

DISASTER RESILIENT URBAN SETTLEMENTS

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

DISASTER RESILIENT URBAN SETTLEMENTS

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Recently, natural disasters with devastating effects on human settlements have proliferated. Against this background, this study outlines a resilience model for urban settlements with respect to natural disasters. The focus on urban settlements has been chosen because of their high disaster risks due to (i) their dense population and construction, (ii) their position as a center of economic and cultural activities, (iii) their location on the significant cross-roads of transportation routes and other modern networks, and (iv) their exploitation of natural resources and generation of environmental pollution. In addition to these reasons, variables of disaster risks in urban settlements may be grouped in two main categories, namely "Risks Stemming from the Urban Settlement" and "Risks Stemming from the Natural Disaster". An assessment of risks stemming from the urban settlement will start with an analysis of peculiar existing features of urban settlements under consideration including the site of the settlement (coastal settlement, hillside settlement, alluvial plain settlement ...), the ground survey of the settlement (whether urban settlement sits on firm ground or not, land liquefaction factors, ground water levels...), the planning standards and criteria of the settlement, land-use, population density, population profile and public awareness for disasters (social indicators),

construction density and quality of the settlement, quality in urban infrastructure & services, economic profile of the settlement (sectors, employment rate and profile, scale of production such as domestic scale production or country scale or international scale). The risks stemming from the natural disaster can be captured in terms of magnitude and range of the natural disasters; the frequency, occurrence time, duration, and type of disasters (e.g. only earthquake or earthquake + flood triggered by earthquake). The combination of such variables determines the degree of risks of a certain urban settlement prone to natural disasters.

The natural disaster risk profile of urban settlements as drawn above shows that it is not possible to resist all devastating effects of natural disasters. Thus, the term resilience implies the adaptation capacity of urban settlements potentially exposed to natural hazards for maintaining or restoring an acceptable level of functioning and structure. This study concentrates on the physical resilience of urban settlements rather than on strengthening social, political, administrative, etc. structures. However, since an urban settlement is a space in which multi-dimensional functions interact, other relevant issues such as political, administrative, economic, and social factors are also taken into consideration to support the physical resilience of urban settlements.

To build a disaster-resilience model for urban settlements, the main objectives are synthesizing data from international studies such as project reports from the UN, World Bank, and EU as well as best country examples; determining strengths, weaknesses, opportunities, and threats for urban settlements prone to disasters; transferring lessons learned from the 1999 earthquakes in Turkey; structuring guidelines; and testing the proposed guidebook. In this respect, a two-fold method is used comprising theoretical and empirical aspects. The theoretical part encompasses literature reviews, desktop researches, institutional documents, and project evaluations as well as lessons learned from various countries and international projects. The empirical part offers a

comparative case study of two high seismic cities: Yalova/TURKEY and Cologne/GERMANY.

While this study searches for best indicators and approaches to design a disaster-resilience model, it also takes into account differences of urban settlements as regards their disaster risks. Especially, in terms of priorities in disaster mitigation activities, two different approaches are proposed for urban settlements of developing countries and developed countries, respectively. First of all, from the perspective of a city planner, it is possible to distinguish between urbanization processes and urban settlements in developing countries and developed countries. According to UN statistics and relevant international data the rate of urbanization in developing countries increased more than that in developed countries due to the rapid population increase in developing countries. The growth of urban population has different reflections to the urban space in developing and developed countries, respectively. While urban settlements grow in a decentralized form in developed countries, agglomerations around urban settlements become the trend of urban growth in developing countries. Secondly, urban settlements play a much more dominant role in developing countries than in developed ones. While urban settlements are the concentration of political, administrative, economic, cultural, technical, and infrastructural functions in developing countries; they are just larger rings of the whole chain of infrastructure and services in developed countries. Due to the dominant role of urban settlements in developing countries, the vulnerability of such settlements translates into vulnerability of the country at large. Thirdly, urban settlements in developing countries tend to be more vulnerable to natural disasters than those in developed countries in terms of physical, social, economical, and environmental aspects. Thus, as a principle, the pertinent priorities of countries are found in disaster mitigation plans developed on the basis of the sustainability concept. Saving lives tends to be the prime focus of disaster mitigation activities in developing countries. On the other hand, disaster mitigation plans and programs in developing countries primarily concentrate on saving assets and establishments of settlements.

In the light of key findings and approaches mentioned above, the model consists of two main parts, namely risk factors of an urban settlement and elements of resilience. Risk factors are classified as natural disaster variables and urban settlement variables. The coping capacity, policies, and instruments of disaster resilience of an urban settlement are assessed in the part of elements of resilience. The model is structured as a standard checklist of key questions to relevant authorities and actors, and it addresses optimum standards for the physical resilience of an urban settlement concerned. However, it suggests different approaches for developing countries and developed countries, respectively. These different approaches are designed in terms of different priorities as already mentioned. The model is flexible enough to be modified for urban settlements with different features in terms of geographic, demographic, administrative, and social aspects. The variables used in the model and the checklist are open to be updated to changing conditions of urban settlements over time. Multi-dimensional features and prospective methods of the discipline of city planning are taken into account in designing the model. Thus, the model concludes with a feedback on a selected country as well as international data on the basis of periodical monitoring and scientific research.

The comparative case study serves a basis for developing and testing the aforementioned model. A synthesis of the 1999 Eastern Marmara Earthquakes lessons learned and the international experience with comparable features provide guidance to building the thrust of the model. Yalova located on the Eastern Marmara Earthquake Zone has been selected to add further specifics to the aforementioned lessons learned. Cologne as a high seismic city in Germany is used to test the proposed model. If the proposed guidelines of the model are confirmed in Cologne, they might also be relevant for other disaster-prone urban settlements. Although there are several urban settlements which are prone to earthquake risks, the City of Cologne was selected due to its remarkable particularities in the dimension of earthquake potential and possible

loss in its valuable urban assets as well as its lack of experience in terms of devastating earthquakes.

The comparative case study also provides an opportunity to support the proposed distinction between urban settlements of developing countries and developed countries, respectively for mitigating natural disasters. Despite the fact that Turkey is not a developing country, she has similar vulnerability features as developing countries due to her rapidly increasing population and densely constructed urban settlements. Firstly, the proposed model is assessed and formed entirely in the frame of the existing urban physical resilience features of Yalova such as recent spatial plans, building codes as well as relevant authorities and their responsibilities. As a result, the degree of its resilience is measured in accordance with the model in accordance with the recommended priorities of developing countries. Secondly, the degree of the physical resilience of Cologne is measured in the lights of interviews with relevant authorities and outputs of questionnaires in the worst case earthquake scenario in accordance with the recommended priorities of developed countries.

The test results aim at paving the way to developing earthquake resilience in Cologne. They may also provide guidance for further disaster resilience activities towards other types of natural disasters by modifying relevant parts of the model. In this respect, the proposed model is an instrument providing guidance to the local authorities as well as to policy- and decision-makers of Cologne by asking them some key questions and proposing some studies in response to their answers. However, due to time constraints for the study, the confidential nature of some data, and the hesitation of some authorities to give genuine answers to questions on earthquake risks, the proposed model could not be entirely completed on the basis of information received from authorities. Rather, the model was supplemented according to data collected via interviews and questionnaires in Cologne.

The proposed model of disaster resilience can be modified according to the different features of an urban settlement concerned as well as characteristics of the natural disaster which threaten that urban settlement. If applied correctly, the model will provide guidance towards a disaster resilient urban settlement. The success of the model depends on the willingness and openness of the relevant authorities to apply it. In the meantime, the checklist form of the model provides an opportunity for further development. Experience from applying the model to different urban settlements prone to various disasters can add further questions or modify existing ones. To have a potential for dynamic development, the proposed disaster resilience model can provide long-term guidance to urban settlements.

Keywords: Disaster mitigation, urban settlements, physical vulnerabilities of urban settlements, risk assessment, disaster resilience, disaster resilience model

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CHAPTER 1:

1. INTRODUCTION

1.1. Hypothesis and Research Questions

Recently, natural disasters with devastating effects on human settlements have proliferated. In light of this fact, this study aims at searching for the possibility of designing a disaster resilience model for urban settlements. Since urban settlements are habitats of human beings where are densely populated and constructed (infrastructure and buildings), they have high natural disaster risks. Unless the new planning strategies integrated with disaster mitigation approaches are not applied into the urbanization process, urban settlements unfortunately will still have high natural disaster risks. There are some main principles, policies, strategies, and standards to guide disaster prone urban settlements to mitigate disasters. In sum, the following hypothesis is the main determinant of the scope of this study:

HYPOTHESIS: As urban settlements are particularly vulnerable to various types of disasters, new strategies and concepts are needed to enhance disaster resilience of urban settlements.

To clarify the above hypothesis, two issues, namely urban settlements and disaster resilience need to be explained shortly. The further explanations about urban settlements and disaster resilience are also available in the following parts and chapters (see also "1.2. Definitions and Concepts" & "4.1. Analysis of Existing Risks in urban Settlements"). The reasons of remarkable disaster vulnerability of urban settlements are (i) high population, (ii) dense construction in terms of super- and infra-structure, (iii) degradation of environmental quality due to their overpopulation and dense construction, (iv) economically and technologically high investments. Thus, urban settlements need to be disaster resilient which implies elasticity and flexibility in coping with

the particular challenges of the various natural disasters(Vale, L. J., Campanella, T. J.; 2005).

To serve this hypothesis, the main objectives are synthesizing data from international studies such as project reports from the UN, World Bank, and EU as well as best country examples; determining strengths, weaknesses, opportunities, and threats for urban settlements prone to disasters; transferring lessons learned from the 1999 earthquakes in Turkey; structuring guidelines; and testing the proposed guidebook. The method towards such a disaster-resilience model consists of a theoretical and an empirical part. The theoretical part consists of literature reviews, desktop researches, institutional visits and documents, and project evaluations and lessons learned from various countries and international projects. The empirical part consists of a comparative case study on earthquakes. Although the scope of the study covers all types of natural disasters, it won't be practical to test the disaster-resilience model for each natural disaster case. Based on field experience of the author, earthquakes are chosen as a topic of comparative case study. Yalova as a Turkish city located on the south-eastern coastal part of the Marmara Sea (see also fig. 9) and Cologne as a Germany city lies on the River Rhine in the Federal State of North Rhine-Westphalia (see also fig. 10) are selected for the comparative earthquake case study. While Yalova experienced a high intensity earthquake in 1999, Cologne has not yet experienced a devastating earthquake despite of its high seismic risk. This difference creates an opportunity to test the proposed disaster-resilience model which is designed based on lessons learned from the 1999 earthquakes in Turkey. The empirical part of the study also constitutes with additional relevant examples from personal experience in the Turkish Government in the field of urban planning and disaster mitigation, tests of the proposed model, and reflections of criticism received from international and scientific platforms.

In order to fulfill both theoretical and practical studies, the following research questions provide guidance:

RESEARCH QUESTIONS

- I.** How can disaster risks for urban settlements be defined and categorized?
- II.** What types of improvement should be proposed to develop disaster resilience of urban settlements (development of a resilience policy, a mitigation plan, an effective controlling process on construction and infrastructure quality, a comprehensive legislation, public awareness...)?
- III.** How can general rules be formulated in light of different local conditions for disaster resilient urban settlements?
- IV.** Is it possible to derive some principles, guidelines, strategies and standards from a review of international best practices?
- V.** Is it possible to test those principles, guidelines, strategies and standards in a (comparative) case study?

1.2. Definitions and Concepts

Definitions and concepts are important issues because there is not (yet) existing commonly shared established disaster terminology. In this study, since the main concept is resilience, the terminology on disaster, damage, hazard, loss, risk, resilience, recovery, mitigation is studied intensively. The concepts used in this study are more physical than social. Thus the concepts like damage, loss, hazard, risk, resilience, etc. denote physical dimension of settlements.

On the other hand, natural disasters, especially earthquakes are the core of the study. That's why a few concepts such as adaptation and coping capacity are defined according to the natural disaster features.

In order to define the principal terms, a literature survey was carried out. The terminology of the UN, JICA, FEMA, EU, and Turkish literature (including scientific publications and the documents and files of the Ministry of Public Works & Settlement) were scanned. The report prepared by experts of the ARMONIA (=Applied Multi Risk Mapping of Natural Hazards for Impact Assessment) Project funded by the European Community was also be taken into account in proposing a disaster terminology. Some key definitions related to the study are set out in the Annex III (see also Annex III). However the term "disaster resilience" is analyzed more than other terms due to its significance with respect to the topic of the study.

The concept of disaster resilience has been developed in the 21st century, in lieu of the previous concept of disaster resistance. Unlike the concept of disaster resistance, the concept of disaster resilience emphasizes elasticity and flexibility in coping with the particular challenges of the various natural disasters (Vale, L. J., Campanella, T. J.; 2005). Especially, with regard to the uncertainty of natural disasters, the term of resilience can provide a better guidance to produce effective disaster mitigation approaches in urban settlements. The disaster resilience concept is defined in terms of the adaptation capacity of a settlement system (built up and non-built up environment as well as community of life) potentially exposed to natural hazards with a view to maintaining or restoring an acceptable level of functioning and structure (Greiving et al.,2006). As already mentioned, this study focuses on physical resilience of urban settlements in the case of disasters.

In addition to developing a disaster terminology it is useful to clarify the concept of urban settlement. The definitions of urban settlement are varying country by country and/or institution by institution like disaster terms. Actually, the concept of urban does not denote a

certain definition but a process. It is possible to describe this process as a scale proceeding from rural to urban. In this frame, all cities are urban settlements but not all urban settlements are cities. Although the concept of urban settlement differs country by country, it is generally identified in terms of size & function, threshold number of inhabitants, combination of criteria such as population density, political function, and predominant activity of the region (World Resources Institute, 1996-97).

In order to clarify the concept of urban settlements it is useful to review various planning approaches in terms of their criteria to form urban settlements during the urban history (Theory of Spatial Planning-Lecture Notes, 2009). As John Friedmann mentioned, a city is a place with all subjects concerning its functions, namely demographic, social, cultural, economic, technical-technological, physical, and administrative (Faludi, 1973: 212).

On the other hand, a rural settlement is also a place with similar functions such as demographic, social, cultural, economic, technical-technological, physical, and administrative. In this frame, criteria of the aforementioned functions are the key issues to clarify the differences between urban and rural settlements. For instance, in terms of demographic criteria, urban settlements has higher amount of population and density. In terms of social criteria, they have more heterogeneous and modern communities. The more, the urban social life is open to publicity. In terms of economic criteria, they have more economic developments, larger scale markets, various innovations in production, and different type of labour and labour organizations (Campbell & Fainstein, 2003). In terms of physical criteria, urban settlements have larger area and various types of land-uses which are more controlled with respect to development, conservation, environmental protection as well as urban design values (Faludi, 1973).

After clarifying the concept of urban settlements, it is easier to explain why urban settlements are at the focus of the thesis. Since an urban settlement is a center of denser population, construction, infrastructure, it has a high risk potential for disasters. In other words, urban settlements are more vulnerable settlements than rural settlements.

With respect to vulnerability, the thesis focuses on physical assets of urban settlements rather than social, administrative or psychological issues. That is to say, the disaster resilience of an urban settlement is supported by the model which includes construction, infrastructure, planning standards, and technical services. This approach also satisfies the concept of risk determined in this study for urban settlements prone to natural disasters. According to the definition, risk is a combination of the probability (or frequency) of occurrence of a natural hazard and the extent of the impacts. It is a function of the exposure and potential impacts as perceived by a community or settlement (see also Annex III). Since this study aims at reducing the undesired physical effects of natural disasters on urban settlements, the resilience model is developed on normative aspects such as codes, standards, guiding rules. As also stated in the annual report of "German Advisory Council on Global Change", when the effects of disasters are undesired, the concept of risk always implies a normative aspect (WBGU, 1998). On the other hand, when generating rules, methods, standards, and techniques to maintain physical resilience of urban settlements, it is difficult to separate the administrative, social, and economic issues from features of the urban physical structure. Thus, the administrative, social, and economic issues will also be evaluated in this study but the core of the study will focus on the physical/constructed part of urban settlements.

1.3. Objective and Purposes of the Thesis

The thesis, on the basis of a review of the pertinent literature is envisaged to ascertain some broad guidelines for disaster mitigation, including standards, criteria, and building codes for disaster-prone urban settlements. These guidelines will be tested in the comparative case study. The guidelines that tested will provide the basis for formulating short-, medium-, and long-term policies and strategies for promoting disaster resilient urban settlements in Turkey, especially in earthquake-prone regions. These strategies and policies will finally be translated into planning principles for disaster resilient urban settlements in Turkey (1999 Marmara Earthquake Region). Then the city which has earthquake risks but not yet experienced a severe earthquake, namely Cologne will be tested by these determined policies, strategies, and criteria. Finally, pathfinder recommendations will be explored for disaster resilient urban settlements in worldwide.

The proposed thesis is envisaged to provide a contribution to disaster mitigation know-how developed under the lead of the EU, the World Bank, UNDP, and JICA. Such a contribution would be particularly useful for Turkey where non-compliance to building codes and negligence in urban planning have significantly exacerbated the damages caused by (natural) disasters and where continued population agglomerations in some regions with high disaster propensity further increase the threads of future catastrophes.

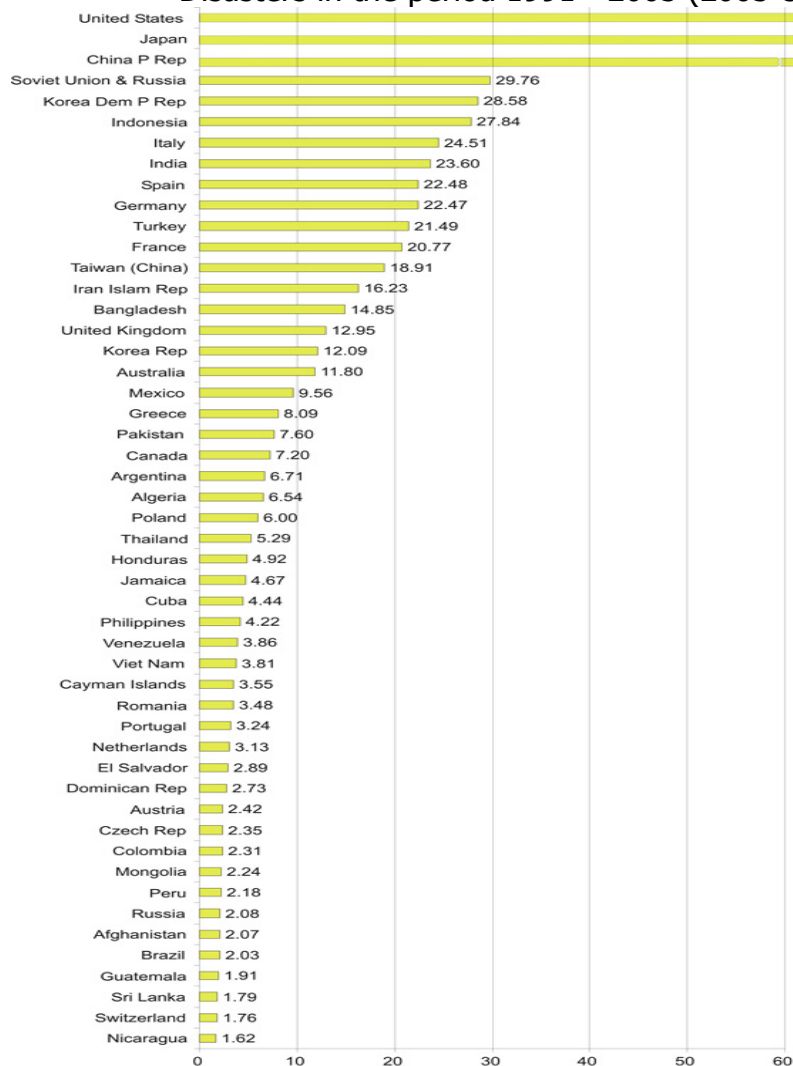
The aforementioned organizations have played an important role towards improving disaster-prone settlements. They have also carried out projects for enhancing early warning systems, disaster preparedness, and public awareness. However, city planners in Turkey would obtain useful guidance from a synthesis of the lessons learnt in the various activities on disaster-resilient settlements. In this context, the author is benefiting from her involvement in the disaster mitigation

of the 1999 earthquakes in Turkey (team leader of relevant World Bank Project, Department Head of newly established D.G. of Emergency Management). The 1999 earthquakes present a milestone in disaster mitigation experience in view of their magnitudes (7.4 / 7.2 Richter Scale) and extensive devastating effects on the densely populated heartland of Turkish industry (JICA, 2004). From the dynamics of disaster mitigation experienced in this case, tentative conclusions can be drawn for disaster mitigation at large.

1.4. Scope of the Study

Recently, natural disasters with devastating effects on human settlements have proliferated. The top 50 countries of the world are ranked by International Strategy of Disaster Reduction on the basis of their financial losses suffered in the last decade due to natural disasters (see also fig.1). The propensity of disasters is increasing in the light of such trends as increasing rate of population in and around metropolitan areas, degrading environmental quality, global heating. By the year 2000, half the world's population will live in urban areas, crowded into 3% of the earth's surface (Domeisen & Palm, 1996). In addition to the density of population, urban settlements are especially prone to high risks of natural disasters due to the density of construction and accumulation of investments (see further "4.1. Analysis of Existing Risks in Urban Settlements").

Figure 1: Total Amount of Reported Economic Damages: All Natural Disasters in the period 1991 - 2005 (2005 US \$ Billion)



SOURCE: Website of International Strategy of Disaster Reduction (<http://www.unisdr.org>)

Especially in Turkey, since the 1999 Eastern Marmara Earthquakes, it is understood that urban settlements have higher risks than other settlements such as rural settlements and villages constructed in low density. In the 1999 Eastern Marmara Earthquakes of Turkey, five main cities were affected by the disaster, namely Istanbul, Kocaeli, Sakarya, Düzce, and Yalova. The magnitude of losses was due to high population and construction density in the region. Moreover, many industrial production facilities were located on fault lines. As a result, those cities were faced with some major technological disasters triggered by the earthquake such as the fire in TÜPRAS Gas Refinery

and the spilling over of some dangerous and poisonous chemicals from the AKSA textile factory.

Thus, urban settlements are high disaster risk areas not only because they are densely constructed but also due to the vicinity of accident prone plants to residential areas. Technological disasters may lead to a collapse of infrastructure and main technical services, such as electricity, water, and gas.

Another major difficulty has been experienced in, disaster response activities such as search and rescue, debris clearance, evacuation of people, provision of food and shelter, and provision of security in urban settlements in the course of disasters. Firstly, such activities include time consuming efforts and require an extensive organization of works. Secondly, disaster response activities in urban settlements have led to considerable interruptions and delays in daily routines of the country. Thirdly, they come at considerable financial expenses. For those reasons, it is useful to concentrate on disaster resilient urban settlements with a view of saving human life, economic resources, environmental sustainability as well as socio-cultural and historical assets.

In order to draw the guidelines for disaster resilience, this study starts from the 1999 Eastern Marmara Earthquakes in Turkey as a lesson learned example. As already mentioned, although the scope of the study covers all types of natural disasters, it won't be practical to test the disaster-resilience model for each natural disaster case. Based on field experience of the author, earthquakes are chosen as a theme for the process of the model building. In this process, some principles are derived with the aim of providing guidance for urban settlements on how to be disaster resilient. In the context of resilience, as already mentioned, the proposed model focuses on physical resilience (see also

"1.2. Definitions and Concepts"). However, it should be emphasized that the term "resilience" does not covers only a spatial issues but also all other relevant processes affecting spatial development. Such endeavours as construction and infrastructure quality upgrading, proper site development, correct implementation of planning principles are not only related to spatial issues. In order to carry out those endeavours, proper legislation (laws, by-laws, building codes, and related standards) and implementing as well as controlling capacities are required. The study also explain the roles of the key actors, appropriate procedures, roles of stake holders, roles of policy makers, interactive process among all decision makers with a view to the dynamics of urban disaster resilient settlement.

The guidelines derived from the analysis of the 1999 Eastern Marmara Earthquakes in Turkey are compared with accumulated disaster mitigation experiences reported in international literature and project reports of international organizations on selected disasters. As a result of this comparison, it is expected to attain a synthesis of the 1999 Eastern Marmara Earthquake experiences with international experiences towards comparable features.

Since disaster boundaries do not necessarily coincide with political borders (e.g. A disaster occurred in a country can possibly affect several neighbour countries), this study encompasses geographical regions neighbouring Turkey. For instance, in the past several disasters that occurred in Turkey had sequential effects in European countries. In addition, there exist some geographical and geological sources of disaster risks that is common in Turkey and European countries such as fault lines, mountains, and rivers. For these reasons, a comparative case study between a Turkish city (Yalova) and a European city (Cologne) is included in the study.

1.5. Methodology

As already mentioned in "1.1.Hypothesis and Research Questions", the method towards a disaster-resilience model consists of a theoretical and an empirical part. The theoretical part consists of literature reviews, desktop research, institutional visits and documents, and project evaluations and lessons learned from various countries and international projects. The empirical part consists of (i) a comparative case study on earthquakes as a basis of testing the proposed model, (ii) additional relevant examples from personal experience in the Turkish Government in the field of urban planning and disaster mitigation, and (iii) reflections of criticism received from international and scientific platforms.

To build a disaster resilience model for urban settlements, an integrated disaster mitigation approach is proposed in view of the multi-dimensional aspects of urban settlements. An integrated disaster mitigation approach does not only focus on urban space but also considers other aspects of urban settlements to maintain physical resilience. While the details of this approach are reflected in the proposed model subsequently, the following main components of this approach are listed below:

- Policy making process (supranational, international, interregional, national, local),
- Organizational procedures to address relevant actors/responsible bodies (at international, national, regional, local, citizens levels),
- Legislation and Control (laws, by-laws, building codes, standards, controlling mechanisms),
- Scientific research and technological integration,
- Coordination, organization, networking and harmonization.

The above method is developed in light of best international examples and lessons learned from 1999 earthquakes in Turkey. The relevant

experience in Yalova served to further develop the model. As a result of the above studies, some main principles, policies, strategies, and standards are derived to provide guidance in form of a checklist for other disaster prone urban settlements with a view to disaster resilience. To illustrate the applicability of the model, the aforementioned checklist is tested with respect to Cologne. The results of this test provide two opportunities, namely assessing the physical resilience of Cologne to earthquakes and modifying the test according to dynamics of an urban settlement.

CHAPTER 2:

2. MAIN DISASTER MITIGATION APPROACHES IN THE WORLD

In this part it is aimed to draw a disaster mitigation profile upon a review of approaches worldwide. For that purpose disaster mitigation approaches of some countries and some organizations will be surveyed. These countries & organizations will be selected with a view to sampling the most developed legislation and organizational structures. The scope of these samples will be determined within the timing and financial parameters of the thesis.

At the end of this chapter, the comparative analysis of the following selected examples with respect to their disaster mitigation activities is presented in a table (see also table 5). This analysis can provide guidance to design a rough draft of disaster resilience model.

2.5. United Nations Organizations

The following United Nations organizations have issued documents that reflect multi-country experiences on disaster prevention and mitigation: International Strategy for Disaster Reduction(=ISDR), Office for Coordination of Humanitarian Affairs(=OCHA), The Office of the United Nations Disaster Relief Co-ordinator (=UNDRO), United Nations

Development Program(=UNDP), The United Nations Disaster Assessment and Coordination (UNDAC) team, International Search and Rescue Advisory Group (=INSARAG), Field Coordination Support Section (FCSS), Virtual Operations Coordination Centre (VOSOCC), UN Volunteers(=UNV), Relief Web,...

Especially for this study, documents and activities of ISDR are helpful. Because "the ISDR aims at building disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable development, with the goal of reducing human, social, economic and environmental losses due to natural hazards and related technological and environmental disasters." (http://www.unisdr.org/eng/about_isdr/isdr-mission-objectives-eng.htm)

International Strategy for Disaster Reduction (=ISDR)

Actually ISDR is an successor program of the International Decade for Natural Disaster Reduction (=IDNDR). On 11 of December 1987, the General Assembly of the United Nations designed a program to decrease the loss in disasters in the period of 1990-2000. According to the UN assessment at the end of the IDNDR period, there are some achievements especially in facilitating the common efforts of political, scientific, and technological groups on disasters. IDNDR had also efficient publications called "Stop Disasters" that are also useful for disaster researches e.g. many volumes of that periodical were used in this study. (IDNDR:1994) Due to these remarkable success, the United Nations designed a new program after IDNDR as a new body of coordinated action programs which is called International Strategy for Disasters (=ISDR). (ISDR:2007)

As it is mentioned before, ISDR is designed by the UN Assembly as a successor program of IDNDR. It aims disaster reduction by increasing

of disaster awareness as an integral part of sustainable development. ISDR tries to satisfy that aim to build an integral approach of social, economic, and environmental dimension of communities on the basis of disaster resilience. ISDR generated 4 main objectives to achieve that aim as follows:

1. Increase public awareness to understand risk, vulnerability and disaster reduction globally
2. Obtain commitment from public authorities to implement disaster reduction policies and actions
3. Stimulate interdisciplinary and inter-sectoral partnership, including the expansion of risk reduction networks
4. Improve scientific knowledge about disaster reduction

The central office of ISDR is in Geneva/Switzerland and regional units are in Costa Rica and Kenya. ISDR is also focal point in the UN System to coordinate and support all disaster related efforts such as disaster reduction activities, disaster policy integration, disaster awareness campaigns, disaster related publications, and information. ISDR works in a cooperation with the Inter-Agency Task Force on Disaster Reduction (=IATF/DR) and the Inter-Agency Secretariat of the ISDR to achieve efficiency in disaster reduction. (ISDR Mission and Objectives:2007)

One of the main recent initiatives of ISDR is guiding to establish/support National Platforms for Disaster Risk Reduction. This initiative was organized after the December 2004 Indian Ocean tsunami disaster. Various countries who have national platforms for disaster risk reduction and who have some plan to establish national platforms for that purpose, entrusted the UN/ISDR secretariat to their national data and documents to reorganized as a new reference document. The concept of disaster reduction consists of many fields or denoted various mechanisms such as political and legal issues and frames, public awareness, science and technology, planning and

standards, organization & coordination, early warning systems, response mechanisms, and effective disaster preparedness. This concept also denotes multi-stakeholder national mechanisms such as various government sectors, NGOs, academic institutions, private sectors, and the media. The countries which prepared their data and documents according to this main frame are China, France, Germany; Iran; Italy, Japan, Madagascar, Nigeria, Norway, Panama, Peru, Senegal, South Africa, and Uganda.

In the World Conference of Disaster Reduction 2005, 168 governments adopted the Hyogo Framework Action for the period of 2005-2015 to build disaster resilient nations and communities. The main objectives of the Hyogo Framework Action are establishing and strengthening multi-disciplinary national platforms for disaster risk reduction and coordinating the all national platforms via UN/ISDR secretariat to facilitate integrating them in the case of disaster. (International Strategy for Disaster Reduction; 2007)

The Office of the United Nations Disaster Relief Co-ordinator (=UNDRO):

The UNDRO has published a seven-volume-study on Disaster Prevention and Mitigation including a methodology for evaluating economic effects of natural disasters. It suggests that economic effects of natural disasters be grouped into three categories:

- Direct effects on the property and income of the persons, business enterprises and communities affected by the disasters
- Indirect effects which result from the reduction in family income and the decline in the production of other business enterprises, in a chain reaction

- Secondary effects which may appear some time after the disaster such as epidemics, inflation, increase in income disparities, isolation of farming areas.

The first group includes the loss and damage to properties such as buildings and equipment. In this context, properties may be related to some main sectors such as agriculture, industry, infrastructure, housing, commerce, and services. These sectors are typically concentrated in urban settlements. Due to such concentration, the vulnerability of urban settlements to natural disasters such as earthquakes, floods, landslides, avalanches, volcanic eruptions, cyclones tend to be higher than in other regions.

The features and dynamics of urban settlements vary according to levels of development and other particularities. Importantly, urban settlements in developing countries tend to be more vulnerable to natural disasters than those in developed countries. This proposition is supported by the following characteristics of conurbations in developing countries:

- ✓ Special difficulties in disaster response and mitigation due to rapid urbanization and population agglomeration
- ✓ Lack of resources for the disaster improvement works while investment programs in other regions run
- ✓ Problem of enforcing building codes and planning standards despite highly populated and rapidly growing conurbations
- ✓ The higher economic loss in urban settlements resulting from local concentration of facilities due to high population

Against this background, UNDRP has developed some proposals on approaches toward improving disaster resilience of disaster prone urban settlements. One of its proposals is to carry out simulation studies with a view to obtaining a better assessment of the

vulnerability of urban settlements which are particularly prone to natural disasters. Such studies, it is further proposed, could provide the basis for designing a global prevention policy comprising measures towards more effective protection of the population and the reflection of disaster resilience objectives in urban planning regulations.

UNDRO furthermore proposed to assess urban settlement policies in light of actual disaster experiences by means of Cost-Benefit Analysis. From the economic point of view cost-benefit analyses at first sight appear as an appropriate tool for such assessment. However cost-benefit analyses depend on various types of direct and indirect costs and benefits of assessed policies and their implementations. Since the planning is a multi-dimensional discipline, multiple criteria should be used to make such assessment meaningful. UNDRO recognizes this difficulty and tries to develop a model towards an integrated planning methodology. It includes analytical steps backwards where results appear to be inadequate. For instance, alternative urban projects are developed for disaster mitigation. If the criteria under one approach do not sustain a desired result towards disaster resilient settlements, it is possible to go back to test an alternative approach to reach that result. As a result of cost-benefit analyses through integrated planning methodology exercises, it is possible to determine some principles of efficient planning for disaster resilient urban settlements. The main principle to serve this objective is to integrate vulnerability analysis into physical planning policy. An action program to satisfy this main principle may be drawn up into the following stages:

- ✓ To prepare checklists of risk for each type of natural disaster
- ✓ To prepare checklists of risk-relevant urban features (building stocks, open spaces, quality of infrastructure and services, population and immigration statistics)

- ✓ To re-model urban centers to make them safer for each type of natural disaster
- ✓ To synthesize outputs of different re-models
- ✓ To make zoning in light of risk propensity and urban planning constraints
- ✓ To draw effective policies with a view to minimizing the vulnerability of each zone

According to UNDRO such action program is not sufficient for disaster mitigation in the cases of earthquake and cyclones that are effective on a country-wide. For such cases, risk analyses must be carried out at the regional or even national scale planning into account such factors as seismicity indicators on the basis of geological formations and the sites of previous epicenters together with historical records which vary both in scale and type.

UNDRO concludes that in order to be fully effective in disaster mitigation, the analyses should be carefully adapted to the institutional structures and procedures generally used in the planning process and in the prevention of disasters. In the prevention and mitigation of natural disasters, proper socio-economic studies are inevitable. In this context, effective means of improving the coordination of the activities of responsible authorities (ministries, public bodies, and local communities), research centers and other competent organizations play an important role. (The United Nations Disaster Relief Co-ordinator Office, 1979)

The UN-SPIDER:

The UN-SPIDER is a quite new program of the United Nations Office for Outer Space Affairs (UNOOSA). It is an information provider program for space-based information for Disaster Management and Emergency

Response. In other words, UN-SPIDER has a larger definition in UNOOSA Website as in the following:

“In its resolution 61/110 of 14 December 2006 the United Nations General Assembly agreed to establish the “United Nations Platform for Space-based Information for Disaster Management and Emergency Response – UN-SPIDER”, as a new programme of the United Nations Office for Outer Space Affairs, to provide universal access to all countries and all relevant international and regional organizations to all types of space-based information and services relevant to disaster management to support the full disaster management cycle by being a gateway to space information for disaster management support, serving as a bridge to connect the disaster management and space communities and being a facilitator of capacity-building and institutional strengthening, in particular for developing countries.” (The United Nations Office for Outer Space Affairs; 2007)

The UN-SPIDER is a voluntary program based on voluntary contribution of member states. So far, voluntary contribution countries are Germany, Switzerland, and China. China has well-established office in Beijing, Germany has in Bonn, and Germany & Switzerland have a liaison office in Geneva. It is likely that voluntary contributions will increase over time (see also Annex I.1).

Despite it is newly organized program, UN-SPIDER already organized a workshop to promote the access and use of space-based technologies and solutions for disaster management and emergency response within the relevant communities in 29–31 October 2007 in Bonn/GERMANY. The workshop participants are decision-makers and senior experts of various responsible national and regional institutions for providing disaster management support, capacity building in and promoting the use of space-based technologies; UN SPIDER Regional Support Offices and national focal points; UN agencies and NGOs involved in disaster management mitigation and relief; space agencies; academic and

research institutions; geospatial information management and IT companies.

Major topics on the basis of UN-SPIDER objectives to be discussed at the workshop were as follows:

- Identification of relevant space-based information for Disaster Management Support and Emergency Response including on-going and planned initiatives, case studies and best practices, archived data for disaster studies and capacity building opportunities.
- Definition of a Knowledge Portal to ensure that relevant information is easily accessible and disseminated to all interested end-users including the design of an appropriate information database system
- Identification of existing and planned Communities of Practice that contribute to bringing together the space-based technology and disaster management communities
- Discussion and definition of a knowledge management and transfer framework and implementation of specific activities that will contribute to the transfer of knowledge.
- GEOSS Capacity Building Task CB-07-02 - Knowledge Sharing for Improved Disaster Management and Emergency Response
- Harmonisation of the various existing initiatives that are contributing to helping developing countries access and use space-based technologies for disaster management and risk reduction (The United Nations Office for Outer Space Affairs; 2007)

While UN-Spider has still organized meetings, conference, and workshops on disasters, it regularly informed to various interest groups about those activities.

2.6. USA

In the USA, the main approach for emergency disaster management is "Integrated Emergency Management System" instead of drawing separate management methods for each disaster. The Integrated

Emergency Management System (=IEMS) provides an opportunity to incorporate all available resources such as federal and local resources as well as resources of NGOs and other interest groups. There are four phases in IEMS namely, preparedness, response, recovery, and mitigation. According to the general point of view, since "all disasters are local"(International Emergency Management Symposium, 2002), local authorities are responsible for the first response and the emergency management. Nevertheless there is coordination among the federal government, the federal state, and local authorities to support all activities in financial and technical terms.

There is an agency for emergencies and disasters that reports directly to the President. It is called Federal Emergency Management Agency (=FEMA). USA has ten disaster regions in which FEMA cooperates with regional organizations, local governments, private volunteer organizations, units of international organizations and other local organizations. In 1999 Eastern Marmara Earthquake, a central disaster coordination organization like FEMA was built in Turkey. It is called the General Directorate of Turkish Emergency Management which works under the Prime Ministry. (See also "3.2. Institutions Involved in the Disaster Mitigation Process") FEMA and its modern operations are very important examples for the thesis.

FEMA was established in 1979. It was originated from the Council of National Defence in 1916. The main task of FEMA is providing guidance in national level, funding, disaster training, and recovery programs. The legal frame of its responsibilities is drawn by the Robert T. Stafford Act. The Act clarifies the requirements for the Presidential Declaration of Disaster or Emergency. According to the Act, the Federal Government activates resources of FEMA and the Federal Response Plan when the means of a disaster prone State are beyond to cope with the disaster. The Federal Response Plan considers all federal agencies, establishes policies and procedures, defines the scope of operations, builds coordination mechanism among, explains the federal responsibilities

and capabilities, the federal government and federal states, addresses response, recovery, and mitigation activities. In sum, the Federal Response Plan integrates the central and local needs and provides assistance to restore infrastructure and to protect the disaster prone region against future disasters (International Emergency Management Symposium, 2002).

On the other hand, the Robert T. Stafford Act provides a mitigation planning framework for each federal state to facilitate the preparation of its own disaster plan of actions. The mitigation planning framework drawn by the Act constitutes following components (Godschalk, 1999):

- Assessment of natural hazards
- Analysis of existing policies and local capabilities of the hazard mitigation
- Hazard mitigation goals and objectives
- Proposed strategies, programs, and actions
- Proposed approach to implementation
- Proposed approach to monitoring of implementation and hazard conditions
- Proposed approach to updating the plan
- Proposed approach to evaluating the plan and its implementation

Each federal state must have a mitigation plan prepared according the components above if it needs to get federal grants for hazard mitigation following a declared disaster. Each federal state should also prepare an identification of a project which will be funded and a coordination schedule with other related local institutions.

The Federal Disaster Recovery Program constitutes with individual assistance, public assistance, hazard mitigation, and small business administration is another program also managed by FEMA. The share of the federal government to fund the Program is 75%. The rest is

funded by federal states (International Emergency Management Symposium, 2002).

It is possible to see that an increasing awareness of environmental protection influences the activities of FEMA such as disaster response, recovery, mitigation, and preparedness. In parallel to Federal environmental laws, FEMA guides to local authorities and central institutions to insert environmental requirements into the mission of disasters, e.g. site selection of temporary housing, debris management, improvement of infrastructure, hazard mitigation projects, etc. FEMA aims at not only protection of environmental resources but also minimizing potential adverse impacts to children and low income and minority groups of people (Environmental Documents, 2008).

Since the scope of the thesis is to draw the guidelines for disaster resilience based on lessons learned 1999 Eastern Marmara Earthquake in Turkey, it is also useful to pay much attention on the earthquake mitigation policy of the USA. The USA earthquake mitigation policy constitutes of updated building codes, mapping of fault zones, determining restrictions on buildings in fault zones, inserting seismic elements, general safety elements and retrofitting programs into local plans. To serve the earthquake mitigation policy, the USA has an initiative called the National Earthquake Hazard Reduction Program (=NEHRP). The program was created by the Earthquake Hazards Reduction Act in 1977. The scope of NEHRP is funding earthquake research activities, clarifying the dynamics of seismic hazards, and organizing training and technical assistance. NEHRP supports central and local earthquake mitigation activities via some sources of funds, namely, the Federal Emergency Management Agency (=FEMA), the U.S. Geological Survey (=USGS), the National Science Foundation (=NSF), and the National Institute for Standards and Technology. In addition to these funds, the USA also updates seismic insurance system (Godschalk, 1999).

In addition to those efforts of the central government, each federal state pays its own effort for disaster mitigation. For instance, the practice in the State of California is remarkable to be mentioned shortly. The California Public Resources Law requires that all natural hazards should be mapped. The local governments in the State of California have to display these maps publicly to provide transparency for the real estate market. The data of these maps are updated by the feedback of relevant public institutions such as the US Geological Survey and the California Geological Survey as well as relevant experts e.g. planners, geologists, etc. The California Geological Survey manages geological surveys in the State of California in the directions of the Alquist-Priolo Earthquake Faults Zoning Act. According to the Act, it is compulsory to prepare 1/24.000 scale geological and seismic failure map in each earthquake zone. As a synthesis of various earthquake zone maps, an Urban Geology Master Plan for the State of California was already prepared. This Master Plan shows guidance to spatial planners for the preparation of settlement plans of each settlement in California (The Turkish Ministry of Public Works & Settlement, 2006).

2.7. The European Union

The review of related legislation in the EU will encompass both the Acquis Communautaire and Member States legislations. Although the Acquis Communautaire does not include a legislative framework for disasters, in last 5-6 years there are some relevant EU initiatives, such as the Community Mechanism for Civil Protection(Council Decision of 23 October 2001), EU Strategic Environmental Assessment Directive (SEA, 2001/42/EC; European Parliament & European Council, 2001), a Community Framework For Cooperation in the Field Of Accidental or Deliberate Marine Pollution (a later Commission Decision of 29 December 2003 laid down the rules for the DECISION No 2850/2000/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 December 2000).

While there are only a few ad hoc legislations, Europe as a geographical region is prone to various natural disasters. Since the Western, Eastern, and Central parts of Europe have big rivers, these parts have been threatened by floods. The Southern part of Europe and the Mediterranean region have been threatened by forest fires and drought. The Western part of Europe and British Islands have been threatened by storms. The mountain areas notably the Alps, the Pyrenees, and the Carpathians have been threatened by landslides and avalanches. Earthquakes and volcanic eruptions pose relatively smaller threats in the European region compared to the other types of natural disasters. Only some specific areas in the Central and Eastern Mediterranean are threatened by earthquakes and volcanic eruptions. The table below provides a natural disaster profile of Europe. However, these table figures do not show all disaster events in the period of 1970-2005. Disaster events were recorded only either caused more than 10 casualties and/or 100 or more people were injured; and/or there was a declaration of a state of emergency; and/or there was a call for international assistance.

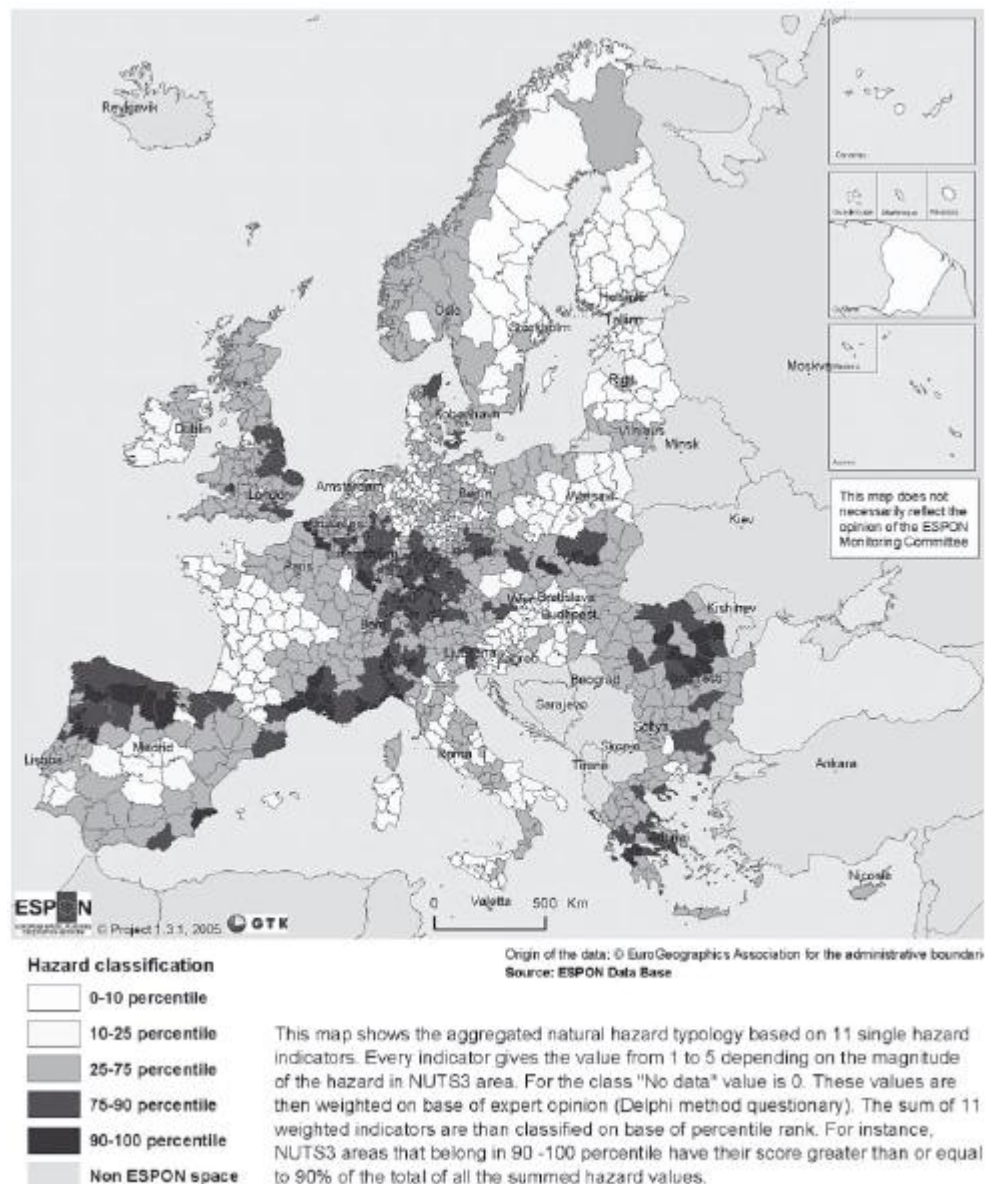
Table 1: Reported Effects of Selected Larger Natural Disasters on European Countries (1970-2005)

DISASTERS/RECORDS	NUMBER OF DISASTERS	CASUALTIES	ESTIMATED COSTS FOR DAMAGE (in 1000 €)
FLOOD	274	3 270	53 577 458
WINDSTORM	215	1 546	34 403 573
EARTHQUAKE	123	19 644	43 936 462
EXTREME TEMPERATURE	69	47 466	1 889 329
WILD FIRES	63	248	2 471 688
SLIDES	46	1 314	1 023 464
DROUGHT	26	0	12 989 281
VOLCANO ERUPTIONS	7	9	36 769
WAVE/SURGE	1	11	0
TOTAL	824	73 508	150 328 003

SOURCE: Greiving et al., 2006 (EM-DAT, 2005)

The above figures clearly show that financial losses from natural disasters are high in the EU while casualties from natural disasters are relatively lower compare to the casualty figures of developing countries. The table below shows the geographic distribution of natural hazards in Europe. The table is prepared according to the "NUTS" definition used for statistical purposes in the European Union. NUTS means "Nomenclature of territorial units for statistics" and NUTS 3 refers to the regional level. The aggregated natural hazard typology consisting of 11 natural disasters is used for preparing the figure below (see also fig.2). These disasters are avalanches, droughts, earthquakes, extreme temperatures, floods, forest fires, landslides, storm surges, tsunamis, volcanic eruptions, and winter & tropical storms. For each natural disaster, there is a scale showing the magnitude of the hazard from 1 to 5 (Greiving et al., 2006).

Figure 2 : Aggregated Natural Hazards in Europe



SOURCE: Schmidt-Thomé, 2006

The "Figure 2" shows that the damages from natural disasters in Europe are considerable. In addition to the EU Solidarity Fund which intervenes mainly in cases of major natural disasters, the European Union should have a developed disaster legislation and multidimensional disaster mitigation policy. While this does not exist thus far, the European Union has taken some relevant initiatives in the last few years. For example, one of its recent attempts is a Directive on the Assessment and Management of Floods adopted by the European Commission on 18 January 2006 (COM (2006)15 final of 18.1.2006).

The Directive mostly outlines approaches and a general frame for flood risk management but does not describe the tools in detail. It proposes the following obligations of the Member States:

1. Preliminary Flood Risk Assessment: Risk mitigation measures should focus on areas where potential significant flood risks exist or are reasonably foreseeable in the future. River basins, sub-basins or stretches of coastline with potentially significant flood risk at present or in the future, should be identified in the Preliminary Flood Risk Assessment. For these river basins and/or sub-basins no further action would have to be taken.
2. Flood Risk Maps: With the possible exceptions provided for in the Preliminary Flood Risk Assessment, flood risks would be mapped for the river basins and sub-basins with potentially significant risk of flooding in order to increase public awareness; support the process of prioritizing, justifying and targeting investments and developing sustainable policies and strategies; as well as to support flood risk management plans, spatial planning and emergency plans. Where maps conforming to the requirements of the directive already exist for river basins and stretches of coast line, Member States may use these existing maps for the purposes of satisfying the directive.
3. Flood Risk Management Plans: With the possible exceptions provided for in the Preliminary Flood Risk Assessment, flood risk management plans would be developed and implemented at the river basin/sub-basin level to reduce and manage the flood risks. These plans would include an analysis and assessment of flood risk, a definition of the level of protection, and an identification of sustainable measures. Such measures would follow the principle of solidarity which require not to pass on problems to upstream or downstream regions and preferably to contribute to reducing flood risks in upstream and downstream regions.

While the general guidelines above are compulsory, the details of implementation such as detailed objectives and deadlines for managing

flood risks are left to the Member States. ("European Flood Action Program":2006)

Furthermore, there are EU documents that indirectly provide guidance on enhancing disaster resilience such as Eurocode 7 & 8. These two documents were originally prepared for the purpose of designing spatial planning policies among Member States in late 1990s. (Eurocode 7-1997, Eurocode 8-1998) Eurocode 7 deals with geotechnical design including ground surveys and soil analysis. Eurocode 8 addresses the design of structures for earthquake resistance. However these two documents are not binding legal instrument but recommendations to Member States in designing their own laws for building disaster resilient settlements. (The Turkish Ministry of Public Works & Settlement-General Directorate of Disaster Affairs: 2006)

As a result, The European Union should start to pay more intension on disaster mitigation. Recently, EU has much intention on cohesion policies and economic models. Since the loss in disasters will cause many economic problems, it may possible to insert disaster mitigation approaches into the cohesion policies. The studies in vulnerability analysis, hazard assessment, and risk mitigation approaches should be supported in national and regional level. For example the existing Strategic Environmental Assessment Directive can be developed on this basis. It is also possible to update the Water Framework Directive under the threat of floods due to the climatic change or to assess together with the new Directive on the assessment and management of floods. Besides EU should also review its Interreg policies on the basis of disaster mitigation because disaster never pay attention on political boundaries. It is also possible to define new disaster interregional areas to produce efficient policies for the risk mitigation. Some Member States pay much attention to disaster issues like

Germany or France. Thus it is beneficial to study disaster mitigation implementations and some best examples. The examples of Germany, United Kingdom, and France are outlined bellows. Since the disaster mitigation is, or at least ought to be integrated into overall spatial and land-use planning, the review will start from general planning procedures, include building codes and construction permits, and add also institutions and mechanisms specifically aimed at disaster mitigation.

GERMANY

Before examining spatial planning system in Germany, it will be useful to review Germany's underlying administrative structure (see also fig.3). This structure sets on five hierarchical level namely, Federation (=Bund), sixteen federal states (=Länder), sub-districts (=Regierungsbezirken), counties (=Kreisen), and municipalities. The federal states have their own state authority and their own legislation. Thus authorities and responsibilities of administrative units vary from one state to another (Greiving et al., Eds. 2006).

Figure 3: Administrative Boundaries of Federal States in the Federal Republic of Germany



SOURCE: Statistisches Bundesamt Deutschland, 2008

As any other EU Member Country, Germany has spatial planning policies and the legislation initiated from the EU level. Despite the fact that there is no common Spatial Planning Act in the EU level, various frame laws and legislations have led to member countries in their spatial planning studies, e.g., EU Strategic Environmental Impact Assessment Directive (SEA, 2001/42/EC; European Parliament & European Council, 2001). The more, there are such EU programs leading to spatial policy making issues as “European Inter-regional Cooperation” (=INTERREG IV) and as its subprogram “European Spatial Development Perspective” (=ESDP), “European Spatial Planning

Observation Network" (=ESPON). Studies and projects of all these programs have been managed and organized by the Federal Ministry of Transportation, Building and Urban Development in Germany (The Federal Office for Building and Regional Planning of Germany,2008). Some other EU programs and perspectives have also some indirect effects on designing spatial planning policies of member countries. For instance, spatial planning policies and macro scale decisions in Germany are prepared in the lights of the Lisbon Strategy which aims at supporting inter-regional competitiveness and the European Union Territorial Agenda which aims at building efficient connections among cities and regions (Federal Ministry of Transport, Building and Urban Development of Germany, Eds.2006).

In country level spatial planning issues, in line with the federal state structure of Germany, spatial planning and land-use planning take place at the federal level (Bund), federal state level (Länder), and municipality level (Städte). On the federal level, macro goals and principles are defined and broad procedures are set out by (framework) legislation. On the federal state level, according to the Federal Regional Planning Act (Raumordnungsgesetz) the federal states are responsible for managing land-use policies by the "Regional Plan for the Territory of the State" (Raumordnungsplan fuer das Landesgebiet) and "Regional Plans for parts of the States" (Regionalplan). These plans include many aspects as energy, security, telecommunication networks, protection of nature, transportation, and economic development. On the municipal level, preparation of land-use plans are determined and executed. (Federal Ministry of Economics of Germany Twinning-Project in cooperation with the Turkish Treasury; 2005) In the preparation of land-use plans, the Federal Building Code (Baugesetzbuch) lays down similar objectives, instruments, and procedures for all municipalities. The land-use planning consists of two levels namely, preparatory land-use plan (Flaechennutzungsplan) and detailed land-use plan (Bebauungsplan). The preparatory land-use plan determines the main

features of the different types of land-uses for the whole area of the municipality. The detailed land-use plan determines the legally binding designations for small areas as a basis for building permissions (Greiving et al., Eds.2006).

The following table provides an overview of the responsibilities of the various planning institutions:

Table 2: Planning Institutions & Functions at the Federal Level

INSTITUTION	FUNCTION
Federal Parliament (Bundestag & Bundesrat) ¹	<ul style="list-style-type: none"> • Deals with macro level legislation such as environmental law
Federal Ministry of Transport, Building & Urban Development	<ul style="list-style-type: none"> • Responsible for the regional planning and settlement policy • Responsible for spatial planning • Formulates policies on national scale spatial planning, transportation, and urban development • Informs federal states about regional scale plans • Maintains federal highways and railways
Federal Office for Building & Regional Planning	<ul style="list-style-type: none"> • Builds information system on regional development • Assesses and comments on the regional development plans of the Federal Government
Federal Office of Statistics	<ul style="list-style-type: none"> • Plays subsidiary institutional role to support planning works

SOURCE: Kayikci, 2003

¹ The Federal Parliament in Germany constitutes with the Federal Council (=Bundesrat) and the Federal Diet (=Bundestag) . For detailed information see also. <http://www.bundesregierung.de>

The Federal Office for Building & Regional Planning has a remarkable function in planning process as it provides technical support and views on issues of spatial planning, urban development, and settlement to the Federal Government and other related authorities. It is a research institution affiliated with the Federal Ministry of Transport, Building & Urban Development. It was founded in 1998 assuming the functions of the previous Federal Public Works Directorate and the Research Institution of Regional Planning. According to the Federal Regional Planning Act, the Federal Office for Building & Regional Planning prepares periodic "Spatial Planning Reports" for submission to the Parliament through the Federal Ministry of Transportation, Building & Urban Development. The reports address spatial planning and development as well as sectoral planning issues in a detailed way. The reports suggest future spatial development trends in light of emerging dynamics. In preparing the reports, the office relies on the data of the Spatial Information System. Thus, the Federal Office plays a significant role in providing coordination and integration in the planning process in Germany. It collects all spatial data, processes, assesses and writes reports, and informs related institution including the Federal Parliament to achieve a consistency of overall central policies and planning policies.

In Germany, the main objectives in spatial planning and spatial planning policies are achieving a balance between advantageous and disadvantageous features of the development, reducing regional disparities, and creating conditions for ensuring equivalent living conditions in all regions. At this respect equivalence and sustainability are two key concepts in spatial planning studies. Equivalence does not mean to create identical living conditions in each settlement but equality of chances and ensuring certain minimum standards with respect to accessibility and availability of public services and other living standards. Sustainable spatial development is a concept also takes place in the Federal Regional Planning Act. It implies that the

social and economic demands on space are to be harmonized with its ecological functions. (Federal Ministry of Transport, Building and Urban Development of Germany/Federal Office for Building and Regional Planning of Germany;2006)

The planning process in Germany is furthermore characterized by horizontal and vertical coordination among planning institutions. Vertical coordination refers to the coordination of activities among at different levels of the State (central-federal states-municipal). Horizontal coordination refers to the coordination of activities among authorities at the same level of the State; the concept also extends to the consultation process among public and private stake holders in the planning process. Planning in Germany is moreover governed by the principle of "reverse flow". This principle implies a decision making process which starts from the bottom and develops to the top. That is to say, a certain decision is generated based on the data of municipalities, developed and controlled in districts, federal states and federation levels. The following table compiles the planning tools used in Germany (Kayikci, 2003):

Table 3: Plans & Programs in the German Planning System

PLANS/PROGRAMS	FEATURES
FEDERAL SPATIAL DEVELOPMENT PROGRAM	<ul style="list-style-type: none"> • 1:4 000 000 scale plans • Objective is to provide equal living conditions in all regions • Provides guidance to all spatial plans • Multidisciplinary orientation frame for planning on national plane. • Supports federal states in implementing their plans. • Citizens do not participate in development of program.
PROVINCIAL PLANS & PROGRAMS,	<ul style="list-style-type: none"> • 1:500 000 - 1:200 000 scale plans.

<p>PROVINCIAL SPATIAL PROGRAMS (Landesentwicklungsprogramm) (Landesentwicklungsplan)</p>	<ul style="list-style-type: none"> • Plans determine the goals of spatial development and provincial plans on the basis of the Law of Spatial Development and the Law of Provincial Planning. • Plans and programs can be organized as integrated plans and programs.
<p>REGIONAL PLANS, REGIONAL DEVELOPMENT PLANS, REGIONAL DEVELOPMENT PROGRAMS (Regionalplan)</p>	<ul style="list-style-type: none"> • 1:300 000 - 1:50 000 scale plans. • Regional plans and programs govern sub-regional plans. • The organizations supporting these plans are regional planning communities, regional planning institutions, and federal states planning institutions • Regional plans and programs set out regional objectives for spatial development based on federal states plans. They also set out regional objectives for residential areas and infrastructures for commerce, industry, agriculture, forests, traffic, communication, schools, and social services.
<p>PREPARATORY LAN-USE PLANS (Flaechennutzungsplan)</p>	<ul style="list-style-type: none"> • 1:50 000 - 1:5 000 scale plans. • apply to defined parts of cities or districts. • are land-use plans reflecting existing land-use and urban development decisions. • are harmonized with the objectives of provincial plans and regional plans. • provide the legislative frame of

	<p>detailed land-use plans.</p> <ul style="list-style-type: none"> • Preparatory land-use plans do not have direct legal effects on citizens but are obligatory for communities and participatory planning organizations.
<p>DETAILED LAND-USE PLANS (Bebauungsplan)</p>	<ul style="list-style-type: none"> • 1:2 000 - 1:500 scale plans. • apply to defined part of cities. • provide obligatory rules for urban development. • are designed for the implementation of building codes. (Thus, they are legal basis for required building codes.) • derive from preparatory land-use plans and are developed under the authority of city councils/ municipalities. • set out direct tasks and obligations for citizens.
<p>BUILDING PERMISSION (Baugenehmigung)</p>	<ul style="list-style-type: none"> • 1:100, 1:50 or 1:10 scale plans. • apply to individual buildings. • set out criteria and standards of the buildings such as site, section, and elevation.

SOURCE: Kayikci, 2003

After examining the whole planning system starting from the larger scale down to the smaller scale, it is useful to have a short look at the building control system as an integral part of the spatial planning field. The building control system is closely related to land-use planning and a prerequisite of disaster mitigation. The responsible body for construction control in Germany is "The Directorate of High Planning & Building" affiliated to the federate states. The Directorate is responsible

for controlling the design, static, and electricity projects; calculations of sound and thermo isolation projects; precautions against earthquakes and fires through control engineers. Control engineers (=Prüfingenieure) and insurance systems are also pillars of the building control system in Germany. On the other hand, building works for private properties are controlled by Building Directorates which are part of district administrations (municipal level). Building Directorates control each construction at three levels namely, project controlling (static, sound and thermo isolation, precautions against earthquakes and fires), implementation project controlling, building controlling. (METU Group of Professors in Fac. of Arch & Civ. Eng.;1999)

After the review of the planning system in Germany, the disaster plans and programs of ad hoc authorities will be examined as an integral part of the planning system. In Germany, the Federal Government has only framework competences in the field of disaster risk assessment and management. In this frame, it provides disaster-related guidance to the Federal States in the exercise of its spatial planning competences. It mostly deals with observations on various planning issues such as demography, urbanization, transport, environment, etc. While the Federal Government deals with questions related to disaster risk assessment and management, it has no framework for disaster hazards and vulnerability analysis.

According to the existing natural disaster profile of Germany, the major sources of disaster hazards can be ranked as winter storms, thunder storms, hail storms, river floods, flash floods, forest fires, avalanches, land slides, and earthquakes. All these natural disasters certainly vary from region to region in Germany. The federal states set their disaster plans and programs as part of their regional plans. The table below provides an overview of the plans and/programs on disaster mitigation (Greiving et al., Eds. 2006):

Table 4: Plans & Programs of Federal States on Disaster Mitigation

PLAN OR PROGRAMME	FOREST FIRES	AVALANCHES/ LANDSLIDES	EARTHQUAKES	FLOODS
Baden-Wuerttemberg Regionalplan Region Bodensee Oberschwaben, Regionalverband Bodensee- Oberschwaben (1996)	-	-	-	River Floods
Baden-Wuerttemberg Regionalplan Schwarzwald-Baar Heuberg 2003, Regionalverband SBH	-	-	-	River Floods
Bavaria Regionalplan Allgäu, Region 16 (PV Ingoldstadt, 2000)	-	Avalanches Landslides Protective Forest	-	Flash Floods
Bavaria Regionalplan Regensburg Reg PV Regensburg 2000	-	Avalanches	-	River Floods
Hesse Regionalplan Mittelhessen 2001, RegPräs Gießen	-	-	-	River Floods
Hesse Regionalplan Nordhessen 2001, RegPräs Kassel	-	-	-	River Floods
Mecklenburg-Western Pommerania RROPro Westmecklenburg 1996	-	-	-	Coastal Protection
North Rhine-Westphalia Gebietsentwicklungsplan RB Köln, Teilabschnitt Aachen 2003	-	-	-	River Floods
North Rhine-Westphalia Gebietsentwicklungsplan Teilabschnitt Köln 2003	-	-	-	River Floods
Rhineland-Palatinate Planungsgemeinschaft Region Trier, Regionales Raumordnungsprogramm Region Trier 1985	-	-	-	River Floods
Rhineland-Palatinate Regionales Raumordnungsprogramm Mittelrhein-Westerwald, Planungsgemeinschaft M-W, Entwurf 2002	-	Landslides	-	River Floods
Saxony Regionalplan Oberes Elbtal/ Osterzgebirge, Reg. PV, 2001	-	-	-	River Floods
Schleswig-Holstein Regionalplan Kreisfreie Stadt Flensburg, Kreise Nordfriesland und Schleswig-Flensburg (Planungsraum V, 2002), Ministerium für ländliche Räume, Landesplanung, Landwirts. & Tourismus	-	-	-	Coastal Protection
Thuringia Regionales Raumordnungsprogramm Nordthüringen, Reg. Planungsgem. Nordthüringen 1999	-	-	-	-

SOURCE: Greiving et al., 2006

As the above table shows, the major and most frequent natural hazards in Germany are river floods and flash floods. Floods are the main natural disasters in Germany. The main risky rivers of Germany are Elbe and Rhine which cross many large cities.

As it was mentioned before, regional and/or spatial planning responsibilities lie with the federal states. The spatial plans of the federal states include many sectors such as energy, water, security, telecommunication networks, protection of nature, transportation, and economic development. Each planning authorities take the responsibility for the planning and implementation of related projects specified with sectoral aspects according to the adhoc sectoral planning act. At the level of the Federal law the "Water Management Act" provides some basic legal framework for flood protection. On the basis of "Water Management Act", the federate states are dealing with flood protection. In addition to the national scale programs and projects there are several international commissions and projects for transboundary rivers such as Rhine, Elbe, Odra, and Danube.

As a secondary level natural hazard, landslides and avalanches usually occur in Germany in the Federal State of Bavaria. While there is no federal legislation on landslides and avalanches, there are some plans and programs prepared by the federal states, notably the Federal State of Bavaria. It is possible to group the plans and programs of the Federal State of Bavaria for landslides and avalanches such as risk assessment and management.

As a mitigation method for forest fires, the forest plans in Germany are implemented at the regional level. While the legal frame for forest management is provided by the Federal Forest Act, planning authorities aim at developing and protecting the environmental and economic functions of forests through Forest Framework Plans. These Plans

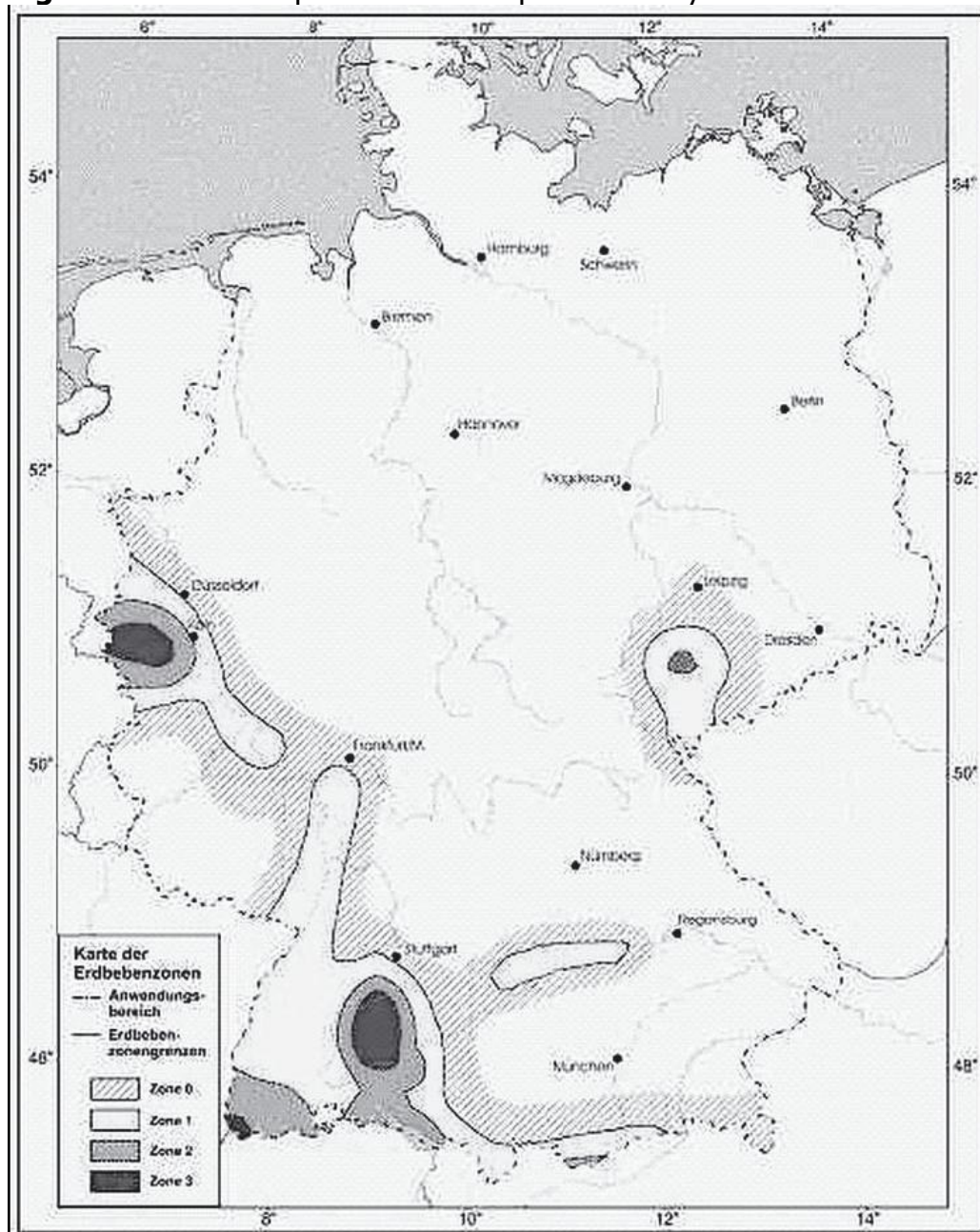
focused more on the threat of landslides, avalanches and river floods than on forest fires. The main areas prone to forest fires in Germany are in the north part of the country between Lower Saxony and Brandenburg (near Polish Border). The Federal Agency for Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung) prepares forest fire statistics and publishes annual reports. However, all statistics are on the hazard component, not on the vulnerability.

