enough.



3. It is explicitly seen from experiences both in Turkey and in the world that cost endured after earthquake in cases where there is no sound earthquake preparedness is well above the cost of pre-earthquake preparations. Therefore, Turkey should give priority and importance to the studies directed towards best use of her limited resources and minimization of post-earthquake costs.
4. This report focuses on Istanbul's earthquake preparedness. Short and medium-term preparatory works devoted to minimize earthquake damages

are, in principle, coordinated and executed by the Office of Istanbul Governor on the one hand. On the other hand, studies the effects and results of which appear within longer terms such as building development plans and construction works, etc are under the responsibility of Istanbul Metropolitan Municipality and district municipalities.

5. According to Turkey's current legal arrangements, the organizational structures charged with preparing and executing disaster plans are Provincial Emergency Response Organizations. Where severity of disaster requires crisis management, Provincial Crisis Management Centers step in upon the demand of Prime Ministry Crisis Management Center. Activities of Provincial Emergency Response Organizations are not pre-earthquake oriented but directed towards activities to be carried out during and after an earthquake. (p. 2.2, 2.3, 2.4)
6. To remedy mentioned deficiency, Istanbul Governorship established a new structure under the name "Disaster Management Center" for disaster preparedness on 1.1.2000. The aim of this center is to ensure work-sharing, cooperation and coordination among institutions to recover from disasters with the least damage within the time elapsed from pre-disaster period, the time of the incidence until the end of its effects. The objective of Disaster Management Center is to ensure that preventive and protective measures are taken to mitigate disaster hazards and to coordinate emergency plans. (P. 2.4)
7. Disaster Management Center has a role of coordinating emergency planning activities of Provincial Emergency Response Organizations and is organized in such a way that it can be transformed into Provincial Crisis Management Center at the time of crisis. Disaster Management Center carries out its activities within the framework of duties and authorities of Istanbul Governorship. Namely, its organizational structure is not based on a legal ground. Additionally, there are problems in maintaining cooperation and coordination, allocation of resources, planning, executing, monitoring and assessment of activities. (P. 2.4, 2.7, 2.8, 2.11, 2.16)

- 8.** The leading element affecting adversely the proper execution of earthquake preparedness is that result-oriented and effective cooperation among institutions working in this field in Istanbul cannot be maintained. There is no sound approach towards the issue of coordination and cooperation among institutions. Who determines the responsible persons for which activity is not important. Institutions should have an agreement on the optimum results within the framework of objectives and targets that they determine together. At the same time, within the framework of accountability principles, who is responsible for what should be clear. (P. 2.9, 2.12, 2.14)
- 9.** It has not been possible to obtain effective results as institutions responsible for and have a role in attaining certain results have not function in such a manner that they can accomplish pre-designated objectives and targets. Additionally, it is not possible to allocate resources based on needs analysis and priorities and optimum results cannot be achieved inasmuch as activities are not carried out based on principles of accountability and transparency within the framework of long-term strategic plans and annual action plans. (P. 2.17, 2.18)
- 10.** One of the risk elements that is to increase earthquake damages in a possible Istanbul earthquake is fire likely to break out after earthquake. Hence, effective safeguards that reduce pre-earthquake risks should be developed. Works related to fires are carried out by Istanbul Metropolitan Municipality Directorate of Fire Brigade. Directorate of Fire Brigade together with Directorate of Control finalized the identification of risky regions and facilities; nevertheless, concrete steps towards solving problems have not been taken due to lack of resource and planning. Moreover, existing number of stations, equipment and personnel of the Directorate is not sufficient for risk minimization. (P. 2.21, 2.22, 2.23, 2.24, 2.25)
- 11.** Istanbul Gas Distribution Industry and Trade Inc. Co. is trying to realize Earthquake Shut off Valves Project while Kandilli Observatory and Earthquake Research Institute works on Rapid Response and Early Warning System. Early warning parts of either project are related to post-earthquake fire risk minimization. Conduct of individual projects in a

coordinated manner would be of great use in terms of good use of resources. (P. 2.26)

12. Service groups building up Provincial Emergency Response Organization prepare plans that shall be implemented at the time of disasters. These plans are in the nature of documents that list persons in the service groups, and outlines duties of service groups and inventory of existing materials and equipment, which is a reason for why they focus on activities during and after an earthquake rather than pre-earthquake preparations. Since that earthquake hazards can also be minimized through works during and after an earthquake, four service groups of Provincial Emergency Response Organization were selected as sample groups and their plans were analyzed. As a result of analysis on the mentioned plans and interviews with responsible personnel, following deficiencies and weaknesses were revealed:

- In the content of the plans prepared by service groups, while the duties and responsibilities of group and service heads are determined, only the names of other personnel are mentioned. Moreover, not all persons assigned in the plan are notified about their assignment. It was seen that even some personnel were not informed of their roles specified in the plan. However, albeit all its difficulties, it is of vital importance for the success of the plan that there should be detail information with regard to the identification of those that have role in the plan. Additionally, assigned personnel should know what is expected from them in detail and plan should be kept up-to-date. (P. 2.28, 2.29)
- In the preparatory phase, institutions and organizations taking part in plans did not come together and discuss what they could contribute, namely how and to what extent they would realize their duties in order to materialize fully the objectives and targets of plans. For this reason, high level of participation could not be achieved. (P. 2.30)
- It is not clear who shall cover which necessities, when and how. Although there is no such a preparation reflected in the plans, certain service groups set their needs. Still, no progress can be achieved with regard to fulfillment of needs specified. (P. 2.31)
- In plans prepared by some service groups, it was not considered that assigned personnel themselves might be earthquake victim and their substitutes were not designated. (P. 2.32)

- Plans are not prepared with an approach that puts forward the concepts of risk and priority. Risks and priorities are not taken into consideration in the planning. (P. 2.32)
 - Persons who have a role in the plan do not have necessary training enabling them to do their share of task. For instance, the knowledge of personnel trained for search and rescue, is below international standards of this field, and quality as well as the duration of training is dramatically insufficient. (P. 2.33)
 - Although the inventory of equipments to be used for rescue services is kept, there is no system that monitors and updates the movement and last status of these equipments. (P. 2.33)
 - There exist problems related to the management and coordination of service groups' works. For instance, plans prepared by service groups are different from those drafted by Provincial Disaster Bureau. It was seen that plans of Provincial Disaster Bureaus were not updated. (P. 2.34)
- 13.** Shanty settlements, illegal and unplanned housing not based on any project, wrong selection of place, licensed but uncontrolled housing, and lack of sufficient legal measurements that is to prevent all these deficiencies may cause a possible earthquake to turn into a deadly event. (P. 3.2)
- 14.** Despite timing of possible Istanbul earthquake is not known precisely, possibility of its occurrence within 30 years is estimated to be %65. Anti-earthquake reinforcement of buildings that will be constructed within this period and added to the housing stock of Istanbul is of vital importance. For this reason, works related to building construction planning and its implementations in Istanbul are directly associated with reduction of earthquake damage risk. (P. 3.1-3.20)
- 15.** Followings are the deficiencies that were detected during the observations made at Istanbul Metropolitan Municipality and selected sample municipalities:
- In general, master and building development plans, which display the forms of land use, has not been completed yet. Therefore, lands inappropriate for settlement throughout Istanbul are not fully known. (P. 3.3, 3.4, 3.5, 3.6, 3.7)

- Ground survey that might constitute a database for the works of Metropolitan Municipality and provincial municipalities related to building development planning have not been finalized completely. (P.3.8)
 - At certain locations found inappropriate for settlement after ground survey, there are buildings that were constructed beforehand. There is no plan or project related to these buildings.
 - Municipalities charged with conducting building development plans do not have adequate facilities, equipments and personnel to fulfill this duty in an effective manner. (P. 3.12, 3.13)
 - Provisions of legislations related to prevention of buildings constructed without license or against its license cannot be enforced decently. Establishment of building inspection firms is a positive progress. However, these authorities shall control whether the licensed buildings are constructed according to their licenses. As a matter of fact, more than half of the total number of buildings in Istanbul is unlicensed. As long as safeguards are not taken to prevent the construction of unlicensed buildings or those constructed against their licenses; it is explicitly clear that arrangements introduced with the Law on Building Inspection No: 4708 and dated 29.6.2001 alone shall not be adequate. (P. 3.14, 3.15, 3.16, 3.17, 3.18)
 - There are no prevocational and in-service training safeguarding the professional competence of personnel working at construction sites. (P. 3.19)
- 16.** For mitigating earthquake hazards, the extent to which existing buildings in Istanbul are resistant to earthquake should be known, buildings that are to collapse should be reinforced within a certain plan and according to determined priorities, or those that cannot be reinforced should be evacuated. Such a program requires government-level policies, long-term strategies, sound resources, and is above the capacities of individual institutions. First step taken towards reinforcing buildings is the launch of an initiative on 15. 04. 2001 related to the detailed ground surveys agreed between JICA (Japanese International Cooperation Agency) and Istanbul Metropolitan Municipality and approved by the Council of Ministers. Mentioned studies are planned to be finalized until the end of 2002. Detailed ground surveys and subsequent earthquake risk analysis shall

enable the detection of structural behaviors of buildings according to possible earthquake scenarios. Such studies are for detecting earthquake safety risks of buildings. Istanbul can be an earthquake-safe city only with the projects to be developed in the light of information obtained from such studies. (P. 3.22)

