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International Disaster and Risk Conference (IDRC), Davos

Session on

“Cultural Heritage and Risk: Some European experiences”

Davos, Switzerland, 26 August 2008

CONCLUSIONS

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1. Background

Cultural heritage is a key element of the history and identity of societies, contributing also to their economy and well being. Disaster reduction, as a tool of sustainable development, concerns not only the prevention of loss of lives and property but also the protection of cultural assets and the environment from natural or technological hazards.

Over the last twenty years, the Council of Europe has been promoting the reduction of the vulnerability of ancient buildings and historical settings from earthquakes and other risks. *The European and Mediterranean Major Hazards Agreement (EUR-OPA)* counts with a network of 25 Specialised Centres, some of which develop projects and activities on cultural heritage and risks. Certain topics dealt with concern the assessment of the vulnerability to seismic risks of monuments, historical settings and archaeological sites, the retrofitting of historical buildings (engineering and cultural approaches), the use of local seismic culture for restoration, traditional seismic techniques, historical city centres and risks, archaeology and seismicity, etc.

More than 60 seminars, courses, round tables and workshops have been held over the past years. Four of the Centres of the EUR-OPA network have been focusing much of their attention on this subject: the European University Centre for the Cultural Heritage (Ravello, Italy), the European Centre for Prevention and Forecasting of Earthquakes (Athens, Greece), the European Centre on Urban Risks (Lisbon, Portugal) and the European Centre on Vulnerability of Industrial and Lifeline Systems (Skopje, the former Yugoslav Republic of Macedonia). New work on cultural heritage and risk under the EUR-OPA Agreement will also cover the conservation of cultural heritage from climate change risks.

2. Input at the IDRC Davos 2008 Conference

In the framework of the International Disaster and Risk Conference (IDRC Davos 2008), the European and Mediterranean Major Hazards Agreement organised a session on "Cultural Heritage and Risk: Some European Experiences".

The aim of the session was twofold :

- to present work on cultural heritage and risk in Europe and to hear about similar experiences elsewhere
- to gather ideas for further Council of Europe work in the field.

A detailed programme of the Session can be found in Appendix 1 to this report and the speakers' presentations are set out in Appendix 2.

3. Proposals for action

The Secretariat proposed that activities of the Agreement in this field be prepared under the coordinated action of a group of experts on cultural heritage and risk. This group shall meet, after the approval of the Committee of Permanent Correspondents, in Athens in January 2009.

The Specialised Centres of the Agreement and Governments interested in cultural heritage and risk will be invited to participate. Ideally the group should be composed of

ten to fifteen persons from different fields. UNESCO will be invited to participate, as well as the Cultural Heritage Division of the Council of Europe.

The group of experts will put forward a proposal for its own "Terms of reference" for examination by the Committee of Permanent Correspondents and will suggest a programme of activities for 2009-2011.

Some activities already proposed for 2008-2009 were:

- a report on cultural heritage and climate change (to be finalised in November 2008)
- a Master course on cultural heritage and climate change
- a workshop on cultural heritage and climate change
- a workshop on strategies toward seismic protection of monuments.

APPENDIX 1

P R O G R A M M E

1. ***Introduction to the Council of Europe's European and Mediterranean Major Hazards Agreement (EUR-OPA)***
Eladio FERNANDEZ-GALIANO, Executive Secretary of the EUR-OPA Major Hazards Agreement

2. ***Presentation of twenty years of experience at the European University Centre for the Cultural Heritage (CUEBC), Ravello, Italy,***
Eugenia APICELLA, Secretary General, European University Centre for the Cultural Heritage (CUEBC), Ravello, Italy (*APOLOGISED FOR ABSENCE*)

3. ***Protecting monuments and historical settings from the next earthquake,***
Eleftheria PAPANITRIOU, Professor of Seismology, Department of Geophysics Aristotle University of Thessaloniki, Greece

Linda PELLI , Director of EPPO (Earthquake Planning and Protection Organization of Greece (E.P.P.O.)); Deputy Director of ECPFE (European Centre for Prevention and Forecasting of Earthquakes, Athens, Greece

4. ***Seismic analysis of the aggregates of historical buildings,***
Luis MENDES-VICTOR, Director, European Centre on Urban Risks (CERU), Lisbon, Portugal

5. ***Modelling and testing retrofitting of historical buildings: an engineer's approach***
Mihail GAREVSKI, Institute of Earthquake Engineering and Engineering Seismology (IZIIS), Skopje, Former Yugoslav Republic of Macedonia