Storms are another type of natural disasters in Germany affecting mostly coastal areas. For many centuries therefore, storms are addressed as a part of coastal protection activities. Areas prone to storms are along the North Sea Coast in Germany. Activities towards disaster mitigation for storms are hence specially found in the federal states of Lower Saxony, Schleswig-Holstein, Mecklenburg-Pomerania, Bremen and Hamburg. The disaster mitigation for storms is directly included in federal state coastal protection legislation and indirectly addressed in the Water Management Act, because coastal protection is a part of the water management. Under German Basic Law, there is a joint responsibility for coastal protection between of the Federation and federal states. While previously the coastal areas in Germany were protected by the Federal State's the Water Management Act and federal states' related legislation, Germany is introduced "Integrated Coastal Zone Management" (ICZM) as a new concept of the European Union. ICZM provides for a coastal protection policy with a view to the multidimensional use and functions of coastal areas. Some federal states recently revised their implementation processes and procedures according to the principles of ICZM. In this context, methods of risk estimation, assessment of hazard potentials, vulnerability analysis, and risk management have been integrated into the coastal protection programs.

Earthquakes are not considered as especially significant disasters in Germany as the earthquake zones map below shows (see also fig.4).

Thus the threats of earthquakes are usually not taken into consideration in spatial planning although geological surveys of the 16 federal states provide information about earthquake (seismic) hazards. As for other natural disasters, federal states are in charge of preparing earthquake plans. Some federal states, such as North Rhine-Westphalia and Bavaria, deal with earthquake issues and provide guidance to the municipalities. Institutional awareness on earthquake threat focuses only on building standards and permits.

Figure 4: The Earthquake Hazard Map of Germany



SOURCE: Greiving et al., 2006(Deutsches Institut für Normung, DIN 4149)

There exists a joint agency of the Federation and federal states, called Deutsches Institut für Bautechnik (German Institute for Structural Engineering). The main task of this institute is to define common technical building standards to be intended in the building legislation of the federal states. The institute designed a bundle of technical building standards (DIN 4149) for areas prone to earthquake risks. These standards were updated in 2002 due to EU standardization. As mentioned above under the heading of "European Union", Eurocode 8 (EC 8) "Design provision for earthquake resistance of structures" was prepared by the European Committee for Standardization (CEN) on behalf of the EU. Since Eurocode 8 provides a frame code rather than detailed bundle of standards, each Member States will prepare its own detailed legislation. Germany as a country less frequently threatened by earthquakes, prepared its own standards with a view to different earthquake risk zones. In the past, two significant earthquake events have occurred in Germany; one in Albstadt (1978) and the other in Roermond (1992) at the German-Dutch border. In those events, buildings were damaged that had failed to comply with DIN 4149.

Recent researches show that some parts of Germany geologically are exposed to earthquake risks. Germany has now been divided into one alert zone (see also fig.4-Zone 0) and three hazard zones (see also fig.4-Zones 1,2,3), based on new probabilistic assessment methods, which lead to a serious extension of the hazard zones. In each hazard zone, special technical standards imposed by municipalities as a condition of obtaining construction permits. These standards vary from zone to zone, e.g., while four-storey-buildings are permitted in Zone 1, only two-storey-buildings are permitted in Zone 3 (Greiving et al., Eds. 2006).

Conclusion

As already mentioned (see also "1.1. Hypothesis & Research Questions" and "1.3. Objectives & Purposes of the Thesis") that a city at high seismic risk in Germany (Cologne) is chosen for comparative case study in the thesis, it is useful to examine the spatial planning and building system of Germany as a framework of disaster mitigation. It is easily understood that the planning system is effectively structured in Germany through to vertical and horizontal organization and coordination. Especially, the method for coordination between spatial planning policy and overall federal policies is noteworthy (This coordination is supported by the Federal Office for Public Works & Regional Planning through periodic "Spatial Planning Reports" to the Federal Parliament.). In Turkey, there is still a big gap between technical policies and General Government policies. Due to this gap, there are many shortcomings in the implementation of spatial planning and disaster legislation.

Since the effectiveness and efficiency in planning and building system can be assumed as a prerequisite step of disaster mitigation, Germany is rather well organized for disaster mitigation with respect to spatial planning standards and building codes. Nevertheless, the whole spatial planning and building process and procedures should be updated in the light of new disaster mitigation policies.

While the German disaster mitigation system appears to be well structured, various weaknesses should be noted with a view to future disaster threats. According to existing studies and programs for all expected types of disasters in Germany, it is clearly understood that most of the efforts of the central and local authorities focus on disaster prevention and response. The planning standards, building codes, and existing insurance system are put into the core of disaster mitigation. Furthermore, the existing legislation and standards were developed in light of former disaster experiences. Most of the institutional capacities

and scientific studies concentrate on floods because of the high frequency of flood events in Germany. However, new disaster trends are emerging. For instance, the earthquake risks in the beginning of 20th century and present earthquake risks in Germany are not same. Hence, Germany needs newly developed, multidimensional tools in the legislation and implementation process to build especially disaster resilient urban settlements. The existing legislation and implementation process needs to be updated under changing environmental conditions and various threats of disasters such as recent effects of climatic changes and some high risk disasters like earthquakes. By taking into account this issue, the Federal Government of Germany adopted a new strategy on 17.12.2008. The new strategy, namely "The German Adaptation Strategy" provides a framework of adaptation to impacts of climate change. It has an integral approach on risk assessment and mitigation activities with a view to sustainable development of Germany (The German Adaptation Strategy; 2008).

It will now be beneficial to develop further strategies with regard to other types of disasters like earthquakes. In this context, it must be noted that new risks may well activate old disaster potentials. For instance, earthquakes have a quite big potential to trigger floods in Germany. ***The newly developed strategies and multidimensional tools advocated in this study should be reflected in regional and local level implementation plans.***

UNITED KINGDOM (UK)

In the United Kingdom, local authorities are the authorities who are primarily responsible for disaster response. However, the central government has some responsibilities as may be required. For instance, local authorities can ask for the help of the central government in some special cases like nuclear accidents or satellite accidents. There are also Regional Emergency Committees to support the local authorities.

In emergency cases, a principal responsible unit is determined for disaster response and coordination of different institutions. During the improvement and recovery period, responsibilities are assumed by different institutions. (METU Group of Professors in Fac. of Arch & Civ. Eng.; 1999)

Floods and landslides mainly determine the natural disaster profile of the United Kingdom. Accordingly the UK's spatial planning policy concentrates on floods and landslides. Nevertheless, there are some monitoring studies on other type of natural disasters such as earthquakes.

The planning system of the United Kingdom (UK) consists of two levels, namely regional planning strategies for each English regions and local development frameworks. The English regions denote that England, Northern Ireland, Scotland, and Wales as they take place in the United Kingdom Parliament. The Regional Spatial Strategies for each English region provide guidance to the development plan and carry the weight of laws. The policies in a development plan must be in conformity with the Regional Spatial Strategies. The planning permits for all proposed developments are issued by local authorities. Within the overall planning system in the UK there are some variances region by region.

In the UK, a few authorities at both central and local levels deal with floods. The Environment Agency is responsible for flood warnings and flood management. Also, Drainage Boards and local authorities are active in flood management and prevention. Several institutions are involved in the flood emergency response process such as the police, local authorities, and emergency services. In the wake of climatic change, an increasing amount of rainfall causes floods and coastal degradations. In response, the Environment Agency recently became involved in floods and coastal erosion; and developed an integrated

management framework with long term plans. This new integrated management framework is linked to spatial plans and planning policies which vary region by region in the UK.

There is no established planning policy guidance with respect to landslides which are another major natural disaster in UK. The efficient planning policy guidance called PPG14 and land-use plans apply to England and Wales. PPG14 assesses landslides with a wider perspective in conjunction with various events such as land instability arising from past mining or from coastal erosion, unstable slopes, and other type of landslides. While local authorities often adopt their own local strategies to deal with landslides, the Environment Agency and maritime local authorities cooperate in the Shoreline Management Plan preparation process.

As already noted, the UK primarily focuses on the disaster management of floods. In order to maintain efficient disaster management on floods, the responsible authorities try to improve existing approaches especially by taking into consideration the implications of future climate change. Rivers and coastal areas are evaluated in an integrated risk management framework with a view to the threat of heavy rainfalls causing floods and coastal degradation. Thus, existing Shoreline Management Plans and Catchment Flood Management Plans are upgraded from engineering documents to spatial documents including social, economic, and environmental considerations.

The recent efforts of the UK with respect to floods are parallel to similar approaches in the EU. Especially the "Integrated Coastal Zone Management" and "Flood Risk Assessment and Management" approaches of the EU provide planning authorities with more detailed, long-term risk assessment techniques and policy frameworks than previously (Greiving et al., 2006).

FRANCE

Since her territory covers various types of geographical regions (coastal areas, big rivers, big mountain systems), France is prone to most of the existing natural hazards, notably floods, windstorms, droughts, avalanches and other slides, forest fires, earthquakes and volcanoes. In France, the Directorate of Civil Defense under the Ministry of Interior is responsible for disaster management and response. The Directorate of Civil Defense carries out two main plans, namely general aid and emergency aid. The Directorate operates in 9 regions of the country. In each region, there is a vertical organizational structure from the regional level to village level. In addition, all ministries have some responsibilities for disaster mitigation and risk mitigation. (METU Group of Professors in Fac. of Arch & Civ. Eng.; 1999)

The major natural disasters in France are river floods and winter storms according to data covering the period 1909-2005. Land slides, wild fires, and extreme temperatures come after those two major natural disasters in the natural disaster profile of France. France has a quite systematic approach in dealing with natural hazards responsive to interrelations among natural hazards with respect to risk assessment, risk management, and planning.

Because of the increasing number of natural hazards since 1970s, the Government of France in 1982 developed a prevention system for natural hazards. The government also adopted a ten-year programme for the prevention of major natural risks in response to many serious flood events in the early 1990s. (Programme décennal de prévention des risques naturels majeurs of 24 January 1994). This programme consists of cartography, risk prevention and development control in areas prone to flood risk.

France has quite a long experience in preparing risk and hazard maps, as well as in managing natural disaster risks. All risk information plans

and disaster mitigation approaches are developed in the central level while risk prevention plans are prepared at the local levels. Natural risk prevention plans include risk zoning regulations which in term include compensation rules. Natural risk prevention plans provide detailed information about the area at risk and relevant building authorizations. Natural risk prevention plans exist only for some natural disasters, namely river floods, landslides, avalanches, forest fires, earthquakes, and volcanic eruptions.

The French Government has published a general guidebook and specialized handbooks on flood risks, seismic risks, forest fire risks, and coastal risks for developing risk prevention plans. There are also informative hazard zoning approaches at the central level for each type of natural hazards. In consonance with the hierarchical structure of the French administration, regional information about major risks is under the responsibility of governors while local information and technical mapping are under the responsibility of municipalities.

France has recorded success in coordinating natural disaster mitigation and planning activities. For example, the integration of risk prevention plans into the local plans is a significant achievement in linking risk management with spatial development. Another successful feature of the French disaster mitigation system is the hierarchical process in developing pertinent policies from the central government (ministries) to local authorities such as governorates and municipalities. There are possibly some weaknesses and/or problems in disaster mitigation system in France such as conflicts between policy makers at different levels. Nevertheless, the French disaster mitigation system can be evaluated as well structured, especially owing to its integration into the spatial planning system (Greiving et al., 2006).

2.4. Japan

The organization and coordination for natural disasters are established by the "Basic Law of Disaster Prevention" of 1961 as amended 1997. The Law prescribes disaster responsibilities, management of disaster preparedness, emergency response, and recovery activities, establishment of a comprehensive and objective administrative system for disaster management process, and declaration of state of emergency (International Emergency Management Symposium, 2002).

According to that law, there are two types of organizations, i.e., a permanent organization and an ad hoc organization. The disaster coordination authority in Japan is the National Land Agency; it belongs to the Office of the Prime Minister like its Turkish counterpart (General Directorate of Emergency Management of Turkey). In the permanent organization, there is an emergency center called "Headquarter for Major Disaster Control and Emergency Disaster Control". This headquarter is managed by the Prime Minister in the case of large scale disasters. In the case of smaller scale disasters, it is managed by the State Minister in charge of the National Land Agency Works. The ad hoc organization operates at three levels, namely national, provincial, and municipal (METU Group of Professors in Fac. of Arch & Civ. Eng.,1999).

In the frame of disaster management, efficient emergency operations and recovery activities are organized according to the Basic Plan for Disaster Management based on the Basic Law of Disaster Prevention. The Basic Plan for Disaster Management is prepared in national level conducted by the Prime Minister. The plan presents the main governmental policy on disaster management, the organization and program of the national disaster management system, methods serves fast and efficient ways in recovery and reconstruction activities, the support of scientific and technological researches. The plan is updated after significant disasters.

The National Land Agency plays a significant role in the context of integration of land use plans and disaster mitigation issues. The National Land Agency prepares the national land use plans as a part of National Development Plans. In the process of land use plan preparations, the Office of Earthquakes belongs to the National Land Agency reflects its recommendations and precautions in the respect of earthquake loss mitigation (The Turkish Ministry of Public Works & Settlement, 2006).

To pay attention in coordination in disaster management, Japanese central and local institutions yearly come together to make comprehensive disaster management training. For that purpose 1st of September is designated as "Disaster Prevention Day" in Japan (International Emergency Management Symposium, 2002).

The disaster management system in Japan has also close contact with UN International Strategy for Disaster Reduction (see also "2.1.United Nations Organizations"). The International Disaster Reduction Liaison Council is established by the participation of heads of related departments from various ministries and institutions.

The Japan International Cooperation Agency (=JICA) also has responsibilities in the field of disasters. JICA focuses on advancing international cooperation through the sharing of knowledge and experience. In this context, JICA has prepared many reports and studies; and it has carried out many projects and training programs related to disasters. In fact, JICA was founded to provide technical cooperation to developing countries in 1954. While in the beginning, the scope of JICA's programs is technical cooperation, development of investments and financing, emigration service, and training of personnel, JICA expanded its programs such as "Promotion of Implementing Grant Aid Project", "Youth Invitation", and "Disaster Relief" (Overview of JICA, 2008). Due to the fact that Japan and Turkey are two earthquake prone countries, JICA provided assistance to Turkey in strengthening disaster prevention

system and disaster recovery activities. The Government of Japan established JICA Turkey Office in June 1995 with a view to enable more appropriate response to emerging assistance needs in the country. JICA Turkey Office also focuses on ongoing activities and projects, monitoring and evaluation of the activities and strengthening further cooperation between two countries (JICA, 2004).

2.5. International Seminars & Conventions

It is also useful to examine the disaster-related seminars and conventions such as Hyogo Framework for Action 2005-2015, the Yokohama Strategy, the Stability Pact, etc. Every year many seminars are held in the field of disasters, offering remarkable scientific presentations and papers. Thus, outcomes of those international seminars and conventions provide an opportunity to understand the degree of disaster resilience of human settlements.

THE YOKOHAMA STRATEGY & PLAN OF ACTION

The Yokohama Strategy is one of the significant UN initiatives in prevention, preparedness, and mitigation of natural disasters at the international level. The member states of the United Nations and other states met in the World Conference on Natural Disaster Reduction in Yokohama/JAPAN from 23 to 27 May 1994. In this global conference, the profile of participants varied from central government authorities to NGOs, international organizations, scientific communities, business, industry, and media group. The main objective of the conference was expressing global concern and attention on devastating effects of natural disasters on human life and environment. On this basis, the Yokohama Strategy and Plan of Action was adopted. All participants of the conference agreed on the following topics:

- Devastating effects of natural disasters on human lives and countries' economies have been increasing.

- All nations should incorporate disaster prevention, preparedness, mitigation, and response activities to ensure sustainable development policies.
- Since natural disasters are not limited by political borders, all countries should act in a spirit of partnership to build a safer world, and enhance various regional & international cooperation in disasters.
- The optimum provision of information, knowledge, and technology is necessary to reduce the effects of natural disasters.
- Community involvement and their active participation in disaster phases (preparedness, prevention, mitigation, and response) should be encouraged.
- The Yokohama Strategy for a Safer World should be perceived as a call to action by all participant countries. While each country has strengthened its natural disaster coping capacity, developing sub-regional, regional, and international cooperation , and paying primary attention to developing countries, least developing countries, land-locked countries, and small island developing countries.

On the basis of common topics, the participants drew a series of principles, strategies, and a plan of action. The principles were adopted on the following concepts:

- Importance of risk assessment
- Primary intention on disaster prevention and preparedness
- Integration of disaster mitigation approaches into development policies
- Development of disaster coping capacity and support follow-up activities

- Strengthening of early warning systems and mechanisms provided by telecommunications measures as key factors to successful disaster prevention and preparedness
- Supporting multi-level participation in disaster studies from the local community to the international level
- Reducing the vulnerability by enhancing public awareness and community training
- Building technological cooperation among the international communities to prevent, reduce, and mitigate natural disasters
- Considering environmental protection as a component of sustainable development in the prevention and mitigation of natural disasters
- Prior intention on developing and least developed countries

By taking the principles above into consideration, the Yokohama Strategy was stipulated as follows:

- In order to reduce devastating effects of natural disasters, countries should strengthen the traditional disaster mitigation methods and explore new ways to live with such risks.
- Vulnerable groups should receive primary attention. In this context, developing countries, least developed countries, small island developing countries, and land-locked countries are the most vulnerable countries. The poor and socially disadvantaged groups in all countries are other vulnerable groups.
- The primary aim in effective disaster management is to reduce casualties and physical losses.
- The efforts and capacities should be directed more on disaster prevention and mitigation than response.

In the light of principles and strategies above, the Conference adopted a plan of action for the future comprising series of actions at the

community and national levels, sub-regional and regional levels, and the international level. At the community and national levels, all countries agreed up on enhancing national capacities to review related legislation, policy decisions, participation programs for various levels; to mobilize domestic resources (money, equipment, human resources, information, knowledge, technology,...); to develop infrastructure and services; and to strengthen national committees for the promotion and the coordination of the disaster reduction activities. At the regional and sub-regional; and regional levels, the countries decided to build sub-regional and regional centers for disaster reduction; to design common training programs, technical information exchange systems, and early warning mechanisms; to establish joint projects & mutual assistance agreements; and to give importance of vulnerable groups (countries and communities). At the international level, the countries agreed to set up a disaster fund supported by voluntary contribution from governments, international organizations, private sectors, etc. In addition to this financial initiative, they all agreed to organize various development projects financed by multilateral financial institutions, to promote all regional and sub-regional level activities to the international level, and to hold of a review conference on natural disaster reduction at the end of the decade in order to draw a new strategy for natural disasters in the course of 21st century.

At the end of the conference, all outcomes of the conference and reports prepared by participants were all organized by the Secretariat of United Nations. In the case of necessity, national committees, non-governmental organizations, scientific and technical associations, private sectors, etc. could easily reach those outcomes to implement in their further plans. That type of approach can provide an opportunity to design effective disaster mitigation approaches in the future. (Yokohama Strategy and Plan of Action for a Safer World; 2007)

THE HYOGO FRAMEWORK FOR ACTION FOR 2005-2015

The Hyogo Framework is another remarkable international cooperation and partnership in reduction of disaster risks and vulnerabilities. This Framework was adopted in the World Conference on Disaster Reduction that was held from 18 to 22 January 2005 in Kobe-Hyogo/JAPAN. The Hyogo Framework for Action can be perceived as a successor of the Yokohama Strategy & a Plan of Action. The World Conference on Disaster Reduction in Hyogo started on the basis of conclusions and lessons learned from the Yokohama Strategy. According to the assessment on the Yokohama Strategy, the specific gaps and challenges of disaster risk reduction were stipulated into 5 key topics for the decade 2005-2015 in Hyogo:

1. Governance with a view to organizational, legal, and policy frameworks
2. Risk identification, assessment, monitoring, and early warning
3. Knowledge management and education
4. Reducing underlying risk factors
5. Preparedness for effective response and recovery

The World Conference in Disaster Reduction in Hyogo has also similar goals in disaster reduction like the Yokohama Strategy. Despite this similarity, the Conference in Hyogo much focused on two remarkable concepts namely, resilience and risk reduction. In this respect, the Conference stipulated the following strategic goals to draw a "Framework for Action":

- Disaster risk prevention measures should be integrated into sustainable developments policies, plans, and programs at all levels (community levels, national levels, sub-regional and regional levels, international level).
- Institutions, mechanisms, and capacities at all levels should be developed and strengthened with a specific focus on community levels to build hazard resilience.

- Risk reduction approaches should be systematically incorporated into the preparedness, response, and recovery programs when the disaster affected communities are reconstructed.

Since the Conference was held by the United Nations, the International Strategy for Disaster Reduction (=ISDR) has assisted in implementing the Hyogo Framework for Action. In order to assist the Framework for Action ISDR has following tasks:

- Developing a matrix of roles and initiatives in support of follow up to the Framework for Action
- Facilitating the coordination of actions within the UN organizational network and among other relevant international and regional organizations
- Consulting with relevant UN agencies and organizations, regional and multilateral organizations and technical and scientific institutions as well as interested governments and civil societies
- Ensuring support to national platforms for disaster reduction
- Coordinating with the secretariat of the Commission of Sustainable Development to ensure that relevant partnership
- Creating and maintaining a global information platform on disaster risk reduction for the benefit of the participants in the Framework
- Preparing periodic progress reports on the Framework for Action for UN bodies and other interested participants.

(Hyogo Framework for Action 2005-2015)

THE EUR-OPA MAJOR HAZARDS AGREEMENT

As another international initiative, the "EUR-OPA Major Hazards Agreement" established an intergovernmental platform for co-operation on prevention and mitigation of major natural and technological disasters among Eastern European, Western European, and Southern countries. This agreement encompasses myriad aspects of natural and

technological disasters such as knowledge generation, prevention, risk management, post-crisis analysis and rehabilitation. (The Eur-opa Major Hazards Agreement, 2007)

In 1987, the Committee of Ministers of the Council of Europe opened for signature the EUR-OPA Major Hazards Agreement. It was also called "Open Partial Agreement" because Non-Member States of the Council of Europe were invited to accede in addition to Member States. To date, the Agreement has 25 Member States namely, Albania, Algeria, Armenia, Azerbaijan, Belgium, Bulgaria, Cyprus, Croatia, France, Georgia, Greece, Lebanon, Luxembourg, Malta, Moldova, Monaco, Morocco, Portugal, San Marino, Romania, Russia, Spain, "the Republic of Macedonia", Turkey, Ukraine.

In addition to states, European Commission, UNESCO, The World Health Organisation (WHO), the International Strategy for Disaster Reduction (ISDR) of the United Nations, the Office for Co-ordination of Humanitarian Affairs of the United Nations (OCHA) and the United Nations Institute for Training and Research (UNITAR) cooperate in the implementation of the Agreement.

The Agreement provides a framework for co-operation of Member States and participating organizations in a multidisciplinary context with a view to empowering risk management with respect to major natural and technological disasters. The EUR-OPA Major Hazards Agreement acknowledged two following facts:

- Societies are increasingly vulnerable to natural and other related technological and environmental hazards, whose impact is made more acute by the consequences of demographic, economic and social changes including urbanization and development processes

- Disaster reduction is one central element of sustainable development and the associated integrated disaster risk management is a primary responsibility of governments

In the frame of the Agreement, significant European programmes have been launched since 1987 through a network of 26 specialized European Centers, especially in research, training, and dissemination of information and expertise related to disaster management. The network comprises the following centers:

- CRSTRA - Euro-Mediterranean Center on research in arid zones (Biskra, Algeria)
- ECTR - European Interrregional Educational Centre for Training Rescuers (Yerevan, Armenia)
- ECMHT - European Centre on Training and Information of Local and Regional Authorities and Population in the Field of Natural and Technological Disasters (Baku, Azerbaijan)
- ISPU - Higher Institute of Emergency Planning (Florival, Belgium)
- ECRP - European Centre for Risk Prevention (Sofia, Bulgaria)
- BE-SAFE-NET - European Centre for Disaster awareness with the use of the Internet (Nicosia, Cyprus).
- EMSC - European Mediterranean Seismological Centre (Bruyères-le-Châtel, France)
- EMORIM – Euro-Mediterranean Observatory on Risk Management (Montpellier, France)
- CERG - European Centre for Seismic and Geomorphological Hazards (Strasbourg, France)
- CETICA - Euro-Mediterranean Centre for Technologies of information and Communications Applied to Risk Management (Draguignan, France)
- EMORIM – Euro-Mediterranean Observatory on Risk Management (Montpellier, France)
- GHHD - European Centre on Geodynamical Risks of High Dams (Tbilisi, Georgia)

- ECPFE - European Centre on Prevention and Forecasting of Earthquakes (Athènes, Greece)
- ECFF - European Centre on Forest Fires (Athens, Greece)
- CUEBC - European University for the Cultural Heritage (Ravello, Italy)
- ECGS - European Centre for Geodynamics and Seismology (Walferdange, Luxemburg)
- ICoD - Euro-Mediterranean Centre on Insular Coastal Dynamics (Valletta, Malta)
- ECILS - European Centre on the Vulnerability of Industrial and Lifeline Systems (Skopje, Former Yugoslav Republic of Macedonia)
- ECMNR - European Centre for Mitigation of Natural Risks (Kishinev, Moldova)
- CEPRIS - Euro-Mediterranean Centre for Evaluation and Prevention of Seismic Risk (Rabat, Morocco)
- CERU - European Centre on Urban Risk (Lisbon, Portugal)
- ECBR - European Centre for Rehabilitation of Buildings (Bucharest, Romania)
- ECNTRM - European Centre of New Technologies for the Management of Natural and Technological Major Hazards (Moscow, Russian Federation)
- CEMEC - European Centre for Disaster Medicine (San Marino)
- CEISE - Centro Europeo de Investigación Social de Situaciones de Emergencia (Madrid, Spain)
- TESEC - European Centre of Technological Safety (Kiev, Ukraine)
- **AFEM - European Natural Disasters Training Centre (Ankara, Turkey)**

As noted before EUR-OPA Major Hazards Agreement provides an elaborate framework for regional co-operation among northern and southern Mediterranean countries and South Eastern Europe by furthering inter-sectoral and multidisciplinary cooperation by active institutions in regional/spatial planning, environmental and civil protection by offering platform for multinational and trans-frontier co-operation on prevention, protection and awareness-raising policies, and by fostering the coordination of initiatives between member countries.

The signatory countries of the EUR-OPA Major Hazards Agreement are guided by objectives and strategies set out in the United Nations International Strategy for Disaster Reduction. With parallel to the ISDR principles, the EUR-OPA Major Hazards Agreement has some plans in making expertise as well as training and research capacities of the 26 Euro-Mediterranean Centers to the international community in particular with a view to supporting initiatives for assistance to Asia. (DRAGONI, 2005) Besides, in co-operation with the relevant EUR-OPA Major Hazards Agreement Centre from the region, took the initiative to organize the adequate working groups in the Caucasus region (Regional Co-operation in the Field of Risk Mitigation and Emergency Management, 2004).

After 26th of December 2004, a tsunami of unprecedented violence hit the coastlines of fifteen South-East Asian countries by an earthquake of extraordinary magnitude; the EUR-OPA Major Hazards Agreement has paid much attention on the importance of earthquake and tsunami hazards and early warning systems. Especially, the EUR-OPA Major Hazards Agreement has set up a number of centers specializing in this field. The 2004 catastrophe highlights the urgency of the objectives pursued by the Agreement that is to define a new framework for hazard management on an unprecedented scale. Thus the EUR-OPA Major Hazards Agreement developed a plan to focus on two themes, namely "risk prevention and management" and "contribution of the EUR-OPA Major Hazards Agreement".

The "sectoral policy" on disaster prevention must be closely coordinated with the Commission of the European Union, especially the latter's "ECHO-DIPECHO" disaster preparedness program and other pertinent programs notably those of the European Commission's. More systematic interaction of the Agreement's European centers and international institutions should be sought in such fields as public information and education, legislation and decision-making assistance.

The expertise accumulated by all the Agreement's European centers might be pooled for that purpose. (Le Clei, 2005)

So far, the EUR-OPA Major Hazards Agreement has also organized various meeting, workshops, and ministerial meetings to enhance regional co-operation in the field of risk mitigation and risk management. (AFEM; 2006)

NORTH ATLANTIC TREATY ORGANIZATION (=NATO)

The North Atlantic Treaty Organization (=NATO) is an alliance of 26 countries from North America and Europe committed to safeguard the freedom and security, common values of democracy of themselves. The organization was found by signing the North Atlantic Treaty on 4 April 1949. In addition to its major peacekeeping activities, NATO has been dealing with civil emergency planning (=CEP) in disaster relief. While the member states have been dealing with the preparation of civil emergency planning and disaster relief in national level, NATO CEP has been assisting nations in planning and preparing and to facilitate effective international response in cases where a given nation is not able to handle a disaster by itself. The coordination of these efforts is managed by the Euro-Atlantic Disaster Response Coordination Center (=EADRCC). (NATO Activities; 2007)

Since 1950s, NATO has been involved with coordinating assistance in response to disasters when a major disaster strikes in a member or partner country. In 1998, it established the Euro-Atlantic Disaster Relief Coordination Centre (EADRCC) to coordinate the responses of NATO member and partner countries to disasters occurring in the Euro-Atlantic region. The EADRCC serves as a focal point for information-sharing, ensuring that all respondents had accurate and timely overviews of the events. The centre, which is located at NATO Headquarter in Brussels, is operational 24 hours, ready to respond quickly when needed.

The Euro-Atlantic Disaster Relief Unit (EADRU) is another organ of NATO. It is comprised of multi-national mix of national civil and military assets and resources such as qualified, search and rescue personnel, medical supplies and equipment, strategic airlift capabilities, temporary housing, and water sanitation equipment that countries are prepared to make available at short notice in the case of a disaster's strike. That is to say it is a non-standing unit. The composition and size of this multinational unit is determined by the requirements of disasters.

According to NATO principles, when a NATO country is stricken by a major natural or man-made disaster, the assistance provided by other countries should comply with the requirements of a disaster stricken country. The assistance should also be delivered as quick as possible to the area designated by the disaster stricken country. The procedures of EADRU are organized into 5 phases namely, Preparedness Phase, Emergency Phase, Deployment, Withdrawal, After Withdrawal. (EADRCC; 2008)

STABILITY PACT

Despite the mission of the Stability Pact is long-term conflict prevention strategy in the South Eastern Europe, it has also an initiative for disaster preparedness and prevention. The Stability Pact is an EU initiative which was adopted on 10 June 1999 in Cologne/GERMANY. The Stability Pact aims to foster peace, democracy, respect for human rights, and economic prosperity in order to achieve stability in the South Eastern Europe. In the summit meeting in Sarajevo on 30 July 1999, the Pact was reaffirmed by more than 40 countries and organizations. The Stability Pact partners are:

- The Countries in the Region: Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Moldova, Montenegro, Romania, Serbia, and Republic of Macedonia
- The European Union Member States and the European Commission

- Other Countries: Canada, Japan, Norway, Russia, Switzerland, Turkey, USA
- International Organizations: United Nations(=UN), Organization for Security and Co-operation in Europe(=OSCE), Council of Europe, United Nations Commission on Human Rights (=UNCHR), North Atlantic Treaty Organization(=NATO), Organization for Economic Co-operation and Development(=OECD)
- International Financial Institutions: World Bank, International Monetary Fund(=IMF), European Bank for Reconstruction and Development(=EBRD), European Investment Bank(=EIB), Council of Europe Development Bank(=CEB)
- Regional Initiatives: Black Sea Economic Cooperation(=BSEC), Central European Initiative(=CEI), South East European Co-operative Initiative (=SECI), and South East Europe Co-operation Process(=SEECOP)

(About the Stability Pact; 2007)

On the March 16, 2000, the Stability Pact has an attempt for disaster preparedness and prevention initiative for South Eastern Europe, in Brussels/BELGIUM. The objective of this initiative was to join the international and local efforts in disasters (natural & man-made) to encourage the full participation and mutual support of all regional countries. The initiative also brings together donor countries and international governmental and non-governmental organizations to coordinate ongoing and future activities in order to improve the efficiency of national disaster management systems within the regional cooperation framework. The structure of DPPI constitutes the decision making and governing body which defines goals and objectives for DPPI SEE activities, based on actual needs and potentials and in line with the overall policy of the Stability Pact for South Eastern Europe. The DPPI SEE Secretariat consists of Head of the Secretariat and Administration/Finance Assistant and function as the administrative and

supporting structure to the DPPI SEE Regional Meeting. The DPPI SEE Secretariat enhances regional cooperation by being the guardian of responsible for monitoring and implementation of the decisions reached by the DPPI SEE Regional Meeting. The 13 member countries meet bi-annually in Disaster Preparedness and Prevention Initiative for South Eastern Europe (=DPPI SEE) Regional Meetings hosted by one regional country.

The first operational step of DPPI was organizing an operational team which led an assessment of the needs and capacities related to the disaster preparedness of 12 countries in the region. The operational team was constituted by the participation of experts from Bulgaria, Croatia, Italy, Sweden, Turkey, USA, the International Federation of Red Cross and Red Crescent Societies(=IFRC), NATO, and the United Nations Development Programme(=UNDP). The team assessed disaster preparedness and prevention necessities and capabilities; examined natural and technological disaster risks; studied on existing disaster management and preparedness plans; and identified ongoing emergency response projects and coordination procedures. At the end of the area visits and the study, the operational team prepared a "The Regional Report" that was discussed at the Geneva Workshop on 16-17 June 2001(Regional Report of the DPPI Operational Team; 2001). On the following workshop of DPPI in Banja Luka, from 10-12 October 2001, regional countries brought several project proposals on disasters. Follow-up and prioritization of the projects was done on DPPI working meeting in Budapest/HUNGARY, from 11-13 March 2002. On 5 June 2002, the Declaration on Cooperation in Disaster Preparedness and Prevention in South Eastern Europe was signed by 11 countries and International Federation for Red Cross and Red Crescent Societies. in Bucharest/ROMANIA. At the DPPI Regional Meeting in Sofia/BULGARIA, 16-18 September 2002, a new Disaster Preparedness and Prevention Initiative for South Eastern Europe (=DPPI SEE) structure was adopted

and the DPPI SEE Action Plan with Terms of Reference for Advisory Board was determined by participants.

From 2002 to 2006, the remarkable activity of DPPI was "Disaster Management Training Program 2002 – 2006". During this period more than 700 participants participated to 53 training events. The DPPI has organized 2007-2008 training program in the light of previous training experiences. In addition to these disaster management training program DPPI has "Joint Fire Fighting Unit Project" that has been concluded with the Joint Fire-fighting Exercise, held in May 2004 in Budva/MONTENEGRO. Another disaster project of DPPI is "The Harmonization of Seismic Risk Hazard Maps". The project has been supported by the NATO Science for Peace Program and the implementation of the project by Moldova, Bulgaria, Romania and Turkey started in late 2004. The objective of the Project is to determine the new seismic hazard maps of the region designed by new technologies. Maps should ensure harmonization of seismic hazard within the broader region in the sense of applied methodology, as well as to overcome the problem of present differences of seismic hazard in border regions. Maps will also satisfy the formats of seismic zoning drawn by European Standards namely, Eurocode 8.

In the case of floods in the South Eastern European Region, the DPPI Secretariat and Hungary developed a "Project Proposal for the Establishment of Joint Emergency Response Units" to improve the conditions for flood protection. The overall objective of the JERU Project is to improve regional preparedness and response capacity in case of floods regardless of the national borders by equipping and jointly training 8 emergency response units in 8 countries of the SEE region. The training for the JERU Operation Officers/Team Leaders was conducted in November 13-17, 2006; and with the First/Main and Final Planning Conference to be concluded with the Joint Emergency

Response Unit Exercise, are tentatively scheduled for 2008/9 respectively (DPPI; 2008).

As a recent development, the Stability Pact for South Eastern Europe came to an end and the Pact's Secretariat was officially closed on 30.06.2008. But the Regional Cooperation Council (RCC) was officially launched on 27 February 2008, as the successor of the Stability Pact for South Eastern Europe. The Regional Co-operation Council and its Secretariat in Sarajevo/BOSNIA AND HERZEGOVINA formally intended to sustain responsibility for promoting regional co-operation processes as well as the DPPI activities in South Eastern Europe through a regionally owned and led framework that also supports European and Euro-Atlantic integration (RCC, 2009).

GENEVA CONVENTIONS

The Geneva Conventions has pretty different status among other international organizations and seminars above in the field of disasters. Despite the Geneva Conventions aim protection of victims of international armed conflicts, it has recently some arrangements for disasters.

The Geneva Conventions originally were initiated by a Swiss Man, Henry Dunant in 1859 after the Battle of Solferino. The Geneva Conventions were basically formulated as 4 treaties of international law about humanitarian issues in Geneva/SWITZERLAND. The content of these 4 treaties are as follows:

1. First Geneva Convention was adopted in 1864 and revised in 1949. (For the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field)
2. Second Geneva Convention was adopted in 1949. (For the Amelioration of the Condition of the Wounded, Sick and Shipwrecked Members of Armed Forces at Sea)

3. Third Geneva Convention was adopted in 1929 and revised in 1949. (Relative to the Treatment of Prisoners of War)
4. Fourth Geneva Convention was adopted in 1949. (Relative to the Protection of Civilian Persons in Time of War)

In addition to the conventions above there are three more protocols namely, Protocol of Protection of Victims of International Armed Conflicts, Protocol of Victims of Non-International Armed Conflicts, and Protocol of Adoption of an Additional Distinctive Emblem. In sum the Geneva Conventions are completely non-disaster topic legislative documents. (Geneva Conventions; 2008)

While the Geneva Conventions are mainly concern with the protection of humans in various types of armed conflicts, in the last decade of 20th century, initiatives were taken with a view to inserting disaster issues into additional protocols. The following statement formulated in the in 22-24 June 1988 Hague International Conference on Humanitarian Assistance in Armed Conflict is a significant indicator of increasing attention paid by various relief organizations to natural disasters, even their original missions are in different fields:

“Each National Society must prepare itself to assume the responsibility devolving on it in the case of disaster. It must establish its own plan of action, adapt its organization accordingly, recruit, instruct and train the necessary personnel, and ensure the availability of the reserves in cash and kind which it might need in the emergency phase of a relief operation.” (Kvelalshoven; 1988)

These instruments start to provide guidance to member states in shaping disaster response and relief actions as well as relevant bi- and multilateral cooperation activities.

Conclusion and Synthesis on Main Disaster Mitigation Approaches in the World

At the end of this chapter, a brief conclusion on the above best examples of countries and organizations as well as international seminars and conventions provides guidance to develop a disaster resilience model in Chapter 4. As "Table 5" shows, the comprehensive information on "Main Disaster Mitigation Approaches in the World" are summarized under two sub-headings, namely "approaches on disaster mitigation" and "relevant achievements of best examples".

Table 5: A Synthesis on Main Disaster Mitigation Approaches in the World

COUNTRY/ORGANIZATION/ SEMINAR/CONVENTION	APPROACHES ON DISASTER MITIGATION	RELEVANT ACHIEVEMENTS
United Nations Organizations	<ul style="list-style-type: none"> • Increasing public awareness • Implementing disaster reduction policies and actions • Building relevant cooperation at international, regional, and national levels 	<ul style="list-style-type: none"> • Motivating international and inter-sectoral cooperation on disaster reduction activities
USA	<ul style="list-style-type: none"> • Building an integrated emergency management system 	<ul style="list-style-type: none"> • A federal plan for disaster response, recovery, and mitigation activities
The European Union	<ul style="list-style-type: none"> • Building cooperation and solidarity in disaster preparedness and response among the Member States • Preparing some frame directives to provide guidance to the Member States 	<ul style="list-style-type: none"> • Providing guidance for cooperation in disaster response activities and coordination in preparation of disaster legislation
Germany	<ul style="list-style-type: none"> • Organizing disaster preparedness activities by complying with building codes and planning standards • Developing disaster response activities 	<ul style="list-style-type: none"> • Optimal compliance with building codes & planning standards with respect to disaster prevention

United Kingdom	<ul style="list-style-type: none"> • Building capacity for disaster management activities • Developing disaster prevention methods especially for floods 	<ul style="list-style-type: none"> • Integrated Coastal Zone Management as a tool for disaster mitigation for floods
France	<ul style="list-style-type: none"> • Developing multi-disaster mitigation approach • Designing disaster prevention activities by taking into consideration of risk assessment, management & planning • Integrating disaster mitigation methods into spatial plans 	<ul style="list-style-type: none"> • A detailed disaster prevention program • A general guidebook and specialized handbooks on various risk prevention plans
Japan	<ul style="list-style-type: none"> • Performing activities of disaster preparedness, recovery & management as well as emergency response in accordance with the frame law 	<ul style="list-style-type: none"> • A plan for disaster management • Integration of disaster mitigation tools into spatial plans
International Seminars & Conventions	<ul style="list-style-type: none"> • Enhancing regional and international as well as sectoral cooperation in disaster prevention, preparedness, response & mitigation activities • Developing information, knowledge & technology on disaster mitigation issues • Enhancing public awareness & training • Considering environmental protection in disaster mitigation activities • Supporting vulnerable groups and developing countries 	<ul style="list-style-type: none"> • Integration of disaster mitigation approaches into development policies • Supporting scientific studies on disaster • Maintaining solidarity activities in case of emergencies

SOURCE: Own source

Each of the above best examples focuses on different approaches to mitigate natural disasters. For instance, while USA focuses on building an effective disaster management system, the European Union mostly supports activities of disaster response and preparedness. However, each Member State has some differences in accordance with its national priorities. The successful implementations of the best examples, such as (i) inter-sectoral cooperation in disaster reduction of the UN Organizations, (ii) optimal compliance with building codes and planning standards of Germany, (iii) integration of disaster mitigation approaches of international seminars and conventions into development policies will provide valuable participation to develop the disaster resilient model in this study.

CHAPTER 3:

3. DISASTER MITIGATION APPROACHES AND LESSONS LEARNED IN TURKEY

It is useful to start with writing up the story of 1999 Earthquakes in Turkey. This also clarifies the reason why 1999 Earthquakes lessons learned are chosen as an initiative of the thesis. However, before drawing the profile of the 1999 earthquakes, it is useful to give brief information about the hierarchic administrative system in Turkey. Turkey is a centralized state comprising 81 provinces. At the top of the provincial administrations are governors as appointed by the central government. Governors delegate some of their authorities to district governors who manage some administrative issues in districts of provinces. According to the administrative structure in Turkey governorates and district governorates mostly have administrative responsibilities as local agencies of the central government. In addition

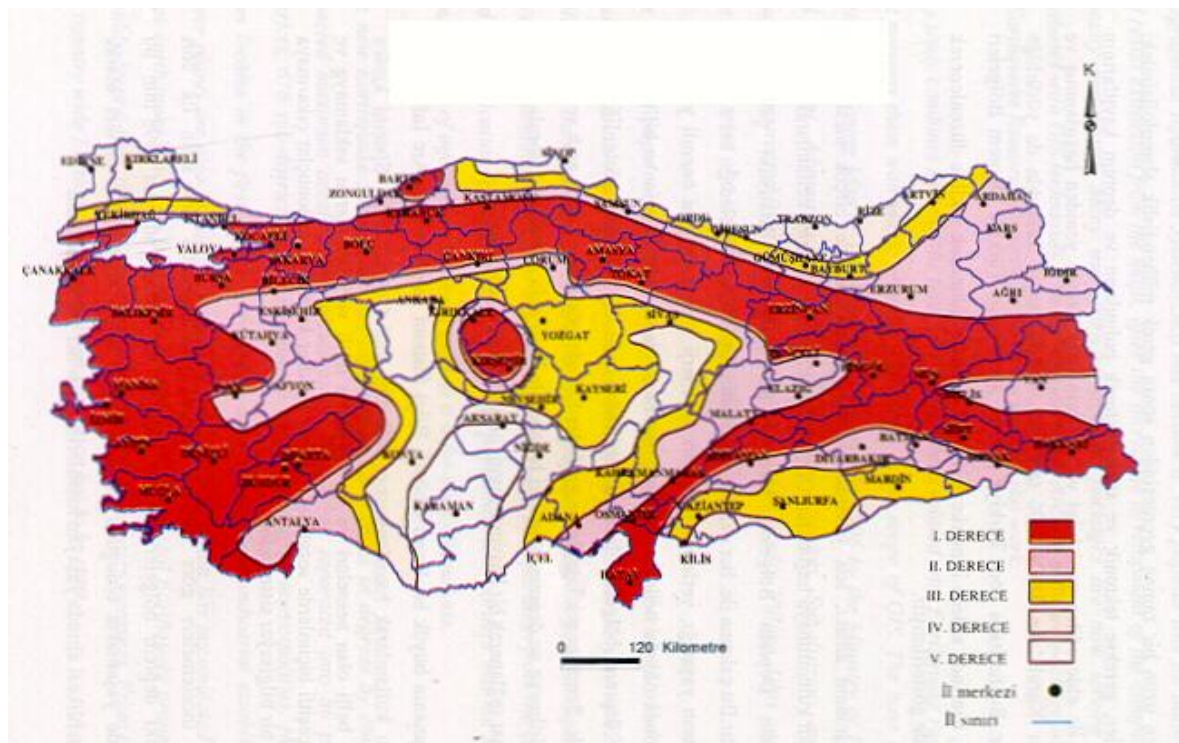
to this administrative hierarchy, mayors (mayors of provinces and district mayors) take place in administrative system of provinces. While mayors are locally elected for 5-year-period governors are appointed by the Ministry of Interior (SPO, 2006).

Since Turkey is a country which frequently subjects to natural disaster, mainly earthquakes, a destructive earthquake occurs within 1.5 year-period or shorter than it. According to the statistical data on natural disasters within last 60 years, earthquakes cause 62% of the natural hazards in Turkey. Another significant issue for Turkey is the majority of total population and a great proportion of the economic activities have been subjected to the high earthquake risks.

“In the last century, 58 damaging earthquakes occurred in Turkey caused almost 100 000 casualties and more than 500 000 seriously damaged and collapsed housing units. Erzincan (1939), Gediz (1970), Erzurum-Kars (1983), Erzincan (1992) and the recent Earthquakes are the most severe disasters. However, the Eastern Marmara Earthquakes have exceeded by far the other earthquake experiences in Turkey so far.” (Ministerial Meeting on Regional Cooperation and Coordination in Crisis Management, 2000; p.1)

The following map which is prepared by the Turkish Ministry of Public Works & Settlement/General Directorate of Disaster Affairs shows earthquake hazard zones in Turkey (see also fig.5). According to this map Turkey is divided into 5 different earthquake hazard zones. The red zone represents high earthquake zone areas and the white zone represents earthquake safe areas.

Figure 5: The Earthquake Hazard Map of Turkey



SOURCE: Turkish Ministry of Public Works & Settlement-General Directorate of Disaster Affairs, 1996

In 1999, two terrible earthquakes dated on 17th of August and 12th of November occurred in the most industrialized and highly populated region of Turkey. The first Eastern Marmara earthquake struck at 03.02 (local time) on 17 August 1999 with a magnitude of 7.4 and the second one struck at 18.57 (local time) with a magnitude of 7.2. The first earthquake has two epicenters such as İzmit Bay and Adapazarı (city center of Sakarya) while the second one's epicenter is Düzce. The earthquakes affected a region covering 9 provinces that are located on the North Anatolian Fault Zone, namely, Istanbul, Yalova, Kocaeli, Sakarya, Bolu, Düzce, Eskişehir, Bursa, and Zonguldak. In those earthquakes, there were 18 373 casualties and 48 901 injured people in addition to severe damage in 317 493 dwelling units and 47 412 offices. Some regional technical infrastructure networks and transportation routes were affected heavily such as some severe damages in the Ankara-Istanbul highway due to the fault ruptures and

liquefactions and high damages (more than 50%) in the drinking water and sewerage systems in the region.

Those earthquakes gave crucial damage to the Turkish economy. Firstly, the earthquakes hit major industrial zone of Turkey. Secondly, when the earthquakes occurred, Turkey had a critical economic period. In mid-1999 Turkish Government had launched an extensive economic reform program to control high inflation and build sustainable economic growth. The total financial loss is estimated as more than 10 billion US\$ according to the 2000 economic figures. That amount of the financial loss refers 5% of Turkey's Gross National Product (GNP) in 2000. The per capita GNP in 2001 decreased by 26.7 percent, dropping to 2,123 US\$ due to the economic recession and the decrease in the value of the Turkish Lira (JICA, 2004;pp. 6-7).

The following figures are denoting regional dispersion of physical damages and losses clearly:

Table 6: The Number of Casualties in the Eastern Marmara Earthquakes in 1999

PROVINCES	NUMBER OF CASUALTIES
BOLU	318
BURSA	268
DÜZCE	838
ESKİŞEHİR	87
ISTANBUL	981
KOCAELİ	9 476
SAKARYA	3 894
YALOVA	2 505
ZONGULDAK	6
TOTAL	18 373

SOURCE: Turkish Ministry of Public Works & Settlement (PW & S)/ General Directorate of Disaster Affairs, Crisis Management Center, 2000

Table 7: The Building Stock Damage Assessment Results in the Eastern Marmara Earthquakes in 1999

PROVINCES	DAMAGE CLASSIFICATION					
	COLLAPSED/HEAVILY DAMAGED		MODERATELY DAMAGED		SLIGHTLY DAMAGED	
	DWELLING UNITS	OFFICES	DWELLING UNITS	OFFICES	DWELLING UNITS	OFFICES
BOLU	2 334	219	6 099	902	5 736	837
BURSA	141	3	571	25	940	68
DÜZCE	16 666	3 873	10 968	2 573	10 124	1 422
ESKİŞEHİR	90	21	167	18	314	22
ISTANBUL	3 051	447	15 102	2 510	14 065	1 943
KOCAELİ	35 839	5 478	41 100	5 861	45 111	6 122
SAKARYA	24 689	5 146	18 406	3 764	24 423	2 349
YALOVA	13 895	751	14 540	1 159	11 879	1 885
ZONGULDAK	91	1	286	4	691	8
TOTAL	96 796	15 939	107 315	16 816	113 382	14 657

SOURCE: Turkish Ministry PW & S/ DG of Disaster Affairs, Crisis Management Center, 2000

Many factors caused those catastrophes, namely, magnitude and range of the earthquakes; disaster occurrence times; demographic & economic conditions of the disaster areas; public awareness & institutional technical care for constructions; limited existing economic conditions of the country; and existence of rapid and distorted urbanization & industrialization in disaster areas. Those factors became the items of lessons learned of Turkey. In addition to these items Turkey gained some experiences in disaster response process. That is to say some problems such as lack of coordination and organization showed the weakness of the country disaster response capacity.

In sum, Turkey has some lessons learned stemming from disaster response, recovery, and preparedness processes of 1999 Eastern Marmara Earthquakes. Thus, it could be beneficial to start this study based on Turkey's lessons learned from 1999 Eastern Marmara

Earthquakes to share previous experiences in the scientific era as an efficient initiation for strengthening technical capacity of other disaster prone countries.

3.5. Review in Turkish Disaster Legislation

In Turkey, the whole body of legislation related to disaster issues can be elaborated into three groups such as disaster legislation, planning legislation, and the building legislation. The current disaster legislation consists of various laws, decree laws, regulations, directions and circulars. The major laws on disasters can be summarized as follows:

(a) The Law on Civil Defense No. 7126 of 13 June, 1958: Some amendments were made in due course in parallel with the changing requirements. The Ministry of Interior is responsible for implementing the law. The law aims at minimizing the losses of lives and properties due to reasons or armed conflicts, foreign attacks, natural disasters and big fires; protecting the substantial plants and ensuring the continuity of public services. The law also sets out the organization, tasks and responsibilities of the national defence authorities.

(b) The Law on Precautions and Aids for Disasters Influenced the Common Daily Life, No. 7269 of 25 May, 1959: According to the Law, the Ministry of Public Works and Settlement is in charge of responsibilities in the case of the natural disasters. After some disaster experiences such as earthquakes and floods, the law was needed to be enlarged. Hence, some substantial amendments were made by the Law No. 1051 of 1968 and latter amendments were made by Laws No.4123 and 4133. The Law with its amendments aims to serve disaster response, emergency aid, and recovery activities. To fulfill this aim, the Law determines the procedures, principles, and responsibilities of authorities in the case of disaster hazards such as earthquakes, fires, floods, landslides and avalanches.

(c) The Prime Ministry /Turkey Atomic Energy Institution is in charge of responsibilities of nuclear security by the Law on Turkish Atomic Energy No. 2690 of 9 July, 1982: The purpose of the law is to

determine the organization, responsibilities and tasks of the Turkey Atomic Energy Institution with respect to planning and supervision of usage of nuclear energy, security of radiation, and protection of nuclear plants, and prevention of nuclear accidents in Turkey.

(d) The Regulation on Constructions in Disaster Areas: The regulation is issued in the official gazette of 13 May, 1996, no. 22635 (second print) provides that constructions in disaster prone areas must comply with the "Turkish Standards and the General Technical Contract of the Ministry of Public Works and Settlement".

(e) The Regulation on Principles of City and Town Plans and of Significant Buildings and Establishments in terms of Civil Defence, Decree No. 4/11715 of 6 July, 1959: This regulation sets out standards and procedures of settlement areas and construction plans of cities and towns in sensitive areas as a matter of civil defence.

(f) The Regulation No. 88/12777 on "Emergency Relief Organization and Planning Principles on Disasters" which is legally based on the Law on Precautions and Aids for Disasters Influenced the Common Daily Life (Law No. 7269) is issued in the official gazette of 8.5.1988, no. 19808. The regulation determines principles for organizing central and local emergency management institutions and designing an emergency management plan.

(g) The Prime Ministry Crisis Management Center Decree No. 96/8716 of 9 January, 1997: The aim of the regulation is to determine the organization, tasks, working procedures, and responsibilities of the Prime Ministry Crisis Management Center. The regulation was updated due to the reasons of establishment of the General Directorate of Turkish Emergency Management and building efficient organization and coordination in disasters in 4.7.2002 by the decision of the Cabinet no. 2002/4518.

(h) The Decree Law No. 99/583 (issued in the official gazette of 22.12.1999, no: 23884) and Decree Law No. 600 (issued in the official

gazette of 14.7.2000, no: 24079) on the establishment of Turkey Emergency Management. These decree laws aim at ensuring the countrywide effectiveness of emergency management in the event of natural and technological disasters. The implementing principles and procedures are to be determined by subsequent regulation (Alarslan; 2001).

The planning legislation is mainly constituted with the Public Works Law (Law No.3194) and its related regulations and circulars. The existing Public Works Law that came into force in 1985 designates principles, processes, procedures and responsible institutions in all planning and public works in Turkey. In addition to planning issues, there are construction issues such as standards and procedures, building and residence permits, technical responsibilities, quality controls, qualification of contractors, and construction penalties in the Public Works Law. The law also consists of procedures of disaster plans. In its 9th article, 2nd paragraph, the law assigns the preparation and modification of plans in disaster prone areas to the Ministry of Public Works and Settlement. 39th article of the Law serves to purpose of disaster mitigation indirectly with the explanation on technical procedures of insecure buildings (The Turkish Ministry of Public Works & Settlement-General Directorate of Disaster Affairs; 2006). After 1999 earthquake experience, the Ministry of Public Works and Settlement had many updates on this law and related regulations. In 2004, the Ministry prepared a draft law (Draft Law of Public Works and Urbanization) to serve more modern and safer settlements and built environments. Nevertheless, that draft law is still in evaluation process.

In addition to the Public Works Law, there are a few complementary regulations which are indirectly related to the disaster legislation. These are:

- The Regulation on Tasks and Responsibilities of Technicians Except Engineers, Architects, and City Planners (issued in the official gazette of 2.11.1985, no. 18916 (second print))
- The Regulation on Tasks and Responsibilities of Electrical Technicians(issued in the official gazette of 11.11.1989, no. 20339)
- The Regulation on Qualifications of Map Preparation Contractors (issued in the official gazette of 11.10.1993, no.21725)
- The Regulation on Qualifications of Plan Preparation Contractors(issued in the official gazette of 7.1.2005, no. 26046)
- The Regulation on Principles of Plan Preparation(issued in the official gazette of 2.11.1985, no. 18916 (second print))
- The Regulation on Development of Non-Planned Areas (issued in the official gazette of 2.9.1999, no.23804)

The regulations above denote that the planning legislation in Turkey does not only cover the principles of planning but also sets out principles of technical qualifications of planners and technicians in the sector, criteria of building and residence permits, and standards of buildings. It is still discussed that whether all building regulations and/or standards should be gathered under the building act. In addition to these regulations, many circulars related planning, disaster, and building issues cause confusion in the implementation frequently. On the other hand, the planning legislation itself is very complicated in Turkey due to the fact that there are many ministries, local authorities, and institutions took part in spatial planning (Duyguluer, 2007).

The building legislation in Turkey is not well organized. It consists of the technical specifications, related regulations, circulars, standards of building materials, the Public Procurement Law (Law No. 4734) (issued in the official gazette of 22.01.2002, no.24648) and its regulations came into force by the Ministry of Public Works and Settlement, the Building Inspection Law (Law No.4708) (issued in the official gazette of

13.07.2001, no.24461) and the Building Insurance. The more, as it is already mentioned that there are legal provisions related with buildings in the Public Works Law. The building related regulations can be listed as follows:

- The Standard Regulation for Development of Non-Metropolitan Municipalities(issued in the official gazette of 2.11.1985, no.18916)
- The Additional Regulation for Bunkers (issued in the official gazette of 25.8.1988, no. 19910)
- The Regulation for Development of Metropolitan Municipalities (Each Metropolitan Municipalities has its own original regulation)
- The Regulation for High Rise Buildings in Metropolitan Municipalities(Each Metropolitan Municipalities has its own original regulation)
- The Regulation for Installation for Metropolitan Municipalities(Each Metropolitan Municipalities has its own original regulation)
- The Regulation of Thermal Isolation (issued in the official gazette of 8.5.2000, no. 24043)
- The Regulation of Buildings in Earthquake Prone Areas (issued in the official gazette of 6.3.2007, no.26454)
- The Regulation of Building Materials(issued in the official gazette of 1.12.2006, no. 26363)
- The Regulation of Elevator(issued in the official gazette of 15.2.2003, no. 25021)
- The Regulation of Fire(issued in the official gazette of 26.7.2002, no. 24822)

The main technical specifications are on the principles on ground survey and soil analysis, preparation of architectural and engineering projects, architectural and engineering works in buildings.

After 1999 Marmara Earthquake and some successor earthquakes in Turkey, it was decided to build a building inspection system due to the fact that main earthquake hazards stems from non-controlled constructions. In 2001, the Building Inspection Law (Law No.4708) came into force. The law also brought some new concepts and processes to the construction field in Turkey such as building inspection institutions. All types of buildings and constructions defined in the Public Works Law are subject to the building inspection. Building inspection institutions certified by the Ministry of Public Works and Settlement are in charge of building inspection in Turkey. They are responsible for;

- i. examining the ground survey and soil analysis of the building lot and all types of building plans and projects such as architectural, static, electric,
- ii. assenting to projects for the building permit application
- iii. inspecting the building process and building materials
- iv. controlling occupational safety and health in the construction site
- v. informing to building and residence permit authorities in respect to the construction quality.

Another initiative after 1999 Marmara Earthquake is "Earthquake Insurance". Due to the reason that the Disaster Fund belonged to the Disaster Law did not surmount on all earthquake hazards, the necessity of earthquake insurance arose. The Decree Law on Compulsory Earthquake Insurance (Decree Law No. 587) came into force in 1999 established the earthquake insurance system in Turkey (issued in the official gazette of 27.12.1999, no. 23919 (second print)). The Decree Law assigned a "Natural Disaster Insurance Institution" reported to the Undersecretary of Turkish Treasury. The earthquake insurance system in Turkey aims to compensate the losses of dwelling units due to the earthquake hazards while facilitates the responsibilities of central government. Besides it ensures sharing earthquake risks in the country

while transfers some of the risks to the international market via reinsurance. The system insures losses of dwelling units due to earthquakes and fires, explosions, and land slides triggered by earthquakes. The earthquake insurance system covers all registered/legal dwelling units and all commercial and administrative units located in residential buildings. Hence public buildings, non-residential buildings, and buildings in villages are not subject to the earthquake insurance system (The Turkish Ministry of Public Works & Settlement; 2004). The earthquake insurance is compulsory where the Natural Disaster Insurance Institution declared. Failure to comply with the insurance requirement results in for feature of public assistance in ability to register property title, and denial of access to drinking water and natural gas, electricity, telephone, cable TV, and other utilities (Gençosmanoğlu; 2005).

3.6. Institutions Involved in the Disaster Mitigation Process

Before introducing the institutions with responsibilities in the disaster mitigation process, it is useful to draw a profile of Turkish disaster institutions from a historical perspective. The existing geography of Turkey has witnessed many disasters especially earthquakes since ancient times. According to one of the oldest Ottoman documents, earthquake recovery activities had mostly focused around Istanbul (JICA; 2004). From the foundation of Turkish Republic up to now, some milestones can be highlighted in building disaster-related institutions and disaster management system.

Between last decade of the Ottoman Empire and the foundation of the new Turkish Republic (1914-1930) the most active institution was the Turkish Red Crescent Society. It provided emergency relief to the people in both disaster and war cases. In the period of 1930-1944, various laws were enacted to enlarge the responsibilities of municipalities and the Ministry of Public Works and Settlement for the

improvement and reconstruction of settlements. Those responsibilities may be characterized as disaster recovery activities. In this period, because of extensive loss of lives and properties due to flash floods and earthquakes, some important legislative and institutional arrangements were adopted. Thus, in 1943, the Directorate of State Hydraulic Works was founded by the Law of Precautions and Preventions of Floods and Underground Waters. In 1944, the responsibility of the Ministry of Public Works and Settlement was enlarged by a law on "Measures to Be Put into Effect Prior and Subsequent to Ground Tremors" (Law No. 4623). The Ministry of Public Works and Settlement prepared the first earthquake hazard map of Turkey and adopted a regulation on compulsory technical building requirements in cooperation with universities and other related governmental institutions. This law also charged the municipalities with the task of implementing technical building requirements. In the period of 1944-1958, there were many revisions of the earthquake hazard map and the regulation on compulsory technical building requirements. After 1950, the rapid increase in population and urbanization and industrialization caused a gradual diminishing importance of those obligations (JICA; 2004). According to Ergunay, due to the fact that there was no major earthquake during 1950-1960, some political repercussions arose and the implementations based on the Law No. 4623 lost their effectiveness (Management of Natural Disasters in the Eastern Mediterranean Region, 1998). With the rapid increase in population, construction and planning activities rose tremendously. In response to these developments, the Ministry of Public Works and Settlement was reorganized (assuring tasks of physical planning, land-use, disaster affairs, and hydraulic works) by a new law of 1956 (Law No. 6785). In 1958, another new institution, the General Directorate of Civil Defence was founded to conduct search and rescue operations in disasters. The legal base of the General Directorate of Civil Defence was the Civil Defence Law (Law No. 7126). In 1959, the Ministry of Public Works and Settlement assumed further responsibilities in natural disasters such as earthquakes, floods, landslides, rock falls and fires by

Law No. 7269 on "Precautions and Aids for Disasters Influenced the Common Daily Life" which is still in force as of today . In line with this new disaster law, the General Directorate of Disaster Affairs which reported to the Ministry of Public Works and Settlement was established in 1965. Another new feature of the Law is the establishment of a "Disaster Fund" to finance necessary disaster activities without depending on the central budget. In 1971, the Earthquake Research Institute (currently Earthquake Research Department) was established in the General Directorate of Disaster Affairs. The Institute was responsible for earthquake research activities in cooperation with universities and other scientific institutions. In 1972, a special "Earthquake Fund" was created by Law No. 1571. In the period of 1970-2000, while the General Directorate of Disaster Affairs developed its organization, technology, and personnel profile, several disaster research centers were established in universities, e.g. the "Earthquake Engineering Research Center" in the Middle East Technical University/Ankara, the "Turkish National Committee on Earthquake Engineering" in the Istanbul Technical University. In this period, the Ministry of Public Works and Settlement also developed some public awareness and training projects and programs (JICA; 2004). The European Disaster Training Center (=AFEM) was established under the Ministry on the basis of the Council of Europe's Open Partial Agreement of 1988(The Turkish Ministry of Public Works & Settlement, 2007) (see also "International Seminars & Conventions"-AFEM). In the period of 1990-2000, the International Decade for Natural Disaster Reduction (=IDNDR) (see also "International Seminars & Conventions"-IDNDR) organized a center under the chair of the Deputy Undersecretary of the Ministry of Public Works and Settlement. This center and its activities provided an opportunity to criticize the disaster management system and mitigation activities of Turkey. The center prepared a National Plan of Turkey for the IDNDR period and distributed it to all pertinent institutions and decision making authorities (JICA; 2004).

The Eastern Marmara Earthquakes in 1999 became a milestone for the history of disaster legislation and institution building in Turkey. The responsible institutions started to criticize the disaster management system and its features such as organization, funds, and legislation. In contrast to these positive initiatives, the economic crisis after the earthquakes caused some adverse effects such as the transfer of earthquake and all other special funds to the central budget. In the period of 1999-2004, the Turkish Government promulgated many decrees, regulations, decree laws and laws in conjunction with the creation of some new institutions, such as the Natural Disaster Insurance Institution, the General Directorate of Turkish Emergency Management (JICA; 2004).

The creation of the ad hoc Turkish National Earthquake Council is another initiative in the wake of the 1999 Eastern Marmara Earthquakes. The Turkish National Earthquake Council aimed at making scientific assessments of earthquake predictions and informing the public, identifying the priority of researches on earthquake mitigation, policy development, and strategy building, and proposing necessary actions and programs. The Council comprised twenty independent scientists; it was established by circular of the Prime Ministry dated 21.3.2000. These scientists came from various universities and scientific research institutions, and they included 8 earth scientists, 8 structural and earthquake engineers, an architect, a city planner, a social psychologist, and an environmental engineer. The Council determined its own working principles, made numerous public announcements, organized many researches and studies, and published a booklet called "The National Earthquake Mitigation Strategy" as a result of its studies. This booklet was published in 2002 and distributed extensively to universities, central and local authorities, members of the Parliament, etc. (JICA; 2004). The outcomes of the National Mitigation Strategy document were also taken into

consideration of latter "Earthquake Council" organized by the Ministry of Public Works and Settlement (The Turkish Ministry of Public Works & Settlement; 2004). The Council was abolished by circular of the Prime Ministry dated 6.1.2007.

In September 29-October 1, 2004, the Ministry of Public Works and Settlement, organized an event called "Earthquake Council" with the participation of universities, public institutions and other pertinent authorities, NGOs and interest groups. This event aimed at evaluating future proposals on earthquake-related precautions and regulations; it had been prepared by seven ad hoc committees that had worked for approximately 3 months on the following topics: Institutional Building, Legislation, Disaster Information System, Examination of Existing Building Stock & Building Inspection, Building Materials, Funding & Disaster Insurance, Disaster Training (The Turkish Ministry of Public Works & Settlement; 2004).

Currently, the following institutions are involved in disaster management and mitigation system in Turkey:

Tasks of the Prime Ministry/General Directorate of Turkish Emergency Management (Responsibilities and authorities as per decrees law nos. 583 and 600)

- a) To ensure that the public institutions involved in disaster field form emergency management centers with the aim of efficient emergency management and co-ordination in accordance with sound working procedures
- b) To evaluate the precautionary measures taken by institutions in order to prevent disasters and/or to minimize the damages, including the preparation of short- and medium-term plans and the establishment of information banks

- c) To maintain coordination services for the employment of rescue and aid equipment, land, sea and air vehicles belonging to public and private sectors in cases of emergency
- d) To prepare regulations encouraging the voluntary aid institutions to coordinate in the deliverance, protection and transference of aid equipment

Tasks of the Ministry of Public Works & Settlement/General Directorate of Disaster Affairs

- a) To implement and coordinate emergency aid in cases of disasters
- b) To ensure that the short- and medium-term measures are taken in disaster stricken areas in order to provide temporary settlement, to distribute services to these areas to maintain cooperation and coordination among public institutions involved.
- c) To identify disaster prone areas and to take due measures towards preventing disasters,
- d) To determine and implement measures and principles aiming at minimizing the death toll and loss of property in disaster areas in cooperation with relevant ministries and public institutions.