- 17.** Repair works of public buildings damaged from Marmara earthquake of 17 August cannot be completed. Although the figures related to damage assessment are unreliable, it is calculated by Disaster Management Center that 146.9 Billion TL in total is necessary for the repair and reinforcement of municipal, university and other public buildings. In spite of this, as of 5.2.2002, the total amount of appropriation allocated to institutions for repair and reinforcement works is 33,6 billion TL. (P. 3.23, 3.24, 3.25)
- 18.** Apart from repair works of public buildings damaged from Marmara earthquake of 17 August, earthquake resistance of all public buildings, particularly schools, hospitals, bridges, viaducts, tunnels, buildings of historical and cultural value should be detected, and accordingly, those considered necessary should be reinforced. Institutions are financing reinforcement works from their own resources. Although the Ministry of Health at 26 state hospitals and the Ministry of Culture on historical assets have initiated such activities, the reinforcement works do not progress rapidly as required due to lack of resource. Public buildings and facilities that need reinforcement should be reinforced as soon as possible by means of internal and external resources to be obtained. In the efforts for mobilizing external resource to reinforce public buildings, concrete progress has been attained. When public buildings and facilities are reinforced with the mobilized financing, risk of damage of possible earthquake shall be lessened largely. (P. 3.26)
- 19.** Private buildings, if necessary, should be reinforced and those reinforcement of which is not possible should be demolished. There is a need for projects that lay down the necessary legal and financial background for buildings reinforcement or demolition of which is deemed necessary through risk analysis and ground surveys mentioned at p. 16. Both Disaster Management Center and scientists have carried out studies with reference to the financial cost caused by anti-earthquake

reinforcement. Reinforcement is the sole solution that is to lessen the earthquake damage, which is at the same time cost-effective. There is an urgent need for projects developed within the framework of strategies and have secure resources for Istanbul's well preparedness to a possible earthquake. (P. 3.27, 3.28, 3,29)

Recommendations

1. Activities towards minimizing the effects of a prospective earthquake should be handled under two main groups. Activities of anti-earthquake reinforcement, as first group of activities, are towards the basic solution. If the structures are resistant to earthquake, then the loss will be incidental and small-scaled. This can only be realized through anti-earthquake reinforcement of current housing stock and construction of new ones anti-earthquake resistant. Second group of activities will be complementary of first group activities and are of vital importance until first group activities are completed and Istanbul has a safe housing stock. It comprises of all relatively short-term activities and focuses on hazard mitigation under current conditions by taking existing housing stock as basis.
2. Complying with the approach mentioned in the first p., first and foremost condition for Istanbul being fully prepared for a prospective earthquake is anti-earthquake reinforcement of existing housing stock. Therefore, detailed ground surveys and subsequently a comprehensive risk analysis required to be made on the housing stock as a whole should urgently be carried out based on priorities.
3. Activities mentioned in the second p. are, as a result, assessments that are to determine behavior of structures in the presence of a scenario earthquake, and the starting point for anti-earthquake reinforcement activities. Main activities that are to minimize earthquake effects cover reinforcement, evacuation, demolition, provision of housing, etc that shall be done based on these assessments. Dimensions of legal, financial and administrative problems brought about by these activities require for a planning framed with government-level decisions.

4. Starting from the land and features of settlement, approval of housing projects, control on the compliance of constructions with their projects, science and engineering to processes related to residential usage license and systems of these processes are under the control and guarantee of state authority, which are at the same time subject to tax, levy and duty. For this reason, not only buildings owned by public institutions but also privately owned buildings are within the sphere of interest and responsibility area of the state. While preparing Istanbul for a possible earthquake, steps should be taken in line with this understanding and activities such as reinforcement, demolition, provision of housing, etc should not be left to the capacity and initiative of individuals. Otherwise, as in the case with the last Marmara earthquake, the government would be in a position to undertake more than what it would do before occurrence of an earthquake such as post-earthquake aids, temporary-permanent housing, etc. And more importantly, a huge number of lives are lost.
5. Two thirds of Istanbul's current housing stock is comprised of buildings with no building permit or certificate of occupancy. Uncontrolled housing is an important handicap on the way to construct an anti-earthquake housing stock. Within this framework, through giving weight to measures against obstacles before the struggle against illegal housing, equipment and personnel needs of municipalities should be addressed; administrative and legal deficiencies covering also sufficient security measures should be eradicated.
6. Through enforcing the provision of Urban Improvement Law No: 3194 and dated 03.05.1985 envisaging that buildings with no certificate of occupancy shall not be provided with utilities such as electricity, water, etc; illegal housing should be counteracted.
7. Record and competency system for personnel working at each phase of constructions should be developed; pre-service and in-service trainings should be organized, and professional associations, academicians and relevant administrations functioning in this field should create a cooperation environment.

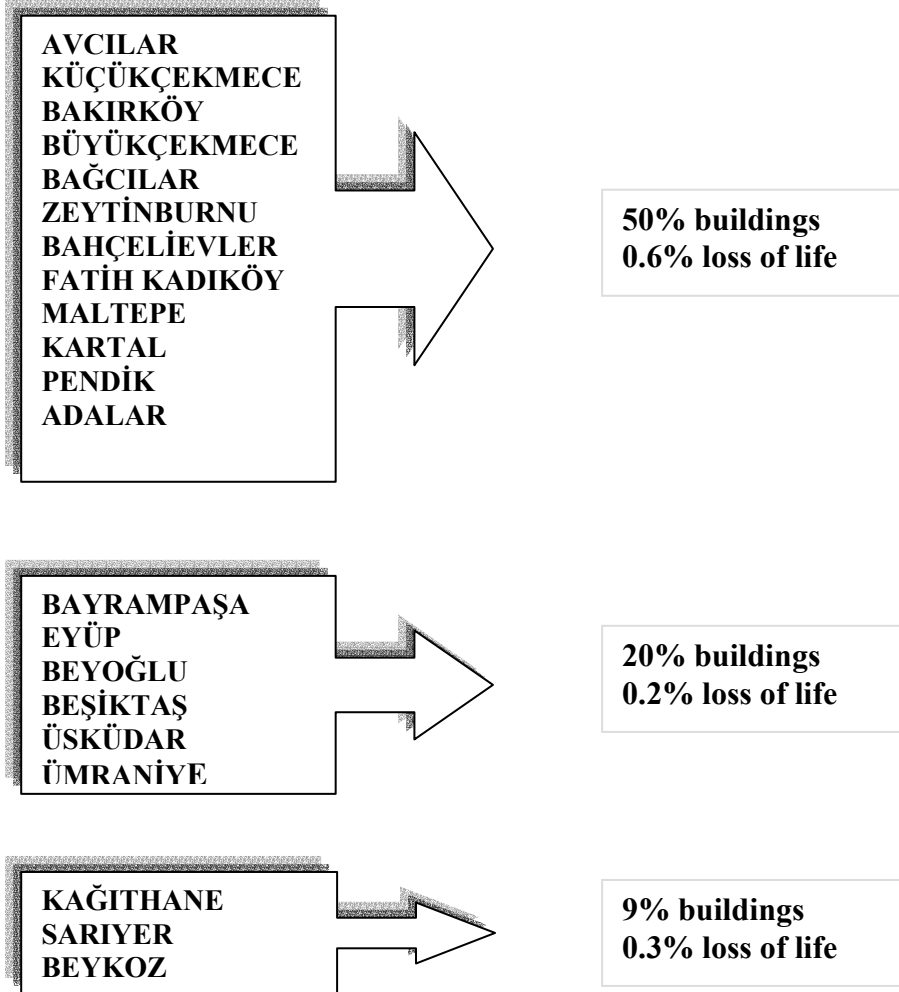
8. For Istanbul's preparedness for a possible earthquake in the best possible way and minimizing the likely damage, there is a need for a new management approach. To this aim, which outputs are desired to be achieved in the short, medium and long-term should be set clearly and at the same time, institutions that have a role and function in obtaining these outcomes should work in cooperation. Achieving targeted results depends on the development of cooperation among public institutions based on accountability relations. In cooperation established on the ground of accountability, who will be responsible for what and how long, resource needs and allocations, commitments and expectations should be determined clearly. Public institutions should start working in cooperation within the framework of accountability, relevant public institutions should set their objectives and develop strategies and action plans in order to reach set objectives. Additionally, ongoing projects and emergency plans in Istanbul should be integrated to the strategic plan the framework of which is drawn above and should be reviewed to ensure its compliance with objectives and targets.
9. Provincial emergency plans should be implemented with the contributions of those institutions and organizations that have a role in the plans; there should be realistic and up-to-date documents that can respond to alternative scenarios, and are clear and simple enough for the relevant persons. These documents should also be open to improvements and updates. Persons and institutions that have a role in the plan should be aware of and adopt what is expected from them.
10. Deficiencies in the training of persons that have a role in provincial emergency plans should be eradicated. Persons to take part in search and rescue should be provided with a trainings complying with the international standards; training should be handled in a systematic way, and in the planning and execution of training activities, experienced personnel and organizations such as AKUT (Search and Rescue Association) should be utilized.

