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NARPIMED

NAtural Risk Prevention In MEDiterranean countries

MANUAL FOR NATURAL RISK PREVENTION IN THE EUROMEDITERRANEAN REGION: HYPOTHESIS AND EXPERIENCE BY NARPIMED PROJECT

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Manual For Natural Risk Prevention In The Euromediterranean Region: Hypothesis And Experience By Narpimed Project

(NAtural Risk Prevention In MEDiterranean countries)

CONTENT

CHAPTER 1

GENERAL BACKGROUND, KEY CONCEPTS AND STATE OF THE ART.

1. 1. Introduction.

The necessity to develop some techniques, methods and procedures aimed at promoting new policies for natural risk prevention (focusing on seismic risks) at the national and European level has been the origin of NARPIMED project[1] considering the existing procedures for risk prevention in all the participating countries (Spain, Italy and Greece).

Over the last years, it can be observed a growing impact of natural hazards on the Euro-Mediterranean countries caused by an increased vulnerability and exposure of people and assets to natural hazards in these countries. The growing concentration of people and economic activities in conurbations, the increase in the use of bad land (including reclaimed lands) due to an inadequate land-use zoning and planning, a fast industrial development, environmental degradation, urban expansion and infrastructure construction with inadequate construction standards and an insufficient level of disaster risk prevention and preparedness are some of the inter-linked factors that increase their vulnerability.

The natural risk prevention is an important need in EU, and more pressing in the Mediterranean region where threaten natural phenomena are more abundant and their vulnerability to natural disasters is higher than other European regions.

The *natural risk prevention* is seen in this work as all those activities which can be taken to avoid or to alleviate the effects of natural hazards or to reduce futures losses, whether in terms of human casualties or physical or economic losses.

Generally speaking, risk is the chance of loss (physical, economic, and societal). Risk management is the public process of deciding what to do when risk assessments indicate that an unacceptable risk exists (Hays, 2001)[2]. Following Hays proposal, an adequate risk management encompasses choices and actions for the stakeholders (communities, businesses, organizations, and individual citizens) that include: public policies on prevention, preparedness, emergency response, and recovery and reconstruction, individually and collectively designed to:

1. *Stop increasing the risk* to people, buildings, and infrastructure that future construction and urban development will place at risk to natural hazards.

2. *Start decreasing the risk* to people, organizations, businesses, buildings, and infrastructure already placed at risk to future natural hazards by the vulnerabilities of past urban development.

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[1] NARPIMED. *Natural Risk Prevention in Mediterranean Countries* is an European project, EC DG Environment, N 070401/2008/507838/SUB/A3

[2] Hays, W. (2001). Building technical and political capacity for seismic risk reduction. *International Workshop on Disaster Reduction*, 19-22 August 2001, Reston, VA, pp. 18.

3. *Continue planning and implementing* ways to respond to and recover from the occurrence of natural disasters, including low probability extreme events that could cause a severe impact on the people, environment and socio-economic activities of individual communities and the nation.

Progress in natural risk reduction has been substantial due to increasing of scientific and technical capabilities but yet the cost of natural hazard impact is still rising, and the number of fatalities does not decrease the same in all places. In this line, it is important reduce the large variability in the application or enforcement of prevention measures in different countries and to advance and communicate knowledge on hazard prevention and on disaster preparedness, response and recovery.

This manual is aimed at providing policy guidance in the field of natural hazard prevention and natural disaster risk reduction in Euro-Mediterranean countries and has been developed under the auspices of the EC DG Environment, into the European project NARPIMED.

1. 2. From disaster-driven to prevention and reduction of risk: Worldwide initiatives in Disaster Risk Reduction (DRR).

The risk to life from natural hazards (Coburn and Spence, 2002)[3] is increasing in hazardous regions due to an increasing vulnerability to natural disasters, mainly in developing countries, and particularly in fast growing areas. It is well-known that prevention is better than cure. Risk can be reduced investing in the vulnerability reduction of elements at risk and strengthening disaster preparedness and response before a severe hazard takes place. ***Disaster Risk Reduction*** (DRR) is a systematic approach to identifying, assessing and reducing the risks of disaster. It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them.

The main objective of the *International Decade for Natural Disaster Reduction* (IDNDR 1990-1999)[4] was to save lives and to reduce the enormous social and economic cost of the natural risks but his great success was to increase awareness of the great importance of disaster reduction and *achieve a relevant shift from disaster-driven to disaster risk reduction* increasing global protection culture.

When it drew to an end, the IDNDR was replaced and continued by the *International Strategy for Disaster Reduction* (ISDR). The Member States of the United Nations adopted the ISDR and established the UN/ISDR secretariat in 2000. This strategy called for interdisciplinary involvement to coordinate, guide and implement DRR with development partners working in close coordination with disaster management institutions. The UN's International Strategy for Disaster Reduction (UN/ISDR) was designed to proceed from protection against hazards to the management of risk through the integration of risk reduction into sustainable

[3] Coburn, A. and R. Spence (2002). *Earthquake protection*, John Wiley & Sons publisher, 420 pp doi: 10.1002/0470855185)-

[4] The General Assembly of the United Nations designated the 1990's as the International Decade for Natural Disaster Reduction (IDNDR) (On 11 December 1987 at its 42nd session). The basic idea behind this proclamation of the Decade was and still remains to be the unacceptable and rising levels of losses which disasters continue to incur on the one hand, and the existence, on the other hand, of a wealth of scientific and engineering know-how which could be effectively used to reduce losses resulting from disasters.

development. The ISDR system[5] supports national policies and coordination mechanisms, facilitates regional and international coordination, stimulates the exchange of good practices, reviews and documents progress towards implementation of the HFA (*Hyogo Framework for Action 2005-2015*) and produces practical tools to help policymakers and decision makers promote and implement disaster risk reduction measures in their respective countries and regions. The UN-ISDR is the focal point in the UN System which promotes links and synergies between, and the coordination of, disaster reduction activities in the socio-economic, humanitarian and development fields, as well as supporting policy integration.

The ISDR defines ***Disaster Risk Reduction*** (DRR)[6] as: "*Actions taken to reduce the risk of disasters and the adverse impacts of natural hazards, through systematic efforts to analyse and manage the causes of disasters, including through avoidance of hazards, reduced social and economic vulnerability to hazards, and improved preparedness for adverse events*". In short, disasters can be reduced implementing adequate strategies (Figure 1.1).

In the Declaration of Madrid[7] (2003) it was emphasized that Disaster Risk Reduction is one central element of sustainable development and the associated integrated disaster risk management is a primary responsibility of governments. Such risk management should be based on a holistic approach to risk prevention and reduction combining scientific knowledge, vulnerability assessment and the competencies of disaster managers. Furthermore, the civil society, the private sector, including insurance companies, experts and academia must be fully involved.

At the second World Conference on Disaster Reduction held in Kobe, Japan, in 2005, the international community adopted a 10-year DRR strategy, the ***Hyogo Framework for Action 2005-2015***[8] (HFA) *(Building the Resilience of Nations and Communities to Disasters*) in order to promote a strategic and systematic approach to reducing vulnerabilities and risks to hazards. The HFA sets out three strategic goals and outlines five priorities for action, which cover the main areas of DRR (see Figures 1.1 and 1.2).

The IDNDR, the ISDR and the HFA have established at the international level a global approach to DRR in its political, scientific and socio-economic dimensions.

The ***Hyogo Framework for Action*** point out specific gaps and challenges identified from the review of progress made in implementing the Yokohama Strategy[9]. The HFA emphasizes that disaster risk reduction is a central issue for development policies, in addition to being of interest to various science, humanitarian and environmental fields.

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[5] The term ISDR system means the various international, regional and national bodies, platforms, programmes and mechanisms expressly established to support the implementation of the ISDR and the HFA. (See www.unisdr.org for more information).

[6] UN/ISDR. Terminology on Disaster Risk Reduction (2009). For definitions of terms used in disaster risk reduction, please see: http://www.unisdr.org/eng/library/UNISDR-terminology-2009-eng.pdf

[7] Declaration of Madrid. *Conclusions and Recommendations of the Euro-Mediterranean Forum on Disaster Reduction.* Madrid (Spain) 2003. 4 pp

[8] UN-ISDR Hyogo Framework for Action 2005-2015: *Building the Resilience of Nations and Communities to Disasters.* 18-22 January 2005, Kobe, Japan. It can be downloaded from the ISDR website at: www.unisdr.org/hfa. For a complete list of HFA focal points within the European geographical context see UN/ISDR secretariat website: www.unisdr.org/europe

[9] *Review of the Yokohama Strategy and Plan of Action for a Safer World* (A/CONF.206/L.1).

Disasters undermine development achievements, impoverishing people and nations. Without serious efforts to address disaster losses, disasters will become an increasingly serious obstacle to the achievement of the Millennium Development Goals (UN/ISDR 2007). The five main areas considered were the followings:

(a) Governance: organizational, legal and policy frameworks.

(b) Risk identification, assessment, monitoring and early warning.

(c) Knowledge management and education.

(d) Reducing underlying risk factors.

(e) Preparedness for effective response and recovery.

The ***World Conference on Disaster Reduction*** adopted five ***priorities for action*** (Figure 1.2) that provides *landmark guidance on reducing disaster risk and the impacts of disasters* for global application and therefore useful also for the European region. These priorities for action transferred to the needs of EU are the followings:

1. ***Make Disaster Risk reduction a Priority***: *Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.* This means that European countries must develop policy, legislative and institutional frameworks to promote national, regional and local mechanisms; resources allocation and community participation in disaster risk reduction.

2. ***Know the Risks and Take Action:*** *Identify, assess, and monitor disaster risks* and *enhance early warning*. Disaster risk arises when hazards interact with physical, social, economic and environmental vulnerabilities. The knowledge of the hazards, the vulnerabilities to natural hazards of the elements at risk and their temporal change is an appropriate approach for reducing vulnerabilities and risks to hazards. Consequently, it is necessary to assess hazard, vulnerability and risk at national and local level followed by dissemination of the results to decision-makers, the public and populations at risk. Countries must support the infrastructure and scientific, technological and technical capacities for monitoring hazard and risk purposes and develop early warning systems to forecast natural and related hazards, where possible. National and local institutions should ensure that early warning systems are well integrated into governmental policy and decision-making processes and emergency management systems.

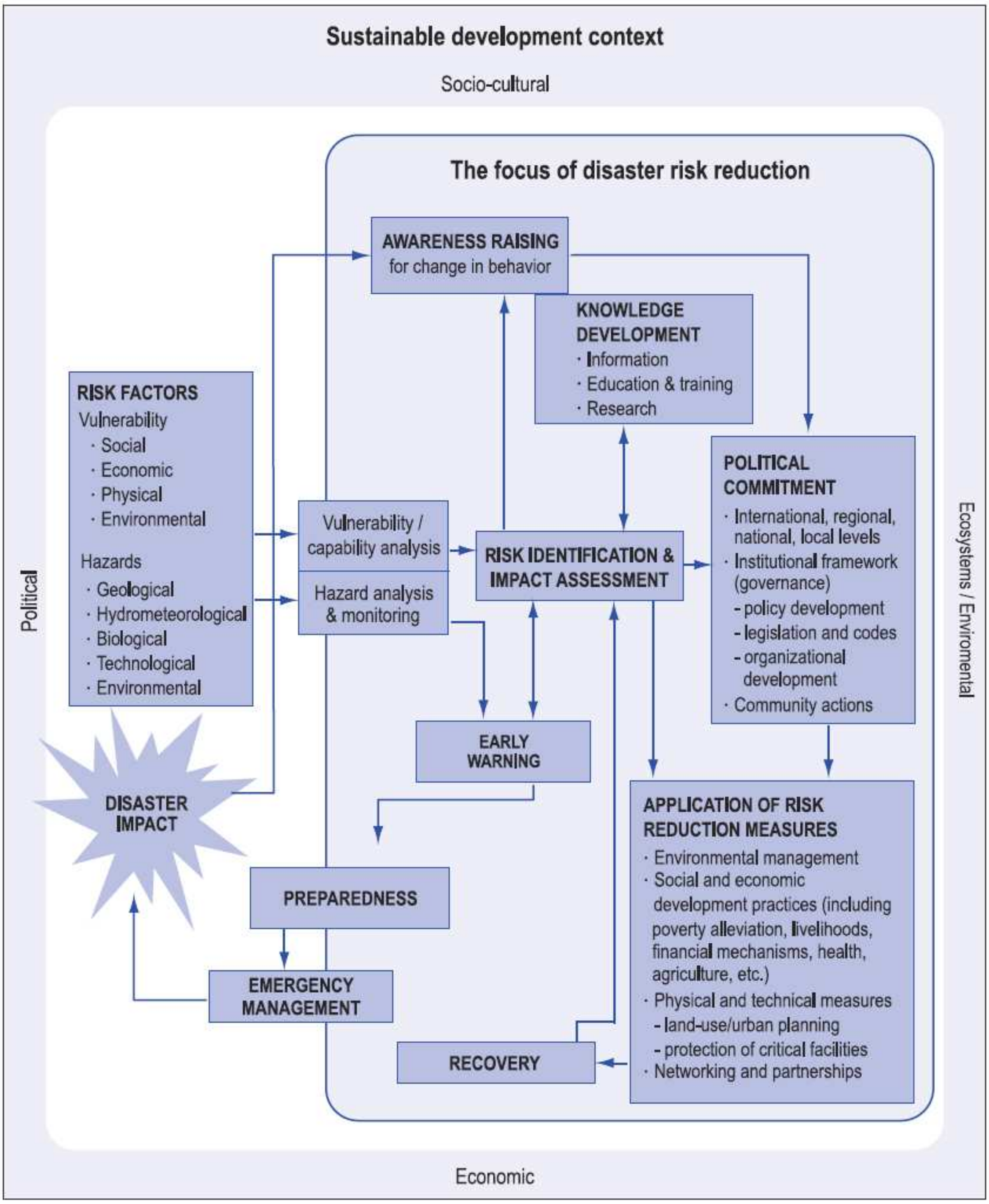

Figure 1.1 *A conceptual framework for Disaster Risk Reduction (UN/ISDR 2007).*

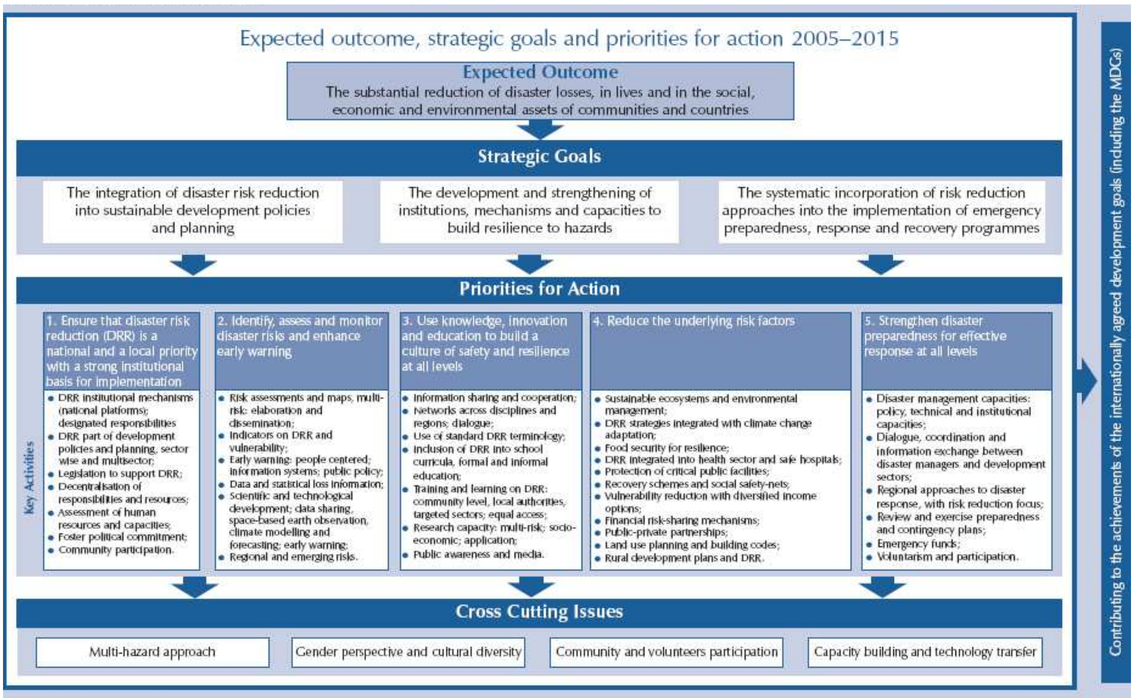

Figure 1.2: *Diagram of the Hyogo Framework for Action 2005-2015 (courtesy of UN's International Strategy for Disaster Reduction).*

3. ***Build Understanding and Awareness:*** *Use knowledge, innovation and education to build a culture of safety and resilience at all levels.* To substantially reduce natural risks it is relevant that people are well informed and motivated to take action to reduce risks and build resilience. To achieve this goal requires the dissemination of easily understandable information on disaster risks and protection to citizens, especially those living in high-risk areas, the inclusion of this knowledge in schools and the development of training and learning programmes in disaster risk reduction targeted at specific sectors such as development planners, emergency managers, local government officials, etc.

4. ***Reduce Risk****: Reduce the underlying risk factors.* Disaster risks must be appropriately addressed in sector development planning and programmes as well as in post-disaster situations. Therefore, *structural measures* (engineering measures and construction of hazard-resistant and protective structures and infrastructure) and *non-structural measures* (policies, awareness, knowledge, methods and operating practices,...) on disaster risk reduction must be incorporated into *pre-disaster processes* mainly those related to land-use planning and other technical measures (building codes, standards, rehabilitation and reconstruction practices) and also in *post-disaster processes* in order to develop more resilient physical, social, economic and environmental capacities during the recovery phase.

5. ***Be Prepared and Ready to Act*** *Strengthen disaster preparedness* for effective response at all levels. At times of disaster, impacts and losses can be substantially reduced if authorities, individuals and communities in hazard-prone areas are well prepared and ready to act and are equipped with the knowledge and capacities for effective disaster management. Thus, a set of disaster risk reduction activities such as risk management, coordination between actors, disaster preparedness, updating emergence plans, or active participation of relevant stakeholders should be enhanced or strengthened at national, regional and local levels.

Disaster risk reduction (DRR)[10] is the conceptual framework of elements considered with the purpose of minimizing vulnerabilities and disaster risks throughout a society in order to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, and facilitate sustainable development. DRR is a systematic approach to identifying, assessing and reducing the risks of disaster. It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them.

Disaster risk reduction is a cross-cutting and complex issue. It requires political and legal commitment, public understanding, scientific knowledge, careful development planning, responsible enforcement of policies and legislation, people-centred early warning systems, and effective disaster preparedness and response mechanisms. A multi-stakeholder ***National Platform***[11] for DRR can provide or mobilize the combined knowledge, skills and resources required for DRR and their mainstreaming into development policies, planning and programmes (UN/ISDR. 2007)[12].

Disasters are first and foremost a local phenomenon. Local communities are on the frontlines of both the immediate impact of a disaster and the initial, emergency response, which, experience has shown, is crucial for saving the most lives[13]. Consequently, from the regional to the municipal level, ***Local Governments*** (LGUs)[14] have a key role to play in reducing disaster risks and vulnerabilities. The local government is the first responder, and the one responsible for community development and sustainable disaster risk reduction[15]. Risk reduction at the local level depends on good local governance, particularly in political decision-making, formulation of policy, and enforcement relating to land use planning, regulatory controls, zoning, and construction standards.

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[10] Disaster Risk Reduction (DRR) is a broad and relatively new concept. There are different definitions of the term in the technical literature but it is generally understood to mean the broad development and application of policies, strategies and practices to minimise vulnerabilities and disaster risks throughout society.

[11] National Platform for DRR. It can be defined as a multi-stakeholder national mechanism that serves as an advocate of DRR at different levels. It provides coordination, analysis and advice on areas of priority requiring concerted action.

[12] UN/ISDR. 2007. *Guidelines. National Platforms for Disaster Risk Reduction* UN/ISDR-03-2007-Geneva, Switzerland, 18 + vi pp.

[13] Margareta Wahlström in Foreword of *Building Disaster Resilient Communities: Good Practices & Lessons Learned* Geneva, June 2007

[14] Term to describe governments of urban and rural communities of different size and level (regional, provincial, metropolitan, cities, municipalities, townships and villages).

[15] *Local Governments and Disaster Risk Reduction. Good Practices and Lessons Learned*. Published by the UNISDR Geneva, Switzerland, March 2010.

The age-old challenge that still exists with many local (and some national) governments, is to change the mindset[16] ***from disaster response to disaster reduction and preparedness.*** The IDNDR prompted a major conceptual shift from disaster-driven to disaster reduction underscoring the crucial role of human action.

1. 3. Definitions of key DRR concepts: Hazards, Vulnerability, Risk, Disaster, Mitigation, Prevention, Protection, Resilience.

The ISDR defines three key concepts, namely natural hazards, vulnerability and risk. Other terms such as disaster, mitigation, prevention, protection or resilience (and others listed in Annex 1) are central in DRR. It is important to think about what these mean before using the tables of characteristics. This will mainly use definitions provided by UN/ISDR, Terminology on Disaster Risk Reduction, 2009.

Hazard*: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage*. Hazards can include latent conditions that may represent future threats and can have different origins: natural (such as earthquakes, volcanic activity, landslides, tsunamis, tropical cyclones and other severe storms, tornadoes and high winds, river floods and coastal flooding, wildfires and associated haze, drought and sand/dust storm) or induced by human processes (environmental degradation and technological hazards), sometimes acting in combination. In technical settings, hazards are described quantitatively by the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis (UN/ISDR. Terminology on DRR, 2009).

Vulnerability to natural hazards is a function of human actions and behaviour. It describes the degree to which a socio-economic system is either susceptible or resilient to the impact of natural hazards and related technological and environmental disasters. The degree of vulnerability is determined by a combination of several factors including hazard awareness, the condition of human settlements and infrastructure, public policy and administration, and organized abilities in all fields of disaster management. Poverty is also one of the main causes of vulnerability in most parts of the world.

A ***natural disaster*** is when a natural hazard causes a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. ***Disaster impacts*** may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

[16] ***Mindset*** means the understanding, the awareness and current way of understanding and doing things.

The ***natural disaster risk*** is the potential natural disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period. This definition reflects the concept of disasters as the outcome of continuously present conditions of risk. The evaluation of natural disaster risk is the probability of a natural disaster occurring. This evaluation includes vulnerability assessment and impact prediction taking into account thresholds that define acceptable risk for a given society.

Mitigation:. The outright avoidance of adverse impacts of hazards and related disasters. It expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance such as construction of dams or embankments that eliminate flood risks, land-use regulations that do not permit any settlement in high-risk zones, and seismic engineering designs that ensure the survival and function of a critical building in any likely earthquake.

Prevention. First at all the ***Prevention of natural risk*** can be defined as *the prevention, reduction and repair of any potential threat and damage to people life, property, environment and society as a hole by natural disasters.* Nevertheless, there are several understandings of the natural risk prevention concept. Generally all consider prevention such us those activities and tools referred to reinforce buildings, facilities and response systems to reduce future losses due to the effects of natural hazards. This is similar in meaning to the well-known *Disaster Risk Reduction*. These approaches generally consider the following tools to be part of risk prevention: Risk mapping, Spatial planning, Building codes, Education and awareness, Emergency plans and exercises, Development and exchange of best practices.

A more widely meaning should be all those activities dealing with the protection of life, property and livelihoods from the destructive power of natural hazards. Furthermore, it is patent that there are many different *prevention perceptions* among the different stakeholders involved in the issue. Thus, *Civil Protection initiatives* and strategies have been traditionally focused on better preparedness in order to respond to emergencies. Thus, initiatives such as risk mapping, Early Warning Systems (EWS), information to the public, awareness and capacity building have been promoted by Civil Protection because they are crucial for efficient disaster response. These initiatives are especially centred on short and very short terms. Whereas the interpretation of disaster prevention habitually has been rooted in a civil protection understanding other longer termed views, (e.g. those from environment areas), with more emphasis on adaptation and on thematic issues are gradually gaining momentum. In this line, spatial planning based on hazard zoning, building codes based on hazard assessment and strengthening of existing building and infrastructures are usual long term approach to natural risk prevention.

As regards to give different meaning to the same concept put in evidence by the 2005 EUROPA study (and also by the study aforementioned), it was given an outline of the different meanings of prevention:

- In *environmental law,* prevention essentially concerns *measures to minimise risk exposure.*

- In *civil protection*, prevention involves *crisis management preparedness measures* or pre alerts and/or *alert measures* to prevent accidents from degenerating into crises or *measures to limit damaging effects*.

Finally, the ***natural risk prevention*** is all those activities which can be taken to alleviate the effects of natural hazards or to reduce futures losses, whether in terms of human casualties or physical or economic losses. Thus, the natural risk prevention must include human, financial, social and administrative aspects of reducing natural hazard effects.

Protection. The term earthquake protection refers to the total scope of all those activities which can be taken to alleviate the effects of earthquakes, or to reduce future losses, whether in terms of human casualties or physical or economic losses. The term is similar in meaning to the more widely used expression earthquake risk mitigation, although this usually refers primarily to interventions to strengthen the built environment, whereas earthquake protection is taken to include the human, financial, social and administrative aspects of reducing earthquake effects (Coburn and Spence, 2002).

Resilience. Many attempts have been made to define 'resilience'. The more useful for operational purposes is: "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions". The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need (UN/ISDR. 2009 *op. cit.*). An ideal disaster-resilient community is the safest possible community that we have the knowledge to design and build in a natural hazard context Geis DE (2000).

1. 4. Natural disasters in the regions involved in the project: Local, regional and trans-national dimensions.

1. 4. 1. Intensive and extensive natural disasters

Severe natural hazard losses are caused by interactions between the destructive power of hazards and the vulnerability of exposed elements that make them susceptible to damage. The analysis of the natural risks, type by type, indicate the *natural risks could be classified according their acute impacts* in terms of mortality and economic loss, taking into account people and activities affected joint to their respective vulnerabilities. For example, the UN-ISDR proposed to differentiate between ***Intensive Disaster Risk Hotspots,*** and ***Extensive Disaster Risks***[17]. The first scenarios are those where significant concentration of people and economic activities are exposed to severe, large-scale hazards which combined with the vulnerabilities of the element at risk can lead to large-scale impact in terms of mortality and economic loss. The second type of risk correspond to scenarios where smaller concentrations of people and economic activities are exposed to frequently occurring but highly localized hazards

[17] UN-ISDR Global disaster risk 2007 prepared for the First Session of Global Platforms. For definitions of these terms, please see Annex 1: Key terms in natural disaster prevention and risk reduction.

events with relatively low intensity asset loss and livelihood disruption over extensive areas, such as flash floods, landslides and wildland fires.

In Europe, the more ***significant events***, understood as those events with capacity to generate victims, are *earthquakes and floods*. Both can be regarded like European intensive disasters. *Damaging earthquakes*, in spite of their low rate of occurrence, they should be considered of high priority in prevention policy due to their high mortality risk. *Large Floods* are frequent, happen near all regions in Europe, they have consequences on extensive areas and can generate an important number of fatalities and homeless people. In some cases both types of these events can cause trans-boundary impact.

1. 4. 2. Risk prevention in Europe: Local, regional and trans-national dimensions

The impact of disasters in Europe is relevant in terms of physical damage and economic consequences. Therefore, natural risk prevention is an important need in EU, and more in the Mediterranean region where threaten natural phenomena are more abundant and their vulnerability to natural disasters is higher than other European countries. Consequently, efficient disaster prevention strategies must be developed facing hazardous phenomena.

Along these lines, a decisive advance directed towards DRR was taken by the European Commission in 2008, when a *Communication on reinforcing the Union's Disaster Response capacity* (COM (2008)130)[18] was adopted. The purpose of this Communication was to make proposals to reinforce the EU's disaster response capacity, building on what has already been achieved. These proposals have been a first step on the road to a comprehensive and integrated EU response and were aimed at reinforcing and creating synergies between existing instruments, and at strengthening coordination between them.

Hitherto, natural disaster-driven has been a traditional mechanism to respond to disasters rather than preventing and reducing the vulnerability at source, being natural risk prevention a new challenge and a new individual and societal responsibility. Natural risk prevention strategy and implementation is a straightforward way not only to significantly reduce human, social and economic damages but also to avoid laborious rescue and expensive damaged zones recovery.

The Communication cited before adopted an integrated approach encompassing all stages of disasters (prevention, preparation, immediate response, recovery), addressing all types of disasters (inside or outside the EU, natural or man-made), and covering all EU instruments as well as inter-institutional coordination. In addition, for facing the overall challenge of disaster prevention, mitigation and response it is need to prevent, reduce and remedy any potential natural or manmade threat and damage inflicted on people, property, environment and society as a hole.

Over the last 30 years, disasters have increased both in frequency and intensity. Since 1990 natural disasters have been identified as a growing threat for European Union Member States (UE MS) due to vulnerability to natural disasters is increasing and having some times trans-boundary impacts (e.g. see recent floods & fires).

[18] COM (2008) 130 final. *Communication from the Commission to the European parliament and the Council on Reinforcing the Union's Disaster Response capacity.* Brussels, 5.3.2008

According to CRED report[19] for 2007, natural disasters have a high economic impact on developed countries such as Japan, the United States, and Europe.

Global analyses carried out by the UN and other international organisations have highlighted a growing vulnerability to disasters, partly as a consequence of increasingly intensive land use, industrial development, urban expansion and infrastructure construction[20]. Furthermore, economical analyses show an increased cost in response and recovery operations after the occurrence of disasters in Europe. This increasing is due in large part to high value assets in European countries hit by these phenomena.

The economic cost of disasters in Europe is estimated to be €15 billion yearly, being natural disaster the more important part. This impact may adversely affect the economic growth and competitiveness of EU regions (and hence the EU as a whole). This is a European problem and a challenge to sustainable development into European Union.

In addition, if an increasing in the effects of natural disasters over the coming years it is expected, an effective DRR policy at all levels (Community, national, regional and local ones) is a priority need because can reduce the loss of life and property. ***Cost-benefit analysis*** (CBA) and related economic appraisal methodologies suggest that investments in disaster risk reduction can generate high economic returns. CBA suggest benefits in terms of prevented or reduced disaster impacts of two to four dollars for each dollar invested in DRR[21]. In the case of earthquakes this ratio could vary much more. It is estimated that additional earthquake-related requirements of building codes approximately account for 1% of the investment on construction of new buildings in seismically hazardous regions and the retrofitting cost of existing buildings can be around 20% of the value of the building. In contrast, the repairing cost of buildings with severely earthquake-damage can reach up to 100%.

Large and trans-boundary impacts of natural disaster make essential to develop among European countries a common approach on natural risk prevention. Recently, the European Parliament and the Council have both called for urgent action in the area of disaster prevention.

Along these lines, and to contribute to the implementation of the HFA 2005-2015, the European Commission adopted two communications related to disasters: a Community approach to reducing the impact of natural and man-made disasters within the EU[22], and on an EU-strategy for disaster risk reduction in developing countries[23]. Both communications are addressed to the European Parliament and the Council, and to the European Economic and Social Committee and to the Committee of the Regions also in the first case. These two proposals mean a relevant milestone and reference European framework in disaster risk reduction.

[19] EM-DAT 2007 Disasters in Numbers, http://www.emdat.be/Documents/ConferencePress/2007- disasters-in-numbers-ISDR-CRED, and Press Release UN/ISDR 2008/01, 18 January 2008.

[20] ISDR, Global Trends Report, 2007.

[21] DFID (2006): *Reducing the Risk of Disasters*.

[22] COM (2009) 82 final. *A Community approach on the prevention of natural and man-made disasters*.

[23] COM 2009 84 final. *EU strategy for supporting disaster risk reduction in developing countries*,

The necessity *to develop some techniques, methods and procedures aimed at promoting new policies for natural risk prevention (focusing on seismic risks) at the national and European level* has been the origin of NARPIMED project[24], considering the existing procedures for risk prevention in all the participating countries (Spain, Italy and Greece).

1. 5. Natural hazards in Europe

Natural hazards such as earthquakes, floods, drought, and other ones cause yearly tens of thousands of deaths, hundreds of thousands of injuries, millions of homeless people and billions of euros in economic losses around the world.

1. 5. 1. European natural hazards in worldwide contest.

The six most important "natural hazards" with a high potential to generate disasters in the world are: earthquakes, droughts, floods, cyclones, landslides and volcanoes. The natural hazards and their corresponding disasters can be grouped in two main categories namely ***geophysical disasters*** and ***hydrometeorological disasters***; the last one is subdivided in droughts and related disasters, floods and related disasters, and windstorms. Rates of occurrence of these disasters over the previous century are the following:

• ***Geophysical or geological disasters*** include earthquakes (83%), volcanic eruptions (16%) and tsunamis (1%).

• ***Hydrometeorological disasters:***

- *Droughts and related disasters* include droughts (58%), extreme temperatures (21%) and wildfires (21%).

- *Floods and related disasters* include floods (84%), landslides and mudflows (13%) and avalanches (3%).

-*Windstorms* include storms (31%), typhoons (20%), cyclones (16%), hurricanes (13%), winter storms (9%), tornadoes (7%) and tropical storms (4%).

In relation to their impact on individuals, already recent evidence suggests that an estimated 25 million square kilometres, or about 19% of the Earth's land area, and about 3.4 billion people out of 6.53 billion are highly exposed to one natural hazard, e.g. floods. Some 3.8 million square kilometres and 790 million people are exposed to at least two natural hazards, and approximately 105 million people are exposed to three or more hazards, e.g. floods, cyclones and landslides (Dilley et al, 2005)[25].

In relation to spatial distribution of natural disaster occurrence for the years 1900-2003 [26] most natural hazards are confined to specific regions, although some

[24] NARPIMED. *Natural Risk Prevention in Mediterranean Countries* project, EC DG Humanitaria Aid and Civil Protection

[25] Maxx Dilley *et al*., *Natural Disaster Hotspots: A Global Risk Analysis*, The World Bank, Washington, DC, 2005,

[26] *EM-DAT: The OFDA/CRED International Disaster Database* – Universitè Catholique de Louvain – Brussels – Belgium, www.em-dat.net

hazards have global effects; for example tornadoes are confined mostly to the North America and Australia. Near two-thirds of all natural disasters are accounted in Asia and Americas. Asia accounted for 39%, America 27%, Africa 15%, Europe 13% and Oceania 6% (Figure 1.3).

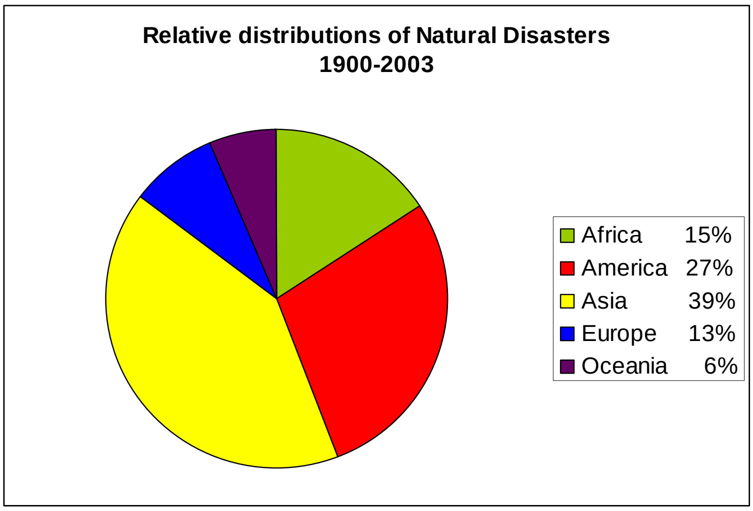
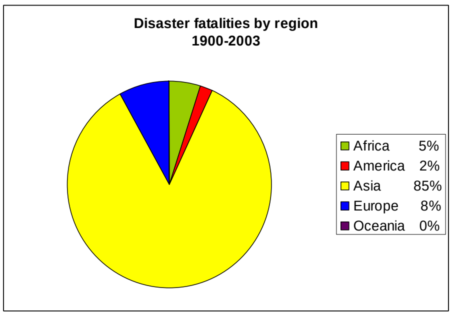


Figure 1.3. *Relative distribution of natural disasters reported in the five global regions from 1900-2003.* (Source *EM-DAT: The OFDA/CRED International Disaster Database – Universitè Catholique de Louvain – Brussels – Belgium, www.em-dat.net)*

In relation to spatial distributions of fatalities and economic loss from natural disasters, Figure 1.4 shows that Asia clearly bears the weight of most disaster fatalities (85%), being followed by Europe with a 8%. Figure 1.4 shows that economic losses are strongly related with accounting of disaster occurrence; Asia (37%), America (33%) and Europe (25%) accounted for a staggering 95 percent of the total disaster losses for the period 1900-2003.



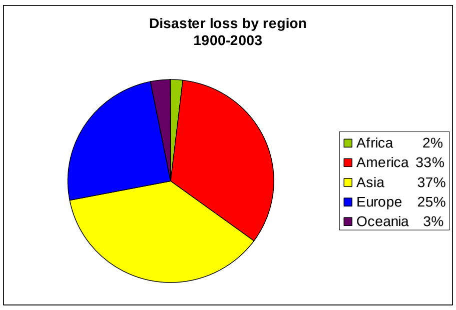


Figure 1.4. *Relative distribution of fatalities (left) and losses (right) in natural disasters reported in the five global regions from 1900-2003.* (Source: EM-DAT, 2004, www.em-dat.net)

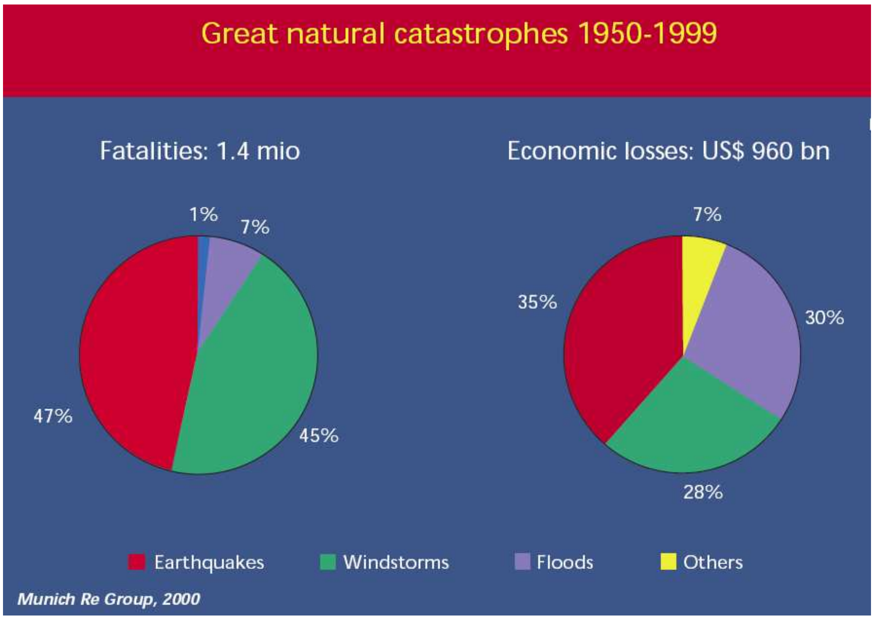
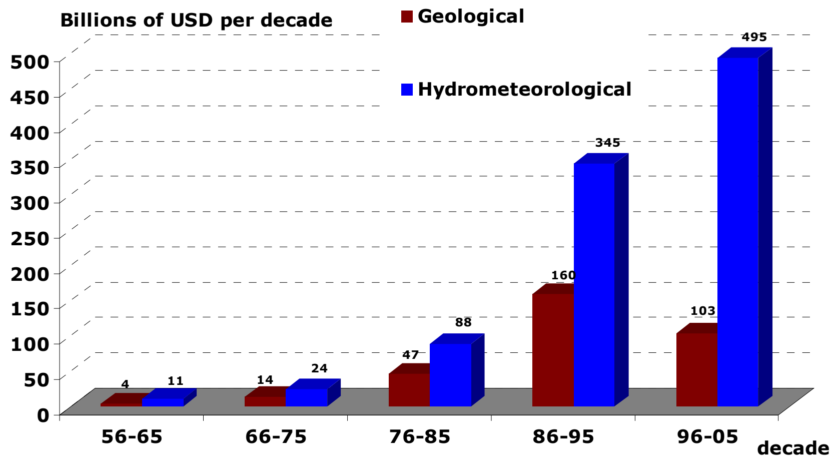


Figure 1.5. *Predominant relative importance of earthquakes from natural hazards worldwide in terms of loss of lives and economic losses. (Source: Munich Re Group, 2000 [27]).*

Based on the analysis of worldwide natural disaster data (*German Reinsurance Co. statistics, 1950-1999 period*) in term of disaster occurrence the most frequent natural disasters are wind and storm (38%), earthquakes (29%) and flood (27%). In terms of death toll and economic losses, it can be seen on the Figure 1.5 that earthquakes represent the most acute and important risk from natural hazards worldwide. During these 50 years, earthquakes were responsible for almost 47% of all deaths from natural disasters (the highest proportion of deaths from any disaster type), with wind and storm coming in a close second with 45% and flood with a 7%. About every 20 years a single earthquake occurs that takes over 100,000 lives.

But, what is the temporal evolution of hydro-meteorological and geological disasters, in the world?. During the period 1956-2005 economic losses related to both type of disasters are on the way up while casualties related to hydro-meteorological disasters are decreasing (Figure 1.6).

[27] Munich Re Group: Schematic figure E/3. Pacific Earthquake Engineering Research Center, Berkeley CA: 35/9



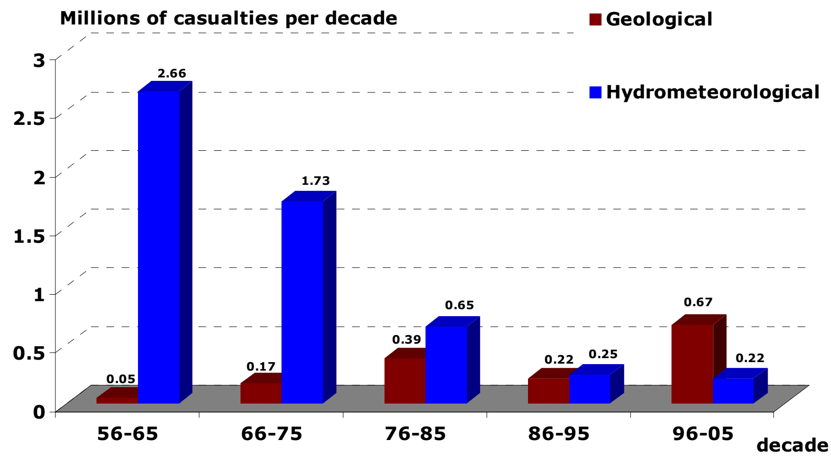


Figure 1.6. *Comparison of economic losses (top) and casualties (down) related to geological and hydro-meteorological disasters for the period 1956-2005. It is remarkable that the casualties related to hydro-meteorological disasters are decreasing. (Source: EM-DAT: The OFDA/CRED International Disaster Database).*

During the period 1976-2005 the most important disasters in terms of loss of lives were the 1976 Tangshan earthquake (China), and Sumatra earthquake-tsunami (2004) with 290,000 and 283,00 fatalities, respectively. Two disasters have had a major economic impact: the 1995 Kobe earthquake and the hurricane Katrina of 2005 (Figure 1.7). During last part of this period, the occurrence of hydro-meteorological disasters show a remarkable increase (Figure 1.8) and geological disasters have had a high variability but with a visible increasing trend (Figure 1.9) In this period victims of the geological disasters are far fewer than victims of hydro-meteorological disasters.

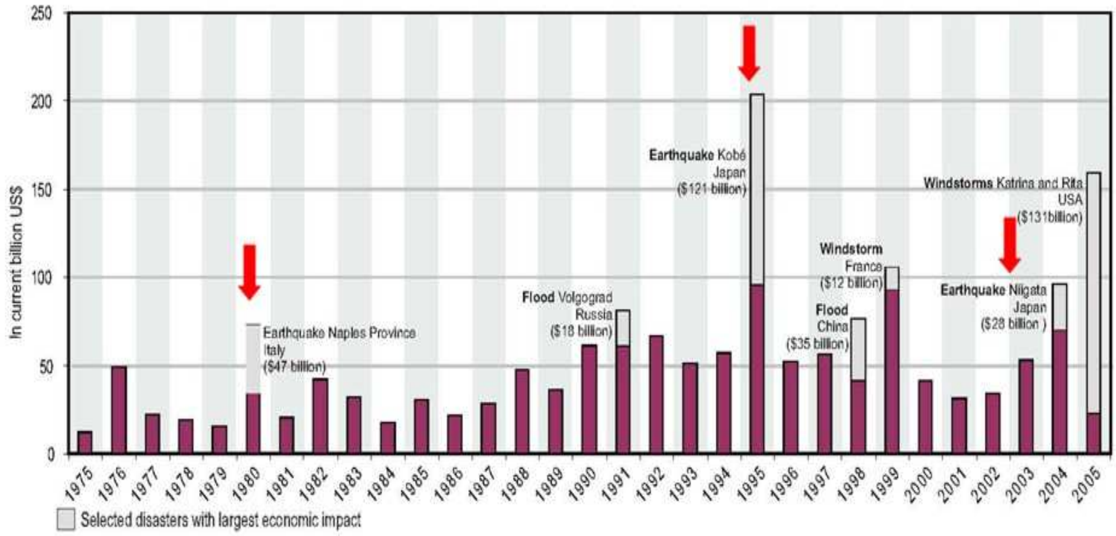


Figure 1.7. *Annual economic damages due to natural disasters, 1976-2005 period (Source: EM-DAT, 2004, www.em-dat.net).*

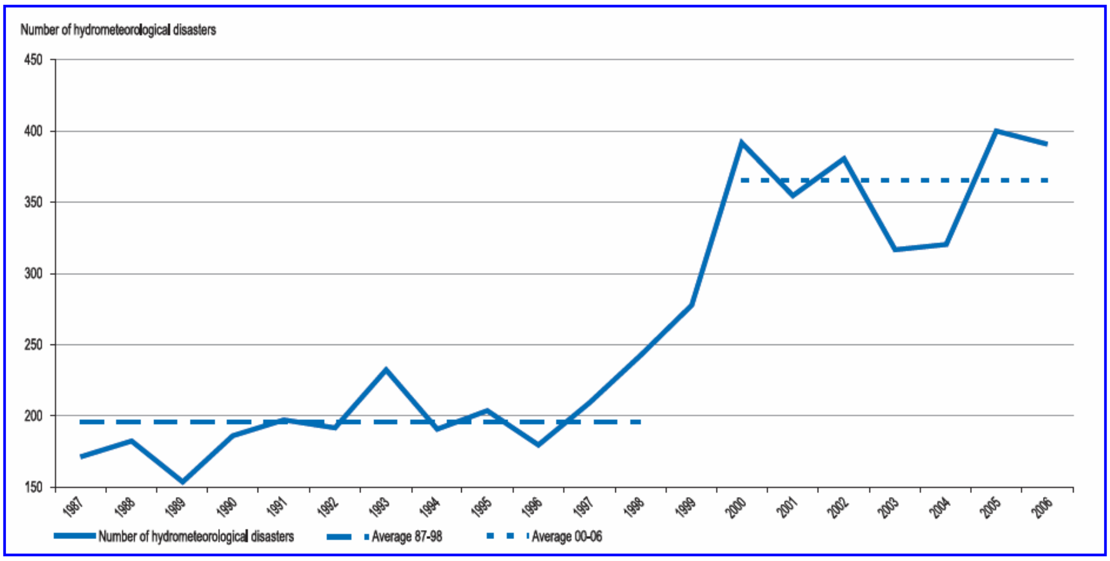


Figure 1.8. *Occurrence of hydro-meteorological disasters: 1987-2006. A significant change can be observed by the comparison of the occurrence average for periods 1987-1998 and 2000-2006 (Source: EM-DAT, 2004, www.em-dat.net).*

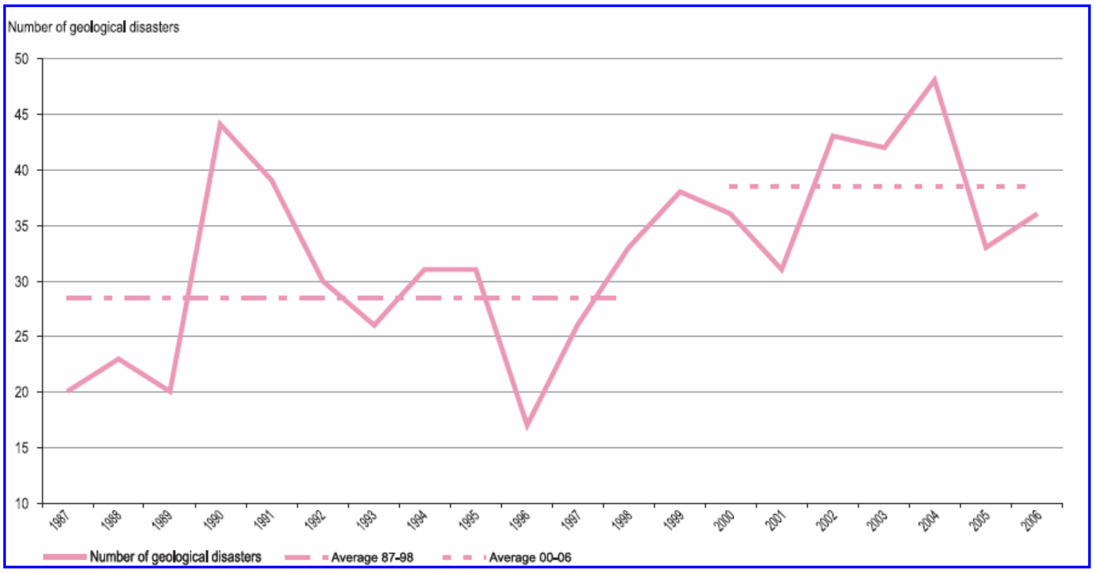


Figure 1.9. *Occurrence of geological disasters: 1987-2006 and change observed in the occurrence average trend for periods 1987-1998 and 2000-2006. (Source:EM-DAT, 2007, www.em-dat.net).*

The regional distribution of number of events, victims and economic losses of the hydro-meteorological and geological disasters during the period 1980-2007 is shown in Figure 1.10.

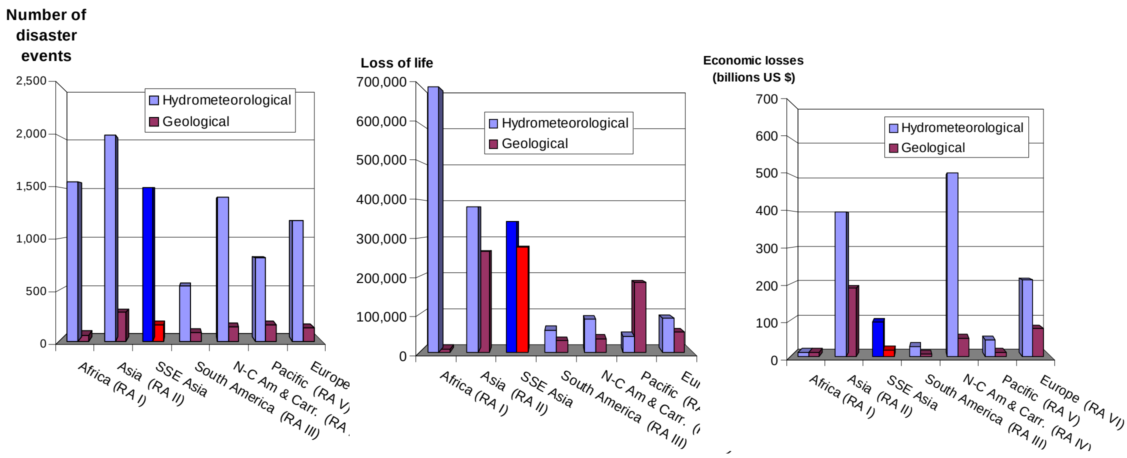


Figure 1.10. *Regional distribution of Number of disasters, Casualties and Economic losses caused by natural hazards (1980-2007) (Source: EM-DAT: The OFDA/CRED International Disaster Database - Université Catholique de Louvain - Brussels – Belgium).*

1. 5. 2. Geographical distribution of natural hazards in Europe.

Natural hazards are a relevant part of disaster-generating in the European Union (EU). Several types of natural hazards, such as earthquakes, floods, landslides or volcanic eruptions, can cause environmental devastating effects, and major impact in terms of loss of life and economic loss in the European Union. Furthermore, some of them can precipitate other geological and technological hazards increasing the potential of morbidity and mortality.

The Natural Hazards considered to be a risk to some or all of the EU Member States are: Avalanches, Dam bursts, Drought, hot, humid, summer days, Earthquakes, Floods, Forest fires, Landslides, Tornadoes, Tsunamis and Volcanic eruptions.

Natural disaster data show different geographic pattern in the dominant types of natural hazards. The flooding and landslides are predominant in the north and middle of Europe whereas drought, earthquakes and wild fires are more frequents to the south.

Data on disaster occurrence, their effect upon people and cost to regions and countries are gradually improving, but they remain at best irregular. Although these data have to be handle with care, it is possible analyse the differences among different geographic regions of Europe using international data base (Table 1.1). To compare the number and impact in number of killed and affected people for different types of hazards and regions the 1974-2003 data from CRED (2004)[28] it is used here.

Table 1.1 *Number of natural disasters and their mean annual number of victims (per 100,000 inhabitants) for different parts of Europe and for all in the world (1974-2003).*

	GEOLOGICAL DISASTERS		**HIDROMET. DISASTERS**		**ALL NATURAL DISASTERS**		
Europe	**N**	**MAN**	**N**	**MAN**	**N**	**MAN**	**Total V**
Eastern	19	6,2	222	117	241	123,2	11.259.231
Northern	7	0	95	46,4	102	46,4	1.282.049
Southern	61	54,2	200	247,7	261	3019	12.888.036
Western	5	0,1	244	88,8	249	88,8	4.872.843
Total Europe	**92**	**13,1**	**761**	**125,7**	**853**	**138,8**	**30.572.159**
Total World	**767**	**55**	**5600**	**3079,2**	**6367**	**3135,1**	**5.071.495. 618**

N *Total number of disasters.*

MAN *Mean annual number of victims (people killed and affected) of disasters per 100,000 inhabitants.*

Total V *Total number of victims (people killed and affected) of natural disasters: 1974 – 2003*

The data of the period 1974-2003 show that *geological disasters* in Europe are more abundant in southern (66,3 %) and eastern (20,6 %) parts, having a great impact on people in the first one (54,2 per 100.00 inhabitants), due to the majority are earthquakes. These type of severe hazards accounting only a 11,9 % of all in the world.

The data on *hydro-meteorological disasters* in Europe for the 1974-2003 period show they are frequent in all Europe but have the most people effect in southern part of the region (247,7 victims per 100.00 inhabitants). These impacts affecting southern Europe are mainly due to droughts because windstorms and floods are most frequent in the other European regions.

[28] D. Guha-Sapir, D. Hargitt, P. Hoyois (2004) *Thirty years of natural disasters 1974-2003: the numbers*. CRED– Universitè Catholique de Louvain – Brussels – Belgium

On a global scale, and compared to the period 2000-2007, Europe in 2008 showed the greatest decline in reported natural disaster occurrence among the five continents, being only 9% in comparison with 16% of previous years and, consequently, experienced a decrease in victims. Likewise, economic damage costs due to those disasters dropped from 16% (2000-2007) to 2.5% (2008) of worldwide damage costs. Unfortunately, this does not reflect a decreasing trend in damage costs in Europe; rather it reflects the impact of mega-disasters that happened in 2008 on other continents[29].

1. 6. Analysis of some natural disasters in the regions involved in the project.

Severe *natural hazard losses* are caused by interactions between the destructive power of hazards and the vulnerability of exposed elements that make them susceptible to damage. A hazard's destructive potential is a function of the magnitude, duration, location and timing of the event joint to intrinsic characteristics, or vulnerabilities, of the elements at risk. These elements are people, infrastructure, environment and economic activities. Significant losses can occur mainly during severe hazard events in those areas where population and economic investment are concentrated and when elements at risk are weak against those hazards.

Taking total number of victims (people killed and affected) into account as the main factor for disaster risk reduction, diverse strategies and different priorities can be considered in the natural risk management. In Europe, the more significant events are *earthquakes and floods*. Both can be regarded like European intensive disasters. In this line, *damaging earthquakes***,** in spite of their low rate of occurrence, they should be considered of high priority due to their high mortality risk. There were a total of 5006 deaths during the second half of the XX century, 4069 in Italy, 879 in Greece and 58 in Portugal.