Tasks and Brief Introduction of the European Natural Disasters Training Centre (AFEM)

The European Natural Disasters Training Centre (AFEM) is a non-profit organization which provides training on hazard reduction techniques. AFEM was established within the EUR-OPA framework in 1988 and affiliated to the Ministry of Public Works and Settlement. Its institutional structure and operational procedures are governed rules and establishment principles have been determined by Turkish legislation. AFEM focuses on providing training for technicians and executives who with responsibilities for management of natural disasters. Bodies of AFEM are of the Council, the Scientific Committee and the Training Centre. The Council makes decisions on the annual programs and budget of the Centre. It in particular sets priorities for

topics, target groups, policies and strategies of AFEM. The members of the Council are appointed by the Member States of the Eur-OPA Major Hazard Agreement. Budget of AFEM is in equal parts provided from the budgets of the European Open Partial Agreement (OPA) and the Turkish Government. Additional contributions come from international organizations, and special projects are financed by much organizations, such as DIFD-of U.K., The World Bank, etc. (The Turkish Ministry of Public Works & Settlement, 2007)

More specifically, AFEM carries out three types of activities:

- training of technicians and governmental officers
- preparation of visual and written training materials for citizens in all age and occupation categories
- organization of seminars for specialized target groups

In addition to these three tasks above, AFEM has been searching on development of training programs.

Tasks of the Ministry of Interior/General Directorate of Civil Defence

- a) To ensure the security of people and property at the time of war, to rescue lives and property in the event of disasters and to encourage the civil society to support defence activities case of war
- b) To organize civil defence services across the country, to maintain and supervise the preparation, implementation and coordination of these services at public and private institutions
- c) To plan and implement armless, protective and rescue precautions, emergency rescue and first aid activities, to determine measures against fires and standards for fire brigades, to educate, supervise and coordinate the personnel, to keep civil defence search and rescue teams ready and to entrust them when necessary

The General Directorate of Civil Defence in co-operation with the Ministry of Finance discharges these functions through Civil Defence Expertise in public and private institutions and Civil Defence Directorates in cities and provinces (Alarslan, 2001).

Tasks of the General Directorate of Red Crescent

- a) Provides services such as distribution of tents, blankets, food and clothing for the disaster stricken areas
- b) Provides urgent shelter for disaster stricken people in cooperation with the relevant institutions as per decisions of its own committee and provides food at common shelters.
- c) Collects foreign or local aid equipment and distributes it to the shelter areas determined by the committee.
- d) Provides medical equipment and services such as health teams, blood and blood products in cooperation with the Ministry of Health and relevant institutions, if necessary.

The Undersecretary of Treasury/ the Natural Disaster Insurance Institution (=DASK)

The Decree Law on Compulsory Earthquake Insurance (Decree Law No. 587) came into force in 1999 established the earthquake insurance system in Turkey (issued in the official gazette of 27.12.1999, no. 23919 (second print)). The Decree Law assigned a "Natural Disaster Insurance Institution" reported to the Undersecretary of Turkish Treasury. The Natural Disaster Insurance Institution is responsible for insurance and designation of insurance obligators. The Institution performs its duties on hazard assessment, marketing, and administrative procedures for earthquake insurance and reinsurance via service procurements. It is a public and non-profit institution. It is managed by a steering committee constituted by seven members including the chief executive. Other committee members are executive officers from various fields (4 of them), private sector representatives (2 of them), and an academic staff (The Turkish Ministry of Public Works & Settlement; 2004).

In addition to aforementioned organizations, the organization and co-ordination of Turkish institutions in disaster field –in emergency cases- is provided by the Regulation No. 88/12777 on “Emergency Relief Organization and Planning Principles on Disasters” (issued in the official gazette of 8.5.1988, no. 19808) for both of central and provincial levels:

(1) Central Organization: There are three pieces of legislation on the central organization of disaster management. The boundaries among these legislations are as yet indefinite. Thereunder, the following bodies are envisaged:

(a) “Central Coordination Council on Disasters” is a disaster management center which shall be established in case a disaster affects common life and exceeds the city boundaries. Its competencies are set out in Regulation No. 88/12777 of the Ministry of Public Works and Settlement.

The council is chaired by the Undersecretary of the Ministry of Public Works and Settlement, and it consists of the following undersecretaries. The participant authorities of the council are responsible for maintain accurate information about their own technical, financial, and personnel resources for efficient coordination.

*The Ministry of National Defence

* The Ministry of Foreign Affairs

* The Ministry of Finance

* The Ministry of Justice

*The Ministry of National Education

* The Ministry of Health

* The Ministry of Transportation

* The Ministry of Energy and Natural Resources

* The Ministry of Agriculture and Rural Affairs

- * The Ministry of Environment and Forestry
- * The Ministry of Labour and Social Security
- * The Ministry of Industry and Commerce

(b) "Turkish Emergency Management Department" was established by the Decree Law No. 583 of 15 November, 1999 and No. 600 of 14 June, 2000. The department is charged with taking necessary precautions for the efficient functioning of emergency management in events of the earthquakes, landslides, fires, accidents, meteorological disasters, nuclear and chemical accidents and immigration movements affecting the safety of the country. The department also tasked with coordinating institutions implementing studies on precautionary measures taken to prevent or mitigate disasters, on search and rescue activities and on the improvement facilities after disasters.

(c) "Prime Ministry Crisis Management Center" (BKYM) shall be organized at the central level in case of a crisis (including disasters) as stipulated by the Regulation No. 96/8716 of the Prime Ministry. The Center is to operate under the authority of the General Directorate of Turkish Emergency Management.

The aim of the regulation is to determine the organization, working procedures, mission statement and responsibilities of BKYM and to ensure that

- preparations and activities are performed correctly in accordance with the national interests to prevent or end a crisis, and
- a crisis causes minimum damage and interests are preserved by maintaining coordination and cooperation among General Staff, relevant ministries and other institutions.

The mission statements, responsibilities and working procedures of these three centers are generally similar.

(2) Organization of Provinces: Civil defence services established by the Ministry of Internal Affairs under the Law No. 7126 are organized in a

way to provide services during and after wars. They are not envisaged for disasters.

To fill this legislative gap, the Ministry of Internal Affairs has interpreted the term "movable teams" under its enabling legislation and established Civil Defence Unions in Ankara (35 staff), İstanbul and Erzurum (20 staff). These new bodies were employed successfully in local disasters. However the fact that they were inadequately staffed during the last local disasters (and subjective press statements) led to the underestimation of their activities and to criticisms.

The Ministry of Public Works and Settlement (General Directorate of Disaster Affairs) established "Central Coordination Council for Disasters" for the fight against disasters and disaster management and "Emergency Aid Service Groups for Disasters" in cities and provinces.

Emergency Aid Provincial Organization for Disasters in Cities and Districts

In cities and city districts "City Rescue and Aid Committees" are created under the chairmanship of the governor or deputy governor; these consist of:

- *Municipality representatives
- *City Gendarme Regiment Commandership
- *Chief of Police
- *Chief of Civil Defence
- * Directorate of National Education Youth and Sports
- *Directorate of Public Works and Settlement
- *Directorate of Agriculture
- *Directorate of Forestry
- *Representative of Turkish Red Crescent

*Garrison commander or highest ranked military officer of the area.

Tasks

The Committee

1. ensures that the emergency aid plans are developed and implemented
2. evaluates the provincial plans and submits them to the governor for ratification
3. establishes service groups in accordance with the plans and determines arrangements for staffing, educating, and making such groups ready for service
4. determines the principles of relief management and satisfaction of needs
5. determines the operational principles of the service groups, coordinates follow up the activities
6. maintains cooperation and coordination among institutions responsible for the implementation of emergency aid services
7. evaluates the disaster relief activities and their results
8. coordinates the provision of personnel and equipment for service groups.
9. returns back to the central fund account funds allocated for emergency aid activities but not spent
10. makes relief proposals such as postponement of debts and opening of new credits for the disaster-stricken people.

These following service groups may be credited in cities and provinces to perform emergency aid activities:

*Transportation Service Groups

*Communication Service Groups

*Rescue and Debris Removal Groups

*Preliminary Damage Determination and Temporary Settlement Service Groups

*Security Service Groups

*Purchasing, Renting, Detention and Distribution Service Groups

*Agriculture Service Groups

*Electricity, Water and Sewerage Service Groups

3.7. Criticism on Existing Disaster Mitigation System and Process in Turkey

The problems and shortcomings resulting from deficient legislation, procedures, and implementing practices, have been documented in many written or oral evaluations after the 1999 Eastern Marmara Earthquake in Turkey. In response, many laws, regulations, and directives were issued to resolve observed problems and conflicts. These attempts at modernizing disaster legislation, however, failed to achieve expected results. Thus far many efforts in Turkey have been made as reactions to disaster experience; yet even the recent legislation fails to set out an effective system of precautionary measures aimed preventing disaster-related damages.

The lack of a general policy and/or master plan for disasters in Turkey is widely criticized. Although Turkey is one of the high risk disaster countries, she has no country scale disaster policy as a tool for disaster mitigation. In the Turkish Five Year Development Plans, a first attempt for disaster awareness can be found in the 4th Five Year Development Plan for the period of 1973-1979 which stated:

“In natural disaster sensitive areas, special standards and by-laws shall be applied for the structures to be built, and renewal and retrofitting works will be carried out for existing buildings.” However, this statement was misused as a basis for obtaining the government cooperation in legalizing unsafe and irregular constructions in urban settlements.

In the 5th Five Year Development Plan (1985-1989), the following statement was made under the heading of Principles and Policies:

“The villages located in disaster zones will have first priority with respect to improving activities for residential buildings by supporting training, application and encouragement and developing village type dwelling units.”

While the above principle was developed, Public Works Law numbered 3194 was newly became into force in 1984. Regrettably, the Law failed to set out an approach for taking into account natural disasters in the planning process. Approaches on disaster risk mitigation were first laid down in the 6th Year Development Plan (1990-1994). The Erzincan Earthquake in 1992 also prompted some initiatives for disaster emergency management and improvement of building stocks in disaster areas.

The 7th (1995-2000) and 8th (2000-2005) Five Year Development Plans provided more concrete approaches such as the preparation of country scale earthquake zoning maps and the insertion of local earthquake hazard zones into the physical plans. The Public Works Law and related planning legislation were updated in those periods in accordance with the main policies set out in the Development Plans. Especially in the period of 8th Five Year Development Plan with the experience of 1999 Earthquake in Turkey, many modern approaches were initiated such as the preparation of country scale disaster maps, designing an integral planning process together with a building quality control system, and establishing a national scale disaster information system. (The Turkish Ministry of Public Works & Settlement (General Directorate of Disaster Affairs), 2006)

The recent adoption of the Ninth Seven-Year Development Plan (2007 – 2013) provided an opportunity of remedying the main policy deficit

and/or sustainability, but again it was missed. Although the Seven-Year Development Plan sets out a comprehensive medium-term master plan for economic, social, and regional development in Turkey, it does not include policies and strategies on disasters. It is believed that the criticism of Seven-Year Development Plan (2007–2013) would be an efficient initiation to examine the disaster implementations in Turkey.

The Ninth Seven-Year Development Plan (2007 – 2013) was prepared by the State Planning Organization (SPO) and adopted by the National Assembly. The SPO is the undersecretariat of the Prime Minister in charge of overall economic and development planning. The multi-year development plans are the main instruments of medium- and long-term economic policy planning and coordination. They set out a comprehensive vision for development and outline in broad terms strategic action plans towards this vision. Since the 1990s, international field disaster mitigation is considered as an important element for achieving sustainable development. In this frame, development plans could make a significant contribution to disaster mitigation by including this topic into Turkey's macro-economic policy framework (BALAMİR, 2006).

However, the Ninth Seven-Year Development Plan addresses urbanization and urban settlements issues only in a socio-economic context and entirely ignores the spatial planning and disaster prevention challenges. Although Turkey is one of the high disaster risk countries, such topics as urban risk assessment, disaster threats for urban settlement, disaster mitigation to achieve sustainable urban settlements are not mentioned at all in the Development Plan. While special ad hoc-committees had been convened in the preparation of the Development Plan on myriad policy areas (see table below), the issues of disasters or risk mitigation in urban areas were not studied in this frame at all (The Prime Ministry/SPO, 2006).

Disaster prevention and management are addressed in the Development Plan only in the context of "Rationalizing the Authority and Responsibilities among Different Institutions" and "Provision of Development in Rural Areas". Under the first heading, questions of administrative competencies and responsibilities among various state authorities involved in disaster prevention and management are discussed; and under the second heading, disaster mitigation is recognized as a planning priority for high risk rural areas (The Prime Ministry/SPO, 2006).

Particularly after the 1999 earthquakes in Turkey, it is understood that Turkey urgently needs a macro policy and a master plan on disaster prevention and management. To serve as an effective policy instrument towards this objective, the Ninth Seven-Year Development Plan would have to set out basic principles and main actions on disaster mitigation. These would have to focus on urban areas where disaster risks are demonstrably higher than in the rural areas of Turkey.

After the criticism of Seven-Year Development Plan as a macro political tool for the country, various implementations in Turkey will be examined such as directives on decision-making mechanisms, plans, programs, controlling mechanisms. The existing process and procedures of various working committees set up by the Ministry of Public Works and Settlement in 2004 with respect to an "Earthquake Council" will be reviewed. Seven ad hoc committees worked on the topics of institution- building, legislation, disaster information system, examination of existing building stock and building inspection, building materials, funding and disaster insurance, and disaster training (The Turkish Ministry of Public Works & Settlement; 2004) (see also "3.2. Responsible Institutions in the Disaster Field").

Before reviewing existing process and procedures of the various working committees, a profile of difficulties in the emergency management of the 1999 earthquakes will be drawn. A task paper prepared by an official worked in the Prime Ministry Crisis Management Center pointed out the following shortcomings (Göktürk & Yilmaz, 2005):

- Shortcomings in Personnel: The staff of the Emergency Management Center of the Prime Ministry lacked proper professional orientation, work discipline, as well as foreign language skills to communicate with foreign assistance programs.
- Shortcomings in Transportation and Organization: The staffs of the Emergency Management Center and urgently needed services were not quickly transported to disaster prone areas. For instance, satellite based communication systems were transported via highways rather than by air, even though highways to disaster prone areas were blocked by earthquakes for several days. Work shifts in the Emergency Management Center as well as distribution of urgent goods and services to disaster prone areas also functioned suboptimally.
- Shortcomings in Coordination: Inefficient coordination problem between the Prime Ministry Emergency Management Center and regional emergency management centers in disaster prone areas often created chaotic conditions during the crisis time.
- Problems with Media: The Prime Ministry Emergency Management Center experienced difficulties in securing the release of accurate information to the media, i.e. the dissemination of wrong or biased information created misjudgments or adverse reactions of the public.

- Inefficiencies in Emergency Management: The competition among government executives slowed down decisions on necessary emergency measures.
- Pressures from Private Firms of Pre-fabricated Housing: The decision making on numbers and site of temporary housing units was hampered by attempts of firms of pre-fabricated housing at influencing decisions of Prime Ministry Emergency Management Center on building temporary houses.

It is an interesting point of experiences in 1999 earthquakes that while governmental institutions revealed major shortcomings, non-governmental organizations and volunteer groups played a remarkably active and efficient role in responding to the 1999 earthquakes, arising as a new sector in the disaster response system of Turkey.

The Institution-Building Committee aimed at analyzing the existing situation of the disaster management system in Turkey, pointing out problematic fields, and designating compulsory measures and precautions. The following main problems of the Turkish disaster management system can be identified in light of the findings of the Committee:

MAIN CONCERN: Although Turkey is prone to many types of natural and man-made disasters, the main concern relates to the natural disasters and mostly earthquakes. Accordingly, the legislation and institutional structure of disaster management chiefly focus on earthquakes (see also 3.1. Review in Turkish Disaster Legislation and 3.2. Institutions Involved in the Disaster Mitigation Process).

Moreover, existing institutional organization and legislation mostly concentrate on disaster response and recovery activities. Precautions and measures for disaster preparedness

are inadequately developed. Even legislative and institution-building initiatives in the wake of the 1999 earthquakes are mainly concerned with improving recovery activities or disaster response organization. Notably, the activities of public training, disaster recognition and awareness in relation to disaster preparedness have not been properly organized in Turkey, as yet. Another significant shortcoming in the disaster preparedness process relates quality control and construction standards. A study of the Union of Turkish Contractors proposes the vocation of a new quality control and insurance mechanism in Turkey and a mechanism should be introduced by legislation and rely on the cooperation of and contribution from local authorities, private sector and other interest groups (Karaesmen, 1996).

COORDINATION & ORGANIZATION: All disaster mitigation plans and programs need to be prepared before actual disasters occur, and they need to be coordinated under one single authority. Although there are many institutions with disaster-related responsibilities, including coordination functions in Turkey, ***a single coordination authority is still outstanding.*** As noted before, the “General Directorate of Turkey Emergency Management” founded by the decrees with the force of law nos. 99/583 and 600 is charged with coordinating the institutions involved in the preparation, response, and recovery process of earthquakes, land slides, falling rocks, fires, accidents, meteorological disasters, nuclear and chemical accidents, and people movements affecting the security of the country. Yet, this General Directorate thus far fails to operate effectively due to staff and budget constraints. A draft law on “Tasks and Organization of the Directory of Disaster and Emergency Management” was introduced on 18.03.2008 to the Parliament where it is still pending. The draft law aims at regulating conflicts among various Turkish institutions with similar roles in disaster mitigation such as the General Directorate of Disaster Affairs, General

Directorate of Civil Defence, and General Directorate of Turkish Emergency Management. The proposed Directory of Disaster and Emergency Management will report to the Prime Ministry. Discussions are still proceeding on the abolishment of existing institutions envisaged in the draft law. If adopted, the law will accomplish a remarkable reform of the more than fifty year old framework of disaster institutions (see also Annex I.17).

Overlapping responsibilities of authorities in disaster events sometimes cause gaps in the provision of services and inconsistencies of instructions issued by different authorities.

Conflicts have sometimes been experienced even in the same institutions. For instance, in the 1999 Marmara Earthquake, the settlement plans for disaster prone areas were prepared by two different General Directorates of the Turkish Ministry of Public Works and Settlement in the exercise of planning responsibilities provided in the Public Works Law (Law No.3194) and the Disaster Law (Law No.7269). Both of the laws provide for plan preparation responsibilities in disaster areas without addressing a specific General Directorate. To resolve the ensuring ambiguity, two General Directorates negotiated an ad hoc formula for the coordinating settlement plans in disaster prone areas; however, this formula applied only to the 1999 earthquakes. Similar problems were experienced in search and rescue activities and relief organizations after disasters.

Several disaster mitigation activities revealed a lack of coordination between central and local authorities. There are some fundamental reasons behind it. First of all, Turkey is a central state with a strong central government. Secondly, many disaster-related responsibilities are bestowed on ministries and other central authorities due to the fact that central authorities have better financial resources and technical personnel than local authorities. Although local authorities are easier accessible and are more familiar with local conditions, central authorities in Turkey traditionally wield most

powers. In order to improve cooperation and coordination among central and local authorities in the disaster mitigation process, a new system should be developed with devolution of competencies to local authorities, NGOs, and various organizations of local community (Management of Natural Disasters in the Eastern Mediterranean Region, 1998).

The 1999 Marmara Earthquakes, inconsistencies were observed among disaster management approaches, methods, and even terminologies of various governmental and non-governmental organizations involved in the process. Hence, disaster managers in GOs and NGOs should be trained according to a common concept of disaster management, organization and coordination with common approaches and disaster terminology (The Turkish Ministry of Public Works & Settlement; 2004). Moreover, an integral disaster management system is urgently needed; this system would have to intend all phases of disaster management, namely, preparedness, prevention, response, recovery and mitigation. A single institution should coordinate the interaction institutions and organizations operating within this system.

INTEGRATION OF DISASTER MITIGATION ACTIVITIES AND SPATIAL PLANNING INSTRUMENTS: Although Turkey is prone to frequent natural disasters, ***disaster mitigation techniques and approaches are not reflected in spatial planning methods and procedures.*** This dichotomy undermines the effectiveness of disaster mitigation in Turkey, notably with respect to earthquake hazards. As earthquake hazards correlate with spatial planning standards and building codes, earthquake mitigation techniques should be inserted in tools of spatial planning and construction works. Natural disaster mitigation techniques should thus become an integral part of national and local level planning activities (Management of Natural Disasters in the Eastern Mediterranean Region, 1998).

The "GEMITIS" Project introduced in the International Seminar on the Management of Natural Disasters in the Eastern Mediterranean Region presents an example for integrating disaster mitigation techniques into spatial planning approaches. The GEMITIS Project which is supported by the French Committee for IDNDR, aims at forming of regional networks of cities committed to joint action in the spheres of disaster prevention and sustainable development. Disaster mitigation will be at the core of close collaboration between cities until a systematic exchange of information and experiences coordinated by French specialists. Reference procedures will be adapted by the participating cities to their socio-economic, technical, political, and cultural circumstances (Management of Natural Disasters in the Eastern Mediterranean Region, 1998).

Akin to the GEMITIS Project's dynamics and principles, disaster hazard assessment data can be inserted into spatial planning analysis base maps which provide guidance to spatial planning decisions. Risk assessment and mitigation techniques can also be taken into consideration in making spatial planning decisions. For instance, disaster risks and other spatial planning criteria can be taken into account in developing site of the residential areas, standards and construction details of new residential areas. Such approaches were initiated in Turkey in areas with high earthquake hazards, especially after 1999 Marmara earthquakes. It is recommended to redesign all spatial planning tools and materials with a view to various natural disaster risks in countries prone to frequent natural disasters like Turkey.

In addition to integrating disaster mitigation approaches with spatial planning tools, Turkey needs to rearrange her entire spatial planning procedures and processes. At present, ***Turkey has a quite chaotic spatial planning system overlapping responsibilities of various institutions involved in spatial planning with various planning***

legislations. The existing spatial planning system of Turkey consists of 18 institutions and 56 different types of spatial plans. Besides, there are more institutions (approximately 50 institutions having responsibility of spatial plans and decision making processes) took part in the decision making process of the spatial planning (Duyguluer, 2007). Fragmented spatial planning responsibilities and complex planning processes tend to cause difficulties in integrating disaster mitigation approaches with spatial planning tools.

PUBLIC & INSTITUTIONAL AWARENESS AND TRAINING: This topic will be developed in some detail in the criticism of the "Disaster Training Committee". In this context, some topics and principal recommendations will be underlined with respect to institutional awareness and training which indirectly affect public awareness. All institutions taking part in disaster mitigation and management processes should provide training to their staff and they should follow a common definition of key disaster-related terms such as risk, mitigation, hazard, vulnerability, etc. All institutions with responsibilities related to spatial planning and building sectors should be fully familiar with the control process for spatial plans and constructions. Such institutions should employ planners, architects, civil engineers, geologists, cartographers, etc. with criteria of technical proficiency, liability, and experience.

Spatial planning institutions should also initiate a public participation process in planning and disaster mitigation topics. Such initiative might be easier to adopt on the local level than on the central level. Local citizens or civil society organizations can be involved in the process of developing local spatial plans and disaster mitigation projects via local authorities, i.e., municipalities and governorates (The Istanbul Metropolitan Municipality, 2002).

SUSTAINABILITY OF INSTITUTIONS AND INSTITUTIONAL

ACTIVITIES: The criticism under this subtitle derives from on personal practical experience and observations as well as international working groups on disaster mitigation and cooperation in Turkey. Turkey has a high capacity of building new institutions and enacting new legislation. ***Nevertheless, Turkey has experienced many failures in sustaining new institutions and organizations as well as in solving conflicts between new legislation and related (existing) legislation.*** For instance, the Prime Ministry/General Directorate of Turkish Emergency Management was established in the wake of the 1999 earthquakes to coordinate disaster activities has thus for failed to provide effective coordination. To some extent, such failure is due to weaknesses of the enabling legislation of decree laws (law nos. 583 and 600) rather than full-fledged laws with proper budgetary allocations. Another unfortunate example is the Turkish National Earthquake Council. Established in 2000 (just after the 1999 Marmara Earthquake) due to urgent needs, the Council was abolished by circular of the Prime Ministry dated 6.1.2007. It is difficult to explain the instability of these key institutions in the light of the high disaster threats and hazards in Turkey. The decision makers in Turkey should review their approaches to institution-building. Adequate time and efforts should be spent on deciding the question whether a new institution is necessary or not. Before it is decided to establish a new institution, legislative, financial, and organizational foundations should be designed properly. Similarly, before an institution is abolished, a cost-benefit analysis should be carried out including an assessment of its activities and an evaluation of its performance.

Frequently, the members of committee or working groups on disaster topics do not serve sufficiently long terms to sustain activities or programs. For instance, the Turkish Delegation to the South-eastern European Countries Civil-Military Cooperation Workshops

(see also 2.5 International Seminars & Conventions-Stability Pact) in 2000-2001, attracted considerable criticism because of frequent changes of its members. Several measures are proposed to remedy this problem. First members of both local and international working committees should be carefully selected and appointed. Secondly, technical persons appointed to various disaster working groups should be able to accomplish their tasks without fear of being replaced arbitrarily or as a matter of administrative routine. Thirdly, working group or committee members should be relieved from other tasks so that they can devote sufficient time to the task of the committee or working group. Lastly, members of disaster committees should not be replaced as a result of changes in the central government and other political conflicts.

FINANCE: Securing sufficient financing is a significant challenge in organizing or reorganizing the disaster management system in Turkey. Lack of financial support and budgetary constraints related to disaster mitigation activities make it difficult to organize an effective disaster management system and to build necessary institutions. As substantiated in more detail under the criticism of the "Funding and Disaster Insurance Committee", new funds, budgetary items and related financial measures are necessary to sustain an efficient disaster management system in such a disaster prone country as Turkey. New financial measures are also necessary for scientific research and technological developments for disaster mitigation. Especially with respect to earthquakes, scientific researches and technology based methods are inevitable for building disaster resilient settlements since major threats do not emanate from the earthquakes themselves but inadequate and inefficient adherence to construction and spatial planning standards.

The Disaster Legislation Committee aimed at examining and criticizing the existing earthquake legislation in Turkey. As already

mentioned, in Turkey, the earthquake legislation is understood to encompass legislation directly addressing earthquake issues, spatial planning legislation, and building legislation (see also “3.1. Review in Turkish Disaster Legislation”).

The main criticism relates to the chaotic condition of the earthquake legislation itself with myriad of laws, regulations, and decrees enacted by various institutions in various earthquake incidents without coordination. As a result, many conflicts among different institutions have been experienced so far. It is strongly recommended to build a new coherent legislative system that furthers a common understanding, terminology, approach, and coordination among related institutions.

The existing earthquake legislation moreover does not include definitions of key terms, such as risk, risk assessment, and disaster mitigation. An effective earthquake legislation is especially important for Turkey where more than half of the population lives in urban areas. In accordance with the assumption of this study, urban areas are more vulnerable to earthquakes than rural areas due to the density of population and constructions.

Detailed criticism of existing earthquake legislation and proposals for new legislation will be elaborated under three following three subtitles:

EARTHQUAKE LEGISLATION: As noted above the existing earthquake legislation consists of myriad laws, decree laws and regulations with insufficient coordination among various institutions involved. To resolve this problem a new earthquake frame law clarifying responsibilities and interaction of various institutions in the pre-disaster period, in the course of disaster, and the post- disaster period is needed. The new frame law should outline disaster mitigation activities and approaches. Disaster mitigation activities should encompass:

- i) preparation of earthquake hazard and risk maps
- ii) building and developing local and international networks of earthquake information
- iii) preparation of urban earthquake risk maps and risk assessment studies
- iv) management of the earthquake insurance system

PLANNING LEGISLATION: The existing spatial planning system chiefly concentrates on earthquake recovery activities. After 1999 earthquakes, some amendments to the existing planning legislation addressed risk prevention (see also “3.1. Review in Turkish Disaster Legislation”). These amendments, however, are not sufficient to make settlements disaster resilient. The Public Works Law (Law No.3194) as a main planning law has been criticized for rather soft obligations and penalties with respect to building permits. According to a 1992 report on the assessment of the earthquake in Erzincan, especially articles 31, 32, and 42 of the existing Public Works Law need to be revised urgently. These articles set out obligations and penalties in the case of buildings without construction and/or settlement permits (Ergunay et al., 1993).

In terms of approaches, the spatial planning legislation needs to be revised with respect to risk assessment and disaster mitigation. For that purpose, the Disaster Legislation Committee proposes to incorporate some new terminologies and approaches into the existing planning legislation. These are “micro-zoning”, “mitigation plan”, and “urban transformation action plan”.

The concept of “micro-zoning” requires the preparation of maps that relate earthquake risks to settlement areas. For this purpose, settlement areas could be divided into a few types of micro zones such as zones where buildings are prohibited, zones where special ground survey analyses are required, zones where buildings are permitted only

subject to adherence to special technical standards, and safe zones. This approach should also be inserted into spatial plans. Spatial plans should also have plan notes to determine conditions of settlement and construction for each earthquake risk zone.

The “mitigation plan” is a document to provide guidance on coordinating outputs of risk analyses and risk management activities in various sectors such as housing, transportation, infrastructure, public services, etc. Such guidance can be provided, and hence mitigation plans be prepared, for settlements, regions, or an entire country. Mitigation plans serve to: (i) create data bases for risk analyses of various sectors, (ii) assess risks, (iii) generate methods for risk reduction and sharing, (iv) prepare multi-stake holder mitigation programs in the short-, medium-, and long-run, (v) prepare public training and awareness programs and projects, and (vi) organize monitoring programs for mitigation activities. A mitigation plan should also address responsibilities of various institutions involved in action program of disaster mitigation for a settlement prone to earthquakes. A mitigation plan should be prepared as a base map of a spatial plan. All planning decisions should be taken in light of the risks pointed out by the mitigation plan.

An “urban transformation action plan” is a spatial plan with an action program; this might include resettlement activities, measures to strengthen all constructions, measures to upgrade the environment in high disaster risk areas pointed out in the mitigation plans.

BUILDING LEGISLATION: As already mentioned, the building legislation in Turkey comprises technical specifications for constructions, building related regulations, circulars, and standards for building materials. It also includes the Public Procurement Law No. 4734 with implementing regulations issued by the Ministry of Public Works and Settlement as well as, the Building Inspection Law No.4708 and the building

insurance legislation. Provisions on buildings can furthermore be found in the Public Works Law (see also “3.1. Review of Turkish Disaster Legislation”). It is recommended to aggregate all these partial legislations in a new “Building Law” to improve efficiency and effectiveness in the quality control of building stocks.

As a complementary part, the Turkish building legislation entails provisions on the ground survey analysis. In the light of lessons learned from 1999 earthquakes, the following basic mistakes are addressed in the respect to ground survey analyses of buildings:

- ! The difference between geological surveys for spatial plans and ground survey analyses is often misunderstood or ignored. Geological surveys for spatial plans serve the purpose of proper site development for settlement areas. So far, results of geological surveys for spatial plans have been used in lieu of ground survey analyses for building dots. However, ground survey analyses are necessary to establish basic technical standards for buildings. To clarify roles of geological surveys and ground survey analyses, respectively, ***the Ministry of Public Works and Settlements has prepared a document called “Basic Principles on Preparation of the Report on Ground Survey and Analysis of Building Foundations” in 1993. The document was prepared on the basis of Eurocode 7.***
- ! Lack of control and unqualified staff engaged in ground survey analyses have caused many failures and losses in earthquakes, even though such deficiencies are not peculiar to earthquake events. Ground survey and building foundation analyses should only be performed by expert engineers who bear all technical responsibilities. In the case of larger area ground survey and building foundation analyses, an expert engineer group consisting of geological engineers, geo-physical engineers, civil

engineers, and mining engineers should be appointed (The Turkish Ministry of Public Works & Settlement; 2004).

The Disaster Information System Committee has been tasked with developing a Disaster Information System that would gather process and assess all geological and seismic data. A Disaster Information System (in Turkey mainly with a view to earthquakes) is considered as a useful basis for a Disaster Mitigation System. Building a Disaster Information System requires four steps, namely (i)rehabilitating and integrating existing seismic networks and observatories, (ii) designing a seismic and geological data base and building an earthquake data bank, (iii) determining earthquake threats, and (iv)micro-zoning.

In Turkey, some existing seismic observatories and networks are already operative. These networks need to be upgraded in response to existing needs and in light of modern technologies. Turkey needs a National Seismic Network System which will help to observe and asses seismic data, send reliable data rapidly to disaster emergency management units, disseminate information to the media and public, generate and file data for scientific researches on disaster mitigation. The Committee proposed a National Seismic Network System with the following sub-systems:

- A National Earthquake Observatory
- A National Seismic Network
- A National Network on Strong Motions
- Regional, Local and Temporal Networks

A reliable and sufficiently comprehensive data base on geological and seismic conditions is a prerequisite for determining real earthquake threats; such determination in turn provides the basis for disaster mitigation activities. The Committee proposed that data base

concentrate mainly on active fault lines and paleo-seismology which explains numbers and frequency of hazardous earthquakes stemming from active fault lines in historical and pre-historical periods. A seismology map showing fault lines and protection zones should be prepared based on such data bases.

In conjunction with creating the aforementioned data base, the Committee also proposed to build an earthquake data bank which provides an opportunity to share and exchange all earthquake related data by all types of users, such as emergency management units, relief organizations, scientific researchers, etc. Some initiatives on this topic have been taken by some universities and municipalities in Turkey, but none of them has sufficiently progressed yet. Towards a national scale earthquake data bank, the Committee proposed to:

- Build an earthquake data center based on space technology and GIS(=Geological Information System) to manage the data bank,
- Adopt governmental policies that guide institutions in participating in data gathering and assessment that institutionalize coordination among the various institutions involved in the process,
- Define a common terminology and information standards for disasters and/or earthquakes, and
- Strengthen international cooperation on space based technology and organize training programs in this field.

As already mentioned, the concept of threat implies a combination of the probability (or frequency) of occurrence of a natural hazard (see also Annex III). In accordance with this basic definition, an earthquake threat can be described in terms of the probability of occurrence of a hazardous earthquake. The determination of earthquake threats in the frame of a National Disaster Information System implies analytical studies of geological, seismological and historical data, classification

and mapping of earthquake sources, modeling on earthquake events and reoccurrences, and transforming outputs of earthquake threat analyses into technical specifications for buildings.

Micro-zoning is a method for preparing detailed analyses of the geological structure and ground conditions in regions threatened by earthquake. The micro-zoning mainly serves to purpose of determining earthquake hazard zones in urban plans. Micro-zoning can be implemented in three basic steps and scales: (i) In 1/25 000 scale maps, main characteristics of earthquakes are determined in accordance with probabilistic method for different regions. (ii) In 1/5 000 scale maps, geological, topographical, and geo-technical features of ground strata are determined for each regions. (iii) In 1/ 5 000 or 1/1 000 scale maps, micro zones are determined to guide planning decisions of urban settlements (The Turkish Ministry of Public Works & Settlement; 2004).

Since disaster mitigation has many interrelated sub-topics, different working committees sometimes have presented common solutions, e.g. micro-zoning. While this method is a proposal of the Disaster Legislation Committee, the Committee of Disaster Information System also suggests this method as a disaster mitigation measure.

The Examination of Existing Building Stock and Building Inspection Committee aimed at analyzing the disaster/earthquake resilience of existing building stocks as well as at determining problematic areas in the building process and possible solutions for improvements. The Committee proposed a method of graduated assessment of the existing building stock. This method envisages three grades of assessment:

1. Primary Grade: Quality assessment of buildings on the basis of observation from outside, e.g. from the street. At this level, data

such as outlook of a building, number of storeys, single or attached building, and overhangs can be collected.

2. Secondary Grade: Detailed analysis and data collection from the inside of a building. At this level, data are collected from architectural and structural plans, sections, etc. The assessment at this level mostly serves risk classification. The outcomes of this assessment improve decision-making on the future of the building stocks, such as retrofitting, removal, and renovation (Sucuoğlu, 2006).
3. Tertiary Grade: At this level, detailed analysis is performed on buildings in need of special attention, such as highly damaged buildings and important public service buildings. Detailed information on ground survey of the building, building materials, bearing system materials, etc. is needed for that purpose.

The proposed method of graduated assessment should also be supported by data from earthquake risk maps and micro-zoning. The stability of buildings and building performance can be measured by synthesizing geological data and building data.

As another important element of the method of graduated assessment foresees a classification of building stock. The Committee proposed to classify urban building stocks in Turkey according to their use and building types as follows:

- 1-7 storey concrete buildings
- 1-5 storey masonry buildings
- High rise buildings (more than 7 storeys), such as business centers and residential buildings
- Schools, hospitals, and fire brigade buildings
- Public buildings

- Single industrial buildings, such as 1-2 storey concrete buildings, prefabricated buildings, organized industrial site buildings, etc.
- Industrial establishments, such as factories
- Strategically important buildings
- Buildings containing hazardous waste
- Bridges and viaducts
- Wood constructions
- Infrastructure networks
- Cultural assets

The method of graduated assessment for the examination and measurement of earthquake safety of existing building stock should be supported by building inspection. Building inspection involves two steps, namely project control and construction control. Project control denotes the control of architectural, static, electrical plans by the authorities in charge according to principles drawn laid down in the Public Works Law (Law No. 3194). Construction control is based on the Building Inspection Law (Law No.4708) (see also "3.1. Review in Turkish Disaster Legislation"). The Building Inspection Law sets out a building inspection system aimed at saving lives and assets, increasing the quality of buildings for that purpose, clarifying responsibilities and authorities of technical staff such as building contractors and building inspection institutions², architect and engineer controllers in the building process. The building inspection system also aims at increasing awareness of consumers, protecting of consumers, and applying sanctions in the case of failure in legal aspects. The implementation of

² Building inspection institutions are incorporated institutions certified by the Ministry of Public Works and Settlement. They have to employ at least 8 architects and engineer controllers). Building inspection institutions play an intermediate role between building owners and relevant authorities. They are responsible for controlling the entire construction process and procedures; they have to guarantee the safety of the building for a certain period of time determined in the Law (The Turkish Ministry of Public Works & Settlement; 2004).

the system is presently tested in 19 provinces in Turkey on a pilot implementation basis.

The Building Inspection Law (Law No.4708) has some weaknesses. Most notably is the failure of setting out a compulsory the building insurance system in the frame of the Law. ***The Committee strongly recommended a building insurance system that would facilitate improving the solidity of buildings and the prompt repair of constructional damages*** (The Turkish Ministry of Public Works & Settlement; 2004).

The Building Materials Committee aimed at analyzing existing construction quality and building materials in Turkey and at developing some recommendations on improving the build-up environment. Since this thesis mainly focuses on spatial planning for urban settlements, the topic of building materials is not studied in detailed. Only the quality and usage of building materials are significant in the context of the present thesis.

The Committee categorized building materials into three groups, namely main building materials, repairing and rehabilitation materials, and isolation materials. Two main problem areas related with building materials are -relevant in the present context- inadequate quality of building materials and improper use of building materials in a construction. For instance, buildings have severe damages after earthquakes due to low quality of building materials, failure to observe technical standards in the construction process, and improper condition of fixing building materials. In light of lessons learned in the 1999 Marmara earthquakes in Turkey, the Regulation on "Building Materials" was adopted (issued in the official gazette of 1.12.2006, no.26363). This Regulation was based on EU Directives on "Construction Products" (EU Directive No.89/106EEC).

The Committee also categorized materials used in existing building bearing systems in Turkey as follow (The Turkish Ministry of Public Works & Settlement; 2004):

- In Concrete Construction: Concrete and steel installation
- In Masonry Construction: Bricks
- In Wood Construction: Wooden materials
- In Construction of Rural Areas (Stone & Sun-dried Brick construction): Stone and Sun-dried Bricks
- In Steel Construction: Steel and metal materials

Upon the analysis of the existing situation, the Committee made the following recommendations towards improving the quality and use of building materials (The Turkish Ministry of Public Works & Settlement; 2004):

- A comprehensive legislation on building materials should be prepared.
- A market surveillance and control system for building materials based on the existing and/or new legislation should be established.
- The number of building material testing laboratories should be increased to support the market surveillance and control system.
- A Supreme Council for building materials which guides surveillance and control of building material with respect to issues of principle building, activities, control and training should be established.

The Funding and Disaster Insurance Committee aimed at mitigating disaster risks by a disaster insurance system and designing a model for financing necessary activities in pre-disaster and after disaster periods. Since all aforementioned ad hoc committees

concentrated on earthquakes, an insurance system and a finance model were derived from the dynamics of earthquakes.

The Committee recommended creating the following systems and facilities for financing activities in the pre-disaster, in disaster, and post-disaster periods:

- ***A Disaster Insurance System***
- ***A National Disaster Fund***
- ***A Model on Sustainable Housing Ownership Subsidy and Rehabilitation***

In Turkey, so far, activities, measures, and programs in the course of disasters and in post-disaster periods have been financed by the central government budget. Foreign grants and credits have been obtained and new taxes have been imposed to finance budget deficits emanating from disaster related expenditures and investments. This traditional mode of financing had caused a lack of investments in disaster preparedness in Turkey. While a compulsory earthquake insurance system was established in 2000, the following problems remain unresolved (see also "3.1.Review in Turkish Disaster Legislation"):

- Due to economic crises in the wake of disasters, lack of public awareness and recognition of earthquake risks, and weak enforcement of the compulsory earthquake insurance system, the rate of insured dwelling units remains low.
- The Natural Disaster Insurance Institution under the Undersecretariat of the Turkish Treasury faces organizational and legislative difficulties. It in particular needs an enabling legislation which provides sufficient authority and sanctions to implement compulsory earthquake insurance system.

- Especially after 1999, the increasing number of devastating disasters worldwide lead to a shortage of reinsurance capacity and a rise of reinsurance premiums. This has adversely affected the insurance market in Turkey for disaster risks.

In light of these problems, Governmental incentives are strongly advised by the Committee to increase the number of earthquake insurance holders. In addition to such incentives, the following financing methods are recommended to decrease the risk of earthquakes and the costs of possible earthquake hazards.

Since Turkey is a country prone to disasters which may exceed her own coping capacity, the Committee strongly advised to create a main disaster authority that organizes disaster preparedness and response activities with the support of special funds and an organizational structure(The Turkish Ministry of Public Works & Settlement, 2004). Although a special “Earthquake Fund” had already existed, the fund was in the wake of 1999 earthquakes transferred to the central budget (see also “3.2.Institutions Involved the Disaster Mitigation Process”). The Committee strongly recommended a new disaster fund supported by some other monetary resources such as some transfers from the insurance sector, revenues from the use of some goods and commodities (e.g. certain percentage of Value Added Tax), and some portions of the central budget revenues.

Another recommendation of the Committee was a model for a sustainable housing ownership and rehabilitation subsidy to help people living in earthquake prone areas to improve the building stock. This model recommends public-private partnerships for new housing areas and rehabilitation projects for existing settlement areas (The Turkish Ministry of Public Works & Settlement; 2004). Recommendations of the Committee do not imply a fundamentally

different approach than that followed by the Ministry of Public Works and Settlement in earthquake related projects. The latter Ministry prepares many plans and construction projects for temporary settlement (prefabricated units for earthquake victims after earthquakes) and permanent settlement areas. Nevertheless the Ministry of Public Works and Settlement encounters considerable difficulties due to the lack of financial resources and technical personnel. Better results could be achieved through a public-private partnership model with the support of financing methods as proposed by the Committee. The author's practical experiences on earthquake mitigation projects suggests that existing and experienced institutions rather than newly founded institutions should be responsible for planning and constructing new settlement areas as well as rehabilitating existing settlement areas. Otherwise all lessons learned from former disasters can fall into oblivion.

In addition to the above outlined financial proposals, regional and international cooperation in accordance with the principles of the Yokohama Strategy and the Hyogo Framework, is essential to mitigate disaster risks including strengthening of financial coping capacities (see also "2.5. International Seminars and Conventions").

The Disaster Training Committee aimed at organizing training on disaster mitigation topics at various levels. The task of this Committee hence included compiling techniques and methods that should be used in disaster mitigation of a country like Turkey where 92% of its land is prone to earthquakes (See also "3. Disaster Mitigation Approaches and Lessons Learned in Turkey"). Before designing effective training methods and techniques, the Committee drew a hazard profile of earthquakes in Turkey with the following items:

- Casualties

- Injuries, permanent physical disabilities, and mental defects depending on post traumatic stress
- Loss of livestock
- Loss of building
- Building hazards
- Transportation route hazards (roads, railways, ports, etc.)
- Infrastructure hazards (sewerage, pipelines, etc.)
- Technical service hazards (electricity, drinking water, energy lines, telecommunication networks, etc.)
- Interruption in public services (security, health, education, etc.)
- Hazards of cultural assets (historic buildings, culturally protected buildings, archaeological sites, etc.)
- Environmental degradation

With a view to the above hazard items, ***the Committee distinguished between two main training groups, namely formal education and mass education.*** Formal education comprehends compulsory education from pre-school education to university education. In this process, hazard-related theoretical and practical lectures are inserted into students' study curriculum. Mass education relies on the voluntary participation and contribution of people. In the mass education process, there are two main target groups, namely (i) people who are prone to disasters and (ii) politicians, administrative staff, and public personnel who take place in the political, economic, social, and physical planning procedures. More specifically, the Committee identified four target groups for mass education:

- ❖ National education
- ❖ Adult education
- ❖ On-the-job training
- ❖ Training of business groups and NGOs

In national and adult education, priority is given to teachers, heads of districts/villages, group leaders and members of district volunteer organizations, building managers, chaplains, disabled people. The primary target groups for on-the job training are the staff of central authorities, local authorities, sectors of civil defence, fire brigades, public works, conservation of cultural, historical, and natural environment, education, rural affairs and forestry, health, technical infrastructure, transportation, telecommunication, security, and armed forces. Technical training and certification programs for professionals and university students in spatial planning, geology, and the construction sector can be carried out in the frame of both on-the-job training programs and training of business groups and NGOs. Especially in earthquakes, where risks are largely exacerbated by improper constructions, co-workers and technicians in spatial planning, geology, and construction sectors should be well trained on standards, qualified works, and new technologies. Media representatives are another target group which should be taken into a consideration for training of business groups and NGOs. The Media representatives should be trained on methods of obtaining reliable and transparent information and disseminating such information without creating panic among the people, as well as on building efficient and effective relationship with governmental bodies and scientific groups in light of the psychology of people prone to disasters. ***The Media should also be trained on how to inform people about risks and increase public awareness of disasters*** (The Turkish Ministry of Public Works & Settlement; 2004).

It is moreover important to increase community awareness by training people on what should be done before, during, and after disasters. Such training programs can be carried out in meeting format such as lectures, seminars, workshops as well as published documents such as handbooks, posters, etc. Prior to disasters, people

and institutions can be trained on techniques of staying alive in the course of disasters, search and rescue activities, first aid methods, construction qualities in housing markets, and risk awareness for their living environment. Public administration staff should also be trained in disaster preparedness, response, relief, and recovery process, in addition to disaster and risk management methods and strategies. After disasters, people and institutions should be organized to conclude lessons learned and overall criticism of last events (Karanci & Aksit, 2000).

The Disaster Training Committee finally recommended to include disaster management in the university curricula for city planning, architecture, civil engineering, public administration, and other related disciplines. These curricula should offer lectures on disaster risks, disaster mitigation, disaster management, and related topics (The Turkish Ministry of Public Works & Settlement; 2004).

3.8. SWOT Analysis as an Evaluation

In this part, the findings under the above chapters ("3.3") will be evaluated in terms of Strengths-Weaknesses-Opportunities-Threats (SWOT). A SWOT Analysis will be helpful in designing a best model for disaster resilience for several purposes, such as decision making, physical planning, controlling procedures, participation and organization.

Originally, the SWOT analysis was designed as a strategic tool for planning and decision making at multiple levels within an enterprise or public or private organization. The father of the SWOT analysis was Albert Humphrey. Albert Humphrey and Robert Stewart developed the SWOT analysis in a team work with colleagues in the Stanford Research Institute during 1960s. The SWOT Analysis was initially developed for business management purposes, soon became a planning tool (SWOT Analysis Resource Page, 2008).

Four aspects of the SWOT analysis can be defined in several ways. In this study, the Turkish Disaster Mitigation System will be elaborated in the light of following criteria of the SWOT aspects:

- **Strengths:** As a simple definition, the strengths of the Turkish Disaster Mitigation System denote the positive results, achievements, and sustainable trends to the benefit of various stakeholders, such as institutions, organizations, media, business owners, and citizens. From a deeper perspective, strengths can be determined in terms of factors crucial to the effectiveness of the mitigation system, namely general advantageous in comparison with other countries, geographical location, geopolitical status, institutional coping capacities, resources, assets, experience & knowledge, innovations & technology used, finance & marketing items, cultural level (literacy, value judgments, attitudes) & awareness, administrative & management process and procedures.
- **Weaknesses:** Weaknesses denote exactly the opposite of strengths. However, in order to define weaknesses of a disaster mitigation system, it is also possible to use similar criteria as for "strengths". For instance, while the vast human resources in Turkey can be evaluated as strength, over population and/or misallocation of human resources may well be interpreted as weakness.

To avoid confusion, different criteria are suggested for measuring strengths and weaknesses, respectively, to the extent possible. Thus, weaknesses of the disaster mitigation system may best be measured in terms of general disadvantageous, adaptation and development capacities in general, institutional and legislative gaps, regional cohesion, shortage of resources, vulnerable items, frequency of disasters and time frames for preparedness and recovery, reliability of institutions, authorities, and other stakeholders in the disaster mitigation system.

- **Opportunities:** Although opportunities have some similarities with strengths; the main distinctive feature of opportunities can be determined as positives stemming from external effects. The criteria for assessing opportunities can be a peaceful and stable political atmosphere, positive global influences, new technologies and business sectors, new markets and export quotes, willingness of foreign partners in cooperation on various topics, such as information, disaster projects, funding, exchange programs, etc., innovations and international scientific studies.
- **Threats:** Similar to the relationship between opportunities and strengths, threats have some common features with weaknesses. Both threats and weaknesses refer to negatives yet, while threats refer to external negatives on the disaster mitigation system, weaknesses denote shortcomings in the system.

Criteria used in the SWOT analysis for assessing opportunities may also be used for assessing threats. For instance while the geo-political situation of Turkey provides some advantageous, it may also entangle Turkey in political problems. While Turkey has a chance of building cooperation in her region on earthquake mitigation, such efforts can suffer from the political turmoil in her neighbour countries. The following aspects may be taken into account is assessing threats in the context of a SWOT analysis: disaster profiles in neighbouring regions, adverse political developments, international and bilateral agreements and conventions, environmental effects such as transboundary waters, pollutions and contaminations, adverse climate effects such as global warming, erosion, external market dynamics such as import, export, oil prices, changing trends in technology and consumption behaviours.

In the following tables (see also table 8 & 9), disaster mitigation activities and programs in Turkey are examined on the basis of the

SWOT analysis. Disaster mitigation activities and programs in Turkey are organized in accordance with the terms of reference of working committees of the Ministry of Public Works and Settlement in 2004 (see also "3.3.Criticism on Existing Disaster Mitigation System and Process in Turkey"). However, it is useful to add two remarkable issues to the results of the following tables. As already mentioned, the first issue is lack of general policy and/or master plan for disasters in Turkey. Although Turkey is one of the high disaster risk countries, such topics as urban risk assessment, disaster threats for urban settlement, disaster mitigation to achieve sustainable urban settlements are not mentioned at all in the recent (9th plan for 7 years) Development Plan. The second issue is many failures of governmental organization in disaster response activities of 1999 earthquakes due to many shortcomings. These shortcomings are very similar to the various weaknesses underlined in below tables. Hence, resolution of weaknesses mentioned below will serve to a better disaster mitigation process as well as an effective disaster response program in Turkey.

Table 8: SWOT Analysis-I for Disaster Mitigation Activities in Turkey

SWOT -I-	Institutional Building	Disaster Legislation	Disaster Information System	Existing Building Stock and Building Inspection
S T R E N G T H S	<ul style="list-style-type: none"> • A single coordination authority is still outstanding • Specialized institutions on earthquakes • Developed capacity on disaster response and recovery activities 		<ul style="list-style-type: none"> • Presence of several seismic observatories and data collecting institutions 	<ul style="list-style-type: none"> • New Law on Building Inspection • New building insurance system for earthquakes

W E A K N E S S E S	<ul style="list-style-type: none"> • Shortage of funds and budgetary constraints • Instability of institutional structures • Insufficient sustainability of institutional programs and projects • Insufficient institutional awareness with respect to earthquake hazards • Insufficient attention to natural disasters except earthquakes • Inadequate organization and coordination among various institutions • No common terminology among GOs and NGOs • Overlapping responsibilities of various disaster mitigation authorities • Insufficient coordination between disaster mitigation methods and tools of spatial planning 	<ul style="list-style-type: none"> • Incoherent and fragmented legislation • Conflicts among various laws • The main focus in only on disaster response and recovery activities but preparedness and mitigation • Absence of some basic concepts and approaches such as risk assessment, risk prevention • Rules for building permits and penalties for illegal constructions not sufficiently strict 	<ul style="list-style-type: none"> • No “National Seismic Network System • Difficulties in sharing seismic data with the public • Insufficient effort on implementing an earthquake threat model 	<ul style="list-style-type: none"> • Insufficient coordination and mutual reinforcement between the building inspection law and insurance system
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O P P O R T U N I T I E S	<ul style="list-style-type: none"> • Institutional initiatives on coordination in light of lessons learned of 1999 earthquakes • Various institutional innovations in terms of approaches and organizations • Remarkable active and efficient roles of NGOs in response activities especially in 1999 earthquakes 	<ul style="list-style-type: none"> • Preparation of a draft law on disaster mitigation • Introduction of common terminologies of key terms, such as micro-zoning, risk mitigation, urban transformation action plans • Updates in building quality control system 	<ul style="list-style-type: none"> • Awareness of necessity of a data collecting and processing center for earthquakes 	<ul style="list-style-type: none"> • Pilot implementation of the building inspection system covering 19 province
T H R E A T S	<ul style="list-style-type: none"> • Competition among disaster mitigation institutions for lead role • Perceiving other institutions as threats due to conflicting interests 	<ul style="list-style-type: none"> • Disagreement of various institutions on new approaches and responsibilities 		<ul style="list-style-type: none"> • Weaknesses and failures of the existing building stock

SOURCE: Own source

Table 9: SWOT Analysis-II for Disaster Mitigation Activities in Turkey

SWOT -II-	Building Materials	Funding and Disaster Insurance	Disaster Training
S T R E N G T H S	<ul style="list-style-type: none"> • New Directive on "Building Materials" patterned after EU Directive No.89/106EEC 	<ul style="list-style-type: none"> • New compulsory disaster insurance system for earthquakes 	<ul style="list-style-type: none"> • Professional staffs such as planners, architects, engineers have basic knowledge and experience on disasters

W E A K N E S S E S	<ul style="list-style-type: none"> • Inadequate quality of building materials • Improper use of building materials 	<ul style="list-style-type: none"> • Existing disaster insurance system covers only pre-disaster period • No National Disaster Fund and No Model on Sustainable Housing Ownership Subsidy & Rehabilitation for disaster and post-disaster periods • Shortcomings of existing legislation on disaster insurance 	<ul style="list-style-type: none"> • Insufficient training on disaster management • Insufficient knowledge and experience on working principles in disasters on the part of media • Insufficient training on public awareness with respect to necessary actions before, during and after disasters
O P P O R T U N I T I E S	<ul style="list-style-type: none"> • Generation of numerous proposals on legislation; a system for market surveillance and control; testing laboratories for building materials; and a supreme council for building materials 	<ul style="list-style-type: none"> • Various proposals for government subsidies, funds, and instruments for disaster insurance 	<ul style="list-style-type: none"> • Many universities designed their curricula and created new departments in accordance with needs in the field of disaster mitigation
T H R E A T S	<ul style="list-style-type: none"> • Deficiencies in existing building materials (already in use) 	<ul style="list-style-type: none"> • Public negligence and low rate of insured dwelling units due to the economic crisis in Turkey • Shortage of reinsurance capacity and remarkable rise in reinsurance premiums (due to increasing number of devastating disasters worldwide) 	<ul style="list-style-type: none"> • Due to some misinformation of Media, the willingness of citizens to support the disaster mitigation activities may reduce

SOURCE: Own source

As an overall assessment of disaster mitigation activities and programs in Turkey, some basic strengths can be acknowledged in terms of institutions, theoretical frame of legislation, spatial planning standards and building codes, technical staff, building inspection and insurance system. These strengths are, however, undermined by many shortcomings on specifics. For instance, Turkey has several institutions specializing on disasters, but efficient operations of these institutions are curtailed by instable institutional structure, budgetary constraints, and inadequate organization and coordination. On the other hand, the 1999 earthquakes gave rise to reviewing the entire disaster mitigation system. Many initiatives and ongoing studies on legislation, institution-building, insurance, and quality control look promising for disaster resilient settlements.

Institutional cooperation, coordination, and organization are three key issues to be developed in Turkey to sustain various initiatives after the 1999 earthquakes. Experiences of Turkey in former devastating earthquakes show that inefficiencies in institutional organization, coordination and cooperation are main threats for a modern disaster mitigation system (see also "3. Disaster Mitigation Approaches and Lessons Learned in Turkey" and "3.2. Institutions Involved in the Disaster Mitigation Process"). In this respect, after 1999 earthquakes, an initiative for establishing a single disaster coordinator institution is an promising event. However, the process and procedures of organization of this authority is still continuing due to an introduction of new legislation and disagreement of relevant institutions (see also Annex I.17).

Lessons learned from 1999 earthquakes also emphasized the necessity of building a Disaster Information System in Turkey. Despite of the presence of several seismic observatories and data collecting institutions, there are many problems in data collecting and sharing. Thus, Turkey needs a National Seismic Network System to provide a

modern services in observing and assessing seismic data as well as user friendly platform for data sharing and updating.

Training and public awareness are other weaknesses in such a densely populated country as Turkey. It is obvious that an effective disaster mitigation system cannot be built on well designed institutional structures and legislation alone. ***It should also be supported by public awareness which requires public training.*** Turkey is capable of organizing disaster training programs for a broad public. According to outputs of the SWOT Analysis above, new curricula and approaches should be introduced in Turkey. For instance, disaster training programs should not be limited to teaching survival techniques to the public in the course of disasters. Various training programs can be designed for different target groups such as local authorities, citizens, trainer for trainees, etc. The ultimate issue of public awareness and training refers the training of Media on public information. According to the lessons learned of 1999 earthquakes, it is understood that citizens can reduce the willingness to comply with essential rules and procedures of disaster mitigation activities when they are misinformed about some public services or when they are in a panic due to some inappropriate information of the media.

As a consequence, lessons learned from the 1999 earthquakes can provide guidance to design a disaster resilience model for urban settlements. While the evaluation of best international examples gives precious inspirations to develop the model (see also table 5), the results of the SWOT Analysis above share more hints of the disaster mitigation capacity of a country prone to devastating earthquakes.

CHAPTER 4:

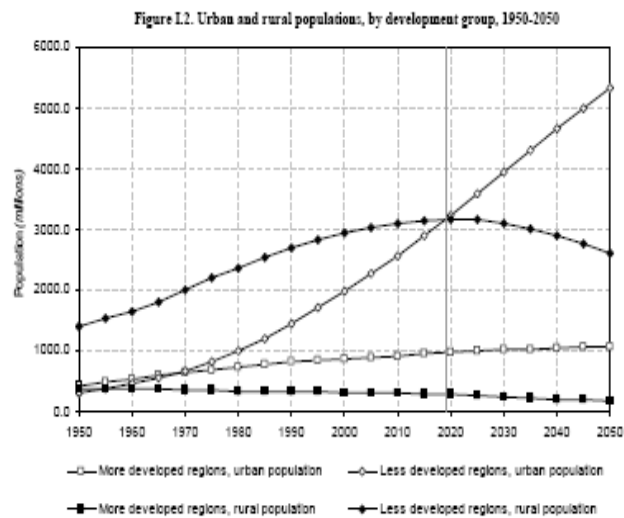
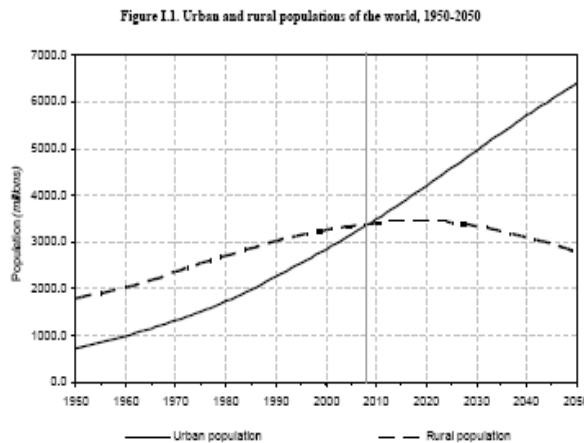
4. DISASTER RISKS ON URBAN SETTLEMENTS

4.5. Analysis of Existing Risks in Urban Settlements

As already mentioned (see also "1.4. Scope of the Study"), especially, in last twenty years, natural disasters with devastating effects on human settlements have proliferated. The propensity of disasters is increasing in the light of such trends as increasing rate of population in and around urban areas, degrading environmental quality, global heating. By the year 2000, half the world's population will live in urban areas, crowded into 3% of the earth's surface (Domeisen & Palm, 1996).

While urban settlements exploit natural resources and cause environmental pollution due to their dense population and construction, they are the core area of economic and cultural activities as well as significant cross-roads of transportation routes, technologies, and other modern networks. Despite their disadvantageous features, urban settlements have therefore attracted and are attracting their increasing populations. According to the United Nations' figures, the share of the world's population in urban settlements has risen to 50% from 30% since the 1950s and this share is expected to increase to 60% in 2030 (Munich Re Group; 2004). The increasing trend of urban population can be observed in the following graphics (see fig. 6) in the period 1950-2050 based on the United Nations data. While the global trends of increasing population in urban and rural settlements are shown in the graphic on the left side, the same trend are categorized as the population increase in developing countries and developed countries, respectively, on the right side.

Figure 6: Urban vs Rural Population Increasing Trends Comparing to Figures in Developing and Developed Countries



SOURCE: The United Nations; 2008

Owing to the density of population, construction, and accumulation of investment, urban settlements are especially prone to high risks of natural disasters (Management of Natural Disasters in the Eastern Mediterranean Region, 1998). The statement above emphasizes two remarkable issues, namely (i) urban settlements are at risk of natural disasters and (ii) this risk is high due to their density of population, construction, and accumulation of investment. Hence, variables of disaster risks may be grouped in two main categories, namely "Variables of the Urban Settlement" and "Variables of the Natural Disaster". An assessment of variables of the urban settlement will start with an analysis of peculiar existing features of urban settlements under consideration such features include the site of the settlement (coastal settlement, hillside settlement, alluvial plain settlement ...), the ground survey of the settlement (whether urban settlement sits on firm ground or not, land liquefaction factors, ground water levels...), the planning standards and criteria of the settlement, land-use, population density, population profile and public awareness for disasters (social indicators), construction density and quality of the settlement, the

quality in urban infrastructure & services, economic profile of the settlement (sectors, employment rate and profile, scale of production such as domestic scale production or country scale or international scale). The variables of the natural disaster can be expressed in terms of magnitude and range of the natural disasters; the frequency, the occurrence time and duration of disasters, and type of disasters, e.g. only earthquake or earthquake + flood triggered by earthquake. While each variable is equally effective on the risk, the combination of all below variables would determine the degree of risks of a certain urban settlement prone to natural disasters.

A third dimension will be added to the below matrix which may be called "total capacity of disaster response" in an urban settlement. Actually the total capacity will be compounded two parts namely, national disaster response capacity and local disaster response capacity which partially covers institutional coping capacity. Then the synthesis of these three dimensions (variables for urban settlements-variables for disasters-total capacity of disaster response) will provide the basis for determining the risk profile and the vulnerability level of urban settlements.

Table 10: Key Variables of Natural Disaster Risks in Urban Settlements

NATURAL DISASTER VARIABLES URBAN SETTLEMENT VARIABLES	C a u s e s	Type (Single- Multi)	M a g n i t u d e	R a n g e	F r e q u e n c y	Disaster Occurrence Time	Duration of the Disaster
Population Size							
Population Density							
Land-use							
Construction Density							
Construction Quality							
Infrastructure Quality							
Geology-Geomorphology							
Planning & Building Regulations and Legislation							
Control & Monitoring							
Institutional Coping Capacity							
Institutional Coordination & Organization Capability							
Public Awareness & Training Level							
Economic Activities of the Settlement							
Economic Conditions of the Country							

SOURCE: Own source.

After drawing the main frame of risk profile of urban settlements, two different approaches are proposed to lessen the hazardous effects of natural disasters on urban settlements of developing countries and developed countries, respectively. Actually, a need for different approaches in disaster mitigation with respect to developed and developing countries has been recently argued by many researchers and academics. For instance, a group of scientific researchers prepared an article in 1999 called "A New Approach to Disaster Mitigation and Planning in Megacities" (Valasquez et al., 1999). First of all, from the perspective of a city planner, it is possible to distinguish between

urbanization processes and urban settlements in developing countries and/or population increasing countries and developed countries. In 1950, more than half of the population of developing countries lived in urban areas whereas the proportion was around 18% in developed countries (Munich Re Group, 2004). Since then, the rate of urbanization in developing countries increased more than that in developed countries due to the rapid population increase in developing countries (see also fig. 15). The growth of urban population has different reflections to the urban space in developing and developed countries. While urban settlements grow in a decentralized form in developed countries, agglomerations around urban settlements become the trend of urban growth in developing countries. In many developing countries, central and local authorities have numerous difficulties to provide adequate infrastructure and urban services to citizens. Besides, densely populated squatter settlements around urban settlements create more difficulties in the provision of urban services and infrastructure in developing countries. On the other hand, the people living in squatter settlements are mostly prone to risks of natural disasters such as floods, land slides, and earthquakes (Domeisen & Palm, 1996).

Outcomes of main international seminars and programs, and projects of international organizations also indirectly support the need of two different approaches. Thus, the Office of the United Nations Disaster Relief Coordinator(=UNDRO) has published a seven-volume study on Disaster Prevention and Mitigation including a methodology for evaluating economic effects of natural disasters. According to this study, features and dynamics of urban settlements vary according to levels of development and other particularities. Importantly, urban settlements in developing countries tend to be more vulnerable to natural disasters than those in developed countries (UNDRO, 1979). At the World Conference on Natural Disaster Reduction in Yokohama,

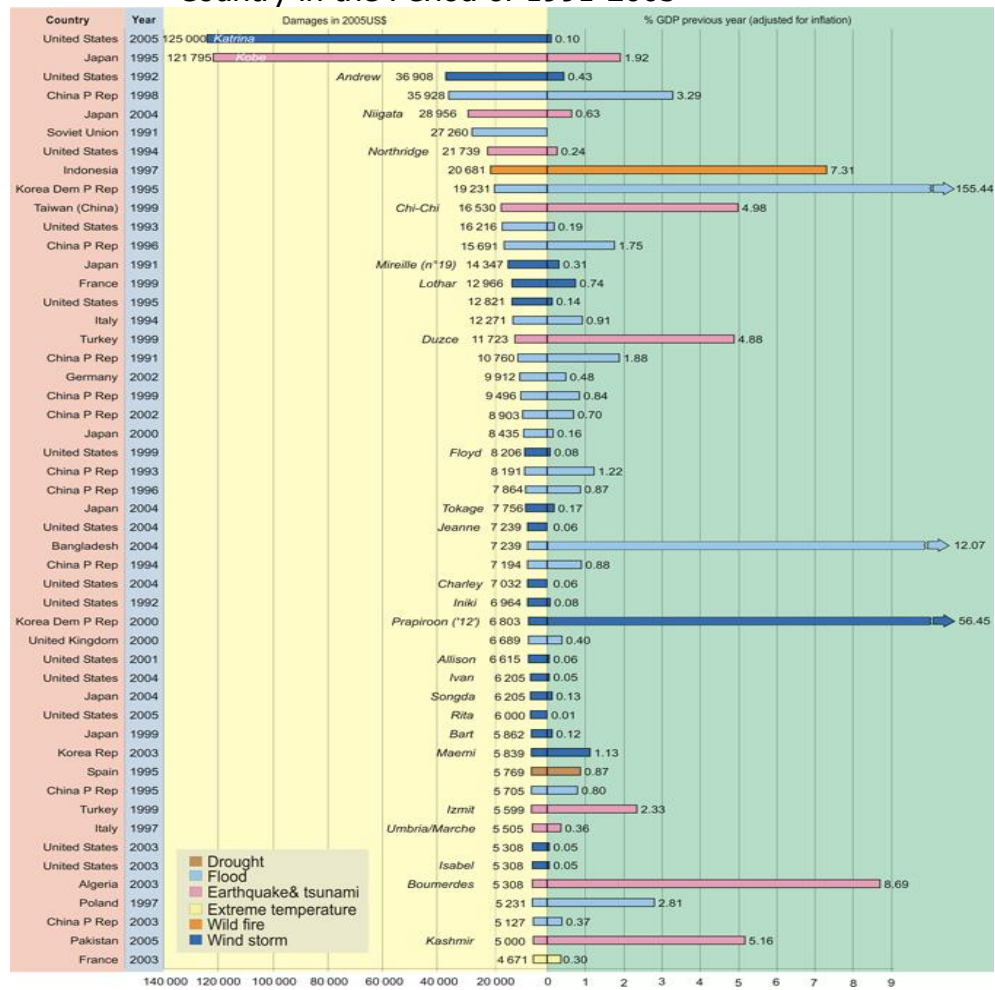
JAPAN from 23 to 27 May 1994, participant countries agreed on some principles for disaster mitigation. One of these principles is "Vulnerable groups should receive primary attention. In this context, developing countries, least developed countries, small island developing countries, and land-locked countries are the most vulnerable countries. The poor and socially disadvantageous groups in all countries are other vulnerable groups" (ISDR, 2007). This principle and related approaches were also supported at the World Conference on Disaster Reduction that was held from 18 to 22 January 2005 in Kobe-Hyogo, JAPAN (Hyogo Framework for Action 2005-2015). According to a study prepared by Godschalk, Edward, and Kaiser, the priorities of the countries are set in disaster mitigation plans designed on the basis of the sustainability concept. While sustainability comprises economic features as well as social and environmental features of a country, economic conditions possibly determine the priorities of mitigation (Burby, 1998).