Part 1: Introduction

Background

1.1 Earthquakes occurred on 17 August and 12 November 1999 displayed tragically how loss of life and property can reach to great dimensions when caught unprepared. Istanbul is face to face with a serious earthquake hazard in the near future. According to scientists, probability of an earthquake occurring in the next 30 years is estimated at 65 per cent. Additionally in the report of Bogazici University Kandilli Observatory and Earthquake Research Institute, assumptions with regard to uninhabitable buildings among multi-storey, medium high reinforced concrete buildings and loss of lives in case of a magnitude MW 7.5 earthquake are as follows:





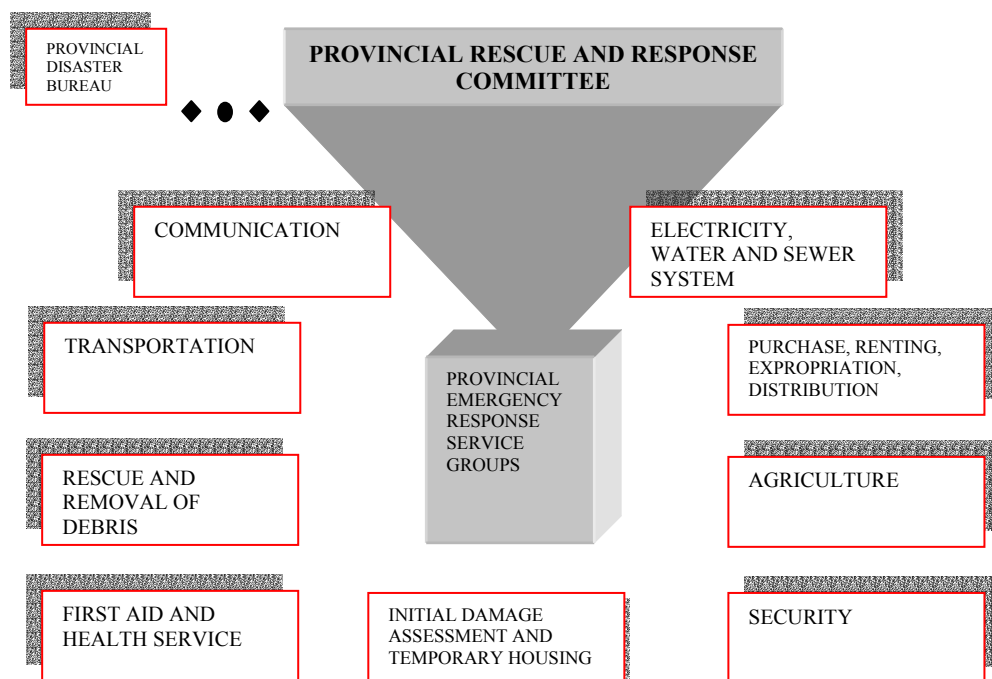
Additionally, in case of a possible earthquake;

- Multiple under and over passes as well as viaducts would be damaged;
 - E-5 and TEM highways would be blocked;
 - Damages to natural gas network would lead to big explosions and fires unless the pressure was reduced via an “Early Warning” system;
- Ambarlı Thermal Power Plant would be severely damaged, and become nonfunctional, which would lead to longtime electricity cut in Istanbul according to assumptions in case of a scenario earthquake.

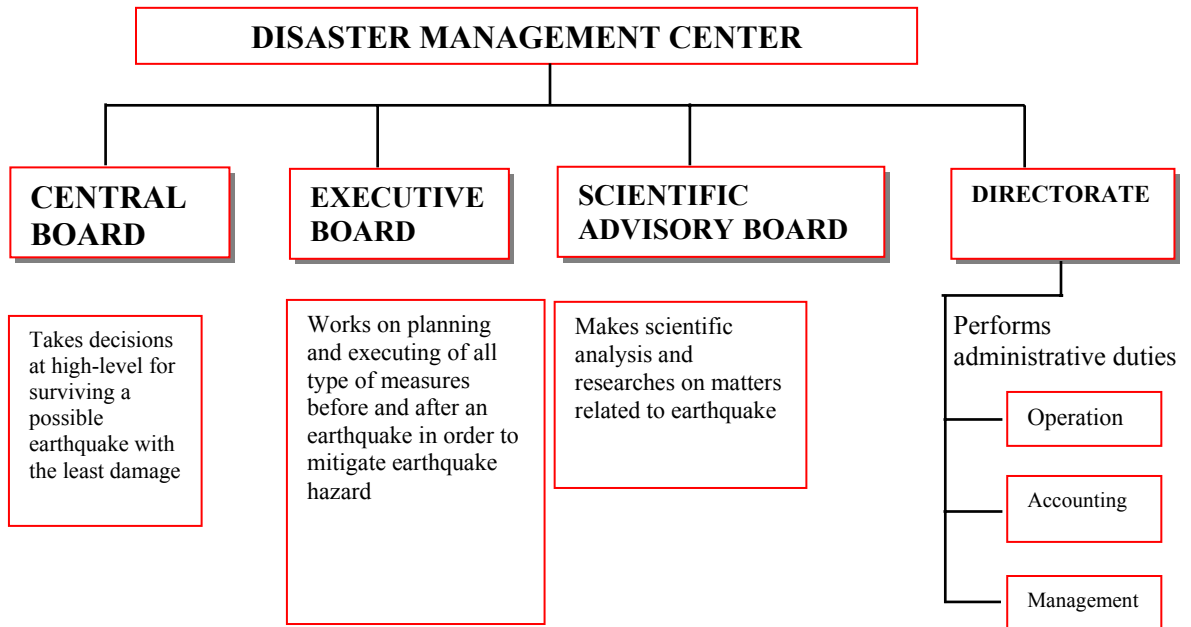
1.2 There are approximately 1 200 000 privately-owned and over 10 000 public building in Istanbul where more than half of current housing stock is either unlicensed or contrary to their licenses, and there is no possibility of deriving sound statistical information as most of the buildings are not registered.

1.3 Two different organizations were established for the fulfillment of disaster related tasks not only for Istanbul but also for all provinces likely to be exposed to disaster. One of them is Provincial Emergency Response Organization. The other one is Provincial Crisis Center, which is tasked with taking and implementing necessary measures for preventing crisis events. Provincial Emergency Response Organization is composed of Provincial Rescue and Response Committee and Provincial Emergency Response Service Groups. Provincial Rescue and Response Committee is in charge of ensuring planning and implementation of provincial and district emergency plans, determining aid principles, addressing the needs, and ensuring coordination among service groups and responsible institutions. Secretariat tasks of the Committee are done by disasters bureaus organized within Provincial Directorates of Public Works and Settlement. (Table 1 illustrates the organization chart of Provincial Emergency Response Organization.)

TABLE 1



1.4 The Governorship of Istanbul detected that with this organizational structure, an adequate preparation cannot be made for an earthquake. With its own initiative, the Governorship of Istanbul established a new organizational structure under the name “Disaster Management Center” on 1.1.2000. (Table 2 illustrates the organizational chart of the Disaster Management Center and functions of its boards.)