Large Floods are frequent, happen near all regions in Europe, they have consequences on extensive areas and can generate an important number of fatalities and homeless people. During mentioned period, floods, flash floods and landslides generate an important number of fatalities: 2101 in Italy, 564 in Portugal and more than 500 in Spain, being also significant in France (200), United Kingdom (144) and Austria (125). On several occasions earthquakes and floods can cause trans-boundary impact.

An adequate risk assessment of dangerous areas in terms of potential losses to people and their assets is the first step to risk reduction in these areas because such information can inform a range of disaster prevention and preparedness measures and risk management strategies.

1. 6. 1. Characteristics of the natural hazards in Europe type by type.

Hazards and natural risks vary among regions in the EU as well as among Member States. Many regions of Europe have been affected by multiple and repeated natural hazard, to know their characteristics provide insights into the expected future disasters. After the previous statistical summary on natural hazards in Europe we analyse now the characteristics and consequences of these natural hazards type by type

Earthquakes are one of nature's most terrifying phenomena that occur suddenly and can not be forecast yet. They can cause a high percentage of destruction in a large area depending on the magnitude of the earthquake and intensity of the ground shaking. European earthquakes with

[29] J. Rodríguez, F. Vos, R.Below and D. Guha-Sapir (2009). *Annual Disaster Statistical Review 2008 – The numbers and trends.* Centre for Research on the Epidemiology of Disasters. CRED. 2009. www.cred.be

magnitude M_w greater than 6 can cause victims but those events with $M_w > 7$ have a great potential to produce a large number of persons killed, injured or missing and numerous homeless people. All those events with capacity to generate victims are known as "*significant earthquakes*"[30] Furthermore floods, landslides, fires and technological accidents may be caused as a result of the ground shaking and essential facilities and lifelines located within the disaster zone can suffer heavy damage also.

Earthquakes are widespread in the Europe. The most destructive events occurred in the Euro-Mediterranean countries, particularly Greece, Italy and Turkey. Albania and Romania have experienced major earthquakes also (Vatavali, 2003) [31]. Although in other EU countries smaller earthquakes are felt, there is generally little or no damage. In the Mediterranean countries, the seismic activity and the seismic hazard decrease from east to west. The seismic risk follows the same trends but its distribution is more irregular.

The *European Mediterranean Seismological Centre* (EMSC)[32] has set up an operational alert system triggering to any earthquake whose magnitude is greater than 5.0 over the European and Mediterranean regions, but all the world magnitude 6,0 events also.

Tsunamis are relevant phenomena with long recurrence periods. This catastrophic phenomenon occurs in large marine earthquakes. Eastern Mediterranean countries and Portugal and Spain are the European zones exposed to this natural risk.

Volcanic eruptions are also other disaster that can occur suddenly. Their effects are generally localized in the zone around the volcano. These hazards are relevant in Italy, and in the Atlantic islands of Portugal and Spain.

Droughts are a phenomenon of common occurrence in the southern countries of the Community, particularly during summer season, and can be a risk factor for forest risk occurrence. This hazard can cause environmental damage and have a negative incidence on agriculture (crops and plantations) and animal husbandry.

Floods are one of the most frequent types of natural disaster in Europe with consequences on extensive areas. They can be forecast in many cases and the areas at risk can be identified in advance, such as river beds and low-lying areas. The number of victims may be very high depending of the population density and can cause large number of homeless people. Floods affect near all regions in Europe, being less dangerous in the north but they are a great threat to eastern, southern and western regions. In some cases they cause trans-boundary impact.

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[30] The *USGS National Earthquake Information Center* (NEIC) considers as "*significant earthquakes*" those "*with magnitude 6.5 or greater or ones that caused fatalities, injuries, or substantial damage*". NEIC provides also an accessible database of international earthquake activity. http://earthquake.usgs.gov/eqcenter/eqarchives/significant/

[31] Vatavali, F. (2003). *Earthquakes in Europe. National, international and European policy for the prevention and mitigation of seismic disaster.* EC DG Environment. 2003.

[32] The European Mediterranean Seismological Centre (EMSC) was founded in 1975 on a recommend-dation by the European Seismological Commission. The EMSC maintains a 24h/24 and 7d/7 operational earthquake information service, sending alert messages to appropriate authorities, international organisations, and EMSC members with the location and magnitude parameters.

Recently the *European Floods Directive* (2007/60/Ec)[33] is a framework Directive establishing a process-oriented framework for prevention of one of the most frequent disaster types in EU. This comprehensive Directive on the assessment and management of flood risks recognise the potential of floods "*to cause fatalities, displacement of people and damage to the environment, to severely compromise economic development and to undermine the economic activities of the Community*". The objective of this sector-specific Directive is to avoid or reduce the risk of adverse consequences, especially for human health and life, the environment, cultural heritage, economic activity and infrastructure in the floods area concerned.

Landslides and avalanches are phenomena restricted to mountainous regions in Europe. They can totally destroy everything in its path. In many cases, it can be forecast on the basis of topographic and soil conditions and local climate characteristics. These phenomena can be triggered by severe earthquake ground motion.

Wildfires are a frequent occurrence in the Mediterranean region, particularly during the summer season. Only a 13 % of them are considered major fires and 2 % as catastrophic but both ones generate a considerable environmental impact. Furthermore, the destruction of the plant cover over large areas can lead to other ecological hazards like desertification, erosion, landslides and in certain cases of mountain regions, flash floods.

Windstorms in Europe include storms, winter storms and tornadoes. The storms and tornadoes can generate flooding due to heavy rain. Tornadoes mainly affect coastal regions and can inflict destruction over thousands of square kilometres.

Extreme temperatures can be a serious threat on the health of weak persons. This hazard is so different for different regions of the Europe. In the Mediterranean countries hazardous temperatures are higher ones. The known as ***Hot Humid Summer days*** are an infrequent phenomena that only occur during the summer season. This phenomenon is essentially restricted to the urban centres and zones with high population density, where temperatures of between 40° and 50°C in the shade may continue for several days. A large number of people become ill or die as a result of heatstroke. In other regions of Europe to the north of Mediterranean countries, the dangerous extreme temperature days are those with temperatures below -10º C occurring during winter season.

1. 6. 2 Damaging European earthquakes

In Europe, earthquakes can cause catastrophic damages. The higher seismic zone appears to be Greece, however strong seismicity is also present in western Turkey, Albania and the countries of the former Yugoslavian. But from the standpoint of the impact and casualties caused by earthquakes, the six deadliest earthquakes (> 20.000 casualties) occurred in the European during the XVII to XX centuries are listed in Table 1.2. Most damaging was the Messina earthquake in 1908. Most of the casualties due to this event, as well as the Lisbon earthquake in 1755, were due to associated earthquake generated tsunamis.

[33] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.

Table 1.2 . *The most deadliest and destructive historical earthquakes in Europe since 1600* (*listed in order of death toll*).

Date	Country	Location	Casualties	Mw
1908, 28 Dec.	Italy	Messina	> 86.000	7.5
1755, 1 Nov.	Portugal	Lisbon	70.000	8.7
1693, 11 Jan.	Italy	Catania	~ 60.000	7.4
1999, 17 Aug.	Turkey	Kocaeli	17.127 official, >40.000 estimated *43.953 injured off.*	7.4
1783, 5. Feb.	Italy	Calabria	> 35.000	6.9
1915, 13. Jan.	Italy	Avezzano	32.610	7.0

A selection of well investigated damaging earthquakes in Europe since 1976 is listed in Table 1.3. The most destructive earthquake was the Irpinia earthquake in southern Italy in 1980, where almost 3.000 people were killed, 10.000 were injured and 300.000 lost their homes. Damages amounted to up to 40 billion contemporary US-$. The second largest earthquake disaster since 1976 was in 1977 in Bucharest, where 1.500 people died because of an earthquake which occurred at a depth of 150 km. Other earthquakes listed in Table 1.3 are also remarkable as they, despite their moderate magnitudes (Mw < 6.0), caused a number of casualties and significant damage.

From the perspective of countries with greater seismic activity, it is well known that ***Greece*** is the most hazardous seismic zone of the whole Euro-Mediterranean area (M_{max} ~ 8.0 and largest rate of M>5). The entire territory of Greece is subjected to strong earthquakes. Furthermore, Greece has shallow and intermediate to deep earthquakes and it can also be affected by quakes of neighbouring countries Albania, Macedonia, Bulgaria and Western Turkey.

The whole territory of ***Italy*** is subjected to moderate seismic events and some zones to relatively large earthquakes.The average return period for the whole Italy for intensities VIII andIX (MCS) (~ VII and VIII in EMS scale)are 16 and 43 years,respectively[34].In Italy 10 damaging earthquakes with more than 10.000 fatalities have occurred during the last millennium. Seven quakes have led victims since 1976 (Table 1.3).

[34] A. Marcellini, R. Daminelly, M. Pagani & F. Riva (2006). Seismic hazard of Mediterranean area. Proc. Of the 11th European Conf. on Earthquake Engineering. Balkema, Rotterdam, Netherland, 1999

Table 1. 3. *Selection of damaging earthquakes in Europe since 1976.*

Location	Year	Mw	Dead	Details	Damages *in billion €*
Italy, Friuli	1976	6.5	989	2.400 injured, 157.000 homeless	4,25
Romania, Bucharest	1977	7.0	1,581	11.000 injured,	0,8
Portugal, Azores	1980	6.8	56	400 injured	0,01
S Italy, Irpinia	1980	6.9	2914	10.000 injured, 30.0000 homeless	40
Greece, Athens	1981	6.8	16		>0,025
Belgium, Liege	1983	5.0	2	26 injured, hundreds of damaged buildings	0,05
S Italy, Abruzzo	1984	5.8	7	100 injured	0,025
Romania, Bucharest	1986	6.9	2	enormous damages, 132 km depth	0,73
Greece, Kalamata	1986	5.9	20	330 injured, 35.000 homeless,	>0,025
Italy, E of Sicily	1990	5.8	19		
Greece, Aigion	1995	6.6	26	12.000 homeless, 6300 damaged build.	0,45
Italy, Umbria	1997	5.6	11		4,5
Greece, Athens	1999	6.0	143	1.600 injured, 70.000 homeless	4,0
Italy, Molise	2002	5.9	29	2.925 homeless	
Greece, Patras	2008	6.5	2	227 injured	
Italy, L'Aquila	2009	6.3	308	1.500 injured 65.000 hom.	16

Historical records report severe damaging earthquakes (I ≥ IX EMS) in other Euro-Mediterranean countries, e.g. 1431, 1522, 1829, 1884 events in ***Spain***, or the great 1755 Lisbon earthquake, with epicentre located southwest of Cape St. Vincent (***Portugal***).

1. 6. 3 Analysis of some European earthquake cases

Many lessons can be learnt by analysing the effects, and the prevention, preparedness and response measures taken in several earthquake disasters occurred in Greece[35] and Italy. The objective is to summarise the lessons learnt concerned with this type of disaster but can also be of help in the prevention of, preparedness for and response to other types of disasters.

The Kalamata (Greece) earthquake of September 13, 1986.

The earthquake, although, moderately strong (reported magnitude Ms = 6.2) caused heavy damage, devastated the city of Kalamata, and killed 20 people. There were 330 people injured (82 needed hospitalisation), whilst the rest suffered serious psychological reactions (earthquake stress). Furthermore, 35.000 people were left homeless.

Although Kalamata city does not extend over a large area, the observed distribution of damage for the same type of construction was quite non-uniform. This suggests significant variations in the amplitude of ground motion, which can be attributed to possible differences in local soil conditions. The significant vertical component of the strong motion, very high spectral acceleration values (for periods ranging from 0.25 to 0.70 sec), noteworthy torsional component of ground motion, short duration, and site effects were the dominant factors of the building damage.

The *estimated economic losses* were: 250 million € in material loss and 180 million € for response measures taken. The earthquake highlighted deficiencies in prevention. The event confirmed the vulnerability of various structural choices applied in constructions such as low underpinnings and asymmetries. *Main prevention lessons learnt* are: The strong need to risk assessment, microzonation, urban planning and land use regulations and to re-examine the building code requirements, especially in high-risk zones.

With regard to *preparedness and response measures*, the existence of the 1984 plan achieved a significantly high degree of preparedness (of the local authorities and the population) and an organised search and rescue operations of trapped persons in collapsed buildings. The *main needs detected* were: to set up and implement training programmes in schools and communities to support and improve public actions during and immediately after an earthquake; to take advantage of international co-operation with bilateral and multilateral agreements focus on response, relief and rehabilitation procedures.

The Aigion (Greece) earthquake of June 15, 1995.

On 15th of June 1995, 00:15 (GMT) a large earthquake of magnitude M_w = 6.4 occurred in the western end of the Gulf of Corinth near at the city of Aigion. The earthquake although it was moderate, caused very serious damages: 26 lives claimed, more than 200 people were injured and 2 100 were made homeless. Particularly damaged were the cities of Aigion, Eratini and in many villages around the Gulf of Corinth. About 2.000 houses were classified as inhabitable, 2.300 temporarily inhabitable and 3 400 slightly damaged.

[35] Ch. Theofili & A.L. Vetere Eds. (2001) *Lessons learnt from earthquake disasters that occurred in Greece.* NEDIES project: Natural and Environmental Disaster Information Exchange System project.. Institute for the Protection and Security of the Citizen. 25 pp

The only strong motion instrument in Aigion recorded a peak ground horizontal acceleration (PGA) as high as 0.54 g (the highest ever recorded in Greece) in the vicinity of a collapsed building. The main characteristic of the recorded strong ground motion is the pulse-like shape of its most intensive part, with a period of about 0.45 sec. The macroseismic observations are in good agreement with the distribution of the peak horizontal acceleration - recorded at epicentral distances from 18 km to 78 km.

However, despite the very high recorded accelerations and the highest response spectra resulting from them, damage was not as much as one might have expected, considering the poor earthquake design and construction practices under which the majority of the buildings in the town and its surroundings had been built. This earthquake demonstrated among others, the great improvement in seismic behaviour of buildings affected by the application of the revised Greek Seismic Design Code of 1984, along with the importance of strength reserves of existing buildings in alleviating the consequences of strong ground motions.[36] The *main preventive measure* was the anti-seismic regulation of 1992 with some changes, which were introduced in 1995.

There was a *local emergency plan* for the region not used during the emergency because it was not found! This put in evidence the need emergency plan must be easily accessible and continuously updated.

Extensive *search and rescue* (SAR) operations were conducted by the Greek rescue team in collaboration with the French and Swiss rescue teams. 17 persons trapped into the ruins were rescued successfully. The SAR operation lasted for many days after the earthquake under very difficult conditions. Fortunately, after 4 days of search operations a small boy was rescued from the ruins of the collapsed apartment building. Sanitary provisions, first care and psychological support were provided to the population affected to a great extent.

Other lessons learnt in this case are: the preparedness is an important factor to improve the response, relief and rehabilitation procedures; search and rescue actions need a reliable and timely information; role identification of each actor taking part in the response phase (voluntary organisations included), before the disaster occurs, is essential in ensuring a faster and efficient response.

The Athens (Greece) earthquake of September 7, 1999.

This strong earthquake with magnitude M_w 5.9 occurred in the vicinity of the capital of Greece Athens. The earthquake caused the collapse of 65 buildings, all but a few residential, killing 143 persons and injuring about 750. More than 70,000 families became homeless.

Once again bad concrete quality, torsional effects, insufficient reinforcement, lack of infill walls in pilotis, pounding of adjacent structures, site conditions, short column effects and lack of ductility of buildings played an important role in damage caused by an earthquake in Greece. In spite of the high recorded ground accelerations (PGA around 0.30g and exceptionally 0.53 g at an epicentral distance of 15 km) and resulting high spectral values, the overall damage was not as severe and widespread as one might have expected, despite the relatively poor design and construction practices applied in the past.

[36] Lekidis, V. A. ; Karakostas C. Z. ; Dimitriu P. P.; Margaris B. N. ; Kalogeras I. ; Theodulidis N. (1999) The Aigio (Greece) seismic sequence of June 1995 : Seismological, strong motion data and effects of the earthquakes on structures *Journal of earthquake engineering*, vol. 3, no3, pp. 349-380.

Like previous earthquakes in Greece to hit urban areas, the Athens earthquake once again revealed the *most common factors and design/construction malpractices* affecting the seismic resistance of structures:

• Sites with poor soils (reclaimed land, river/stream beds, etc.) or irregular topography (hills or abrupt river banks).

• Unauthorized removal of infill walls (or even columns!) to increase usable area.

• Soft ground stories.

• Inadequate number of shear walls.

• Short columns, especially on basement and ground levels.

• Staircases without shear wall cores.

• Adjacent buildings with unequal height (*pounding effect*).

• Foundations on different levels, non-uniform basements.

• Non-uniform horizontal and/or vertical distribution of stiffness and mass.

• Later modifications in load-bearing elements in order to house heating/cooling and drainage Systems.

Regarding *seismic safety* it should be emphasized that: more effort should be placed regarding land use and urban planning, the improvement of design of structural and non-structural elements; the development of seismic risk assessment to know the possible effects of future earthquakes. Therefore, experience gathered from this and previous events points out the key role of several vulnerability-reducing factors, such as the rational use of infill walls and the regular configuration of structural systems, along with good material and workmanship quality.

Search and rescue operations started immediately after the earthquake and lasted for about a week. A total of 150 rescue squads were operating in 32 sites of collapsed buildings, among them 6 factories. A number of 85 people trapped in the ruins were rescued while 115 were pulled out of the rubble dead.

Accommodating those left without shelter was another priority. Tent camps (with some 8,000 tents) were quickly erected in the stricken areas, while an additional number of 12,000 tents were distributed to individuals. A lesson learnt was: a monitoring and management system of temporary settlements should be set up in order to help minimise the negative side effects, such as social degradation.

The next day following the earthquake, a *rapid first-degree safety assessment* of buildings began, starting with critical facilities (hospitals, bridges, fire stations, etc.) and extending to other public and private buildings. About 280 000 inspections were carried performed in the broader area of Athens, with approximately 50% of the buildings deemed not safe to occupy. Fifteen days after the earthquake, the second-degree damage assessment of buildings started. The entire task of damage assessment (both stages) was completed in about two months. Inspection of buildings was completed timely and successfully because a standard rapid method of inspection of buildings issued by the Earthquake Planning and Protection Organisation (EPPO) in 1998 was used.

The L'Aquila (Italy) earthquake of April 6, 2009.

On Monday April 6, 2009 at 3:32 a.m. local time, an Mw 6.3 earthquake with shallow focal depth (10 km) struck central Italy in the vicinity of L'Aquila, a city of about 73,000 people that is the capital of the Abruzzo region. Much of the damage occurred in this city, although many small villages in the surrounding regions were significantly damaged including Paganica, Castelnuovo, and Onna.

The earthquake struck when most people were sleeping. 308 people were killed, and approximately 1,500 people were injured (202 serious, 898 triaged), making this the deadliest earthquake to strike Italy since the 1980 Irpinia earthquake. The earthquake caused damage or destroyed to between 10,000 and 15,000 buildings, provoked the temporary evacuation of 70,000-80,000 residents, and left more than 65,000 homeless. A total of 81 municipalities were affected by the earthquake, and 49 of them had an intensity ≥ VI (MCS). The estimated economic cost were 4 billion € only in building material loss.

Historical destructive earthquakes since 1300 B.C. have been documented (Stucchi *et al.* 2007)[37]. According to historical data, L'Aquila has been severely damaged at least five times in the last seven centuries: in 1315 ($M_w \approx$ 6.7), 1349 ($M_w \approx 6.5$), 1461 ($M_w \approx 6.5$), 1703 ($M_w \approx 6.7$), and 1915 ($M_w \approx 7.0$) [38]. The 1461 event shows a magnitude, damage distribution and epicenter similar to that of the April 6 earthquake. The 2009 seismic sequence was located between 1997 Umbria-Marche (to the NW) and Molise 2002 (to the SE) seismic series. The main earthquake was preceded by an intense seismic activity, and was followed by many aftershocks.

Five stations, located within 10 km of the epicenter, recorded a horizontal peak ground acceleration exceeding 0.35g (and the AQM station recorded more than 1g, saturated). The recorded *PGA values were higher than those predicted* for short distances (< 20 km) by strong motion models (e.g. Ambraseys et al, 2005; Faccioli and Cauzi, 2008; Bindi et al, 2008; Akkar y Bomme, 2007 and Sabetta Pugliese, 1996). This a first interesting lesson.

Site amplification on soil deposits was evident in the towns and villages east of L'Aquila, down the axis of the Aterno River valley. Many affected villages founded at least partly on soft alluvium deposits (Onna, Paganica, Castelnuovo) had high damage levels (Onna was almost destroyed by the earthquake) while only light damage was observed in neighboring villages on bedrock materials (e.g. Tussio, Monticchio) that have URM buildings of the same quality and characteristics.

Masonry structures suffered the worst damage. The poor quality of the materials (rubble stone, brick, and hollow clay tile), the lack of interlocking elements between external and internal units of the wall section and lack of connection between crossing walls, excessive wall thicknesses without connection with each other, are among the most common deficiencies of poorly constructed masonry structures. These walls caused an increase in earthquake loads. However, *those masonry buildings with cross-ties* situated adjacent and parallel to the walls (with the purpose of limiting the out-of-plane deformation of the buildings) *generally performed well*, displaying only minor cracking in their walls and corners.

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[37] Stucchi M., Camassi R., Rovida A., Locati M., Ercolani E., Meletti C., Migliavacca P., Bernartdini F. and R. Azzaro (2007). DBMI04, il database delle osservazioni macrosismiche dei terremoti italiani utilizzate per la compilazione del catalogo parametrico CPTI04. http://emidius.mi.ingv.it/DBMI04/ . *Quaderni di Geofisica*, 49, pp.38. in Italian

[38] Learning from Earthquakes. *The Mw 6.3 Abruzzo, Italy, Earthquake of April 6, 2009.* EERI Special Earthquake Report — June 2009. http://www.eeri.org/site/images/eeri_newsletter/2009_pdf/LAquila-eq-report.pdf

Several modern, non-ductile *reinforce concrete* (RC) buildings had collapsed. In reinforced concrete structures, many structural deficiencies such as non-ductile detailing, poor concrete quality, strong beams-weak columns were commonly observed.

In this earthquake, the overall *death/ injury ratio* of 0.20 *was relatively low*, as 0.33 has been hypothesized for medium-to-large earthquakes. The case *fatality rates* of 0.17 overall and 0.60 for serious and critical (hospitalized) injuries are low in the first case and high in the second, as the ratio of serious to all injuries was only 0.13, which is somewhat small by comparison with similar earthquakes elsewhere (commonly it might be 0.15-0.25).

Coordination of the relief effort was impressive and rapid. The *Operational Committee* was activated in Rome immediately after the event, and an advanced team was deployed to the site two hours later. The level of the emergency was immediately set as "National". The coordination activities had to cope with the fact that the Prefecture building had collapsed during the quake. Then, the Central Coordination Center of the emergency was run by the Department of Civil Protection from the campus of the local police academy school in Coppito, outside L'Aquila. Local management was delegated to seven (after that increased to eight) different coordination centres in the affected area.

Within a short time, the authorities had deployed up to 12,000 people directly working for the emergency. By April 8, a total of 2,250 firefighters, 1,500 army personnel, 2,000 policemen, more than 1,000 technical employees of the Abruzzo Regional office and 3,000 volunteers were already working in the region.

As of April 23, about 63,000 people were in *temporary shelters*, 36,000 in 5700 tents, and 28,000 in 433 hotels and 1,600 private dwellings (Figure 1. 11). 160 'tent cities' were installed surrounded the main towns. On April 29, the mayor of L'Aquila declared that the people whose dwellings were declared safe for occupancy could go back. *Field hospitals* were also installed to provide first emergency aid.

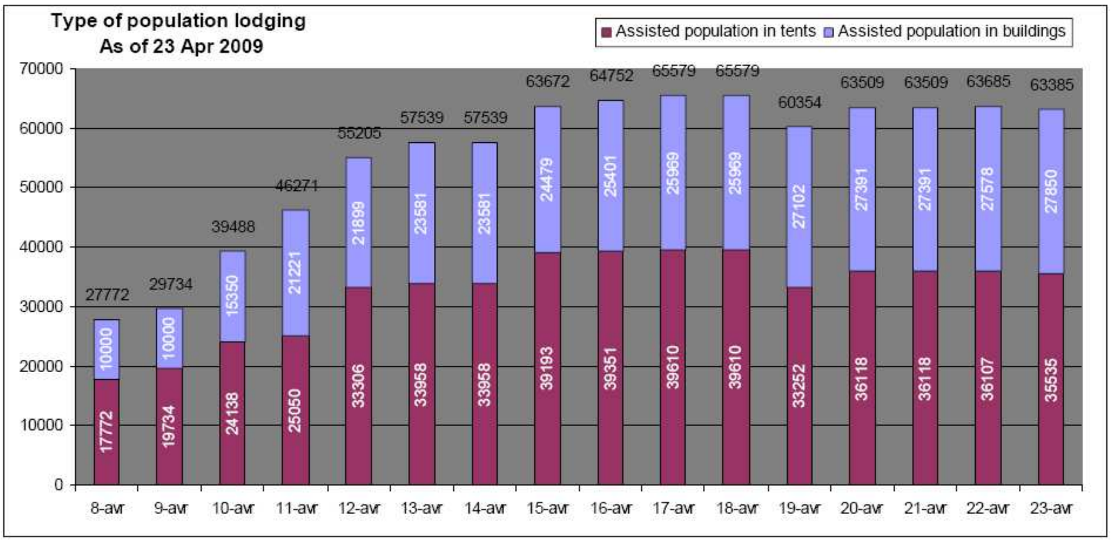

Figure 1.11. *The 2009 L'Aquila (Italy) earthquake. Temporary evolution of number of people assisted in temporary shelters.*

Two days after the quake, when inspections teams had completed public buildings such as hospitals and schools, the *assessment of the usability of buildings* began (Figure 1.12). Field hospitals were installed to provide first emergency aid. The *systematic inspections* of all the residential buildings started from the less damaged neighborhoods and moved gradually to the most damaged ones, with the aim of bringing as many people as possible back to their places as soon as possible. The assessment was based on visual inspection and relied on assessment forms which were produced by the Italian Civil Protection.

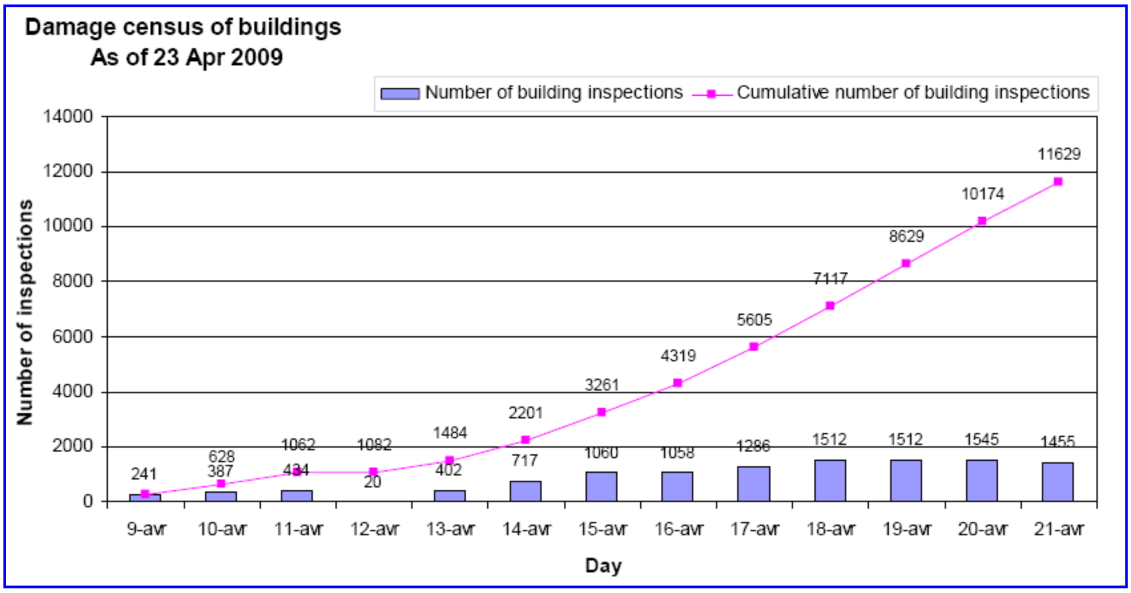

Figure 1.12. *The 2009 L'Aquila (Italy) earthquake. Number of inspected buildings as of April 23, 2009.*

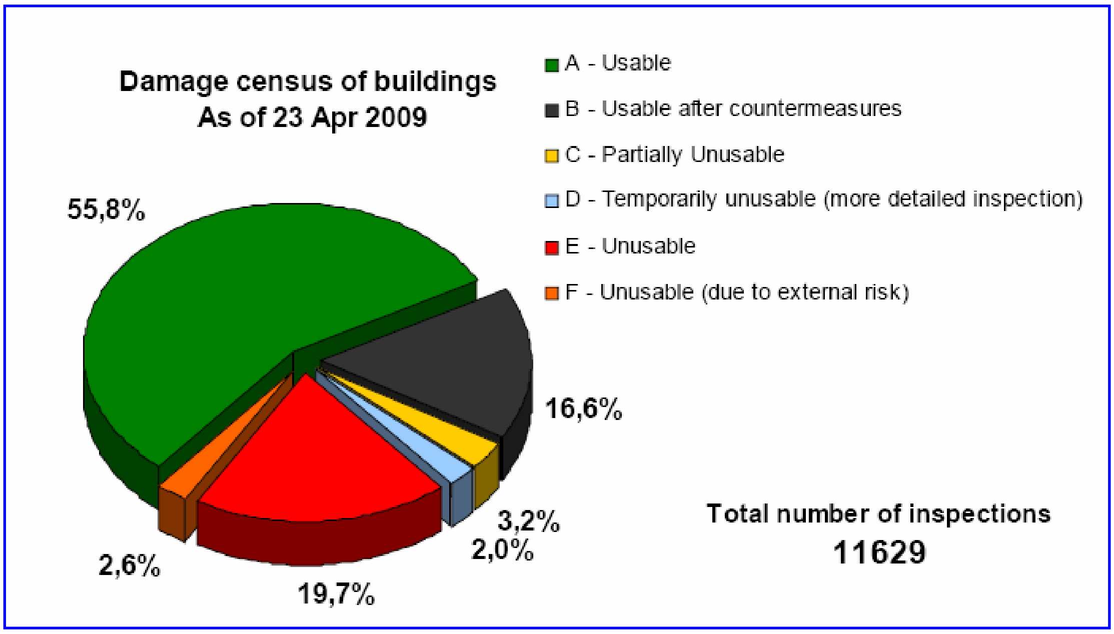

Figure 1.13. *The 2009 L'Aquila (Italy) earthquake. Usability classification of inspected buildings as of April 23, 2009.*

About 1,500 inspectors were deployed every day to evaluate about 1,000 buildings daily. Each squad comprised three building professionals. Inspections were also carried out by engineers from other EU countries (Spain, Portugal, Slovenia, Germany, France, and Greece) sent by the Monitoring Information Center of the European Community and a group of technicians sent by the Ministry of the Russian Federation. As of April 23, about 11,600 buildings had been inspected. About 56% of the buildings were green tagged (ready for occupancy), 22% were red tagged (unsafe for occupancy) and other 20% were unusable after countermeasures or more detailed inspection (Figure 1.13).

Main damage-related lessons learnt from this quake are:

- The presence of *large historical earthquakes* in the area was a clear warning that destructive earthquakes were expected. Thus, greater efforts in risk assessment, in the enforcement of seismic code and the right strengthening of vulnerable structures should have been a priority before the earthquake.
- Recorded *PGA's values* are compatible with seismic hazard maps of 2006, so these maps should be taken into account not only for prevention (seismic codes) but also for preparedness, emergency response and recovery.
- Largest *levels of damage* were associated to local effects (soil amplification, fault rupture, etc.) highlighting the importance of seismic hazard assessment (mainly at local level) and seismic microzonation improvement to implement effective urban planning in hazardous areas.
- Extensive damage was observed in *masonry structures* due to poor performance, lack of connection between crossing walls or heavy roofs or floors and workmanship quality. Nevertheless, the use of steel chains proved to be effective in mitigating the damage in URM structures. This suggests the need for strengthening the structures guided by experts.
- In the case of *reinforced concrete structures* (RC), observed extensive damage was due to many structural deficiencies such as large flexibility, strong beams-weak columns, inadequate detailing and rebar corrosion and poor concrete quality. This advised to make an effort regarding the improvement of design of structural and non-structural elements and to improve the national building codes and building safety requirements, introducing right procedures of building control (especially in high-risk zones).

Main emergency response-related lessons learnt from this quake are:

- Civil protection, as a direct service of the Presidency of the Council of Ministers, had a role of coordination, rather than providing direct assistance. Response operation centers were quickly set up, and relief efforts were well mobilized immediately after the quake.
- The *coordination of emergency response* was effective and sufficient because of coordination was planned before the earthquake occurrence. Regional and local Civil Protection acted according to preset protocols. Within a short time, the coordination was applied to 12,000 individuals directly working for the emergency, including volunteers. It was crucial for the effectiveness of emergency response that resources at a regional and national level were available in the aftermath of the earthquake.
- A rapid and accurate evaluation of earthquake parameters and earthquake intensity maps provided an overview of the size and extent of affected area. This was possible due to an

adequate monitoring and evaluation of seismic activity and their effects during all seismic sequence carried out by the experts of the Istituto Nazionale di Geofisica e Vulcanologia (INGV) in collaboration with specialist of the National Civil Protection.

- The *search and rescue of victims* was laborious due to the type of damage in masonry structures. This was achieved with a large number of firefighters, police, sanitary and civil protection people working very hard during the first week after the mainshock. Despite the efforts, the Red Cross reported that very few people were found alive. People were either able to escape on their own, with the help of neighbours or sadly died.
- Around 50,000 people who were made homeless by the earthquake found relatively quickly accommodation in tented camps and a further 10,000 were housed in hotels on the coast. More than one hundred fifty 'tent cities' were installed surrounded the main towns. Field hospitals were also installed to provide first emergency aid.
- The assessment *of the usability of buildings* was based on visual inspection and relied on assessment forms which were produced by the Italian Civil Protection and shared with the European earthquake engineering community. The instructions regarding the use of the forms were provided by Mr. A. Goretti of the Italian civil protection. A policy of "*evacuate all*" was adopted by the Civil Protection, until buildings have all been inspected by qualified engineers with earthquake engineering experience.

1. 7 Lessons learned from major natural hazards and relevant disasters in the regions involved in the project

Progress in natural risk reduction has been substantial due to increasing of scientific and technical capabilities but yet the cost of natural hazard impact is still rising, and the number of fatalities does not decrease the same in all places. In this line, it is important reduce the large variability in the application or enforcement of prevention measures in different countries and to advance and communicate knowledge on hazard prevention and on disaster preparedness, response and recovery.

This manual suggests a set of measures to reduce natural risk and the convenience for a *common strategy in the prevention of natural risk* in the Euro-Mediterranean countries. Often, the diversity of methodological approaches has reduced compatibility of information and makes it difficult for information to be consolidated at the European level. As consequence there is no overall picture of the risks.

Prevention is *to prevent disasters from happening and try to minimize their impacts*. It is emphasized the development of common methodologies and approaches cal help to avoid or reduce the natural hazard effects and an important tool is provide a common guide on natural risk prevention.

Analysis carried out on the specialized literature, the lesson learnt from several damaging earthquakes and the experience in different European countries lead to formulate several ***main recommendations on natural risk prevention*** that can be summarised in the following points, here specified for ***earthquake prevention***:

1. ***Developing guidelines on land use, spatial planning and built environment:*** Certain areas that are prone to particular risk may have restricted building codes that protect against risks. The primary cause of casualties due to earthquakes is the collapse of buildings. Therefore, the degradation of already fragile structure increases the level of the effect of the event.

It is observable that almost all damage, loss of human life and socio-economic destruction associated with earthquake disasters occur as a result of the failure of the built environment (structurally, functionally, environmentally and socially). In this sense a seismic risk assessment and land use planning should also be incorporated as part of the prevention measures.

The following needs are identified:

- Decide on *priorities for land use and urban planning* to reduce the effects of earthquake disasters according to hazard level of the areas identified on the basis of hazard mapping studies. Additional attempt should be placed regarding *land use and urban planning in respect to seismic safety* because in most earthquakes, ground shaking is the principal source of losses. For this, geological and geotechnical studies as well as seismic microzoning studies should be conducted in order to implementing effective urban planning through seismic microzonation.
- Where exist, it is useful *updating microzonation studies, neotectonic mapping* and *building codes.*
- *Seismic hazard assessment* needs to be improved, mainly at local level, when arise new data or methods. Immediate changes to the National Earthquake Building Code Map must be introduced according to new significant seismic hazard estimations.
- Community *guidelines for hazard, vulnerability and risk mapping* need to be developed, because the diversity of methodological approaches reduces comparability of information and there is no overall picture of the risks the EU is facing.
- Community *guidelines for creating earthquake scenarios* must be developed. RISK-UE project methodologies could be considered as starting point.
- *Risk assessment and land use planning* should also be incorporated as part of the prevention measures.
- *Improving current standards of construction* of new buildings and infra-structures must be performed during upgrading and implementation of national building codes. The earthquake-resistant advances from earthquake engineering and the lessons learned from last Euro-Mediterranean earthquake disasters must be taken into account. The common European design codes for buildings and civil works (in particular *Eurocode-8*) *must be fully integrated into the national codes and regulations*.
- It is necessary to *ensure total quality control of building construction* (study, construction and materials used) to achieve an adequate level of safety for all constructions. Special attention should be given to *the control on the implementation of regulations*, mainly regarding construction of private buildings.
- Control must be increased to *avoid the illegal building construction*.
- It is necessary to increase *the level of awareness* of the wider engineering community with regards to *building construction, safety requirements and regulation implementation.*
- There is also a need for interventions for *seismic strengthening existing buildings and infrastructures* for reducing vulnerability, mainly those affected in recent earthquakes.

- All essential facilities, public buildings and lifelines should *be maintained* and their *safety requirements* should be periodically checked. Safety requirements of all buildings should be also periodically checked.
- Reducing the vulnerability of the older buildings and of the historical and monumental heritage through *strengthening and retrofit*.
- Using *tax incentives and insurance polices* to reduce the cost of reconstruction and archive higher safety standards.

2. ***Improving earthquake regulation and legislation:*** Regulations and legislation pave the way to a better co-ordination of earthquake disaster management. It is also very important to ensure that updated versions of regulations and legislation are available.

   The improvements in earthquake management could be:

   - In a lot of places *earthquake-proof urban planning and land-use regulations* are required. The urban planning should be developed on the basis of seismic hazard (ground shaking) and other associated hazards and with the earthquake event in mind.
   - It is necessary to *re-examine* and *improve the national building codes* and building safety requirements on a systematic basis, especially in high-risk zones, introducing *right procedures of building control*.
   - *More strict requirements regarding seismic safety* should be included in the Building Code for the design of structural and non-structural elements, as seismic safety has much to do with the overall design of the building.
   - The *improvement of seismic risk assessment* would also be a useful in order *to obtain a clear view of the possible effects of future earthquakes* in a determined area and to support decision making on earthquake protection.
   - Seismic zonation and building code only apply on new buildings. The problem is to reduce the vulnerability of existing buildings. It is possible reduce the building vulnerability with appropriate *strengthening and retrofitting techniques.* National and local *strategies for strengthening existing buildings* on the basis of empirical experience and new regulations for disaster mitigation should be developed. The high cost of retrofitting suggests providing institutional funding and taxes incentives to promote these mitigation measures in high-risk areas.
   - An institutional framework for the *recovery and reconstruction phases* should be set up.
   - The *updating of the existing emergency plan* is of extreme importance and to be regulated. The emergency earthquake plan should provide for feedback procedures in order to record experience from this major disaster and integrate lessons learnt.
   - The need to establish an institutional framework on *how to intervene and evaluate building safety.*
   - *Reinforce international co-operation and bilateral agreements* can improve the response, relief and rehabilitation procedures. Trans-frontier cooperation in prominent hazards or intensive disasters is vital.

3. ***Improve the vulnerability knowledge and how reduce our vulnerabilities:*** While each disaster has its own characteristics, all disasters, whatever their types, present a number of common features. The potential effects of earthquakes can be in some way "*tuned up*" by local conditions, which determine the actual consequences and the type of information required for disaster management.

- The *strategic goal* in succeed in reducing our vulnerabilities is *working together* to increase capacity on local, national, and regional scales. Our first need will be increase our understanding of the seismic vulnerability.

- Local profiles should be established a priori, so as to help plan an effective management of disasters, from prevention and community preparedness to rescue and relief. A *detailed matrix of earthquake impacts* should be defined and refined on the basis of empirical experience and case studies in order to obtain a complete image of the extent and combinations of these effects. The extent and combination of the dominant effects of earthquakes on life, health, life support, housing, utilities, transport, and the associated secondary hazards depend on a number of local factors. These factors may be categorised in permanent variables (geographic, demographic, housing, resources, utilities, access routes and communications, potential parameters in propagating the effect) depending on the place of the disaster, and transient variables, related to the time of occurrence and the climatic conditions. The possibility of assistance will also vary according to these variables. Many of these factors can increase the vulnerability to earthquake hazard and thus initiate a disaster.

- *The criteria and procedures for vulnerability assessment* of buildings, essential facilities, and lifelines *should be standardized*. Vulnerability assessment in this regional component comprises the estimation of the degree of direct loss due to building damage (both structural and non-structural). By direct loss we refer to social losses (i.e. injuries, fatalities) and economic losses (i.e. repair costs, downtime) that can be directly correlated to the damage resulting from ground shaking at a given level of intensity.

- Th*e losses may be calculated directly* as a function of the intensity of the hazard, or through models which estimate first the damage given a level of intensity and then the social or economic loss given a level of damage. These methods and estimations might be based on past observations of damage/loss (empirical), through expert opinion or based on numerical models of the considered phenomenon (analytical).

- The implementation of GIS for the representation and simulation of seismic risk, allows the creation of hazard maps of the territory in respect of seismic risk and maps that *characterize the vulnerability* of the building. In addition it allows to create *damage scenarios* which can produce both thematic maps concerning the mitigation of seismic risk in terms of prevention and to simulate the consequences that would be created (as a result of a seismic event) and finally, to prepare contingency plans. The ability to calculate risk measures on the area certainly represents an important aid to the activities of regional planning in terms of development and redevelopment of urban settlements purposes.

- Develop a *Post-Earthquake Building Safety Assessment Gui*de describing procedures for deciding what buildings must be firstly investigated, building evaluation methodology, safety classification criteria, descriptions of typical levels of damage for different types of buildings and the relation of such damage to safety, responsibilities of project participants, formation and dispatch of investigation teams,and dissemination of the information collected.

Therefore, it is important that different procedures and inspection forms should be issued. Furthermore, the spatial distribution of damage should be an outcome of the assessment in fast and detailed inspections.

4. ***Improve the coordination and the prevention measures in the emergency phase:*** Often the coordination among government, agencies, volunteers, humanitarian organizations, etc. is currently insufficient. The goal is facilitate the coordination among disaster response organisations before the occurrence of natural hazards. A set of actions must be planned and tested before.

   - *Mobilisation time* should be minimised. In addition, the strengthening of the resources available and the role at a local level should be established.
   - *Role identification* of each actor from all types of organisations taking part *in the response phase*, before the disaster occurs, is essential in ensuring a coordinated, faster and more efficient response and to facilitate emergency operations.
   - Civil Protection and competent authorities should *develop a protocol* to assure that *people should be conscious of staying away from the risk places* (e.g. collapsed or seriously damaged buildings) during the emergency phase.
   - It is essential that *resources are available in the aftermath of an earthquake*. The creation of inventories and data bases on resources at a regional and national level, along with its continuous update, are considered important measures for an effective response.
   - There is a need to have a *coordination body that deals with volunteers* (NGOs, charity organisations and individuals). Volunteers played a significant role in aid provision after the earthquake (e.g. Kobe earthquake). There is still a strong need to clarify their role in the preparation for a potential disaster and their interaction with all actors involved in responding to any major emergencies. Experience shows that their contribution would have been greater if there would have been some form of coordination at either Municipal or Government level. It is imperative that the role of volunteers is taken into account in the Emergency Plan in order to tackle these matters.
   - *Local response* is crucial in earthquake emergency and local institutions and their human and physical resources must be well coordinated. Municipalities should be taken into account in emergency planning. They should be assigned roles and they also should be accountable for disaster response and relief.
   - It is essential that the *adequate use of information and the* media be carried out. Media can play a crucial role in the management of an emergency. It is important appoint to a local radio station the task to disseminate instructions to the citizens in case of an emergency. Observed over-reactions of the population were influenced and exaggerated by broadcasted remarks mainly from seismologists on predictions for oncoming earthquake.

- It is necessary that *information technology* be used in order to manage information. It is textbook knowledge that real-time, accurate information is vital in emergency respond and disaster management. An operational MIS (Management Information System) and GIS (Geographical Information System) can make a difference in effectiveness of disaster management.
- It is necessary to establish a *monitoring and management system of temporary settlements* in order to help minimise the negative side effects, such as social degradation.
- It is important to note that accesses and escape ways from buildings and towns must be ensured and be widely known to the population.

5. ***Response actions and effectiveness of search and rescue operations:*** The ability of citizens and policy makers to mitigate disasters depends, to a great extent, on access to reliable and fast information on earthquake data and potential consequences.

- In the case of earthquakes, of magnitude 5 or more, an *automatic procedure* is need to be immediately activated by national seismic networks to produce data, maps, and information concerning the epicentral area. Thus, maps and data, giving a complete description of the main features of the stricken area will be transmitted, in the aftermath hours after the event, to the Civil Defence departments and authorities. The Euro-Mediterranean Seismological Centre (EMSC) operates a system for rapid determination of the European and Mediterranean earthquakes for determining the principal parameters (epicentre, depth, magnitude, focal mechanisms...) of major seismic events located within the European-Mediterranean region and dispatch widely the corresponding results.
- After a seismic event it is very important to recognise the dimension of the problem as soon as possible. Particularly useful is the use of a G.I.S. A *preliminary evaluation of earthquake ground motion scenario* (geographical distribution of intensity, PGA, etc.) and *earthquake damage scenario* (damages and losses) can be estimated on the basis of attenuation and vulnerability relations for each municipality surrounding the epicentre. These data can be calculated if a simulation software and attenuation and local amplification relations joint to vulnerability functions have been previously implemented in a system. This is crucial information for an adequate and effective earthquake disaster response.
- In recent years the *use of GIS* for the needs of Civil Protection assumes an increasingly important role in the context of forecasting and risk prevention as well as in support to decisions to be taken to manage the emergency. Operating GIS allows create earthquake damage scenarios which can simulate the consequences created as a result of a seismic event showing a “*blind prediction*” of damage distribution very useful in prioritizing tasks in response to quake.
- The availability of reliable and timely information is vital for an efficient search and rescue. This information is essential for putting priorities on search and rescue actions and for allocating the available resources and means appropriately.
- The different *procedures and inspection forms* should be issued to inspection buildings following a response plan for safety evaluations of damaged buildings to be activated efficiently and effectively following a major earthquake.
- The living conditions in the *temporary settlements* need to be improved, along with facilities and services.

6. ***Improve the training and the level of preparedness through adequate and constant information to population, school education and technical training of experts:*** Prevention and information on risk and risk protection walk together.

- Promoting an alert and prepared community to cope with disaster through activities of training and spreading information on risk prevention.

- It would be useful to *set up and implement training programmes* that can be used in schools and communities can support public actions before, during and immediately after an earthquake,

- It is necessary to raise the awareness of Municipal authorities and administration and the *training of their personnel* involved in prevention and earthquake emergency response and relief should be intensified.

- *Informative seminars* should also be introduced to raise public awareness prior to and after an earthquake.

- The promotion of a broad-based public awareness scheme, coupled with a better understanding of earthquakes is required, so as to obtain public support for actions to reduce the impacts of earthquakes.

- Methods of *improving the communication to the public* would be of great help.

- Increasing *the awareness of the citizens* regarding the European emergency Number 112 in partnership with the Member States.

- The social component in earthquake disaster management is crucial and is required for planning efficient mitigation programs, as the success or failure of mitigation programs is also strongly influenced by people's perceptions of the earthquake threat and how to adjust to it, the organisation and cultural make-up of the community involved.

7. ***Improving research activities:*** The develop of tools to model the impacts of damage provide opportunities to advance in modelling and observational systems, that help to respond to disasters, and share information about the risk of natural processes or phenomena that may be a damaging event

- A new challenge in Earthquake Engineering is now *looking beyond "life safety"* to further reduce the damage to buildings and critical facilities must be promoted because we can reduce not only fatalities but also economic losses.

- Improve the *methodologies and automatic procedures* to produce data, maps, and information concerning the epicentral area to be immediately activated in the case of earthquakes of great magnitude.

- It is important invest in research on the development of *early warning systems* and on exchange of information and monitoring systems.

- Develop research activities joint with the civil protection linked to the disaster management cycle.

- Develop of *overall scenarios* based on disasters which have occurred in the past.

- The development of *hazard and risk maps* can aim to identify the areas prone to risk. Furthermore, they provide information to the citizens and an important tool for planning to the authorities.

- Emphasis should be placed on technological perspectives, such as the design of monitoring and warning systems.

8. *Improve the knowledge and data on the social component of earthquake disasters:*

Available data on earthquake impacts and consequences is currently limited and suffers from a lack of comparability. It is necessary a comprehensive inventory of existing sources of information related to earthquake disasters. On the other hand, information on the economic impacts of earthquake disasters is particularly important since it can allow policy makers to properly assess the costs and benefits of different disaster prevention measures.

For a better understanding of disasters it is necessary:

- To create *European and National databases of earthquake impacts and consequences* that show the consequences of earthquakes, including building damage, damage to lifelines and other infrastructure, ground failure, human casualties, social disruption, and financial and economic impacts.
- Create a *European and National databases of seismic vulnerability estimations* using common methods for all countries/regions in order to allow a global risk assessment to be carried out.
- There is a need to document experiences and disseminate the results gained.
- Improving emergency management and prompt intervention after destructive earthquakes.

1. 8 Objectives of the Manual for Natural Risk Prevention.

EU Member States generally appear to have developed quite effective and well-coordinated mechanisms for crisis management (response and recovery), also in regard to specific disaster types[39]. This reflects that crisis management and civil protection are areas with a long history and a strong national momentum.

However, disaster prevention is a newer discipline and natural risk prevention is a recent area within this. At the beginning of this chapter, *natural risk prevention* was defined as all those activities which can be taken to avoid or to alleviate the effects of natural hazards or to reduce futures losses, whether in terms of human casualties or physical or economic losses. One way to identify, prioritize and implement preventive measures for natural disasters is to take the result of past experiences and identify those actions that have been recognized as correct in the prevention and mitigation of damages.

Good practices in natural risk prevention are those groups of actions and processes to be effective reducing disaster impact (losses of life, property, and function) based on the experience acquired in past natural disasters. Their usefulness lies in the fact that they improve public policies, increase the awareness level of those people working in prevention and mitigation of natural risks (decision makers, risk managers, technicians, civil protection workers, etc.) and of the population.

The main aim of this manual is to develop some common techniques, methods and procedures aimed at promoting new policies for natural risk prevention (focusing on seismic risks) at the national and European level.

[39] *Member States' Approaches towards Prevention Policy - a Critical Analysi. Final Report.* European Commission DG Environment. March 2008. 81 pp.

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A fuller **bibliography** of relevant documents on indicators, resilience and community DRR.http://www.unisdr.org/local-government

Local Government Alliance for Disaster Risk Reduction. A compilation of good practices and lessons learnt by local governments in disaster risk reduction. Local-level implementation of the Hyogo Framework for Action remains one of the major challenges to achieve, requiring the active participation and involvement of local government actors at different levels. From the regional to the municipal level, local governments have a key role to play in reducing disaster risks and vulnerabilities. http://www.unisdr.org/Global -Facility DRR.pdf

Global Facility for Disaster Reduction and Recovery. Disaster reduction is a critical dimension of the global poverty reduction agenda as disasters impact poor the most. With this in view, the World Bank is developing various instruments to support its client governments to integrate risk reduction strategies in development processes at the country and local levels, especially in countries where risks are high. http://www.reliefweb.int/ocha_ol/index.html

United Nations Office for Coordination of Humanitarian Affairs (UN-OCHA). The mission of UN-OCHA is to mobilize and coordinate the collective efforts of the international community, in particular those of the UN system, to meet in a coherent and timely manner the needs of those exposed to human suffering and material destruction in disasters and emergencies. This involves reducing vulnerability, promoting solutions to root causes and facilitating the smooth transition from relief to rehabilitation and development.http://www.reliefweb.int/undac/index.html

UNDAC (United Nations Disaster Assessment and Coordination). The UNDAC team is a stand-by team of disaster management professionals who are nominated and funded by member governments, OCHA, UNDP and operational humanitarian United Nations Agencies such as WFP, UNICEF and WHO. Upon request of a disaster-stricken country, the UNDAC team can be deployed within hours to carry out rapid assessment of priority needs and to support national Authorities and the United Nations Resident Coordinator to coordinate international relief on-site. Particularly after earthquakes the UNDAC team has to be mobilized rapidly in order to effectively coordinate the search and rescue (SAR) operation of international SAR teams together with the national authorities of the affected country.http://www.virtualref.com/uncrd/_sub/s287.htm

UNDRO (Office of the United Nations Disaster Relief Co-ordinator). United Nations office established in 1972 to coordinate international relief activities to countries struck by natural or other disasters. It is headed by a disaster relief coordinator who reports directly to the UN secretary-general and works closely with the United Nations Development Programme (UNDP). http://www.unisdr.org/unisdr/radiusindex.htm, http://www.geohaz.org/radius

Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters (RADIUS). RADIUS is an initiative launched in 1996 by the secretariat of the International Decade for Natural Disaster Reduction (IDNDR 1990-2000), United Nations, Geneva, with financial assistance from the Government of Japan. It aimed to promote worldwide activities for reduction of seismic disasters in urban areas, particularly in developing countries. The RADIUS initiative has developed practical tools for seismic risk assessment of urban areas, raised public awareness and provided directions for the development and implementation of disaster mitigation measures.

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The **European-Mediterranean Seismological Centre** (EMSC) was founded in 1975, following a recommendation from the European Seismological Commission (ESC). The ESC is a regional commission of the International Association of Seismology and Physics of the Earth's Interior (IASPEI), itself a specialized association of the International Union of Geodesy and Geophysics (IUGG). The EMSC maintains a 24h/24 and 7d/7 operational earthquake information service, sending alert messages to appropriate authorities, international organisations, and EMSC members with the location and magnitude parameters.

http://www.eldis.org/guides/index.htm

Eldis is an internet based information service: filtering, structuring and presenting development information via the web and email. They maintain an ever-growing library of editorially selected and abstracted online documents, and an organisational directory of development-related internet services.

http://www.riskinstitute.org/test.php?pid=clear. **PERI. The Public Entity Risk Institute's** mission is to serve public, private, and nonprofit organizations as a dynamic, forward thinking resource for the practical enhancement of risk management.

http://www.eeri.org/site/

EERI. The **Earthquake Engineering Research Institute** is a national, nonprofit, technical society of engineers, geoscientists, architects, planners, public officials, and social scientists.

http://www.colorado.edu/hazards/about/

The **Natural Hazards Center** has served (since 1976) as a national and international clearinghouse of knowledge concerning the social science and policy aspects of disasters. The Center collects and shares research and experience related to preparedness for, response to, recovery from, and mitigation of disasters, emphasizing the link between hazards mitigation and sustainability to both producers and users of research and knowledge on extreme events.

http://www.southwestcoloradofires.org/default.asp

Wildland Fire. The purpose of this website is to inform citizens, government agencies and leaders, and any interested people about current efforts to prevent unwanted damage from wildfire on private and public lands.

KEY TERMS IN NATURAL DISASTER PREVENTION AND RISK REDUCTION

Acceptable risk - The level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions. In engineering terms, acceptable risk is also used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems to a chosen tolerated level, according to codes or "accepted practice" which are based on known probabilities of hazards and other factors.

Capacity (***or*** **capability) -** The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals. Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management. *Capacity assessment* is a term for the process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action. Capacity may also be described as capability.

Disaster - A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences.