Another international study on disaster risks states that saving lives is the prime focus of disaster mitigation activities in developing countries and slum settlements in all countries (Wisner, 2004). On the other hand, disaster mitigation plans and programs in the United States focus primarily on saving assets and establishments of settlements (Godschalk, 1999). This distinction also supports to two different types of approaches towards the disaster mitigation process in different urban settlements with different primary concerns. While saving urban assets is the primary concern in developed countries, developing countries' primary concern is preventing casualties. The top 50 countries of the world are ranked by International Strategy of Disaster Reduction on the basis of their financial losses suffered in the last decade due to natural disasters. Despite their high-tech methods, sophisticated standards of planning, building codes and infrastructures, disaster insurance systems, well organized public awareness

campaigns and public training; many developed countries suffer significant financial losses from natural disasters. This fact can also be seen in the figures that among the top ten countries with highest losses are six developed countries (see also fig. 1).

Another difference between developing and developed countries stems from the dominance of urban settlements. Urban settlements play a much more dominant role in developing countries and/or population increasing countries than in developed ones. While urban settlements are the concentration of political, administrative, economic, cultural, technical, and infrastructural functions in developing countries; they are just larger rings of the whole chain of infrastructure and services in developed countries. Due to their dominant role of urban settlements in developing countries, the vulnerability of such settlements translates into vulnerability of the country at large. This trend can easily be observed in the following graph. Although many developed countries suffer significant financial losses from natural disasters, financial vulnerability is much higher in developing countries in relation to the GDPs (see also fig. 7). Mostly, the vulnerability extends beyond financial losses and even triggers severe interruption of basic services in developing countries. Thus, rebuilding the active daily life of the entire country requires both time and monetary investments. For instance, "Japan can recover quickly from the destruction of an event such as the Kobe earthquake in 1995 while Nicaragua financially suffered till the end of 20th century because of the Managua earthquake in 1972" (Management of Natural Disasters in the Eastern Mediterranean Region, 1998).

Figure 7: Economic Damages: Amount Reported by Natural Disaster & Country in the Period of 1991-2005



SOURCE: Website of International Strategy of Disaster Reduction (<http://www.unisdr.org>)

Despite the different disaster risk features of urban settlements in developing and developed countries, respectively, losses of urban settlements for both groups of countries can be categorized as i) environmental losses such as contamination of air, soil, water, damage to flora & fauna, etc.; ii) human resource losses such as casualties, accidents, epidemics, etc.; iii) property losses such as livestock, movables, immovables, etc.; iv) economic losses such as financial losses, business interruptions, etc. (Munich Re Group, 2004). In this frame, one of the main differences between developing countries' and developed countries' urban settlements lies in the magnitude of such losses as a share of GDP. International studies, country reports, and statistics show that developed countries can easily cope with disaster

related losses, as casualties and property losses tend to amount to only minor fraction of overall GDP. Thus governments can easily mobilize resources for the recovery of public life, business sectors, infrastructure, etc. In developing countries, central and local governments face a much more serious problem to recover from damages and losses due to disasters. While authorities in developing countries even in normal times have inadequate resources to supply basic public services, housing and infrastructure facilities due to rapid population increase and migration from rural areas to urban areas, in the case of disasters, they need foreign aid and support to prevent turmoil in urban settlements. In addition to these problems, disaster struck urban settlements in developing countries face further environmental degradation because of squatter settlements and illegal constructions.

In sum, despite all urban settlements are at disaster risk, risks and vulnerabilities vary in developing and developed countries, respectively. In order to reduce the risk of natural disasters, two different approaches are effective by considering the differences in vulnerabilities of developing and developed countries.

4.6. Vulnerability and Coping Capacity of An Urban Settlement

After examining risks in urban settlements, urban settlements are analyzed in lights of two more concepts: Vulnerability and Coping Capacity. Like any other disaster term, vulnerability has numerous definitions. Variations notwithstanding, the concept of vulnerability is described in terms of different correlations with hazard, exposure, risk, coping capacity, and susceptibility (Greiving et al., 2006, Villagrán de León, J.C.,2006). In order to develop a useful definition, the following questions need to be addressed:

- What type of threat induces vulnerability? (a natural disaster, a technological disaster, climate change, war, etc.)
- What type of vulnerability is relevant for the core of the study? (physical, technical, institutional, social, cultural, environmental, economical, political, administrative, etc. or a holistic definition)
- With respect to whom will vulnerability be measured? (with respect to the community, poor, the administrators or policy makers, academicians, entrepreneurs, etc.)
- What is the scale of vulnerability? (with respect to an individual person or a company, with respect to a small or large settlement, with respect to a country or a region, etc.)
- For what purpose is vulnerability assessed? (for assessing absolute vulnerability or for making a comparative analysis for a certain region based on relative vulnerability data)
- Over what time span is vulnerability assessed? (elements of vulnerability can change during short- and long-term studies)

In light of the above questions, the concept of vulnerability is in this study, defined as “the degree of fragility of general living conditions of a community and a settlement prone to the natural disasters” (see also Annex III). In accordance with the frame of the study, the fragility of general living conditions of an urban settlement will be analyzed in terms of physical assets. These physical assets in urban settlements can be categorized in three scales (see also table 11).

Table 11: Vulnerable Physical Elements of Urban Settlements

<p>MACRO SCALE</p> <p>At the Settlement Level</p>	<p>❖ <u>Natural Environment</u></p> <p>-Air (urban atmosphere)</p> <p>-Soil</p> <p>-Water Resources (rivers, lakes, seas, underground waters)</p>
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	<p>-Flora</p> <p>-Fauna</p> <p>❖ <u>Built-up Environment</u></p> <p>-Housing Areas</p> <p>-Health Services</p> <p>-Education Services</p> <p>-Social Services</p> <p>-Administrative and Security Areas</p> <p>-Commercial Areas</p> <p>-Industrial Areas</p> <p>-Infrastructure & Technical Service Areas</p> <p>-Transportation Routes & Terminals</p> <p>-Open & Green Areas</p> <p>-Protection Zones (Cultural, historical, natural assets)</p>
<p>MESO SCALE</p> <p>At the</p> <p>Urban</p> <p>Functions</p> <p>Level</p>	<p>-Housing Areas</p> <ul style="list-style-type: none"> • Mass housing complex • Individual buildings <p>-Health Services</p> <ul style="list-style-type: none"> • Neighbourhood unit health care centers • Hospitals • Special rehabilitation clinics (for old, disabled, poor, etc.) • Health centers (hospitals + labs+ research units) • Medicine and other medical material warehouses • Pharmacies <p>-Education Services</p> <ul style="list-style-type: none"> • Day-care centers • Kindergartens • Primary schools • High schools • Academies and universities • Special schools for disabled persons • Education centers for adults (vocational or other

	<p>social purposes)</p> <ul style="list-style-type: none"> • Libraries and archives <p>-Social Services</p> <ul style="list-style-type: none"> • Theatre, opera, and cinema buildings • Concert and congress halls • Sport centers, stadiums, Olympic complexes • Museums, art galleries and other cultural facility buildings • Cultural clubs and society buildings • Foundations <p>-Administrative and Security Areas</p> <ul style="list-style-type: none"> • Administration centers (Governorates, municipalities, district administration centers) • Relevant public buildings • Fire brigades • Police stations • Gendarmerie centers • Military and security facilities • Civil defence centers and their warehouses and sanctuaries • Warehouses for vehicles, technical equipments, and other materials for search and rescue purposes <p>-Commercial Areas</p> <ul style="list-style-type: none"> • Retail commercial areas • Wholesale commercial areas • Central Business Districts • Shopping Malls and Centers • Hotels and other tourism facilities • Restaurants, Cafes, and Bars <p>-Industrial Areas</p> <ul style="list-style-type: none"> • Industrial buildings • Industrial estates • Warehouses • Technical equipment and vehicle parking areas
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	<ul style="list-style-type: none"> • Power stations • Storage facilities for hazardous materials • Nuclear power plants <p>-Infrastructure & Technical Service Areas</p> <ul style="list-style-type: none"> • Sewerage • Drinking water • Gas • Electricity • Telecommunication networks (TV, phone, mobile, Internet, etc.) • Waste water treatment and solid waste disposal areas • Energy generation and transformer stations • Gasoline stations • Dams <p>-Transportation Routes & Terminals</p> <ul style="list-style-type: none"> • Motorways, highway, bus terminals, and highway service stations • Railways and railway stations • Airports and heliports • Harbours, marinas, embankments, docks, quays • Bridges, tunnels, viaducts • Public transportation routes, subway lines, stops, pedestrian underground and overpasses • Closed car parking areas <p>-Open & Green Areas</p> <ul style="list-style-type: none"> • Green parks and playground areas • Open air sport facilities (tennis courts, swimming pools, motor-racing tracks, horse riding and racing areas, etc.) • Big urban parks • Arboretums • Open market areas • Cemeteries <p>-Protection Zones (Cultural, historical, natural</p>
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	<p>assets)</p> <ul style="list-style-type: none"> • Architectural heritage (buildings, monuments, bridges, aqueducts, fountains, etc.) • Other cultural and historical sites • Archeological assets and excavation sites • National parks, endemic species habitats
<p>MICRO SCALE At the Citizens Level</p>	<p>-Vulnerable Elements of Indoors (houses, offices, shopping centers, etc.)</p> <ul style="list-style-type: none"> • Elements of rooms such as walls, columns, windows, doors, etc. • Elements of buildings such as stairs, balconies, alcoves, chimneys, towers, minarets, pendent elements, sign boards, lifts, garden walls, water tanks, laundries, storerooms, bunkers, etc. • Elements of technical services such as electric cables, heating system, drinking water, and gas pipe lines, sewerage systems, ventilation systems, power control, etc. • Elements of personal assets such as furniture, money, documents, archives, dresses, food, etc. <p>-Vulnerable Elements of Outdoors (streets, car parking areas, green parks)</p> <ul style="list-style-type: none"> • Elements on streets such as buildings, street and traffic lamps, vehicles, garbage storage areas, parking areas and bus-stops, etc. • Elements in neighbourhood units such as buildings, emergency centers, health care centers, schools, shops, roads, underground and overpasses, energy links, telecommunication lines, fire plugs, trees, etc.

Source: Own source.

All vulnerable physical elements of urban settlements above are categorized in three scales in accordance with the scales in spatial planning. Hierarchical scales and elements of spatial plans are thus used as a method to draw the above table. In the macro scale, vulnerable elements of an urban settlement are listed in the regional planning scale (1: 100 000, 1:50 000, 1:25 000 scales). Spatial plans in regional scale can only show basic features of an urban settlement, such as housing areas, industrial areas, main transportation routes and environmental elements surrounding an urban settlement, such as rivers, forests, natural conservation areas, etc. In this respect, vulnerable physical elements of macro scale may deserve attention by urban policy-makers and administrative officers of the central government or decision makers in the upper level of the local government. In meso scale, vulnerable physical elements are eliminated under the urban planning scale such as 1:5 000 and 1: 1000. In 1:5 000 and 1:1 000 scale spatial plans, detailed decisions are produced for various land use areas. For example, spatial plan decisions lead to site selection for factories and technical standards of warehouses, power stations, related infrastructures in industrial areas. Thus, vulnerable physical elements in meso scale can be taken into consideration at the municipal level. Mayors, district mayors, decision-makers of local authorities, chambers of related business groups, trade associations, academics and scientific researchers, NGOs which work at the urban settlement scale can be actors to prepare vulnerability analyses and generate solutions to decrease vulnerability in this scale. Vulnerable physical elements in micro scale are eliminated in small scale urban design or architectural scale such as 1:100, 1:50. As also described in the above table, citizens are the target group for paying attention to vulnerabilities and taking some precautions. Moreover, construction institutions (public & private), insurance firms, relevant technical professionals such as architects, landscape architects, and

engineers, quality control bodies, and community level NGOs can play roles in preparing vulnerability analyses and producing solutions.

The measurement and assessment of vulnerability is another challenge. What types of indicators or tools can be helpful for measuring physical vulnerability of an urban settlement? A similar approach as used for the categorization of vulnerable physical elements in urban settlements can be applied for analyzing indicators of vulnerability. In other words, indicators of vulnerability can be grouped in three scales, namely macro, meso, and micro. According to Queste and Lauwe, scale indicators are especially important with respect to regional differences of a country. In this frame, vulnerability indicators are grouped into local, regional, and national levels. At the local level, vulnerability indicators are closely related to local settlement features such as building codes, public information campaigns, local capability for disaster response, etc. At the regional level, vulnerability indicators are mostly characterized by disaster management features such as distribution of resources, knowledge of vulnerability, regional policies, etc. At the national level, the disaster-related legislative framework, coordination and organization, financial policies and nation-wide policies are examples of vulnerability indicators (Birkmann, 2006).

To come back to the approach in fig. 17, many indicators can be listed in addition to the strengths/weaknesses of vulnerable physical elements in urban settlements. At the macro scale, indicators for effectively measuring the vulnerability are main policies of the country and the urban settlement; financial programs; economic indicators such as GNP (=Gross National Product) per capita, tax revenues, employment rates; population indicators such as population increasing rate, immigration; institutional structure and organizational profile. ***At this level, urban policy makers, officials of the central government, and decision makers at the upper levels of the***

local governments can assess the level of vulnerability by answering the following key questions:

- Are economic indicators of the country and/or urban settlement good? (GNP per capita, employment rate, budget deficiencies, economic consistency,...)
- In case of a natural disaster are there sufficient financial resources for disaster mitigation?
- What financial and economic means are available in terms of the disaster precaution such as insurances, funds, subsidies, etc?
- Are the country and/or the urban settlement ready for cooperating with foreign assistance programs and organizations in the case of an unexpected natural disaster?
- What is the basic demographic trend of the country and/or urban settlement (population increase or decrease)?
- Is there any migration to or from the urban settlement?
- Is there any population agglomeration around the urban settlement? If yes, are urban infrastructures and facilities capable to respond to this agglomeration? What types of policies have been generated for the migration so far? Are they successful?
- Does the administrative structure of the country and/or the urban settlement work efficiently? If not, what are basic problems? Can these problems be resolved in the short-, medium- or long-term?
- Are there deficiencies in the coordination and organization among institutions responsible for disaster mitigation?
- Are there problems in disaster legislation causing inefficiencies in disaster mitigation? If yes, can these problems be resolved in the short-, medium- or long-term (update of existing legislation or an enactment of a new law)?

- What type of policies and strategies are in place to preserve natural resources and assets (air, soil, water, flora, fauna,...) surrounding the urban settlement against negative effects of disasters and response activities?

In this study, at the meso scale, the focus is on main functions of the urban settlement. Some researchers suggest other methods to assess/measure vulnerability. For instance, according to Masure, an analysis of earthquake vulnerability for an urban settlement is applied to the interactive base of social and functional vulnerabilities (Masure, 2002). Under the approach of this study which is derived from spatial planning dynamics, appropriate indicators for vulnerability assessment are; (i) local resources (financial, technical, personnel), (ii) local spatial plans and programs, (iii) existing conditions of superstructures and infrastructures, technical and social services, (iv) basic features of different areas in the urban settlement such as construction density of housing areas, (v) types of industrial zones, (vi) age of settlement areas, (vii) number of historic and archeological sites, and (viii) disaster indicators such as types of disasters to which the urban settlement is prone, chronological records of disasters and damage profiles. ***At this level, mayors, decision makers of local authorities, chambers of various business groups, trade associations, academics and scientific researchers, NGOs which work at the urban settlement scale can assess the vulnerability by answering the following questions:***

- In case of a natural disaster, are there sufficient local financial, technical, and personnel resources for disaster mitigation?
- What is the basic geographic character of the urban settlement? Is the settlement located on a coastal area, plateau, river side, etc.?

- What is the basic function of the urban settlement? Is it an commercial, industrial, touristic, historical, business, recreational, etc. urban settlement?
- What is the political importance of the urban settlement? Is it a capital, metropolitan, international center, regional center, small urban settlement?
- What types of disasters have threatened the urban settlements so far?
- What is chronological damage and loss profile of the urban settlement due to disasters?
- What is the hazards profile of the urban settlement?
- Who/Which institutions are responsible for the administrative issues of the urban settlement? Do they work efficiently?
- Are these institutions efficient and effective in terms of organization and coordination?
- What is the growth potential and development policy of the urban settlement?
- Do spatial plans of the settlement contain disaster mitigation policies and strategies?
- Does the legislation encourage spatial plans and programs containing disaster mitigation issues?
- Do planning standards sufficiently support disaster mitigation strategies and methods in various land use areas such as housing, industry, health, education, commerce?
- Do controlling mechanisms effectively secure the appropriate implementation of planning standards?
- Do trade unions and chambers of various business groups prepare their mitigation plans for the case of a disaster?
- How strong are the main transportation routes connecting the urban settlement to other regions in the course of a disaster?
- Have feasibility analyses been carried out with respect to main terminals, ports, and airports in relation to disaster hazards?

- What types of precautions have been taken to conserve natural, historical, archeological protection areas?

At the micro scale, appropriate indicators to assess vulnerability are the architectural and design features of constructions, construction projects and the controlling system, building codes, construction standards, quality of construction materials, reliability of technical service networks and emergency services, daily habits and the life style of citizens reflected on the urban space, such as their tendencies to use open spaces, demands for indoor and outdoor activities, etc., population profile of the community (gender, age, occupation, ratio of disabled people,...), capacities of search and rescue teams and organizations, etc. Citizens, community-based organizations, construction companies, insurance firms, technical experts working on spatial issues (such as architects, landscape architects, civil engineers, geological engineers, quality controllers), municipal construction controlling directories, private construction controlling firms, search and rescue organizations, and other relevant organizations may ask ***the following question to assess vulnerability at the micro scale:***

- Are building codes capable to cope with natural disaster risks?
- Are existing construction standards and quality of building materials adequate for disaster resilience?
- Do controlling mechanisms for constructions function effectively?
- Is there any illegal construction? If yes, what is the share of illegal constructions in all constructions of the settlement?
- Do public utility networks such as electricity, drinking water, gas, function effectively? Do they need upgrading in view of their age, capacity, and other reliability factors?

- Are there risks of explosion, fire or other dangerous incident that might be triggered by a disaster in the urban settlement?
- Do inner-city transportation routes have sufficient capacities to respond to existing demands?
- Are inner-city transportation routes capable for emergency use in the course of disasters?
- Do features of super structures (design, height, density, etc.) include means of disaster mitigation?
- Are there any architectural elements that aggravate disaster risks? (E.g. minarets, some bridges, alcoves, pendent elements can have high risks in terms of earthquakes.)
- Is there a balance between open spaces and built-up areas? If not, which part is dominant: Buildings or open spaces?
- Is sufficient space reserved for emergency uses? (storage areas, bunkers, temporary shelters, emergency aid centers)
- Are organizations for search and rescue as well as other emergency services adequately equipped to respond to a possible disaster?
- Do community-based organizations sufficiently interact with citizens and organize citizens with a view to enhancing disaster awareness and preparedness?
- In what type of areas do citizens tend to spend most of their time? (In open spaces, such as green and urban parks, stadiums, open sport complexes and outdoor activities, picnic areas, open air bazaars, exhibition and museum areas or in closed spaces, such as houses, shopping malls, operas, theaters, cinemas, museums, conference halls, sport centers?)
- Do citizens have any insurance for their assets such as homes, cars, furniture, lives?
- What is the ratio of people at high risk in terms of natural disasters, such as children, old-age people, disabled and sick people in the urban community?

Vulnerability assessments on the basis of the above questions should be undertaken periodically. Since urban settlements develop dynamics akin to living organisms, the vulnerability of an urban settlement changes over time. Hence, actors who ask these questions at macro, meso, and micro scales should update their answers periodically and, especially, after each disaster striking an urban settlement.

Outputs derived from vulnerability assessments as explained above will also be helpful to test the coping capacity of an urban settlement. In this study, coping capacity is defined as means used by people, organizations, and authorities in organizing available resources and abilities with a view to lessening adverse consequences of a disaster (see also Annex III). In this respect, outputs of vulnerability assessments can provide detailed picture of potential adverse consequences of disasters.

In addition to the vulnerability assessment, some other main determinants for the coping capacity of an urban settlement are risk perception, institutional and public awareness, organizational, administrative, technical, and financial structure and equipment (which are partially taken into account in vulnerability assessment). A SWOT analysis can be applied for measuring the coping capacity as used in this study for assessing the disaster mitigation capacity of Turkey (see also “3.4. SWOT Analysis As An Evaluation”). Wisner also advocated about the SWOT Analysis as a tool used by communities to understand their vulnerabilities and coping capacities in his paper on “Self-assessment of Coping Capacity”, (Birkmann, Ed. 2006). Table 12 reflects administrative, communal, financial, and geographical features as components of the coping capacity for urban settlements. It also serves to clarify the differences between urban settlements of

developing countries and developed countries as already mentioned in "4.1. Analysis of Existing Risks in Urban Settlements".

Determinants as risk perception, institutional and public awareness, organizational, administrative, technical, and financial structure and equipment can be analyzed at settlement, regional, and national levels due to the fact that urban settlements are parts of regional and/or national systems. From a broader perspective, it is also possible to analyze these determinants at the global level. According to the paper prepared by the International Strategy for Disaster Reduction, global factors and the transboundary nature of natural hazards are features to be taken into consideration in designing strategies for development policies towards reducing disasters vulnerabilities. Such global factors as economic crisis, deforestation, and climatic changes can possibly increase the vulnerability of an urban settlement and its coping capacity. The transboundary nature of natural hazards such as seismic faults and transboundary river basins is another factor for the vulnerability and coping capacity of an urban settlement (ISDR, 2003). However, in this study, the vulnerability analysis and the assessment method for coping capacity are structured with a view to settlement, regional, and national levels. In accordance with the location of an urban settlement, global factors underlined by ISDR could be inserted into the vulnerability analysis and the assessment of the coping capacity. For instance, if an urban settlement located nearby a transboundary river, it is inevitable to include transboundary effects into the vulnerability analysis. However, if an urban settlement is located on a single island which has no common feature of risk with neighbouring geographical areas, analyses on national, regional, and settlement levels will be sufficient.

Table 12: The Coping Capacity of an Urban Settlement

		SETTLEMENT LEVEL			REGIONAL LEVEL	NATIONAL LEVEL
		I N D I V I D U A L	S E C T O R A L	T O T A L		
RISK PERCEPTION		Strengths	S.	S.	Strengths	Strengths
		Weaknesses	W.	W.	Weaknesses	Weaknesses
		Opportunities	O.	O.	Opportunities	Opportunities
		Threats	T.	T.	Threats	Threats
INSTITUTIONAL AWARENESS		Strengths	S.	S.	S.	S.
		Weaknesses	W.	W.	W.	W.
		Opportunities	O.	O.	O.	O.
		Threats	T.	T.	T.	T.
PUBLIC AWARENESS		Strengths	S.	S.	S.	S.
		Weaknesses	W.	W.	W.	W.
		Opportunities	O.	O.	O.	O.
		Threats	T.	T.	T.	T.
STRUCTURING & EQUIPMENT	ORGANIZATIONAL	Strengths	S.	S.	S.	S.
		Weaknesses	W.	W.	W.	W.
		Opportunities	O.	O.	O.	O.
		Threats	T.	T.	T.	T.
	ADMINISTRATIVE	Strengths	S.	S.	S.	S.
		Weaknesses	W.	W.	W.	W.
		Opportunities	O.	O.	O.	O.
		Threats	T.	T.	T.	T.
	TECHNICAL	Strengths	S.	S.	S.	S.
		Weaknesses	W.	W.	W.	W.
		Opportunities	O.	O.	O.	O.
		Threats	T.	T.	T.	T.
	FINANCIAL	Strengths	S.	S.	S.	S.
		Weaknesses	W.	W.	W.	W.
		Opportunities	O.	O.	O.	O.
		Threats	T.	T.	T.	T.

Source: Own source.

At the urban settlement level, determinants of the coping capacity should be examined with a view to three categories, namely total, sectoral, and individual. In this respect, results of SWOT analyses can vary for these different categories in terms of risk perception, institutional and public awareness, and structuring & equipment. For instance, the institutional awareness may be different for a gas distribution company (individual level), a sector of gas distribution (sectoral level), and all stakeholders of the gas distribution system in an urban settlement (total level). As another example, the risk perception of a household can be different from that of the population in a neighbourhood unit and that the total population in an urban settlement. Hence, a detailed classification of determinants of coping capacity at the settlement level will provide more meaningful results of assessments which in turn will facilitate resilient approach for an urban settlement.

4.7. Policies and Instruments Related to Disaster Resilience

Upon drawing a vulnerability profile and assessing the coping capacity of an urban settlement, an effective disaster mitigation approach can be designed with a view to disaster resilience. Unless new planning strategies together with disaster mitigation approaches are applied to the urbanization process, urban settlements will remain exposed to high and probably increasing natural disaster risks. Some main principles, policies, strategies, and standards are proposed to guide disaster prone urban settlements on disaster mitigation. Because of the multi-dimensional structure of disaster mitigation, approaches to policy-making, organizational structure, legislation and control, scientific research and technological integration will be explained with a view to urban settlements prone to natural disasters. The elements of the disaster mitigation process will be analyzed with a view to the question of "What makes urban settlements disaster resilient?"

As already mentioned, the concept of disaster resilience has been developed in the 21st century, in lieu of the previous concept of disaster resistance. Unlike the concept of disaster resistance, the concept of disaster resilience emphasizes elasticity and flexibility in coping with the particular challenges of the various natural disasters. The disaster resilience concept is defined in terms of the adaptation capacity of a settlement system (built up and non-built up environment as well as community of life) potentially exposed to natural hazards with a view to maintaining or restoring an acceptable level of functioning and structure (see also "1.2. Definitions and Concepts"). It is still difficult to estimate the probability of occurrence and the magnitude of many natural disasters, especially earthquakes. Thus, uncertainties of natural disasters also support the method of resilience instead of resistance. The term uncertainty does not imply incapacity to act, but unpredictable consequences of disasters. There are various methods such as observation, modeling and scenario formation to assess unpredictable consequences but none of them resolves the issue of uncertainty completely (WBGU, 1998). Hence, in accordance to its own aim, this study focuses on physical resilience of urban settlements to reduce disaster risks and to prepare urban settlements for uncertainties.

After the definition and explanation of disaster resilience, the instruments available for designing a disaster resilience process will be outlined. In this context, the following questions will be addressed:

- What particular features of urban settlements imply risks and challenges for a disaster resilience policy?
- What particular features of urban settlements are supportive of a disaster resilience policy?
- What long-, medium- and short-term approaches can be envisaged towards improving disaster resilience of urban settlements?

- What processes and instruments may be available in implementing disaster resilience policies?
- What (potential) side-effects of disaster resilience policies and measures must be taken into account?

The first two questions were mainly answered in the “4.1. Analysis of Existing Risks in Urban Settlements”. However, the topic of risk with respect to the challenge for disaster resilience needs to be explored further in the light of vulnerability and coping capacity of an urban settlement. The detailed features of vulnerability and coping capacity in terms of the relationship with risk were examined in “4.2. Vulnerability and Coping Capacity of An Urban Settlement”.

To design relevant long-, medium and short-term approaches towards improving disaster resilience, it is important to know the administrative structures and division of competences in urban settlements. For instance, the decision making process on priorities of an urban settlement for disaster resilience touches upon responsibilities of policy makers and administrators. Policy makers and administrators need to cooperate on the basis of long-term action plans for the future of urban settlements due to multi-dimensional aspects of urban settlements (see also “1.2. Definitions and Concepts”). In addition to the multi-dimensional aspects of urban settlements themselves, effects of a natural disaster on an urban settlement are another multi-dimensional topic (see also table 10). In that respect, decisions on priorities of an urban settlement for disaster resilience should be handled and designed as long term approaches. On the other hand, the answer of how to behave as a citizen in the course of a natural disaster is a typical short term approach. In this example, the core issue is saving lives and preserving urgent materials such as water, basic foods, medicine, etc. Tactics and techniques that should be used in the course of a natural disaster for survival are mostly designed as a part of disaster prevention activities by citizen

organizations and NGOs. Due to dynamics of disaster prevention activities and working principles of NGOs or citizen organizations, approaches to behaviours in the course of natural disasters need to be developed with a focus on short-term activities.

In addition to categorizing activities for disaster resilience by their duration, each pertinent activity can be analyzed in terms of its long-, medium and short-term goals and methods. For example, with respect to the decision making process on priorities of an urban settlement for disaster resilience, long-, medium and short-term goals and methods could be characterized as follows:

Short-term goals: to describe existing weaknesses and strengths of the urban settlement

Short-term methods: to carry out analyses on urban assets, services, daily activities, etc. with a view to identifying strengths and weaknesses

Medium-term goals: to draw vulnerability profile of urban settlements in the light of natural hazard maps and weaknesses of the urban settlements concerned

Medium-term methods: to prepare natural hazard maps for urban settlements and to determine weaknesses that can trigger hazards in the course of natural disasters

Long-term goals: to design a scheme which determines priority needs, investment areas, and shortcomings of urban settlements and to mobilize available resources and capabilities for implementing this scheme

Long-term methods: to design a working program including actors, responsible bodies, resources and financing; to organize and coordinate different activities under the working program; and to build monitoring, feedback, and updating mechanisms

Every urban settlement prone to natural disasters needs similar analyses and studies as outlined above to build its resilience for natural disasters.

In order to answer the question of “what processes and instruments may be available in implementing disaster resilience policies”, the list of vulnerable physical elements of urban settlements (see also table 11) will be helpful. Scales and items of vulnerable physical elements in urban settlements will inspire features and dynamics of relevant physical resilience processes and instruments. As the following selected examples show, various relevant instruments, approaches, and processes in implementing disaster resilience policies in urban settlements can be designed with respect to the needs of the target communities:

EXAMPLE 1: In Italy, seismic codes and zoning are used as instruments to mitigate earthquake risks. After the seismic emergency of 23 January 1985 in the Tuscany Region, a new law was enacted and the administration of Tuscany carried out its own research program on seismic hazards, building codes, spatial planning, public information and professional training programs. As a result of this research program, vulnerability analyses on urban centers are prepared with a view to their infrastructures, transportation systems, urban services, social profiles as well as geographical and geological features. Based on outputs of the research program, the most seismically vulnerable features in urban settlements are defined and the people living in this region are informed adequately (Ferrini, 1994).

EXAMPLE 2: In Caribbean countries, the Government with the supports of the United Nations Development Program (=UNDP) and the United Nations Center for Human Settlements (=UNCHS) organized a project in 1990s. The project aimed at mitigating damage caused by

natural disasters such as earthquakes, hurricanes, volcanic eruptions. Since many housing units and infrastructure facilities did not meet applicable building codes and planning standards, local technical staff and citizens were supported to upgrade existing buildings to minimum acceptable levels and to make low-cost improvements. The minimum acceptable levels for building codes and planning standards were defined by the local planning departments and building inspectorates. However, the Government and the United Nation institutions concluded that these efforts can only be effective when disaster mitigation approaches are integrated with economic and social conditions of the society (Gavidia, 1996).

EXAMPLE 3: In 1990s, the United Nations Center for Human Settlements entered into a cooperation with the Technical Research Center of Finland (=VTT) to develop a new approach for disaster mitigation in urban planning. This approach is called "ViSP-Visual Settlement Planning". The ViSP approach can be described as a computerized approach in land-use planning. The major steps of ViSP are: (i) Data collecting for the target area via existing land use maps, aerial photos and videos, flights over the area; (ii) data processing, building photo mosaics, arranging image materials, preparation of a GIS map; (iii) making statistical analyses and preparation of thematic maps; (iv) preparation of spatial plans on the collected data, (v) organizing training activities to use this approach, (vi) follow-up activities. The ViSP approach can also be used in spatial planning and urban management projects as well as disaster mitigation efforts (Nieminen, 1996).

EXAMPLE 4: Many Latin American Countries face high risks of natural disasters. Approximately half of the hospitals in the Caribbean Basin are at high risk and the majority of them have no disaster preparedness plan and proper conditions in terms of disaster resilience.

In view of the importance of health facilities for disaster mitigation, in 1990, the Pan American Health Organization (=PAHO) developed a "Disaster Mitigation in Hospitals" project in accordance with the goals of the International Decade for Natural Disaster Reduction 1990-2000 (=IDNDR). The project aimed at promoting risk assessments in local hospitals, and taking mitigation measures for construction, renovation, and maintenance facilities. The project was assisted by Canadian and U.S. agencies as well as the European Community Humanitarian Affairs Office in assessing and reducing seismic vulnerability. Hospitals in Chile, Colombia, Ecuador, and Venezuela were selected as pilot projects (Ville de Goyet & Rosales, 1996).

EXAMPLE 5: The 1993 was announced by the International Decade for Natural Disaster Reduction as a year of vulnerability reduction of schools and hospitals. In the wake of this announcement, the Organization of American States (=OAS) launched a program towards reducing the vulnerability of schools and libraries. At the start, the program took stock of considerable deterioration of schools and libraries during the 1980s and recognized the crucial roles of schools and libraries. Schools are places for training of future generations as well as shelters in case of emergency; and libraries are important for repositions of culture and cultural heritage of the societies. The program prepared by the OAS provides technical assistance and training for technical staff to conduct vulnerability assessments and organize a vulnerability reduction programs. It also supported disaster management activities by addressing the physical vulnerability of schools and libraries. The OAS Member States carried out this program through various working groups and submitted the final report to the central government for implementing (Higuero, 1993).

EXAMPLE 6: In accordance with the policy of IDNDR on school buildings in 1990s, a checklist approach was developed by UNESCO for

various stages of school inspections. Under this approach, each community was tasked with preparing a list including (i) site plans and locations of school buildings, (ii) numbers of classroom and students in the schools, (iii) disaster-prone areas in the settlements, and (iv) a brief damage report of former disasters. Thereupon, checklists showing detailed information about buildings and disaster mitigation measures were to be prepared. Checklist included the following items (Macks, 1996):

- ✓ Measures for annual inspection of schools in terms of design, equipment, maintenance requirements, building codes, light, ventilation, and site planning
- ✓ Measures of spatial and building plans in terms of plan preparation and documentation
- ✓ Measures for construction details in terms of construction systems, materials, quality of materials and workmanship

In the beginning of 1990s, the above approach was implemented in Bangladesh in view of Bangladesh's exposure to frequent cyclone events. In the frame of this approach, proper schools were built with accessible concrete roof platforms to accommodate people in the case of floods (Macks, 1996).

EXAMPLE 7: Japanese researchers have studied on a new approach for the safety of buildings through the traditional way of construction. Although Japan has been experienced frequent earthquakes, the traditional multi-storey pagodas³ were not damaged. In 1995, while the Hanshin Awaji Earthquake caused the collapsing of many high rise buildings around Kobe, 13 storey pagodas in Hyogo near to Kobe have no damage. Pagodas are typical Japanese temples which looks similar to pines. The following features make pagodas earthquake resilient (Atsushi, 2005):

³ In Japan, five-storey pagodas are representatives of traditional architecture for temples. However Japanese called a five-storey pagoda as „go-ju no to". It means a „five-layer-tower" (Atsushi, 2005).

- The basic material of pagodas is wood which has a remarkable elasticity in the course of earthquakes.
- In pagodas, the conjunction materials of the construction are also wooden. Hence, elasticity of the construction increases in the course of earthquakes.
- Since pagodas are constructed like boxes connected from bottom to top, each box (each floor) tends to stabilize itself independently when an earthquake starts to shake. These movements keep pagodas resilient.
- Each pagoda has a basic column which stands in the center of the temple and rises from the first floor to the top. In the course of earthquakes, this column pulls floors back after their deviation from the center. The column thus ensures a vertical lock safety in the temple.

EXAMPLE 8: As already mentioned in “4.1. Analysis of existing Risks in Urban Settlements”, urban settlements are especially prone to high risks of natural disasters due to the density of population, construction, and facilities. UNDP, in its “Sustainable Cities Program”, suggests that these risks can be reduced by effective and efficient approaches of local authorities in urban planning and management. The Sustainable Cities Program was originally designed in the early 1990s with an aim of setting guidelines for a sustainable urban environment. The program had addressed disasters such as industrial and other accidents, caused by environmental degradation in urban areas. Such accidents are frequently triggered by natural disasters. For that reason many initiatives of the Sustainable Cities Program addressed issues of treatment of solid waste, establishment of storm water drains, management of hazardous lands, and control of sewage discharge into local rivers. In order to reduce the risks in urban settlements, cities participating in the program suggested the preparation of a strategic development plan covering environmental planning, management

strategies, sector-investment strategies, financial planning, and administrative requirements. To sustain this strategic development plan, a monitoring process and exchange of knowledge and experience with other cities were recommended (Deshpande, 1996).

EXAMPLE 9: Urban settlements are also prone to high risks of natural disasters with respect to archeological sites and other cultural heritage. There are various studies on how to preserve cultural heritage structures and archeological sites especially against the threat of earthquakes. In a Seminar on the "Protection of Cultural Heritage Against Earthquakes" in 1992, the topics of (i) general approaches for the protection of historical buildings against earthquakes, (ii) analysis of earthquake hazards for historical buildings, and (iii) techniques of protection and reinforcement with case studies from various countries were discussed (The Turkish Ministry of Public Works & Settlement, 1992). As the protection of cultural heritage involves high expenses, the priority given to such protection tends to depend on the economic conditions of the country. Moreover, techniques and strategies applied in the conservation program of cultural heritage require specialized knowledge and training (Helly, 1995).

The above examples show that various approaches and instruments of spatial planning are used to strengthen the physical resilience for urban settlements prone to natural disasters, especially earthquakes. In principle, policies for disaster resilient urban settlements should include a synthesis of instruments of spatial planning and disaster mitigation methods. As already mentioned in "3.3 Criticism on Existing Disaster Mitigation System and Process in Turkey", urban settlements can be developed in the light of some spatial planning techniques, namely micro-zoning, mitigation plan, and urban transformation action plan. A micro-zoning technique must be based on an analysis on the urban settlement concerned with its particular spatial and disaster risk

features. As a result of micro-zoning, urban settlement areas are divided into a few types of micro-zones such as safe zones, zones where buildings are permitted subject to adherence to special technical standards, and building prohibited zones.

Mitigation plans provide guidance on coordinating outputs of risk analyses and risk management activities in various sectors, such as housing, transportation, infrastructure, public services, etc. They serve to assess risks, generate methods for risk reduction, prepare multi-stakeholder mitigation programs for the short-, medium-, and long-run, prepare public training and awareness programs and projects, and organize monitoring programs for mitigation activities. On this basis, mitigation plans should interact with micro-zones in urban settlements.

Similar to mitigation plans there are also some approaches towards preparing an emergency plan on the basis of a spatial plan. Preparing an emergency plan for an urban settlement requires an analysis of the existing situation, a risk analysis, and the development of possible disaster scenarios. Each urban settlement has different settlement features, disaster risks, and coping capacities. Hence, emergency plans for urban settlements are developed on the basis of spatial plans. Emergency plans should include action programs with clear determinations of responsible institutions, management and control procedures, resource management, evacuation plans, communication, public information, early warning, etc. (Kadioğlu & Özdamar, Eds.2006).

An Urban transformation action plan is a spatial plan including an action program. It aims at driving resettlement activities, measures to strengthen constructions, measures to upgrade the environment in high disaster risk areas pointed out in the mitigation plans.

To sustain disaster resilient urban policies, relevant spatial planning instruments should be supported by controlling mechanisms and processes as well as dynamics of institutional and public awareness. Controlling processes and measures towards increasing institutional and public awareness play integral roles in implementing a disaster resilience policy. The controlling process consists of different types of controlling mechanisms for construction and planning standards of urban settlements. For an efficient controlling process, suitable methods should be developed on the basis of an analysis of strengths and weaknesses of the various controlling mechanisms.

Public and institutional awareness helps to build disaster resilience policies which implement relevant spatial planning standards and methods and foresee adequate disaster preparedness measures. Disaster awareness of citizens and institutions also tends to increase qualities in urban planning and construction activities, as lessons learned in 1999 earthquakes of Turkey show (see also "3.3.Criticism on Existing Disaster Mitigation System and Process in Turkey"). To achieve a desirable level of public and institutional awareness in an urban settlement, answers may be sought to the following questions:

- How can public & institutional awareness for the importance of disaster resilience be increased?
- What are the dynamics of building public & institutional awareness for disasters in disaster prone societies?
- What methods are useful to build public & institutional awareness for disaster resilience policies?
- What outcomes can be expected from awareness building measures for the effectiveness of disaster resilience policies?

In order to answer the question of "What (potential) side-effects of disaster resilience policies and measures must be taken into account?", some key topics such as environmental pollution, environmental

degradation, spatial distortion and chaos will provide guidance. Most natural disasters cause damages to urban built-up environment as well as natural environment, depending on their scales, frequencies, and extent of own impacts. Clearly, many countries are increasingly becoming more vulnerable due to impacts of natural disasters as those can aggravate environmental degradation, deforestation, unplanned occupation of conservation areas (Kreimer et al., 2003). Similarly, some efforts in disaster response period and disaster mitigation activities can possibly cause environmental degradation, spatial distortion and disorder. ISDR points out the similar issues with a following phrase:

“Disaster reduction policies and measures need to be implemented to build disaster resilient societies and communities, with a two-fold aim: to reduce the level of risk in societies, while ensuring, on the other hand, that development efforts do not increase the vulnerability to hazards but instead consciously reduce such vulnerability (ISDR, 2003).”

According to the field experience of the author in 1999 earthquakes in Turkey, such damages possibly resulted from disaster response activities in urban settlements can be grouped as follows:

- Damages on the urban environment such as contamination of air, soil and water as well as some harm on human health, flora, and fauna may frequently occur as a result disaster of some response activities. For instance:
 - During response activities, marine coastal areas, rivers, lakes may be polluted by some search and rescue activities, debris clearance, misplanned infrastructural facilities of temporary housing areas and tent cities
 - Some response activities for accidents and fires triggered by disasters may cause some damages on human health,

flora, and fauna and/or may contaminate air, soil, and water.

- Distortion and disorder of urban spaces are also likely to occur in the disaster response process. For instance:
 - An urban settlement may lose the space quality, unless the site selections of temporary houses and tent cities are well planned. The macro form of an urban settlement may be distorted due to misuse of space. Thus, site selection of temporary houses should be determined in urban spatial plans in case of natural disasters.
 - The decision of evacuation in case of natural disasters may be another source of threats on urban space quality. People subject to evacuation and resettlement areas should be planned in advance for various possible natural disasters. Otherwise, unauthorized occupation of forest and natural conservation areas, as well as fertile agricultural lands and urban green areas will become inevitable.
 - Since disaster response activities and humanitarian assistance absorb remarkable amounts of resources (financial & technical), urban settlements can possibly suffer from unplanned urbanization and uncontrolled development due to lack of resources (ISDR, 2003).

All the above issues can be interpreted as side-effects of disaster response activities. Some disaster mitigation activities cause similar side-effects, too. These side-effects can be grouped as follows:

- Side-effects of disaster mitigation activities on the urban environment: While new settlement policies and new permanent housing sites are developed, planning authorities should take environmental conservation measures and collect technical data on disaster safe areas under consideration. Urban settlements should

not suffer from the environmental degradation while they are designed to become disaster resilient.

- Side-effects of disaster mitigation activities on the urban space: Similar to side-effects of disaster response activities, insufficiently planned disaster mitigation activities such as site selection, infrastructure, classification of building damages and their rehabilitation process, rehabilitation of transportation routes may cause spatial distortion and disorder.

In addition to these side-effects of disaster resilience activities, development trends and policies of countries may create further undesired results on and vulnerabilities of urban settlements. As already mentioned (see also "4.1. Analysis of Existing Risks in Urban Settlements"), developing countries and countries with rapidly increasing population are more vulnerable in disasters than developed countries. Furthermore, according to the ISDR study, there is especially in developing countries, a close correlation among growing environmental degradation, increased human vulnerability, and the intensity of disasters (ISDR, 2003). This vulnerability of urban settlements in developing countries can be evaluated on the basis of interactive relationships of intensity of disasters, environmental degradation, and side-effects of disaster resilience policies & activities.

After examining different disaster experiences of various countries in the world, notably Asian, European, American countries, some common features and typical local differences can be found with respect to disaster mitigation. Such findings in light of available instruments in designing disaster resilience policies –which are highlighted out by key questions in this part- provide an opportunity of designing a standard model for guiding disaster resilient urban settlements. In addition to international studies on disaster prone urban settlements, lessons learned from the 1999 earthquakes in Turkey and various disaster

mitigation studies in Germany are especially helpful to design an international standard model. This standard model can be designed as a check list of actions rather than a detailed and comprehensive guidebook.

CHAPTER 5:

5. EVALUATION AND MODEL BUILDING

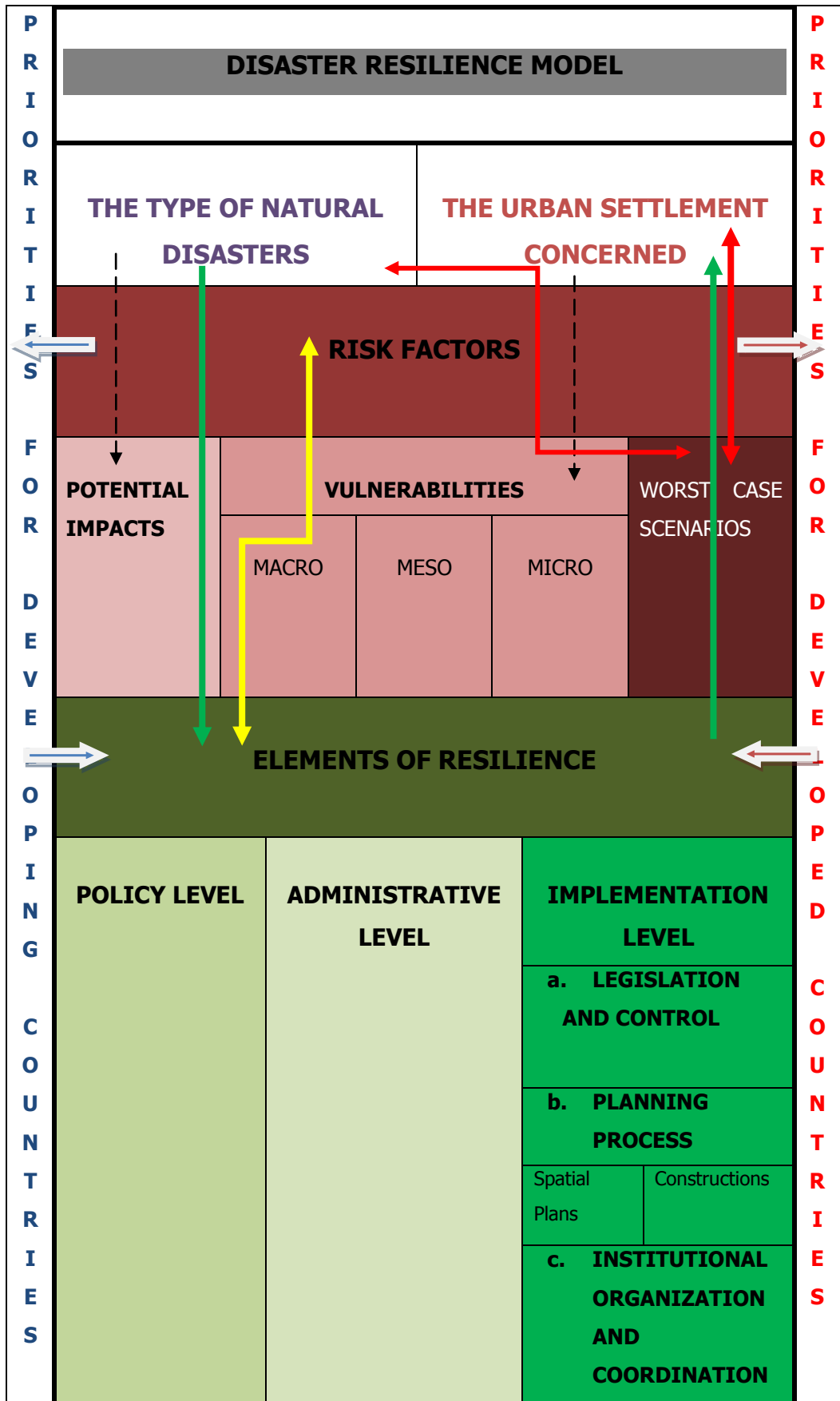
After examining different disaster features of various countries -in terms of both developing and developed countries- in the world, some common features and local differences in disaster mitigation can be identified (Arnold, 2006). Such common features and local differences together with a synthesis of project outcomes of international organizations provide an opportunity to design a model for disaster resilient urban settlements. The model is envisaged to develop guidelines for disaster mitigation, including standards, criteria, and building codes for disaster-prone settlements. On the basis of such guidelines, proposals are formulated for short-, medium-, and long-term strategies and policies for promoting lessons learned from 1999 earthquake in Turkey and various disaster mitigation studies in Germany (Gruenthal, 2004) as well as international studies in disaster prone urban settlements which were already mentioned in the theoretical part of the study.

As already mentioned, this model is aimed at maintaining physical resilience of urban settlements rather than strengthening social, political, administrative, etc. structures (see also "1.2. Definitions and Concepts"). However, since an urban settlement is a space in which multi-dimensional functions interact, other relevant issues

such as political, administrative, economic, and social are also taken into consideration to support the physical resilience of urban settlements (see also "1.4. Scope of the Study"). The disaster resilience model is structured with a view to correlations between disaster mitigation stages and the procedure of spatial planning in various scales. This structure was also applied in listing vulnerable physical elements of urban settlements (see also "4.2.Vulnerability and Coping Capacity of An Urban Settlement").

The model has two main parts, namely risk factors of an urban settlement and elements of resilience. Risk variables are classified as shown in "Table 10". Natural disaster variables and urban settlement variables are taken into consideration in drawing the risk profile of an urban settlement. Although the total disaster response capacity of an urban settlement is mentioned as a third dimension of risk variables in "4.1. Analysis of Existing Risks in Urban Settlements", it is evaluated as a part of "Elements of Resilience" in the model. Similarly, coping capacity, policies, and instruments of disaster resilience of an urban settlement are assessed in the part of "Elements of Resilience" (see also fig. 8). As "Figure 8" shows, the parts of the model interact each other to adapt to the dynamic features of the urban settlement concerned or those of the natural disaster threatened the urban settlement.

Figure 8: A Disaster Resilience Model for an Urban Settlement



Source: Own source.

The model is designed as a checklist of actions rather than as a detailed and comprehensive guidebook. This checklist of actions and recommendations can be easily modified to urban settlements of both developing and developed countries in light of the relevant set of priorities. The model is designed in a hierarchical structure from macro policies to implementation details through the headings set out below:

1. Risk Factors (of a Settlement)

a. Potential Impacts

For a certain urban settlement, the characters/features, magnitude and range of the natural disasters as well as the frequency, the occurrence time, the duration of disasters, and the type of disasters (e.g. only earthquake or earthquake + flood triggered by earthquake) should be determined by considering recorded historical data. Depending on historical damage reports of natural disasters, future potential hazard estimations should be calculated (see also table 10).

Natural hazards are parts of potential impacts of natural disasters. As already defined, impacts are consequences on natural and human systems (see also "1.2. Definitions & Concepts"). In this respect, flood hazards can be determined as damages on vegetation and forests, coastal degradation (e.g. lakes, rivers, ponds), precipitation. The typical features of drought hazards can be extinction of species and degradation of soil. Hazards of volcanic eruptions can be characterized by damages on flora, fauna, and soil, collapse of cavities in the earth's crust. Landslides hazards can be figured out by geographical deformation, damages on vegetation and forests. Cyclones hazards can be environmental degradation, floods, damages on flora and fauna. Although the proposed model aims at maintaining the physical resilience for urban settlements

prone to natural disasters, in this study, the theme of the model is earthquakes (see also "1.4. Scope of the Study").

In the case of earthquakes, ground shaking, surface faulting, liquefaction, landslides, tectonic deformation are all features of natural hazards (Melching & Pilon, Eds.2006). In addition to these hazards, the potential impact of earthquakes cover environmental, technological, social, political and infrastructure risks as well as economic risks (Munich Re Group, 2004). A risk assessment study for an urban settlement prone to earthquakes should be prepared by considering each feature of potential earthquake impacts. Furthermore, such a risk assessment study can be enriched by long-, medium-, and short-term impact analyses. Following a detailed risk assessment study, efficient solutions can be produced for earthquake resilience.

b. Vulnerabilities

In light of the aforementioned potential impacts, a vulnerability analysis should be prepared with respect to each feature of an urban settlement, such as the site of the settlement (coastal settlement, hillside settlement, alluvial plain settlement ...), the ground survey of the settlement (whether urban settlement sits on firm ground or not, land liquefaction factors, ground water levels...), the planning standards and criteria of the settlement, land-use, population density, the population profile and public awareness for disasters (social indicators), the construction density and quality of the settlement, the quality in urban infrastructure & services, economic profile of the settlement (sectors, employment rate and profile, scale of production such as domestic scale production or country scale or international scale) (see also table 10). In order to facilitate a vulnerability analysis for an urban settlement, the table

of vulnerable physical elements (see also table 11) is used as a checklist.

As already mentioned, vulnerable physical elements of urban settlements are grouped in three scales in accordance with the scales in spatial planning. In the macro scale, vulnerable elements of an urban settlement are checked at the regional planning level. In the meso scale, vulnerable elements of an urban settlement are checked at the level of main urban functions such as transportation, residential area, and commerce. In the micro scale, vulnerable elements of an urban settlement are checked at the level of detailed urban features, such as architectural and design features of constructions, building codes, reliability of technical service networks and emergency services, and daily habits and the life style of citizens reflected on the urban space. In this frame, the following check list provides guidance for measuring physical vulnerability of an urban settlement. In each level, useful questions are recommended to relevant authorities and other responsible bodies for assessing physical vulnerability.

Table 13: The Measurement of Vulnerable Physical Elements of the Urban Settlement at Macro Scale

THE MEASUREMENT OF VULNERABLE PHYSICAL ELEMENTS AT MACRO SCALE	
LEVEL	Settlement Level
RELEVANT AUTHORITIES	<ul style="list-style-type: none"> ‡ Urban policy-makers and officials of the central government ‡ Decision makers in the upper levels of local governments.
QUESTIONS TO BE RAISED	<ul style="list-style-type: none"> ? Are economic indicators of the country and/or urban settlement good? (GNP per capita, employment rate, budget deficiencies, economic consistency...) ? In case of a natural disaster are there sufficient

	<p>financial resources for disaster mitigation?</p> <ul style="list-style-type: none"> ? What financial and economic means are available in terms of the disaster precaution such as insurances, funds, subsidies, etc? ? Are the country and/or the urban settlement ready for cooperating with foreign assistance programs and organizations in the case of an unexpected natural disaster? ? What is the basic demographic trend of the country and/or urban settlement (population increase or decrease)? ? Is there any migration to or from the urban settlement? ? Is there any population agglomeration around the urban settlement? If yes, are urban infrastructures and facilities capable to respond to this agglomeration? What types of policies have been generated for the migration so far? Are they successful? ? Does the administrative structure of the country and/or the urban settlement work efficiently? If not, what are basic problems? Can these problems be resolved in the short-, medium- or long-term? ? Are there deficiencies in the coordination and organization among institutions responsible for disaster mitigation? ? Are there problems in disaster legislation causing inefficiencies in disaster mitigation? If yes, can these problems be resolved in the short-, medium- or long-term (update of existing legislation or an enactment of a new law)? ? What type of policies and strategies are in place to preserve natural resources and assets (air, soil, water, flora, fauna,...) surrounding the urban settlement against negative effects of disasters and response activities?
<p>LIST OF PHYSICAL VULNERABLE</p>	<p>❖ <u>Natural Environment</u> -Air (urban atmosphere)</p>

ELEMENTS	<ul style="list-style-type: none"> -Soil -Water Resources (rivers, lakes, seas, underground waters) -Flora -Fauna ❖ <u>Built-up Environment</u> -Housing Areas -Health Services -Education Services -Social Services -Administrative and Security Areas -Commercial Areas -Industrial Areas -Infrastructure & Technical Service Areas -Transportation Routes & Terminals -Open & Green Areas -Protection Zones (Cultural, historical, natural assets)
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Table 14: The Measurement of Vulnerable Physical Elements of the Urban Settlement at Meso Scale

THE MEASUREMENT OF VULNERABLE PHYSICAL ELEMENTS AT MESO SCALE	
LEVEL	Urban Functions Level
RELEVANT AUTHORITIES	<ul style="list-style-type: none"> ‡ Mayors ‡ Decision makers of local authorities ‡ Chambers of various business groups ‡ Trade associations ‡ Academics and scientific researchers ‡ NGOs which work at the urban settlement scale
QUESTIONS TO BE RAISED	<ul style="list-style-type: none"> ? In case of a natural disaster, are there sufficient local financial, technical, and personnel resources for disaster mitigation? ? What is the basic geographic character of the urban settlement? Is the settlement located on a coastal area, plateau, river side, etc.? ? What is the basic function of the urban settlement? Is it an commercial, industrial, touristic, historical,

	<p>business, recreational, etc. urban settlement?</p> <p>? What is the political importance of the urban settlement? Is it a capital, metropolitan, international center, regional center, small urban settlement?</p> <p>? What types of disasters have threatened the urban settlements so far?</p> <p>? What is chronological damage and loss profile of the urban settlement due to disasters?</p> <p>? What is the hazards profile of the urban settlement?</p> <p>? Who/Which institutions are responsible for the administrative issues of the urban settlement? Do they work efficiently?</p> <p>? Are these institutions efficient and effective in terms of organization and coordination?</p> <p>? What is the growth potential and development policy of the urban settlement?</p> <p>? Do spatial plans of the settlement contain disaster mitigation policies and strategies?</p> <p>? Does the legislation encourage spatial plans and programs containing disaster mitigation issues?</p> <p>? Do planning standards sufficiently support disaster mitigation strategies and methods in various land use areas such as housing, industry, health, education, commerce?</p> <p>? Do controlling mechanisms effectively secure the appropriate implementation of planning standards?</p> <p>? Do trade unions and chambers of various business groups prepare their mitigation plans for the case of a disaster?</p> <p>? How strong are the main transportation routes connecting the urban settlement to other regions in the course of a disaster?</p> <p>? Have feasibility analyses been carried out with respect to main terminals, ports, and airports in relation to disaster hazards?</p> <p>? What types of precautions have been taken to conserve natural, historical, archeological protection areas?</p>
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<p>LIST OF PHYSICAL VULNERABLE ELEMENTS</p>	<p>-Housing Areas</p> <ul style="list-style-type: none"> • Mass housing complex • Individual buildings <p>-Health Services</p> <ul style="list-style-type: none"> • Neighbourhood unit health care centers • Hospitals • Special rehabilitation clinics (for old, disabled, poor, etc.) • Health centers (hospitals + labs+ research units) • Medicine and other medical material warehouses • Pharmacies <p>-Education Services</p> <ul style="list-style-type: none"> • Day-care centers • Kindergartens • Primary schools • High schools • Academies and universities • Special schools for disabled persons • Education centers for adults (vocational or other social purposes) • Libraries and archives <p>-Social Services</p> <ul style="list-style-type: none"> • Theatre, opera, and cinema buildings • Concert and congress halls • Sport centers, stadiums, Olympic complexes • Museums, art galleries and other cultural facility buildings • Cultural clubs and society buildings • Foundations <p>-Administrative and Security Areas</p> <ul style="list-style-type: none"> • Administration centers (Governorates, municipalities, district administration centers) • Relevant public buildings • Fire brigades • Police stations • Gendarmerie centers • Military and security facilities • Civil defence centers and their warehouses and
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	<p>sanctuaries</p> <ul style="list-style-type: none"> • Warehouses for vehicles, technical equipments, and other materials for search and rescue purposes <p>-Commercial Areas</p> <ul style="list-style-type: none"> • Retail commercial areas • Wholesale commercial areas • Central Business Districts • Shopping Malls and Centers • Hotels and other tourism facilities • Restaurants, Cafes, and Bars <p>-Industrial Areas</p> <ul style="list-style-type: none"> • Industrial buildings • Industrial estates • Warehouses • Technical equipment and vehicle parking areas • Power stations • Storage facilities for dangerous materials • Nuclear power plants <p>-Infrastructure & Technical Service Areas</p> <ul style="list-style-type: none"> • Sewerage • Drinking water • Gas • Electricity • Telecommunication networks (TV, phone, mobile, Internet, etc.) • Waste water treatment and solid waste disposal areas • Energy generation and transformer stations • Gasoline stations • Dams <p>-Transportation Routes & Terminals</p> <ul style="list-style-type: none"> • Motorways, highway, bus terminals, and highway service stations • Railways and railway stations • Airports and heliports • Harbours, marinas, embankments, docks, quays • Bridges, tunnels, viaducts • Public transportation routes, subway lines, stops,
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	<p>pedestrian underground and overpasses</p> <ul style="list-style-type: none"> • Close car parking areas <p>-Open & Green Areas</p> <ul style="list-style-type: none"> • Green parks and playground areas • Open air sport facilities (tennis courts, swimming pools, motor-racing tracks, horse riding and racing areas, etc.) • Big urban parks • Arboretums • Open market areas • Cemeteries <p>-Protection Zones (Cultural, historical, natural assets)</p> <ul style="list-style-type: none"> • Architectural heritage (buildings, monuments, bridges, aqueducts, fountains, etc.) • Other cultural and historical sites • Archeological assets and excavation sites • National parks, endemic species habitats
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Table 15: The Measurement of Vulnerable Physical Elements of the Urban Settlement at Micro Scale

THE MEASUREMENT OF VULNERABLE PHYSICAL ELEMENTS AT MICRO SCALE	
LEVEL	Citizens Level
RELEVANT AUTHORITIES	<ul style="list-style-type: none"> ‡ Citizens ‡ Community based organizations ‡ Construction companies ‡ Insurance firms ‡ Technical experts working on spatial issues such as architects, landscape architects, civil engineers, geological engineers, quality controllers, etc. ‡ Municipal construction controlling directories ‡ Private construction controlling firms ‡ Search and rescue organizations and other relevant organizations
QUESTIONS TO BE RAISED	<ul style="list-style-type: none"> ? Are building codes capable to cope with natural disaster risks? ? Are existing construction standards and quality of

	<p>building materials adequate for disaster resilience?</p> <p>? Do controlling mechanisms for constructions function effectively?</p> <p>? Is there any illegal construction? If yes, what is the share of illegal constructions in all constructions of the settlement?</p> <p>? Do public utility networks such as electricity, drinking water, gas, function effectively? Do they need upgrading in view of their age, capacity, and other reliability factors?</p> <p>? Are there risks of explosion, fire or other dangerous incident that might be triggered by a disaster in the urban settlement?</p> <p>? Do inner-city transportation routes have sufficient capacities to respond to existing demands?</p> <p>? Are inner-city transportation routes capable for emergency use in the course of disasters?</p> <p>? Do features of super structures (design, height, density, etc.) include means of disaster mitigation?</p> <p>? Are there any architectural elements that aggravate disaster risks? (E.g. minarets, some bridges, alcoves, pendent elements can have high risks in terms of earthquakes.)</p> <p>? Is there a balance between open spaces and built up areas? If not, which part is dominant: Buildings or open spaces?</p> <p>? Is sufficient space reserved for emergency uses? (storage areas, bunkers, temporary shelters, emergency aid centers)</p> <p>? Are organizations for search and rescue as well as other emergency services adequately equipped to respond to a possible disaster?</p> <p>? Do community-based organizations sufficiently interact with citizens and organize citizens with a view to enhancing disaster awareness and preparedness?</p> <p>? In what type of areas do citizens tend to spend most of their time? (In open spaces, such as green and</p>
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	<p>urban parks, stadiums, open sport complexes and outdoor activities, picnic areas, open air bazaars, exhibition and museum areas or in closed spaces, such as houses, shopping malls, operas, theaters, cinemas, museums, conference halls, sport centers?)</p> <p>? Do citizens have any insurance for their assets such as homes, cars, furniture, lives?</p> <p>? What is the ratio of people at high risk in terms of natural disasters, such as children, old-age people, disabled and sick people in the urban community?</p>
<p>LIST OF PHYSICAL VULNERABLE ELEMENTS</p>	<p>-Vulnerable Elements of Indoors (houses, offices, shopping centers, etc.)</p> <ul style="list-style-type: none"> • Elements of rooms such as walls, columns, windows, doors, etc. • Elements of buildings such as stairs, balconies, alcoves, chimneys, towers, minarets, pendent elements, sign boards, lifts, garden walls, water tanks, laundries, storerooms, bunkers, etc. • Elements of technical services such as electric cables, heating system, drinking water, and gas pipe lines, sewerage systems, ventilation systems, power control, etc. • Elements of personal assets such as furniture, money, documents, archives, dresses, food, etc. <p>-Vulnerable Elements of Outdoors (streets, car parking areas, green parks)</p> <ul style="list-style-type: none"> • Elements on streets such as buildings, street and traffic lamps, vehicles, garbage storage areas, parking areas and bus-stops, etc. • Elements in neighbourhood units such as buildings, emergency centers, health care centers, schools, shops, roads, underground and overpasses, energy links, telecommunication lines, fire plugs, trees, etc.

c. Worst Case Scenarios

In order to be prepared for the future natural disasters, the administrative body or disaster management authorities of the urban settlement should prepare various alternative disaster management plans and programs based on possible destructive natural disaster scenarios. These scenarios should be designed by the participation of disaster experienced executives, technical experts, academics and members of other scientific institutions, representatives of search and rescue teams and relief organizations, NGOs, other public interest groups, the Media. To prepare urban settlements for natural disasters according to the following criteria worst case scenarios should be designed:

- Disaster scenarios should be creative due to the fact that many devastating natural disasters are not predictable.
- Disaster scenario should include either biggest magnitude of a single threatening disaster event or various combinations of disaster events.
- Disaster scenarios should describe various damages and losses which are estimated according to existing statistics and other quantitative data of urban settlements and recorded facts from former disasters.
- Disaster scenarios should point out uncertainties.
- Disaster scenarios should address relevant institutions and fields and scale of relief.
- Disaster scenarios should denote consequences with respect to existing capacity and capability of urban settlements.

The worst case scenarios are designed according to above criteria should lead participants (such as disaster experienced executives, technical experts, academics and members of other scientific institutions, representatives of search and rescue teams and relief organizations, NGOs, other public interest groups, the Media) to

answer the following questions in the case of materialization of the scenario:

- What are major lessons learned?
- What are priority topics?
- What are challenges in terms of institutional, financial, organizational, administrative, and political capacities and capabilities?
- If possible, what are the results of SWOT Analysis in terms of local coping capacity?
- What short-, medium-, and long-term solutions can be generated?

2. Elements of Resilience

a. Policy Level

At the policy level, urban policy-makers and governors, mayors, and relevant local administrative officers as well as agents of the central governments who are in charge of local development policies should design an effective disaster mitigation approach with a view to disaster resilience. As already mentioned, unless new planning strategies together with disaster mitigation approaches are applied to the urbanization process, urban settlements will remain exposed to high and probably increasing natural disaster risks. Some main principles, policies, and strategies are proposed to guide disaster prone urban settlements on disaster resilience. The elements of the disaster resilience policies should be analyzed with a view to the question of ***"What makes the urban settlement disaster resilient?"*** The policy instruments available for designing a disaster resilience process should be determined by the guidance of the following questions:

- **What particular features of the urban settlement imply risks and challenges for a disaster resilience policy?** This question should be answered in the light of risk elements and vulnerable items of the urban settlement which are already

mentioned in the part of "Risk Factors" of this disaster resilience model.

- **Which elements of the coping capacity of the urban settlement are supportive of a disaster resilience policy?**

This question can be answered with a preparation of a table as shown in the "Figure 19". As already mentioned, that table aims at analyzing and measuring coping capacity of the urban settlement. By considering the national and regional effects on the urban settlement, the total coping capacity of the urban settlement are measured at national, regional and urban settlement levels in terms of risk perception, institutional awareness, public awareness, as well as structuring and equipment. At the urban settlement level, determinants of the coping capacity should be examined with a view to three categories, namely total, sectoral, and individual. The method of SWOT analysis is used in analyzing and measuring the coping capacity of the urban settlement (see also "3.4. SWOT Analysis as an Evaluation").

- **What long-, medium- and short-term approaches can be envisaged towards improving disaster resilience of the urban settlement?**

To design relevant long-, medium and short-term approaches towards improving disaster resilience, the administrative structures and division of competences in urban settlements will provide guidance. For instance, the decision making process on priorities of an urban settlement for disaster resilience touches upon responsibilities of policy makers and administrators. Policy makers and administrators need to cooperate on the basis of long-term action plans for the future of urban settlements due to multi-dimensional aspects of urban settlements (see also "1.2. Definitions and Concepts"). On the other hand, the answer of how to behave as a citizen in the course of a natural disaster is a typical short term approach. In this example, the core issue is saving lives and

preserving urgent materials such as water, basic foods, medicine, etc. Tactics and techniques that should be used in the course of a natural disaster for survival are mostly designed as a part of disaster prevention activities by citizen organizations and NGOs.

Another significant issue is categorizing activities for disaster resilience by their duration. Thus, each pertinent activity can be analyzed in terms of its long-, medium and short-term goals and methods. For example, with respect to the decision making process on priorities of an urban settlement for disaster resilience, long-, medium and short-term goals and methods could be characterized as follows (see also "4.3. Policies and Instruments related to Disaster Resilience"):

Short-term goals: to describe existing weaknesses and strengths of the urban settlement

Short-term methods: to carry out analyses on urban assets, services, daily activities, etc. with a view to identifying strengths and weaknesses

Medium-term goals: to draw vulnerability profile of the urban settlement in the light of natural hazard maps and weaknesses of the urban settlement concerned

Medium-term methods: to prepare natural hazard maps for the urban settlement and to determine weaknesses that can trigger hazards in the course of natural disasters

Long-term goals: to design a scheme which determines priority needs, investment areas, and shortcomings of urban settlements and to mobilize available resources and capabilities for implementing this scheme

Long-term methods: to design a working program including actors, responsible bodies, resources and financing; to organize and coordinate different activities under the working program; and to build monitoring, feedback, and updating mechanisms

- **What processes and instruments are available in implementing disaster resilience policies?**

In order to answer this question, the list of vulnerable physical elements of urban settlements (see also table 11) will be helpful. Scales and items of vulnerable physical elements in urban settlements will inspire features and dynamics of relevant physical resilience processes and instruments. For further explanations in terms of various relevant instruments, approaches, and processes in implementing disaster resilience policies designed with respect to the needs of the target communities, the aforementioned international disaster mitigation examples in “4.3. Policies and Instruments related to Disaster Resilience” could be helpful.