6. ***Risk, local culture of risk, development***
Ferruccio FERRIGNI, Activity coordinator, European University Centre for the Cultural Heritage (CUEBC), Ravello, Italy

7. ***On-going initiatives to assess the impact of climate change on cultural heritage***
Roger-A. LEFEVRE, University Paris XII, Paris, France

8. **Discussion**

APPENDIX 2

PRESENTATIONS BY SPEAKERS

PRESENTATION OF TWENTY-FIVE YEARS OF EXPERIENCE AT THE EUROPEAN UNIVERSITY CENTRE FOR THE CULTURAL HERITAGE (CUEBC)

*Eugenia APICELLA, Secretary General,
European University Centre for the Cultural Heritage (CUEBC), Ravello, Italy*

The European University Centre for Cultural Heritage - which works within the European cooperation in the field of protection, conservation and enhancement of cultural heritage - aims at contributing, in connection with national and international competent bodies, to the implementation of a policy for cultural heritage, with reference to personnel training and specialisation, to professional code of conduct and to scientific consulting, as well as to the protection, promotion and enhancement of artistic and historic assets.

The Centre collaborates as a matter of course with professors, researchers and students from all over Europe, and it actively promotes the participation of scientists and students from all European countries. It also co-operates with scholars from other continents. In particular, it includes a program of activities specifically designed for countries on the North African and Middle Eastern shores of the Mediterranean.

The Centre's actions mainly focus on the following sectors:

- Archaeology, history, culture
- Sciences and materials of cultural heritage
- Historical environment and landscape
- Risks and cultural heritage
- Books, libraries and audiovisual assets
- Study, protection and fruition of cultural heritage
- European Observatory on Cultural Tourism
- Computing science and cultural heritage

The presentation will outline the most important actions carried out - or to be carried out by the Centre in the near future - with particular relation to its engagement in promoting the intercultural reflection on European values, by means of planning and carrying out several European culture-based projects of cooperation.

Main activities currently in progress:

- **Ravello LAB:** follow-up of 2007 edition and planning 2008 activities **Ubimino**r, Leonardo project: in progress in cooperation with Quality Program; Comune di Matera; Quality For; EBNT; CUEBC; Univ. di Bari; Hellenic ICOMOS; Development Centre of Kalambaka-Pyli S.A. (KEN.A.KA.P. S.A.); Hellenic Association of Travel Tourism Agencies; Educational Consulting Community; Consorcio de Turismo de Barcelona; Fundation Privada Valor Y Arte; Univ. Autonoma di Barcelona; I.M.F.E. Instituto Municipal de Formación y Empleo, Ayuntamiento de Granada; Gazi Üniversitesi, Ticaret ve Turizm Eğitim Fakültesi; ITIS Malta
- **EUROMEDITERRANEAN/CULTURE**, Cultural Heritage and development, in cooperation with Link Campus-University of Malta
- **PaCE**, Culture Programme 2007-2013: project in progress. Organisation of the start-up meeting (Ravello 23-24/11/2007) in cooperation with University of Modena and Reggio Emilia, University of Rome 'La Sapienza', University of Bergen, Jagiellonian University of Krakow, University of Barcelona, European University Cultural Heritage Center of Ravello
- **Master Erasmus Mundus “Cultural Heritage management. Knowledge and heritage conservation to build tomorrow’s culture”** - Planning of the training modules “Cultural landscapes management” - “Retrofitting of ancient non monumental built-up environment and local seismic culture: problems, methods, techniques” in cooperation with University of Saint-Etienne, University of Stuttgart and University of Naples “Federico II”
- **In Byte Bemolle. Technological innovation and audio heritage**, Planning of the Course “Technological innovation and audio heritage”, and the Exhibition “FONOGRAFICA. History of the sound’s reproduction from Edison to the digital” in cooperation with Discoteca di Stato-Museo dell’Audiovisivo
- Workshop **“The quality of the touristic development and cultural heritage. Institutional and normative systems in comparison”**, 24-25 October 2008
- Research **“European normative frame in relation to cultural tourism”**
- Euro-Mediterranean meeting **“Major hazards and cultural heritage: preventive strategies”**, 27 October - 1 November 2008, in collaboration with EUR-OPA Major Hazards-Council of Europe, University de Bordeaux and Réseau FER-PACT

**PROTECTING MONUMENTS AND HISTORICAL SETTINGS
FROM THE NEXT EARTHQUAKE**

Eleftheria PAPANIMITRIOU

Prof. Aristotle Univ. Thessaloniki, member of E.P.P.O and E.C.P.F.E.