Disaster impacts - May include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

Disaster mitigation - The lessening or limitation of the adverse impacts of hazards and related disasters. The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures encompass engineering techniques and hazard-resistant construction as well as improved environmental policies and public awareness.

Disaster prevention (*or* Prevention) - The outright avoidance of adverse impacts of hazards and related disasters. It expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance such as construction of dams or embankments that eliminate flood risks, land-use regulations that do not permit any settlement in high-risk zones, and seismic engineering designs that ensure the survival and function of a critical building in any likely earthquake.

Disaster risk - The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period. The definition of disaster risk reflects the concept of disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socio-economic development, disaster risks can be assessed and mapped, in broad terms at least.

Disaster risk management - The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. This term is an extension of the more general term “risk management” to address the specific issue of disaster risks. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness.

Disaster risk reduction (DRR) - This is a broad and relatively new concept. The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. A comprehensive approach to reduce disaster risks is set out in the United Nations-endorsed Hyogo Framework for Action, adopted in 2005, whose expected outcome is “*The substantial reduction of disaster losses, in lives and the social, economic and environmental assets of communities and countries*.” The International Strategy for Disaster Reduction (ISDR) system provides a vehicle for cooperation among Governments, organisations and civil society actors to assist in the implementation of the Framework. Note that while the term “disaster reduction” is sometimes used, the term “disaster risk reduction” provides a better recognition of the ongoing nature of disaster risks and the ongoing potential to reduce these risks.

Disaster risk reduction plan - A document prepared by an authority, sector, organization or enterprise that sets out goals and specific objectives for reducing disaster risks together with related actions to accomplish these objectives. Disaster risk reduction plans should be guided by the Hyogo Framework and considered and coordinated within relevant development plans, resource allocations and programme activities. National level plans needs to be specific to each level of administrative responsibility and adapted to the different social and geographical circumstances that are present. The time frame and responsibilities for implementation and the sources of funding should be specified in the plan.

Early warning system - The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss. This definition encompasses the range of factors necessary to achieve effective responses to warnings. A people-centred early warning system necessarily comprises four key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received. The expression “***end-to-end warning system***” is also used to emphasize that warning systems need to span all steps from hazard detection through to community response.

Emergency - Unforeseen or sudden occurrence, especially danger, demanding immediate action.

Emergency management - The organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps. A crisis or emergency is a threatening condition that requires urgent action. Effective emergency action can avoid the escalation of an event into a disaster. Emergency management involves plans and institutional arrangements to engage and guide the efforts of government, non-government, voluntary and private agencies in comprehensive and coordinated ways to respond to the entire spectrum of emergency needs. The expression "*disaster management*" is sometimes used instead of emergency management.

Environmental degradation - The reduction of the capacity of the environment to meet social and ecological objectives and needs. Degradation of the environment can alter the frequency and intensity of natural hazards and increase the vulnerability of communities. The types of human-induced degradation are varied and include land misuse, soil erosion and loss, desertification, wild-fires, loss of biodiversity, deforestation, mangrove destruction, land, water and air pollution, climate change, sea level rise and ozone depletion.

Environmental impact assessment - Process by which the environmental consequences of a proposed project or programme are evaluated, undertaken as an integral part of planning and decision-making processes with a view to limiting or reducing the adverse impacts of the project or programme. Environmental impact assessment is a policy tool that provides evidence and analysis of environmental impacts of activities from conception to decision-making. It is utilized extensively in national programming and project approval processes and for international development assistance projects. Environmental impact assessments should include detailed risk assessments and provide alternatives, solutions or options to deal with identified problems.

Exposure - People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

Extensive and intensive risks - *Extensive risk :* the widespread risk associated with the exposure of dispersed populations to repeated or persistent hazard conditions of low or moderate intensity, often of a highly localized nature, which can lead to debilitating cumulative disaster impacts. Extensive risk is mainly a characteristic of rural areas and urban margins where communities are exposed to, and vulnerable to, recurring localised floods, landslides storms or drought. Extensive risk is often associated with poverty, urbanization and environmental degradation.

Intensive risk: the risk associated with the exposure of large concentrations of people and economic activities to intense hazard events, which can lead to potentially catastrophic disaster impacts involving high mortality and asset loss. Intensive risk is mainly a characteristic of large cities or densely populated areas that are not only exposed to intense hazards such as strong earthquakes, active volcanoes, heavy floods, tsunamis, or major storms but also have high levels of vulnerability to these hazards.

Hazard - A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. The hazards of concern to disaster risk reduction as stated in footnote 3 of the *Hyogo Framework* are "… *hazards of natural origin and related environmental and technological hazards and risks*." Such hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological, and technological sources, sometimes acting in combination. In technical settings, hazards are described quantitatively by the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis.

Hazard analysi: identification, studies and monitoring of any hazard to determine its potential, origin, characteristics and behaviour.

Natural hazard: natural process or phenomenon that may cause adverse impacts. Natural hazards are a sub-set of all hazards. The natural hazards can be grouped in two main categories namely *geophysical hazards* and *hydrometeorological hazards*; the last one is subdivided in droughts and related hazards, floods and related hazards, and windstorms. The term natural hazards is used to describe actual hazard events as well as the latent hazard conditions that may give rise to future events. Natural hazard events can be characterized by their magnitude or intensity, speed of onset, duration, and area of extent. For example, earthquakes have short durations and usually affect a relatively small region, whereas droughts are slow to develop and fade away and often affect large regions. In some cases hazards may be coupled, as in the flood caused by a hurricane or the tsunami that is created by an earthquake.

Geological hazard: A dangerous geological process or phenomenon that may cause adverse impacts. Geological hazards include internal earth processes, such as earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements, landslides, rockslides, surface collapses, and debris or mud flows. Hydrometeorological factors are important contributors to some of these processes.

Tsunamis: are difficult to categorize; although they are triggered by undersea earthquakes and other geological events, they are essentially an oceanic process that is manifested as a coastal water-related hazard.

*Hydrometeorological hazard**:*** A dangerous process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause adverse impacts. Hydrometeorological hazards include tropical cyclones (also known as typhoons and hurricanes), thunderstorms, hailstorms, tornados, blizzards, heavy snowfall, avalanches, coastal storm surges, floods including flash floods, drought, heatwaves and cold spells. Hydrometeorological conditions also can be a factor in other hazards such as landslides, wildland fires, locust plagues, epidemics, and in the transport and dispersal of toxic substances and volcanic eruption material.

Land-use planning -The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long term economic, social and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses. Land-use planning is an important contributor to sustainable development. It involves studies and mapping; analysis of economic, environmental and hazard data; formulation of alternative land-use decisions; and design of long-range plans for different geographical and administrative scales. Land-use planning can help to mitigate disasters and reduce risks by discouraging settlements and construction of key installations in hazard-prone areas, including consideration of service routes for transport, power, water, sewage and other critical facilities.

National platform for disaster risk reduction - A generic term for national mechanisms for coordination and policy guidance on disaster risk reduction that are multi-sectoral and inter-disciplinary in nature, with public, private and civil society participation involving all concerned entities within a country. Disaster risk reduction requires the knowledge, capacities and inputs of a wide range of sectors and organisations, including United Nations agencies present at the national level, as appropriate. Most sectors are affected directly or indirectly by disasters and many have specific responsibilities that impinge upon disaster risks. National platforms provide a means to enhance national action to reduce disaster risks, and they represent the national mechanism for the International Strategy for Disaster Reduction.

Preparedness - The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. Preparedness action is carried out within the context of disaster risk management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response through to sustained recovery. Preparedness is based on a sound analysis of disaster risks and good linkages with early warning systems, and includes such activities as contingency planning, stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises. These must be supported by formal institutional, legal and budgetary capacities. The related term “readiness” describes the ability to quickly and appropriately respond when required.

Prevention - The outright avoidance of adverse impacts of hazards and related disasters. (See disaster prevention). Very often the complete avoidance of losses is not feasible and the task transforms to that of mitigation. Partly for this reason, the terms prevention and mitigation are sometimes used interchangeably in casual use.

Public awareness - The extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards. Public awareness is a key factor in effective disaster risk reduction. Its development is pursued, for example, through the development and dissemination of information through media and educational channels, the establishment of information centres, networks, and community or participation actions, and advocacy by senior public officials and community leaders.

Recovery or Post-Disaster Recovery - The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors, in accordance with the principles of "build back better". The recovery task of rehabilitation and reconstruction begins soon after the emergency phase has ended, and should be based on pre-existing strategies and policies that facilitate clear institutional responsibilities for recovery action and enable public participation.

Residual risk - The risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained. The presence of residual risk implies a continuing need to develop and support effective capacities for emergency services, preparedness, response and recovery together with socio-economic policies such as safety nets and risk transfer mechanisms.

Resilience - The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. Resilience means the ability to "resile from" or "spring back from" a shock. The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need. Resilience is generally seen as a broader concept than 'capacity' because it goes beyond the specific behaviour, strategies and measures for risk reduction and management that are normally understood as capacities (J. Twigg, 2007).

Response - The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. ***Disaster response*** is predominantly focused on immediate and short-term needs and is sometimes called "*disaster relief*". The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Risk - The combination of the probability of an event and its negative consequences. This definition closely follows the definition of the ISO/IEC Guide 73. The word "risk" has two distinctive connotations: in popular usage the emphasis is usually placed on the concept of chance or possibility, such as in "the risk of an accident"; whereas in technical settings the emphasis is usually placed on the consequences, in terms of "potential losses" for some particular cause, place and period. It can be noted that people do not necessarily share the same perceptions of the significance and underlying causes of different risks.

Risk assessment/analysis - A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. Risk assessments (and associated risk mapping) include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.

Risk management - The systematic approach and practice of managing uncertainty to minimize potential harm and loss. Risk management comprises risk assessment and analysis, and the implementation of strategies and specific actions to control, reduce and transfer risks. It is widely practiced by organizations to minimise risk in investment decisions and to address operational risks such as those of business disruption, production failure, environmental damage, social impacts and damage from fire and natural hazards. Risk management is a core issue for sectors such as water supply, energy and agriculture whose production is directly affected by extremes of weather and climate.

Risk transfer - The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party. Insurance is a well-known form of risk transfer, where coverage of a risk is obtained from an insurer in exchange for ongoing premiums paid to the insurer. Risk transfer can occur informally within family and community networks where there are reciprocal expectations of mutual aid by means of gifts or credit, as well as formally where governments, insurers, multi-lateral banks and other large risk-bearing entities establish mechanisms to help cope with losses in major events. Such mechanisms include insurance and re-insurance contracts, catastrophe bonds, contingent credit facilities and reserve funds, where the costs are covered by premiums, investor contributions, interest rates and past savings, respectively.

Structural and non-structural prevention measures.

Structural measures - Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems;

Non-structural measures - Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education. Common structural measures for disaster risk reduction include dams, flood levies, ocean wave barriers, earthquake-resistant construction, and evacuation shelters. Common non-structural measures include building codes, land use planning laws and their enforcement, research and assessment, information resources, and public awareness programmes. Note that in civil and structural engineering, the term “structural” is used in a more restricted sense to mean just the load-bearing structure, with other parts such as wall cladding and interior fittings being termed non-structural.

Sustainable development - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition coined by the 1987 Brundtland Commission is very succinct but it leaves unanswered many questions regarding the meaning of the word development and the social, economic and environmental processes involved. Disaster risk is associated with unsustainable elements of development such as environmental degradation, while conversely disaster risk reduction can contribute to the achievement of sustainable development, through reduced losses and improved development practices.

Vulnerability - The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors. Examples may include poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for wise environmental management. Vulnerability varies significantly within a community and over time. This definition identifies vulnerability as a characteristic of the element of interest (community, system or asset) which is independent of its exposure. However, in common use the word is often used more broadly to include the element's exposure.

CHAPTER 2

EU NATURAL RISK PREVENTION FRAMEWORK

2. 1 Introduction

2. 1.1 General observations

Disasters, especially those caused by natural hazards, are one of the greater threat to humanity. Over the last quarter century, the number of reported natural disasters and their impact on human and economic development worldwide has been increasing yearly[40]. *Natural disaster risk* is intimately connected to processes of human action. These processes intervene in the translation of physical exposure into natural disaster events because vulnerability is a fundamental factor intervening in the growth of disaster. This vulnerability is generated by social, economic and political processes that influence how hazards affect people in varying ways and with differing intensities.

Severe natural hazard losses are caused by interactions between the destructive power of hazards and the vulnerability of exposed elements that make them susceptible to damage. A hazard's destructive potential is a function of the magnitude, duration, location and timing of the event joint to intrinsic characteristics, or vulnerabilities, of the elements at risk. These elements are people, infrastructure, environment and economic activities. Significant losses can occur mainly during severe hazard events in those areas where population and economic investment are concentrated and when elements at risk are weak against those hazards.

The difference between a hazard and a disaster is an important one. A disaster takes place when a society or community is affected by a hazard (it is usually defined as an event that overwhelms a society's capacity to cope)[41]. As mentioned above, the impact of the disaster is heavily influenced by the degree of the community's vulnerability to the hazard. This vulnerability is not natural. It is the human dimension of disasters, the result of the whole range of economic, social, cultural, institutional, political and even psychological factors that shape people's lives, and create the environment that they live in. This question of society's resilience and vulnerability is very important for understanding the impact of disasters, and making choices about how to intervene.

Global analyses carried out by the UN and other international organisations have highlighted a growing vulnerability to natural phenomena. It is worrying that disaster risk and impacts have been increasing during a period of global economic growth.

[40] UNDP (2004). *Reducing Disaster Risk: A Challenge for Development. A Global Report.* United Nations Development Programme. Bureau for Crisis Prevention and Recovery. New York, 2004.

[41] Twigg, J. (2004). *Disaster risk reduction. Mitigation and preparedness in development and emergency programming.* Overseas Development Institute, London, 2004. 365 pp.

In Europe, and especially in Mediterranean region, the updated information shows the impact of natural hazards is relevant in terms of physical damage and economic consequences. The more ***significant events***, understood as those events with capacity to generate victims, are *earthquakes* and *floods*. Both can be regarded like European intensive disasters.

Damaging earthquakes, in spite of their low rate of occurrence, they should be considered of high priority in prevention policy due to their high mortality risk.

Large Floods are frequent, happen near all regions in Europe, they have consequences on extensive areas and can generate an important number of fatalities and homeless people. In some cases both types of these events can cause trans-boundary impact.

The analysis of the characteristics, frequency and consequences of the natural hazards has shown a strong variation among regions in the EU. Natural disaster data from the last century show *different geographic pattern* in the dominant types of natural hazards. The flooding and landslides are predominant in the north and middle of Europe whereas drought, earthquakes and wild fires are more frequents to the south.

Over the last 30 years, disasters have increased both in frequency and intensity. Since 1990 natural disasters have been identified as a growing threat for European Union due to vulnerability to natural disasters is increasing and having some times trans-boundary impacts (e.g. see recent floods & fires).

According to CRED report[42] for 2007, natural disasters have a high economic impact on developed countries such as Japan, the United States, and Europe. The economic cost of disasters in Europe is estimated to be €15 billion yearly, being natural disaster the more important part. This impact has been recognized as a European problem because it may adversely affect the economic growth and competitiveness of European Union and have an effect on the sustainable development into EU.

The overall problem on natural disaster prevention in Europe is dealing with saving lives, to protect the environment and to reduce social and economic costs of society.

Disaster risk is not inevitable and the application of strategies and good practices in prevention and disaster risk reduction can contribute to a serious reduction in natural hazards impact. The management of natural and technological disasters is a clear example of the added value of action at community level, where national responsibility for dealing directly with disasters remains unchallenged but is facilitated and assisted by the sum total of shared Community resources[43].

Only after the overall risk is fully understood should mitigation measures be identified, prioritized, and implemented. Basic principles underlying this process include:

- The impacts of natural hazards and the costs of the disasters they cause will be reduced whether mitigation measures are implemented during new construction (preventively) or as retrofits (correctively). *Proactively integrating mitigation measures* into new construction is typically more economically feasible than retrofitting existing structures.
- Risk reduction techniques must address as many applicable hazards as possible. This approach, known as *multi-hazard mitigation*, is the most *cost-effective approach*, maximizes the protective effect of complementary mitigation measures and optimizes multi-hazard design techniques with other building technologies.

[42] EM-DAT 2007 Disasters in Numbers, http://www.emdat.be/Documents/ConferencePress/2007- disasters-in-numbers-ISDR-CRED, and Press Release UN/ISDR 2008/01, 18 January 2008.

[43] *Resist Natural Hazards* by the WBDG Secure/Safe Committee, Last updated: 06-02-2010 http://www.wbdg.org/design/resist_hazards.php

The overall objective is to reduce the risk of disasters and the adverse impacts of natural hazards, implementing adequate prevention strategies. This means systematic efforts to analyse and manage the causes of disasters, including through avoidance of hazards, reduced social and economic vulnerability to hazards, and improved preparedness for adverse events.

Bringing disaster risk reduction and development concerns closer together requires three main steps[44]:

a. The collection of *basic data on disaster risk* and the development of planning tools to track the relationship between development policy and disaster risk.

b. The collection and dissemination of *best practice* in development planning and policy hat reduce disaster risk.

c. The galvanising of political will to reorient both the development and disaster management sectors.

2. 1. 2 Specific challenges in natural risk reduction

There are many challenges to be overcome, but change is possible and there are encouraging signs of progress in many national and Community organisations. One of the *major challenges* to manage and reduce risk for the coming years is to enhance Community, national and local capabilities through *cooperation and a more pro-active approach* to informing, motivating and involving people in all aspects of disaster risk reduction in their own local communities. *All mitigation is local*, and the challenge is to provide the necessary resources to the communities that need them (Allen, 2007[45]).

Another challenge of natural risk reduction generally, and earthquake risk mitigation in particular, is *the long return interval of the major events* in each area. The infrequency of large earthquakes provides limited data set on earthquake impacts on modern cities and the high uncertainty on the next event occurrence often lead to assign low priority to earthquake risk reduction.

Another of the major challenges in natural risk reduction (perhaps the greatest one) it is the implementation of the prevention strategies in hazard-prone regions. Reducing the human, social and economical losses cost in future natural hazard requires first identifying the hazards and then implementing appropriate risk reduction strategies.

Normally it is stressed the importance of sufficient resources allocated specifically for the realization of risk reduction and building resilience objectives, either at the Community, national or the regional level, however other less generic elements have not been recognised as relevant as the investment, e.g. education, incentives, legislation or research activities on prevention and reduction of vulnerability and risk levels.

Education and incentives are two key elements to implement prevention strategies. *Education about the risk* and *available prevention approaches* is necessary to motivate mitigation actions and legal or economic incentives are therefore also important, especially in hazard-prone areas with densely populated urban zones or economically depressed populations.

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[44] UNDP (2004). *Reducing Disaster Risk …* op. cit.

[45] Allen, R.M. (2007). Earthquake hazard mitigation: New directions and opportunities, In "*Treatise on Geophysics*". G. Schubert (ed.), Vol. 4 (H. Kanamori ed.), pp. 607-648, Elsevier.

Recently, a communication of the European Commission[46] faced the problem of having no strategic approach, at the Community level, for the prevention of natural and man-made disasters. The objective of that Communication was to identify measures which could be included in a Community strategy for disaster prevention, building upon and linking existing measures. The basic action to reach common final actions between EU partners is to start and use *common methods and procedures*. This is another specific challenge. The goal is to make the different national approaches consistent with common objectives and similar results.

2. 2 Community directives and Member States legal basis

2. 2. 1 Historical background of European Civil Protection

European Union law[47] is a body of treaties, law and court judgments which operates alongside the legal systems of the European Union's Member States (EUMS). It has direct effect within the EU's member states. The primary source of EU law is the EU's treaties. The legislative acts of the EU come in two forms: *regulations* (that become law in all member states the moment they come into force) and *directives* (that require member states to achieve a certain result while leaving them discretion as to how to achieve the result).

There is no Title on Civil Protection and no specific legal base in the Treaty establishing the European Community (TEC)[48] . This means that action has to be based on the unwieldy flexibility clause (Article 308, TEC). Nevertheless, civil protection is not forgotten. Article 3(1)(u) TEC lists '*measures in the spheres of energy, civil protection and tourism*' among the activities of the European Community (Grahn, 2009)[49].

However, the *Treaty of Lisbon*[50] would give EU measures against natural and man-made disasters a new legal base. In Title XXIII Civil protection, Article 196 of the *Treaty on the Functioning of the European Union* (TFEU) appears as follow:

> *1. The Union shall encourage cooperation between Member States in order to improve the effectiveness of systems for preventing and protecting against natural or man-made disasters.*
>
> *Union action shall aim to:*
>
> > *(a) support and complement Member States' action at national, regional and local level in risk prevention, in preparing their civil-protection personnel and in responding to natural or man-made disasters within the Union;*
> >
> > *(b) promote swift, effective operational cooperation within the Union between national civil-protection services;*
> >
> > *(c) promote consistency in international civil-protection work.*

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[46] COM(2009) 82 final. *A Community approach on the prevention of natural and man-made disasters.* Commission of the European Communities, COM(2009) 82, Brussels, 23.02.2009,

[47] Historically called *European Community law.*

[48] Consolidated Versions of the Treaty on European Union and of The Treaty Establishing the European Community. *Official Journal of the European Union, OJEU 29.12.2006 C 321 E,* 331 pp. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2006:321E:0001:0331:EN

[49] Grahn, R. (2009). EU Law: Civil protection. http://grahnlaw.blogspot.com/2009/01/eu-law-civil-protection.html

[50] Consolidated Versions of the Functioning of the European Union. *Official Journal of the European Union, OJEU 9.5.2008 C 115/135–136* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:115:0047:0199:EN

> *2. The European Parliament and the Council, acting in accordance with the ordinary legislative procedure shall establish the measures necessary to help achieve the objectives referred to in paragraph 1, excluding any harmonisation of the laws and regulations of the Member States.*

In the Title I on *Categories and Areas of Union Competence* of the TFEU, Civil Protection appears as one of the seven policy areas of competence:

> *The Union shall have competence to carry out actions to support, coordinate or supplement the actions of the Member States. The areas of such action shall, at European level, be:*
>
> *(a) protection and improvement of human health;*
>
> *(b) industry;*
>
> *(c) culture;*
>
> *(d) tourism;*
>
> *(e) education, vocational training, youth and sport;*
>
> *(f)* ***civil protection****;*
>
> (g) administrative cooperation.

The area of Civil Protection is for the first time formalized as a specific policy area in the EU through the Treaty of Lisbon. A solidarity clause is introduced as well. From a short-term perspective no specific consequences for the area are expected. However, from a long-term perspective incentives are given to further deepen the cooperation within the area. Moreover, the Treaty of Lisbon will make it important for Member States to act pre-emptively in the policy-process of the EU and to build alliances in order to pursue national interests within Civil Protection[51].

However, we now review the historical background of European Civil Protection. The very foundations of civil protection co-operation at a Community level were set up in the May 1985 ministerial meeting in Rome. Six resolutions were consequently adopted over the following 9 years and a number of operational instruments covering both preparedness and response were established. Activities were organised on the basis of the subsidiarity principle laid down in the Maastricht Treaty. The most significant was the *Resolution of 8 July 1991*[52]on improving mutual aid between Member States in the event of natural or technological disasters.

Other legal texts were highly relevant to promote Civil Protection, being precursors to the current framework. On 19 December 1997 the Community launched the first ***Community Action Programme*** to promote civil protection, covering the years 1998 and 1999. The *Council Decision 199/847/EC*[53] of 9 December 1999 outlines the way the Community action programme is to be pursued during the period 2000- 2004. *Council Decision 2005/12/EC*[54] prolongs the action programme until 2006.

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[51] Åhman, T. (2010). *The Treaty of Lisbon and Civil Protection in the European Union*. FOI, Swedish Defence Research Agency, FOI-R--2806—SE, User Report. November 2009, Stockholm. 81 pp.

[52] Resolution of the Council and of the representatives of the Governments of the Member States, meeting within the Council of 8 July 1991 on improving mutual aid between Member States in the event of natural or technological disaster. *Official Journal C 198 , 27/07/1991 P. 0001 - 0003*

[53] *1999/847/EC:* Council Decision of 9 December 1999 establishing a Community action programme in the field of civil protection. *Official Journal OJ L 327, 21.12.1999*, p. 53–57

[54] *2005/12/EC:* Council Decision of 20 December 2004 amending Decision 1999/847/EC as regards the extension of the Community action programme in the field of civil protection, Text with EEA relevance. *Official Journal OJ L 6, 8.1.2005, p. 7–7*

The *Council Decision of 23 October 2001* [55] established the original ***Community Civil Protection Mechanism*** to strengthen cooperation between the Community and the Member States in civil protection assistance interventions in the event of major emergencies which may require urgent response actions. This applies also to situations where there may be an imminent threat of such major emergencies. A later *Commission Decision of 29 December 2003* (*2004/277/EC, Euratom)*[56]laid down the rules for the implementation of the Community Mechanism, defining its duties and the functioning of the various tools made use of in the Mechanism. In January 2006, the Commission proposed to reinforce and reshape the existing European Civil Protection Mechanism on the basis of past experience and to provide a suitable legal basis for future action in this area. This reinforcement is designed to deal with the increase in frequency and seriousness of natural and man-made disasters[57]. This cooperation instrument was established by *Council Decision 2007/779/EC, Euratom* (*recast*) of 8 November 2007and the amending act *Decision 2008/73/CE, Euratom* (recast) [58] and it replaces the mechanism for assistance interventions established by Council Decision 2001/792/EC, Euratom.

The ***Community Civil Protection Mechanism*** supports and facilitates the mobilisation of the emergency services to meet the immediate needs of countries hit by disaster or at risk from one. It improves the coordination of assistance interventions by defining the obligations of Member States and the Commission and by establishing certain bodies and procedures, such as the *Monitoring and Information Centre* (MIC). The Mechanism covers primarily people but also the environment and property, including cultural heritage, in the event of natural and man-made disasters, acts of terrorism and, technological, radiological or environmental accidents, including accidental marine pollution, occurring inside or outside the Community. The Mechanism takes account of the special needs of the isolated, outermost and other regions or islands of the Community in the case of an emergency.

The ***Monitoring and Information Centre*** is the heart of the Community Mechanism. It is part of Directorate-General for Humanitarian Aid & Civil Protection of the European Commission and accessible 24 hours a day. It gives countries access to a platform, to a one-stop-shop of civil protection means available amongst the all the participating states. Any country inside or outside the Union affected by a major disaster can make an appeal for assistance through the MIC. It acts as a communication hub at headquarters level between participating states, the affected country and dispatched field experts. It also provides useful and updated information on the actual status of an ongoing emergency.

In accordance with the principle of subsidiarity, the Mechanism can provide added-value to European civil protection assistance by making support available on request of the affected country. This may arise if the affected country's preparedness for a disaster is not sufficient to provide an adequate response in terms of available resources. By pooling the civil protection capabilities of the participating states, the Community Mechanism can ensure even better protection primarily of people, but also of the natural and cultural environment as well as property.

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[55] *2001/792/EC, Euratom*: Council Decision of 23 October 2001 establishing a Community mechanism to facilitate reinforced cooperation in civil protection assistance interventions. *Official Journal OJ L 297, 15.11.2001, p. 7–11*

[56] *2004/277/EC,Euratom*: Commission Decision of 29 December 2003 laying down rules for the implementation of Council Decision 2001/792/EC,

[57] *COM(2006)29 final*. Commission proposal for a Council Decision Establishing a Community civil protection mechanism (recast) {SEC(2006)113.

[58] *Council Decision 2007/779/EC, Euratom* of 8 November 2007 establishing a Community Civil Protection Mechanism (recast) *Official Journal OJ L 314, 1.12.2007, p. 9–19* and the amending act *Decision 2008/73/CE, Euratom* (recast)). *Official Journal OJ EU 51, 24.01.2008, p.239–34.*

On the other hand, the Commission also adopted a *Proposal for a Council Regulation establishing a Rapid Response and Preparedness Instrument for major emergencies* on 20 April 2005[59] that provided the future legal framework for the financing of civil protection operations. In doing so, the Commission recognised the importance of immediate civil protection assistance as a tangible expression of European solidarity in the event of major emergencies. The ***Civil Protection Financial Instrument*** was established by *Council Decision of 5 March 2007 establishing a Civil Protection Financial Instrument*[60] to support and complement the efforts of the Member States for the protection, primarily of people but also of the environment and property, including cultural heritage, in the event of natural and man-made disasters, acts of terrorism and technological, radiological or environmental accidents and to facilitate reinforced cooperation between the Member States in the field of civil protection.

The ***Community Civil Protection Mechanism*** and the ***Civil Protection Financial Instrument*** are two main pieces of European legislation that cover European Civil Protection. Together, these centrepieces cover three of the main aspects of the disaster management cycle (prevention, preparedness and response) and they are also complementary. The Mechanism itself covers response and some preparedness actions, whereas the Financial Instrument enables actions in all three fields.

There are of course other previous legal texts with a great relevance in the development of the current European Civil Protection and others which are not yet legislative pieces but contain proposals or observations which will have a bearing on civil protection. In *Annex 2.1* are listed some of the legislation on civil protection and a number of documents and decisions of the Commission.

2. 2. 2 European Community directives on natural disaster prevention

The way to achieve the general goal to prevent, reduce and remedy any potential natural or manmade threat and damage inflicted on people, property, environment and society in the EU is to have common objectives and apply common actions in the EU countries in order to reach finally similar results.

The first step in Natural Disaster Prevention is to use common methods and procedures. A second and more difficult step is to overcome the organizational differences between States and get similar and coordinated actions.

The European Commission, in addition to create Civil Protection instruments to strengthen intervention actions in emergencies, is developing a series of directives and documents addressed to promote a strategic and systematic approach to Disaster Risk Reduction and to implement a Community strategy for the prevention of natural disasters. Several of these directives and documents are discussed below.

[59] *COM(2005) 113 final*. Proposal for a Council Regulation establishing a Rapid Response and Preparedness Instrument for major emergencies {SEC(2005) 439

[60] *2007/162/EC,Euratom:* Council Decision of 5 March 2007 establishing a Civil Protection Financial Instrument. *Official Journal OJ L 71, 10.3.2007, p. 9–17*

In the *Declaration of Madrid*[61] (2003) it was emphasized that Disaster Risk Reduction (DRR) is one central element of sustainable development and the associated integrated disaster risk management is a primary responsibility of governments. Such risk management should be based on a holistic approach to risk prevention and reduction combining scientific knowledge, vulnerability assessment and the competencies of disaster managers. Furthermore, the civil society, the private sector, including insurance companies, experts and academia must be fully involved.

As has been mentioned in Chapter 1, the World Conference on Disaster Reduction (2005) adopted the *Hyogo Framework for Action 2005-2015*[62] (**HFA**) in order to promote a strategic and systematic approach to reducing vulnerabilities and risks to hazards. The **HFA** considered five main areas:

(a) Governance: organizational, legal and policy frameworks;

(b) Risk identification, assessment, monitoring and early warning;

(c) Knowledge management and education;

(d) Reducing underlying risk factors;

(e) Preparedness for effective response and recovery.

The **HFA** established five ***priorities for action*** that provides *landmark guidance on reducing disaster risk and the impacts of disasters* for global application. These priorities for action transferred to the needs of EU are the followings:

1. *Ensure that disaster risk reduction is a national and a local priority* with a strong institutional basis for implementation.

2. *Identify, assess and monitor disaster risks* and *enhance early warning*.

3. *Use knowledge, innovation and education to build a culture of safety and resilience* at all levels.

4. *Reduce the underlying risk factors.*

5. *Strengthen disaster preparedness* for effective response at all levels.On the other hand, large and trans-boundary impacts of natural disaster make essential to develop among European countries a common approach on natural risk prevention. Furthermore, there are strong reasons to strategies on natural disaster prevention should be considered at the European level: disasters can have a *national and transnational negative impact* (disasters do not respect national borders) and can affect to current Community policies, and, moreover, Community support is often required to deal with the aftermath of disasters.

Along these lines, a first and decisive advance directed towards DRR was taken recently by the European Commission in 2008, when a *Communication on reinforcing the Union's Disaster Response capacity* (COM (2008)130)[63] was adopted. The purpose of this Communication was to make proposals to reinforce the EU's disaster response capacity, building on what has already been achieved. This Communication adopted an integrated approach encompassing all stages of disasters

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[61] Declaration of Madrid. *Conclusions and Recommendations of the Euro-Mediterranean Forum on Disaster Reduction.* Madrid (Spain) 2003. 4 pp

[62] UN-ISDR Hyogo Framework for Action 2005-2015: *Building the Resilience of Nations and Communities to Disasters*. 18-22 January 2005, Kobe, Japan.

[63] COM(2008) 130 final. Communication from the Commission to the European Parliament and the Council on Reinforcing the Union's Disaster Response capacity. Brussels, 5.3.2008

(prevention, preparation, immediate response, recovery), addressing all types of disasters (outside the EU, natural or man-made), and covering all EU instruments as well as inter-institutional coordination.

After that, the European Parliament and the Council have both called for urgent action in the area of disaster prevention. In response to this request, and to contribute to the implementation of the HFA 2005-2015, the European Commission adopted two communications related to disaster prevention: *a Community approach to reducing the impact of natural and man-made disasters within the EU*[64], and on *an EU strategy for disaster risk reduction in developing countries*[65]. These two proposals mean a relevant milestone and reference European framework in disaster risk reduction.

In the *communication COM 2009-82* it is emphasized that action at the Community level should complement national actions and should focus on areas where a common approach is more effective than separate national approaches. In particular, the EU will seek *to reduce the impact of disasters* within the EU by:

- Creating the conditions for the development of knowledge based disaster prevention policies at all levels of government;
- Linking the relevant actors and policies throughout the disaster management cycle;
- Improving the effectiveness of existing policy instruments with regard to disaster prevention.

This Communication sets out an overall European approach to the prevention of disasters. It identifies areas for action and outlines specific measures to boost disaster prevention in the short term. The implementation of these measures will take account of actions already undertaken by the Community, thus creating the necessary conditions for bringing the latter together under a consistent and effective Community framework.

The *communication COM (2009) 84 final* proposes an EU strategy for supporting DRR in developing countries through both development cooperation and humanitarian aid, to help support the 2005 Hyogo Framework for Action and achieve the Millennium Development Goals (MDGs). Based on Article 180 of the Treaty establishing the European Community, this Strategy forms one half of a package covering aspects of DDR within and beyond the EU, addressing also appropriate links between the two dimensions.

The overall objective of this communication is to contribute to sustainable development and poverty eradication by reducing the burden of disasters on the poor and the most vulnerable countries and population groups, by means of improved DRR.

2. 2. 2. 1 List of European Community documents related to natural disaster prevention.

In addition to the above documents, a chronological list of those most important documents related to the prevention of natural disasters in Europe it is provided bellow.

[64] COM (2009) 82 final. *A Community approach on the prevention of natural and man-made disasters*. C Brussels, 23.2.2009. http://ec.europa.eu/environment/civil/pdfdocs/com_2009_82en.pdf

[65] COM 2009 84 final. *EU strategy for supporting disaster risk reduction in developing countries*, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0084:FIN:EN:PDF

Declaration of Madrid (2003): *Conclusions and Recommendations of the Euro-Mediterranean Forum on Disaster Reduction* (Madrid, 6-8 October 2003), 4 pp.

EC DG Environment (2003). *Earthquakes in Europe. National, international and European policy for the prevention and mitigation of seismic disaster*. European Commission.
http://ec.europa.eu/environment/civil/pdfdocs/earthquakes_en.pdf

COM (2004) 65 final. Global Monitoring for Environment and Security (GMES) (2004) *Establishing a GMES capacity by 2008 - (Action Plan (2004-2008))* - Brussels, 3.2.2004. http://ec.europa.eu/gmes/pdf/COM-2004-065.pdf

COM (2004) 472 final. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. *Flood risk management, Flood prevention, protection and mitigation*, Brussels, 12.07.2004. *Official Journal C 49, 28 February 2006*

http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2004:0472:FIN:EN:PDF

Civil protection and Cross-border cooperation - *A greater role for regional and local authorities.* Committee of the Regions - Udine, 27.11.2005.
http://www.epp.cor.europa.eu/safety_platform/civil.htm

COM (2005) 37 final. Commission Staff Working Document, *Annex to* The 2005 Review of the EU Sustainable Development Strategy: Stocktaking of Progress.

http://ec.europa.eu/sustainable/docs/sec2005_0225_en.pdf

COM (2005) 565 final. Global Monitoring for Environment and Security (GMES): *From Concept to Reality* - Brussels, 10.11. 2005.

www.gmes.info/.../reference-documents/?...2005-565-final...

COM (2005) 576 final. Green Paper on a European programme for Critical Infrastructure Protection, Brussels 15.11.2005,

http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0576en01.pdf

COM (2005) 658 final. Communication from the Commission to the Council and the European Parliament on *the review of the Sustainable Development Strategy, A platform for action*, Brussels, 13.12.2005.

http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0658en01.pdf

EUR-OPA (2005). *Major Hazards Agreement, Comparative Analysis of the Interministerial Management of Major Hazard (Belgium, France, Russia, Bulgaria).*

http://www.coe.int/t/dg4/majorhazards/ressources/APCAT/2005/APCAT-2005-30-e-AnalyseComp-GestionInterm.pdf

Technical standards for buildings (2005). OJ No 222 of 23 September 2005 - Suppl. Ordinary n.159

Strategic Evaluation on Environment and Risk Prevention under Structural and Cohesion Funds for the period of 2007-2013, No. 2005.CE.16.0.AT.016. Synthesis Report, Directorate General Regional Policy, November 7, 2006.

COM (2006) 302 final. Communication from the Commission to the Council and the European Parliament on *an EU Forest Action Plan* {SEC(2006) 748}.

http://ec.europa.eu/agriculture/fore/action_plan/com_en.pdf

COM (2006) 786 final. Communication from the Commission on *a European Programme for Critical Infrastructure Protection,* Brussels 12.12.2006.

http://eur-lex.europa.eu/LexUriServ/site/en/com/2006/com2006_0786en01.pdf

Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks. *OJ L 288, 6.11.2007, p. 27–34.*

http://eurlex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=2007&nu_doc=60

COM (2007) 354 final. Green Paper from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions *Adapting to climate change in Europe* – options for EU action - Brussels, 29.6.2007.

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0354:FIN:EN:PDF

COM (2007) 414 final. Communication from the Commission to the European Parliament and the Council *Addressing the challenge of water scarcity and droughts in the European Union*, Brussels, 18.7.2007. http://www.europarl.europa.eu/meetdocs/2004_2009/documents/com/com_com(2007)0414_/COM_COM(2007)0414_en.pdf

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2. 3 Civil Protection in the European Union.

The European Union suffers regularly from major hazards. Examples in previous decades include earthquakes, floods, landslides, forest fires in southern Europe, environmental emergencies etc. which can have serious environmental consequences due to increasing vulnerability of current societies.

Given the diverse nature and extent of the risks many European nations face it is easy to understand the scale of the task presented to national administrations. The types of hazards were largely dependent on the geography and climate of the individual nations concerned. Many southern States were especially prone to earthquakes or forest fires, while in northern Europe disasters tended to be smaller and related to technology, such as industrial or transport accidents.

In some cases, countries were able to cope with such catastrophes on their own. But often, emergency assistance was required from other nations and it was in this context that the European concept of Civil Protection emerged. It was recognised that different countries had developed different areas of expertise to cope with the different types of hazards they faced and that there were benefits and efficiencies to be gained through cooperation.

EU institutions and EU Member States have over time increased their reliance on co-operation for the provision of civil protection assistance in order to be as effective as possible on the site of a disaster. There is clear added-value in working together.

Cooperation allows for the pooling of resources and the maximising of collective effort. It is a good example of the value of transnational cooperation at a European level, where national responsibility for dealing directly with the management of the effects of disasters remains unchallenged, but the abilities of countries to deal with those emergencies are enhanced through mutual assistance.

To help address the natural risks (and technological ones) and be prepared to manage the crisis situations to which they can lead, the European Union has set up mechanisms to assist the Member States in supporting one another when faced with natural or man-made catastrophes, and in supporting third countries in times of crisis.

The European Commission is the body responsible for supporting and supplementing efforts at national, regional and local level with regard to disaster prevention, the preparedness of those responsible for Civil Protection and the intervention in the event of a disaster.

2. 3. 1 Civil Protection structure and risk management.

The legislative framework for European Civil Protection enables the Commission to establish a framework for effective and rapid cooperation between national Civil Protection services when mutual assistance is needed[66]. The Commission provides for seminars, expert exchanges, workshops and other training tools in cooperation with Civil Protection training institutions or similar establishments. Information sharing and highlighting good practice ensures that Civil Protection teams are both compatible with each other as well as complementary.

Over the years, the EU has developed major tools through which all its policy objectives in the field of Civil Protection may be achieved. The ***Community Action Programme,*** which supported projects in the field of prevention, preparedness and response to disasters caused by natural hazards, was adopted in 1999 and ended in 2006.

The ***Community Civil Protection Mechanism***, which was created in 2001 to reinforce the cooperation in Civil Protection assistance interventions, has now developed into a robust platform for European Civil Protection cooperation. The Community Mechanism is not the only EU institution with a potential role in a post-disaster environment. The *European Commission Humanitarian Aid* department (ECHO) plays a fundamental role in the provision of humanitarian aid at European level.

So as to enable and ensure an effective delivery of assistance, it was recognised that teams working in emergency situations need to be mobilised rapidly, with coordination and flexibility, and to this end the Mechanism was given the following tools: the *Monitoring and Information Centre*, the *Common Emergency and Information System*, *Civil Protection Modules and a Training Programme*, among others.

The ***Monitoring and Information Centre*** (MIC) is the operational heart of the Mechanism. The MIC is operated by the Directorate General Environment of the European Commission and is permanently accessible. It gives countries access to a platform collecting information on the Civil Protection means available among all participating states. Any country inside or outside the Union affected by a major disaster can make an appeal for assistance through the MIC. The request is then immediately forwarded to all participating countries, whose responses are compiled by the MIC and provided to the requesting country, which can pick and choose the help available in accordance with its priority needs. It also provides useful and updated information on the actual status of an ongoing emergency. It can also send on-the-spot experts in order to assess needs and coordinate incoming assistance at the field level. The MIC is assisted by the *EU Joint Research Centre*, which provides technical support through modelling, satellite applications and integrated analysis.

The ***Common Emergency and Information System*** (CECIS) is a reliable web-based alert and notification application created with the intention of facilitating emergency communication among the participating states. It provides an integrated platform to send and receive alerts, details of assistance required, to make offers of help, and serve other information-sharing purposes.

[66] *The Structure, Role and Mandate of Civil Protection in Disaster Risk Reduction for South Eastern Europe.* 202 pp. 2009, http://preventionweb.net/go/9346

Civil Protection modules are made of national resources from one or more Member States on a voluntary basis. They constitute a contribution to the Civil Protection rapid-response capability called for by the European Council in its Conclusions in June 2005, and by the European Parliament in its Resolution on the tsunami disaster in January 2005. Thirteen types of Civil Protection modules have been identified by the Commission together with Member States.

Finally, a *training programme* has also been set up with a view to improving the coordination of Civil Protection assistance interventions by ensuring compatibility among the intervention teams from the participating states. It also enhances the skills of experts involved in Civil Protection assistance operations through the sharing of good practices. This programme involves training courses and a system of exchange of experts of the participating states. The training programme is complemented by a number of large scale simulation exercises undertaken in the framework of the Mechanism each year.

2. 3. 1. 1 The Community Civil Protection Mechanism.

In October 2001 a Council Decision was adopted establishing a ***Community Civil Protection Mechanism*** "*to facilitate reinforced cooperation between the Community and the Member States in civil protection assistance intervention in the event of major emergencies, or the imminent threat thereof, which may require urgent response action.*"[67]

This mechanism was intended "*to help ensure better protection, primarily of people but also of the environment and property, including cultural heritage, in the event of major emergencies, i.e. natural, technological, radiological or environmental accidents occurring inside or outside the Community, including accidental marine pollution.*"

In February 2006 the Commission proposed revising the 2001 Decision. The changes made to the Community Mechanism in the recast Decision were not major. The Decision was adopted on 8 November 2007, and is the instrument now in force[68]. Detailed rules are contained in a Commission implementing decision[69].

The Community Mechanism has now developed into a robust platform for European Civil Protection cooperation. Currently 31 countries (all 27 EU Member States plus Iceland, Liechtenstein, Norway and Croatia) participate in the European Civil Protection Mechanism, so as to ensure an effective delivery of assistance in emergencies which may require urgent responses. The Mechanism is open to candidate countries and also cooperates with other regional organisations and third countries.

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[67] Council Decision of 23 October 2001 establishing a Community Mechanism to facilitate reinforced cooperation in civil protection assistance interventions (2001/792 EC, Euratom) (*OJ L 297, 15.11.2001, p 7*).

[68] Council Decision of 8 November 2007 establishing a Community Civil Protection Mechanism (recast) (2007/779 EC, Euratom) (*OJ L 314, 1.12.2007, p. 9*).

[69] Commission Decision of 29 December 2003 laying down the rules for the implementation of Council Decision of 23 October 2001 establishing a Community Civil Protection Mechanism to facilitate reinforced cooperation in civil protection assistance interventions (2004/277 EC, Euratom) (*OJ L 87, 25.3.2004, p.20*).

Because the Community Mechanism was originally designed to deal principally with environmental disasters, within the Commission it was the Directorate- General for the Environment which took responsibility for it. This is still the case, despite the fact that the Mechanism is now intended to deal with disasters which could not be described as environmental.

This cooperation mechanism is set up to improve the coordination of civil protection assistance intervention in major emergencies. Such cases may arise from a natural, technological, radiological or environmental disaster, including accidental marine pollution, or from a terrorist act, occurring or threatening to occur inside or outside the European Union.

Thanks to this Mechanism, countries over the world can benefit from European assistance to reduce the consequences of disasters: this year for example the Mechanism contributed to the response provided to the Aquila earthquake in Italy and to the floods in Namibia and Tadjikistan. Last year the Mechanism was involved in 20 events worldwide, including the dramatic earthquake in Chine and cyclone Nargis in Myanmar[70].

The mechanism is based on a *series of elements and actions*, including:

- compiling an inventory of assistance and intervention teams available in the Member States;
- establishing a training programme for members of such teams;
- launching workshops, seminars and pilot projects on the main aspects of interventions;
- setting up assessment and coordination teams;
- establishing a Monitoring and Information Centre (MIC) and a common communication and information system;
- establishing a Common Emergency Communication and Information System (CECIS) between the MIC and the Members States' contact points;
- helping to develop detection and early warning systems;
- facilitating access to equipment and transport by providing information on the resources available from Member States and identifying resources available from other sources;
- making additional transport resources available.

Preparing for emergencies

In order to establish this mechanism, Member States must in particular:

- identify the teams available for intervention within 12 hours following a request for assistance;
- select experts who can be called upon to take part in an assessment or coordination team;
- develop interoperable intervention modules employing the resources of one or more Member States, which are able to carry out missions in case of emergencies;
- examine the possibility of providing additional specialised assistance should a particular emergency occur;

[70] Second session of the Global Platform for Disaster Risk Reduction, 16-19 June 2009, Geneva, A European Community strategy on disaster risk reduction, Intervention by the European Commission.

- provide all relevant information for setting up the mechanism, not later than six months after the adoption of this Decision;
- designate the competent authorities and contact points for implementing this Decision.

Furthermore, if they so wish, Member States may provide information on the availability of military resources in their response to requests for assistance.

For its part, the European Commission assumes responsibility for setting up and managing the MIC, the CECIS and the training programme for intervention teams. It will mobilise and send small teams of experts to the site of the emergency to assess their needs and, if necessary, to help coordinate operations there. It will also introduce a programme of lessons learned from interventions and disseminate these lessons throughout the information system, and collect and centralise information on national medical resource availability.

Information on the national civil protection capabilities available for assistance interventions is compiled in a database. This includes the contents of the military database, compiled by the *EU Military Staff* (EUMS), giving it a broad picture of all resources available to manage the consequences of disasters.

Responding to emergencies

The operational heart of the mechanism is the *Monitoring and Information Centre* (MIC), which is based at the European Commission in Brussels. Through the MIC, which is accessible 24 hours a day, the Commission can facilitate the mobilisation of civil protection resources from the Member States in the event of an emergency.

2. 3. 1. 2 The Monitoring and Information Centre (MIC).

The Monitoring and Information Centre[71] (MIC), operated by the European Commission in Brussels, is the operational heart of the Community Mechanism for Civil Protection. It is available on a 24/7 basis and is staffed by duty officers working on a shift basis. It gives countries access to the community civil protection platform. Any participating country affected by or at risk of being affected by a major disaster - inside or outside the EU - can launch a request for assistance through the MIC. As explained bellow, the MIC then immediately forwards the request to the network of national contact points. They inform the MIC whether they are in a position to offer assistance. The MIC then compiles the responses and informs the requesting State of the available assistance. The affected country selects the assistance it needs and establishes contact with the assisting countries.

During emergencies the MIC plays three important roles:

Communications hub **-** Being at the centre of an emergency relief operation, the MIC acts as a focal point for the exchange of requests and offers of assistance. This helps in reducing the 31 participant states' administrative burden in liaising with the affected country. It provides a central forum for participating states to access and share information about the available resources and the assistance offered at any given point in time.

[71] http://ec.europa.eu/echo/civil_protection/civil/prote/mic.htm

Information provision - The MIC disseminates information on civil protection preparedness and response to participating states as well as a wider audience of interested. As part of this role, the MIC disseminates early warning alerts (MIC Daily) on natural disasters and circulates the latest updates on ongoing emergencies and Mechanism interventions.

Supports co-ordination - The MIC facilitates the provision of European assistance through the Mechanism. This takes place at two levels: at headquarters level, by matching offers to needs, identifying gaps in aid and searching for solutions, and facilitating the pooling of common resources where possible; and on the site of the disaster through the appointment of EU field experts, when required.

Activation of the Mechanism inside the EU. The Mechanism can be activated through the MIC by any participating state seeking prompt international assistance following a major disaster. A state usually calls on the Mechanism when the effects of the disaster cannot be matched by its own civil protection resources.

As soon as the MIC receives a request for assistance, the Centre immediately forwards it to its 24-hour network of national contact points. These contact points represent the participating states' civil protection authorities. They assess their available resources and inform the MIC whether or not they are in a position to help. The MIC then matches the offers made to the needs and informs the requesting state of the type and quantity of available assistance from the Community.

Activation of the Mechanism outside the EU. As mentioned above, any third country affected by a disaster can also make an appeal for assistance through the MIC. Following a formal request for assistance from a third country, different procedures are applied for the activation of the Mechanism. In such cases, the Commission needs to consult the Presidency of the Council so as to determine the course of action it needs to take. In the case of an assistance intervention in a third country, the Council Presidency is responsible for the political and strategic coordination of the operations, while the Commission retains its role as operational coordinator. Operational coordination involves in particular the task of facilitating dialogue and contact with the national contact points, the third country affected and other relevant actors such as the services of the United Nations (UN) such as the UN Office for the Coordination of Humanitarian Affairs (OCHA), the Commission's Humanitarian Aid Department (ECHO) and the Red Cross when these are present on the ground. In addition, the UN is responsible for overall coordination of the operations when it is providing services at the scene of the emergency.

Arrangements for the ***dispatch of the accepted assistance*** (delivery, transport, visa requirements, customs, etc.) are made directly between the offering and requesting states. If required, the MIC may play a facilitating role. Any intervention teams or assistance sent from the EU to a disaster area remains under the direction of the national authorities of the affected country, which has the right to ask European teams to stand down at any time. European teams are subject to local law and should operate in conformity with national rules and procedures governing their work. The requesting State can delegate the supervision of the operations to the intervention teams who must then coordinate their actions, if necessary with the support of the experts from the assessment and/or coordination teams.

To facilitate the technical co-ordination of European civil protection assistance a small team of experts can be despatched on site by the MIC. This team will ensure effective liaison with local authorities and any other relevant actors so as to integrate European civil protection assistance into the overall relief effort and facilitate the work of European teams on the ground. Moreover, as they continue to monitor the emergency and assess its development, they can keep the MIC headquarter updated.

According to the implementing rules of the Mechanism, the state requesting assistance shall bear *the costs of assistance* provided by the participating states. However, the participating state providing assistance may, bearing in mind the particular nature of the emergency and the extent of any damage, offer its assistance entirely or partially free of charge. In practice, the majority of participating states offer assistance free of charge as a gesture of solidarity. Since 2007, up to 50% of the costs of transporting assistance can be co-financed by the European Commission under the Civil Protection Financial Instrument.

2. 3. 2 Civil Protection Financial Instrument.

The Financial Instrument[72] was adopted on 5 March 2007[73] and aims at supporting and complementing the efforts of Member States for the protection, primarily of people, but also of the environment and property, including cultural heritage, in the event of natural and man-made disasters, acts of terrorism and technological, radiological or environmental accidents. Furthermore, it intends to facilitate reinforced co-operation between the Member States in the field of civil protection.

The Civil Protection Financial Instrument covers three main aspects of civil protection activities: prevention, preparedness and response. The new financial instrument will cover:

- response and preparedness actions covered by the EU's civil protection mechanism;
- actions already covered by the 2000-2006 civil protection action programme, such as prevention (study of the causes of disasters, forecasting, public information) and preparedness (detection, training, networking, exercises, mobilisation of expertise) within the EU;
- new areas such as additional transport in response actions under the civil protection mechanism.

The financial envelope allocated to the instrument under the EU's 2007-13 financial framework amounts to €189.8 million. Indicative annual amounts of €20 million are available for actions within the EU and €8 million for actions in third countries.

The civil protection financial instrument will cover the financial aspects the preparedness and response actions covered by the Community mechanism for civil protection. In terms of response, this will cover the requirements of the MIC to fulfil its operational functions, as well as preparedness actions such as training, exercises and exchange of experts.

[72] http://ec.europa.eu/echo/civil_protection/civil/prote/finance.htm
[73] Council Decision No 2007/162/EC, Euratom, of 5 March 2007 establishing a Civil Protection Financial Instrument http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007D0162:EN:NOT

The Financial Instrument allows participating states to request the European Commission to provide support and co-financing for the *transport of civil protection assistance* to a country affected by an emergency, subject to certain conditions. The Financial Instrument entrusts the Commission with new responsibilities to support:

- the sharing or pooling of participating states' transport assets made available on a voluntary basis,
- the identification of transport assets available on the commercial market or from any other sources and
- the use of Community funding to hire the necessary transport assets.

The Financial Instrument allows Community financing to be used only when all other options available to participating states are exhausted and when the pooling or sharing of transport resources between participating states have not yielded results. Only transport operations which cover vital needs and are complementary to the overall EC humanitarian assistance are considered eligible for Community financing. Participating states requesting financial support for the transport of their assistance shall reimburse at least 50% of the Community funds received.

The adoption of the Commission Decision (2007/606/EC, Euratom) completes the legal framework which will allow the Commission to make an important contribution to the reduction of the deficit in transport resources which has impaired the functioning of the Community civil protection Mechanism in the past. This Decision provides for detailed rules for implementing these provisions. The European Commission can give financial support, at the request of the participating states, either through direct grants or through the provision of a transport service which will be contracted through a broker.

2. 3. 3 EU Civil Protection Prevention Policies.

In 2008, the Commission presented proposals for reinforcing the European Union’s disaster response capacity[74] indicating to react effectively to natural or man-made disasters, a comprehensive approach including risk assessment, forecast, prevention, preparedness and rehabilitation is required.

While the Community Civil Protection Mechanism serves as a good platform for the coordination of response to disasters, there was no comprehensive approach to disaster prevention at EU level. In the COM 2008/130, the Commission announced its intention to present an integrated approach to disaster prevention in the European Union, as well as a European Strategy for Disaster Risk Reduction in Developing Countries. Furthermore, the European Parliament and the Council called for urgent action in the area of disaster prevention.

[74] COM(2008) 130 final. Communication from the Commission to the European Parliament and the Council of 5 March 2008 on “*Reinforcing the Union's Disaster Response Capacity*”.

In February 2009, the European Commission adopted a Communication (COM 2009/82)[75] to introduce a *Community approach to reducing the impact of natural and man-made disasters within the EU*. In this Communication, the Commission argued the measures taken regarding disaster prevention are mainly at national level. Disaster prevention should nevertheless be approached at European level, since hazards often have cross-border impact and effects on the growth and competitiveness of the European Union (EU). The introduction of a Community approach is necessary in order to better anticipate and manage natural or man-made disasters that occur in the EU. In this regard, certain types of intervention may be implemented at Community level.