- **What (potential) side-effects of disaster resilience policies and measures must be taken into account?**

To answer this question, some key topics such as environmental pollution, environmental degradation, spatial distortion and chaos will provide guidance. Most natural disasters cause damages to urban built-up environment as well as natural environment, depending on their scales, frequencies, and extents of own impacts. Clearly, many countries are increasingly becoming more vulnerable due to impacts of natural disasters as those can aggravate environmental degradation, deforestation, unplanned occupation of conservation areas. Similarly, some efforts in disaster response period and disaster mitigation activities can possibly cause environmental degradation, spatial distortion and disorder (see also “4.3. Policies and Instruments related to Disaster Resilience”).

However, development trends and policies of countries may create further undesired results on and vulnerabilities of urban settlements. As already mentioned (see also “4.1. Analysis of Existing Risks in Urban Settlements”), developing countries and

countries with rapidly increasing population are more vulnerable in disasters than developed countries. While this model serves to both developing and developed countries, it is useful to emphasize that developing countries should pay more attention on generating policies to reduce environmental degradation. In this context, the vulnerability of urban settlements in developing countries should be evaluated on the basis of interactive relationships of intensity of disasters, environmental degradation, and side-effects of disaster resilience policies & activities. On the other hand, in developed countries, various approaches and methods are available with a view to protect the environment such as policy instruments for sustainable urban settlements and EU Strategic Environmental Impact Assessment Directive (SEA, 2001/42/EC; European Parliament & European Council, 2001). Hence, developed countries should integrate these instruments into disaster resilience programs of urban settlements.

In general, policy designers and decision makers of the urban settlement should pay attention on negative effects of disaster response and mitigation activities as well as general development policies and settlement strategies on urban environment and space. In this respect, the following questions will provide guidance to policy designers and decision makers of the urban settlement:

? What are the possible sources of environmental contamination and damages in the urban settlement during the disaster response activities? This question should be answered in terms of following issues:

- Contamination of air
- Contamination of soil
- Contamination of water
- Damage on flora
- Damage on fauna

- Damage on human health
- ? What types of disaster response activities can give damage to the urban space in terms of disorder and distortion? To answer this question the following key topics should be taken into consideration:
- The process and procedures of the site selection of temporary houses and tent cities
 - The decision of evacuation in case of emergencies
 - The emergency activities need some urgent construction and spatial arrangement works such as land filling, construction of temporary walls, bridges, and relevant structures, cutting trees
 - The financial and technical capacity used in the disaster response with a view to effective planning of local resources for pre- and post-disaster periods
- ? What are the possible sources of environmental contamination and damages in the urban settlement as a result of disaster mitigation activities? Similar to the question for disaster response activities, this question should be answered in terms of following issues:
- Contamination of air
 - Contamination of soil
 - Contamination of water
 - Damage on flora
 - Damage on fauna
 - Damage on human health
- ? What types of disaster mitigation activities can give damage to the urban space in terms of disorder and distortion? To answer this question the following key topics should be taken into consideration:

- The process and procedures of the site selection for new housing areas and other relevant land-uses
 - The damage classification of the existing building stock and the rehabilitation process of the buildings subject to moderate damages
 - The construction project and process of infrastructure and networks of utilities
 - The rehabilitation process of transportation routes which are damaged by earthquakes
 - The financial and technical capacity used in the disaster mitigation activities (A lack of resources may cause a disorder in the urban settlement leading by incomplete construction projects.)
- ? What are the possible sources of environmental contamination and damages in the urban settlement as a result of general development policies and settlement strategies? To answer this question the following key topics should be taken into consideration:
- Contamination of air
 - Contamination of soil
 - Contamination of water
 - Damage on flora
 - Damage on fauna
 - Damage on human health
- ? What types of general development policies and settlement strategies can give damage to the urban space in terms of disorder and distortion? To answer this question the following key topics should be taken into consideration:
- Over constructed urban settlements in response to high demand for new housing stocks

- Misplanning of transportation routes, energy networks and telecommunication links which do not comply with settlement strategies
- Amnesties for illegal settlement areas and constructions such as squatter areas
- Un-well planned regional, national and international nucleus such as regional business centers, international scale harbours, free trade zones
- The misallocation of financial and technical resources in the infrastructure facilities of urban settlements

In the light of the above questions, the preparations of the following documents are strongly recommended to build effective disaster resilience policies:

- A macro scale disaster mitigation map should be prepared on a national scale land-use base map and identifying all natural disasters prone area and risk zones.
- A macro scale spatial policy document which outlines national scale policies and approaches towards mitigating the disasters should be prepared. The macro scale spatial policy document should be integrated with the macro scale disaster mitigation map. This would facilitate the inclusion specific policies and approaches for each risk zone of the country.
- In the light of the macro scale disaster mitigation map and the spatial policy document, the local scale disaster mitigation map and spatial policy document including relevant local details should be prepared. The local level spatial policy document should also be designed on the basis of interdisciplinary and inter-sectoral partnership. An efficient resilient policy should be constituted with the participation and sharing knowledge of central governmental institutions, local authorities, NGOs and community-based organizations

as well as private sector representatives, academic and research institutions, search and rescue teams, disaster assistance organizations, and media (ISDR, 2003).

The aforementioned above documents should be updated periodically (e.g. in each five year period and especially after disasters).

The ultimate remarkable question in terms of disaster resilience policies is whether a threat of earthquake/natural disaster may have trans-boundary effects. In this case, a coordinated disaster resilience policy of the countries which are prone to the same earthquake is likely to produce better results for disaster resilience of the urban settlement concerned. For instance, if an urban settlement is located in a region that has common seismic fault lines and geological failure zones with other settlements in the neighbour countries, the more effective disaster resilience policies could be designed in light of each individual urban settlement's coping capacity.

b. Administrative Level

One of the pre-requisites of an effective disaster management is a well-organized administrative structure as well as institutional organization and coordination. In case of problems and inefficiencies in the administrative structure and institutional organization the following questions would be helpful to designate problem areas and to find effective solutions out:

? Is there any conflict or gap among the responsibilities of various institutions in terms of disaster mitigation, preparedness and response? If yes, the following criteria will provide guidance to the reorganization of tasks and responsibilities among institutions:

- Historical background of an institution (age and experience)

- Field of experience in terms of disaster mitigation (response, preparedness, recovery, mitigation)
- Financial and technical capacity and capability
- Institutional performance in case of disasters (overall assessment of institutional capacity as well as capability of intercommunication and coordination of relevant institutions and organizations)

? Are responsibilities efficiently shared by relevant institutions?
 Is there any overloaded or below capacity worked institution?
 Is there any institution which misfit to its field of work?
 According to answers of these three questions, the establishment of a new institution and/or reorganization of an existing institution may be necessary. In this respect, national and international best practices in the disaster management will be helpful. In case of a new institution or reorganization, legislative and financial arrangements should be performed accordingly.

With a view to build a well-organized administrative structure, local authorities and central government institutions should be equally taken critics and proposals coming from governmental institutions as well as scientific groups and committees, universities, NGOs, private companies, entrepreneurs, and the media into the consideration.

c. Implementation Level

Implementation level can be divided under three subtitles namely, legislation and control, planning process, and institutional organization & coordination.

c-1. Legislation and Control

To sustain disaster resilient urban settlements, relevant spatial planning instruments should be supported by effective legislation, controlling mechanisms and processes as well as dynamics of

institutional and public awareness. In terms of effective legislation the following principles are recommended. Unless the existing legislation satisfies the following principles, the new legislation should be design with respect to these principles.

- A macro scale disaster frame law should be prepared. (In the case of conflicts among various types of disaster legislation of the country, this framework law will provide guidance for relevant activities and organizations in various phases of disasters such as preparedness, response, recovery and mitigation.)
- All disaster related-legislations of the country should be brought in line with this macro scale disaster framework law.
- Controlling mechanism and processes should be described and clarified through execution of the legislation. Responsible authorities should be clarified with a view to avoiding conflicts and gaps.
- Controlling processes and measures towards increasing institutional and public awareness play integral roles in implementing a disaster resilience policy. The controlling process consists of different types of controlling mechanisms for construction and planning standards of urban settlements. For an efficient controlling process, suitable methods should be developed on the basis of an analysis of strengths and weaknesses of the various controlling mechanisms.
- Public and institutional awareness facilitates to build disaster resilience policies which implement relevant spatial planning standards and methods and foresee adequate disaster preparedness measures. Disaster awareness of citizens and institutions also tends to increase qualities in urban planning and construction activities, as lessons learned in 1999

earthquakes of Turkey show (see also "3.3.Criticism on Existing Disaster Mitigation System and Process in Turkey"). To achieve a desirable level of public and institutional awareness in an urban settlement, answers may be sought to the following questions:

- How can public & institutional awareness with a view to disaster/earthquake resilience be developed?
- What are the dynamics of building public & institutional awareness for disasters/earthquakes in disaster prone societies?
- What methods are useful for disaster/earthquake resilience policies to create public & institutional awareness?
- What is the importance of training and public information on disaster/earthquake risks to raise public awareness?
- What outcomes can be expected from awareness building measures for the effectiveness of disaster/earthquake resilience policies?

c-2. Planning Process

Spatial plans are important to prepare a base for a disaster resilient urban settlement. For the disaster resilience, multi-dimensional planning instruments and integrated process of spatial planning and disaster mitigation are useful. Disaster mitigation techniques should be included in the preparation process of a spatial plan; more specifically, the process should include the i) preparation of analysis maps, ii) preparation of a synthesis map by inserting data of analysis maps, iii) preparation of a spatial plan based on a synthesis map. It is possible to insert disaster/earthquake mitigation techniques and approaches into these steps of spatial plan preparation process as follows:

- Preparation of a land-use map (Preparation of land-use map reflecting existing land-use texture of the urban settlement is a

basic work. The land-use map can be prepared at various levels such as macro, meso and micro levels to guide effective hazard and vulnerability analyses. For instance, optimum scales for the preparation land-use map of an urban settlement can be 1:50 000 for macro level, 1:10 000 for meso level and 1:1 000 for micro level)

- Preparation of various layers of analysis maps (population distribution and density & texture of property, geological (geomorphological + geo-physical + geo-seismic) features, soil analysis, slopes, climatic elements such as wind directions, rain/snow falls, sunny areas, etc.)
- Preparation of vulnerability analysis maps of different land-uses with respect to the records of previous disasters/earthquakes (Physical vulnerable elements can also be helpful in each different scale.)
- Preparation of disaster/earthquakes risks maps (These maps are prepared as a synthesis of hazard maps and an analysis map of spatial distribution of vulnerable physical elements.)
- Preparation of spatial plans of the urban settlement in various scales such as 1:50 000, 1:10 000, 1:5 000, and 1:1 000.
- Preparation of a micro zoning map (A micro-zoning technique must be based on an analysis on the urban settlement concerned with its particular spatial and disaster/earthquake risk features. As a result of micro-zoning, urban settlement areas may be divided into a few types of micro-zones such as safe zones, zones where buildings are permitted subject to adherence to special technical standards, and building prohibited zones.)
- Preparation of a risk mitigation plan including an evacuation plan and an urban transformation action plan (see also "4.3. Policies and Instruments Related to Disaster Resilience") in the case of emergency (Risk mitigation plans should constitute

with spatial plans and action program sheets referred actors and target groups)

As integral parts of spatial planning process, building plans and construction process should also serve to earthquake resilience. In this respect, this model provides guidance to the actors involved with building design and construction process on what types of strategies and instruments can be useful to enhance earthquake resilience. Among these actors, local authorities should play an important role with regard to issues such as building standards, including the enforcement of building codes as well as the regulation and taxation of land and property markets, planning, infrastructure construction and management. The recommended strategies and instruments serving to earthquake resilience of buildings are stipulated as follows:

- ✓ Preparation of existing building stock analysis in terms of quantifying the amount and likelihood of losses that buildings may suffer in future earthquakes.
- ✓ The recommended analysis should be prepared according to different indicators, such as function of the building, construction style and materials of the building, other relevant technical construction details of the building, height of the building, age of the building, soil ground analysis of the building (Meskouris, Kuhlmann, Mistler, 2003). This analysis should also be prepared for other types of construction elements such as storage areas, terminals, bridges, dams, viaducts, etc.
- ✓ Preparation of feasibility analyses of various alternative programs aimed at reducing the possible loss in future earthquakes (FEMA, 2004)

- ✓ Designing earthquake resilience action programs in cooperation with building insurance and building permit authorities and their procedures.

c-3. Institutional Organization & Coordination

The effective institutional organization and coordination is a significant issue in terms of implementation of disaster resilience on the urban settlement. All disaster mitigation plans and programs need to be prepared in the pre-disaster period, and they need to be coordinated under one single authority. In this context, the following key questions should be answered to find an effective coordinator institution:

- ? Is there an institution in charge of coordinating all disaster mitigation activities and programs in the urban settlement?
- ? If yes, does this institution work effectively?
- ? If not, what are the shortcomings of the existing coordinating institution?
- ? Is the existing institution able to overcome such shortcomings or is a new coordinating institution required?

After clarifying the position of coordinating institution, the dynamics of the institutional structure in terms of coordination and organization should be determined. In this respect, such an analysis as in the “Figure 19. The Coping Capacity of an Urban Settlement” will provide guidance to determining the most suitable position for each institution or organization in the local organizational setting. As already mentioned, main elements of institutional coping capacity are (i) risk perception: (ii) institutional awareness, (iii) organizational administrative, technical, financial structures and equipments. Furthermore, these elements should be elaborated at three levels, namely urban settlement, regional, national levels. As a result of

SWOT analyses of each element and each level, the most suitable position for each institution or organization will be found out.

In terms of working principles with a view to a disaster resilient urban settlement, the following key concepts and standards should be incorporated into the institutional and organizational structures:

- Efficiency and effectiveness
- Openness to new technologies and information systems
- Institutional transparency
- Reliability and sustainability
- Cooperation & interaction capacity with other institutions and organizations
- Supporting public awareness and public participation
- Technical and scientific capabilities
- Modernity and self-criticism

The above outlined model is aimed at providing guidance to urban settlements with a view to disaster resilience. Though based on a standard checklist, the model will include the different approaches for developing countries and developed countries, respectively. In this part, these different approaches are clarified in terms of different priorities of developing and developed countries. The following topics are stipulated to provide guidance to developing countries with respect to their priorities in terms of disaster resilience:

- ✓ Survival of citizens (Due to the high rate of casualties in earthquakes/natural disasters, the prior issue of earthquake resilient urban settlement is the resilience of the citizens.)
- ✓ Provision of shelter, security, and some basic goods and services for survival of citizens (Policies, relevant process, procedures, and resources should be designed to serve this priority.)

- ✓ Organizing public campaigns and well-attended public training programs to teach citizens how to apply self-survival techniques.
- ✓ Considering the limit of financial resources, strengthening of super- and infrastructure starting from centers of provision of essential services such as hospitals, fire brigade and police departments, water tanks, electricity supply units, main transportation terminals, schools. If further financial resources are available, relevant building codes and planning standards should be applied gradually.
- ✓ Prevention of environmental degradation and protection of natural resources (In the post-earthquake period, the urban settlement needs these resources to sustain its daily activities.)

The implementation of this model is recommended in the light of above priorities for developing countries. For instance, for developing countries, geographic distribution of casualties guides to policy and decision makers how priority areas are described and organized.

For developed countries, the following issues are recommended as priorities:

- ✓ Strengthening of super- and infrastructure
- ✓ Building effective disaster/earthquake insurance system for both buildings and infrastructure
- ✓ Designing the new program and process to provide earthquake/disaster resilience in provision of main services and utilities, such as electricity, telecommunication, energy and drinking water pipelines as well as emergency service units (hospitals, police and fire brigade departments, etc.)
- ✓ Building and developing the capacity of airway transportation modes and vehicles for disaster response

- ✓ Enhancing civil initiatives and community based organizations with a view to increase public awareness on disasters

The priorities above should always be taken into consideration while each part of model is applied on the concerned urban settlement. However, these priorities will provide more guidance in the part of "Element of Resilience" rather than "Risk Factors" due to the structure of check list in terms of potential impacts and vulnerabilities. While the questions and items of check lists in the part of "Risk Factors" can easily direct authorities and responsible institutions to raise specific features of the urban settlement, there will be no need to make another classification to reach an effective result in terms of disaster resilience. However in the part of "Element of Resilience" the way of applying policies and other relevant instruments is much more important than types of policies and instruments applied on the urban settlement. In this respect, above priorities for urban settlements in developing and developed countries, respectively, will provide guidance to the relevant authorities to reach efficient results.

This model is flexible enough to be modified for an urban settlement with different features in terms of geographic, demographic, administrative, and social aspects. The variables used in the model and the checklist will be open to be updated to changing conditions of urban settlements over time. Multi dimensional features and prospective methods of the discipline of city planning will be taken into account in designing the model. Thus, the model will conclude with a feed back on a selected country as well as international data on the basis of periodical monitoring and scientific research.

CHAPTER 6:

6. COMPARATIVE CASE STUDY:

6.5. Scope

In this study, it is aimed to focus on the pre-disaster period in the frame of lesson learned examples from past disasters. In order to serve this aim, the guidelines derived from a synthesis of the 1999 Eastern Marmara Earthquake experience and accumulated disaster mitigation experiences reported in international literature and project reports of international organizations on selected best examples with comparable features are applied to a comparative case study in Yalova as an Eastern Marmara City (see also fig. 9) and Cologne as a high seismic city lies on the River Rhine in Germany (see also fig. 10). ***Since Yalova experienced a high intensity earthquake in 1999, the aforementioned guidelines are updated and detailed in light of local experiences in Yalova. On the other hand, Cologne has not yet experienced a devastating earthquake despite of its high seismic risk. This difference creates an opportunity to test the proposed disaster-resilience model which is enriched by the local experiences of Yalova ultimately.***

If the proposed guidelines are confirmed in the case study, those guidelines might also be relevant for other disaster prone European urban settlements where locate close to Turkey. There are several European cities which are prone to earthquake risks and are therefore potential candidates for a comparative study. Among these cities, the City of Cologne has remarkable particularities in the dimension of earthquake potential and possible loss in its valuable urban assets. Also these issues are highlighted in the study of the Munich Reinsurance Company (Munich Re) (Allman &, Smolka, 2000). In addition to the study of the Munich Re, there are other studies prepared by other research groups and universities in Germany such as the German Research Network Natural Disasters (Friedrich & Merz, 2002),

Comparative Risk Assessments for the City of Cologne (Gruenthal et al., 2004), Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (Kleist et al., 2006), An Earthquake Catalog for the Northern Rhine Area, Central Europe (Hinzen & Reamer, 2004). It is therefore intended to compare the earthquake risk potential of Cologne with that of Yalova affected by the 1999 Eastern Marmara Earthquake. This comparative study will provide an opportunity to formulate some lesson learned experiences from the 1999 Eastern Marmara Earthquake with respect to the City of Cologne.

On the other hand, the comparative case study will also provide an opportunity to support the proposed method in "4.1. Analysis of Existing Risks in Urban Settlements". As already mentioned, two different approaches are proposed to lessen the hazardous effects of natural disasters on urban settlements of developing countries and developed countries, respectively. Despite the fact that Turkey is not a developing country, she has similar vulnerable features as in developing countries due to rapidly increasing population and densely constructed urban settlements. Especially, what Yalova experienced in the 1999 earthquake presented very typical earthquake damage features in the developing countries. As another city of the comparative case study, Cologne is a representative urban settlement of a developed country. Hence the proposed model is tested on Cologne in accordance with relevant priorities of developed countries.

For the comparative case study, first, existing features of two cities will be analyzed. Secondly, risk assessments of each city will be done in the light of outputs of the existing features analyses. In accordance with the disaster risk variables shown in the Table 10 (see also table 10); two cities are examined through earthquake risk variables and settlement variables. Earthquake

variables of each city are examined with a chronological perspective. Urban settlement variables are examined through spatial planning activities and responsibilities of relevant institutions to reflect physical and/or spatial features. Thirdly, institutional coping capacities of these cities are tried to be measured to complete the inputs of the risk assessment analyses. To measure coping capacity of each city, **two different methods are used**. Since Yalova already experienced a severe earthquake in 1999, all reports, documents of field trips, personal contacts and experience of the author during the disaster mitigation activities between 1999 and 2002 facilitate the analysis of problems, conflicts as well as institutional coordination and organization activities. On the other hand, since Cologne has not yet experiences as similarly devastating earthquake, an interview method is used to measure Cologne's institutional coping capacity. Through this interview, relevant local actors are interviewed with a view to assessing their risk perceptions and determining their responsibilities in case of a severe earthquake. The interviewees include the following actors:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of industrial and business sectors
- ‡ Media

In the light of findings about two cities of the comparative case study, the proposed resilience model (see also "5. Evaluation and Model Building") is enriched on the basis of a feedback process. To test the proposed model on Yalova, the existing urban physical features such as recent spatial plans, building codes, relevant authorities and their responsibilities are compared to proposed guidelines of the model. As a result, the degree of its resilience will be measured in accordance with

the model. Due to experiences from 1999 earthquake, Yalova has plenty of projects and organizations to be tested through recommendations of the model. On the other hand, outputs of interviews for Cologne give general frame and tendencies of earthquake mitigation capability of the settlement. According to those general frame and tendencies, the degree of earthquake resilience will be measured.

6.6. Analysis of Existing Urban Structures

Yalova as a city in the Marmara Region in Turkey and Cologne as a city with high seismic risk in Germany will be analyzed in this chapter. In addition to common high seismic risks, these cities have some other common features in terms of geological and some urban features. Both of them are coastal cities. While Yalova lies on the Marmara Sea coastal area, Cologne lies on the River Rhine coastal area. In terms of geological features, both of them are surrounded by fault lines and partially locate on an alluvial plain. Hence, these cities similar risks due to land liquefaction and amplification in case of earthquakes.

In terms of urban features, both of them have ports and other coastal facilities such as marine transportation, quays, coastal land filling areas. In the aspect of urban activities, Yalova and Cologne are not completely different. While Cologne is a metropolitan city, Yalova used to be a part of Istanbul Metropolitan City since 1930. In 1995, Yalova became a city according to the Law No. 550. In terms of touristic and cultural activities, they may have similar attractiveness. While Cologne is famous for Carnival activities, Yalova is famous to be a summer town where especially attracted by people living in Istanbul (The Governorate of Yalova & the Municipality of Yalova, 2006).

According to some common historical features and archeological assets, Yalova is as vulnerable as Cologne in the case of earthquakes. Both of these cities are used to be Roman cities. Yalova used to be a

Roman city between 1st century B.C. and 14th century A.D. till the Ottoman's Period (The Governorate of Yalova & the Municipality of Yalova, 2006). Especially, thermal baths of Yalova are famous since the Roman Period. Cologne is used to be a Roman city from the 1st to 3rd century A.D. till (Hinzen & Schuette, 2003). In addition to archeological remnants of the Roman Period, these cities have further historical and archeological monuments and sites.

The characteristics of these two urban settlements will initially be analyzed. This analysis was done into three subheadings namely, (i) Geological and Seismic Retrospective View of Cities, (ii) Existing Planning Situation and Disaster Mitigation Activities, and (iii) Institutional Coping Capacity and Problems. The analysis of existing urban structures of these cities will serve a technical base for risk assessment which will be explained in "5.3. Risk Assessment".

6.6.1. Analysis of Existing Urban Structure of Yalova

GEOLOGICAL AND SEISMIC RETROSPECTIVE VIEW OF YALOVA:

Yalova is a Turkish city located on the south-eastern coastal part of the Marmara Sea (see also fig.9). She lies on the Northern Anatolian Fault Zone. Since 1509, the Marmara Sea has been affected largely by six major earthquakes bigger than 7 magnitude. These occurred on 10 September 1509, 25 May 1766, 5 August 1766, 10 July 1894. The last severe earthquake was the Eastern Marmara Earthquake with a 7.4 magnitude in 17 August 1999 (see also "3. Disaster Mitigation Approaches and Lesson Learned in Turkey"). In Yalova, 9 474 dwelling units (12% of total) and 726 work places (10% of total) were destroyed by this earthquake. 22 162 dwelling units and 3 021 work places were damaged in varying degrees. In addition the Eastern Marmara Earthquake caused 2505 casualties and 5 937 injuries in Yalova (see also "3. Disaster Mitigation Approaches and Lesson Learned in Turkey").

“Yalova itself lies on a coastal fringe largely composed of recent Quaternary Deposits. Such deposits also infill the base of valleys as a result of active erosion of the landscape. The existing geological formation of Yalova forms low hills between the coastal part to the north and the mountainous part to the south. This formation is composed of weak rocks that easily weather to soil which, as a result of tectonic disturbance, are frequently reduced to their residual shear strength. In these areas, a high water table exists and this, together with the low shear strength, frequently creates slope instability” (BECT, 2000). Thus, the geologic and geomorphologic features of Yalova made the settlement especially vulnerable to the tremors of 1999 Earthquake; wide-spread failure of constructions in complying with Turkish Building Codes exacerbated the vulnerability. It is possible to group geological failure areas in Yalova except fault lines as follows:

- Areas with the slope instability resulting in deep landslides
- Areas of deep fine alluvium and organic material likely prone to liquefaction
- Areas with limestone sub-formations prone to cavitations and collapse
- Areas with irregular weathering profiles
- Areas with the gypsum hazardous to concrete foundations

The geological profile drawn above illustrates the unsafe conditions for constructions in Yalova in the absence of compliance with the relevant building codes and planning standards.

Although 1999 Earthquake has been the largest earthquake in Yalova, Yalova has a quite long history of major earthquakes. The previous earthquake that affected Yalova significantly occurred on 18 September 1963 and had the magnitude 6.4. The earthquakes in the region are all result of tectonic processes, which take place within the crust of the earth. Tectonic deformation in the Middle East and Eastern

Mediterranean region is occurring at the boundaries between three major tectonic plates, namely, The Eurasian Plate, the African Plate, and the Arabian Plate. Smaller, relatively rigid, blocks or micro-plates, including the Anatolian and the Iranian micro-plates, separate these major plates. The Anatolian macro-plate is bounded to the north by the 1200km long Northern Anatolian Fault Zone and to the south and east by the Eastern Anatolian Fault Zone. The relative movement between the major plates results in the westward movement of the Anatolian micro-plate (BECT, 2000, p.2.7).

While the British Earthquake Consortium for Turkey mentioned the seismic profile of Yalova Region briefly in the above paragraph, it is possible to find detailed historical records for the Marmara Region in the report of Prof. Dr.Yüçemen. According to the report there were many destructive earthquakes in the period of 281 BC- 1899 AD. The area with the highest earthquake density covers Istanbul, the Gulf of Izmit, the Gulf of Saros, Gemlik-Bandırma-Biga line and Bursa. "Most of devastating historical earthquakes occurred around Istanbul in order of chronological records, 325, 427, 478, 866, 986, 1344, 1462, 1509, 1659, 1766, 1894. Devastating earthquakes around the Gulf of Izmit in the Eastern Marmara Region, occurred in order of chronological records in 358, 447, 553, 1719, 1754. Moreover, the 1354, 1766, 1893 earthquakes occurred around the Gulf of Saros, the 24, 715, 1863 earthquakes in the Iznik-Gemlik Region, the 170, 543, 1064, 1556, 1737 earthquakes in the Bandırma-Edincik-Denizkent-Bayramic Region, and 1855 earthquakes (2 events) in Bursa" (Yüçemen et al., 2005). Yalova is hence surrounded by high seismic risk areas. While a large alluvial plain facilitates the devastating effects of earthquakes in the neighbour regions, Yalova has its own earthquake risks due to fault lines in its region. The Marmara region has also been seismically active in the period of 1900-2003. In this period, 25 devastating earthquakes

-including 1999 earthquakes- occurred with magnitudes ranging between 5 to 7.4 (Yüçemen et al., 2005).

Most of the earthquakes in the Marmara Sea Region are the results of the North Anatolian Fault Zone movements. The movements along the Northern Anatolian Fault Zone have been shaping the region. These movements can be categorized in two groups, namely normal and strike-slip faulting. Several earthquake experts assume that the main character of movements on the Northern Anatolian Fault Zone is migrating along its length by periodic earthquake hits. And each hit made the Northern Anatolian Fault Zone to slip to the west. Especially the strike-slip faulting of the Northern Anatolian Fault Zone has caused many drastic results. The main fault lines in Yalova are, Taskopru, Tavsanlı, Subasi, Yalova, Cınarcık, Calica, Kocadere, and Laledere faults as parts of the North Anatolian Fault Zone (Yüçemen et al., 2005). Another severe hazard risk stems from the fault ruptures in the Marmara Sea Region as a result of various earthquakes, where larger ruptures can easily cause a real fatal tragedy. Furthermore, experts in geo-seismology suggest that fault ruptures in the Marmara Sea are worse than those in the land (BECT, 2000).

The detailed information above shows the high earthquake risk of settlements in Yalova. Landslide hazards triggered by earthquakes further exacerbate the damage potential. Since the settlement of Yalova is mainly located on an alluvial plain irrigated by various streams, soil creeping, flow slides, rotational slips, and land liquefaction are other threats for the urban settlement. Segments of former tidal lagoon channels and river channels of the coastal zone and in downstream sections of the river valleys are formed by fine Alluvium and organic materials. As these materials are mostly soft residuals, building foundations should be designed on the basis of an adequate site investigation and ground analysis.

Another type of active erosion in Yalova can be observed in the form of steep slopes in hilly areas that lay behind the costal alluvial plain. In Yalova, there is a form of slope instability with rocks located at the top of steep slopes. It gradually creeps forward separating from surrounding rocks along joint planes. Slope instability can be triggered by erosion or undercutting of the toe of a slope, a rise in water levels, heavy rainfall or seismic activity. Thus, land slide hazards have been observed in Yalova especially in the course of earthquakes. There are also other ground-related hazards in the Yalova area such as irregular weathering of rocks, collapsed cavities, Karstic zones (deeply incised rock joints, surface holes, caves, cavities, residual soils). These ground-related hazard features can easily lead to a foundation collapse if it is not recognized in time.

All the information above relates to the main geological features of the settlement of Yalova. In addition to high seismic hazard risk, the following kinds of hazard risks are triggered by earthquakes:

- **Liquefaction** or loss of strength in saturated granular soil due to a built-up of pore water pressure under cyclical loading. Liquefaction is a process by which non-cohesive or granular sediments below the water table temporarily lose strength and behave as a viscous liquid rather than solid ground when subjected to strong ground shaking during an earthquake. Typically saturated, poorly graded, loose, and granular deposits with low fines content are most susceptible to liquefaction. The liquefaction process itself may not necessarily be particularly damaging or hazardous. For construction purpose, it is not the occurrence of liquefaction as such that is important, but the capability of the process and associated hazards to cause damage to structures.
- **Fault movements**, which can prove damaging to structures constructed across a fault. A fault is a fracture in the crust of

the earth along which the ground on one side has moved relative to the other. Surface rupture occurs when displacement on a fault deep within the earth breaks through to the surface. It typically occurs during large earthquakes when the surface area of the fault is large enough to fracture the earth's crust from depth right through the surface. Only more powerful earthquakes result in surface rupture. In this case, determination of the location of active faults is an essential component of the seismic hazard mitigation process. In the Yalova region, there are numbers of active fault segments associated with the North Anatolian Fault Zone.

- **Landslides and mud flows**, often triggered by liquefaction of a soil stratum. Although the landslide hazard is very present in Yalova, it poses only a moderate risk for human lives and properties, as urban areas have historically been constructed away from landsliding zones. The greatest current landslide risk might apply to roads, pipelines, and cables that have to cross landslide zones. This condition has sometimes created continuous creep movements increasing maintenance needs and occasionally leading to severance of roads, etc. The hazard of landslides always presents itself as a natural process. Landslide events can be triggered by an earthquake with its lateral accelerations and ground motions. If it can be demonstrated that instability is due to a high water table, stability can even in earthquakes be achieved by lowering water level with drains. Geologists recommend that areas prone to landslide risks should not be used for settlements unless adequate stabilization measures can be taken. In sum, in earthquake prone areas, landslides and earthquakes form unfortunate integral relationships. While extensive slope instability predates the earthquake, the earthquake triggers a number of new landslides.

- **Tsunamis or sea waves**, which are caused by the sudden change in sea bed level that may occur in an offshore earthquake. Wave heights tend to increase as they enter shallow water. A tsunami is a sea wave caused by an earthquake caused by mass movements of part of the seafloor. As the wave approaches the shore, the decreasing depth of water causes the height of the wave to increase resulting in a high energy wave that travels significant distances inland potentially causing substantial damage. Over last 500 years, at least 9 tsunamis have occurred in the Marmara Sea. The last one happened on 17 August 1999. Wave heights at the coastline are reported to have been in the range of 1 meter to 2.5 meters with a maximum height of 4 meters reported near Gölcük located in the east of Yalova. However, no significant damage was reported from these waves so far in the Marmara Region.
- **Seiches or waves** in lakes due to resonance of the water with the earthquake motions. Earthquake induced waves in enclosed bodies of water, such as lakes or reservoirs are called "seiches". A seiche is commonly caused when long period seismic waves match the natural period of oscillation of the body of water leading to a formation and amplification of a surface wave. Seiches may also be caused by fault displacement or earthquake induced landslides within the lake or reservoir. The seiches are associated with fault rupture near the water bodies. Nevertheless, no seiche or other surface wave in the lakes or water reservoirs in the Yalova region have been reported subsequent to the 17 August 1999 earthquake.

Some man-made actions exacerbate the risk exposure of the Yalova settlement in addition to the aforementioned risk factors. Such actions include:

- Non compliance of buildings and other structures with applicable building codes. People are seldom killed by the ground shaking itself; the main cause of death is the collapse of structures triggered by a shaking.
- Fall of objects from the outside of buildings such as cladding and balcony.
- Floods due to dam failures.
- Fires caused by electrical faults, overturned fires, fractured gas pipelines, etc. in the wake of an earthquake.
- Explosions of gas and oil tanks and other dangerous chemicals (BECT, 2000).

Upon drawing a detailed geologic and/or seismic hazard profile of the settlement of Yalova, some conclusions can be drawn to provide guidance building disaster resilient settlement. According to a very well-known formula for determining risk ($\text{Risk} = \text{hazard} \times \text{vulnerability}$), the risk in the settlement of Yalova can be decreased by building awareness of hazards as well as designing and building of all infrastructure and superstructure with a view to decreasing vulnerability. For an earthquake, many authorities and citizens are already aware of the hazard of a certain magnitude. However disaster awareness and improvement processes are still complicated in such a country with an increasing population like Turkey. Because of the multitude of institutional responsibilities for relevant public services such as planning and infrastructure works, the awareness of disasters is not always sufficient to prevent the next disaster hazard. With this shortcoming in mind, measures towards lessening vulnerability can be grouped under three headings:

- Site and Location: Ground survey, soil analysis and geological report of the area are basic for all infrastructures and

superstructures. Either constructions should be prohibited in geological failure areas, non-stable ground bases, fault lines or technology intensive (that is to say high cost techniques) construction methods should be applied to offset the risk features of these areas.

- **Construction Quality and Design:** For settlement areas prone to earthquake risks, the building codes should be different than for other settlement areas. For instance reinforced concrete and shear walls should be required for issuing construction permits. The design of infrastructure and superstructure should be assessed with a view to decreasing risks to an acceptable level. For instance, although building a mosque with minaret is quite an old cultural trend in Turkey, mosques in earthquake-prone areas should be redesigned with a view to lessening hazards of minarets on human life in the course of an earthquake.
- **Control and Monitoring:** The process of control is quite long and multidimensional in the construction field. The whole controlling procedures and processes range from project control over construction control to construction material quality control. In the 1999 earthquake in Yalova, it is notable that many collapsed buildings had proper architectural and construction projects. Nevertheless most of the building stocks were severely damaged due to lack of control of construction and quality. For instance, many field surveys in the earthquake area proved that marine sand had been widely used in buildings. Periodical monitoring is another essential service especially in such an often earthquake prone settlement like Yalova. The control and current condition assessment should be done periodically and especially after each earthquake hit.

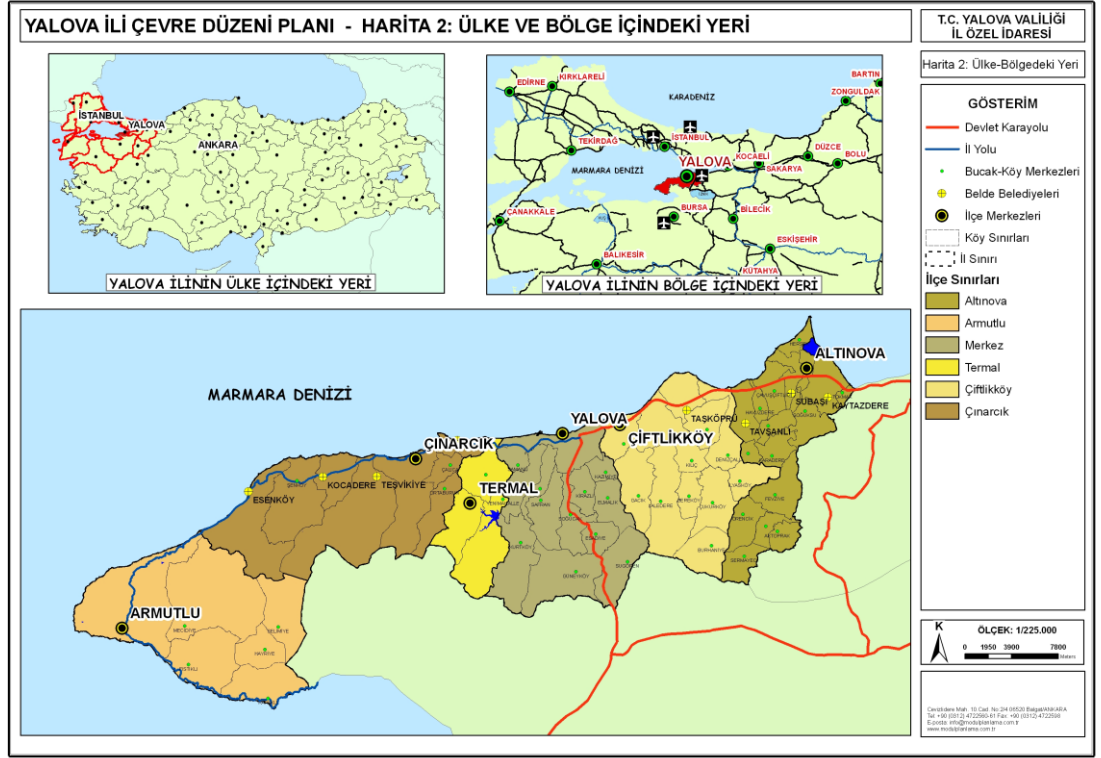
EXISTING PLANNING SITUATION AND DISASTER MITIGATION FOR THE CITY OF YALOVA:

According to the population census data of Turkey Statistics Institute in 2000, Yalova has 168 593 inhabitants. Due to the 1999 earthquake, the urban population has increased less than the population in rural areas. It should be noted, however, that Yalova serves as a summer residence so that the population increases considerably during the summer season. The Province of Yalova comprises a total of 16 municipalities. Of these, 6 form the central municipalities and districts (Yalova-Center, Altinova, Armutlu, Cinarcik, Ciftlikkoy, Termal) and 10 smaller municipalities (Kadıköy, Kaytazdere, Subaşı, Tavşanlı, Koruköy, Esenköy, Teşvikiye, Kocadere, Kılıç, Taşköprü) are at the periphery of the province (see also fig.9). Each of these districts is also a municipality with a mayor of its own. Accordingly, Yalova has 5 district governors (The district of Yalova Center is under the responsibility of the Governor in Yalova) and 16 mayors (The Governorate of Yalova & the Municipality of Yalova, 2006).

Spatial planning responsibilities are divided among governorates and municipalities. Municipalities have responsibilities for spatial plans in local scales in addition to their administrative responsibilities (see further "3. Disaster Mitigation Approaches and Lessons Learned in Turkey"). Nevertheless, some tasks for spatial plans are given to governorates by the Law of Provincial Special Authority (Law. No. 5302 issued in the official gazette of 4.3.2005, no: 25745). According to the Law of Provincial Special Authority, the Governorate of Yalova has a responsibility for coordination to prepare large scale provincial master plans by participation of the Provincial Special Authority and municipalities. In Yalova 6 district municipalities play major role to prepare spatial plans. Especially for the preparation of existing Yalova Provincial Master Plan, the Municipality of Yalova-Center and the

Provincial Special Authority worked together in 2007 (see also Annex I.16).

Figure 9 : The Location Map of Yalova and Its Districts



SOURCE: The Governorate of Yalova & the Municipality of Yalova, 2006

Procedures of and responsibilities for spatial planning in Turkey have undergone major changes over the past decade. Until 1985, the role of the central government had virtually been comprehensive. In 1985, however, the Law of Public Works (Law No.3194) transferred some planning authorities from the Ministry of Public Works and Settlement to local authorities. This law distinguishes three main planning categories, namely regional plans, large scale (1/25 000) master plans, and implementation plans. Regional plans which focus on economic development are prepared by the State Planning Organization reporting to the Prime Ministry. Master plans in 1/25 000 scale, setting out main land use decisions for settlements and their periphery are prepared by the Ministry of Public Works and Settlement. According to

the main land use decisions, 1/5000 and 1/1000 scale implementation level plans are prepared by municipalities while they used to be prepared and approved by the Ministry of Public Works and Settlement before 1985. The transition period for transferring planning authorities to local authorities caused some problems, such as misuse of public benefit areas e.g. forests, coastal zones, agricultural areas, etc., illegal housing areas, misapplication of planning legislation due to the lack of knowledge and experience. For these reasons, since 1990, the authority of the Public Works and Settlement for plan preparation was re-increased (BECT, 2000). Over the past 4 years (2004-2008), spatial planning proceeded dynamically in Turkey with numerous institutions taking part in the planning process and numerous planning legislations becoming effective without considering conflicts and duplications among planning authorities.

When the earthquake hit Yalova in 1999, Yalova had a plan in 1/25 000 scale approved by the Ministry of Public Works and Settlement on 4.8.1982. The plan called "Cinarcik-Yalova-Karamürsel Master Plan" was cancelled on 18.6.2002 on the ground that it no longer responded to needs of the settlement. After the earthquake, 1/5000 and 1/1000 scale plans were prepared by the Ministry (General Directorate of Technical Research and Implementation) for new settlements areas for citizens who were prone to the disaster. At the same time, the Ministry approved a frame of principles to provide guidance to municipalities in preparing spatial plans in Yalova in 2002. This frame explains principles and standards of spatial plans; as lays down rules and standards for buildings in various earthquake prone areas such as alluvial lands, land slide areas, etc.

After 2004, Turkey again adopted new planning laws and modified authorities, e.g. Provincial Special Authorities. In this frame, Yalova have a recent spatial plan in 1/25 000 scale. This plan was approved in

coordination with the Municipality of Yalova and the Provincial General Council on 8.6.2007 (The Governorate of Yalova & the Municipality of Yalova, 2006). On 8.8.2008, the Ministry of Public Works & Settlement also prepared and approved a large scale plan for Yalova and the Izmit Gulf area in light of the significant earthquake risks in these regions. The plan was prepared with a view to the concept of Integrated Coastal Zone Management along Izmit Gulf and Yalova coastal areas. It sets out main policies and principles for land uses in the region concerned. The Ministry prepared this plan in 1/50 000 scale on the basis of the Public Works Law (Law No. 3194) and the Coastal Law (Law No. 3621). In addition to these large scale spatial plans, the Ministry of Public Works and Settlement approved various coastal area plans (including quays, naval docks, marinas) in 1/1000 scale on the basis of its authority under the Coastal Law (Law No.3621) (see also Annex I.16).

In addition to preparing spatial plans, the Ministry of Public Works and Settlement was responsible for organizing temporary and permanent housing works in the wake of the 1999 earthquakes. To provide immediate shelter and better housing conditions for disaster-struck citizens, site survey and selection procedures for temporary housing areas (prefabricated units and tents) were completed quickly. In the mean time, the Ministry initiated a process for the construction of permanent housing units in view of the approaching winter season. Nevertheless, completion of the work took more than one year due to the process consisting of site analysis and selection, expropriation (if necessary), geological examination, preparation of spatial plans, preparation of infrastructure projects, related consultancy works for housing, construction, and control. The whole housing process followed by the Ministry is illustrated in the following table (The Turkish Ministry of Public Works & Settlement, 2000):

Table 16: The Process of Temporary and Permanent Housing Followed by the Ministry of Public Works & Settlement in 1999 Earthquakes

HOUSING PROJECTS STEPS IN THE PROCESS	TEMPORARY HOUSING PROJECTS	PERMANENT HOUSING PROJECTS
SITE ANALYSIS & SELECTION	<ul style="list-style-type: none"> ➤ data gathering in coordination with Governorates ➤ priority given to lands owned by public and/or treasury 	<ul style="list-style-type: none"> ➤ data gathering in coordination with Governorates ➤ priority given to lands owned by public and/or treasury ➤ geological surveys ➤ other feasibility analyses
GENERATION OF ALTERNATIVES FOR HOUSING PROJECTS	<ul style="list-style-type: none"> ➤ tent cities ➤ prefabricated housing units ➤ rent subsidies 	<ul style="list-style-type: none"> ➤ reconstruction of existing housing units ➤ aid for housing repairs ➤ aid for new housing units
PLAN PREPARATION	<ul style="list-style-type: none"> ➤ schematic preparation 	<ul style="list-style-type: none"> ➤ large scale spatial plans (1/25 000) ➤ implementation plans in 1/5000 & 1/1000 scales
CONSULTANCY & CONSTRUCTION	<ul style="list-style-type: none"> ➤ infrastructure (basic works for prefabricated units) ➤ housing 	<ul style="list-style-type: none"> ➤ infrastructure (technical services and transportation facilities)

		➤ housing
CONTROL	➤ basic quality control of construction materials ➤ prefabricated units financed by foreign aid controlled by firms contracted by funding institutions	➤ construction permit ➤ settlement permit

SOURCE: Own Source

The Ministry of Public Works and Settlement (General Directorate of Disaster Affairs) carries out geotechnical and geomorphologic surveys in earthquake prone areas. Since the extensive damage in 1999 earthquakes was to a large extent attributed to unplanned urban development and constructions with insufficient consideration of geological and ground conditions, the Ministry performed numerous geological and geotechnical studies in Yalova as well as other earthquake prone cities. In these studies, the Ministry gave a priority to accomplishing geotechnical and geomorphologic surveys in permanent housing areas for earthquake-struck citizens in Yalova. According to results of those surveys, permanent housing areas were grouped into the following three zones (The Turkish Ministry of Public Works & Settlement, 2000):

1. Zone with no need for a geotechnical study
2. Zone with a need for the geotechnical study
3. Zone with a hard soil sedimentation (can only be suitable for green areas)

Under these 3 zones, special technical requirements for constructions were adopted. While new housing units were constructed, damage assessment and categorization studies of existing building stocks were carried out by the General Directorate of Disaster Affairs. For the purpose of damage assessment studies, the existing building stock was categorized according to the damage level. Moderately damaged

buildings were rehabilitated while heavily damaged ones were demolished. According to damage assessment and categorization studies in Yalova, 14 646 units (dwelling units +offices) were determined as heavily damaged and/or collapsed, and 15 699 units (dwelling units +offices) were determined as moderately damaged. However, only 8184 applications were recorded in the inventory of the Ministry of Public Works and Settlement with respect to heavily damaged buildings as well as 8607 applications with respect to moderately damaged buildings. Differences in numbers between damaged units and applications for governmental support may be explained by casualties in 1999 earthquakes (The Turkish Ministry of Public Works & Settlement, 2000).

As an affiliated organization of the Ministry of Public Works and Settlement, the General Directorate of Provinces had also some responsibilities in earthquake areas with respect to disaster mitigation. This General Directorate is an organization responsible for preparation of small scale spatial plans, construction of drinking water and sewerage systems of municipalities, and financing of their projects. After 1999 earthquakes, the General Directorate took part in cartography and preparation of small scale plans in cooperation with the General Directorate of Technical Research and Implementation. Various sewerage and drinking water supply projects were also implemented by the General Directorate (The Turkish Ministry of Public Works & Settlement, 2000).

The General Directorates of Highways used to be an institution of the Ministry of Public Works and Settlement. It is responsible for building and maintenance of highways except municipal roads. In the wake of the 1999 earthquakes, rehabilitation projects of main routes which link the Eastern Marmara Region to other regions were carried out by the

General Directorate of Highways (The Turkish Ministry of Public Works & Settlement, 2000).

In addition to all mitigation activities above, as already mentioned in "3.2. Institutions Involved in the Disaster Mitigation Process", other necessary activities and projects were organized by relevant ministries as well as local authorities in the coordination of the Ministry of Public Works and Settlement via Central Coordination Council on Disasters.

INSTITUTIONAL COPING CAPACITY AND PROBLEMS: In Turkey, the main challenge of the institutional coping capacity for disasters stems from gaps and conflicts among authorities and relevant institutions. Gaps and conflicts between central and local authorities arose immediately just after earthquakes in 1999. The Ministry of Public Works and Settlement established the legal obligations for municipalities with respect to the preparation of local scale geological maps and ground survey analyses with a view to ensuring appropriate constructions (see also "3.1. Review in Turkish Disaster Legislation"). However, many municipalities failed to comply with these obligations due to insufficient financial capacities. Municipalities also failed in building local organization and coordination for disaster mitigation due to their lack of financial and technical capacities.

Another conflict was derived from different approaches of local and central authorities, respectively. For instance, results of building damage assessment reports and damage classification studies are remarkable to point out the conflict. According to the Law on Precautions and Aids for Disasters Influenced the Common Daily Life (Law No. 7269), the Ministry of Public Works and Settlement is responsible for the preparation of damage assessment reports and classifying damaged buildings for rehabilitation works. While the Municipality of Yalova-Center had limited buildings to a maximum of 3

storeys, the Ministry of Public Works and Settlement's damage assessment reports and building rehabilitation credits gave support for some 6 storey damaged buildings (Göktürk & Yılmaz, 2005). Consequently, many contradicting decisions in building permits were issued due to differences in working principles of the Ministry and municipalities in Yalova.

The disagreement between the Ministry of Public Works and Settlement and industrial companies located on earthquake hazardous areas is another source of conflicts. Although the Izmit Bay region and the coastal zone of Yalova are prone to earthquakes, more than half of these areas are covered by industrial plants (see also "3. Disaster Mitigation Approaches and Lessons Learned in Turkey"). The Ministry of Public Works and Settlement had suggested moving industrial areas damaged drastically in 1999 earthquakes from the Izmit Bay and Yalova coastal areas to another suitable areas. However, this suggestion failed due to unwillingness of the industrial sector. Among many industrial plants, "AKSA (Acrylic Chemical Industry)" is introduced below as an example of an industrial site with high earthquake hazards in Yalova. The following paragraph is quoted and summarized from a paper which was presented in the First Annual IIASA-DPRI Meeting in Laxenburg, in 2001:

"AKSA is a large acrylic fiber manufacturing facility located in Yalova on the southern shore of the Marmara Sea, which produces large quantities of acrylonitrile (ACN), a highly toxic and flammable compound. The ACN is stored in eight tanks at the plant; the three partly-full tanks suffered major damage as a result of the earthquake. Concrete containment dikes around the tanks cracked, and the liquid ACN flowed through the storm water drainage channel into the Bay of Izmit. The leaking ACN was discovered at about 8 a.m. (earthquake occurrence time was 3:02 a.m.) In the confusion following the earthquake, due to the failure of the electricity system and the

resulting loss of lighting, the plant employees were not immediately aware of the leakage. Even the distinctly acrid odour of ACN was not reported until morning. After various emergency efforts, AKSA staff began to control the ACN runoff to the Bay of Izmit at about 10:30 am. People in the immediate area of the plant began to evacuate after AKSA managers informed the government at 11 a.m. that there was a dangerous ACN release. Ultimately, it took 40 hours from the time the earthquake struck to stem the liquid and gaseous releases from the plant. Environmental damage due to the ACN release included the death of all animals on the grounds of the plant and all vegetation within 200 meters of the tanks. No one at the plant or in the neighbouring community died due to the release. Although authorities in Yalova had established a protection zone of 1.2 km around the plant, some development had nevertheless occurred within the area. Since the area affected was much larger than the designated protection zone, people living outside the protection zone around the plant were likely exposed to uncomfortably high concentrations of carcinogenic ACN. Despite the fact that the ACN also affected the sea in the Bay of Izmit Bay, as well as soil and groundwater in the area, - by chance- there was little reported fish killed. There is concern, however, about the long-term effects of ACN on the ecosystem of the Bay of Izmit and faculty from the University of Istanbul are engaged in long-term monitoring of the Bay (Steinberg, L.J. et. al., 2001)."

The author of this thesis had interviewed executives of AKSA Factory in the context of a field trip to earthquake struck areas 2-3 months after the earthquake. The interviewed executives made it clear that AKSA had no plan to move to a safer site. They explained that the AKSA Factory would continue its production because many precautions had been taken against future earthquake strikes; and they took comfort from an Environmental Impact Assessment carried out the Ministry of Environment. Yet, they were unable to answer the question what would happen if another earthquake hit the factory. Examples of

industrial accidents in the course of earthquakes have illustrated that total losses and damages in 1999 earthquakes are not attributed to a lack of knowledge or quality control but also to conflicts between public interests and entrepreneurial profits.

On the other hand, much criticism was voiced from media and some other institutions, such as the Chambers of City Planners regarding the efficiency of planning and disaster mitigation activities of the Ministry of Public Works and Settlement. While the Minister of Public Works and Settlement in 1999 publicly defended the Ministry against these criticisms, the Ministry internally embarked on a process of self-criticism (Göktürk & Yilmaz, 2005). Although this process led to some considerable improvements (see also "3.1.Review in Turkish Disaster Legislation"), the Ministry faces still many difficulties in providing spatial plans in various scales (1/25 000, 1/5000, 1/1000) to all cities in Turkey. Furthermore, the Ministry has thus far failed to produce a general spatial planning policy for the country due to the work overload. At present, a study is pending towards a draft law (Draft Law of Public Works and Urbanization) on modernising and increasing safety of settlements and constructions in Turkey (see also "3.1. Review in Turkish Disaster Legislation").

In the spatial planning sector in Turkey, as already mentioned, new institutions after 2004 started to take part. While the Ministry of Public Works & Settlement was the main institution for plan preparation and approval, some central and local authorities were eager to assume responsibilities in the field of spatial planning. Metropolitan municipalities took charge of large scale plans in their metropolitan boundaries by the Law of Greater Municipality (Law. No. 5216 issued in the official gazette of 23.7.2004, no. 25531). Municipalities other than metropolitan municipalities were also given larger planning authorities by the new Law of Municipality (Law. No. 5393 issued in the official gazette of 13.7.2005, no. 25874). Provincial Special

Authorities obtained new planning authorities by the Law Provincial Special Authority (Law.No. 5302 issued in the official gazette of 4.3.2005, no. 25745). The Ministry of Environment & Forestry has assumed also new planning authority by an amendment of the Law of Environment (Law.No. 2872) in 26.4.2006. The Ministry of Culture & Tourism has obtained new planning authorities by an amendment of the Law of Promotion of Tourism (Law.No. 2634) in 24.7.2003. By this amendment, the Ministry of Culture & Tourism now has a planning authority for "tourism centers" and "regions for protection and development of tourism". In Yalova, two areas were declared as tourism centers by the Ministry of Culture & Tourism via official gazette of 16.12.2006, no.26378. These tourism centers are "Yalova (Center) Thermal Tourism Center" and "Yalova-Armutlu Thermal Tourism Center". The Ministry of Culture & Tourism approved two tourism master plans in these two tourism centers in 25.12.2006 (The Governorate of Yalova & the Municipality of Yalova, 2006). As a result of these new legislation and new planning authorities, chaos in spatial planning became inevitable. As the oldest planning authority, the Ministry of Public Works & Settlement published a circular in 2008 to provide guidance to central and local planning authorities in the case of confusion about plan changes or preparations (see also Annex I.16).

All conflicts mentioned above denote lack of coordination and organization among central and local authorities in the disaster mitigation. In 1999, another remarkable conflicts were between the Government of Turkey and foreign aid and credit institutions such as the World Bank, the European Investment Bank, etc. In the processes of disaster mitigation and disaster response, many international aid and credits institutions and various NGOs tried to support efforts of the Turkish Government (JSPS, 2004). In organizing foreign aids, especially in disaster mitigation activities, the main problem of Turkey stemmed from the lack of organization and limited number of technical

personnel in 1999 earthquakes. For instance, the Ministry of Public Works and Settlement had many difficulties in the site development of permanent housing areas for projects financed by the World Bank. While the Ministry hardly performed the site development works for permanent housing units due to the lack of safe land and limited financial resources for the expropriation, the World Bank asked for the land for housing projects in a limited time. Such credit or financial aid institutions as the World Bank who has own limits and procedures have experienced some conflicts about process planning with the Government of Turkey. In Yalova, similar difficulties and desynchronized efforts had been experienced between technical teams of British Earthquake Consortium for Turkey (BECT) and the Ministry of Public Works and Settlement. Due to some bureaucratic procedures, these teams could not support each other sufficiently despite the fact that they both aimed at guiding to spatial plans of Yalova. While the team of the BECT needed some bureaucratic permission to start, the technical team of the Ministry had to finish the site selection of permanent housing areas. Thus, according to the feasibility report of the BECT, sites developed for permanent housing units were not embraced completely (BECT, 2000). As a conclusion, the organization of foreign aids exceeded over the institutional capacity of Turkey while disaster mitigation institutions had tremendous work loads in 1999 earthquakes.

6.6.2. Analysis of Existing Urban Structure of Cologne

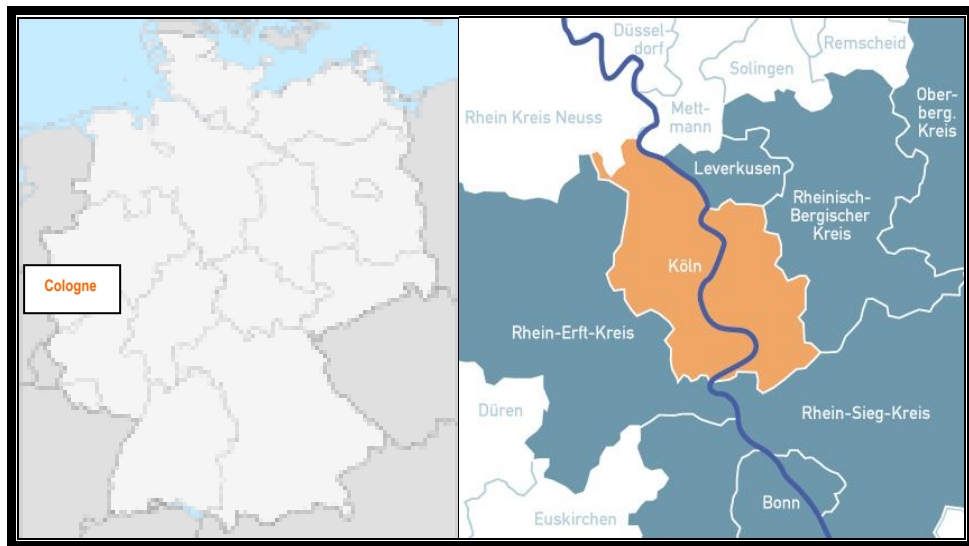
GEOLOGICAL AND SEISMIC RETROSPECTIVE VIEW OF COLOGNE:

Cologne is a German city lies on the River Rhine in the Federal State of North Rhine-Westphalia (see also fig. 10). Cologne has 9 districts(=Stadtbezirke) and 86 neighbourhood units (=Stadtteile). The city administration of Cologne constitutes with a metropolitan municipality and other district municipalities namely, Rodenkirchen, Lindenthal, Ehrenfeld, Nippes, Chorweiler, Porz, Kalk, and Mülheim.

Cologne is recently, an important cultural and media center in Germany (Sub-district Authority of Cologne, 2008).

The City of Cologne has quite long historical background, e.g. approximately 2000 years. The first settlement was founded by the German Tribe of Ubians on the left coastal part of River Rhine around 38 B.C. After the signing of a peace agreement with the occupying Romans, the Romans and Ubians together founded the common settlement *oppidum ubiorum* (city of the Ubier) and constructed a new provincial state. During the Roman period, the building activities bloomed. According to the wish of Agrippina, who was born in Cologne later married to Emperor Claudius, attained for the Ubierian settlement in 50 A.D. She transformed the small settlement into a colony with a name of "Colonia Claudia Ara Agrippinensium" (CCAA). It means "Colony of Claudius and site of the Alter of Agrippina". This settlement was located on a plateau which extended approximately 1km² and has 14-16m altitude from the river basin. There was a natural harbour in the east part of the settlement in the first century A.D. The settlement was surrounded by the city walls like any other Roman City. Large public buildings such as the Temple of Capitoline Trias, the Prætorium, the Temple of Mars Ultor were built on the lower terrace on the west bank of the Rhine (Hinzen & Schuette, 2003).

Figure 10: The Location Map of Cologne



SOURCE: The Website of Region Köln/Bonn (<http://www.region-koeln-bonn.de>)

The modern city is located today, in the south-eastern part of lower Rhine or Northern Rhine. The Northern Rhine Area where includes the City of Cologne, is a part of European rift system. This system extends over 1 100km in south-north direction (started from Rhone Valley and Upper Rhine high plateaus in the south to the Lower Rhine embayment and North Sea in the north). The active and most significant seismic zone in the Middle Europe north of the Alps extends from Upper Rhine Area to Belgian earthquake zone. (Hinzen & Reamer, 2004) The ground soil of the settlement consists of alluvial and marine sediments. Thus, the City of Cologne and her surroundings have been still prone to earthquakes. The recorded figures starting from 1600 could give an idea about the seismic dynamism of Northern Rhine Area. The Verviers earthquake on 18 September 1692 had 6.8 magnitude and its epicentre was Brabant. Two earthquakes in Dueren dated on 27 December 1755 and 18 February 1756. The first one had 5.7 magnitude and the second one had 6.4. (Hinzen & Reamer, 2007) For the recent earthquakes it is possible to give much more explanation. For instance, an earthquake with 5.1 magnitude caused injuries and property damages on 14 March 1951 in the Northern Rhine Area. The epicentre was near the Euskirchen (south-west of Cologne). Another

remarkable earthquake with 5.9 magnitude was in Roermond (in north-west of Cologne), in 1992. The Roermond earthquake caused 1 casualty, 25 injuries, and 7 200 building damages. (Gruenthal et al., 2004) The Alsdorf earthquake on 22 July 2002 affected quite large areas as Belgium, Netherlands, Luxembourg, and France as well as Germany. The epicentre was close to Alsdorf where 54 km east of Cologne was. The magnitude was 4.9. (Hinzen & Reamer, 2007) Moreover, several fault lines such as Erft Fault Line and Viersen Fault Line lay down in eastern part of the lower Rhine. According to the historic seismic data, geological measures and observations indicate that these fault lines have still some movements. For instance, a moderate earthquake at the Erft Fault Line has a moment magnitude of 5.8 or 5.9. This will possibly cause liquefaction at the Rhine River banks in Cologne. In addition to those two close fault lines, despite of their distance to Cologne, Rurrand Fault Line and Feldbiss Fault Line has earthquake risks in the case of 6.2(Rurrand) and 6.6(Feldbiss) magnitudes. Some ancient traces of measures to build safer building foundations in the City of Cologne which were taken in Roman Period have also showed that earthquake threats are not new topics. Despite of those measures, the ruins of Roman buildings today, unfortunately clarified the severe damage of historic disasters namely, earthquakes. Despite the historical earthquake index for Central Europe has no data between 600 and 900 A.D., the historical earthquake index of Germany lists ten events in this period around the northern Rhine area. These listed events are mostly took place in the corridor of Aachen, Cologne and Lower Rhine area. (Hinzen & Schuette, 2003)

However the demolition of ancient buildings might not only stem from disaster but also change in surface topography of the City of Cologne. Such a city has 2000 thousand years history like Cologne possible shows typical surface topographical change due to human-beings use. The remnants of ancient buildings denote that the settlement surface

has been slowly rising for centuries. For instance while a famous Dionysus mosaic was used to be the floor of the main room of Roman villa in 1-3rd centuries A.D., it recently lays down 6 meters below the current surface of south of the Cologne Cathedral. (Hinzen & Schuette, 2003)

The most seismic data used in this study are gathered from the Earthquake Station of the University of Cologne in Cologne-Bensberg and the North Rhine-Westphalia (NRW) State Office of Geological Survey in Krefeld. However there are three seismic observatories in the North Rhine-Westphalia State. These are the Observatory of the Ruhr University in Bochum, the Observatory of North Rhine-Westphalia (NRW) State Office of Geological Survey, and the Observatory of Bensberg. The NRW State Office of Geological Survey which reported to the NRW Ministry of Economics, Energy and Medium-size Enterprises (Ministerium für Wirtschaft, Energie und Mittelstand des Landes Nordrhein-Westfalen) was founded in 1957. Its observatory was founded in 1980 with 3 borehole seismometer stations. Recently, it has 13 seismic receiver stations. According to its catalogue, there are over 1100 tectonic seismic events since 1980. The task of the office is answering geo-seismic questions of the institutions and individuals in the North Rhine-Westphalia, preparing geological maps of the NRW State, making ground survey and soil analyses, recording seismic data of Lower Rhine embayment, and reporting tectonically-induced seismic conditions of NRW State to the NRW Ministry of Economics, Energy and Medium-size Enterprises. In Bochum, the Institute of Geology, Mineralogy and Geophysics at the Ruhr University is responsible from observatory. The main field of seismic studies of the observatory in Bochum focuses on mining-induced seismic events in the Ruhrgebiet Region. The Observatory of Bensberg focuses scientific researches on seismic events. (see also Annex I.13)

The seismic network of Bensberg consists of twenty stations located in Northern Rhine Area. While there was a single seismic monitoring station available in this area, it was upgraded to a network in mid of 1970s. After 1996, the network was also upgraded to a digital system while the previous records were paper plots and handwritten notes. The Bensberg Earthquake Station developed a study on 1 336 data selected from Bensberg Catalogue from 20 years operation (1975-1995) in the Northern Rhine Area. According to outcomes of the study, it is understood that despite rare devastating earthquake events in the Northern Rhine Area, earthquakes with magnitudes above 3 can easily create panic among the people living in Lower Rhine Area, e.g. the earthquake with 3.9 magnitude in Meckenheim in 20.01.2000, the earthquake with 4.9 magnitude in Alsdorf in 22.07.2002. (Hinzen & Reamer, 2004)

The Bensberg Study is not only seismic study for the City of Cologne. The findings of the German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) have been pointed out the significant earthquake risk for Cologne. In January 2000, Germany organized an initiation for scientific and technological know-how in research of natural disasters with the participation of 15 German and Austrian organizations. This initiative was funded by the German Federal Ministry of Education and Research with duration of 3 years. The German Research Network Natural Disasters aimed to provide fundamentals of advanced risk managements for network users and support integral disaster research and disaster mitigation. The Network developed a study for the seismic risk assessment and disaster mitigation for earthquakes by testing its outcomes on a case study: Cologne. According to the outcomes of the study, the City of Cologne is determined as a high earthquake risk urban settlement. There are two major reasons behind this high earthquake risk: 1) The historical

seismic background 2) The existing settlement conditions. When the German Research Network Natural Disasters developed a method based on geological background data of Cologne and seismic parameters, the earthquake risk profile of Cologne was drawn on the assumption that she is prone to quite severe earthquake hits (intensity 6-7 according to the European Macro-seismic Scale) with a 10% probability of exceedance in 50 years. Also Cologne is under considerable earthquake risk because of its dense population and constructed areas. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has 989 800 inhabitants (Statistisches Bundesamt Deutschland, 2008). Cologne is a vulnerable city with respect to vulnerable conditions of main business sectors such as industry, commerce, media, etc. as well as many cultural heritage assets and archeological sites (Gruenthal et al., 2004). In addition to these two major reasons, soil conditions of the settlement area increase the vulnerability of the settlement. Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavourable soil amplification factors can also augment the earthquake destroying effects. In the present settlement conditions of Cologne, high rise buildings and the Cathedral may suffer moderate damages of earthquakes as well as bridges (According to the study of the German Research Network Natural Disasters, Koeln-Deutzer Bridge, Severins Bridge, and Mülheimer Bridge may suffer earthquake damages of various degrees.). This assumption also implies severe conditions of response activities in Cologne in the case of an earthquake. Because many streets will be blocked by debris, fire, and may be water incursion from the River Rhine; and transportation and some communication activities will be significantly disturbed by the temporary closing of the bridges on the Rhine (Friedrich & Merz, 2002).

On the other hand, the analysis on existing building stock can give some positive results in the respect of vulnerability. Despite there is not yet a certain study to measure the earthquake resilience of all building stock in Cologne, according to the joint study of the "GeoForschungsZentrum" in Potsdam, the University of Bauhaus in Weimar, the University of Leibzig, and the Munich Reinsurance Company, it is possible to draw the building vulnerability profile for the city center of Cologne. In that study, 800 building in the city center were analyzed according to criteria of building type, structural system, importance of usage, and age of building. The outcomes of this analysis have been pointed out that majority of building stock can be assessed as low vulnerability structures. However this outcome depends on the fact that the large numbers of buildings were erected in past 50 year after the severe destruction of 2nd World War. Thus according to overall risk assessment for Cologne, seismic risk is the prime risk among the other natural disaster risks which has higher probable financial loss. (Gruenthal et al.; 2004)

Another dimension of high earthquake risk in Cologne stems from the high value of residential buildings. According to the study of the Center for Disaster Management and Risk Reduction Technology(=CEDIM) in Germany, the Federal State of Northern Rhine Westphalia has the highest per capita value of residential building asset. In the Federal State of Northern Rhine Westphalia, the highest values are around the City of Cologne. The original aim of the CEDIM's study was to prepare a risk map for natural disasters such as windstorms, earthquakes, and floods in Germany. For this task, a consistent framework performed the quantitative risk assessments in term of a financial appraisal was prepared. The whole residential building stocks in the country are evaluated according to their market values/current values and replacement/reconstruction costs. As a conclusion, Cologne has also a

high financial vulnerability in the case of natural disasters (Kleist et al, 2006).