TABLE 2

1.5 Disaster Management Center functioning not only with its boards but also with temporarily assigned personnel has a role of supporting and improving the functions of Provincial Emergency Rescue and Response Committee, and at the same time, is organized in such a manner that it can be turned into a Provincial Crisis Center in case of crisis. In addition to these, Disaster Management Center undertakes the duty to coordinate all kinds of activities for earthquake hazard mitigation. In this context, development of Rapid Response and Early Warning Project and Disaster Information System, establishment of Disaster Association and Disaster Radio Channel were all realized by the Disaster Management Center.

1.6 Relevant units of Istanbul Metropolitan Municipality take part in Emergency Response Service Groups as shown in Table 1. The municipality has also established a separate structure under the name “Disaster Coordination Center” (DCC) with a view to ensuring the coordination of its rescue, respond, social services and other activities in the event of a disaster. This centers aims at maintaining communication and cooperation between all units of the Metropolitan Municipality and institutions affiliated to it in case of a disaster through facilitating coordination with Provincial Crisis Center. Moreover, the Metropolitan Municipality established disaster response centers, developed various projects for observing ground movements, and earthquake sensor project. It has also initiated a training seminars for training first aid volunteers within the scope of First Aid Volunteers Project and prepared an “Emergency Access and Action Plan” with regard to a likely earthquake.

1.7 Damage to structures is the major cause for loss of life and property during a quake. Therefore, the leading measure for minimizing earthquake damage is constructing earthquake-resistant buildings on firm grounds. Constructing buildings on firm ground is associated with the soundness of building development plans and ground surveys taken as basis for these development plans. Authority to draft building development plan that lay down the way how land is used is entrusted to Metropolitan and district municipalities and to the Ministry of Public Works and Settlement. Metropolitan municipalities are authorized to prepare Master Plans, 1/5000 scaled land use maps for development plans. District municipalities prepare implementory development plans in compliance with Master Plans and these plans can only be implemented after the approval of metropolitan municipalities. On the other hand, according to Article 9 of Urban Improvement Law No: 3194, if required, the Ministry of Public Works and Settlement can be furnished with the authority to draft Master Plan.

1.8 Istanbul Metropolitan Municipality is continuing the preparatory works of 1/5000 scale Master Plan based on districts. The Directorate of ground surveys and Earthquake has drafted geological maps as well as maps on the habitability of lands, which are to be taken as basis for these plans, except maps of two districts. As of December 2000, four Master Plans related to European side were finalized, approved by Metropolitan Municipal Council and subsequently sent to relevant district municipalities. Twenty-nine plans are still under way.

On the Anatolian side, seven Master Plans were approved by Municipal Council and sent to district councils, whilst six plans were submitted to Municipal Council for its approval. Studies related to seven plans are still going on. District municipalities charged with drawing 1/1000 scale implementation plans based on Master plans have ground surveys that are to form the ground for these plans either done by private organizations or universities through tendering. Metropolitan Municipality compares between and ensures compliance of ground surveys made by Directorate of ground surveys and Earthquake and results sent by district municipalities.

1.9 Earthquake-resistant housing is closely associated with sound implementation of construction works as well. District municipalities carry out construction related tasks, which are issuance of project approval, building permit and occupancy permit, detection of licensed buildings and buildings violating license and application of required procedures in such cases. Technical staff working at building development directorates of District municipalities carries out these tasks. Building Development Directorate affiliated to Istanbul Metropolitan Municipality Department of Planning and Building Development supervises applications of district municipalities. District municipalities are liable for sending a copy of each permit and their annexes issued by them.

1.10 The Urban Improvement Law No: 3194 introduces a technical implementation liability for ensuring compliance of buildings with their permits and annexes. Since it was seen that this system did not operate properly, the Law on Building Inspection No: 4708 was introduced with the aim of ensuring project and structure investigations and to regulate the principles and procedures related to investigations. With the help of the investigations, structures shall be constructed according to building development plan, the rules of science, art and health and standards, through which life and property can be secured.

Scope and Methodology of Examination

1.11 This study explores how the activities towards minimizing a possible Istanbul earthquake damage were planned and executed, to the extent to which the plans and works done can be effective and sufficient in earthquake hazard

mitigation. It further surveys whether risks and priorities were taken into account in facing and solving problems; adequacy and deficiencies in the building development planning and implementation activities of Metropolitan and district municipalities that aims at ensuring construction of earthquake-resistant buildings together with relevant legislation.

1.12 The question “**How well is Istanbul getting prepared for the earthquake?**” is discussed in two parts. In the first part:

- Whether the institutional structuring charged with preparing Istanbul for an earthquake is adequate and proper for addressing the requirements in terms of duties, authority and cooperation;
- Whether preparatory activities were planned effectively, whether implementations were monitored while activities were being planned and executed and targeted outcomes were obtained, whether results were reported credibly, and eventually whether there is a disaster management information system to fulfill all these with success;
- How well the plans of Emergency Response Service Groups were prepared;
- Whether activities on earthquake fires, the leading factor increasing life and property loss, are adequate for addressing the needs are evaluated.

In the second part;

- How building development planning and implementation activities of Istanbul Metropolitan Municipality and district municipalities are executed;
- Which parts of these activities are deficient;
- To the extent to which the measures taken for the construction of buildings resistant to earthquake and legislation are adequate;
- What has been done and must be done to reinforce existing structures are surveyed.

1.13 In order to make evaluations related to first part of the study, works of Disaster Management Center established within the Office of Istanbul Governor and headed by one lieutenant governor and of the fire department were examined. During preliminary study and full study, auditors audited on site activities of Disaster Management Center. In this way, works of Disaster Management Center and provincial emergency plan together with its all

1.14 documents and files were analyzed. Face to face interviews were made with authorized personnel of Disaster Management Center, heads and personnel of service groups and with persons taking part in emergency plans. Since their number is high, not all the service groups but those that can have a key role in minimizing risks in the event of a likely earthquake were selected and the preparatory works of these groups were examined. Selected emergency response service groups are: Transportation, communication, rescue and debris removal, first aid and health service groups.

1.15 For the second part of the study, building development planning, application works and reinforcement activities of Istanbul Metropolitan Municipality and district municipalities were examined. Not all district municipalities were covered in the study. A representable number of district municipalities were selected, which are Avcılar, Bakırkoy and Maltepe located in the first-degree seismic zone, and Bağcılar municipality located in the second-degree seismic zone. Building development planning and application activities of these municipalities were examined on site. Their building development plans and ground conditions reports were scrutinized. Interviews were made with all key personnel working on these matters. During examinations, particularly problems and drawbacks in the implementation were tried to be detected.

1.16 As required by the methodology we followed, a significant number of scientists known to have contributed in minimizing earthquake risks, heads of relevant professional associations, and representatives of AKUT and similar NGOs were consulted at both stages when we formulated audit criteria and obtained audit findings.

Part 2: Does Organizational Structure charged with Earthquake Preparedness for Istanbul measure up to meet necessities?

2.1 This part of the report discusses following matters;

- To the extent to which the organizational structure is adequate in respect to authority, duty, responsibility, use of resources, planning and execution of activities, coordination and collaboration, monitoring activities, assessing results and reporting;
- Whether the studies on earthquake fires exacerbating earthquake hazards are adequate;
- How well the service groups prepare emergency response plans.

How an organizational structure prepare Istanbul for earthquake?

2.2 With Article 14 of the Implementing Regulation on Disaster Emergency Response Organization and Planning Principles, the duty to plan all state power and resources before a disaster and to ensure cooperation and coordination among institutions charged with operating and delivering emergency services is entrusted to Provincial Rescue and Emergency Response Committee and Provincial Emergency Response Organization, which is composed of service groups. Moreover, in case of disasters having a broad affect on life in general, Disaster Management Coordination Board is formed.

2.3 Istanbul Province Emergency Response Organization functions under the responsibility of Istanbul Governorship. With the appearance of signs of a crisis specified in the Implementing Regulation of Prime Ministry Crisis Management Center, Prime Ministry Crisis Management Center takes action. Based on the nature of the crisis-causing event, Ministerial Crisis Centers and Provincial Crisis Centers are formed upon the decision of Crisis Coordination Board and the directive of the Prime Minister. In such a case, crisis is managed by Prime Ministry Crisis Management Center and Provincial Crisis Center.