Action at the Community level should complement national actions and should focus on areas where a common approach is more effective than separate national approaches. In particular, the EU will seek to reduce the impact of disasters within the EU by:

- the development of knowledge based disaster prevention policies at all levels of government;
- linking the relevant actors and policies throughout the disaster management cycle;
- improving the effectiveness of existing policy instruments with regard to disaster prevention

The Communication concluded that these improvements could be made within the existing legal structure for civil protection. The Commission is also reviewing the existing civil protection legislation. The review will assess the effectiveness of support through the Financial Instrument and the Mechanism.

Following the publication of the mentioned Prevention Communication, the Commission is working to implement the actions proposed in the document. Further input from the European Parliament and Council will also be sought.

With regard to developing countries, the Commission is setting out an EU strategy for supporting DRR[76] to help reduce the impact of natural disasters on countries considered to be high-risk. The proposed strategy builds on strategic work done by the European Commission and EU Member States, and DRR lessons learnt from all developing country regions. While the priority areas for intervention below are fully in line with the priorities of the Hyogo Framework (HFA), the strategy's objectives, and the implementation priorities specifically reflect the context of existing partnership and cooperation between the EU and developing countries, including at the regional level.

The *overall objective* of this DRR strategy is to contribute to sustainable development and poverty eradication by reducing the burden of disasters on the poor and the most vulnerable countries and population groups, by means of improved DRR.

[75] COM(2009) 82 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions of 23 February 2009 - *A Community approach on the prevention of natural and man made disasters* .

[76] COM (2009) 84 final. *EU strategy for supporting disaster risk reduction in developing countries.* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0084:FIN:EN:PDF , 12 pp.

To achieve this overall objective, the EU will support the following *strategic objectives*:

- support developing countries in integrating DRR considerations into their development policies and planning effectively;
- support developing countries and societies in reducing disaster risk more effectively, through targeted action on disaster prevention, mitigation and preparedness;
- integrate DRR considerations more effectively into EU development and humanitarian aid policies and programming, and crisis response where it covers disaster response and recovery.

The strategy combines support for the integration of DRR in EU external action and in developing countries' strategies, and targeted DRR action which can usefully complement integration efforts with great immediate impact. The *priority areas for intervention* are the following:

- Ensure that DRR is a national and local priority with a strong institutional basis for implementation.
- Identify, assess, and monitor disaster risks – and enhance early warning.
- Use knowledge, innovation, and education to build a culture of safety and resilience at all levels.
- Reduce the underlying risk factors.
- Strengthen disaster preparedness for effective response at all levels.

The EU will support the full implementation of the strategy making use of its wide experience with DRR. This Communication sets out the following action priorities for implementing this strategy:

• Strengthening of political dialogue on DRR with developing regions and countries;

• Development and implementation of DRR regional action plans in disaster-prone regions, starting with one for the Caribbean, and should follow, e.g. for Latin America, South-East Asia, Africa and the Pacific regions.

• Integration of disaster risk reduction into both EU and developing countries' policy and action, including EU support for key national DRR investments;

2. 3. 3. 1 Community natural risk reduction strategies.

Effective natural risk reduction strategies fall into two groups, short- and medium-to-long term. *Short-term risk reduction* is provided by emergency response to natural hazard where rapid post-disaster information and warning systems are now considered critical information, especially in damaging earthquakes.

Long-term risk reduction focuses on buildings and infrastructure able of withstanding natural hazard. This strategy, when sufficiently implemented, could be more effective in reducing the impact of natural hazards (fatalities, economic losses, ..) than even accurate short-term predictions or efficient emergency response.

By combining *long-term strategies* to prevent serious damage to people, building and infrastructure, and *short-term strategies* linked mainly to rapid response to potential disasters, it is possible reduce the impact of a natural hazard.

In the past, the development of natural risk reduction strategies *has been largely reactive* and driven by scarce and non systematic observed effects in some recent disasters. Let us briefly discuss the approaches of short and long terms is.

Elements of short term prevention:

First of all indicate that prevention has been mainly, although not solely, *tackled as mitigation* in the sense of limiting the effects of disasters. Thus, the following topics traditionally considered to be part of natural disaster reduction are those related with *short term actions* and are consequently conditioned by *preparedness and disaster response*:

- Natural risk knowledge,
- Prevention action plans and its implementation,
- Reduction of the underlying risk factors,
- Monitoring risk and early warning tools
- Emergency plans and exercises,
- Information and education on risk prevention to population
- Technical training to prevention and emergency actors.

Elements of medium- and long-term prevention. Prevention s.s.

When we want to prevent taking into account *medium and long term* aims, not only short term actions previously cited are considered, then it is also necessary *incorporate other themes* that can be applied to disaster reduction into strategies more proactive and more preventive (*sensu stricto*):

- Natural hazard and risk assessment and risk mapping.
- Land use and spatial planning according to risk mapping.
- Developing and implementation of Building codes.
- Regulations and legislation on disaster prevention.
- Research activities and technological development.
- Plus those related with *preparedness and disaster response*, previously mentioned as mitigation.

New relevant elements: Community common approach.

As mentioned above, Community and national strategies and actions on prevention should be complemented and *common approach* has proved to be more effective. From this point of view, a set of *new relevant items* could be incorporated to those previously mentioned:

- *Community and national inventories of information* on natural disasters and disaster risk reduction (risk assessment, legislation, prevention measures, emergency, etc.).
- Developing *guidelines for common practices in risk assessment.*
- Exchange of information on *best practices and lessons learnt* from disasters.
- *Extending relevant practices and strategies* on disaster prevention.
- *Linking the actors* involved in developing and implementing measures on disaster prevention.
- *Facilitate cooperation between countries and regions*, especially in the cases where negative impact beyond the borders.
- *Establish internationally agreed policies* on disaster risk reduction

Key elements of a European Community approach

Regarding a Community approach on prevention we consider a set of *key elements* to have into account:

Preliminary multi-hazard assessment and norm setting

- Preliminary multi-hazard assessment
- Integrated and cross cutting mapping of potential disasters
- Potential adverse consequences of future disasters for human health, the environment, cultural heritage and economic activity
- Overview of parameters and characteristics for vulnerability and existing resilience
- Based on the above, the Member States identify national norms on risk acceptance.

Scenario development

- Development of overall scenarios based on disasters which have occurred in the past, forecasts of inter alia climate change, development trends and other relevant sources.
- Development of EU-wide scenarios which will be addressed through more specific, downscaled sector based and thematic scenarios.
- Development of scenarios focusing on regional and cross border scenarios.

Risk assessment and risk mapping

- Catalogue of risk assessment methodologies.
- Compatible/comparable data on selected risk types especially those with cross border impact.

- Member States shall prepare risk maps, at the most appropriate scale for the areas identified under the preliminary multi-hazard assessment.
- Assessment of likelihood and consequences for each scenario.
- Preparation of disaster risk maps for areas identified under the preliminary multi-hazard assessment which are shared with other Member States shall be subject to prior exchange of information between the Member States concerned.
- Priorities for risks where actions on prevention will be taken according to national norms.
- Reporting to EU Commission on hazard assessment and risk maps.

Prevention Action Plans (thematic or sectoral approach)

- Cost-benefit assessments (environmental, economic and social issues) on preventive actions.
- Preparation of prevention and risk management plan and supporting measures (public consultations, awareness, capacity building and preparedness).
- Coordination between sector plans.
- Coordination of cross border action plans.
- Reporting to EU Commission on content of action plans.
- Establishment of appropriate objectives for the management of prevention and risks for the areas identified under the preliminary multi-hazard assessment
- Ensurance that prevention and risk management plans include measures for achieving the objectives.

Implementation of Action Plan

- Implementation plans with institutional responsibilities, resources and financing.
- Reporting to the EU Commission on implementation.
- Systematic follow up and feed back
- In addition, Member States should ensure systematic follow-up and feed-back on the following:
  - Monitoring of progress of implementation according to national indicators and norms.
  - Supporting Research.
  - Lessons learnt.
  - Feedback to improve the new EU Framework on prevention.
  - Mechanisms for data sharing.
  - List of potential indicators to be used in national indicator development.
  - Mechanisms for applied research and sharing of results.
  - Coordination of research (e.g. coastal erosion, common methods e.g. cost-benefit analysis, standards for risk mapping).

2. 3. 3. 2 National approach on natural disaster prevention.

In accordance with the Hyogo Framework for Action (HFA), states have the main responsibility for reviewing the progress in implementation of the framework; at the same time regional inter-governmental and international organizations are mandated to review the progress and status of the implementation of the framework at regional and global level.

At the country level the review process of HFA implementation will be carried out at the national level capturing the national level input to DRR; and at the local level capturing the impact and status of DRR at the local level. The overall process is greatly dependent on the engagement of stakeholders at both national and local level; ranging from nodal ministries, departments, UN country team and national organisations to local governments, city authorities and local civil society organisations. The key factor that will determine the success of the local and national progress review process is the effective collaboration among these diverse stakeholders.

Based on the observations from the current study of different Euro-Mediterranean countries involved in the Narpimed project and the desk research on results from the last exploratory studies and existing data by other connected European projects and directives on risk prevention, we have found a set of *key elements for natural disaster prevention* from a *national point of view*. These elements have been recognised to be most important to provide a good framework for analysing the gaps, strengths and challenges at Member State level about their policies aimed at the prevention of disasters.

The concrete *nine key elements* identified for risk prevention are the followings[77]:

• ***Actors and stakeholders*** - identifying and involving these to get a full picture and to get broad awareness and commitment; on a broad scale these should include citizens, enterprises, organisations, public sectors, research institutions etc. Identify *bilateral and international actors* of relevance.

• ***Scenarios*** - constructing scenarios building on *international standards* and developing these in close collaboration with key stakeholders.

• ***Risk Mapping*** - Based on the previous steps, risks are mapped and translated into scenarios with variations relevant to relevant sectors at national, regional/county and municipal/local levels, providing valid decision information for understanding the *potential disasters* of the country and for prioritisation.

• ***Strategy*** - Develop *national, regional and local strategies* defining goals (security objectives and performance objectives) and way to go (push/pull, which themes to include, time horizon, mainstreaming or centralised model, overall organisational model, legislation mechanisms, central funding and financial mechanisms, information and communication, etc.). The need for *a comprehensive strategy* that, based on the above steps, looks further ahead and that not only considers the more recent disasters.

[77] *Member States' Approaches towards Prevention Policy - a Critical Analysis*. Final report. COWI. 2008. European Commission DG Environment.

• ***Action Plan*** - Steps to be taken to accomplish strategic goals and indicators and identify relevant stakeholders/actors. The need to develop an *action plan* that corresponds to the strategy developed and to update this concurrently with new risk information and with knowledge of effects of interventions based on national as well as international experience.

• ***Implementation*** - *Horizontal coordination* of involved actors, competencies, who does what. The implementation of the action plan and the capacity of the country and of the international community to coordinate, cooperate and integrate efforts is crucial.

• ***Systematic follow-up-*** How to measure progress systematically and bring lessons learnt back into the circuit. To ensure value for money and use of best practice monitoring and *systematic evaluation of disaster prevention measures* as to effect and cost-effectiveness will be key instruments in achieving worthwhile disaster prevention.

• ***Distribution of responsibilities-*** Who does what - *allocate precise responsibilities* for disaster prevention according to adequacy and efficiency, i.e. the organisational set-up matching the problem has to be addressed. The more traditional case-by-case or sector-by-sector approach will not be able to respond to the challenges of disaster prevention, thus the Member states and EU will have to examine existing mechanisms that may be strengthened and enhanced to suit the purpose and to find out how to evolve a culture of comprehensive/horizontal approach.

• ***Resources and capacity allocation*** - Persons, materials, funding mechanisms etc. *Funding of disaster prevention* is crucial at national as well as at EU levels. *Capacity building* will be required to ensure sufficient and well-trained human resources, especially as regards integrated approaches.

2. 3. 3. 3 National Platforms for Disaster Risk Reduction.

National platforms for Disaster Risk Reduction[78] (NPs) were an integral part of the International Decade for Natural Disaster Risk Reduction (IDNDR), where they proved to be effective partners within the international structure. After phasing out of the IDNDR, they took the same crucial position within its successor arrangement, the International Strategy for Disaster risk reduction (ISDR). Therefore, NPs continue to be the pillars of the international initiatives to reduce the vulnerability to disasters at the national level.

National Platform for DRR can be defined[79] as a multi-stakeholder national mechanism that serves as an advocate of DRR at different levels. It provides coordination, analysis and advice on areas of priority requiring concerted action through a coordinated and participatory process.

[78] UN/ISDR. 2008. *Disaster risk reduction in Europe: Overview of European national platforms, Hyogo Framework for Action focal points and regional organizations /institutions*. 94 pp

[79] UN/ISDR 2006, *Guiding principles for National Platforms for Disaster risk reduction*. 17 pp. http://www.unisdr.org/eng/about_isdr/isdr-publications/03-guidelines-np-drr/eng-guidelines-np-drr.pdf

The NPs in Europe reflect very well this concept of NPs. They serve as forum to bring together relevant stakeholders in DRR. Their strength is the plurality of their members, which enables them to provide expertise for all aspects of the cross cutting issue of DRR. The added value of this composition is the capacity to establish the link between different stakeholders, to bring them together, and to stimulate interdisciplinary and cross-sectoral activities.

NPs thus provide the groundwork for putting DRR on the national agendas. In addition to the national component of their activities, cross border cooperation linked to catchment areas and/or river basins provide a regional perspective and added value to DRR in Europe.

NPs fill an important gap covering key activities, which cannot be undertaken by regional entities, the UN or international stakeholders alone. The activities include integrating DRR into school curricula; setting research priorities on DRR at national level; monitoring and reporting on the implementation of the HFA; mobilizing/investing resources at local/national level; advocating developing of policy/plans/strategies; and identifying challenging areas and concerns.

To utilize the potential of NPs in Europe to advance on disaster risk reduction, a few steps should be taken. Governments and civil society need to increase their support to NPs. Additional NPs need to be established. The consolidation of efforts and exchanges among national platforms, within the context of a network of NPs, should facilitate the establishment of a regional platform on disaster risk reduction stimulating a high level political debate. The development and practicing of so-called “twinning” among existing NPs and NPs to be should be practised. This can be done within the European context as well as amongst NPs outside of Europe, therewith contributing internationally to a strengthened UN/ISDR system on disaster risk reduction. The European Network of National Platforms and HFA Focal Points for Disaster Reduction, the Council of Europe (EUR-OPA) and the UN/ISDR are actively supporting “twinning” of national platforms.

2. 3. 3. 4 Local Governments and Disaster Risk Reduction.

Local-level implementation of the Hyogo Framework for Action (HFA) remains one of the major challenges to achieve, requiring the active participation and involvement of local government actors at different levels. From the regional to the municipal level, local governments have a key role to play in reducing disaster risks and vulnerabilities.

It is the local government that is the first responder, and the one responsible for community development and sustainable disaster risk reduction. The empowerment of local governments must be a key priority in order to encourage democratic decision-making that involves the citizens and all key stakeholders at the local level. The proper confirmative authority of the local government, human capacity and allocation of appropriate resources needs to be ensured.

Risk reduction at the local level depends on good local governance, particularly in political decision-making, formulation of policy, and enforcement relating to land use planning, regulatory controls, zoning, and construction standards. Risk reduction calls for flexibility in the decision-making process and the empowerment of communities, which in turn pushes transparency and good governance.

Every disaster brings to bear questioning of accountability of local and regional authorities, and whether they are over-ruled by national authorities. Each local or provincial government should have an explicit policy and action plan for disaster risk reduction, and dedicated personnel and budget assigned.

A recent publication on LGUs and DRR concludes that there are four ***key roles*** (opportunities) for LGUs to reduce disaster risks:

i) ***Build awareness.*** The need to increase *knowledge, understanding and general awareness* of the many issues about disaster risk reduction, to build capacity in the LGU with persons who learn and teach others about DRR and climate change adaptation options as well;

ii) ***Know the risks.*** The need to know *local risks and vulnerabilities*. This is at the very heart of any disaster risk reduction strategy. It is most important to assess those risks, to know what are the possible hazards, how they will impact the community, and what are the likely consequences? Is it a disaster, or is it a situation that can be more controlled?.

iii) ***Maintain infrastructure.*** Maintaining and upgrading of *critical infrastructure*; while local governments are responsible for a variety of critical infrastructure (such as water, drainage, sewage, schools, hospitals), investments to make them resilient to disaster risks are not very visible and sometimes neglected or ignored. *Capital investment planning* should properly address disaster risks, based on a good risk assessment as suggested above!

iv) ***Leadership.*** By including long-term ideas in current planning is critical. Being a long-term process, a DRR initiative can sometimes loose momentum from staff changes and uneven interest among them. Long-term *political commitment* is crucial to successfully implement DRR programmes over time. There needs to be strong *leadership* at the top of the local government and this may mean providing on up-to-date information on DRR, examples from elsewhere that have worked well.

2. 3. 4 Trans-national cooperation.

The EU Member States suffers regularly from major natural disasters and given the scale and/or the cross-border nature that disasters may assume, it is appropriate and necessary to enhance cooperation, both at regional and EU level, based on complementarity of action and the principle of solidarity between Member States[80].

It is a long tradition for EU Member States to express their solidarity with EU Member States and third countries affected by major disasters by providing civil protection assistance. However, the coordination of the assistance has only really started a decade ago, increasing over time the reliance on co-operation and the pooling of resources in order to be as effective as possible on the disaster site.

[80] Motion for a European Parliament Resolution. *A Community approach on the prevention of natural and man-made disasters* (2009/2151(INI)). European Parliament. Committee on the Environment, Public Health and Food Safety 26.2.2010 Draft Report, PR\806220EN.doc, 8 p. http://www.europarl.europa.eu/meetdocs/2009_2014/documents/envi/pr/806/806220/806220en.pdf

The legislative framework for European civil protection enabled the Commission to establish a framework for effective and rapid co-operation between national civil protection services when mutual assistance is needed and more recently this transnational co-operation is extended to disaster prevention. The EU has developed and continuously reinforced the *Community Civil Protection Mechanism* which facilitates these cooperation efforts.

Cooperation between member states and European Union action to protect EU citizens against natural or man-made disasters is one of the improvements of the Treaty of Lisbon. In paragraph 1 of the Article 196 'Civil Protection' it is said:

The Union shall encourage cooperation between Member States in order to improve the effectiveness of systems for preventing and protecting against natural or man-made disasters. Union action shall aim to:

(a) support and complement Member States' action at national, regional and local level in risk prevention, in preparing their civil protection personnel and in responding to natural or man-made disasters within the Union;

(b) promote swift, effective operational cooperation within the Union between national civil-protection services;

(c) promote consistency in international civil-protection work.

Thus, although Member States are primarily and chiefly responsible for the protection of their citizens and for disaster prevention, heightened cooperation in the area of prevention is fully justified, as are improved coordination of efforts, enhanced solidarity and mutual assistance. Consequently, cooperation between national, regional and local authorities with responsibilities for disaster management, spatial planning and risk mapping and management is highly recommended.

The creation of a network of these authorities with the role in exchanging experiences and prevention measures it is desirable because these authorities and their organisations have a detailed knowledge of local characteristics and conditions related to disasters.

Along these lines, over the years networking and cooperation among NPs in Europe has improved. So far, practically oriented themes on cross-border aspects of DRR (e.g. floods, wind storms) worked best and were the most promising ones, providing concrete results. Within the context of coordinating efforts amongst national platforms at the European level, the European Network of National Platforms and HFA Focal Points for Disaster Reduction was established in 2007.

Furthermore, cooperation among NPs and HFA Focal Points of different European countries can be a key tool to consolidate and strengthen efforts at national level and to reach out to influence regional and global developments with relevance for DRR, following the many recommendations in this regard made by the UNISDR for implementing Hyogo Framework for Action.

On the other hand, the European Union/European Commission itself (DG Environment -Civil Protection-, DG Development, DG Relex, DG Research, DG Enlargement, DG ECHO, JRC, etc.) and a set of European organisations (such as EUR-OPA Agreement, Disaster Preparedness and Prevention Initiative for South Eastern Europe [DPPI SEE], Regional Cooperation Council for South Eastern Europe [RCC SEE], Central European Disaster Prevention Forum [CEUDIP], Organisation for Economic Cooperation and Development [OECD], the European Network of NPs) they work to promote, facilitate and support this transnational cooperation in the area of DRR.

As an example of this strategy, the CP financial instrument finances an array of actions dealing with cooperation projects on prevention and preparedness, actions that previously were covered by the Action programme. These projects are designed and implemented by trans-national partnerships involving entities from at least three Member States. The objectives of 2009 call for proposals are: Contribute to the development of knowledge-based disaster prevention policies and Promote consistency in the "prevention-preparedness-response-remediation" chain.

Finally, among the main objectives recently formulated for the Internal Security Strategy for the EU[81] are the prevention and anticipation of natural and man-made disasters, and the mitigation of their potential impact. This strategy therefore emphasise prevention and anticipation, which is based on a proactive and intelligence-led approach as well as the prosecution's requirements for evidence. This strategy has a clear transnational meaning.

ISS recommends EU action in the field of civil protection should be guided by the objectives of reducing vulnerability to disasters by developing a strategic approach to disaster prevention and anticipation and by further improving preparedness and response while recognising national responsibility. Guidelines for hazard and risk-mapping methods, assessments and analyses should be developed as well as an overview of the natural and man-made risks that the EU may face in the future.

2. 4 Development and implementation of seismic codes. Eurocode-8 and national earthquake-resistant codes of construction.

2. 4. 1 Development and implementation of seismic codes.

Natural disasters involve the intersection of society, the built environment, and natural processes. Earthquakes pose inevitable risks to everyone who lives in a seismically active region. Even though the hazard is well recognized, the earthquake hazard is inevitable because we do not now know when an earthquake will strike any specific area or how severe it will be, and it is unclear whether the capability to predict earthquakes ever will be achieved. However, earthquake disasters ultimately can be prevented by implementing cost-effective mitigation (planning, design and construction according to hazard level) and response measures that will minimize the catastrophic losses associated with large earthquakes (injuries, loss of life, property damage, and the interruption of economic and social activity).

[81] Draft Internal Security Strategy for the European Union: "*Towards a European Security Model*" Presidencia Española de la Union Europea, 14 pp. http://www.statewatch.org/news/2010/jan/spain-draft-internal-security.pdf

Earthquakes will continue to occur, but the disasters that they cause will be a thing of the past. Technology is just one element of earthquake disaster prevention, however. Preventing earthquake disasters requires the public and policy makers must be convinced that the threat is real and that earthquake disaster reduction is necessary, economical, and achievable.

Earthquake engineering is the branch of engineering devoted to mitigating earthquake hazards. It covers the investigation and solution of the problems created by damaging earthquakes, and consequently the work involved in the practical application of these solutions. Consequently, it concerns with engineering actions that we take to achieve earthquake-resistant constructions, whether in the design of new buildings or civil engineering structures, or in the modification of existing ones to avoid serious damage from earthquakes. The failure of buildings and other man-made structures in earthquakes is the main cause of the majority of casualties and social and economic losses. The principal cause of failure of constructions in earthquakes is ground shaking. For this reason the seismic-resistant design provisions of most codes are concerned only with assuring an effective design and construction of structures against damage that might be induced by the vibratory response of the structure to the shaking introduced at their foundation by the ground.

Seismic design is based on authorized engineering procedures, principles and criteria meant to design or retrofit structures subject to earthquake exposure. Those criteria are consistent just with the contemporary state of the knowledge about earthquakes and structures. Therefore, the building design which blindly follows some seismic code regulations does not guarantee safety against collapse or serious damage.

The *conceptual design and the detailing* of the structural elements (walls, columns, slabs) and the non-structural elements (partition walls, façades) plays a central role in determining the structural behaviour (before failure) and the earthquake vulnerability (sensitivity to damage) of buildings[82]. Errors and defects in the conceptual design or in the selection of non-structural elements, in particular partition walls and facade elements, cannot be compensated for in the following calculations and detailed design of the engineer.

The *philosophy of earthquake design* for structures other than essential facilities has been well established and has been based on the concept of an "*acceptable risk*". The level of resistance aimed for in seismic design and accepted in seismic codes in many countries has the following objectives:

a. To prevent non-structural damage in frequent minor ground shaking.
b. To prevent structural damage and minimize non-structural damage in occasional moderate ground shaking.
c. To avoid collapse or serious damage in rare major ground shaking and to maintain life safety.

[82] Hugo Bachmann (2002). *Seismic Conceptual Design of Buildings – Basic principles for engineers, architects, building owners, and authorities.* Eds. Swiss Federal Office for Water and Geology & Swiss Agency for Development and Cooperation Biel 2002, 81p. Available at www.bwg.admin.ch

Thus, each seismic code establishes the technical conditions which must be met by building structures so that their behaviour, in the event of seismic phenomena, prevents serious consequences for personal health and safety, avoids financial losses and aids the preservation of basic services for society in cases of destructive earthquakes. Thus, The intent of earthquake design provisions in building codes for new construction is safeguarding human life, not damage prevention.

On the other hand, it is recognised that certain critical facilities should be designed to remain fully operational during and after an earthquake.

Field inspection and analyses of the performance of structures during earthquake shaking of their foundations have clearly shown that building design which blindly follows seismic code regulations *does not guarantee safety against collapse or serious damage*[83].

There are a set of factors that affect and are affected by the design of the building. Knowledge of these factors[84]: the building's period, torsion, damping, ductility, strength, stiffness, and configuration can help one determine the most appropriate seismic design devices and mitigation strategies to employ.

There are also several *strategies and devices* can be used in seismic design such as follows: diaphragms, shear walls, braced frames, moment-resistant frames, energy-dissipating devices, and base isolation[85].

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[83] V. V. Bertero (1997). *Earthquake Engineering*, National Information Service for Earthquake Engineering. University of California, Berkeley. Structural Engineering Slide Library, W. G. Godden, Editor. http://nisee.berkeley.edu/bertero/

[84] *Torsion:* If the mass of a building is uniformly distributed then the geometric center of the floor and the center of mass may coincide. Unbalanced mass distribution will position the center of mass outside of the geometric center causing "torsion" generating stress concentrations. A certain amount of torsion is unavoidable in every building design. Symmetrical arrangement of masses, however, will result in balanced stiffness against either direction and keep torsion within a manageable range.

Damping: Buildings in general are poor resonators to dynamic shock and dissipate vibration by absorbing it. Damping is a rate at which natural vibration is absorbed.

Ductility is the characteristic of a material (such as steel) to bend, flex, or move, but fails only after considerable deformation has occurred. Non-ductile materials (such as poorly reinforced concrete) fail abruptly by crumbling. Good ductility can be achieved with carefully detailed joints.

Strength is a property of a material to resist and bear applied forces within a safe limit.

Stiffness of a material is a degree of resistance to deflection or drift (drift being a horizontal story-to-story relative displacement).

Building Configuration defines a building's size and shape, and structural and non-structural elements. Building configuration determines the way seismic forces are distributed within the structure, their relative magnitude, and problematic design concerns.

[85] *Diaphragms*: Floors and roofs can be used as rigid horizontal planes, or diaphragms, to transfer lateral forces to vertical resisting elements such as walls or frames.

Shear Walls: Strategically located stiffened walls are shear walls and are capable of transferring lateral forces from floors and roofs to the foundation.

Braced Frames: Vertical frames that transfer lateral loads from floors and roofs to foundations. Like shear walls, they are designed to take lateral loads but are used where shear walls are impractical.

Moment-Resistant Frames: Column/beam joints in moment-resistant frames are designed to take both shear and bending thereby eliminating the space limitations of solid shear walls or braced frames. The column/beam joints are carefully designed to be stiff yet to allow some deformation for energy dissipation taking advantage of the ductility of steel.

Energy-Dissipating Devices: Making the building structure more resistive will increase shaking which may damage the contents or the function of the building. Energy-Dissipating Devices are used to minimize shaking. Energy will dissipate if ductile materials deform in a controlled way. An example is Eccentric Bracing whereby the controlled deformation of framing members dissipates energy. However, this will not eliminate or reduce damage to building contents. A more direct solution is the use of energy dissipating devices

Design and construction of a structure are intimately related. *Earthquake construction* means implementation of seismic design to facilitate building and non-building structures to withstand the anticipated earthquake exposure up to the expectations and in compliance with the applicable building codes. The achievement of good workmanship depends, to a large degree, on the simplicity of detailing of the members and of their connections and supports. A design is only effective if it can be constructed and maintained. Field inspection of the performance of structures during earthquakes has revealed that a large percentage of damage and failure has been due to poor quality control of structural materials and/or poor workmanship - problems which could have been corrected if the buildings had been carefully inspected during construction.

In order to obtain good performance of structures during severe seismic ground shaking it is necessary to analyze thoroughly the dynamic characteristics of the real three-dimensional soil-foundation (substructure)-superstructure system.

In *earthquake-resistant foundation* design, the following two main (basic) guidelines should be borne in mind: first, select a foundation layout and substructure system as simple as possible; and second, tie together the different elements of the substructure. The latter is of utmost importance in the case of a structure built at a site with poor, loose saturated granular soil, where moderate or strong ground-shaking (with effective peak accelerations exceeding about 0.15g) involving several cycles may cause permanent horizontal displacements due to lateral spreading and/or subsidence of the ground.

One of the most critical decisions influencing the ability of a superstructure to withstand earthquake ground shaking is the choice of its basic plan shape and configuration. Experience has shown that simple and symmetrical structures perform much better than complex and unsymmetrical ones.

Thus, there are *certain basic or guiding principles of seismic-resistant design* that can be used as guidelines in selecting an adequate building configuration structural layout, structural system, structural material and the non-structural components. These basic guidelines are as follows:

1. *Building (superstructure and non-structural components) should be light and avoid unnecessary masses*.
2. *Building and its superstructure should be simple, symmetric, and regular in plan and elevation* (to prevent significant torsional forces, avoiding large height-width ratio and large plan area).
3. *Building and its superstructure should have a uniform and continuous distribution of mass, stiffness, strength and ductility*, (avoiding formation of soft stories).

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that function like shock absorbers in a moving car. The period of the building will be lengthened and the building will "ride out" the shaking within a tolerable range.

Base Isolation: This seismic design strategy involves separating the building from the foundation and acts to absorb shock. As the ground moves, the building moves at a slower pace because the isolators dissipate a large part of the shock. The building must be designed to act as a unit, or "rigid box", of appropriate height (to avoid overturning) and have flexible utility connections to accommodate movement at its base. Base Isolation is easiest to incorporate in the design of new construction but may require serious alterations in existing buildings.

4. *Superstructure should have relatively shorter spans than non-seismic-resistant structure and avoid use of long cantilevers.*

5. *The non-structural components should be effectively isolated from, or properly integrated with, the basic structural system.*

6. *Superstructure should be detailed so that the inelastic deformations can be constrained (controlled) to develop in desired regions and according to a desirable hierarchy.*

7. *Superstructure should have the largest possible number of defense lines*, that is, it should be composed of different tough structural subsystems which interact or are interconnected by very tough structural elements (structural fuses) whose inelastic behaviour would permit the whole structure to find its way out from a critical stage of dynamic response.

8. *Superstructure should be provided with balanced stiffness and strength between its members, connections and supports*.

9. *The stiffness and strength of the entire building should be compatible with the stiffness and strength of the soil foundation.*

Many building codes and governmental standards have implemented these principles; several of them have been developed in recent years. *Building code requirements* are primarily prescriptive and *define seismic zones and minimum safety factors to "design to"*. Codes pertaining to seismic requirements may be local, state, or regional building codes (or amendments) and should be researched thoroughly by the design professional.

One benchmark that records when a country begins to seriously undertake the engineering developments necessary for earthquake-resistant construction is the year when seismic regulations were first adopted and broadly applied[86].

In the early 20th century, the first seisic provisions in building codes were introduced in a few countries with high seismicity[87]. These early seismic codes have been periodically updated with increasing knowledge in earthquake engineering. In the 1960's and 1970's, countries with moderate seismicity began to adopt seismic requirements in their building codes. In the same period, the better understanding of dynamic soil behaviour as well as inelastic structural behaviour led to the development of more advanced seismic codes

Today, the principles of capacity design together with the concepts of ductile behaviour allow a safe and cost effective earthquake resistant design. The latest efforts of seismic code development were mainly focused on internationally harmonized standards like ISO 3010, Eurocode 8, and UBC.

[86] Robert Reitherman (2008). *International Aspects of the History of Earthquake Engineering*. EERI. 2008. Part 1. 132 pp. http://www.eeri.org/site/images/awards/reports/reithermanpart1.pdf

[87] G. Lorant (2010). *Seismic Design Principles*, FAIA. Lorant Group, Inc. & Gabor Lorant Architects, Inc. http://www.wbdg.org/resources/seismic_design.php

2. 4. 2 Eurocode-8.

EN 1998 Eurocode 8 (*Design of structures for earthquake resistance*) explains how to make building and civil engineering structures resistant to earthquakes. This European Standard applies to the design and construction of buildings and other civil engineering works in seismic regions. Its purpose is to ensure that in the event of earthquakes[88]:

- human lives are protected;
- damage is limited;
- structures important for civil protection remain operational.

The Eurocode 8 (EC8) contains only those provisions that, in addition to the provisions of the other relevant Eurocodes, must be observed for the design of structures in seismic regions. It complements in this respect the other EN Eurocodes.

This European Standard shall be given the status of a National Standard, either by publication of an identical text or by endorsement, at the latest by June 2005, and conflicting national standards shall be withdrawn at latest by March 2010.

EC8 is a typical of the newest generation of seismic codes. This has been designed to be applicable throughout of the European Union. The basic concept of EC8 is that in the planning, design and construction of structures in European seismic regions the requirements of no-collapse and limiting susceptibility to damage. Different levels of reliability are envisaged according to the consequences of failure. Adequate reliability against collapse is ensured if certain specified detailing rules are observed, and if verifications of strength, ductility and overall stability are performed. Adequate reliability against damage is ensured if specified deformation conditions are satisfied[89].

Background of the Eurocode programme. In 1975, the Commission of the European Community decided on an action programme in the field of construction based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications. Within this action programme, the Commission took the initiative to establish a set of harmonised technical rules for the structural design of construction works which, in the first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee containing Representatives of Member States, conducted the development of the Eurocodes programme, which led to the publication of a set of first generation European codes in the 80’s.

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[88] The random nature of the seismic events and the limited resources available to counter their effects are such as to make the attainment of these goals only partially possible and only measurable in probabilistic terms. The extent of the probabilistic protection that can be provided to different categories of buildings is a matter of optimal allocation of resources and is therefore expected to vary from country to country, depending on the relative importance of the seismic risk with respect to risks of other origin and on the global economic resources.

[89] A. Coburn and R. Spence (2002). *Earthquake protection.* 2nd edition. Jonh Willey& sons, Ltd. 420 p.

In 1989 , the Commission and the Member States decided, on the basis of an agreement with CEN[90], endorsed by the SCC, to transfer the preparation and the publication of the Eurocodes to CEN through a Mandate, in order that they would, in the future, have the status of European Standards (EN).

1992-1998**.** Originally, the Eurocodes were elaborated by CEN as 62 pre-standards (ENVs). Most were published between 1992 and 1998, but, due to difficulties in harmonizing all the aspects of the calculation methods, the ENV Eurocodes included “boxed values” which allowed Members States to choose other values for use on their territory. National Application Documents, which gave the details of how to apply ENV Eurocodes in Member States, were, generally, issued with a country’s ENV.

In 1998 started the conversion of ENVs into European standards.

Publication of the EN Eurocode Parts is expected between 2002 and 2006.

By 2010 all national rules are to bee replaced by the EN Eurocodes.

The European Commission has supported, from the beginning, the elaboration of Eurocodes, and contributed to the funding of their drafting. It continues to support the task mandated to CEN to achieve the publication of EN Eurocodes. It will watch the implementation and use of the EN Eurocodes in the Member States.

EN 1998 Eurocode 8 is in six parts[91] and covers all aspects of seismic design for a wide range of both material types and structures. It includes geotechnical aspects, but excludes special structures. It is based on justified models, rather than an empirical approach. The seismic hazard is expressed by a single parameter, e.g. the peak ground acceleration at the surface on rock for a reference mean return period (475 years recommended). The work conducted in the last ten years have allowed the development of a unified seismic hazard model for the European-Mediterranean region, from the estimates of the seismic hazard in terms of PGA and spectral accelerations with a homogeneous hazard calculation procedure. For the European-Mediterranean region, these estimates for the peak ground acceleration at a 10% probability of exceedance in 50 years for stiff soil conditions are shown in Fig.2.1. This map has been published in 2003 under the auspices of the European Seismological Commission (ESC). Ground motion values for other mean return periods could also be readily established, and uniform response acceleration spectra (with a specified probability of exceedance in years) can be determined, too.

[90] Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

[91] Eurocode 8: *Design of structures for earthquake resistance:*

- EN 1998-1 -Part 1: General rules, seismic actions and rules for buildings, CEN, December 2004,
- EN 1998-2 - Part 2: Bridges, CEN, November 2005,
- EN 1998-3 - Part 3: Assessment and retrofitting of buildings, CEN, June 2005,
- EN 1998-4 – Part 4: Silos, tanks and pipelines, CEN, July 2006,
- EN 1998-5 – Part 5: Foundations, retaining structures and geotechnical aspects, CEN, November 2004,
- EN 1998-6 – Part 6: Towers, masts and chimneys, CEN, June 2005.

The geotechnical issues are fully covered in EC8, including: soil properties, site characteristics, foundation design, interaction between soil and structure, and earth retaining structures. The Eurocode 8 (EC8) currently proposes two standard shapes for the design response spectra. Type 1 spectra are enriched in long period and are suggested for high seismicity regions. Conversely, Type 2 spectra are proposed for low to moderate seismicity areas (like France), and exhibit both a larger amplification at short period, and a much smaller long period contents, with respect to Type 1 spectra.

The design of buildings is discussed, including material specific rules. Existing buildings, bridges and other structural types are also addressed. The code provides simplified design methods for areas of low seismic activity.

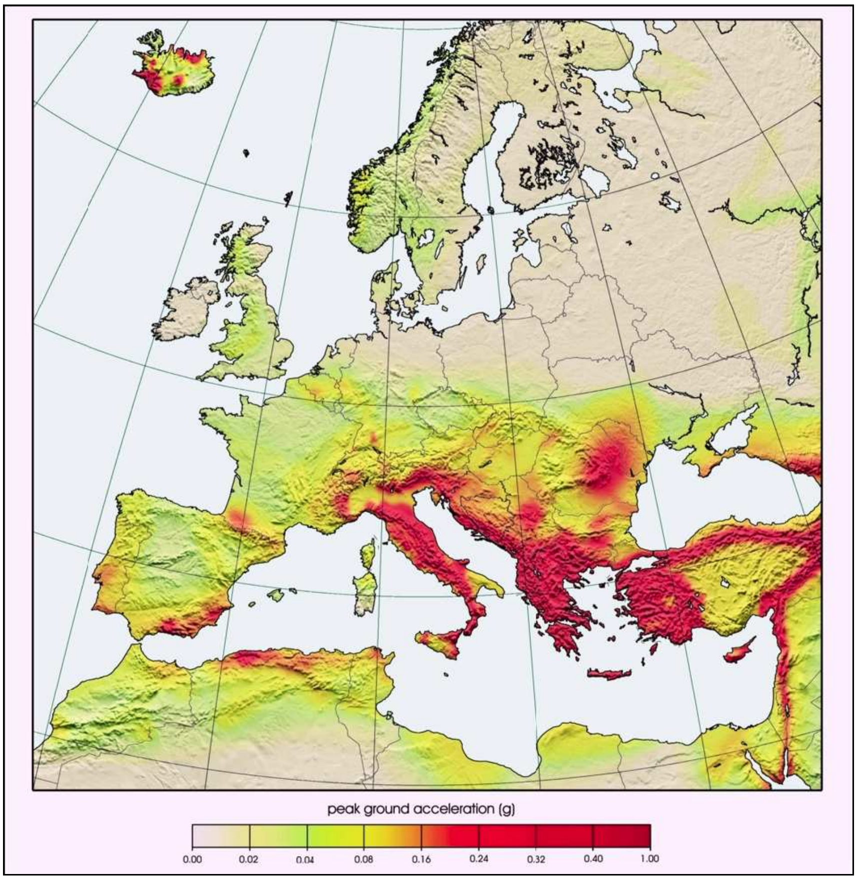

Figure 2.1. The ESC-SESAME European-Mediterranean seismic hazard map for the peak ground acceleration (PGA) with 10% probability of exceedance in 50 years for stiff soil condition (Jimenez et al, 2003).

Part 1: General rules, seismic actions and rules for buildings. EN 1998-1: 2005. Complementary to Eurocodes 1 to 7 and 9. Additional provisions for the structural design of buildings and civil engineering works to be constructed in seismic regions where risk to life and/or risk of structural damage are required to be reduced. General requirements and rules for assessment of seismic actions and combinations with other actions. General rules for earthquake-resistant design of buildings and specific rules for buildings and elements constructed with each of the various structural materials.

Part 2: Bridges. EN 1998-2: 2006. Complementary to EN 1992-2, EN 1993-2 and EN 1994-2. Design rules for earthquake-resistant design of steel, concrete and composite bridges.

Part 3: Strengthening and repair of buildings. EN 1998-3: 2005. Guidelines for the evaluation of the seismic performance of existing structures, the selection of corrective measures and the design of repair and/or strengthening measures with additional considerations for monuments and historic buildings.

Part 4: Silos, tanks and pipelines. EN 1998-4: 2006. Complementary to material-related Eurocode parts dealing with silos, tanks and pipelines. Design rules for the earthquake-resistant design of groups of silos, storage tanks including single water towers and pipeline systems.

Part 5: Foundations, retaining structures and geotechnical aspects. EN 1998-5: 2005. It is complementary to Eurocode 7. Additional rules for the design of various foundation systems, earth-retaining structures and soil-structure under seismic actions in conjunction with the structural design of buildings, bridges, towers, masts, chimneys, silos, tanks and pipelines.

Part 6: Towers, masts and chimneys. EN 1998-6: 2005. Complementary to material-related Eurocode parts dealing with towers, masts and chimneys. Design rules for the earthquake-resistant design of tall, slender structures: towers, including bell-towers and intake towers, masts, industrial chimneys and lighthouses constructed in reinforced concrete or steel.

2. 4. 3 National earthquake-resistant building codes.

Historically, national building regulations have come about through the desire of governments to safeguard the health of their citizens. With the European Community incorporating countries at different stages of development both nationally and in terms of their regulations and codes, as well as a wide range of environmental conditions, there was obviously a need to establish areas of commonality.

The European countries have made progress towards an earthquake-safe society throughout the implementation of national seismic codes (but the successes and failures differ considerably between countries) and its development has been somewhat slower than developed countries with high seismic activity such as Japan and USA. A major reason for this is the lower recurrence rate of large magnitude and highly destructive earthquakes in European countries. E.g., since the 1980 Irpinia earthquake, there has been no event causing more than 1,000 deaths in any of the European countries.

Each of the countries in Europe developed different laws and regulations governing building. We review briefly those corresponding to Narpimed project: Greece, Italy and Spain.

Greece. Of all three countries, Greece is perhaps the most earthquake-aware, and in some respects deserves to be described as a success story[92]. Over the last 50 years, the public's perception of the earthquake risk has been frequently jolted by damaging events which have caused human casualties. It was the major 1953 Ionian Islands earthquakes (causing 476 deaths), which started the process towards the production of the first Greek Code in 1959. Since 1978 the most significant earthquakes have been: Thessaloniki in 1978, Athens in 1981 and 1999, Kalamata in 1986 and Aeghion in 1995—causing 257 further deaths, and enormous economic losses. As a result of these disasters affecting urban areas, the Greek earthquake code was upgraded three times in this period, in 1984, 1995 and again in 2004.

As well as the relatively low-death tolls in the frequent earthquakes, the high earthquake risk awareness of the general population is perceived as the basis of Greece's earthquake protection success. This has led to a rapid government response to earthquakes in revising the building code and the seismic zonation, and a demand by the public for safer buildings. Standards of urban construction improved after the 1978 and 1981 earthquakes caused serious damage in the two major cities; the training of engineers in this subject is perhaps the best in Europe, leading to a good standard of Code implementation in all engineered construction.

The Greek government has also set up a national Earthquake Planning and Protection Organisation (OASP), founded in 1983, to plan and oversee a national policy for earthquake protection. The activity of OASP has led to significant action to mitigate losses through evaluating and upgrading the existing stock of public buildings. A programme is in place to assess the safety of all school buildings, as well as the hospitals in the major cities.

But these successes are tempered by a number of perceived failures. Much of the pre-1984 urban construction, comprising nearly 80% of the country's residential building stock, is considered substandard by today's understanding, even if built to the 1959 code, and some of this building stock, particularly the 30% built during the post-war boom before 1960, may be unsafe.

Italy is like Greece in having very extensive areas of high seismicity and a history of damaging earthquakes, but unlike Greece, much of its population and most of its major cities—Rome, Milan, Florence—are located in regions of relatively low seismicity[93].

Action towards the development of a national seismic building code started earlier than elsewhere in Europe, after the huge *Messina disaster of 1908* which killed over 80,000: but the seismic zonation of the time applied only to the south of the country. The classification of the territory into areas with different levels of harm in terms of earthquake began then with the Messina earthquake and continued in later years through legislative measures, under the successive earthquakes and not on the basis of specific studies and assessments relating to the history and characteristics of seismic seismic-tectonics of the area.

[92] Spence, R (2007) Saving lives in earthquakes: successes and failures in seismic protection since 1960 *Bull. Earthquake Eng.* (2007) 5:139–251 DOI 10.1007/s10518-006-9028-8,

[93] Spence, R (2007) *Saving lives in earthquakes* … opus cit.

The events of Friuli in 1976 (with 929 deaths) and Irpinia in 1980 (killing 4680 people), showed the very high vulnerability of much of the traditional masonry building stock and triggered the production of a national seismic zonation, which brought many additional areas under the seismic building code. Only after the Irpinia earthquake of 1980 the Commission for the Seismic Reclassification, established for the first time the general criteria to be applied nationwide, for the inclusion of Municipalities within the lists of classification. The Decree of the Ministry of Public Works on July 14, 1984 represents the latest in a series of decrees issued by this Ministry between 1979 and 1984 by which the Ministry redraw seismic classification without "declassify" any municipality. The 1984 was the first *seismic classification* of the National territory, originated by the "*Map of the seismic hazard of Italy*" made by CNR-GNDT and derived by studies on seismic hazard and max intensity (Imax) felt (deduced from Historic catalogue);

More recently, the fatalities in the 1997 Umbria-Marche earthquake, and particularly the Molise earthquake of 2002, triggered both a new code and seismic zonation, and a programme for the assessment and strengthening of existing buildings. With the legislative decree n. 112 of 31 March 1998[94], Regions and local authorities are responsible for "identification of seismic areas, creation and updating of the areas", while National Administration "keeps its functions related to (…) general criteria for areas identification and technique regulations for the construction of the same areas". Since the middle of the 90s, new scientific knowledge allow to constitute, a working group within the National Seismic Service, made up of the major National experts in the field. The Group prepared the "Re-classification proposal of 1998".

The Molise event, a comparatively small (Mw= 5.7) event, which caused the collapse of one school building in San Giuliano, killing 27 pupils and their teachers, was particularly tragic and shocking to the nation, because the area had not previously been classified as a seismic area, and the masonry school building had recently been modified in ways which were unsafe in an earthquake area. Rapid action by the government resulted in the formulation of a new seismic code and seismic zonation, and a number of actions to stimulate intervention in the existing vulnerable building stock.

After the Molise earthquake, Presidency of the Council of Ministries established a group of experts which adopts the "*Re-classification proposal of 1998*" and reshapes the entire regulation of the sector with Decree PCM 3274/2003. Declassification was not chosen, so the map of 2003 resulted from the overlapping The 4 areas of classification are associated with values of maximum acceleration on hard ground with a 10% probability of exceedance in 50 years. Regions and Autonomous Provinces, within their respective powers, shall, in some cases with integrations, adopt the new classification. By order of the Ministry of infrastructure and transport: September 14, 2005, were approved *technical standards for buildings* [95]

In 2006 an order of the president of the council of ministers (april 28, 2006 no 3519) established general criteria for the identification of seismic zones and for creation and updating of the lists of the same areas. During the year 2007 the commission for monitoring at Superior Committee for Public Works proceed to the revision of the technical standards for construction in

[94] Decreto Legislativo 31 marzo 1998, n. 112 . Conferimento di funzioni e compiti amministrativi dello Stato alle regioni ed agli enti locali, in attuazione del capo I della Legge 15 marzo 1997, n. 59

[95] OJ No 222 of 23 September 2005 - Suppl. Ordinary n.159

2005 and reaches the formulation of a new legislative text, in which, inter alia, the definition of "*seismic action*" is not any more connected to the seismic zoning and assessed locally on the base of data on danger by point published by the National Institute of Geophysics and Volcanology for different periods of return and with different probabilities of exceedance. In the Superior Council of Public Works is approved, as attachments to the rating n.36 of 27.07.2007, a new requirement on "*Seismic hazard and general criteria for the seismic classification of the national territory*". The classification in zones to deal with technical and administrative problems typical of the management of territories is still defined by the Regions according to the maximum horizontal ground acceleration $a_{g,475}$, namely that of the 50th percentile, to a life of reference of 50 years and an exceeding probability of 10%.

In 2008 (with order of Ministry of Infrastructures and Transports of 14 January 2008) a *new technical regulation* for constructions is established (NTC 08); it regulates the determination of the seismic parameters based on conventional points and therefore no longer linked exclusively to the seismic classification of municipalities.

Unlike many countries in which the building code is a national standard, adopted within the contract and specification for a new building, in Italy the entire Code, and the associated seismic zonation, has the status of a law, and must thus pass through parliament.

Perceived *successes of earthquake protection* in Italy[96] are the formulation of the first seismic code in 1909, its upgrading in 1984 and in 2003, and its application in the construction of many buildings in the defined high-risk areas. Italy, like Greece, has a well-developed programme of earthquake–engineering training in its Universities, and many excellent research centres for earthquake engineering research. In addition substantial upgrading of buildings affected by 1976 and subsequent earthquakes has taken place, under programmes funded by the central government and the regions. Also, since 2002, plans have been put in place for the seismic assessment and upgrading of key strategic buildings and schools, and in some high-risk regions (e.g. in Eastern Sicily), residential buildings also.

Perceived failures in Italy are the government's slowness in adopting new seismic codes and zonations (partly for the reasons explained above) after previous earthquakes. This has meant that before 1976 only about 20% of all comuni in Italy required any level of seismic design, compared with 55% today. As a result much of the construction in Italy during the post-war years was built with no attention to seismic loading. In 1991, although 45% of the country was classified as seismic, only 14% of the buildings were built to earthquake–resistant design standards. Thus, in addition to the many remaining low-strength masonry buildings from the pre-war period, the bulk of post-war reinforced concrete is below today's standards, and much of it may be unsafe. Other perceived failures are that in recent years, there has been difficulty in the application of the new 2003 code, because of many postponements, and because engineers are perceived to have difficulty in understanding some of the new concepts. And, while programmes are in place for the evaluation and strengthening of existing buildings, both a lack of resources and difficulties in deciding on prioritisation means that this strengthening is proceeding very slowly.

[96] Spence, R (2007) *Saving lives in earthquakes* … opus cit.

Spain is a country with areas of low to moderate seismicity that experienced damaging earthquakes in the past, but their experience of earthquakes in twentieth century has been limited. In Spain, earthquake risk is mainly concentrated in the southern regions of Murcia and Andalusia, where several lethal historic earthquakes have occurred, most recently in 1993-94, 2000 and 2004 seismic sequences of small magnitude and extent in these regions. Furthermore, offshore large events as the 1755 Lisbon earthquake, considered the most catastrophic European earthquake disaster of the last millennium, caused serious damage in Southwestern part of Spanish territory. Spain has its own earthquake loading code, now in the process to be harmonised with the Eurocode EC8, but general awareness of the earthquake risk is low among the population, and in the construction industry. *Perceived successes* in prevention is the introduction of earthquake-resistant design regulations, and the activity of the collegial and interministerial Standing Committee on Earthquake Resistance Standards in preparing the basis for these regulations. In Spain these design regulations have been since 1968, with subsequent updates in 1974, 1994 and 2002, for ordinary buildings.

The *Earthquake-Resistant Construction Standard: general part and buildings* (NCSE-02), was approved in September of 2002[97], by the Ministerio de Fomento (Production Ministry). Application of this code and previous one in design, thanks to training efforts is thought to have been relatively good.

The *NCSE-02 Standard* replaces the previous one known as NCSE-94 (approved by Royal Decree No 2543 of 29 December 1994). The new Standard, which is in line with the current state of knowledge on seismology and seismic engineering, establishes the technical conditions which must be met by building structures so that their behaviour, in the event of seismic phenomena, prevents serious consequences for personal health and safety, avoids financial losses and aids the preservation of basic services for society in cases of high-intensity earthquakes.

The scope of the Standard extends to all designs and construction works relating to buildings and, subsidiarily, to civil engineering and other types of structures for which no specific standards have been approved. The object of this Standard is to set out the criteria which must be followed within the Spanish territory (Figure 2.2) when considering seismic actions in the design, construction, repair and conservation of those buildings and works to which it applies.

The *ultimate goal* of these criteria is *to prevent the loss of human life* and *to reduce the damage and financial cost* which future earthquakes may cause. The developer may require higher performance qualities than those required in this Standard, for example the continued operation of essential services.

The achievement of the objectives of this Standard is dependent, on one hand, on the *rules limiting the use of land* laid down by the competent Public Administrations, and on the *calculation and design* specified in this norm, and, on the other, on the *appropriate construction* and *conservation* of buildings.

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[97] Royal Decree 997/2002, published at the Official Gazette: BOE number 244, october 11th, 2002. This decree is available at http://www.proteccioncivil.org/centrodoc/legisla/NCSR-02.pdf

In Spain, prevention activity has recently been started to identify some of the highest risks among public buildings, so that strengthening action can be taken. This has been concentrated on the cities with the greatest risk, such as Barcelona. In all three countries the perceived failures are a lack of adequate quality control of what is built on site, and a still limited understanding by ordinary design professionals of seismic design concepts. In Spain (Spence, 2002) it is reported that even when buildings are designed to required earthquake loading, the detailing of the structural members required for ductile performance in earthquakes is often missing; and flat slab or waffle slab designs (with their inherent weakness in earthquakes) are often used for multi-storey construction. Because of the late application of the code, a high proportion of the national building stock is below current regulations, but it is thought that buildings constructed according to existing codes for concrete and steel would survive the expected moderate earthquakes. Many masonry buildings however may be at risk.

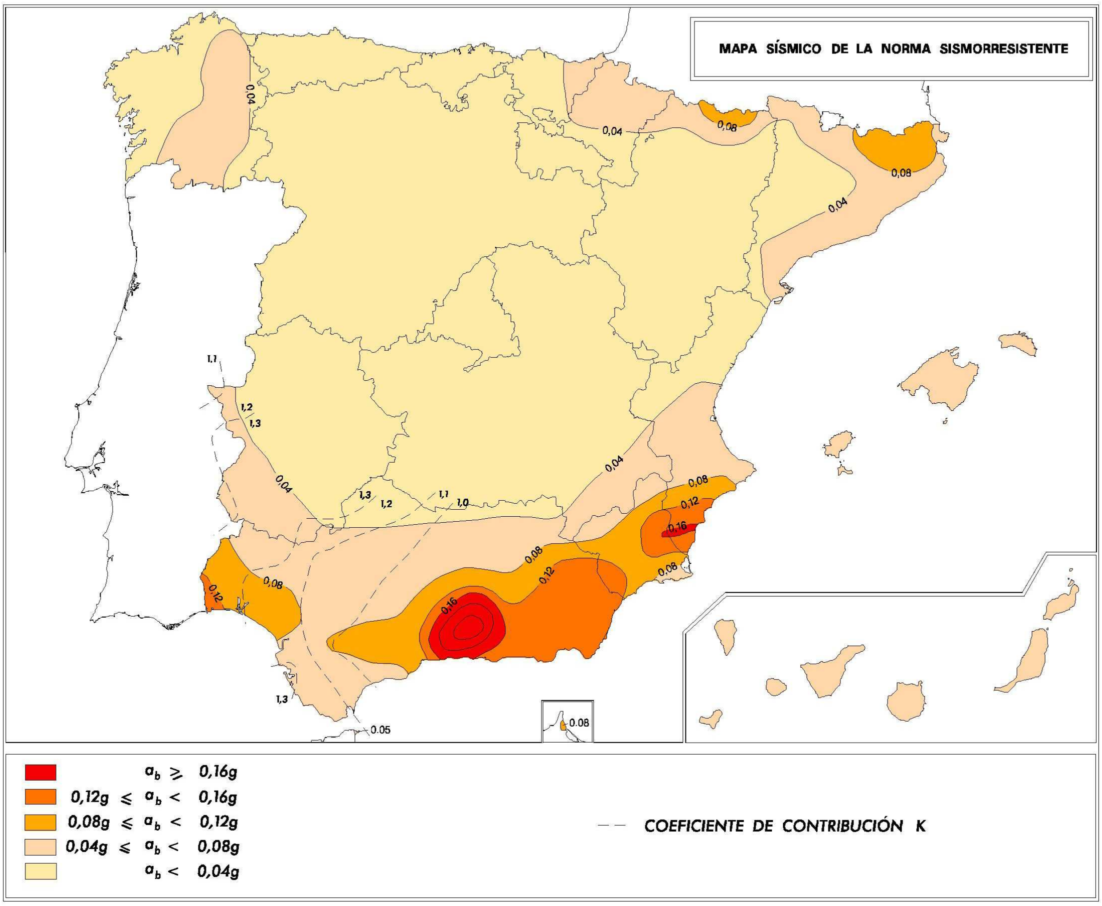

Figure 2.2. Seismic hazard map of the last Spanish seismic code NCSE-02.