Linda PELLI

*Civil Eng. Msc, Director Earthquake Planning Division E.P.P.O., Deputy Director
E.C.P.F.E*

Greece is the most prone area of Europe. In our Country the seismic energy released amounts to half of the total energy of that released in Europe. The Earthquake is perhaps one of the most destructive contributors amongst other factors e.g. (Age, Dump, Soil Condition, Atmospheric Pollution, Lack of Maintenance etc), that cause damages or even collapse.

In order to reduce the scale of destructions, Seismic Risk (SR) in other words the consequences of a catastrophic earthquake must be minimized. Seismic Risk in mathematical terms, or else the possibility a large Earthquake occurring in the area the next T years, is expressed as: *Seismic Risk= Seismic Hazard of the Area * Vulnerability.*

Vulnerability expresses the seismic Response of the Monument to seismic event with unknown characteristics in combination with the degree of uncertainty in the determination of the constructural characteristics. The random nature of the seismic loading as well as the random nature of the properties of the monument that influence its seismic response, are co-assessed.

Seismic Hazard that is the possibility of a large Earthquake taking place as well as the time of occurrence in a specific area is one of the three factors that define the scale of Risk and consequently the expected scale of destruction.

A third factor that contributes to Seismic Risk, are at "Risk Values" of the Monument in its current status e.g. (human life, historical value, historical materials and techniques, socio – economic values of elements or infrastructure, aesthetic value etc.), are almost beyond intervention.

Consequently the reduction of the Seismic Risk to a Monument from a Future Earthquake is mainly a Factor of reducing its vulnerability.

The presentation deals with the various methods of reducing the vulnerability of monuments.

SEISMIC ANALYSIS OF THE AGGREGATES OF HISTORICAL BUILDINGS

*Prof. Luiz MENDES-VICTOR
European Centre on Urban Risks (CERU), Portugal*

The seismic analysis of the building stocks behavior of the Historical Centers has to be performed taking into consideration the previous studies on the source locations, soil effects, past seismicity, typologies and spatial aggregations.

To assess the frequency of the natural vibrations of the aggregates, composed by different aging building, it is necessary to select the adequate technical information and chosen field methodologies, integrating up-dated GIS data.

Even if, some less known parameters can misjudge the estimated frequency, it is possible to accept a mixed evaluation (empirical and theoretical) of the individual components of the aggregates and consequently promote a valid assessment for various seismic scenarios.

Goals

Typology buildings characterization.

Natural Vibrations of buildings in the Historical Center of Lagos (HCL), Portugal.

Identification of seismic vulnerable aggregates, for different seismic scenarios, taking into consideration site effects, soil behavior and the type of aggregation.

Buildings Characterization: Typologies

Label	Description	Height		
		Class		Characteristic
		height	Stories	Meters
C1L	Concrete Moment Frame 1970-1985	Low-rise	1-3	6
C3L	Concrete Frame with Unreinforced Masonry Infill Walls 1970-1985	Low-rise	1-3	6
C3M		Mid-rise	4-7	16
PC2L	Precast Concrete Frames with Concrete Shear Walls > 1985	Low-rise	1-3	6
RM1L	Reinforced Masonry Bearing Walls with wood or Metal Deck Diaphragms	Low-rise	1-3	6
URML	Unreinforced Masonry Bearing Walls <1775	Low-rise	1-2	6

Natural vibration of the buildings

Structure Type	Period (s)(Davidovici,1999)	Typology
Unreinforced Masonry (1)	$T = 0,10 (H/Lx)^{1/2}$	URML
Precast Concrete 2)	$T = 0,08 (H/Lx)^{1/2} \cdot [(H/(Lx + H))]^{1/2}$	PC2L
Reinforced Masonry Bearing Walls With wood or Metal Deck Diaphragms (3)	$T = 0,06 (H/Lx)^{1/2} \cdot [(H/(2Lx + H))]^{1/2}$	RM1L, C3L, C1L, C3M

H= Height (number of stories x 3m); Lx= width façade

To characterize the building area of HCL an Inquire was performed to get:

- Experimental evaluations of buildings frequency
- Aggregation structure with photos of the front and back façades

Theoretical frequency computed for each aggregate (HZ) by weight averages



The number of homeless and injured people was computed from the percentage of the number of collapsed buildings with several damages (Coburn and Spence, 1992)

Final considerations

With this work it was possible to characterize the exposed vulnerability of the aggregates in the Historical Center of Lagos. The localization of the most susceptible areas of suffering seismic damages in this historical center, was made using GIS support. Policy decision-makers and population can now design a more efficient emergency plan.