2.4 Both of these two structuring focus on pre and post-earthquake activities. Having detected that this organizational structure is unable to prepare Istanbul for an earthquake and that the key mitigation activities are preparatory activities, the Governorship of Istanbul established a new organizational structure under the name “Disaster Management Center” on 1.1.2000 apart from these two structures. **Purpose** of Disaster Management Center headed by one lieutenant governor is to ensure work distribution, cooperation and coordination among institutions in order to survive a disaster with least damage within the time elapsed between before, during and after a disaster. **Target** of Disaster Management Center is to ensure that preventive and protective measures for earthquake hazard mitigation are taken and to coordinate emergency response plans. Apart from maintaining coordination of activities regarding earthquake preparedness and cooperation among institutions, Disaster Management Center also assumes a role of complementing and improving the functioning of Provincial Emergency Rescue and Response Committee established in accordance with the “Implementing Regulation on Disaster Emergency Response Organization and Planning Principles”. Moreover, it is organized in such a way that it can be transformed into Provincial Crisis Center in case of any crisis. Some activities that have been realized so far under the coordinatorship of Disaster Management Center are as follows:

- Implementation of project on ground motions record network system intended for early warning and emergency response;
- Setting up of a Disaster Information system;
- Establishment of Disaster Association with the aim of supplying devices, equipment to and staffing the Disaster Management Center;
- Supply of caravans and containers as donations from voluntary organizations;
- Taking inventory of air, land and marine vehicles that can be used in the event of a disaster and detection of heliports;
- Provision of search and rescue training to volunteers;
- Supply and storage of tents to be needed in the aftermath of a disaster;
- Detecting the amount of appropriation required for repair and reinforcement of public buildings and demanding it from relevant ministries;

- Founding Disaster FM broadcasting programs related to disaster training and to raise public awareness, preparation of films, CDs, cassettes and books, etc;
- Allocation of Channel 9 owned by Directorate of Security as disaster coordination channel and establishment of mobile satellite ground terminals enabling uninterrupted communication in the course of disasters thanks to planning of inter-institutional wireless code system.

2.5 For effective fulfillment of emergency management, General Directorate of Emergency Management was established in Ankara on 22 November 1999. In spite of this, a structure capable of planning pre- and post-disaster activities as well as ensuring central and local coordination during a disaster has not yet been established.

2.6 Events experienced previously at big earthquakes explicitly showed that Provincial Emergency Rescue and Response Committees and Crisis Centers were not effective enough in mitigating earthquake hazards. Therefore, the need for a new structuring aimed at minimizing risks and damages, making it possible to keep all pre-, syn- and post-disaster activities in perspective, effective in ensuring coordination of activities and equipped with adequate legal authorities and possibilities has become irrecusable.

2.7 Both the Disaster Management Center set up from the initiative of Istanbul Governorship and the General Directorate of Emergency Management established by the government arised from this necessity. However, as explained in P. 2.5, General Directorate of Emergency Management does not have a structuring that meets necessities. Istanbul Governorship adopting a risk-management approach towards earthquake preparedness noticed this inadequacy and took important steps such as the establishment of Disaster Management Center. The Disaster Management Center carries out its activities within the framework of responsibilities and authorities of Istanbul Governorship. Disaster Management Center is unable to make a comprehensive planning in accordance with necessities. The reason is that the Center neither conducts its structuring and activities pursuant to a special code nor does it have adequate resources. Moreover, it does not carry out its activities based on pre-defined, clear and measurable targets and annual objectives. Therefore, no action plan and strategies directed towards reaching

set objectives are developed; to the extent to which the targets are achieved is not assessed either. These deficiencies lead to problems both in execution, monitoring and evaluation of activities and in matters related to cooperation and collaboration.

How are resources allocated for earthquake preparedness?

2.8 Disaster Management Center is staffed with 40 personnel temporarily employed from various institutions with the directive of the Governorship and the building of the center is allocated again by the Governorship. As existing personnel does not have adequate experience and knowledge on disaster; analysis of information accumulated at the Center, monitoring of the projects and provision of necessary guidance cannot be done properly. Additionally, Istanbul Governorship also founded Disaster Association with a view to aiding the Disaster Management Center in meeting its staffing, instruments and vehicle needs. As explained in P. 2.7, a fund or appropriation cannot be allocated directly by the government, since the Disaster Management Center was not established with a law. Although the Center does not have its own budget, its needs are covered from following resources upon the instruction of the Governor:

- Ministry of Public Works and Settlement Disaster Fund
- Social Assistance and Solidarity Foundation
- Special Provincial Administration budget
- Special Provincial Administration Fund
- Istanbul Disaster Association
- Various grants

Additionally, different institutions cover the cost of earthquake preparatory activities from their own budgets. For instance, the formation of eight Earthquake Record Stations and the Project of City Geology being handled by Istanbul Municipality is financed from municipal budget, whilst emergency response and early warning project implemented by Bogazici University is financed with external credits.

2.9 As is seen, earthquake preparedness activities are financed from various sources. The leading beneficiaries of these sources are the Governorship, Metropolitan Municipality and Bogazici University. However, these institutions are unable to establish a result-oriented cooperation, whereas they

could agree on the results, monitor the progresses and report achieved results as they are serving for the same purpose. Accordingly, resource allocation cannot be based on priorities and oriented towards results.

2.10 A meeting was organized on 14-15 November 2000 in Ankara with the participation of Prime Ministry Crisis Management Center, General Directorate of Emergency Management of Turkey, Istanbul Governorship and Metropolitan Municipality in order to see the details of the disaster plan to be implemented in case of a disaster in Istanbul and action plan covering the pre-disaster activities, to set cooperation principles among stakeholders, to detect deficiencies in plans and programs and the solutions to them. In this meeting, the Disaster Management Center revealed that approximately 565 trillion Turkish Liras is needed for the projects developed by 14 organizations functioning at Istanbul so that the service group would be able to serve better. How and from which source this financing need calculated to be 565 trillion TL could be addressed was not solved in this meeting. Therefore, the importance of cooperation and coordination activities directed towards sourcing is ever growing.

Is effective coordination and cooperation established?

2.11 Disaster Management Center established within the Governorship is trying to coordinate pre-disaster preparations and to establish inter-institutional cooperation by means of correspondences, Central and Executive Boards meetings and weekly regular meetings. At weekly meetings, it is discussed whether previously assigned duties have been fulfilled and the units are reminded of ensuing necessary activities. The demand of Disaster Management Center is unity in the preparatory works achieved through correspondences and its being informed concerning the ongoing activities at certain intervals to be used as basis for the forthcoming studies. However, despite the efforts of the Center, the duty to ensure coordination and cooperation cannot be fulfilled effectively and continuity cannot be maintained in the information flow. The Disaster Management Center received the Action Plan for Emergency Transportation prepared by MMs after several correspondences. This plan includes information with respect to first- and second- degree priority highways, areas for tent camps, medical centers, heliports, etc as well as information regarding how transformation will be secured in case of a possible

disaster. However, some part of the information covered in this Action Plan was separately provided by the Disaster Management Center from district governorships within the scope of update and improvement of disaster information system. There is incompliance between the information used to update disaster information system and those presented in the Action Plan. (For instance; information on heliports)

2.12 Disaster Coordination Center (DCC) was established within Istanbul Metropolitan Municipality in order to ensure coordination with the Governorship (Disaster Management Center-Governorship Crisis Center) during possible disaster preparations and in the course of a disaster, and to establish coordination and cooperation among all units of municipality and institutions affiliated to it. However, when considered its activities (P. 1.6, 2.11), it is obvious that DCC not only maintains coordination and cooperation, but also carries out earthquake preparatory activities.

2.13 Awareness raising activities are conducted by various institutions and organizations. In this respect, Disaster Management Center, Istanbul Technical University Turkish Earthquake Foundation, Bogazici University Kandilli Observatory and Earthquake Research Institute and several voluntary organizations are individually carrying out activities. However, mentioned training activities are not organized within a certain plan and coordination, which leads to deficiencies in maintaining educational standards as well as to resource and time waste.

2.14 Explanations made in previous paragraphs show the extent to which the result-oriented cooperation directed towards same objectives and targets whereby the stakeholders agree on the targeted objectives and assume responsibilities is important. Where such an effective cooperation is achieved, it will get easier to mobilize voluntary organizations and non-governmental organizations in these activities. Establishment of an effective coordination and collaboration is also an facilitating factor in resource allocation.

Are activities properly planned and executed?