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CHAPTER 3

GOOD PRACTICE GUIDES: METHODS AND PRODUCERS TO AVOID OR REDUCE NATURAL DISASTERS.

3. 1 Introduction

After the first emergency phase, recognizing the importance to the preparatory stages of reconstruction of the studies of seismic micro-zoning, the Department of Civil Protection, with n.DPC/DIP/0003488 note, sent the "general guidelines for the seismic micro-zoning of the municipalities affected by earthquakes. "

With Commissarial Order No. 14 of 05.28.2003, the President of the Molise Region, Deputy Commissioner, appointed the Commission of Experts on the implementation of the guidelines prepared by the Department of Civil Protection for the micro-zoning of the municipalities affected by the earthquake.

The seismic micro-zoning, therefore, must be seen as a basic tool in the activities of urban planning and civil protection and support to those planning and reconstruction.

For this reason, it is intended to recognize a scale sufficient to detail the conditions of the site that may significantly change the characteristics of seismic motion, or could generate significant coseismic effects (landslides, fractures, liquefaction, etc.).

In essence the study of micro-zoning returns a map of the territory on which they are listed:
areas where the ground motion is amplified (indicating which frequencies the amplification occurs) because of the morphological, structural, stratigraphic, geophysical and geotechnical soil;
areas where there are, or are capable of activation, landslides or ground deformation due to earthquake.

As is known, it is worth repeating that the geology and litho sites may strongly influence the shape of the elastic response spectrum.

In general, for determining the effects of the site or the local seismic response may be made by or expeditious way for subsequent searches. The tests usually consist of expeditious geological and geomorphological features, more or less detailed, view the identification and delimitation of areas of conditions and the same characteristics that determine the seismic responses experimentally known. Subsequent investigations, however, require the performance of specific geological and geophysical surveys and application of numerical analysis of increasing complexity. The study is mainly due to the need to know, a priori, a number of parameters needed for modeling of stratigraphic columns (definition of the sections which need to be modeled for the retrieval of geophysical and geotechnical parameters such as speed S waves, P waves speed , shear modulus, Poisson's ratio, damping coefficient, density, etc.).

3. 1. 1 Analysis of seismic hazard [98]

Before starting any study of seismic micro-zoning, it is essential to define the level of seismicity which we mean (seismic input reference).The definition of ground motion input is crucial to set the input signal for the evaluation of possible local amplifications and to constrain the response spectrum. Basically you need to define a level of shaking (earthquake reference) to determine the extent to which the phenomena of amplification due to the particular geological, geomorphological and geotechnical site.

The determination of the seismic input is not limited, in general, the definition of the expected level of PGA, but may contain important modifications of the spectrum of ground motion, according to the characteristics of the event that generates the seismic motion.

Specifically, with reference to the 2002 Molise earthquake, an earthquake with an epicenter that originate farther than that recorded, but with higher magnitude (earthquakes Matese the 1688 M = 7.3 and the 1805 M = 6.7; Capitanata earthquake of 1627 M = 7.0) would have on the municipalities of the Province of Campobasso shaking with a PGA maybe less, but with predominant lower frequencies and longer. The consequence would be a very different pattern of damage. It should also be noted that the seismic input in general is bound by the choice of the complexity of the procedures to be applied to micro-zoning. The greater the danger or scuotibilità a given site, the greater and more accurate will be the investigation to be made.

An important contribution to improving knowledge of the seismic input could, for example, result from a careful review of all information gathered by monitoring networks and velocimetric accelerometer, installed for the sequence analysis of the earthquake of October 2002. This analysis would allow to calibrate the spectra of equiprobable studies at national scale and to define the most appropriate reference spectra for the areas considered. Of particular importance if we consider this working hypothesis, it would be a more complete characterization in terms of geomechanics of the sites where the mobile networks were installed.

Relative to what has been done on specific indication of seismologists experts, appointed by the Deputy Commissioner, was conducted probabilistic seismic hazard analysis (Probabilistic Seismic Hazard Analysis - PSHA) in order to define the values of spectral acceleration (spectra isoprobabili) include the value of peak horizontal acceleration (g), with 10% probability of exceedance in 50 years (return period RP = 475 years). Subsequently, based on information provided by geological and geotechnical investigations carried out in several measurement campaigns, and following a numerical one-dimensional (1D), we have determined the values of fundamental frequency and the amplification level of each local situation analyzed within the urban area studied.

The seismic hazard of the entire national territory has been determined by the order of PCM No 3274 of 20 March 2003 that the municipalities of the Province of Campobasso falling in seismic zone 1, 2 and 3. More recently, the National Institute of Geophysics and Volcanology (INGV) has restated using the current methodology and reproducible (as required by the Ordinance), the seismic hazard of Italy (MPS Working Group, 2004).

[98] "*Guidelines for the Seismic microzonation Communities of the Province of Campobasso*" - Dr. Charles Geol Scasserra, Prof. Marcello Bernabini, Prof. Claudio Eva, Prof. Paolo Mauriello, Prof. Rinaldo Nicolich.

Nevertheless, in order to provide local results in terms of elastic response spectra uniform hazard (Uniform Hazard Spectra or Spectra isoprobabili) related to a return period of 475 years and to be able to run the danger of breakdown, it became required reassessment of the seismic hazard of sites of interest. The spectra, calculated for the rock site, they were considered as reference for the characterization of the seismic input for each site.

The calculation of seismic hazard of a site or area according to the classical probabilistic approach (Cornell, 1968; Reiter, 1991) provides:

1) the geometric characterization of one or more models seismogenic;

2) determining the rate of occurrence of earthquakes above a given threshold magnitude for each seismogenic source;

3) The use of attenuation relationships that describe the amplitude of shaking according to the size of the earthquake, in terms of magnitude or intensity, and distance-source site (eg, epicentral, hypocentral);

4) assessing the probability of exceedance of predetermined values of ground shaking.

3. 1. 2 Catalogue of earthquakes [99]

For the characterization of regional seismicity was used parametric catalog of Italian earthquakes CPTI04 (Working Group CPTI, 2004), properly completed for the preparation of the recent Italian seismic hazard map (MPS Working Group, 2004). The catalog in question, which is an evolution and an update of the catalog CPTI99 (Working Group CPTI, 1999), includes a time window that extends from the year 217 BC to 2002 A. D. Sections 1000-1980 and before 1000 there have been some changes compared with previous catalogs, of which the highlights are: determination of the moment magnitude, Mw, and the magnitude Msp (necessary for the proper use of the attenuation relationship of Sabetta and Pugliese) , The updating and completion for the periods 1981-2002.

In accordance with the Poisson model, the catalog does not contain any events defined as precursors and replicas. With regard to the thresholds of magnitude, the catalog for windows CPTI04 inherits the minimum pre-1980 catalog NT4.1 (Camassi and Stucchi, 1997) and CPTI99, which is derived and contains only events with magnitude Ms ≥ 4.0, where Ms is the magnitude calculated from surface waves.

For sections post-1980 was adopted, with the exception of the Etna area, a minimum threshold of slightly higher magnitude (Ms ≥ 4.15).

[99] "*General methodological preliminary to studies of seismic microzonation for municipalities in the Province of Campobasso*" - Department for the Study of Territory and its Resources - University of Genoa.

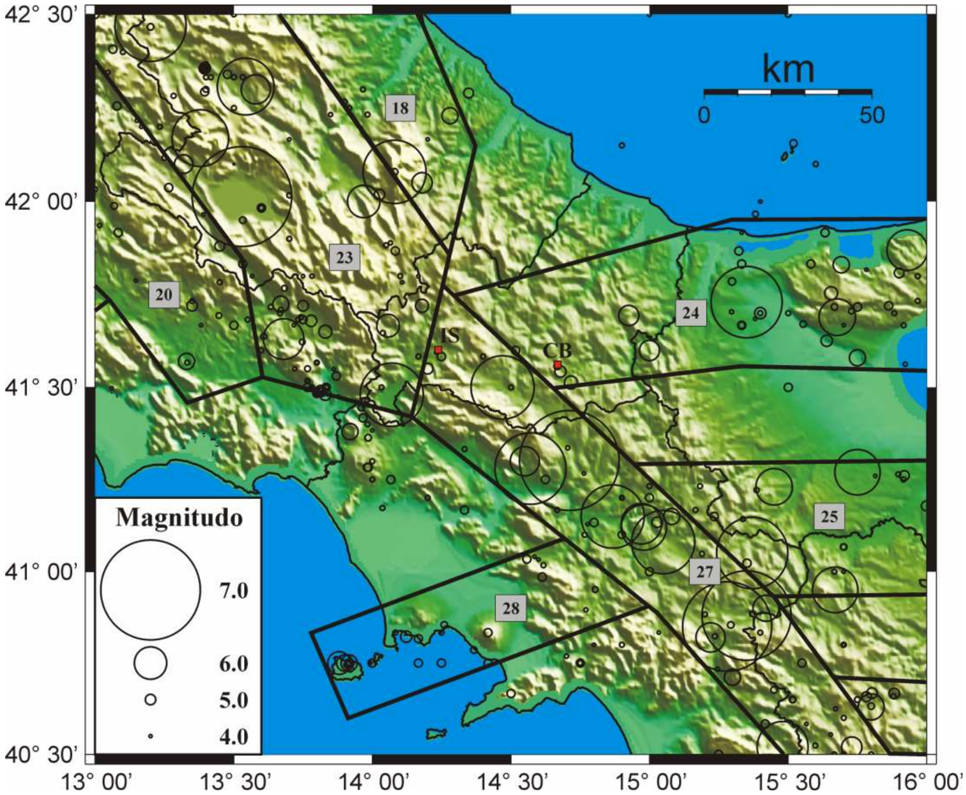


Figure 1 Distribution of seismicity in the study area. Events in the catalog CPTI04 (Working Group CPTI, 2004). Overlap of the seismogenic zonation ZS9 (MPS Working Group, 2004).

Figure 1 shows the distribution of seismicity for the region of Molise. It is clear that the distribution of epicenters corresponds to a widespread regional seismicity in the presence of significant earthquakes with magnitude Ms> 6.0 (05/12/1456 Molise Ms = 6.7; Matese 05/06/1688 Ms = 7.3; Matese 26 / 07/1805 Ms = 6.7; Sannio 21/08/1962 Ms = 6.2).

3. 1. 3 Seismogenic zonation

Seismogenic zone is the boundary of the projection area of all structures considered sources of earthquakes at high and low energy: it contains, then, is occurring in higher segments of minor faults. In assessments of seismic hazard, based on a probabilistic approach, the seismogenic zones are taken as uniform areas with seismic activity. They are, therefore, homogeneous areas in terms of the potential of generating earthquakes as it is assumed that earthquakes can occur at any point in the same area with equal probability

.

For the purposes of this study was adopted uncritically the seismogenic zonation ZS9 recently developed by the Working Group MPS (2004) and used for the preparation of the new seismic hazard map of the country. The areas that most interest the study area are shown in Figure 1, superimposed on the distribution of epicenters in the catalogs CPTI04.

The ZS9 seismogenic zones cover 36 and has been developed since the previous zonation ZS4 (Meletti et al., 2000) following the approach of cinematic Scandone et al. (1990). In particular, compared with ZS4, significant changes have been made to reflect the latest knowledge on the active tectonics and distribution of seismogenic sources, overcoming the problem of the small size of the source areas and the consequent limited number of earthquakes in each of them. ZS9 also provides an estimate for each seismogenic zone of the average depth of earthquakes and faulting mechanism prevalen

For the purposes of this study were considered all the areas considered influential on the seismic hazard of Commons Molise.

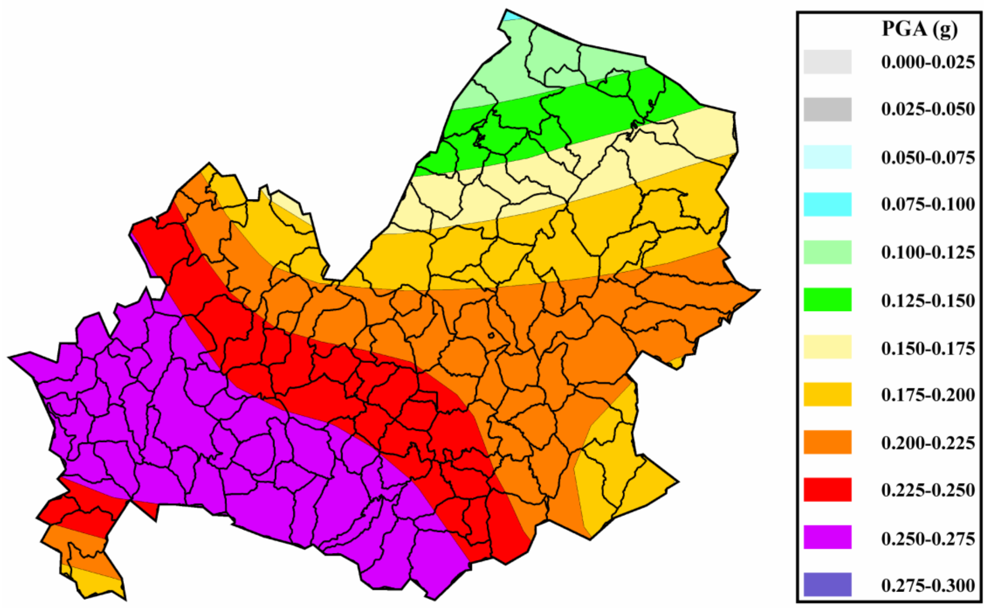


Figure 2 Map of seismic hazard of the Molise Region (MPS Working Group, 2004): PGA values with 10% probability of exceedance in 50 years (return period: 475 years).

3. 1. 4 Analysis of seismic response

3. 1. 4. 1 Legislative aspect

By Order of the President of the Council of Ministers of 10/04/2003 n.3279, entitled "Further provisions of the civil protection aims to tackle the damage caused by the severe earthquake that occurred in the province of Campobasso, was attributed to the Deputy Commissioner Inter alia, the overall coordination of seismic micro-zoning of the municipalities affected by the earthquakes.

The lack of a specific methodology and reference standards of national importance, has led the Deputy Commissioner, as already mentioned, to appoint, by Decree No. 14 of 28/05/2003, a commission of experts for scientific advice needed activity to be undertaken and for the preparation of "Guidelines for seismic micro-zoning of the municipalities in the province of Campobasso. The same "guidelines", approved by Decree of the Deputy Commissioner of 08/06/2003 and published on BURMA no.27 of 16/08/2003 n. 17, indicates that among the studies, in preparation for reconstruction, are of particular than direct relevance to the conduct of investigations for the seismic micro-zoning of the territory to which any findings, prescriptive, must be adapted to local planning instruments, as required by Article 13 of the LR 20/05/2004

3. 1. 5 The phases of the study

3. 1. 5. 1 The protagonists

Seismic micro-zoning of the planned activities, coordinated by the Geological Survey and the Regional Structure commissioner, has primarily focused on urban centers of the Province of Campobasso with priority to those falling in the "crater" and, later, to those covered by the higher hazard seismic activity, according to the classification in force.

To carry out these activities has been used in more professionalism and cooperation of public and university research.

The Commission of Experts has provided scientific advice for the duration of the study, from the analysis and planning of investigations in the synthesis and evaluation of results.

For the cognitive stages have been used to their professional geologists registered at regional level. They, under the coordination and validation of the STAT Department of the University of Molise, performed in the sites examined, the findings in geological, geomorphological and litho needed to develop relevant, namesake card base. In support of these papers has been prepared a map of the damage by non-geologists, engineers (engineers, architects and surveyors).

3.1. 5. 2 Activities

To support the information available from the surface reliefs were consulted the results of existing surveys and, therefore, plan new investigations of character lithostratigraphic, geotechnical and geophysical, entrusted by public tender by the Interregional Public Works Campania, Molise, companies specializing in the field.

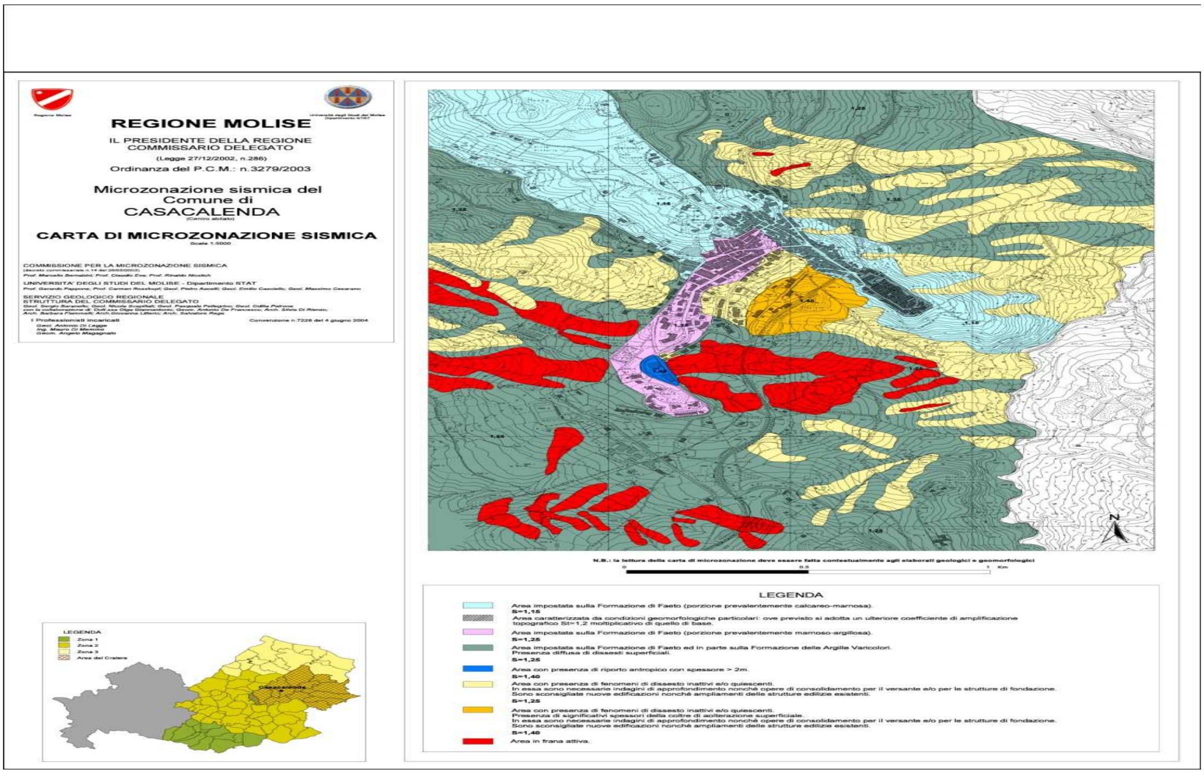
Great importance has taken the step of obtaining the results of several investigations background and is held by public authorities (municipalities, provinces, sub-regional bodies, the superintendency to Public Works), responsible for various reasons over the territories studied. In particular, we have recovered a continuous core of about 1700 surveys as well as a significant number of geophysical and geotechnical testing laboratory. This preparatory phase has been found essential for a first knowledge of the subsoil under study, and the economy overall investigative work.

In relation to information derived from existing surveys, however, previously subjected to careful validation, new surveys are planned additional, more specialized and in accordance with current legislation, for a more precise characterization of the sites investigated.

Overall, were carried out:

- -N.180 polls continuous core (depth between 30 and 70 meters), equipped to test seismic hole (Down-Hole) with the extraction of undisturbed samples n.400;
- - N.400 SPT;
- - N.500 microtremor measurements in the open air;
- - N.21 geoelectric prospecting by the method;
- - N.4 SASW (spectral analysis of surface waves);
- - N.15 seismic refraction;
- - N.2 resonant column.

In the Boiano also ran a greater knowledge of the structural characteristics, with a deep seismic reflection and seismic response, through monitoring of the temporary "instrumental" low intensity, making it a more comprehensive study.



Charter of the town of microzonation Casacalend

3. 1. 5. 3 Costs and conclusions

The overall micro-zoning studies focused n.98 sites with the highest density anthropogenic (urban centers and industrial areas), falling in common n.82, for a total cost of approximately € 3,200,000, except that they are on the town of San Giuliano di Puglia, sent direct from the Civil Protection Department and the municipality of Ripabottoni, run by the University of Genoa with the National Group for Defense from Earthquakes.

The path that led to the preparation of seismic micro-zoning maps can be summarized as follows.

On the basis of all geological, geophysical surveys and geognostic it was possible to define rock types or parts of geological formations to conduct sufficiently homogeneous. Each unit litho was characterized by a value of V 30 and later associated with one of the categories of foundation soil provided by the seismic force.

The different soils was associated with a coefficient of site D, as defined by law, takes into account the stratigraphic profile of the foundation soil. This led to the development of micro-zoning maps preliminary, based only on geological and geotechnical and geomorphological parameters, the information derived from the corresponding maps for the professionals in charge and validated by the University of Molise.

For each survey, in which it was tested down-hole and sites that have been carried out 2D seismic profiles, sometimes integrated as planned, with investigations based on recording of microtremor, has carried out a modeling of 1D stratigraphic columns, in order to determine transfer functions and the natural frequencies of the ground. In general, modeling was not performed when the depth to bedrock was less than 5 m.

From the relationship between the spectra obtained (soil / bedrock) has been evaluated the amplification factor Fa This factor was evaluated for the spectral range: 0.1-1.0 s. This band refers mainly to the high frequency components contained in the spectrum and, therefore, is linked to very shallow layers. The values of the amplification factor, so calculated, were compared with those derived (coefficient D) information from geological, geomorphological, geophysical and litho and critically evaluated for each survey. Where possible, the values of fundamental frequencies obtained by the transfer functions were compared with those derived from H / V ratio, obtained through analysis Nakamura. In some cases the results of these trials as they have allowed to derive useful information also on the thicknesses of layers surface.

The values of F, calculated for each site, based on information obtained from geological and geomorphological studies, have helped to establish the definitive values of the parameter S, used in the preparation of micro-zoning maps.

The results of the expert analysis that, by extension of the investigated areas (the entire province of Campobasso) in relation to the level of detail, they represent a test case and one in Italy, were published on the website of the Molise Region, and thus, made available to all those who work in various capacities in the area. In fact, local governments and concerned professionals have been equipped with an instrument of knowledge of seismic hazard sites urbanized and a georeferenced database, which together constitute support elements for the proper management and planning, but also support for a specific project.

3. 1. 6 Seismic microzoning: research in the town of L'Aquila

After the eartquake of Avril the 6th 2009 (1.32 AM-UTC; Magnitude 5.8) in the town of L'Aquilathe Department of civil protection organized together with Abruzzo Region the study of seismic microzoning in the villages mostly damaged by the earthquake nearby L'Aquila.

The work has been realized with the cooperation of 150 researchers and technicals, 9 Italian Universities (L'Aquila, Chieti-Pescara, Genova, Politecnico di Torino, Firenze, Basilicata, Roma "La Sapienza", Roma Tre, Siena), 8 Institutes of research (CNR, INGV, AGI, RELUIS, ISPRA, ENEA, OGS, GFZ-Postdam), and the cooperation of Regions and independent Provinces (Abruzzo, Lazio, Emilia-Romagna, Toscana e Provincia di Trento).

The studies of seismic microzoning consents to identify the territory in a seismic aspect, identifying and delimiting the areas that have the same reaction, separating stable zones, local amplifying stable zones and unstable zones, such us landslips superficial fractures and soil liquefaction. So they are very important in the urban planning and in the step of restoration of the town after the eartquakes.

They are also very important in emergency planning as they consent a better and conscious individuation of strategic elements and resources of civil protection.

The study has been very important, for the first time we have, in Italy and abroad, this kind of assembled dates and in this quantity, and for the first time a such great number of researchers, Universities and also other Institutes of research were involved.

The dates obtained will allow the administrations to begin the buildings restoration considering the different seismic risk of the various territories under their authority, influencing urban choices and planning.

The results of studies is useful for technicals to understand the seismic amplification.
They will use the right instruments to know wich are the necessary analysis to define exactly the state of the site.

For each zone, are available : geolithological map, surveys map, microzones map level 1,seismic microzone level 3, linking the website: http://www.protezionecivile.it/

3. 2 Hazard and risk scenarios

The two earthquakes of October 31, 2002 (Ml = 5.4) and November 1, 2002 (Ml = 5.0), with its epicenter in the mountainous region of Frentani in the province of Campobasso, and the next swarm of more than 1,000 aftershocks have hit some towns on the border between the regions of Molise and Puglia.

For many of them was estimated MCS macroseismic intensity between the sixth and seventh grade, with a maximum value of 'able VIII-IX. The National Group for Defense from Earthquakes (GNGTS) has promoted and carried out surveys in some municipalities affected.

In the town of Ripabottoni (CB) who has suffered damage to the seventh degree of the MCS scale, was carried out a survey and design characteristics of the seismic vulnerability of all buildings, almost all brick, using a methodology based on a card expeditious. The seismic damage was classified using the measurement levels of the European macroseismic scale EMS-98 and a procedure based on the identification of certain mechanisms of collapse.

Figure 1 - Aerial view of the town of Ripabottoni

In parallel survey was conducted prior to the study of geological seismic micro-zoning of the center, to analyze a possible correlation between the observed damage and the existence of morpho-lithological conditions favorable for the occurrence of local effects.

In the course of the methodology was tested for the recognition of the damage and collapse mechanisms of masonry structures of recent formulation (Zuccaro and Papa, MEDEA).

Investigations and survey instruments used

	ACTIVITY	'INSTRUMENTS
1	Survey of the typological characteristics of the seismic vulnerability of buildings and common	Card expeditious derived from the 1st and 2nd level GNDT (Cherubini, Martinelli)
2	I note the types of masonry	Procedure derived from card type masonry (Binda)
3	Surveying the damage to buildings	Procedure derived from the card AEDES of fitness for human habitation (SSN - GNDT)
4	Identification of the mechanisms of damage	Methodology procedure derived from MEDEA (Zuccaro, Pope)
5	Survey of damage and vulnerability of the churches	Card churches - (Lagomarsino, Mayor)
6	Photographic documentation	
7	Geological and geotechnical survey	Tests, surveys, card expeditious microzonation (Di Capua, Peppoloni)

3. 2. 1 Geology and geomorphology of the town

The town of Ripabottoni located on the end of a ridge trending approximately EW, and developed between 600 and 660 m above sea level The survey is the Flysch di San Bartolomeo (Di Capua and Peppoloni, 2004). This training is presented in alternating layers, or powerful banks sandstone and sandy with thin pelitic levels. Around the ground sandstone, found in the less, appear the land belonging to the formation of clays Varicolori. Outcrops of these clay soils can be found also in the central part of the country, with a thickness in some places reaching 15-20 m deep. A blanket of landfill covers with varying thickness of the two formations present.

3. 2. 2 Geognostic

To integrate information on soil derived from previous investigation campaigns, three new polls have been conducted in the center of the country, made using the continuous core. During drilling tests were carried out SPT, which in almost all cases led "Cancel ". Were also collected samples of undisturbed soil, then subjected to laboratory tests.

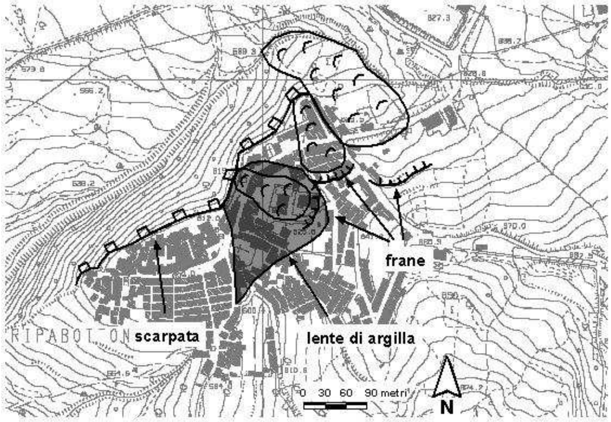


Figure 2 - Center of Ripabottoni: location of lithological and morphological evidence for significant amplification of a possible earthquake.

3. 2. 3 Preliminary seismic micro-zoning

On the lithology and morphology were considered significant for three elements of a preliminary assessment of the possible local effects and therefore useful to define areas of the town to conduct seismic differentiated (Fig. 2):

• the lens of Clay Varicolori, outcropping in the core of the country;

• the active landslides in the north-east of the town;

• the morphological slope skirting the town to the north-west.

In the presence of the clay lens amplification of ground motion would be generated as a result of the passage of waves from lithoid substrate (bedrock), represented by the sandstones of the flysch S. Bartholomew, the clayey material tectonized, the physical and mechanical properties inferior (cover). For the same reasons, it could lead to amplification in the presence of the landslide, which have in fact only interested in the surface soil. Finally, the presence of morphological slope would be a predisposing factor to the occurrence of phenomena of focusing incident seismic energy.

With the overlap of morpho-lithological data and data on corruption and has focused on the development of a preliminary zoning map of the town, only qualitative value since it is based on considerations relating to geology, geomorphology and damage to buildings. The town was divided into 5 zones with intensity of damage and increasing the local seismic hazard (Fig. 4).

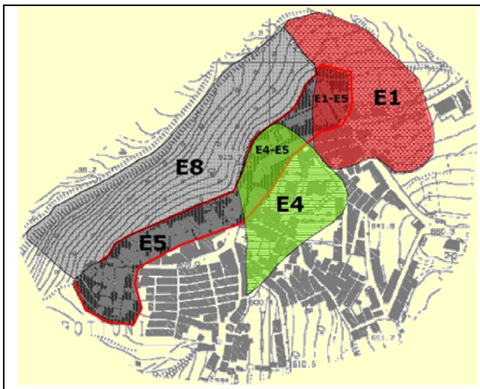


Figure 3 - Charter of the areas susceptible to amplification or instability of local dynamics: E1, an area characterized by active landslides, E4, an area with particularly poor foundation soils, E5, an area of eyelash H> 10 m; E8, foothills of layer of debris.

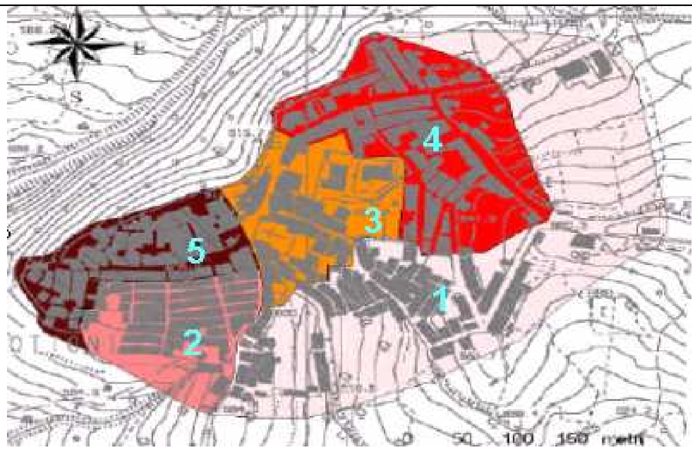


Figure 4 - Preliminary Zonation of the town of Ripabottoni (CB). Moving from zone 1 to zone 5 there is an increase of the damage to buildings in relation to greater influence of the morpho-lithological elements present.

3. 2. 4 Basic seismic hazard

The town of Ripabottoni located in an area that until the events of 2002 was considered a low seismic hazard. On maps drawn on a national scale in 1999 by GNGTS and the National Seismic Service (AA.VV., 2001) shows that in the town of Ripabottoni you can expect a value of peak acceleration (PGA) equal to 0.14 g, a value that has the 10% chance of exceedance in 50 years (return period = 475 years) whereas the standard deviation of the attenuation relationship.

With the new seismic code of 2003 (Order of the PCM No 3274) the town of Ripabottoni has been included in Seismic Zone 2, in which there is a PGA value for the anchorage of the elastic response spectrum of 0.25 g.

3. 2. 5 The architectural heritage Ripabottoni

Most of the buildings of the village is mainly residential and is characterized by terraced houses, built mainly distributed on three levels in the first basement level assigned to the warehouse and access road from the valley, the first floor used as living and the third level in the bedroom. The ranks are arranged either along the contour lines in the orthogonal direction. The vertical structures in most cases are made of stone hewn texture with horizontal there are many cases of squared masonry, the wall hangings, usually two, are matched or slightly clamped. The floors are wood, iron and bricks in most cases with a wooden roof. Are to be reported in the urban seismic many elements of the garrison as chains, huddled bodies arched and spurs.

The buildings of greater architectural merit, Palazzo Cappuccilli, municipal property, and the two churches of St. Mary of the Immaculate Conception and the Assumption, which houses paintings by Gamba valuable and was badly damaged by the recent earthquake.

Building type characteristic of the urban center of Ripabottoni

3. 2. 6 Typological surveys and vulnerability

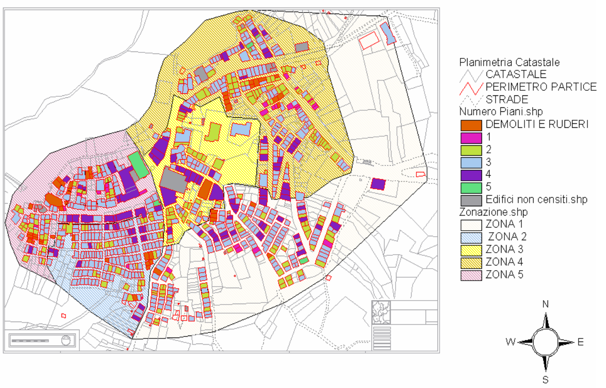
The survey design features covered almost all the buildings in the center and was carried out using a method for detecting type quickly, based on the observation of typological and vulnerability factors partially derived from that of the 1 st GNDT and 2nd level (Petrini, 93).

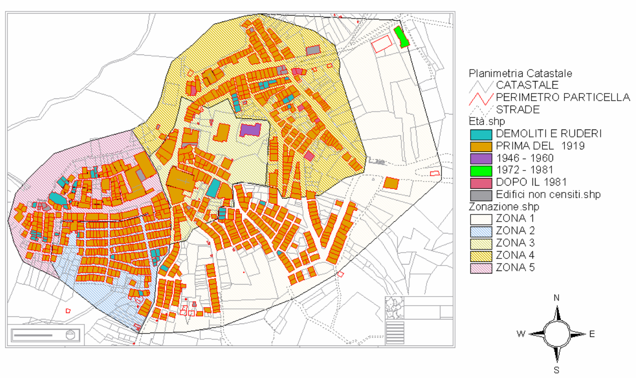
The information contained in the schedules relating to the characteristics and behavioral aspects of construction, cover the basic metrics, the types of vertical and horizontal structures, and some elements of assessment are closely related to the seismic behavior, easily detectable.

This expeditious methodology for the occasion was supplemented with additional indicators for a more accurate assessment of the characteristics of masonry and for the recognition of local building types that characterize the housing stock is as principals seismic (catene..) and as indicators of vulnerability (weak floors, large windows ...).

The collected data were computerized and georeferenced in a GIS environment for their mapping and vision combined with other spatial information. The assessment model associated with the survey process that was applied to data collected in a first draft is based on the determination of the vulnerability in the manner of the methodology GNGTS. Figure 5-a shows a representation of the indices of vulnerability map obtained for the masonry buildings in the usual scale of 0 to 100.

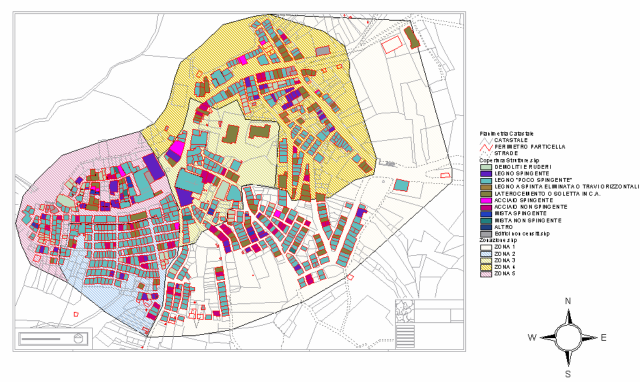
Distribution map data of the detection of vulnerability



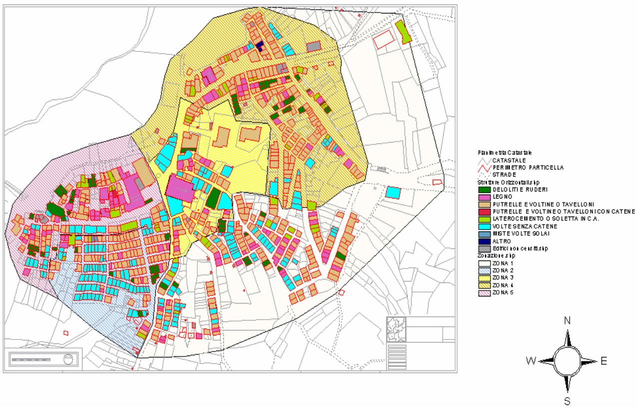


Number of floors

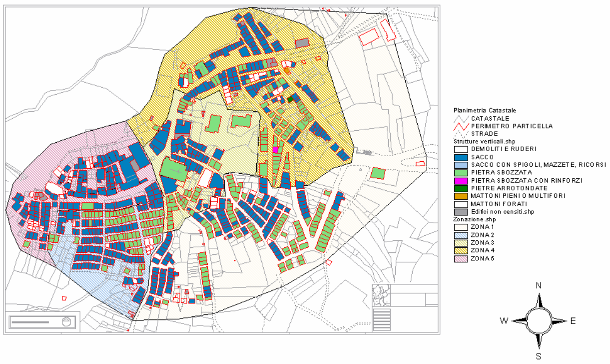
Age of buildings



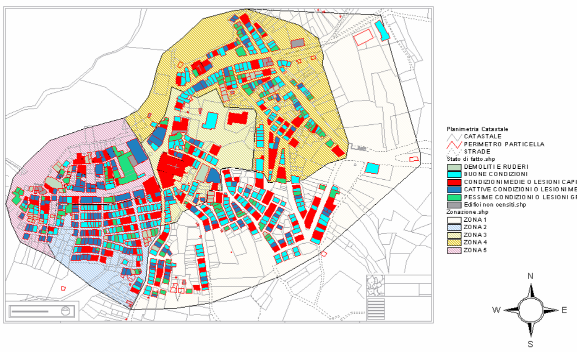
Roof structure

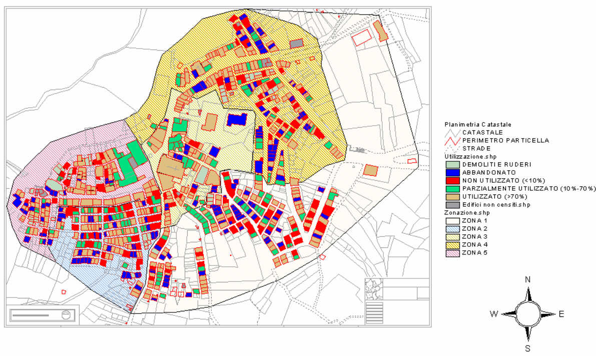


Horizontal Structures



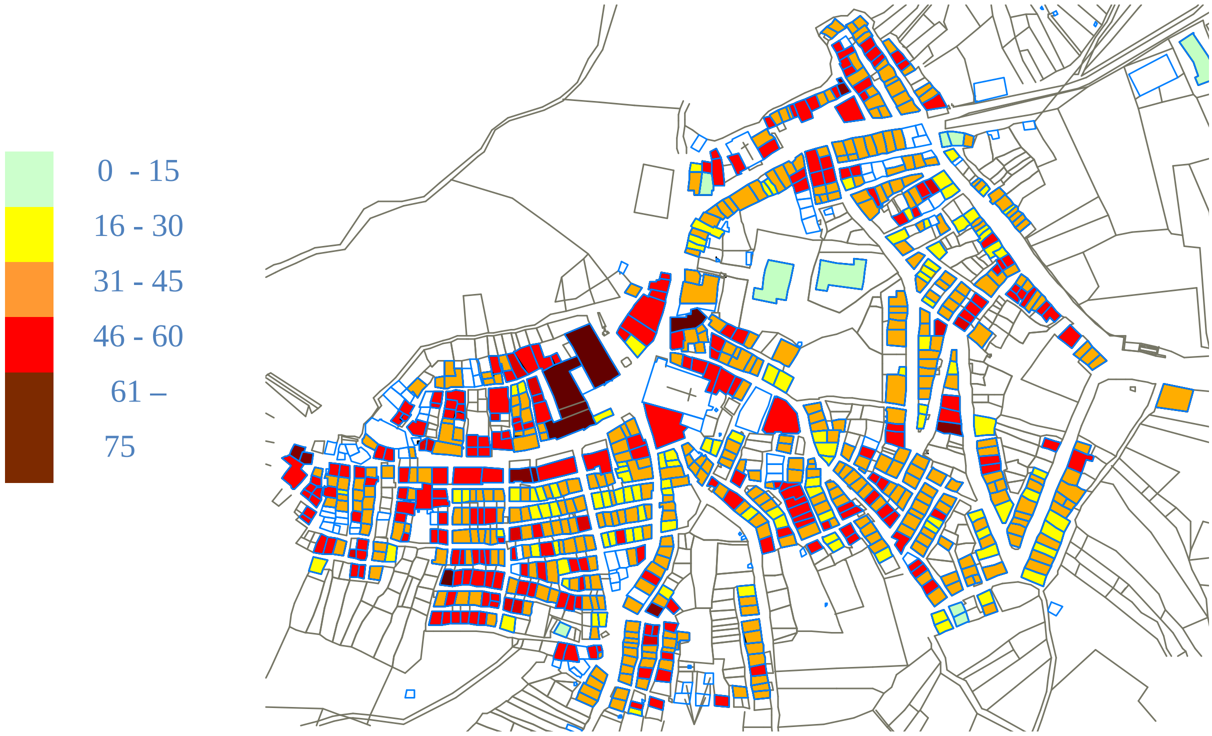
Vertical Structures





State of affairs

Use



GIS representation of the vulnerability of buildings (a).

Examples of masonry prevailing in the center (b).

3. 2. 6. 1 Survey of the walls

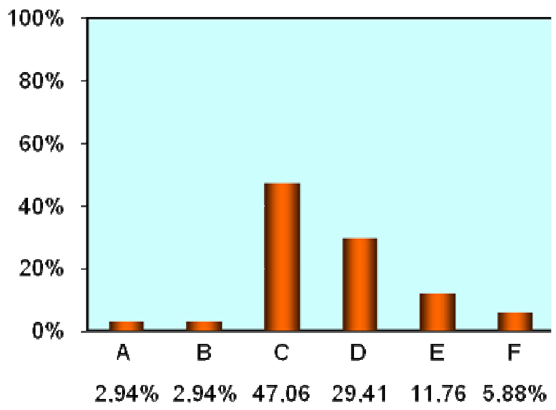
For masonry buildings, knowledge of the type and quality of masonry structures is a fundamental and therefore the data collection was accompanied by a specific survey aimed at the identification and classification of the building in the center. Although this work has been performed through the use of a codified system in support schedografico for typological identification and reading of meaningful measures of quality and endurance.

In the center is primarily a masonry of limestone varying from two types: one characterized by more regular and stone elements connected garments on average, a less regular stone elements and vestments disconnected. The mortars are of a plane and generally low quality (Fig. 5-b).

3. 3 Classification of types of masonry

The types found in California show a high prevalence of stone hewn limestone organized differently, with or without bribes in the corners. For each type were also found some sottotipologie characterized by the variability of specific factors such as weaving, laying, plastering the presence and state of preservation.

In Table A2.1 shows the method used to recognize the type of walls based on the characteristics identified with the board walls. Classes C and D on the stone hewn, are further divided into subclasses based on the characteristics of the masonry (weaving, installation, section,...) (see Tables A2.1 and A2.2).



GNDT Types I and II level
A = cavity walls with stones of varying size
B = cavity walls with stones of regular size
C = hewn stone masonry of poor quality
D = stone hewn edges, bribes and appeals in stone or brick
E = stone rounded river pebbles
F = stone or river rock with rounded corners, bribes or appeals
G = squared stone masonry
In the sample showed a prevalence (45%) of hewn stone walls (C) and stone hewn edges and bribes (D) (25%) and absence of cavity walls (AB) (<5%).

Figure A2.1 - Distribution of sample% of the building detected in California in accordance with the classification board GNDT

The collected data were analyzed to identify the most common types of construction which involve the reference values for mechanical characteristics such as: fm = average compressive strength of masonry;τ 0 = average shear strength of masonry;
w = specific weight of the masonry.
In Table A2.2 shows the average values of mechanical quantities above which lists the relative standard deviation and the average shear strength of masonry.

MAIN TYPES OF WALL FOUND IN TOWN RIPABOTTONI

<table>
<tr><td>Type B - stone masonry with untidy stacks and applications in stone or brick.
Elements: limestone of regular sizes slightly rough average size;
Malta: lime act as entrapment in poor condition;
Laying of the elements: horizontal equipment into wedges with irregular horizontal courses of stone and the absence of complaints and listatura;
Cross section: two juxtaposed or weakly clamped vestments;
Plaster: partially absent and degraded;
Links: weakly effective in the hammer with angled blocks of larger size with detachable poor.
Talks at the walls: none</td><td>
Masonry type B</td></tr>
<tr><td colspan="2">Type C - rough-hewn ashlar masonry in the presence of irregularities
Elements: limestone of regular sizes slightly rough average size
Malta: lime act as entrapment in poor condition
Erection of elements:
– equipment disordered random stone with wedges and the absence of complaints and listatura (C1)
– irregular courses with wedges of stone and the absence of complaints and listatura (C2)
– horizontal equipment into irregular courses with wedges of stone and the absence of complaints and listatura (C3)
Cross section: two robes approached (C1), weakly clamped (C2), clamped (C3)
Plaster: absent, partially missing, this - Connections: ammorsamento poor (C1), irregular (C2), regular (C3) in the hammer with an angle of larger (C2, C3) or similar to the wall (C1)</td></tr>
</table>

	
masonry type c1	MASONRY TYPE C2
	
Masonry type C2	Masonry type C2

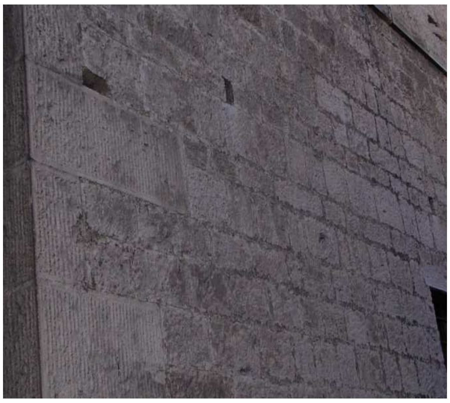
Type D: masonry blocks with rough-hewn edges, bribes and / or appeals squared stone
Elements: limestone of regular sizes slightly rough average size
Malta: lime act as entrapment in poor condition
Erection of elements:
– equipment disordered random stone with wedges and the absence of complaints and listatura (D1)
– irregular courses with wedges of stone and the absence of complaints and listatura (D2)
– horizontal equipment into irregular courses with wedges of stone and the absence of complaints and listatura (D3)
Cross section: two robes approached (D1), weakly clamped (D2), clamped (D3)
Plaster: absent, partially missing, this
Links: ammorsamento poor (D1), irregular (D2), regular (D3) in the hammer with an angle of larger (D2, D3) or similar to the wall (D1)

Type H: square blocks of stone masonry
Constituent parts: mid-sized square Limestone
Malta: lime inconsistent with the function of filling in fair working conditions and fair
Laying of the elements: horizontal, equipment to horizontal courses of stone with wedges and the absence of complaints and listatura –
Cross section: two vestments clamped with section 80 cm
Plaster: none - *Connections*: effective in the hammer with angled blocks of similar size to the wall –
Work to walls: none

MASONRY TYPE H

MASONRY TYPE H

MASONRY TYPE H



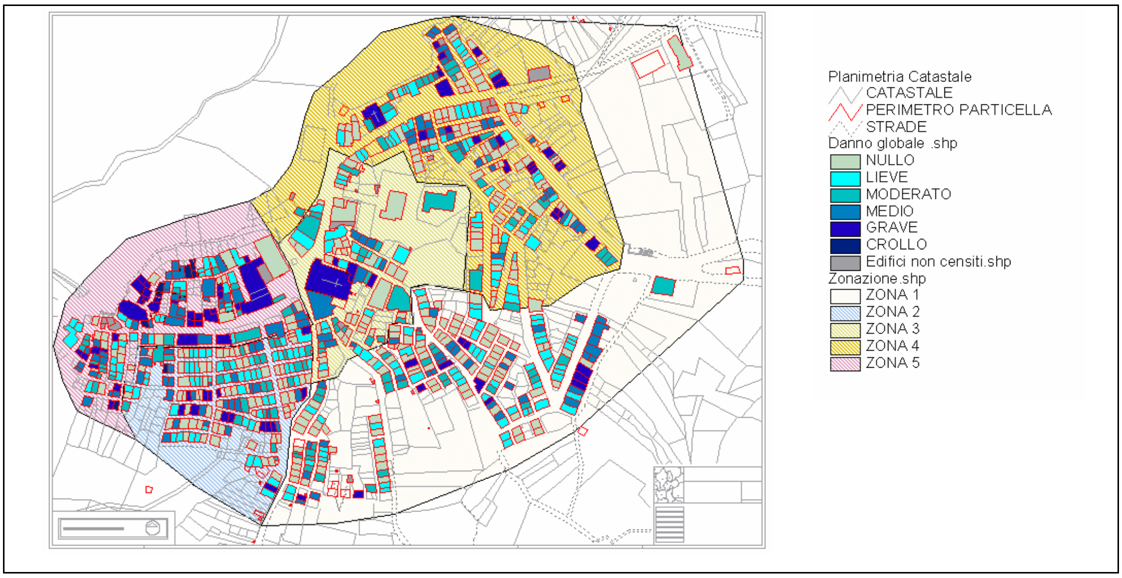
MASONRY TYPE H

Type I - solid and hollow brick masonry with lime mortar or concrete

MASONTRY TYPE I

3. 3. 1 Survey of damage

The survey of the damage and dell'agibilità played by teams that have worked for the Commission of Aedes Larino with the card based on three levels has been converted into Ems98 scale so you can assign a level of overall damage to the structure. For this conversion has been used version of the board Aedes developed by M. Sweet and others (2003) used to measure the damage in San Giuliano di Puglia.



6 - GIS representation of the level of overall damage to the buildings (a) and percentage distribution in the five areas identified under(b).

Livello - estensione / Componente strutturale - Danno preesistente	DANNO (1) D4-D5 Gravissimo > 2/3			D2-D3 Medio grave > 2/3			D1 Leggero > 2/3			**Nullo**	PROVEDIMENTI DI P.I. ESEGUITI Nessuno	Demolizioni	Cerchiature e/o tiranti	Riparazione	Puntelli	Transenne e protezione passaggi
	> 2/3	1/3 - 2/3	< 1/3	> 2/3	1/3 - 2/3	< 1/3	> 2/3	1/3 - 2/3	< 1/3							
	A	B	C	D	E	F	G	H	I	L	A	B	C	D	E	F
1 Strutture verticali	❐	❐	❐	❐	❐	❐	❐	❐	❐	❍	❍	❐	❐	❐	❐	❐
2 Solai	❐	❐	❐	❐	❐	❐	❐	❐	❐	❍	❍	❐	❐	❐	❐	❐
3 Scale	❐	❐	❐	❐	❐	❐	❐	❐	❐	❍	❍	❐	❐	❐	❐	❐
4 Copertura	❐	❐	❐	❐	❐	❐	❐	❐	❐	❍	❍	❐	❐	❐	❐	❐
5 Tamponature-tramezzi	❐	❐	❐	❐	❐	❐	❐	❐	❐	❍	❍	❐		❐	❐	❐
6 Danno preesistente	❐	❐	❐	❐	❐	❐	❐	❐	❐	❍						

(1) - Di ogni livello di danno indicare l'estensione solo se esso è presente. Se l'oggetto indicato nella riga non è danneggiato campire **Nullo**.

Aedes board - rigid structural damage to three levels of intensity and extent

To convert levels of damage from the card to the usability scale Ems 98 were applied the following criteria which take into account both the amount that the extent of the damage.