EXISTING PLANNING SITUATION AND DISASTER MITIGATION FOR THE CITY OF COLOGNE: As already mentioned on the planning system in Germany (see also "2.3. The European Union/Germany"), planning procedures are handled in Federation Level, Federal State Level (for the City of Cologne the North Rhine-Westphalia State), Sub-district Level (Regierungsbezirk Köln), and Municipal Level (Stadt und Gemeinde). The Sub-district Authority and Municipality of Cologne are two major plan preparation institutions for the region of Cologne. The sub-district of Cologne covers the sections of Cologne, Bonn, and Aachen. The Municipality of Cologne prepares detailed implementation plans in conformity with larger scale (1/50 000) regional plans prepared by the sub-district authority of Cologne (About the Sub-district Authority of Cologne, 2008).

The Sub-district Authority of Cologne prepares regional plans in accordance with the Regional Planning Act of the North Rhine-Westphalia (Bundesraumordnungsgesetz & Landesplanungsgesetz). The regional plans are prepared in 1/50 000 scale which include the existing land-use and regional development features. The regional plan is constituted of spatial plans and the plan report. The existing regional plan of Cologne is prepared in 1/50 000 scale for the following 15 years. It constitutes with two parts namely, Cologne and Bonn areas. The existing regional plan of Cologne was ratified in 2006.

The regional plan of Cologne reflects only the anxieties of flood in the aspect of disaster mitigation. After some flood invasions in Cologne (especially in 1993 and 1995), it is possible to see some areas in the plan such as flood invasion area, flood protection area, and potentially flood prone areas. The planning authority brought some rules of usage

according to the level of flood risks. In the regional plans, flood risky areas and flood invasion areas are shown as zones. The details are reflected in local scale municipal plans. The Sub-district Authority of Cologne controls the local scale municipal plan in the aspects of flood prevention measures.

Despite high seismic risks of Cologne, geological failure areas or fault lines do not take place on the plan. Nevertheless, the relevant precautions for earthquakes and geological hazards are taken in the plan preparation process. When the plan proposals are prepared, they are sent to the North Rhine Westphalia State Office of Geological Survey. The State Office of Geological Survey examines plan proposals and if necessary gives technical recommendations to change plan decisions according to the fault line and geological failure areas. The State Office of Geological Survey also takes place in the implementation process of plans. ***The companies and citizens are not allowed to build a new building, house or industrial establishment without taking technical approval of the State Office of Geological Survey. The State Office has also an authority of controlling new constructions according to the geo-technical feasibility (see also Annex I.13).***

While the sub-district Authority of Cologne is responsible for the preparation and modification of plans, the Regional Council of Cologne is responsible for the ratification and decision making for plans. The council takes decisions about the main regional planning problems and discusses on loan programs. The Regional Council of North Rhine-Westphalia constitutes with deputies of the Federal State of North Rhine-Westphalia. The sub-district Authority of Cologne is obliged to inform the Regional Council about the main regional developments and spatial planning issues namely, town planning, residential areas and construction, education, health, sports facilities, traffic planning,

cultural and touristic facilities, recreation and landscape planning, drinking water, waste management, and sanitation.

The regional plans in Germany play an intermediate role between federal level of planning decisions, documents and municipal level of implementation plans. Since regional plans cover more than one municipality, continuity and harmony in plans are recently arising topic in the context of regional planning. There are some new approaches to build an inter-municipal cooperation in planning. This voluntary basis cooperation serves not only to the purpose of plan continuity among different municipalities but also to decrease the gap between city centers and their peripheries. For instance in the Region of Bonn-Rhein-Sieg-Ahreweiler, a regional common research group started to study on traffic and planning issues on the basis of municipal cooperation with reference to the decision of German Federal Parliament (Bundestag) dated on June 1991. In reality Germany is not a country which has remarkable differences between city centers and peripheries. However the new approach of inter-municipal cooperation would bring the effectiveness and efficiency in land-use (About the Sub-district Authority of Cologne, 2008). Especially, in the neighbouring region of Cologne, this initiative looks promising in terms of coordination and continuity of land use decisions.

So far, spatial planning procedures and process have been elaborated with respect to disaster mitigation. However, infrastructure is one of the significant elements of urban planning. The Ministry of Interior/The Federal Office of Civil Protection and Disaster Assistance has an initiative for the protection of critical infrastructures in the field of disaster mitigation. Especially after the attacks in New York and Washington on 11 September 2001, in Madrid on 11 March 2004, and in London on 7 & 21 July 2005, the Federal Government of Germany has paid attention on the topics of vulnerability of open societies. The maintenance of daily activities of urban societies dominantly depends

on infrastructural facilities. Natural disasters such as floods, earthquakes, and windstorms as well as terrorist attacks have been assessed as threats for urban infrastructural facilities.

Actually, the Federal Office of Civil Protection and Disaster Assistance was established on 1st May 2004 for ensuring the safety of the population, coordinating and organizing all relevant tasks and information in one center. For the initiative of the protection of critical infrastructures, the Office drafted a "Guideline for the Establishment and Operation of Emergency Electricity Supply in Authorities and Other Important Public Facilities" in 2005 to establish and maintain a reliable emergency electricity supply. This guideline aims to create awareness of the risk in electricity provision and to give recommendations for authorities to maintain basic services in the case of power interruptions. Then, this concept was developed for all types of infrastructure. Critical infrastructures are categorized by the Federal Office of Civil Protection and Disaster Assistance as energy, information and telecommunication technology, supply (water supply and waste water disposal, food supply, healthcare, emergency and rescue services), dangerous substances, traffic and transport, finance, monetary system and insurance, authorities and administration, further critical infrastructures (media, major research facilities, cultural property).

The mission of protection of critical infrastructures is providing a technical frame for enterprises in Germany to reduce the vulnerability of critical infrastructures to natural hazards, accidents, criminal acts and terrorist attacks. This technical frame includes recommendations on construction, organisational, personnel and technical protection of infrastructure facilities. That is to say this technical frame is not an obligatory legal document but a guidebook for the maintenance of infrastructural facilities. The Federal Office of Civil Protection and

Disaster Assistance has informed enterprises, authorities and citizens about the importance of the protection of critical infrastructures, tried to build and develop co-operations between public and private sectors; made analysis and proposed short-, medium- and long-term measures for the protection of critical infrastructures. The Federal Office of Civil Protection and Disaster Assistance has also contacts with NATO and the EU for the purpose of the protection of critical infrastructures. (Critical Infrastructure Protection, 2008)

While this technical frame aims to provide safer modern society, the initial target infrastructure operator companies. The security officers of the Federal Office of Civil Protection and Disaster Assistance have mostly contacted with private sector companies to install the strategic concept of the technical frame into their security systems. The strategic concept constitutes of risk analysis, risk management, and risk minimization items. On the other hand, building trustful cooperation between the Federal Government and infrastructure operators is another essential topic of the protection of critical infrastructures. Since infrastructure operators have sufficient information of their infrastructures, relevant protection measures can be produced within a cooperation of the Federal Government. Some studies should be done for making clear the degree of protection needed. These are categorizing threats such as natural disasters, accidents as well as terrorism; defining protection measures; testing the system by designed disaster scenarios; analysing of weaknesses; reformulating of protection measures according to the weaknesses; defining necessary public-private cooperation; monitoring the system and measures periodically. The Federal Office of Civil Protection and Disaster Assistance prepared a questionnaire and a checklist to facilitate the study above. In these documents there are many questions about analysing the risk of the company in the respects of general safety of working place, geographic location of the company,

the type of facility or the sector of production, interaction with other infrastructures, and the capacity of public cooperation in emergencies. The documents also analyze risk factors such as employees, organizational structure of the work, natural threats (natural disasters, epidemics), and the technology used. After the companies filled this document, recommendations and proposals for short-, medium- and long-term measures are done by the Federal Office of Civil Protection and Disaster Assistance. As it is stated before, since all these studies depend on voluntary participation of companies, all improvements for critical infrastructures could be done by only voluntary participator companies (The Federal Ministry of Interior in Germany, 2005).

In sum, this initiative of the Federal Ministry of Interior is a quite efficient way of sustaining disaster resilient settlements. Despite the fact that the Ministry originally organized the whole work because of terrorist attacks to cities, the method has been serving to the purpose of disaster resilience. The sequence of the work such as risk definition, risk analysing and mitigation, is exactly similar to that of spatial planning. In that respect, the future cooperation between spatial planning institutions and the Federal Office of Civil Protection and Disaster Assistance would give fruitful results for disaster resilient urban settlements in Germany.

In Cologne, the Flood Protection Authority is the main local authority in terms of disaster mitigation. It reports to the Municipality of Cologne. The basic legislative frame of its activities is the Disaster Management Law of North Rhine Westfalia (=Katastrophenschutzgesetz des Landes Nordrhein-Westfalen). In Germany, each Federal State has its own disaster management law. The specific name of the disaster management law of the North Rhine Westphalien State is "Gesetz Ueber den Feuerschutz und die Hilfeleistung" (see also Annex I.5).

The Flood Protection Authority is not a planning institution but an authority which has responsibilities in the disaster field (flood). After two major flood events in 1993 and 1995, it was established in the frame of the flood protection concept which was adopted on 1st of February 1996 by the City Council of Cologne (About the Municipal Sewage Enterprise in Cologne, 2008). The main activities of the Flood Protection Authority of Cologne focus on prevention of and response to floods. According to the studies of the Flood Protection Authority, the most important source of flood events is the River Rhine. The rain falls alone are not defined as major threat in this context. Three working groups have been set up within the Authority. The first group organizes emergency activities; the second builds defense line against floods; and the third group organizes evacuation plans for people. The authority uses a GIS (=Geological Information System) based map. It is possible to see the different risk zones on the map in the case of various levels of river invasion to the settlement areas. The integration of GIS techniques into the disaster management system would provide an opportunity to build disaster resilient settlements. A GIS based map provides a possibility to insert many features of a settlement into its spatial plans. Hence, disaster management authorities can easily see the weaknesses and strengths of the settlement and make an efficient orientation of resources.

In operation times or in disaster response times, the Flood Protection Authority works in cooperation with other local authorities. The Authority has a "Flood Task Force" chart prepared for the case of flood. When the water level of the Rhine exceeds a critical level, the Flood Task Force is managed by the Municipal Sewage Enterprise; and all actions are coordinated by the Flood Protection Center into which the Flood Protection Authority is transformed. At this point, there are three different compositions of the Flood Protection Center according to the water level at the gauge of Cologne. The optimum water level

at the gauge is 3,5 meters. While the Center constitutes some local authorities at the 4,5 meter water level, all local authorities are involved with the task at the 7,5 meter water level. In the case of 10 meter water level, the Flood Protection Center transforms into a "Emergency Task Force" The Flood Protection Center comprises both permanent and ad hoc units. The permanent units include such units as fire brigade, streets and traffic technical services, harbor and freight traffic services, police, search and rescue team (THW). Ad hoc units include such units as building inspection unit, office of business development, social welfare service, environmental and consumer protection unit, municipal transportation company of Cologne. The Flood Protection Center closely cooperates with the municipal press office as well as local information and management offices. (see also Annex I.5)

The Cologne Flood Protection Authority has some efforts to increase institutional coping capacity for floods. The Authority has organized a "European Center of Excellence for Flood Management". The center aims at building a network to collect and disseminate empirical and theoretical information and experiences on the basis of flood management. The networks has been constituted with research institutes, universities, private companies, public authorities, NGOs, and other types of citizen organizations in regional, national, and European levels (see also Annex I.5).

The Cologne Flood Protection Authority is also a member of the International Commission for the Protection of Rhine. The International Commission for the Protection of Rhine is a multinational NGO aims to protect people and their assets against flood in the Rhine area. It was originally prompted by a chemical accident which created poisonous pollution the River Rhine between Basel and Koblenz in 1986. Hence, States of Rhine (Switzerland, Germany, France,

Luxemburg, and Netherland) needed to be organized to protect the River Rhine. Their governments charged the International Commission for the Protection of Rhine. On 22 January 1998, the International Commission for the Protection of Rhine adopted an "Action Plan on Floods" in the 12th Conference of Rhine Ministers in Rotterdam. The Action Plan was designed to rehabilitate the Rhine by 2000. (About International Commission for the Protection of the Rhine, 2008)

Despite the fact that the Cologne Flood Protection Authority is not a multi-purpose disaster authority, it has many ideal features to be a promising authority with respect to technology used, level of interaction with related institutions, willingness to increase coping capacity. In the case of possibility to strengthen the Cologne Flood Protection Authority by better technical equipment and scientific information, funding, and personnel, the efficiency and effectiveness in disaster resilience of Cologne would be increased.

INSTITUTIONAL COPING CAPACITY AND PROBLEMS: As already mentioned (see also "2.3. The European Union/Germany"), relevant institutions took place in the spatial planning process work in a well organized and coordinated way in Germany. Since the effectiveness and efficiency in planning and building system can be assumed as a prerequisite step of disaster mitigation, Germany is rather well organized for disaster mitigation with respect to spatial planning standards and building codes. Nevertheless, the whole spatial planning and construction process and procedures should be updated in the light of new disaster mitigation policies. ***Especially interviews with relevant persons take part in the spatial planning and disaster mitigation process in Cologne show that disaster mitigation***

approaches and strategies are not sufficiently integrated with spatial plans (see also Annex I.18).

The lack of integration between spatial planning and disaster mitigation activities is also criticized by Birkmann (Birkmann, 2008). Birkmann made a vulnerability analysis of existing demographic, social, economic, environmental, institutional and critical infrastructural features of spatial planning activities. Then he assessed each of these features with a view to integrated perspective of methods of spatial planning and means of coping capacity, vulnerability analysis and risk mitigation. He mainly denoted that in the existing case, vulnerability of all these spatial planning features are assessed individually without concerning relations with other features in spatial planning. For instance, economic vulnerability of each land use is currently assessed according to the exposed value. However, the vulnerability of each different land-use should be assessed as a summation of various possible losses in multi-dimensional respects. Therefore, the vulnerability of ski slopes is not only matter of winter sports but also matters of tourism and natural conservation issues.

Furthermore, spatial planning activities did not introduce yet with some new disaster mitigation concepts such as critical infrastructure and institutional vulnerability. It would be useful to integrate spatial planning tools with methods of natural hazard vulnerability assessment for creating disaster resilient urban settlements in Germany. Especially in Cologne, an approximation process between disaster mitigation and spatial planning activities should be immediately initiated while Cologne is at seismic risk. The approximation process can be fulfilled by effective coordination among relevant institutions and newly designed fields of cooperation with a view to disaster resilience.

While the German disaster mitigation system appears to be well structured, various weaknesses should be noted with a view to future disaster threats. Hence, Germany needs newly developed, multidimensional tools in the legislation and implementation process to consider changing environmental conditions and various threats of disasters such as recent effects of climatic changes and some high risk disasters like earthquakes. By taking into account this issue, the Federal Government of Germany adopted a new strategy on 17.12.2008. The new strategy, namely "The German Adaptation Strategy" provides a framework of adaptation to impacts of climate change. It has an integral approach on risk assessment and mitigation activities with a view to sustainable development of Germany (The German Adaptation Strategy; 2008).

However, in Cologne, most of the institutional coping capacity and scientific studies still focus on floods because of the high frequency of flood events. It will now be beneficial to prepare new strategies with regard to other types of disasters like earthquakes. The earthquake risks in Cologne at the beginning of 20th century and present are not same. Because buildings, infrastructure, especially underground transportation routes, bridges are getting older. This observation is somehow demonstrated by an event in Cologne which happened during the period of this study. The city historic archive building collapsed on 3rd of March, 2009. According to the official preliminary report of the Fire Brigade Department of Cologne, the details of this event as follows:

The Severin Street where the city archive building located lies in the southern part of Cologne. The city archive building was a six-storey building with 48 m width and 14m length. The city archive has many historic documents on the City of Cologne as well as important

collections of the Rhine Region and Central Europe. The oldest document of the city archive dates from 922 A.D.

The event caused the collapse of the building of city archive was the underground construction of a new three-storey railways. This underground construction reaches a maximum sub-soil depth of 28 meters. First, a staff of the underground construction side noticed that the city archive was about the collapse and made an emergency call to the Fire Brigade Department. According to the technical investigation after the collapse showed that a large amount of ground soil under the building of city archive had moved into the sub-soil construction side of the railways, from broken pipelines water steam and gas were leaking, and there were cracks in the road surface (According to the official report of the Fire Brigade Department, the reason of the movement of the ground soil is yet unknown.). Then the building collapsed and this collapse caused the destruction of a neighboring building on each side of the city archive building.

Disaster response activities and emergency precautions extended over twelve days (till 14th of March). The whole crisis was managed by the ad hoc group headed by the city administration (Stadtdirektor). This ad hoc group included almost all department heads of the Cologne City Administration as well as representatives of the Cologne Transportation Services and several construction firms. The ad hoc group also called upon civil engineering experts on a necessity basis.

Despite the fact that the sudden collapse of the city archive building could have triggered even more severe damages and casualties, the event caused 2 casualties, 53 people lost their apartments, and financial in excess of 400 million Euros including unique cultural inheritance.

Another source of weaknesses in disaster mitigation activities is the main focus. Most of the efforts of the central and local authorities focus on disaster prevention and response. The planning standards,

building codes, and existing insurance system are put into the core of disaster mitigation. ***Nevertheless, Cologne needs newly developed, multidimensional tools in the legislation and implementation process to be a disaster resilient urban settlement.*** The existing legislation and standards were developed in the light of former disaster experiences. However, new disaster trends are emerging. It should also be noted that new disaster risks may well activate old disaster potentials. For instance, earthquakes have a quite big potential to trigger floods in Cologne.

To make a detailed analysis on the institutional coping capacity of Cologne, methods of interview and questionnaire with relevant authorities and target groups are applied (see also Annex I and II). According to the results of interviews with local and some relevant central authorities, the profile of disaster mitigation activities of Cologne was drawn. Despite of some difficulties to measure institutional coping capacity due to unclear answers and the lack of publications on this topic, the basic trends of institutional problems and coping capacities are described. Through the questionnaire, relevant local actors and some non-local experts whose professional background and experiences provide guidance are interviewed with a view to assessing their risk perceptions and determining their responsibilities in case of a severe earthquake. Thus, the questionnaire was designed into two parts, namely basic questions about the existing seismic risk of Cologne and personal assessments of interviewees in the case of worst earthquake scenario. This worst case scenario is derived from the outputs of various scientific studies in Germany and recorded seismic facts. According to this scenario;

- ~~☒~~ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne,
- ~~☒~~ Many high-rise buildings and the Cathedral suffer moderate damage,

- ✎ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees,
- ✎ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire,
- ✎ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.

In the case that above worst case scenario would materialize, all interviewees conveyed their personal reactions and preferences. The interviewees include the following actors:

- † Academics
- † Local authorities
- † Insurance companies
- † NGOs and citizen organizations
- † Members of industrial and business sectors
- † Media

All interviewees in the group of academics are very well aware that Cologne is at seismic risk. They also aware that neither an organization nor a program nor an initiative does not yet exist to strive increasing the earthquake resilience in Cologne.

Despite the fact that their knowledge of seismic risk and field of studies are similar, each of them has a risk perception at a different degree. But they have a consensus on the topic of livability of Cologne. Despite the high seismic risk of Cologne, most of them feel safe to live in Cologne. Furthermore, in the case of worst case scenario, none of them prefers to move to a safer region permanently. The reasons for their preferences vary person by person as follows:

- Trusting on personal preparedness
- Trusting on institutional capacity in Cologne

- Perceiving the seismic risk as relatively low comparing to other significant risks of life such as war, traffic accident, severe illnesses of elderly
- Being dependant on place of work (due to their jobs they cannot move out from Cologne)

Another remarkable point is awareness and attentions of interviewees in the group of academics on earthquake insurance. In the questionnaire, the question of whether they have earthquake insurance was not fully positively answered. Some of them were not sure whether their existing home insurance packages cover earthquake risks or not. Hence, the general tendency of academics in earthquake risk perception is not much high.

On the other hand, all of them agree on enhancing earthquake resilience of Cologne especially in terms of infrastructure and buildings of industrial sites, bridges, and some utilities such as gas pipelines, electricity lines. Their recommendation on most suitable institutions or organizations which can lead to an earthquake resilience initiative in Cologne include the Parliament of the North Rhine Westphalia, local authorities, media, NGOs, and insurance companies. However, the majority of answers focused on media and NGOs.

The interviewees in the group of local authorities include officials in spatial planning, disaster response and mitigation as well as geological survey. Only one interviewee works in the central authority, namely The Ministry of Interior/The Federal Office of Civil Protection and Disaster Assistance. Since he is in charge of developing guidelines to protect critical infrastructure, he has indirectly informed about the existing conditions of critical infrastructure in Cologne. Thus, the earthquake risk perception and assessments of him are complementary with those of other representatives of local authorities.

Lack of coordination among some relevant organizations in disaster mitigation activities may cause a weakness in the local institutional coping capacity. ***Nevertheless, according to the answers of the interviewees in the group of local authorities, there is no institutional conflict bothered activities of local authorities.*** Despite of the Severin Street's event caused the collapse of the historical building of city archive; it is quite sceptical not to find any problem in the field of institutional coordination and organization. In this context, there are two problems which are indicated the difficulty in coordination and the conflict between different authorities. The regional planning authority underlined some conflicts experienced between politicians and bureaucrats in generating spatial planning decisions. But most of the time, possible extreme pressures of politicians on spatial planning decisions can be altered by the support of the media and public pressure. Another problem indicated the difficulty in coordination of different seismic networks. An initiative to build the "Earthquake Network of NRW" has no certain development yet due to the disagreement of three seismic observatories. As already mentioned there are three seismic observatories in the North Rhine-Westphalia State (see also "Geological and Seismic Retrospective View of Cologne"). The NRW Ministry of Economics, Energy and Medium-size Enterprises recently organized an initiative to join these 3 different observatories into one network called "Earthquake Network of NRW" (Erbebennetzwerk NRW). The negotiations, technical and academic studies about this initiative are still continuing (see also Annex I.13).

Consequently, the reasons of failure in finding problems out in the field of institutional organization and coordination can be stipulated as follows:

- ***Local authorities in Cologne have not yet met any significant problem to interrupt the provision of local services.***

- ***There is no publicly available critical study on the efficiency of the coordination of local authorities in Cologne.***
- ***Due to some private reasons, representatives of local authorities have no willingness to share the problems experienced in the field of local coordination.***

However, answers of interviewees clarified some other relevant issues such as earthquake risk perception and institutional coping capacities. All of them are very well aware of the earthquake risk in Cologne with many technical details. Despite of the awareness of earthquake risk in Cologne, most of the interviewees feel safe living in Cologne. Only two interviewees feel unsafe, namely the Head of the Flood Protection Authority and the Division Chief of Geophysics and Earthquake Safety in the Geological Department of NRW. However all of them agree on extra risks coming from industrial plants, gas pipelines, electricity lines, drinking water pipelines, and high rise buildings, almost all interviewees have no earthquake insurance except one person. Similar to academics, many local authorities underrate the earthquake risk in Cologne despite of sufficient level of knowledge. ***Not only NGOs but also local authorities may hardly believe that an earthquake can create devastating effects on Cologne due to a lack of experience.***

On the other hand, in the case of worst case scenario, all of them – without any exception- prefer to move out of Cologne on a temporary base. The decision of temporarily moving out of Cologne is related with similar reasons already mentioned as interviewees in other target groups.

While answering the question of “Have you ever been informed about any organization or initiative striving to increase the City of Cologne’s resilience for earthquake?”, only two representatives of local authorities

thought that their own institution partially took place in the earthquake resilience, namely the Flood Protection Authority and the Geological Department of the North Rhine-Westphalia. However all of them agreed on local authorities in Cologne as best suited organizations for enhancing earthquake resilience. This consensus may be interpreted that many local authorities are open to develop themselves with a view to earthquake resilience.

The interviewees of the group of insurance companies are the Union of German Insurance Companies (GDV) and a reinsurance company, namely Deutsche Rueckversicherung. These two interviewees are chosen by considering to collect data on the proportion of earthquake insured assets such as dwelling, industrial, commercial units in Cologne as well as to measure their risk perceptions. During the interview time with the contact person of the Deutsche Rueckversicherung, it was not possible to get the detailed data on earthquake insured assets in Cologne except some basic facts. For instance, there is no car insurance package including earthquake risks in Germany. To reach relevant insurance data in Cologne there are two main difficulties: (i) Data of insurance companies reinsured by the Deutsche Rueckversicherung are confidential. (ii) There is no publicly available paper or document which specifically includes information on the proportion of earthquake insured assets in Cologne. Because of difficulties to achieve the relevant data on earthquake insurance, the contact person of the Deutsche Rueckversicherung recommended to contact to the Union of German Insurance Companies (GDV). The GDV is an umbrella organization for private insurers in Germany. At present, it counts 457 member companies. The GDV publishes annual periodicals which include data on various lines of insurance business, such as life, home, car insurances. The GDV collects these data from the member insurance companies to make annual analyses and assessments. Furthermore the GDV prepared a seismic risk map of

Germany in terms of earthquake insurance premiums. This map was prepared based on data of the geo-seismic hazard map of the Center of Geological Research in Potsdam. According to the seismic risk map of GDV, there are three different seismic risk zones (1: Less seismic risk zone 2: Medium seismic risk zone 3: High seismic risk zone). The region between Aachen and Cologne locates in the second seismic risk zone (see also Annex I.19).

Although, the GDV in principal recommends inclusion of earthquake coverage in elementary insurance packages, not all members follow this recommendation. Thus, there are some differences of elementary insurance packages in Cologne, too. The data records of the GDV covers only the number of contracts for residential insurance in Cologne. 25% of these insurance contracts covers elementary insurance package. However there are three indefinite features for the number of insured residential units in Cologne. First, the GDV does not have any data for non-insured residential units. Second, since a contract owner may have more than one residential unit, the number of insurance contracts is not helpful to see the proportion of insured dwelling units in Cologne. Third, the GDV is not informed the details of elementary insurance contracts whether they cover earthquake risks or not (see also Annex I.19).

Furthermore, due to complexities in calculating risk insurance in the industrial and commercial sectors, member companies do not provide detailed data on the operations of these sectors to the GDV. In sum, data of the GDV cannot give a clear view of Cologne in terms of earthquake insurances (see also Annex I.19). At the beginning of this study, data of the insurance sector were assumed to provide guidance to describe the local risk perception and coping capacity in Cologne. ***Nevertheless, due to aforementioned above difficulties, to***

draw an earthquake insurance profile of Cologne can be a major topic of another scientific study.

On the other hand, personal perspectives and assessments of two interviewees in the insurance group are remarkably helpful to understand institutional awareness in terms of earthquake risks. In general, answers of these two interviewees are quite similar. Both of them are very well aware of earthquakes risk in Cologne especially due to their profession. ***With this background, both interviewees answered negatively to the question of "With a worst case scenario in mind, do you feel safe living in Cologne?"*** These common negative answers are remarkable because most of interviewees gave positive answers to the above question including academics. On the other hand, both of them prefer to stay in Cologne but to take other precautions in case of earthquakes. This preference can be interpreted by the anxiety of keeping the existing job. Not only interviewees in the insurance group but also other interviewees expressed this anxiety during the interviews. In terms of most suitable institutions to strive earthquake resilience in Cologne, interviewees preferred local authorities and insurance companies. All their answers can point the following questions out:

- Do risk calculation techniques and methods of the insurance sector increase the risk perception?
- Are people prone to earthquake risk not only dependant on earthquake threats but also on job and family issues to make their future plans?
- Is there a perception that effectiveness of institutional activities in terms of earthquake resilience are more likely to increase at the local level?

The aim of making interviews with NGOs is to assess the risk perception of citizens of Cologne and to understand their coping

capacity. To consider approximately 1 000 000 inhabitants living in Cologne and time and technical limits of this study, it would facilitate to fulfill the aim to contact with NGOs who represent different segments of the population. In this respect, two NGOs which were established after a severe flood event in Cologne in 1993 and one NGO which works in the field of the emergency response in disasters are chosen. The NGOs which were established just after the flood event in 1993 has approximately 400-600 members. One of them constitutes with mostly business owners in the old city called "Interest Group of Old City-Interessengemeinschaft Altstadt" (see also Annex II.4). The Interest Group of Old City has been actively working to inform public for flood protection and to develop better strategies in flood protection in coordination with the Flood Protection Authority of Cologne. The other NGO constitutes with the people living in Rodenkirche where locates in the southern part of Cologne. Rodenkirche was terribly exposed to the flood in 1993. Two days after this flood event, "Citizens Initiative of Rodenkirche against Floods- Buergerinitiative Hochwasser Altgemeinde Rodenkirchen e.v." was established to investigate which institution or authority was responsible for the losses and damages of the people living in Rodenkirche. But then, the Citizens Initiative of Rodenkirche Against Floods has developed their activities and programs in terms of disaster preparedness and response. The third NGO is the German Institute for Disaster Medicine which is a free non-governmental organization operating worldwide. It aims at developing and improving emergency and disaster medicine for the benefit of humanity. The center of the institute is in Tuebingen. The institute collaborates with all relevant governmental and non-governmental organizations. The interviewee of this NGO, a citizen of Cologne, is a director of public health (see also Annex II.4).

As a result, the profile of interviewees in the NGOs group is helpful to clarify the risk perception of local people and the ability to take part in

disaster mitigation activities. It is clearly derived from the answers of interviewees about the seismic risk of Cologne ***that most of citizens in Cologne are not aware of the seismic risks.*** Only an interviewee works in an executive position in the German Institute of Disaster Medicine is very well aware of the risk while other two interviewees have almost no information about it. An interviewee from the Citizens Initiative of Rodenkirche against Floods suggests that the people living in Cologne may not be aware of disaster risk without actually experiencing it (see also Annex II.4).

One of the interesting findings as a result of the interviews with NGOs shows that the people living in Cologne underrate the earthquake risks in light of the quality of urban life and attractiveness of urban services. Although all interviewees were informed about the seismic risk of Cologne -during the interviews- with reference to remarkable scientific studies on Cologne, all interviewees have similar answers in terms of feeling safe living in Cologne. They perceive that the risk of living in Cologne cannot be higher than any other city in the world.

However, they all can guess the sources of extra risks, such as industrial plants, gas pipelines, and bridges in case of earthquakes. Despite of scientific information on earthquake risks and their foresights on risky areas in Cologne, none of them thought to move out of Cologne even in the case of the aforementioned worst case scenario. But all of them have insurance while only one of them was not sure about the insurance coverage.

In terms of the most effective institutions which enhance earthquake resilience in Cologne, they have a consensus on local authorities and NGOs. This consensus can be the result of their common experiences in the disaster response period. All interviewees are experienced

enough about difficulties and potential solutions in case of disasters to discover effective institutions to serve earthquake resilience. Another reason of their consensus –in terms of the preference of NGOs as best suited institutions for enhancing earthquake resilience- can stem from the willingness to take part in earthquake resilience process and procedures of their home town.

The interviewees in the group of “members of industrial and business sectors” come from the sectors of construction, land development, and chemical industry. Although this target group should principally obtain firms in various industrial sectors such as energy, water supply, hazardous materials; ***many interviews planned were failed due to hesitation and caution of interview candidates on the topic of earthquakes.***

All interviewees in this group are very well aware of the earthquake risk in Cologne with many technical details. Especially staffs of construction companies know the risk due to application of some technical seismic standards, such as DIN 4149. Furthermore, according to the information of interviewee of the chemical industry, the chemical industrial firm in which he has still been working initiate to design new standards for chemical industry against earthquake risks in the Federal State of North Rhine-Westphalia in cooperation with the Geological Department of NRW. The draft version is available in the website of “www.VOI.de” (see also Annex II.5).

Despite of their detailed technical knowledge about the earthquake risk in Cologne, all of the interviewees agreed on feeling safe living in Cologne. Furthermore almost all thought that their moveable and immovable assets would be safe in the case of earthquakes. Nevertheless all interviewees except one supposed some risks may come from the industrial sites and gas pipelines. Although these answers seemed to be quite confusing, this confusion can be explained

by ***the conflict of technical knowledge and a lack of belief of living in an unsafe environment.*** Similar to other citizens in Cologne, the people work in the business sector have very limited earthquake risk perceptions due to fact that they have not experienced a severe earthquake yet. Except one person, all of the interviewees have earthquake insurance for their homes. The interviewee has no earthquake insurance and no strong belief on the possibility of severe earthquake gave very remarkable answer to the question of "*If you knew that the aforementioned worst case scenario would materialize, which precautions would you take?*": *If I knew this, I would sell or insure the things which would loose their value by earthquake damage.* This answer can clarify his hesitation in between his professional technical knowledge and limited earthquake risk perception. Other interviewees answered the above question, such as temporarily moving out of Cologne, moving out of house, and taking additional insurance and strengthening measures.

In terms of most suitable institutions to initiate earthquake resilience in Cologne, the interviewees have common perspectives on local authorities in cooperation with technical experts and insurance companies. As a conclusion, from the perspective of construction and industrial sectors, the institutional coping capacity of local authorities is perceived as sufficient for earthquake resilience. Furthermore, this coping capacity should be strengthened by technical knowledge and detailed risk assessments as insurance companies do.

The interviewees in the group of the media are constituted with two local journalists. One of them works in the Cologne Representative Office of a Turkish Newspaper while other works in a German broadcast institution. Both journalists have similar earthquake risk perceptions for Cologne. They assess the risk as moderate. Furthermore, they feel safe living in Cologne due to the compliance of buildings with the building codes. The interviewees admitted that they

have neither any precaution nor earthquake insurance due to their lack of information. After reading the worst case scenario, they started to think about on bridges and gas pipelines as sources of risks in case of earthquakes. On the other hand, they have different reaction in case of the materialization of the worst case scenario. While one of them preferred to move out of Cologne temporarily, other one prefer to stay in Cologne because she believed that she had nothing to do with earthquakes in any city. They thought that scientific research centers, media and relevant institutions in the Federal Level are most suitable institutions to initiate earthquake resilience in Cologne.

As a result of these interviews, the following findings can be helpful to draw the picture of Cologne in terms of local earthquake risk perception and coping capacity:

- ✓ The insurance sector has the highest risk awareness and perception of earthquakes in Cologne. In terms of risk awareness, academics, local authorities, and members of business and industrial sectors follow the insurance sector despite their risk perceptions are not as high as the insurance sector's. The media and citizens have very limited earthquake risk awareness and perception; especially, citizens (their tendencies were measured via NGOs) know almost nothing about the earthquake risk in Cologne.
- ✓ Local authorities of Cologne –especially the fire brigade and the department of building permits- are recognized as most suitable institution to initiate earthquake resilience in Cologne. Insurance companies, media and NGOs are other institutions which are capable to support the activities on the earthquake resilience. Academics are perceived as consulting or advisory group to support the activities of local authorities. There is also very minor expectancy from some institutions in the Federal Government and the Federal State of North

Rhine-Westphalia in terms of capacity building of earthquake resilience.

In the light of above issues as well as other findings and information about coping capacities and institutional problems, ***Cologne needs to develop the local coping capacity in terms of earthquake resilience.*** Local authorities in Cologne should build better coordination and organization among relevant spatial planning and disaster mitigation institutes. ***Furthermore, public awareness and training programs on earthquakes are other significant issues to consider.*** The activities and programs on the earthquake resilience should be supported by the participation of academics, insurance companies, representatives of business and industrial sectors, local media, and NGOs.

6.7. Risk Assessment

As explained in the first chapter (see also Annex III), risk assessment *is* a combination of risk analysis and risk evaluation to estimate the risks posed by hazards. Thus, the earthquake hazards (frequency, magnitude) and its consequences (damage potential) must be analyzed with respect to each city in order to prepare an earthquake risk assessment in light of the information given in "6.2.1. Analysis of Existing Urban Structure of Yalova" and "6.2.2. Analysis of Existing Urban Structure of Cologne". In this context, it should be noted from the outset that the risk assessment of Yalova will be quite different from that of Cologne in view of the significant experience of the 1999 earthquakes in Turkey. However, this study aims at building a disaster resilience model based on the Turkish lessons learned and testing that model on an urban settlement at seismic risk. Hence, the differences in risk assessment analyses between Yalova and Cologne will not create any challenge to the efficiency of the proposed model.

Earthquake risk analyses of Yalova and Cologne are performed with a view to risk factors, legislation, and recent approaches and initiatives. Risk factors are elaborated in terms of seismic risks, institutional coping capacity, and institutional & public awareness. Legislation is elaborated in terms of disaster legislation, spatial planning legislation, and building legislation. Recent approaches and initiatives are elaborated in terms of new organizations and projects with respect to earthquake mitigation. These items of risk analysis provide guidance for the risk evaluation of each city.

Risk Factors in Yalova/TURKEY

1. Seismic Risks

Turkey is exposed to frequent natural disasters, mainly earthquakes; and a destructive earthquake occurs within 1.5 year or even shorter period. In Turkey, the majority of the entire population and a significant proportion of the economic activities are exposed to high earthquake risks (see also "3.Disaster Mitigation Approaches and Lessons Learned in Turkey").

Yalova lies at the Marmara Sea on the Northern Anatolian Fault Zone. Since 1509, the Marmara Sea has been affected by six major earthquakes bigger than 7 magnitude. The last severe earthquake with 2505 casualties and 5 937 injuries was the Eastern Marmara Earthquake on 17 August 1999 with a 7.4 magnitude (see also "3.Disaster Mitigation Approaches and Lesson Learned in Turkey"). In addition to the fault lines, Yalova has some other geological and seismic-related risk areas, especially soil liquefaction areas due to deep fine alluvium, landslide zones, some areas prone to cavitations and collapse, and sea waves -effective on coastal areas- due to high intensity earthquakes. Thus, Yalova is a city at high seismic risk.

2. Institutional Coping Capacity

Since Turkey has a central administrative system, the institutional coping capacity of Yalova should be analyzed in terms of central and local institutions as follows:

- At Central Level: The results of the SWOT analysis on the existing disaster mitigation system and process in Turkey reflect the institutional coping capacity, especially at the central level (see also "3.4. SWOT Analysis As An Evaluation"). Turkey has several institutions specializing on disasters, but efficient operations of these institutions are curtailed by instable institutional structure, budgetary constraints, and inadequate organization and coordination. Experiences of Turkey in former devastating earthquakes show that inefficiencies in institutional organization, coordination and cooperation are main threats for a modern disaster mitigation system (see also "3. Disaster Mitigation Approaches and Lessons Learned in Turkey" and "3.2. Institutions Involved in the Disaster Mitigation Process"). Another threat stems from the recent chaos in the spatial planning sector in Turkey. As already mentioned (see also "6.2.1. Analysis of Existing Urban Structure of Yalova"), due to creation of new institutions after 2004, gaps and conflicts have arisen among the responsibilities of various spatial planning authorities. These gaps and conflicts also affect disaster mitigation implementations.
- At Local Level: The main challenge to the institutional coping capacity at the local level is caused by gaps and conflicts between the responsibilities of central and local authorities as well as among relevant local authorities. In Yalova, local tasks related to spatial planning and disaster mitigation activities are mainly divided among the Governorate and the municipalities. NGOs as a part of the local capacity mostly take part in the disaster response period. Since various types of civil society organizations, such as citizens' initiatives, neighbourhood organizations, local disaster relief groups are newly developing in Turkey, local institutions are still represented by

governorates and municipalities in terms of relation to disaster mitigation activities. In the light of lessons learned in the 1999 earthquakes, coordination and organizational activities on spatial planning as well as disaster mitigation are in progress. However, there are still some problems threatening the local institutional coping capacity, namely a lack of financial & technical resources, inefficiencies in controlling mechanisms of building codes and spatial planning standards, and difficulties in coordination and organization among relevant authorities.

3. Institutional and Public Awareness

It is obvious that an effective disaster mitigation system does not require only well designed institutional structures and legislation but also institutional and public awareness. Inadequate institutional and public awareness was one of the main reasons of the devastating effects of the 1999 earthquake in Yalova. As already mentioned in "Existing Planning Situation and Disaster Mitigation for The City of Yalova" (see also "6.2.1. Analysis of Existing Urban Structure of Yalova"), Yalova is one of the summer residences in Turkey. Hence, widespread ignorance of building codes, ground survey analyses of buildings and relevant spatial planning standards are remarkable, especially since most of house owners are coming from middle and upper middle income classes. This feature shows that public awareness does not necessarily have a direct correlation with financial conditions and the level of education of a society. Devastating effects of natural disasters do not always hit only settlements of the poor and marginal groups. Thus, public awareness, especially for earthquake resilience, needs a disaster training program including response and mitigation methods.

According to outputs of the SWOT Analysis, Turkey is capable of organizing disaster training programs for a broad public. Thus, new curricula and approaches, such as various training programs designed

for different target groups (local authorities, citizens, trainer for trainees, etc.) should be introduced in Turkey.

Public awareness can also be increased by institutional awareness. Institutional awareness of earthquake risks must come along with sufficient knowledge of relevant legislation, experience in the implementation process, awareness of strengths and weaknesses of the settlement prone to earthquakes. Despite the fact that many institutions in Turkey are sufficiently aware of earthquake risks, they may fail in disaster mitigation due to a lack of personnel and financial resources as well as overloaded work programs. In case of the 1999 earthquake in Yalova, while central authorities were failed due to the latter reasons, local authorities had mostly failed due to a lack of technical training and information.

Earthquake Legislation in Yalova/TURKEY

As already mentioned (see also 3.1. review in Turkish Disaster Legislation), the earthquake-related legislation in Turkey directly addresses earthquake issues alongside with spatial planning legislation and building legislations. The direct earthquake legislation encompasses only the response and recovery periods but not the preparedness period. Moreover, it does not include definitions of key terms, such as risk, risk assessment, and disaster mitigation. (see also "3.3. Criticism on Existing Disaster Mitigation System and Process in Turkey").

The earthquake legislation encompasses with various laws, decree laws, regulations, directions, and circulars. Spatial planning legislation which also refers to some earthquake issues comprises a frame law (Law No. 3194), various regulations and circulars. Building legislation which covers earthquake resilience measures is not anchored in a specific law but incorporated in relevant provisions of the planning law and regulations thereunder. Furthermore, the Building Inspection Law

and the Decree Law on compulsory earthquake insurance are also referring to some measures towards preventing earthquake damages.

In Yalova, the relevant planning notes of two recent spatial plans are also parts of earthquake legislation. These plans are the 1/25 000 scale spatial plan approved in coordination with the Municipality of Yalova and the Provincial General Council on 8.6.2007 and the 1/50 000 scale plan for Yalova and the Izmit Gulf area approved by the Ministry of Public Works & Settlement on 8.8.2008 (see also "6.2.1. Analysis of Existing Urban Structure of Yalova").

Turkey has experienced a quite chaotic process due to this fragmented structure of the earthquake legislation. As a result, many conflicts among different institutions have been experienced so far. It is strongly recommended to develop a new coherent legislative system that furthers a common understanding, terminology, approach, and coordination among related institutions.

Recent Approaches and Initiatives in Yalova/TURKEY

The 1999 earthquakes gave rise to reviewing the entire disaster mitigation system. Many initiatives and ongoing studies on legislation, institution-building, insurance, and quality control look promising for disaster resilient settlements. Institutional cooperation, coordination, and organization are three key topics to be developed in Turkey to sustain various initiatives after the 1999 earthquakes. Although these initiatives have already been portrayed in a detailed way, the following short review would be helpful for the risk assessment of Yalova (see also "3.2. Institution Involved in the Disaster Mitigation Process" and "3.3. Criticism on Existing Disaster Mitigation System and Process in Turkey").

1. Institutional Level

Since the 1999 earthquakes in Turkey, two new institutions were established and are presently being developed, namely a central coordinating institution for disasters and emergencies and a body responsible for the earthquake insurance system. Although the General Directorate of Turkey Emergency Management was founded as a coordinating institution, it thus far fails to operate effectively due to staff and budget constraints. A draft law on "Tasks and Organization of the Directorate of Disaster and Emergency Management" was submitted on 18.03.2008 to the Parliament where it is still pending. The Natural Disaster Insurance Institution under the Undersecretariat of the Turkish Treasury is still preoccupied with resolving various organizational and legislative difficulties. It in particular needs an enabling legislation which provides sufficient authority and sanctions to implement the compulsory earthquake insurance system.

In addition to the above institutional initiatives, the aforementioned Earthquake Council in 2004 outlined needs for many institutional changes as well as proposals on many topics in the light of lessons learned (see also "3.3. Criticism on Existing Disaster Mitigation System and Process in Turkey").

In Yalova, local authorities (the Provincial Special Authority and the Municipality of Yalova) were entrusted with additional responsibilities on spatial planning in the wake of the adoption of new planning laws and institutional rearrangements in Turkey after 2004.

2. Legislative Level

In the light of lessons learned from the 1999 earthquakes, the existing disaster legislation was partially updated. As the Ministry of Public Works and Settlement has been responsible for the main part of disaster legislation, it updated the Public Works Law (Law No.3194)

and the Law on Precautions and Aids for Disasters Influenced the Common Daily Life (Law No. 7269) as well as related regulations under these laws. New regulations, directions, and circulars which provide better standards in planning and construction were adopted. Furthermore, Turkey passed new laws and regulations such as the Decree Law (Decree Law No. 600) on the establishment of the Turkey Emergency Management, the Building Inspection Law (Law No.4708), the Decree Law on Compulsory Earthquake Insurance (Decree Law No. 587).

3. Implementation Level

After the 1999 earthquakes, ground survey and soil analyses became prerequisite for construction permits in all earthquake-prone regions, such as Yalova. Furthermore, the earthquake insurance for registered/legal dwelling units and all commercial and administrative units located in residential buildings became compulsory. Failure to comply with the insurance requirement results in for feature of public assistance in ability to register property title, and denial of access to drinking water and natural gas, electricity, telephone, cable TV, and other utilities (see also "3.1. Review in Turkish Disaster Legislation").

Risk Evaluation of Yalova

According to the results of the above risk analysis, Yalova is at high risk in terms of earthquake hazards as well as urban vulnerabilities. However, the earthquake risk in Yalova today is relatively lower than at the time of the 1999 earthquake. Since the 1999 earthquake, the former earthquake risk has been reduced by improvements of the legislation and implementation procedures as well as a rearrangement of responsible institutions. Nevertheless, the earthquake risk in Yalova remains considerable due to problems in institutional organization and coordination, overlapping legislation, and not sufficiently developed public and institutional awareness. Thus, Yalova still needs further

efforts at the policy, administrative, and implementation levels as explained in the resilience model.

Risk Factors in Cologne/GERMANY

1. Seismic Risks

Earthquakes are not considered as especially significant disasters in Germany as the earthquake zones map shows (see fig. 4). However, geological surveys of the 16 federal states provide information about earthquake (seismic) hazards. Some federal states, such as North Rhine-Westphalia and Bavaria, deal with earthquake issues and provide guidance to municipalities. Cologne, as a city of the Federal State of North Rhine-Westphalia, is located on the active and most significant seismic zone in Middle Europe. This seismic zone covers the north of the Alps and extends from the Upper Rhine Area to the Belgian earthquake zone. The recorded events -between magnitudes of 4.9 and 6.8- starting from 1600 A.D. took place in the corridor of Aachen, Cologne and the Lower Rhine Area. Some ancient traces of measures to build safer building foundations in the City of Cologne which were taken in the Roman Period also show that earthquake threats are not new topics. Thus, the City of Cologne and her surroundings are still prone to earthquakes. Furthermore, since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavourable soil amplification factors can also easily augment the earthquake effects. Some scientific studies in Germany have made an assumption that the earthquake risk profile of Cologne was derived from an earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years ($T=1/P_e$ T: return period/reoccurrence time P_e : probability of exceedance of a given damage in monetary terms) (see also "5.2.2. Analysis of Existing Urban Structure of Cologne").

2. Institutional Coping Capacity

Since the effectiveness and efficiency of the planning and building system can be considered as a prerequisite step of disaster mitigation, Germany is rather well organized for disaster mitigation with respect to spatial planning standards and building codes. Nevertheless, the whole spatial planning and construction process and procedures should be updated in the light of new disaster mitigation policies. Interviews with relevant persons take part in the spatial planning and disaster mitigation process in Cologne show that disaster mitigation approaches and strategies are not sufficiently integrated with spatial plans.

While the German disaster mitigation system appears to be well structured in terms of effective coordination and division of responsibilities among the Federation and Federal States, various weaknesses should be noted with a view to future disaster threats. The existing legislation and implementation process needs to be updated under changing environmental conditions and various threats of disasters such as recent effects of climatic changes and some high risk disasters like earthquakes. By taking into account this issue, the Federal Government of Germany adopted a new strategy on 17.12.2008. The new strategy, namely "The German Adaptation Strategy" provides a framework of adaptation to impacts of climate change. It has an integral approach on risk assessment and mitigation activities with a view to sustainable development of Germany (The German Adaptation Strategy; 2008). However, in Cologne, most of the institutional coping capacity and scientific studies still focus on floods because of the high frequency of flood events. It will now be beneficial to prepare new strategies with regard to other types of disasters like earthquakes. Furthermore, most of the relevant institutions focus on disaster prevention and response while the institutional activity programs in Cologne have no framework for disaster hazards and vulnerability analysis that could lead to disaster mitigation and

resilience (see also "5.2.2. Analysis of Existing Urban Structure of Cologne").

In sum, Cologne needs to reorganize the institutional capacities, relevant legislation and implementation process with a view to multi-disaster risks mitigation approaches and disaster mitigation methods as an integral part of spatial planning.

3. Institutional and Public Awareness

The general attitude of relevant spatial planning institutions in Cologne is to rely on existing spatial planning standards and building codes. Most of these institutions do not perceive seismic risks as a threat to existing buildings and infrastructure. Institutions which are in charge of seismic observation, geological survey as well as disaster emergency institutions and construction companies in Cologne are more anxious than spatial planning authorities. Local media newly pays attention on earthquakes especially after the event in Severin Street in March 2009.

After experiencing two devastating flood events in Cologne, citizens have been sufficiently informed about floods but not about earthquakes. One of the results of interviews suggests that the people living in Cologne may not be aware of disaster risk without actually experiencing it (see also Annex II.4). Most citizens appear to be unaware of whether their home insurance covers earthquakes.

Earthquake Legislation in Cologne/GERMANY

Similarly to Turkey, the disaster-related legislation in Germany can be found in three legislative domains, namely disaster legislation, spatial planning legislation, and building legislation. The disaster legislation of Germany in two major respects differs from that of Turkey due to differences in the administrative structures of two countries. While the

first difference reflects the EU membership, the second reflects the federal structure of Germany.

At the EU level, there are some frame directives related to earthquakes, such as Eurocode 7 and 8. Since these directives provide a frame rather than a detailed set of standards, each Member States will prepare its own detailed legislation. Germany as a country less frequently threatened by earthquakes, prepared its own standards (DIN 4149) with a view to different earthquake hazard zones.

At the Federal level, the Federal Government has only framework competences in the field of disaster risk assessment and management. In this frame, it provides disaster-related guidance to the Federal States in the exercise of its spatial planning competences. While the Federal Government deals with questions related to disaster risk assessment and management, it does not itself have any framework for disaster hazards and vulnerability analysis. There only exists the "Civil Protection Law" (Zivilschutzgesetz) which is applied in the case of foreign threat and war.

At the Federal States level, each Federal State has its own disaster management law (Katastrophenschutzgesetze). The specific name of the disaster management law of the Federal State of North Rhine-Westphalia is "Gesetz Ueber den Feuerschutz und die Hilfeleistung" (see also "6.2.2. Analysis of Existing Urban Structure of Cologne").

As already mentioned (see also "2.3. The European Union/Germany"), procedures on spatial planning are found at the Federal Level, Federal State Level (for the City of Cologne the North Rhine-Westphalia State), Sub-district Level (Regierungsbezirk Köln), and Municipal Level (Stadt und Gemeinde). The Sub-district Authority and Municipality of Cologne are two major plan preparation institutions for the region of Cologne. The sub-district of Cologne covers the sections of Cologne, Bonn, and

Aachen. The Sub-district Authority of Cologne prepares regional plans (in 1/50 000 scale) in accordance with the Regional Planning Act of North Rhine-Westphalia (Bundesraumordnungsgesetz & Landesplanungsgesetz). The Municipality of Cologne prepares detailed implementation plans in conformity with the regional plan prepared by the Sub-district Authority of Cologne. The existing regional plan of Cologne was ratified in 2006 (see also "5.2.2. Analysis of Existing Urban Structure of Cologne").

As regards the building legislation in Germany, a joint agency of the Federation and Federal States, called Deutsches Institut für Bautechnik (German Institute for Structural Engineering) plays an important role. This institute is chiefly tasked with defining common technical building standards to be included in the building legislation of the federal states. The institute designed proposed a set of technical building standards (DIN 4149) for areas prone to earthquake risks. The building code of DIN 4149 is compulsory in the Federal State of North Rhine-Westphalia by the decree of the NRW Ministry of Building and Traffic on 30th of November, 2006 (see also Annex I.13).

Another important element of the earthquake-related building legislation are the building plans (Lageplaene, Grundrisse) prepared at the single object level for granting building permissions. These are 1:100, 1:50 or 1:10 scale plans which set out criteria and standards for the buildings such as site, section, and elevation (see also "2.3. The European Union/Germany").

Recent Approaches and Initiatives in Cologne/GERMANY

1. Institutional Level

At the central level, the Federal Office of Civil Protection and Disaster Assistance was established on 1st May 2004 with the mandate of protecting urban societies from various threats. Although the Federal

Ministry of Interior originally established this new office and prepared its working program with a view to protecting critical infrastructure against terrorist attacks to cities, this initiative of the Ministry has become quite an efficient way of promoting disaster resilient settlements (see also "5.2.2. Analysis of Existing Urban Structure of Cologne").

In terms of disaster-related scientific research and academic studies, Germany has increased activities over the last decade. Many scientific organizations and institutions prepared various seismic studies on Germany in general and Cologne in particular such as the German Research Network of Natural Disasters (DFNK), the Center of Geological Researches in Potsdam, the MunichRe, The University of Cologne, the University of Karlsruhe-Center for Disaster Management & Risk Technology (CEDIM), the UN University (see also "5.2.2. Analysis of Existing Urban Structure of Cologne").

As a new program of the United Nations Office for Outer Space Affairs (UNOOSA), the UN-SPIDER aims at providing universal access to all countries and all relevant international and regional organizations to all types of space-based information and services relevant to disaster management. It thus stands to serve as a bridge between the disaster management and space communities and to facilitate relevant capacity-building and institutional strengthening, in particular in developing countries. The UN-SPIDER is a voluntary program financed by voluntary contributions of UN Member States. With a contribution of the Federal Government of Germany, the UN-Spider Center in Bonn/Germany was established in 2007. The UN-Spider itself organizes meetings, conference, and workshops on disasters; and it regularly informs various interest groups about these activities (see also "2.1. United Nations Organizations").

At the local level, The NRW Ministry of Economics, Energy and Medium-size Enterprises recently organized an initiative to join three different observatories into one network called "Earthquake Network of NRW" (Erdbebennetzwerk NRW). These are the Observatory of the Ruhr University in Bochum, the Observatory of North Rhine-Westphalia (NRW) State Office of Geological Survey, and the Observatory of Bensberg in the University of Cologne. The negotiations, technical and academic studies about this initiative are still proceeding (see also Annex I.13).

2. Legislative Level

At present, the Federal Office for Building and Regional Planning is conducting a study towards legislation in response to climate change; this study also addresses disaster mitigation. The study is planned to be published in three volumes. The first volume will focus on building protection measures and techniques for flood protection, the second on the legal framework, and the third on climate change issues (see also Annex I.8). Although this study does not directly deal with earthquakes, it explores disaster mitigation techniques and prevention measures which can also support methods of earthquake resilience.

In the planning field, a debate is proceeding since 2006 on the question of whether Federal States should assume more planning responsibility. The present Federal Government has prepared a draft law on spatial planning which would transfer planning responsibilities to the Federal States (see also Annex I.6). This new approach can provide opportunities to the Federal States to integrate disaster mitigation methods into broader spatial planning approaches.

3. Implementation Level

The Federal Office of Civil Protection and Disaster Assistance has prepared a guidebook for the maintenance of critical infrastructural

facilities which sets out strategic concepts of risk analysis, risk management, and risk minimization. This guidebook provides a technical frame for enterprises in Germany on how to reduce the vulnerability of critical infrastructures to natural hazards, accidents, criminal acts and terrorist attacks. It includes recommendations on construction, organisational, personnel and technical protection of infrastructure facilities. The Federal Office of Civil Protection and Disaster Assistance has informed enterprises, authorities and citizens about the importance of the protection of critical infrastructures, tried to build and develop co-operations between public and private sectors; made analysis and proposed short-, medium- and long-term measures for the protection of critical infrastructures (see also "6.2.2. Analysis of Existing Urban Structure of Cologne").

As a new approach, some disaster mitigation techniques are inserted in spatial plans, such as the demonstration of flood protection zones in the regional plan of Cologne. Nevertheless, despite high seismic risks of Cologne, geological failure areas or fault lines are not drawn in any spatial plan. The regional plan of Cologne reflects only the anxieties of floods with respect to disaster mitigation. Since some flood invasions in Cologne (especially in 1993 and 1995), flood prone areas have been shown in the plan such as flood invasion area, flood protection area, and potentially flood-prone areas. The regional planning authority brought some rules of usage according to the level of flood risks. In the regional plans flood-risky areas and flood invasion areas are shown as zones. The details are reflected in local scale municipal plans. The Sub-district Authority of Cologne controls the local scale municipal plan with respect to flood prevention measures (see also "6.2.2. Analysis of Existing Urban Structure of Cologne").

Risk Evaluation of Cologne

According to seismic features and background, Cologne is prone to similar seismic risk as Yalova. However, so far, Cologne has been

reducing this risk by virtue of better building codes and planning standards as well as more efficient construction quality processes and procedures. The results of risk analysis show that Cologne needs some upgrading and changes in terms of disaster legislation, institutional organization as well as institutional and public awareness with a view to a disaster resilient urban settlement. These needs can be summarized as follows:

- ***Disaster mitigation policies and strategies should be integrated into spatial planning instruments.***
- ***Disaster mitigation approaches and methods in Cologne should be developed to include earthquake risks.***
- ***The programs of relevant institutions in Cologne should be redesigned in terms of disaster hazards and vulnerability analysis leading to disaster mitigation and resilience.***
- ***New activities and training programs should be organized to increase public and institutional awareness on earthquake risks.***

Unless the above recommendations will be taken into consideration, the earthquake risk will increase due to deprivation of existing super- and infrastructure in Cologne.

The process of risk analyses of Cologne and Yalova as well as personal experiences from the 1999 earthquakes in Turkey provide an opportunity to discover one of the main features of disaster risks. ***Institutions and the public at large tend to similarly underrate disaster risks when they exceed their coping capacity and when they do not appear to create a challenge.*** According to personal observations in the wake of the 1999 earthquakes in the Marmara Region, citizens and enterprises have been unwilling to take earthquake risks fully into account because the risks are too high to cope with them adequately. Interviews and answers to the

questionnaire in Cologne revealed an unrealistically low risk perception of citizens, enterprises, and local authorities because no devastating earthquakes had been experienced in the past in this region.

6.8. Model Fixing and Testing

In this part, the proposed model will be tested on Cologne in accordance with the aim of this study that is envisaged to develop guidelines for disaster resilient urban settlements. As already mentioned, the theme of the model for Cologne is its resilience to an earthquake. Thus, at the end of the testing process, the earthquake resilience of Cologne will be measured. The proposed model constitutes with two main parts –namely risk factors of urban settlements and elements of resilience- is designed as a check list with relevant details and explanations. In the part of “Risk Factors”, while methods of defining and assessing potential impacts and physical vulnerabilities are explained, the basic information is given how to prepare a worst case scenario for the concerned urban settlement. In the part of “Elements of Resilience”, policies with relevant instruments to serve disaster resilience in short-, medium-, and long-terms as well as strategies, tactics, principles, criteria, standards, and responsible institutions with respect to administrative and legislation issues are described. Furthermore, the priorities for developed countries emphasized by the model will be taken into consideration in the testing process for Cologne.

This model aims at providing guidance to local authorities or policy and decision makers of the concerned urban settlement by asking them some key questions and proposing some studies. However, in this study, the model will be test in accordance with relevant data collected so far. The aforementioned data and the settlement profile of Cologne in the parts of “6.2.2. Analysis of Existing Urban Structure of Cologne” and “6.3.Risk Assessment” will provide guidance to find out local

particularities of Cologne in terms of earthquake resilience. In this frame, all these data and information on Cologne will be processed with respect to each part of the model as follows:

1. Risk Factors of Cologne

a. Potential Impacts:

As a part of potential impacts, earthquake hazards are figured out ground shaking, surface faulting, land liquefaction, and soil amplification in Cologne. Since Cologne has not recently experienced a severe earthquake, ***the preparation of a comprehensive hazard assessment report or study is not assumed as a prior topic of the local agenda.*** In addition to earthquake hazards, the potential impacts of earthquakes cover physical, technological, social, political, and environmental risks as well as economic risks. There is no initiative to prepare an earthquake risk assessment study for Cologne in terms of each feature of above potential earthquake impacts, either. Local authorities in Cologne can possibly initiate an earthquake hazard assessment study in cooperation with academics as well as earthquake risk assessment study enriched by long-, medium-, and short-term impact analyses. The latter two studies would provide guidance to generate solutions for earthquake resilience of Cologne.

b. Vulnerabilities:

As already mentioned, vulnerable physical elements of urban settlements are elaborated in three scales in accordance with the scales in spatial planning, namely macro scale, meso scale, and micro scale vulnerable elements. In the light of information in "6.2.2. Analysis of Existing Urban Structure of Cologne" and "6.3.Risk Assessment", the vulnerable physical elements of Cologne will be assessed with respect to each scales.

MACRO SCALE: At the Settlement Level

RELEVANT AUTHORITIES: Relevant authorities are determined as urban policy-makers and officials of the central government as well as decision makers in the upper levels of local governments at this level. Since the administrative system in Germany is structured as a federal system, each Federal State is in charge of provision of its own services rather than the Federal Government. In this respect, the State of North Rhine-Westphalia is quite capable to mobilize its own resources for disaster resilience. Thus, relevant authorities at macro level are policy and decision makers of the NRW and local authorities of Cologne.

QUESTIONS TO BE RAISED: At this level there are some questions about the macro scale economic, political, environmental and legislative conditions of Cologne (see also "5. Evaluation and Model Building"). Since Germany is a developed country all the relevant questions of this level should be answered by taking an earthquake insurance system in Cologne into consideration. Other key issues that should be considered at this level are effective coordination and organization of local institutions in terms of disaster mitigation and in the case of necessity, describing the topics of cooperation with the Federal Government. As already mentioned, Cologne needs to reorganize the institutional capacities, relevant legislation and implementation process with a view to multi-disaster risks mitigation approaches and disaster mitigation methods as an integral part of spatial planning (see also "6.3. Risk Assessment").

LIST OF VULNERABLE PHYSICAL ELEMENTS AT THE SETTLEMENT LEVEL:

❖ **Natural Environment**

The Municipality of Cologne (Stadt Köln) has a department of environment in charge of environmental protection. This department should prepare a new study to assess the vulnerability of natural environmental elements of Cologne such as air, river (water), soil, flora and fauna in the case of earthquakes. To prepare such a study, the department should work in cooperation with spatial planning and disaster mitigation authorities.

❖ **Built-up Environment**

At the settlement (macro) level, the Sub-district Authority of Cologne (Regierungsbezirk Köln) should prepare a macro scale earthquake vulnerability analysis map of various land-use areas such as housing, education, health, social, cultural and historical protection, green, administrative, commercial, industrial, technical infrastructure and utilities as well as transportation lines and facilities. This macro scale earthquake vulnerability analysis map can be prepared in cooperation with the Geological Department of NRW or other relevant local departments.

MESO SCALE: At the Urban Functions Level

RELEVANT AUTHORITIES: At this level, the relevant authorities for Cologne which partially covered the target groups of the aforementioned interview (see also "6.2.2. Analysis of Existing Urban Structure of Cologne") are mayors and other local decision makers, chambers of business groups, trade associations, academics, and NGOs in Cologne.

QUESTIONS TO BE RAISED: The Municipality of Cologne should answer the questions of meso level in cooperation with its district municipalities namely, Rodenkirchen, Lindenthal, Ehrenfeld, Nippes, Chorweiler, Porz, Kalk, and Mülheim. The Metropolitan Municipality should initiate some studies to evaluate local resources and capacities in case of earthquakes, to assess earthquake risks

and to prepare a mitigation plan in cooperation with academics, spatial planning and disaster mitigation authorities. In this respect, Cologne has some advantageous such as having a seismic observatory in Bensberg and already prepared studies and publications on this topic (see also "6.2.2. Analysis of Existing Urban Structure of Cologne"). Furthermore, the Metropolitan Municipality should keep contact with the relevant institutions at macro level to sustain the continuity of efforts in terms of earthquake resilience. With a view to earthquake resilience, the Metropolitan Municipality should also lead an effective coordination among the district municipalities, relevant institutions as well as local actors such as business owners, trade unions, NGOs. The event of Severin Street occurred on 3.3.2009 can provide guidance for effective coordination in the light of its lessons learned (see also "6.2.2. Analysis of Existing Urban Structure of Cologne").

LIST OF VULNERABLE PHYSICAL ELEMENTS AT THE URBAN FUNCTIONS LEVEL:

-Housing Areas: Although there is no official and publicly available paper on the physical resilience of the building stock in Cologne, according to the director of a construction company, 20 % of total buildings in Cologne may not be safe due to their age and methods of construction (see also Annex II.5). Similar to the scientific study called "Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany"; residential units of Cologne should be assessed in terms of the earthquake vulnerability (Kleist et al., 2006). In this respect, the vulnerability analyses of residential units can be performed in two categories, namely individual buildings and houses and mass housing complexes. Since there is no recorded event of building failure due to ignorance of building codes, ground survey analyses and relevant spatial planning standards in Cologne, DIN 4149 and other relevant

standards will be supplementary references to provide guidance to such vulnerability analysis.

-Health Services: Since the building safety of health centers and sustainability of health services are significant in case of earthquakes, the vulnerability of such areas should be prepared as quick as possible. The earthquake vulnerability analysis should include neighbourhood unit health care centers, hospitals, special rehabilitation clinics (for old, disabled, poor, etc.), health centers (hospitals + labs+ research units), medicine and other medical material warehouses, and pharmacies.

-Education Services: The earthquake vulnerability analysis of the education services in Cologne is as significant as that of the health services with respect to such vulnerable people as babies, children, disabled persons, and large groups of students. Hence the earthquake vulnerability analysis should be prepared for Cologne including day-care centers, kindergartens, primary schools, high schools, academies and universities, special schools for disabled persons, education centers for adults (vocational or other social purposes), libraries and archives.

-Social Services: These areas culturally important areas. Further more, in performance times, they host remarkable high amount of people. In this respect, the earthquake vulnerability analysis should be prepared in terms of theatre, opera, and cinema buildings, concert and congress halls, sport centers, stadiums, olympic complexes, museums, art galleries and other cultural facility buildings, cultural clubs and society buildings, and foundations.

-Administrative and Security Areas: These areas are strategically important areas in terms of decision making and disaster management. Hence they should be safe and capable to sustain their daily and emergency functions. In this respect, the earthquake vulnerability analysis should be performed for administration centers (governorates, municipalities, and district

administration centers), relevant public buildings, fire brigades, police stations, gendarmerie centers, military and security facilities, civil defence centers and their warehouses and sanctuaries, warehouses for vehicles, technical equipments, and other materials for search and rescue purposes.

-Commercial Areas: Since these areas are the center of local economic facilities, a severe earthquake can bring about a remarkable interruption of daily economic activities. Especially considering the metropolitan scale of commercial and business facilities of Cologne, such vulnerabilities will not give damage to only local economic activities but also larger scale economic activities served to hinterland of Cologne. In this respect, the earthquake vulnerability analysis should be prepared in cooperation with relevant local, regional, central institutions in terms of retail commercial areas, wholesale commercial areas, central business districts, shopping malls and centers, hotels and other tourism facilities, restaurants, cafes, and bars.

-Industrial Areas: The vulnerability analysis of industrial areas in Cologne which are possibly at high earthquake risk should be performed in terms of industrial buildings, industrial estates, warehouses, technical equipment and vehicle parking areas, power stations, storage facilities for hazardous materials, nuclear power plants. In this respect, the existing relevant studies such as the preparation of new standards for chemical industry against earthquake risks should be taken into consideration (see also "6.2.2. Analysis of Existing Urban Structure of Cologne").

-Infrastructure & Technical Service Areas: Especially for this topic Cologne needs a detailed earthquake risk analysis guided by the vulnerability analysis. The Metropolitan Municipality should immediately initiate a project in cooperation with technical experts and academics in the field of civil, chemical, electronic-electrical, mechanical, environmental engineers as well as experts from

insurance companies. Before the heavy corrosion of infrastructure in Cologne, the relevant renewal project should be run with a view to earthquake resilience.

With a broader perspective on the vulnerability analysis for infrastructure and technical services, there is an ongoing project for the protection of critical infrastructures conducted by the Federal Office of Civil Protection and Disaster Assistance (see also "6.3. Risk Assessment"). Since this project is performed on the voluntary base of the critical infrastructure supplier companies, a limited number of companies and institutions involved. However, a well-attended participation to this project would bring fruitful results to Cologne in terms of the assessment of vulnerabilities of critical infrastructure.