2.15 Earthquake preparedness is in general handled with traditional approach. Therefore, activities to be carried out during and after an earthquake are planned and how various service groups will serve is determined in disaster plans. Certainly, it is important to make preparations related to activities during and after an earthquake in the best way and is an effective factor in earthquake hazard mitigation. However, experiences in all over the world show that activities during and after an earthquake have limited effect in earthquake hazard mitigation. To mitigate earthquake hazard significantly, focus should be on pre-earthquake preparations and studies should be done on risk basis.

2.16 As explained in P. 2.4, to eradicate above-mentioned deficiencies, Istanbul Governorship established a separate structure under the name of Disaster Management Center. Still, activities cannot be planned and implemented in the optimum way due to limitations both in legal authorities and resource utilization as well as deficiencies in coordination and cooperation.

2.17 It is not possible to achieve effective results due to the fact that the institutions likely to have role and duty in pre-earthquake preparedness do not cooperate with a result-oriented approach and the institutions responsible for and taking part in the achievement of certain results do not function within the framework of strategic plans to reach their objectives and targets. Since activities are not carried out based on accountability and transparency and within the framework of long-term strategic plans and annual action plans; resource allocation cannot be done according to needs analysis and priorities, and it is not assessed whether optimum results have been achieved or not.

2.18 There is need for an up-to-date, valid, reliable and comprehensive Management Information System appropriate for integrating cost and activity data for implementation of activities according to long-term strategic plans and annual plans, monitoring and measuring progress achieved, administration to take corrective actions within the shortest time when required. Istanbul

Governorship detected this necessity and established Disaster Information System within Disaster Management Center in November, 1999.

2.19 In the Disaster Information System, all kinds of information and data such as information concerning buildings, areas subject to construction ban, cemeteries, military zones, industrial sites, temporary housing areas, waste and debris disposal areas, roads and railways, transformer stations, gas stations, etc appropriate for disaster management are collected; 70 per cent of transfer of data to the system has been completed.

2.20 Moreover, a wireless pc network project that is to enable data transfer during a possible disaster and would not be affected by disaster is tried to be realized. Within this project, uninterrupted communication among 32 provinces, 9 service groups and 9 strategic units is aimed. Financing of the project amounted to approximately 500 billion TL has not been obtained.

Is there sufficient work related to fires that increase earthquake damage?

2.21 Works related to fires are handled by Metropolitan Municipality Department of Fire Brigade. Disaster Management Center is informed with regard to planned and ongoing activities.



2.22 Istanbul Metropolitan Municipality Department of Fire Brigade divides Istanbul into four

zones in terms of fire risk. First-degree risk zone covers areas where there are storage and filling units for explosive and flammable substances as well as industrial facilities intensely using such substances. Areas where there are

houses, shopping centers, hotels and small workshops are within second-degree risk zone. Additionally, in Istanbul, there are 1300 narrow and staired streets where fire brigades are unable to access and wooden buildings predominate. Although, in general, these zones that create fire risk and where risk will increase in case of a possible earthquake have been detected; applications that are to eradicate or minimize risk cannot be put into implementation. For instance, how fire brigades will fight with fires in narrow and staired streets to which they have no access has not been solved. Plans related to relocation of storages and filling facilities for explosive and flammable substances likely to cause a major fire in to safe zones case of an earthquake have not been prepared.

2.23 Istanbul Metropolitan Municipality Department of Control detected that there are 6368 facilities bearing fire risk, 4844 of which are unlicensed. Nearly half of 266 Gas Stations and LPG stations are unlicensed either. Addresses of combustible, inflammable and chemical substance storages were notified to the Disaster Management Center. However, as mentioned in the previous p., there is no plan or project regarding these facilities.

2.24 There are 37 fire stations affiliated to Istanbul Metropolitan Municipality Department of Fire Brigade. Considering possible problems in transportation in the event of a disaster, establishment of 100 mini-stations with 2-3 vehicles and 6-10 personnel capacity at different parts of Istanbul is under work. However, this project has not been put into implementation due to lack of adequate resource.

2.25 Istanbul Metropolitan Municipality Department of Fire Brigade had been serving at 37 fire stations with 254 vehicles and 2017 personnel until 17.8.1999. Due to escalating expectation of an earthquake in Istanbul, it has increased its number of vehicle and personnel to 321 and 2100 respectively.

2.26 Two new projects have been developed for mitigating fire hazard in the event of a likely Istanbul earthquake. These are **Earthquake Shut off Valves Project** carried out by IGDAŞ (Istanbul Gas Distribution Industry and Trade Inc. Co.) and **Record Network System for Rapid Response and Early**

Warning System by Kandilli Observatory and Earthquake Research Institute. Tender price of Rapid Response and Early Warning System Project of Kandilli Observatory and Earthquake Research Institute is 3.070.000 USA Dollars. The Project has two components. Early warning system is the first component, which aims at shutting off critical network operations through detecting at first the seismic wave at allocation nearest to seismic focus and communicating information by means of electromagnetic waves to all relevant centers after ensuring the reliability of the data. During meetings held at target-institutions of the project, it was seen that institutions that had to be included in the system (İGDAŞ, BOTAŞ-Petroleum Pipeline Corporation, TEK-Turkish Electricity Authority, Metro etc.) were not integrated in the project. On the other hand, authorized persons from Directorate General of İGDAŞ stated that this project was not an issue for them. They justified this by saying that shutting off valves at main pipes would take two minutes and thus, it would be of no importance to receive signal 5-8 seconds before. Emergency response is the second component of the project. The aim of this component is to establish ninety strong ground motion stations at densely populated settlement, commercial and industrial areas of Istanbul. The idea behind this is that after the stimulation of stations by earthquake, stations would assess parametric data immediately, detect spatial distribution of strong ground movement, pinpoint damaged places and dimensions of earthquake damage as well as approximate number of deaths and injured in Istanbul with a preliminary assessment to be made within 2-3 minutes in electronic environment. It is planned that this information shall be communicated to Governorship, Municipality, First-Army and Directorate of Security electronically. The project related to gas shut off which is stimulated by an earthquake carried out by Directorate General of İGDAŞ aims at detecting seismic movements and shutting off gas over internal wiring. This project would be beneficial only for buildings left standing. Since valves inside demolished buildings would also be damaged, the system would not function in such buildings. It is estimated that there are 170-180 thousands buildings that needs earthquake valves. Although they are directed towards same objectives, these projects which are carried out different institutions and without any coordination, are a dramatic example of deficiencies stemming from weaknesses at organizational structure and lack of coordination in earthquake preparedness and lead to waste of potentials.

How well service groups prepare emergency plans?

2.27 In order to assess how well service groups prepare emergency plans, it was searched whether persons given a role by the plan were aware of their roles and responsibilities, whether plan was prepared with the broadest participation. It was further analyzed whether needs were determined realistically or not, whether risks and priorities were taken into account during plan drafting, whether the coordination of national and international organizations likely to participate in search, rescue and first-aid operations was planned or not.

2.28 To search whether persons assigned duty by the plan were aware of their roles and responsibilities, plans of four service groups were analyzed and interviews were made with 23 persons among heads and members of service groups. When plans of service groups were examined, it was seen that only the responsibilities and authorities of group and service heads were designated, whilst the responsibilities and duties of other service members were not specified. For instance; in the plan of Transportation Services Group, the responsibilities and authorities of group head are listed; however, the duties and responsibilities of individual members of 15-service groups are not specified; only their names are listed either as service head or as member.

2.29 It is understood from the examinations made on files of Service Groups Headships that although heads and members of service groups were notified of their assignments, a significant number of personnel were not informed, and several persons were unaware of their duties and responsibilities given in the plan.

2.30 When plans of service groups are examined, it can be seen that the participation of natural, real and legal persons was not ensured at sufficient level. In other words, the highest participation was not objected. What is meant by broadest participation is not solely the participation of institutions and organizations having a role in the plans. Those having role in the plan should gather at preparatory stage and understand clearly what is expected from them for the achievement of objectives and targets set out in the plan, and put

forward how and to what extent they can fulfill their duties, whether their knowledge and experience in this field are sufficient and if any how they can eradicate their deficiencies. However, it is seen that nothing has been done in this respect. For instance, it was detected that universities, non-governmental organizations and organizations such as AKUT were not invited to plan preparation of Rescue and Debris Removal Service Groups and similarly, Istanbul Metropolitan Municipality Department of Health was not included in plan preparations of First-Aid and Health Services Group. Another significant deficiency is that there is no sound communication established among service groups. For instance, although works of Transportation and Communication Service Group are of great importance for the functioning of other service groups, no mechanism has been developed for communication among groups.