Componente strutturale - Danno preesistente	DESCRIZIONE SINTETICA DEL DANNO NULLO	1	2	3	4	5
1 Strutture verticali	❐	❐	❐	❐	❐	❐
2 Solai	❐	❐	❐	❐	❐	❐
3 Scale	❐	❐	❐	❐	❐	❐
4 Copertura	❐	❐	❐	❐	❐	❐
5 Tamponature-tramezzi	❐	❐	❐	❐	❐	❐
6 Danno preesistente	❐	❐	❐	❐	❐	❐

DANNO GLOBALE ALL'EDIFICIO NULLO	1	2	3	4	5
❐	❐	❐	❐	❐	❐

La descrizione globale del danno è riferita ai livelli della scala EMS 98:
0 0 Nullo Nullo
1 1 Lieve Nullo
2 2 Grave Lieve
3 3 Medio-Grave
4 4 - Crollo parziale
5 5 - Crollo Totale

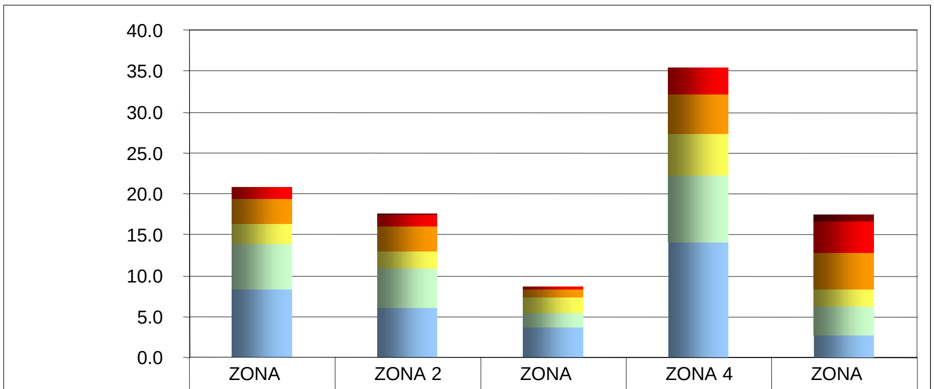
Livelli di danno secondo Ems 98

Criteria for evaluating the damage under Ems 98 in vertical structures

n.	**Damage level EMS 98**	**Description of damage**
0	No damage	No non-structural and structural damage
1	Slight damage	Slight non-structural damage and no structural damage

2	Moderate damage	Serious non-structural damage and minor structural
3	Average damage	Moderate to severe structural damage
4	Serious	Serious structural partial collapse
5	Collapse	Total collapse

Levels of damage on the scale EMS 98



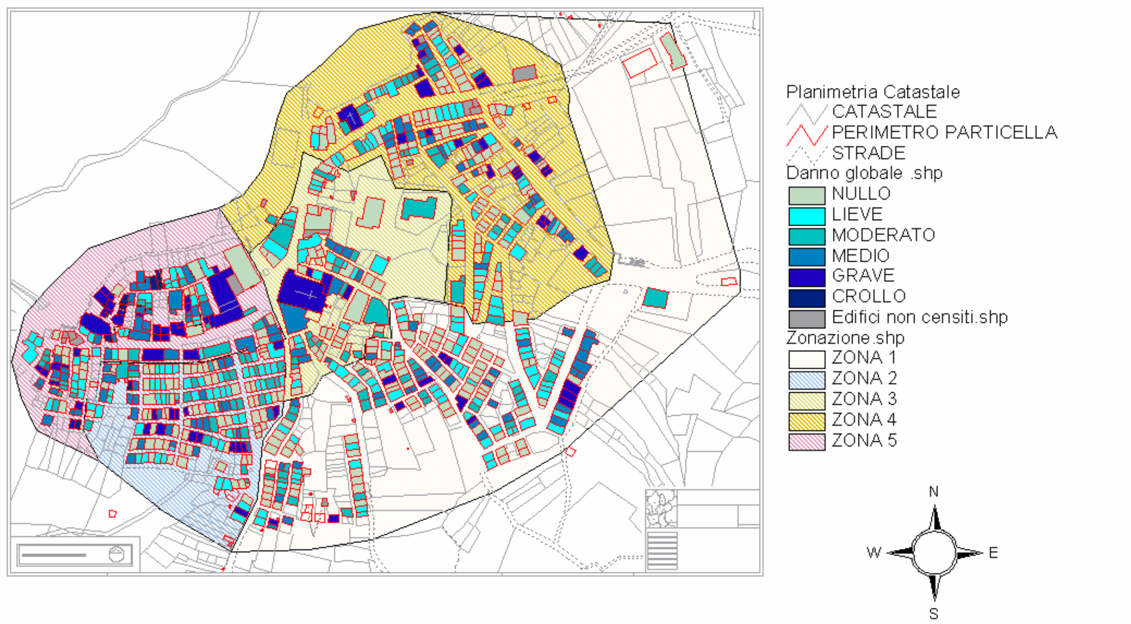
	ZONA	ZONA 2	ZONA	ZONA 4	ZONA
Croll	0.00	0.12	0.0	0.00	0.83
Danno Grave	1.42	1.42	0.3	3.19	3.90
Danno	3.07	3.07	0.9	4.72	4.37
Danno Moderato	2.36	2.13	1.8	5.19	2.13
Danno	5.55	4.84	1.7	8.15	3.54
Danno	8.38	6.02	3.6	14.05	2.72

Distribution of damage to areas

Mapping of damage levels Ems 98

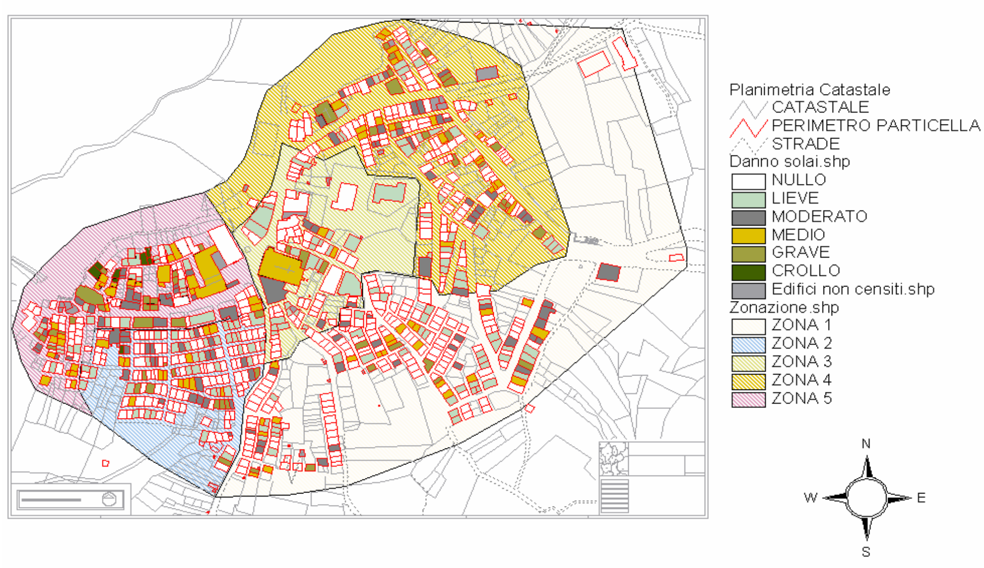
The city built on a cadastral map for each building and each structural component and the overall damage was assessed, the level of damage as indicated above.

Thematic maps so constructed for identifying and assessing the damage in individual buildings and the buildings could be related to the conditions of viability, vulnerability and zoning derived from micro-zoning.



Overall damage

Damage to vertical structures



Damage in the horizontal structures

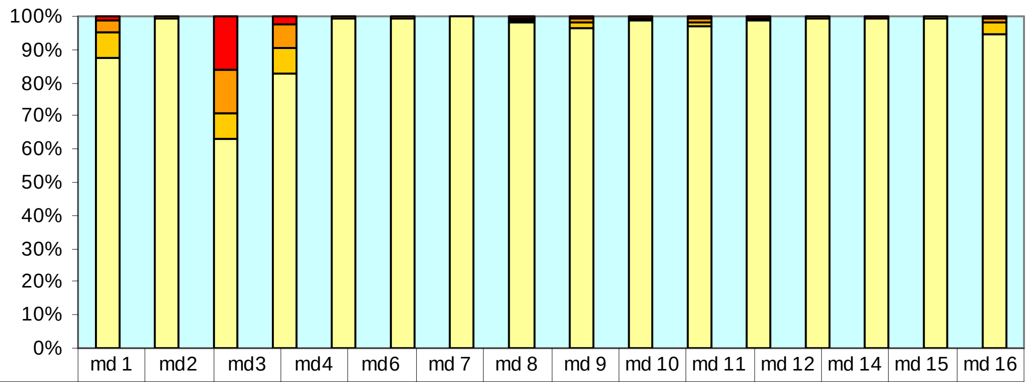
The greatest damage was detected in zone A where the oldest buildings are abandoned and in poor maintenance. Areas B and C buildings are more recent and less damaged.

The comparison of the structural components is a major damage to the vertical structures coincide in almost all cases the overall damage while the floors and cladding have a lower average loss of one or two levels, the difference is even greater damage to the stairs (2-3 levels) while almost all the existing buildings, the damage is zero. This preliminary analysis of the damage based on the card AEDES, for a more immediate and meaningful assessment of the damage can be reduced to a three grade levels (0-1 = mild to significant light = 2-3, severe = 4, collapse = 5) correlated to the levels of damage identified in the CTS for the calculation of contributions.

A forecast scenario

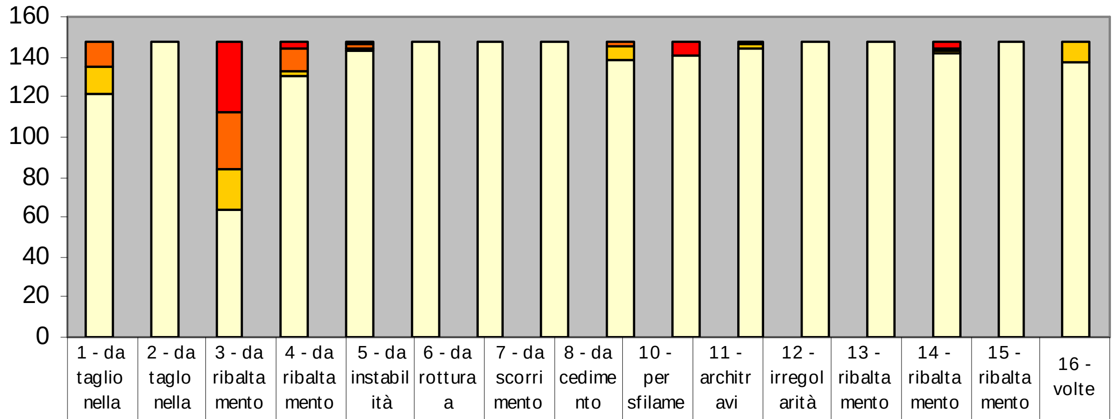
A test of checking the predictive power of the expected damage of the procedure based on the index of vulnerability and fragility curves (Petrini, 1993) was made in developing a scenario of damage to a macroseismic intensity 7, which was compared with the damage found in the campaign of verification dell'agibilità. The comparison of Figure 8 with 6, containing levels of damage, the model shows a good efficacy in the identification of areas with major damage. This initial analysis is not possible a direct comparison of levels of harm to the different definition of indicators, since the overall structural damage in the case of observed data and an indicator of economic (cost recovery compared to the new) in the case of the results scenario, and also because it has not been defined in operational terms the influence of local geomorphic effects in the valuation model of the scenario.

Examination of the conditions of damage-vulnerability with the card Medea
From an initial processing of data collected with the card Medea was able to identify the mechanisms activated by the earthquake and its damage level.



	md 1	md2	md3	md4	md6	md 7	md 8	md 9	md 10	md 11	md 12	md 14	md 15	md 16
3 - danno grave	0.95%	0.24%	16.19	2.25%	0.24%	0.00%	0.59%	0.71%	0.83%	0.71%	0.35%	0.47%	0.12%	0.47%
2 - danno medio	3.66%	0.47%	12.77	7.45%	0.12%	0.00%	0.71%	1.18%	0.00%	0.83%	0.47%	0.12%	0.12%	1.30%
1 - danno lieve	7.68%	0.12%	8.04%	7.68%	0.00%	0.00%	0.59%	1.77%	0.24%	1.18%	0.47%	0.24%	0.12%	3.78%
0 - assenza di danno	87.71	99.17	63.00	82.62	99.65	100.00	98.11	96.34	98.94	97.28	98.70	99.17	99.65	94.44

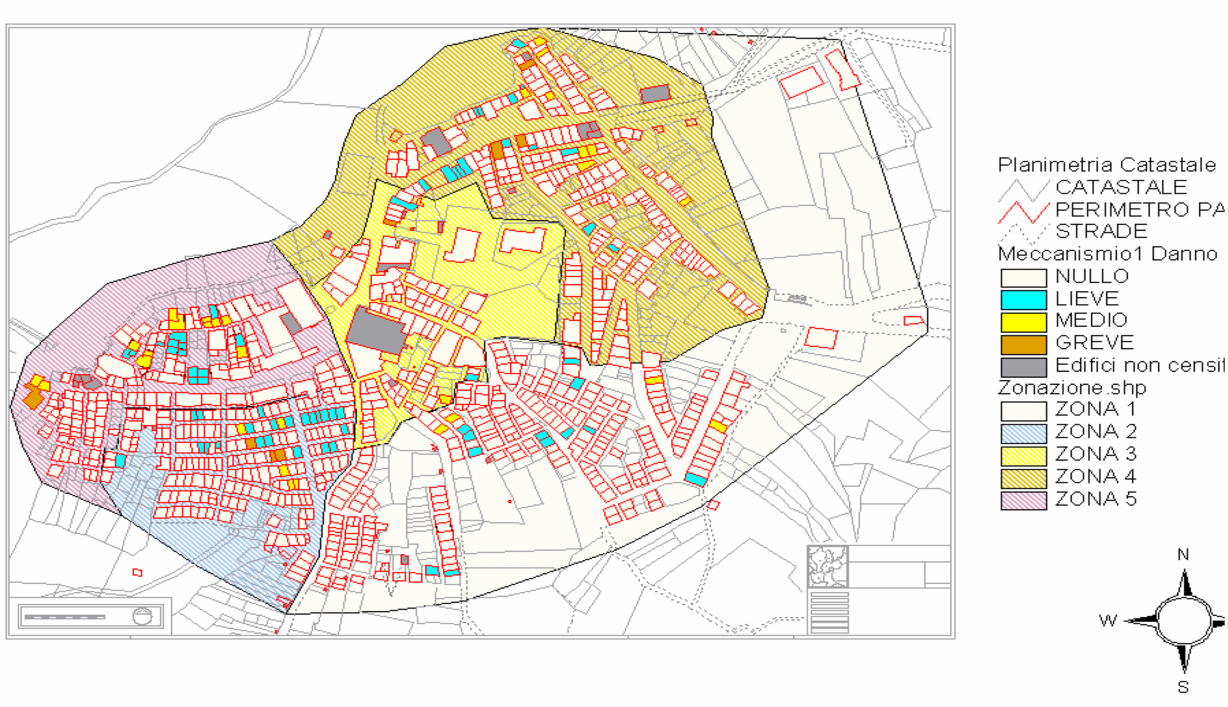
Mechanisms activated and levels of damage by cutting into the wall = 1 - 2 = cutting the top - 3 = from tip overall - 4 = partial rollover from - 5 = vertical instability - 6 = Break-bending - 7 = creep the horizontal plane - 8 = bottom subsidence - 9 = irregularities between adjacent structures - 10 = pull-out beams - 11 = lintels - 12 = irregularities in the walls - eardrum 13 = tip - tilt angle = 14 - 15 = Tip top of the wall - = 16 times



	1 - da taglio nella	2 - da taglo nella	3 - da ribalta mento	4 - da ribalta mento	5 - da instabil ità	6 - da rottura a	7 - da scorri mento	8 - da cedime nto	10 - per sfilame	11 - architr avi	12 - irregol arità	13 - ribalta mento	14 - ribalta mento	15 - ribalta mento	16 - volte
danno grave	1	0	36	4	2	0	0	1	7	1	0	1	4	0	0
danno medio	12	0	28	11	2	1	0	0	0	1	0	0	1	0	1
danno lieve	14	0	21	3	1	0	0	0	0	2	1	0	1	0	10
danno nullo	121	148	63	130	143	147	148	147	141	144	147	147	142	148	137

Zone 5 - damage mechanisms and levels of damage

9.4.1 - Mapping of collapse mechanisms

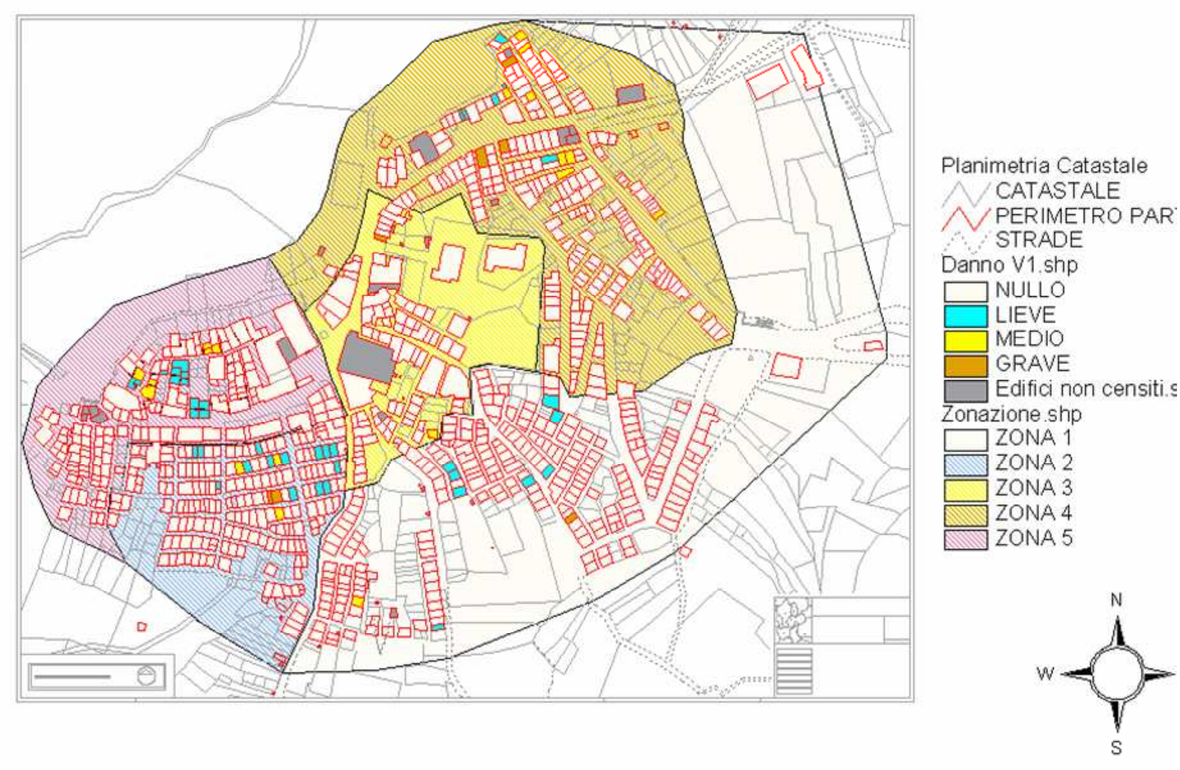


Mechanism n. 1 by cutting the whole wall

Mechanism n. 3 of the whole wall

The mechanisms are more active and are the first way of overturning the entire wall (No. 3) and the upper part (4) while it shows a limited activation of the mechanisms of action in the way of the second floor (n1 and n. 2). In addition to the mechanisms identified with the project Medea by observation of the ways of damage has been possible to identify the activation of additional mechanisms due to actions such as the vertical deflection on the walls and pillars, the failure of the supports in the horizontal structures and the breakdown of lintels.

Mapping of the mode of damage



Damage V1 - diagonal lesions in males

3. 4 Tools for risk management (planning)

TOOLS FOR THE RELIEF OF DAMAGE AND VULNERABLE EARTHQUAKE OF CULTURAL HERITAGE

METHODOLOGY FOR THE ASSESSMENT OF DAMAGE, AND VULNERABILITY AND INSTRUCTIONS FOR COMPLETING THE STATEMENT OF CHURCHES LEVEL II

3. 4. 1 General Description of the Methodology

The historical artifacts in stone, especially if they are monumental in nature, generally made from the finest workers with good quality materials and generally have an adequate level of security to ordinary shares and high durability, and their presence is in itself a testimony of static efficiency.

The history of the building offers us, even in small towns, which now manufactures surprised by their boldness structure. The materials, natural materials (stone, wood) or artificial (mortars, bricks), and in some cases even improve over time, their mechanical properties (pozzolanic lime mortar, wood) are sufficiently protected through a continuous maintenance (plaster, roofing , hydrogeological conditions in the foundation).

In the past, buildings were built using the experience gained from existing buildings, translated into rules of the art in most cases not written. The manufacturer used good intuition, due to the concepts of balance between bodies, and testing, scale models, to develop new technological solutions or geometric proportions more daring, even these became rules of art, if it is proved correct as a result of their use. Then, implement the project in accordance with the rules of art amounted to meet current testing standard, one can therefore say that, speaking today on an artifact, recognizing compliance with the rules of art and read the story of the building is, in essence, how to make the test.

For these reasons, the structural analysis of a monumental building should be framed within a multidisciplinary study, which addresses the restoration project, starting from a thorough knowledge, addressed the following aspects: its history (growth, transformation, trauma), the critical survey (geometry, technology), the characteristics of materials and their degradation, the importance of the crack and deformation. The synthesis of this information to interpret the structural behavior and the diagnosis of the article, which highlights any weak points of the body, whether original or a result of the instability and degradation.

This approach falls partially at fault when you consider exceptional actions, such as earthquake, which represents a greater risk of impact on historical buildings. Masonry buildings are characterized by an inherent vulnerability seismic action: the "structure" masonry, despite the many forms that can be seen, is essentially designed to withstand vertical loads. The arrangement of the segments for horizontal rows, can be attributed to the will of the manufacturer to arrange the elements of greatest weakness (the mortar joints) orthogonal to the curve of pressures induced by the actions of pure compression (or bring their own weights).

During an earthquake, the horizontal action generates the states of shear stress and tensile strength exceeding the weakness of the material flow resulting in injury to, or detachment of the elements. The history of these artifacts also characterized by various phases of construction, emphasizes that behavior by parts, which is already inherent in the material which composes them, the growth, the additions, extensions planimetric determine the presence of many structures to 'inside the same building whose behavior is strongly influenced by the action which it invests. In the case of an earthquake the horizontal inertial forces are capable of causing loss of balance in slender elements or not properly connected to the rest of the building.

In view of these considerations, which can be ascribed to an inherent vulnerability of these structures, it is important to remember that the greatest damage to structures now strongly needed "degraded. " The growth of decay that these structures have endured over the past 50 years is attributable to lack of maintenance that was constantly on the work done instead, made minor repairs continue, which had the merit of maintaining the security level of the building to an acceptable level without changing the behavior of the original building.

Another vulnerability can be represented by landslides occurred during historical earthquakes: Although in many cases, the earthquake can be seen as a test of the work, we must stress that we return an object from the structural behavior is profoundly different than prior to 'event. The lesions in the walls are wounds that are never fully erased. The seismic event can be a sort of testing, but also represents a partial reset of the seismic history, and in many cases, it is in front of factories that have never undergone the maximum intensity for the site and then waiting for many buildings lack a true test.

Clearly, there are rules of art focused specifically on protecting themselves from this action: the good quality of detachable, the use of lintels of adequate stiffness, the construction of a box-behavior through hoops and chains, the insertion of spurs in contrast tilting mechanisms are examples of technological solutions commonly adopted in the areas of highest seismic risk. However, the earthquake action is rare and perhaps this is the key for the interpretation of this vulnerability: the return period for an earthquake of significant intensity is at least 100 years, then about three generations.

The rules of art were the result of the experience of the manufacturer and were passed on to the student: When a manufacturer acquired the experience of the earthquake, observing directly the mechanisms of damage products through an intuitive understanding of structural behavior and a set of measures to good building and improvement of earthquake damaged buildings. These rules were applied for one, maybe two generations, but were gradually abandoned precisely because, having lost the memory of the damage caused by the earthquake, was not really understood the need.

In many old towns, in fact, it is possible to identify design features, all dating back to the same historical period, usually immediately following a traumatic event, put in place to implement some sort of improvement during the seismic repair of the damage. In this case we can speak of a culture of seismic repairs at the moment that raises the security level of the old town, being a sporadic event in the life of the urban sprawl. Where these design solutions alter the way of building local, you can talk about culture seismic prevention and you can see, reading the urban fabric of a historic seismic as principals (buttresses, arches contrast, chains and hoops) are widely used on the building.

When it comes to monumental structures, although the variety of types of buildings is very large (noble buildings, masonry bridges, towers, walls, castles, archaeological sites, entire city centers) can not be ignored due to the churches a special role. Especially in Italy the large number of such buildings in the territory on the high percentage (about 80% of the architectural heritage is, in fact, consists of places of worship) determines the need for evaluations that take a strong connotation of the cue types of such articles to define the most appropriate prevention policies.

The observation of the damage caused by earthquakes in recent years Italian (Garfagnana and Lunigiana 1995, Umbria and the Marches 1997, 1998 Pollino, Piemonte 2000, 2001 Lazio, Tuscany 2001, 2002 Molise, Piemonte 2003), including those of low intensity, confirmed as the seismic behavior of the church was classified according to recurring phenomena.

In fact, even in the variety of construction techniques, dimensions and forms in which they have asked for and importance of different ages, the factory is almost always consists of a facade, a room (with one or more aisles), a presbytery and an apse, these elements can be added to the transept, the dome, the side chapels also almost always has a bell or a sail. In this classification of architectural elements in general is a largely autonomous structural behavior, precisely because of these types of artifacts: large space without interior walls of the plug (with the exception of the columns and arches separating the aisles), no intermediate horizontal elements (or at least there once), slender walls, successive accretions of the factory, in appearing with seamless walls. The structure is then, in most cases, quite clearly legible and simplified analysis can be done through qualitative evaluation.

These factors have led to the formulation of a methodology that summarizes the various modes of damage were reported following the quake in a number of fundamental mechanisms of collapse, so the different ways in which different macro proportions and materials lesions are recognized and taking in the mechanism of collapse, which is the very essence of vulnerability. These moving parts are always related to the two basic mechanisms that take place between two rigid bodies, or between the two portions which divides the solid wall due to a crack: rotation or relative sliding. These mechanisms are generally associated with the behavior of the elements as requested, respectively, of the action out of the plane or in the plane of the same, they show differently in different macroelements of the church, according to their shape.

The methodology adopted for the analysis of vulnerability of the churches of Molise, can be used in prevention, emergency and after an earthquake in the next phase of reconstruction. At the end of a more reliable prediction of expected damage, as well as some dimensional information, the card aims to identify the structural deficiencies that promote the activation of each mechanism of injury, and these are often linked to details rather than general considerations on the shop floor (presence of chains, detachable, etc.).. In addition, the importance of pre-existing damage is a further valuable information, since past earthquakes often leave marks that are not deleted and can still be recognized. The result of this analysis is of course the scenario of expected damage to the front of the reference earthquake for the region.

This may address prevention strategies at the regional level, or through cost-benefit analysis to define how to best use the resources available to reduce the seismic risk, and suggest, for the individual artifact, the upgrades that make it possible to obtain effective keep the property. without underestimating the problems of security. The card is structured to guide the detector in the interpretation of damage mechanisms activated by the earthquake and in the identification of key construction details with regard to vulnerability. This method of relief for the damage which is a real diagnosis of the preliminary seismic response of the building.

The reworking of the data, following the major earthquakes Italian (Umbria and Marche 1997; Pollino 1999, Lunigiana and Garfagnana 1995, 2000 Lazio, Molise 2002 2001m Asti and Alessandria, Piemonte 2003), pointed out that the methodology used to measure the damage and vulnerability (Lagomarsino, 1998; Podesta, 2002), represents a valuable tool for evaluating the seismic behavior of religious buildings (churches), which may be drawn not only useful in an emergency phase but also suggestions for more difficult phase of reconstruction.

The concept of macro-, portion of the factory is characterized by a structural response predominantly independent (Doglioni et al. 1996; Lagomarsino et al., 1997), may, however, fall into default when the census is done of the damage occurred before the earthquake highlights so clearly the behavior for parts of the building. In particular, the prediction of the damage mechanism, which may be activated during an earthquake, must be assessed in terms of a more careful assessment of vulnerability indicators, which in the original version of the card had been identified in two at each mechanism collapse, creating the inevitable approximations and uncertainties on the compilation.

The presence of large churches also makes the summaries produced by the instrument schedografico, in many cases too far, to the point of confusion in attributing the damage occurred to the proper mechanism. The presence of damage at once or a side chapel, is not, in fact, a right position, unless you confuse it with a general corruption at times, creating for the parameters introduced (damage index) values that can distort the overall assessment.

These considerations have led the authors will produce a new methodology, which was able to eliminate the weak points of the form used in the earthquake in Umbria and the Marches (Lagomarsino et al. 2001).

The research carried out is placed in parallel with an initiative of the Department of Civil Protection, which established, in cooperation with the Ministry of Interior and the Ministry of Culture, a committee whose task is to write up important tools for a variety of monumental buildings so they can be used both during and prior to following an event are of different nature.

The recent earthquake that hit the province of Campobasso (seismic crisis began Oct. 31, 2002) allowed to use the new methodology developed in the field, alongside the institutional survey carried out via a card given by the Ministry of Culture and Public Works that the requirement for the major structural damage GNDT refers to the methodology used for the earthquake in Umbria and Marche.

In particular, the new method can overcome the problems encountered in previous campaigns census extending the number of damage mechanisms from 18 to 28. The extension does not lose, however, the territorial aspect of the methodology and application, and allows a more precise description of both the vulnerability and the damage, because the introduction of some new mechanisms allow a more accurate description of situations that often so too were assigned to the same approximate collapse mechanism. The 28 mechanisms present, related to a revised schedule also in parts previously present, allowing, in fact, a more detailed description of the kinematics activated, thus providing, to the detector, a number of additional parameters useful to express sull'agibilità of the building.

Below is the table in the list of damage mechanisms considered: the two side columns have been reported parts of the church and the ways of damage (out of the action plan: The way, the action plan: The way) associated to each mechanism of collapse expected. It seems evident that certain mechanisms are difficult to correlate a single mode of damage, which is, however, introduced a schematic for understanding the behavior of walls over by seismic action, for the times or loses the coverage this simplification, in fact, meaning, because the damage that occurs in these architectural elements, if not strictly connected with a more general, such as the answer may be transverse or longitudinal classroom, is to be associated with a single damage mechanism.

3. 5 Description of data for the survey of damage and vulnerability

The board is divided into three distinct parts that describe, albeit with several changes, the seven sections in the previous version used in Umbria and Marche (Lagomarsino and Podestà, 2004). The first part is devoted to general knowledge of the factory, meaning, therefore, the formal characteristics, the main dimensions of the architectural elements that compose it, the characteristics of the walls of the various macronutrients. With regard to the typological and dimensional data has sought to expand the sections that were not sufficient to describe large churches and the presence of numerous side chapels of various invoice and size, the presence of different types than the traditional curtain-shaped hut , this new version is in the right place in order to avoid confusion to the detector while the absence of many records in free field who have the disadvantage of being easily storable and processable data. In particular we want to emphasize that the attempt to sequentially analyze such data (type, size or nature of the building, works carried out recently) may provide that information to the detector which are absolutely necessary, in completing the second part, that is, when it will be called to judge the harm and the overall vulnerability of the factory.

The data collected are, in fact, the inherent vulnerability of the factory, which plays a key role, as demonstrated by the observation of damage in structural behavior, it is also important to remember that the subjectivity of the information collected, which is inevitable when you have to do with technical different cultural background, can be contained below an acceptable threshold, if the information gathered enables the detector to provide the correct elements to compensate for the different level of preparation and different experience.

Elenco dei meccanismi di danno proposti nella nuova metodologia di rilievo

MECCANISMO DI COLLASSO	***Modo di danno***	***Parte della chiesa***
1 - RIBALTAMENTO DELLA FACCIATA	I	FACCIATA
2 – MECCANISMI NELLA SOMMITÀ DELLA FACCIATA	I	
3 – MECCANISMI NEL PIANO DELLA FACCIATA	II	
4 - PROTIRO – NARTECE	I o II	
5 - RISPOSTA TRASVERSALE DELL'AULA	I	AULA
6 – MECCANISMI DI TAGLIO NELLE PARETI LATERALI	II	
7 - RISPOSTA LONGITUDINALE DEL COLONNATO (chiese a più navate)	I	
8 - VOLTE DELLA NAVATA CENTRALE	I o II	
9 - VOLTE DELLE NAVATE LATERALI	I o II	
10 - RIBALTAMENTO DELLE PARETI DI ESTREMITÀ DEL TRANSETTO	I	TRANSETTO
11 - MECCANISMI DI TAGLIO NELLE PARETI DEL TRANSETTO	II	
12 - VOLTE DEL TRANSETTO	I o II	
13 - ARCHI TRIONFALI	II	ARCO TRIONFALE
14 - CUPOLA - TAMBURO/TIBURIO	I o II	CUPOLA
15 - LANTERNA	I o II	
16 - RIBALTAMENTO DELL'ABSIDE	I	ABSIDE
17 - MECCANISMI DI TAGLIO NEL PRESBITERIO O NELL'ABSIDE	II	
18 - VOLTE DEL PRESBITERIO O DELL'ABSIDE	I o II	
19 - MECCANISMI NEGLI ELEMENTI DI COPERTURA (pareti laterali aula)	I o II	COPERTURA
20 - MECCANISMI NEGLI ELEMENTI DI COPERTURA (transetto)	I o II	
21 - MECCANISMI NEGLI ELEMENTI DI COPERTURA (abside, presbiterio)	I o II	
22 - RIBALTAMENTO DELLE CAPPELLE	I	CAPPELLE CORPI ANNESSI
23 - MECCANISMI DI TAGLIO NELLE PARETI DELLE CAPPELLE	II	
24 - VOLTE DELLE CAPPELLE	I o II	
25 - INTERAZIONI IN PROSSIMITÀ DI IRREGOLARITÀ	I o II	
26 - AGGETTI (VELA, GUGLIE, PINNACOLI, STATUE)	I	AGGETTI CAMPANILE
27 - TORRE CAMPANARIA	I o II	
28 - CELLA CAMPANARIA	I o II	

The second part is related to the relief of the damage and the vulnerability of the church, the changes in this section are those that appear to be the most significant. 28 The mechanisms provided allow the analysis of even large churches with the same degree of accuracy. One example, which can be significant in this preliminary description, is represented by the mechanisms of collapse of the roof, which in the previous version were incorporated into a single indicator.

Diversification introduced in 3 different mechanisms to detect and classify more precisely the construction features. In large churches, made up of many macro (classroom, apse, transept, nave and side), there are, in many cases, different types of coverage, which already generate dissimilar behavior in static situations (central truss in the classroom, struts groundwater in the apse), which must be independently identified and cataloged.

The optics of this revision was, therefore, be to pay more attention to the importance of construction details that play a key role on the seismic behavior of such structures. In this spirit, the original significance of the issue is being run as a two-pronged approach: indicators of vulnerability and seismic safeguards. In this way it is immediate understanding of the structural information required, facilitating the compilation and reliability of the survey. If the presence of a spur or a chain can be seen as a defense capable of countering the anti-seismic enable the evolution of a mechanism, the presence of pushing elements or the presence of concentrated loads at once a source of vulnerability . The attempt to put all the information in positive or negative made difficult to understand the operation of relief and the mechanical meaning that is associated with each of it. For each of the 28 mechanisms of injury was therefore drawn up a list of principals and informative vulnerability which is possible in any case increase in relation to construction details that may be typical for a given area but from the perspective of spatial analysis are difficult to predict.
The following is an example, the section on the mechanisms of the cover of the classroom.

19 – MECCANISMI NEGLI ELEMENTI DI COPERTURA - PARETI LATERALI DELL'AULA				
Presenza del macroelemento in relazione al meccanismo: Si ☐ No ☐				Punta di danno massimo (da 0 a 5): __
Vulnerabilità	Si	No	*Presidi antisismici*	
	☐	☐	Presenza di cordoli leggeri (metallici reticolari, muratura armata, c.a. sottili)	☐ ☐ ☐
	☐	☐	Presenza di collegamento puntuale delle travi alla muratura	☐ ☐ ☐
	☐	☐	Presenza di controventi di falda (tavolato incrociato o tiranti metallici)	☐ ☐ ☐
	☐	☐	Presenza di buone connessioni tra gli elementi di orditura della copertura	☐ ☐ ☐
	☐	☐	....	☐ ☐ ☐
	Si	No	*Indicatori di vulnerabilità*	
	☐	☐	Presenza di copertura staticamente spingente	☐ ☐ ☐
	☐	☐	Presenza di cordoli rigidi, copertura pesante	☐ ☐ ☐
	☐	☐	....	☐ ☐ ☐
Danno	attuale		Lesioni vicine alle teste delle travi lignee, scorrimento delle stesse – Sconnessioni tra i cordoli e muratura – Movimenti significativi del manto – Sconnessioni e movimenti tra gli elementi di orditura principale	☐ ☐ ☐ ☐ ☐
	vecchio		Lesioni vicine alle teste delle travi lignee, scorrimento delle stesse – Sconnessioni tra i cordoli e muratura – Movimenti significativi del manto – Sconnessioni e movimenti tra gli elementi di orditura principale	☐ ☐ ☐ ☐ ☐

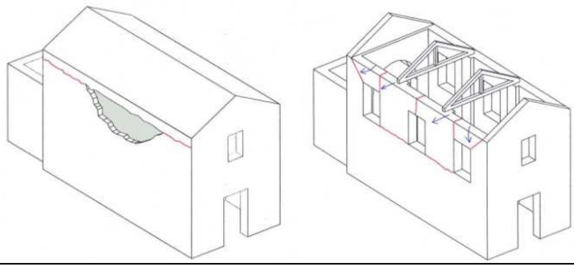
Part of the form relating to a collapse mechanism on the cover.

The methods of compilation are quite similar to the original version: in the first row shows the name of the macro-system or that you want to evaluate the vulnerability by side with a box in which the macro-mark if there is the church that you are recital. In that version, in order to avoid inconsistencies in the process of revision, was prepared a double box, so that no doubts arise about the reliability of drawing on the possible activation of some mechanisms of damage. She has also been planned for some mechanisms provide the ability to define the significance of some mechanisms of injury in order to graduate in a more correct index for the subsequent evaluation of damage and vulnerability.

It is emphasized that some mechanisms should be provided the opportunity to make an assessment of the tip resulting damages. For the kinematics of collapse affecting the vaults of the church, although there is, in this version, a distinction between the elements of the nave or side, the presence of damage concentrated on a single span of the church determined, in many cases or Feedback highly punitive, or an underestimation of the severity of the injury to account implicitly for an average rating of the entire macro-damage. In this way, however, the overall assessment is provided in terms of damage to the macro-average but with the possibility
of damage to report tips on specific elements of the macro element.

On the next line shows, however, a series of seismic safeguards that can counteract the activation of this linkage and a series of indicators of vulnerability that might further increase the propensity for corruption. In each case, the detector will detect the presence or absence (Yes - No), and in the right column to express an opinion on the effectiveness of particular construction, modulating his opinion on three different levels (0: ineffective; 1: modest, 2: good, 3: Fully effective). The presence of a chain which opposes the overturning of the facade, for example, is not ever a good defense, its location or the fact that it is "slow", can make it, in fact, ineffective for impulsive action like that of a earthquake. It should be noted, also, as the list of principals and indicators have been designed so that it can be updated from time to time according to geographical area that is mapped. In the last box is instead reported the finding of damages, which the assessment will be conducted with regard to 5 levels of damage in accordance with the methodology EMS98 (Grüntal et al., 1998; Lagomarsino and Podestà, 1999). Even in this case than the original version of the assessment on the damage detected is divided into two subsets: actual damage, directly attributable to the earthquake and pre-existing damage, pre-existing seismic event that is being analyzed.

19 – MECCANISMI NEGLI ELEMENTI DI COPERTURA: PARETI LATERALI DELL'AULA



Schematic representation of the mode of damage

This is crucial for very old structures that, in most cases, have undergone several historical earthquakes or landslides of different nature. The difficulty in describing correctly, especially in non-epicenter, the ones that are usually listed as aggravation of pre-existing damage can be easily overcome by describing the damage detected as the sum of two separate factors, the actual damage will be assessed the total loss , expressing, in the box pre-existing damage, an assessment of the degree which is believed to be already present before the earthquake, in order to calibrate, so even sull'agibilità the proceedings of the structure in a proper way.

The evaluation of seismic behavior of the interior building, like the previous version, obtained from the calculation of two indices (index of harm and vulnerability) which represent the damage assessment and vulnerability media found during the inspection. Regarding the index of damage, it is represented by an average normalized measured by:

$$i_d = \frac{1}{5} \frac{\sum_{k=1}^{N} \rho_k d_k}{\sum_{k=1}^{N} \rho_k} \qquad (1)$$

where: ρ_k is the weight assigned to each of them, dk is the level of damage suffered in respect of the k-th mechanism (0 to 5), N is the number of mechanisms that could be activated in the church ($N \leq 28$). In particular, the previous version was added to the parameter k which allows ρ weigh about the relationship between the different damage mechanisms that are considered. This operation is partly automatic (the weights are assigned directly to individual mechanisms) and partly depends directly on the detector, based on its direct assessment of the macro-on the individual church. The following table shows the 28 mechanisms of damage, the values of the coefficients ρ_k directly assigned to the interval over which the detector can be varied in the importance of the macro element of the product. It seems evident that if the macro element is not present in the factory or the damage mechanism associated with it is not activated, the value of this parameter is zero.

List of coefficients ρ k for the different damage mechanisms

MECCANISMO DI COLLASSO	***Valore assegnato***	***Range di variabilità***
1 - RIBALTAMENTO DELLA FACCIATA	***1***	
2 - MECCANISMI NELLA SOMMITÀ DELLA FACCIATA	***1***	
3 - MECCANISMI NEL PIANO DELLA FACCIATA	***1***	
4 - PROTIRO – NARTECE		***0.5 ÷1***
5 - RISPOSTA TRASVERSALE DELL'AULA	***1***	
6 - MECCANISMI DI TAGLIO NELLE PARETI LATERALI	***1***	
7 - RISPOSTA LONGITUDINALE DEL COLONNATO (chiese a più navate)	***1***	
8 - VOLTE DELLA NAVATA CENTRALE	***1***	
9 - VOLTE DELLE NAVATE LATERALI	***1***	
10 - RIBALTAMENTO DELLE PARETI DI ESTREMITÀ DEL TRASETTO		***0.5 ÷1***
11 - MECCANISMI DI TAGLIO NELLE PARETI DEL TRANSETTO		***0.5 ÷1***
12 - VOLTE DEL TRANSETTO		***0.5 ÷1***
13 - ARCHI TRIONFALI	***1***	
14 - CUPOLA - TAMBURO/TIBURIO	***1***	
15 – LANTERNA	***0.5***	
16 - RIBALTAMENTO DELL'ABSIDE	***1***	
17 - MECCANISMI DI TAGLIO NEL PRESBITERIO O NELL'ABSIDE	***1***	
18 - VOLTE DEL PRESBITERIO O DELL'ABSIDE		***0.5 ÷1***
19 - MECCANISMI NEGLI ELEMENTI DI COPERTURA - (pareti laterali aula)	***1***	
20 - MECCANISMI NEGLI ELEMENTI DI COPERTURA - (transetto)		***0.5 ÷1***
21 - MECCANISMI NEGLI ELEMENTI DI COPERTURA - (abside, presbiterio)	***1***	
22 - RIBALTAMENTO DELLE CAPPELLE		***0.5 ÷1***
23 – MECCANISMI DI TAGLIO NELLE PARETI DELLE CAPPELLE		***0.5 ÷1***
24 - VOLTE DELLE CAPPELLE		***0.5 ÷1***
25 - INTERAZIONI IN PROSSIMITÀ DI IRREGOLARITÀ		***0.5 ÷1***
26 - AGGETTI (VELA, GUGLIE, PINNACOLI, STATUE)	***0.8***	
27 - TORRE CAMPANARIA	***1***	
28 - CELLA CAMPANARIA	***1***	

The calculation of the vulnerability in this version is slightly more complex than the form used in Umbria and Marche. The structure of the board, in fact, provides for a distinction in the survey design characteristics that can influence (contrast or favoring activation) directly on the mechanism of collapse. This change allows, during the relief operations a better understanding of the structural features of the work of the kinematic activities, resources or deficiencies that the facility has in relation to new earthquakes, the knowledge of principals and indicators of vulnerability of specific macro-information are also essential for the final assessment of viability of the building that is obviously an opinion that may not be subject to any analytical algorithm but depends on the final evaluation of technical defects.

The decision to make, therefore, the information you encounter a clearer understanding has led, however, a slightly more complicated than the previous formulation, the calculation of the total vulnerability of the building, being evaluated using the following continuous function :

$$i_v = \frac{1}{6} \frac{\sum_{k=1}^{28} \rho_k \left(v_{ki} - v_{kp} \right)}{\sum_{k=1}^{28} \rho_k} + \frac{1}{2} \qquad (2)$$

where the k-th mechanism: VKI and VKP are, respectively, the score obtained from the survey of indicators of vulnerability and seismic safeguards in relation to the criterion shown in Table.

The vulnerability index varies between 0, where the principals are present and no effective anti-seismic structural deficiency, to a representative of the opposite case.

Assessment of the vulnerability score for each damage mechanism

Giudizio dell'efficacia	Numero degli indicatori di vulnerabilità o dei presidi antisismici	Punteggi v_k
3	almeno 1	3
2	almeno 2	
2	1	2
1	almeno 2	
1	1	1
0	-	0

In the third part has been given space in sections free field to enter information that has not are shown in the previous sections, or that help to better understand the structure of the church (sketches, drawings, photographs). E 'was also for this purpose also included a part in which you can insert references to archival historical geometric reliefs, which can be useful if the object of in-depth investigation needs through the application of models mechanics, who generally need a number of information difficult to find during a census year on a regional scale.

1 This section is significant only in the emergency earthquake, which requires a review of the structure sull'agibilità. This view is, in fact, a key aspect in a campaign of post-earthquake relief and puts the detector, taking direct responsibility. However, in order to make objective assessment in relation to the state of damage and vulnerability detected is important to reiterate some of the concepts that must be taken into account. First you must have a clear type of seismic action with respect to which we must ensure the viability of the building. It is clear that, especially for historic buildings in brick, an earthquake of high intensity is a real danger to the stability of the building, because of the inherent vulnerabilities that arise when these types of structures are subjected to horizontal action. This consideration would lead to incorrect conclusion to assess unusable most of the structures of a given territory: it is really important to remember, as a seismic event is characterized by tremors that have the most intensive in its initial phase. This must suggest, therefore, like the trial of feasibility should be related to the earthquake that is being evaluated, considering therefore the safety level of buildings in relation to seismic action comparable to that initial intensity.

Another important aspect is also represented by the level of damage that the structure shows that during the survey is carried out after an earthquake. Leaving aside cases where the damage is such that the unequivocal assessment of the safety of the church should focus on those situations where the level of damage limitation makes the evaluation very problematic. The presence of a cracking state, after an earthquake is a physiological consequence for a masonry building. The solutions of continuity in each wall structure, determine, in fact, plans preferential damage already inherent in the wall even before the earthquake makes them so clearly legible. This determines that, for cracking were limited, the risk of collapse of the structure is often greater than the original situation is not damaged. The example in the following figure shows a type of damage can easily be found inside the classroom of a church, where there is a time structure. The detachment of the barrel vault of the façade, however, does not represent a real danger of collapse for the time you are setting on the side walls.

Even in a situation before the earthquake, in fact, the detachable between the vault and the wall was non-existent and the sealing of the joint is often made with a simple renderings of plaster, with no structural function.

In this situation the danger is not so much from the vault, which has lost its structural function, but eventually the front wall, which could be rotated outward. In such cases, the usability of assessment must be linked, in addition to cracking state found, the condition of the structural deformation following the earthquake.

Prepare your own opinion, not only the extent of injury (length or width), but the state is connected to the strain that was damaged, allows the assessment of those questionable situations without excessive caution, but at the same time without jeopardizing the safety people.

Another difficult aspect to consider is represented by non-structural elements, in buildings such as churches, the presence of various kinds of furniture, such as decorative stucco high altitude can be a real danger in the event of collapse, in addition, also as a result of 'events of low intensity, these elements are the first to show gaps and injuries, resulting in the total unavailability of the church. In most cases, however, when the gap is not only related to a structural element, the ability to adjust its assessment on different levels can also consider intermediate solutions without compromising the usability of the building.

The board of relief of seismic damage to churches, provides, in fact, six different levels of courts: accessible, unusable, partially accessible, fit for use with emergency measures, external causes and unusable temporarily unusable. In the case of partial fitness for use, the unit should indicate which part of the factory feels agile, or rather which areas should be fenced because they are considered not usable (such as an aisle).

For selection of accessibility with measures of early intervention is required, however, that details the measures deemed necessary, against which you can immediately restore usability to the factory. Unfit for use temporary means, however, where inaccessibility of some areas of the building (roof, bell tower, etc..) or the complexity of the building does not allow the detector to express an opinion on the usability of the work. In this case, declaring the temporary unavailability of the building in a precautionary manner, highlighting the need for further inspection.

The last available option involves the unavailability due to external causes. Such cases are rare for churches, are generally due to the presence, not because of an injury or a vulnerability of the work, but at the risk of collapse of adjacent buildings that may affect the facility.

Although the assessment is necessarily subjective, the structure of the board, through its divisions makes the initial assessment of the building mechanical lesions found by associating each state, a mechanism of collapse, in which case the evaluation dell'agibilità, appears to be the homogeneous as possible. In addition, having clarified the nature of vulnerability mechanisms, many churches can regain its functionality with a simple interventions for safety, despite having damaged by the earthquake.

3. 6 Training of operators of civil protection

Awareness-raising of the general public can also contribute to disaster prevention – for example, citizens should be aware of what to do in the event of an earthquake.
According to the new policy documents on disaster preventionn and reduction100, the Commission is preparing proposals for enhancing Community-level disaster management training. The Commission will integrate prevention into these proposals and develop specific courses on prevention within the Community civil protection training programme101. The training programme is an essential part of the Community Mechanism.

It is crucial in preparing experts for international civil protection assistance interventions inside as well as outside the European Union. It also provides an excellent platform for experience-sharing and networking between national experts from participanting countries.
According to the procedure for participation, each participating State has appointed a national training coordinator who is responsible for identifying and nominating experts to attend each training course. It is therefore not possible for national experts to sign up for a course directly and this is a kind of restriction to whom it may concern.

One may argue that, these rules need to be revisited to answer the question whether they offer a large participation to motivated experts who really want to attend these trainings and they cannot.

Very often some other EC – Funded projects in the field of risk prevention offer some opportunities for participants to train people and experts on the topics that are really close to the Community agenda.

Whithin the framework of the project "Natural Risk Prevention in the Mediterranean Countries" for instance, two intensive training courses on "Good practices, methods and procedures to avoid or reduce natural disasters in the Mediterranean Countries", were held from 29 March to the 1st of April 2010 in S.Agata Li Battiati (Catania), Sicily, and from June 28 to June 30, 2010 in Granada (Spain). These trainings are addressed to natural risk experts working in civil protection centres and local communities of Italy, Greece and Spain.

The training content focused on Civil Protection regulatory systems and governance in the project participating countries (Italy, Spain and Grece) and associated Countries (Algeria, Morocco and Turkey) on techniques and methods for risk monitoring, prevention and mitigation including emergency planning and management. At the end of the courses, the more than 150 trainees were able to compare the characteristics and the mechanisms of the Italian, Spanish and Greek civil protection systems in view of better planning the development of civil protection action programs at national, regional and local level in their country.

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[100] Brussels, 23.2.2009 COM(2009) 82 final
COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. A Community approach on the prevention of natural and man-made disasters.

[101] Since it was launched in 2004, the training programme has developed and expanded significantly and now includes 11 courses. The target group is wide, which opens the training programme to many different categories of experts. These can range from assessment and coordination experts to specialists within a certain field of work, such as marine pollution experts, environmental experts (landslides waste management, dam stability etc), experts in geo-hazards or logistics in emergency operations, and medical staff. For further information see: The European Community Civil Protection Mechanism Training Programme Luxembourg: Office for Official Publications of the European Communities, 2009 — 20 pp. — ISBN 978-92-79-11215-7.

CHAPTER 4

POLICY RECOMMENDATIONS.

4. 1 Introduction.

In recent years EU is creating the way to establish policies having the aim to structure common interventions in the field of risk prevention following the decisions of The United Nations and of the World Conference of Disasters Reduction102.

After the Lisbon Treaty (2007)103 which gave the new general address in the Civil Protection matter and entered in force force on 1 December 2009 we have had an exchange of documents between the Council104, the European Parliament105 and the European Commission106.

One of the most important documents is the Communication from the Commission to the European Parliament and the Council on reinforcing the Union's disaster response capacity (COM(2008)0130), in which the Commission proposed, among other things, to create an European Disaster Response Training Network.

The issue is important to determine whether the exchange of documents has meant that one of the legislative bodies is required to make mandatory or not, for the future, to a specific behavior.
According to the doctrine more widespread107 it's possible to say that these texts are only internal documents tending to form a common opinion among the various bodies of the EU about this matter. In fact they are not addressed to any Member State and over all the Commission wrote clear words about this question.

The Commission itself has affirmed on February 2009 that "there is, however, no strategic approach at the Community level, for disaster prevention"108. Consequently there is no binding act addressed to the Member States.

The exchange of these documents is, therefore, the basis for reaching this strategic approach but the way to get a binding act is probably still long.

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[102] Hyogo Framework for Action 2005 – 2015

[103] The Lisbon Treaty was signed by the EU member states on 13 December 2007, and entered into force on 1 December 2009. It amends the Treaty on European Union (TEU; also known as the Treaty of Maastricht) and the Treaty establishing the European Community (TEC; also known as the Treaty of Rome). In this process, the Rome Treaty was renamed to the Treaty on the Functioning of the European Union (TFEU).

[104] Council Conclusion of 16 June 2008

[105] European Parliament Resolution of 19 June 2008 on stepping up the Union's disaster response capacity and European Parliament Resolution of 14 November 2007 on the regional impact of earthquakes

[106] Commission of the European Communities, COM(2009) 82, Brussels, 23.02.2009

[107] Compare, for example, B. CONFORTI, *Diritto Internazionale*, Naples, VI edition, 2005" p.153 et seq.

[108] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, A Community approach on the prevention of natural and man-made disasters, Brussels, 23.2.2009.COM(2009) 82 final, p. 3.

The Commission's Communication "A Community approach on the prevention of natural and man-made disasters" abovementioned is very important because it is probably the practical basis of the new legislation and will include the main lines of it; so before to examine its contents it's necessary to briefly remind which are the previous documents in order of approval and what are their contents.

Previous documents.

Several EU documents aim to improve the approach of the EU towards the prevention of risk. All of these have been also listed in our document "Natural Risk Prevention in Mediterranean Countries: State of the art".

We will speak separately of the Lisbon Treaty (2007) and of the Commission Communication COM(2009)82-final

Here we describe briefly some other documents:

International Decade for Natural Disaster Reduction (IDNDR 1990-1999): that, having the aim to save lives and reduce the social cost of disasters, had the great success to increase awareness of the great importance of disaster reduction. In these document were defined three key concepts: natural hazards, vulnerability and risk;

Declaration of Madrid (Euro-Mediterranean Forum on Disaster Reduction) on 2003: it was affirmed that

- Disaster Risk Reduction is one of the central element of sustainable development;
- Associated integrated disaster risk management is a primary responsibility of governments: achievable through al holistic approach combining vulnerability assessment, scientific knowledge and competencies of disaster managers and involving civil society, private sector (also insurance companies) and academics.

World Conference on Disaster Reduction (Kobe, Japan 2005, Hyogo Framework for Action 2005 – 2015 (HFA) (Building the Resilience of Nations and Communities to Disasters): the conference promoted a strategic and systematic approach to reducing vulnerabilities and risks to hazards.

Communication to the Parliament from the European Commission (COM (2008)130) on Reinforcing the Union's Disasters Response Capacity: The purpose of this Communication is to make proposals for an integrated European approach to the prevention of natural disasters and for an EU strategy for disaster reduction in developing countries. Particularly in these Communication the Commission submitted to Parliament the proposal for some different tools like a ***Monitoring and Information Centre*** or an ***European Disaster Response Training Network***.

In the Annex reserved to Forest Fires of this communication, within the framework of the chapter didicetd to fire prevention, the Commission encourages the Member States to screen national legislation to identify any perverse effects on the occurrence of acts of arson. The communication confirmed that, the Commission was assessing the need for a European integrated approach to the prevention and studying Community guidelines for the prevention of forest fires based on Member State best practices;

European Parliament Resolution of 19 June 2008 on stepping up the Union Disaster response capacity: the European Parliament criticised the Commission's Communication COM(2008)130 in a very critical way.

In fact irritation is manifested in many Points of this Resolution. Here we list entirely the most important:

"11. Calls on the Commission and the Member States to address not only risk-based approaches to prepare for extreme events, but also to address ways of reducing vulnerability at EU policy level through appropriate planning and risk reduction measures in due time, taking due account, where appropriate, of environmental and climate change policies and legislation;…

13. Calls on the Commission to present proposals as a matter of urgency, and no later than the end of 2008, regarding disaster prevention within the Union, together with an EU strategy for disaster risk reduction in developing countries; …

15. Regrets that the proposal made by former Commissioner Michel Barnier to create a European civil protection force remains a dead letter and highlights the need, in this context, to pursue the development of a rapid response capacity on the basis of the civil protection modules of Member States, in accordance with the mandate issued by the European Council meeting of 15 and 16 June 2006, and calls on the Commission to develop a specific proposal to that end;

16. Deplores the fact that the Council appears to have reached a decision not to proceed with the adoption of the new EU Solidarity Fund (EUSF) regulation, despite the strong support of Parliament for the revision of the existing instrument; reminds the Council that Parliament adopted its position by an overwhelming majority at first reading in May 2006, and that the relevant dossier has been blocked in the Council for more than two years; reiterates its conviction that the new EUSF regulation, which – among other measures – lowers the thresholds for the mobilisation of the Fund, will put the Union in a better position to address damage caused by disasters in a more effective, flexible and timely manner; strongly urges the European Council to take a decision not to reject this regulation and to request the immediate revision of the current EUSF;

17. Calls on the Commission to mobilise, when appropriate, the current EUSF in the most flexible manner possible and without delay; considers that, in the event of a natural disaster, it is of paramount importance that the necessary EUSF resources be made available immediately for the purpose of relieving the suffering and satisfying the needs of victims and their immediate families;

18. Calls on the Commission to carry out more research geared to improving forest fire prevention and forest fire-fighting methods and materials and to review planning and land use; urges the Member States, therefore, to take strong action to improve and implement their forest protection legislative framework and to abstain from commercialisation, reclassification and privatisation activities, thus limiting intrusion and speculation; considers that all available EU know-how, including satellite systems, should be used to this end;

*19. U**rges the Commission to submit a package of legally binding instruments (e.g. a framework directive)** with a view to filling in gaps in existing EU legislation, policies and programmes as regards disaster prevention and response; …*

31. Urges the Commission to assess a wide range of options for setting up a sustainable European disaster response training network, covering all phases of disaster management, and to present proposals for such a structure as soon as possible; calls, moreover, for further enhancement both of the preparedness of civil protection services and of the capacity of teams and modules from different Member States to work together;"[109].