-Transportation Routes & Terminals: The vulnerability analysis of transportation routes and terminals should be specialized into four topics, namely highways, railways, airways, and maritime lines. In the frame of highways, motorways, bus terminals, service stations, public transportation routes, bridges, tunnels, viaducts pedestrian underground and overpasses, closed car parking areas should be analyzed in terms of earthquake vulnerability. Similar to some studies to analyze seismic vulnerability of bridges in Cologne, further analyses should be performed for the aforementioned items of the highway transportation as well as railway transportation. In terms of maritime lines, the vulnerability assessment of coastal areas especially along the River Rhine, such as land filling areas, ports, quays, marinas should be taken into consideration. In this respect, the integrated coastal zone management methods of spatial planning authorities would be helpful (see also "2.3.The European Union / Germany"). To consider the priority of building and developing the capacity of airway transportation modes and vehicles for disaster response in developed countries, a comprehensive vulnerability analysis should be performed on airway

transportation in Cologne. For this analysis, existing local financial conditions, capacities of airports and heliports as well as technical equipments and personnel should be assessed and vulnerable features should be found out.

Since transportation routes in Cologne are parts of national transportation routes, some projects on earthquake vulnerability analysis should be designed on the basis of cooperation and coordination with relevant institutions of the Federal Government of Germany.

-Open & Green Areas: The criteria of the earthquake vulnerability analyses of open and green areas can vary with respect to usage of these areas. For instance, while environmental issues, such as protection of trees, plants, and animals are the criteria of earthquake vulnerability analysis, building codes and construction quality of open air sport facility units, such as tennis courts, swimming pools, stadiums, motor-racing tracks as well as service facilities of these areas, such as cafes, changing rooms, and shower cabins. In terms of public health issues, cemeteries need to be analyzed in light of different criteria whether they can create risk of pollution in case of earthquakes.

Another aspect in the earthquake vulnerability analysis is to assess the level of safety for these open and green areas. In this respect, the key question is how safety these areas will be for the provision of temporary shelter and other relevant services in case of emergencies.

-Protection Zones (Cultural, historical, natural assets): To assess the earthquake vulnerability of architectural, cultural, archeological, and other historical heritage assets, such as buildings, monuments, bridges, aqueducts, fountains as well as excavation sites, some seismic modeling methods and engineering

calculations are available, e.g. an earthquake simulation model for the Cathedral of Cologne (Meskouris et al., 2006). The similar studies should be increased in terms of drawing physical vulnerabilities of such assets. Furthermore, similar approaches and techniques can be applied for natural conservation areas prone to earthquake risks.

MICRO SCALE: At the Citizens Level

RELEVANT AUTHORITIES: The relevant authorities of Cologne who find out answers of the questions raised at this level are citizens, community based organizations, construction companies, insurance firms, technical experts working on spatial topics such as architects, landscape architects, civil engineers, geological engineers, quality controllers, etc., municipal construction controlling directories, private construction controlling firms, search and rescue organizations and other relevant organizations. The aforementioned authorities and experts should be guided by the Metropolitan Municipality and work in coordination with it.

QUESTIONS TO BE RAISED: At this level the main local actors are NGOs. According to the results of interviews, NGOs in Cologne are eager to participate to disaster resilience especially in cooperation with local authorities (see also "6.2.2. Analysis of Existing Urban Structure of Cologne"). Hence the relevant questions of this level should be answered by various experts and authorities on building design, building quality, construction control, infrastructure and utilities, domestic transportation lines, landscape planning, urban design, evacuation and rescue plans in case of emergencies, insurance for moveable and immovable assets in coordination with NGOs.

LIST OF VULNERABLE PHYSICAL ELEMENTS AT THE CITIZENS LEVEL:

-Vulnerable Elements of Indoors (houses, offices, shopping centers, etc.): In terms of citizens' safety in their living and working environments, the check list including following elements should be prepared. The earthquake vulnerability of these elements should be calculated and assessed by using relevant engineering models and formulas.

- Elements of rooms such as walls, columns, windows, doors, etc.
- Elements of buildings such as stairs, balconies, alcoves, chimneys, towers, minarets, pendent elements, sign boards, lifts, garden walls, water tanks, laundries, storerooms, bunkers, etc.
- Elements of technical services such as electric cables, heating system, drinking water, and gas pipe lines, sewerage systems, ventilation systems, power control, etc.
- Elements of personal assets such as furniture, money, documents, archives, dresses, food, etc.

-Vulnerable Elements of Outdoors (streets, street furniture, car parking areas, green parks): The earthquake vulnerability analysis of outdoor elements is the complementary work of the vulnerability analysis of indoor elements. Thus the similar checklist should be prepared including the following items. The vulnerability assessment should be performed by the participation of experts from various fields such as engineering, architecture, urban design, and insurance.

- Elements on streets such as buildings, street and traffic lamps, vehicles, garbage storage areas, parking areas and bus-stops, etc.
- Elements in neighbourhood units such as buildings, emergency centers, health care centers, schools, shops,

roads, underground and overpasses, energy links, telecommunication lines, fire plugs, trees, etc.

c. Worst Case Scenario:

Currently, any organization or institution in Cologne has not prepared the worst case scenario for earthquakes, yet. In order to be prepared for the possible future earthquakes, ***the Municipality of Cologne can organize a task group*** by the participation of relevant disaster mitigation and spatial planning institutions as well as local administrative authorities and other local actors such as district mayors, technical experts, academics and members of other scientific institutions, representatives business and insurance sectors, search and rescue teams and relief organizations, NGOs, other public interest groups, the media.

The task group should design various worst case scenarios according to aforementioned criteria in the part of "4.4. Evaluation and Model Building". In the preparation of such scenarios, recently experienced lessons learned of authorities and citizens can also be useful (e.g. the event of Severin Street). For each alternative, worst case scenario could be materialized in a "live exercise" in case of willingness of participants. As a result of the oral assessment and/or a live exercise of each worst case scenario, the participants of the task group should try to answer the following questions:

- What are major lessons learned with respect to each local actor, such as the Metropolitan Municipality, the Fire Brigade, an industrial firm, a NGO?
- What are prior topics in terms of local needs, capacities, and main policies?
- What are challenges for institutional, financial, organizational, administrative, and political capacities and capabilities in Cologne?

- What are the strengths, weaknesses, opportunities, and threats of local authorities and actors as well as their technical, financial, organizational, and personnel capacities? In order to answer this question, the SWOT Analysis for the local capacities of Cologne would be fitted. This analysis should be performed by either participants of the task group or a private consultant firm.
- What short-, medium-, and long-term solutions can be generated in accordance with the findings of the performed worst case scenario? This question should also be answered with respect to each local authority and actor of Cologne.

2. Elements of Resilience

a. Policy Level:

Cologne has no local policy on providing guidance to an effective disaster mitigation approach with a view to earthquake resilience. To design an effective disaster resilience policy, governors, mayors, and relevant local administrative officials as well as relevant institutions and representatives of the Federal State of North Rhine-Westphalia should work in cooperation.

For an effective local earthquake resilience policy, it should be noted that unless new planning strategies together with disaster mitigation approaches are applied to the urbanization process, ***Cologne will remain exposed to high and probably increasing earthquake risks.*** Furthermore, the elements of the earthquake resilience policies should be analyzed with a view to the question of **“What makes the City of Cologne earthquake resilient?”** The useful policy instruments to design an earthquake resilience process should be determined by the guidance of the following questions:

- **What particular settlement features of Cologne imply risks and challenges for an earthquake resilience policy?** This

question should be answered in the light of findings in the part of "Risk Evaluation of Cologne" (see also "6.3. Risk Assessment") and physical vulnerability profile which is drawn in the part of "Vulnerabilities" of this model as well as the data in the part of "Potential Impacts".

- **Which elements of the coping capacity of the City of Cologne are supportive to an earthquake resilience policy?**

This question can be answered with a preparation of a table as shown in the "Figure 19". By considering the national and regional effects on the urban settlement, the total coping capacity of the urban settlement are measured at national, regional and urban settlement levels in terms of risk perception, institutional awareness, public awareness, as well as structuring and equipment. For Cologne, the aforementioned table can be modified as the Federal State of NRW level, regional level (Regierungsbezirk Köln) and urban settlement level (Stadt Köln). The method of SWOT analysis is prepared in coordination with authorities in regional and the Federal State of NRW levels (see also "3.4. SWOT Analysis as an Evaluation").

- **What long-, medium- and short-term approaches can be envisaged towards improving earthquake resilience of the City of Cologne?**

For the City of Cologne, to design relevant long-, medium and short-term approaches towards building earthquake resilience, the period of rule for each administrative/governing authority will provide guidance. For instance, the period of rule of the Metropolitan Municipality, the Parliament of the Federal State of North Rhine-Westphalia, and relevant authorities in the NRW will clarify short-, medium-, and long-term approaches to fulfill an effective earthquake resilience policy. Especially for the long-term approaches, the cooperation among different level of authorities is a significant issue.

Another significant issue is categorizing relevant approaches to enhance the earthquake resilience policy according to their time span. Thus, each pertinent activity can be analyzed in terms of its long-, medium and short-term goals and methods. For further explanations, the examples were already given in the part of Model Building will be useful (see also "4.4. Evaluation and Model Building"):

- **What processes and instruments are available in implementing earthquake resilience policies?**

In order to answer this question, the list of vulnerable physical elements of urban settlements (see also table 11) will be helpful. Scales and items of vulnerable physical elements in urban settlements will inspire features and dynamics of relevant physical resilience processes and instruments. For further guidance can be provided by academics and scientific researchers to find out relevant instruments, approaches, and processes in implementing disaster resilience policies designed with respect to the needs of the different groups, such as local authorities, business owners, NGOs. In this respect, the most suitable policy instruments, approaches, and processes for Cologne can be inspired from the international best practices.

- **What (potential) side-effects of earthquake resilience policies and measures must be taken into account?**

As already mentioned in the part of "Evaluation and Model Building", some key topics such as environmental pollution, environmental degradation, spatial distortion and chaos will provide guidance to answer this question. The findings in the worst case scenario studies will also helpful what sorts of negative effects stemming from earthquake preparedness, response, recovery, and

mitigation activities in Cologne. Two big flood events in the last decade may give some hints, too.

However, Germany as a developed country, has various approaches and methods with a view to protect the environment such as policy instruments for sustainable urban settlements and EU Strategic Environmental Impact Assessment Directive (SEA, 2001/42/EC; European Parliament & European Council, 2001). Hence, these instruments should be integrated into disaster resilience programs of Cologne and other urban settlements in Germany.

The relevant ministries and institutions of the Federal State of North Rhine-Westphalia as well as the Municipality of Cologne should take the following questions into account with respect to environmental degradation:

? What are the possible sources of environmental contamination and damages in Cologne during the disaster response activities?

This question should be answered in terms of following issues:

- Contamination of air
- Contamination of soil
- Contamination of water
- Damage on flora
- Damage on fauna
- Damage on human health

? What type of disaster response activities can give damage to the urban space in terms of disorder and distortion? To answer this question the following key topics should be taken into consideration:

- The process and procedures of the site selection of temporary houses and tent cities
- The decision of evacuation in case of emergencies

- The emergency activities need some urgent construction and spatial arrangement works such as land filling, construction of temporary walls, bridges, and relevant structures, cutting trees
 - The financial and technical capacity will be used in the disaster response with a view to effective planning of local resources for pre- and post-disaster periods
- ? What are the possible sources of environmental contamination and damages in Cologne as a result of disaster mitigation activities? Similar to the question for disaster response activities, this question should be answered in terms of following issues:
- Contamination of air
 - Contamination of soil
 - Contamination of water
 - Damage on flora
 - Damage on fauna
 - Damage on human health
- ? What type of disaster mitigation activities can give damage to the urban space in terms of disorder and distortion? To answer this question the following key topics should be taken into consideration:
- The process and procedures of the site selection for new housing areas and other relevant land-uses
 - The damage classification of the existing building stock and the rehabilitation process of the buildings subject to moderate damages
 - The construction project and process of infrastructure and networks of utilities
 - The rehabilitation process of transportation routes which are damaged by earthquakes
 - The financial and technical capacity will be used in the disaster mitigation activities (A lack of resources may cause

a disorder in the urban settlement leading by incomplete construction projects.).

? What are the possible sources of environmental contamination and damages in the urban settlement as a result of general development policies and settlement strategies? To answer this question the following key topics should be taken into consideration:

- Contamination of air
- Contamination of soil
- Contamination of water
- Damage on flora
- Damage on fauna
- Damage on human health

? What types of general development policies and settlement strategies can give damage to the urban space in terms of disorder and distortion? To answer this question the following key topics should be taken into consideration:

- Over constructed urban settlements in response to high demand for new housing stocks
- Misplanning of transportation routes, energy networks and telecommunication links which do not comply with settlement strategies
- Amnesties for illegal settlement areas and constructions such as squatter areas
- Un-well planned regional, national and international nucleus such as regional business centers, international scale harbours, free trade zones
- The misallocation of financial and technical resources in the infrastructure facilities of urban settlements

In the light of the above questions and relevant analyses, the preparations of ***the following documents are strongly recommended to build effective earthquake resilience policies in Cologne:***

- A macro scale disaster mitigation map should be prepared on a national scale land-use base map and identifying all natural disasters prone area and risk zones. This task refers to the relevant ministries the Federal Government. So far, Germany has a country scale earthquake hazard map (see also fig.4). The Federal Government can possibly organize a task group among the relevant authorities of all federal states to prepare such disaster mitigation map including earthquake data.
- A macro scale spatial policy document which outlines national scale policies and approaches towards mitigating the disasters should be prepared. The macro scale spatial policy document should be integrated with the macro scale disaster mitigation map. This would facilitate the inclusion specific policies and approaches for each risk zone of the country. In Germany, the monitoring of spatial developments and up to date information about factors that influence spatial development are performed by the Federal Office for Building and Regional Planning (The Federal Ministry of Transport, Building and Urban Development of Germany, 2001). In the context of the proposed macro scale policy document, the existing work of the Federal Office for Building and Regional Planning can possible enlarged with disaster mitigation data.
- In the light of the macro scale disaster mitigation map and the spatial policy document, the local scale disaster mitigation map and spatial policy document including relevant local details should be prepared. In Cologne, the regional planning authority can prepare this document by

using the Regional Plan of Cologne (see also "6.2.2. Analysis of Existing Urban Structure of Cologne").

The aforementioned above documents should be updated periodically (e.g. in each five year period and especially after disasters).

b. Administrative Level:

One of the pre-requisites of an effective disaster management is a well-organized administrative structure as well as institutional organization and coordination. In this respect, Cologne takes place in administratively well-organized structure (from the Federal State of NRW to the City Administration). However, in case of natural disasters, –with respect to two main flood events in last decade– there may be some problems and inefficiencies in the administrative structure and institutional organization. In this respect, the scope of institutional organization is larger than that in the implementation level. While the scope of institutional organization covers only disaster mitigation institutions in "c.Implementation Level", here, the administrative structure and institutional organization imply all types of local institutions in Cologne. Thus the following questions would be helpful to designate problem areas and to find effective solutions out:

- ? Is there any conflict or gap among the responsibilities of various institutions in terms of disaster mitigation, preparedness and response?
 - ? Are responsibilities efficiently shared by relevant institutions?
Is there any overloaded or below capacity worked institution?
Is there any institution which misfit to its field of work?
- According to answers of these three questions, the establishment of a new institution and/or reorganization of an existing institution may be necessary. In this respect, national and international best practices in the disaster

management will be helpful. In case of a new institution or reorganization, legislative and financial arrangements should be performed accordingly.

With a view to build a well-organized administrative structure, local authorities and central government institutions should be equally taken critics and proposals coming from governmental institutions as well as scientific groups and committees, universities, NGOs, private companies, entrepreneurs, and the media into the consideration.

c. Implementation Level:

In accordance with the proposed model, the implementation level of Cologne will be examined under three subtitles namely, legislation and control, planning process, and institutional organization & coordination.

c-1. Legislation and Control

As already mentioned, according to the administrative structure in Germany, the earthquake-related legislation extents from the EU level to the Federal State level, e.g. the disaster management law of the Federal State of North Rhine-Westphalia (see also "5.3.Risk Assessment"). Thus, as a disaster frame law, the disaster management law of the NRW (Gesetz Ueber den Feuerschutz und die Hilfeleistung) provides guidance to all disaster management activities in Cologne. With a view to earthquake resilience, the following issues should be taken into consideration:

- The disaster management law of the Federal State of North Rhine-Westphalia should be renewed in terms of natural hazard analysis, vulnerability assessment, and multi-risk mitigation.

- With a view to building uniformity among earthquake-related legislations at various levels, the EU directives related to earthquakes, such as Eurocode 7 and 8, DIN4149, and the disaster management law of the Federal State of North Rhine-Westphalia should be reviewed.

In terms of controlling process and procedures, Cologne has no basic problems. However, the following issues should be considered to have better conditions in terms of earthquake resilience:

- The processes and procedures of building permits, compliance with DIN 4149, and compulsory earthquake insurance should be designed as an integral implementation frame.
- An intensive coordination should be built among regional and local spatial plans and geological analyses in Cologne.

Public and institutional awareness are other significant factors to strengthen the earthquake resilience of Cologne. According to the results of interviews on Cologne, local authorities and citizens needs to be informed about earthquake risks and resilience policies. The most sensitive group in Cologne in terms of earthquake risks constitutes with insurance companies. Hence, information and knowledge of insurance companies on earthquake risks of Cologne can provide guidance to develop institutional and public awareness.

Another remarkable point –as a recommendation of the proposed model for developed countries- is ***enhancing civil initiatives and community based organization with a view to increase public awareness on earthquakes***. To find out best solution to enhance the public & institutional awareness with respect to the earthquake resilience, the following questions should be answered by the City Administration:

- What are the dynamics of building public & institutional awareness for disasters/earthquakes in disaster prone societies?
- What methods are useful for earthquake resilience policies to create public & institutional awareness?
- What is the importance of training and public information on earthquake risks to raise public awareness?
- What outcomes can be expected from awareness building measures for the effectiveness of disaster/earthquake resilience policies?

c-2. Planning Process

Similar to other urban settlements', spatial plans of Cologne are important to prepare a base for earthquake resilience. In this respect, multi-dimensional planning instruments and integrated process of spatial planning and disaster mitigation are useful. In terms of this recommended integrated process, main critics on spatial plans of Cologne as follows:

- While the regional and local scale land-use maps of Cologne are currently available, the earthquake hazard and vulnerability analyses are not reflected on these maps. It is recommended that, the land-use maps synthesized with the earthquake hazard and vulnerability analyses should be prepared in 1:50 000 (macro level), 1:10 000 (meso level), and 1:1 000 (micro level) scales. As a result of the synthesis of earthquake hazards and existing land-use texture of Cologne, some decisions of restrictions on some land-uses can be produced. For instance, some residential areas can be designated as "retrofitting area", some industrial areas can be subject to move to another regions or to change their modes of production. These decisions are formulated in the risk mitigation plan which will be informed soon in the following.

- It needs to be prepared the earthquakes risks maps as a synthesis of hazard maps and an analysis map of spatial distribution of vulnerable physical elements.
- It needs to be prepared a micro zoning map. As already mentioned in "4.4. Evaluation and Model Building", the technique of micro-zoning is based on various analyses of such an earthquake prone city like Cologne. As a result of micro-zoning, the City of Cologne may be divided into a few types of micro-zones such as safe zones, zones where buildings are permitted subject to adherence to special technical standards, and building prohibited zones.
- Preparation of a risk mitigation plan including an evacuation plan and an urban transformation action plan is an ultimate necessity for Cologne. The risk mitigation plan should constitute with spatial plans and action program sheets referred relevant actors and target groups.

In accordance with the principles of the disaster model, as an integral parts of spatial planning process, building permission procedures and process as well as construction process should also serve to earthquake resilience. In this respect, Cologne has no problems. Nevertheless, the scope of construction process should not only refer to super structure but also infrastructure and technical services. Hence, Cologne may have possible vulnerabilities in terms of infrastructure and technical services. As a result, the following analyses and programs are recommended to prepare:

- ✓ Preparation of existing building stock analysis in terms of quantifying the amount and likelihood of losses from which buildings may suffer in future earthquakes.
- ✓ The recommended analysis should be prepared according to different indicators, such as function of the building, construction style and materials of the building, other relevant

technical construction details of the building, height of the building, age of the building, soil ground analysis of the building (Meskouris, Kuhlmann, Mistler, 2003). This analysis should also be prepared for other types of construction elements such as storage areas, terminals, bridges, dams, viaducts, etc.

- ✓ Preparation of feasibility analyses of various alternative programs aimed at reducing the possible loss in future earthquakes (FEMA, 2004)
- ✓ Designing earthquake resilience action programs in cooperation with building insurance and building permit authorities and their procedures as well as volunteer business groups. For instance, the existing study on the preparation of new standards for chemical industry against earthquake risks should be taken into consideration (see also "6.2.2. Analysis of Existing Urban Structure of Cologne").
- ✓ Similar to the existing building stock analysis, the vulnerability analysis for infrastructure and technical services should also be prepared. In this context, an ongoing project for the protection of critical infrastructures conducted by the Federal Office of Civil Protection and Disaster Assistance can give some inspirations (see also "6.3. Risk Assessment").

c-3. Institutional Organization & Coordination

The effective institutional organization and coordination is a significant issue in terms of fulfillment of earthquake resilience in Cologne. All earthquake mitigation plans and programs need to be prepared in the pre-disaster period, and they need to be coordinated under one single authority. In this context, the Flood Protection Authority and its organization can give some inspiration to develop a new authority or restructure the Flood Protection Authority with respect to earthquakes and floods. The following key

questions can provide further guidance to find and/or create an effective coordinator institution:

- ? Is there an institution in charge of coordinating all disaster mitigation activities and programs in the urban settlement?
- ? If yes, does this institution work effectively?
- ? If not, what are the shortcomings of the existing coordinating institution?
- ? Is the existing institution able to overcome such shortcomings or is a new coordinating institution required?

The dynamics of the total institutional structure in terms of coordination and organization in disasters should also be determined. In this respect, such an analysis as in the "Figure 19".The Coping Capacity of an Urban Settlement" will provide guidance to determining the most suitable position for each institution or organization in the local organizational setting. As already mentioned, main elements of institutional coping capacity are; (i) risk perception, (ii) institutional awareness, (iii) organizational administrative, technical, financial structures and equipments. Furthermore, these elements should be elaborated at three levels, namely urban settlement, regional, national levels. As a result of SWOT analyses of each element and each level, the most suitable position for each institution or organization will be found out. For Cologne this analysis should be performed at levels of the Federal State of North Rhine-Westphalia, the regional administration (Regierungsbezirk Köln), and the city administration (Stadt Köln).

After performing the analysis above, for the relevant working principles with a view to earthquake resilience, the following key concepts and standards should be incorporated into an updated institutional and organizational structures in Cologne:

- Efficiency and effectiveness
- Openness to new technologies and information systems

- Institutional transparency
- Reliability and sustainability
- Cooperation & interaction capacity with other institutions and organizations
- Supporting public awareness and public participation
- Technical and scientific capabilities
- Modernity and self-criticism

6.9. Evaluation and Recommendation

Since the proposed model itself focus on the physical resilience of an urban settlement, the whole test results denote physical strengths and weaknesses. These results may pave the way to develop earthquake resilience in Cologne. They may also provide guidance in further disaster resilience activities towards other types of natural disasters by modifying relevant parts of the model.

As already mentioned, the proposed model aims at providing guidance to local authorities as well as to policy and decision makers of Cologne by asking them some key questions and proposing some studies according to their answers. However, due to time constraints on the study, the confidential nature of some data, and the hesitation of some authorities to give genuine answers to questions on earthquake risks, the proposed model was not entirely completed by the authorities mentioned above. Instead, the model was supplemented according to data collected via interviews and questionnaires in Cologne.

In terms of earthquake resilience, local capacities of Cologne mostly rely on compliance to planning standards and building codes as well as sufficiently performed construction controlling process. Nevertheless, all these restraints are not enough to create effective earthquake resilience. The SWOT analysis method can be helpful in revealing how much of Cologne is resilient for earthquakes. The following table

clarifies the results of the model testing by using the SWOT analysis in discovering Cologne's strengths, weaknesses, opportunities and threats:

Table 17: The SWOT Analysis on Earthquake Resilience of Cologne

S.W.O.T. PARTS OF THE MODEL	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
1.Risk Factors of Cologne <i>a.Potential Impacts</i>	+No earthquake damage experienced so far <u>in terms of having no loss</u>	-No earthquake damage experienced so far <u>in terms of lack of awareness</u> -Fault lines -Alluvial plain caused land liquefaction and soil amplification		-No earthquake hazard assessment is available
1.Risk Factors of Cologne <i>b.Vulnerabilities</i>	+Adequate economic conditions +Partially sufficient legislative conditions for disasters +No significant environmental problem	-Historical and archeological sites -Industrial sites and buildings -Infrastructure and technical services -Some transportation routes and terminals such as	+DIN 4149 +The elementary natural hazard insurance package already covered earthquake hazards	-Lack of institutional and public awareness

	+ More than 50% of housing units are earthquake resilient	bridges and railways -Possibly vulnerable street fixtures such as traffic lights and bus stops		
1.Risk Factors of Cologne <i>c.Worst Case Scenarios</i>	+Various academics already studied on earthquake risks of Cologne	-No prepared worst case scenario	+The opportunity of having a chance to design various worst case scenarios and be prepared accordingly without experiencing any devastating earthquake. +Recently experienced event to show the vulnerabilities (Severin Street) +Willingness of NGOs	-Lack of institutional and public awareness
2.Elements of Resilience <i>a.Policy Level</i>	+Well organized administrative structure +The disaster management law of the NRW	-No local policy on earthquake resilience -No macro scale disaster mitigation map -No macro scale spatial policy document	+Two severe floods experienced in the last decade pointed out the need for disaster resilience +A national scale earthquake hazard map is available +The Federal Office for Building and Regional Planning	-Possible side effects of earthquake resilience policies

			may develop their work on monitoring of spatial developments and updating relevant data as including disaster mitigation issues.	
2.Elements of Resilience <i>b.Administrative Level</i>	+Well organized structure from the Federal State of NRW to the Municipality of Cologne	-The institutional capacity mostly focused on disaster preparedness and response rather than mitigation.		
2.Elements of Resilience <i>c.Implementation Level</i> <u><i>c.1.Legislation & Control</i></u>	+Clearly structured legislation on disasters +Compulsory implementation of relevant building codes called DIN 4149 +No major problem in construction controlling process	-The disaster management law of NRW did not include hazard analysis, vulnerability assessment and techniques on multi-risk mitigation.	+Integration of earthquake insurance system into construction and building controlling procedures +The existing relevant studies such as the preparation of new standards for chemical industry against earthquake risks. +In terms of the vulnerability analysis for infrastructure and technical services, an ongoing project for	-The compliance with the EU level disaster related legislation such as Eurocode 7 and 8 -Lack of public awareness on earthquakes

			the protection of critical infrastructures conducted by the Federal Office of Civil Protection and Disaster Assistance.	
2.Elements of Resilience <i>c.Implementation Level</i> <u><i>c.2.Planning Process</i></u>	+Currently available regional and local scale land-use maps and spatial plans +No major problems in building permission procedures and process as well as construction controlling process	-Earthquake hazard and vulnerability analyses are not reflected on spatial plans -No earthquake risk map of Cologne -No micro zoning map on earthquakes -No earthquake risk mitigation plan is available	+An analysis on existing building stock in terms of quantifying the amount and likelihood of losses resulting from future earthquakes (by developing the existing scientific studies on this topic) +Designing earthquake resilience programs in cooperation with building insurance and building permit authorities	-Hesitation of insurance companies to share their data -Corrosion of buildings and infrastructure in Cologne by time
2.Elements of Resilience <i>c.Implementation Level</i> <u><i>c.3.Institutional Organization & Coordination</i></u>	+The Flood Protection Authority & the Fire Brigade Department are 2 experienced local authorities in terms of disaster management +Local	-A need for an institution who coordinates all disaster mitigation activities and programs for Cologne -Lack of coordination among spatial	+The model of the Flood Protection Authority and the Flood Protection Centre can inspire further institutional developments.	-Lack of risk perception and institutional awareness

	technical and scientific capabilities in Cologne	planning and disaster-related institutions		
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Source: Own source.

According to the results of the above SWOT analysis, Cologne is one of the well-planned and properly constructed cities in Germany. In spite of its big potential earthquake impacts, Cologne has not yet experienced any severe earthquake. In this respect, ***Cologne has the advantage of being able to prepare many worst case scenarios involving earthquakes and generate effective solutions before it faces with a severe earthquake.*** Many projects and programs leading to earthquake resilience are inevitable for Cologne when the above weaknesses are taken into consideration.

In order to enhance the earthquake resilience of Cologne, some studies should be organized at the level of Federal Government and the State of North Rhine-Westphalia, namely a macro scale disaster mitigation map and a macro scale spatial policy document. At the local level, with respect to the aforementioned weaknesses, earthquake hazard and vulnerability analyses should be prepared first. In cooperation with relevant spatial planning and disaster-related authorities, an earthquake micro zoning map and a risk mitigation plan should also be prepared. In terms of building and infrastructure qualities, the existing standards, procedures and potential studies as well as earthquake insurances should be reviewed and synthesized into an integrated process. Another significant issue to be taken into consideration ought to be building a relevant institutional organization to support all these studies and programs. Institutional capacity and organization should include not only disaster preparedness and response but also disaster mitigation and recovery activities and programs. New institutional restructuring or reorganization should provide opportunities to integrate disaster mitigation techniques into spatial planning methods.

The ultimate issue in terms of earthquake resilience of Cologne is institutional and public awareness. Without working to develop effective institutional and public awareness on earthquake risk, the efforts to build up Cologne's earthquake resilience will remain futile until the event of a significant earthquake.

When applied correctly, the above evaluation can provide Cologne with guidance towards an earthquake resilient urban settlement and highlight dynamics underlying a disaster resilience model. These recommendations and solutions are a result of a two-year intensive study on Cologne. With a detailed and a longer study in cooperation with local authorities, more effective and efficient approaches and concrete results could be produced.

CHAPTER 7:

7. CONCLUSION

7.5. Overall Assessment

This study is built on the following a hypothesis:

"As urban settlements are particularly vulnerable to various types of disasters, new strategies and concepts are needed to enhance disaster resilience of urban settlements."

With a view to this hypothesis, research questions were formulated ("1.1. Hypothesis and Research Questions"). Furthermore, the relevant disaster terminologies used in this study were clarified. In this respect, ***definitions of some relevant terms proved problematic, since different and sometimes contradictory definitions referred to the same term.*** Hence, definitions used in this study were modified in a redefining process till almost the end of the study. There are two more important aspects in the definition of terms, namely the scope of this study and the type of disaster. Since this study aims at designing a disaster resilience model for urban settlements in terms of physical

resilience, the main emphasis of the terminology is on urban space and constructions. The focus of the study is on natural disasters. Especially, earthquakes are at the core of the proposed disaster resilience model. In terms of disaster risks for urban settlements and its categorization, international studies and best practices of various countries provided guidance. In the respect to best practices, the disaster mitigation systems of the United States and Japan as well as some successful countries of the European Union were examined. With respect to various projects and programs on natural disasters, the experience of relevant UN organizations contributed to understanding disaster vulnerabilities of different countries and to becoming acquainted with various methods of disaster mitigation. Furthermore, international seminars and conventions on natural disasters over the past decade which have been mostly organized in the last decade clarify the dynamics of disaster risks and propose effective methods for disaster resilience. Especially, the Yokohama Strategy and the Hyogo Framework include numerous guiding principles for drawing global profile of natural disasters as well as generating basic principles and policies for permanent solutions in disaster mitigation.

In addition to the aforementioned basic principles and policies for permanent solutions in disaster mitigation of the international best examples, the proposed model of disaster resilience was also developed in light of the lessons learned of the 1999 earthquakes in Turkey. To convey the lessons learned of the 1999 earthquakes, the reflection of the existing disaster mitigation system of Turkey in terms of legislation, organizational structure and relevant responsibilities composed an important part of the study. For the overall assessment of these lessons learned, the method of SWOT analysis was used. The results of the SWOT analysis led to main principles, approaches, and methods to formulate a rough draft of the proposed disaster resilience model.

A comparative case study has been carried out with a focus on Yalova and Cologne. Yalova is one of the cities affected by the 1999 earthquakes in Turkey. Cologne is a city in Germany which has significant earthquake risks due to its seismic background and existing settlement conditions. Since Yalova experienced a high intensity earthquake in 1999, the proposed model is updated and detailed in light of local experiences in Yalova. Both cities were analyzed with reference to their seismic backgrounds, existing spatial planning and disaster mitigation activities as well as institutional coping capacity and problems. Subsequent to the analyses of these two cities, the earthquake risk assessments of the cities were performed. It should be noted from the outset that the risk assessment of Yalova will be quite different from that of Cologne in view of the significant experience of the 1999 earthquakes in Turkey. However, this difference creates an opportunity to test the proposed model enriched by the local experiences of Yalova on Cologne which has not yet experienced a devastating earthquake despite of its high seismic risk.

The proposed model was developed in a dynamic process. While the main headings were structured into hierarchical steps –from macro to micro level-, many feedbacks facilitated further developments of the proposed model. Hence, the various issues addressed in the proposed model could be developed in light of findings from the comparative case studies, the risk assessment of the aforementioned cities as well as results from the model testing.

As another notable point, this model sets out two different approaches to lessen the hazardous effects of natural disasters on urban settlements. From the perspective of a city planner, it is possible to distinguish between urbanization processes and urban settlements in developing countries and/or population increasing countries on the one

hand and developed countries on the other hand. Such distinction will lead to two different approaches in the disaster mitigation process in different urban settlements. Even the main concerns of these two approaches are different. Thus, the proposed model offers two different sets of priorities with respect to developed and developing countries, respectively, while the main body of the model remains intact. The model should be applied in accordance with the relevant priorities of the concerned urban settlement.

As a result of testing the model, the earthquake resilience of Cologne was assessed successfully. The results of the test paved the way to develop earthquake resilience in Cologne. The strengths, weaknesses, opportunities and threats were outlined in terms of risk factors and elements of resilience with a view to priorities of developed countries. The model facilitated to generate useful and effective approaches, methods, and instruments for further earthquake resilience activities. In this respect, the proposed model is an instrument providing guidance to the local authorities as well as to policy- and decision-makers of Cologne by asking them some key questions and proposing some studies in response to their answers. However, due to time constraints on the study, the confidential nature of some data, and the hesitation of some authorities to give genuine answers to questions on earthquake risks, the proposed model could not be entirely completed on the basis of information received from authorities. Rather, the model was supplemented according to data collected via interviews and questionnaires in Cologne.

The proposed model of disaster resilience can be modified according to the different features of the concerned urban settlement as well as characteristics of the natural disaster which threaten that urban settlement. For instance, when the disaster threatened an urban settlement has trans-boundary effects

(affecting the neighbouring regions and countries), some parts of the model such as grouping of vulnerable physical elements, the scope of policy making, the composition of administrative groups need to be modified with respect to scale of the disaster. If applied correctly, the model will provide guidance towards a disaster resilient urban settlement. The success of the model depends on the willingness and openness of the relevant authorities to apply it. In the meantime, the checklist form of the model provides an opportunity for further development. Experience from applying the model to different urban settlements prone to various disasters can add further questions or modify the existing ones. To have a potential for dynamic development, the proposed disaster resilience model can provide long-term guidance to urban settlements.

7.6. Evaluation for Turkey

Since the model building part mainly relies on lessons learned from the 1999 earthquakes, conclusions were drawn specifically for Turkey. As already mentioned, a detailed critical study on the failure of the disaster mitigation system had already been prepared previously (see also "3.3.Criticism on Existing Disaster Mitigation System and Process in Turkey"). In light of this study as well as personal experience of the author, the overall assessment was performed by using the SWOT analysis method.

The 1999 earthquakes gave rise to reviewing the entire disaster mitigation system in Turkey in light of the lessons learned. Many initiatives and ongoing studies on legislation, institution-building, insurance, and quality control look promising for disaster resilient settlements. On the other hand, there are some threats regarding these initiatives due to instable institutional structure, budgetary constraints, lack of public awareness as well as inadequate organization and coordination.

Since Turkey is a country prone not only to earthquakes but also to various other natural disasters, such as floods, land slides and avalanches, disaster resilience is a crucial issue in terms of sustainable development of the country. With reference to the different approaches set out in the proposed model, it is suggested that Turkey should follow the priorities of developing countries. Although Turkey is not a developing country, she has some crucial features similar to those developing countries, such as a rapidly increasing population, agglomerations around urban settlements, and economic difficulties. On the other hand, Turkey has similar features with developed countries in terms of know-how on disaster mitigation. It is very interesting that Turkey has advantages over Germany in terms of more comprehensive disaster legislation, a compulsory earthquake insurance system, and more integration of disaster mitigation issues into the spatial plans. Yet Germany performs well in running relevant processes, such as compliance with spatial planning standards and building codes. Hence, Turkey can build on her success in process planning in terms of disaster resilience as well as planning and construction activities to support disaster mitigation.

The ultimate challenge for Turkey in terms of disaster resilience relates to public awareness. ***Many international best practices as well as interviews in Cologne underline the fact that NGOs play an important role in raising public awareness.*** In Turkey, most of the disaster mitigation responsibilities are still undertaken by governmental institutions, chiefly by central governmental institutions. In the course of the 1999 earthquakes, NGOs in Turkey worked in search, rescue, and relief activities. Henceforth, non-governmental institutions need to be activated with a view to increase public awareness. As NGOs in Cologne in the wake of flood events, NGOs in Turkey may be more effective on creating disaster resilience than the

governmental institutions (see also Annex II.4). Support NGOs and their cooperation with local authorities can reduce the work load of governmental institutions in Turkey. As already mentioned, in the course of disasters, many governmental institutions only inadequately cope with problems of disasters due to the work load of other public services.

Consequently, while lessons learned from the 1999 earthquakes can inspire new approaches and methods of disaster resilience for other countries, ***Turkey still needs to develop effective institutional organizations and coordination structures, well planned processes of construction control, application of relevant spatial planning standards, a more comprehensive disaster insurance system as well as public awareness.***

7.7. Recommendations and Suggestions of Other Countries

As noted before, despite the different disaster risk features of urban settlements in developing and developed countries, respectively, losses of urban settlements for both groups of countries can be categorized as environmental losses, human resource losses, property losses, and economic losses. The common features and local differences of the countries are synthesized in the disaster resilience model for urban settlements. In a view of various dynamics and particularities of disasters, it cannot be expected to produce a comprehensive guidebook on disaster resilience. In light of the vast experience with earthquake risks in Turkey and the professional involvement of the author in the mitigation and evaluation of such risks for many years, the proposed model offer main applicable policies supported by relevant instruments on short-, medium-, and long-terms as well as strategies, tactics, principles, criteria, standards, and responsible institutions with respect to administrative and legislation issues to advance disaster resilience of urban settlements in physical term.

All developed and developing countries that are willing to apply this model can follow the similar steps as in the testing process of Cologne. The priorities recommended in the model should be reviewed in light of particular priorities of the urban settlement concerned, e.g. priorities of the urban settlement in a developing country. Local authorities are the main actors that consider the key questions and recommended tasks in the model. They should organize relevant working groups and build necessary cooperation to fulfill the recommendations of the model. Although the model proposes various policies, methods and procedures for an urban settlement, the cooperation and coordination of relevant authorities at regional, national, and sometimes international level are important in terms of maintaining disaster resilience.

In the future, with respect to further implementation of the model, a "twin cities" or "sister cities" approach may well be suitable. Urban settlements already advanced in applying the model can volunteer to provide guidance to cities at the start. It is also believed that with the guidance of city planners, the disaster resilience model will be further developed.

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9. ANNEXES

ANNEX I: INSTITUTIONAL VISITS AND INTERVIEWS ON DISASTER MITIGATION

INSTITUTIONAL VISITS AND INTERVIEWS ON DISASTER MITIGATION -I.1-	
COUNTRY	Germany
CITY	Cologne
DATE	21.November.2007
INSTITUTION	German Aerospace Center
CONTACT PERSON(S)	Dr. Robert BACKHAUS, Project Manager
TOPIC	Foundation of UN-Spider Center in Germany
ISSUES DISCUSSED	<p><u>What is UN-Spider?</u> The UN-SPIDER is a quite new program of the United Nations Office for Outer Space Affairs (UNOOSA).</p> <p><u>General Information About Un-Spider:</u> It is an information provider program for space-based information for Disaster Management and Emergency Response. The UN-SPIDER is a voluntary program based on voluntary contribution of member states. So far, voluntary contribution countries are Germany, Switzerland, and China. China has well-established office in Beijing, Germany has in Bonn, and Germany& Switzerland have a liaison office in Geneva.</p> <p><u>Goals and Objectives:</u> It aims to provide universal access to all countries and all relevant international and regional organizations to all types of space-based information and services relevant to disaster management to support the full disaster management cycle by being a gateway to space information for disaster management support, serving as a bridge to connect the disaster management</p>

and space communities and being a facilitator of capacity-building and institutional strengthening, in particular for developing countries.

Ongoing and/or Planned Activities: Despite it is newly organized program, UN-SPIDER already organized a workshop to promote the access and use of space-based technologies and solutions for disaster management and emergency response within the relevant communities in 29–31 October 2007 in Bonn/GERMANY. The workshop participants are decision-makers and senior experts of various responsible national and regional institutions for providing disaster management support, capacity building in and promoting the use of space-based technologies; UN SPIDER Regional Support Offices and national focal points; UN agencies and NGOs involved in disaster management mitigation and relief; space agencies; academic and research institutions; geospatial information management and IT companies.

Major topics on the basis of UN-SPIDER objectives to be discussed at the workshop were space-based information for disaster management support and emergency response, definition of a knowledge portal, definition of a kn

www.unoosa.org/oosa/index.html

Recommended Institutions Related My Doctoral Study:

- University of Cologne/Earthquake Center in Bensberg- Dr. Klaus G. HINZEN
- DKKV(=Deutsches Katastrophenvorsorge/German Committee for Disaster Reduction)-Otto ZENTEL
- Karlsruhe University/Geophysical Institute- Prof. Dr. Friedemann Wenzel
- University of Wuerzburg/Institute of Geography- Hannes Taubenboeck

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.2-

COUNTRY	Germany
CITY	Cologne
DATE	5.December.2008
INSTITUTION	University of Cologne/Earthquake Observatory in Bensberg
CONTACT PERSON(S)	Prof.Dr. Klaus G. HINZEN, Director of the Earthquake Observatory
TOPIC	Seismic Conditions of Cologne
ISSUES DISCUSSED	<p><u>Historical Seismic Background of Cologne:</u></p> <p>The City of Cologne has quite long historical background, e.g. approximately 2000 years. The ancient settlement was also located on the river side. The modern city is located today, in the south-eastern part of lower Rhine. Thus, The ground soil of the settlement consists of alluvial and marine sediments. Due to these reasons land liquefaction and soil amplification incidents occur with earthquakes.</p> <p>On the other hand, the area where includes the City of Cologne, is a part of European rift system. This system extends over 1 100km in south-north direction. Moreover, several fault lines such as Erft Fault Line and Viersen Fault Line lay down in eastern part of the lower Rhine. As a consequence, the City of Cologne and her surroundings</p>

have been still prone to earthquakes. According to the historical records, Cologne faced with many severe earthquakes since 17th century.

Existing Seismic Risk in Cologne:

According to the historic seismic data, geological measures and observations indicate that the fault lines which are close to Cologne have still some movements.

The Earthquake Station of the University of Cologne in Bensberg has a seismic network consists of twenty stations located in Northern Rhine Area. While there was a single seismic monitoring station available in this area, it was upgraded to a network in mid of 1970s. After 1996, the network was also upgraded to a digital system while the previous records were paper plots and handwritten notes. The Bensberg Earthquake Station developed a study on 1 336 data selected from Bensberg Catalogue from 20 years operation (1975-1995) in the Northern Rhine Area. According to outcomes of the study, it is understood that despite rare devastating earthquake events in the Northern Rhine Area, earthquakes with magnitudes above 3 can easily create panic among the people living in Lower Rhine Area, e.g. the earthquake with 3.9 magnitude in Meckenheim in 20.01.2000, the earthquake with 4.9 magnitude in Alsdorf in 22.07.2002.

Scientific Recommendations on Seismic Hazard Mitigation:

At the end of the interview, Dr. Klaus G. HINZEN underlined two following topics with a strong emphasis:

- According to the studies of the Bensberg Earthquake Station, the City of Cologne is determined as a high earthquake hazard risk urban settlement. While her dense population and

	<p>constructed areas are taken into the consideration, precautions and improvement activities should urgently be started.</p> <ul style="list-style-type: none">• In order to get better seismic data, the Bensberg Earthquake Station which deals with scientific researches in the Cologne Area, should be supported financially and technically. In the existing situation, the major studies of the station are realized by the efforts of Dr.Klaus G. HINZEN and his students.
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**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.3-

COUNTRY	Germany
CITY	Bonn
DATE	13.December.2007
INSTITUTION	University of Bonn/ Institution of Geography
CONTACT PERSON(S)	Prof.Dr. Jürgen POHL, Head of Department
TOPIC	Disaster Risks of North Rhine-Westphalia State and Cologne
ISSUES DISCUSSED	<p><u>Disaster Risks of North Rhine-Westphalia State:</u></p> <p>Since Prof. Pohl's has been working on the topic of flood, the overall information was about the risk of Rhine. The most information about his study focus on geology and hydro-geology of Rhine Valley and its surroundings. Thus he strongly gave advice to build contact with the Cologne Flood Protection Authority for spatial information and plans of Cologne. He also informed that he study of the United Nations University lead by Dr. Birkmann would be helpful for my study.</p> <p><u>Institutions and Contact Persons Related with My Study:</u></p> <ul style="list-style-type: none"> ➤ United Nations University in Bonn - Dr. Joern BIRKMANN ➤ Municipality of Cologne/Cologne Flood Prevention Authority- Reinhard VOGT

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.4-

COUNTRY	Germany
CITY	Bonn
DATE	7.January.2008
INSTITUTION	United Nations University (UNU-EHS)
CONTACT PERSON(S)	Dr. Jörn BIRKMANN, Head of Section
TOPIC	Disaster Risks of Cologne
ISSUES DISCUSSED	<p><u>Disaster Mitigation and Vulnerability</u></p> <p>In the interview with Dr.Birkmann, he mainly mentioned me about social vulnerability, vulnerability of the society in the case of disasters. Since my doctoral study focuses on physical vulnerability of urban settlements, our conversation mostly based on conceptual topics of disasters. He also proposed me some UN studies and documents and gave me a book called "Measuring Vulnerability to Natural Hazards".</p> <p><u>A Case Study on Cologne for Disaster Mitigation</u></p> <p>A group of students who are leading by Dr. Birkmann prepared a study on Cologne. The aim of the study to measure the vulnerability of the people living in Cologne. The outputs of the study would be eligible for my doctoral study. Unfortunately I could not get any data from him yet despite we agreed on data sharing.</p>

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.5-

COUNTRY	Germany
CITY	Cologne
DATE	17.Januar.2008
INSTITUTION	The Metropolitan Municipality of Cologne/Cologne Flood Prevention Authority
CONTACT PERSON(S)	Mr. Reinhard VOGT, Head of Department Ms. Yvonne WIECZORREK
TOPIC	Activities of Cologne Flood Protection Authority
ISSUES DISCUSSED	<p><u>Activities of the Flood Protection Authority:</u> The most activities of the Flood Protection Authority of Cologne focus on prevention and response. According to the studies of the Flood Protection Authority, the most important source of flood events is the River Rhine. The rain falls are not defined as major threat in this context. In this frame, three working groups are organized in the Authority. The first group organizes the emergency activities; the second organizes defense line in the case of flood; and the third group organized evacuation plan of people. The authority uses GIS based map. It is possible to see the different risk zones on the map in the case of various levels of river invasion to the settlement areas.</p> <p><u>Institutional Organization:</u></p> <p>In operation times/ in disaster response times, the Flood Protection Authority works in cooperation with other local authorities. The Authority has a "Flood Action Force" chart in the case of flood. When the water level of the Rhine exceeds a critical level, the Flood Action Force is managed by the Municipal</p>

Sewage Enterprise; and all actions are coordinated by the Flood Protection Center into which the Flood Protection Authority is transformed. At this point, there are three different compositions of the Flood Protection Center according to the water level at the gauge of Cologne. The optimum water level at the gauge is 3,5 meters. While the Center constitutes some local authorities at the 4,5 meter water level, all local authorities are involved with the task at the 7,5 meter water level. In the case of 10 meter water level, the Flood Protection Center transforms into a "Emergency Task Force" The Flood Protection Center comprises both permanent and ad hoc units. The permanent units include such units as fire brigade, streets and traffic technical services, harbor and freight traffic services, police, search and rescue team (THW). Ad hoc units include such units as building inspection unit, office of business development, social welfare service, environmental and consumer protection unit, municipal transportation company of Cologne. The Flood Protection Center closely cooperates with the municipal press office as well as local information and management offices.

Contacts with Other Organizations:

The Cologne Flood Protection Authority is a member of the International Commission for the Protection of Rhine. The International Commission for the Protection of Rhine is a multinational NGO aims to protect people and their assets against flood in the Rhine area. It was originally prompted by a chemical accident which created poisonous pollution the River Rhine between Basel and Koblenz in 1986. Then States of Rhine

(Switzerland, Germany, France, Luxemburg, and Netherland) need to be organized to protect the River Rhine. Their governments charged the International Commission for the Protection of Rhine. On 22 January 1998, the International Commission for the Protection of Rhine adopted an "Action Plan on Floods" in the 12th Conference of Rhine Ministers in Rotterdam. The Action Plan was designed to rehabilitate the Rhine by 2000. The Flood Protection Authority provided me various document about the International Commission for the Protection of Rhine. It is also possible to reach detailed information about it in the following web-link:

<http://www.iksr.org>

The Cologne Flood Protection Authority has also some efforts to increase institutional coping capacity for disasters namely, floods. The Authority has organized a "European Center of Excellence for Flood Management". The center aims to build a network to collect and disseminate empirical and theoretical information and experiences on the basis of flood management. The networks has been constituted with research institutes, universities, private companies, public authorities, NGOs, and other types of citizen organizations in regional, national, and European levels.

Related Legislation:

The Disaster Management Law of North Rhine-Westphalia/Katastrophen Schutz Gesetze der Nord Rhein West Fallen is the basic law. In Germany each Federal State has its own disaster management law. The specific name of the disaster managment law of the North Rhine-Westphalia State is "Gesetz Ueber den Feuerschutz und die Hilfeleistung"

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.6-

COUNTRY	Germany
CITY	Bonn
DATE	30.January.2008
INSTITUTION	Federal Office for Building and Regional Planning
CONTACT PERSON(S)	Mr. Martin SPANGENBERG, Senior Officer
TOPIC	Planning System in Germany and Existing Plans of Cologne
ISSUES DISCUSSED	<p><u>Planning Institutions and Their Roles in Germany:</u></p> <p>According to the Federal Planning Act, spatial planning and land-use planning take place at the federal level(Bund), federal state level(Laender), and municipality level(Staedte). On the federal level, macro goals and principles are defined and broad procedures are set out by (framework) legislation. On the federal state level, according to the Federal Regional Planning Act (Raumordnungsgesetz) the federal states are responsible for managing land-use policies by the "Regional Plan for the Territory of the State" (Raumordnungsplan fuer das Landesgebiet) and "Regional Plans for parts of the States" (Regionalplan). These plans include many aspects as energy, security, telecommunication networks, protection of nature, transportation, and economic development. On the</p>

municipal level, preparation of land-use plans are determined and executed. In the preparation of land-use plans, the Federal Building Code (Baugesetzbuch) lays down similar objectives, instruments, and procedures for all municipalities. In sum, while there is only one frame law in planning (the Federal Planning Act), there are various Planning Implementation Laws changing from one Federal State to another.

In the planning field, a debate has recently arisen on the question of whether federal states should take more planning responsibility since 2006. The present federal government has prepared a draft law on spatial planning which would transfer planning responsibilities to the federal states.

Responsibilities of Federal Office for Building and Regional Planning

The responsibilities of the Federal Office are controlling regional plans prepared by Federal States and building necessary coordination among different regional plans on the basis of the Federal Planning Act, relevant planning standards and building codes, e.g. DIN 4149, minimum distance between two industrial sites,... The Federal Office examines the plan and if necessary sends the plan back to the related Federal States to make changes. After changes, the plan is sent back to the Federal Office. The Federal Office keeps regional plans of all Federal States in its archive.

So far, the Federal Office has no special planning studies on disasters and/or climate change issues. The flood protection zones are the only instruments have been used in plans and controlled by the Federal Office.

The detailed information about the Federal Office and its activities are available in the following web-site:

www.bbr.bund.de

Regional Plans of Cologne:

The Sub-district Authority and Municipality of Cologne are two major plan preparation institutions for the region of Cologne. Thus, firstly, Mr. Spangenberg strongly advised me to visit the Sub-district Authority of Cologne to get detailed information about spatial plans of Cologne. The sub-district of Cologne covers the sections of Cologne, Bonn, and Aachen. Secondly, the Municipality of Cologne would be useful to learn more plan details in the local scale.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.7-

COUNTRY	Germany
CITY	Bonn
DATE	12.February.2008
INSTITUTION	Federal Office for Building and Regional Planning
CONTACT PERSON(S)	Mr. Paul Schmitz, Civil Engineer
TOPIC	Building Stock Assessment in Cologne
ISSUES DISCUSSED	<p>I visited to the Federal Office for Building & Regional Planning/Department of Building, Housing, and Architecture to get the information about existing building stock in Cologne. Since I learnt from the official web-site (www.bbr.bund.de) of the Federal Office and its booklet that the Federal Office is responsible for the following issues:</p> <ul style="list-style-type: none"> • ministerial research, analyses, reports and consultation in the areas housing and property market, housing economics, cost reduction, housing benefit, housing prognoses • Eastern Europe consulting in the area of housing • constructional ministerial research projects, processing of legal regulations concerning energy saving, sustainable building • research and project monitoring in the area

"architecture and building culture", urban development, conservation of historical buildings

- fundamental developments in building, building economics, building management methods
- construction and building documentation, construction software
- optimisation of total energy efficiency of federally owned buildings (monitoring of operations)

After some phone calls, I had an appointment with Mr. Paul Schmitz. Despite his friendly help and cooperative behaviours, I could not get the detailed building evaluation report because it went beyond his authority. However he gave me the summary of the report of building safety in Germany. Since the report includes very global data in Germany, unfortunately it didn't serve the purpose of my study.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.8-

COUNTRY	Germany
CITY	Bonn
DATE	12.February.2008
INSTITUTION	Federal Office for Building and Regional Planning
CONTACT PERSON(S)	Dr. Bernard FISCHER, Civil Engineer Mr.Christian AHRENS, Biologist
TOPIC	Existing Studies on Disaster Mitigation at Federation Level
ISSUES DISCUSSED	<p><u>Recent Disaster Activities of Federal Office for Building and Regional Planning:</u></p> <p>In addition to the information given by Mr. Spangenberg, Dr. Fischer informed that there is a ongoing study for the topic of climate change in the Federal Office for Building and Regional Planning. A working team has prepared this study as three volume books. The first volume will contain building protection measures and techniques for flood protection, the second one contains the legal frame, and the third one contains climate change issues.</p> <p>Dr. Fischer also informed that the related experts from the Federal Office regularly participate the workshops of the Academia for Spatial Research and Planning(=Akademie fuer Raumforschung &</p>

	<p>Landesplanung) to exchange information & experiences.</p> <p><u>Institutions and Contact Persons Related with My Study:</u></p> <ul style="list-style-type: none">➤ Federal Office for Building and Regional Planning/ The Construction Office in the Ministry of Education- Peter GEORGIAN➤ University of Munich-Ivana MALA
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**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.9-

COUNTRY	Germany
CITY	Bonn
DATE	13.February.2008
INSTITUTION	Federal Office for Building and Regional Planning
CONTACT PERSON(S)	Mr. Peter GEORGIAN, Civil engineer
TOPIC	Disaster Response and Building Standards
ISSUES DISCUSSED	<p><u>THW(Technische Hilfswerk)</u></p> <p>The Federal Agency for Technical Relief (THW: Technische Hilfswerk) is an organization for civil protection and disaster assistance. THW is report to the Federal Ministry of Interior. It has major responsibilities in disaster response and search & rescue activities. In the search and rescue team of THW there are many volunteer participators. Mr. Peter Georgian is one of them while he works in the Federal Office for Building and Regional Planning as a civil engineer. He informed me about the performance of THW and his international experience on search and rescue activities. For the detailed information about THW the following web-site will be useful:</p> <p>http://www.thw.bund.de</p> <p><u>Legislative Frame</u></p> <p>In Germany, the legal responsibilities of disaster management and civil protection are shared among the federal(central) government and federal states. At the</p>

federation level there is a "Civil Protection Law"(Zivil Schutz) which is applied in the case of foreign threat and war. At the federal level, each Federal State has its own disaster management law (Katastrophen Schutz Gesetze).

Mr. Georgian mostly informed me about the activities of The Federal Agency for Technical Relief (THW). The search and rescue team of the Agency has activities depending on these two laws above. While the main mission of team focuses on disaster response, it can take part in the crisis organization in the case of country wide crisis.

DIN4149

I also asked him some question about building codes and standards. He gave me the original DIN 4149 document. Since the original language is German, I have been informed about the content of DIN4149. The document basically includes the earthquake risk zones of Germany (there are 4 earthquake categories in Germany), building standards and formulas should be applied in the construction for each zone. Despite Germany is a country less frequently threatened by earthquakes, already prepared its own standards with a view to different earthquake risk zones. These standards were updated in 2002 due to EU standardization. As a European Union standard, Eurocode 8 (Design provision for earthquake resistance of structures) provides a framework rather than detailed bundle of standards, each Member States will prepare its own detailed legislation. However the DIN4149 is not an obligatory document but technical guidance in construction.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.10-

COUNTRY	Germany
CITY	Cologne
DATE	19.02.2008
INSTITUTION	Sub-district Authority of Cologne (Regierungsbezirk Köln)
CONTACT PERSON(S)	Mr. Helmut BLEEKER, Head of Department
TOPIC	Existing Spatial Plans of Cologne Region and Disaster Mitigation Approaches in Spatial Plans
ISSUES DISCUSSED	<p><u>Planning Law and Institutional Responsibility:</u></p> <p>In Germany", planning procedures are handled in Federation Level, Federal State Level (for the City of Cologne the North Rhine-Westphalia State), Sub-district Level (Koeln Regierungsbezirke), and Municipal Level (Stadt und Gemeinde). The Sub-district Authority and Municipality of Cologne are two major plan preparation institutions for the region of Cologne. The sub-district of Cologne covers the sections of Cologne, Bonn, and Aachen. The Municipality of Cologne prepares detailed implementation plans in conformity with larger scale (1/50 000) regional plans prepared by the sub-district authority of Cologne.</p> <p>The Sub-district Authority of Cologne prepares regional</p>

plans in accordance with the Regional Planning Act of the North Rhine-Westphalia (Bundesraumordnungsgesetz & Landesplanungsgesetz). The regional plans are prepared in 1/50 000 scale which include the existing land-use and regional development features. The regional plan is constituted of spatial plans and the plan report. While the sub-district Authority of Cologne is responsible for the preparation and modification of plans, the Regional Council of Cologne is responsible for the ratification and decision making for plans. The council takes decisions about the main regional planning problems and discusses on loan programs. The Regional Council is constituted with deputies of the Federal State. That is to say, the Regional Council of North Rhine-Westphalia constitutes with deputies of the Federal State of North Rhine-Westphalia.

The sub-district Authority of Cologne is obliged to inform the Regional Council about the main regional developments and spatial planning issues namely, town planning, residential areas and construction, education, health, sports facilities, traffic planning, cultural and touristic facilities, recreation and landscape planning, drinking water, waste management, and sanitation.

Existing Regional Plan of Cologne:

In my institutional visit, the head of the department, Mr. Helmut BLEEKER had informed me about the main planning features of the Cologne. The regional plan of Cologne is prepared in 1/50 000 scale for the following 15 years. It constitutes with two parts namely, Cologne and Bonn areas. Since Mr. Bleeker and his staff did not

speaking English sufficiently, they advised me to visit the website of "Koeln Regierungsbezirke".(www.bezreg-Koeln.nrw.de) After my visit, they sent me a well prepared folder of Cologne's plans including the plan reports. The existing regional plan of Cologne was ratified in 2006.

Disaster Mitigation Approaches on the Regional Plan:

The regional plan of Cologne reflects only the anxieties of flood. Despite high seismic risks of Cologne, geological failure areas or fault lines do not take place on the plan. After some flood invasions in Cologne, it is possible to see some areas in the plan such as flood invasion area, flood protection area, and flood potential areas. The planning authority brought some rules of usage according to the level of flood risks. In the regional plans flood risky areas and flood invasion areas are shown as zones. The details are reflected in local scale municipal plans. The Sub-district Authority of Cologne controls the local scale municipal plan in the aspects of flood prevention measures.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.11-

COUNTRY	Germany
CITY	Bonn
DATE	20.February.2008
INSTITUTION	Ministry of Interior/Federal Office for Civil Protection & Disaster Response/Center for Critical Infrastructure Protection
CONTACT PERSON(S)	Mr. Christoph RIEGEL
TOPIC	Disaster Legislation and Critical Infrastructure Studies in the Federal Office
ISSUES DISCUSSED	<p><u>Disaster Legislation in Germany:</u></p> <p>In Germany, the legal responsibilities of disaster management and civil protection are shared among the federal (central) government and federal states. At the federation level there is a "Civil Protection Law"(Zivil Schutz) which is applied in the case of foreign threat and war. At the federal level, each Federal State has its own disaster management law (Katastrophen Schutz Gesetze).</p> <p><u>Responsible Institutions and Organizations:</u></p> <p>Since the terrorist attack in USA on 11th of September, 2001 and the flood event of the River Elbe in 2002, Germany changed her system of emergency and disaster prevention. The federal government developed a new strategy with the cooperation of 16 federal states. According to this new strategy while the federal government is responsible for national defense, the federal states are responsible for disaster prevention and</p>

response. In the case of crisis or extreme events in the country, the federal government and federal states organize a joint program comprising participation of municipalities and relief organizations.

Mission of the Federal Office for Civil Protection & Disaster Response:

The Federal Office of Civil Protection and Disaster Assistance (Bundesamt fuer Bevoelkerungsschutz und Katastrophenhilfe) was founded on 1st of May, 2004 due to the reason of terrorist attacks in 2001 and flood event of the River Elbe in 2002. The mission of this office is to contribute the new strategy of Federal Government on the protection of the population in Germany. Together with the Federal Agency for Technical Relief (THW: Technische Hilfswerk), the Federal Office are report to the Federal Ministry of Interior. These two organizations mainly focus on civil protection and disaster assistance. While THW has major responsibilities in disaster response and search & rescue activities, the Federal Office for Civil Protection and Disaster Assistance has responsibilities on planning and preparation of civil protection measures, building cooperation with the federal government in the case of danger and foreign threat, training of decision makers and executive staff in the country, organizing medical and hygienic measures against epidemics and biological threat, building public warning system and organizing public awareness campaigns, developing scientific researches and studies on related topics, and execution of critical infrastructure activities.

Activities of Center for Critical Infrastructure Protection:

For the initiation of the protection of critical infrastructures, the Federal Office for Civil Protection and Disaster Assistance drafted a "Guideline for the Establishment and Operation of Emergency Electricity Supply in Authorities and Other Important Public Facilities" in 2005 to establish and maintain a reliable emergency electricity supply. This guideline aims to create awareness of the risk in electricity provision and to give recommendations for authorities to maintain basic services in the case of power interruptions. Then, this concept was developed for all types of infrastructure. Critical infrastructures are categorized by the Federal Office of Civil Protection and Disaster Assistance as energy, information and telecommunication technology, supply (water supply and waste water disposal, food supply, healthcare, emergency and rescue services), dangerous substances, traffic and transport, finance, monetary system and insurance, authorities and administration, further critical infrastructures (media, major research facilities, cultural property).

The mission of protection of critical infrastructures is providing a technical frame for enterprises in Germany to reduce the vulnerability of critical infrastructures to natural hazards, accidents, criminal acts and terrorist attacks. This technical frame includes recommendations on construction, organisational, personnel and technical protection of infrastructure facilities. That is to say this technical frame is not an obligatory legal document but a guidebook for the maintenance of infrastructural facilities. The Federal Office of Civil Protection and Disaster Assistance has informed enterprises, authorities and

citizens about the importance of the protection of critical infrastructures, tried to build and develop co-operations between public and private sectors; made analysis and proposed short-, medium- and long-term measures for the protection of critical infrastructures.

The Federal Office of Civil Protection and Disaster Assistance prepared a questionnaire and a checklist to facilitate the study. In these documents there are many questions about analysing the risk of the company in the respects of general safety of working place, geographic location of the company, the type of facility or the sector of production, interaction with other infrastructures, and the capacity of public cooperation in emergencies. The documents also analyze risk factors such as employees, organizational structure of the work, natural threats (natural disasters, epidemics), and the technology used. After the companies filled this document, recommendations and proposals for short-, medium- and long-term measures are done by the Federal Office of Civil Protection and Disaster Assistance. Since all these studies depend on voluntary participation of companies, all improvements for critical infrastructures could be done by only voluntary participator companies.

I would like to thank for Mr.Christoph RIEGEL to help me to contact some companies in Cologne who voluntarily filled the questionnaires and submitted to the Federal Office. Despite many phone calls, I could not get any success to make interviews with them. If I had made, I would have some opportunity to draw disaster resilience profile of companies and/or industrial establishments in Cologne.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.12-

COUNTRY	Germany
CITY	Bonn
DATE	28.March.2008
INSTITUTION	UN-Spider Office of Bonn
CONTACT PERSON(S)	Dr. Robert BACKHAUS, Project Manager
TOPIC	Last Developments in Disaster Activities of UN-Spider Office
ISSUES DISCUSSED	<p><u>Last Activities of UN-Spider:</u></p> <p>UN-Spider recent activities can be stipulated as follows:</p> <ul style="list-style-type: none"> • Central American Probabilistic Risk Assessment Platform (CAPRA) • EU Plans to Reinforce Disaster Response Capacity by End 2008 • E-Health and Telemedicine Associations of Germany, Austria and Switzerland Join Forces • Google and UN Team Up to Map Refugee Crises • ITU Vows to Lend Mobile Satellite Telecoms for Disaster Preparedness • Emergency and Disaster Information Service (EDIS) • High Resolution Population Maps for Low Income Nations: Combining Land Cover and Census in East Africa • European Commission's Research and Technological Development Framework Programme - Call for Proposals • Joint GEO and UNOOSA/UN-SPIDER Special Session at the International Disaster and Risk Conference IDRC, 25-

29 August 2008, in Davos, Switzerland

- Internship Opportunities

UN-Spider Organization already designed a “Conferences & Workshops” part in its own web-site. In addition to various international conferences and workshops UN-Spider organizes some following activities in the till November 2008:

- Working Meeting: United Nations Initiatives in the Area of Risk and Disaster Management and Emergency Response and Space-based Solutions and Information in New York/USA, 8 May 2008.
- United Nations Regional UN-Spider Workshop: Building Upon Regional Space-based Solutions for Disaster Management and Emergency Response for the Caribbean in Barbados, 8-11 July 2008.
- United Nations Regional UN-Spider Workshop: Building Upon Regional Space-based Solutions for Disaster Management and Emergency Response for the Pacific Region in Fiji, September 2008.
- Second United Nations International UN-Spider Bonn Workshop: Disaster Management and Space Technology-Bridging Gap in Bonn/GERMANY, 13-15 October 2008.
- 5th UN-wide Meeting on the Use of Space Technologies for Emergency Response and Humanitarian Assistance in Bonn/GERMANY, 16-17 October 2008.
- Iranian Space Agency/ UN-Spider Regional Workshop: Building Upon Regional Space-Based Solutions for Disaster Management and Emergency Response in Tehran/Islamic Republic of IRAN, 6-8 October 2008.

A Study on Cologne Cathedral:

Dr. Backhaus proposed me to review the article about the Cologne Cathedral because the University of Cologne has an earthquake simulation program to assess the vulnerability of the

Cathedral in the course of earthquakes.

In this article it is informed that the City of Cologne has been threatened by earthquakes since Roman Era. Since the Bay of Cologne has been an earthquake risky area, there are many historical traces of earthquake preventive measures in buildings and their establishments.

In light of this background, the University of Cologne has carried out further studies on the earthquake vulnerability. For that purpose the University of Cologne has not only studies on the historical seismic background of Cologne but also on some computer simulations for the possible earthquake hits. The Cologne Cathedral was chosen as a case study in that computer simulation program. As a result of this program, the towers of the Cathedral do not break down but deviate seven centimeters from its original vertical line. There are also some damages in ornamental elements of towers.

The University of Cologne explained that all these hazard features were derived from only one computer simulation program. Hence, there is cooperation between the University of Cologne and Berlin to show the various damage levels with different magnitudes of earthquakes. This cooperative study will also show the effects of various earthquakes hits on the Cathedral after some preventive measures.

The original text is on the following web-page in German.