When preparing the emergency plan it is necessary to pay attention to the results obtained from the different seismic scenarios, in order to assure the minimization of damages. For that it is essential to promote some complementary actions, the most important being:

- Education
- Reduction of the Seismic Vulnerability of the exposed buildings.

The minimization of the Seismic Risk can only be achieved if the entire awareness of the SOCIETY is assured.

RISK, LOCAL CULTURE OF RISK, DEVELOPMENT

Ferruccio FERRIGNI

European University Centre for the Cultural Heritage (CUEBC), Ravello, Italy

The Izmit earthquake, the Sarno landslide and the floods in Piedmont all provided dramatic evidence that the human and material losses caused by “natural” disasters are also linked to non-compliance with legislation and the massive use of sites which have always been known to be unsafe. In Umbria, however, the seismic protection regulations had been complied with. Yet many old buildings which had been “reinforced” in accordance with relevant legislation suffered serious damage. In Colombia, while the Armenia earthquake destroyed recent neighbourhoods, in the case of “bahareque” houses (traditional technique using bamboo and clay), only those which were empty before the earthquake or had not been properly maintained collapsed.

These examples demolish an equally widespread and unfounded belief, ie that old buildings are the most vulnerable and that traditional techniques and forms of land use are outdated. Yet the buildings and techniques which have survived until the present day are bound to have proven their worth in standing up to local risks. In regions affected regularly by natural disasters, only buildings which are compatible with their environment can actually become historic. In high-risk areas, there must be a deeply rooted local culture combining technical skills and consistent approaches that is capable of protecting people and property against local risks or of reducing the impact of the latter.

Admittedly, there are now seismic protection regulations and legal requirements, but they usually reflect theoretical models and mostly ignore traditional building techniques and, indeed, almost always ban their use. In short, they destroy old skills without forming a “culture” themselves. In addition, the regulations are applied to new buildings. The problem of protecting everything built before the regulations were adopted remains unsolved. In Italy, 63% of dwellings predate the seismic protection regulations and the figure is not much different in other countries.

Non-application both of the seismic protection regulations and of proven local rules, lack of maintenance and “reinforcements” performed using modern techniques – which are effective in themselves but irreversibly impair the dynamic response of the buildings – are three facets of a single process: the gradual loss of what could be called a “**local risk culture**”.

Restoring the local risk culture could not only make elected representatives and building managers comply more readily with the regulations and local rules but could also strengthen their position in relation to the demands of owners and help them to avoid dangerous schemes, do building work in the manner best suited to the characteristics of the local environment and implement systematic programmes for maintaining and safeguarding local areas. At the same time, reducing the vulnerability of buildings and local areas by restoring the local risk culture requires the use of local resources, involves the revival of traditional techniques and employs labour-intensive procedures. Sustainable local development activities could therefore be based on systematic efforts in this area.

Maintaining and safeguarding regions on the basis of a restored local risk culture not only strengthens the cultural identity of the communities which have adapted the areas to their needs but also improves landscape conservation, the selection of appropriate

types of building and land use and protection against natural disasters. Last but not least, it can be included in sustainable local development programmes. It is therefore a multidisciplinary activity which requires an approach and methodology which are not yet widespread enough and which in any case still have to be tested.

In addition, while the risks vary from site to site, local risk culture rules are often very similar. That presents an opportunity for international activities.

Various studies conducted by research groups from a number of Italian universities can help produce a more systematic approach here and define the most effective criteria, methods and policies in relation to the characteristics of local systems. The experience and programmes of local institutions in Italy can help highlight the problems and positive achievements in this area. The decentralised co-operation policy launched by the Italian Ministry for Foreign Affairs; EDINFODEC, run by the United Nations Office for Project Support (UNOPS), linked with the Local Human Development Programme (PDHL); and the programmes and areas of activity of the European Union (DG VIII, Directorate General for Development; DG I, External Relations) provide the institutional framework in which Mediterranean co-operation – involving risk prevention based on proper management of local areas and the restoration of local risk cultures – could take place.