Language is clearly rude, words are hard and sharp. Especially against the Council[110] which is the through legislator body in EU.

International Strategy for Disaster Reduction (ISDR) realized by UN on 2009:

109 European Parliament Resolution of 19 June 2008 on stepping up the Union's disaster response capacity, p. 3-4

110 Since the Maastricht Treaty (art. 4, ex D), the European Council is "the body" of the Union. Basically European Council is the Europe legislator and Parliament has over all another function: the general political control. Parliament participates in legislative function only through procedures of "cooperation" and "co-decision" with Council. We have to remember, anyway, that the Parliament has the power of "veto" over certain acts.

The United Nations (UN) pointed out that a strategy is needed: from the protection against hazards to the management of risk through the **integration of risk reduction into sustainable development**;

4. 1. 1. Information, awareness and general public responsibility

In the era of computer communication in real time, information, and indeed, even more correct and accurate information is fundamental to promote a deeper awareness in people. In this field a great responsibility lies on the shoulders of researchers, scientists governors and administrators. Recently as a result of the earthquake of L'Aquila (Italy) arose a controversy over the use and dissemination of data on aftershocks. INGV111 has come to threaten not to disclose more data to ensure that they were misinterpreted.

However, this attitude was wrong due to the fact that any action to prevent and complete information should be made in the past. In addtion, the lack of trust that citizens have, after the earthquake, in a science class who, not being able to predict earthquakes, instead of good information and timely about the dangers, merely sought to reassure almost hoping to get lucky that the earthquake did not happen.

Perhaps this is the maximum that could be expected, at a time of crisis, by a scientific organization that has never actually stimulated and urged the State to be more attentive to the prevention.Perhaps this is the maximum that could be expected, also in moments of crisis, from a State that never wanted to take seriously the lessons of the past.

All this only confirms that there is a great responsibility of the public in general, involving all actors: the State, Regional and Local administrations, Scientific institutions, the Research community.

The lesson learned must now be translated into a European law which requires Member States to legislate and allocate resources on prevention. A law that places specific requirements for push States to standardize procedures and institutions.

The basic action to reach common final actions between EU partners is to start and use common methods and procedures. EU does not have legislative capacity about this matter. In fact Article 176 C of Lisbon Treaty112, at paragraph 2 clearly affirmed that European Parliament and Council cannot interfere in the rules and regulations of the States to harmonize their provisions. A fortiori, whether European law can not interfere directly on rules and regulations, is unlikely to take on the harmonization of procedures.

It's a common but primary observation. Obviously each country has his own organization, methods and procedures. The goal is to make this different approaches consistent with common objectives and similar results.

Concerning the Civil Protection matter is necessary, first of all, to clearly understand what are the principles and to start from them.

[111] National Institute of Geophysics and Volcanology.
[112] Article 176c TFEU (ToL) was renumbered Article 196 TFEU in the consolidated version of the Lisbon Treaty (OJEU 17.12.2007 C 306/218).

Prevision, prevention and intervention are the three different moments of enforcement of the different rules and behavior to apply in Civil Protection matter.

Specifically the aim of these Giudelines is to identify the characters of Prevention to minimize consequences of disasters.

"Prevention is understood as (i) where possible preventing disasters from happening, and (ii) where they are unavoidable taking steps to minimize their impacts"[113].

This definition of Prevention needs further studies. In fact the concept of Prevention follows the other concept of Risk that is more comprehensive and intuitively defines the scientific practical approach. Indeed the concept of prevention and the concept of risk appear as if abstract concepts unrelated to direct observation of the territory and the resulting classification of areas for degrees of risk.

Moreover the concepts of "seismic risk" and "seismic classification" are certainly different non including, the first, an evaluation of event probability but certainly including riskiness (or "shookness"). Moreover in Italy, for the uniform case-law of Supreme Court , risk is nothing more than hazard and this is nothing more than probability (and not simple possibility) that, in a specific area, it will be an event. So, being riskiness the ground of seismic classification, even if this one isn't still realized, it's just enough to found the probability and, than, the predictability of a seism (however under the aspect of "dies certus an, sed incertus quando"). Consequence of it is the duty (professional liability for the technicians, considering diligence, prudence and skilfullness) to adopt each appropriate and necessary anti-risk precautionary measures.

Extending this concept of responsibility and including also the other type of risks, you can then say that an equal responsibility from a legal or juridical standpoint, but certainly more in terms of moral, weights on the shoulders of Governments, Regional and local Administrations.

Moreover, having in mind that this work is directed to EU countries and that are major organizational differences between States, the real difficulty lies in finding and suggesting possible forms of organization and involvement of different public Bodies. Also we can't forget that in addition to Public Bodies must necessarily be involved entities such as the Voluntary sector, insurance Companies and especially Research Bodies.

Civil Protection & Web 2.0 : Projects and Experiment. Are we ready ?

Which strategies we can adopt to increase awareness on risk prevention?

Which good practices on communication should be promoted across the EU?
edited by Alessandro Pernice

The Italian Civil Protection is a complex and interralated system that involves diverse operational corps and organizations: fire brigades, forest forces, armed forces, volunteers organisations (more or less 1.3 million people) – Red Cross, National Health service, National Scientific research groups.

[113] Commission of the European Communities, COM(2009) 82, Brussels, 23.02.2009, p. 3

In the last 3 years, 2 projects have been set up in order to **promote a civil protection culture** based on users collaboration approach.

Ispro[114] is a private institute founded by the father of the Italian Civil Protection, and the web site was conceived and implemented as a public platform where users can contribute to set up a shared knowledge in the field, exchange ideas and experiences, through a wiki, gmap information, forums, and a community. Particularly the same type of community, set up in ispro.it for volunteers, has been used by one organisation to manage the volunteers activities and interventions also when the earthquake in Abruzzo occurred.

Civil Protection for Mayors: an e-learning project developed by Formez (Italian National training agency) and National Department of Civil Protection whose aim was to train Italian mayors so to fill the gap on civil protection issues. The moodle platform became a point of interest for not only 2.000 users, but also for some volunteers organisations, that used the training materials and forum to train the volunteers.

These two experiences show that despite of the low Italian Internet penetration the web is a free-will tool used by a lot of volunteer organisations and public administrations at a local level. Moreover during the early phase of the Abruzzo earthquake both Facebook and Twitter played a role to inform and organize solidarity rescue intervention, and now are channels to communicate the state of the art in some rescue camps (see «roio piano» group in Facebook).

These experiences demonstrate that the web could represent an effective tool to manage the great amount of information and data flows the civil protection system has to deal with during a major disaster: certificates of use, goods provision, rescued population census, day-by-day information from the command & control head quarters, and so on.

It is time the civil protection community acknowledges that Web 2.0 is crucial in emergency management and preparedness programmes. Exchange of experiences and ideas in this field (such as the InSteDD projects[115] or our national experiences) could help the disaster managers community both to switch from the day-after approach to the day-before one, and to find out a common way to set up standards and tools to better cope with a major disaster and crisis.

Web 2.0 tool could be a good practice related to information and communication on natural risk prevention and emergency management. Some experts[116] have studied some kind of application of web 2.0 for Civil Protection in the Italian Civil Protection system. Our system has the duty to protect human life and health, goods and properties, national heritage, urban settlements and environment from any kind of natural or man-made disaster.

According to Italian laws, volunteers have a very important role in this complex system. In the Italian system, volunteers organisations are officially involved as well as all the other operational corps or agencies. Vertical coordination is based on “subsidiarity”, supported by the European Union. Subsidiarity is the idea that the central authority should have a subsidiary function, performing only those tasks which cannot be performed effectively at local level.

[114] http://www.ispro.it/site/
[115] http://www.instedd.org/our-work/projects/
[116] Holmes A. (nextgov.com), Rapisardi E., Building Civil Protection 2.0, Thursday, 11/19/2009.

The Role of the Mayor in the Italian Civil Protection system is very important in relation to the following key activites, including information and awareness raising activites:

- Informing the public
- Training
- Preparedness
- Emergency planning
- Mitigation
- Forecast
- Knowledge

The Mayor Local operative organizations are :

- Technical offices
- Municipal police
- Local volunteers groups
- Municipal workers
- Health services
- City services
- Welfare services
- Administrative and financial services

Communication is the main tool to support the whole emergency process:

- preparedness
- management
- relief

Communications is crucial to allow the public to make decisions on how to deal and cope with risk. The question is : who generates content in the web 2.0.

There are some examples on Building Civil Protection 2.0. Institutions, Operators, Research Centres, volunteers, citizens and Media everyday can generate content in the web 2.0 era meaning information and exchgange knowledge. Soon after the Abruzzo Earthquake,130 facebook groups were created with thousands of messages with the aim to to communicate fears, hopelessness, to inform on the victims and the rescue interventions to look for some friends, relatives, to share information on the overall situation to organise donations (money and goods).

There are already some existing web communities of volunteers such as ISPRO on line 2007[117] A section of the ISPRO web site is devoted to the volunteers and to whom may it concern who are willing to be part of one of the existing associations on the Italian territory. Ispro onLine has created some "spaces" open to all for sharing of materials, experiences and knowledges.

Emergency has been managed by civil protection operators – mostly volunteers - working in the field (rescue camps, operational centers, etc) usually on weekly shifts. Internet, phone, mobile connections were active soon after the earthquake, mostly everywhere.

The problems are :

a) Information handover;
b) Local server failures;
c) Fax, radio, phone did not ensure the need of information sharing.

[117] http://www.ispro.it/site/content/volontariato

The solution could be a Free web based tools (Web 2.0) in order to
a) store and categorise all the crucial information
b) allow the creation of a network between all the operators - in the emergency territory and at home - so to exchange information and knowledge at distance.

People, Users, Citizens, Operators in face of disasters are the actors for Building a more Resilient Society and People are the Key.

The main question is: are Civil Protection Bodies ready to cope with participation?
Civil Protection debate is now focused on resilience: involving the public and business community to increase the responsibility for their own risk management.

In the field of Civil Protection participation and collaboration represent the main challenge but Users, Citizens and Volunteers are empowered, and also Users, Citizens, Volunteers and Institutions have a world wide communication channel to jointly contribute to risk prevention, preparedness, management.

The European Union perspective is clearly described and identified, as "The Civil Protection Forum – Towards a more resilient society" brought together over 800 participants to consider how we can enhance Europe's resilience[118].

Participants discussed topics from prevention via the future of the European Civil Protection Mechanism to the governance of European disaster management. The seminars and debates offered a wealth of ideas for further work and European Civil Protection will benefit from this in the coming years.

The European Union perspective can be resumed as follow:

- exploring the concept of resilience;
- a comprehensive European disaster management strategy to enhance resilience
- promote networking, **learn about new technologies** used in civil protection.

Web 2.0 is therefore an opportunity for risks prevention and management and People are the opportunity. On of the policy recommendations in terms of communication and information on natural risks prevention and emergency management can be resumed as follow:

a) Civil protection web open network think-tank, involving organisations, volunteers, operators, different institutional bodies and media representatives;

b) Training programmes including web and communications issues;

c) Raising awareness on Web 2.0 tools;

d) Exchange and sharing of knowledge, information, best practices;

e) Local social networks focused on civil protection.

[118] http://ec.europa.eu/echo/civil_protection/civil/forum2009/index.htm

Ongoing projects on Web 2.0 tools for Civil Protection shoud be taken as example: some of them are briefly described below:

1) Province of Padova.
Content : Presentations on the Web 2.0 tools for Civil Protection aiming at raising awareness and evaluate «how to» manage civil protection activities in a web 2.0 perspective;
2) Distretto Bassa Padovana, Coordination Group.
Content : Training Volunteers on Web 2.0 Platforms - focusing on Instedd \ Riff platform. The aim is to train people on «how to» use web 2.0 platforms to manage operational rooms at local level;
3) Ferrara University, Dept. Human Sciences, College Liberal Arts and Philosophy.
Content: Civil Protection Communications Course, targeting civil protection operators, volunteers, media representatives. One of the issue will be the web 2.0 both as channel of communication and a tool to manage information.

The Commission will use the upcoming calls for cooperation projects under the Civil Protection Financial Instrument to include the possibility to support projects on public awareness and education, such as for example the identification of best practices and the preparation of school curricula.

4. 1. 2 Reinforcing cooperation in the prevention field at the EU level.

The aim of this paragraph is to analyse and describe what the cooperation in the area of 'Civil Protection' will look like in the future once the Treaty of Lisbon has entered into force and what this will entail for the Member States' national crisis preparedness. The following questions guide this analysis:

a) How will the EU's cooperation in the area of Civil Protection be shaped and carried out once the Treaty of Lisbon has entered into force, and
b) what will the most important changes be for the Union and its Member States in relation to the present situation?

Our analysis is primarily aimed at public civil servants working with questions concerning the EU and Civil Protection, in the Member States, but also at all those experts of Civil Protection issues who are interested in the development of European cooperation in crisis management and who are the target Groups of this Operational manual for risk prevention.

The changes brought about by and consequences of the Treaty of Lisbon will be presented in the following paragraph against the background of explanatory descriptions of EU cooperation and the area of civil protection.

The wording of the Treaty of Lisbon has been analysed, with the focus on the context of the area of Civil Protection and the actors, structures, the policy process and procedures involved in the area. The sources of our analysis comprise of interviews and EU documentation. The persons interviewed consist of experts mostly belonging to regional and national leaders and representatives of Civil Protection in Italy, Spain and Greece. Moreover, interviews have been carried out with Professors and academic researchers in l'Aquila (IT), Campobasso (IT), Santa Venerina (IT)[119], Granada (ES) and Kalivia[120] (GR) who are key referenst within the field.

[119] Interview with Prof. Francisco Sanchez Vidal in Santa Venerina Municipalità, Catania (IT) on March 29, 2010, Narpimed, 1st Training Course.
[120] Final Conference of Narpimed project on Natural Risk prevention in Mediterranean Countries: Challenge for the future", September 23, 2010 Kalivia (Greece).

The aim of our analysis has been to get an overview of different possible effects of the Treaty of Lisbon on the area of natural risks prevention and Civil Protection. The aim is also to describe how such changes brought about by the Treaty of Lisbon can conceivably influence the EU's future work on crisis preparedness issues.

The European Commission is eager to improve Europe's capacity to respond to major disasters inside and outside the EU. The capabilities of Member States can be strengthened by working together to create opportunities for greater coordination of existing resources[121].
A more strategic approach to disaster management (***Disaster prevention and reduction***) came closer in February 2009, when the Commission adopted two policy documents on disaster prevention and reduction.

The first of these documents calls for an EU approach to the prevention of natural and man-made disasters within the European Union, with measures seeking to reduce the frequency of disasters and limit their consequences.

Specific proposals include building knowledge networks, improving the links between actors and policies, encouraging Member States to set up coordinated mechanisms for crisis management and making existing EU financial and legislative instruments perform better for disaster prevention.

Cooperation between Member States and European Union action to protect EU citizens against natural or man-made disasters is **one of the improvements of the Treaty of Lisbon.**

Starting from the 1st of December 2009, the Treaty of Lisbon has been adopted in its final formulation and consequently also the "*Treaty of the European Union*" and the "*Treaty of the Functioning of the European Union*" have been adjourned.

The area of Civil Protection is for the first time formalized as a specific policy area in the EU through article 196 of the Treaty of Lisbon[122].

Three areas in the Treaty of Lisbon have been addressed specifically as they are understood to be important in relation to the area of Civil Protection, namely: article 196 'Civil Protection', article 222 the 'Solidarity Clause' and article 71 a 'Standing Committee on Internal Security'.

According to the Treaty of Lisbon, Civil Protection is an area of shared competence between the EU and the Member States. Therefore, the competence of the EU within this area is limited to measures aimed at supporting, coordinating or complementing those measures which are carried out by the Member States.

Civil Protection is more or less linked to other areas in the EU, such as the area of freedom security and justice, an area that has evolved within the framework of the Tampere-programme, the Hague-programme and will most certainly continue to develop in the Stockholm-programme[123].

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[121] ENVIRONMENT FOR EUROPEANS, N°34 2009.
[122] ÅHMAN T. (2009), *The Treaty of Lisbon and Civil Protection in the European Union*, FOI-R--2806--SE User Report Defence Analysis, November 2009, pp5.

Public health, environment, consular protection and humanitarian aid are other examples of areas having linkages to the area of Civil Protection.

From a short-term perspective no specific consequences are expected for these relations. **Nevertheless, from a long-term perspective the Treaty of Lisbon makes possible initiatives aimed at a general coordination of Civil Protection and other policy areas within the EU**[124].

The further establishment of the Union's area of freedom, security and justice through the Stockholm-programme, the new Standing Committee on Internal Security (COSI), the new Chapter 1 'General Provisions on the Union's External Action' in the Treaty of Lisbon offer a possibility to undertake a more comprehensive approach regarding all areas related to the Union's internal as well as its external security. Of course, this will be dependent on the presence of a political momentum to move towards.

Through the Treaty of Lisbon a **solidarity clause is introduced** which is based on the existing solidarity declaration. According the wordings of the solidarity clause, the Member States are requested to act in a spirit of solidarity if another Member States is subject to a terrorist attack, a natural disaster or a manmade disaster.

Hence, the solidarity clause embraces nearly all work within the EU related to crisis management, including Civil Protection. Experts may argue that, besides its symbolic value, the solidarity clause will not bring about anything new for the cooperation in the area of Civil Protection, or for the existing crisis management structures within the EU from a short-term perspective.

However, if a political resolution appears within the EU, the solidarity clause may from a long-term perspective have effects for Civil Protection by offering incentives to further develop and deepen the cooperation.

The Treaty of Lisbon offers improved possibilities for different political actors to influence and shape the area of Civil Protection, not least the Commission, the European Parliament, the national parliaments, and the citizens of the EU.

The EU Institutions and the Policy Process are heavily influenced by the new Treaty.

The Treaty of Lisbon brings about several **important changes regarding the organisational structure of the EU institutions,** the division of power between the institutions and the policy process, which all have effects on the area of Civil Protection.

Through the treaties the Member States have entered into, and now most recently, the current Treaty of Lisbon, they have collectively decided how the institutions should be established, which basic functions they should have and how they should relate to each other in the EU's political process. This also means that the nature of the political decisions may alter if the form and positions of power of the institutions change.

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[123] The Stockholm Programme is to define the framework for EU police and customs cooperation, rescue services, criminal and civil law cooperation, asylum, migration and visa policy for the period 2010–2014. The Programme was discussed at the informal ministerial meeting in Stockholm in July 2009 and will ultimately be adopted by EU Heads of State and Government at the Summit in December 2009.

[124] ÅHMAN T. (2009), *The Treaty of Lisbon and Civil Protection in the European Union*, FOI-R--2806--SE User Report Defence Analysis, November 2009, pp9.

The political institutions constitute the formal frameworks for the EU's collective decision-making. But, within these formal frameworks, informal networks, coalitions between various political actors and bargaining work like a lubricant for the political process.

Through the formal political institutions and the informal interplay between the political actors, a number of political decisions in the form of different regulations and legislation or coordination proposals, e.g. within the area of crisis preparedness, are produced. These all have more or less noticeable consequences within the Member States and the relationships between them or with third parties.

The Lisbon Treaty would give EU measures against natural and man-made disasters a new legal base[125].

As far as the main institutional changes are concerned, we can list briefly here the following: First of all, the **'ordinary legislative procedure'** will be applied for the area of Civil Protection according to the Treaty of Lisbon. **Qualified majority voting will replace consensus in the Council** and the European Parliament would participate as an equal co-legislator.

Consequently, the influence of each Member State is undermined since they alone can not block a proposal. This in turn implies that it will become even more important for the Member States to form coalitions with other Member States and to influence the possible legislative act in a preferable direction already early in the policy process. The new procedures for decision making entail a shift in the balance of power between the Council and the Commission as it may possibly be assumed that the Commission more easily will be able to carry through potential legislative proposals within Civil Protection.

Secondly, **the Council will share both legislative and budgetary power with the European Parliament** in accordance to the co-decisional procedure. In other words, the European Parliament obtains equal legislative power as the Council and is also given the right to modify the Commission's possible legislative proposals within Civil Protection.

From this perspective the Treaty of Lisbon brings about an **important shift in the balance of power between the Council and the European Parliament** within the area.

From a long-term perspective, a potential scenario is that Civil Protection becomes a **political priority for the different party groups of the European Parliament** which could imply that the obtained power may be drawn upon in order to further strengthen and deepen the cooperation within Civil Protection.

Thirdly, an important result of the Treaty of Lisbon is the **strengthened role of the national parliaments in the policy process**, which are given the responsibility of ensuring compliance with the principles of subsidiarity and proportionality. The Treaty of Lisbon establishes that the Commission shall submit the legislative proposals to the national parliaments and that it must as well be able to motivate the proposals in relation to the principles of subsidiarity and proportionality. Each national parliament is provided with two votes and **if one third of the parliaments oppose the legislative proposal, the Commission must reconsider it.**

[125] Grahn R. EU Law: Civil protection,TUESDAY, 20 JANUARY 2009.

A fourth modification, which however is expected to have minor practical implications for Civil Protection, is the introduction of the **'citizens' initiative'**[126]**.** The citizens of the EU are given the opportunity to promote their political interests. By gathering **a million signatures from a significant number of Member States, the citizens of the EU may request the Commission to present a specific draft proposal for example within Civil Protection.** Future events will most certainly determine if the citizens' initiative will have an actual practical impact or if it will be a mere democratic symbol.

A fifth change is the introduction of a **new Standing Committee on Internal Security (COSI)** within the Council. There are important linkages between the area of Civil Protection and the rest of the EU's work on internal security. It is therefore not unlikely that COSI may acquire the responsibility of questions that are dealt with in the **Council Working Party on Civil Protection (PROCIV)**[127] which works with preparedness issues aimed at developing the EU's capacity to prevent and manage disasters.

Moreover, the responsibility of developing the **EU Crisis Coordination Arrangements (CCA)** may possibly fall within the competence of COSI. If the committee is provided with operational tasks, meaning having a role in the event of a crisis, questions are raised concerning how COSI shall relate to the Crisis Steering Group of the CCA.
Finally, there are today several crisis management structures within the Commission (the cross-cutting and early warning system ARGUS, the Monitoring Information Centre – MIC - etc.) and within the Council (for example CCA) which are not established in the treaties.
The Treaty of Lisbon is however not expected to have consequences for these structures.

We saw that Art. 176C of Lisbon Treaty affirmed that EU action in Civil Protection should be aimed at:

1. supporting and completing the action of the Member States in prevention and preparedness fields;
2. promoting cooperation;
3. promoting coherence of international activities.

The Commission Communication of 23 February 2009 n.82-final, is at the moment the final document laying down guidelines by which the EU will move to the future for the practical implementation of the law of the Treaty.

The object of this Communication is "to identify measures which could be included in a Community strategy for the prevention of natural and man-made disasters, building upon and linking existing measures"128. The strategy of the approach is to be able to change building upon and linking what just exists.

This text is perfectly in line with the wording of the Treaty of Lisbon that takes care to explicitly forbid the adoption of rules aimed at harmonizing laws and regulations of the various Member States.

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[126] http://ec.europa.eu/dgs/secretariat_general/citizens_initiative/index_en.htm
[127]
[128] Commission COM(2009)82-final, p.3

The Commission Communication of 23 February 2009 n.82-final also affirmed that "action at the Community level should complement national actions and should focus on areas where a common approach is more effective than separate national approaches"129.

This claim is decidedly cryptic. On which basis can we identify areas with respect to which a common approach is more effective than the approach of a single State?
Anyway the way that this Communication of February 2009 indicates is base on:

1. the development of knowledge based disaster prevention policies at all levels of government;

2. linking the relevant actors and policies throughout the disaster management cycle;

3. improving the effectiveness of existing policy instruments with regard to disaster prevention.130

Regarding the first point the "development of knowledge" appears a synonymous of "awareness" and it's clear that the first result that the Commission want to achieve is to train political classes at all level of government to the politics of prevention. In fact "a better understanding of disasters is a pre-requisite for developing efficient disaster prevention policies"[131].

To obtain this result the European Commission proposes four key elements:

1. Creating an inventory of information on disasters;

2. Spreading best practices;

3. Developing guidelines on hazard/risk mapping;

4. Encouraging research activities.

Regarding the second point the link between actors and policies should be realized through the following actions:

1. Extending the lessons learnt exercises to disaster prevention;

2. Training and awareness-raising in the area of disaster prevention;

3. Improving the linking between the actors;

4. Reinforcing early warning tools.

[129] Commission COM(2009)82-final, point 2, p.4
[130] Commission COM(2009)82-final, point 2, p.4
[131] Commission COM(2009)82-final, point 3.1., p.4

4. 1. 3 Promotion of International, national, regional and local Civil Protection platforms.

National Platforms provide a means to enhance national action to reduce disaster risks, and they represent the national mechanism for the International Strategy for Disaster Reduction.

There is an ever-increasing need to support the Network for Natural Hazards[132] and Civil Protection Platforms that already exist and build new ones to increase the EU's capacity to respond to major disasters. Examples of international platforms include the PPRD South Programme. The ENPI funded PPRD South Programme supports international cooperation for the reinforcement of Civil Protection capacities between the European Union, the Mediterranean and Balkan Partner Countries under the umbrella of the European Neighbourhood Policy (ENP).

Within the overall objective of contributing to reinforce the quality of Civil Protection services in the Euro-Mediterranean region, **the PPRD South has a mandate to foster cooperation in the broad area of prevention, preparedness and response to natural and man-made/technological (human induced)** disasters and to contribute to enhance the capacities in this area in all the Programme Partner Countries[133]**.**

For the most effective use of the available resources, the envisaged cooperation should take place between the EU Member States and the Partner Countries and among the Partner Countries themselves. This cooperation, in particular, shall contribute to:

a) Reinforced mutual knowledge of national systems of Civil Protection;

b) Improved knowledge of the instruments, methodologies and techniques that are adopted to prevent, prepare and respond to disasters at the levels of both EU and the Partner Countries;

c) Enabling the Partner Countries to reinforce, design and implement potentially more efficient policies and initiatives towards disaster risk reduction, in particular in the area of prevention and preparedness to cope with impacts resulting from disasters.

This cooperation is demand-driven, meaning that the Partner Countries are encouraged to request targeted technical assistance to be facilitated by the PPRD South and provided both by the EU Member States and the other Partner Countries[134].

With the publication of the “Guidelines for PPRD South technical assistance”, the PPRD South Programme invited the Partner Countries to consider the possibility of requesting technical assistance support from the PPRD South Programme in view to fulfill the national capacity development priorities in the field of disaster prevention, preparedness and response.

Through the initial PPRD South questionnaire based survey, the civil protection authorities of the PPRD South Partner Countries highlighted a strong interest in the institutional, regulatory and organizational frameworks for civil protection of the EU Member States and of the other PPRD South Partner Countries. On this basis, tools and methodologies which proved effective in the prevention, preparedness and response to disasters are being widely illustrated and promoted during the PPRD South workshops.

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[132] Networks are those linked to EC-Funded projects or consortium of research groups and organisations studying natural hazards and natural risks prevention in different Countries.

[133] Albania, Algeria, Bosnia & Herzegovina, Croatia, Egypt, Israel, Jordan, Lebanon, Montenegro, Morocco, Occupied Palestinian Territory, Syria, Tunisia, Turkey.

[134] GUIDELINES FOR PPRD SOUTH TECHNICAL ASSISTANCE MISSIONS, May 2010.

The PPRD South technical assistance is there to support the possible extension or replication of those experiences, tools and methods in the interested PPRD South Partner Countries.

Following a request for technical assistance support received from a National Correspondent of a PPRD South Partner Country, the Programme may organize targeted technical assistance missions or exchanges of experts aimed at enhancing the quality of Civil Protection services in the Country. The provision of technical assistance in the area of disaster risk reduction, prevention, preparedness and response to natural and man-made/technological (human induced) disasters may cover, but is not limited to:

- Emergency management3,in particular emergency planning and operations management;
- EU requirements regarding the creation of Civil Protection modules;
- The functioning of the EU Civil Protection Mechanism/How to request EU Civil Protection assistance/CECIS network/possibilities of cooperation;
- Early warning systems;
- Simulation exercises;
- Data collection and Geographical Information Systems for Civil Protection;

- Risk assessment4;

- Impact studies;

- Policy analysis, including static and dynamic modeling and evaluation tools (i.e.: benefit-cost analysis, social impact analysis, etc.);

- Research and development;

- Documenting, analyzing and disseminating best practices and lessons learned;

- Institutional adjustments in line with the Hyogo Framework for Action 2005-2015 Priority 1“Make Disaster Risk Reduction a Priority” (e.g.: creation of National Platform);

- Strategies for disaster risk reduction at the national level (including land use planning);

- Monitoring, information generation and dissemination;

- Training, education and public awareness.

All the interested Partner Countries are encouraged to propose further topics and issues for technical assistance in the area of prevention, preparedness and response to disasters, based on their interest and main capacity development challenges and needs.

The consortium of NARPIMED project and in particulat HERIMED association have been working to disseminate all information on the PPRD South Programme and its training/workshops activities to all its Associates. Herimed members have been very interested in that Programme and some of the key referents of HERIMED members are ready to start some kind of cooperation with the PPRD South Executive Director, such as the Ecole Polytchnique d'Architecture et d'Urbanisme (EPAU) of Algiers (Algeria), the Houari Boumediene University(USTHB) Civil Engineering Faculty, Built Environment Res.Lab.(LBE) Algiers, (Algeria) and the An-Najah National University (Palestine).

FINAL CONCLUSIONS

The manual of emergency has been set based on a methodological approach wich includes a state of the art, the analysis of some applications made in Italy, particularly in California, through the use of the instrument for the relief of the damage and seismic vulnerability and risk of fire.
The proposed instruments are related to damage assessment and vulnerability of ordinary buildings and houses of worship and prevention and intervention strategy implemented in Molise (IT) and in the town of Kalivia (Gr).

As for the seismic risk in the case of historic Ripabottoni (CB) has been shown the full implementation of the urban fabric and an analysis conducted according to the model of micro-zoning Molisano. Has been also briefly explained the model used in Abruzzo microzonation after the earthquake of 2009. The manual presents, in general, illustrates the methodology and tools for prevention, in particular, seismic risk.

This methodology has been applied experimentally in other projects in places of worship, French and Portuguese (Interreg IIIC - Project Noè) but was never made an application at local level. The goal is to enable the application of instruments in other European countries and eventually allow their adjustment to the structural features in the local perspective, using tools for the detection of the construction, seismic damage and vulnerability.

Manual contains the experiences in other countries that participated in the project as outsideobservers such as Turkey and Morocco.

Annex I ANNEXES OF THE MANUAL

NATURAL RISK PREVENTION IN TURKEY OR EARTHQUAKERISK PREVENTION IN TURKEY

I I Introduction.

"I. Intensive Training Course" was held in Sicily, Italy between March 28- April 1 2010 by the Italy representation of EUROMED Heritage Organization within scope of project and on behalf of Turkey Civil Engineer Kaan Aklar took part in this course. "II. Intensive Training Course" was held in University of Granada, Spain on June 28-29, 2010 and The Final Meeting was held in Kalivia, Greece on September 20-23, 2010. On behalf of Turkey Civil Engineer D. Selçuk ÇILINGIR took part in this course. "DISASTER AND EMERGENCY MANAGEMENT STRUCTURE and NATURAL RISK PREVENTION STUDIES IN TURKEY", "SEISMIC RISK REDUCTION STUDIES IN TURKEY" and "FIRE RISK REDUCTION STUDIES IN TURKEY" were presented by D.Selçuk ÇILINGIR in Granada and Kalivia.

Potential disasters in Turkey are mostly associated with earthquakes, droughts, heavy rain and floods, landslides, rock falls, forest fires, industrial explosions and fires, wind and snowstorms, avalanches, heat wave, fog, transportation accidents and terrorist attacks. Given the size of Turkey and the fact that the main hazard type is earthquake, most disasters are localized in certain provinces and do not affect the entire country.

Disasters are one of the biggest obstacles to the sustainable development and social security of Turkey. The cost of a single disaster may even exceed a country's annual GDP. Measured in terms of direct economic losses, natural disasters have, on the average, accounted for 1 % of gross national product (GNP), with earthquakes accounting for 0.8 percent of this. The majority of the population lives in earthquake-prone areas, where major economic investments and significant vital infrastructure and related construction take place. Losses like decrease on the market, production losses, and unemployment are even greater.

Recently the earthquakes on 17 August 1999 and 12 November 1999, with magnitude of 7.4 and 7.2 respectively, which took place on the populated and industrial northwestern parts of Turkey.

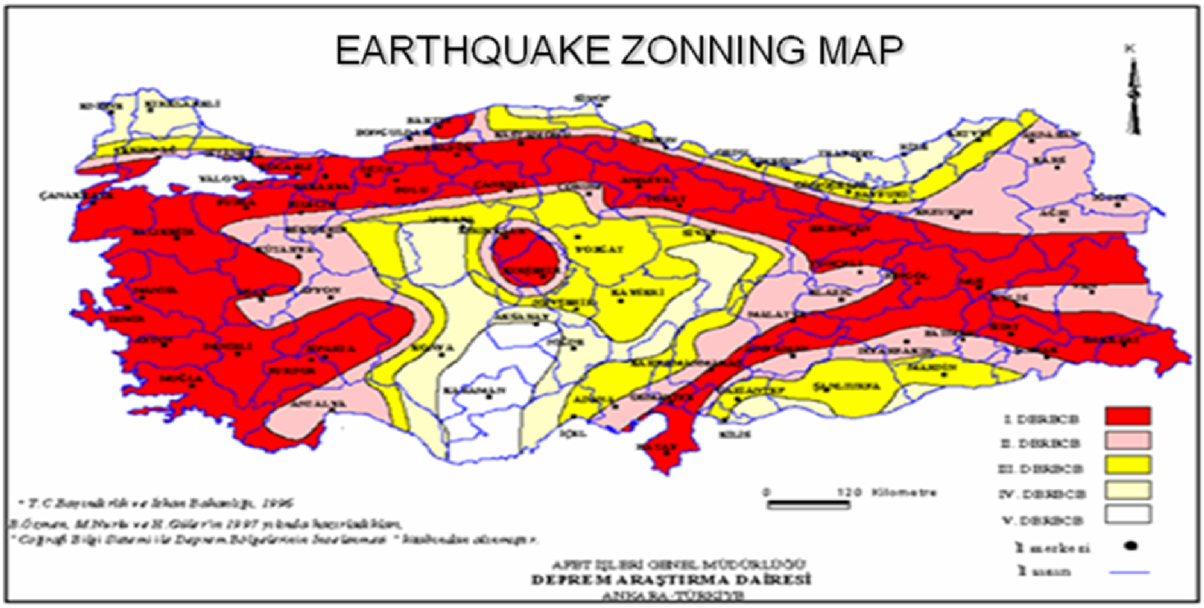
According to official data, the earthquakes caused 18,373 deaths and 48,901 injuries and according to official figures 311,693 residential units and 46,538 business units either collapsed or were lightly to heavily damaged in an area of some 30,000 km2, including 8 urban agglomerations and the country's industrial and economic centre. Numerous schools, health facilities, roads, bridges, water pipes, phone lines, and gas pipelines were severely damaged. Up to 600,000 people were forced to leave their homes, perhaps half of whom became homeless and had to stay in tents, and many of the survivors, especially children, were left deeply traumatized. In mid 1999 the government therefore had launched an extensive economic reform program to defeat the entrenched pattern of high inflation and restore sustained growth.

MAIN NATURAL DISASTERS ACCORDING TO THEIR IMPORTANCE ARE:

- Earthquakes,
- Landslides,
- Floods,
- Rock falls,
- Fires,
- Snow Avalanches and
- Storms etc.

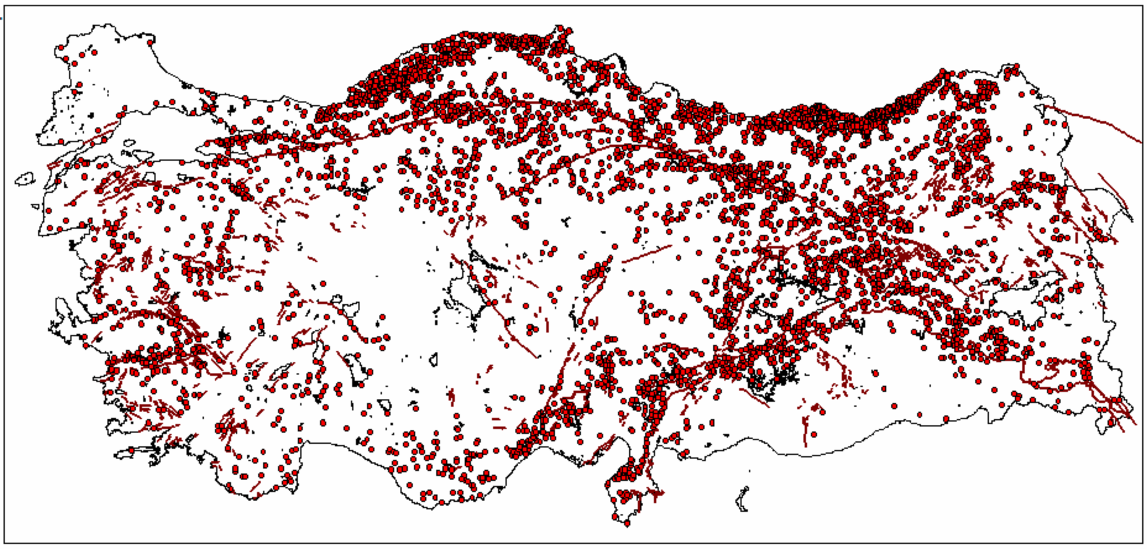
EARTHQUAKES 1900-2010

- 182 damaging earthquakes,
- More than 100.000 people died,
- More than 600.000 dwelling units collapsed or heavily damaged.



LANDSLIDES- 1950-2010

- settlement area,
- 13.494 landslide incident,
- 65.759 houses relocated by MPWS / AFAD



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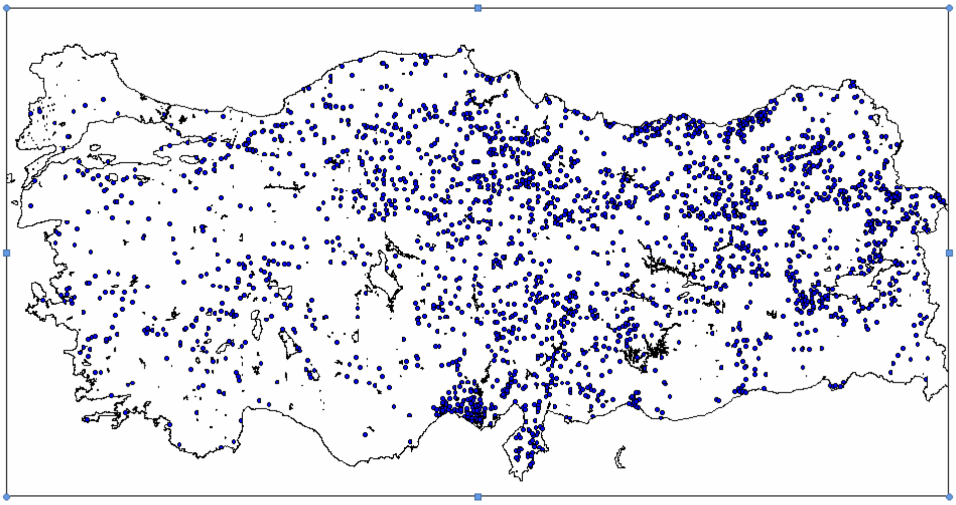
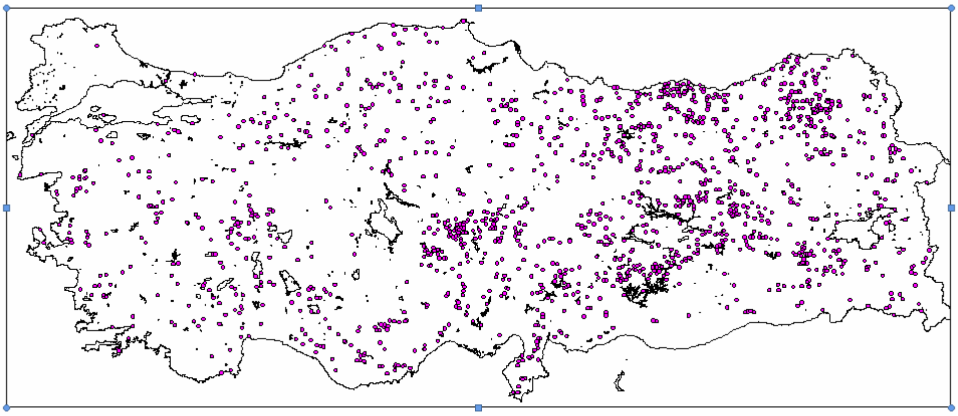
FLOODS- 1950-2010

- 2.924 settlement area,
- flood incident,
- 29.020 houses relocated by MPWS / AFAD.



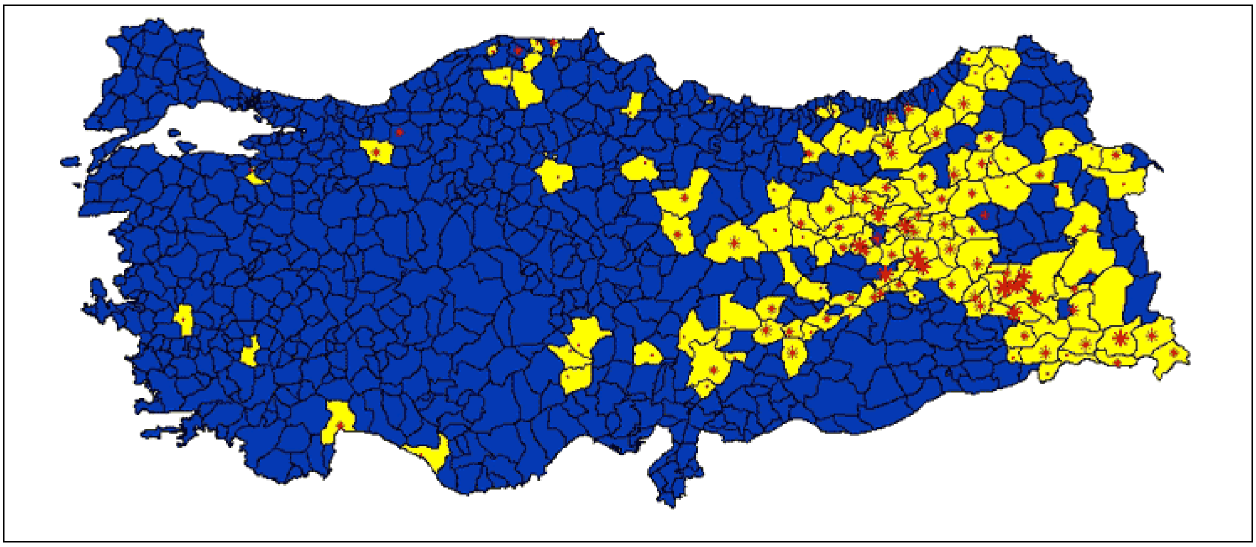
ROCK FALLS 1965-2010

- 1703 settlement area, 2.956 rock falls
- 20.836 houses relocated by MPWS / AFAD,
- 6128 houses in 280 settlement areas secured from rock falling disaster by way of rock cleaning projects.



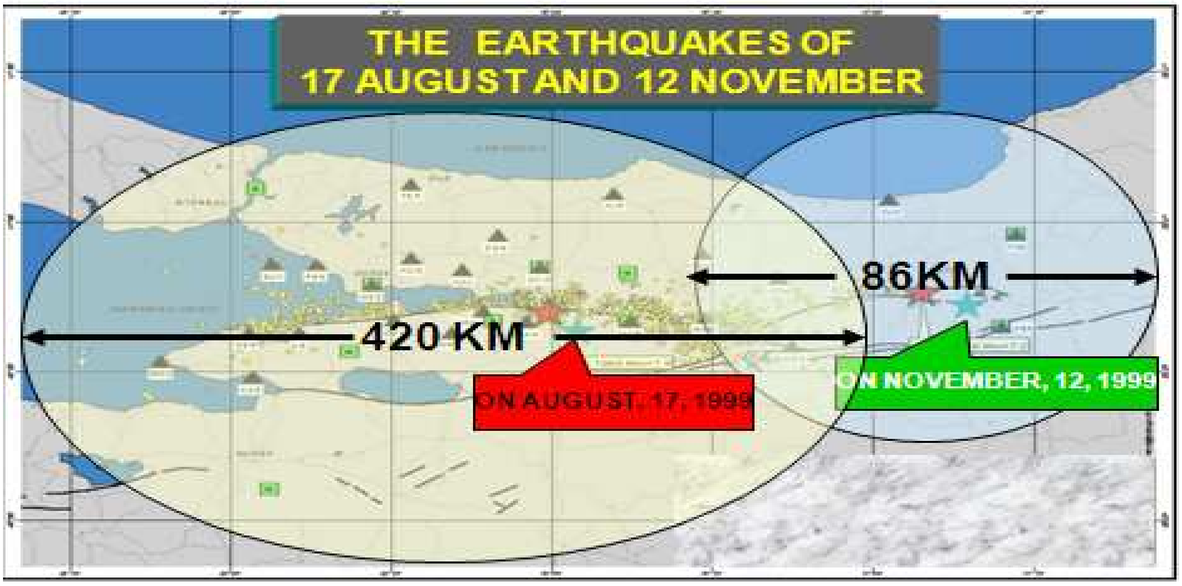
SNOW AVALANCHES 1942-2010

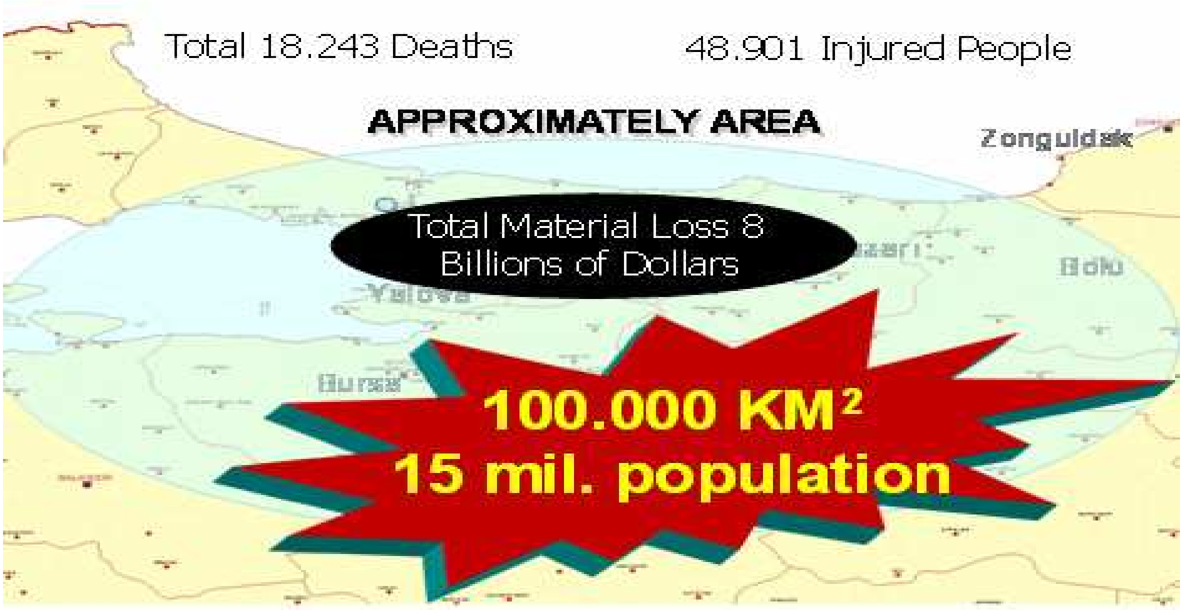
- 6.308 houses relocated by MPWS / AFAD
- 1410 snow avalanches incident,



I II AFAD (DISASTER AND EMERGENCY MANAGEMENT PRESINDENCY).

Turkey's Disaster Management System was mainly focused on the post-disaster period before two catastrophic earthquakes in the year 1999. After these events the main concepts of Disaster Management System has been changed. Many new laws, regulations and other instruments on planning and implementations in all phases of disaster (mitigation, preparedness, response, recovery and rehabilitation) were accepted. In May 2009 with the Law 5902 three main disaster responsible organizations (GD of Disaster Affairs, GD of Civil Defense, GD of Turkish Emergency Management) were merged under one umbrella organization in the office of Prime Ministry and Disaster and Emergency Management Presidency was established.



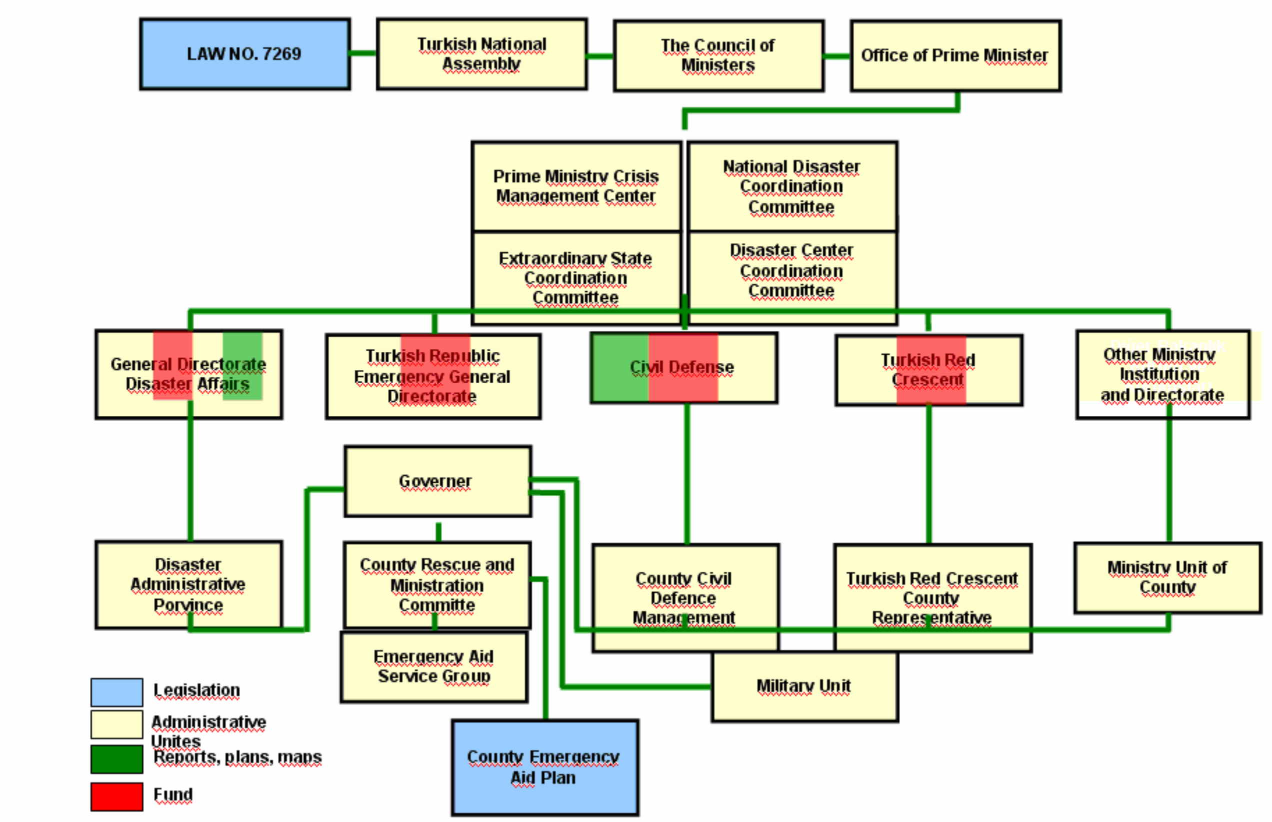


After 99 EQs Fundamental Changes are;

- Turkey Emergency Management DG under the Office of Prime Minister was established,
- Earthquake Insurance Agency Established,
- Urban Search and Rescue (USAR) structural changed.

UNTIL 17th JUNE 2009, 3 CORE AGENCIES WAS IN CHARGE OF DISASTER AND EMERGENCY MANAGEMENT SYSTEM OF TURKEY

GENERAL DIRECTORATE OF CIVIL DEFENCE UNDER MINISTRY OF INTERIOR
GENERAL DIRECTORATE OF DISASTER AFFAIRS UNDER MINISTRY OF PUBLIC WORKS AND SETTLEMENT
GENERAL DIRECTORATE OF EMERGENCY MANAGEMENT UNDER PRIME MINISTRY



General Directorate of Civil Defence:
Tasks:
I. Fulfil civil defence functions through provincial and district Civil Defence Directorates & civil defence experts within public & private institutions
II. Set up civil protection and defence services nationwide and to ensure the planning, implementation, coordination and supervision of measures in government and private establishments

I. Plan and implement all activities for non-armed protection, emergency assistance and first aid
II. Set standards for fire departments, educate their staff, supervise and coordinate them for fire protection and prevention
III. Train civil defence personnel and create public awareness
IV. Encourage voluntary organisations and individuals to provide relief in emergency situations

General Directorate of Disaster Affairs:
Under Ministry of Settlement and Public Works. General Directorate consists of 7 Departments and total 21 divisions which belong to Departments.

Dept. of Emergency Aid, Communication and Mechanics
Dept. of Disaster Reconnaissance and Damage Assessment
Dept. of Earthquake Research
Dept. of Fund Management & Accomplishment
Dept. of Temporary Housing
Dept. of Planning, Right Holderness and Debtorness Works
Dept. of Prefabricated Manufacturing and Mounting

General Directorate of Disaster Affairs is responsible for implementing and coordinating aid operations in case of a disaster, taking measures for immediate sheltering after disaster, providing coordination and cooperation with related units, taking necessary mitigation measures in disaster prone areas. Alongside coordination duties, GDDA provides financial support and assistance to the administrators and authorities within the disaster area as well as conducting studies related to the construction of houses for disaster victims.

General Directorate of Emergency Management

The framework of the Emergency Management in Turkey is added to the responsibilities of the Prime Ministry with the decree no: 583 and "To provide an affective emergency management in case of natural and technological threats which are in such a scale that threatens national security to take necessary measures beforehand and to provide coordination between agencies in search and rescue operations during emergencies and recovery and reconstruction activities after emergencies" are given to TEMAD with the decrees no: 583 and 600. According to this, TEMAD is responsible for ensuring the establishment of emergency management centers at governmental agencies, determining their working and coordination principles, monitoring taking of precautions, preparation of plans and the establishment of data banks by agencies and institutions for hazard mitigation, conducting the activities of coordination in the utilization of all types of transport vehicles and rescue and relief equipment and material, encouraging volunteer organization and individuals, coordinating receipt and protection and usage of relief supplies. As conducting studies related to the construction of houses for disaster victims.

New Emergency Management System

By the Law 29/5/2009 dated and No.5902 Establishment of Disaster and Emergency Management Presidency (AFAD);

- TEMAD Under Prime Ministry
- MoI of Civil Defence DG
- MoPWS Disaster Affairs DG were closed.

At provincial level Disaster and Emergency Management Directorates were established.
Presidency consists of;

- Department of Planning and Risk Reduction
- Department of Response
- Department of Recovery
- Department of Civil Defence
- Department of Earthquake
- Department of Administrative Affairs

AFAD aims to work actively and efficiently with these 6 departments.

By the new system in Central Gov't

- The only responsible organization is AFAD and affiliated to the PM,
- Provincial Administration is still under Governors including capital ANKARA so the Directors of Provincial Administration is responsible directly to Governors as it has been,
- System simplified and qualified,
- All duties, competencies and authorization of three institutions automatically pass into AFAD,
- Main duty of AFAD is assessment and provision of needs in coordination with all gov't institutions in case of disasters at response level.

Aim of new law;

- To take necessary measures to achive an sufficient services nation wide on civil defence and disaster and emergency subjects,
- Coordination, production and application of new policies between the agencies and institutions works on,
- Preparation and risk reduction,
- Response,and recovery phases of disasters and emergencies.

By this law;

- Supreme committee for disaster and emergency situations,
- Coordination committee for disaster and emergency situations,
- Earthquake advisory committee,
- Other committees related to disasters were established.

I	III
I	IV

DISASTER RISK REDUCTION STUDIES IN TURKEY:

MONITOR DISASTER RISKS AND ENHANCE EARLY WARNING.