2.31 When plans of service groups selected as samples were examined, it was seen that no arrangement was made related to which necessities would be met by whom, how and when. Only the inventory of existing vehicles and equipment is shown in the plans. Although there is no such preparation reflected in the plan documents, it was observed that certain service groups had tried to detect their necessities. For instance, General Provincial Director of Rural Services who is at the same time the head of Rescue and Debris Removal Service Group prepared a list of necessary vehicles and equipments and notified Regional Directorate of Rural Services about this necessity which is amounted to approximately 5 trillion. Nevertheless, it is not possible to address needs specified since there is no process arranging this. Likewise, the necessities specified for recovering immediately the damages on main communication network have not been met.

2.32 It was examined whether it was considered that personnel assigned duty in the plan could be an earthquake victim while the plans of service groups were being prepared. It was seen that Transportation Services Group together with First Aid and Health Services Group had taken this matter into account and specified substitutes of assigned personnel by considering that they could be an earthquake victim, but Communication Service Group and Rescue and Debris Removal Service Group did not note this issue in their planing. On the

other hand, it was found out that none of the plans was prepared with an approach focused on risks and priorities.

2.33 Provincial Directorate of Civil Defense being a member of Rescue and Debris Removal Service Group composed rescue teams at every district and drew up their action plans. Additionally, as of April 2001, 30 hours search and rescue training has been given to 6530 persons in total: 3271 officially, 2863 from private sector and 396 voluntary persons. The training given is under the international standards of this field; both the quality and the length of the training are insufficient. In addition, by signing a protocol with 19 provincial governorships, places where the search and rescue teams to be dispatched from these provinces will perform their duties have been determined; however, there is no information with regard to the equipments of these teams. Although the inventory of vehicles and equipments to be used in rescue services was taken, a system monitoring and updating the movement and last status of equipments does not exist. In order to solve language problem with foreign rescue and first-aid teams, a protocol was signed with Istanbul University Faculty of Arts Department of Translation and 30 hour search and rescue training was provided to students within the scope of Interpreter-in-Aid at Disaster Training. Assistance and contribution of search, rescue and first aid teams such as Troop for Natural Disaster Assistance composed within Turkish Military Forces and AKUT were not reflected in the plans.

2.34 There are problems concerning the management and coordination of the works of service groups. For instance, provincial emergency plans are prepared by service groups, and sent to Provincial Disaster Bureau. However, plans of service groups and those of Provincial Disaster Bureau have become different from each other since updated information has not been reflected on the plans of Disaster Bureau.

Part 3: Are building development plans, their implementations and building reinforcement works executed in such a way that is to minimize earthquake hazard?

3.1 This part of the report explores how land use is planned, how building licensing operations and investigations are performed and what has been done with regard to reinforcement of existing buildings.

3.2 Experts list main factors transforming an earthquake into a deadly disaster as follows:

- Unplanned housing, building development plans contradictory to science together with wrong selection of place;
- Illegal, unlicensed housing;
- Licensed but uncontrolled housing;
- Lack of legal sanctions in preventing these irregularities.



Building development planning

3.3 The execution of the last Metropolitan Master Plan dated 1995 with a scale of 1/50 000 which plans settlement areas, the way and density of settlement in Istanbul was stopped by Council of State with the justification that there is no authority to implement a plan of this scale entrusted to Metropolitan Municipality defined in Law on Urban Improvement. Again the Metropolitan Master Plan with a scale of 1/50 000 approved in 1980 by the

Ministry of Public Works and covering the whole provincial boundary became nonapplicable with the decisions envisaging that housing could be independent from major plan called as Improvement Plan particularly after construction amnesty of 1985. Since 1980, several regions of Istanbul, which are inconvenient for housing, have become dense housing areas with the decision of piecemeal plan in parallel to shanty housing.

3.4 It is a scientific requirement that maps of fault lines and earthquake zones are taken into account in the planning phase so that they can have a guiding functionality in city's housing according to these risks.

3.5 At which parts of the city housing limitation can be introduced due to earthquake risk is explicitly illustrated in the 1/50 000 scale Master Plan drawn up within 15 years by Master Plan Bureau, which was established in 1960s. For instance, Avcılar district that suffered the most damage in 17 August 1999 earthquake is shown as low density and low-rise housing zone.

3.6 The Circular No:10 issued by the Ministry of Public Works and Settlement dated 15 October 1999 nullified building development plans drawn up without geological survey reports and required renewal of building development plans after the preparation of geological survey reports. Istanbul Metropolitan Municipality Directorate of Ground Conditions and Earthquake Investigation has finalized most of geological surveys to be used as a ground for Master Plan. In the examination made on the completed part of the study, it was seen that there were licensed and unlicensed buildings constructed previously at areas specified as inconvenient for housing. What kind of measures shall be taken against such buildings has not been determined yet. That these measures shall be determined after the completion of risk analysis and micro-zoning activities suggests that this ambiguity shall last for a while.

3.7 After the completion of ground surveys, Master Plans are prepared and sent to district municipalities to be used as ground for Implementation Plans after the approval of Metropolitan Municipality Council. Works on 1/5000 scale Master Plan carried out by Metropolitan Municipality on district basis have not been finalized yet.

3.8 District Municipalities have ground surveys that are used as ground for Implementation Plan done either by private organizations or universities through tendering within their limits of possibilities. It is detected that ground surveys for the examined districts have not been completed. Recent developments at district municipalities are summarized as follow:

- Avcılar Municipality awarded the tender of ground surveys to private companies; however due to financial incapacibilities, time extension was granted to these firms.
- Bagcılar Municipality finalized ground surveys and results obtained were sent to General Directorate of Disaster Affairs for its approval.
- Bakırkoy Municipality awarded the tender in two parts to Istanbul Technical University Development Foundation and Istanbul University Research and Assistance Foundation. First part of the work was completed on 19.7.2000. Since district as a whole is a settlement area, examination of building foundation systems, ground conditions and taking building inventory through conducting risk analysis related to building-ground interaction was decided. To this aim, the work “Bakırkoy District Research of Risk Analysis related to Ground-Building Interaction” was awarded to Istanbul University Research and Assistance Foundation.
- In Maltepe Municipality, ground surveys are at tender stage.

Construction practices

3.9 Construction practices cover approval of projects implemented by district municipalities, issuance of construction and occupancy permits, detection of unlicensed buildings or those contrary to the license and taking necessary action against these as well as building inspection activities. The Metropolitan Municipality has authority to control these practices.

3.10 The status of 52 buildings in total either collapsed during the earthquake or demolished due to heavy damage in Avcılar that suffered the most damage in Istanbul at 17 August Earthquake are as follows:

- 23 buildings have license and occupancy permit;
- 13 buildings do not have occupancy permit;

- 2 buildings are illegal;
- Cease and Desist Order has been issued for 14 buildings due to violation of license and its annexes.

3.11 As is seen, not only shanty buildings or buildings contrary to license but also buildings with license, occupancy permit and approved project were damaged during the earthquake. These results indicate that there are certain deficiencies in construction practices of district municipalities.

3.12 Following the examinations and interviews made at selected sample districts Avcılar, Bağcılar, Bakırköy and Maltepe Municipalities, it was detected that workload of the personnel was high and necessary training was not given. For instance, at Bağcılar Municipality project license department where three engineers, one architect and two technicians are working, 1844 projects were examined and granted construction licenses between 1998 and 2000. On the other hand, during interviews made with technical personnel investigating buildings it was stated that they needed information concerning “Implementing Regulation on Buildings to be Constructed at Disaster Sites” and professional training, and particularly they were incompetent in terms of project statics.

3.13 More than half of the housing stock in Istanbul is either unlicensed or contrary to license, which indicated that inspections fall insufficient. Municipalities do not have adequate possibilities to prevent such structuring either.

3.14 District municipalities control whether buildings are licensed or not, whether licensed buildings are constructed according to their license and its annexes through demesne inspection, namely on-site inspection. The Metropolitan Municipality carries out demesne investigation and at the same time, examines projects and permits received from district municipalities. Whether metropolitan municipality and district municipalities have sufficient number of personnel and vehicle for the effective fulfillment of these duties was examined. Interviews revealed that number of personnel and vehicle is insufficient in general. Mentioned activities are carried out with;

- 11 technical staff and 2 vehicles at Maltepe Municipality;
- 12 technical staff and 5 vehicles at Bagcılar Municipality;
- 6 technical staff and 2 vehicles at Avcılar Municipality;
- 40 technical staff and 5 vehicles at Metropolitan Municipality.