The aim is to address the principles, problems and potential of maintaining and managing historic regions as a multidisciplinary activity involving the safeguarding of environmental and cultural, disaster prevention and sustainable local development know-how.

ON-GOING INITIATIVES TO ASSESS THE IMPACT OF CLIMATE CHANGE ON CULTURAL HERITAGE

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Key-words: Built Cultural Heritage, UNESCO Policy, EC Research Programmes, Mapping

According to the Fourth Assessment Report (IPCC, 2007) of the Intergovernmental Panel on Climate Change (IPCC), the *temperature* of the Earth's surface has risen by 0.74 °C since the late 1800s and it is projected to increase by another 1.1 to 6.4 °C by the year 2099. The sea level rose on average by 10 to 20 cm during the 20th century and an additional increase of 18 to 59 cm is projected by the end of the current century. That clearly means Venice could be flooded by "Acqua Alta" two times a day all the year round. This emblematic example illustrates the need of urgent measures of mitigation and adaptation of the Cultural Heritage to Climate Change by means of strategic policy, research and training.

The national and international organisations dealing with the Climate Change are numerous, but those dealing with the interactions between Climate Change and Cultural Heritage are scarce.

At the international level the most involved organisation is probably the *World Heritage Centre of the UNESCO* in Paris. The Report n°22 (UNESO, 2007a) follows a qualitative approach by climatic factors interacting with the Cultural Heritage: atmospheric moisture and rain change; temperature change; sea level rises; wind; desertification; climate and pollution acting together; climate and biological effects. The physical, social and cultural impacts on Cultural Heritage are listed in detail. This Report was completed by a Policy Document (UNESCO, 2008), which touches on synergies between conventions on the issue; identification of future research needs in this area, legal questions on the role of the World Heritage Convention with regard to suitable responses to Climate Change, and linkages to other UN and international bodies dealing with the issues of climate change. The publication "Case Studies on Climate Change and World Heritage" (UNESCO, 2007b) contains the assessment of the impacts on some World Heritage sites in Europe: the City of London, Venice and its Lagoon, the historic centres of Cesky Krumlov and Prague.

At the European level, the European Commission funded an important project in the frame of its 6th PCRD: "*Global Climate Change Impacts on Built Heritage and Cultural Landscapes*" ("*Noah's Ark*" Project, 2003-2007). The methodology consists in a quantitative approach combining climatic factors and properties of the materials of the Cultural Heritage. Two deliverables are of a paramount interest: the "Vulnerability Atlas" and the "Guidelines".

The "Vulnerability Atlas" of the "Noah's Ark" Project contains 22 thirty-year mean value maps for recent past (1961-1990), near future (2010-2030) and far future (2070-2099). These maps use climate parameters extracted from the General Climate Model (HadCM3) and the Regional Climate Model (HadRM3) of the Hadley Meteorological Centre (UK). They consist in:

- 6 *Climate maps*: climate change is mapped in terms of the traditional climate parameters relevant to Cultural Heritage (e.g. annual precipitation, frost);
- 4 *Heritage maps* are obtained by combining climate parameters with the aim of producing specific heritage climatologies (e.g. wet-frost cycles, consisting in rain followed by intense freezing);
- 6 *Damage maps* based on damage and dose-response functions (e.g. surface recession of carbonate stones, metal corrosion);
- 6 Risk and multiple-risk maps show areas of increasing/decreasing for one or more deterioration processes of materials in different regions of Europe.

The “Guidelines” of the “Noah’s Ark” give to different user groups adaptation strategies for Cultural heritage management in the face of climate change. These adaptation strategies should enable heritage stakeholders, owners and curators of historic buildings and collections, public policy-makers and national heritage organisations to contemplate future climate change pressures. They offer the potential to balance catastrophic climate impacts of extreme events with more pervasive and subtle long-term effects.

At the national level, the *Centre for Sustainable Heritage of the University College London* is the most involved in the problematics of Climate Change and Cultural Heritage which produced two important reports (Cassar, 2005; Cassar & Hawkings, 2006) the matter of which was integrated in the different publications of the UNESCO-World Heritage Centre and was the basis of the Noah’s Ark Project.

Specific activities of training on the topic are not enough developed and are delivered at the time only by the *European University Centre for Cultural Heritage of Ravello* (Italy) (<http://univeur.org>).