There are different scaled hazard/susceptibility maps prepared for Turkey at national level. One of them is the National Seismic Zoning Map of Turkey. The last seismic zoning map of Turkey (fifth in the history because of development in earthquake science) was prepared in 1996 by using peak ground acceleration contour map that was constructed base on probabilistic method. This zoning map is also available at local level in order give a basic understanding of the seismicity of a specific area. By taking the advantage of geographical information systems, this map can be analyzed both regionally and locally. There are also maps showing the distribution of landslide, rockfall and snow-avalanche affected residential areas at national level. Active fault map is another important input map for seismic analysis and prepared at national level by G.D. Mineral Research and Exploration (MTA). Landslide inventory mapping is also being performed by the same directorate and assumed to be concluded in the near future. G.D of State Hydraulic Works collects the data on floods at national level and published it with annual bulletins. National scaled forest fire susceptibility maps are prepared by G.D. Forestry of Ministry of Environment and can easily be accessed from internet. In addition to national hazard data, there are lots of studies executed at local and regional level in order to evaluate hazard and vulnerability assessment. G.D. Disaster Affairs has started a regional multi-hazard and risk mapping project in 2000 in NW Black Sea region and studies are concluded in 3 main districts in the region. Within this pilot project hazard and vulnerability of whole districts are investigated, vulnerability of key sectors like governmental buildings, factories etc. are also investigated and for some disaster types hazard maps are prepared by using GIS and remote sensing technologies. Another study in this field is executed by Istanbul Metropolitan Municipality with the assistance of JICA in Istanbul where multi-disciplinary and detailed micro-zonation maps were prepared. Some municipalities have prepared disaster recovery plans and those include hazard and vulnerability data, especially vulnerability of critical structures to disaster at multi-hazard approach. Istanbul Metropolitan Municipality has prepared those datasets mainly for whole city.

Disaster Risk Indication study is another local project implemented by Istanbul Metropolitan Municipality (IMM). IMM works together with Earthquake and Megacities Initiative (EMI), Centre for Disaster Management and Risk Reduction Technologies, University of Karlsruhe (CEDIM) and Bogazici University. Within the scope of this study physical vulnerability, social vulnerability and disaster response capability of Istanbul against to catastrophic earthquakes investigated. Response capability and current preparedness background of the city will be rated. Standardization of data production, data usage is an important factor and must be promoted at all levels. This will also contribute to rapid response to disasters and minimize disaster related loss of lives.

Preparation of hazard and risk maps at national level is difficult for some specific disaster types like landslides, rock falls etc. After 1999 earthquakes the municipalities located on 1 stand 2nd degree earthquake zones are obliged to prepare and/or revise their microzonation maps based on multi-hazard approach. However this application has not became prevalent for all municipalities and also for residential areas. Multi-stakeholder participation amongst there levant institutions is a key factor in preparation of national level risk and vulnerability mapping and data collection.

I V MONITOR, ARCHIVE AND DISSEMINATE PROCESSES OF DISASTER DATA.

Disaster data is mainly stored in AFAD’s databases. Databases of earthquakes, landslides, rockfalls and snow-avalanches are stored in this AFAD's database. The databases include date of event, affected geographical area, affected number of people, affected infrastructures and photos if available. Archive of AFAD contains more than 18.000 reports which are in digital environments. Other relevant data on floods and forest fires, marine accidents etc. are stored in relevant institutions’ databases. Some databases like seismic information are open for public use. However databases on landslides, forest fires can be reached from relevant institutions by demand. In order to collect all disaster data in National Disaster one database, in 2004 the project initiated by GDDA, called “Turkish National Disaster Archive System” within Marmara Earthquake Reconstruction Project (MEER) which is funded by World Bank. Within the scope of this project a center is established in GDDA Earthquake Research Department. Other international disaster databases like EMDAT, CRED were investigated and special software was prepared. Data collection process from relevant institutions is continuing.

Archive System is compatible with e-government concept and will be accessible in three languages (Turkish, English and French).In order to decide the criterias on disaster data, the examples of other countries were reviewed and best criteria for Turkish National Disaster Archive was chosen. It will also be open for future developments. After the conclusion of the integration all disaster data, the information will be accessible for public for Istanbul there are some vulnerability analysis of some critical buildings and structures. In Istanbul, where an earthquake is expected bigger than magnitude 7 in the near future, two bridges connecting Asian and European parts are analyzed in terms of their seismic vulnerability. Governmental buildings, especially schools, hospitals, historical and archeological structures have also been analyzed for Istanbul city under ISMEP project conducted by Istanbul Governorate. In developing countries which have poor social memory, the awareness on disasters is being forgotten and people live none of those events ever happened. That’s why archives play an important role in the establishment of disaster awareness. Data storage systems show differences from one institute to another. For this reason, putting all those different formatted datasets into one single database and their mutual integration takes time.

I VI

EARLY WARNING SYSTEMS FOR MAJOR HAZARDS.

In terms of monitoring there are two national seismic observation systems in Turkey. One of them is operated by AFAD and there are 162 seismic stations and 290 strong motion instruments all around the country. Another institute operating seismic network is Bogazici University, Kandilli Observatory. In addition to these national systems, there are some local and regional sub-systems operated by academic research institutes.

Early warning systems in Turkey are operated by several governmental institutions. State Meteorological Organization G.D. has short and long term climate predictions and for some cases announces warning messages for flooding, severe weather conditions, meteorological hazards, extreme heat weather. General Directorate of State Hydraulic Works, operating flood early warning and prediction systems mainly established after 1998 heavy rains and flash flood occurred in NW Black Sea Region which is funded by World Bank. The project is executed for river basins in Black Sea and Western Aegean regions. Within this project there established 206 automatic meteorological stations, 3 meteorological Doppler radar stations, 148 hydrometric data storage platforms and VSAT Telecommunication systems.

By using continuous measurements, the system predicts the floods by using several flood prediction models. There are studies in order to develop those systems for other regions and studies to develop in Thrace Meric and Antalya (Mediterranean) regions have started. In 2008 General Directorate of Forestry started pilot project on forest fires early warning. This is a joint project between Turkish Scientific and Technological Research Council and Bilkent University. The aim of this early warning system is to respond forest fires immediately and effectively. Some forests in the Western parts of Turkey are being monitored by several on-line cameras and analyzed 24 hours basis. The system automatically alarms the administrators and response teams can be directed to the fire in a short time interval. The system also uses geographical information system data layers like topography, vegetation, roads etc. Integration of those systems with online camera records facilitates effective and rapid response to forest fires.

After 1999 earthquake, by taking into consideration the vital importance of Early Warning and Emergency Rapid Response, the project prepared by Bogazici University Kandilli Observatory and Earthquake Research Institute, has been realized. The agreement involving Turkish Republic and Credit Suisse First Boston in relation to Istanbul Earthquake Early Warning System and Rapid (Emergency) Response project that will be carried out by Bogazici University Kandilli Observatory and Earthquake Research Institute, has become valid after decree of Council of Minister on 2001 Fiscal Year. The system is designed and operated by Bogazici University with logistic support of the Governorate of Istanbul, First Army Headquarters and Istanbul Metropolitan Municipality.

Early warning systems for some types of disasters are still polemical and on evaluation process. For example, since there are some theoretical studies on early warning systems for earthquakes, there is no general acceptance on the reliability and use of those systems. Early warning systems for atmospheric and hydrological disasters are effective tools for disaster risk reduction in these fields and national systems might contribute for long term disaster risk reduction achievement.

There had been some experimental early warning systems initiatives on landslides in Denizli (Western Turkey) and Sivas (Eastern Turkey) regions performed by universities, but those are not applicable everywhere at this moment. The high cost of those systems are another factor for not to enhance those technology all over the country.

I VII NATIONAL AND LOCAL RISK ASSESSMENTS AND COOPERATION ON RISK DEDUCTION

Natural disasters have extraordinary results in 21st century. The capacity of each country is not sufficient for dealing with these big events and also disasters are unlimited from borders. Turkey gives great importance for regional and international cooperation on DRR. In the last 40 years we realized many joint projects within the region on this issue.

Turkey has taken an important step forward in order to improve the disaster preparedness, prevention and response capability and co-ordination by signing a memorandum of understanding on the institutional framework of the Disaster Preparedness and Prevention Initiative for South Eastern Europe (DPPI SEE). Document was signed by Turkish Emergency Management Agency General Directorate on 7th of April, 2008. Another regional co-operation in the field of disaster management is Civil-Military Emergency Planning Council of South Easter Europe (CMEP-SEE) which is focused on encouraging civilian control of military resources during disasters within countries while building a multi-national "network of networks" among countries that facilitate regional co-operation among neighboring countries.

UNDP-TCDC PROJECT; The Project title is " Technical Cooperation Amongst Developing Countries, Disaster Information and Disaster Investigation-Education Centers " and initiated in 2005 with a protocol between GDDA and State Planning Organization under support of UNDP TCDC programme. The main scope of this Project is to change and develop views and experiences on local and regional disaster mitigation issues with participant countries by multilateral agreements, technology transfer and development of technical cooperation amongst member countries. We have distinguished administrators and participants from 4 participant countries; Tajikistan (Seismology and Earthquake Engineering Institute), Kyrgyzstan (National Academy of Science, Seismology Institute), Ukraine (National Academy of Science, Geophysical Institute), Kazakhstan (Ministry of Education and Science, Seismology Institute and National Nuclear Center, Geophysical Institute). Some other examples to international co-operations are:
- Council of Europe's ''Open Partial Agreement on Prevention and Protection against Major Natural Disasters,
- Cooperation with Germany on Earthquake prediction,
- Cooperation with China on Earthquake research,
- Cooperation with USA (FEMA and USGS),
- Cooperation with Switzerland and France (on snow avalanches),
- Cooperation with France avalanche modeling,
- Cooperation with Switzerland avalanche prevention,
- Cooperation with NATO (EADRCC and CEP),
- Joint Task Force Agreement between Turkey and Greece,
- Cooperation with Japan (JICA),
- Under Black Sea Economic Cooperation Agreement '' Cooperation among BSEC member states Emergency assistance and emergency response to natural and man made disasters'',

- Hazard and Risk Assessments for mass movement between Mediterranean countries (RISCMASS Project),
- GD of Disaster Affairs became authorized user to ‘’ International Charter for Space and Major Disasters (2005),
- Scientific and Technical Cooperation Agreement for DRR with Bangladesh,
- Agreement on DRR with Azerbaijan.
- Agreement on ‘’ Scientific and Technical Cooperation for Public Works and Natural Disaster Loss Reduction’’ with Lebanon.

I VIII COMMUNITY BASED DRR

Information dissemination is a crucial factor among all disaster related stakeholders. In order to maintain this target a comprehensive archive systems must be established. In Turkey governmental units, academic units and research institutes have their own data storage systems with different formats and different systems. Some of those data, like seismic data, are available through web sources and can easily be accessed from internet. On the other hand most of the disaster related data are stored in institutions’ own data storage systems.

In 2004, the project initiated by GDDA After the conclusion of the integration all disaster data, the information will be accessible for public. Disaster Archive Systems are used and/or designed mainly for collecting and disseminating data on disasters. Since those environments are useful for researchers when analyzing past occurrences of specific types of hazards, may not appeal to all walks of life including public and more Professional users. Archive systems must be supported with geographical information system analysis, web mapping techniques in order to increase the visual quality.

Archive systems may also be used as a good platform for sharing disaster related documents. Those environments could also be used as knowledge portal including full spectrum of educational materials and becomes a one stop shop for users from both academic and private areas. Thus, operators of this system must be well educated on the management of Archive systems and disaster education.

I IX EDUCATION MATERIAL AND RELEVANT TRAININGS INCLUDE DRR, RECOVERY CONCEPTS

Educational activities in order to achieve disaster resilience and awareness are being executed by several governmental bodies and academic units. After two big earthquakes in 1999 Ministry of Education has changed school curricula radically with the help of universities. In primary and secondary level (age 6-14) new curricula focuses on preparation and protection for disasters. In high school (age 15-17) they got more detailed knowledge like reasons of disasters, protection of community, mitigation and response activities. Schools invite external specialist speakers for training of both teachers and students and they do evacuation exercises yearly. Another specialized center is Natural Disasters Education Center (AFEM) under AFAD. AFEM is a specialized center established after EUR-OPA open partial agreement. European Natural Disasters

Training Centre (AFEM) is a non-profit organization which delivers training on hazard reduction activities.

AFEM was established within the EUR-OPA (European Major Hazard Agreement Council of Europe) framework in 1988 and affiliated to the Ministry of Public Works and Settlement. Its operating rules and establishment principles have been determined by Turkish laws. AFEM aims to reduce the destructive effects of disasters through training. AFEM's target group comprises technicians, administrators several groups who have responsibilities on various disaster management subjects, as of before, during and after disasters and public. Due to extensive target area of training, programs proposed by AFEM should have done in training of trainer's manner. On the other hand, documents of training programs should have disseminated to member countries in order to make the training comprise whole target area. Printing and publishing the information both make the information permanent and give opportunity to maximum number of publication. This will also ensure the activity of the center. Direct training techniques like courses, seminars, working groups and circular desk meeting should be revived by audio-visual training tools and in-situ watching etc. techniques. In addition, besides dissemination of information by printing and publishing, most attractive methods for public like television, video and cinema films should be considered.

In addition to governmental bodies, there are specialized research centers in the field of disaster management within Istanbul Technical University and Middle East Technical University. Amongst them, Istanbul Technical University, Center of Excellence for Disaster Management is established to serve activities e.g. training, consulting and research to the public and to all establishments in our country. The activities in the center are conducted by certified faculty members and experts in disaster management field. The broad aims of the center are to follow up the principles of modern disaster and emergency management, to develop strategies and projects due to developments, to construct a bridge between neighboring countries and developed countries specifically in disaster management. The members in the center are motivated to conduct research and development activities comprising all levels of disaster management e.g. preparedness, mitigation, response and recovery phases ranging from both natural disasters to man-made. The center has a master degree programme on several branches of disaster management. 15 people graduated from this programme and by June 2008, seven people are continuing their studies.

Between 2000 and 2008, 25 training activities organized by the center. The center also published 20 professional educational materials in the field of disaster management.

One of the objectives of Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) is to conduct public awareness campaigns and training in emergency management. Target groups of those educations are individuals, families, disaster volunteers, disabled people, students, officials. Some training topics are; survival under extraordinary situations, first aid, structural awareness, non-structural risk awareness, retrofitting of public buildings etc. Japan International Cooperation Agency, organized training activities at different formats like educational activities, publications, visual training sets (in CD and DVD format), video conference trainings in the field of Disaster Management in coordination with different governmental organizations. Target groups of these trainings are governmental officers, emergency managers and technical staff. 253 high level local administrators like governors, deputy governors benefited from this training activity. As the result of this programme, an interactive training set in DVD format was prepared and book of “Basic Principles of Disaster Management” published and both of them were distributed to all governmental units, civil society and universities. JICA also organized video conference training programmes. With this programme, Japanese experiences on disaster risk reduction are transmitted to the Turkish counterparts by creating on line dialogue system.

I X RESEARCH METHODS AND TOOLS FOR MULTI-RISK ASSESSMENTS AND COST BENEFIT ANALYSIS ARE DEVELOPED AND STRENGHTENED.

In Turkey almost all governmental units like AFAD, MTA, etc. uses geographical information system (GIS) tools in their studies including disaster management and other related topics. There are numerous studies on the integration of all historical disaster data into digital databases and all of them are compatible wit GIS. For example, relevant data on previous earthquakes, landslides, rockfalls, snow-avalanches, floods and forest fires are stored by using GIS tools. Most scientific and technological development projects also involve GIS as a tool for spatial analysis and visualization. Some municipalities preparing micro-zonation maps, disaster response and rehabilitation maps also uses GIS and some of them like Istanbul Metropolitan Municipality, Ankara Metropolitan Municipality and many others established specialized GIS laboratories. In 2001 GDDA was started a pilot project in Northern parts of Turkey called “Multi-hazard mapping of North Western Black Sea Region”.

Another technology used in disaster management is the use of satellite imagery and remote sensing. In this respect, AFAD is acting as national focal point to UN-SPIDER and also is the authorized user of International Charter “Space and Major Disasters”. The use of satellite data on disaster related studies is increasing by the day with an increase in experienced people in this field. In the field of GIS and remote sensing, JICA has organized two video conference type educations on these two topics. Experts working on AFAD, GD. of Hydraulic Works and G.D. of Meteorology benefited from those courses. There are also academic programmes offering Msc. degrees in GIS and remote sensing technologies. In this field Istanbul city could be termed as a well-prepared since most of the hazard and vulnerability analysis were completed within the boundaries of Metropolitan Municipality. With JICA supported project, all geological and seismic vulnerabilities were determined. In addition to this study, ISMEP project also contributed to this vulnerability analysis and in detail some studies have been carried out in some parts of the city like Zeytinburnu, Avcilar, etc.

I XI COUNTRY WIDE PUBLIC AWARENESS STRATEGY EXISTS TO STIMULATE A CULTURE OF DISASTER RESILIENCE, WITH OUTREACH TO URBAN AND RURAL COMMUNITIES.

Public awareness campaigns conducted by AFAD aims to build a culture of disaster resilience at all levels. In this respect first off all education and training activities at schools are given importance. Another pilot project started at GDDA was in Ankara region and aims to train school children on disaster, especially earthquakes.

There have been lots of public awareness campaigns organized by different governmental and academic units. For example Middle East Technical University, Disaster Management Implementation and Research Center (METU-DMC) conducted a local pilot project namely “Strengthening citizen participation in disaster management; Pilot project in Bursa". DMC also started a painting contest for school children on disasters ISMEP Project is also a good example to public awareness activities in Turkey. Within the aim of the project there are public awareness campaigns and training activities to be conducted in Istanbul. Istanbul Metropolitan Municipality plans to establish Natural Disasters Training Park in Istanbul in 2009. The aim of this project is defined as to increase the awareness of public. There is planned to be first aid unit, shaking table unit, fire smoke simulation unit, simulation rooms for different types of disasters, etc.

Another good example is the publication of disaster training books. One of them is the "I am Learning Safe Life" and 240.000 of this publication is distributed at schools in Istanbul. In order to improve public awareness, a pilot project is being implemented in a district of Ankara province. ''Çubuk District Disaster Education Program'' has 5 sub Project and the aim of program is educate nearly 45.000 citizens aged between 6 and 65. 5 different education modules were using and at the end of this program it is expected to change their behavior against disasters.

I XII REDUCE THE UNDERLYING RISK FACTORS.

Turkey gives importance on the coordination of disaster risk reduction with environmental and natural resources policies. In all plans and programs, one of the key elements of the feasibility reports is the disaster risks of the area. Detailed geological and geotechnical reports and water/meteorological reports are necessary for final decision to avoid or to limit adverse impact of hazards. Climate chance issues are a new concept for Turkey on Disaster risk reduction subject and environment. The National Environmental Approximation Strategy was adopted by Higher Planning Council and then AFAD has undertaken the responsibilities of adaptation of climate chance issue. A special division was established under the organization and they begin to coordinate with other governmental units and important NGO's for joint projects and training. The Ministry of Environmental and Forestry (MEF) gives special importance on the adaptation of climate changes issues and they made substantial progress in strengthening the administrative and institutional capacity at central level.

As a result of the new concept of environment, GD of State Hydraulic Works joined to MEF last year. The 5th World water Forum will be held in Istanbul, Turkey from 16 to 22 March 2009. In the Forum the specialists all over the world will be discuss impact of climate changes, water related disasters, vulnerability assessments and adaptation measures.

I XIII SOCIAL DEVELOPMENT POLICIES AND PLANS ARE BEING TED TO REDUCE THE VULNERABILITY OF POPULATIONSMOST AT RISK.

In every 5 Year Development Plan and also mid and short term plan one of the aim is to increase the resilience of vulnerable people. The government initiated a new program ''Urban re-generation'' and one of the aim of this program is to build a safe building for people most at risk. The expenditure of the cost of disasters is spent from Disaster Fund under Disaster Law (Law No: 7269). Disaster Fund is supplemented with annual allocation from yearly national budget. In case of a big event, government decide extra budget for rehabilitation and construction affairs. New buildings constructions expenditure made for victims of disasters are without interest and paid back in 15-20 years. After Compulsory Disaster Insurance Fund established (only for urban area) there was confusion about the urban and rural areas disaster victims. Most of the poor people have illegal houses (slum dweller) and after a disaster happen, they don't have a legal right of being a beneficiary from disaster fund.

Protection of the people most at risk is a heavy work that needs extra financial sources. Local authorities don't have enough money and specialists for planning poverty reduction works.

I XIV ECONOMIC AND PRODUCTIVE SECTORIAL POLICIES AND PLANS HAVE EMENTED TO REDUCE THE VULNERABILITY OF ECONOMIC ACTIVITIES.

Turkey, having 96% of its land is on variously risked earthquake regions. The Compulsory Earthquake Insurance Pool (DASK) is a system which is formed with the collaboration of the State and the private sector is also an important insurance application relating to the financial consequences of earthquake. DASK is a non-profit institution, having the status of a public co-operation, established with the Decree No: 587 pertaining to the Compulsory Earthquake Insurance, to provide compulsory Earthquake insurances and to perform its affairs in full compliance with the insurance techniques. The primary objectives of DASK can be summarized as follows:

1. To provide insurance coverage for all the dwellings within the scope of its establishment against earthquake in return for a premium,
2. To ensure risk sharing within the country and also to distribute the financial liabilities caused by earthquake onto international reassurance markets through insurance,
3. To mitigate the possible financial burdens on the government due to earthquakes (especially in terms of building disaster victims dwellings after the earthquakes),
4. To utilize the insurance system as a mean for the construction of reliable structures,
5. To ensure the accumulation of long term resources to meet the earthquake damages,
6. To contribute to the development of earthquake consciousness in the public.

In general terms, the Compulsory Earthquake Insurance is an insurance product oriented towards the dwellings within the boundaries of the municipalities. This coverage is a mandatory insurance, for which the guarantee is provided by DASK but the marketing authority is given to the authorized insurance companies and their agencies to provide coverage for the financial damages caused by the Earthquake on dwellings. DASK is a very important application for Turkey which suffers from various magnitudes of earthquakes, which application aims at meeting property damages caused by earthquakes by means of insurances and also by risk sharing (co-insurance). Turkey is one of the rapidly growing countries in the world and in the last 10 years the growth rate was nearly %6-7 percent. Key production and service sectors are construction, automotive, textile, energy, agriculture, tourism and mining. Each of these sectors will be subject to specific natural disasters because most of them concentrated on Marmara and Aegean region where most of our disaster incidents occur. Turkish Government uses Development Plans to distribute the investments geographically all over the country by using premiums. Also Government is bound to coordination between development plan and sectoral plan with disaster risk reduction. In 2008 Yearly Plan ‘’ in order to establish safe and lively cities by preventing and reducing possible natural disasters damages, public investments are essential to improve damage reducing strategies and implement these strategies in cross sector. Furthermore, disaster risks should be taken into consideration in the selected process of new investment projects. The new disaster sub-sector department in State Planning Organization can be a very useful agent for his objective. According to Earthquake Zoning Map nearly %70 of our population and surface area is on the 1. and 2. degree zones. Most of the economic activities are concentrated on these dangerous regions. One of the reasons for concentration is closeness of sea and harbor for export and import. So it’s not easy to control the distribution of economic activities all around the country. After 1999’s two big earthquake the economic losses reached 12-15 Billion USD. The use of earthquake insurance system is not applicable for whole country at the moment and it is only restricted with earthquakes. There are some restrictions on the implementation of this system.

I XV PLANNING AND MANAGEMENT OF HUMAN SETTLEMENTS ATE DISASTER RISK REDUCTION ELEMENTS, INCLUDING ENFORCEMENT OF BUILDING CODES.

The seismic design code of Turkey was revised several times; and the last four previous revisions were made in 1968, 1975, 1998 and 2007. These revisions made the Turkish Seismic Design Code include the most up-to-date information available worldwide. Although, Turkey experienced catastrophic consequences after earthquakes, it is believed that the damage did not stem from insufficiency of codes but substandard construction practice, inadequate inspection and the insufficient enforcement of seismic design codes. The knowledge of existence of many structures, which were not constructed according to seismic design codes and are highly vulnerable in terms of seismic damage, urged the Ministry of Public Works and Settlement to form a commission for revising the 1998 version of the Turkish Seismic Design Code and drafting a new chapter on seismic safety evaluation and retrofitting of existing structures. This new chapter sets standards for assessment and rehabilitation of existing buildings. Retrofit techniques are also proposed for reinforced concrete (RC) buildings. Building designs and construction are supervised by the municipalities. Provincial offices of the Ministry of Public Works and Settlement supervise public buildings under construction and buildings in rural areas. After the 1999 earthquakes, the government enacted new laws, firstly the Decree No. 595 and later Law No. 4708 for building construction supervision. Accordingly, the building supervision firm exercises the duties of the municipal offices in ensuring the correctness of designs and construction conformed to the design. Land use plans those are prepared at several scales are based on disaster risk reduction policies.

It is generally agreed that building departments of municipalities are not technically manpower, laboratory etc.) capable of fulfilling their intended building supervision duty of providing final quality assurance of structural design. Currently legislative regulation for building supervision (Law No: 4708) covers 19 provinces out of 81 and excludes supervision of buildings up to two storey with less than 200 m2 construction area.

I XVI INTEGRATION OF DISASTER RISK REDUCTION INTO POST DISASTER **RECOVERY**

Turkey gives highest importance for disaster risk reduction activities relationship with post disaster activities. According to provisions of Disaster Law, the government is responsible for replacement of destroyed building and infrastructure and rehabilitation of moderately damaged building stock. After a big disaster occurrence (disaster that affected general public) Ministry of Public Works and Settlement's (MPWS), AFAD experts mobilize to disaster stricken area and make damage assessment, geological, geophysical, geotechnical investigations for proper site selection of permanent housing settlement. They also take advice and support from universities (which have disaster management center) and NGO's. Urban plans of new settlement areas are prepared by city and regional planners of MPWS's Technical Research and Implementation G.D. Important governmental buildings (hospitals, schools, fire brigade, police stations etc) are inspected carefully by structural engineers and architects of MPWS's GD of Construction Affairs for disaster resistant standard. Construction of permanent houses and rehabilitation of existing buildings and governmental offices are under the supervision of the same GD and their local bureau. Infrastructure works (water supply, waste water) and environmental design are under MPWS's Bank of Provinces GD and Ministry of Environmental and Forest (MEF) responsibilities. They all use high level construction standards and official building code. Before investments begin decision makers come together and makes detailed risk assessments of selected area. Up to now the results are very positive that we never had a human and property loss in this kind of new settlement areas.

In Turkey the human and material toll of disasters are severe. The combination of high property and human losses is evidence of a systemic failure to enforce building codes and implement appropriate land use and planning policies even in relation to known risks. Coordination deficiency between central and local level authorities may have been a negative factor also.

I XVII MAJOR DEVELOPMENT PROJECTS ON INFRASTRUCTURE.

Before the realization of big development project (housing development, dam, power plant, pipeline, organized industrial region, educational and health facilities), public authority request detailed risk analysis for disaster risk assessments of the project. This analysis is a sub section of Environmental Impact Assessment (EIA) report for reducing the reverse impacts. It is known that natural disasters are a development issue and they can dampen growth by destroying capital and diverting resources toward relief and reconstruction. As an example of this kind of procedure BTC pipeline EIA can be given. In this 1.075 km length petroleum pipeline the whole area (in Turkey, Azerbaijan and Georgia) were explored and reviewed both geologically and meteorologically for disasters. Mitigating the effects of disasters prevention measures were implemented. EIA of BTC Project included a detailed risk assessment and provided alternative solutions or options.

Environmental and disaster risk management practitioners involved deeply on this special project. However in practice we have some difficulties to coordinate the disaster risk reduction efforts and development projects. As being fast developing country (%6-7 in the last ten years) execution of risk reduction efforts is inefficient. There are some duplication and overlapping of authorities in Turkey’s Disaster Management System and also we have some financial restrictions on budget. These are some barriers for effective assessments on disaster risk impacts of major development project. One of our main deficiency is that disaster affected areas are countries industrial heartland and nearly % 70 of our population live in this dangerous area.

Turkey’s Disaster Management System has been mainly focused on post-disaster period and there were no incentives or legislations to encourage risk analysis or risk reduction approaches before 1999’s big two earthquakes. After these two big events the main concepts of Disaster Management System has been changed. In 2004 Ministry of Public Works and Settlement organized first ‘’ Earthquake Convention’’ and more than 300 specialist, decision makers and academicians discussed disaster related issues. They decided mainly ‘’the proactive role of government and public administration on disaster management’’. The lack of ‘’National Disaster Management Strategy’’ were expressed also. We need to rectify the duplication of central and local level authorities’ responsibilities in our disaster management system. Public participation mechanism into disaster management system is not sufficient also.

In 2008 Annual Program that is issued by SPO; it is stated that ‘’ Priority/Plan: Organizational and administrative improvement shall be established in order to have an integrated system which covers risk mitigation of disaster management, preparation, intervention (response) and reconstruction / recovery stages. Works to be done and explanation: In order to provide emergency response and relief timely and effectively at the time of disaster and aftermath, coordination will be controlled from one center. Parallel to that, new opportunities for local administrations in which those provide emergency response and relief directly will be structured. In this context, overlapping responsibilities and authorizations of disaster management related organizations will be solved by revising and making necessary measurements to current laws and regulations.

Annex II

NATURAL RISK PREVENTION IN MOROCCO.

II I INTRODUCTION

Policies on natural disaster prevention in Morocco have been for a while neglected. The increasing risk due to the high demographic growth and economic and urban raising drew the government interest mainly after the Agadir 1960 earthquake. Nevertheless, most of the operational political and legislative reforms began effectively during the international decade for natural disaster reduction, further to 1994 Alhoceima earthquake and 1995 Ourika floods.

II II NATIONAL POLICY AND THE PROGRAMMES

To develop adequate prevention planning strategy, decision makers need precise and integrated information on the different natural risk assessments based on deep coordinated scientific studies.

Providing fundamental means for such research and close collaboration with all partners (universities, research institutions, civil and military protection and administrative institutions) should guide officials at local, regional and national levels to formulate development strategies aiming to reduce the impact of disasters.

II III **MOROCCO CIVIL PROTECTION**

II IV MAIN RESPONSIBILITIES OF THE MOROCCO CIVIL PROTECTION

The civil protection institution has the responsibility of the following missions:

- Organize, animate and coordinate the implementation of the measures of protection and help of the persons and the properties during disastrous events;
- Insure the protection of the population and the national heritage saving during circumstances recovering the civil defense;
- Organize and insure the administrative and technical management of the Services of help and Fire fighting;
- Prepare and begin any action share of fight of Plagues of the Desert Locust.
- Promote all kind of risk prevention and fight against all disasters mainly fires

II V STRUCTURE OF THE MOROCCO CIVIL PROTECTION SYSTEM

Instituted basically by the Dahir (Real Decree) of April 30th 1955, the decree of December 15th, 1997 gives the attributions of CP as Authority of Civil Protection belonging to the Ministry of Interior. Its action's field is the protection and the defense of the civil population and properties in any circumstances.

In Morocco, the Centers of decision of CP services are articulated as follows:

- At the governmental level, the general policy of CP falls to the Prime Minister. Which has the function to 1) Maintain the public order; 2) Define the National policy of Civil Protection and 3) Interministerial coordination.

- In the level of the Central Administration, the execution of this general policy returns to the Ministry of Interior by the adoption of protective measures and the coordination of National, Local authorities, Public and Private Institution's help means.
- At regional level, 16 regional commands of CP services were recently created to exercise as technical and operational adviser with Walis of regions and Governors of Prefectures and Provinces. The regional commands are in charge of staying up the security of the citizens and the protection of their goods in any circumstances under the authority of the Governor of the Prefecture or the Province, the administrative centre of the region. 1) Authorizations' concessions , 2)

II VI NATIONAL EMERGENCY PLANS.

To face the several natural disasters, the policy of Moroccan government aims to set up operational emergency plans which objectives are the coordination of national organizations to reduce the risk. The following table shows three emergency plans with legal references and official interested institutions.

Emergency plan in case of forest fire	**FOREC**	Ministerial Instruction N° 14.539 INT/DA/T3 of 25/08/1960	- Ministry of Agriculture Rural Development and Fisheries - High Commission for Water, Forests and Desertification Control
Emergency plan in case of Earthquake	**SEISME**	Ministerial Instruction N° 33 CL/5 du 04/02/1966	- Ministry of Housing and urban Development and Space planning
Emergency plan in case of flouds	**SINON**	Ministerial Instruction N° 285 INT/CL5 du 13/12/1963	- ***State Secretariat of Water*** and Environnement

II VII FIRE AND FOREST FIRE RISK

With a rate of almost 1 million ha burned per year, fire is one of the most destructive natural disasters of the Mediterranean environment.
Morocco currently loses 30,000 hectares of forest per year, due to a number of problems including human activity, climate change and fires. Fires are in 95% unknown origins which make it difficult to put up an adequate preventive strategy.

The government has implemented laws, regulations and prevention and control measures in high-risk forest districts. An inter-ministerial committee has drafted a national forest fire prevention strategy which outlines the regions threatened by fires and their main causes. The strategy aims to help put in place a prevention and information program to tackle the problem in stages.
Prevention and intervention measures have been put in place to limit the devastation that forest fires cause. One of the new measures taken is a dynamic risk map that will help the civil protection to manage the blazes. The map can produce two risk assessment reports per day and identify high-risk areas based on national weather data. It complements also other measures put in place with various national intervenors, including the police, armed forces, civil defence authorities, auxiliary forces, air force, and local authorities and councils.

The most affects provinces are located in northern Morocco: Chefchaouen, Tetouan, Larache, Tangiers, Taza, Taounate, Kenitre and Khemisset.

II VIII OFFICIAL INSTITUTION

The ***High Commissionership for water and Fight against desertification*** **HC** (belonging to the Prime Ministry) made up a plan of fires management strategy called **PDI** "*Plan Directeur des Incendies de Forets*". It is based on 5 sections:

1- Equipment and infrastructure
2- Cooperation with potential partners
3- Fighting operational plan
4- Formation
5- Popular increased awareness.

II IX PREVENTION STRATEGY

The governmental action through the HC includes 3 main aspects:

a- prevention: solving the problem of fire in their origin

b- Monitoring: consists on earliest detection of fires and giving alarms within small delays after fire sitting-of

c- Fighting with an anticipative approach to control the fire in their beginning stage and to limit the extension. 3 levels of intervention are considered in this last point according to engraving situation:

1- HC and Civil Protection
2- Royale Gendarmerie aircrafts
3- Military intervention with C130 planes.

II X EARTHQUAKES AND SEISMIC RISK

The seismic monitoring is performed by two national institutions: **1)** The “Centre National de la Recherche Scientifique et Technique” *CNRST* in Rabat controlling a telemetric short period network and few accelerographes installed in dams. **2)** The “Institut Scientifique” *IS* belonging to Mohamed Vth University in Rabat controlling an old analogical short period network. Both institutions are nowadays updating their networks with new broad-band seismic stations within national and international projects contexts.

II XI MOROCCAN SEISMIC CODES

The first Moroccan seismic code was formulated just after the Agadir 1960 earthquake and called “*Normes d’Agadir 1960*” (*NA1960*). It was applied in the city during the reconstruction period.

A new regulation, called " RPS on 2000 " was ruled on by the decree n°2-02-177 of February 22nd, 2002. The same decree founded the *National Committee of Seismic Engineering (NCSE)* which objectives are:

- Proposition and recommendation to improve the seismic zonation and building codes
- Improving the urban planning through seismic microzonation

The RPS 2000 divides the whole national territory into 3 zones of seismicity and is applied since September 23rd, 2002 to the new constructions exceeding 50 m^2 of surface and to the existing buildings that must undergo important modifications. It covers only the structures in reinforced and steel concrete, and excludes the traditional constructions which abound in rural areas and undergo the most serious damages during earthquakes as it was observed after the 2004 Alhoceima Earthquake.

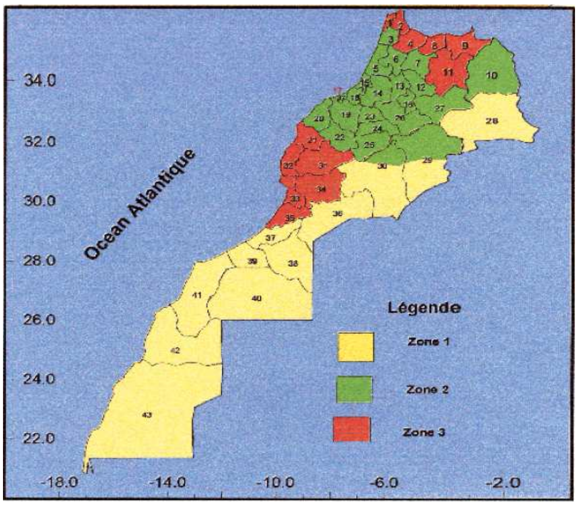


Figure1: Moroccan seismic zoning according to the RPS2000

During 2008, the The Ministry of Housing, Town Planning and Development through the *NCSE* promotes the new version of RPS 2000. According to *NCSE*, the revision is justified by diverse reasons. *First*, different users (engineering consulting firms and control) showed difficulties for the suitable application of the various prescriptions of the regulation. *Second*, there is no reliable and validated software for the conception and works' sizing in accordance with the RPS 2000. *Finally*, the seismic data which were used for the RPS 2000 seismic risk determination covered only the period before 1980.

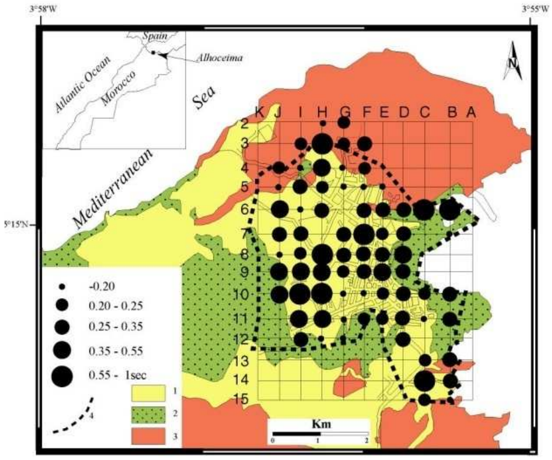
As general precautions to be taken according to the RPS 2000 we can specify: *1)* any building's construction must be forbidden in the neighborhood of the active or passive faults; *2)* ground foundation studies are compulsory and applied in the same way as in high and low seismic risk situations. They have to allow in particular the classification of the site with regard to the various types prescribed by the code; *3)* a particular attention must be given in the conditions of sites at risk such as the presence of unconsolidated or reconstituted ground, the presence of near water table which may cause liquefaction during earthquake, the risk of landslide.

The policy followed by the government to guarantee the RPS 2000 application was based on several meetings, broadcasting of documents to raise population awareness, implication of all operators such professionals, engineers, architects, promoters and entrepreneurs of the construction sector. An interactive web site was set up by the Ministry to conduct a survey with professionals, engineers, architects and different intervenors construction fields at national and local levels.
Many efforts, however still to be done to improve the social implication and the level of preparedness through:

- Adequate and constant information to population,
- School education and technical training of experts,
- Development and improvement of emergency management and immediate intervention after catastrophic earthquakes, (The panic observed during the catastrophic 2004th Alhoceima event showed how weak was the experience and preparedness of civil protection).

II XII SEISMIC MICROZONATION

Earthquake hazard zonation for urban areas is the first and most important step towards a seismic risk analysis and mitigation strategy in densely populated regions. Recently, in Alhoceima region, an experimental seismic microzoning is curried up in all projected areas for urbanization to obtain a good understanding of the local subsurface conditions. In the figure, a geographical distribution of predominant period determined by microtremor measurements in Alhoceima city is presented. These results obtained in 1999 were compared with damages distribution related to the 2004 Alhoceima earthquake. There was a good agreement with predicted ground amplification. Such study is being performed in Alhoceima region at a large-scale.



Soil features of the Alhoceima area and predominant periods. 1) Sandstone, soft soil; 2)Limestone and schistes, 3) Limestone, hard rock; 4) Urban area

II XIII FLOOD'S RISK IN MOROCCO

II XIV FLOODS RISK STATE

The droughts in Moroccan climatic history are frequent and caused even famines. Morocco undergoes really the effects of a climatic change and it is suitable to study the consequences. The droughts are henceforth longer, more frequent and they succeed themselves. They are sometimes interrupted by abundant rainy episodes that originate dreadful floods.

During the recent history, Morocco suffered from several catastrophic floods. We can mention the one that devastated Sefrou on 25/9/1950 when the city was flooded with 6m water's high causing about one hundred victims.

- The Moulouya river floods occurred on May 23 1963 were with an extreme violence and took the left shore foundation of Mohammed V dam (the floods had a debit of 7200 m3/s and a volume of 570 millions of m3 which is the equivalent of the withholding capacity).
- The floods that ravaged the Valley of Ziz on 5/11/1965 had left 25000 homeless which accelerated the realization of the Hassan Addakhil's dam.
- The violent floods of the Sebou River each two years made the Gharb plain suffer consequences.
- More recently, the collective memory will keep forever the disastrous events of the Ourika in 1995, of El Hajeb in 1997, of Tetoaun 2001, of Settat and Mohammedia in 2002 and of Tan Tan, Nador, Al Hoceima and Khénifra in 2003; Fnideq, Tanger, Ouarzazate, Nador, the Gharb, 2008. The Figure shows the administrative geographical distribution of flooded areas.

Three decades dominated by heavy drought made the formerly flowing rivers dry and encouraged rural citizens crowd and constructing over river beds. The proliferation of vulnerable constructions over flooding spaces put in risk the life of innocent citizens.

The flood phenomenon comes back again to recall the authorities their responsibilities to guarantee the protection of the citizens that becomes more and more vulnerable. Demographic growth, economical advancement and urban expansion, agricultural, industrial and tourist development induce growing vulnerable zones.

The worsening of the extreme phenomena (drought and raw) following the climatic changes seems to be behind the observed localized, quick and violent floods.

The big rivers of Morocco such as Moulouya, Sebou, Oum Er Rbia, Tensift, Sous, Drâa and Ziz have their versant basins surpassing the 10 000 km^2 of surface. During flood periods, their alluvial plains are covered slowly by water within large ranges giving relatively long alarm delay. Nevertheless, several technical, economical and social challenges make them generally insufficient. The coastal rivers, having small to medium versant basins are characterized by quick floods and very short response time to the rain. The alarm delays are hence reduced and, sometimes torrential floods produce important damages like the ones observed during the floods of Oued Fnideq (northern Morocco) of 2008. Small other rivers all alongside Morocco can generate the same type of torrential floods threatening towns and cities such as Marrakesh, Mohammedia, Settat, Berrechid, Beni-Mellal, Errachidia, Oujda Tangier …etc.

II XV OFFICIAL INSTITUTIONS

The State Secretariat of Water (SSW), official organism in charge of floods monitoring, adopts a methodical gait to reach the objective of floods risk mitigation at national level. To ensure the protection of vulnerable zones, the SSW bases its mitigation approach on Prevention Planning and Monitoring. Several hydrologic stations were newly installed on the principal rivers and others portables were obtained in sight of eventual interventions. Risk maps were elaborated and put at the disposal of national and local authorities. Other special measures of prevention were taken in the case of the valley of Ourika for example by installing an alarm system that allows launching the alarm system and proceed to the evacuation of population at before floods.

II XVI PREVENTION STRATEGY

The National Plan of Protection against Floods (PNF) allowed identifying 390 priority centers of which the treatment will be realized before 2020. This PNF's ambitious plan consists on the constructions of several protection pieces of work (dams, channels...etc.), basin versant planning, regulation, organization and consciousness-raising.

CONCLUSIONS AND PERSPECTIVES

Many efforts have been used during the last decade by the Moroccan government to improve his policy in natural risk assessment. Several administrative commissions have been created to set up operational plans of emergency, to develop new scientific approach for natural disaster prevention, and to establish a national communication and consciousness system.

Nevertheless, many efforts still to be developed and maintained. Links and coordination between different national and local institution working on natural risk assessment can help to:

- Improve the management of disasters
- Train of operators of civil protection
- Set up and Improve Hazard and risk scenarios

In the seismic risk field, the RPS2000 should be updated taking into consideration new scientific results and methodologies. New seismic zoning and microzoning should be prepared: Current standards and rules of construction of new buildings and infrastructures must be improved and Cultural Heritage must be preserved.

It is finally necessary to develop regional and international cooperation. NARPIMED project is one pilot project that can lead the exchange and transfer expertise between all members.

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Annex III — DISASTER RISK REDUCTION IN ALGERIA. GENERAL POLICY AND TECHNICAL DEVELOPMENTS

III I INTRODUCTION

The Algerian experience in the field of Natural and Technological disaster risk Reduction has begun after the major earthquake of EL Asnam of 10th of October 1980 which caused the loss of more than 3000 human lives and more than 3 billion US Dollars of damage and was enriched after the huge flash floods of Bab El Oued (a populous district of Algiers City) of 10 Nov,2001 (900 dead or missing people and about 1 billion of US Dollars of damage) and the very damaging Boumerdes earthquake of 21st may, 2003 which caused the loss of more 2200 lives and about 5 billion US dollars of damage.

The national policy of disaster risk reduction and management emphasizes on the national and local institutions and deals with the two fields of disaster risk reduction and organization of response and rescue.

The national policy goals aim especially at:

- Strengthening of the knowledge, identification and assessment of the hazards, vulnerabilities and risks.
- Information and public education
- Reinforcement of the institutional capacities.
- Fostering of the collaboration policy and cooperation between the institutions and bodies concerned by the assigned goals.
- Promotion and development of multiform cooperation at regional and international level.

The measures undertaken deal with institutional, regulatory and organizational aspects, the listing of capacities and the increasing of scientific, technical and operating intervention potentials.

The institutions in charge of the implementation are:

-At the central level, they are entrusted to the ministry departments.

-At the local level, the missions of following and controlling the application of the programme of actions are entrusted to the local authorities of the wilaya (province) and municipalities with the technical assistance of the de-concentrated services of the ministries.

III II TECHNICAL AND SCIENTIFIC DEVELOPMENTS

On the technical and scientific aspects, institutions that activate in these fields are:

- **CRAAG:The Centre for Research in Astronomy Astrophysics and Geophysics**

The CRAAG which is under the authority of the Ministry of Interior has the following main missions:

- Research in the fields of Astrophysics and Geophysics.
- Public service in the field of seismic monitoring

- CGS: Earthquake Engineering Center

- The Earthquake Engineering Center which is under the authority of the Ministry of Habitat has the following missions:
- Develop, implement and disseminate scientific knowledge in earthquake engineering to contribute to the seismic risk reduction in Algeria.
- Seismic hazard, vulnerability and risk assessment.
- Develop standards and rules for constructions

- Universities: Training an Research

- example: **Faculty of Civil Engineering at the University Houari Boumedienne.** Training of engineers in civil engineering: supported by courses and research in the field earthquake resistant design of structures.
- Reasearch and post graduateTraining and Ph.D. in the field of earthquake engineering (**Laboratory LBE**)
- Specialized training PGS (post graduation,18 months with diploma) for senior civil protection.

- CGS activities program

- Earthquake Hazard assessment
- Seismic micro-zoning for several urban sites across the country
- Vulnerability of assessment for strategic structures in many cities in Algeria
- Seismic risk identification in urban sites

- Technical Regulations established by the CGS

Rules Algerian Earthquake "Rpa99 / Version 2003" currently under revision for 2011 version.

Guide To Earthquake resistant design for Buildings and individual houses

Technical Recommendations For The Repair And Strengthening Of earthquake damaged structures;

Catalogue Of Repairs of earthquake damaged structures
Earthquakes: How To Include In Case Of Earthquakes "
The Rules Of Designing Concrete Structures Cba93
The Rules Of Execution Of concrete Construction Works
Rules Of Design Of Steel Structures
Recommendation For Implementation Of Steel Structures:
Design Of Steel-Mixed Concrete Structures

III III THE IMPLEMENTATION OF THE NATIONAL POLICY AND THE PROGRAMMES

III IV REINFORCEMENT OF THE HAZARDS OR PHENOMENA SURVEY **NETWORK**

Telemetered seismic survey network by CRAAG (32 stations in 1990-92).
Network of earthquake strong motion recorders (300 accelerographs installed through the national territory.

10 mobile seismographs at CGS and 10 others at CRAAG for aftershocks recording (they have fully been used during the Boumerdes earthquake aftermath.

Mobile and fixed equipments for dynamic testing of structures at CGS Center, including a very modern shaking table of 6m x 6m with 6 degrees of freedom.

III V …ARDS OR RISKS ASSESSMENTS AT NATIONAL LEVEL BY MOST OF THE …D SECTORS WITH VARIABLE ACCURACY LEVELS

Seismic hazards maps at national and regional levels (iso-accelerations maps).

Seismic microzoning maps of 30 cities of the regions of Chlef (El Asnam), Algiers, Mascara and Ain Temouchent, and many Important work sites (dams, electrical energy plants and hospitals…)

Seismic vulnerability assessment of some strategic buildings.

Seismic vulnerability and risk assessment for the central part of Algiers.

National map of desertification sensitiveness.

Index map of vegetation performed for the potential regions of locust reproduction (south of Algeria and the northern parts of Niger and Mali).

III VI …NS FOR DISASTER RISKS REDUCTION OR DETAILED PLANS FOR DISASTER MANAGEMENT

In the field of the disaster reduction policy, the Algerian government has adopted in 29 may, 1985 " a national plan of disaster prevention and organization of intervention and rescue".
Actually, the Ministry of Interior is in charge through the General Directorate of Civil Protection of the disaster risk reduction management.

It has been followed by the enactment of two decrees which codified this policy:
The decree n°85-231 of 25-08-1985 related to the organization of intervention and rescue in case of disaster.

The decree n°- 85-232 of 25-08-1985 related to disaster risk reduction.

In this framework, some plans of prevention have been elaborated at the national and local levels. We can mention as examples:

Prevention Plans for forest fires
National plan against desertification
National plan for locust fighting
National emergency plan against sea pollution (named "PLAN TEL BAHR NATIONAL").
Prevention and intervention plans for economical and industrial facilities.

III VII EASY ACCESS TO THE RAPID (OR EARLY) WARNING SYSTEMS AT GLOBAL, NATIONAL, REGIONAL OR LOCAL LEVELS:

Rapid warning systems exist in some sectors or fields such as:
National system of warning by radio for forests fire
National rapid warning system for massive outflows of hydrocarbons.
National rapid warning system by radio for outflows or bursting of dams.
Pilot system for prediction and warning for floods in the basin of Sebaou river
Specific rapid warning systems for the huge industrial areas (petrol and petro- chemical areas in particular.)

Meteorological warning system for prediction and prevention of storms and strong winds. rapid warning system (divided in 3 levels according to the magnitude of the event and to the vulnerability of the concerned region) for earthquake or early warning for floods (these systems are in process of formal and official setting).

The methods used for the diffusion of information are generally:
Leaflets and posters
Conferences, meetings and exposition at schools level
Advertising spots in TV and radio.

These actions will certainly receive a new impulse with the creation of a «national commission of communication related to major risks”. (decree n° 04-181 of 24 June 2004)

Concerning the training, we should note the introduction of the teaching of the 2 modulus entitled «structural dynamics" and «earthquake resistant design of structures" since 1984 in the numerous existing civil engineering institutes.

It has also been proceeded in 2004 to the elaboration of education programmes at the third year of the middle level (the ninth year of education) of a matter related to «the environment and natural disasters". The pedagogical and didactic supports are being elaborated.

III VIII ANCE SECTOR FOR NATURAL DISASTERS RISK REDUCTION

In this field, the efforts have lead to the publication of the " Ordinance of 26 august, 2003 related to the obligation of insuring the natural disasters and to the indemnification of victims“ (in force on 1st September, 2004).

III IX LEGAL AND REGULATORY FRAMEWORK

Two major disasters fully contributed to rise the awareness and impulse the programmes and the actions.

The first one was the huge flash floods of 10 Nov, 2001, that have affected Bab El Oued (a populous district of Algiers City) and other regions of the country and have resulted in 900 dead or missing people and about 1 billion of US Dollars of damage.

The second one was the very strong earthquake (Magnitude 6.8) of 21 May, 2003 that has badly stricken the very populated regions of Boumerdes and Algiers in the central part of the country and that resulted in more than 2200 dead people and more than 3 billions of US Dollars of damage. As a consequence the government has updated and strengthened the National policy and also the legal and regulatory framework.

Enacting on 25 Dec. 2004 of the "**Law related to major risks reduction and management in the framework of sustainable development**".

This law, in addition to the requirements dealing with all the aspects of the reduction and the management of major disasters that have to be considered by the institutional bodies, the communities and all the stakeholders, require in its item 68 the setting up of the "National Delegation for Major Risks (NDMR)" .

The missions of this National Delegation are of "advising, assessment, and coordination of actions aiming at reducing the impacts of major disasters on the economy of the country and the security of people and property".

Enacting of "**Ordinance (law) of 26 Aug. 2003 related to the obligation of natural disasters insurance and to indemnification of the victims**". This law is in application since 1 Sept., 2004 with, as a first step, the insurance for earthquakes and floods risks concerning all buildings and, in some cases of contents also.

Enacting of "**Law 04-05 of 14 Aug., 2004, modifying and supplementing the law 90-29 of 1 Dec., 1990, related to land management and urban planning**" .

It deals with a better definition of the hazards and the hazards prone areas where building is forbidden or limited, but, above all, it stipulates two very important requirements, that are:
Immediate demolishing of all new construction without legal permit.

Architectural lay-out must be signed by an architect and the structural lay-out by a structural engineer, in the technical application presented for the demand of building permit.

Enacting of "Ministerial Decision" of 4 Jan. 2004 of Ministry of Habitat and Urban Planning approving the new Earthquake resistant design regulations for building, known as RPA 99 / Reviewed 2003" which is being revised and is supposed to be published and implement by 2011.

At Institutional and Organisational levels, in addition to the creation of **National Delegation for Major Risks**, we can mention three other items:

The setting up by the Decree 02-232 of 08 Aug., 2003 of the "**National Crisis Management Centre (CNAD)**"; it is in charge of "permanent monitoring and survey of different major risks and assistance to the Authorities in the management of the crisis related to major disasters
Setting up of "**National Agency for Earth Sciences**", by the decree 04-194 of 15 Jul., 2004;
Setting up by the decree 04-181 of 24 June, 2004 of the "National Commission of communication related to natural and technological major risks".

III X REGIONAL AND INTERNATIONAL COOPERATION

Setting up of National Committee of IDNDR (1990-1999) with its various activities related to cooperation aspects.

"**Project for improvement of the natural disasters insurance system**" has got the support of German Government. The achievement of this project can be considered as a "success story" in the field of co-operation.

National experts integrated UN regional and international activities and institutions, organization of African Unity (OAU) experts Committee, Maghrebian, Arab, Europe-Mediterranean and African projects dealing with major risks reduction as for the seismic risk reduction and the locust fighting.

As for the seismic risk, we can mention the projects "Seismed" (1990-1991), "Radius" (1998-1999) and "Risk-UE" (2001-2004) and the fruitful exchanges between Maghrebian in the framework of "Earthquake Engineering Maghrebian Association.

Locust fighting is the field of the International co-operation in the region where Algeria plays an essential part.

We have to admit that results expected were globally not met because, the non-existence of international financing mechanism; that remain to be done for the future.

In the meanwhile, we must promote exchange and technical assistance relations at regional and sub-regional scales; this will allow closest collaboration between the different potential partners, optimisation of the use of existing potentials in the least developed countries, and foster the emergence of locally available and mobilizable expertise.

Finally, for the case of natural disaster emergency, it would be highly wished to organize regional mechanisms of solidarity and mutual help so that a country which is badly stricken by a major disaster could urgently benefit from effective intervention and rescue assistance of other neighbouring countries.

III XI RECOMMENDATIONS AND PERSPECTIVES

The activities that have to be undertaken for 2005-2015 period would aim at solving constraints and difficulties previously experienced, and at developing a large and sustainable series of actions in the field of disaster reduction. We can mention the following actions:

Rapid kick-off and development of activities of the “National Delegation for Major Risks NDMR” and the “National Centre for Crisis Management NCCM/CNAD”.

Process of implementation of the law of Dec. 2004.
Setting up of provincial and local “ Disaster Reduction and Management committees”.
To progressively take into consideration the various local hazards.
To design and implement specific projects aiming at disaster reduction at national and local levels.
To foster regional and international cooperation following available opportunities, particularly through “pilot projects” including real technology transfer.

Develop at a higher scale public education actions.

Integrate the National Plan of Action in the global framework (ISDR) to benefit, at least for informational aspects, from the experience of all other countries.