Webpage:<http://www.3sat.de/3sat.php?http://www.3sat.de/nano/cstuecke>

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.13-

COUNTRY	Germany
CITY	Krefeld
DATE	8.May.2008
INSTITUTION	North Rhine-Westphalia State Office of Geological Survey (Geologischer Dienst NRW)
CONTACT PERSON(S)	Dr. Klaus LEHMANN, Director
TOPIC	Geological and Seismic Conditions of North Rhine Westphalia State
ISSUES DISCUSSED	<p><u>North Rhine Westphalia State Office of Geological Survey</u></p> <p>The NRW State Office of Geological Survey which reported to the NRW Ministry of Economics, Energy and Medium-size Enterprises (Ministerium für Wirtschaft, Energie und Mittelstand des Landes Nordrhein-Westfalen) was founded in 1957. Its observatory was founded in 1980 with 3 borehole seismometer stations. Recently, it has 13 seismic receiver stations. According to its catalogue, there are over 1100 tectonic seismic events since 1980.</p> <p><u>The Task of the Office and Earthquake Codes</u></p> <p>The task of the office is answering geo-seismic questions of the institutions and individuals in the North Rhine-Westphalia, preparing geological maps of the NRW State, making ground survey and soil analyses, recording seismic data of Lower Rhine embayment, and reporting tectonically-induced seismic conditions of NRW State to the NRW Ministry of Economics, Energy and Medium-size Enterprises.</p>

The legislative frame of the State Office of Geological Survey is drawn by the Disaster Management Law of North Rhine-Westphalia (Katastrophen Schutz Gesetze der Nord Rhein West Fallen: Gesetz Ueber den Feuerschutz und die Hilfeleistung) and various types of building+construction codes. The building code of DIN 4149 is obligatory in the Federal State of North Rhine-Westphalia by the decree issued by NRW Ministry of Building and Traffic on 30th of November, 2006 after DIN 4149 was updated according to the EU earthquake standards, namely Eurocode 7 & 8. The State Office prepared an implementation map of DIN 4149 earthquake zones for the Federal State of NRW. According to this map, it is clearly shown which town and/or small district belongs to which earthquake zone. There is no confusion to inform citizens about the earthquake zones in which their dwelling units take place.

In addition to DIN 4149 there also some other construction codes such as DIN 19700 for dams, KTA 2201 for nuclear power plants. All these types of codes are obligatory in the Federal State of NRW. The Association of Chemical Industry (=Verband der Chemischen Industrie) initiated a Guidance for Chemical Establishment (Leitfaden). This guidance is in developing process and used by the State Office.

Geological Studies and Seismic Observatories in the State of North Rhine Westphalia

There are three seismic observatories in the North Rhine-Westphalia State. These are the Observatory of the Ruhr University in Bochum, the Observatory of North Rhine-Westphalia (NRW) State Office of

Geological Survey, and the Observatory of Bensberg in the Universities of Cologne. The Ruhr-University of Bochum, Institute of Geology, Mineralogy and Geophysics has been operating with its network (BUG) in the Ruhr coal mining area. They focus on mining-induced seismic events in this region. The Seismic Station Bensberg of Cologne University (BNS) has been working as a research institute in seismic field. The Geological Survey of North Rhine-Westphalia (Geologischer Dienst NRW) has been operating its network (GD NRW) focussing on tectonically-induced seismic events in the Lower Rhine Embayment and its surroundings.

The NRW Ministry of Economics, Energy and Medium-size Enterprises recently organized an initiative to join these 3 different observatories into one network called "Earthquake Network of NRW" (Erdbebennetzwerk NRW). The negotiations, technical and academic studies about this initiative are still continuing.

Problem Areas

Dr. Lehmann pointed out three sets of problems that they have:

1. A need for financial support to the State Office of Geological Survey
2. Lack of coordination among three different observatories in the State of North Rhine-Westphalia
3. Lack of coordination among four different federal states along the River Rhine despite the fact that seismic features and earthquake threats are similar in regions extended along the Rhine.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.14-

COUNTRY	Germany
CITY	Potsdam
DATE	19.May.2008
INSTITUTION	The Center of Geological Search in Potsdam (Geoforschungszentrum Potsdam)
CONTACT PERSON(S)	Prof.Dr. Jochen ZSCHAU, Director of Department Dr. Heiko WOITH, Geologist
TOPIC	Seismic Studies in Germany and Turkey
ISSUES DISCUSSED	<p>The Center of Geological Research in Potsdam has many international geo-seismic studies and some projects in Turkey. During my visit to the center our conversation was mostly focused on the seismic features and vulnerability of Cologne and Yalova. Prof. Zschau has many studies and publications on Cologne in cooperation with his colleagues. Most of those publications are already used in my study.</p> <p>For Turkey and Yalova, Prof. Zschau and his working team has also many finished and some ongoing projects. The recent project on Yalova aims to build a seismic observatory network. On that topic, the contact person of the project namely, Dr.Heiko WOITH gave me a detailed explanation. We agreed on to exchange information about Yalova.</p>

Recommended Publications for My Study:

Prof. Zschau showed me many interesting power point presentations on the seismic assessment of Germany and Cologne, and vulnerability analysis of Cologne. However many data and information are not in an appropriate format to use in doctoral study, he could only suggest me a recently published article in the Natural Hazards and Earth Sciences. This article was prepared by Tyagunov, Gruenthal, Wahlstroem, Stempniewski, and Zschau in 2006. The title of the article is "Seismic Risk Mapping for Germany".

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.15-

COUNTRY	Germany
CITY	Aachen
DATE	23-24.May.2008
INSTITUTION	University of Aachen (RWTH)
CONTACT PERSON(S)	Prof.Dr. Konstantin MESKOURIS, Vice President of the University
TOPIC	Seismic Risks and Related Studies in Germany and Turkey
ISSUES DISCUSSED	<p><u>Seismic Studies and Earthquake Engineering:</u></p> <p>Since Prof. Meskouris has been involved many international and national scale earthquake projects, I learned a lot about the vulnerability assessment and strengthening methods to make super structures earthquake resilient. Especially he gave estimated financial losses in Cologne in the case of earthquakes with more than 6 magnitudes. These figures were calculated by MunichRe by considering only hazards of super structure. So far, no institution or authority has calculated loss in infrastructure in the case of earthquake. However the loss in infrastructure is more expensive than the super structure. The more, the renovation of damaged infrastructure needs more money and time comparing to the renovation of super structure.</p> <p>We also argued on the following formula frequently used for earthquake reoccurrence time:</p> <p>$T=1/P_e$ (T: return period/reoccurrence time P_e: probability of exceedance)</p>

Despite the fact that geosciences have some limited information about the earth, how much can we rely on this formula to be safe in earthquake prone areas? This question is the focus of our discussion. Prof. Meskouris explained that the formula above can be used efficiently in the static and engineering calculations of a building taking into consideration of the duration of that building. In preparation of spatial plans or development plans of settlements, authorities should consider multi-dimensional earthquake risks and a broader perspective for the future of settlements.

Donated Publications from Prof. Meskouris:

Prof. Meskouris generously gave many of his publications and presentations to me. In addition to his publications he also gave me the following publications to support my study:

- Karimi, I. ;(2005): Risk Management of Natural Disasters: A Fuzzy-Probabilistic Methodology and Its Application to Seismic Hazard, Aachen.
- Sadegh-Azar, H. ;(2002): Schnellbewertung der Erdbebengefaehrdung von Gebaeuden, Aachen.
- Mistler, M. ;(2006): Verformungsbasiertes Seismisches Bemessungskonzept fuer Mauerwerksbauten, Aachen.
- Kuhlmann, W. ;(2004): Gesamtkonzept zur Ermittlung der Seismischen Vulnerabilitaet von Bauwerken am Beispiel Unterirdischer Rohrleitungen, Aachen.
- Renault, P.L. ;(2007): Bewertungsverfahren zur Beurteilung der Erdbebensicherheit von Brueckenbauwerken, Aachen.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.16-

COUNTRY	Turkey
CITY	Ankara
DATE	23.September.2008
INSTITUTION	Turkish Ministry of Public Works & Settlement
CONTACT PERSON(S)	Mr. Koray CAKAN, Division Chief
TOPIC	Spatial Plans of Yalova
ISSUES DISCUSSED	<p><u>Spatial Plans of Yalova since 1999 Earthquake</u></p> <p>When the earthquake hit Yalova in 1999, Yalova had a plan in 1/25 000 scale approved by the Ministry of Public Works and Settlement. The plan called "Cinarcik-Yalova-Karamürsel Master Plan" was cancelled in 18.6.2002 due to the fact that the plan did not respond needs of the settlement anymore. After the earthquake, 1/5000 and 1/1000 scale plans were prepared by the Ministry for new settlements areas of disaster prone citizens. At the same time the Ministry approved a frame of principles which lead municipalities how to prepare spatial plans in Yalova. This frame of principles explains principles and standards of spatial plans while lays down rules and standards for buildings in various earthquake risky areas such as alluvial lands, land slide areas, etc.</p>

Turkey introduced with various new planning laws and authorities after 2004. Due to these new planning authorities e.g. Provincial Special Authorities, Yalova have a recent spatial plan in 1/25 000 scale. This plan was approved in coordination with the Municipality of Yalova and the Provincial General Council in 8.6.2007. Mr. Cakan also informed about the plan consultant firm for that Yalova Plan. It is possible to find detailed information about the plan, planning notes, and plan report in the following website of the firm:

www.modulplanlama.com.tr

In 8.8.2008, the Ministry of Public Works & Settlement also prepared and approved a large scale plan for Yalova and Izmit Gulf area where is significantly prone to earthquakes. The plan was prepared on the concept of Integrated Coastal Zone Management along Izmit Gulf and Yalova coastal area. It aims to design main policy and principles for land uses in the planning area. The Ministry prepared this plan in 1/50 000 scale and approved based on the Public Works Law (Law No. 3194) and the Coastal Law (Law No. 3621). In addition to these large scale spatial plans, the Ministry of Public Works and Settlement approved various coastal area plans (including quays, naval docks, marinas) in 1/1000 scale depending on its authority in the Coastal Law (Law No.3621).

Planning Responsibilities of the Ministry of Public Works & Settlement so far

As it was already mentioned new institutions started to take part in spatial planning field after 2004 in Turkey. While the Ministry of Public Works & Settlement was

the main institution for plan preparation and approval, some central and local authorities were eager to take responsibilities in the field of spatial planning. Metropolitan Municipalities have the responsibility of large scale plans in their metropolitan boundaries by the Law of Greater Municipality (Law. No. 5216) issued in the official gazette of 23.7.2004, no. 25531. Municipalities differ than Metropolitan Municipalities also have larger planning authorities by the new Law of Municipality (Law. No. 5393) issued in the official gazette of 13.7.2005, no. 25874. Provincial Special Authorities have new planning authorities by the Law Provincial Special Authority (Law.No. 5302) issued in the official gazette of 4.3.2005, no. 25745. The Ministry of Environment & Forestry has also new planning authority by a change in the Law of Environment (Law.No. 2872) in 26.4.2006.

The Ministry of Culture & Tourism has new planning authorities by a change in the Law of Promotion of Tourism (Law.No. 2634) in 24.7.2003. By this change, the Ministry of Culture & Tourism has a planning authority in the "tourism centers" and "regions for protection and development of tourism".

As a result of these new legislation and new planning authorities, a chaotic atmosphere in spatial planning is inevitable. As an oldest planning authority, the Ministry of Public Works & Settlement published a circular in 2008 to lead central and local planning authorities in the case of confusion about plan changes or preparations.

**INSTITUTIONAL VISITS AND INTERVIEWS
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-I.17-

COUNTRY	Turkey
CITY	Ankara
DATE	24.September.2008
INSTITUTION	Turkish Prime Ministry/ General Directorate of Turkish Emergency Management
CONTACT PERSON(S)	Mr. Hasan IPEK, General Director
TOPIC	Disaster Legislation in Turkey
ISSUES DISCUSSED	<p><u>Updates in the Existing Disaster Legislation and the Future Status of the General Directorate of Turkish Emergency Management in Turkey</u></p> <p>The General Directorate of Turkish Emergency Management was established by the Decree Law No. 583 of 15 November, 1999 and No. 600 of 14 June, 2000. The department is charged with taking necessary precautions for the efficient functioning of emergency management in events of the earthquakes, landslides, fires, accidents, meteorological disasters, nuclear and chemical accidents and immigration movements affecting the safety of the country. The department also tasked with coordinating institutions implementing studies on precautionary measures taken to prevent or mitigate disasters, on search and rescue activities and on the improvement facilities after disasters. Yet, this General Directorate thus far fails to operate effectively</p>

due to staff and budget constraints.

Mr. Ipek informed about the draft law on "Tasks and Organization of the Directory of Disaster and Emergency Management". This draft law is prepared on 18.03.2008 and in the process of examining by the Parliament. The draft law aims to regulate conflicts among various institutions in Turkey to play similar roles in disasters such as General Directorate of Disaster Affairs, General Directorate of Civil Defence, and General Directorate of Turkish Emergency Management.

The proposed Directory of Disaster and Emergency Management will be reported to the Prime Ministry. According to Mr. Ipek the draft law has some disadvantageous with respect to abolish old institutions. E.g. the General Directorate of Civil Defence does not only serve in disaster times but also in external threats to the country. Nevertheless the draft law aims to serve in all disaster, emergency, and civil defence conditions.

If the draft law will be accepted by the Parliament, a remarkable reform will occur among disaster institutions which have displayed in disasters more than 50 years.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.18-

COUNTRY	Germany
CITY	Cologne
DATE	4.March.2009
INSTITUTION	The Metropolitan Municipality of Cologne/ Department of City Planning
CONTACT PERSON(S)	Mr. Rainer Drese, Director of Preparatory Land-use Planning
TOPIC	Relationships and Coordination Activities between Disaster Mitigation Projects and Local Plans
ISSUES DISCUSSED	<p><u>Brief information on Local Plans:</u></p> <p>In accordance with the Regional Plan of Cologne, preparatory land-use plans (Flaechennutzungsplan) and detailed land-use plans (Bebauungsplan) are prepared in the municipal level. The preparatory land-use plan (in 1:20 000, 1:10 000, 1:5 000 scales) determines the main features of the different types of land-uses for the whole area of the municipality. The detailed land-use plan (in 1:2 000 and 1:1 000 scales) determines the legally binding designations for small areas as a basis for building permissions.</p> <p><u>Coordination Procedure of Local Plans with Disaster Mitigation Issues:</u></p> <p>While local plans are prepared the Department of City Planning invites all planning related authorities such as the Regional Planning Authority, the Department of Environment, The Flood Protection Authority, The</p>

Department of Transportation, etc. for a meeting. All authorities and departments invited come to the meeting with their documents relevant to the plan proposal. After having a consensus on plan decisions, the Department of City Planning puts the plan proposal into the ratification process.

With this approach, plan decisions and land-use decisions in Cologne obey the disaster mitigation approaches. Despite the fact that fault lines, seismic risky zones and alluvial plains are not reflected to local plans of Cologne, buildings safety is maintained by coordination of the Department of Geology and the Department of Building Permits which applies DIN 4149 standards.

For flood protection issues, local plans are prepared in accordance with the Regional Plan of Cologne prepared by Sub-district Authority (Köln Regierungsbezirke). Since the regional plan has flood protection zones and relevant planning notes clarifying land-use issues, local plans are automatically reflect these decisions into a local scale.

**INSTITUTIONAL VISITS AND INTERVIEWS
ON DISASTER MITIGATION**

-I.19-

COUNTRY	Germany
CITY	Berlin
DATE	22.April.2009
INSTITUTION	The Union of German Insurance Companies in Berlin (Gesamtverband der Deutschen Versicherungswirtschaft e.V.)
CONTACT PERSON(S)	Dr. Ulrich Broecker, Senior Officer
TOPIC	Existing data on earthquake insurance in Cologne
ISSUES DISCUSSED	<p><u>Insurance Companies and the Union of German Insurance Companies (GDV):</u></p> <p>The Union of German Insurance Companies (GDV) is the umbrella organisation for private insurers in Germany. At present, it counts 457 member companies (see also www.gdv.de). The GDV publishes annual periodicals which include data on various lines of insurance business, such as life, home, car insurances. The GDV collects these data from the member insurance companies to make annual analyses and assessments. Member insurance companies use these analyses and assessments for their future business planning.</p> <p>Furthermore, the GDV is a source of expert information about topics related to the insurance sector for both insurance companies and the public. The GDV provides guidance to its members on developing better strategies in response to new social and political</p>

developments.

Existing Conditions of Earthquake Insurance in Cologne:

GDV prepared a seismic risk map of Germany in terms of earthquake insurance premiums. This map was prepared based on data of the geo-seismic hazard map of the Center of Geological Research in Potsdam. According to the seismic risk map of GDV, there are three different seismic risk zones (1: Less seismic risk zone 2: Medium seismic risk zone 3: High seismic risk zone). The region between Aachen and Cologne locates in the second seismic risk zone.

Although, the GDV in principal recommends inclusion of earthquake coverage in elementary insurance packages, not all members follow this recommendation. Thus, there are some differences of elementary insurance packages in Cologne, too. The GDV has only the number of residential insurance contracts of Cologne. $\frac{1}{4}$ of these insurance contracts cover elementary insurance package. However there are three indefinite features for the number of insured residential units in Cologne. First, the GDV does not have any data for non-insured residential units. Second, since a contract owner may have more than one residential unit, the number of insurance contracts is not helpful to see the proportion of insured dwelling units in Cologne. Third, the GDV is not informed the details of elementary insurance contracts whether they cover earthquake risks or not.

Due to complexities in calculating risk insurance in the

	<p>industrial and commercial sectors, member companies do not provide detailed data on the operations of these sectors to the GDV. In sum, data of the GDV cannot give a clear view of Cologne in terms of earthquake insurances.</p>
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ANNEX II: A QUESTIONNAIRE ON COLOGNE

Annex II.1. Academics

CONTACT PERSON : Dr. Robert Backhaus
OCCUPATION : Director of the UN-Spider in Bonn (He has been living in Aachen. He used to work in Cologne for 22 years till 2008)
DATE :15.January.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes, I learned this risk due to the earthquake in the early 1990s. I woke up at night with the shake of this earthquake.

☞ If yes, what do you know about the seismic risk in Cologne?

As far as I know, the seismic risk in Cologne is rather moderate.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk;*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

- Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.
- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✍ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Yes, I felt safe during the time I worked in Cologne.

2. Do you consider your moveable and immoveable assets to be safe?

Since I used to work in DLR, I felt safe. Another reason to feel safe is the probability of traffic accident or serious illness is more than a earthquake risk.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

I am only concerning of physical injury in case of earthquakes.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

According to the scenario, the district of Wessling (an industrial site located on the southern part of Cologne) can bring extra risks due to its industrial establishments.

5. Do you have an earthquake insurance? (home, car, furniture, life)

I have a home insurance but I am not sure whether it includes earthquakes or not.

6. What type of precautions have you taken for the case of earthquakes?

Nothing.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

Even if I experienced an earthquake with a construction damage in Cologne, I would only think to change my office. I don't think to move to another town. Especially compare to the damage experienced just after the 2nd World War in Cologne, an earthquake will not create more damage.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

Despite I am in charge of organizing space technology activities for natural disasters in the Un-Spider, I only heard your doctoral study about the disaster resilience of Cologne.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- **The Federal State Parliament in cooperation with the NRW Parliament would be best suited for enhancing earthquake resilience in terms of legal enforcement.**
- **Media would play important role to build political pressure up for earthquake resilience.**

CONTACT PERSON : Dr. Robert Backhaus
OCCUPATION : Director of the UN-Spider in Bonn (He has been living in Aachen. He used to work in Cologne for 22 years till 2008)
DATE :15.January.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes, I learned this risk due to the earthquake in the early 1990s. I woke up at night with the shake of this earthquake.

☞ If yes, what do you know about the seismic risk in Cologne?

As far as I know, the seismic risk in Cologne is rather moderate.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk;*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*

- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✎ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✎ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. **With such a scenario in mind, do you feel safe living in Cologne?**

Yes, I felt safe during the time I worked in Cologne.

- 2. Do you consider your moveable and immovable assets to be safe?**

Since I used to work in DLR, I felt safe. Another reason to feel safe is the probability of traffic accident or serious illness is more than a earthquake risk.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

I am only concerning of physical injury in case of earthquakes.

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

According to the scenario, the district of Wessling (an industrial site located on the southern part of Cologne) can bring extra risks due to its industrial establishments.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

I have a home insurance but I am not sure whether it includes earthquakes or not.

- 6. What type of precautions have you taken for the case of earthquakes?**

Nothing.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

Even if I experienced an earthquake with a construction damage in Cologne, I would only think to change my office. I don't think to move to another town. Especially compare to the damage experienced just after the 2nd World War in Cologne, an earthquake will not create more damage.

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

Despite I am in charge of organizing space technology activities for natural disasters in the Un-Spider, I only heard your doctoral study about the disaster resilience of Cologne.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

- **The Federal State Parliament in cooperation with the NRW Parliament would be best suited for enhancing earthquake resilience in terms of legal enforcement.**
- **Media would play important role to build political pressure up for earthquake resilience.**

CONTACT PERSON : Dr. Juan Carlos Világran de León
OCCUPATION : Academic Officer and Head of Section Risk in the UN University (UNU-EHS) in Bonn (He is living in Bonn and specialized on earthquakes.)
DATE :14.January.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes, I learned from papers and other publications of German researchers.

However, as far as I concern, Cologne is not at considerable earthquake risk.

☞ If yes, what do you know about the seismic risk in Cologne?

- The risk of flood is higher than the risk of earthquake in Cologne.
- In terms of earthquakes, hazard and vulnerability is small in Cologne.
- Building codes are pretty good.
- There is no probability of a landslide triggered by earthquakes as experienced in (European countries) Italy, Turkey, Greece, Spain, (Other countries in the world) Japan, Latin American Countries, USA, Canada, Indonesia.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*

1) *The historical seismic background*

2) *The existing settlement conditions.*

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✍ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

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Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

- 1. With such a scenario in mind, do you feel safe living in Cologne?**

I may be a little bit less safe than other cities in Germany. Nevertheless I feel definitely much safer in Cologne than other cities at earthquake risk in the world.

- 2. Do you consider your moveable and immovable assets to be safe?**

I have no car and I have been living in Bonn for four years in an apartment (in a two storey-building). If I lived in Cologne, my moveables and immovables would be safe.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

Yes, my state of preparedness is sufficient.

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

In my residential area, I feel safe due to the fact that building codes, service standards, and infrastructure facilities are remarkably good. In general, Germany is good at these standards.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

No, I don't have an earthquake insurance. I come from Guatemala and I have a rental apartment in Bonn. I have a life insurance but not specially covers earthquakes.

- 6. What type of precautions have you taken for the case of earthquakes?**

I have no precautions except some emergency package and survival techniques in the course of earthquakes.

7. **If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

I would do nothing because this worst case scenario is not enough threatening to move. Besides I cannot go to another city due to my job.

8. **Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

No.

9. **If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

- **Metropolitan Municipality of Cologne (City Council)**
- **Search and Rescue Team of the Federal Ministry of Interior (THW)**
- **Media**
- **Insurance companies**
- **Community organizations/focus groups**

CONTACT PERSON : Prof. Dr. Klaus Hinzen
OCCUPATION : Director of the Bensberg Earthquake Observatory in Cologne and the Lecturer in the University of Cologne
DATE :16.January.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- † Academics
- † Local authorities
- † Insurance companies
- † NGOs and citizen organizations
- † Members of the industrial and business sector
- † Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes, I am very well aware of this risk depending on my task and professional education for 35 years.

☞ If yes, what do you know about the seismic risk in Cologne?

I know about seismic hazards more than seismic risks in Cologne. In terms of seismic hazards, Cologne is the only city in Germany that has a seismic risk. Seismic hazard of Cologne is moderate. When I think about the future of Cologne, I perceive the seismic risk higher than other target groups in this interview. Despite the fact that the seismic risk seems as a low probability, it is not zero.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✍ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

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Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

I feel safe. The observatory was built on the rock base.

2. Do you consider your moveable and immovable assets to be safe?

My house is in Overath locates 12 km away from Cologne. I have an earthquake insurance after experiencing some earthquakes.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

Yes.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

I am sure that there will be no risk. Since Bensberg Observatory locates far from the city center, densely populated area, and industrial site, I feel safe. But if I worked in Wesseling, I wouldn't be safe.

5. Do you have an earthquake insurance? (home, car, furniture, life)

Yes, I have a home insurance for earthquakes.

6. What type of precautions have you taken for the case of earthquakes?

Since the Observatory is safe and has independent power supply, I do not need to take any precaution.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

Since I already took some precautions, I have nothing to do more.

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

As an observatory, we would like to build cooperation with other relevant institutions to create earthquake resilience. However, only Aachen Fire Brigade Department built a contact with us so far.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**
- I think that the most effective institution will be media. But it should be careful to choose an efficient media institution.**
 - Federal States' ministries**

CONTACT PERSON : Prof.Dr. Konstantin Meskouris
OCCUPATION : The Deputy President of the University of Aachen and Lecturer on the topic of Seismic Risks (He is living in Aachen but he professionalized on seismic risk on Germany and some other countries.)
DATE :4.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

Cologne is located on a seismic risk according to the German standards, namely DIN4149. Cologne is in the "Zone 2".

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

- Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.
- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.
- ✍ Many high-rise buildings and the Cathedral suffer moderate damage.
- ✍ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.
- ✍ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.
- ✍ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

- 1. With such a scenario in mind, do you feel safe living in Cologne?**

Yes, I feel safe because I trust on relevant authorities to cope with the emergency management.

- 2. Do you consider your moveable and immovable assets to be safe?**

I feel safe because I live in a relatively new building (built in the period of 1960-1970). If I lived in an old building (built before 1950s), I would examine the details of construction and try to discover weaknesses. As far as I concern, in general, the building safety is sufficient in Cologne. But there may be some risks in industrial sites, high rise buildings, bridges, and infrastructure due to the ground soil structure.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

If I lived in Cologne, my state of preparedness would be basically sufficient. I am broadly aware of seismic risks and prepared for earthquakes due to my professional background and private past (I come from Greece where is prone to earthquakes.)

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

I do not perceive extra risks in case of an earthquake with intensity 7. However areas close to chemical plants, power plants, and industrial site are at risk.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

If I lived in Cologne, I would have an earthquake insurance.

- 6. What type of precautions have you taken for the case of earthquakes?**

If I lived in Cologne, I would examine the construction details of my house. And if possible, I would search for an extra insurance.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

I would temporarily move from Cologne with my family and valuables (50km away from Cologne is enough.).

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

I have not been informed especially about the City of Cologne, but DKKV has dealt with similar projects for all Germany.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

- Search and rescue teams like THW and other aid NGOs such as the Red Cross**
- Media could play an important role to raise public awareness.**

Annex II.2. Local Authorities

CONTACT PERSON : Dr. Klaus Lehmann (He used to live in Domstrasse in Cologne in the period of 2000-2003)
OCCUPATION : Division Chief of Geophysics and Earthquake Safety in the Geological Department of NRW
DATE :5.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

We are living in a moderate seismic hazard region and Cologne is a part of this region. With respect to Cologne's seismic background, several earthquakes can occur in the future. Cologne is vulnerable due to the fact that it is an economic and industrial center. In terms of transportation routes, Cologne is vulnerable, too. Especially River Rhine bringing extra risks to Cologne.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*

1) *The historical seismic background*

2) *The existing settlement conditions.*

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✎ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✎ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

No.

2. Do you consider your moveable and immovable assets to be safe?

No.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

No, I have no state of preparedness. At least, it is not in a sufficient level.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

I used live in the city center of Cologne. It was a very old district. Streets are very narrow. Thus debris can easily interrupt to access the area in case of the collapse of buildings. The more, an important bridge called Koeln-Deutzer Bruecke is close to this area.

5. Do you have an earthquake insurance? (home, car, furniture, life)

No.

6. What type of precautions have you taken for the case of earthquakes?

Nothing.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another

town, taking additional insurance, strengthening your building, ...)

I move to another town temporarily. Due to my job, I cannot move permanently.

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

I do not know any organization or project for the resilience of Cologne. But our institution is in charge of showing guidance in standards and principles of construction and renovation activities.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

- Local authorities and administrative persons

CONTACT PERSON : Dr. Martin Wesolowski
OCCUPATION : Public Officer in the Fire Brigade Department of Cologne (He is responsible for determining the best sites of fire brigade rescue stations in Cologne. He is also in charge of calculating the maximum number of rescue vehicles fitting into the central garage of the Cologne Fire Brigade Department.)
DATE :18.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics (Topic of his thesis on geomorphology of Cologne)
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

As a geographer, I think that this risk is not so big due to the probability of exceedance (10% probability of exceedance in 50 years). Besides there is no epicenter in the settlement of Cologne.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
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QUESTIONS:

1. **With such a scenario in mind, do you feel safe living in Cologne?**
When I am at the office, I do not feel safe. But I feel safe at home (He is living in Bruehl).
2. **Do you consider your moveable and immoveable assets to be safe?**
I consider that my movable and immovable assets are safe.
3. **Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**
Yes.
4. **If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**
Since Cologne is surrounded by chemical industry, gas pipelines, etc., an earthquake can trigger some accidents related with these sites.
5. **Do you have an earthquake insurance? (home, car, furniture, life)**
No.
6. **What type of precautions have you taken for the case of earthquakes?**
Nothing.
7. **If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**
I move to another town temporarily.
8. **Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- **For the organization issues, I believe that the Fire Brigade Department can work efficiently.**
- **For organizing resilience projects, the local authority namely, Building Permission Department can be suited in a coordination with the Geological Department of NRW (e.g. NRW Geologische Dienst).**

CONTACT PERSON : Helmut Bleeker
OCCUPATION : Head of the Department of Spatial Planning in
Cologne Regional Administration
DATE :17.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes. My graduate degree is in the University of Cologne, Department of Geology and Geography. One of my professor is used to be the director of Bensberg Earthquake Observatory in Cologne.

☞ If yes, what do you know about the seismic risk in Cologne?

As far as I know, the settlement of Cologne is not an epicenter of any earthquake so far. However, the region surrounding Cologne has some seismic features such as fault lines (Erft, Ruhrand, Feldbis, Viersen) and other geological failure areas e.g. sandy and alluvial ground. Roughly, it is possible to say that the east part of Cologne is safer than west part.

Facts:

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- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
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- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✎ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

- 1. With such a scenario in mind, do you feel safe living in Cologne?**

Despite of this worst case scenario, I feel safe in Cologne. My answer also depends on the duration of the earthquake. In this scenario, the intensity is only mentioned.

- 2. Do you consider your moveable and immovable assets to be safe?**

Since I am aware of the seismic risk in Cologne, I have a home insurance (I have been living in Euskirchen since my childhood). But I don't think that my car will be safe in such a scenario in Cologne.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

Yes, I think my personal preparedness is sufficient. Nevertheless, I am cautious for my the conditions of my office.

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

I do not think that buildings in surroundings can bring extra risk but bridges, pipelines, electricity lines and other cable lines. As far as I concerned, cables on the ground are safer than those in the underground.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

I have an earthquake insurance for my home which also covers the furniture.

6. What type of precautions have you taken for the case of earthquakes?

I have no precaution except the insurance.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

I would go to a holiday quickly. Since I have one-storey house, I feel safe at home. I also know the main construction details of my house. But regard to the risk at office, I would preferred to go somewhere for a short period of time.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- **Local authorities such as the Flood Protection Authority**
- **Politicians, mayors, and other important actors can attract the public attention and lead to new projects.**
- **Academics and technical staff can also play important role in coordination with local authorities.**

Mr. Bleeker's evaluation on institutional coordination in Cologne in relation the last question: According to Mr. Bleeker, the major difficulty in coordination stemmed from the conflict between the technical staff generates the spatial planning decisions and politicians. If political decisions are in conflict with technical spatial planning decisions, media are usually fast in drawing public attention and exposing the apparent priority of political over technical necessities. Compare to these conflicts experienced in

Turkey, Germany has one advantage that politicians cannot change the position of technical staff and bureaucrats easily. Another advantage of Germany is to have a federal administrative structure. Hence, different federal states can be governed by different political parties; there is a balanced political and administrative atmosphere. E.g. North Rhine Westphalia is governed by CDU, while Rhineland Palatinate is governed by SPD. As a conclusion, the competition may create better results in administration and governmental policies in terms of public benefit.

CONTACT PERSON : Mr. Wolfgang Efferz
OCCUPATION : Senior Officer in the Planning Department of Cologne Metropolitan Municipality.)
DATE :4.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes. I am a geographer.

☞ If yes, what do you know about the seismic risk in Cologne?

Cologne is at risk but not a high risk. I experienced an earthquake when I worked in the office a few years ago. The building of the Municipality (Stadthaus) has some damage that can still be observed from inside e.g. some creeks in the painting part of the wall, some damages in the side lines of stairs.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

- Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.
- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.
- ✍ Many high-rise buildings and the Cathedral suffer moderate damage.
- ✍ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.
- ✍ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.
- ✍ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Yes, I do.

2. Do you consider your moveable and immoveable assets to be safe?

Yes, they are safe.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

I am not prepared at all.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Yes, I think there are many risks coming from gas pipelines and industrial explosive materials.

5. Do you have an earthquake insurance? (home, car, furniture, life)

No.

6. What type of precautions have you taken for the case of earthquakes?

Nothing.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

I prefer to move from Cologne.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- **Local authorities**

CONTACT PERSON : Mr. Reinhard Vogt
OCCUPATION : Head of the Flood Protection Department of Cologne
DATE :9.April.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

Cologne is a city prone to earthquakes for many years. However, the biggest earthquake I knew personally was an event of intensity 5.2.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
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- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✎ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✎ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

No.

2. Do you consider your moveable and immovable assets to be safe?

No.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

No.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Yes, I think that the gas pipelines and industrial sewerage lines could possibly bring extra risks to Cologne in case of earthquakes. Especially industrial sewerage lines are significant due to their containing of dangerous chemical substances.

5. Do you have an earthquake insurance? (home, car, furniture, life)

I have no earthquake insurance. (Despite the fact that he is a house owner and living in the district which is close to the Cologne Airport.)

6. What type of precautions have you taken for the case of earthquakes?

Nothing.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

If I knew that that scenario would come to pass, I would design an emergency plan for my family including preparation of emergency package, important documents, training evacuation plan. I would move from Cologne permanently, if I knew that earthquake would give severe damages. Otherwise I would only move from Cologne temporarily.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- The Department of Fire Brigade

CONTACT PERSON : Ms. Yvonne Wiczorreck
OCCUPATION : Senior Officer in the Department of Environment of the Cologne Metropolitan Municipality (She used to work in the Flood Protection Department of Cologne as a second leader in the period of 2002-2008)
DATE :4.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

I saw the presentation of the Potsdam Center on seismic risks of Cologne.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
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- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
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Scenario:

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QUESTIONS:

- 1. With such a scenario in mind, do you feel safe living in Cologne?**

Yes, I feel safe in Cologne despite the fact that there is an earthquake risk.

- 2. Do you consider your moveable and immovable assets to be safe?**

Yes, they are safe.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

No, I do not think that my existing state of preparedness is sufficient.

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

Yes, I think that the construction around my house could bring extra damage in the case of earthquakes. For instance, gas pipelines, main industrial pipe line, etc. I am living in the northern part of Cologne.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

I have no earthquake insurance.

- 6. What type of precautions have you taken for the case of earthquakes?**

Nothing. But I visited to Potsdam Climate Institute Center to get general information about the City of Cologne. Consequently, there is an earthquake risk but not very high.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

I would make a home insurance covering all natural hazards. I would start to pack my personal belongings such as identity, money. I would check all my family members' safety. Then I would visit to my friends living outside of Cologne.

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

Yes, the booklets prepared by the Flood Protection Authority aim at increasing awareness and preparedness of citizens in case of all types of natural disasters. The website of the Metropolitan municipality of Cologne (Stadt Cologne) is also designed to inform/help citizens for natural disasters. The Department of Firebrigade provides information for citizens, too.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

- The Metropolitan Municipality of Cologne should lead projects of disaster resilience.**
- Academics and insurance companies should support these projects.**
- Insurance companies should be in charge of informing citizens about technical details and increasing awareness.**

CONTACT PERSON : Mr. Peter Lauwe
OCCUPATION : Division Chief in charge of developing guidelines for protecting critical infrastructure (energy, healthcare, food supply, emergency services, industrial hazardous materials)/ The Federal Ministry of Interior
DATE :12.May.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- † Academics
- † Local authorities (Although he works in the Federal Ministry of Interior, his work focuses on local critical infrastructure via questionnaires)
- † Insurance companies
- † NGOs and citizen organizations
- † Members of the industrial and business sector
- † Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

In Germany, we have two high seismic risk areas. Cologne is one of them. Since Cologne is a metropolitan city, it is prone to more risk than the other area. According to the Hazard Map of Germany, Cologne takes place in the second hazard area. Furthermore, the earthquake risk in Cologne has 10% probability of exceedance in 50 years. Nevertheless, earthquakes are not prior disaster topics in Germany due to rare earthquake events and the absence of devastating earthquakes.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*

1) The historical seismic background

2) The existing settlement conditions.

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✎ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✎ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net)

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

If I lived in Cologne, I would feel safe because the probability of earthquake is very low. According to my professional background and experiences, I quite trust on emergency organization and services.

2. Do you consider your moveable and immoveable assets to be safe?

According to this scenario, of course, my moveable and immoveable assets are not safe.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

No.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

As far as I concern, pipelines are main source of risks such as drinking water, sewerage, and gas pipelines. In addition to the disruption of pipelines, high-rise buildings, industrial plants, and some bridges may bring extra risks.

5. Do you have an earthquake insurance? (home, car, furniture, life)

No.

6. What type of precautions have you taken for the case of earthquakes?

I have nothing specifically for earthquakes but some preparations for emergency cases. I prepared an emergency package including water, some dried foods, medicine, a small radio, telecommunication instruments, and important documents.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

If I knew, I would move out Cologne temporarily. I do not feel that earthquake risk is high. Furthermore, as far as I concerned, every settlement has different risks.

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

I know about a scientific study prepared by the University of Aachen on physical resilience of bridges. Another scientific study on the topic of earthquake resilience is prepared by the University of Karlsruhe/CEDIM.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

Despite the fact that I am not very well informed about legal and organizational capacities of relevant institutions in Cologne, I suppose that a consortium constitutes with local authorities, insurance companies, academics, NGOs, etc would give a best result.

Annex II.3. Insurance Companies

CONTACT PERSON : Dr. Thomas Bistry
OCCUPATION : Senior Officer in a Reinsurance Company in
Duesseldorf (Deutsche Rueckversicherung)
DATE :17.February.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

I have been studying on a seismic model of Cologne for approximately 10 years. Depends on this model and my professional experience, Cologne is the second highest seismic area in Germany. The first one is the region of "Schwebian Alp" in the Federal State of Baden Wuetenberg. With reference to the data of the reinsurance company, I have all ground survey analysis data for each building in Cologne.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✎ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✎ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

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Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

I don't live in Cologne but if I were living in Cologne, I would not feel safe.

2. Do you consider your moveable and immovable assets to be safe?

My answer depends on the construction details and the site of the building. I would feel safer on the east part of Cologne where more rocky ground base has.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

Yes.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Yes, partially.

5. Do you have an earthquake insurance? (home, car, furniture, life)

Since I am a tenant, I don't insure my home for earthquakes. The furniture is only insured for floods. In Germany, the car insurance package does not include earthquakes.

6. What type of precautions have you taken for the case of earthquakes?

If I lived in Cologne, I would immediately have an earthquake insurance.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

I would not move to another town but take other precautions.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

I am only informed by scientific researches.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- Insurance companies**
- Local authorities**

CONTACT PERSON : Dr. Ulrich Broecker
OCCUPATION : Senior Officer in the Union of German Insurance Companies in Berlin (Gesamtverband der Deutschen Versicherungswirtschaft e.V.)
DATE :22.April.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- † Academics
- † Local authorities
- † Insurance companies
- † NGOs and citizen organizations
- † Members of the industrial and business sector
- † Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

I know that the seismic risk in Cologne is not the highest one in Germany. Due to my profession, I am aware of the seismic risk around Cologne and Aachen. In our works we prepare a seismic risk map of Germany in terms of earthquake insurance premiums. This map was prepared according to the geo-seismic hazard map prepared by the Potsdam Geological Research Center. According to our seismic risk map, the region between Aachen and Cologne locates in the second seismic risk zone.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk;*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✎ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✎ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Probably not. However, I must admit that I have no earthquake experience yet.

2. Do you consider your moveable and immovable assets to be safe?

Probably not. That's why we (GDV) work on insurance sector also on Cologne.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

Yes.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Yes, especially very old buildings, churches can create extra risks in case of an earthquake.

5. Do you have an earthquake insurance? (home, car, furniture, life)

If I lived in Cologne, I would have an earthquake insurance.

6. What type of precautions have you taken for the case of earthquakes?

If I lived in Cologne, I would have an earthquake insurance.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

I moved to another town permanently. But if I had a job in Cologne, I would prefer to move to another town temporarily.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- Local authorities which give building permits and provide the service of building quality control.**

Annex II.4. NGOs and Citizen Organizations

CONTACT PERSON : Dr. Norman Hecker
OCCUPATION : Medical Doctor and Director of Public Health in the German Institute for Disaster Medicine and Emergency Medicine (Deutsche Insitutet fuer Katastrophenmedizin) (The German Institute for Disaster Medicine is a free non-governmental organization operates worldwide. It aims at developing and improving emergency and disaster medicine for the benefit of humanity. The center of the institute is located in Tuebingen. The institute collaborates with all relevant governmental and non-governmental organizations. The detailed information about the institute is available in the website of <http://www.disaster.disaster-medicine.de>)
DATE :3.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- † Academics
- † Local authorities
- † Insurance companies
- † NGOs and citizen organizations
- † Members of the industrial and business sector
- † Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes, I was born in Cologne and still live in the city center of Cologne.

☞ If yes, what do you know about the seismic risk in Cologne?

Cologne is under seismic risk because of its proximity to the Eifel Mountain Area. The more, the risk is getting higher with the alluvial sedimentary basin of Cologne.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*

- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✍ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

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(<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)*

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Yes, I still feel safe in Cologne because, as far as I concern, other cities would not be safer than Cologne.

2. Do you consider your moveable and immovable assets to be safe?

No, they are not safe.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

Yes, I believe that I can cope with an earthquake depending on my professional background, because I am a medical doctor and a disaster manager.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Yes, I think that there are some risks coming from the surrounding of my apartment. According to my philosophy, to being at the right place at the right time is important.

5. Do you have an earthquake insurance? (home, car, furniture, life)

I only have a household-insurance covers furniture against to natural hazard. But I am not sure whether it covers earthquakes.

6. What type of precautions have you taken for the case of earthquakes?

Nothing, nothing specific.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

I think, I would call my relatives and friends to warn them. I might try to arrange some furniture at home. Then I would go back to my office to be ready for helping other people.

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

No, I only be informed by this interview.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

Each sector in the society should take a part in the earthquake resilience activities. Media has an important role initiate these activities since they can easily reach many people. Local authorities should set rules, media should build information system, aid and response organizations and other NGOs should take part in implementation process.

CONTACT PERSON : Mr. Thomas Kahlix
OCCUPATION : Second Chairman of the Citizen Initiative on Flood in Rodenkirchen (Buergerinitiative Hochwasser Altgemeinde Rodenkirchen e.V.) (He is a retired biology teacher.)
DATE : 19.April.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- † Academics
- † Local authorities
- † Insurance companies
- † NGOs and citizen organizations
- † Members of the industrial and business sector
- † Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

I know that Cologne is at medium seismic risk compare to other seismic regions in Germany.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

- Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.
- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✍ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

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Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Despite the fact that I am surprised by such a scenario, I did not feel unsafe much. Because I am also experienced on flood mitigation activities.

2. Do you consider your moveable and immovable assets to be safe?

No. Furthermore, I have no idea about the construction features and degree of strength of my house.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

Not really. I must admit that this interview made me think first time about seismic risks.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Yes, I think that there are some risks coming from especially chemical industrial site in Wesseling and individual gas supplier of houses.

5. Do you have an earthquake insurance? (home, car, furniture, life)

Yes.

6. What type of precautions have you taken for the case of earthquakes?

Nothing.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

I would move out of house but not out of town.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

If risk is really as high as described in the worst case scenario, the Department of Building Permits of Municipality of Cologne would best suited to provide guidance for the public.

I strongly believe that NGOs and organized citizen groups would be best suited for performing effective earthquake resilience measures.

Brief Information on Buergerinitiative Hochwasser Altgemeinde Rodenkirchen e.V.: The Citizen Initiative on Flood in Rodenkirchen (Buergerinitiative Hochwasser Altgemeinde Rodenkirchen e.V.) was founded on 27th of December, 1993. Two days after the flood in Cologne in 1993, this NGO was founded to find the institution that citizens could complain about their losses and damages due to the flood event. Then the Citizen Initiative on Flood decided to develop techniques and measures to be prepared for the next flood event. So far, they have approximately 500 members. This NGO recently works on strengthening their local capacity for disaster response and recovery. Rodenkirchen is a district of Cologne where located in the southern part. Despite the fact that the residence profile of Rodenkirchen has a wide spectrum, the majority of people living in the district represent upper and middle income groups. Rodenkirchen is famous for its touristic facilities in terms of swimming and beach facilities. Rodenkirchen is also called as "Cologne Riviera". According to Mr. Kahlix, people living in Rodenkirchen have no idea about the seismic risk of Cologne due to the fact that they have no experience about earthquakes in the region.

CONTACT PERSON : Mr. Wilhelm H. Wichert
OCCUPATION : Restaurant Owner and Chief Executive of the Old City Interest Group in Cologne (Interessengemeinschaft Altstadt)
DATE : 9.April.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

No. (Despite the fact that he is the chief executive of a NGO in Cologne aimed at protecting the city from floods. "Old City Interest Group" was founded just after the big flood event in Cologne in 1993. It has recently 600 members. The Old City Interest Group has been working in cooperation with the Department of Flood Protection of Cologne. The NGO informs public about flood protection.)

☞ If yes, what do you know about the seismic risk in Cologne?

Nothing.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*

- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
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Scientific Basis and Technical Findings:

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Yes, I still feel safe in Cologne because, there is no 100% safe settlement in the world.

2. Do you consider your moveable and immovable assets to be safe?

Since my moveables are insured, I feel safer. (He has a restaurant at the coast of Rhine. The restaurant building has been standing for 777 years.)

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

No.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Yes, I think that there are some risks coming from especially gas pipelines and bridges.

5. Do you have an earthquake insurance? (home, car, furniture, life)

I do not know. I have to check.

6. What type of precautions have you taken for the case of earthquakes?

Nothing.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

I would keep my family and employees in safer regions.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

Local authorities would be best suited in cooperation with research institutes and emergency organizations.

Annex II.5. Member of Industrial and Business Sectors

Name : Dr. Christoph Butenweg
Occupation : Shareholder and Managing Director of SDA-Ingenieurgesellschaft GmbH (Engineering Firm in Herzogenrath where is close to Aachen)
Date : 12.03.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

- *Cologne is located in a seismic active region*
- *Cologne requires strategies for disaster management after strong earthquakes*
- *Earthquake damages can cause interruptions of the transportation and communication systems*

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

- Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.
- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✍ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net)

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

- 1. With such a scenario in mind, do you feel safe living in Cologne?**

Yes.

- 2. Do you consider your moveable and immovable assets to be safe?**

Yes.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

The experience with strong earthquakes in Germany is rare and it is difficult to predict the state of preparedness for a city with almost a million inhabitants. But it must be expected, that a strong earthquake will cause several problems.

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

The structural safety of all dams in Germany is verified according to DIN 19700. But the safety level of industrial facilities is still an open question for human and environment.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

Yes, for my home.

- 6. What type of precautions have you taken for the case of earthquakes?**

I never thought about precautions for an earthquake.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

Taking additional insurance and strengthening measures of my home.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

I am informed about damage scenario simulations for parts of Cologne. Furthermore the earthquake safety of existing bridges was investigated by the authorities.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

Jointly initiatives of authorities, associations and research institutions.

CONTACT PERSON : Dr. Helge Juergen Dargel
OCCUPATION : Director of Civil-, Structural-, Architectural
Engineering of Bayer Technology Services GmbH
DATE :6.May.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- † Academics
- † Local authorities
- † Insurance companies
- † NGOs and citizen organizations
- † Members of the industrial and business sector
- † Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes. He is leading an initiative on designing new standards for chemical industry against earthquake risk in the Federal State of North Rhine-Westphalia in cooperation with the Geological Department of NRW (The draft version is available in the website of www.VOI.de). (He explained how this initiative was first organized. After introducing DIN 4149 in 2000, a group of technical staff organized a task group to prepare a set of new standards address to prevent chemical accidents. In 2002, when the Bayer Company decided to build a new industrial plant in Dormagen, this task group applied DIN 4149 and some of their newly designed standards. The task group still works on these standards.)

☞ If yes, what do you know about the seismic risk in Cologne?

According to the DIN4149, we know how to build new buildings. Nevertheless, due to old buildings, Cologne is at earthquake risk. The Bayer Company prepared some standards to prevent industrial accidents (chemical industry) triggered by earthquakes. As people living in Cologne, we have not paid attention on earthquakes yet but we should consider the earthquake risk seriously. As far as I concern, Aachen has more

earthquake risks than Cologne. In this region, I know about the fault line called Erft.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*
- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✍ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✍ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✍ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.*
- ✍ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✍ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Yes, because the earthquake risk in Cologne is one of the risks in life. However, I am living in Bergischgladbach (where locates in the periphery of Cologne).

2. Do you consider your moveable and immoveable assets to be safe?

My immoveable assets are safe but I am not sure about my movable assets.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

Yes.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

Since I foresee the risks coming from the industrial sites in Cologne, I initiated the aforementioned study on new standards for chemical plants. Furthermore dams and old building are other sources of risks in case of earthquakes.

5. Do you have an earthquake insurance? (home, car, furniture, life)

No, but I am not sure about the coverage of my home insurance.

- 6. What type of precautions have you taken for the case of earthquakes?**

Nothing.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

I would prefer to move out of Cologne temporarily. Then I would come back to Cologne because it is my home town in which my family and friends live.

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

No.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

- Local authorities which give building permits and control the building codes**
- Insurance companies**

Name : Dr. Wolfram Kuhlmann

Occupation : Head of the Structural Dynamics Division at Kempen Krause
Ingenieurgesellschaft (Engineering Firm in Aachen)

Date : 11.03.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes.

☞ If yes, what do you know about the seismic risk in Cologne?

Compared to the largest earthquakes worldwide the risk in Cologne is small.

Within Germany the earthquake risk Cologne has to be considered for

buildings in Cologne, but Cologne is not in the highest German seismic zone.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk;*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*
- *Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.*

- *Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.*
- *Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects*

Scenario:

- ✎ *An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.*
- ✎ *Many high-rise buildings and the Cathedral suffer moderate damage.*
- ✎ *Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Müllheimer Bridge suffer damages of various degrees.*
- ✎ *Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.*
- ✎ *Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.*

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

I consider the above mentioned scenario unrealistic and unlikely. It sounds like a headline in the yellow press. This does not mean that there is no seismic risk, but the scenario is simply too extreme.

Without a doubt I still feel safe.

2. Do you consider your moveable and immovable assets to be safe?

Yes. Smaller damage might occur. But these are unlikely to happen. I if worried about this option to become real, I could spend my whole life with worrying about all kinds of unlikely risks.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

Yes.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

In areas with high rise buildings minor damages could occur, e.g. falling (non-structural) parts which might hit a person. Pipelines and bridges are safe enough to keep standing.

5. Do you have an earthquake insurance? (home, car, furniture, life)

No.

6. What type of precautions have you taken for the case of earthquakes?

Nothing special. Keeping away from buildings in case of an earthquake, but when an earthquake occurs, there is no choice where I will be - I will simply be where I will be. The short duration of an earthquake leads to the

conclusion that even walking out of the house might take longer than the duration of the earthquake.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

If I knew this I would sell or insure the things which would lose their value by the earthquake damage.

However, this scenario is very unlikely. The question sounds more like a question to a clairvoyant...

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

I know that investigations of the cathedral and Rhine river bridges have been carried out.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

For information: city authorities (in cooperation with experts in the field of earthquake engineering)

For enhancing earthquake resilience: all owners of buildings themselves.

CONTACT PERSON : Mr. Guido Kirsch (He answered the questions of the interview with his colleague, Mr. Christian Richert)
OCCUPATION : Technical Director in a construction company in Cologne (IDK Kleinjohann GmbH & Co. KG)
DATE : 18. February. 2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes. This is also a part of my job and work in Cologne.

☞ If yes, what do you know about the seismic risk in Cologne?

I think that the risk is not very high. The last earthquake in Cologne was approximately 10 years ago. Even there will be a new earthquake; I do not expect a severe damage.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

- Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.
- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.
- ✍ Many high-rise buildings and the Cathedral suffer moderate damage.
- ✍ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.
- ✍ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.
- ✍ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

- 1. With such a scenario in mind, do you feel safe living in Cologne?**

Yes.

- 2. Do you consider your moveable and immoveable assets to be safe?**

My house is not safe due to its age and construction system. I also think that 20 % of total buildings in Cologne may not be safe due to similar reasons.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

Yes.

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

Since I live in a single house, there is no risk which will come from the surroundings of my house. However, in Cologne, there are some areas which will bring extra risks in case of earthquakes.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

Yes, I have an earthquake insurance for my home and furniture together.

- 6. What type of precautions have you taken for the case of earthquakes?**

Except the earthquake insurance, I have no precaution.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

I would build a tent in my garden, and then I and my family move into this tent. I would also pick my family up and move to my parents' house temporarily. (Mr. Richert emphasized that tenants living in Cologne may move to another district instead of to another town. Since tenants have their jobs in Cologne, they

wouldn't move to another city but they could easily move to another district where is safer.)

- 8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?**

I have not heard any initiative yet, so far.

- 9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?**

- Insurance companies and their research departments in which civil engineers work**
- Academics and other professionals in this field**

CONTACT PERSON : Mr. Alparslan Marx
OCCUPATION : Owner of a Land Development and Construction Agency in Cologne (Marit GmbH)
DATE :10.March.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes. I have been living in Cologne for 20 years.

☞ If yes, what do you know about the seismic risk in Cologne?

Cologne has a historical seismic background. I know that the River Rhine occurred by an ancient earthquake. In 1990s I experienced some shakes due to the earthquake in Roermond. Nevertheless, I did not take it serious because there was only a slight damage. After the earthquake in Roermond, insurance companies started to pay attention on seismic risks.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

- Also Cologne is under considerable earthquake risk because of its large population and dense urban agglomeration. According to figures in the Statistical Yearbook 2008 for the Federal Republic of Germany, Cologne has almost a million inhabitants.
- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.
- ✍ Many high-rise buildings and the Cathedral suffer moderate damage.
- ✍ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.
- ✍ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.
- ✍ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.

Scientific Basis and Technical Findings:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

1. With such a scenario in mind, do you feel safe living in Cologne?

Since I was born and grew up in Istanbul, I feel safe in Cologne.

2. Do you consider your moveable and immoveable assets to be safe?

I do not feel them safe completely.

3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?

No.

4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)

I think that gas pipelines will especially bring an extra risk.

5. Do you have an earthquake insurance? (home, car, furniture, life)

I have only a home insurance for natural hazards which does not cover earthquakes.

6. What type of precautions have you taken for the case of earthquakes?

I have no precaution.

7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)

I would pick my family up and move to the outside of Cologne temporarily.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

No.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

– Local authorities

Annex II.6. Media

CONTACT PERSON : Ms. Filiz Kalaman
OCCUPATION : Journalist working in Cologne (One of the famous Turkish Newspaper, namely Hürriyet)
DATE :27.February.2009

INTERVIEW PAPER ON COLOGNE

THEME OF THE INTERVIEW:

Measurement of Resilience in terms of seismic risk perception, coping capacity, means of preparedness and mitigation. Respondents: Institutions and citizens of Cologne.

TARGET GROUPS:

- ‡ Academics
- ‡ Local authorities
- ‡ Insurance companies
- ‡ NGOs and citizen organizations
- ‡ Members of the industrial and business sector
- ‡ Media

BASIC QUESTIONS:

☞ Are you aware of the fact that Cologne is at seismic risk?

Yes but this risk is negligible. I do not think that it is a major risk.

☞ If yes, what do you know about the seismic risk in Cologne?

I experienced an earthquake at the beginning of 1990s in Cologne. I also have some information about the earthquake risk via media.

Facts:

- *The City of Cologne is a significant earthquake risk urban settlement.*
- *There are two major reasons behind its significant earthquake risk:*
 - 1) *The historical seismic background*
 - 2) *The existing settlement conditions.*
- *The earthquake risk profile of Cologne was derived on the assumption that the city is prone to earthquake event of intensity 7 according to the European Macro-seismic Scale with a 10% probability of exceedance in 50 years.*

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- Cologne is also vulnerable with respect to its many cultural heritage assets and archeological sites.
- Since the City of Cologne is located on an alluvial sedimentary basin, land liquefaction and unfavorable soil amplification factors can also easily augment the earthquake effects

Scenario:

- ✍ An earthquake with intensity 7 according to the European Macro-seismic Scale hits the City of Cologne.
- ✍ Many high-rise buildings and the Cathedral suffer moderate damage.
- ✍ Some bridges, such as the Koeln-Deutzer Bridge, Severin Bridge and Mülheimer Bridge suffer damages of various degrees.
- ✍ Disaster response activities are hampered because many streets are blocked by debris, and possibly fire.
- ✍ Transportation and communication activities are significantly disturbed, the former by possible short-term bridge closures, the latter e.g. by overloaded wireless and fixed telephone networks.

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Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (=Deutsches Forschungsnetz Naturkatastrophen) (<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

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Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

QUESTIONS:

- 1. With such a scenario in mind, do you feel safe living in Cologne?**

Despite of this frightening scenario, I feel safe in Cologne. Because I perceive Cologne as a safe city where I also grew up.

- 2. Do you consider your moveable and immoveable assets to be safe?**

I think that my home is safe but not my car. Since I had a chance to observe the construction process of the building where I am living now, I am quite comfortable about my apartment safety.

- 3. Do you think that your existing state of preparedness is sufficient for coping with an earthquake situation?**

I do not take any precaution due to the lack of my awareness about earthquakes.

- 4. If this is the case, are you aware of any special risks inherent to your environment? (e.g. other buildings, towers, bridges, infrastructure, dams, gas pipelines, industrial sites etc.)**

I am not aware of the risk that can come from the surrounding of my apartment. I do not guess any risk coming from other buildings but natural gas pipelines and other networks of utilities.

- 5. Do you have an earthquake insurance? (home, car, furniture, life)**

I have no earthquake insurance.

- 6. What type of precautions have you taken for the case of earthquakes?**

I have no precaution.

- 7. If you knew that the scenario above would come to pass, which precautions would you take? (moving to another town, taking additional insurance, strengthening your building, ...)**

If I had this information, I would take my son and move to another town temporarily. I would also inform all my friends and relatives about the earthquake comes soon.

8. Have you ever been informed about any organization or initiative striving to increase the City of Cologne's resilience for earthquakes?

I have no information.

9. If no, what type of organizations or initiatives would in your opinion be best suited for enhancing earthquake resilience?

- Media.

CONTACT PERSON : Ms. Gönül Topuz
OCCUPATION : A journalist working in a German broadcast institution, namely West Deutsche Rundfunk
DATE :17.May.2009

Interviewleitfaden für Köln:

Thema des Interviews:

Erfassung der seismischen Widerstandsfähigkeit und Ausfallsicherheit im Hinblick auf Erdbebenrisikowahrnehmung, Handlungsmöglichkeiten, vorhandene Mittel sowie Maßnahmen zur Schadensminderung. Befragte: Kölner Institutionen und Bürger.

Zielgruppen:

- ‡ Akademiker
- ‡ Örtliche Verwaltungsstellen und Entscheidungsträger
- ‡ Versicherungsgesellschaften
- ‡ NGOs and Vereine
- ‡ Persönlichkeiten aus Industrie und Wirtschaft
- ‡ **Media**

Grundlegende Fragen:

☞ Ist Ihnen bewusst, dass Köln erdbebengefährdet ist?

Yes.

☞ Wenn ja, was wissen Sie über das seismische Risiko Kölns?

I heard about some seismic risks in Cologne like Istanbul. Nevertheless, I did not expect that Cologne can experience the similar intensity of earthquake as in Turkey due to fault lines.

Fakten:

- 📄 *Köln ist eine Stadt mit bedeutendem Erdbebenrisiko.*
- 📄 *Es gibt zwei Hauptgründe für das Erdbebenrisiko in Köln:*

1) Die historisch verbürgte seismischen Aktivität im Kölner Raum,

2) Die urbane Situation in Köln

- ☞ Erdbebenszenarien von Köln basieren auf der Annahme, dass in der Stadt Beben mit einer Vor-Ort-Intensität entsprechend Stufe 7 auf der Europäischen Makroseismischen Skala (EMS) mit einer Eintrittswahrscheinlichkeit von 10% in 50 Jahren möglich sind.
- ☞ Das relativ hohe Erdbebenrisiko hängt mit der hohen Bevölkerungsdichte und den kompakt bebauten Flächen zusammen. Nach dem statistischen Jahrbuch 2008 der Bundesrepublik Deutschland hat Köln fast eine Million Einwohner.
- ☞ Die seismische Verwundbarkeit resultiert auch aus der hohen Anzahl von kulturellen Denkmälern und geschichtlich wertvollen Bauten.
- ☞ Da Köln auf einem alluvialen Sedimentbecken liegt, können durch Bodenverflüssigung und Erdbeben weitere Schäden entstehen

Szenario:

- ☞ Ein Erdbeben der Intensität 7 nach der europäischen makroseismischen Skala erschüttert die Stadt Köln.
- ☞ Viele Hochhäuser und der Kölner Dom erleiden Schäden unterschiedlichen Ausmaßes.
- ☞ Einige Brücken, so z.B. die Köln-Deutzer-Brücke, die Severins-Brücke und die Mühlheimer Brücke, werden leicht bis mittelschwer beschädigt.
- ☞ Maßnahmen zur Katastrophenabwehr werden durch blockierte Straßen (infolge von herab fallenden Bauteilen) und örtlichen Feuerausbrüchen behindert.
- ☞ Transport und Kommunikation werden durch kurzzeitige Sperrungen der Rheinbrücken und ihrer Zufahrten (erstere) oder Überlastung von Funk- und Festnetzen (letzte) behindert.

Wissenschaftliche Grundlagen und Technische Untersuchungen zu diesem Szenario:

Friedrich, J., Merz, B. (2002): German Research Network Natural Disasters (= Deutsches Forschungsnetz Naturkatastrophen)

(<http://www.iiasa.ac.at/Research/RMS/dpri2002/Papers>)

Gruenthal, G. et al.; (2004): Comparative Risk Assessments for the City of Cologne, Potsdam

Kleist, L. et al.; (2006): Estimation of Regional Stock of Residential Buildings as a Basis for a Comparative Risk Assessment in Germany (www.nat-hazards-earth-syst-sci.net).

Hinzen, G.K., Reamer, S.K. (2004): Seismological Research Letters (Vol:75 No:6): An Earthquake Catalog for the Northern Rhine Area, Central Europe (1975-2002), San Diego.

Fragen:

1. Fühlen Sie sich angesichts dieses Szenarios in Köln sicher?

Despite everything, I feel safe living in Cologne. I am not sure about other districts of Cologne but I am quite safe in my apartment located in the west part of the River Rhine.

2. Betrachten Sie Ihre Immobilien und Ihre mobile Habe als sicher?

Due to the compliance to building codes in Germany (unlike Turkey), I do not think that my apartment is at seismic risk. Especially, since my apartment takes place in a building that is built in 1960s, I feel safer. As far as I concerned, the old building staff in Cologne have better building quality.

3. Sind Sie der Meinung, dass Ihr jetziger Stand der Vorbereitung dazu ausreicht, um mit einem Erdbeben nach obigem Szenario „klar zu kommen“?

Actually, I have no preparation so far. But, I started to think about the earthquake risk in Cologne especially considering the bridges in Cologne. Furthermore, I started to pay attention on the furnitures at my home.

4. Wenn ja, gibt es weitere Risiken in Ihrem Umfeld? (z.B. andere Gebäude, Türme, Brücken, Infrastruktur, Dämme, Gas-Pipelines, Industrieanlagen etc.)

Köprüler I think the bridges in Cologne can bring extra risks especially considering the site of my apartment where locates near by two bridges. Moreover, the building in which I am living is a high storey building. This made me a bit concerned.

5. Sind Sie gegen Erdbeben versichert? (Haus, Auto, Einrichtung, Leben)

I have no insurance.

6. Welche Sicherheitsvorkehrungen haben Sie für den Fall eines Erdbebens unternommen?

I am not prepared yet.

7. Wenn Sie wüssten, dass sich das oben genannte Szenario bewahrheitet, welche Sicherheitsvorkehrungen würden Sie treffen? (Umzug in eine andere Stadt, Zusatzversicherung, Verstärkung von Bauten, andere...)

I would not move out Cologne because it is not possible to escape from natural disasters. I can get an home insurance. In accordance with my financial conditions, I would like live in a one storey house.

8. Sind Ihnen Organisationen oder Initiativen bekannt, deren Zweck es ist, die die Stadt widerstandsfähiger gegenüber Erdbeben zu machen?

I do not know any organization or project about earthquake resilience in Cologne

9. Wenn nein, welche Art von Organisation oder Initiative wäre Ihrer Meinung nach am ehesten dazu geeignet?

- Federal Ministries and their affiliated insitutions
- Members of scientific research centers and earthquake research centers such as seismic observatories as well as academics

ANNEX III: RELEVANT TERMINOLOGY ON DISASTERS

In order to define the principal terms, a literature survey was carried out. The terminology of the UN, JICA, FEMA, EU, and Turkish literature (including scientific publications and the documents and files of the Ministry of Public Works & Settlement) were scanned. The report prepared by experts of the ARMONIA (=Applied Multi Risk Mapping of Natural Hazards for Impact Assessment) Project funded by the European Community was also be taken into account in proposing a disaster terminology. Below some key definitions related to the study are set out (Greiving et al.,2006):

Adaptation: Adjustment of natural or man-made systems in response to actual or expected natural hazards or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, as well as autonomous and planned adaptation.

Adaptive Capacity: The ability of a natural or man-made system to adjust to natural hazards and to moderate potential damages, to take opportunities, or to cope with the consequences.

Consequence: An impact such as economic, environmental or other type of physical damage that may result from a hazard. It may possibly expressed quantitatively (e.g. by monetary term), by category (e.g. by scale or amount) or descriptively (e.g. by giving details).

Coping Capacity: The means used by people, organizations, and authorities in organizing available resources and abilities with a view to lessening adverse consequences of a disaster.

Damage: The amount of adverse change in natural, financial, environmental, and other physical assets as a consequence of an occurred hazard.

Damage potential: The amount of potential destruction in natural, financial, environmental, and other physical assets of a defined area.

Disaster: A serious disruption of the functioning of a community or a settlement causing widespread human, material, economic, environmental, and/or other physical losses which exceed the coping capacity of the affected community or settlement. A disaster results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

As a main theme of the study natural disasters are the disasters occurred by natural events such as earthquakes, floods, land slides, avalanches, falling rocks, volcanoes, tornadoes, cyclones, storms, typhoon, tsunamis, etc.

Hazard: A potentially damaging physical event, phenomenon or human activity, which may cause the loss of life or injury, property damage, physical and economic disruption or environmental degradation. Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its timing, location, intensity and probability.

Impacts: Consequences on natural and human systems. Depending on the consideration of adaptation, adaptive and coping capacity one can distinguish between potential and residual impacts.

Intensity: Intensity refers to the damage-generating attributes of a hazard. For example, intensity value of an earthquake –contrary to the magnitude- always refer to a specific site and describe the effects of the earthquake at that site in more or less qualitative terms. Well-known intensity scales are the MSK (=Medvedev-Sponheuer-Karnik) and the Modified Mercalli (MM) Scale (Meskouris, 2000).

Losses: The amount of realized damages as a consequence of an occurred hazard.

Magnitude: A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard. For instance, “the magnitude of an earthquake is a measure of the energy released by it and is thus independent of the observer’s standpoint” (Meskouris, 2000).

Mitigation or disaster mitigation: A strategy on short, middle, and long-term efforts and/or interventions focusing on short, middle, and long-term goals and objectives to prevent adverse effects of natural hazards and/or potentially harmful processes.

Preparedness: All efforts enclosing precautionary and preparatory measures of all kind that are taken with a view to minimizing the risk and reducing or even preventing the effects of natural disasters on people and settlements, including measures for warning, evacuation, and emergency planning.

Prevention: Efforts to provide avoidance of the adverse impact of natural disasters.

Recovery: The last step of post disaster actions, such as rebuilding or retrofitting of damaged structures.

Resilience: The capacity of a settlement system covering built up and non-built up environment, and community life potentially exposed to hazards to adapt, by resisting or changing in order to restore or maintain an acceptable level of functioning and structure.

Response: All efforts during and immediately after the occurrence of a disaster, to ensure that disaster effects are minimized and people are given immediate relief and support.

Risk: A combination of the probability (or frequency) of occurrence of a natural hazard and the extent of the impacts. A risk is a function of the exposure and potential impacts as perceived by a community or settlement.

Risk analysis: The analysis of a hazard (frequency, magnitude) and its consequences (damage potential).

Risk assessment: It is a combination of risk analysis and risk evaluation to estimate the risks posed by hazards.

In this study, since the urban disaster resilience model will be designed according to features of earthquakes, two principal methods in seismic risk assessment can be mentioned here. These are deterministic and probabilistic risk assessments. The deterministic method aims at assessing earthquake risks based on a single, specific earthquake scenario for a certain settlement with a finite probability of occurrence. The probabilistic method aims at including all deterministic events with a finite probability of occurrence. Each of the methods has some advantages and disadvantages. They are rather successor than alternative methods to assess the earthquake risks. Because of their complementary features, it is possible to check deterministic events by probabilistic analyses and vice versa (Mc Guire, 2001).

Risk evaluation: Establishment of a qualitative relationship between risks and benefits, involving the complex process of determining the significance of the identified hazards and estimated risks to the people living in certain settlement concerned with or affected by them.

Risk Management (Disaster Risk Management): The systematic process of using administrative, operational, and organizational capacities in implement policies, strategies, and tactics to lessen the impacts of natural disasters.

Uncertainty: It is an occasion results from lack of knowledge concerning outcomes, imprecise data measures, and imprecise knowledge of risk.

Vulnerability: It is the degree of fragility of general living conditions of a community and a settlement prone to the natural disasters.

Threat: A combination of the probability (or frequency) of occurrence of a natural disaster. Despite the definition of threat is very similar to the definition of risk, the main difference between risk and threat is the consequence. For instance, while the earthquake threat implies the probability of occurrence of a hazardous earthquake, the earthquake risk implies together the probability of occurrence of an earthquake and all possible damages after it (Brauch, 2005).