3.15 Through investigations carried out by district municipalities, buildings the construction of which is started without license or contrary to license and its annexes are sealed according to Article 32 of Urban Improvement Law No: 3194 and construction is stopped. Where owner of the building does not obtain license at most within one month or correct violations, building must be demolished upon the decision of the council. However, there is no team responsible for demolition work. On the other hand, it takes approximately two months to notify owner of the council's demolition order after stop of the work and within this period, construction of the building is completed and household starts living, which makes evacuation and demolition difficult. Actions taken by sample district municipalities related to buildings that were started to be constructed without license or violated license and its annexes between 1998-2000 are as follows:

TABLE 3

Actions related to unlicensed buildings and buildings violating license

Municipality	Number of Cease and Desist Order	Demolition Decision and fine	Executed demolition decision
AVCILAR	856	856	8
BAGCILAR	5411	5411	21
MALTEPE	581	581	10
BAKIRKOY	590	590	-

As is seen from the figures in the table, a small part of demolition decisions could be executed.

3.16 The provision of Article 31 of the Urban Improvement Law No:3194 saying “ buildings that are not granted and do not obtain occupancy permit cannot be allowed to benefit from electricity, water and sewer services and facilities “ has not been put into implementation. Since such structures are

allowed to benefit from these services, obtaining an occupancy permit loses its meaning and municipal inspections at this stage are avoided.

3.17 In order to ensure the compliance of a completed building to its license, the system called as physical liability was introduced with the Law No:3194. However, expected results could not be achieved. Instead of eradicating drawbacks of this system, with a view to securing life and property, the Law on Building Inspection No:4708 dated 29.6.2001 was enacted, which regulated principles and procedures related to project and building inspection to ensure construction of buildings of quality in accordance with building development plan, science, art and health standards. Building inspection organizations were established with this law.

3.18 Although the extent to which these building inspection organizations shall be effective is not certain at the moment, it is considered that their effectiveness will fall behind in reducing earthquake hazard risk. In other words;

- The activity field of building inspection organizations is limited with investigation of licensed buildings. The inspection of these organizations is directed towards ensuring compliance of buildings finished with licenses. Nevertheless, as highlighted above, most of the buildings in Istanbul are unlicensed. Thus, arrangements introduced with the law no:4708 alone is not adequate to reduce earthquake damage.
- Since municipalities are responsible for preventing construction of shanty buildings and those violating their licenses, it is clear that the Law on Building Inspection cannot be as effective as expected without expanding the authorities and possibilities of municipalities and bringing provisions of the Law No:3194 into force.

3.19 Building workers, foreman and master builders are not trained. Such training considered to be necessary by the experts for maintaining building quality and safety is only provided by Bagcılar Municipality. Such training activities should be made widespread and systematic.

Reinforcement of existing structures

3.20 There are approximately 1.200.000 buildings: 2.400.000 houses and above 10.000 public buildings in Istanbul. The reason for why these figures are approximate is that more than half of the existing housing stock is composed of shanty houses and illegal houses, which are not recorded.

3.21 One of the most vital ways of reducing life and property loss is to measure earthquake-resistance of exiting buildings and to reinforce if necessary. To initiate reinforcement works, at first the building inventory meaning building identification should be taken; micro zoning that determine the level of earthquake effect on ground should be carried out and accordingly, risk analysis meaning detection of the response of structures to earthquake, should be made.

3.22 Studies mentioned in P. 3.21 have not been realized. Among these,

- The tender procedure for the project on “Istanbul Earthquake Risk Analysis” was launched by Istanbul Metropolitan Municipality, the scope of which is building inventory.
- On 17 October 2000, Istanbul Metropolitan Municipality and the Japan International Cooperation Agency (JICA) agreed on a study focused mainly on disaster prevention, mitigation in Istanbul and covering at the same time seismic micro zoning. The study covers building up a building inventory to estimate how buildings in Istanbul will be affected from earthquake region-by-region and to make evaluations as well. In this study projected to be finalized by the end of 2002, information collection phase has ended and collected information is started to be assessed. As a result of this study, it shall be determined which districts would be under how much risk according to three different earthquake scenarios.

3.23 There is no study related to detection of buildings that need to be reinforced throughout Istanbul in line with earthquake preparedness aim. As per the Law No:7269 and dated 15.5.1959; the Ministry of Public Works and

Settlement assessed the extent of the damage. However, this should have been done after 1999 Marmara Earthquake and is not a preparatory activity.

3.24 Provincial Directorate of Public Works and Settlement initiated damage assessment activities giving priority to schools and hospitals after 17 August earthquake. Although it is indicated in the documents obtained from Disaster Management Center that apart from schools and hospitals, among 13595 public buildings, 2683 of them were taken under damage assessment, authorized personnel of Provincial Directorate stated that damage assessment was finalized at public buildings and the buildings shown in the list as not being assessed could be the buildings that were not damaged. Officials from Disaster Management Center expressed their hesitations with regard to the accuracy of these figures, which indicates that there is not a sound information flow with regard to damage assessments of buildings.

3.25 Repair works of damaged buildings cannot be carried out due to inadequacy of appropriation. It was understood from the information received from Disaster Management Center that an appropriation amounted to 146.9 trillion TL was demanded to be used in the repair and reinforcement of municipalities, universities and other public buildings, but an appropriation of 33.6 trillion TL was allocated. The Ministry of Public Works and Settlement has included a part of public buildings suffered moderate damage in the repair and reinforcement program and repair works of schools among these are carried out within the possibilities of appropriations.

3.26 Apart from repair works on public buildings suffered damage during 17 August earthquake, all public buildings particularly schools, hospitals, bridges, tunnels, viaducts, buildings of historical value should be assessed in terms of earthquake-resistance and reinforced in case of necessity. Since these works are limited with possibilities of appropriation, they cannot be carried out within a plan and rapidly. Certain institutions are continuing these works with their own possibilities. Within the scope of reinforcement of structural systems of 26 state hospitals, hospitals in Istanbul and İzmir against earthquake risk, Laing-Owen Williams joint ventures examined the situation and reinforcement projects were developed. However, projects could not be implemented due to inadequate appropriation. The Ministry of Culture in cooperation with Bogazici University is conducting a study in order to detect the extent to which

historical assets will be affected by a possible earthquake within the limits of appropriation. Public buildings and facilities that need reinforcement should be reinforced immediately by means of national and external sourcing. When initiatives for finding external resource for reinforcement come up with positive results, earthquake hazard risk will be reduced considerably.

3.27 Apart from reinforcement of public buildings, privately owned buildings should also be reinforced. In order to determine whether buildings would be left standing in the event of an earthquake and necessary reinforcement procedures if required necessary; ground conditions of the buildings should be investigated; a geotechnical assessment should be made for the status of foundations; foundation should be examined in terms of sitting, sliding and liquefaction separately and in detail. If the building does not have a project, architectural and static survey of the building should be done; if it has, whether the construction complies with the project or not should be controlled. Additionally, concrete quality should be checked and vibration analysis of bearing system should be made. As a result of these studies, it is understood whether building is earthquake-resistant. Besides, for reinforcement of privately owned buildings, legal, administrative problems related to infrastructure should be solved and projects that are to solve financing problems should be developed.

3.28 Various studies have been conducted regarding how much time and resources is needed. According to the study made by the Disaster Management Center, moving from the assumption that approximately 30 per cent of existing 2.400.000 houses would not need reinforcement; considering also the number of laboratories that can conduct building examination and reinforced concrete together with project preparation procedures, 100 teams composed of 200 people could develop reinforcement project for approximately 1.680.000 houses within more than 50 years. Moreover, the cost of this project would be more than 500 million Dollars and reinforcement cost would reach to 6 billion Dollars. In a paper prepared by Istanbul Technical University Lecturer Prof. Dr. Erol Kulaksızoğlu dated 30.3.2000 related to this matter; it is stated that the number of houses that needs repair and reinforcement at Istanbul coastal strip, which would suffer the most damage in the event of an earthquake, is

1.020.000. It follows with indicating that approximately 400 project consultancy companies could finalize repair and reinforcement works in 17 years, the cost of which would be 510 trillion TL, and demolishing fully and reconstructing these houses would cost 18 Quadrillion TL. To perform all these activities, there is neither sufficient resource nor adequate number of personnel having expertise in reinforcement, and these requirements are well above the potential of a province. Therefore, for planning, implementing and monitoring these activities, there is needs for government-level policies, long-term strategies and projects with sound financing.